INFORMATION SHEET

PRESIDING: Commissioner Brown-Bland, Presiding; Chair Mitchell and Commissioners Clodfelter, Duffley, Hughes, McKissick, Jr., and Kemerait
PLACE: Raleigh, NC
DATE: Tuesday, May 30, 2023
TIME: 2:05 p.m. – 2:13 p.m.
DOCKET NO.: E-7, Sub 1285
COMPANY: Duke Energy Carolinas, LLC
DESCRIPTION: In the Matter of Application of Duke Energy Carolinas, LLC for Approval of Demand-Side Management and Energy Efficiency Cost Recovery Rider Pursuant to N.C.G.S. § 62-133.9 and Commission Rule R8-69

VOLUME NUMBER:

APPEARANCES
See Attached

WITNESSES
See Attached

EXHIBITS
See Attached

REPORTED BY: Tonja Vines	TRANSCRIPT PAGES: 16
TRANSCRIBED BY: Tonja Vines	PREFILED PAGES: 88
DATE FILED: June 20, 2023	TOTAL PAGES: 104

DATE: Tuesday, May 30, 2023

TIME: 2:05 p.m. - 2:13 p.m.

DOCKET NO: E-7, Sub 1285

BEFORE: Commissioner ToNola D. Brown-Bland, Presiding

Chair Charlotte A. Mitchell

Commissioner Daniel G. Clodfelter

Commissioner Kimberly W. Duffley

Commissioner Jeffrey A. Hughes

Commissioner Floyd B. McKissick, Jr.

Commissioner Karen M. Kemerait

IN THE MATTER OF:

Application of Duke Energy Carolinas, LLC,
for Approval of Demand-Side Management and
Energy Efficiency Cost Recovery Rider
Pursuant to N.C.G.S. § 62-133.9 and
Commission Rule R8-69

A P P E A R A N C E S:
FOR DUKE ENERGY CAROLINAS, LLC:
Kendrick Fentress, Esq.
Associate General Counsel
Duke Energy Corporation
P.O. Office Box 1551, NCRH 20
Raleigh, North Carolina 27607

FOR NORTH CAROLINA JUSTICE CENTER, NORTH CAROLINA HOUSING COALITION,
SOUTHERN ALLIANCE FOR CLEAN ENERGY:
Munashe Magarira, Esq., Staff Attorney
601 West Rosemary Street, Suite 220
Chapel Hill, North Carolina 27516

FOR CAROLINA INDUSTRIAL GROUP FOR FAIR UTILITY RATES III:
Christina Cress, Esq., Partner
Douglas D.C. Conant, Esq., Associate
Bailey & Dixon, LLP
434 Fayetteville Street, Suite 2500
Raleigh, North Carolina 27601

A P P E A R A N C E S (Cont'd):

FOR CAROLINA UTILITY CUSTOMERS ASSOCIATION:
Marcus Trathen, Esq.
Brooks, Pierce, McLendon, Humphrey & Leonard, LLP
Wells Fargo Capitol Center
150 Fayetteville Street, Suite 1700
Raleigh, North Carolina 27601

FOR THE USING AND CONSUMING PUBLIC:
Anne M. Keyworth, Esq.
Nadia Luhr, Esq.
Public Staff - North Carolina Utilities Commission
4326 Mail Service Center
Raleigh, North Carolina 27699-4300

T A B L E O F C O N T E N T S

E X A M I N A T I O N S

E X H I B I T S

NORTH CAROLINA UTILITIES COMMISSION

APPEARANCE SLIP

DATE: 05/30/2023 **DOCKET NO.:** E-7, Sub 1282 and E-7, Sub 1285

ATTORNEY NAME and TITLE: Thomas Gooding, Associate Attorney

FIRM NAME: Southern Environmental Law Center

ADDRESS: 601 W. Rosemary St., Suite 220

CITY: Chapel Hill **STATE:** NC **ZIP CODE:** 27516

APPEARANCE ON BEHALF OF: E-7, Sub 1282 - SACE

E-7, Sub 1285 - NC Justice Center, NC Housing Coalition, and SACE

APPLICANT: ___ **COMPLAINANT:** ___ **INTERVENOR:** X

PROTESTANT: ___ **RESPONDENT:** ___ **DEFENDANT:** ___

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SIGNATURE: [signature]

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NORTH CAROLINA UTILITIES COMMISSION

APPEARANCE SLIP

DATE: 05/30/23 **DOCKET NO.:** E-7, Sub 1282 and 1285

ATTORNEY NAME and TITLE: Munashe Magarira, Staff attorney

FIRM NAME: Southern Environmental Law Center

ADDRESS: 601 W Rosemary St, Ste 220

CITY: Chapel Hill **STATE:** NC **ZIP CODE:** 27516

APPEARANCE ON BEHALF OF: E-7, Sub 1282 - SACE
E-7, Sub 1285 - NC Justice Center, NC Housing Coalition and SACE

APPLICANT: ___ **COMPLAINANT:** ___ **INTERVENOR:** ✓

PROTESTANT: ___ **RESPONDENT:** ___ **DEFENDANT:** ___

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Email: MMagarira@selcnc.org

SIGNATURE: [signature]

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Jun 28 2023

NORTH CAROLINA UTILITIES COMMISSION

APPEARANCE SLIP

DATE: 5/30 DOCKET NO.: E-7 Sub 1285

ATTORNEY NAME and TITLE: Kendrick Fentress, Associate Attorney General

FIRM NAME: Duke Energy

ADDRESS: P O Box 1551

CITY: Raleigh STATE: NC ZIP CODE: 2760[illegible]

APPEARANCE ON BEHALF OF: Duke Energy

APPLICANT: ✓ COMPLAINANT: ___ INTERVENOR: ___

PROTESTANT: ___ RESPONDENT: ___ DEFENDANT: ___

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Email: Kendrick.Fentress@duke-energy.com

SIGNATURE: [signature]

(Signature Required for distribution of CONFIDENTIAL information)

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Jun 28 2023

NORTH CAROLINA UTILITIES COMMISSION

APPEARANCE SLIP

DEC Rider Hearings

DATE: 5/30/2023 **DOCKET NO.:** E-7, Subs 1281, 1282, 1285

ATTORNEY NAME and TITLE: Christina Cress, Partner

Douglas "D.C." Conant

FIRM NAME: Bailey & Dixon, LLP

ADDRESS: 434 Fayetteville St., Ste. 2500

CITY: Raleigh **STATE:** NC **ZIP CODE:** 27601

APPEARANCE ON BEHALF OF: CIGFUR III

APPLICANT: ___ **COMPLAINANT:** ___ **INTERVENOR:** X

PROTESTANT: ___ **RESPONDENT:** ___ **DEFENDANT:** ___

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Email: ccress@bdixon.com

SIGNATURE: [signature]

(Signature Required for distribution of CONFIDENTIAL information)

NORTH CAROLINA UTILITIES COMMISSION

APPEARANCE SLIP

E-7, Sub 1282
E-7, Sub 1285
E-7, Sub 1281

DATE: 5-30-23 DOCKET NO.: ______

ATTORNEY NAME and TITLE: ______

Marcus Trathen

FIRM NAME: Brooks Pierce

ADDRESS: Suite 1700, Wells Fargo Building

CITY: Raleigh STATE: NC ZIP CODE: 27601

APPEARANCE ON BEHALF OF: CUCA

APPLICANT: ___ COMPLAINANT: ___ INTERVENOR: X

PROTESTANT: ___ RESPONDENT: ___ DEFENDANT: ___

Non-confidential transcripts are located on the Commission's website. To view and/or print transcripts, go to https://www.ncuc.net/, hover over the Dockets tab, select Docket Search, enter the docket number, and click search, select the highlighted docket number and select Documents for a list of all documents filed.

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(Signature Required for distribution of CONFIDENTIAL information)

NORTH CAROLINA UTILITIES COMMISSION
PUBLIC STAFF - APPEARANCE SLIP

DATE: May 30, 2023

DOCKET #:E-7. Sub 1285
DEC DSM/EE 2023

PUBLIC STAFF ATTORNEYS: Anne Keyworth & Nadia Luhr

TO REQUEST A **CONFIDENTIAL** TRANSCRIPT, PLEASE PROVIDE YOUR EMAIL ADDRESS BELOW:

ACCOUNTING ______
CONSUMER SERVICES ______
COMMUNICATIONS ______
ENERGY ______
ECONOMICS ______
LEGAL anne.keyworth@psncuc.nc.gov; nadia.luhr@psncuc.nc.gov
TRANSPORTATION ______
WATER ______

Non-confidential transcripts are located on the Commission's website. To view and/or print, please access https://ncuc.net.

COUNSEL/MEMBER(s) REQUESTING A **CONFIDENTIAL** TRANSCRIPT WHO HAS SIGNED A CONFIDENTIALITY AGREEMENT WILL NEED TO SIGN BELOW.

/s/ Anne Keyworth
/s/ Nadia Luhr

STATE OF NORTH CAROLINA
UTILITIES COMMISSION
RALEIGH

DOCKET NO. E-7, SUB 1285

BEFORE THE NORTH CAROLINA UTILITIES COMMISSION

In the Matter of Application of Duke Energy Carolinas, LLC for Approval of Demand-Side Management and Energy Efficiency Cost Recovery Rider Pursuant to N.C. Gen. Stat. § 62-133.9 and Commission Rule R8-69	))))))	**APPLICATION OF DUKE ENERGY CAROLINAS, LLC FOR APPROVAL OF RIDER 15**

Duke Energy Carolinas, LLC ("DEC," "Company," or "Applicant"), pursuant to North Carolina General Statutes ("N.C. Gen. Stat.") § 62-133.9 and North Carolina Utilities Commission (the "Commission") Rule R8-69, hereby applies to the Commission for approval of its demand-side management ("DSM") and energy efficiency ("EE") cost recovery rider, Rider EE, for 2024 ("Rider 15"). Rider 15 has been calculated in accordance with the Company's DSM/EE cost recovery mechanism approved by the Commission in Docket No. E-7, Sub 1032, and the revised Mechanism approved in the Commission's *Order Approving Revisions to Demand-Side Management and Energy Efficiency Cost Recovery Mechanisms,* issued on October 20, 2020, in Docket Nos. E-2, Sub 931 and E-7, Sub 1032 ("*2020 Sub 1032 Order*") (collectively, the "Mechanisms"). The prospective components of Rider 15 include estimates of the revenue requirements for Vintage 2024[1] DSM and EE programs, as well as an estimate of the second year of net lost

[1] A vintage year is the twelve-month period in which a specific DSM or EE measure is installed for an individual participant or a group of participants. Each vintage is referred to by the calendar year of its respective rate period (*e.g.*, Vintage 2024).

revenues for Vintage 2023 EE programs, the third year of net lost revenues for Vintage 2022 EE programs, and the fourth year of net lost revenues for Vintage 2021 EE programs. The Rider 15 Experience Modification Factor ("EMF") includes the following true-ups: (i) a true-up of Vintage 2016 DSM/EE programs, (ii) a true-up of Vintage 2017 DSM/EE programs, (iii) a true-up of Vintage 2018 DSM/EE programs, (iv) a true-up of Vintage 2019 DSM/EE programs, (v) a true-up of Vintage 2020 DSM/EE programs, (vi) a true-up of Vintage 2021 DSM/EE programs and (vii) a true-up of Vintage 2022 DSM/EE programs.

In support of this Application, DEC respectfully shows the Commission the following:

1. The Applicant's general offices are located at 526 South Church Street, Charlotte, North Carolina, and its mailing address is:

Duke Energy Carolinas, LLC
P. O. Box 1321
Charlotte, North Carolina 28201

2. The name and address of Applicant's attorney is:

Kendrick C. Fentress, Associate General Counsel
Duke Energy Corporation
P.O. Box 1551/NCRH 20
Raleigh, North Carolina 27602
(919) 546-6733
Kendrick.Fentress@duke-energy.com

3. N.C. Gen. Stat. § 62-133.9(d) authorizes the Commission to approve an annual rider to the rates of electric public utilities to recover all reasonable and prudent costs incurred for the adoption and implementation of DSM/EE programs. Recoverable costs include, but are not limited to, all capital costs, including cost of capital and depreciation expense, administrative costs, implementation costs, incentive payments to

program participants, and operating costs. Such rider shall consist of the utility's forecasted cost during the rate period and an EMF rider to collect the difference between the utility's actual reasonable and prudent costs incurred during the test period and actual revenues realized during the test period. The Commission is also authorized to approve incentives for adopting and implementing DSM/EE programs, including appropriate rewards based on a percentage of avoided costs achieved by DSM/EE measures.

4. The Company's cost recovery mechanism is described in the Agreement and Stipulation of Settlement that DEC reached with the Public Staff – North Carolina Utilities Commission, the North Carolina Sustainable Energy Association, Environmental Defense Fund, Southern Alliance for Clean Energy, the South Carolina Coastal Conservation League, Natural Resources Defense Council, and the Sierra Club and filed with the Commission on August 19, 2013 (the "Stipulation"). The Commission approved the cost recovery mechanism as described in the Stipulation, as well as DEC's portfolio of DSM/EE programs, in its *Order Approving DSM/EE Programs and Stipulation of Settlement* issued October 29, 2013 ("*Sub 1032 Order*"), and the Commission approved the revised Mechanism in the *2020 Sub 1032 Order*. The approved Mechanisms are designed to allow DEC to collect revenue equal to its incurred program costs for a rate period plus a Portfolio Performance Incentive based on shared savings achieved by DEC's DSM/EE programs, and to recover net lost revenues for EE programs. In addition, per the *2020 Sub 1032 Order*, beginning in 2022, the Income-Qualified EE and Weatherization programs are eligible to receive a Program Return Incentive based on shared savings achieved by these programs.

5. Rule R8-69(b) provides that the Commission will each year conduct a proceeding for each electric public utility to establish an annual DSM/EE rider to recover DSM/EE related costs.

6. Pursuant to the provisions of N.C. Gen. Stat. § 62-133.9 and Rule R8-69, DEC requests the establishment of Rider 15 to recover: (1) a prospective component consisting of the estimated revenue requirements associated with Vintage 2024 of DEC's current portfolio of DSM/EE programs, the second year of net lost revenues for Vintage 2023 of DEC's EE programs, the third year of net lost revenues for Vintage 2022 of DEC's EE programs, and the fourth year of net lost revenues for Vintage 2021 of DEC's EE programs; and (2) an EMF component truing up Vintage 2016, Vintage 2017, Vintage 2018, Vintage 2019, Vintage 2020, Vintage 2021 and Vintage 2022 of DEC's DSM/EE programs.

7. Pursuant to the provisions of N.C. Gen. Stat. § 62-133.9 and Rule R8-69, the Company requests Commission approval of the following annual billing factors (all shown on a cents per kilowatt hour ("¢/kWh") basis, including gross receipts tax and regulatory fee):

Residential Billing Factors	**¢/kWh**
Residential Billing Factor for Rider 15 Prospective Components	0.4320
Residential Billing Factor for Rider 15 EMF Components	(0.0503)

Non-Residential Billing Factors for Rider 15 Prospective Components	**¢/kWh**
Vintage 2021 EE participant	0.0313
Vintage 2022 EE participant	0.0468

Non-Residential Billing Factors for Rider 15 Prospective Components	**¢/kWh**
Vintage 2023 EE participant	0.0802
Vintage 2024 EE participant	0.3869
Vintage 2024 DSM participant	0.0897

Non-Residential Billing Factors for Rider 15 EMF Components	**¢/kWh**
Vintage 2018 EE participant	(0.0001)
Vintage 2018 DSM participant	0.0000
Vintage 2019 EE participant	(0.0014)
Vintage 2019 DSM participant	(0.0001)
Vintage 2020 EE participant	(0.0068)
Vintage 2020 DSM participant	0.0002
Vintage 2021 EE participant	(0.0082)
Vintage 2021 DSM participant	(0.0073)
Vintage 2022 EE participant	(0.1732)
Vintage 2022 DSM participant	(0.0017)

Consistent with the Commission's *Order on Motions for Reconsideration*, issued on June 3, 2010 in Docket No. E-7, Sub 938 and the *Sub 1032 Order*, Rider 15 will be in effect for the twelve-month period January 1, 2024 through December 31, 2024. Also in accordance with these Orders, the test period for the Vintage 2022 EMF Component is the period January 1, 2022 through December 31, 2022; the test period for the Vintage 2021 EMF component is the period January 1, 2021 through December 31, 2021; the test period for the Vintage 2020 EMF component is the period January 1, 2020 through December 31, 2020; the test period for the Vintage 2019 EMF component is the period January 1, 2019 through December 31, 2019; the test period for the Vintage 2018 EMF component is the period January 1, 2018 through December 31, 2018; the test period for the Vintage 2017 EMF component is the period January 1, 2017 through December 31, 2017; and the test period for the Vintage 2016 EMF component is the period January 1, 2016 through December 31, 2016.

8. The Company has attached hereto, as required by Rule R8-69, the direct testimony and exhibits of witnesses Shannon R. Listebarger and Casey Q. Fields in support of the requested change in rates.

WHEREFORE, the Company respectfully prays:

That consistent with this Application, the Commission approve the rates as set forth in paragraph 7 above.

Respectfully submitted, this the 28th day of February, 2024.

Kendrick C. Fentress

Kendrick Fentress
Associate General Counsel
Duke Energy Corporation
P.O. Box 1551/NCRH 20
Raleigh, North Carolina 27602
Telephone: (919) 546-6733
Kendrick.Fentress@duke-energy.com

ATTORNEY FOR DUKE ENERGY CAROLINAS, LLC

VERIFICATION

☐STATE OF OHIO)
) DOCKET NO. E-7, SUB 1285
COUNTY OF LICKING)

Shannon R. Listebarger, being first duly sworn, deposes and says:

That she is Rates and Regulatory Strategy Manager for Duke Energy Carolinas, LLC, applicant in the above-titled action; that she has read the foregoing Application and knows the contents thereof; that the same is true except as to the matters stated therein on information and belief; and as to those matters, she believes them to be true.

Shannon R. Listebarger

Shannon R. Listebarger

Sworn to and subscribed before me
this the 27 day of February, 2023.

(Official Seal)

NOTARIAL SEAL STATE OF OHIO

MARY C. MARIETTA
Notary Public, State of Ohio
My Commission Expires
March 20, 2023

Official Signature of Notary
Mary C Marietta

, Notary Public
Notary's printed or typed name
Mary C Marietta
My commission expires: 03/20/2023

/A

Duke Energy Carolinas
Fields Exhibit 1
Vintage 2016 True Up - January 1, 2016 to December 31, 2016
Docket Number E-7 Sub 1285
Load Impacts and Estimated Revenue Requirements by Program

	Residential Programs	System kW Reduction - Summer Peak	System Energy Reduction (kWh)	A System NPV of Avoided Costs	B Total Cost	C Shared Savings %	D =(A-B)*C Incentive	E = (B+D) System Revenue Requirement	F NC Retail kWh Sales Allocation Factor	G NC Allocation Factor (2)		H NC Residential Revenue Requirement	NC Residential Adjusted Revenue Requirement
	EE Programs												
1	Appliance Recycling Program	21	164,720	$ 59,758	$ (97,397)	11.5%	$ 18,073	$ (79,324)	73.0962827%		E1 * F1	$ (57,983)	
2	Energy Efficiency Education	1,512	6,441,283	$ 3,695,507	$ 2,126,509	11.5%	$ 180,435	$ 2,306,944	73.0962827%		E2 * F2	$ 1,686,290	
3	Energy Efficient Appliances and Devices	14,518	120,226,223	$ 82,262,218	$ 24,069,774	11.5%	$ 6,692,131	$ 30,761,905	73.0962827%		E3 * F3	$ 22,485,809	
4	HVAC Energy Efficiency	2,462	6,294,837	$ 7,476,100	$ 7,839,566	11.5%	$ (41,799)	$ 7,797,767	73.0962827%		E4 * F4	$ 5,699,878	
5	Low Income Energy Efficiency and Weatherization Assistance	649	4,801,478	$ 2,984,760	$ 4,792,436	0.0%	$ -	$ 4,792,436	73.0962827%		E5 * F5	$ 3,503,093	
6	Multi-Family Energy Efficiency	1,572	15,235,497	$ 8,950,706	$ 2,518,988	11.5%	$ 739,648	$ 3,258,636	73.0962827%		E6 * F6	$ 2,381,941	
7	Residential Energy Assessments	1,070	7,389,091	$ 6,822,806	$ 2,678,893	11.5%	$ 476,550	$ 3,155,443	73.0962827%		E7 * F7	$ 2,306,512	
8	Total for Residential Conservation Programs	21,804	160,553,127	$ 112,251,855	$ 43,928,769		$ 8,065,038	$ 51,993,807				$ 38,005,540	
9	My Home Energy Report	70,977	282,250,993	$ 20,409,636	$ 10,822,444	11.5%	$ 1,102,527	$ 11,924,971	73.0962827%		E9 * F9	$ 8,716,711	$ (1,204)
10	Total Residential Conservation and Behavioral Programs	92,782	442,804,121	$ 132,661,491	$ 54,751,213		$ 9,167,565	$ 63,918,778				$ 46,722,251	$ (1,204)
									NC Residential Peak Demand Allocation Factor				
11	Total DSM Programs(2)	825,492	718,623	$ 98,643,760	$ 28,406,298	11.5%	$ 8,077,308	$ 36,483,606		33.797348%	E11 * F11	$ 12,330,491	
12	Total Residential	918,274	443,522,744	$ 231,305,251	$ 83,157,511		$ 17,244,873	$ 100,402,384				$ 59,052,742	

	Non-Residential Programs	System kW Reduction - Summer Peak	System Energy Reduction (kWh)	System NPV of Avoided Costs	Total Cost	Shared Savings %	Incentive	System Revenue Requirement	NC Retail kWh Sales Allocation Factor		NC Non-Residential Revenue Requirement	
	EE Programs											
13	Non Residential Smart Saver Custom Technical Assessments	1,584	16,953,402	$ 9,572,687	$ 2,034,308	11.5%	$ 866,914	$ 2,901,222	73.0962827%	E12 * F12	$ 2,120,685	
14	Non Residential Smart Saver Custom	7,934	52,154,624	$ 39,025,086	$ 7,356,509	11.5%	$ 3,629,838	$ 10,986,347	73.0962827%	E13 * F13	$ 8,030,611	
15	Non Residential Smart Saver Energy Efficienct Food Service Products	356	3,809,316	$ 2,474,312	$ 324,117	11.5%	$ 247,272	$ 571,389	73.0962827%	E14 * F14	$ 417,664	
16	Non Residential Smart Saver Energy Efficienct HVAC Products	808	3,316,901	$ 3,344,669	$ 1,473,991	11.5%	$ 215,128	$ 1,689,119	73.0962827%	E16 * F16	$ 1,234,683	
17	Non Residential Smart Saver Energy Efficienct Lighting Products	29,268	167,342,422	$ 120,392,639	$ 39,622,944	11.5%	$ 9,288,515	$ 48,911,459	73.0962827%	E17 * F17	$ 35,752,458	
18	Non Residential Smart Saver Energy Efficienct Pumps and Drives Products	368	2,494,340	$ 1,574,965	$ 471,930	11.5%	$ 126,849	$ 598,779	73.0962827%	E18 * F18	$ 437,685	
19	Non Residential Energy Efficienct ITEE	107	2,462,027	$ 777,601	$ 285,430	11.5%	$ 56,600	$ 342,030	73.0962827%	E19 * F19	$ 250,011	
20	Non Residential Smart Saver Energy Efficienct Process Equipment Products	50	313,131	$ 279,184	$ 125,947	11.5%	$ 17,622	$ 143,569	73.0962827%	E20 * F20	$ 104,944	
21	Smart $aver(R) Non Residential Performance Incentive Program	-	-	$ -	$ 35,670	11.5%	$ (4,102)	$ 31,568	73.0962827%	E21 * F21	$ 23,075	
22	Small Business Energy Saver	16,110	85,687,928	$ 55,685,830	$ 15,360,852	11.5%	$ 4,637,372	$ 19,998,224	73.0962827%	E22 * F22	$ 14,617,959	
23	Smart Energy in Offices	3,505	16,842,267	$ 1,843,559	$ 1,061,729	11.5%	$ 89,911	$ 1,151,640	73.0962827%	E23 * F23	$ 841,806	
24	Business Energy Report	388	5,561,349	$ 302,497	$ 263,169	11.5%	$ -	$ 263,169	73.0962827%	E24 * F24	$ 192,367	
25	Total for Non-Residential Conservation Programs	60,480	356,937,707	$ 235,273,030	$ 68,416,596		$ 19,171,918	$ 87,588,514			$ 64,023,948	
									NC Non-Residential Peak Demand Allocation Factor			
26	Total DSM Programs(2)	825,492	718,623	$ 98,643,760	$ 28,406,298	11.5%	$ 8,077,308	$ 36,483,606	40.8166437%		$ 14,891,384	
27	Total Non-Residential Revenue Requirement	885,972	357,656,330	$ 333,916,790	$ 96,822,894		$ 27,249,226	$ 124,072,120			$ 78,915,332	
28	Total All Programs	1,804,245	801,179,074	$ 565,222,040	$ 179,980,405		$ 44,494,099	$ 224,474,504			$ 137,968,074	$ (1,204)

	Total DSM Program Breakdown								NC Non-Residential Peak Demand Allocation Factor		
28	Power Manager (Residential)	455,393	-	$ 54,179,776	$ 13,644,970	11.5%	$ 4,661,503	$ 18,306,473			
29	EnergyWise for Business	1,199	718,623	$ 574,590	$ 470,304	11.5%	$ 11,993	$ 482,297			
30	PowerShare®	368,900	-	$ 43,889,394	$ 14,291,024	11.5%	$ 3,403,812	$ 17,694,836			
31	Total DSM Programs	825,492	718,623	$ 98,643,760	$ 28,406,298		$ 8,077,308	$ 36,483,606	74.6139917%	$ 27,221,875	

(1) My Home Energy Report impacts reflect cumulative capability as of end of vintage year, including impacts for participants from prior vintages
(2) Total System DSM programs allocated to Residential and Non-Residential based on contribution to retail system peak

/A

Duke Energy Carolinas
Fields Exhibit 1
Vintage 2017 True Up - January 1, 2017 to December 31, 2017
Docket Number E-7 Sub 1285
Load Impacts and Estimated Revenue Requirements by Program

#	Program	System kW Reduction - Summer Peak	System Energy Reduction (kWh)	A System NPV of Avoided Costs	B Total Cost	C Shared Savings %	D =(A-B)*C Incentive	E = (B+D) System Revenue Requirement	F NC Retail kWh Sales Allocation Factor	G NC Allocation Factor (2)		H NC Residential Revenue Requirement	NC Residential Adjusted Revenue Requirement
	Residential Programs												
	EE Programs												
1	Appliance Recycling Program				$ 5,307	11.5%	$ (610)	$ 4,697	72.8087506%		E1 * F1	$ 3,420	
2	Energy Efficiency Education	1,393	5,932,086	$ 3,597,724	$ 2,077,611	11.5%	$ 174,813	$ 2,252,424	72.8087506%		E2 * F2	$ 1,639,962	
3	Energy Efficient Appliances and Devices	24,605	137,909,103	$ 105,352,687	$ 30,340,728	11.5%	$ 8,626,375	$ 38,967,103	72.8087506%		E3 * F3	$ 28,371,461	
4	HVAC Energy Efficiency	1,850	6,712,977	$ 7,287,263	$ 7,403,327	11.5%	$ (13,347)	$ 7,389,980	72.8087506%		E4 * F4	$ 5,380,552	
5	Income Qualified Energy Efficiency and Weatherization Assistance	771	5,341,624	$ 3,185,867	$ 5,505,992	0.0%	$ -	$ 5,505,992	72.8087506%		E5 * F5	$ 4,008,844	
6	Multi-Family Energy Efficiency	2,056	19,038,529	$ 13,539,656	$ 3,168,422	11.5%	$ 1,192,692	$ 4,361,114	72.8087506%		E6 * F6	$ 3,175,272	
7	Energy Assessments	1,040	7,720,549	$ 6,602,773	$ 2,909,098	11.5%	$ 424,773	$ 3,333,871	72.8087506%		E7 * F7	$ 2,427,350	
8	Total for Residential Conservation Programs	31,715	182,654,868	$ 139,565,970	$ 51,410,486		$ 10,404,695	$ 61,815,181				$ 45,006,861	
9	My Home Energy Report	76,632	307,515,903	$ 21,434,622	$ 13,812,250	11.5%	$ 876,573	$ 14,688,823	72.8087506%		E9 * F9	$ 10,694,748	$ (24,596)
10	Total Residential Conservation and Behavioral Programs	108,347	490,170,771	$ 161,000,592	$ 65,222,736		$ 11,281,268	$ 76,504,004				$ 55,701,609	$ (24,596)
									NC Residential Peak Demand Allocation Factor				
11	Total DSM Programs(2)	846,941	2,943,906	$ 105,087,510	$ 29,822,652	11.5%	$ 8,655,459	$ 38,478,111		33.807510%	E11 * F11	$ 13,008,491	
12	Total Residential	955,288	493,114,677	$ 266,088,102	$ 95,045,388		$ 19,936,727	$ 114,982,115				$ 68,710,100	
		System kW Reduction - Summer Peak	System Energy Reduction (kWh)	System NPV of Avoided Costs	Total Cost	Shared Savings %	Incentive	System Revenue Requirement	NC Retail kWh Sales Allocation Factor			NC Non-Residential Revenue Requirement	
	Non-Residential Programs												
	EE Programs												
13	Non Residential Smart Saver Custom Technical Assessments	1,627	15,791,732	$ 10,272,302	$ 2,139,875	11.5%	$ 935,229	$ 3,075,104	72.8087506%		E12 * F12	$ 2,238,945	
14	Non Residential Smart Saver Custom	6,010	40,609,855	$ 34,693,083	$ 7,304,838	11.5%	$ 3,149,648	$ 10,454,486	72.8087506%		E13 * F13	$ 7,611,781	
15	Non Residential Smart Saver Energy Efficienct Food Service Products	112	1,383,542	$ 959,251	$ 306,488	11.5%	$ 75,068	$ 381,556	72.8087506%		E14 * F14	$ 277,806	
16	Non Residential Smart Saver Energy Efficienct HVAC Products	894	2,954,877	$ 2,958,336	$ 1,560,769	11.5%	$ 160,720	$ 1,721,489	72.8087506%		E16 * F16	$ 1,253,395	
17	Non Residential Smart Saver Energy Efficienct Lighting Products	47,322	270,572,885	$ 240,054,511	$ 66,689,770	11.5%	$ 19,936,945	$ 86,626,715	72.8087506%		E17 * F17	$ 63,071,829	
18	Non Residential Smart Saver Energy Efficienct Pumps and Drives Products	687	4,806,849	$ 3,070,044	$ 528,937	11.5%	$ 292,227	$ 821,164	72.8087506%		E18 * F18	$ 597,879	
19	Non Residential Energy Efficient ITEE	-	2,945	$ 523	$ 61,215	11.5%	$ (6,980)	$ 54,235	72.8087506%		E19 * F19	$ 39,488	
20	Non Residential Smart Saver Energy Efficienct Process Equipment Products	99	651,289	$ 530,295	$ 162,413	11.5%	$ 42,306	$ 204,719	72.8087506%		E20 * F20	$ 149,054	
21	Smart $aver(R) Non Residential Performance Incentive Program	3	12,373	$ 8,958	$ 320,559	11.5%	$ (35,834)	$ 284,725	72.8087506%		E21 * F21	$ 207,305	
22	Small Business Energy Saver	17,263	90,297,362	$ 63,169,894	$ 17,350,972	11.5%	$ 5,269,176	$ 22,620,148	72.8087506%		E22 * F22	$ 16,469,447	
23	Smart Energy in Offices	2,138	10,272,154	$ 1,067,480	$ 891,010	11.5%	$ 20,294	$ 911,304	72.8087506%		E23 * F23	$ 663,509	
24	Business Energy Report	3	42,398	$ 696	$ 126,680	11.5%	$ -	$ 126,680	72.8087506%		E24 * F24	$ 92,234	
25	Total for Non-Residential Conservation Programs	76,158	437,398,260	$ 356,785,373	$ 97,443,527		$ 29,838,800	$ 127,282,328				$ 92,672,672	
									NC Non-Residential Peak Demand Allocation Factor				
26	Total DSM Programs(2)	846,941	2,943,906	$ 105,087,510	$ 29,822,652	11.5%	$ 8,655,459	$ 38,478,111	40.0747013%			$ 15,419,988	
27	Total Non-Residential Revenue Requirement	923,098	440,342,166	$ 461,872,882	$ 127,266,180		$ 38,494,259	$ 165,760,439				$ 108,092,660	
28	Total All Programs	1,878,386	933,456,843	$ 727,960,984	$ 222,311,568		$ 58,430,986	$ 280,742,553				$ 176,802,760	$ (24,596)
	Total DSM Program Breakdown								NC Non-Residential Peak Demand Allocation Factor				
28	Power Manager (Residential)	501,118	-	$ 61,074,105	$ 14,021,500	11.5%	$ 5,411,050	$ 19,432,549					
29	EnergyWise for Business	5,453	2,943,906	$ 2,530,761	$ 2,484,618	11.5%	$ 5,306	$ 2,489,924					
30	PowerShare®	340,369	-	$ 41,482,644	$ 13,316,535	11.5%	$ 3,239,103	$ 16,555,638					
31	Total DSM Programs	846,941	2,943,906	$ 105,087,510	$ 29,822,652		$ 8,655,459	$ 38,478,111	73.8822117%			$ 28,428,479	

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Fields Exhibit 1
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Load Impacts and Estimated Revenue Requirements by Program

				A	B	C	D	E	F	G		H
							=(A-B)*C	= (B+D)				
	Residential Programs	System kW Reduction - Summer	System Energy Reduction (kWh)	System NPV of Avoided Costs	Total Cost	Shared Savings %	Incentive	System Revenue Requirement	NC Retail kWh Sales Allocation Factor	NC Allocation Factor (2)		NC Residential Revenue Requirement
	EE Programs											
1	Energy Efficiency Education	967	5,530,707	$ 2,863,491	$ 1,992,260	11.5%	$ 100,192	$ 2,092,451	72.7130507%		E1 * F1	$ 1,521,485
2	Energy Efficient Appliances and Devices	35,125	194,356,910	$ 137,695,195	$ 42,687,244	11.5%	$ 10,925,914	$ 53,613,158	72.7130507%		E2 * F2	$ 38,983,763
3	HVAC Energy Efficiency	1,640	6,367,174	$ 7,088,494	$ 6,955,146	11.5%	$ 15,335	$ 6,970,481	72.7130507%		E3 * F3	$ 5,068,449
4	Low Income Energy Efficiency and Weatherization Assistance	888	6,845,653	$ 4,253,631	$ 6,490,735	0.0%	$ -	$ 6,490,735	72.7130507%		E4 * F4	$ 4,719,611
5	Multi-Family Energy Efficiency	2,336	20,923,363	$ 13,614,922	$ 3,604,921	11.5%	$ 1,151,150	$ 4,756,071	72.7130507%		E5 * F5	$ 3,458,285
6	Residential Energy Assessments	929	7,716,668	$ 5,756,868	$ 2,836,229	11.5%	$ 335,874	$ 3,172,102	72.7130507%		E6 * F6	$ 2,306,532
7	Total for Residential Conservation Programs	41,885	241,740,474	$ 171,272,602	$ 64,566,534		$ 12,528,465	$ 77,094,999				$ 56,058,125
8	My Home Energy Report	93,425	340,819,517	$ 22,236,642	$ 12,765,286	11.5%	$ 1,089,206	$ 13,854,492	72.7130507%		E8 * F8	$ 10,074,024
9	Total Residential Conservation and Behavioral Programs	135,309	582,559,991	$ 193,509,244	$ 77,331,820		$ 13,617,671	$ 90,949,491				$ 66,132,149
									NC Residential Peak Demand Allocation Factor			
10	Power Manager®	533,506	-	$ 61,923,998	$ 14,423,610	11.5%	$ 5,462,545	$ 19,886,154	73.6287551%	43.675154%	(E10+E26) *F10 *G10	$ 12,360,441
11	Total Residential	668,816	582,559,991	$ 255,433,242	$ 91,755,430		$ 19,080,215	$ 110,835,645				$ 78,492,590
	Non-Residential Programs	System kW Reduction - Summer Peak	System Energy Reduction (kWh)	System NPV of Avoided Costs	Total Cost	Shared Savings %	Incentive	System Revenue Requirement	NC Retail kWh Sales Allocation Factor			NC Non-Residential Revenue Requirement
	EE Programs											
12	Non Residential Smart Saver Custom Technical Assessments	13	83,588	$ 67,306	$ 407,293	11.5%	$ (39,099)	$ 368,195	72.7130507%		E12 * F12	$ 267,726
13	Non Residential Smart Saver Custom	4,054	30,333,040	$ 23,321,911	$ 6,068,902	11.5%	$ 1,984,096	$ 8,052,998	72.7130507%		E13 * F13	$ 5,855,580
14	Non Residential Smart Saver Energy Efficienct Food Service Products	59	744,066	$ 433,191	$ 235,605	11.5%	$ 22,722	$ 258,327	72.7130507%		E14 * F14	$ 187,838
15	Non Residential Smart Saver Energy Efficienct HVAC Products	893	2,908,386	$ 2,810,153	$ 1,620,748	11.5%	$ 136,782	$ 1,757,530	72.7130507%		E16 * F16	$ 1,277,953
16	Non Residential Smart Saver Energy Efficienct Lighting Products	31,548	177,845,339	$ 146,378,119	$ 25,872,380	11.5%	$ 13,858,160	$ 39,730,540	72.7130507%		E17 * F17	$ 28,889,288
17	Non Residential Smart Saver Energy Efficienct Pumps and Drives Products	421	2,669,016	$ 1,617,740	$ 277,785	11.5%	$ 154,095	$ 431,880	72.7130507%		E18 * F18	$ 314,033
18	Non Residential Energy Efficienct ITEE	-	17,639	$ 3,025	$ 36,875	11.5%	$ (3,893)	$ 32,982	72.7130507%		E19 * F19	$ 23,982
19	Non Residential Smart Saver Energy Efficienct Process Equipment Products	75	331,222	$ 226,724	$ 67,509	11.5%	$ 18,310	$ 85,819	72.7130507%		E20 * F20	$ 62,402
20	Smart $aver(R) Non Residential Performance Incentive Program	168	3,271,186	$ 1,671,783	$ 479,610	11.5%	$ 137,100	$ 616,710	72.7130507%		E21 * F21	$ 448,429
21	Small Business Energy Saver	13,374	76,696,523	$ 46,832,675	$ 15,977,993	11.5%	$ 3,548,288	$ 19,526,282	72.7130507%		E22 * F22	$ 14,198,155
22	Smart Energy in Offices	310	1,488,592	$ 143,284	$ 219,748	11.5%	$ (8,793)	$ 210,954	72.7130507%		E23 * F23	$ 153,391
23	Total for Non-Residential Conservation Programs	50,914	296,388,596	$ 223,505,910	$ 51,264,448		$ 19,807,768	$ 71,072,216				$ 51,678,777
									NC Non-Residential Peak Demand Allocation Factor			
24	EnergyWise for Business	7,999	2,599,904	$ 2,279,951	$ 3,062,816	11.5%	$ (90,029)	$ 2,972,787	73.6287551%			
25	PowerShare®	332,631	-	$ 36,012,634	$ 12,922,977	11.5%	$ 2,655,311	$ 15,578,288	73.6287551%			
26	Total for Non-Residential DSM Programs	340,629	2,599,904	$ 38,292,585	$ 15,985,794		$ 2,565,281	$ 18,551,075	73.6287551%	56.324846%	(E10+E26) *F26 *G26	$ 15,940,412
27	Total Non Residential	391,543.87415	298,988,500	$ 261,798,495	$ 67,250,242		$ 22,373,049	$ 89,623,291				$ 67,619,189
28	Total All Programs	1,060,360	881,548,492	$ 517,231,737	$ 159,005,671		$ 41,453,264	$ 200,458,936				$ 146,111,779

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				A	B	C	D =(A-B)*C	E = (B+D)	F	G		H
	Residential Programs	System kW Reduction - Summer Peak	System Energy Reduction (kWh)	System NPV of Avoided Costs	Total Cost	Shared Savings %	Incentive	System Revenue Requirement	NC Retail kWh Sales Allocation Factor	NC Allocation Factor (2)		NC Residential Revenue Requirement
	EE Programs											
1	Energy Efficiency Education	841	6,713,787	$ 2,519,645	$ 1,644,077	11.5%	$ 100,690	$ 1,744,767	73.0903918%		E1 * F1	$ 1,275,257
2	Energy Efficient Appliances and Devices	31,844	187,571,870	$ 102,716,013	$ 40,433,533	11.5%	$ 7,162,485	$ 47,596,018	73.0903918%		E2 * F2	$ 34,788,116
3	HVAC Energy Efficiency	2,029	7,329,114	$ 7,079,940	$ 7,402,907	11.5%	$ (37,141)	$ 7,365,766	73.0903918%		E3 * F3	$ 5,383,667
4	Low Income Energy Efficiency and Weatherization Assistance	967	6,442,193	$ 2,800,084	$ 7,344,325	0.0%	$ -	$ 7,344,325	73.0903918%		E4 * F4	$ 5,367,996
5	Multi-Family Energy Efficiency	2,610	21,339,210	$ 10,815,659	$ 3,681,262	11.5%	$ 820,456	$ 4,501,718	73.0903918%		E5 * F5	$ 3,290,323
6	Residential Energy Assessments	946	7,886,916	$ 4,413,585	$ 3,153,757	11.5%	$ 144,880	$ 3,298,637	73.0903918%		E6 * F6	$ 2,410,987
7	Total for Residential Conservation Programs	39,238	237,283,091	$ 130,344,926	$ 63,659,861		$ 8,191,370	$ 71,851,232				$ 52,516,346
8	My Home Energy Report	89,435	325,184,686	$ 22,952,523	$ 10,558,344	11.5%	$ 1,425,331	$ 11,983,674	73.0903918%		E8 * F8	$ 8,758,914
9	Total Residential Conservation and Behavioral Programs	128,672	562,467,777	$ 153,297,448	$ 74,218,205		$ 9,616,701	$ 83,834,906				$ 61,275,260
									NC Residential Peak Demand Allocation Factor			
10	Power Manager®	568,235	-	$ 69,783,157	$ 13,386,942	11.5%	$ 6,485,565	$ 19,872,507	74.2414264%	45.955615%	(E10+E26) *F10 *G10	$ 13,609,686
11	Total Residential	696,908	562,467,777	$ 223,080,605	$ 87,605,147		$ 16,102,266	$ 103,707,413				$ 74,884,946

	Non-Residential Programs	System kW Reduction - Summer Peak	System Energy Reduction (kWh)	System NPV of Avoided Costs	Total Cost	Shared Savings %	Incentive	System Revenue Requirement	NC Retail kWh Sales Allocation Factor			NC Non-Residential Revenue Requirement
	EE Programs											
12	Non Residential Energy Efficienct ITEE	-	11,262	$ 1,385	$ 44,335	11.5%	$ (4,939)	$ 39,395	73.0903918%		E12 * F12	$ 28,794
13	Non Residential Smart Saver Custom	10,109	52,522,612	$ 35,884,367	$ 8,873,872	11.5%	$ 3,106,207	$ 11,980,079	73.0903918%		E13 * F13	$ 8,756,287
14	Non Residential Smart Saver Custom Technical Assessments	148	1,930,762	$ 691,285	$ 296,006	11.5%	$ 45,457	$ 341,463	73.0903918%		E14 * F14	$ 249,577
15	Non Residential Smart Saver Energy Efficient Food Service Products	77	985,314	$ 406,024	$ 339,996	11.5%	$ 7,593	$ 347,589	73.0903918%		E16 * F16	$ 254,054
16	Non Residential Smart Saver Energy Efficient HVAC Products	1,697	7,535,327	$ 5,519,013	$ 2,208,364	11.5%	$ 380,725	$ 2,589,088	73.0903918%		E17 * F17	$ 1,892,375
17	Non Residential Smart Saver Energy Efficienct Lighting Products	29,566	163,560,290	$ 105,608,459	$ 20,834,766	11.5%	$ 9,748,975	$ 30,583,741	73.0903918%		E18 * F18	$ 22,353,776
18	Non Residential Smart Saver Energy Efficienct Process Equipment Products	111	732,043	$ 416,343	$ 119,843	11.5%	$ 34,097	$ 153,941	73.0903918%		E19 * F19	$ 112,516
19	Non Residential Smart Saver Energy Efficient Pumps and Drives Products	232	1,464,266	$ 722,433	$ 189,172	11.5%	$ 61,325	$ 250,497	73.0903918%		E20 * F20	$ 183,089
20	Smart $aver(R) Non Residential Performance Incentive Program	391	4,545,995	$ 2,238,186	$ 785,165	11.5%	$ 167,097	$ 952,262	73.0903918%		E21 * F21	$ 696,012
21	Small Business Energy Saver	10,403	57,747,534	$ 28,628,598	$ 11,421,399	11.5%	$ 1,978,828	$ 13,400,227	73.0903918%		E22 * F22	$ 9,794,278
22	Smart Energy in Offices	-	-	$ -	$ -	11.5%	$ -	$ -	73.0903918%		E23 * F23	$ -
23	Total for Non-Residential Conservation Programs	52,735	291,035,406	$ 180,116,093	$ 45,112,917		$ 15,525,365	$ 60,638,283				$ 44,320,758
									NC Non-Residential Peak Demand Allocation Factor			
24	EnergyWise for Business	11,714	5,135,154	$ 3,395,640	$ 3,687,462	11.5%	$ (33,560)	$ 3,653,902	74.2414264%			
25	PowerShare®	342,590	-	$ 42,072,382	$ 13,022,816	11.5%	$ 3,340,700	$ 16,363,516	74.2414264%			
26	Total for Non-Residential DSM Programs	354,304	5,135,154	$ 45,468,022	$ 16,710,278		$ 3,307,141	$ 20,017,419	74.2414264%	54.044385%	(E10+E26) *F26 *G26	$ 16,005,163
27	Total Non Residential	407,039	296,170,559	$ 225,584,116	$ 61,823,195		$ 18,832,506	$ 80,655,701				$ 60,325,921
28	Total All Programs	1,103,947	858,638,336	$ 448,664,721	$ 149,428,343		$ 34,934,771	$ 184,363,114				$ 135,210,868

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				A	B	C	D =(A-B)*C	E = (B+D)	F	G		H
	Residential Programs	System kW Reduction - Summer Peak	System Energy Reduction (kWh)	System NPV of Avoided Costs	Total Cost	Shared Savings %	Incentive	System Revenue Requirement	NC Retail kWh Sales Allocation Factor	NC Allocation Factor (2)		NC Residential Revenue Requirement
	EE Programs											
1	Energy Efficiency Education	(276)	4,746,423	$ 1,234,203	$ 1,113,485	11.5%	$ 13,883	$ 1,127,367	73.2212736%		E1 * F1	$ 825,473
2	Energy Efficient Appliances and Devices	16,975	110,986,906	$ 62,028,986	$ 22,124,101	11.5%	$ 4,589,062	$ 26,713,163	73.2212736%		E2 * F2	$ 19,559,718
3	HVAC Energy Efficiency	2,190	7,689,428	$ 7,811,427	$ 7,538,303	11.5%	$ 31,409	$ 7,569,712	73.2212736%		E3 * F3	$ 5,542,640
4	Low Income Energy Efficiency and Weatherization Assistance	214	1,238,118	$ 773,651	$ 2,787,490	0.0%	$ -	$ 2,787,490	73.2212736%		E4 * F4	$ 2,041,036
5	Multi-Family Energy Efficiency	522	4,042,084	$ 2,156,883	$ 1,613,839	11.5%	$ 62,450	$ 1,676,289	73.2212736%		E5 * F5	$ 1,227,400
6	Residential Energy Assessments	944	7,891,628	$ 4,582,748	$ 3,358,880	11.5%	$ 140,745	$ 3,499,625	73.2212736%		E6 * F6	$ 2,562,470
7	Total for Residential Conservation Programs	20,570	136,594,586	$ 78,587,898	$ 38,536,099		$ 4,837,548	$ 43,373,647				$ 31,758,737
8	My Home Energy Report	90,279	328,510,581	$ 23,467,660	$ 12,749,651	11.5%	$ 1,232,571	$ 13,982,222	73.2212736%		E8 * F8	$ 10,237,961
9	Total Residential Conservation and Behavioral Programs	110,849	465,105,167	$ 102,055,558	$ 51,285,750		$ 6,070,119	$ 57,355,869				$ 41,996,698
									NC Residential Peak Demand Allocation Factor			
10	Power Manager®	593,227	-	$ 74,785,083	$ 14,303,277	11.5%	$ 6,955,408	$ 21,258,684	74.1953449%	45.442653%	(E10+E26) *F10 *G10	$ 13,099,702
11	Total Residential	704,075	465,105,167	$ 176,840,640	$ 65,589,027		$ 13,025,527	$ 78,614,554				$ 55,096,400
	Non-Residential Programs	System kW Reduction - Summer Peak	System Energy Reduction (kWh)	System NPV of Avoided Costs	Total Cost	Shared Savings %	Incentive	System Revenue Requirement	NC Retail kWh Sales Allocation Factor			NC Non-Residential Revenue Requirement
	EE Programs											
12	Non Residential Energy Efficienct ITEE	-	9,917	$ 1,734	$ 15,179	11.5%	$ (1,546)	$ 13,632	73.2212736%		E12 * F12	$ 9,982
13	Non Residential Smart Saver Custom	4,785	21,156,703	$ 15,898,503	$ 5,771,790	11.5%	$ 1,164,572	$ 6,936,362	73.2212736%		E13 * F13	$ 5,078,893
14	Non Residential Smart Saver Custom Technical Assessments	76	1,413,836	$ 518,862	$ 330,629	11.5%	$ 21,647	$ 352,275	73.2212736%		E14 * F14	$ 257,941
15	Non Residential Smart Saver Energy Efficienct Food Service Products	33	479,609	$ 216,824	$ 533,411	11.5%	$ (36,407)	$ 497,004	73.2212736%		E16 * F16	$ 363,912
16	Non Residential Smart Saver Energy Efficienct HVAC Products	1,683	9,273,190	$ 7,425,418	$ 2,450,713	11.5%	$ 572,091	$ 3,022,804	73.2212736%		E17 * F17	$ 2,213,336
17	Non Residential Smart Saver Energy Efficienct Lighting Products	18,365	109,556,031	$ 71,995,510	$ 13,098,851	11.5%	$ 6,773,116	$ 19,871,967	73.2212736%		E18 * F18	$ 14,550,507
18	Non Residential Smart Saver Energy Efficienct Process Equipment Products	206	567,122	$ 236,299	$ 29,681	11.5%	$ 23,761	$ 53,442	73.2212736%		E19 * F19	$ 39,131
19	Non Residential Smart Saver Energy Efficienct Pumps and Drives Products	225	1,403,243	$ 758,367	$ 167,464	11.5%	$ 67,954	$ 235,418	73.2212736%		E20 * F20	$ 172,376
20	Smart $aver(R) Non Residential Performance Incentive Program	223	5,961,326	$ 2,035,780	$ 751,724	11.5%	$ 147,666	$ 899,391	73.2212736%		E21 * F21	$ 658,545
21	Small Business Energy Saver	5,718	30,315,123	$ 15,587,393	$ 6,933,130	11.5%	$ 995,240	$ 7,928,370	73.2212736%		E22 * F22	$ 5,805,254
22	Smart Energy in Offices	-	-	$ -	$ -	11.5%	$ -	$ -	73.2212736%		E23 * F23	$ -
23	Total for Non-Residential Conservation Programs	31,314	180,136,100	$ 114,674,690	$ 30,082,573		$ 9,728,094	$ 39,810,666				$ 29,149,877
									NC Non-Residential Peak Demand Allocation Factor			
24	EnergyWise for Business	11,854	2,602,452	$ 2,504,602	$ 2,941,282	11.5%	$ (50,218)	$ 2,891,064	74.1953449%			
25	PowerShare®	276,583	-	$ 34,867,428	$ 12,082,697	11.5%	$ 2,620,244	$ 14,702,941	74.1953449%			
26	Total for Non-Residential DSM Programs	288,437	2,602,452	$ 37,372,030	$ 15,023,979		$ 2,570,026	$ 17,594,004	74.1953449%	54.557347%	(E10+E26) *F26 *G26	$ 15,727,184
27	Total Non Residential	319,751	182,738,552	$ 152,046,720	$ 45,106,551		$ 12,298,119	$ 57,404,671				$ 44,877,061
28	Total All Programs	1,023,826	647,843,719	$ 328,887,360	$ 110,695,578		$ 25,323,646	$ 136,019,225				$ 99,973,461

(1) My Home Energy Report impacts reflect cumulative capability as of end of vintage year, including impacts for participants from prior vintages
(2) Total System DSM programs allocated to Residential and Non-Residential based on contribution to retail system peak

/A

Duke Energy Carolinas
Fields Exhibit 1
Vintage 2021 True Up - January 1, 2021 to December 31, 2021
Docket Number E-7 Sub 1285
Load Impacts and Estimated Revenue Requirements by Program

Residential Programs

					A	B	C	D =(A-B)*C	E = (B+D)	F	G		H
	Residential Programs	System kW Reduction - Summer Peak	System kW Reduction - Winter Peak	System Energy Reduction (kWh)	System NPV of Avoided Costs	Total Cost	Shared Savings %	Incentive	System Revenue Requirement	NC Retail kWh Sales Allocation Factor	NC Allocation Factor (2)		NC Residential Revenue Requirement
	EE Programs												
1	Energy Efficiency Education	(1,192)	40	7,013,162	$ 1,513,478	$ 1,147,501	11.5%	$ 42,087	$ 1,189,588	73.5233682%		E1 * F1	$ 874,625
2	Energy Efficient Appliances and Devices	8,813	6,584	51,700,635	$ 25,474,094	$ 10,824,171	11.5%	$ 1,684,741	$ 12,508,912	73.5233682%		E2 * F2	$ 9,196,973
3	Residential Smart $aver Energy Efficiency	2,556	2,713	9,425,675	$ 8,402,753	$ 8,156,036	11.5%	$ 28,372	$ 8,184,408	73.5233682%		E3 * F3	$ 6,017,453
4	Low Income Energy Efficiency and Weatherization Assistance	325	376	1,599,643	$ 1,077,736	$ 4,634,161	0.0%	$ -	$ 4,634,161	73.5233682%		E4 * F4	$ 3,407,192
5	Multi-Family Energy Efficiency	302	361	2,080,199	$ 1,020,435	$ 517,454	11.5%	$ 57,843	$ 575,296	73.5233682%		E5 * F5	$ 422,977
6	Residential Energy Assessments	748	573	6,590,951	$ 3,278,832	$ 3,326,179	11.5%	$ (5,445)	$ 3,320,734	73.5233682%		E6 * F6	$ 2,441,516
7	Total for Residential Conservation Programs	11,552	10,646	78,410,264	$ 40,767,328	$ 28,605,502		$ 1,807,599	$ 30,413,100				$ 22,360,736
8	My Home Energy Report	64,713	51,826	348,783,481	$ 18,281,223	$ 7,072,233	11.5%	$ 1,289,034	$ 8,361,267	73.5233682%		E8 * F8	$ 6,147,485
9	Total Residential Conservation and Behavioral Programs	76,266	62,472	427,193,746	$ 59,048,551	$ 35,677,734		$ 3,096,633	$ 38,774,367				$ 28,508,221
										NC Residential Peak Demand Allocation Factor			
10	Power Manager®	456,664	-	-	$ 57,584,854	$ 16,829,058	11.5%	$ 4,686,917	$ 21,515,975	74.3563771%	47.000070%	(E10+E26) *F10 *G10	$ 14,259,587
11	Total Residential	532,929	62,472	427,193,746	$ 116,633,405	$ 52,506,792		$ 7,783,549	$ 60,290,342				$ 42,767,808

Non-Residential Programs

	Non-Residential Programs	System kW Reduction - Summer Peak	System kW Reduction - Winter Peak	System Energy Reduction (kWh)	System NPV of Avoided Costs	Total Cost	Shared Savings %	Incentive	System Revenue Requirement	NC Retail kWh Sales Allocation Factor			NC Non-Residential Revenue Requirement
	EE Programs												
12	Non Residential Energy Efficienct ITEE	-	-	2,353	$ 416	$ 74,699	11.5%	$ (8,543)	$ 66,156	73.5233682%		E12 * F12	$ 48,640
13	Non Residential Smart Saver Custom	6,572	4,125	30,798,533	$ 19,324,372	$ 7,505,201	11.5%	$ 1,359,205	$ 8,864,406	73.5233682%		E13 * F13	$ 6,517,410
14	Non Residential Smart Saver Custom Technical Assessments	110	6	921,248	$ 432,158	$ 293,539	11.5%	$ 15,941	$ 309,480	73.5233682%		E14 * F14	$ 227,540
15	Non Residential Smart Saver Energy Efficienct Food Service Products	82	78	1,221,948	$ 490,896	$ 203,130	11.5%	$ 33,093	$ 236,223	73.5233682%		E16 * F16	$ 173,679
16	Non Residential Smart Saver Energy Efficienct HVAC Products	3,327	5,263	21,060,332	$ 14,904,327	$ 4,899,800	11.5%	$ 1,150,521	$ 6,050,320	73.5233682%		E17 * F17	$ 4,448,399
17	Non Residential Smart Saver Energy Efficienct Lighting Products	20,321	19,280	116,765,282	$ 68,937,962	$ 17,924,291	11.5%	$ 5,866,572	$ 23,790,863	73.5233682%		E18 * F18	$ 17,491,844
18	Non Residential Smart Saver Energy Efficienct Process Equipment Products	117	117	824,803	$ 257,010	$ 87,540	11.5%	$ 19,489	$ 107,029	73.5233682%		E19 * F19	$ 78,691
19	Non Residential Smart Saver Energy Efficienct Pumps and Drives Products	239	244	1,522,100	$ 666,967	$ 202,615	11.5%	$ 53,401	$ 256,016	73.5233682%		E20 * F20	$ 188,231
20	Smart $aver(R) Non Residential Performance Incentive Program	1,039	1,014	8,247,437	$ 4,200,059	$ 342,826	11.5%	$ 443,582	$ 786,408	73.5233682%		E21 * F21	$ 578,193
21	Small Business Energy Saver	6,325	7,486	35,056,241	$ 16,391,449	$ 8,935,952	11.5%	$ 857,382	$ 9,793,334	73.5233682%		E22 * F22	$ 7,200,389
22	Smart Energy in Offices	-	-	-	$ -	$ -	11.5%	$ -	$ -	73.5233682%		E23 * F23	$ -
23	Total for Non-Residential Conservation Programs	38,133	37,612	216,420,278	$ 125,605,617	$ 40,469,592		$ 9,790,643	$ 50,260,235				$ 36,953,016
										NC Non-Residential Peak Demand Allocation Factor			
24	EnergyWise for Business	11,564	232	1,436,361	$ 1,964,689	$ 2,463,194	11.5%	$ (57,328)	$ 2,405,866	74.3563771%			
25	PowerShare®	335,086	311,630	-	$ 42,254,098	$ 13,583,912	11.5%	$ 3,297,071	$ 16,880,983	74.3563771%			
26	Total for Non-Residential DSM Programs	346,651	311,862	1,436,361	$ 44,218,787	$ 16,047,106		$ 3,239,743	$ 19,286,849	74.3563771%	52.999930%	(E10+E26) *F26 *G26	$ 16,079,915
27	Total Non Residential	384,784	349,474	217,856,640	$ 169,824,404	$ 56,516,699		$ 13,030,386	$ 69,547,085				$ 53,032,931
28	Total All Programs	917,713	411,947	645,050,386	$ 286,457,809	$ 109,023,491		$ 20,813,936	$ 129,837,426				$ 95,800,739

(1) My Home Energy Report impacts reflect cumulative capability as of end of vintage year, including impacts for participants from prior vintages
(2) Total System DSM programs allocated to Residential and Non-Residential based on contribution to retail system peak

/A

Duke Energy Carolinas
Fields Exhibit 1
Vintage 2022 True Up - January 1, 2022 to December 31, 2022
Docket Number E-7, Sub 1285
Load Impacts and Estimated Revenue Requirements by Program

					A	B	C	D	E	F	G	H	I
										=A*C*D*UCT Ratio	=(A-B)*C*D		
	Residential Programs	System kW Reduction - Summer Peak	System kW Reduction - Winter Peak	System Energy Reduction (kWh)	System NPV of Avoided Costs	Total Cost	Shared Savings %	NC Retail kWh Sales Allocation Factor	NC Allocated Total Cost	NC PRI	NC PPI	NC PPI Cap Reduction	NC Revenue Requirement
	EE Programs												
1	Energy Efficiency Education	(996)	33	5,862,809	$ 1,329,554	$ 1,092,967	10.6%	73.8925998%	$ 807,622		$ 18,531		$ 826,153
2	Energy Efficient Appliances and Devices	14,451	11,966	95,753,301	$ 50,016,991	$ 16,531,134	10.6%	73.8925998%	$ 12,215,284		$ 2,622,818		$ 14,838,103
3	Low Income Energy Efficiency and Weatherization Assistance	1,053	1,006	3,553,027	$ 3,281,889	$ 7,184,505	10.6%	73.8925998%	$ 5,308,817	$ 156,298			$ 5,465,116
4	Multi-Family Energy Efficiency	737	961	5,374,930	$ 2,788,411	$ 995,923	10.6%	73.8925998%	$ 735,913		$ 140,399		$ 876,312
5	Residential Energy Assessments	581	451	5,120,221	$ 2,720,722	$ 2,497,450	10.6%	73.8925998%	$ 1,845,430		$ 17,488		$ 1,862,918
6	Residential New Construction	163	168	505,459	$ 659,766	$ 397,283	10.6%	73.8925998%	$ 293,563		$ 20,559		$ 314,122
7	Residential Smart $aver Energy Efficiency	2,563	2,626	9,382,811	$ 8,805,522	$ 7,706,916	10.6%	73.8925998%	$ 5,694,840		$ 86,050		$ 5,780,890
8	Total for Residential Conservation Programs	18,553	17,210	125,552,558	$ 69,602,854	$ 36,406,176			$ 26,901,470	$ 156,298	$ 2,905,845	$ -	$ 29,963,614
9	My Home Energy Report	67,095	53,733	361,618,365	$ 18,862,829	$ 6,346,116	10.6%	73.8925998%	$ 4,689,310		$ 980,386		$ 5,669,696
10	Total Residential Conservation and Behavioral Programs	85,647	70,943	487,170,923	$ 88,465,683	$ 42,752,292			$ 31,590,780	$ 156,298	$ 3,886,231	$ -	$ 35,633,310
								NC Residential Peak Demand Allocation Factor					
11	Power Manager®	573,826	12,416	-	$ 73,997,721	$ 17,825,199	10.6%	72.9576004%	$ 13,004,838		$ 4,344,105		$ 17,348,943
12	Total Residential Demand Response Programs	573,826	12,416	-	$ 73,997,721	$ 17,825,199	10.6%	72.9576004%	$ 13,004,838	$ -	$ 4,344,105	$ (904,329)	$ 16,444,614
12	Total Residential	659,473	83,359	487,170,923	$ 162,463,404	$ 60,577,492			$ 44,595,618	$ 156,298	$ 8,230,336	$ (904,329)	$ 52,077,923

	Non-Residential Programs	System kW Reduction - Summer Peak	System kW Reduction - Winter Peak	System Energy Reduction (kWh)	System NPV of Avoided Costs	Total Cost	Shared Savings %	NC Retail kWh Sales Allocation Factor	NC Allocated Total Cost	NC PRI	NC PPI	NC PPI Cap Reduction	NC Revenue Requirement
	EE Programs												
13	Non Residential Energy Efficienct ITEE	-	-	97,843	$ 19,013	$ 22,596	10.6%	73.8925998%	$ 16,697		$ (281)		$ 16,416
14	Non Residential Smart Saver Custom	4,213	3,700	21,230,192	$ 14,657,385	$ 6,629,597	10.6%	73.8925998%	$ 4,898,782		$ 628,786		$ 5,527,567
15	Non Residential Smart Saver Custom Technical Assessments	60	111	822,162	$ 487,004	$ 257,878	10.6%	73.8925998%	$ 190,553		$ 17,947		$ 208,499
16	Non Residential Smart Saver Energy Efficienct Food Service Products	38	34	740,565	$ 297,177	$ 181,831	10.6%	73.8925998%	$ 134,359		$ 9,035		$ 143,394
17	Non Residential Smart Saver Energy Efficienct HVAC Products	2,489	3,018	19,522,815	$ 12,252,034	$ 3,883,081	10.6%	73.8925998%	$ 2,869,310		$ 655,508		$ 3,524,818
18	Non Residential Smart Saver Energy Efficienct Lighting Products	17,215	16,390	94,248,537	$ 60,136,829	$ 16,523,700	10.6%	73.8925998%	$ 12,209,792		$ 3,416,049		$ 15,625,840
	NR E-2, Sub 1180 Adjustment (AEC)					$ 468,065		100.0000000%	$ 468,065		$ -		$ 468,065
19	Non Residential Smart Saver Energy Efficienct Process Equipment Produ	11	12	102,938	$ 40,207	$ 39,696	10.6%	73.8925998%	$ 29,332		$ 40		$ 29,372
20	Non Residential Smart Saver Energy Efficienct Pumps and Drives Product	172	176	1,163,223	$ 512,344	$ 193,125	10.6%	73.8925998%	$ 142,705		$ 25,003		$ 167,708
21	Smart $aver(R) Non Residential Performance Incentive Program	5,485	5,299	3,676,020	$ 9,515,713	$ 2,362,687	10.6%	73.8925998%	$ 1,745,851		$ 560,269		$ 2,306,120
22	Small Business Energy Saver	7,573	8,301	40,074,276	$ 22,073,030	$ 9,384,672	10.6%	73.8925998%	$ 6,934,578		$ 993,830		$ 7,928,408
23	Smart Energy in Offices	-	-	-	$ -	$ -	10.6%	73.8925998%	$ -		$ -		$ -
24	Total for Non-Residential Conservation Programs	37,258	37,043	181,678,572	$ 119,990,735	$ 39,946,926			$ 29,640,022	$ -	$ 6,306,186	$ (137,713)	$ 35,808,495
								NC Non-Residential Peak Demand Allocation Factor					
24	EnergyWise for Business	7,249	464	244,116	$ 1,020,153	$ 2,289,089	10.6%	72.9576004%	$ 1,670,064		$ (98,133)		$ 1,571,931
25	PowerShare®	426,830	396,952	-	$ 54,349,652	$ 17,870,297	10.6%	72.9576004%	$ 13,037,740		$ 2,821,133		$ 15,858,873
26	Total for Non-Residential DSM Programs	434,080	397,416	244,116	$ 55,369,805	$ 20,159,387		72.9576004%	$ 14,707,805	$ -	$ 2,723,000	$ -	$ 17,430,804
27	Total Non Residential	471,338	434,459	181,922,688	$ 175,360,540	$ 60,106,313			$ 44,347,827	$ -	$ 9,029,185	$ (137,713)	$ 53,239,299
28	Total All Programs	1,130,811	517,818	669,093,611	$ 337,823,944	$ 120,683,805			$ 88,943,445	$ 156,298	$ 17,259,521	$ (1,042,042)	$ 105,317,223

(1) My Home Energy Report impacts reflect cumulative capability as of end of vintage year, including impacts for participants from prior vintages
(2) Total System DSM programs allocated to Residential and Non-Residential based on contribution to retail system peak

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Duke Energy Carolinas
Fields Exhibit 1
Vintage 2024 Estimate - January 1, 2024 to December 31, 2024
Docket Number E-7, Sub 1285
Load Impacts and Estimated Revenue Requirements by Program

					A	B	C	D	E	F =A*C*D	G =(A-B)*C*D	H	I
	Residential Programs	System kW Reduction - Summer Peak	System kW Reduction - Winter Peak	System Energy Reduction (kWh)	System NPV of Avoided Costs	Total Cost	Shared Savings %	NC Retail kWh Sales Allocation Factor	NC Allocated Total Cost	NC PRI	NC PPI	NC PPI Cap Reduction	NC Revenue Requirement
	EE Programs												
1	Energy Efficiency Education	(2,021)	67	11,893,795	$ 2,537,623	$ 2,323,870	10.6%	73.8925998%	$ 1,717,168		$ 16,742		$ 1,733,910
2	Energy Efficient Appliances and Devices	3,922	6,893	30,907,435	$ 20,125,871	$ 4,452,044	10.6%	73.8925998%	$ 3,289,731		$ 1,227,671		$ 4,517,401
3	Low Income Energy Efficiency and Weatherization Assistanc	1,555	1,438	5,468,776	$ 5,893,640	$ 8,807,135	10.6%	73.8925998%	$ 6,507,821	$ 461,626			$ 6,969,447
4	Multi-Family Energy Efficiency	1,381	2,632	12,731,495	$ 7,926,573	$ 1,890,393	10.6%	73.8925998%	$ 1,396,861		$ 472,791		$ 1,869,651
5	Residential Energy Assessments	1,673	1,340	15,374,141	$ 8,782,495	$ 7,187,986	10.6%	73.8925998%	$ 5,311,389		$ 124,892		$ 5,436,281
6	Residential New Construction	4,729	4,940	17,649,052	$ 26,461,729	$ 12,879,538	10.6%	73.8925998%	$ 9,517,025		$ 1,063,841		$ 10,580,866
7	Residential Smart $aver Energy Efficiency	1,835	2,028	7,041,190	$ 8,253,222	$ 6,624,441	10.6%	73.8925998%	$ 4,894,971		$ 127,576		$ 5,022,548
8	Total for Residential Conservation Programs	13,073	19,338	101,065,884	$ 79,981,153	$ 44,165,406			$ 32,634,966	461,626	$ 3,033,513	-	$ 36,130,105
9	My Home Energy Report	69,101	55,339	372,429,514	$ 22,583,768	$ 8,168,321	10.6%	73.8925998%	$ 6,035,785		$ 1,129,107		$ 7,164,891
10	Total Residential Conservation and Behavioral Programs	82,174	74,677	473,495,398	$ 102,564,921	$ 52,333,726			$ 38,670,751	$ 461,626	$ 4,162,619	$ -	$ 43,294,996
								NC Residential Peak Demand Allocation Factor					
11	Power Manager®	593,572	65,283	-	$ 109,372,304	$ 24,875,563	10.6%	72.9576004%	$ 18,148,614		$ 6,534,560		$ 24,683,174
12	Total Residential Demand Response Programs	593,572	65,283	-	$ 109,372,304	$ 24,875,563	10.6%	72.9576004%	$ 18,148,614	$ -	$ 6,534,560	$ (2,855,525)	$ 21,827,649
12	Total Residential	675,746	139,960	473,495,398	$ 211,937,225	$ 77,209,289			$ 56,819,365	$ 461,626	$ 10,697,180	$ (2,855,525)	$ 65,122,646

	Non-Residential Programs	System kW Reduction - Summer Peak	System kW Reduction - Winter Peak	System Energy Reduction (kWh)	System NPV of Avoided Costs	Total Cost	Shared Savings %	NC Retail kWh Sales Allocation Factor	NC Allocated Total Cost	NC PRI	NC PPI	NC PPI Cap Reduction	NC Revenue Requirement
	EE Programs												
13	Non Residential Energy Efficienct ITEE	-	-	13,788	$ 2,396	$ 5,467	10.6%	73.8925998%	$ 4,040		$ (241)		$ 3,799
14	Non Residential Smart Saver Custom	7,867	7,867	53,822,292	$ 34,671,581	$ 10,630,183	10.6%	73.8925998%	$ 7,854,918		$ 1,883,070		$ 9,737,989
15	Non Residential Smart Saver Custom Technical Assessments	316	316	2,321,759	$ 1,446,398	$ 631,382	10.6%	73.8925998%	$ 466,545		$ 63,837		$ 530,382
16	Non Residential Smart Saver Energy Efficienct Food Service	97	88	1,482,462	$ 638,463	$ 307,149	10.6%	73.8925998%	$ 226,960		$ 25,951		$ 252,911
17	Non Residential Smart Saver Energy Efficienct HVAC Produc	4,124	6,209	27,291,488	$ 25,568,132	$ 6,621,188	10.6%	73.8925998%	$ 4,892,568		$ 1,484,041		$ 6,376,609
18	Non Residential Smart Saver Energy Efficienct Lighting Prod	26,614	25,300	156,043,327	$ 111,232,897	$ 28,716,935	10.6%	73.8925998%	$ 21,219,690		$ 6,463,158		$ 27,682,848
19	Non Residential Smart Saver Energy Efficienct Process Equip	217	226	1,074,842	$ 481,223	$ 221,687	10.6%	73.8925998%	$ 163,811		$ 20,328		$ 184,139
20	Non Residential Smart Saver Energy Efficienct Pumps and D	221	226	1,423,751	$ 769,342	$ 211,472	10.6%	73.8925998%	$ 156,262		$ 43,696		$ 199,958
21	Smart $aver(R) Non Residential Performance Incentive Prog	3,609	3,609	31,619,073	$ 17,156,413	$ 3,620,233	10.6%	73.8925998%	$ 2,675,084		$ 1,060,237		$ 3,735,321
22	Small Business Energy Saver	10,542	10,279	58,826,567	$ 38,068,318	$ 13,763,928	10.6%	73.8925998%	$ 10,170,524		$ 1,903,669		$ 12,074,194
23	Smart Energy in Offices	-	-	-	$ -	$ -	10.6%	73.8925998%	$ -		$ -		$ -
24	Total for Non-Residential Conservation Programs	53,607	54,119	333,919,349	$ 230,035,164	$ 64,729,623			$ 47,830,402	$ -	$ 12,947,747	$ (1,309,638)	$ 59,468,511
								NC Non-Residential Peak Demand Allocation Factor					
24	EnergyWise for Business	12,223	5,957	762,197	$ 3,049,486	$ 2,461,251	10.6%	72.9576004%	$ 1,795,669		$ 45,491		$ 1,841,161
25	PowerShare®	438,351	407,667	-	$ 77,192,656	$ 17,502,126	10.6%	72.9576004%	$ 12,769,131		$ 4,616,171		$ 17,385,302
26	Total for Non-Residential DSM Programs	450,574	413,623	762,197	$ 80,242,142	$ 19,963,377		72.9576004%	$ 14,564,801	$ -	$ 4,661,662	$ (2,163,611)	$ 17,062,852
27	Total Non Residential	504,182	467,743	334,681,546	$ 310,277,306	$ 84,693,000			$ 62,395,202	$ -	$ 17,609,409	$ (3,473,249)	$ 76,531,363
28	Total All Programs	1,179,928	607,703	808,176,944	$ 522,214,531	$ 161,902,290			$ 119,214,567	$ 461,626	$ 28,306,589	$ (6,328,773)	$ 141,654,009

(1) My Home Energy Report impacts reflect cumulative capability as of end of vintage year, including impacts for participants from prior vintages
(2) Total System DSM programs allocated to Residential and Non-Residential based on contribution to retail system peak

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Duke Energy Carolinas, LLC
For the Period January 1, 2016 - December 31, 2024
Docket Number E-7 Sub 1285
North Carolina Net Lost Revenue Estimates for Vintages 2016 - 2024

Line	Vintage 2016 Residential	2016	2017	2018	2019	2020	2021	2022	2023	2024	Total
1	Appliance Recycling Program	$ 5,096	$ 8,147	$ 4,719	$ -	$ -	$ -	$ -	$ -	$ -	$ 17,961
2	Energy Efficiency Education	142,689	301,026	174,350	-	-	-	-	-	-	618,064
3	Energy Efficient Appliances and Devices	2,642,555	5,739,377	3,325,073	-	-	-	-	-	-	11,707,005
4	Low Income Energy Efficiency and Weatherization Assistance	115,500	242,117	140,230	-	-	-	-	-	-	497,847
5	Multi-Family Energy Efficiency	347,362	698,540	403,459	-	-	-	-	-	-	1,449,361
6	My Home Energy Report	13,046,967	-	-	-	-	-	-	-	-	13,046,967
7	Residential Energy Assessments	193,357	336,600	194,978	-	-	-	-	-	-	724,934
8	Residential Smart $aver Energy Efficiency	155,324	382,963	221,798	-	-	-	-	-	-	760,085
9	Total Lost Revenues	16,648,849	7,708,770	4,464,606	-	-	-	-	-	-	28,822,224
10	Found Residential Revenues *	-	-	-	-	-	-	-	-	-	-
11	Net Lost Residential Revenues	**$ 16,648,849**	**$ 7,708,770**	**$ 4,464,606**	**$ -**	**$ -**	**$ -**	**$ -**	**$ -**	**$ -**	**$ 28,822,224**

Line	Non-Residential	2016	2017	2018	2019	2020	2021	2022	2023	2024	Total
12	EnergyWise for Business	$ 15,922	$ 36,788	$ 29,659	$ 11,749	$ -	$ -	$ -	$ -	$ -	$ 94,117
13	Non Residential Energy Efficient ITEE	59,904	75,403	61,876	9,734	-	-	-	-	-	206,918
14	Non Residential Smart Saver Custom	914,009	1,703,790	1,402,690	486,428	-	-	-	-	-	4,506,918
15	Non Residential Smart Saver Custom Technical Assessments	199,079	389,585	319,852	115,838	-	-	-	-	-	1,024,354
16	Non Residential Smart Saver Energy Efficienct Food Service Products	24,889	66,328	54,216	24,402	-	-	-	-	-	169,835
17	Non Residential Smart Saver Energy Efficienct HVAC Products	46,952	103,028	83,861	32,382	-	-	-	-	-	266,223
18	Non Residential Smart Saver Energy Efficienct Lighting Products	2,925,514	6,589,455	5,336,671	2,104,081	-	-	-	-	-	16,955,721
19	Non Residential Smart Saver Energy Efficienct Process Equipment Products	4,731	10,652	8,827	3,530	-	-	-	-	-	27,740
20	Non Residential Smart Saver Energy Efficienct Pumps and Drives Products	38,898	66,558	54,582	16,747	-	-	-	-	-	176,784
21	Small Business Energy Saver	2,145,932	4,346,981	3,515,959	1,249,614	-	-	-	-	-	11,258,485
22	Smart Energy in Offices	227,062	418,553	-	-	-	-	-	-	-	645,616
23	Total Lost Revenues	6,602,893	13,807,121	10,868,193	4,054,505	-	-	-	-	-	35,332,711
24	Found Non-Residential Revenues *	-	-	-	-	-	-	-	-	-	-
25	Net Lost Non-Residential Revenues	**$ 6,602,893**	**$ 13,807,121**	**$ 10,868,193**	**$ 4,054,505**	**$ -**	**$ -**	**$ -**	**$ -**	**$ -**	**$ 35,332,711**

* Found Revenues - See Fields Exhibit 4
(a) Lost revenues were estimated by applying forecasted lost revenue rates for residential and non-residential customers to state specific forecasted program participation.

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Line	Vintage 2017 Residential	2016	2017	2018	2019	2020	2021	2022	2023	2024	Total
26	Energy Efficiency Education	$ -	$ 165,283	$ 220,500	$ 141,389	$ 52,081	$ -	$ -	$ -	$ -	$ 579,252
27	Energy Efficient Appliances and Devices	-	3,386,885	5,115,898	3,283,530	1,420,545	-	-	-	-	13,206,858
28	HVAC Energy Efficiency	-	197,134	263,862	169,198	64,171	-	-	-	-	694,365
29	Low Income Energy Efficiency and Weatherization Assistance	-	141,450	209,847	134,636	57,497	-	-	-	-	543,431
30	Multi-Family Energy Efficiency	-	535,154	740,924	472,212	185,165	-	-	-	-	1,933,455
31	My Home Energy Report	-	14,336,758	-	-	-	-	-	-	-	14,336,758
32	Residential Energy Assessments	-	198,264	273,953	175,697	69,115	-	-	-	-	717,029
33	Total Lost Revenues	-	18,960,928	6,824,985	4,376,661	1,848,574	-	-	-	-	32,011,149
34	Found Residential Revenues *	-	-	-	-	-	-	-	-	-	-
35	**Net Lost Residential Revenues**	**$ -**	**$ 18,960,928**	**$ 6,824,985**	**$ 4,376,661**	**$ 1,848,574**	**$ -**	**$ -**	**$ -**	**$ -**	**$ 32,011,149**

Line	Non-Residential	2016	2017	2018	2019	2020	2021	2022	2023	2024	Total
36	EnergyWise for Business	$ -	$ 85,268	$ 158,514	$ 158,611	$ 71,388	$ -	$ -	$ -	$ -	$ 473,781
37	Non Residential Energy Efficient ITEE	-	82	162	162	71	-	-	-	-	478
38	Non Residential Smart Saver Custom	-	435,407	871,334	901,523	410,462	-	-	-	-	2,618,725
39	Non Residential Smart Saver Custom Technical Assessments	-	220,191	358,289	366,388	142,716	-	-	-	-	1,087,584
40	Non Residential Smart Saver Energy Efficient Food Service Products	-	28,410	40,771	41,426	12,465	-	-	-	-	123,071
41	Non Residential Smart Saver Energy Efficient HVAC Products	-	61,639	110,255	110,069	46,607	-	-	-	-	328,570
42	Non Residential Smart Saver Energy Efficienct Lighting Products	-	6,200,869	10,299,304	10,364,600	3,966,381	-	-	-	-	30,831,155
43	Non Residential Smart Saver Energy Efficient Process Equipment Products	-	8,160	12,172	12,409	4,010	-	-	-	-	36,751
44	Non Residential Smart Saver Energy Efficient Pumps and Drives Products	-	58,808	127,509	132,526	65,995	-	-	-	-	384,837
45	Small Business Energy Saver	-	2,203,337	3,774,927	3,784,317	1,511,250	-	-	-	-	11,273,832
46	Smart $aver(R) Non Residential Performance Incentive Program	-	66	774	759	552	-	-	-	-	2,151
47	Smart Energy in Offices	-	209,310	149,382	-	-	-	-	-	-	358,692
48	Total Lost Revenues	-	9,511,547	15,903,393	15,872,791	6,231,898	-	-	-	-	47,519,629
49	Found Non-Residential Revenues *	-	-	-	-	-	-	-	-	-	-
50	**Net Lost Non-Residential Revenues**	**$ -**	**$ 9,511,547**	**$ 15,903,393**	**$ 15,872,791**	**$ 6,231,898**	**$ -**	**$ -**	**$ -**	**$ -**	**$ 47,519,629**

* Found Revenues - See Fields Exhibit 4

(a) Lost revenues were estimated by applying forecasted lost revenue rates for residential and non-residential customers to state specific forecasted program participation.

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Fields Exhibit 2, page3

Line	Vintage 2018 Residential	2016	2017	2018	2019	2020	2021	2022	2023	2024	Total
51	Energy Efficiency Education	$ -	$ -	$ 128,311	$ 265,267	$ 172,311	$ -	$ -	$ -	$ -	$ 565,889
52	Energy Efficient Appliances and Devices	-	-	4,282,358	9,200,784	5,975,763	-	-	-	-	19,458,905
53	HVAC Energy Efficiency	-	-	161,443	324,295	210,669	-	-	-	-	696,407
54	Low Income Energy Efficiency and Weatherization Assistance	-	-	154,376	340,042	220,844	-	-	-	-	715,262
55	Multi-Family Energy Efficiency	-	-	493,320	1,087,466	707,931	-	-	-	-	2,288,716
56	My Home Energy Report	-	-	15,557,605	-	-	-	-	-	-	15,557,605
57	Residential Energy Assessments	-	-	204,097	359,848	233,732	-	-	-	-	797,677
58	Total Lost Revenues	-	-	20,981,509	11,577,702	7,521,250	-	-	-	-	40,080,462
											-
59	Found Residential Revenues *	-	-	-	-	-	-	-	-	-	-
60	**Net Lost Residential Revenues**	**$ -**	**$ -**	**$ 20,981,509**	**$ 11,577,702**	**$ 7,521,250**	**$ -**	**$ -**	**$ -**	**$ -**	**$ 40,080,462**

Line	Non-Residential	2016	2017	2018	2019	2020	2021	2022	2023	2024	Total
61	EnergyWise for Business	$ -	$ -	$ 66,282	$ 120,440	$ 78,851	$ -	$ -	$ -	$ -	$ 265,573
62	Non Residential Energy Efficienct ITEE	-	-	185	876	573	-	-	-	-	1,634
63	Non Residential Smart Saver Custom	-	-	462,774	773,838	502,673	-	-	-	-	1,739,285
64	Non Residential Smart Saver Custom Technical Assessments	-	-	212	866	564	-	-	-	-	1,642
65	Non Residential Smart Saver Energy Efficienct Food Service Products	-	-	14,176	22,681	14,685	-	-	-	-	51,543
66	Non Residential Smart Saver Energy Efficienct HVAC Products	-	-	50,245	116,425	75,664	-	-	-	-	242,334
67	Non Residential Smart Saver Energy Efficienct Lighting Products	-	-	4,088,002	6,697,444	4,357,995	-	-	-	-	15,143,441
68	Non Residential Smart Saver Energy Efficienct Process Equipment Products	-	-	6,501	10,497	6,820	-	-	-	-	23,818
69	Non Residential Smart Saver Energy Efficienct Pumps and Drives Products	-	-	66,649	87,658	56,898	-	-	-	-	211,206
70	Small Business Energy Saver	-	-	1,776,069	3,461,673	2,256,564	-	-	-	-	7,494,306
71	Smart $aver(R) Non Residential Performance Incentive Program	-	-	20,243	84,754	54,723	-	-	-	-	159,720
72	Smart Energy in Offices	-	-	39,733	3,847	-	-	-	-	-	43,580
73	Total Lost Revenues	-	-	6,591,073	11,381,000	7,406,010	-	-	-	-	25,378,082
											-
74	Found Non-Residential Revenues *	-	-	-	-	-	-	-	-	-	-
75	**Net Lost Non-Residential Revenues**	**$ -**	**$ -**	**$ 6,591,073**	**$ 11,381,000**	**$ 7,406,010**	**$ -**	**$ -**	**$ -**	**$ -**	**$ 25,378,082**

* Found Revenues - See Fields Exhibit 4

(a) Lost revenues were estimated by applying forecasted lost revenue rates for residential and non-residential customers to state specific forecasted program participation.

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Line	Vintage 2019 Residential	2016	2017	2018	2019	2020	2021	2022	2023	2024	Total
76	Energy Efficiency Education	$ -	$ -	$ -	$ 148,216	$ 254,148	$ 105,420	$ 87,526	$ -	$ -	$ 595,310
77	Energy Efficient Appliances and Devices	-	-	-	4,857,811	6,712,042	2,618,427	1,742,847	-	-	15,931,128
78	Low Income Energy Efficiency and Weatherization Assistance	-	-	-	185,331	216,602	70,044	46,019	-	-	517,997
79	Multi-Family Energy Efficiency	-	-	-	600,390	795,885	300,444	208,913	-	-	1,905,632
80	My Home Energy Report	-	-	-	16,376,622	-	-	-	-	-	16,376,622
81	Residential Energy Assessments	-	-	-	195,756	270,357	106,537	72,906	-	-	645,556
82	Residential Smart $aver Energy Efficiency	-	-	-	217,687	334,280	152,447	100,557	-	-	804,971
83	Total Lost Revenues	-	-	-	22,581,813	8,583,316	3,353,319	2,258,768	-	-	36,777,216
											-
84	Found Residential Revenues *	-	-	-	-	-	-	-	-	-	-
85	Net Lost Residential Revenues	**$ -**	**$ -**	**$ -**	**$ 22,581,813**	**$ 8,583,316**	**$ 3,353,319**	**$ 2,258,768**	**$ -**	**$ -**	**$ 36,777,216**

Line	Non-Residential	2016	2017	2018	2019	2020	2021	2022	2023	2024	Total
86	EnergyWise for Business	$ -	$ -	$ -	$ 114,341	$ 186,627	$ 80,085	$ 53,392	$ -	$ -	$ 434,445
87	Non Residential Energy Efficienct ITEE	-	-	-	334	438	132	104	-	-	1,008
88	Non Residential Smart Saver Custom	-	-	-	872,885	1,456,848	660,676	453,233	-	-	3,443,642
89	Non Residential Smart Saver Custom Technical Assessments	-	-	-	83,809	57,508	1,710	1,613	-	-	144,640
90	Non Residential Smart Saver Energy Efficient Food Service Products	-	-	-	13,075	18,731	7,644	5,147	-	-	44,596
91	Non Residential Smart Saver Energy Efficient HVAC Products	-	-	-	179,387	322,968	153,913	109,790	-	-	766,058
92	Non Residential Smart Saver Energy Efficient Lighting Products	-	-	-	3,673,309	4,767,273	1,693,589	1,113,797	-	-	11,247,968
93	Non Residential Smart Saver Energy Efficient Process Equipment Products	-	-	-	20,702	19,330	3,140	1,913	-	-	45,085
94	Non Residential Smart Saver Energy Efficient Pumps and Drives Products	-	-	-	27,307	41,723	18,917	12,786	-	-	100,733
95	Small Business Energy Saver	-	-	-	1,428,454	1,910,476	677,101	469,820	-	-	4,485,851
96	Smart $aver(R) Non Residential Performance Incentive Program	-	-	-	24,374	106,377	86,207	80,071	-	-	297,029
97	Total Lost Revenues	-	-	-	6,437,977	8,888,299	3,383,113	2,301,665	-	-	21,011,055
											-
98	Found Non-Residential Revenues *	-	-	-	-	-	-	-	-	-	-
99	Net Lost Non-Residential Revenues	**$ -**	**$ -**	**$ -**	**$ 6,437,977**	**$ 8,888,299**	**$ 3,383,113**	**$ 2,301,665**	**$ -**	**$ -**	**$ 21,011,055**

* Found Revenues - See Fields Exhibit 4
(a) Lost revenues were estimated by applying forecasted lost revenue rates for residential and non-residential customers to state specific forecasted program participation.

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Line	Vintage 2020 Residential	2016	2017	2018	2019	2020	2021	2022	2023	2024	Total
100	Energy Efficiency Education	$ -	$ -	$ -	$ -	$ 87,413	$ 209,790	$ 216,285	$ 146,028	$ -	$ 659,516
101	Energy Efficient Appliances and Devices	-	-	-	-	2,857,887	4,360,791	4,499,488	2,110,461	-	13,828,627
102	Low Income Energy Efficiency and Weatherization Assistance	-	-	-	-	36,052	48,760	50,303	22,095	-	157,211
103	Multi-Family Energy Efficiency	-	-	-	-	159,241	117,897	121,006	8,091	-	406,235
104	My Home Energy Report	-	-	-	-	16,500,921	-	-	-	-	16,500,921
105	Residential Energy Assessments	-	-	-	-	157,162	330,157	340,609	208,522	-	1,036,451
106	Residential Smart $aver Energy Efficiency	-	-	-	-	221,534	436,501	450,185	255,844	-	1,364,064
107	Total Lost Revenues	-	-	-	-	20,020,211	5,503,895	5,677,877	2,751,040	-	33,953,024
											-
108	Found Residential Revenues *	-	-	-	-	-	-	-	-		-
109	Net Lost Residential Revenues	**$ -**	**$ -**	**$ -**	**$ -**	**$ 20,020,211**	**$ 5,503,895**	**$ 5,677,877**	**$ 2,751,040**	**$ -**	**$ 33,953,024**

Line	Non-Residential	2016	2017	2018	2019	2020	2021	2022	2023	2024	Total
110	EnergyWise for Business	$ -	$ -	$ -	$ -	$ 75,574	$ 109,115	$ 113,013	$ 58,169	$ -	$ 355,871
111	Non Residential Energy Efficienct ITEE	-	-	-	-	170	391	405	293	-	1,259
112	Non Residential Smart Saver Custom	-	-	-	-	323,487	731,699	759,881	496,940	-	2,312,007
113	Non Residential Smart Saver Custom Technical Assessments	-	-	-	-	18,170	20,604	22,406	8,391	-	69,571
114	Non Residential Smart Saver Energy Efficienct Food Service Products	-	-	-	-	8,350	15,521	16,430	8,810	-	49,110
115	Non Residential Smart Saver Energy Efficienct HVAC Products	-	-	-	-	138,219	415,995	431,950	316,989	-	1,303,153
116	Non Residential Smart Saver Energy Efficienct Lighting Products	-	-	-	-	2,381,827	4,152,149	4,301,181	2,385,440	-	13,220,597
117	Non Residential Smart Saver Energy Efficienct Process Equipment Products	-	-	-	-	30,146	30,517	31,612	1,743	-	94,018
118	Non Residential Smart Saver Energy Efficienct Pumps and Drives Products	-	-	-	-	37,666	47,062	49,084	13,755	-	147,567
119	Small Business Energy Saver	-	-	-	-	749,809	1,281,121	1,327,243	729,503	-	4,087,676
120	Smart $aver(R) Non Residential Performance Incentive Program	-	-	-	-	89,407	131,298	144,482	54,332	-	419,519
121	Total Lost Revenues	-	-	-	-	3,852,825	6,935,473	7,197,687	4,074,365	-	22,060,349
											-
122	Found Non-Residential Revenues *	-	-	-	-	-	-	-	-	-	-
123	Net Lost Non-Residential Revenues	**$ -**	**$ -**	**$ -**	**$ -**	**$ 3,852,825**	**$ 6,935,473**	**$ 7,197,687**	**$ 4,074,365**	**$ -**	**$ 22,060,349**

* Found Revenues - See Fields Exhibit 4

(a) Lost revenues were estimated by applying forecasted lost revenue rates for residential and non-residential customers to state specific forecasted program participation.

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Fields Exhibit 2, page 6

Line	Vintage 2021 Residential	2016	2017	2018	2019	2020	2021	2022	2023	2024	Total
124	Energy Efficiency Education	-	-	-	-	-	200,130	380,109	398,141	182,695	1,161,075
125	Energy Efficient Appliances and Devices	-	-	-	-	-	1,410,540	2,520,688	2,660,275	1,124,471	7,715,974
126	Low Income Energy Efficiency and Weatherization Assistance	-	-	-	-	-	38,978	84,055	88,044	46,189	257,267
127	Multi-Family Energy Efficiency	-	-	-	-	-	29,769	134,906	141,684	109,599	415,959
128	My Home Energy Report	-	-	-	-	-	17,765,303	-	-	-	17,765,303
129	Residential Energy Assessments	-	-	-	-	-	160,310	352,170	368,750	196,949	1,078,179
130	Residential Smart $aver Energy Efficiency	-	-	-	-	-	284,316	535,357	560,612	255,372	1,635,657
131	Total Lost Revenues	-	-	-	-	-	19,889,346	4,007,285	4,217,508	1,915,275	30,029,414
132	Found Residential Revenues *	-	-	-	-	-	-	(27,465)	(18,310)	-	(45,775)
133	Net Lost Residential Revenues	**$ -**	**$ -**	**$ -**	**$ -**	**$ -**	**$ 19,889,346**	**$ 4,034,750**	**$ 4,235,818**	**$ 1,915,275**	**$ 30,075,189**

Line	Non-Residential	2016	2017	2018	2019	2020	2021	2022	2023	2024	Total
134	EnergyWise for Business	$ -	$ -	$ -	$ -	$ -	$ 54,555	$ 103,019	$ 108,057	$ 49,292	$ 314,923
135	Non Residential Energy Efficient ITEE	-	-	-	-	-	108	153	161	44	466
136	Non Residential Smart Saver Custom	-	-	-	-	-	554,154	1,334,359	1,426,356	809,323	4,124,192
137	Non Residential Smart Saver Energy Efficienct Food Service Products	-	-	-	-	-	18,379	47,651	50,980	30,430	147,439
138	Non Residential Smart Saver Energy Efficient HVAC Products	-	-	-	-	-	615,258	1,069,727	1,128,440	461,213	3,274,638
139	Non Residential Smart Saver Energy Efficient Lighting Products	-	-	-	-	-	2,827,973	5,558,375	5,877,267	2,794,598	17,058,213
140	Non Residential Smart Saver Energy Efficienct Process Equipment Products	-	-	-	-	-	9,090	36,256	38,578	28,624	112,548
141	Non Residential Smart Saver Energy Efficienct Pumps and Drives Products	-	-	-	-	-	22,383	58,836	62,545	37,991	181,755
142	Small Business Energy Saver	-	-	-	-	-	769,805	1,686,051	1,781,834	945,200	5,182,890
143	Smart $aver(R) Non Residential Performance Incentive Program	-	-	-	-	-	33,397	85,603	93,346	55,233	267,579
144	Total Lost Revenues	-	-	-	-	-	4,905,101	9,980,031	10,567,564	5,211,948	30,664,643
145	Found Non-Residential Revenues *	-	-	-	-	-	-	-	-	-	-
146	Net Lost Non-Residential Revenues	**$ -**	**$ -**	**$ -**	**$ -**	**$ -**	**$ 4,905,101**	**$ 9,980,031**	**$ 10,567,564**	**$ 5,211,948**	**$ 30,664,643**

* Found Revenues - See Fields Exhibit 4

(a) Lost revenues were estimated by applying forecasted lost revenue rates for residential and non-residential customers to state specific forecasted program participation.

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Fields Exhibit 2, page 7

Line	Vintage 2022 Residential	2016	2017	2018	2019	2020	2021	2022	2023	2024	Total
147	Energy Efficiency Education	$ -	$ -	$ -	$ -	$ -	$ -	$ 136,898	$ 292,757	$ 230,687	$ 660,342
148	Energy Efficient Appliances and Devices	-	-	-	-	-	-	2,151,054	4,392,680	3,581,438	10,125,172
149	Low Income Energy Efficiency and Weatherization Assistance	-	-	-	-	-	-	74,008	116,229	106,012	296,249
150	Multi-Family Energy Efficiency	-	-	-	-	-	-	132,384	263,608	213,190	609,182
151	My Home Energy Report	-	-	-	-	-	-	18,557,668	-	-	18,557,668
152	Residential Energy Assessments	-	-	-	-	-	-	152,780	254,745	219,473	626,998
153	Residential New Construction	-	-	-	-	-	-	8,316	29,833	17,765	55,915
154	Residential Smart $aver Energy Efficiency	-	-	-	-	-	-	296,041	515,372	437,687	1,249,100
155	Total Lost Revenues	-	-	-	-	-	-	21,509,149	5,865,224	4,806,252	32,180,624
156	Found Residential Revenues *	-	-	-	-	-	-	(17,435)	(24,129)	(6,985)	(48,549)
157	Net Lost Residential Revenues	**$ -**	**$ -**	**$ -**	**$ -**	**$ -**	**$ -**	**$ 21,526,584**	**$ 5,889,353**	**$ 4,813,237**	**$ 32,229,174**

Line	Non-Residential	2016	2017	2018	2019	2020	2021	2022	2023	2024	Total
158	EnergyWise for Business	$ -	$ -	$ -	$ -	$ -	$ -	$ 16,486	$ 18,710	$ 18,710	$ 53,907
159	Non Residential Energy Efficienct ITEE	-	-	-	-	-	-	2,598	4,891	4,147	11,636
160	Non Residential Smart Saver Custom	-	-	-	-	-	-	548,328	939,496	818,205	2,306,029
161	Non Residential Smart Saver Custom Technical Assessments	-	-	-	-	-	-	23,669	37,045	34,233	94,947
162	Non Residential Smart Saver Energy Efficient Food Service Products	-	-	-	-	-	-	13,288	29,326	24,535	67,148
163	Non Residential Smart Saver Energy Efficient HVAC Products	-	-	-	-	-	-	931,398	1,401,417	1,263,368	3,596,182
164	Non Residential Smart Saver Energy Efficient Lighting Products	-	-	-	-	-	-	2,606,534	4,287,876	3,807,997	10,702,408
165	Non Residential Smart Saver Energy Efficient Process Equipment Products	-	-	-	-	-	-	2,027	4,182	3,613	9,822
166	Non Residential Smart Saver Energy Efficient Pumps and Drives Products	-	-	-	-	-	-	19,529	36,105	32,259	87,892
167	Small Business Energy Saver	-	-	-	-	-	-	1,070,209	1,945,088	1,733,483	4,748,780
168	Smart $aver(R) Non Residential Performance Incentive Program	-	-	-	-	-	-	72,643	109,399	103,973	286,015
169	Total Lost Revenues	-	-	-	-	-	-	5,306,709	8,813,535	7,844,523	21,964,768
170	Found Non-Residential Revenues *	-	-	-	-	-	-	-	-	-	-
171	Net Lost Non-Residential Revenues	**$ -**	**$ -**	**$ -**	**$ -**	**$ -**	**$ -**	**$ 5,306,709**	**$ 8,813,535**	**$ 7,844,523**	**$ 21,964,768**

* Found Revenues - See Fields Exhibit 4

(a) Lost revenues were estimated by applying forecasted lost revenue rates for residential and non-residential customers to state specific forecasted program participation.

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Fields Exhibit 2, page 8

Line	Vintage 2023 Residential	2016	2017	2018	2019	2020	2021	2022	2023	2024	Total
172	Energy Efficiency Education	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ 367,192	$ 682,100	$ 1,049,292
173	Energy Efficient Appliances and Devices	-	-	-	-	-	-	-	1,468,035	2,739,019	4,207,054
174	HVAC Energy Efficiency	-	-	-	-	-	-	-	202,306	373,527	575,834
175	Low Income Energy Efficiency and Weatherization Assistance	-	-	-	-	-	-	-	228,933	428,743	657,676
176	Multi-Family Energy Efficiency	-	-	-	-	-	-	-	513,283	947,600	1,460,883
177	My Home Energy Report	-	-	-	-	-	-	-	17,467,498	-	17,467,498
178	Residential Energy Assessments	-	-	-	-	-	-	-	436,907	762,600	1,199,507
179	Residential New Construction	-	-	-	-	-	-	-	462,348	853,566	1,315,914
180	Total Lost Revenues	-	-	-	-	-	-	-	21,146,502	6,787,155	27,933,657
181	Found Residential Revenues *								(2,935)	-	(2,935)
182	Net Lost Residential Revenues	$ -	$ -	$ -	$ -	$ -	$ -	$ -	**$ 21,149,437**	**$ 6,787,155**	**$ 27,936,592**

Line	Non-Residential	2016	2017	2018	2019	2020	2021	2022	2023	2024	Total
183	EnergyWise for Business	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ 17,255	$ 31,855	$ 49,109
184	Non Residential Energy Efficienct ITEE	-	-	-	-	-	-	-	329	607	936
185	Non Residential Smart Saver Custom	-	-	-	-	-	-	-	616,396	1,137,962	1,754,358
186	Non Residential Smart Saver Custom Technical Assessments	-	-	-	-	-	-	-	52,857	97,581	150,438
187	Non Residential Smart Saver Energy Efficienct Food Service Products	-	-	-	-	-	-	-	41,666	76,922	118,588
188	Non Residential Smart Saver Energy Efficient HVAC Products	-	-	-	-	-	-	-	950,071	1,753,978	2,704,049
189	Non Residential Smart Saver Energy Efficient Lighting Products	-	-	-	-	-	-	-	4,341,628	8,015,312	12,356,940
190	Non Residential Smart Saver Energy Efficient Process Equipment Products	-	-	-	-	-	-	-	39,529	72,977	112,506
191	Non Residential Smart Saver Energy Efficient Pumps and Drives Products	-	-	-	-	-	-	-	50,829	93,838	144,667
192	Small Business Energy Saver	-	-	-	-	-	-	-	1,312,351	2,422,802	3,735,152
193	Smart $aver(R) Non Residential Performance Incentive Program	-	-	-	-	-	-	-	244,585	451,541	696,126
194	Total Lost Revenues	-	-	-	-	-	-	-	7,667,494	14,155,374	21,822,868
195	Found Non-Residential Revenues *								-	-	-
196	Net Lost Non-Residential Revenues	$ -	$ -	$ -	$ -	$ -	$ -	$ -	**$ 7,667,494**	**$ 14,155,374**	**$ 21,822,868**

* Found Revenues - See Fields Exhibit 4

(a) Lost revenues were estimated by applying forecasted lost revenue rates for residential and non-residential customers to state specific forecasted program participation.

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Fields Exhibit 2, page 9

Line	Vintage 2024 Residential	2016	2017	2018	2019	2020	2021	2022	2023	2024	Total
197	Energy Efficiency Education	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ 345,244	$ 345,244
198	Energy Efficient Appliances and Devices	-	-	-	-	-	-	-	-	918,130	918,130
199	Low Income Energy Efficiency and Weatherization Assistance	-	-	-	-	-	-	-	-	147,022	147,022
200	Multi-Family Energy Efficiency	-	-	-	-	-	-	-	-	373,248	373,248
201	My Home Energy Report	-	-	-	-	-	-	-	-	20,490,637	20,490,637
202	Residential Energy Assessments	-	-	-	-	-	-	-	-	482,735	482,735
203	Residential New Construction	-	-	-	-	-	-	-	-	499,206	499,206
204	Residential Smart $aver Energy Efficiency	-	-	-	-	-	-	-	-	200,908	200,908
205	Total Lost Revenues	-	-	-	-	-	-	-	-	23,457,131	23,457,131
206	Found Residential Revenues *									(52,456)	(52,456)
207	Net Lost Residential Revenues	**$ -**	**$ -**	**$ -**	**$ -**	**$ -**	**$ -**	**$ -**	**$ -**	**$ 23,509,586**	**$ 23,509,586**

Line	Non-Residential	2016	2017	2018	2019	2020	2021	2022	2023	2024	Total
208	EnergyWise for Business	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ 484,354	$ 484,354
209	Non Residential Energy Efficienct ITEE	-	-	-	-	-	-	-	-	311	311
210	Non Residential Smart Saver Custom	-	-	-	-	-	-	-	-	1,172,149	1,172,149
211	Non Residential Smart Saver Custom Technical Assessments	-	-	-	-	-	-	-	-	50,474	50,474
212	Non Residential Smart Saver Energy Efficient Food Service Products	-	-	-	-	-	-	-	-	40,618	40,618
213	Non Residential Smart Saver Energy Efficient HVAC Products	-	-	-	-	-	-	-	-	924,388	924,388
214	Non Residential Smart Saver Energy Efficient Lighting Products	-	-	-	-	-	-	-	-	3,935,584	3,935,584
215	Non Residential Smart Saver Energy Efficient Process Equipment Products	-	-	-	-	-	-	-	-	27,270	27,270
216	Non Residential Smart Saver Energy Efficient Pumps and Drives Products	-	-	-	-	-	-	-	-	38,018	38,018
217	Small Business Energy Saver	-	-	-	-	-	-	-	-	1,399,581	1,399,581
218	Smart $aver(R) Non Residential Performance Incentive Program	-	-	-	-	-	-	-	-	688,738	688,738
219	Total Lost Revenues	-	-	-	-	-	-	-	-	8,761,484	8,761,484
220	Found Non-Residential Revenues *									-	-
221	Net Lost Non-Residential Revenues	**$ -**	**$ -**	**$ -**	**$ -**	**$ -**	**$ -**	**$ -**	**$ -**	**$ 8,761,484**	**$ 8,761,484**

* Found Revenues - See Fields Exhibit 4

(a) Lost revenues were estimated by applying forecasted lost revenue rates for residential and non-residential customers to state specific forecasted program participation.

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Fields Exhibit 3

Duke Energy Carolinas, LLC
For the Period January 1, 2019 - December 31, 2022
Docket Number E-7 Sub 1285
Actual Program Costs for Vintage Years 2019, 2020, 2021, 2022

		Carolinas System - 12 months Ended 12/31/2019	Carolinas System - 12 months Ended 12/31/2020	Carolinas System - 12 months Ended 12/31/2021	Carolinas System - 12 months Ended 12/31/2022
1	Appliance Recycle Program	-	-	-	-
2	Energy Efficiency Education	1,644,077	1,113,485	1,147,501	1,092,967
3	Energy Efficient Appliances and Devices	40,433,533	22,124,101	10,824,171	16,531,134
4	Energy Management Information Systems	-	-	-	-
5	Income Qualified Energy Efficiency and Weatherization	7,344,325	2,787,490	4,634,161	7,184,505
6	Multi family Energy Efficiency	3,681,262	1,613,839	517,454	995,923
7	My Home Energy Report	10,558,344	12,749,651	7,072,233	6,346,116
8	Residential Energy Assessments	3,153,757	3,358,880	3,326,179	2,497,450
9	Residential New Construction	-	-	-	397,283
10	Residential Smart $aver Energy Efficiency	7,402,907	7,538,303	8,156,036	7,706,916
11	Nonresidential Smart Saver Custom Energy Assessments	296,006	330,629	293,539	257,878
12	Non-Residential Smart Saver Custom	8,873,872	5,771,790	7,505,201	6,629,597
13	Non-Residential Smart Saver Performance Incentive	785,165	751,724	342,826	2,362,687
14	Non-Residential Energy Efficient Food Service Products	339,996	533,411	203,130	181,831
15	Non-Residential Smart Saver Energy Efficient HVAC Products	2,208,364	2,450,713	4,899,800	3,883,081
16	Non-Residential Smart Saver Energy Efficient Lighting Products	20,834,766	13,098,851	17,924,291	16,991,765
17	Nonresidential Energy Efficient Pumps and Drives Products	189,172	167,464	202,615	193,125
18	Nonresidential Energy Efficient ITEE	44,335	15,179	74,699	22,596
19	Nonresidential Energy Efficient Process Equipment Products	119,843	29,681	87,540	39,696
20	Smart Energy In Offices	-	-	-	-
21	Small Business Energy Saver	11,421,399	6,933,130	8,935,952	9,384,672
22	Business Energy Report	-	-	-	-
23	Power Manager	13,386,942	14,303,277	16,829,058	17,825,199
24	EnergyWise for Business	3,687,462	2,941,282	2,463,194	2,289,089
25	Power Share	13,022,816	12,082,697	13,583,912	17,870,297
26					
27	**Total Energy Efficiency & Demand Side Program Costs**	**$ 149,428,343**	**$ 110,695,578**	**$ 109,023,491**	**$ 120,683,805**
28	NC Allocation Factor for EE programs	73.0903918%	73.2212736%	73.5233682%	73.8925998%
29	NC Allocation Factor for DSM programs-Residential	34.1181040%	33.7163333%	34.9475492%	34.3192361%
30	NC Allocation Factor for DSM programs-Non-Residential	40.1233224%	40.4790117%	39.4088278%	38.6383643%
31	NC Allocation Factor for DR programs	74.2414264%	74.1953449%	74.3563771%	72.9576004%

		NC Allocated - 12 Months Ended 12/31/2019	NC Allocated - 12 Months Ended 12/31/2020	NC Allocated - 12 Months Ended 12/31/2021	NC Allocated - 12 Months Ended 12/31/2022
32	Appliance Recycle Program	$ -	$ -	$ -	$ -
33	Energy Efficiency Education	$ 1,201,662	815,308	843,681	807,622
34	Energy Efficient Appliances and Devices	$ 29,553,027	16,199,549	7,958,295	12,215,284
35	Energy Management Information Systems	$ -	-	-	-
36	Income Qualified Energy Efficiency and Weatherization Assistai	$ 5,367,996	2,041,036	3,407,192	5,308,817
37	Multi family Energy Efficiency	$ 2,690,649	1,181,674	380,449	735,913
38	My Home Energy Report	$ 7,717,135	9,335,457	5,199,744	4,689,310
39	Residential Energy Assessments	$ 216,352	242,090	215,820	1,845,430
40	Residential New Construction	$ 2,305,093	2,459,415	2,445,519	293,563
41	Residential Smart $aver Energy Efficiency	$ -	-	-	5,694,840
42	Nonresidential Smart Saver Custom Energy Assessments	$ 5,410,814	5,519,641	5,996,592	190,553
43	Non-Residential Smart Saver Custom	$ 6,485,948	4,226,178	5,518,076	4,898,782
44	Non-Residential Smart Saver Performance Incentive	$ 573,880	550,422	252,057	1,745,851
45	Non-Residential Energy Efficient Food Service Products	$ 248,504	390,570	149,348	134,359
46	Non-Residential Smart Saver Energy Efficient HVAC Products	$ 1,614,102	1,794,444	3,602,498	2,869,310
47	Non-Residential Smart Saver Energy Efficient Lighting Products	$ 15,228,212	9,591,146	13,178,542	12,677,856
48	Nonresidential Energy Efficient Pumps and Drives Products	$ 138,267	122,620	148,969	142,705
49	Nonresidential Energy Efficient ITEE	$ 32,404	11,114	54,921	16,697
50	Nonresidential Energy Efficient Process Equipment Products	$ 87,594	21,733	64,362	29,332
51	Smart Energy In Offices	$ -	-	-	-
52	Small Business Energy Saver	$ 8,347,945	5,076,526	6,570,013	6,934,578
53	Business Energy Report	$ -	-	-	-
54	Power Manager	$ 10,268,601	9,888,075	11,489,414	13,004,838
55	EnergyWise for Business	$ 2,664,815	2,324,090	1,988,733	1,670,064
56	Power Share	$ 9,411,189	9,547,293	10,967,378	13,037,740
57	**Total Energy Efficiency & Demand Side Program Costs**	**$ 109,564,190**	**$ 81,338,380**	**$ 80,431,604**	**$ 88,943,445**

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Fields Exhibit 4

Duke Energy Carolinas, LLC
January 2018 - December 2022 Actuals
January 2023 - December 2024 Estimates
Docket Number E-7, Sub 1285
North Carolina Found Revenues

	Actual/ Reported KWH							Estimated KWH			Decision Tree Node
	2016	2017	2018	2019	2020	2021	2022	2023	2024	Total	
Economic Development	271,322,290	348,693,600	507,965,880	285,918,000	330,562,641	159,451,000	270,267,900	-	-	2,174,181,311	Box 5 - exclude
Plug-in Electric Charging Station Pilot	-	-	-	-	-	-	-	-	-	-	Box 3 - exclude
Lighting										-	
Residential	90,608	78,437	62,832	48,249	33,562	37,786	43,772	43,772	43,772	482,790	Box 6 - include
Non Residential (Regulated)	96,691	102,200	67,443	105,681	130,447	170,265	179,675	179,675	179,675	1,211,752	Box 6 - include
MV to LED Credit - Residential (Regulated)	(189,823)	(172,702)	(150,968)	(113,648)	(50,351)	-	-	-	-	(677,492)	Box 6 - include
MV to LED Credit - Non-Residential (Regulated)	(173,799)	(193,494)	(248,852)	(232,984)	(367,126)	(335,262)	(491,866)	(759,732)	(99,278)	(2,902,392)	Box 6 - include
Total KWH	271,145,967	348,508,041	507,696,335	285,725,298	330,309,173	159,323,789	269,999,481	(536,285)	124,169	2,172,295,969	
Total KWH Included	(176,323)	(185,559)	(269,545)	(192,702)	(253,468)	(127,211)	(268,419)	(536,285)	124,169	(1,885,342)	
Total KWH Included (net of Free Riders 15%)	(149,875)	(157,725)	(229,113)	(163,797)	(215,448)	(108,129)	(228,156)	(455,842)	105,544	(1,602,541)	
Annualized Found Revenue - Non Residential	$ (37,374)	$ (47,791)	$ (96,542)	$ (69,401)	$ (135,345)	$ (73,706)	$ (204,417)	$ (409,761)	$ 56,794	$ (1,017,543)	
Annualized Found Revenue - Residential	$ (67,984)	$ (63,987)	$ (59,309)	$ (44,621)	$ (11,981)	$ 27,465	$ 32,701	$ 34,436	$ 34,436	$ (118,844)	

	2016	2017	2018	2019	2020	2021	2022	2023	2024	Total
Vintage 2014 - Non Res	(3,700)	(5,174)								(8,873)
Vintage 2015 - Non Res	(37,868)	(37,868)	(13,108)							(88,844)
Vintage 2016 - Non Res	(19,617)	(37,374)	(30,720)	(10,169)						(97,880)
Vintage 2017 - Non Res		(19,415)	(47,791)	(47,791)	(21,240)	-				(136,237)
Vintage 2018 - Non Res			(51,711)	(96,542)	(56,316)	-	-			(204,569)
Vintage 2019 - Non Res				(24,424)	(54,495)	(27,392)	(19,040)	-	-	(125,351)
Vintage 2020 - Non Res					(54,740)	(112,798)	(112,798)	(58,776)	-	(339,112)
Vintage 2021 - Non Res						(26,985)	(73,706)	(49,137)	-	(149,828)
Vintage 2022 - Non Res							(107,715)	(153,357)	(51,235)	(312,307)
Vintage 2023 - Non Res								(187,580)	(306,639)	(494,219)
Vintage 2024 - Non Res									30,763	30,763
Net Negative Found Revenues to Zero*	61,185	99,831	143,330	178,925	186,791	167,176	313,259	448,849	327,111	1,926,458
Subtotal - Non Res	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
Vintage 2014 - Res	(34,952)	(22,005)								(56,958)
Vintage 2015 - Res	(55,340)	(55,340)	(17,981)							(128,660)
Vintage 2016 - Res	(38,231)	(67,984)	(39,657)	-						(145,873)
Vintage 2017 - Res		(26,862)	(50,953)	(32,706)	(14,824)	-				(125,346)
Vintage 2018 - Res			(28,325)	(59,309)	(34,597)	-	-			(122,230)
Vintage 2019 - Res				(18,413)	(34,847)	(17,075)	(11,862)	-	-	(82,197)
Vintage 2020 - Res					(3,377)	(10,433)	(10,433)	(6,105)	-	(30,348)
Vintage 2021 - Res						18,237	27,465	18,310	-	64,012
Vintage 2022- Res							17,435	24,129	6,985	48,549
Vintage 2023- Res								2,935	(12,718)	(9,784)
Vintage 2024- Res									52,456	52,456
Net Negative Found Revenues to Zero*	128,523	172,192	136,917	110,428	87,644	9,271	-	-	-	644,975
Subtotal - Residential	$ -	$ -	$ -	$ -	$ -	$ -	$ 22,605	$ 39,269	$ 46,722	$ 108,597
Total Found Revenues	$ -	$ -	$ -	$ -	$ -	$ -	$ 22,605	$ 39,269	$ 46,722	$ 108,597

* Eliminates the inclusion of total negative found revenues at the Residential and Non-Residential level

Fields Exhibit 5

Duke Energy Carolinas

System Event Based Demand Response January 1, 2022 - December 31, 2022

Docket Number E-7, Sub 1285

Date	State	Program Name	Event Trigger	Customers Notified/Switches Dispatched	MW Reduction (at Generator)
1/18/2022	NC and SC	Power Manager - BYOT M&V	System Test	7,293 Thermostats	5.3
1/24/2022	NC and SC	Power Manager - BYOT M&V	System Test	5,848 Thermostats	4.1
1/27/2022	NC and SC	Power Manager - BYOT M&V	System Test	5,800 Thermostats	4.5
2/1/2022	NC and SC	Power Manager - BYOT M&V	System Test	5,616 Thermostats	5.0
2/7/2022	NC and SC	Power Manager - BYOT M&V	System Test	5,628 Thermostats	3.5
2/9/2022	NC and SC	Power Manager - BYOT M&V	System Test	5,580 Thermostats	4.8
2/14/2022	NC and SC	Power Manager - BYOT M&V	System Test	5,621 Thermostats	4.3
2/15/2022	NC and SC	Power Manager - BYOT M&V	System Test	5,616 Thermostats	4.5
2/28/2022	NC and SC	Power Manager - BYOT M&V	System Test	5,534 Thermostats	3.3
3/14/2022	NC and SC	Power Manager - BYOT M&V	System Test	5,545 Thermostats	3.0
3/28/2022	NC and SC	Power Manager - BYOT M&V	System Test	5,513 Thermostats	3.7
5/20/2022	NC and SC	Power Manager - BYOT M&V	System Test	50,780 Thermostats	56.9
6/2/2022	NC and SC	Power Manager - AC Full Shed Test	System Test	293,251 Switches	335.7
6/15/2022	NC and SC	Power Manager - AC Cycling & BYOT	Capacity Needs	298,075 Switches 53,684 Thermostats	274.6
8/31/2022	NC and SC	Power Manager - AC Cycling Test	System Test	302,028 Switches	37.6
9/6/2022	NC and SC	Power Manager - AC Cycling Test	System Test	301,712 Switches	46.7
12/24/2022	NC	Interruptible Service (Rider IS)	Capacity Needs	16 Customers / 35 Sites	29.7
12/24/2022	NC and SC	PowerShare (Rider PS)	Capacity Needs	87 Customers / 160 Sites	168.1
12/24/2022	NC	Standby Generator (Rider SG)	Capacity Needs	7 Customers / 11 Sites	0.9
12/25/2022	NC and SC	Power Manager - BYOT	Capacity Needs	18,921 Thermostats	18.7
12/26/2022	NC and SC	Power Manager - BYOT	Capacity Needs	18,916 Thermostats	20.8
12/26/2022	NC	Interruptible Service (Rider IS)	Capacity Needs	16 Customers / 35 Sites	44.5
12/26/2022	NC and SC	PowerShare (Rider PS)	Capacity Needs	87 Customers / 160 Sites	263.8
12/26/2022	NC	Standby Generator (Rider SG)	Capacity Needs	7 Customers / 11 Sites	1.4

Duke Energy Carolinas, LLC – Executive Summary

A. Description

During the first quarter 2023, Duke Energy Carolinas product managers prepared reports on each program describing the offerings and detailing each program's performance. This Executive Summary describes how the Company performed at an aggregate level during the full year of Vintage 2022 in comparison to as-filed information. Program-specific details are provided in the individual reports.

Program reports include:

Program	Category	Customer
Energy Assessments	EE	Residential
Energy Efficient Appliances and Devices	EE	Residential
Energy Efficiency Education Programs	EE	Residential
Residential – Smart $aver Energy Efficiency Program (HVAC EE)	EE	Residential
Income Qualified Energy Efficiency and Weatherization Assistance	EE	Residential
My Home Energy Report	EE	Residential
Multi-Family Energy Efficiency	EE	Residential
Non-Residential Smart $aver Prescriptive	EE	Non-residential
Non-Residential Smart $aver Custom	EE	Non-residential
Non-Residential Smart $aver Custom Assessment	EE	Non-residential
Non-Residential Smart $aver Performance Incentive	EE	Non-residential
Business Energy Saver	EE	Non-residential
EnergyWise for Business	EE/DSM	Non-residential
Power Manager	DSM	Residential
PowerShare	DSM	Non-residential

Audience

All retail Duke Energy Carolinas customers who have not opted out.

B &C. Impacts, Participants and Expenses

The tables below include actual results for Vintage 2022 in comparison to as-filed data for Vintage 2022.

The Company includes the number of units achieved and a percentage comparison to the as filed values. The unit of measure varies by measure as a participant, for example, may be a single LED bulb, a kW, a kWh, a household or a square foot. Due to the multiple measures in a given program or programs, units may appear skewed and are not easily comparable.

Carolinas System Summary[1]

$ in millions, rounded	Vintage 2022 As Filed	Vintage 2022 YTD December 31, 2022	% of Target
NPV of Avoided Cost	$416.8	$339.1	81%
Program Cost	$158.7	$120.4	76%
MW[2]	1,107.7	1,102.6	100%
MWH	814,299.7	674,196.0	83%
Units	120,960,328	53,887,536	45%

1) Values are reflected at the system level.

2) As filed MW are annual maximum peak. Coincident peak is tracked for impacts.

Duke Energy Carolinas, LLC – Executive Summary

Carolinas Demand Response Summary[1]

$ in millions, rounded	Vintage 2022 As Filed	Vintage 2022 YTD December 31, 2022	% of Target
NPV of Avoided Cost	$120.0	$129.1	108%
Program Cost	$37.3	$38.0	102%
MW[2]	936.4	979.4	105%
MWH	0.0	244.1	-
Units[3]	901,160	971,091	108%

1) Values are reflected at the system level.
2) MW capability derived by taking the average over the PowerShare and PowerManager contract periods.
3) Units included in filing represented kW at meter, rather than number of participants. YTD value reflects average participation for 2022.

Carolinas Energy Efficiency Summary[1]

$ in millions, rounded	Vintage 2022 As Filed	Vintage 2022 YTD December 31, 2022	% of Target
NPV of Avoided Cost	$296.8	$210.1	71%
Program Cost	$121.3	$82.5	68%
MW[2]	171.2	123.3	72%
MWH	814,299.7	673,951.9	83%
Units	120,059,169	52,916,444	44%

1) Values are reflected at the system level.
2) As filed MW are annual maximum peak. Coincident peak is tracked for impacts.

D. Qualitative Analysis

Energy efficiency impacts have primarily been driven by a reduction in lighting measures qualified for programs for both residential and non-residential customers. Programs are working to compensate for lower lighter savings with innovative marketing and incentives.

Highlights

Energy Efficiency
Customer participation continues to be largely driven by lighting and assessments programs. These measures provide customers with a relatively low-cost efficiency upgrade, with minimal effort, creating a positive initial energy efficiency experience.

Demand Side Management (DSM)
The DSM portfolio is comprised of PowerShare (non-residential), Power Manager (residential), and EnergyWise for Business (non-residential) programs. The impacts and participation were very close to the 2022 as-filed targets.

Issues

A few of the Company's programs filed for program modifications at the close of the year. The Company faces a significant challenge with reductions in avoided costs, making programs and their measures potentially less impactful. As a result of this and other factors, the Company's continued assessment of its portfolio may result in the removal of or change in measures.

Potential Changes

Several programs are reviewing their current processes and are considering potential changes to increase customer adoption. Potential changes are discussed in individual program reports.

E. Marketing Strategy

Located in individual reports.

F. Evaluation, Measurement and Verification

Located in individual program reports.
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Income-Qualified Energy Efficiency and Weatherization Assistance Program

A. Description

The purpose of the Low-Income Energy Efficiency and Weatherization Assistance Program (“Program”) is to assist low-income customers with installing energy efficiency measures in their homes. There are three offerings currently in the Program:

- Neighborhood Energy Saver (“NES”)
- Weatherization and Equipment Replacement Program (“WERP”)
- Refrigerator Replacement Program (“RRP”).

WERP and RRP are available for income-qualified customers in Duke Energy Carolinas, LLC’s (the “Company’s”) service territory for existing, individually metered single-family homes, condominiums, and mobile homes. Funds are available for (i.) weatherization measures and/or (ii.) heating system replacement with a 15 or greater SEER heat pump, and/or (iii.) refrigerator replacement with an Energy Star appliance. The measures eligible for funding will be determined by a full energy audit of the residence. Based on the results of the audit, customers are placed into a tier based on energy usage so that high energy users to receive more extensive weatherization measures. (Tier 1 provides up to $600 for energy efficiency services; and Tier 2 provides up to $4,000 for energy efficiency services, including insulation and up to $10,000 when HVAC replacement is involved.) WERP and RRP are delivered in coordination with State agencies that administer the state’s weatherization programs.

Customers participating in NES receive a walk-through energy assessment to identify energy efficiency opportunities in the customer’s home and a one-on-one education on energy efficiency techniques and measures. Additionally, the customer receives a comprehensive package of energy efficient measures. NES participants may have the measures listed below installed in their homes based on the opportunities identified during the energy assessment.

1. Energy Efficient Bulbs - Up to 15 energy efficient bulbs (LEDs) to replace incandescent bulbs
2. Electric Water Heater Wrap and Insulation for Water Pipes
3. Electric Water Heater Temperature Check and Adjustment
4. Water Saving Faucet Aerators - Up to three faucet aerators
5. Water Saving Showerheads - Up to two showerheads
6. Wall Plate Thermometer
7. HVAC Winterization Kits – Up to three kits for wall/window air conditioning units will be provided along with education on the proper use, installation, and value of the winterization kit as a method of stopping air infiltration.
8. HVAC Filters - A one-year supply of HVAC filters will be provided along with instructions on the proper method for installing a replacement filter.
9. Air Infiltration Reduction Measures - Weather stripping, door sweeps, caulk, foam sealant and clear patch tape will be installed to reduce or stop air infiltration around doors, windows, attic hatches and plumbing penetrations.

Based on the opportunities identified during the energy assessment, customers could be eligible to receive the following NES 2.0 measures:

1. Attic insulation
2. Duct sealing
3. Air sealing w/ blower door
4. Floor/Belly insulation for mobile homes
5. Smart Thermostat

Audience

WERP is available to qualified customers in existing individually metered, owner-occupied single-family residences, condominiums, or manufactured homes.

RRP is available to qualified customers in individually metered residences irrespective of whether the property owner or the tenant owns the refrigerator.

Income-Qualified Energy Efficiency and Weatherization Assistance Program

NES is available to individually metered residential customers in selected neighborhoods where ~50% of the homeowners have income equal to or less than 200% of the Federal Poverty Guidelines, based on third party and census data.

B &C. Impacts, Participants and Expenses

Income Qualified Energy Efficiency and Weatherization Assistance[1]

$ in millions, rounded	Vintage 2022 As Filed	Vintage 2022 YTD December 31, 2022	% of Target
NPV of Avoided Cost	**$6.3**	**$3.3**	**52%**
Program Cost	**$8.8**	**$7.2**	**82%**
MW	**2.0**	**1.0**	**53%**
MWH	**9,754.7**	**3,553.0**	**36%**
Units	**12,975**	**7,332**	**57%**

1) Values are reflected at the system level.

D. Qualitative Analysis

Highlights

Neighborhood Energy Saver: After receiving regulatory approval from both the North Carolina Utilities Commission and the South Carolina Public Service Commission in the fall of 2012, the Program was officially launched by the Company in March 2013. The yearly goal is to serve a minimum of 7,500 households. Honeywell Building Solutions was awarded the contract through a competitive bid process to administer the Program through 2021. Franklin Energy was awarded the contract for DEC through a competitive bid process beginning in January 2021

In 2022 the Program offered free walk-through energy assessments and installing measures in the homes of customers in Kannapolis, East Charlotte, Salisbury NC and Anderson and Greenville, SC. There were 2,532 NES 2.0 measures installed in 2022.

Weatherization: The Company launched WERP and RRP in February 2015 in North and South Carolina. The Company selected the program administrator, North Carolina Community Action Agency (NCCAA), in December 2014 via competitive bidding. The company is working with the NC and SC Weatherization Agencies to deliver this program.

In through December 2022, 199 refrigerators replaced, 179 Tier 1 services provided, 396 Tier 2 services provided, and 247 HVAC systems were replaced.

E. Marketing Strategy

Neighborhood Energy Saver: NES continues to target neighborhoods with a significant low-income customer base using a grassroots marketing approach to interact on an individual customer basis and gain trust. Participation is driven through a neighborhood kick-off event that includes trusted community leaders and local and state officials explaining the benefits of the Program. The purpose of the kick-off event is to rally the neighborhood around energy efficiency and to educate customers on methods to lower their energy bills. Customers have the option to make an appointment for an energy assessment at the time of the event. The community kick-off events were held virtually in the first half of 2021 in accordance with Covid operating procedures and transitioned to outdoor pop-up tent events in the latter half of 2021 to maintain social distancing and other Covid safety protocols while engaging customers in person. Kick-off events continued to operate under Covid procedures throughout 2022.

In addition to the kick-off event, the Company uses the following avenues to inform eligible customers about the Program:

- Direct mail (letters and reminder post cards)
- Door hangers
- Press releases and/or neighborhood flyers
- Community presentations and partnerships
- Inclusion in community publications such as newsletters, etc.

Weatherization: WERP and RRP plan to piggy-back the marketing efforts of the current state Weatherization Assistance Programs administered by the state weatherization service providers. Additionally, agencies may utilize referrals generated from other Company energy efficiency programs as well as from their existing pool of weatherization applicants.

Potential Changes
No potential changes

F. Evaluation, Measurement and Verification

The DEC Weatherization evaluation was completed in December of 2022 and evaluated program participation from January 1, 2019, to December 31, 2020. The evaluation had 1,167 participants and found net annual program savings of 1,627 MWh, 217 kW of summer coincident demand savings, and 517 kW of winter coincident demand savings.

The combined DEC/DEP NES evaluation was completed in May of 2022.The evaluation focused on participation from July 1, 2018, through June 30, 2019, and found that the program served 5,619 DEP households and 10,277 DEC households in 25 neighborhoods. At the program level, DEP participants saved 3,031 MWh, 488 summer coincident kW and 508 winter coincident kW while DEC participants saved 2,276 MWh, 413 summer coincident kW and 418 winter coincident kW.
The next combined DEC/DEP NES evaluation is in the beginning stages of data collection and surveying, with a final report scheduled for November of 2023.

Energy Efficiency Education Program

A. Description

The Energy Efficiency Education Program ("Program") is available to students in grades K-12 enrolled in public and private schools in the Duke Energy Carolinas (the "Company" or "DEC") service territory. The current curriculum administered by The National Theatre for Children ("NTC") provides performances in elementary, middle and high schools.

The Program provides principals and teachers with an innovative curriculum to educate students about energy, resources, how energy and resources are related, ways energy is wasted, and how to be more energy efficient. The centerpiece of the curriculum is a live theatrical production focused on concepts such as energy, renewable fuels and energy efficiency and performed by two professional actors. Teachers receive supportive educational material for classroom and student take-home assignments. The workbooks, assignments and activities meet state curriculum requirements.

School principals are the main point of contact for scheduling their school's performance at their convenience. Two weeks prior to the performance, all materials are delivered to the principal's attention for classroom and student distribution. Materials include school posters, teacher guides, and classroom and family activity books.

Students are encouraged to compete an online request form with their families to receive an Energy Efficiency Starter Kit. The kit contains specific energy efficiency measures to reduce home energy consumption. It is available at no cost to eligible Duke Energy customer households at participating schools.

Similar to 2021, many of the aspects of the Energy Efficiency Education program continued to be impacted by the COVID-19 pandemic in 2022. No in-person school performances were permitted for the first half of the year. As a result, the program continued to offer livestream performances so schools and students could still participate. At the beginning of the Fall 2022 semester, in-school live performances resumed as the effects of the pandemic lessened and troupes were allowed back into the schools. More details are provided below in section D.

Audience

Eligible participants include the Company's residential customers who reside in households served by Duke Energy Carolinas with school-age children enrolled in public and private schools.

B &C. Impacts, Participants and Expenses

Energy Efficiency Education[1]

$ in millions, rounded	Vintage 2022 As Filed	Vintage 2022 YTD December 31, 2022	% of Target
NPV of Avoided Cost	**$3.2**	**$1.3**	**41%**
Program Cost	**$2.4**	**$1.1**	**45%**
MW	**1.0**	**(1.0)**	**-96%**
MWH	**8,276.0**	**5,862.8**	**71%**
Units	**30,552**	**11,615**	**38%**

1) Values are reflected at the system level.

D. Qualitative Analysis

Highlights

The Company is supporting arts and theatre in schools while providing an important message about energy efficiency for students through an innovative delivery channel. Enhancing the message with a live theatrical production captivates the students' attention and reinforces the classroom curriculum materials provided.

Starting in the spring semester of the 2019-2020 school year, the COVID-19 pandemic brought on unprecedented challenges to the program with schools temporarily closing and reverting to virtual learning. As a result, live performances ceased on March 13, 2020. This continued to be the case for the first half of 2022. During the Summer, the program resumed the booking of in-school live performances.

For the first half of 2022, the program continued to offer these educational performances via online livestream for all three levels of schooling in the Spring semester. This consisted of a live host providing educational information and narrating between four different segments of the theatrical performance that would normally be given in schools by professional acting troupes. In addition, for added flexibility, the program offered a video recording of a livestream performance for schools/ classrooms that preferred to share the content when it best fit into their lesson plan, at a later date. In late Spring, the program received internal approval to resume live in-person performances beginning in the Fall semester, while adhering to the customer engagement safety protocols established by the company.

Consistent with past years, each performance had content that was appropriate with its educational level. In the Spring, Elementary schools were able to view livestream performances of "Nikki Neutron's Energy Adventure"; "Energy Agents" was made available to Middle schools and High Schools were able to watch "Global Gamble". For the Fall 2022 Semester, the titles were replaced with live in-school performances of "Eco Guardians", "Conservation Café" and "Your Planet, Your Future" respectively. Though these titles changed for 2022-2023 school year, the core of the educational content remained the same; as has been the case in previous years. Students and teachers also had access to a Q&A with the host and an e-learning package that includes games, quizzes and lesson plans for the class that reinforce concepts from the show.

Overall, in 2022, a total of 571 schools participated (NC: 434, SC: 137) in the program in the Company's DEC service territory, reaching 162,711 students (NC: 123,519; SC: 39,192) and spurring the distribution of 11,615 kits (NC: 8,921; SC: 2,694).

Once an eligible customer submits a completed energy efficiency, the Energy Efficiency Starter Kit is shipped for delivery within two to four weeks.

In order to help encourage student participation, the program vendor, The National Theatre for Children, rewarded teachers $50 for every 20 Energy Efficient kit requests. Additionally, various rewards for schools and participating families were offered to encourage additional kit requests.

Updates

The Company continues to enhance the Program by the following:

- Introducing new productions each school year to refresh and refocus the materials and scripts to keep participating schools engaged.
- Promoting the program through social media to encourage awareness, recognition and participation.
- Partnering with Duke Energy Account and District Managers to leverage existing relationships in the community to develop positive media stories while encouraging kit sign ups.
- Enhancing the offering by providing educational materials for all student households, but particularly those that have already received the current Energy Efficiency Starter Kit as well as non-Duke Energy customer student households; both of which are ineligible for an EE Starter Kit.
- Inclusion of the Kilowatt Krush mobile gaming application that will allow users to learn about smart energy use and conservation through an engaging arcade of action-packed, energy themed games. Students build and customize virtual houses in the neighborhood of their choice while learning about energy efficiency and safety education.

E. Marketing Strategy

The National Theatre for Children is responsible for all marketing campaigns and outreach. The marketing channels may include but are not limited to the following:

- Direct mail (letters to school administrators)
- Email
- In-Person
- Program Website
- Events or assemblies
- Printed materials for classrooms
- Social media promotions

These marketing efforts engage students and their families in energy conservation behavior and provide energy saving opportunities through the Energy Efficiency Starter kits.

F. Evaluation, Measurement and Verification

The final evaluation covering period covering August 2019 – July 2020 was completed in December of 2021. Results were presented at the December 2021 DEC/DEP Collaborative. The 2022 process and impact evaluations are underway and will consist of a consumption and engineering analysis. The evaluation is scheduled to be completed during the third quarter of 2023.

Energy Efficient Appliances and Devices

A. Description

The Energy Efficient Appliances and Devices program ("Program") offers a variety of measures to eligible Duke Energy Carolinas, LLC (the "Company") customers to facilitate a reduction in their energy consumption. The Program includes offers for lighting, water measures, smart strips and smart thermostats through the online store, website and points of purchase.

Specialty Lighting

The Duke Energy Savings Store ("Store") is an on-demand ordering platform enabling eligible customers to purchase a variety of energy efficient products for their home. The Store launched on April 26, 2013 and offers a variety of Light Emitting Diodes lamps ("LEDs"), smart thermostats, smart strips, water fixtures, and small appliances. The incentive levels vary by product, and the customer pays the difference. Various promotions are conducted throughout the year, offering customers reduced prices as well as shipping promotions, ranging from free to a reduced flat rate price.

The maximum number of incented products are listed below with the associated limits (per account)

- LED lighting, 36 per account.
  - LED lighting product offering is comprised of - reflectors, globes, candelabra, 3-way, dimmable bulbs. The incentive levels vary by bulb type
- Smart thermostats, 2 total
- Water measures, 3 total
- Smart Strips, 4 total
- LED fixtures (direct wires, portable, & outdoor photocell), limit 8 total
- Small appliance, dehumidifiers & air purifiers, limit 2 each total

Customers may choose to order additional products without the Company's incentive.

The Store is managed by a third-party vendor, Uplight, Inc. (Uplight). Uplight is responsible for maintaining the Store website, fulfilling all customer purchases, supporting the program call center, and recommending products. The store's landing page provides information about the store, product offerings, promotions, and featured items. Support features include a toll-free number, email, chat, package tracking and frequently asked questions.

Educational information is available to help customers with their purchase decisions. This information includes videos and documents that speak to how the customer can reduce their energy usage while maintaining a comfortable atmosphere within their home.

Product pages include application photos, product images, product specifications, purchase limits, and program pricing. Customers may place items in their shopping carts to purchase later. Customers validate their eligibility for incentives and pay for their purchases with a credit card in the check-out process.

Retail Lighting

The Retail Lighting Program's primary objective is the reduction of electric energy consumption and peak demand through increased awareness and adoption of energy-efficient lighting technologies. The program partners with retailers and manufacturers across North and South Carolina to provide price markdowns on customer purchases of efficient lighting. The product mix includes Energy Star-rated standard, reflector, and specialty LEDs and fixtures. Participating retailers include a variety of store types, including Big Box, DIY, and discount stores.

The program promotes customer awareness and the purchase of program-discounted products through a range of marketing and outreach strategies, that may include in-store collateral, bill inserts, direct mail and email marketing, mass media advertising, and online advertising. The program also provides training to store staff to enable better customer education at the point of purchase. Ensuring customers are purchasing the right bulb for the application through proper customer education is imperative to obtain high satisfaction with lighting products and subsequent purchases.

Water Measures

The Save Energy and Water Kit Program ("SEWK") launched in 2014. The program is designed to increase the energy efficiency of residential customers by offering customers energy efficient water fixtures and water heater pipe insulation wrap for use within their homes.

The SEWK program is offered through a selective eligibility process, enabling eligible customers to request a kit and have it shipped directly to their homes. Kits are available in two sizes for homes with one or more full bathrooms and contain varying quantities of wide spray showerheads, two bathroom aerators, one kitchen aerator and two, three-foot sections of water heater pipe insulation wrap. Program participants are eligible for one kit shipped free of charge to their homes.

Audience

The Save Energy and Water Kit Program is offered to customers residing in a single-family home with an electric water heater who have not received similar measures through another company-offered energy efficiency program.

B &C. Impacts, Participants and Expenses

Energy Efficient Appliances and Devices[1]

$ in millions, rounded	Vintage 2022 As Filed	Vintage 2022 YTD December 31, 2022	% of Target
NPV of Avoided Cost	$34.7	$50.0	144%
Program Cost	$16.1	$16.5	103%
MW	7.7	14.2	185%
MWH	78,229.8	95,753.3	122%
Units	2,232,634	3,387,239	152%

1) Values are reflected at the system level.

D. Qualitative Analysis

Specialty Lighting

Highlights
The Online Savings Store provides an ecommerce platform that allows customers to purchase a variety of energy efficient products, including LEDs, smart thermostats, smart strips and more, at any time. During 2022, the program delivered the following to North Carolina customers: 161,458 specialty LED bulbs, 10,372 smart thermostats, 939 thermostat trim kits, 817 smart strips, 198 water products, 13 LED fixtures, 404 air purifiers and 184 dehumidifiers.

Respectively, during 2022 the program delivered the following to South Carolina customers: 55,548 specialty LED bulbs, 3,343 smart thermostats, 330 thermostat trim kits, 223 smart strips, 50 water products, 3 LED fixtures, 149 air purifiers and 37 dehumidifiers.

Issues
Educating and bringing awareness to the variety of products in the Store to eligible customers is the program's primary issue.

Energy Efficient Appliances and Devices

Potential Changes
The program continues to explore opportunities to facilitate ease of use shopping online as well as additional product offerings for consideration to enhance energy savings.

Retail Lighting

Highlights
In 2022, the program moved a total of 2,611,019 measures; 2,135,773 of which were purchased at retailers in NC and 475,246 from retailers in SC.

The DEC Energy Efficiency Program had 7 lighting retail channels actively participating in 2022. While the top three retail channels account for 66% of the program sales, all retail channels are important in that they allow access to the program for a widely diverse and geographically spread population of DEC customers. Locations are selected to ensure that the Program reaches 90% of customers within 30 miles of a participating retail location.

In addition, a key strategy for the program was continuing to increase its presence in Hard-to-Reach stores that have a high propensity of shoppers that would not adopt EE lighting had incentives not been made available to patrons at these locations. These stores include Dollar Tree, Habitat ReStore, Goodwill and Family Dollar. Overall, approximately 66% of program sales came from these types of stores.

The Program operated efficiently with 81% of overall Program costs going directly to customers in the form of incentives. Most of the remaining Program costs (18%) were spent on implementation and administration of the Program. The remaining 1% of costs were spent on marketing and labor.

In November, the program expanded it's offering to include incentives on Smart Thermostats, Air Purifiers, Dehumidifiers and Ceiling Fans at participating retailers (Best Buy, Home Depot, Lowes, ecobee.com, and Google Store). To take advantage of the program offers, store patrons will need to validate that they are a Duke Energy customer by accessing the instant rebate portal on their smart phone or personal computer. If eligible, the customer will receive a barcode to be scanned at checkout (in-store or online) to receive the instant rebate. While the program saw 270 coupon reservations, due to launching late in 2022 and expected lag in sales data from manufacturers, program participation was not seen until early 2022.

Issues
No issues to report at this time.

Potential Changes
As a result of changes to upcoming EISA guidelines resulting in many of the programs lighting products being pulled from the shelves, the Retail Lighting Program is scheduled to discontinue by 6/30/2023. In the early part of the 2023, the program will continue to operate while program sunset activities will commence as we get closer to the Summer. This will be inclusive of, but not limited to, notification of program discontinuance to all program partners, removal of in-store signage attributable to the program and removing of program store locator website.

While incentives will be removed from stores by 6/30/2023, with customers no longer being able to make a purchase on Duke Energy incentivized products, the program will continue to receive sales data from manufacturers through 9/30/23 for purchases made prior to 6/30/2023. This is driven by standard delays in receiving point-of-sales data from manufacturers.

Save Energy and Water Kit Program

Energy Efficient Appliances and Devices

Highlights
In 2022, the program distributed 392,480 water measures in 37,594 kits to North Carolina customers. These kits delivered 75,188 bath aerators, 37,594 kitchen aerators, 54,134 showerheads and 225,564 feet of pipe insulation.

Respectively, the program distributed 149,672 water measures in 14,357 kits to South Carolina customers. These kits delivered 28,714 bath aerators, 14,357 kitchen aerators, 20,459 showerheads and 86,142 feet of pipe insulation.

Issues
The program continues to review customer satisfaction surveys to identify opportunities for improvement with installation rates and overall customer satisfaction.

Potential Changes
The program transitioned to a new vendor in Q1 of 2022, AM Conservation. AM Conservation will provide a new online platform in Q1 2023, allowing customers who navigate to it from the BRC or email to request a kit with an option to upgrade their showerhead to a hand-held model for a discounted price. The platform will also provide a new fresh design and improved customer experience, increasing participation, installation of the measures, and overall satisfaction with the program.

E. Marketing Strategy

Specialty Lighting

Since the launch of the Store, marketing efforts include the following:

- Duke Energy Program website
- Bill messages and inserts
- General awareness and special promotion email and direct mail campaigns
- and digital media channels

Awareness and education will continue to be a focus in collateral messages to eligible customers, as well as highlighting great pricing and other promotional offerings such as free shipping.

Retail Lighting

The program's marketing efforts for both lighting and the program expansion to non-lighting measures included the following:

- Point of purchase materials at participating retailer locations
- Duke Energy Program website
- General awareness email and direct mail campaigns
- Cross-promotional opportunities in via internal marketing channels (Other programs, Residential newsletters)

In general, these marketing efforts are designed to create customer awareness of the Program, to educate customers on energy saving opportunities, and to emphasize the convenience of Program participation.

In addition, the program also had in-store retail events to assist store patrons with any questions related to their lighting needs.

Save Energy and Water Kit Program

The overall strategy of the program is to reach residential customers who have not adopted low flow water devices.

Marketing channels include both a direct mail business reply card (BRC) and direct email. Customers receiving the BRC may request a free kit by returning the BRC. Customers receiving a direct email simply click on a redemption link to redeem the offer online. Upon receiving the order from the customer through one of these methods, the program vendor will ship the pre-determined kit to the customer. Due to the unique eligibility requirements of this program, direct mail (BRCs) and direct email are the only two methods being used to solicit customers for participation.

The program has a website in place that customers can access to learn more about the program or to download an installation guide to aid in installing the kit measures.

F. Evaluation, Measurement and Verification

Residential Lighting

The evaluation for the DEC/DEP Online Saving/Marketplace Program included participation from Jan 2019 – March 2021. The evaluation report was completed November 30, 2021 and presented at the July Collaborative. The next evaluation is scheduled to begin the second quarter of 2023, with a tentative report completion date in late 4th Quarter 2023.

The DEC/DEP Retail Lighting evaluation was completed on December 5, 2022, and consisted of an impact and process evaluation. The DEC program realized 104.9 GWh in ex post gross energy savings, 17.2 MW in summer peak demand savings, and 7.3 MW in winter peak demand savings during the evaluation period. Net-to-gross varied by measure, however program-wide NTG was estimated at .604.

Save Energy & Water

The evaluation for combined DEC/DEP, including participation from July 2020 – June 2021 is currently underway, with a final report scheduled for the first quarter of 2023. As part of this evaluation, the evaluator will also survey non-participants to better understand their decisions to not participate in the program.

Energy Assessments

A. Description

The Home Energy House Call Program ("Program") is offered under the Energy Assessment Program. Duke Energy Carolinas, LLC (the "Company") partners with several key vendors to administer the Program.

The Program provides a free in-home assessment performed by a Building Performance Institute ("BPI") certified energy specialist and designed to help customers reduce energy usage and save money. The BPI-certified energy specialist completes a 60- to 90-minute walk through assessment of a customer's home and analyzes energy usage to identify energy savings opportunities. The energy specialist discusses behavioral and equipment modifications that can save energy and money with the customer. The customer also receives a customized report that identifies actions the customer can take to increase the home's efficiency. Examples of recommendations might include the following:

- Turning off vampire load equipment when not in use.
- Turning off lights when not in the room.
- Using energy efficient lighting.
- Using a programmable thermostat to better manage heating and cooling usage.
- Replacing older equipment.
- Adding insulation and sealing the home.

In addition to a customized report, customers receive an energy efficiency starter kit with a variety of measures that can be directly installed by the energy specialist. The kit includes measures such as energy efficiency lighting, a low-flow shower head, low flow faucet aerators, outlet/switch gaskets, weather stripping, and an energy saving tips booklet.

Additionally, bath aerators and pipe wrap are also available for free at the time of the assessment. New discounted measures may be purchased and installed during the assessment including LED specialty lighting (i.e. Globes, Candelabra and Recessed), Hand-held Showerhead, Smart Thermostats and a Blower Door test.

Audience

Eligible Program participants are the Company's residential customers that own a single-family residence with at least four months of billing history and central air, electric heat or an electric water heater.

B &C. Impacts, Participants and Expenses

Energy Assessments[1]

$ in millions, rounded	Vintage 2022 As Filed	Vintage 2022 YTD December 31, 2022	% of Target
NPV of Avoided Cost	$7.7	$2.7	35%
Program Cost	$5.6	$2.5	45%
MW	1.6	0.6	36%
MWH	14,772.7	5,120.2	35%
Units	125,315	21,584	17%

1) Values are reflected at the system level.
2) Units represent number of kits, and do not include additional LEDs.

D. Qualitative Analysis

Highlights

The Company continues with a multi-channel approach which includes Duke Energy website pages, website banners, online services banner, paid search campaigns, Facebook, email, bill inserts, bill messages, direct mail, and customer segmentation to reach customers with a high propensity to participate. Program staff explores other channels for marketing campaigns to reach the target audience and maximize both program performance as well as customer experience.

Vendors, partners and the team at Duke Energy collaborate regarding marketing initiatives, future scheduling, availability, routing, targeting, backlog, etc. to drive efficient operations as well as customer satisfaction.

Through June 30, 2022, the program conducted 3781 assessments. The program additionally installed 3768 feet of pipe insulation and 622 additional bathroom aerators. The program also installed the following discounted measures: 1232 specialty LED globes, 1055 recessed bulbs, 2088 candelabra LEDs, 107 Hand-held Showerheads, 26 Blower Door audits and 286 Smart Thermostats were installed to eligible customers. The program continues to focus on maximizing the number of measures installed as well as cross-promoting other Duke Energy programs and offerings. The program continues to focus on cross promotion of other programs and integration of in-field referrals for FindItDuke.

Potential Changes

Some program enhancements to increase the effectiveness of the Program being considered include the following:

- Continuing to optimize the online scheduling tool to enhance the customer experience
- Evaluating Virtual Audit capabilities to included townhomes/condos/Manufactured homes.
- Implementing post audit follow up with reminders of recommendations/referrals.

Issues

Duke has been working with the vendor to evaluate resource requirements, improve the appointment scheduling process, improve customer satisfaction, and update call center training documentation. The program continues to coordinate closely with the vendor to monitor incoming demand, evaluate marketing strategies, improve customer communication and to ensure adequate appointment slots are available.

E. Marketing Strategy

Program participation continues to be driven through a multichannel approach including targeted mailings to pre-qualified residential customers, bill inserts, online promotions, and online video. For those who elect to receive offers electronically, email marketing continues to be used to supplement direct mail. The Program management team continues to explore additional channels to drive awareness such as social, event marketing and other cross-promotional opportunities. The creative team continues to drive engagement and interest in the program based on online survey results and enrollment. The program has also incorporated seasonal thermostat promotions as part of the marketing campaigns. In between larger initiatives, such as bill inserts, the program utilizes direct mail which can easily be modified based on demand. Core messaging remains simple and focused on key benefits—a free energy assessment from Duke Energy can help save energy and money while also increasing comfort and it only takes three easy steps (You Call, We Come Over, You Save).

Home Energy House Call program information and an online assessment request form are available at www.duke-energy.com.

F. Evaluation, Measurement and Verification

To accommodate the additional measures now included in the energy assessment program and to work around the program suspension due to COVID, the combined DEC/DEP evaluation timeframe has been pushed back to cover the period Sept 2020 – Aug 2021. The activities will begin in earnest in Fall 2021 with a final report scheduled for First Quarter 2023.

It is anticipated that the evaluation will consist of a billing analysis that will compare the consumption of program participants to future program participants. Engineering estimates for the kit measures will also be conducted to provide insight into the behavioral impacts achieved through the program and to provide impacts for the Additional Bulbs and other optional measures provided to program participants. Participants surveys will be used to determine in-service rates and determine free ridership at the measure level.

The process evaluation will consist of participant surveys which will identify barriers to participation, improve program processes and assess overall participant satisfaction.

My Home Energy Report

A. Description

The Home Energy Report program ("HER" or the "Program") is a periodic usage report that compares a customer's energy use to similar residences in the same geographical area based upon the age, size and heating source of the home. The report includes recommendations to encourage energy saving behaviors. Customers with email addresses on file receive an electronic version of their reports monthly.

Customers receive reports up to 12 times per year via paper and electronic delivery. (Delivery may be interrupted during the off-peak energy usage months in the fall and spring.) The report delivers energy savings by encouraging customers to alter their energy use. Customer's usage is compared to the average homes (top 50 percent) in their area as well as the efficient homes (top 25 percent). It also suggests energy efficiency improvements, given the usage profile for that home. In addition, the report recommends measure-specific offers, rebates or audit follow-ups from the Company's other programs, based on the customer's energy profile. As of January 1, 2023, over 1.25 million single-family DEC customers and over 177 thousand multi-family DEC customers receive the Home Energy Report.

The Home Energy Report Interactive website links customers to a portal where they can complete their home energy profile, explore a robust library of energy savings tips, and get answers to their personal energy questions from an energy expert. Customers can also see how much electricity they might use in the coming months based on their usage history. As of January 1, 2023, over 32 thousand single-family customers and over 4 thousand multi-family customers were enrolled on the portal.

Audience

Target customers reside in individually metered, single-family and multi-family residences with active accounts and 13 months of concurrent service from Duke Energy Carolinas, LLC (the "Company"). Single-family residences receive up to 8 printed reports and, if they have an email address on file, 12 electronic reports throughout the year. Multi-family residences with registered email addresses with the Company receive up to 4 printed reports and 8 electronic reports throughout the year. Multi-family residences without registered email addresses with the Company receive up to 6 printed reports a year with a strong call to action to provide their email addresses.

B & C. Impacts, Participants and Expenses

My Home Energy Report[1]

$ in millions, rounded	Vintage 2022 As Filed	Vintage 2022 YTD December 31, 2022	% of Target
NPV of Avoided Cost	**$22.1**	**$18.9**	**85%**
Program Cost	**$12.2**	**$6.3**	**52%**
MW[2]	**92.5**	**67.1**	**73%**
MWH[2]	**333,200.7**	**361,618.4**	**109%**
Units[3]	**1,377,387**	**1,432,449**	**104%**

1) Values are reflected at the system level.

2) Values represent the annual MW and MWH savings associated with 2022 year-end participation.

3) At year-end 2022, single-family participation was 1,254,520 while multifamily participation was 177,929.

D. Qualitative Analysis

As customers receive subsequent reports and learn more about their specific energy use and how they compare to their peer group, their engagement increases. The report then provides tools in the form of targeted energy efficiency tips with actionable ideas to become more efficient. Program participants are encouraged to contact the Company with their questions, comments and report corrections. Property information corrections continue to generate the largest number of inquiries. In 2022 a total of 35 customers in DEC opted-out of the HER program, representing 0.002% HER participants in DEC.

Highlights

In 2021, the program launched a new HER design for the paper and email reports as well as an updated interactive website with new insights for customers. New website capabilities for customers include single sign on (a more seamless way to sign in to the site using Duke Energy credentials), updated profile experience that updates usage disaggregation real time, current week and month daily comparisons of energy usage compared to similar homes, and the ability for customers to see how their monthly energy usage by category compares to other similar homes.

In Q4 2021, the program also launched the first Seasonal HER experience. This winter seasonal HER sent to customers via paper, email, also had a new web page that highlights for customers their heating usage, how it compares to similar homes, and provides a checklist of tips to complete that would reduce heating usage and heat loss in the home. This Seasonal HER experience was expanded in 2022 to provide the program's first summer seasonal HER. The summer seasonal experience follows the same channels of communication as the winter seasonal and instead highlights customers' cooling usage and provides a checklist of tips to complete that would reduce cooling usage.

E. Marketing Strategy

The Program is marketed on the reports themselves by referring customers to the program website for additional information, Frequently Asked Questions ("FAQs") and contact resources. The HER Interactive portal is marketed by email and printed reports.

In 2021, the program introduced a new Welcome Letter mailed to all customers with their report to further awareness of the interactive portal. In 2022, the program continued on-report marketing campaigns.

F. Evaluation, Measurement and Verification

The combined DEC/DEP evaluation, covering the period Feb 2020 – Jan 2021, was completed March 6, 2022 and presented at the July collaborative. The new evaluation is scheduled to begin in the first quarter of 2023 with a tentative completion date of November 2023.

Residential Smart $aver® Energy Efficiency Program

A. Description

The Residential – Smart $aver® Energy Efficiency Program ("Program") offers measures that allow eligible Duke Energy Carolinas, LLC (the "Company") customers to reduce energy consumption in the home. The Program provides incentives for the purchase and installation of eligible central air conditioner or heat pump replacements in addition to Wi-Fi enabled Smart Thermostats when installed and programmed at the time the heating ventilation and air conditioning (HVAC) system is installed. Program participants may also receive an incentive for attic insulation, air sealing, duct sealing, variable speed pool pumps, and heat pump water heaters.

Program staff is responsible for establishing relationships with HVAC and home performance contractors ("Trade Allies") who interface directly with residential customers. These Trade Allies market and leverage the Program to assist with selling these products and services to customers. Once the Trade Ally has sold the service/product, they complete and submit incentive applications on behalf of the customer. An incentive is disbursed to the customer after the application has been approved and processed.

Duke Energy contracts with a third-party vendor for application processing, incentive payment disbursement, and Trade Ally and customer call processing.

Audience

The Company's residential customers that meet the eligibility requirements of the Program may participate.

B &C. Impacts, Participants and Expenses

Residential - Smart $aver Energy Efficiency Program[1]

$ in millions, rounded	Vintage 2022 As Filed	Vintage 2022 YTD December 31, 2022	% of Target
NPV of Avoided Cost	$5.5	$8.8	161%
Program Cost	$5.7	$7.6	132%
MW	1.5	2.6	175%
MWH	5,457.7	9,382.8	172%
Units	19,330	27,342	141%

1) Values are reflected at the system level.

D. Qualitative Analysis

Highlights

The DEC Smart $aver® incentive program ended 2022 with strong results. As of December 31, 2022, Duke Energy Carolinas participation was 27,342, remaining consistent but 882 lower than 2021 results of 28,224.

The program team continues to emphasize best practices and to build support by offering additional training to the Trade Allies (i.e. streamlined rebate processing, rebate submission training, selling higher efficiency products) and modifications to program requirements when needed.

Customer engagement also continues to be a focus of the Program especially through the "Find It Duke referral platform that positions Duke Energy as a trusted advisor by providing free home improvement referrals through a premier network of qualified contractors who deliver exceptional customer service. Several enhancements were made to the Find it Duke website that improved the presence of available rebates as well as special offers that are available from time to time. These enhancements intercept customers that may not be aware of our rebates as they enter the site to generate a referral. Available rebates and special offers are shown to the customer based on the referral category they have chosen.

In 2022, the Find it Duke referral channel experienced a 7% increase in volume due to increased recruitment of Trade Allies and coverage across non-major markets.

The buy-in and participation of the Trade Ally network is vital to the success of the Program. Trade Allies are important to the Program's success because they interface with the customer during the decision-making event. Customers who responded to a survey to rate their experience provided an average contractor rating of 4.75 out of 5.0 stars during 2022.

E. Marketing Strategy

Promotion of the rebate Program is targeted to HVAC and home performance contractors as well as pool and plumbing contractors that install variable speed pumps and heat pump water heater technology.

Information to educate customers about the Program and encourage participation and Trade Ally enrollment links are available on the Program's website. Improvements were also made the Smart Saver website to improve the visibility and ease for trade allies to learn about our program and easily register. Increasing the overall awareness of the Program and the participation of Trade Allies ensures more customers are considering the benefits of the Program at the time of purchase. Rebate marketing materials remain in place throughout the Carolinas in Lowe's and Home Depot stores that inform customers about the water heater rebates available and how to apply for them post-purchase. The Midstream channel has also been used to promote Pool Pump rebates through one national distributor along with local Pool Retailers throughout NC/SC.

Various customer marketing campaigns during 2022 leveraged channels such as TV, radio, social media and email and direct mail to build awareness of the available rebates and the referral service. Other marketing efforts, such as paid search and co-branded special offer campaigns throughout the year created awareness and drove referral volumes up for the channel.

F. Evaluation, Measurement and Verification

The joint DEC/DEP evaluation for the HVAC measures is currently underway. A participant survey was fielded in October of 2022, and a final evaluation report is scheduled for June 2023.

The evaluation will consist of a mix of methodologies, including a metering study for the HVAC measures, a consumption analysis for the smart thermostat measure, and engineering algorithms for the remaining measures. Participant surveys will be utilized to refine inputs into the engineering algorithms.

A. Description

The purpose of this Program is to incent new construction that falls within the 2018 North Carolina Residential Building Code to meet or exceed the 2018 North Carolina Energy Conservation Code High Efficiency Residential Option("HERO"). If a builder or developer constructing to the HERO standard elects to participate, the Program offers the homebuyer an incentive guaranteeing the heating and cooling consumption for the dwelling's total annual energy costs. Additionally, the Program incentivizes the installation of high-efficiency heating ventilating and air conditioning("HVAC") equipment in new residential construction.

Audience

The Program is available to builders and developers installing high-efficiency HVAC equipment in new single family, manufactured, and multi-family residential housing units that are served under any of the Company's residential rate schedules.

The program is also available to builders and developers of new single family and multi-family residential dwellings (projects of three or fewer stories) that comply with all requirements of the 2018 HERO standard and are served under any of the Company's residential schedules. Manufactured housing, multi-family residential housing projects over three stories in height, and any other dwellings which do not fall within the 2018 North Carolina Residential Building Code, are not eligible for any whole-house incentives.

The Program also supports the initial homeowner for any home constructed to meet or exceed the HERO standard when the builder or developer elects to extend a heating and cooling energy usage guarantee to the homeowner. At the sole option of the builder or developer, homeowners may be offered a Heating and Cooling Energy Usage Limited Guarantee for homes with a HERS Index Score verified by a certified HERS rater calculating the heating and cooling energy usage that the home should use during an average weather year.

B & C. Impacts, Participants and Expenses

Residential New Construction1

$ in millions, rounded	Vintage 2022 As Filed	Vintage 2022 YTD December 31, 2022	% of Target
NPV of Avoided Cost	**$0.0**	**$0.7**	**-**
Program Cost	**$0.0**	**$0.4**	**-**
MW	**0.0**	**0.2**	**-**
MWH	**0.0**	**505.5**	**-**
Units	**0**	**371,990**	**-**

1) Values are reflected at the system level.

D. Qualitative Analysis

Highlights

The Program move to a whole-house incentive structure which pays incentives to builders for HERO-compliant homes based solely on annual kWh savings continues to drive builders toward increasing savings.

Currently there are 80 builders and 15 approved raters registered in the Program. The Program saw a steady increase in homes submitted from Program launch in August through December. There was a decrease in December, likely because of the shortened invoicing period around the Holidays. Overall, the Program has a 70% pass rate and an average of 2,806 kWh per home. ICF is responsible for the operational oversight of Home Energy Raters and builders or developers participating in the Program.

Whole-House Requirement	Eligibility	Incentive
HERO	Meet 2018 NCECC HERO standards	$650
HERO plus HERS Score	Meet HERO standards and submit confirmed annual kWh savings from the Energy Summary Report.	• HERO+ all electric home heating savings - $0.40/kWh • HERO+ all electric home – other savings - $0.75/kWh • HERO+ natural gas heating – all savings - $0.75/kWh • All savings types capped at $6,000
	Equipment Description	**Incentive**
Equipment Incentive	AC or heat pump with SEER 15 or higher	$300 per unit

Issues

Delaying of SC approval delayed purchasing managers working in both SC and NC looking to make a clean sweep with all practices. Several builders will start making purchasing changes as new communities come aboard but will not make upgrades in mid-build cycle because of SC delays.

Potential Changes

E. Marketing Strategy

The Company promotes awareness through various marketing channels that include but are not limited to the following:

- Duke Energy Progress website
- NCHBA events
- Local HBA events/webinars
- Social media promotions

These marketing efforts are designed to create customer awareness of builders participating in the Program and to educate customers on the quality, comfort, and energy savings these homes offer. Please see Appendix for examples.

F. Evaluation, Measurement and Verification

The evaluation for DEC will occur after a full year of implementation, depending upon participation. The evaluator will conduct an engineering-based analysis to estimate the energy and demand impacts achieved by the program via developing energy simulation models, calibrating simulated models using AMI billing data and weather. Prescriptive measures will be evaluated using appropriate technical resource manuals.

Net-to-gross will be determined by surveys conducted with participating builders, non-participating builders, and HERS Raters.

Multi-Family Energy Efficiency Program

A. Description

The Multi-Family Energy Efficiency program ("Program") provides energy efficient lighting and water measures to reduce energy usage in eligible multi-family properties. The Program allows Duke Energy Carolinas, LLC (the "Company") to utilize an alternative delivery channel which targets multi-family apartment complexes. The measures are installed in permanent fixtures by Franklin Energy, the program administrator. Franklin Energy oversees all aspects of the Program including outreach, direct installations, and customer care.

The Program helps property managers save energy by offering energy efficient lighting and water products. The Program offers LED lighting measures including A-lines, globes, candelabras, recessed, and track bulbs, and energy efficient water measures such as bath and kitchen faucet aerators, water saving showerheads, pipe wrap and smart thermostats are available at a discounted price to Property Managers. Water measures are available to eligible customers with electric water heating. Customers are also able to purchase smart thermostats, and have them installed, at a discounted price. These measures assist with reducing maintenance costs while improving tenant satisfaction through lower energy bill
The Program offers a service where Franklin Energy installs the lighting, water measures and smart thermostats during scheduled visits. If the customer opts into purchasing the discounted smart thermostats, Franklin will also install those. Crews carry tablets to keep track of which measures are installed in each apartment.

After installations are completed, Quality Assurance ("QA") inspections are conducted on 20 percent of properties that completed installations in each month. The QA inspections are conducted by an independent third party. Any QA adjustments are provided to the Company to update participation records.

Audience

The target audience is property managers who have properties served on individually metered residential rate schedules. To receive water measures, apartments must have electric water heating. Properties with CFL installations over 5 years old are eligible for all the new LEDs and water measures. Lighting measures are only installed in permanent lighting fixtures such as ceiling lights, recessed lighting, track lighting, ceiling fan lights, and bathroom vanity lighting.

B &C. Impacts, Participants and Expenses

Multi-Family Energy Efficiency[1]

$ in millions, rounded	Vintage 2022 As Filed	Vintage 2022 YTD December 31, 2022	% of Target
NPV of Avoided Cost	**$9.7**	**$2.8**	**29%**
Program Cost	**$3.2**	**$1.0**	**31%**
MW	**2.4**	**0.7**	**31%**
MWH	**18,499.0**	**5,374.9**	**29%**
Units	**440,736**	**104,689**	**24%**

1) Values are reflected at the system level.

D. Qualitative Analysis

Highlights

In early 2021, the Program filed a request to add 1.25 GPM showerheads and discounted smart thermostats to the program. The new measures were approved and were included upon the relaunch of the program in late July 2021. Both of these measures are currently being offered and installed in DEC.
In 2022, North Carolina had 86 properties served, which included 8,243 units (apartments) and 81,224measures. These measures consist of 53,763 LED lightbulbs, 10,389aerators, 5,209 showerheads, 11,630 pipe wraps and 233 smart thermostats. South Carolina had 22 properties

completed, which included 1,977 units and 23,465 measures. These measures consist of 15,929 LED lightbulbs, 2,841 aerators, 1,513 showerheads, and 3,182 pipe wraps.

Issues

Reducing unit cancellations has been a focal point for the program. These cancellations can be a result of COVID, loose pets, safety issues, or not having access to the unit. The first six months of the year saw 1,371 unit cancellations. The last 6 months of the year, cancellations decreased to 998.
Resource constraints have continued to be the major issue with the program. Turnover of direct installers has been high and filling these positions has been difficult. Currently, 6 direct installers of the 16 total positions that were planned for the program in DEC have been filled. Franklin Energy is working with recruiters to find more candidates.

The Program continues to see a shortage of maintenance employees at properties, which has caused a delay in getting into these properties to install.

Potential Changes

The Program is exploring new measures to offer to customers. This includes T8 tubes, weather stripping, and additional thermostat offerings.

E. Marketing Strategy

As program implementer, Franklin Energy is responsible for marketing and outreach to property managers in the Company's service territory. Marketing is primarily done through outbound appointment setting calls, industry trade events, and on-site visits to gauge initial interest in the program. The Program staff also utilizes local apartment association memberships to obtain access to contact information for local properties and attends association trade shows or events to promote the program.

A Multi-Family Energy Efficiency public website landing page is available for property managers to learn more about the Program. A program brochure and a frequently asked question sheet are available for download. All marketing materials were updated to include the new measures, the 1.25 GPM showerheads and discounted smart thermostats. This website was recently updated and a request for assessment was added. Duke also sent out emails to customers in December to encourage participation. So far this has led to 1,202 measures installed.

Other ways a property manager may learn more about this Program are through the MyDuke Portal, an online tool used to pay the utility bills of vacant units at their property. The MyDuke Portal presents a promo link that directs the user to the Program website for more information.

Once enrolled, Franklin Energy provides property managers with a variety of marketing tools to create awareness of the Program among their tenants. The tools include letters to each tenant informing them of energy efficient measures being installed and of when the installations are taking place. Tenants receive educational leave-behind brochures when the installation is complete. Feedback from both property managers and tenants is important for the Program's continued success. Property managers are provided with leave-behind materials about the program which also includes a survey for them to complete and return. For tenants, the educational leave-behind brochure includes a satisfaction survey to return to Duke Energy. Online versions of both the Program Manager and Tenant surveys are also available.

After the installation, window clings are placed in strategic areas throughout the property, specifically in the common areas, entry and on each residential building on site (to the extent applicable). Using the window cling ensures that the program and Duke Energy are recognized long after the installation has taken place.

F. Evaluation, Measurement and Verification

The combined DEC/DEP EM&V evaluation for the Multifamily program covered participation from July 2019 – June 2021 and included an impact and process evaluation. As part of the impact evaluation, virtual site verifications were conducted to measure installations and collect data for use in the engineering analysis. The evaluation was completed April 20, 2022, and presented at the July Collaborative. The next evaluation is scheduled to begin the second quarter of 2023.

G. Appendix

Program Brochure-

Updated to add Commercial Offerings partnership and new water measures

FAQ for Property Managers

What does the install process look like?
On your scheduled installation days, our team will arrive at 8:45 a.m. to begin working by 9 a.m. A member of your staff will need to accompany our installers and handle keys throughout the installation process. The time spent in each unit varies depending on the layout and products being replaced. We will leave a flyer for each resident explaining what was installed and a survey providing an opportunity to give us feedback. It's that simple and that fast!

How do we qualify?
The Multifamily Energy Efficiency Program is available to eligible customers of Duke Energy Carolinas, Duke Energy Progress, Duke Energy Kentucky and Duke Energy Indiana. Additional qualifications depend on several factors such as metering, existing products, and method for water heating. To see which offerings your property qualifies for, you will need to schedule a complimentary energy assessment with one of our Energy Advisors by calling **888.297.1671** or emailing **dukeenergymultifamilyeep@franklinenergy.com**.

How much does it cost?
Products are offered at no cost with the exception of smart thermostats, which are available for installation at a discounted price. This program is part of many programs Duke Energy offers its customers from funds set aside to help reduce energy use. There are two parts to our program: residential (inside tenant units) and commercial (common areas). There are no limits on how many products we can install. Your Energy Advisor will go over your qualifications during the energy assessment.

What safety precautions should we know before installation?
As we are going through the units, if there are any unsecured pets or unattended minors, we will not be able to enter to perform the installation. During product installation, we ask that all small children be kept at a safe distance from the installers. The installers will provide further direction once on-site.

What precautions are you taking for COVID-19?
We will take precautions for the safety of our customers and workers including: asking about the health of the home's occupants prior to appointments, wearing protective equipment, practicing social distancing on-site and limiting in-home contact as much as possible. We will ask property staff to do the same during the install process.

What is the next step?
Call **888.297.1671** or email **dukeenergymultifamilyeep@franklinenergy.com** to schedule an appointment for an energy assessment.

This program is administered by Franklin Energy, a contractor of Duke Energy with experience in the installation of home energy-saving products.

Contact us today!

Phone
888.297.1671

Website
duke-energy.com/multifamily

Email
dukeenergymultifamilyeep@franklinenergy.com

This program is administered by Franklin Energy, a contractor of Duke Energy with experience in the installation of home energy-saving products.

DUKE ENERGY.

Multifamily Energy Efficiency Program

It's what's on the inside that counts.
Our **FREE** energy-saving lightbulbs and water-saving devices can help your residents save money.

DUKE ENERGY.
BUILDING A SMARTER ENERGY FUTURE®

Start saving now with the latest FREE energy-saving products.

Multifamily Energy Efficiency Program
If you are a Duke Energy customer, your residents may receive energy-saving products – installed in each multifamily residence and qualifying common areas at no cost. Optional smart thermostats are available for installation at a discounted price. The Multifamily Energy Efficiency Program is available to customers of all Duke Energy utilities.

See what other property managers had to say.

You guys got top marks
"I received the satisfaction survey and filled it out. You guys got top marks. I received a lot of compliments about how friendly and professional you all were. Thank you again for all that you did!"
– Asheville Property Manager

They were so polite and professional
"I just wanted to let you know that your team did a wonderful job installing the energy-saving products. They were so polite and professional, which made the residents feel more at ease with the installation. I really appreciate all the hard work that went into making this project run so smoothly. We are now officially energy efficient!"
– Raleigh Property Manager

Standard, Globe, Candelabra, Recessed and Track LEDs
ENERGY STAR® light-emitting diodes, or LEDs, use **up to 90% less energy** and **can save at least $80** over their lifetime in energy costs compared to traditional incandescent bulbs. A popular residential option, LEDs can be installed in bathrooms, track lights, ceiling fans, recessed lights and other high-usage permanent fixtures. A19 models are not available for common areas, and T8 LEDs are available for common areas only.

Exit Sign LEDs
Exit signs are necessary to keep your residents safe. Save on operating and labor costs by replacing incandescent exit sign bulbs with LEDs.

Google Nest
The optional **Google Nest Thermostat** can help you save an average of 10% to 12% on heating costs and 15% on cooling costs.[2]

Bathroom and Kitchen Faucet Aerators
These faucet aerators use **up to 55% less water** than traditional 2.2-gallons-per-minute (gpm) faucets, which can reduce water and sewer costs, as well as the amount of energy used to heat the water.[1]

Outer ring allows for adjustable flow

Water-saving Showerheads
These showerheads use **up to 40% less water** than traditional 2.5-gpm showerheads, which can reduce water and sewer costs, as well as the amount of energy used to heat the water.[1]

Outer ring allows for adjustable flow

Hot Water Pipe Wrap
Pipe wrap insulation reduces water and energy use by preventing heat loss while hot water travels through your building's pipes.[1]

1 If water is heated by electricity, savings are not guaranteed.
2 Independent studies conducted in the U.S. showed that Nest thermostats saved people an average of 10% to 12% on heating and 15% on cooling. Individual savings are not guaranteed. Learn more at nest.com/real-savings.

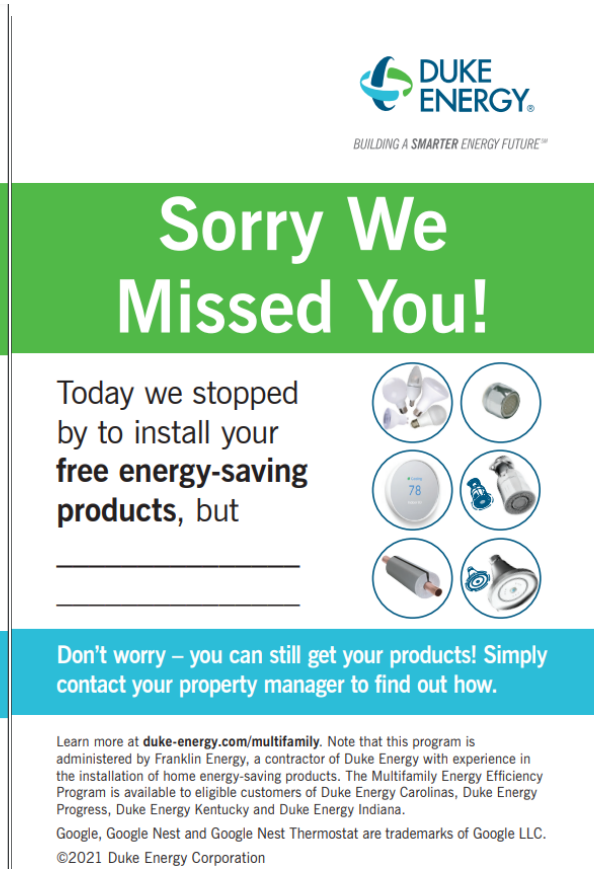
Google, Google Nest and Google Nest Thermostat are trademarks of Google LLC.
This program is administered by Franklin Energy, a contractor of Duke Energy with experience in the installation of home energy-saving products.

DUKE ENERGY.

Multi-Family Energy Efficiency Program

Sorry We Missed You

Door post-it



/A

Multi-Family Energy Efficiency Program

Window Cling

Multi-Family Energy Efficiency Program

Tenant Notice

You're Invited!

Save money on your energy bill with free products from Duke Energy.

Dear Resident:

Congratulations! Your property manager has enrolled your building in the **Multifamily Energy Efficiency Program**. Based on an assessment of your home, a selection of these complimentary products may be installed to help reduce your monthly energy usage:

Standard, globe, candelabra, recessed and track LED lightbulbs to replace your outdated incandescent lightbulbs. *(Track lighting can get very hot; please make sure your track lights are turned off before our installers arrive.)*

Water-saving showerheads to replace your existing fixtures.

High-efficiency faucet aerators for your kitchen and bathroom sinks.

Hot water pipe wrap to reduce heat loss.

Google Nest Thermostat to help you save an average of 10% to 12% on heating costs and 15% on cooling costs[1]

Help Us Help You!

In preparation for your installations, please make sure to:

- Safely contain your pet(s) during our visit
- Provide access to your water heater, shower(s), sinks and light fixtures
- Put away your valuables
- Have an adult present during installation
- Keep a safe distance while installers are working in your home

Trained technicians will perform the **free** installations in each residence on the date and time indicated below. The technicians will be accompanied by a member of the maintenance or management staff, who will provide access to your residence if you are not home at the time of installation. Additionally, the technicians will be in uniform with proper photo identification. We will take precautions for the safety of our customers and workers including: asking about the health of the home's occupants prior to appointments, wearing protective equipment, practicing social distancing on-site and limiting in-home contact as much as possible.

Technicians will be in your building:

XXXXXXX, XXXXXXX, XXXXXX

After the installations are completed, you will receive documentation and other educational materials about the energy-saving products that were installed free of charge in your home. Included in these materials is a customer satisfaction survey that we would appreciate your completing.

The Multifamily Energy Efficiency Program is available to eligible customers of Duke Energy Carolinas, Duke Energy Progress, Duke Energy Kentucky and Duke Energy Indiana. For additional information about this offering, or other offerings from Duke Energy, contact the Multifamily Energy Efficiency Program at **888.297.1671**, email **dukeenergymultifamilyeep@franklinenergy.com** or visit **duke-energy.com/multifamily**.

Thank you!
Multifamily Energy Efficiency Team

[1]Independent studies conducted in the U.S. showed that Nest thermostats saved people an average of 10% to 12% on heating and 15% on cooling. Individual savings are not guaranteed. Learn more at nest.com/real-savings.

DUKE ENERGY.

BUILDING A SMARTER ENERGY FUTURE®

Case Study

MULTIFAMILY ENERGY EFFICIENCY PROGRAM CASE STUDY

Here's What They're Saying About Us

"The Duke Energy Multifamily program has been instrumental in reducing the cost of living in Bell communities, enhancing our environmental stewardship and differentiating our NC/SC properties in the marketplace. We look forward to a continued partnership with Franklin Energy and Duke Energy."

– Wes Winterstein, Vice President, Ancillary Services, Bell Partners Inc.

ESTIMATED SAVINGS FOR RESIDENTS

Annual Electric Savings	Annual Electric Bill Savings
1,015 kWh	**$107**

Value and Savings for Bell Partners and Its Residents Through 2018		Going Green Makes a Difference		
Annual Electric Savings	Value of Products and Energy Savings	So far Bell Partners and Duke Energy have delivered energy savings equivalent to:	Cars Taken Off the Road	Trees Planted
2,771,664 kWh	**$434,089**		**314**	**37,653**

DUKE ENERGY AND BELL PARTNERS ARE GOING GREEN!

To date, Bell Partners and Duke Energy have collaborated to make nine communities more energy efficient by replacing standard lighting with LED bulbs, replacing inefficient faucets and showerheads with water-saving products, and insulating hot water heater pipes. The cost to Bell Partners and its residents? Nothing!
In 2017 and 2018, Duke Energy provided and installed:

- $152,000 worth of energy-saving products
- Over 26,000 LED lights
- Nearly 5,600 water-saving faucet aerators
- Over 1,800 energy-saving showerheads
- Nearly 14,000 feet of pipe insulation

Bell Partners residents can save an average of $107 annually on their electric bill. The communities save ongoing O&M expenses. And with the help of Duke Energy, Bell Partners continues to be a leader in the green multifamily market.

DUKE ENERGY.

BUILDING A SMARTER ENERGY FUTURE®

BELL PARTNERS®
APARTMENT INVESTMENT & MANAGEMENT

Multi-Family Energy Efficiency Program

Program Process Map

Multifamily Energy Efficiency Program

11 Steps to Energy Efficiency

We make saving energy at your property easy. Here are the steps we'll guide you through – from beginning to efficiency!

Before Your Installation

- [ ] **1. Schedule On-Site or Virtual Energy Assessment**
  Our team will check your property's eligibility during the energy assessment so we can determine which savings opportunities you qualify for.
- [ ] **2. Provide Property Information and Signed Agreement**
  To schedule your installation, we'll need a unit address list and a signed Service Agreement.
- [ ] **3. Schedule Your Installation Appointment**
  Your Energy Advisor will contact you to schedule the installation and provide a reminder call before we come.
- [ ] **4. Let Your Tenants Know We're Coming**
  Please distribute the personalized notices we give you 24 hours in advance of the installation, letting tenants know what to expect.
- [ ] **5. Select a Staff Member and Pull Apartment Keys**
  We will need a member of your staff (maintenance, leasing agent, intern) to accompany our team inside each unit throughout the installation. Please make sure they have apartment keys ready.

During Your Installation

- [ ] **6. Have Staff Member and Keys Ready by 8:45 a.m.**
  The installation team will arrive at your office by 8:45 a.m., ready to begin at 9 a.m. We will take precautions for the safety of our customers and workers including: asking about the health of the home's occupants prior to appointments, wearing protective equipment, practicing social distancing on-site and limiting in-home contact as much as possible.
- [ ] **7. Receive Regular Check-Ins from Installers**
  Our installers will check in each day to keep you updated on their progress. Please note that as installers are going through the units, if there are any unsecured pets or unattended minors, they will not be able to enter to perform the installation.
- [ ] **8. Review Installation Summary Report**
  Once the installation is completed, the team will check for any missed units and then provide you with a report summarizing what was installed.

After Your Installation

- [ ] **9. Watch for a Possible Quality Assurance Visit**
  To ensure your complete satisfaction, your property may be selected for a quality assurance inspection. If selected, you will be informed within 22 days of the installation, and the inspector will check at least 20% of the units to verify the products were properly installed.
- [ ] **10. Watch for a Possible Call from an Evaluator**
  This program undergoes an annual evaluation process to review and confirm the program's efficiency and effectiveness claims. You may receive a call from a third-party evaluator who will ask you about your experience.
- [ ] **11. Enjoy the New Products and Energy Savings**

Have questions?
Give me a call. I'm here to help!

You can also contact the Multifamily Energy Efficiency Program at 877.334.2680 or dukeenergymultifamilyeep@franklinenergy.com.

The Multifamily Energy Efficiency Program is available to eligible customers of Duke Energy Carolinas, Duke Energy Progress, Duke Energy Kentucky and Duke Energy Indiana.

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Google Nest E Sell Sheet

Multifamily Energy
Efficiency Program

Help Your Residents Save Energy and Money

DISCOVER THE CONTROL, CONVENIENCE AND SAVINGS OF THE GOOGLE NEST THERMOSTAT E[1]

Give your residents something to smile about with the Google Nest Thermostat E. Not only can this smart device help reduce energy usage, it can also help provide a unique level of luxury, convenience and control.

Thanks to Duke Energy, you'll only pay $100 for each thermostat, a price which includes free installation from our professional technicians![2]

BENEFITS FOR YOUR RESIDENTS:

- Can help save an average of 10% to 12% on heating costs and 15% on cooling costs[3]
- Has smart features that allow the Google Nest Thermostat E to turn itself down when no one's home
- Controlled from anywhere using the Google Home app

Want to learn more? Call 888.297.1671 or email dukeenergymultifamilyeep@franklinenergy.

Notes for Property Managers:

- It is required that your property's HVAC technician accompany the installers during the installation process.
- If you are experiencing any issues with the Google Nest Thermostat, please call Nest support at 855-VIP-NEST.

1 Duke Energy does not endorse specific products, services or companies – only energy-efficient technologies.

2 All air conditioning and heating systems must be electric-powered to be eligible for the Google Nest Thermostat E installation.

3 Independent studies conducted in the U.S. showed that Nest thermostats saved people an average of 10% to 12% on heating and 15% on cooling. Individual savings are not guaranteed. Learn more at nest.com/real-savings.

The Multifamily Energy Efficiency Program is available to eligible Duke Energy and Duke Energy Progress customers in the Carolinas, Kentucky and Indiana.

This program is administered by Franklin Energy, a contractor of Duke Energy with experience in the installation of home energy-saving products.

053-0117-07-00

DUKE ENERGY.

Google Nest E Setup Sheet

Multifamily Energy Efficiency Program

Your guide to your new Google Nest Thermostat E

Find what you need to know about setting up and using your thermostat below!

How to Control Your Thermostat

The Google Nest Thermostat E does not have a touch screen. Use the outer wheel, or bezel, to control the thermostat. Turn the dial to toggle between options and press the button to select.

How to Switch Between Modes

Your Google Nest Thermostat E has five available modes: Heat, Cool, Heat/Cool, Off, and Eco. You can switch between these modes using the Google Nest Thermostat E itself.

- Press the button at the bottom of the display to open the menu.
- Rotate the bezel to switch between different modes.
- Press the button at the bottom of the display to confirm your selected mode.

The Heat/Cool mode helps keep your house between a range of temperatures you select. When set to *Heat*, the selected temperature will be orange. When set to *Cool*, the selected temperature will be blue.

How to Turn on Auto Schedule

Auto Schedule is a smart feature that can help you save energy by learning your daily routines. Follow these steps to turn on this feature:

- Rotate the bezel until *Settings* is displayed and press the button.
- Press the button on the bottom of the display screen to confirm your selection.
- Rotate the bezel until *Nest Sense* appears.
- Press the button on the bottom of the display screen to select *Auto Schedule*.
- Press the button on the bottom of the display screen to select *Yes*.
- Press the button on the bottom of the display screen to select *Ok*.

Your Auto Schedule feature is now turned on.

How to Turn on Eco Mode

The Eco mode setting allows your Google Nest Thermostat E to adjust itself when no one is home. Prior to using the Eco mode setting, you must set your preferred temperature settings. Suggested eco settings are: Heat 68 and A/C 78

- Rotate the bezel until *ECO* appears.
- Press the button on the bottom of the display screen to confirm your selection.
- You will see a screen displaying the *Heat* to: temperature and the *Cool* to: temperature.
- Using the bottom button to confirm selection and the bezel to adjust the temperatures, set your preferred Eco mode settings.
- Once you have selected your preferred settings, rotate the bezel to Done and confirm selection.

Next, turn on *Home/Away Assist*.

- Go to *Settings*.
- Rotate the bezel until *Home/Away Assist* appears.
- Press the button on the bottom of the display screen to confirm your selection.
- Press the button on the bottom of the display screen to select *Use Eco*.

Scroll to *Done* and confirm select to turn on Eco mode display.

DUKE ENERGY.

Google Nest E Setup Sheet (Cont.)

Multifamily Energy Efficiency Program

Signing Up in the Nest App

To sign up for the Nest app and connect your thermostat to your phone, first download the Nest app from the Google Play store or the App Store. Then, follow these instructions:

1. Open the Nest app and tap *Sign Up*.
2. Enter your preferred email address.
3. Enter your password.
4. Read and agree to the Google Nest Terms of Service.
5. Check your email for a "Welcome to Google Nest" message and tap on the link to activate your Google Nest account.

Pairing Your Google Nest Thermostat E to the Nest App

Pair your Google Nest Thermostat E with your account:

1. Press the thermostat's bezel to open the Quick View menu.
2. Choose *Settings*.
3. Turn the bezel to Nest Account and press the bezel to select it.
4. Select QR code.
5. Open the Nest app and scan the QR code.

Additional Users Need Both the Google Home App and a Gmail Account

1. Download Google Home app.
2. Click the plus and invite home member.
3. Send invite email.
4. The new user will get an invite to register and log in.

If you are having trouble logging in to the Google Home app, do the following:

- Make sure you are using the latest version of the mobile app.
- Verify that you have entered the correct email address and password.
- Try resetting your password.

For questions about your new thermostat, please visit https://support.google.com/googlenest/gethelp. If you are still having issues, please call the Google Nest support team at 1.855.469.6378.

Google, Google Nest and Google Nest Thermostat E are trademarks of Google LLC
https://widgets.nest.com/nest-thermostat-troubleshooter/

The Multifamily Energy Efficiency Program is available to eligible Duke Energy and Duke Energy Progress customers in the Carolinas, Kentucky and Indiana.

Duke Energy does not endorse specific products, services, or companies – only energy-efficient technologies.

Note that this program is administered by Franklin Energy, a contractor of Duke Energy with experience in the installation of home energy-saving products.

DUKE ENERGY.

A. Description

PowerShare® ("Program") is a demand response program offered to commercial and industrial customers. The Program is comprised of Mandatory ("PS-M"), Generator ("PS-G"), and Voluntary ("PS-V") options, and customers can choose from a variety of offers. Under PS-M and PS-G, customers receive capacity credits for their willingness to shed load during times of peak system usage. Energy credits are also available for participation (shedding load) during curtailment events. The notice to curtail under these offers can be rather short (15-30 minutes), although every effort is made to provide as much advance notification as possible. Failure to comply during an event could result in penalties.

Audience

The Program is offered to Duke Energy Carolinas, LLC's (the "Company's") non-residential customers who have not opted-out and are able to meet the load shedding requirements.

B & C. Impacts, Participants and Expenses

PowerShare[1]

$ in millions, rounded	Vintage 2022 As Filed	Vintage 2022 YTD December 31, 2022	% of Target
NPV of Avoided Cost	$41.0	$54.3	133%
Program Cost	$12.9	$17.9	138%
MW[2]	320.2	450.1	141%
MWH	0.0	N/A	-
Units[3]	301,488	423,752	141%

Notes on Tables:

1) Values are reflected at the system level.
2) MW capability derived by taking average over specific PowerShare contract periods. At month-end December 2022, we had the ability to shed 423.7 MW (at the plant), representing 141% of the as filed capacity.
3) Units included in filing represent average KW at meter, rather than number of participants.

D. Qualitative Analysis

Highlights

PS-M and PS-G continue to be well received by customers who have the flexibility to curtail load upon request in both North Carolina and South Carolina. This is reflected in the considerable growth that the PowerShare program has experienced in 2022.

There were two PowerShare curtailment events in 2022, which occurred on December 24, 2022, from 4:00-12:00 and on December 26, 2022, from 6:00-10:00.

Issues

No current issues.

Potential Changes

The Company continues to work with stakeholder groups to evaluate opportunities for developing new options within the large nonresidential DSM programs that will enhance the flexibility of grid reliability resources available to our system operators. This includes enhancement of economic resources through modification of existing options or introduction of new options.

E. Marketing Strategy

To date, marketing efforts for the Program have focused on the relationship between the Company's account executives and their assigned customers. As part of their normal contact with customers, the account executives introduce the Program, including any new options/offers, while explaining the value proposition to the customer. Account executives share in-house analytics that show the incentives for each offer as applied to the customer's specific load profile and provide marketing collateral to explain the details of all the Program offers.

F. Evaluation, Measurement and Verification

Planning for the PY 2020/2021 evaluation began late 2020. The evaluation will estimate verified demand (kW) impacts using a baseline testing approach (including regression-based and customer baseline, or, CBL) for the period June 1, 2020 through May 31, 2021, with a tentative final report in the third quarter of 2023. These impacts will include:

a. Average kW demand impact per customer for each event, and on average across all events
b. Total program kW demand impact for each event, and on average across all events

Note this evaluation is subject to events occurring during this time period. Guidehouse did not perform an evaluation for the 2019-2020 season since no events occurred.

A. Description

The purpose of Duke Energy Carolinas, LLC's (the "Company's" or "DEC") Business Energy Saver program (the "Program") is to reduce energy usage through the direct installation of energy efficiency measures within qualifying non-residential customer facilities. The Program is administrated through two options: Small Business Energy Saver (SBES) and SmartPath.

SBES - All aspects of SBES are administered by a single Company-authorized vendor, Willdan Services. SBES measures address major energy end uses in customer facilities including lighting, refrigeration, processes and HVAC applications. SBES is designed as a pay-for-performance offering, meaning that the Company-authorized vendor administering SBES is compensated for energy savings produced through the installation of energy efficiency measures.

SmartPath - In 2020 a program modification was approved by the NC & SC utility commissions for SmartPath under the Business Energy Saver Program. SmartPath is meant to build upon the traditional SBES offering by minimizing financial barriers to customer participation by allowing customers to finance and implement energy efficiency upgrades at little to no upfront costs to the customer. SmartPath is implemented by a qualified Trade Ally network who develops proposals and implements the projects on the program's behalf.

Program participants receive a free, no-obligation energy assessment of their facility and a recommendation of energy efficiency measures along with the projected energy savings, costs of all materials and installation, and up-front incentive amount from the Company. If the customer decides to move forward with the proposed project, the customer will make the final determination of which measures will be installed. The vendor then schedules the measure installation at a time convenient for the customer. The Program provides the customer payment options including financing of the remaining project cost.

Audience

SBES is available to existing non-residential customers that are not opted-out of the Company's Energy Efficiency Rider. Program participants must have an average annual demand of 180 kW or less per active account.

SmatPath is available to all existing non-residential customers that are not opted-out of the Company's Energy Efficiency Rider. There are no kW limits associated with the SmartPath option.

B & C. Impacts, Participants and Expenses

Business Energy Saver[1]

$ in millions, rounded	Vintage 2022 As Filed	Vintage 2022 YTD December 31, 2022	% of Target
NPV of Avoided Cost	**$56.4**	**$23.7**	**42%**
Program Cost	**$19.7**	**$9.4**	**47%**
MW	**20.7**	**8.2**	**40%**
MWH	**98,041.8**	**43,263.8**	**44%**
Units[2]	**96,818,848**	**40,920,515**	**42%**

1) Values are reflected at the system level.

2) Units reflect gross kWh.

D. Qualitative Analysis

Highlights

Willdan Services is the Company-authorized vendor administering the SBES Offering in both DEC and DEP service areas.

In 2022, SBES continued to provide services to the Company's small and medium business customers. SBES finished below target due to market conditions. In 2021 SBES closed almost 50% of the project proposals in about 28 days. In 2022, the SBES only closed about 45% of the projects and it took about 50 days to get decisions. The lower close percentage and the delayed decisions slowed the Program in reaching the targets during 2022.

Even with the slowdown, customers were still accepting of SBES and interested in the energy efficiency to help with inflation and growing concerns with market conditions. However, there are concerns from Customers which are slowing the decision process. The Company continues to administer a customer satisfaction survey to SBES participants since SBES launched in DEC. Customers continue to give the SBES high scores and indicates SBES generates a positive view of the Company.

SmartPath was well received by customers and Trade Allies in 2022. Currently the program has enrolled 58 SmartPath Trade Allies to offer the program to Duke Energy customers. In 2022 SmartPath had 78 projects being initiated, up from 22 in 2021. 34 projects totaling 11,500 MWh savings were completed utilizing SmartPath and the project pipeline currently stands at 60 active projects and 31,000 MWh in energy savings heading into 2023.

Issues

While LED lighting measures are expected to remain the primary driver of kWh savings in SBES for the foreseeable future, the Company has been actively working with our vendor Willdan to implement initiatives focused on increasing refrigeration and HVAC measure adoption. With the impacts of COVID, SBES experienced a decline in refrigeration and HVAC measures. Willdan kicked off the year with additional training of their sales staff to promote and sale not only the refrigeration and HVAC measures but also the new process measures added.

Potential Changes

SBES and the Authorized vendor Willdan is working to add additional technologies to the direct install platform. This is being accomplished by working out agreements with equipment manufactures and installers working in the DEC territory. As SBES continues to mature, the Company will continue to evaluate opportunities to add incentivized measures which fit the direct install program model and are suitable for the small business market. Some of the measures currently being considered are window film, ice machine and vent/exhaust hood controls.

E. Marketing Strategy

The Program is marketed primarily using the following channels:

- Willdan field representatives
- Direct mail (letters and postcards to qualifying customers)
- Duke Energy Carolinas website
- Social media and search engine marketing
- Email & Duke Energy Business E-Newsletters
- Direct marketing & outreach via Program administrator
- Outreach via Duke Energy Business Energy Advisors
- Community events

All marketing efforts are designed to create customer awareness of the Program, to educate customers on energy saving opportunities and to emphasize the convenience of Program participation for the target market.

F. Evaluation, Measurement and Verification

No evaluation activities occurred in 2022. A tentative evaluation report is planned for the fourth quarter of 2023.

Non-Residential Smart $aver Prescriptive

A. Description

The Non-Residential Smart $aver® Prescriptive Program (”Program”) provides incentives to Duke Energy Carolinas, LLC’s (the “Company’s”) commercial and industrial customers to install high efficiency equipment. Incentives are provided based on the Company’s cost effectiveness modeling to ensure cost effectiveness over the life of the measure.

Commercial and industrial customers can have significant energy consumption but may lack an understanding of the benefits of high efficiency alternatives. The Program provides financial incentives to help reduce the cost differential between standard and high efficiency equipment, offer a quicker return on investment, save money on customers’ utility bills so it can be reinvested in their businesses, and foster a cleaner environment. In addition, the Program encourages dealers and distributors (or market providers) to stock and provide these high efficiency alternatives to meet increased demand for the products.

The Program promotes prescriptive incentives for the following technologies – lighting, HVAC, pumps, variable frequency drives, food services, process, and information technology equipment.

Audience

All of the Company’s non-residential opt-in customers billed on an eligible Duke Energy Carolinas rate schedule may participate.

B & C. Impacts, Participants and Expenses [1]

Non Residential Smart Saver Prescriptive[1]

$ in millions, rounded	Vintage 2022 As Filed	Vintage 2022 YTD December 31, 2022	% of Target
NPV of Avoided Cost	**$118.8**	**$73.3**	**62%**
Program Cost	**$34.3**	**$21.3**	**62%**
MW	**33.9**	**19.9**	**59%**
MWH	**189,264.1**	**117,927.2**	**62%**
Units	**10,564,165**	**6,600,034**	**62%**

1) Values are reflected at the system level.

D. Qualitative Analysis

Highlights

Over the years, the Program has developed multiple approaches for reaching a broad, diverse audience of business customers, including paper and online options for incentive payment applications, and instant incentives through the midstream marketing channel and the Online Energy Savings Store. Several 2022 program trends are listed below:

- Customers continue to show interest in energy efficiency; however, the program is still in the midst of a sustained decline due to negative conditions related to the COVID-19 pandemic, including inflation, product shortages, and contractor labor shortages.
- Customers continue to utilize the midstream marketing channel by taking advantage of instant incentives through participating equipment distributors; however, product shortages due to the pandemic have caused energy efficiency project delays.

[1] The information reflects results for the Non-Residential Smart $aver Prescriptive program in aggregate. Reference the Appendix for results by technology.

- Outreach continues to support Trade Allies working with the program, with a mix of virtual and phone outreach to Trade Allies, as well as in-person meetings when safe
- A dedicated team of representatives responded to customer questions via phone and email, providing high levels of customer service.

Customers have several options for participating in the Program. The following chart summarizes 2022 total participating customers by Program channel:

Program Option	Participating Customers*	% 2022 Repeat Customer
Paper and Online Application Form	620	65%
Midstream Marketing Channel	2,190	52%
Online Energy Savings Store	1,591	34%
Multifamily Free Channel	61	61%

*May include multiple facilities/sites for one customer.

PAPER AND ONLINE APPLICATIONS

In 2022, the Company paid incentives for 1,110 applications, consisting of 3,894 measures. In total, paid application volume was down in 2022 vs. 2021 by 16%. The average payment per paid application was $7,161.

Many Trade Allies participating in the application process reduce the customer's invoice by the amount of the Smart $aver® Prescriptive incentive and then receive reimbursement from Duke Energy. Customers often prefer this method rather than paying the full equipment cost upfront and receiving an incentive check from Duke Energy.

Duke Energy utilizes an internal database that allows the Program to self-administer Program applications and track program data.

MIDSTREAM MARKETING CHANNEL

The midstream marketing channel provides instant incentives to eligible customers at a participating distributor's point of purchase. Approved midstream distributors validate eligible customers and selected lighting, HVAC, food service and IT products through an online portal and use that information to show customers the reduced price for high efficiency equipment. Upon purchase, the distributor reduces the customer's invoice for the eligible equipment by the amount of the Smart $aver® Prescriptive incentive. Distributors then provide the sales information to Duke Energy electronically for reimbursement. The incentives offered through the midstream channel are consistent with current program incentive levels.

ONLINE ENERGY SAVINGS STORE

Duke Energy also offers the Business Savings Store on the Duke Energy website, with orders fulfilled by a third-party vendor. The site provides customers the opportunity to take advantage of a limited number of incentivized measures by purchasing qualified products from an online store and receiving an instant incentive in the form of a reduced purchase price. The incentives offered in the online store are consistent with current program incentive levels.

MULTIFAMILY COMMON AREA FREE MEASURES

In order to grow the number of accounts participating in EE, particularly in market segments where knowledge of EE is limited, the Program is now collaborating with the Residential Multifamily Direct Install program to offer free low-cost measures to multifamily common areas as well as tenant spaces. Multifamily properties that are being approached by the Residential Multifamily program's vendor, Franklin Energy, are now eligible to add on limited quantities of common area measures. The common area must be on an eligible commercial rate to participate. Measures such as LED screw-in lamps, LED exit signs, low flow shower heads, faucet aerators and pipe insulation are now being installed where possible in multifamily common areas as well as in residential spaces. For those properties that accept the measures, Franklin Energy will directly install them in the common areas when they are on site for the residential installations. Franklin Energy tracks the measures installed by property, as well as total installations and reports this information to the Smart $aver program team. This channel is up and running again in 2022 on a limited basis after being suspended along with the Residential Multifamily Direct Install program for the majority of 2021 due to COVID-19.

TRADE ALLY MANAGEMENT
Over the years, the Program has worked closely with Trade Allies to promote the program to our business customers at the critical point in time when customers are considering standard or high efficiency equipment options. The Smart $aver® outreach team builds and maintains relationships with Trade Allies in and around Duke Energy's service territory. Existing relationships continue to be cultivated while recruitment of new Trade Allies also remains a focus.

The Trade Ally outreach team educates Trade Allies on the program rules and the Smart $aver Program expectations for Trade Ally conduct. The Company continues to look for ways to engage the Trade Allies in promotion of the Program and to target Trade Allies based on market opportunities.

Issues

The primary issues that faced the program in 2022 were all related to the lasting negative effects of the COVID-19 pandemic on business customers. Inflation, energy efficiency product supply shortages, and Trade Ally labor shortages have all brought challenges that persist in the market and have caused Smart $aver® Prescriptive Program participation to decline compared to pre-pandemic levels.

Potential Changes

Program Management implemented a significant change on June 1, 2022, by raising the majority of Smart $aver® Prescriptive incentives as a reaction to inflation and rising product prices. Incentive levels were increased on average by 10% on all cost-effective measures in an effort to boost participation in the second half of 2022 and beyond.

Standards continue to change, and new, more efficient technologies continue to emerge in the market. Duke Energy periodically reviews major changes to baselines, standards, and the market for equipment that qualifies for existing measures and explores opportunities to add measures to the approved Program for a broader suite of options.

Duke Energy is also considering new and innovative ways to reach out to customer segments that have had a lower rate of prescriptive incentive applications and considering options to partner with other Duke Energy EE programs to cover gaps in the market and ultimately, make it easier for customers to participate in Smart $aver incentives. Also, the Duke program team would like to drive deeper customer savings and increase participation in technologies beyond lighting.

E. Marketing Strategy

The marketing plan for 2022 included direct marketing such as email and direct mail, online marketing, print marketing and supporting partnerships.

The internal marketing channel consists of assigned Large Business Account Managers, small and medium Business Energy Advisors, and Local Government and Community Relations, who all identify potential opportunities as well as distribute program informational material to customers and Trade Allies. Duke Energy has Business Energy Advisors in the Carolinas area to perform outreach to unassigned small and medium business customers. The Business Energy Advisors follow up on customer leads, assist with program questions, and steer customers who are not already working with a trade ally to the trade ally search tool. In addition, the Business Energy Advisors contact customers with revenue between $60,000 and $250,000 to promote the Smart $aver® programs. The Economic and Business Development groups also provide a channel to customers who are new to the service territory.

F. Evaluation, Measurement and Verification

A combined DEC/DEP evaluation is currently underway. The evaluation will consist of an impact evaluation and a limited process evaluation. Impacts will be determined from a mix of activities, including deemed savings, engineering desk reviews, participant surveys to refine input parameters, and onsite visits with a sample of main channel and midstream channel participants. NTG will be established through surveys with participants and trade allies.

The evaluation is scheduled to be completed in the first quarter of 2023.

G. Appendix

Non Residential Smart Saver Energy Efficient HVAC Products[1]

$ in millions, rounded	Vintage 2022 As Filed	Vintage 2022 YTD June 30, 2022	% of Target
NPV of Avoided Cost	**$9.7**	**$7.2**	**74%**
Program Cost	**$3.4**	**$2.1**	**61%**
MW	**2.9**	**1.4**	**47%**
MWH	**15,862.1**	**10,252.7**	**65%**
Units	**4,596,799**	**1,986,041**	**43%**

1) Values are reflected at the system level.

Non Residential Smart Saver Energy Efficient Lighting Products[1]

$ in millions, rounded	Vintage 2022 As Filed	Vintage 2022 YTD June 30, 2022	% of Target
NPV of Avoided Cost	**$106.7**	**$33.0**	**31%**
Program Cost	**$29.9**	**$9.1**	**30%**
MW	**30.3**	**9.5**	**31%**
MWH	**168,159.8**	**51,559.4**	**31%**
Units	**5,941,913**	**2,049,055**	**34%**

1) Values are reflected at the system level.

Non Residential Smart Saver Energy Efficient Food Service Products[1]

$ in millions, rounded	Vintage 2022 As Filed	Vintage 2022 YTD June 30, 2022	% of Target
NPV of Avoided Cost	**$0.7**	**$0.1**	**20%**
Program Cost	**$0.3**	**$0.1**	**22%**
MW	**0.1**	**0.0**	**18%**
MWH	**1,588.6**	**302.2**	**19%**
Units	**2,778**	**305**	**11%**

1) Values are reflected at the system level.

Non-Residential Smart $aver Prescriptive

Non Residential Energy Efficient Pumps and Drives Products[1]

$ in millions, rounded	Vintage 2022 As Filed	Vintage 2022 YTD June 30, 2022	% of Target
NPV of Avoided Cost	$1.1	$0.4	31%
Program Cost	$0.4	$0.1	32%
MW	0.4	0.1	32%
MWH	2,468.6	804.4	33%
Units	2,036	780	38%

1) Values are reflected at the system level.

Non Residential Energy Efficient ITEE[1]

$ in millions, rounded	Vintage 2022 As Filed	Vintage 2022 YTD June 30, 2022	% of Target
NPV of Avoided Cost	$0.0	$0.01	52%
Program Cost	$0.0	$0.01	23%
MW	0.0	0.0	-
MWH	95.0	44.2	47%
Units	900	289	32%

1) Values are reflected at the system level.

Non Residential Energy Efficient Process Equipment Products[1]

$ in millions, rounded	Vintage 2022 As Filed	Vintage 2022 YTD June 30, 2022	% of Target
NPV of Avoided Cost	$0.6	$0.02	4%
Program Cost	$0.3	$0.02	9%
MW	0.2	0.0	3%
MWH	1,089.9	60.5	6%
Units	19,737	5,403	27%

1) Values are reflected at the system level.

Non-Residential Smart $aver® Custom Assessment

A. Description

Duke Energy Carolinas, LLC's (the "Company's") Non-Residential Smart $aver® Custom Assessment (the "Program") offers financial assistance to qualifying commercial, industrial, and institutional customers to help fund an energy assessment and retro-commissioning design assistance in order to identify energy efficiency conservation measures of existing or new buildings or systems. The detailed study and subsequent list of suggested energy efficiency measures help customers to utilize the Non-Residential Smart $aver® Custom. The Program delivers a detailed energy report that includes the technical data needed for the Non-Residential Smart $aver® Custom Program and assistance with the Non-Residential Smart $aver® Application. All kWh and kW savings identified from measures implemented as a result of the pre-qualified assessments are attributed to Smart $aver Custom Program.

The intent of the Program is to encourage energy efficiency projects that would not otherwise be completed without the Company's technical and financial assistance. The Program's application requires pre-qualification for eligibility. Assessments are performed by a professional engineering firm pre-selected and contracted by the Company. The current engineering is Willdan.

The program was modified in 2017 to allows customers to choose one of the firms the Company contracted or to seek third party engineering assistance of their own selection and receive the same financial assistance. Pre-established criteria ensuring that the Program maintains high standards for engineering and work quality must be met for the funds to be released. This modification, which provided customers with more flexibility and choices, is expected to drive an increase in participation.

In 2019, the program again modified its approach again by utilizing a "virtual" approach to the assessment. Using energy modeling software called NEO from Willdan and collecting all building information remotely will allow the audit to be completed in 2-3 weeks for less cost. Each audit has a fixed cost of $5,000 which is covered 100% by the program. In 2020, the program was expanded to include buildings with process loads such as manufacturers. Program parameters are a focus on customers with a minimum demand of 180 kW with those below being serviced by Small Business Energy Saver®. The goal of the program is to perform 10-150 assessments annually.

Audience

Pre-qualified non-residential electric customers, except those that choose to opt out of the Program, are eligible.

B & C. Impacts, Participants and Expenses

Non Residential Smart Saver Custom Technical Assessments[1]

$ in millions, rounded	Vintage 2022 As Filed	Vintage 2022 YTD December 31, 2022	% of Target
NPV of Avoided Cost	$2.8	$0.5	17%
Program Cost	$1.5	$0.3	17%
MW	0.6	0.06	10%
MWH	5,350.5	822.2	15%
Units	3,408	3	0%

1) Values are reflected at the system level.

D. Qualitative Analysis

Highlights

Participation in 2022 was light with a total of six customers utilizing either the virtual audit or selecting their own vendor to perform an audit. Program design is being evaluated in Q1 in order to determine if restructuring will drive more participation.

Non-Residential Smart $aver® Custom Assessment

E. Marketing Strategy

The marketing strategy for the Program is to work with those customers that need technical and financial assistance as a companion to their internal resources. Given the facility-wide approach, many of the energy savings opportunities are complex and interactive in nature which fits well with the end-to-end involvement utilized in the Program. Typical customer marketing activity involves direct marketing from Business Account Managers, electronic postcards, e-mails, and information attained through the Company's website and direct customer inquiries. Marketing in the future may shift as the virtual modeling software becomes more applicable. The opportunity to receive a quick readout of a building's efficiency level for a nominal cost will be a compelling message to Duke Energy customers.

F. Evaluation Measurement and Verification

No evaluation activities were conducted in 2022.

Non-Residential Smart $aver® Custom

A. Description

Duke Energy Carolinas, LLC's (the "Company's") Non-Residential Smart $aver® Custom Incentives (the "Program") offers financial assistance to qualifying commercial, industrial and institutional customers (that have not opted-out) to enhance their ability to install cost-effective electrical energy efficiency projects.

The Program is designed to meet the needs of the Company's customers with electrical energy saving projects involving more complicated or alternative technologies, or with measures not covered by the Non-Residential Smart $aver Prescriptive Program. The intent of the Program is to encourage energy efficiency projects that would not otherwise be completed without the Company's technical or financial assistance.

Unlike the Non-Residential Smart $aver Prescriptive Program, the Program requires pre-approval prior to the project initiation. Proposed energy efficiency measures may be eligible for customer incentives if they clearly reduce electrical consumption and/or demand.

The two approaches for applying for incentives for this Program are Classic Custom and Smart $aver Tools. Each approach has a method by which energy savings are calculated, but the documents required as part of the application process vary slightly between the two.

Currently the application forms listed below are located on the Company's website under the Smart $aver® Incentives (Business and Large Business tabs).

- Custom Application, offered in word and pdf format.
- Application Assistance
    - Third party assistance with completing application and collecting necessary documentation
- Energy savings calculation support:
    - Classic Custom excel spreadsheet approach (> 700,000 kWh or no applicable Smart $aver Tool)
        - Lighting worksheet (excel)
        - Variable Speed Drive (VFD) worksheet (excel)
        - Compressed Air worksheet (excel)
        - Energy Management System (EMS) worksheet (excel)
        - General worksheet (excel), to be used for projects not addressed by or not easily submitted using one of the other worksheets
    - Smart $aver Tools approach (< 700,000 kWh)
        - HVAC & Energy Management Systems
        - Lighting (no project size limit)
        - Process VFDs
        - Compressed Air
    - Calculation Assistance
        - Third-party calculation generation for a fixed fee based on technology type

The Company contracts with AESC to perform technical review of applications. All other program implementation and analysis is performed by Duke Energy employees or direct contractors.

Audience

All of the Company's non-residential electric accounts billed on eligible rate schedules, except those that choose to opt-out of the Program, are eligible.

Non-Residential Smart $aver® Custom

B & C. Impacts, Participants and Expenses

Non Residential Smart Saver Custom[1]

$ in millions, rounded	Vintage 2022 As Filed	Vintage 2022 YTD December 31, 2022	% of Target
NPV of Avoided Cost	**$26.2**	**$14.7**	**56%**
Program Cost	**$9.7**	**$6.6**	**69%**
MW	**6.6**	**4.2**	**64%**
MWH	**46,402.4**	**21,230.2**	**46%**
Units	**31,726**	**31,646**	**100%**

1) Values are reflected at the system level.

D. Qualitative Analysis

Highlights

Customers continue to identify energy efficiency opportunities eligible for incentives under this Program. In 2022, 54 new pre-approval applications were submitted. A total of 93 projects were paid out during the calendar year. Additionally, 86 projects were enrolled in new construction which precedes a Smart $aver Custom application. Smart $aver Custom Incentives program uses a flat rate incentive for both energy and demand savings. Incentive rates were increased by over 10% effective August 1, 2022.

In 2023, the program plans to expand the scope of the new construction offering allowing buildings as small as 5,000 square feet to participate from its previous limit of 30,000 sf. The changes will allow new building types to take advantage to energy design consulting services and incentives such as retail, restaurants, convenient stores, and medical offices. A self-service tool is being created to allow customers to easily build their own energy model and select the energy efficiency measures they wish to implement. Support through the construction process will still be available.

In 2021, Application and Calculation Assistance were added. Application Assistance provides third party application completion. Calculation Assistance provides third party calculation generation. Both services are currently being offered at no cost to the customer.

Issues

The Program application process is considered burdensome by some customers due to the individual and technically intensive review required for all projects applying for a custom incentive. Each year, Program staff explores ways to reduce the length of the application. By streamlining processes, the average processing time has dipped to 20 days for all states/jurisdictions. The program is exploring options to remove or limit pre-approval in 2023.

The technical review often requires customers (or their vendors) to quantify the projected energy savings from the proposed project. This process can be lengthy and may require some level of engineering expertise. Where necessary, this requirement will continue, thus ensuring that incentives are being paid for cost-effective verifiable efficiency gains. Indications are that the Smart $aver Tools and online application portal have relieved some of this burden.

Like 2020 and 2020, the custom program's performance was down compared participation levels prior to the COVID-19 pandemic have not yet rebounded and were less than 50% of 2019.

The custom program is still limited by customers who are opted out of the EE Rider. Those customers who are opted out are not eligible to participate and any projects completed by those customers are lost opportunities. The custom program is actively working with internal resources (large account managers and Business Energy Advisors) to determine if opting in to the EE Rider for a potential project is the best option for customers currently opted out.

Finally, the custom program continues to see changes in available technologies as specific measures become eligible for Smart $aver Prescriptive.

Potential Changes

The Custom program continues to evaluate additional improvements to enhance participation, processing speed and program efficiency.

E. Marketing Strategy

The Company continued Program marketing efforts in 2022 through various marketing channels that include but are not limited to the following:

- Direct mail (letters and postcards to qualifying customers)
- Duke Energy website
- Community outreach events
- Small Business Group outreach events
- Paid advertising/mass media
- Social media promotions
- Trade ally outreach
- Account managers
- Business Energy Advisors

These marketing efforts are designed to create customer awareness of the Program, to educate customers on energy saving opportunities, and to emphasize the convenience of Program participation.

Non-residential customers learn of programs via targeted marketing material and communications. Information about incentives is also distributed to trade allies who sell equipment and services to all sizes of nonresidential customers. Large business or assigned accounts are targeted primarily through Company account managers. Unassigned small to medium business customers are supported by the Company's Business Energy Advisors. The Business Energy Advisors follow up on customer leads, assist with program questions, and steer customers who are not already working with a trade ally to the trade ally search tool. In addition, the Business Energy Advisors promote the program to customers with electrical costs between $60,000 and $250,000.

The internal marketing channel consists of Large Business Account Managers and Local Government and Community Relations who all identify potential opportunities as well as distribute program informational material to customers and trade allies. In addition, the Economic and Business Development groups also provide a channel to customers who are new to the service territory.

The Program launched a new marketing channel in 2017 called New Construction Energy Efficiency Design Assistance (NCEEDA) to identify energy efficiency projects for customers currently underserved in the SMB market. This channel will utilize the vendor Willdan Energy Solutions to help identify those opportunities, complete savings calculations, and submit applications for the customer. As of the summer of 30, 2022, NCEEDA will be celebrating 1,000 buildings enrolled and 100 million kilowatt hours saved. DEC represents approximately 70% of the total participation.

F. Evaluation, Measurement and Verification

A combined DEC/DEP Custom evaluation for Program Years 2018-2019 was completed in the second quarter of 2022. The evaluation of Program Years 2020-2021 is underway and began in Q3 of 2022, with a tentative report completion date scheduled for Q3 of 2023.

Non-Residential Smart $aver® Performance Incentive

A. Description

Duke Energy Carolinas, LLC's (the "Company's") Non-Residential Smart $aver® Performance Incentives (the "Program") offers financial assistance to qualifying commercial, industrial and institutional customers (that have not opted-out) to enhance their ability to install cost-effective electrical energy efficiency projects.

The Program is designed to encourage the installation of high efficiency equipment in new and existing nonresidential establishments as well as the performance of efficiency-related repair activities designed to maintain or enhance efficiency levels in currently installed equipment. The Program provides incentive payments to offset a portion of the higher cost of energy efficient installations that are not eligible under either the Smart $aver® Prescriptive or Custom programs. The types of measures covered by the Program include projects with some combination of unknown building conditions or system constraints or uncertain operating, occupancy, or production schedules. The specific type of measures is agreed upon with the Customer. The Program is delivered in close coordination with the existing Custom program team and shares resources for administrative review and payment processing. The Program requires pre-approval prior to project initiation.

The intent of the Program is to broaden participation in the Company's non-residential efficiency programs by providing incentives for projects that previously were deemed too unreliable to calculate an acceptably accurate savings amount predictively and, therefore, were not offered incentives. The program is also expected to provide a platform for gaining a better understanding of new technologies.

The key difference between the Performance Incentive Program and the Custom Program is that the customers in the Performance Incentive Program are paid incentives based on actual measured performance. For each project, a plan is developed to verify the actual performance of the project once completed and is the basis for the performance portion of the incentive.

The Program incentives will typically be paid out in the following manner, though payment installment quantities and timing may vary:

- Incentive #1: For the portion of savings that are expected to be achieved with a high degree of confidence, an initial incentive will be paid. This incentive is paid once installation is complete.
- Incentive #2: After performance is measured and verified, the performance-based part of the incentive will be paid out as follows:
    - If performance exceeds expectations, the incentive payout may be larger.
    - If performance does not meet expectations, the incentive payout may be smaller.

Application forms for applying for incentives are located on the Company's website.

The Company contracts with Alternative Energy Systems Consulting, Inc. (AESC) to perform technical review of applications. All other program implementation is performed by Duke Energy employees or direct contractors.

Audience

All the Company's non-residential electric accounts billed on eligible rate schedules, except those that choose to opt-out of the Program, are eligible.

Non-Residential Smart $aver® Performance Incentive

B & C. Impacts, Participants and Expenses

Non Residential Smart Saver Performance Incentive[1]

$ in millions, rounded	Vintage 2022 As Filed	Vintage 2022 YTD December 31, 2022	% of Target
NPV of Avoided Cost	**$3.4**	**$9.5**	**276%**
Program Cost	**$2.1**	**$2.4**	**111%**
MW	**0.8**	**5.5**	**681%**
MWH	**7,050.4**	**3,676.0**	**52%**
Units	**8,402,092**	**7**	**0%**

1) Values are reflected at the system level.

D. Qualitative Analysis

Highlights

As new technologies are introduced and changes occur in the energy efficiency marketplace, performance incentives are the perfect tool to influence and reward customers who invest in energy efficiency. The Smart $aver Performance Incentives program was launched on January 1, 2017. Efforts to encourage internal resources, trade allies and vendors who sell energy efficient equipment to promote the Program and assist customers to participate are continuous and on-going. In addition, the Program is marketed closely with the Smart $aver Custom Program.

In 2022, the program only received 2 new applications. Since program inception, a total of 42 applications have been received. Of note, the initial payment on the program's first Combined Heat & Power project was paid totaling over $1M. Three additional payments will be made over the next three years.

Although the program experiences large fluctuations in performance due to long project lead times, long monitoring and verification times, and the timing and sizes of projects, it remains an important option in order to assist in incentivizing less standard equipment.

Issues

Program management is monitoring a few areas.

- The preferred method for measurement and verification of performance is gathering, monitoring and analyzing customer billing history. However, energy savings are not significant enough at times to evaluate effectively through the review of billing information. If this is the case, sub-metering is required at the customer's expense and may be a hurdle due to the time and expense of monitoring and verifying savings.

- The Performance program cannot be offered to customers who are opted out of the EE Rider. Performance projects can easily carryover into multiple calendar years because of the monitoring and verification requirement, a situation which could make opting in more difficult to justify.

- Sometimes project M&V can span multiple years thus requiring a customer to be opted-in for multiple years. This is often not preferred, and we are beginning to see customers forfeit a portion of their project incentive to opt-out of the rider.

- Customers may not participate because of the risk of measured energy savings being less than expected and resulting in a smaller incentive payout.

Potential Changes

The Company continuously considers functional improvements to enhance participation, processing speed and program efficiency.

E. Marketing Strategy

The 2022 marketing strategy for the Smart $aver Performance Incentive Program closely aligns with the Custom Program. The goal is to educate the Company's non-residential customers about the technologies incentivized through both programs, as well as the benefits of installing energy-efficient equipment. These efforts encompass a multi-channel approach including but not limited to the following:

- Email (targeted customers)
- Direct Mail (letters to qualified/targeted customers)
- Duke Energy Carolinas website
- Community outreach events
- Print advertising/mass media
- Target customer outreach
- Industry Associations
- Large Account Managers
- Business Energy Advisors
- Trade Ally Outreach

Marketing efforts are designed to create customer awareness of the Program, to educate customers on opportunities to save energy, and to emphasize the convenience of Program participation.

Non-residential customers learn of programs via targeted marketing material and communications. Information about incentives is also distributed to trade allies who sell equipment and services to all sizes of nonresidential customers. Large business or assigned accounts are targeted primarily through Company account managers. Unassigned small to medium business customers are supported by the Company's Business Energy Advisors. The Business Energy Advisors follow up on customer leads, assist with program questions, and steer customers who are not already working with a trade ally to the trade ally search tool. In addition, the Business Energy Advisors contact customers with electrical costs between $60,000 and $250,000 to promote the program.

The internal marketing channel consists of Large Business Account Managers, Business Energy Advisors, and Local Government and Community Relations who all identify potential opportunities as well as distribute program informational material to customers and trade allies. In addition, the Economic and Business Development groups also provide a channel to customers who are new to the service territory.

F. Evaluation, Measurement and Verification

No evaluation activities were planned for 2022. Future evaluation timing will depend upon sufficient participation.

A. Description

Duke Energy Carolinas, LLC's (the "Company's" or "DEC") EnergyWise Business (the "Program") is an energy efficiency and demand response program for non-residential customers that allows the Company to reduce the operation of participants' air conditioning units during the summer and winter (Direct Load Control option) or allow the customer to modify their operations when requested during the winter (Bring Your Own KW option) to help manage the power grid. The Program provides customers with options for how they would like to participate. In exchange for participation, the Company applies an annual incentive directly to their bills or an incentive check.

Direct Load Control Option - For each air conditioning or heat pump unit that they have, Program participants can choose between a Wi-Fi thermostat or a load control switch professionally installed for free by the Program. In addition to choosing the equipment, participants also choose the cycling level at which they participate—30%, 50% or 75%. The levels represent the percentage of the normal on/off cycle of the unit that is reduced. During a conservation period, Company sends a signal to the thermostat or switch to reduce the amount of time a unit is on by the percentage the participant selected. For participating at the 30% level the customer receives a $50 annual bill credit for each unit, $85 for 50% cycling, and $135 for 75% cycling. Finally, participants that have a heat pump unit with electric resistance emergency/back up heat and choose the thermostat can also participate in a winter option that allows the Company to control the emergency/back up heat. For 100% control of the emergency/back up heat, the Company provides an additional $25 annual bill credit.

Participants choosing the thermostat are given access to a portal that allows them to control their units from anywhere they have internet access. They can set schedules, adjust the temperature set points and receive energy conservation tips and communications from the Company. In addition to the portal access, participants also receive conservation period notifications. Notifications allow participants to make adjustments to their schedules or notify their employees of the upcoming conservation period. Participants are allowed to override two conservation periods per year either before or during the conservation period.

Bring You Own KW Option – This option was filed and approved in NC during 2022 and filed in SC. This option allows customer to reduce their energy usage when asked by the Company and in return the customer will receive $30 per KW average reduction during the winter season. The customer can accomplish these reductions by making manual adjustments to their equipment or by connecting their equipment to receive communications for the Company.

Audience

The Program is available to existing non-residential customers that are not opted-out of the DSM portion of the Company's EE/DSM rider, Rider DSM; have at least one air conditioner or heat pump that operates to maintain a conditioned space on weekdays during the calendar months of May through September; and are not served under Schedules BC and HP, Riders NM, SCG, IS, PS or PSC.

B & C. Impacts, Participants and Expenses

EnergyWise for Business[1]

$ in millions, rounded	Vintage 2022 As Filed	Vintage 2022 YTD December 31, 2022	% of Target
NPV of Avoided Cost	**$2.2**	**$1.0**	**47%**
Program Cost	**$5.1**	**$2.3**	**45%**
MW	**17.1**	**7.0**	**41%**
MWH	**0.0**	**244.1**	**-**
Units[2]	**18,452**	**7,414**	**40%**

1) Values are reflected at the system level.
2) Units represent average monthly kW at meter for demand response measures (7,190), plus individual participants for smart thermostat energy efficiency measure (224).

D. Qualitative Analysis

Highlights

During the majority of 2022, the Program continued to operate in maintenance mode with what is now the Direct Load Control option. The Program tried to maintain summer load as reported in the IRP. In 2022, the Program continued to promote the Program, enroll customers and install equipment. The Program recovered some of the lost summer capacity from the pandemic but did not reach the pre-pandemic level.

The Bring Your Own KW option was filled and approved in NC during 2022 and filled in SC (approval received in Jan 2023). This option will allow the Program to grow and target winter capacity and improve the performance of the Program.

Issues

With the program struggling with cost effectiveness, and the change in DEC from a summer peaking utility to mostly winter peaking, the Direct Load Control option was moved to maintenance mode. We have negotiated price reductions with our vendor that will improve the cost effectiveness and allow the program to maintain its current summer capacity levels.

E. Marketing Strategy

For the Direct Load Control option in 2022 the Program continued the efforts of door-to-door marketing using a dedicated canvassing vendor. In addition to canvassing, the Program targets slightly larger and multi-location customers through Duke Energy's Business Energy Advisors.

For the Bring You Own KW option a campaign to reach technology providers kicked off to create a network of providers with technologies that are already connected to the control system. Through these technologies customers can easily participate in load control events call by the Company. Some examples of technologies would be thermostat manufactures, HVAC controls companies and generator companies.

F. Evaluation, Measurement and Verification

The evaluation for the Smart Thermostat (EE) measure for the period of January 2018 – February 2019 was completed in February 2021 and presented at the July 2021 DEC/DEP Collaborative. Impacts for the demand response portion (Summer 2021) for the program has subsequently begun with a final DR report delivered 2nd Quarter 2022.

Power Manager®

A. Description

Power Manager® ("Program") is a residential demand response program that helps ensure power reliability during peak demand periods or if continuity of service is threatened. Duke Energy Carolinas, LLC ("Company") provides two program options designed to reduce load from air conditioning or electric heating when events are called.

The Load Control Device (LCD) Power Manager option utilizes devices controlled via the Company's paging network to reduce the run time and energy use of participating customers' air conditioners for summer events and/or electric heat strips for winter events (currently available in NC only pending approval in SC)**.**

The LCD option is available to qualifying single family homeowners. For their participation, customers receive bill credits:

- Air Conditioner Control – $8 monthly credit on July through October bills (up to $32 annually).
- Heat Strip Control – $6 monthly credit on January through April bills (up to $24 annually)

During LCD events, the indoor fan is not controlled and may run, circulating air during an event.

The program's Smart Thermostat option utilizes a qualifying wi-fi connected thermostat to remotely change participants' temperature setting when the Company initiates a control event. By adjusting the thermostat's setting (up for cooling/down for heating), the system's run-time and energy use can be reduced during an event.

In addition to being able to change the thermostat setting during a control event, it can also be adjusted to pre-cool prior to a summer event and pre-heat prior to a winter event. This increases program effectiveness while minimizing the impacts to customer comfort.

As incentive for participating, customers receive a $75 Visa e-gift card via email upon successful enrollment; and each subsequent year they remain on the program they are emailed a $25 Visa e-gift card.

Audience

The LCD option is available to the Company's qualifying residential customers residing in owner-occupied, single-family residences with a qualifying central air-conditioning unit and, in NC only, ducted electric resistance heating controlled by a central thermostat.

The Smart Thermostat option is available to the Company's qualifying residential customers, with thermostat-controlled central electric heating and cooling, who have installed, connected to the internet, and registered their qualifying smart thermostat with the manufacturer.

Customers may participate in either the LCD or Smart Thermostat Power Manager option.

Power Manager®

B & C. Impacts, Participants and Expenses

PowerManager[1]

$ in millions, rounded	Vintage 2022 As Filed	Vintage 2022 YTD December 31, 2022	% of Target
NPV of Avoided Cost	$76.8	$73.7	96%
Program Cost	$19.3	$17.8	92%
MW[2]	599.1	522.2	87%
MWH	0.0	N/A	-
Units[3]	581,220	539,925	93%

Notes on Tables:

1) Values are reflected at the system level.

2) MW capability at the generator derived from the average reduction during the June - September control season achieved by a full shed of participating air conditioners. At month-end December 2022, we had the ability to shed 540 MW (at the plant), representing 93% of the as filed capability.

3) Units included in filing represent average kW at the meter during the June - September control season. YTD value is based on 301,278 Power Manager devices and 53,633 thermostats at year-end 2022.

D. Qualitative Analysis

Power Manager Events

On eleven days during the months January through March, the company conducted Evaluation, Measurement and Verification study events with customers on the Smart Thermostat winter-focused option. In preparation for the EM&V study, five sample groups were established. On ten of these event days, four sample groups were included and controlled in different ways to enhance the company's learning. One event included all participants.

Following these winter EM&V Smart Thermostat events, the following events were conducted in 2022.

- Two Smart Thermostat summer events. These included all customers in both the original summer only option and the winter-focused option.
- Two winter events as a result of Winter Storm Elliot.

Four summer LCD events were conducted.

- The first was a brief full-shed test initiated by DEC's Energy Control Center.
- The second was a cycling event in which air conditioners were allowed to run, but less than they normally would.
- The final two events were test events using shorter cycling rates at later hours to begin evaluating how Power Manager might be used differently in the future as solar capacity grows.

E. Marketing Strategy

LCD Option

For the Air Conditioner LCD option, outbound telephone calling remains the primary marketing channel, with additional outreach via email, the Company's residential newsletter and ads on the Company's website.

At year-end 2022, 248,825 customers were enrolled in the LCD option (NC: 187,624 and SC: 61,201), representing 301,278 Air Conditioners.

Prior to the start of the event season, participants were sent a thank you/reminder of their participation in the program. For the first time, this reminder was sent via email to 58% of Power Manager participants who had opted in to receive emails from Duke Energy, with the balance receiving a mailed postcard.

Following a controlled rollout of the Heat Strip option in NC, six customers (six heat strips) were enrolled in this new option at year-end.

Smart Thermostat Option

The smart thermostat option is primarily marketed through participating thermostat companies, using marketing messages collaboratively developed with Duke Energy. Once their smart thermostat is installed and registered with the manufacturer, customers are presented with information on the program by the thermostat company.

Channels include the thermostat app, mobile app and email communications. Using these different channels, customers are provided access to the program's requirements, general information and enrollment opportunities.

Duke Energy supplemented thermostat manufacturers' marketing with cross-promotions of smart thermostats available through the Company's Online Savings Store. In addition, email, the Company's residential newsletter and website banner ads were used.

At year-end 2022, 38,523 customers (NC: 31,142 and SC: 7,380) were participating in the smart thermostat option, representing 53,154 thermostats.

F. Evaluation, Measurement and Verification

Results for the Summer 2021 Power Manager program estimating savings for DLC and BYOT programs were completed in the fourth quarter of 2022. The evaluation consisted of a methodology change by incorporating a less complex RCT design mirroring the methodology used for EnergyWise Home program.

/A

Fields Exhibit 7

Duke Energy Carolinas, LLC
Estimate - January 1, 2024 - December 31, 2024
Docket Number E-7, Sub 1285
Projected Program/Portfolio Cost Effectiveness - Vintage 2024

Program	UCT	TRC	RIM	PCT
Residential Programs				
· Energy Efficiency Education Program	1.17	1.19	0.33	13.34
· Energy Efficient Appliances & Devices	4.86	3.41	0.89	5.42
· Smart $aver Energy Efficiency Program	1.34	1.11	0.72	1.69
· Income-Qualified EE Products & Services	0.72	0.72	0.50	1.81
· Multi-Family EE Products & Services	4.51	4.61	0.85	36.08
· My Home Energy Report	2.98	1.85	0.68	7.61
· Power Manager	4.75	9.51	4.75	0.00
· Residential Energy Assessments	1.32	1.29	0.49	19.02
· Residential New Construction	2.21	1.54	0.85	2.27
Residential Total	**2.96**	**2.90**	**1.25**	**4.07**
Non-Residential Programs				
· Custom Energy Assessment & Incentive	3.45	1.30	1.03	1.89
· EnergyWise for Business	1.33	2.39	1.19	79.51
· Smart $aver Energy Efficient Food Service Products	2.23	0.70	0.60	1.64
· Smart $aver Energy Efficient HVAC Products	4.16	2.71	0.92	3.93
· Smart $aver Energy Efficient Lighting Products	4.17	2.13	1.02	3.15
· Smart $aver Energy Efficient Pumps & Drives	3.92	2.68	0.90	4.61
· Smart $aver Energy Efficient Information Technology	0.47	0.50	0.27	5.03
· Smart $aver Energy Efficient Process Equipment	2.34	1.66	0.93	2.47
· Smart $aver Energy Efficient Performance Incentive	5.11	1.33	1.04	1.85
· Business Energy Saver	2.98	1.84	0.95	2.83
· PowerShare	4.77	281.10	4.77	0.00
Non-Residential Total	**3.95**	**2.46**	**1.24**	**2.87**
Overall Portfolio Total	**3.48**	**2.62**	**1.24**	**3.18**

/A

Fields Exhibit 8

Duke Energy Carolinas
Changes to DSM/EE Cost Recovery Vintage 2022 True Up January 1, 2022 - December 31, 2022
Changes from Prior Filing Due to Application of M&V and Participation
System kWh and kW Impacts Net Free Riders at the Plant

Residential Programs

	Filed in Docket E-7, Sub 1249		Filed in Docket E-7, Sub 1285		Overall Variance		E-7 Sub 1249	E-7 Sub 1285	Delta	Variance attributable to Participation		Variance attributable to Mix of Measures		Variance attributable to EM&V		Sum of Variances	
Program Name	kWh	kW	kWh	kW	kWh	kW	System Participation		Participation	kWh	kW	kWh	kW	kWh	kW	kWh	kW
Energy Efficiency Education	8,276,026	1,037	5,862,809	(996)	(2,413,216)	(2,033)	30,552	11,615	(18,937)	(5,129,742)	(643)	-	-	2,716,526	(1,391)	(2,413,216)	(2,033)
Energy Efficient Appliances and Devices	76,626,981	7,393	95,753,301	14,451	19,126,319	7,057	2,232,634	3,387,239	1,154,605	4,107,961	3,319	(1,598,976)	(461)	16,617,334	4,199	19,126,319	7,057
Residential Energy Assessments	14,772,690	1,605	5,120,221	581	(9,652,470)	(1,024)	125,315	21,584	(103,731)	(9,652,419)	(1,035)	-	-	(51)	11	(9,652,470)	(1,024)
Low Income Energy Efficiency and Weatherization Assistance	9,754,693	1,954	3,553,027	1,053	(6,201,666)	(901)	12,975	7,332	(5,643)	(3,874,189)	(724)	(510,562)	13	(1,816,915)	(190)	(6,201,666)	(901)
Multi-Family Energy Efficiency	18,499,000	2,392	5,374,930	737	(13,124,070)	(1,655)	440,736	104,689	(336,047)	(12,544,080)	(1,634)	(753,225)	(79)	173,235	58	(13,124,070)	(1,655)
My Home Energy Report	333,200,740	92,478	361,618,365	67,095	28,417,626	(25,384)	1,377,387	1,432,449	55,062	(311,076,778)	(86,339)	-	-	339,494,404	60,955	28,417,626	(25,384)
Residential New Construction	-	-	505.459	163	505.459	163	-	371.990	371.990	-	-	505.459	163	-	-	505.459	163
Residential Smart $aver Energy Efficiency	7,060,445	1,752	9,382,811	2,563	2,322,366	810	19,330	27,342	8,012	2,322,366	810	-	-	(0)	0	2,322,366	810
PowerManager	-	599,074	-	573,826	-	(25,249)	578,740	539,925	(38,815)	-	435,128	-	(3,207)	-	(457,170)	-	(25,249)
Residential Programs Total	468,190,575	707,687	487,170,923	659,473	18,980,348	(48,214)	4,817,669	5,904,165	1,086,496	(335,846,881)	348,884	(2,357,303)	(3,571)	357,184,532	(393,527)	18,980,348	(48,214)

Non-Residential Programs

	Filed in Docket E-7, Sub 1249		Filed in Docket E-7, Sub 1285		Overall Variance		E-7 Sub 1249	E-7 Sub 1285	Delta	Variance attributable to Participation		Variance attributable to Mix of Measures		Variance attributable to EM&V		Sum of Variances	
Program Name	kWh	kW	kWh	kW	kWh	kW	System Participation		Participation	kWh	kW	kWh	kW	kWh	kW	kWh	kW
Non Residential Smart Saver Custom Technical Assessments	5,350,493	611	822,162	60	(4,528,331)	(551)	3,408	3	(3,405)	-	-	(4,528,331)	(551)	-	-	(4,528,331)	(551)
Non Residential Smart Saver Custom	46,402,377	6,621	21,230,192	4,213	(25,172,186)	(2,408)	31,726	31,646	(80)	-	-	(25,172,186)	(2,408)	-	-	(25,172,186)	(2,408)
Non Residential Smart Saver Energy Efficient Food Service Products	1,588,593	135	740,565	38	(848,028)	(97)	2,778	939	(1,839)	(805,439)	(90)	(33,815)	(7)	(8,774)	(1)	(848,028)	(97)
Non Residential Smart Saver Energy Efficient HVAC Products	15,862,098	2,920	19,522,815	2,489	3,660,716	(431)	4,596,799	3,661,805	(934,994)	6,124,505	(267)	(2,463,789)	(162)	(0)	(2)	3,660,716	(431)
Non Residential Smart Saver Energy Efficient Lighting Products	168,159,774	30,254	94,248,537	17,216	(73,911,236)	(13,038)	5,941,913	2,929,031	(3,012,882)	(69,928,833)	(12,420)	(3,982,403)	(619)	(0)	1	(73,911,236)	(13,038)
Non Residential Smart Saver Energy Efficient Pumps and Drives Products	2,468,639	371	1,163,223	172	(1,305,416)	(199)	2,036	1,014	(1,022)	(964,972)	(148)	(340,444)	(51)	0	-	(1,305,416)	(199)
Non Residential Energy Efficient ITEE	95,047	-	97,843	-	2,796	-	900	754	(146)	15,329	-	(12,534)	-	-	-	2,796	-
Non Residential Smart Saver Energy Efficient Process Equipment Products	1,089,905	174	102,938	11	(986,967)	(163)	19,737	6,492	(13,245)	(707,153)	(112)	(279,814)	(51)	-	-	(986,967)	(163)
Non Residential Smart Saver Performance Incentive	7,050,429	805	3,676,020	5,485	(3,374,408)	4,680	8,402,092	7	(8,402,085)	-	-	(3,374,408)	4,680	-	-	(3,374,408)	4,680
Small Business Energy Saver	98,041,785	20,736	40,074,276	7,573	(57,967,509)	(13,163)	96,818,848	40,920,517	(55,898,331)	(39,061,378)	(9,092)	(16,627,482)	(3,766)	(2,278,649)	(305)	(57,967,509)	(13,163)
EnergyWise for Business	-	17,103	244,116	7,249	244,116	(9,854)	18,452	7,414	(11,037)	-	(11,199)	244,116	59	-	1,286	244,116	(9,854)
PowerShare	-	320,236	-	426,830	-	106,594	301,488	423,752	122,264	-	(34,422)	-	-	-	141,017	-	106,594
Non-Residential Programs Total	346,109,141	399,967	181,922,688	471,339	(164,186,453)	71,371	116,140,179	47,983,374	(68,156,804)	(105,327,941)	(67,751)	(56,571,089)	(2,875)	(2,287,423)	141,997	(164,186,453)	71,371
Total Residential and Non-Residential Programs	814,299,715	1,107,654	669,093,611	1,130,811	(145,206,105)	23,157	120,957,847	53,887,539	(67,070,308)	(441,174,822)	281,133	(58,928,392)	(6,446)	354,897,110	(251,530)	(145,206,105)	23,157

NOTE - The actual per unit impacts are reflective of the following EM&V reports:

Program Name As Filed	Docket	Report Reference	Effective Date
My Home Energy Report (MyHER)	E-7, Sub 1285	My Home Energy Report Program Evaluation	2/1/2021(MYHER),11/1/16 (MFAM MYHER)
Multi-Family Energy Efficiency Program	E-7, Sub 1285	EM&V Report for the Duke Energy Multifamily Energy Efficiency Program	7/1/2021
Neighborhood Energy Saver Program	E-7, Sub 1285	Duke Energy Progress & Duke Energy Carolinas Neighborhood Energy Saver Program - 2021 Evaluation Report - FINAL	7/1/2019
Small Business Energy Saver Program	E-7, Sub 1285	EM&V Report for the Duke Energy Small Business Energy Saver Program 2019-2020 (Revised)	7/1/2020
EnergyWise Business Program	E-7, Sub 1285	EM&V Report for the Duke Energy 2020/2021 EnergyWise Business Program	10/1/2021
Smart $aver Non-Residential Custom Program	E-7, Sub 1285	Smart $aver Non-Residential Custom Program Years 2018-2019 Evaluation Report	8/1/2022
Power Manager	E-7, Sub 1285	2021 Power Manager Evaluation Report (Includes Bring Your Own Thermostat)	10/1/2021
Retail Lighting Program	E-7, Sub 1285	Duke Energy Carolinas & Duke Energy Progress Retail Lighting Program - 2022 Evaluation Report - Final	4/1/2022
Income Qualified Energy Efficiency and Weatherization Assistance	E-7, Sub 1285	Duke Energy Carolinas Low Income Weatherization Program (2019-2020) Evaluation Report	1/1/2021

Duke Energy Carolinas, LLC
List of Industrial and Commercial Customers Opted Out of Vintage 2022
Docket E-7, Sub 1285

	Number of Accounts
DSM RIDER OPT OUT	**4,787**
EE RIDER OPT OUT	**4,516**

Customer Bill Name	DSM YR 21 (Jan 1-Dec 31) RIDER OPT OUT	EE YR 21 (Jan 1-Dec 31) RIDER OPT OUT	GRAND TOTAL
1515 MOCKINGBIRD CHARLOTTE OFFICE LLC	1	1	2
300 SOUTH TRYON LLC	5	5	10
301 COLLEGE STREET CENTER LLC	1	1	2
4 1/2 STREET PARTNERS LLC	1	1	2
4000 Monroe LLC		2	2
4601 PARK CHARLOTTE OFFICE LLC	1	1	2
638 BREWING CO, INC	2	2	4
800 GREEN VALLEY ASSOCIATES LLC	1	1	2
8420 TRIAD DR LLC	2	2	4
A & B OF UNIVERSITY PARK LLC	1	1	2
A & T STATE UNIV	5	3	8
A W NORTH CAROLINA INC	4	4	8
ABB MOTORS AND MECHANICAL INC	8	8	16
ABCO AUTOMATION INC	1	1	2
ABERCROMBIE TEXTILES LLC		1	1
ACUCOTE INC	3	3	6
ADVANCE STORES CO	1	1	2
ADVANCED DRAINAGE SYSTEMS	2	2	4
ADVANCED TECHNOLOGY	2	1	3
AEP INDUSTRIES INC	1	1	2
AERO ACCESSORIES INC	2	2	4
AFRO AMERICAN CULTUR	1	1	2
AIR PRODUCTS & CHEMICALS, INC	1	1	2
AIRGAS USA LLC		1	1
AKZO NOBEL SURFACE CHEMISTRY LLC	9	9	18
ALAMANCE BURLINGTON SCHOOL SYSTEM	6	6	12
ALAMANCE COMMUNITY COLLEGE	8	8	16
ALAMANCE EXTENDED CARE, INC	1	1	2
ALAMANCE FOODS INC		5	5
ALAMANCE REGIONAL MEDICAL CENTER	2	2	4
ALBEMARLE U. S., INC	1	1	2
ALCAN PACKAGING FOOD AND TOBACCO,INC	2	2	4
ALDERSGATE	10	8	18
ALDI (NC) LLC	2	2	4
ALEXANDER COUNTY SCHOOLS	2	2	4
ALEXANDRIA REAL ESTATE EQUITIES INC	7	7	14
ALL GRANITE INC	3	3	6
ALLIANCE ONE INTERNATIONAL	1	1	2
ALLIED DIE CASTING CO OF NC	2	2	4
ALLOYWORKS, LLC		6	6
ALTEC INDUSTRIES INC	3	3	6

AMAZON FULFILLMENT SERVICES, INC	1	1	2
AMAZON.COM SERVICES, INC.	4	4	8
AMAZON.COMM.DEDC,LLC	1	1	2
AMERICAN & EFIRD LLC	8	9	17
AMERICAN AIRLINES	5	2	7
AMERICAN CAMPUS LLC	1	1	2
AMERICAN CONVERTING, CO. LTD	2	2	4
AMERICAN EXPRESS TRAVEL RELATED SERVICES COMPANY	1	1	2
AMERICAN FIBER & FINISHING	1	1	2
AMERICAN HEBREW ACADEMY	10	10	20
American Honda Motor Co., Inc.		1	1
AMERICAN MULTI CINEMA INC	4	4	8
AMERICAN ROLLER BEARING CO	4	4	8
American Snuff Company, LLC	6	6	12
AMERICAN YARNS LLC	3	3	6
AMERICAN ZINC PRODUCTS LLC	1	1	2
AMSTAR SUGAR CORP	1	1	2
ANDALE INC	1	1	2
APPALACHIAN STATE UNIV		1	1
APPLE INC	1	1	2
Apple Maiden	1	1	2
AQUA PLASTICS INC	2	2	4
ARBOR ACRES UNITED METHODIST RETIREMENT COMMUN	8	8	16
ARBORETUM RETAIL, LLC	1	1	2
ARCHER-DANIELS-MIDLAND CO	3	3	6
ARDAGH METAL BEVERAGE USA, INC	2	2	4
ARE-NC REGION NO 11, LLC	2	2	4
ARJOBEX AMERICA	2	2	4
ARMACELL LLC	8	8	16
ARROW INTERNATIONAL INC	4	4	8
ASHLEY FURNITURE INDUSTRIES INC	13	13	26
ASSOCIATED HEALTH SERVICES INC	2	2	4
AT&T BELLSOUTH	3	1	4
AT&T MOBILITY LLC	3	3	6
AT&T WIRELESS SERVICE	1	1	2
ATAPCO UEP, INC	2	2	4
ATLAS WELDING	3	3	6
ATOS IT OUTSOURCING SERVICES	1	1	2
ATOS IT SOLUTIONS AND SERVICES, INC	1	1	2
ATRIUM WINDOWS & DOORS	9	9	18
AUTOMATED SOLUTIONS LLC	2	2	4
AVAGO TECHNOLOGIES WIRELESS(USA) MANUFACTURING	1	1	2
AVDEL USA LLC	1	1	2
AVISTA PHARMA SOLUTIONS	4	4	8
B & E WOODTURNING INC	1	1	2
B & W FIBERGLASS	1	1	2
B V HEDRICK GRAVEL & SAND COMPANY	9	9	18
B&G FOODS SNACKS, INC	1	1	2
B/E AEROSPACE, INC	12	15	27
BAKER INTERIORS FURNITURE COMPANY	5	8	13
Baker Temple Greensboro	1	1	2
BAKERY FEEDS INC	2	2	4

BAKKAVOR FOODS USA		1	1
BANK NOTE CORP	3	3	6
BANK OF AMERICA	3	2	5
BARNHARDT MANUFACTURING COMPANY INC	6	6	12
BARRDAY CORP	3	3	6
BARTIMAEUS BY DESIGN INC	3	3	6
BARTLETT MILLING CO	1	1	2
Bascom's Corner, LLC	1	1	2
BASF AGRICULTURAL SOLUTIONS SEED US LLC	9	9	18
BASF CORPORATION	2	2	4
BAY STATE MILLING	5	5	10
BEACON INDUSTRIAL LLCAttn Monica Miller	2	3	5
BEASLEY FLOORING PRODUCTS INC	2	2	4
BED,BATH & BEYOND	1	1	2
BEKAERT TEXTILES USA	4	4	8
BELK	7	7	14
BELL SOUTH MOBILITY	1	1	2
BELLSOUTH	10	9	19
BELLSOUTH BSC	13	2	15
BELLSOUTH TELECOMMUNICATIONS, LLC	1	1	2
BELMONT ABBEY COLLEGE	19	19	38
BEMIS MANUFACTURING CO	2	2	4
BENJAMIN THOMAS COOPER		1	1
BEOCARE INC	2	3	5
BERNHARDT FURNITURE COMPANY	8	8	16
BERRY GLOBAL, INC		1	1
BERRY TRI PLASTICS		2	2
BESTCO, LLC	5	6	11
BESTREADS INC	4	4	8
BEVERLY KNITS INC	6	6	12
BGO KANNAPOLIS OWNER LLC	1	1	2
BIC CORPORATION	5	5	10
BILLY GRAHAM EVANGELISTIC	6	6	12
BI-LO, LLC	6	6	12
BIOMERIEUX, INC	4	4	8
BISHOP MCGUINNESS CATHOLIC HIGH SCHOOL	3	3	6
BISSELL COMPANIES	1	1	2
BJ'S WHOLESALE CLUB	2	2	4
BLACKSTONE CHARLOTTE, LLC	1	1	2
BLOW MOLDED SOLUTIONS LLC		2	2
BLUE RIDGE COMMUNITY COLLEGE	18	15	33
BLUE RIDGE HEALTH CARE	1	1	2
BLUM, INC	1	1	2
BONSET AMERICA CORP	1	1	2
BORAL COMPOSITES INC.	2	2	4
BOSMERE INC.		1	1
BOSTON GEAR LLC	1	1	2
BOWMAN DAIRY	1	1	2
BOXBOARD PROD INC	2	2	4
BRASS CRAFT MFG CO	1	1	2
BRAXTON SAWMILL INC	2	2	4
BRF-A1,LLC	2	2	4

BRI 1875 MERIDIAN, LLC	7	4	11
BRI 1881 INNOVATION PARK LLC	2	1	3
BRIDGESTONE AIRCRAFT TIRE USA INC	3	3	6
BRIGHT ENTERPRISES INC	4	4	8
BROAD RIVER WATER AUTHORITY	1		1
BSN MEDICAL INC	1		1
BUCKEYE FIRE EQUIPMENT COMPANY	4	4	8
BUD ANTLE, INC	1	1	2
BUDDERFLY INC	3	3	6
BUDDERFLY, INC		3	3
BURKE COUNTY SCHOOLS	26	18	44
C P EAKES CO	1	1	2
CA RETREADING, LLC	2	2	4
CABARRUS COUNTY SCHOOLS	32	32	64
CALICO TECHNOLOGIES INC	2	2	4
CAMBRIDGE ACQUISITIONS LLC	1	1	2
CAMBRO MANUFACTURING CO	4	4	8
CAMCO MANUFACTURING, LLC	6	6	12
CAMFIL USA INC	2	2	4
CANDLE CORPORATION OF AMERICA	2	2	4
CAPITOL BROADCASTING COMPANY INC	8	8	16
CARAUSTAR INC	4	1	5
CARAUSTAR IND & CONSUMER PRODUCTS GROUP	5	3	8
CARDINAL FLOAT GLASS	1	1	2
CARDINAL HEALTH	1	1	2
CARDINAL HEALTH 200, LLC	1	1	2
CARDINAL HEALTH INC	2	2	4
CARGILL, INCORPORATED	9	9	18
CARLIE C'S IGA OF MINERAL SPRINGS	1	1	2
CARLISLE FOOD SERVIC	3	3	6
CARMEL COUNTRY CLUB	28	28	56
CARMEL CTRY CLUB	1	1	2
CARNEGIE/ ROXBOROUGH PROPERTY LLC	1	1	2
CAROLINA BEVERAGE GROUP, LLC	3	3	6
CAROLINA CONTAINER	6	6	12
CAROLINA CUSTOM SURFACES LLC	3	3	6
CAROLINA GLOVE COMPANY	6	6	12
CAROLINA GRAPHIC SERVICES LLC	1	1	2
CAROLINA INVESMENT PROPERTIES	1	1	2
CAROLINA LASER CUTTING INC	1	1	2
CAROLINA MEADOWS INC	21	21	42
CAROLINA NONWOVENS LLC	1	1	2
CAROLINA PERLITE CO	1	1	2
CAROLINA PRECISION COMPONENTS, INC.	1	1	2
CAROLINA PRECISION PLASTICS LLC	6	6	12
CAROLINA STALITE CO	9	9	18
CAROLINA SUNROCK CORP	9	9	18
CAROLINA TRACTOR & EQUIPMENT COMPANY	4	4	8
CAROLINA VILLAGE	2	2	4
CAROLINAS HEALTHCARE SYSTEM	30	30	60
CAROMONT MEDICAL GROUP	1	1	2
CARPENTER COMPANY	4	4	8

CARRIER CORPORATION	2	2	4
CARTMAN HOTEL LLC		1	1
CASCADE DIE CASTING GRP INC		2	2
CASE FARMS	2	2	4
CASTLE & COOKE NORTH CAROLINA LLC	4	4	8
CATAWBA COLLEGE	2	2	4
CATAWBA COUNTY SCHOOLS	6	3	9
CATAWBA VALLEY MEDICAL CENTER	1	1	2
CATO CORP	2	2	4
CBL ASSOCIATES MANAGEMENT, INC	1	1	2
CBP RESOURCES	4	4	8
CCBCC OPERATIONS, LLC	4	4	8
CCC DEVELOPMENT PARTNERS, LLC	1	1	2
CCF OF NC LLC	2	2	4
CCL LABEL INC		3	3
CDP DURHAM CENTER INVESTORS LLC	1	1	2
CEDAR FAIR SOUTHWEST, INC	3	3	6
CELGARD, LLC	1	1	2
CELLCO PARTNERSHIP	1	1	2
CENTRAL CAROLINA PLASTICS INC	1	1	2
CENTRAL CAROLINA PRODUCTS	1	1	2
CENTRAL REGIONAL HOSPITAL		5	5
CENTRILOGIC, INC	1	1	2
CENTURY FURNITURE, LLC	6	9	15
CERTAINTEED CORP	1	3	4
CHAPEL HILL/CARRBORO SCHOOLS	30		30
CHARLOTTE COLOCATION CENTER LLC	1	1	2
CHARLOTTE COUNTRY DAY SCHOOL	7		7
CHARLOTTE LATIN SCHOOLS, INC.	9	9	18
CHARLOTTE PIPE & FOUNDRY	13	13	26
CHARTER COMMUNICATIONS LLC	1	1	2
Chatta Corners Acquisition, LLC	1	1	2
CHEMICAL SPECIALTIES	5	5	10
CHEROKEE BOYS CLUB	3	3	6
CHESAPEAKE TREATMENT COMPANY, LLC	1	1	2
CHICOPEE, INC	1	1	2
CINEBARRE, LLC	7	7	14
CISCO SYSTEMS INC	1	1	2
CITY OF ASHEVILLE	1	2	3
CITY OF BELMONT	2	2	4
CITY OF BURLINGTON	5	5	10
CITY OF CHARLOTTE	87	100	187
CITY OF CHARLOTTE REGIONAL VISITORS AUTHORITY	6	6	12
CITY OF DURHAM	9	9	18
CITY OF EDEN		1	1
CITY OF GASTONIA	3	3	6
CITY OF GRAHAM	2	2	4
CITY OF GREENSBORO	19	21	40
CITY OF HENDERSONVILLE	1	2	3
CITY OF HICKORY	3	3	6
CITY OF KANNAPOLIS		1	1
CITY OF LENOIR	5	7	12

CITY OF MARION	2	2	4
CITY OF MEBANE	1	1	2
CITY OF REIDSVILLE	2	2	4
CITY OF SALISBURY	13	12	25
CITY OF WINSTON-SALEM	18	23	41
CK RIDGE CREEK WEST II, LLC		2	2
CKS PACKAGING INC	4	4	8
CLAPPS NURSING HOME CENTER	1	1	2
CLARIANT CORPORATION	16	16	32
CLARIOS, LLC	1	1	2
CLEARLIGHT GLASS AND MIRROR	2	2	4
CLEARWATER PAPER CORPORATION	5	5	10
CLEMENT PAPPAS NC, INC	4	3	7
CLEVELAND COUNTY SCHOOLS	30	27	57
CMBE	113		113
CMC-NORTHEAST INC	8	8	16
CMHA	14	14	28
COATS AMERICAN	2	2	4
COATS HP INC	2	2	4
COLEY, LLC		1	1
COLONIAL PIPELINE		5	5
COLUMBIA PLYWOOD CORPORATION	6	6	12
COMMONWEALTH HOSIERY	5	5	10
COMMSCOPE, INC.	11	11	22
COMPAERO	1	1	2
CONCRETE SUPPLY	4	4	8
CONCRETE SUPPLY CO	7	7	14
CONCRETE SUPPLY COMPANY LLC	1	1	2
CONOVER LUMBER CO	2	2	4
CONRAD HILL FEED &	1	1	2
CONSENSUS PROTOCOL LLC	1	1	2
CONSOLIDATED CONTAINER COMPANY	5	5	10
CONSOLIDATED METCO INC		1	1
CONTINENTAL AUTOMOTIVE SYSTEMS, INC	2	2	4
CORE SCIENTIFIC INC		2	2
CORMETECH INC	1	1	2
CORNERSTONE CHARTER ACADEMY INC	2	2	4
CORNING CABLE SYSTEMS	3	3	6
CORNING INC	6	6	12
COSTCO WHOLESALE INC	7	7	14
COUSINS PROP INC	1	1	2
COUSINS PROPERTIES LP	3	3	6
CPCC	38	38	76
CRAFT REVOLUTION LLC	1	1	2
CREDIT SUISSE SECURITIES (USA) LLC	1		1
CREDIT SUISSE SECURITIES(USA) LLC CENTER OF EXCELL	1	1	2
CRONLAND LUMBER CO	1	1	2
CROWN CONVERTING	2	2	4
CRWW SPECIALTY COMPOSITES INC	1	1	2
CS CAROLINA INC	3	3	6
CSHV 615 COLLEGE LLC	2	2	4
CSHV SOUTHPARK 6100 FAIRVIEW, LLC	2	2	4

CSHV SOUTHPARK, LLC	2	2	4
CULP HOME FASHIONS	1	1	2
CULP INC	2	2	4
CURTISS-WRIGHT CONTROLS INC	3	3	6
CYRUSONE-NC LLC	2	2	4
DAIMLER TRUCKS NORTH AMERICA, LLC	5	1	6
DALCO NONWOVENS, LLC	2	2	4
DANNY TERRELL	2	2	4
DART CONTAINER CORPORATION OF GEORGIA	2	3	5
DATACHAMBERS, LLC	2	2	4
DAVIDSON COLLEGE	15	15	30
DAVIDSON COUNTY COMMUNITY COLLEGE	3	3	6
DAVIDSON WATER INC		1	1
DC CHARLOTTE PLAZA LLLP	2	2	4
DC74 LLC	3	3	6
DDH NC 1, LLC		1	1
DE FEET INTERNATIONA	3	3	6
DEERE HITACHI CONST MACH	8	6	14
DELTA PHOENIX, INC.	1	1	2
DFA DAIRY BRANDS FLUID, LLC	1	1	2
DFA DAIRY BRANDS FLUIDS, LLC	1	1	2
DHOLLANDIA US, LLC	1	1	2
DIAMOND VIEW I LLC	2	2	4
DIAMOND VIEW II	2	2	4
DILLARDS DEPARTMENT STORE	6	6	12
DIMENSIONAL PLAZA LLC	1	1	2
DISCOVERY PLACE INC	1	1	2
DISNEY WORLDWIDE SERVICES INC	1	1	2
DIZE AWNING TENT CO	1	1	2
DOOSAN INFRACORE PORTABLE POWER - A DIVISION OF C	2	2	4
DOUGHTON MFG CO	3	3	6
DUKE UNIVERSITY	10	10	20
DUKE UNIVERSITY HEALTH SYSTEM INC	6	5	11
DUPONT SPECIALTY PRODUCTS USA LLC	1	1	2
DURHAM BULLS	2	2	4
DURHAM COCA COLA	3	3	6
DURHAM ID PHASE 1 DEVELOPER LLC	1	1	2
DURHAM OB GYN	1	1	2
DURHAM PUBLIC SCHLS	8		8
DURHAM PUBLIC SCHOOLS	55		55
DURHAM TECH COMM COL	1		1
DURHAM TW ALEXANDER LLC	2	2	4
DW EVANS ELECTRIC	1	1	2
DYNAYARN USA, L.L.C.	1	1	2
DYSTAR LIMITED PARTNERSHIP	1	1	2
DYSTAR LP	4	4	8
EASTERN BAND OF CHEROKEE INDIANS	1	1	2
EATON AEROQUIP INC	1	1	2
EATON CORP	2	2	4
ECOFLO INC	3	3	6
EDS PALLETT WORLD INC	4	4	8
ELASTIC FABRICS OF AMERICA	2	1	3

ELECTRIC GLASS FIBER AMERICA,LLC	4	4	8
ELECTROLUX HOME PRODUCTS	2	2	4
ELECTROLUX HOME PRODUCTS, INC	2	2	4
ELEVATE TEXTILES, INC		1	1
ELITE COMFORT SOLUTIONS LLC	1	1	2
ELITE DISPLAYS & DESIGN INC	3	3	6
ELLIS LUMBER CO	3	3	6
ELON UNIVERSITY	67	67	134
EMC CORPORATION	2	2	4
EMERGEORTHO, P.A	1	1	2
ENDURA PRODUCTS INC	5	5	10
ENGINEERED CONTROLS INTERNATIONAL INC	5	5	10
ENSONO, INC	1	1	2
EPA	5	5	10
ESSENTRA PACKAGING US, INC	1	5	6
ETHAN ALLEN OPERATIONS INC	2	2	4
EUROPA CENTER LLC	1	1	2
EVANS,JAMES R	1	1	2
EWE WAREHOUSE INVESTMENTS XXXIII LTD	4	4	8
FAIRFIELD CHAIR CO	6	6	12
FAIRYSTONE FABRICS	4	4	8
FAIST CHEMTEC INC	2	2	4
FAMILY DOLLAR STORES OF NORTH CAROLINA INC	1	1	2
FEDERAL RES BANK	1	1	2
FEDEX GROUND PACKAGE SYS INC	3	3	6
FERGUSON SUPPLY & BOX	2	2	4
FFNC INC	6	6	12
FIBER COMPOSITES CORPORATION	2	5	7
FIBRIX, LLC	2	2	4
FIDDLIN FISH BREWING COMPANY LLC	1	1	2
FIDELITY REAL ESTATE COMPANY, LLC	6	6	12
FIDELITY REAL ESTATE LLC	1	1	2
FIRESTONE FIBERS & TEXTILES COMPANY, LLC	2	2	4
FIRST CITIZENS BANK & TRUST CO	1	1	2
FISERV SOLUTIONS INC	1	1	2
FLETCHER HOSPITAL, INC.	7	8	15
FLEXENTIAL CORP	2	2	4
FLOW PROPERTIES	1	1	2
FLOWERS BAKING COMPANY	1	1	2
FLYNT AMTEX INC	1	1	2
FMC LITHIUM USA CORP	1	1	2
FOCKE & CO, INC	1	1	2
FOOD LION	223	220	443
FORBO MOVEMENT SYSTEMS	1	1	2
FORSYTH TECHNICAL COLLEGE	8	6	14
FOSS AUTO RECYCLING INC	5	5	10
FREUDENBERG PERFORMANCE MATERIALS LP	3	3	6
FRIENDLIEST HOTEL, LLC	1	1	2
FRITO-LAY, INC	1	1	2
FRONTIER COMMUNICATIONS CORPORATE SERVICES, INC	2	2	4
FRONTIER YARNS, INC		3	3
FRYE REGIONAL MEDICAL CENTER	9	9	18

FULLSTEAM BREWERY, LLC	1		1
FUNDER AMERICA INC	4	4	8
FURNITURELAND SOUTH	9	8	17
GALENOR DESIGNS, LLC	1	1	2
GALVAN INDUSTRIES INC	7	7	14
GARDNER WEBB UNIV	1	1	2
GASTON CO SCHOOLS	1	1	2
GASTON COLLEGE	7	7	14
GASTON COUNTY SCHOOLS	22	22	44
GATEWAY RESEARCH PARK, INC	4	4	8
GE LIGHTING SOLUTIONS LLC	6	6	12
GENERAL ELECTRIC	2	2	4
GENERICS BIDCO II, LLC	5	5	10
GENPAK LLC	6	7	13
GENUINE PARTS COMPANY	1		1
GERDAU AMERISTEEL US INC	2	2	4
GETRAG GEARS OF NA	2	2	4
GF LINAMAR LLC	1	1	2
GIGA DATA CENTER - 1 LLC	1	1	2
GILBARCO INC	1		1
GILDAN ACTIVEWEAR (EDEN) INC	4	2	6
GILDAN YARNS, LLC		1	1
GILKEY LUMBER CO INC	7	7	14
GKN DRIVELINE NORTH AMERICA, INC	1	1	2
GKN SINTER METALS	1	1	2
Glatfelter Mt Holly LLC		1	1
GLEN RAVEN INC	3	3	6
GLOBAL TEXTILE ALLIANCE INC	6	6	12
gold bond building products, llc	1	1	2
GOLDING FARMS FOODS	2	2	4
GOODWILL INDUSTRIES OF NW NC		1	1
GRACE AND LOVE LLC	1	1	2
GRANDEUR MFG	1	1	2
GRANGES AMERICAS INC	1	1	2
GRASCHE USA	1	1	2
GRASS AMERICA INC	4	4	8
GRAY MANUFACTURING TECHNOLOGIES LLC	2	2	4
GREENE STREET HOLDINGS	2	2	4
GREENEST HOTEL LLC	1	1	2
GREENSBORO COLLEGE	14	4	18
GREER LABORATORIES INC	4		4
Griffin Charlotte Airport Plaza LLC		1	1
Griffin Charlotte Park II LLC		1	1
Griffin Charlotte Park III LLC		1	1
GRIFFIN INDUSTRIES	2	2	4
GRIFOLS THERAPEUTICS INC	1	1	2
GUILFORD COLLEGE	41	29	70
GUILFORD COUNTY	10	9	19
GUILFORD COUNTY SCHOOLS	208	207	415
GUILFORD TECH COMM COLL	14	14	28
H ALVIS FAUST	2	2	4
H B D INC	1	1	2

HAECO CABIN SOLUTIONS	9	9	18
Hall Star		3	3
HAN FENG INC		1	1
HANCOCK & MOORE, LLC	4	3	7
HANES COMPANIES INC	2	3	5
HANES DYE & FINISHING	1	1	2
HANWHA ADVANCED MATERIALS AMERICA LLC	1	1	2
HARRIS TEETER INC	84	84	168
Hart White Storage LLC	1	1	2
HASHMASTER TECH, LLC		2	2
Haw River Farmhouse Ales, LLC	1	1	2
HAYWARD INDUSTRIES, INC	3	3	6
HENDERSON COUNTY	5	5	10
HENDERSON COUNTY HOSPITAL CORP	5	5	10
HENDERSON COUNTY PUBLIC SCHOOLS	16	16	32
HENKEL CORPORATION	5	5	10
HERBALIFE INTERNATIONAL OF AMERICA INC	1	1	2
HERRON TEST LAB INC	1	1	2
HICKORY ASSOCIATES LLC	2	1	3
HICKORY CITY SCHOOLS	10		10
HICKORY PRINTING SOLUTIONS, LLC	2	2	4
HICKORY SPRINGS MANUFACTURING COMPANY	16	17	33
HIGH ASSOCIATES, LTD	2	2	4
HIGH COUNTRY LUMBER AND MULCH LLC		2	2
HIGH DEFINITION TOOL CORPORATION	1	1	2
HIGHWOODS REALTY LIMITED	1	1	2
HIGHWOODS REALTY LIMITED PARTNERSHIP	15	1	16
HIGHWOODS REALTY LTP	1		1
HILL HOSIERY MILLS	2	2	4
HISTORIC REVOLUTION LLC	3	3	6
HITACHI METALS NC LTD	1	1	2
HOME DEPOT	9		9
HM Tech		1	1
HONDA POWER EQUIPMENT MFG, INC		2	2
Hood Container Corp		2	2
HS MALLARD CREEK CENTER LLC	2	2	4
HSRE-HOCK PLAZA LLC	2	2	4
HTA-MOREHEAD MOB, LLC	1	1	2
HUGH CHATHAM MEM HOSPITAL	39	39	78
HUITT MILLS,INC	2	2	4
HUMACYTE INC	2	2	4
HUNTSMAN INTERNATIONAL LLC	2	2	4
IBM CORPORATION	6	7	13
IGM RESINS USA INC		1	1
Illinois Tool Works Inc	1	1	2
IMAGE MARK BUSINESS SERVICES	1	1	2
IMAGES OF AMERICA	2	2	4
IMC-METALSAMERICA, LLC	1	1	2
IMERYS MICA KINGS MOUNTAIN INC	7	7	14
IMPERIAL HOTEL GROUP INC	3	3	6
INDEPENDENT BEVERAGE CORP	3	3	6
INDEPENDENT BEVERAGE CORPORATION	1	1	2

INDUSTRIAL WOOD PROD	2	2	4
INDUSTRIAL WOOD PRODUCTS	3	3	6
INFO-GEL, LLC	2	2	4
INGERSOLL-RAND COMPANY	14	14	28
Ingles Forest Gate Associates, LLC	1	1	2
INGLES MARKETS INC	25	25	50
INGLES MARKETS, INC.	40	40	80
INGREDION INCORPORATED	1	1	2
INSTEEL INDUSTRIES, INC	2	2	4
INSTITUTION FOOD HOUSE, INC	9	7	16
INTERNATIONAL PAPER COMPANY	4	4	8
INTERTECH CORP	2	2	4
IPEX USA, INC	1		1
IQE INC	3	3	6
IRVING PARTNERS, LTD	1	1	2
ISOTHERMAL COMMUNITY COLLEGE	6	6	12
ITG BRANDS LLC	2	2	4
J C PENNEY CO	1	1	2
JACKSON PAPER MFG CO	1	1	2
JDL CASTLE CORP	1	1	2
JOHN JENKINS CO	1	1	2
JOHN UMSTEAD HOSPITAL		3	3
JOHNSON & WALES UNIVERSITY	3	3	6
JOHNSON CONTROLS BATTERY GROUP, INC	2	2	4
JOWAT CORPORATION	8	8	16
JPS COMPOSITE MATERIALS CORP		1	1
JUST REAL ESTATE INC	4	2	6
KAYSER ROTH CORPORATION	2	2	4
KBI BIOPHARMA, INC	3	3	6
KBSIII CARILLON LLC	1	1	2
KEN SMITH YARN CO	1	1	2
KENDRION-SHELBY	1	1	2
KERRS HICKORY READY MIXED CONCRETE COMPANY INC	2	2	4
KEYSTONE POWDERED ME	1	1	2
KEYSTONE POWDERED METAL COMPANY	1	1	2
KHP GREENSBORO LLC	1	1	2
KIMBERLY CLARK	2	2	4
KIMBERLY-CLARK	3	3	6
KINCAID FURNITURE	6	6	12
KINDER MORGAN SOUTHEAST TERMINAL	3	3	6
KINDER MORGAN TRANSMIX GROUP	1	1	2
KINDRED HOSPITALS EAST LLC	2	2	4
KINGS MOUNTAIN HOLDINGS LLC	1	1	2
KINGS MOUNTAIN INTERNATIONAL INC	2	2	4
KOOPMAN DAIRIES INC	1	1	2
KOURY CORPORATION	48	48	96
KOURY VENTURES	4	4	8
KSM CASTINGS USA INC	2	2	4
KURZ TRANSFER PRODUCTS LP	5	5	10
KYOCERA INTERNATIONAL INC	1	1	2
L B PLASTICS INC	5	5	10
L S STARRETT CO		1	1

La Tortilleria, LLC	3	3	6
LAB CORP	6	6	12
LABELTECH INCORPORATED	2	2	4
LABORATORY CORPORATION OF AMERICA	1	1	2
LABORATORY CORPORATION OF AMERICA HOLDINGS	1	1	2
LAKE HICKORY COUNTRY CLUB		1	1
LANXESS CORP		6	6
LANXESS SOLUTIONS US INC	1	1	2
LASER INK CORPORATION	1	1	2
LEE INDUSTRIES	3	3	6
LEESONA CORP	1	1	2
LEGION BREWING COMPANY LLC	2	2	4
LELOUDIS LIONTIS, LLC	1	1	2
LENNY BOY LLC	1	1	2
LENOVO (UNITED STATES) INC	1	1	2
Leo's Piedmont LLC	1	1	2
LEVEL 3 COMMUNICATIONS LLC	2	2	4
LEVEL 3 TELECOM OF NORTH CAROLINA, LP		1	1
LEXINGTON FURNITURE IND	2	3	5
LIBERTY COMMONS NURSING AND REHABILITATION CENTI	1	1	2
LIBERTY HARDWARE	3	3	6
LIBERTY HEALTHCARE PROPERTIES OF BALLANTYNE LLC	1	1	2
LIBERTY HEALTHCARE PROPERTIES OF MECKLENBURG COU	1	1	2
LIDL US OPERATIONS LLC	1	1	2
LIDL US OPERATIONS, LLC	4	4	8
LIGGETT GROUP INC	1	1	2
LINCOLN COMMUNITY HEALTH CENTER INC	2	2	4
LINDYS HOMEMADE, LLC	1	1	2
LOPAREX LLC	2	2	4
LOTUS BAKERIES US MANUFACTURING, LLC	1	1	2
LOUISIANA-PACIFIC CORPORATION	1	1	2
LOWES FOODS	30	30	60
LOWES HOME CENTERS	1		1
LOWE'S HOME CENTERS, INC	82	30	112
LOWES OF FRANKLIN 717	1		1
LOWE'S OF FRANKLIN 717	1		1
LTF CONSTRUCTION COMPANY LLC	1	1	2
LUBRIZOL ADVANCED MATERIALS INC	3	3	6
LUCK STONE CORPORATION	1		1
LUTHERAN RETIREMENT MINISTRIES OF ALAMANCE CO	11	11	22
LYDALL THERMAL ACOUSTICAL INC	8	5	13
Maersk Agency USA INC	1	1	2
MAERSK INC	2	2	4
MAGNOLIA CASTLE LLC	1	1	2
MANN+HUMMEL FILTRATION TECHNOLOGY US LLC	2	2	4
MANNINGTON MILLS INC	1	1	2
MANUAL WOODWORKERS & WEAVERS INC	2	2	4
MAPLE SPRINGS LAUNDRY INC	4	4	8
MARION CITY SQUARE LLC	1	1	2
MARKET AMERICA		1	1
MARRIOTT INTERNATIONAL INC		2	2
MARSH FURNITURE CO	6	6	12

MARTIN MARIETTA MATERIALS INC	61	60	121
Maryland and Virginia Milk Products Corp	1	1	2
MATERIAL HANDLING INDUSTRY	1	1	2
MAUSER CORP		4	4
MAY DEPT STORE	3	3	6
MAYFLOWER VEHICLE SYSTEMS,LLC	2	2	4
MCCOMB INDUSTRIES LLLP	2	2	4
MCCREARY MODERN INC	8	1	9
McCrory Construction	2	2	4
MCDOWELL HOSPITAL INC	2		2
MCLEOD LEATHR & BELT	1	1	2
MCMICHAEL MILLS INC	2	2	4
MDI MANAGEMENT	1		1
MEAT AND SEAFOOD SOLUTIONS LLC	1	1	2
MECK AREA CATH SCHLS		4	4
MECKLENBURG COUNTY	19	11	30
MEDI MFG INC	1	1	2
MEDICAGO USA, INC	3	3	6
MERCHANTS DISTRIBUTORS , LLC	1	1	2
MERCK SHARP & DOHME CORP	6	6	12
Merck Teknika LLC	1	1	2
MERCY HOSPITAL, INC	1	1	2
MEREDITH WEBB PRINT	3	3	6
MERIDIAN BRICK, LLC	1	1	2
MERIDIAN HOSPITALITY HOLDINGS LLC	1	1	2
MERIDIAN LABORATORY CORP	1	1	2
MERITOR HEAVY VEHICLE SYSTEMS	1	1	2
MERITOR HEAVY VEHICLE SYSTEMS LLC	1	1	2
MESSER LLC	1	1	2
METALS USA CARBON FLAT ROLLED INC	2	2	4
METROLINA GREENHOUSES INC	19	19	38
MICHELIN AIRCRAFT TIRE CO	1	1	2
MICHELIN NORTH AMERICA	2	2	4
MIDNIGHT ENTERPRISES LLC		1	1
MILES TALBOTT	2	2	4
MILLIKEN & COMPANY	2	3	5
MILLSOURCE INC		4	4
MINNESOTA MINING & MFG CO	2	2	4
MINT MUSEUM OF CRAFT & DESIGN	1	1	2
MITCHELL GOLD CO	5	5	10
MODERN DENSIFYING		2	2
MOM BRANDS COMPANY, LLC	1	1	2
MOORE WALLACE NORTH AMERICA INC	1	1	2
MOORESVILLE CITY SCHOOLS	11	11	22
MORINAGA AMERICA FOODS INC		1	1
MORRISETTE PACKAGING INC	2	2	4
MORTON CUSTOM PLASTICS, LLC	2	2	4
MOSES CONE HEALTH SYS	17	17	34
MOUNT VERNON MILLS INC	1	1	2
MRR HOLDINGS, LLC	1	1	2
Mullen Academic Center INC	2	2	4
MULTI SHIFTER INC	1	1	2

N C FOAM IND INC	1	1	2
NATIONAL CONTAINER GROUP	1	1	2
NATIONAL GENERAL MANAGMENT CORP.	4	4	8
NATIONAL PIPE & PLASTIC, INC	1	1	2
NATIONAL PIPE & PLASTICS	2	2	4
NC A&T UNIV FOUNDATION	1	1	2
NC A&T UNIVERSITY	7	6	13
NC AIR NATIONL GUARD	1	1	2
NC BAPTIST HOSPITAL	7	7	14
NC BLUMENTHAL PAC	1	1	2
NC CENTRAL UNIVERSITY	1	1	2
NC DEPT OF HEALTH & HUMAN SERVICES	29	29	58
NC DEPT OF PUBLIC SAFETY	14	17	31
NC DOT	1		1
NC STATE UNIVERSITY	1	1	2
NEPTCO INC	2	2	4
NETAPP, INC	2	2	4
NEW EXCELSIOR, INC		1	1
NEW SOUTH LUMBER COMPANY INC	2	2	4
NEWTON INSTRUMENTS CO INC	11	11	22
NGK CERAMICS USA	2	2	4
NIAGARA BOTTLING LLC	1	1	2
NORAFIN AMERICAS INC	2	2	4
NORDFAB	5	5	10
NORDSTROM INC	2	1	3
NORFOLK SOUTHERN	3	3	6
NORTHERN HOSP OF SURRY CO	2	2	4
NORTHROP GRUMMAN GUIDANCE & ELECTRONICS COMP/	2	2	4
NOVANT HEALTH INC	23	24	47
NOVO NORDISK PHARMACEUTICAL INDUSTRIES, LP	1	1	2
NOVOZYMES NORTH AMERICAN INC	2	2	4
NR CHARLOTTE LLC	1	1	2
NW BALLANTYNE ONE LP	1	1	2
NW BALLANTYNE THREE LP	1	1	2
NW BALLANTYNE TWO LP	1	1	2
NW BETSILL BUILDING LP	1	1	2
NW BOYLE BUILDINGS LP	2	2	4
NW BRIXHAM GREEN ONE LP	1	1	2
NW BRIXHAM GREEN THREE LP	1	1	2
NW CALHOUN BUILDING LP	1	1	2
NW CHANDLER BUILDING LP	1	1	2
NW CRAWFORD BUILDING LP	1	1	2
NW CULLMAN PARK LP	1	1	2
NW EVERETT BUILDING LP	1	1	2
NW GRAGG BUILDING LP	1	1	2
NW HAYES BUILDING LP	1	1	2
NW HIXON BUILDING LP	1	1	2
NW IRBY BUILDING LP	1	1	2
NW JJH BUILDING LP	2	2	4
NW RICHARDSON BUILDING LP	1	1	2
NW SIMMONS BUILDING LP	1	1	2
NW WINSLOW BUILDING LP	1	1	2

NW WOODWARD BUILDING LP	1	1	2
NWBH 1 LP	2	2	4
NYPRO CAROLINA	3	3	6
O T SPORTS IND INC	1	1	2
OIL CHEM INC		1	1
OLD CAROLINA BRICK COMPANY	2	2	4
OLD RIVER FALLS SEWER	1	1	2
O'MARA, INC.	1	1	2
OMNISOURCE LLC		1	1
OMNISOURCE SOUTHEAST	5	5	10
OMNOVA SOLUTIONS	4	4	8
ONEAL STEEL INC	4	4	8
OTTO INDUSTRIES	1	1	2
OWASA	4	4	8
OWENS & MINOR DISTRIBUTION INC		1	1
OWENS ILLINOIS, INC	2	2	4
P G MACHINE SHOP	1	1	2
PACKRITE LLC	5	5	10
PACTIV LLC		3	3
PALLETONE OF NC	8	8	16
PANTHERS STADIUM, LLC	2		2
PARKDALE AMERICA LLC	5	7	12
PARKDALE MILLS, INC		1	1
PARKER HANNIFIN CORPORATION	4	4	8
PARTON LUMBER CO	6	8	14
PATRICK YARN MILL		1	1
PBM GRAPHICS INC	4	4	8
PENN ENG & MANF CORP	2	2	4
PEPSI BOTTLING VENTURES, LLC	7	7	14
PERMA TECH INC	1	1	2
PHARR YARNS, LLC	1	1	2
PHOENIX INDUSTRIES		4	4
PHONONIC DEVICES, INC	2	2	4
PIEDMONT CHEMICAL	2	1	3
PIEDMONT PUBLISHING	1	1	2
PIEDMONT ROW DRIVE, LLC	7	7	14
PIEDMONT TRIAD REG WATER AUTH		4	4
PILGRIM ASSOCIATES	2	2	4
PINE HALL BRICK COMPANY, INC	2	2	4
PINE NEEDLE LNG COMPANY	1	1	2
PIONEER COMMUNITY HOSPITAL OF STOKES	1		1
PIONEER DIVERSITIES CO	2	2	4
PITTSBURGH GLASS WORKS LLC		1	1
PLYCEM USA, INC	1	1	2
PNEUMAFIL CORPORATION	7	1	8
POLK COUNTY SCHOOLS	8	4	12
POLY PLASTIC PRODUCTS OF NC INC	4	4	8
POPPELMANN PLASTICS USA LLC	2	2	4
PowerHouse Recycling Inc.	1	1	2
PPG INDUSTRIES INC	2	2	4
PRECISION FABRICS GROUP INC	2	2	4
PRECISION MATERIALS-BLUE RIDGE LLC	2	2	4

PRECISION WALLS INC		1	1
PRECOR MANUFACTURING LLC	1	1	2
PRESBYTERIAN HOMES,INC	10	10	20
PRESBYTERIAN HOSPITAL	9	9	18
PRESBYTERIAN MEDICAL CARE CORP	1	1	2
PRESTIGE FARMS	1	1	2
PRESTIGE FARMS INC	1	1	2
PRINTCRAFT CO INC	1	1	2
PRINTPACK INC	1	1	2
PROCTER & GAMBLE MANUFACTURING COMPANY	5	5	10
PRODUCTS SE PIPE LINE CORPORATION	4	4	8
Proficient Supply LLC		1	1
PROMISE FOODS INC	1	1	2
PRO-SYSTEM, INC	1	1	2
PRYSMIAN CABLE AND SYSTEMS USA, LLC	1	1	2
PUBLIC LIBRARY MECK CO	2	2	4
PUBLIX NORTH CAROLINA LP	21	21	42
PUROLATOR FACET INC	3	2	5
QG PRINTING II LLC	4	6	10
QORVO US , INC	1	1	2
QORVO US INC	1	1	2
QUALICAPS INC	3	3	6
R & R POWDER COATING INC	1	1	2
RACK ROOM SHOES	1	1	2
RALPH LAUREN CORPORATION	2	2	4
RALPHS FRAME WORKS	2	2	4
RANDOLPH CO BD OF ED	4	4	8
RANDY D MILLER	7	7	14
RAUMEDIC INCORPORATED	1	1	2
RAYMER BROTHERS INC.		1	1
RD AMERICA LLC	1	1	2
REEP-OFC WATER RIDGE NC HOLDCO LLC	4	4	8
REMATTR, INC	2	2	4
RENWOOD MILLS LLC		1	1
REPLACEMENTS LTD	6	6	12
RESEARCH TRIANGLE INSTITUTE		1	1
REVOLUTION TENANT, LLC	2	2	4
REYNOLDA MANUFACTURING SOLUTIONS, INC	3	3	6
RH MANUFACTURING LLC	2	2	4
Richa Forsyth LLC		1	1
RICHA INC	4	4	8
RITZ CARLTON CHARLOTTE	1	1	2
RJ REYNOLDS TOBACCO CO	5	5	10
Robert Bosch Tool Corporation	3	3	6
ROCHLING ENGINEERED PLASTICS	3	3	6
ROCKINGHAM COUNTY GOVERNMENT	2	2	4
ROCKINGHAM COUNTY SCHOOLS	4	4	8
ROCK-TENN CONVERTING COMPANY	1	1	2
ROGER MARK PENDLETON	4	4	8
RONNIE D MILES	1	1	2
ROUSH & YATES RACING ENGINES, LLC	5	5	10
ROWAN COUNTY	4	4	8

ROWAN SALISBURY SCHOOLS	5		5
RUTHERFORD HOSPITAL INC	3	3	6
SAFT AMERICA	4	4	8
SALEM ACADEMY & COLLEGE	11	11	22
SALEM BUSINESS PARK		1	1
SAMS EAST INC	16	16	32
SANDVIK CORP	2	2	4
SANDY RDG GOLF CLUB	4	4	8
SANS TECHNICAL FIBERS, LLC	4	4	8
SAP ACQUISITION,LLC	5	5	10
SAPA BURLINGTON LLC	1	1	2
SARA LEE BAKERY GROUP	4	4	8
SCHAEFER SYSTEMS	6		6
SCHERING-PLOUGH	2	2	4
SCHNEIDER MILLS, INC	1	1	2
SCM METAL PRODUCTS INC	3	3	6
SEALED AIR CORPORATION	1	1	2
SEALED AIR CORPORATION (US)	1	1	2
SEALED AIR CORPORATION US	2	2	4
SEBR 804 LLC	1	1	2
SEBR Airpark East 7025, LLC	1		1
SEBR Airpark East 7027, LLC	1		1
SEBR Airpark East 7029, LLC	1		1
SEBR Airpark East 7031, LLC	1		1
SEBR CENTREPORT 101, LLC	1	1	2
SEBR CENTREPORT 202 LLC	1	1	2
SEBR CENTREPORT LLC	1	1	2
SEBR TRIAD DRIVE, LLC	1	1	2
SECURITY NATIONAL PROPERTIES HOLDINGS LLC	1	1	2
SELEE CORP	2	2	4
SELF HELP VENTURES FUND	1	1	2
SGL CARBON, LLC	1	1	2
SHAMROCK CORPORATION	4		4
SHANER HOTEL GRP LLP	1	1	2
SHEETZ DISTRIBUTION SERVICES LLC	1	1	2
SHERRILL FURNITURE	4	5	9
SHERWIN WILLIAMS COMPANY	5	4	9
SHUFORD YARNS,LLC	2	2	4
SHURTAPE TECHNOLOGIES	8	8	16
SIEMENS ENERGY INC	2	3	5
SIEMENS ENERGY, INC	2	2	4
SIERRA NEVADA BREWING CO	1	1	2
SIMON PROPERTIES GROUP	2	2	4
SLANE HOSIERY MILLS INC		2	2
SNIDER TIRE,INC	1	1	2
Snyder's Lance Inc		1	1
SOCIAL SECURITY ADMINISTRATION	1	1	2
SONOCO CRELLIN INC	3	3	6
SONOCO PRODUCTS COMPANY	2	2	4
SOP 200 N COLLEGE OWNER GP LLC	1	1	2
SOUDER PROPERTIES	1	2	3
SOUTH COLLEGE STREET LLC	1	1	2

SOUTH FORK INDUSTRIES	1	1	2
SOUTH GRANVILLE WATER AND SEWER AUTHORITY	3	3	6
SOUTHCORR PACKAGING	1	1	2
SOUTHEASTERN CONTAINER INC		2	2
SOUTHERN CAST	2	2	4
SOUTHERN CUSTOM SHUTTERS, INC	1	1	2
SOUTHERN FURNITURE	6	3	9
SOUTHERN METALS CO	7	3	10
SOUTHERN PIPE INC	1	1	2
SOUTHERN PRECISION SPRING CO INC	2	2	4
Southpark Towers Propco LLC	2	2	4
SPARTAN DYERS INC	2	2	4
SPECIALIZED PACKAGING FLEXO	1	1	2
SPECIALTY MANUFACTURING INC	2	2	4
SPECTRUM PROPERTIES MANAGEMENT COMPANY	2	2	4
SPEED CHANNEL INC	1	1	2
SPENCERS INCORPORATED OF MOUNT AIRY, NC	2		2
SPORTS MENAGERIE	2	2	4
SPORTS SOLUTIONS INC	2	2	4
SPRINT	1	1	2
SPX FLOW INC.	1	1	2
SRE EV Burgess LLC	2	2	4
ST LUKES HOSPITAL	2	2	4
St. Johns Packaging (USA), Inc.	3	3	6
STAMPSOURCE	1	1	2
STANDARD TOOLS AND EQUIPMENT	3	3	6
STANLEY TOTAL LIVING CENTER	1	1	2
STAPLES INC	2	2	4
STAR PAPER TUBE INC	1		1
STARPORT I,LLC	1	1	2
STARWOOD RETAIL PARTNERS	1	1	2
STEEL SPECIALTIES	2	2	4
STEWART SUPERABSORBENTS, LLC	1		1
STONEFIELD CELLARS WINERY LLC	1	1	2
STONEVILLE LUMBER CO	2	2	4
STS Packaging Charlotte LLC	2	2	4
STURM RUGER & CO INC	2	2	4
SUGAR CREEK BREWING COMPANY	2	2	4
SUMITOMO ELECTRIC ESC, INC	2	2	4
SUMMIT HOTEL TRS 135 LLC	1	1	2
SUNCOM WIRELESS PCS, INC		4	4
SUNTERRACE CASUAL FURNITURE, INC	2	2	4
SV CENTER LLC	2	2	4
SWIFT BEEF COMPANY	2	2	4
SYCAMORE BREWING LLC	1	1	2
SYNCOT PLASTICS, INC	4	4	8
SYNERGY BLUERIDGE INVESTMENTS, LLC	1	1	2
SYNERGY RECYCLING LLC		2	2
SYNGENTA CROP PROTECTION, INC	10	10	20
SYNGENTA CROP PROTECTION, LLC	1		1
SYNTAX SYSTEMS USA, LP	2	4	6
SYNTEC SEATING SOLUTIONS LLC	1	1	2

SYNTHETICS FINISHING	7	7	14
T5@KINGS MOUNTAIN II, LLC	1	1	2
TALBERT BUILDING SUPPLY INC	1	1	2
TARGET STORES	21	5	26
TAYLOR INVESTMENT PROPERTIES, LLC	4	4	8
TAYLOR KING FURNITUR	2	1	3
TCG OF THE CAROLINAS	1	1	2
TDY INDUSTRIES LLC	1	1	2
TE CONNECTIVITY CORPORATION	12	12	24
TEAM INDUSTRIES	1	1	2
TECHNIBILT LTD	2	2	4
TECHNICAL PRECISION PLASTICS	9	9	18
TECHNIMARK LLC	13	13	26
Teijin Automotive Technologies NC,Inc	3	3	6
TELERX MARKETING INC	1	1	2
TERRA-MULCH PRODUCTS, LLC	3	4	7
TEX TECH COATINGS LLC	3	3	6
THE CHARLOTTE-MECKLENBURG HOSPITAL AUTHORITY	2	2	4
THE CHRISTMAN COMPANY	2	2	4
THE CLEARING HOUSE PAYMENTS COMPANY LLC	1	1	2
THE CYPRESS OF CHARLOTTE CLUB, INC	12	12	24
THE DAVID H MURDOCK CORE LABORATORY BUILDING OW	1	1	2
THE EXCHANGE AT MEADOWMOUNT LLC	1	1	2
The Fish Warehouse LLC		1	1
THE LINCOLN NATIONAL LIFE INSURANCE COMPANY	2	2	4
THE MCCLATCHY COMPANY LLC		1	1
THE NC A&T UNIVERSITY	1	1	2
THE NC AT UNIVERSITY A&T FOUNDATION LLC	1	1	2
THE NC OFFICE OF INFORMATION TECHNOLOGY SERVICES	3	3	6
THE POLYMERS CENTER OF EXCELLENCE	1	1	2
THE TIMKEN COMPANY	3	3	6
THE TRANE CO	7	7	14
THERMOFORM PLASTICS	1	1	2
THIEMAN MANUFACTURING TECHNOLOGIES LLC	1	1	2
THOMAS BUILT BUSES	3	3	6
THOMASVILLE,CITY OF	3	3	6
TICONA POLYMERS, INC	1	1	2
TIERPOINT, LLC	9	9	18
TIME WARNER CABLE SE LLC	13	13	26
TIME WARNER CABLE, INC.	1	1	2
TKC 19		1	1
TKC 20		1	1
TORINGDON OFFICE OWNER LLC	6	6	12
TOSAF USA, INC	1	1	2
TOWN BREWING COMPANY, LLC	1	1	2
TOWN OF CHAPEL HILL	2		2
TOWN OF HILLSBOROUGH	2	2	4
TOWN OF MOORESVILLE		2	2
TOWN OF VALDESE	3	3	6
TR 121 W TRADE LLC	1	1	2
TRADE TRYON PLAZA CONDOMINIUM ASSOC INC	1	1	2
TRANSCONTINENTAL GAS	1	2	3

TRANSCONTINENTAL HOLDING CORP	11	11	22
TRANSYLVANIA COMMUNITY HOSPITAL	1		1
TRANSYLVANIA COUNTY	1	1	2
TRANSYLVANIA COUNTY SCHOOLS	11	11	22
TRELLEBORG COATED SYSTEMS US, INC	1	1	2
TRIAD CENTER GREENSBORO OFFICE, LLC	1	1	2
TRIAD HOSPITALITY CORPORATION	1	1	2
TRIBAL CASINO GAMING ENTERPRISES HARRAH'S CASINO &	1		1
TRI-HISHTIL, LLC	2	2	4
TROPICAL NUT & FRUIT CO	1		1
TRUIST BANK	6	12	18
Truist Bank TR Richardson	1	1	2
TRYON PROPERTY OWNER LLC	2	2	4
TUBULAR TEXTILE MACH	1		1
TURBOCOATING CORP	1	1	2
TYSON FARMS INC	19	19	38
U S POSTAL SERVICE	5	5	10
U.S. COTTON, LLC	2	2	4
ULTIMATE TEXTILE INC	2	2	4
UNC - CHAPEL HILL	5	5	10
UNC CENTER FOR PUBLIC MEDIA	6	6	12
UNC GREENSBORO	15	15	30
UNC ROCKINGHAM HEALTH CARE	3	3	6
UNC SCHOOL OF THE ARTS	27	27	54
UNCC	7	7	14
UNC-CHAPEL HILL	6	6	12
UNC-CHARLOTTE- FACILITIES MGMT	9	9	18
UNC-GREENSBORO	8	8	16
UNDERWRITERS LABORATORIES	1	1	2
UNIFI INC	1	1	2
UNIFI MANUFACTURING, INC	3	5	8
UNILIN FLOORING NC LLC	1	1	2
UNILIN NORTH AMERICA, LLC	1	1	2
UNION COUNTY HABITAT FOR HUMANITY		1	1
UNIQUETEX	2	2	4
UNITED AIR FILTER CO	5	5	10
UNITED METAL FINISHING, INC	3	3	6
UNITED PARCEL SERV	3	3	6
UNITED PLASTICS CORPORATION	1	1	2
UNITED STATES COLD STORAGE	2	2	4
UNITED THERAPEUTICS CORPORATION	2	2	4
UNIVERSAL FOREST PRODUCTS	2	2	4
UNIVERSITY OF NC HOSPITALS	8	8	16
UNIX PACKAGING LLC	1	1	2
UPM - RAFLATAC, INC	1	1	2
UPS LOGISTICS	1	1	2
US FOODS, INC	1	1	2
US NATIONAL WHITEWATER CENTER, INC	12	12	24
V F CORPORATION	2	1	3
VALASSIS COMMUNICATIONS	1	1	2
VALDESE WEAVERS	6	6	12
VALLEY HILLS MALL	15	15	30

VALLEY HILLS MALL L.L.C.	8	8	16
VANGUARD FURNITURE CO INC	8	8	16
VECO PLAN, LLC		1	1
VERIZON COMMUNICATIONS	3	3	6
VERIZON WIRELESS	6	6	12
vertical cold storage llc	1	1	2
VF JEANSWEAR LIMITED PARTNERSHIP	1	1	2
VF SERVICES INC	1	1	2
VP 300 SB LLC	1	1	2
VULCAN CONSTRUCTION MATERIALS, LLC	51	51	102
W&G ASSOCIATES	1	1	2
WAGER,ROBERT CO,INC	4	4	8
WAKE FOREST UNIVERSITY	7	7	14
WAKE FOREST UNIVERSITY BAPTIST MEDICALCENTER	2	2	4
WAKE FOREST UNIVERSITY HEALTH SCIENCES	12	12	24
WAL-MART STORES EAST,LP	78	79	157
WATTS REGULATOR COMPANY	6	6	12
WAYNE FARMS LLC	15	15	30
WBTV LLC	2	2	4
WCCB TV INC	2	2	4
WEIL MCLAIN	2	2	4
WELDING UNLIMITED IN	1	1	2
WELL SPRING RET	5	5	10
WELLS FARGO BANK NA	8	14	22
WELLSPRING GROCERY	1	1	2
WELLSPRING RETIREMNT COMM INC	2	2	4
WESTERN CAROLINA UNIVERSITY	1	1	2
WESTLAKE ROYAL BUILDING PRODUCTS INC.	1	1	2
WESTROCK COMPANY	4	4	8
WESTROCK CONVERTING COMPANY	10	10	20
WESTROCK CONVERTING LLC	15	15	30
WEXFORD CHESTERFIELD MT LLC	3	3	6
WEXFORD WINSTON SALEM BUILDING 90, LLC	1	1	2
WEXFORD WINSTON-SALEM BAILEY, LLC	1	1	2
WEXFORD WINSTON-SALEM HOLDING, LLC		1	1
WEYERHAEUSER COMPANY	1	1	2
WFC PROPERTY, LLC	1	1	2
WFMY TV INC	2	2	4
WHOLE FOODS MARKET	7	7	14

Duke Energy Carolinas, LLC
List of Industrial and Commercial Customers Opted Into Vintage 2021
Docket E-7, Sub 1265

Customer Bill Name	Number of Accounts DSM YR 21 (Jan 1-Dec 31)	EE YR 21 (Jan 1-Dec 31)	GRAND TOTAL
4000 MONROE LLC		2	2
ALDERSGATE		1	1
AMERICOLD LOGISTICS LLC		1	1
APPALACHIAN STATE UNIV		1	1
BEACON INDUSTRIAL LLC		1	1
BESTCO, LLC		1	1
BOSMERE INC.		1	1
BRAY PROPERTIES, LLC		1	1
BRI 1875 MERIDIAN, LLC		1	1
BUDDERFLY, INC		5	5
BURKE COUNTY SCHOOLS		1	1
CHADC1 INVESTMENT, LLC		1	1
CK RIDGE CREEK WEST II, LLC		1	1
CHOCOWINITY GROCERY	1		1
COLEY, LLC		1	1
CPI/AHP UNIVERSITY PLACE MOB OWNER		1	1
CREDIT SUISSE SECURITIES(USA) LLC CENTER		1	1
DART CONTAINER CORPORATION OF GEORGIA		1	1
DUCKWORTH'S #3106, LLC		2	2
ESSENTRA FILTER PRODUCTS		3	3
GLATFELTER MT HOLLY LLC		1	1
GRIFFIN CHARLOTTE AIRPORT PLAZA LLC		1	1
GRIFFIN CHARLOTTE PARK II LLC		1	1
GRIFFIN CHARLOTTE PARK III LLC		1	1
GUILFORD COUNTY SCHOOLS		2	2
HENDERSON VENTURES		1	1
HIGHWOODS REALTY LIMITED		11	11
HOOD CONTAINER CORP		2	2
LEVEL 3 TELECOM OF NORTH CAROLINA, LP		1	1
LIBERTY COMMMONS NURSING AND REHABILITAT		1	1
LOWES HOME CENTERS		1	1
MARYLAND AND VIRGINIA MILK PRODUCTS CORP		1	1
MECKLENBURG COUNTY		1	1
MIDNIGHT ENTERPRISES LLC		1	1
MILLSOURCE INC		3	3
MONROE MARKETPLACE PARTNERS LLC		1	1
OIL CHEM INC		1	1
OWENS & MINOR INC.		1	1
PRECISION WALLS INC		1	1
PROFICIENT SUPPLY LLC		1	1
PROMISE FOODS INC		1	1
RAYMER BROTHERS INC.		1	1
RICHA FORSYTH LLC		1	1
RILEY TECHNOLOGIES LLC		2	2
RIVER WOOD PARTNERS LLC		1	1
SNYDER'S LANCE INC		1	1
SOUDER PROPERTIES		2	2

	/A		
SOUTHWESTERN COMMUNITY COLLEGE		1	1
SRE EV BURGESS LLC		2	2
TAILORED CHEMICAL PRODUCTS INC		1	1
THE CYPRESS OF CHARLOTTE CLUB, INC		1	1
THE FILTER SHOP LLC		1	1
THE FISH WAREHOUSE LLC		1	1
THE MCCLATCHY COMPANY LLC		1	1
TRUIST BANK		1	1
TRYON CABOSPARKLES LLC		1	1
UNION COUNTY HABITAT FOR HUMANITY		1	1
WAL-MART STORES EAST,LP		1	1
WESTLAKE ROYAL BUILDING PRODUCTS INC.		3	3
WHITE DISTRIBUTION & SUPPLY, LLC		2	2
WOODGRAIN MILLWORK INC		3	3
Grand Total	1	90	91

Fields Exhibit 10

Duke Energy Carolinas, LLC
Incentive Calculation
Docket Number E-7 Sub 1285
Estimate January 1, 2024 - December 31, 2024

			System
NPV of AC - Res EE[1]		$	96,671,282
NPV of AC - Income Qualified EE			5,893,640
NPV of AC - Non Res EE			230,035,164
NPV of AC - DSM			189,614,446
Total NPV of Avoided Costs	**A**	**$**	**522,214,531**
Program Costs - Res EE[1]		$	43,526,591
Program Costs - Income Qualified EE			8,807,135
Program Costs - Non Res EE			64,729,623
Program Costs - DSM			44,838,940
Total Program Costs	**B**	**$**	**161,902,290**
Net Savings	**C=A-B**	**$**	**360,312,241**
Sharing Percentage	**D**		**10.60%**
Shared Savings - Res EE[1]		$	5,633,337
Shared Savings - PRI Res EE[2]			624,726
Shared Savings - Non Res EE			17,522,387
Shared Savings - DSM			15,346,204
Total Shared Savings	**E=(A-B)*D**	**$**	**39,126,654**

1) Excludes AC and Program Costs associated with Income Qualified Energy Efficiency and Weatherization Assistance programs.
2) Includes the Res EE Programs associated with Income Qualified Energy Efficiency and Weatherization Assistance.
These programs earn a PRI, Program Return Incentive, calculated on the NPV of Avoided Cost.

/A

Fields Exhibit 11

Duke Energy Carolinas, LLC
January 1, 2022 - December 31, 2022
Docket Number E-7, Sub 1285
Actual Program and Avoided Costs, January 1, 2017 - December 31, 2022

		2017		2018		2019		2020		2021		2022	
Market	Program	Program Costs	Avoided Costs	Program Costs	Avoided Costs	Program Costs	Avoided Costs	Program Costs	Avoided Costs	Program Costs	Avoided Costs	Program Costs	Avoided Costs
Residential	Appliance Recycling Program	$ 5,307	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
Residential	Residential Energy Assessments	2,909,098	6,602,773	2,836,229	5,756,868	3,153,757	4,413,585	3,358,880	4,582,748	3,326,179	3,278,832	2,497,450	2,720,722
Residential	Energy Efficiency Education	2,077,611	3,597,724	1,992,260	2,863,491	1,644,077	2,519,645	1,113,485	1,234,203	1,147,501	1,513,478	1,092,967	1,329,554
Residential	Energy Efficient Appliances and Devices	30,340,728	105,352,687	42,687,244	137,695,195	40,433,533	102,716,013	22,124,101	62,028,986	10,824,171	25,474,094	16,531,134	50,016,991
Residential	Low Income Energy Efficiency and Weatherization Assista	5,505,992	3,185,867	6,490,735	4,253,631	7,344,325	2,800,084	2,787,490	773,651	4,634,161	1,077,736	7,184,505	3,281,889
Residential	Multi-Family Energy Efficiency	3,168,422	13,539,656	3,604,921	13,614,922	3,681,262	10,815,659	1,613,839	2,156,883	517,454	1,020,435	995,923	2,788,411
Residential	My Home Energy Report	13,812,250	21,434,622	12,765,286	22,236,642	10,558,344	22,952,523	12,749,651	23,467,660	7,072,233	18,281,223	6,346,116	18,862,829
Residential	Power Manager®	14,021,500	61,074,105	14,423,610	61,923,998	13,386,942	69,783,157	14,303,277	74,785,083	16,829,058	57,584,854	17,825,199	73,997,721
Residential	Residential New Construction	-	-	-	-	-	-	-	-	-	-	397,283	659,766
Residential	Residential Smart $aver Energy Efficiency	7,403,327	7,287,263	6,955,146	7,088,494	7,402,907	7,079,940	7,538,303	7,811,427	8,156,036	8,402,753	7,706,916	8,805,522
Non-Residential	Business Energy Report	126,680	696	-	-	-	-	-	-	-	-	-	-
Non-Residential	Energy Management Information Services	-	-	-	-	-	-	-	-	-	-	-	-
Non-Residential	EnergyWise for Business	2,484,618	2,530,761	3,062,816	2,279,951	3,687,462	3,395,640	2,941,282	2,504,602	2,463,194	1,964,689	2,289,089	1,020,153
Non-Residential	Non Residential Smart Saver Custom	7,304,838	34,693,083	6,068,902	23,321,911	8,873,872	35,884,367	5,771,790	15,898,503	7,505,201	19,324,372	6,629,597	14,657,385
Non-Residential	Non Residential Energy Efficienct ITEE	61,215	523	36,875	3,025	44,335	1,385	15,179	1,734	74,699	416	22,596	19,013
Non-Residential	Non Residential Smart Saver Custom Technical Assessmen	2,139,875	10,272,302	407,293	67,306	296,006	691,285	330,629	518,862	293,539	432,158	257,878	487,004
Non-Residential	Non Residential Smart Saver Energy Efficienct Food Servic	306,488	959,251	235,605	433,191	339,996	406,024	533,411	216,824	203,130	490,896	181,831	297,177
Non-Residential	Non Residential Smart Saver Energy Efficienct HVAC Produ	1,560,769	2,958,336	1,620,748	2,810,153	2,208,364	5,519,013	2,450,713	7,425,418	4,899,800	14,904,327	3,883,081	12,252,034
Non-Residential	Non Residential Smart Saver Energy Efficienct Lighting Pro	66,689,770	240,054,511	25,872,380	146,378,119	20,834,766	105,608,459	13,098,851	71,995,510	17,924,291	68,937,962	16,991,765	60,136,829
Non-Residential	Non Residential Smart Saver Energy Efficienct Process Equ	162,413	530,295	67,509	226,724	119,843	416,343	29,681	236,299	87,540	257,010	39,696	40,207
Non-Residential	Non Residential Smart Saver Energy Efficienct Pumps and	528,937	3,070,044	277,785	1,617,740	189,172	722,433	167,464	758,367	202,615	666,967	193,125	512,344
Non-Residential	Smart $aver(R) Non Residential Performance Incentive Pro	320,559	8,958	479,610	1,671,783	785,165	2,238,186	751,724	2,035,780	342,826	4,200,059	2,362,687	9,515,713
Non-Residential	PowerShare®	13,316,535	41,482,644	12,922,977	36,012,634	13,022,816	42,072,382	12,082,697	34,867,428	13,583,912	42,254,098	17,870,297	54,349,652
Non-Residential	Small Business Energy Saver	17,350,972	63,169,894	15,977,993	46,832,675	11,421,399	28,628,598	6,933,130	15,587,393	8,935,952	16,391,449	9,384,672	22,073,030
Non-Residential	Smart Energy in Offices	891,010	1,067,480	219,748	143,284	-	-	-	-	-	-	-	-
Non-Residential	Disallowed Costs from 2015 Program Costs Audit (Order E-	-	-	-	-	-	-	-	-	-	-	-	-
		$ 192,488,915	$ 622,873,475	$ 159,005,671	$ 517,231,737	$ 149,428,343	$ 448,664,721	$ 110,695,578	$ 328,887,360	$ 109,023,491	$ 286,457,809	$ 120,683,805	$ 337,823,944

Costs as Filed in	Docket Number
2017	E-7, Sub 1285
2018	E-7, Sub 1285
2019	E-7, Sub 1285
2020	E-7, Sub 1285
2021	E-7, Sub 1285
2022	E-7, Sub 1285

Exhibit 12
/A

EM&V IMPACT EFFECTIVE DATES																			
Res/Non-res	EE/DR	Program		2021				2022				2023				2024			
				Qtr 1	Qtr 2	Qtr 3	Qtr 4	Qtr 1	Qtr 2	Qtr 3	Qtr 4	Qtr 1	Qtr 2	Qtr 3	Qtr 4	Qtr 1	Qtr 2	Qtr 3	Qtr 4
Residential	*Energy Efficiency*	Energy Efficiency Education (K12 Curriculum)	Energy Efficiency Education (K12 Curriculum)							**8/1/2022***									
		Energy Efficient Appliances & Devices	Lighting - Smart Saver Retail						**4/1/2022**										
			Lighting - Specialty Bulbs/Retail Marketplace		**4/1/2021**														
			SF Water EE Products			**7/1/2021***													
		Smart $aver Energy Efficiency	HP Water Heater & Pool Pumps						**4/1/2022***										
			Referral and Non-Referral HVAC Measures						**4/1/2022***										
		Income-Qualified Energy Efficiency	Weatherization	**1/1/2021**															
			Refrigerator Replacement	**1/1/2021**															
			Low Income Neighborhood							**7/1/2022***									
			Multi-Family Energy Efficiency			**7/1/2021**						**Plans with sample dates/effective dates not yet determined**							
		Behavioral Programs	MyHER	**2/1/2021**															
			Residential Energy Assessments			**9/1/2021***													
			Residental New Construction																
	Demand Response	Power Manager	Power Manager DLC			**10/1/2021**													
			Power Manager BYOT			**10/1/2021**													
Non-residential	*Energy Efficiency*	Non-Residential Smart $aver Energy Efficiency Custom Non-Residential Energy Assessment	Custom Rebate & Custom Assessment																
		Non-Residential Smart $aver Prescriptive	All Prescriptive Technologies	**1/1/2021***															
		Small Business Energy Saver	SBES																
	Demand Response	PowerShare																	
		Energy Wise for Business	EE									**1/1/2023***							
			DR			**10/1/2021**							**4/1/2023**		**10/1/2023**				

*** Report not yet final**

DEC DSM/EE Programs - Anticipated EM&V Schedule

As of February 24, 2023

DEC DSM/EE Programs - Anticipated EM&V Schedule

Program Name	Short name	2022 4th Quarter	2023 1st Quarter	2023 2nd Quarter	2023 3rd Quarter	2023 4th Quarter	2024 1st Quarter	2024 2nd Quarter	2024 3rd Quarter	Notes
Commercial Demand Response	PowerShare		IMP	IMP	IMP	REP				
Distribution System Demand Response	DSDR									
Nonresidential Smart $aver EE Products & Assessment (Prescriptive)	EEB	PROC/IMP	REP	PROC/IMP	PROC/IMP	PROC/IMP	PROC/IMP	PROC/IMP	REP	Final report in 3rd Q 2024
Nonresidential Smart $aver EE Products & Assessment (Custom)	EEB	PROC/IMP	PROC/IMP	PROC/IMP	PROC/IMP	REP				
Power Manager / BYOT	PM	REP(S)	REP(W)	IMP (S) IMP (W)	REP(S)	REP(W)	IMP (S) IMP (W)	IMP (S) IMP (W)	REP(S)	
EnergyWise for Business	EWB	PROC/IMP	PROC/IMP	PROC/IMP	PROC/IMP	PROC/IMP	PROC/IMP	PROC/IMP	PROC/IMP	Final report in Oct 2024
Energy Efficiency Education	K12	PROC/IMP	PROC/IMP	PROC/IMP	REP					Final report Aug 2023
Residential Energy Assessment	REA	PROC/IMP	PROC/IMP	REP		PROC/IMP	PROC/IMP	PROC/IMP	PROC/IMP	Combined DEC/DEP evaluation in Apr 2023; timing delayed due to COVID-19 and delay in Smart T'stat launch
Lighting (Retail)	EEL	REP				PROC/IMP	PROC/IMP	PROC/IMP	PROC/IMP	Evaluation focused on HTRt retailers; due to COVID, sample frame pushed out past 12/31/2021; subsequent evals will focus on non-lighting measures as part of Retail Rebates
Marketplace/Online Savings Store	OSS			PROC/IMP	PROC/IMP	PROC/IMP	PROC/IMP	REP		2023/2024 will focus on non-lighting
Multi-Family Energy Efficiency	MF			PROC/IMP	PROC/IMP	PROC/IMP	PROC/IMP	REP		Will be combined DEC/DEP evaluationd
My Home Energy Report	MyHER		PROC/IMP	PROC/IMP	PROC/IMP	REP				Final report in Nov 2023
Neighborhood Energy Saver	NES	PROC/IMP	PROC/IMP	PROC/IMP	PROC/IMP	REP		PROC/IMP	PROC/IMP	Final report in Nov 2023
Residential New Construction	RNC					PROC/IMP	PROC/IMP	PROC/IMP	PROC/IMP	Tentative final report 4th Q 2024 (dependent upon participation)
Residential Save Energy & Water Kit	SEW	PROC/IMP	REP			PROC/IMP	PROC/IMP	PROC/IMP	PROC/IMP	
Business Energy Saver	SBES	PROC/IMP	PROC/IMP	PROC/IMP	PROC/IMP	REP				
Residential HVAC	HVAC	PROC/IMP	PROC/IMP	PROC/IMP	REP					Final report planned for Q2-2023 (based on discussions w NCPS, pushed back evaluation timing one year)
Weatherization/Refrigerator Replacement	Wx	REP			PROC/IMP	PROC/IMP	PROC/IMP	PROC/IMP	PROC/IMP	Final report planned for Q4-2024

LEGEND	
PROC	Process surveys/interviews (customers, etc.) for purposes of report that follows
IMP	Impact data collection (onsites, billing, etc.) & analysis for purposes of reporting
REP	Evaluation, Measurement & Verification Report

NOTE: THESE DATES ARE SUBJECT TO CHANGE

/A

Fields Exhibit 14

Duke Energy Carolinas, LLC
For the Period January 1, 2022 - December 31, 2022
Docket Number E-7 Sub 1285

DEC - 2022 Find It Duke Allocations

Revenue

	Services		Amount	% of Total Received
1	Solar	$	83,515	14.6%
2	EV Charging		3,938	0.7%
3	Tree Services [a]		-	0.0%
4	Non-DEC Customers		24,503	4.3%
5	Total Non-DSM/EE	$	111,956	19.6%
6	DSM/EE		458,329	80.4%
7	Overall Total	$	570,285	100.0%

Cost

		% of Revenue		Total Cost		Allocated Cost
8	DSM/EE	80.4%	$	185,272	$	148,900
9	Non-DSM/EE	19.6%		185,272		36,372
10	Total Cost				$	185,272

Summary

		EE Rev Rqmt		Non-Utility Allocation	
		Before	Adjusted	Before	Adjusted
11	Costs	185,272	148,900	-	36,372
12	Revenues	570,285	458,329	-	111,956
13	Net Revenue Reqmt	(385,012)	(309,428)		(75,584)
14	Net Impact (Pre-PPI impact)		75,584		(75,584)
15	PPI Impact (@10.6%)		(8,012)		-
16	Net Revenue Requirement Impact		67,572		(75,584)
			Decrease in Rider		Increase in Expenses

Notes:

[a] Tree Service referrals are no longer offered on Find It Duke.

/A

Reimagine tomorrow.

My Home Energy Report Program Evaluation

Submitted to Duke Energy

March 6, 2022

Principal Authors:

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Tingting Xue, Project Analyst

Contents

List of Figures

List of Tables

Equations

1 Executive Summary

1.1 Program Summary

This report describes process and impact evaluation findings for the Duke Energy Carolinas and Duke Energy Progress My Home Energy Report (MyHER) offered to residential customers who live in single-metered, single family and multi-family homes with thirteen months of usage history. MyHER relies on principles of behavioral science to encourage customer engagement with home energy management and energy efficiency. The program accomplishes this primarily by delivering a personalized report comparing each customer's energy use to that of a peer group of similar homes.[1] MyHER motivates customers to reduce their energy consumption by:

- Showing customers a comparison of their household electricity consumption to that of similar homes;
- Presenting a month-ahead forecast of electricity consumption disaggregated by end-use category;
- Suggesting tips for reducing energy use by changing customers' behavior or installing energy efficient equipment;
- Educating them about the energy savings benefits of Duke Energy's demand side management (DSM) programs; and
- Encouraging active management of their home's energy consumption.

1.2 Evaluation Objectives and High Level Findings

Nexant estimates the annual energy impacts associated with MyHER delivery for the period February 2020 to January 2021[2] This report also presents measurements of customer satisfaction and engagement for MyHER participants. The MyHER program is implemented as a randomized controlled trial (RCT). Customers are randomly assigned to either "treatment" or "control" groups for the purpose of measuring energy savings. Treatment customers are MyHER recipients (participants). The control group is a set of customers from whom the MyHER is intentionally withheld. The control group serves as the baseline against which MyHER impacts are measured. As Duke Energy customers become eligible for the MyHER program, Duke Energy randomly assigns them to one of these two groups.

The energy savings generated by the DEC MyHER program are presented in Table 1-1, showing that the evaluated impacts of the program are 260.5 kWh per household for SF and 77.0 kWh per household for MF. The energy savings generated by the DEP MyHER program

[1] Homes are grouped by characteristics such as location, size, vintage, and heating fuel. Energy use is compared on groups of similar homes.

[2] Nexant analyses the impacts for all months since the prior evaluation, comprising the period June 2018 to January 2020. The reported savings reflect the final 12-month period since the prior evaluation, which is February 2020 through January 2021.

are presented in Table 1-2, showing that the evaluated impacts of the program are 243.2 kWh per household for SF customers and 64.1 kWh per household for MF. These evaluated energy savings for the MyHER program are net of additional energy savings achieved through increased participation by the MyHER treatment group in other Duke Energy programs. Additional information concerning the evaluation period is shown in Table 1-3.

Table 1-1: DEC Deemed and Evaluated Energy Impacts per Participating Household[3]

	Energy (kWh)	Confidence/Precision
DEC SF Evaluated Impacts	260.5	90/9
DEC SF Deemed Impacts	247.7	N/A
DEC MF Evaluated Impacts	77.0	90/30
DEC MF Deemed Impacts	94.7	N/A

*MyHER is an opt-out program. As such, all impacts are considered net impacts; Nexant also calculated the impacts of the MyHER program by removing savings achieved by MyHER participants via other Duke Energy Programs.

Table 1-2: DEP MF Deemed and Evaluated Energy Impacts per Participating Household

	Energy (kWh)	Confidence/Precision
DEP SF Evaluated Impacts	243.2	90/10
DEP SF Deemed Impacts	201.2	N/A
DEP MF Evaluated Impacts	64.1	90/51
DEP MF Deemed Impacts	86.9	N/A

*MyHER is an opt-out program. As such, all impacts are considered net impacts; Nexant also calculated the impacts of the MyHER program by removing savings achieved by MyHER participants via other Duke Energy Programs.

Table 1-3: Sample Period Start and End Dates[4]

Evaluation Component	Start	End
Impact Evaluation Period	February 2020	January 2021
Customer Survey Period	January 2020	December 2020

[3] Values (kWh) are rounded to one decimal point.

[4] Values (kWh) are rounded to one decimal point.

1.3 Evaluation Recommendations

This evaluation finds the DEC SF and MF MyHER programs realized 105% and 81%, respectively, of their claimed impacts. The DEP SF and MF MyHER programs realized 121% and 74% respectively, of their claimed impacts. The MyHER program remains fully deployed at these two Duke Energy jurisdictions due to semiannual introductions of newly eligible customers to the treatment and control program populations. The continual addition of new customers to the program means that there will always be a mix of participants with respect to the duration of the customers' exposure to the treatment. Impacts delivered by behavioral programs such as MyHER have been shown in many evaluations of behavioral programs to vary depending on the length of that exposure, reaching maturity after 1-2 years of exposure to the program. As such, Duke Energy should generally expect that the newest cohorts of MyHER treatment customers will deliver lower energy savings than the established cohorts. In the case of DEC, some cohorts are attaining an age of 10 years.

Duke Energy continued to work closely with Uplight, the implementation contractor, in the planning and coordination of MyHER report delivery. throughout the duration of their contract in planning and coordinating the delivery of MyHER reports. The end of this evaluation period marks the end of the Uplight implementation at Duke Energy – February 2021 marked the launch of Duke Energy's in-house implementation of the program. The program as evaluated for this study has benefited from improved production processes that allowed for the customization of MyHER messages, tips, and promotions on the basis of customer information and exposure to Duke Energy's demand-side management programs. Since the prior MyHER evaluation[5], Uplight has implemented a number of improvements that have resulted in increased product quality, as evidenced by improved performance in Duke Energy's quality checks that take place before each batch of reports is sent to participants. The process evaluation finds that MyHER is successful in a number of areas of interest including enhancing customer motivation, awareness, and attention to saving energy.

Nexant has the following recommendations for enhancing Duke Energy's MyHER program:

- **Continue the commitment to simultaneous control and treatment assignment.** New assignments to treatment and control groups must be simultaneous and Duke Energy should always add all newly assigned treatment and control groups to their respective status in a single billing month, to the extent that is technically feasible.
- **Continue the practice of making assignments of new single-family accounts to MyHER treatment and control groups at most twice a year.** The numbers of Duke Energy customers becoming eligible for the program each year do not facilitate more frequent assignments. This is due to the fact that sufficient numbers of customers must be set aside for the control group each time a group of customers is assigned to treatment in order for the evaluator to be able to measure the energy savings delivered by the new cohort.

[5] DEP and DEC Single Family were previously evaluated in 2019

- **Consider using larger control groups for the multi-family program.** This is the first evaluation in the DEC and DEP service territories and Nexant finds that the 90% confidence bands around the impact estimates for multi-family are very wide. This may improve over time as the first multi-family cohorts mature, but the opportunity for maturation may be less than for single-family due to the more frequent account turnover among multi-family customers. Maturation also may not include less variability in impacts so Duke Energy should consider larger control groups for this program segment.
- **Build on previous successes of Interactive awareness campaigns.** The process evaluation finds that current awareness of Interactive among MyHER participants has slightly increased for single family customers since the last evaluation (DEC: 28% to 31%, DEP: 35% to 38%), but is still somewhat low.
- **Leveraging AMI data and producing content.** In 2019, this data was presented in a pilot project to a small number of eHER recipients in the form of hourly weekday usage graphs. In addition, this data was leveraged to improve the housing model to improve disaggregation modeling. Considering that AMI meters deployment has reached nearly 100% in the DEC and DEP jurisdiction, and the presentation of this data offers older cohorts novel content, Duke Energy should continue to cost-effectively leverage AMI data.
- **Work to improve report satisfaction.** Compared to the previous evaluation, ~~on~~ satisfaction with information in the reports dropped (DEC single family: from 87% to 58%; DEP single family: from 80% to 63%). In addition, single-family and multi-family control customers' expectations regarding the usefulness of some features of HERs tend to be significantly higher than treatment customers' ratings of their actual usefulness, indicating an opportunity to improve these features and align customers' expectations with reality.
- **Tune in to relevant energy-saving behaviors of multi-family customers.** While multi-family customers report high levels of engagement and interest in HERs, their reported energy investments are lower than those of single family customers. While some of these differences are attributable to differing equipment saturation levels between the two segments, these disparities do indicate a need to understand more fully the energy-relevant behaviors, and barriers to energy saving behavior, of multi-family customers so as to make HERs more useful to customers in this segment.
- **Work to inspire trust in report accuracy.** Uplight has continued work to improve the model used for building comparison home groups, including refining customers' accounts who have pools and electric vehicles. In open-ended responses to survey questions regarding suggested improvements to the reports, 24% of the comments for DEC and DEP single family, and 56% of the comments for DEP multi-family centered around concerns about the accuracy and applicability of the reports to their home.
- **Target Interactive customers' summertime usage as an opportunity to increase annual Interactive savings.** Currently, Interactive customers are showing statistically significant uplifts in winter savings, over and above the savings attributable to the report. However, on an annual basis, those savings are eroded by significant increases in energy use in the summertime. MyHER should leverage opportunities to remind Interactive users not to backslide with energy savings behaviors in the summer.

2 Introduction and Program Description

This section presents a brief description of the My Home Energy Report (MyHER) program as it was operated in the DEC and DEP service territories during the evaluation timeframe. This description is informed by document review, in-depth interviews with staff, and Nexant's understanding of program nuance developed through regular communication during the evaluation process.

2.1 Program Description

The MyHER program is a behavioral product for demand-side management (DSM) of energy consumption and generation capacity requirements. The MyHER presents a comparison of participants' energy use to a peer group of similar homes. It is sent by direct mail to single family customers eight times a year, and 12 times a year by email to customers that have provided Duke Energy with their email address.[6] In the case of multi-family customers, the report is sent by mail four times a year and by email 12 times a year to those customers that have provided Duke Energy with their email address.

The MyHER provides customer-specific information that allows customers to compare their energy use for the month and over the past year to the consumption of similar homes as well as homes considered to be energy efficient. Reports include seasonal and household-appropriate energy savings tips and information on energy efficiency programs offered by Duke Energy. Many tips focus on no or low cost actions such as behavioral changes. An additional feature presents a month-ahead forecast of energy usage disaggregated by end-use type. During this evaluation period, Duke Energy contracted with Uplight, Inc. for the management and delivery of its MyHER product.

The MyHER program includes on online component, called MyHER Interactive Portal.[7] MyHER Interactive seeks to engage customers in a responsive energy information and education dialogue. When customers enroll to access the online portal they are given the opportunity to update and expand on information known to Duke Energy about their home and electricity consumption. Customers who have registered to use MyHER Interactive are also sent weekly energy management tips and conservation challenges via email. The general strategy of MyHER Interactive is to open communications between customers and the utility, as well as to explore new ways of engaging households in electricity consumption management.

Customers occupying single-family and multi-family homes with an individual electric meter and at least thirteen months of electricity consumption history are eligible for MyHER in the DEC and

[6] For clarity: MyHERs are only sent to customers randomly assigned to the treatment group. All of the customers in the treatment group receive paper MyHERs 8 times a year. Duke Energy has email contact information for some of the treatment customers – those email customers also receive email MyHERs 12 times a year. Therefore, the email customers receive both an email and paper MyHER 8 months of the year and only an email report 4 months of the year.

[7] We refer to the MyHER Interactive Portal simply as "Interactive" in the remainder of this report.

DEP territories in North Carolina and South Carolina. The program is an opt-out program: customers can notify Duke Energy if they no longer wish to receive a MyHER and will be subsequently removed from the program. Customers who receive both paper and email MyHERs may also opt out of the report format of their choice (i.e., elect to only receive MyHERs by email, or only receive them by U.S. Mail).

Duke Energy placed a portion of eligible customers into a control group to satisfy evaluation, measurement, and verification (EM&V) requirements. These control group customers do not receive MyHERs or communications about MyHER.

Duke Energy has several objectives for the MyHER program, including:

1. Generating cost effective energy savings;
2. Increasing customer awareness of household energy use, engagement with Duke Energy, and overall customer satisfaction with services provided by Duke Energy; and
3. Promoting other energy efficiency and demand response program options to residential customers.

2.2 Implementation

MyHER is implemented by Uplight, Inc., a behavioral science and analytics contractor that prepares and distributes the MyHER reports according to a pre-determined annual calendar. Uplight also generates and disseminates the MyHER Interactive Portal content and email reports, energy savings tips, and energy savings challenges. Uplight and Duke Energy coordinate closely on the data transfer and preparation required to successfully manage the MyHER program, and they make adjustments as needed to provide custom tips and messages expected to reflect the characteristics of specific homes. A more detailed discussion of the roles and responsibilities of both organizations is provided in Section 4.

2.2.1 Eligibility

The MyHER program targets residential customers living in either single family or multi-family dwellings, that are single metered, non-commercial residences with at least thirteen months of electricity consumption history. Approximately 1.2 million DEC and 800,000 DEP residential customers met those requirements as of February 2020 and are assigned to the MyHER treatment groups. Accounts could still be excluded from the program for reasons such as the following: different mailing and service addresses, missing bills[8], and enrollment in payment plans based on income (although Equal Payment Plan customers are eligible). Eligibility criteria for the MyHER program have changed over time, and in some cases, customers were assigned to either treatment or control but later determined to be ineligible for the program. Nexant estimates that 0-2% of assigned DEC customers and 0-1% of assigned DEP customers are ineligible for the program in any given month after having been assigned. Nexant addresses this topic by applying an intention-to-treat analysis (ITT); refer to Section 3.1.2.

[8] Customers must not have more than two missing bills in at least thirteen previous months of consumption history. A missing bill is defined as a bill with less than 150 kWh for customers that are not already enrolled in MyHER.

2.3 Key Research Objectives

The section describes our key research objectives and associated evaluation activities.

2.3.1 Impact Evaluation Objectives

The primary objective of the impact evaluation is to describe the impact of the program on electricity consumption (kWh) and electric demand (kW). Savings attributable to the program are measured across an average annual and monthly time period. The following research questions guided impact evaluation activities:

1. Is the process used to select customers into treatment and control groups unbiased?
2. What is the impact of MyHER on the uptake of other Duke Energy programs in the market?
3. What net energy savings are attributable solely to MyHER reports after removing savings already claimed by Duke Energy's other energy efficiency programs?
4. What incremental savings are achieved by customers participating in the MyHER Interactive portal?

2.3.2 Process Evaluation Objectives

The program evaluation also seeks to identify improvements to the business processes of program delivery. Process evaluation activities focused on how the program is working and opportunities to make MyHER more effective. The following questions guided process data collection and evaluation activities:

1. Are there opportunities to make the program more efficient, more effective, or to increase participant engagement?
2. What components of the program are most effective and should be replicated or expanded?
3. What additional information, services, tips, or other capabilities should MyHER consider?
4. Does MyHER participation increase customer awareness of their energy use and interest in saving energy?
5. What elements of the reports are useful to recipients?
6. How satisfied are recipients with MyHER reports?
7. To what extent does receiving MyHER increase customer engagement in energy saving behaviors and upgrades?
8. Do participants hold more favorable opinions of Duke Energy as a result of receiving the reports?
9. What encourages or prevents households from acting upon information or tips provided by MyHER?
10. To what degree are recipients aware of, and making use of, MyHER Interactive?
11. How can the program encourage additional action?

2.4 Organization of This Report

The remainder of this report contains the results of the impact analysis (Section 3); the results of the process evaluation activities, including the customer surveys (Section 4); and Nexant's conclusions and recommendations (Section 5).

3 Impact Evaluation

3.1 Methods

A key objective of the MyHER impact evaluation is to measure the change in electricity consumption (kWh) resulting from exposure to the normative comparisons and conservation messages presented in Duke Energy's My Home Energy Reports. The approach for estimating MyHER impacts is built into the program delivery strategy. Eligible accounts are randomly assigned to either a treatment (participant) group or a control group. The control group participants are not exposed to MyHER in order to provide the baseline for estimating savings attributable to the Home Energy Reports. In this randomized controlled trial (RCT) design, the only explanation for the observed differences in energy consumption between the treatment and control group is exposure to MyHER.

The impact estimate is based on monthly billing data and program participation data provided by Duke Energy. The RCT delivery method of the program removes the need for a net-to-gross analysis since the billing analysis directly estimates the net impact of the program. After estimating the total change in energy consumption in treatment group homes, Nexant performed an "overlap analysis", which quantifies the savings associated with increased participation by treatment homes in other DEC or DEP energy efficiency offerings. These savings were claimed by other programs; therefore, they are subtracted from the MyHER impact estimates to eliminate double counting.

3.1.1 Data Sources and Management

The MyHER impact evaluation uses a large volume of participation and billing data from Duke Energy's data warehouse. Key data elements include the following:

- **Participant List** – a table listing each of the homes assigned to the MyHER program since its 2010 inception in DEC and its 2014 inception in DEP. This table also indicated whether the account was in the treatment or control group and the date the home was assigned to either group.
- **Billing History** – a monthly consumption (kWh) history for each account in the treatment and control group. Records included all months since assignment as well as the pre-assignment usage history required for eligibility. This file also included the meter read date and the number of days in each billing cycle.
- **MyHER Report History** – a record of the approximate 'drop date' of each MyHER report sent to the treatment group accounts, the messaging included, and the recommended actions. This dataset also contained a supplemental table of treatment group accounts omitted from each MyHER mailing during the evaluation period, and the associated reason for omission.

- **Participation Tracking Data for Other Energy Efficiency Programs offered by Duke Energy** – a table of the Duke Energy DSM program participation of MyHER control and treatment group accounts. Key fields for analysis include the measure name, quantity, participation date, and net annual kWh and peak demand impacts per unit for each MyHER recipient and control group account participating in other DSM programs offered by Duke Energy.

In preparation for the impact analysis, Nexant combined and cleaned the participation and billing data provided by the MyHER program staff and then combined with the cleaned dataset from Nexant's prior MyHER impact evaluation for that jurisdiction.[9] The combined billing dataset includes 2,898,721 distinct DEC accounts and 1,555,640 distinct DEP accounts (however, the number of accounts in analysis varies by month). A number of treatment and control accounts in this dataset have closed prior to the start of this evaluation period and they have been dropped from the analysis dataset. Across DEC and DEP there have been 438,208 such customers not included in analysis due to account closure prior to the start of this evaluation period. Nexant also removed the following accounts or data points from the analysis (total for DEC and DEP and for single family and multi-family):

- 68,420 accounts that had a negative value for billed kWh, where no net energy metering NEM status is present;
- 310 records with unrealistically high usage: any month with greater than six times the 99th percentile value for daily kWh usage, or approximately 900 kWh per day.

Like most electric utilities, Duke Energy does not bill all of its residential customers for usage by calendar month. Instead, billing cycles are a function of meter read dates that vary across accounts. Since the interval between meter reads vary by customer and by month, the evaluation team "calendarized" the usage data to reflect each calendar month, so that all accounts represent usage on a uniform monthly basis. The calendarization process includes expanding usage data to daily usage, splitting the billing month's usage uniformly among the days between reads. The average daily usage for each calendar month is then calculated by taking the average of daily usage within the calendar month.

3.1.2 Intention to Treat

Duke Energy maintains a number of eligibility requirements for continued receipt of MyHER. Not all accounts assigned to treatment remained eligible and received MyHERs over the study horizon. Several programmatic considerations can prevent a treatment group home from receiving MyHER in a given month. Common reasons for an account not being mailed a report include the following:

- **Mailing Address Issues** – mailing addresses are subjected to deliverability verification by the printer. If an account fails this check due to an invalid street name or PO Box or has another issue, the home will not receive the MyHER.

[9] Rather than re-requesting all of the data necessary for this evaluation (pre-treatment and posttreatment usage data for all treatment and control customers), Nexant omitted any data that we already had from the first evaluation – the pre-treatment data for cohorts included in our prior evaluation is still necessary for this current evaluation.

- **Implausible Bill** – if a home's billed usage for the previous month is less than 150 kWh or greater than 10,000 kWh, Uplight does not mail the MyHER.
- **Insufficient Matching Households** – this filter is referred to as "Small Neighborhood" by Uplight and is a function of the clustering algorithm Uplight uses to produce the usage comparison. If a home can't be clustered with a sufficient number of other homes, it will not receive the MyHER.
- **No Bill Received** – if Uplight does not receive usage data for an account from Duke within the necessary time frame to print and mail, the home will not receive MyHER for the month.

The Nexant data cleaning steps listed in Section 3.1.1 do not impose these filters on the impact evaluation analysis dataset. This is necessary to preserve the RCT design because eligibility filters are not applied to the control group in the same manner as the treatment group. Instead, Nexant employed an "intention-to-treat" (ITT) analysis. In the ITT framework, the average energy savings per home *assigned* to the treatment is calculated via billing analysis. This impact estimate is then divided by the proportion of the treatment group homes analyzed that were active MyHER participants. The underlying assumption of this approach is all of the observed energy savings are being generated by the participating accounts.

Nexant relied on Duke Energy's monthly participation counts for the numerator of the proportion treated calculation. MyHER program staff calculates participation monthly according to the business rules and eligibility criteria in place at the time. The denominator of the proportion treated is the number of treatment group homes with billed kWh usage for the bill month. This calculation is presented by month in Table 3-1 and Table 3-2 for DEC MF customers. The average proportion of assigned accounts that were treated during the period of February 2020 to January 2021 was 98% for DEC SF customers and 99.5%, rounding to 100%, for DEC MF customers. The ITT calculation for DEP customers is presented by month in Table 3-3 and Table 3-4. The average proportion of assigned accounts that were treated during the period of February 2020 to January 2021 was 99% for DEC SF customers and 97% for DEC MF customers.

Table 3-1: DEC SF Calculation of Treatment Percentage by Bill Month

Month	Treatment Homes Analyzed	DEC Participant Count	% Treated
Feb-20	1,240,618	1,211,859	98%
Mar-20	1,232,861	1,210,755	98%
Apr-20	1,223,328	1,203,318	98%
May-20	1,215,700	1,199,355	99%
Jun-20	1,208,469	1,193,259	99%
Jul-20	1,256,262	1,221,119	97%
Aug-20	1,244,968	1,223,132	98%
Sep-20	1,234,562	1,216,836	99%
Oct-20	1,224,792	1,211,764	99%
Nov-20	1,214,988	1,201,904	99%
Dec-20	1,205,209	1,191,807	99%
Jan-21	1,195,687	1,182,251	99%
12-month Average Proportion			**98%**

Table 3-2: DEC MF Calculation of Treatment Percentage by Bill Month

Month	Treatment Homes Analyzed	DEC Participant Count	% Treated
20-Feb	197,933	197,607	100%
20-Mar	194,281	194,057	100%
20-Apr	189,715	188,944	100%
20-May	186,317	185,155	99%
20-Jun	182,876	181,900	99%
20-Jul	177,982	177,346	100%
20-Aug	173,082	173,809	100%
20-Sep	168,480	169,085	100%
20-Oct	164,697	164,134	100%
20-Nov	161,448	159,810	99%
20-Dec	158,121	156,140	99%
21-Jan	155,138	152,839	99%
12-month Average Proportion			**100%**

Table 3-3: DEP SF Calculation of Treatment Percentage by Bill Month

Month	Treatment Homes Analyzed	DEP Participant Count	% Treated
20-Feb	740,536	725,283	98%
20-Mar	735,142	725,212	99%
20-Apr	728,397	719,344	99%
20-May	724,174	716,929	99%
20-Jun	720,002	714,581	99%
20-Jul	750,040	737,309	98%
20-Aug	742,628	738,331	99%
20-Sep	736,292	734,948	100%
20-Oct	729,724	731,763	100%
20-Nov	723,593	711,645	98%
20-Dec	717,862	705,104	98%
21-Jan	711,773	700,447	98%
12-month Average Proportion			**99%**

Table 3-4: DEP MF Calculation of Treatment Percentage by Bill Month

Month	Treatment Homes Analyzed	DEP Participant Count	% Treated
20-Feb	79,939	77,591	97%
20-Mar	78,360	76,233	97%
20-Apr	76,748	74,236	97%
20-May	75,535	72,746	96%
20-Jun	74,263	72,110	97%
20-Jul	72,580	70,702	97%
20-Aug	70,606	69,398	98%
20-Sep	69,096	67,637	98%
20-Oct	67,636	65,929	97%
20-Nov	66,307	64,486	97%
20-Dec	65,030	63,061	97%
21-Jan	63,741	61,710	97%
12-month Average Proportion			**97%**

The monthly participation counts shown in Table 3-1 and Table 3-3 were also used by Nexant to estimate the aggregate impacts of the MyHER. Per-home kWh savings estimates for each bill month are multiplied by the number of participating homes to arrive at the aggregate MWh impact achieved by the program.

3.1.3 Sampling Plan and Precision of Findings

The MyHER program was implemented as an RCT in which individuals were randomly assigned to a treatment (participant) group or a control group for the purpose of estimating changes in energy use because of the program. Nexant's analysis methodology relies on a census analysis of the homes in both groups so the resulting impact estimates are free of sampling error. However, there is inherent uncertainty associated with the impact estimates because random assignment produces a statistical chance that the control group consumption would not vary in perfect harmony with the treatment group, even in the absence of MyHER exposure. The uncertainty associated with random assignment is a function of the size of the treatment and control groups. As group size increases, the uncertainty introduced by randomization decreases, and the precision of the estimates improves.

Nexant's MyHER impact estimates are presented with both an absolute precision and relative precision. Absolute precision estimates are expressed in units of annual energy consumption (kWh) or as a percentage of annual consumption.

The four following statements about the MyHER impact analysis reflect absolute precision:

- DEC SF MyHER saved an average of 260.5 kWh per home during the 12-month period February 2020 to January 2021, ± 22.7 kWh. Homes in the treatment group reduced electric consumption by an average of 1.83%, ± 0.16%.
- DEC MF MyHER saved an average of 77.0 kWh per home during the 12-month period February 2020 to January 2021, ± 23.4 kWh. Homes in the treatment group reduced electric consumption by an average of 0.74%, ± 0.22%.
- DEP SF MyHER saved an average of 243.2 kWh per home during the 12-month period February 2020 to January 2021, ± 24.0 kWh. Homes in the treatment group reduced electric consumption by an average of 1.61%, ± 0.16%.
- DEP MF MyHER saved an average of 64.1kWh per home during the 12-month period February 2020 to January 2021, ± 32.9 kWh. Homes in the treatment group reduced electric consumption by an average of 0.64%, ± 0.32%.

In these examples, the uncertainty of the estimate, or margin of error (denoted by "±"), is presented in the same absolute terms as the impact estimate—that is, in terms of annual electricity consumption. Nexant also includes the relative precision of the findings. Relative precision expresses the margin of error as a percentage of the impact estimate itself. Consider the following examples:

- The average treatment effect of DEC SF MyHER during the 12-month period February 2020 to January 2021 is 260.5 kWh with a relative precision of ± 8.71%. In this case, ± 8.71% is determined by dividing the absolute margin of error by the impact estimate: 22.7÷260.5.0 = 0.0871 = 8.71%.

- The average treatment effect of DEC MF MyHER during the 12-month period February 2020 to January 2021 is 77.0 kWh with a relative precision of ± 30.39%. In this case, ± 30.39% is determined by dividing the absolute margin of error by the impact estimate: 23.4÷77.0 = 0.3039 = 30.39%.

- The average treatment effect of DEP SF MyHER during the 12-month period February 2020 to January 2021 is 243.2 kWh with a relative precision of ± 9.87%. In this case, ± 9.87% is determined by dividing the absolute margin of error by the impact estimate: 24.0÷243.2 = 0.0987 = 9.87%.

- The average treatment effect of DEP MF MyHER during the 12-month period February 2020 to January 2021 is 64.1 kWh with a relative precision of ± 51.33%. In this case, ± 51.33% is determined by dividing the absolute margin of error by the impact estimate: 32.9÷64.1 = 0.5133 = 51.33%.

All of the precision estimates in this report are presented at the 90% confidence level and assume a two-tailed distribution.

3.1.4 Assignment Cohorts and Equivalence Testing

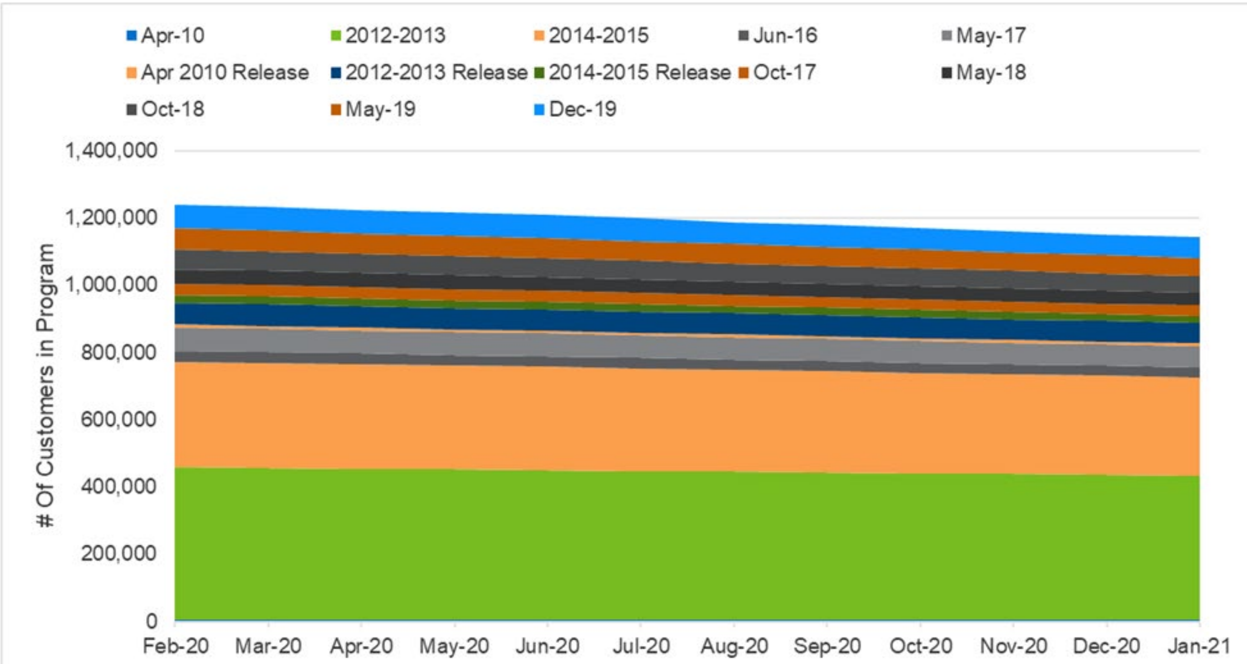
3.1.4.1 Duke Energy Carolinas Single Family

The DEC SF and MF MyHER program has been growing over time since its SF launch in 2010 and MF launch in 2016. Nexant mapped the DEC MyHER population into thirteen SF cohorts and six MF cohorts. The cohort groupings are defined on a temporal basis, generally following the major periods when customers were assigned to treatment and control groups. Cohorts that had been defined in prior evaluations of the DEC and DEP programs were maintained for consistency.

Figure 3-1 shows the timeline of DEC program expansion by cohort from February 2020 to January 2021. At the beginning of the 2020 evaluation period there were about 1.2 million DEC SF customers enrolled in the program. The original pilot cohort started the program in April 2010 which was followed by a large expansion of customers who were added in 2012 and 2013, mainly in September 2012. A second large cohort was added in 2014 and 2015, mainly in December 2014. The program has continued to expand since 2015, in more modest increments relative to the 2012 - 2013 and 2014 - 2015 expansions, as new customers met the program's eligibility criteria. In October 2015, Duke Energy also released a number of DEC customers originally assigned to the control group into treatment from the April 2010, 2012 - 2013, and

2014 – 2015 cohorts. These cohorts are denoted with “Release” in Figure 3-1.[10] These customers were released into treatment starting in October 2015 and began producing impacts in November 2015. Recent cohorts (customers added from May 2018 to Dec 2019) have been smaller, each constituting about 100,000 customers.

Figure 3-1: History of Cohort Assignments for DEC SF MyHER Program



Straightforward impact estimates are a fundamental property of the RCT design. Random assignment to treatment and control produces a situation in which the treatment and control groups are statistically identical on all dimensions prior to the onset of treatment; the only difference between the treatment and control groups is exposure to MyHER. The impact is therefore simply the difference in average electricity consumption between the two groups. The first step to assessing the impact of an experiment involving a RCT is to determine whether the randomization worked as planned.

Table 3-5 presents summary information for each of the thirteen cohorts included in Nexant’s DEC SF analysis, comparing the average annual kWh usage of each cohort’s treatment and control group for the 12 months prior to the beginning of assignment. On an annual basis, the pre-assignment usage is relatively balanced between groups for each of these cohorts, where the largest difference occurs in Cohort 8 (“2014-2015 Release”).

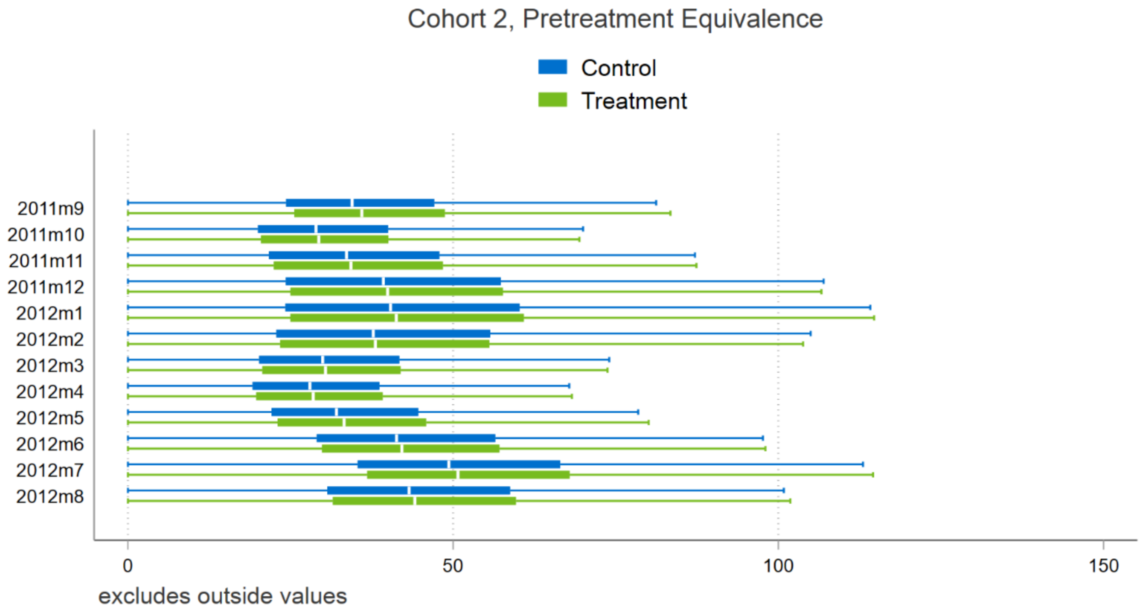
[10] Duke Energy commissioned a review of the MyHER control groups in 2015 to assess whether or not there were any control groups that were larger than necessary for the purpose of EM&V. Four relatively small releases (approximately 110,000 customers total) from the DEC jurisdiction was recommended by that review. Consequently, about 110,000 control group customers from the April 2010, September 2012, December 2014, and January 2015 cohorts were randomly selected for release into treatment.

Table 3-5: DEC SF MyHER Cohort Summary Statistics

Cohort		Pretreatment Period		# Homes		Annual kWh in Pretreatment Period	
		Start	End	Control	Treatment	Control	Treatment
1	Apr 2010	04/2009	03/2010	7,733	5,124	18,024	18,071
2	2012-2013	09/2011	08/2012	22,979	406,584	14,661	14,738
3	2014-2015	12/2013	11/2014	17,954	269,221	15,120	14,995
4	Jun 2016	06/2015	05/2016	10,781	33,927	13,538	13,624
5	May 2017	05/2016	04/2017	5,303	71,593	14,162	14,000
6	Apr 2010 Release	04/2009	03/2010	7,733	8,658	18,024	17,997
7	2012-2013 Release	09/2011	08/2012	24,023	64,737	14,745	14,730
8	2014-2015 Release	12/2013	11/2014	21,266	24,003	14,839	15,102
9	Oct 2017	10/2016	09/2017	14,523	34,773	13,210	13,105
10	May 2018	05/2017	04/2018	6,842	43,381	13,535	13,580
11	Oct 2018	10/2017	09/2018	7,451	59,925	13,990	13,980
12	May 2019	05/2018	04/2019	8,380	63,861	14,428	14,355
13	Dec 2019	12/2018	11/2019	7,931	73,819	13,773	13,794

Since MyHER is evaluated on a monthly basis, a more important equivalency check is on month-to-month comparability between treatment and control groups. Figure 3-2 is a box-and-whisker plot of the average pre-treatment consumption for the treatment and control groups of DEC Cohort 2 (“2012 - 2013”), the largest treatment cohort of the DEC MyHER program. The figure depicts the distribution of monthly average consumption from September 2011 to August 2012, the time period prior to the launch of the cohort. This figure represents usage of all accounts assigned to treatment and control in this cohort. The plot illustrates that usage patterns of the treatment and control customers are grossly similar, however t-tests on the mean consumption for treatment and control groups reveals statistically significant differences between treatment and control customers during much of the pretreatment period. For example, the cohort shown in Figure 3-2 has statistically significant differences between treatment and control groups in 11 of 12 months in the year immediately prior to the onset of treatment. Across all 13 DEC cohorts, the number of pretreatment months that show statistically different differences between treatment and control customers ranges from 0 to 12, with the newer cohorts having stronger pretreatment equivalence. These differences will need to be addressed by the estimation procedure, as we describe later in this section.

Figure 3-2: DEC SF Difference in Average Pre-treatment Billed Consumption (kWh)



3.1.4.2 Duke Energy Carolinas Multi-family

Figure 3-3 shows the timeline of DEC MF program expansion by cohort from February 2020 to January 2021. A small original cohort started the program in November 2016, followed by two larger cohorts in May 2017 and October 2017. There were two smaller cohorts added in May 2018 and October 2018, followed by the largest cohort starting treatment in December 2019. Compared to the SF customers, MF customers have a higher account closure rate which is expected for customers of most electric utilities.

Figure 3-3: History of Cohort Assignments for DEC MF MyHER Program

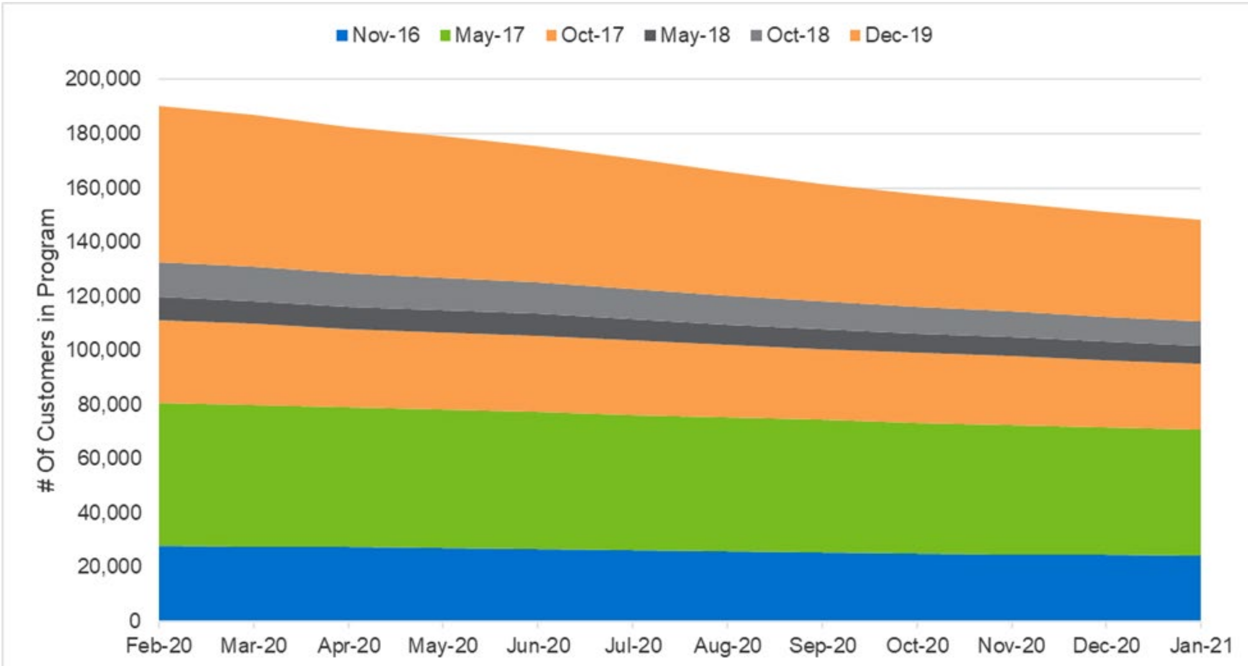


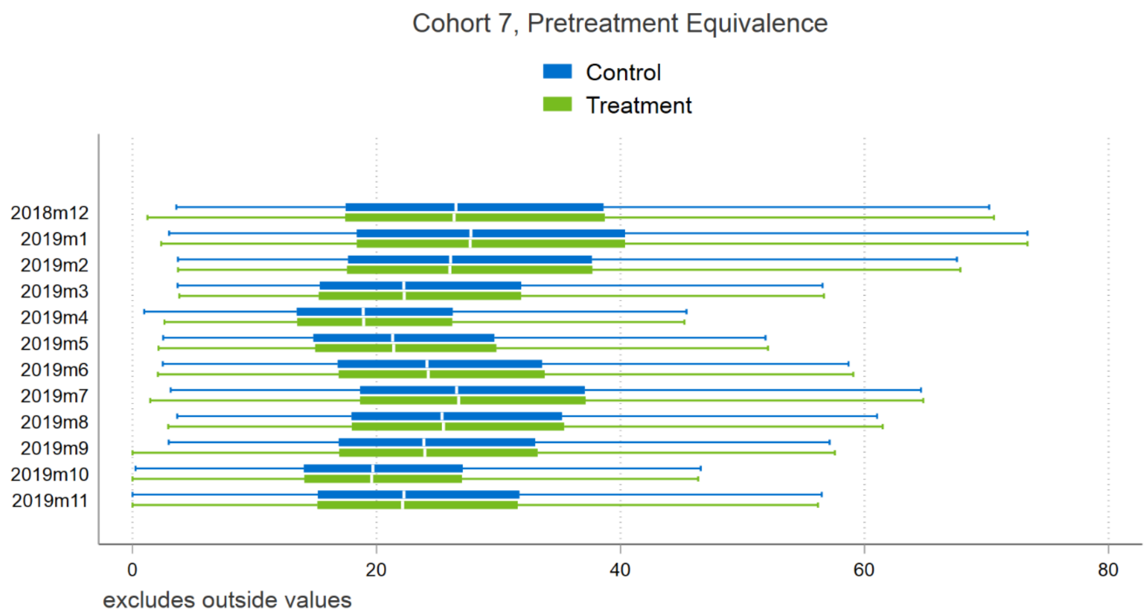
Table 3-6 presents summary information for each of the six cohorts included in Nexant's DEC MF analysis. On an annual basis, the pre-assignment usage is relatively balanced between groups for each of these cohorts, where the largest difference occurs in the first cohort ("November 2016").

Table 3-6: DEC MF Cohort Summary Statistics

Cohort		Pretreatment Period		# Homes		Annual kWh in Pretreatment Period	
		Start	End	Control	Treatment	Control	Treatment
1	Nov-16	11/2015	10/2016	3,954	29,128	11,649	11,506
2	May-17	05/2016	04/2017	7,490	54,450	10,719	10,612
3	Oct-17	10/2016	09/2017	11,993	31,915	9,940	9,971
4	May-18	05/2017	04/2018	8,518	9,451	9,716	9,717
5	Oct-18	10/2017	09/2018	12,806	13,699	9,863	9,777
6	Dec-19	12/2018	11/2019	19,813	62,959	9,794	9,796

Figure 3-4 is a box-and-whisker plot of the average pre-treatment consumption for the treatment and control groups of DEC MF Cohort 7 ("December 2019"), the largest treatment cohort of the DEC MF MyHER program. The figure depicts the distribution of monthly average consumption from December 2018 to November 2019, the time period prior to the launch of the cohort. This figure represents usage of all accounts assigned to treatment and control in this cohort. The plot illustrates that usage patterns of the treatment and control customers are very similar, and the t-tests reveal that most of the months did not have statistically significant differences between them.

Figure 3-4: DEC MF Difference in Average Pre-treatment Billed Consumption (kWh)



3.1.4.3 Duke Energy Progress Single Family

Considering the DEP program, the history of DEP SF cohort assignments is represented in Figure 3-5. The DEP SF customers started treatment with one very large cohort in December 2014. Some of the December 2014 control customers were later released to treatment in 2017. Subsequent DEP SF waves are much smaller than the first treatment wave.

Figure 3-5: History of Cohort Assignments for DEP SF MyHER Program

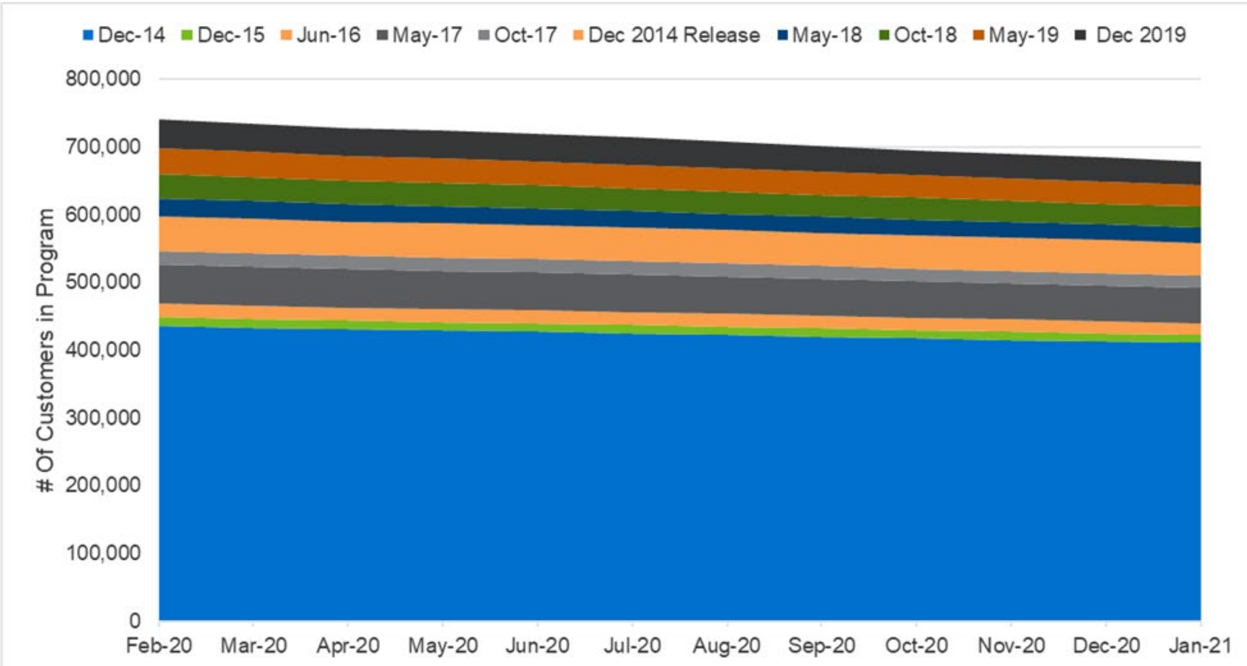


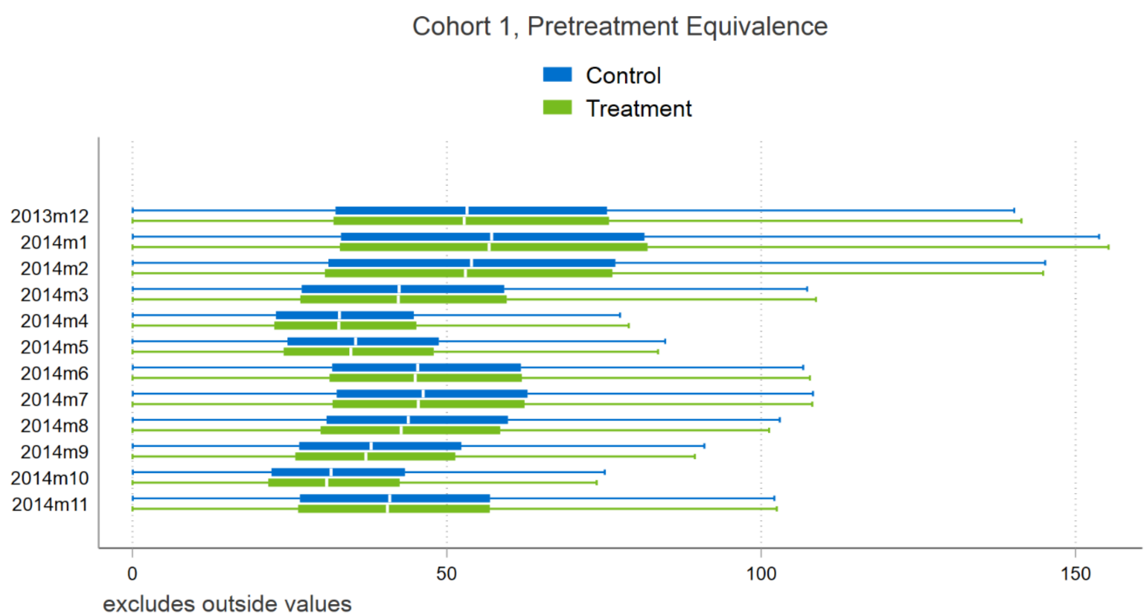
Table 3-7: presents summary information for each of the ten cohorts included in Nexant's analysis, comparing the average annual kWh usage of each cohort's treatment and control group for the 12 months prior to the beginning of assignment. Here as in DEC, on an annual basis, the pre-assignment usage is relatively balanced between groups for each of these cohorts, where the largest difference occurs in Cohort 5 ("October 2017").

Table 3-7: DEP SF MyHER Cohort Statistics

Cohort		Pre-Period		# Homes		Annual kWh in Pre-Period	
		Start	End	Control	Treatment	Control	Treatment
1	Dec 2014	12/2013	11/2014	54,911	424,163	17,129	17,106
2	Dec 2015	12/2014	11/2015	4,348	13,112	15,091	14,960
3	Jun 2016	06/2015	05/2016	8,420	19,333	14,105	14,269
4	May 2017	05/2016	04/2017	4,291	58,014	15,529	15,523
5	Oct 2017	10/2016	09/2017	7,288	20,783	14,011	14,109
6	Dec 2014 Release	12/2013	11/2014	54,911	50,561	17,129	17,122
7	May 2018	05/2017	04/2018	3,886	26,121	14,321	14,479
8	Oct 2018	10/2017	09/2018	4,361	33,747	14,299	14,466
9	May 2019	05/2018	04/2019	4,941	37,836	14,817	14,797
10	Dec 2019	12/2018	11/2019	7,667	43,728	14,198	14,238

On a month-to-month basis, DEP's cohorts perform similarly to DEC's cohorts in terms of equivalence in treatment and control group usage. Figure 3-6 is a box-and-whisker plot of the average pre-treatment consumption for the treatment and control groups of DEP Cohort 1 (“December 2014”), the largest treatment cohort of the DEP MyHER program. The figure depicts the distribution of monthly average consumption from December 2013 to November 2014, the time period prior to the launch of the cohort. This figure represents usage of all accounts assigned to treatment and control in this cohort. As was the case for DEC, this largest of DEP cohorts grossly demonstrates monthly equivalence of treatment and control group usage, but the differences in mean monthly consumption are actually statistically significant for all 12 months of the year immediately preceding the onset of treatment. Across the six DEP cohorts, the number of months of the year immediately prior to the onset of treatment that treatment and control group usage is statistically different ranges from 0 to 12, although the quality of the pretreatment equivalence is best in the more recent treatment cohorts.

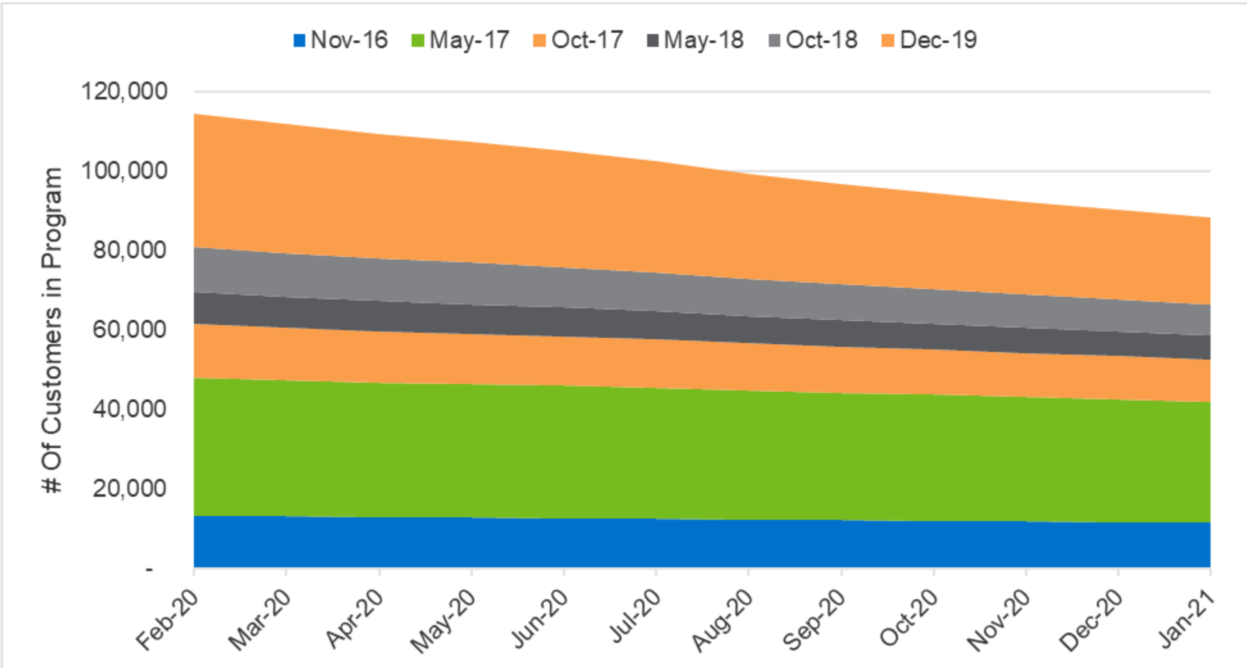
Figure 3-6: DEP SF Difference in Average Pre-treatment Billed Consumption (kWh)



3.1.4.4 Duke Energy Progress Multi-family

Figure 3-7 illustrates the number of DEP MF customers in each treatment cohort from February 2020 to January 2021. Treatment started with a small cohort launching in November 2016, followed by a larger cohort in May 2017. Similar to DEC MF, the DEP MF customers have higher attrition than the SF customers which is due to the fact that multi-family account turnover is usually higher than single family account turnover at most electric utilities.

Figure 3-7: History of Cohort Assignments for DEP MF Customers



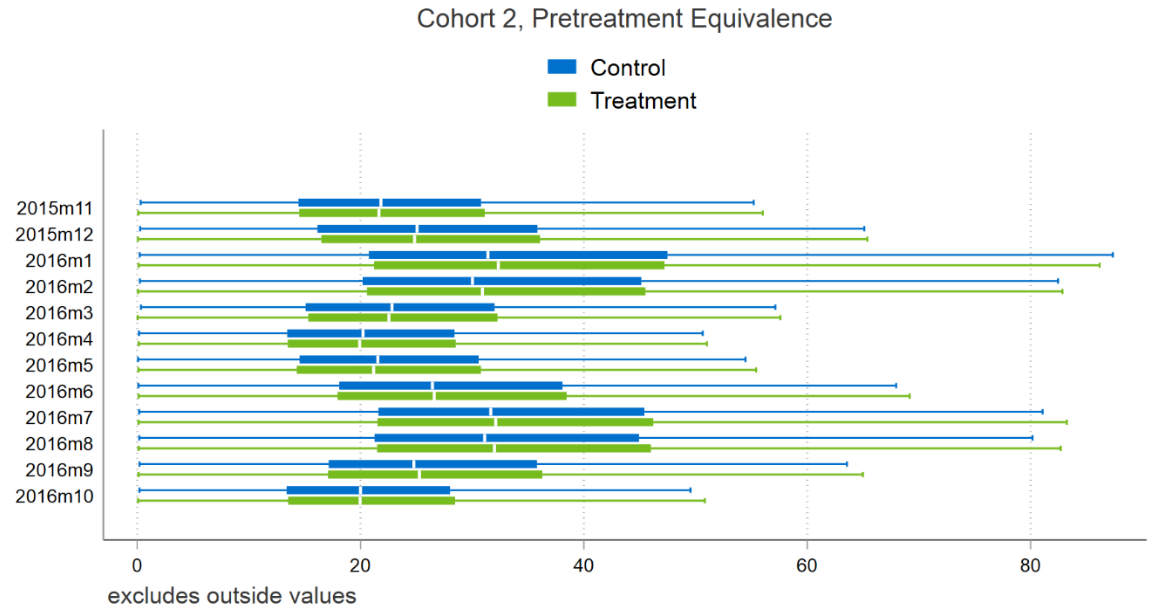
Summary statistics for DEP MF customers are presented in Table 3-8:. Cohort 2 ("May 2017") is the largest cohort and had the biggest difference in pre-treatment usage of about 170 kWh. Cohort 4 and Cohort 5 are much smaller than the previous cohorts, but they also had the smallest difference in pre-treatment electric usage.

Table 3-8: DEP MF MyHER Cohort Summary Statistics

Cohort		Pretreatment Period		# Homes		Annual kWh in Pretreatment Period	
		Start	End	Control	Treatment	Control	Treatment
1	Nov 2016	11/2015	10/2016	1,529	11,918	10,569	10,704
2	May 2017	05/2016	04/2017	4,194	30,751	10,637	10,467
3	Oct 2017	10/2016	09/2017	3,722	9,977	9,321	9,481
4	May 2018	05/2017	04/2018	3,782	4,458	9,759	9,662
5	Oct 2018	10/2017	09/2018	5,524	5,841	9,708	9,699
6	Dec 2019	12/2018	11/2019	16,520	17,830	9,526	9,506

Monthly pre-treatment equivalence for DEP MF Cohort 2, the largest cohort, is presented in Figure 3-8. As with other older cohorts, there are significant differences in electric usage between some of the months. While this was rectified with new assignment strategies in some of the newer cohorts, it is still something that must be addressed for the older cohorts that had a significant difference in electric usage between the treatment and control customers.

Figure 3-8: DEP MF Difference in Average Pre-treatment Billed Consumption (kWh)



3.1.5 Regression Analysis

Separating the MyHER population into cohorts accounts for cohort maturation effects and improves statistical precision relative to differences among the cohorts. Nevertheless, as discussed above, there are still small, but significant, underlying differences between the cohort treatment and control groups that need to be netted out via a difference-in-differences approach. Nexant applied a linear fixed effects regression (LFER) model to account for the month-to-month differences in electricity usage observed in the pre-treatment period between the treatment and control groups. The basic form of the LFER model is shown in Equation 3-1. Average daily electricity consumption for treatment and control group customers is modeled using an indicator variable for the billing period of the study, a treatment indicator variable, and a customer-specific intercept term:

Equation 3-1: Fixed Effects Model Specification

$$\mathrm{kWh}_{\mathrm{ity}} = \mathrm{customer}_{\mathrm{i}} * \beta_{\mathrm{i}} + \sum_{t=1}^{12} \sum_{y=2009}^{2020} \mathrm{I}_{\mathrm{ty}} * \beta_{\mathrm{ty}} + \sum_{t=1}^{12} \sum_{y=2009}^{2020} \mathrm{I}_{\mathrm{ty}} * \tau_{ty} * \mathrm{treatment}_{\mathrm{ity}} + \varepsilon_{\mathrm{ity}}$$

Table 3-9: provides additional information about the terms and coefficients in Equation 3-1.

Table 3-9: Fixed Effects Regression Model Definition of Terms

Variable	Definition
kWh_{ity}	Customer i's average daily energy usage in billing month t of year y.
$customer_i$	An indicator variable that equals one for customer i and zero otherwise. This variable models each customer's average energy use separately.
β_i	The coefficient on the customer indicator variable. Equal to the mean daily energy use for each customer.
I_{ty}	An indicator variable equal to one for each monthly billing period t, year y and zero otherwise. This variable captures the effect of each billing period's deviation from the customers' average energy use over the entire time series under investigation.
β_{ty}	The coefficient on the billing period t, year y indicator variable.
$treatment_{ity}$	The treatment variable. Equal to one when the treatment is in effect for the treatment group. Zero otherwise. Always zero for the control group.
τ_{ty}	The estimated treatment effect in kWh per day per customer in billing month t of year y; the main parameter of interest.
ε_{ity}	The error term.

Nexant estimated the LFER model separately for each of the randomized cohorts included in the analysis for each jurisdiction. Detailed regression outputs are found in Appendix A. The model specification includes an interaction term between the treatment indicator variable and the indicator variable for the bill month term. This specification generates a separate estimate of the MyHER daily impact for each month.

Table 3-10 illustrates the calculation of monthly impact estimates from the regression model coefficients for homes in the DEC SF 2012 - 2013 cohort (DEC SF Cohort 2). The monthly savings shown in Table 3-10 are the unweighted point estimates for that cohort. Each month's average treatment effect is multiplied by an assumed number of days in the month equal to 365.25/12 = 30.4375.

Table 3-10: Impact Calculation Example – DEC SF Cohort 2

Month	Daily Treatment Coefficient (τ)	Monthly Impact (kWh)
Feb-20	1.4	43.7
Mar-20	1.0	30.1
Apr-20	1.0	30.6
May-20	0.9	28.9
Jun-20	0.5	15.5
Jul-20	0.3	9.7
Aug-20	0.4	12.0
Sep-20	0.2	7.5
Oct-20	1.1	33.7
Nov-20	1.2	37.5
Dec-20	1.3	38.8
Jan-21	1.6	47.7
12-month Total		**335.7**

Impact estimates by cohort were combined for each month using a weighted average where the weighting factor is the number of homes with billing data that had been assigned to the treatment group during a prior month (e.g., were in the post-treatment period). These estimates of the average MyHER impact per assigned home were then divided by the proportion of customers treated, as shown in Table 3-1 and Table 3-2, to estimate the average treatment effect per participating home for the single family and multi-family program segments.

3.1.6 Dual Participation Analysis

The regression model outputs and subsequent intention-to-treat adjustments discussed in Section 3.1.5 produce estimates of the total change in electricity consumption in homes exposed to MyHER. Some portion of the savings estimated by the regression may be attributable to the propensity of MyHER treatment group homes to participate in other energy efficiency offerings at Duke Energy at a greater rate than control group homes. The primary purpose of the dual participation analysis is to quantify annual electricity savings attributable to this incremental DSM participation, should it exist, and subtract it from the MyHER impact estimates. This downward adjustment prevents savings from being double counted by both the MyHER program and the program where savings were originally claimed.

A secondary objective of the dual participation analysis is to better understand the increased DSM participation, or "uplift" triggered by inclusion of marketing messages within MyHER. The ability to serve as a marketing tool for other DSM initiatives is an important part of what makes MyHER attractive as Duke Energy assumes the role of a trusted energy advisor with its customer base.

Duke Energy EM&V staff provided Nexant with a dataset of non-MyHER program participation records for the MyHER treatment and control group homes dating back to January 2018. This dataset included nearly 456,603 records of efficient measure installations by the MyHER treatment and control group and formed the basis of Nexant's dual participation analysis.

Table 3-11: and Table 3-12 show the distribution of participation and savings during the 12-month period February 2020 to January 2021 across DEC and DEP's residential portfolio, respectively.

Table 3-11: DEC SF and MF Total EE Program Participation among MyHER Participants

Program Name	Number of Records	Net MWh/year	Net kW/year
DE Residential EE Products & Services	142,910	28,351	3,467
DE Smart Saver Residential	139,857	104,899	18,704
Residential Energy Assessments	13,136	11,752	1,368
Total	**295,903**	**145,003**	**23,538**

Table 3-12: DEP SF and MF Total EE Program Participation among MyHER Participants

Program Name	Number of Records	Net MWh/year	Net kW/year
DEP Elec Wtzn pay per kwh prog Pilot	291	151	31
DEP Home Energy Improvement	15,345	4,707	1,331
DEP Neighborhood Energy Saver	246	192	26
DEP New Construction Program	19	0.4	0.4
DEP ResEE Multi-Family	14,72	279	30
DEP Residential Energy Assessment	8,072	11,069	1,306
DEP Single Family Water Measures	71,148	15,468	1,792
DEP Smart Saver Residential	17,729	10,309	776
Total	**114,322**	**42,176**	**5,292**

The MyHER dual participation analysis included the following steps:

- Match the data to the treatment and control homes by Account ID

- Assign each transaction to a bill month based on the participation date field in the tracking data
- Exclude any installations that occurred prior to the home being assigned to the treatment or control group
- Calculate the daily net energy savings for each efficiency measure
- Sum the daily net energy impact by Account ID for measures installed prior to each bill month
- Calculate the average savings per day for the treatment and control groups by bill month. This calculation is performed separately for each cohort
- Calculate the incremental daily energy saved from energy efficiency (treatment – control) and multiply by the average number of days per bill month (30.4375)
- Take a weighted average across cohorts of the incremental energy savings observed in the treatment group
- Subtract this value from the LFER estimates of treatment effect for each bill month

Table 3-13: shows the dual participation calculations, by bill month, for homes in the DEC 2012 – 2013 Cohort (DEC Cohort 2). Savings from energy efficiency measures climb over time in both groups as additional efficient technologies are installed through Duke Energy's residential energy efficiency portfolio. The treatment group's impacts increase at a slightly greater rate, so the incremental energy savings subtracted from the MyHER treatment effect generally grows as a cohort's duration of exposure lengthens.

Table 3-13: Incremental EE Savings Calculation Example – DEC SF Cohort 2

Month	Mean Daily EE kWh Impact (Control)	Mean Daily EE kWh Impact (Treatment)	Incremental Daily kWh from EE (Treatment – Control)	Uplift %	Incremental kWh Savings
Feb-20	0.38	0.39	0.01	3.0%	0.35
Mar-20	0.39	0.41	0.01	3.0%	0.36
Apr-20	0.41	0.42	0.01	2.7%	0.33
May-20	0.42	0.43	0.01	2.8%	0.35
Jun-20	0.42	0.44	0.02	4.1%	0.52
Jul-20	0.43	0.45	0.02	3.8%	0.50
Aug-20	0.44	0.46	0.02	3.8%	0.51
Sep-20	0.45	0.47	0.02	3.5%	0.49
Oct-20	0.46	0.47	0.02	3.6%	0.50
Nov-20	0.46	0.48	0.01	3.2%	0.46
Dec-20	0.47	0.48	0.02	3.4%	0.48
Jan-21	0.48	0.49	0.02	3.3%	0.47
12-month Total					**5.31**

While the incremental participation rate of the treatment group in other EE programs is modest when considered in total, increased uptake of measures immediately following promotional messaging within MyHER mailers could be much more dramatic. Each MyHER issued has space for one product promotion message that is used to market other Duke Energy programs or initiatives. Duke Energy provided Nexant with records of the exact messages received by each home. Table 3-14: and Table 3-15: show the number of homes that received each combination of messages for the DEC SF and MF customers, respectively. The same information is presented for DEP SF and MF customers in Table 3-16 and Table 3-17.

Table 3-14: DEC SF Promotional Messaging by Month

Source Month	Message 1 - Details	Message 2 - Details	Number of Homes
02/2020	Don't Sweat The Small Stuff	Dryer Best Practices	488
02/2020	Here's A Bright Idea! Free LED Bulbs	Don't Sweat The Small Stuff	156,536
02/2020	Ready For Your Free Contractor Referral?	Don't Sweat The Small Stuff	530,201
03/2020	Our Energy Pro Can Help You Save	Heavy And Light	143,996
03/2020	Save Energy. Save Money. Save Time. Shop Online!	Heavy And Light	355,950
03/2020	Saving $100* Is As Easy As Sun, Two, Three!	Heavy And Light	24,477
03/2020	Spend Money To Make Money	Heavy And Light	633,106
04/2020	Spring Into Savings With Free LEDs	Adjusting To Daylight	70,228
04/2020	Spring Into Savings With Free LEDs	Do You Have An Electric Water Heater?	3,734
04/2020	Turn Up To Save	Do You Have An Electric Water Heater?	29,395
04/2020	Turn Up To Save	Adjusting To Daylight	594,317
05/2020	Close In The Cool	Registers Free And Clear	592,463
05/2020	Close In The Cool	Discover Ways To Save On Your Bill	225,409
05/2020	Close In The Cool	Let LEDs Lower Your Cooling Bills	439
05/2020	Confirm Your Electric Water Heater!	Registers Free And Clear	13,225
05/2020	Confirm Your Electric Water Heater!	Discover Ways To Save On Your Bill	19,832
05/2020	Confirm Your Electric Water Heater!	Let LEDs Lower Your Cooling Bills	10
05/2020	Do You Have An Electric Water Heater?	Registers Free And Clear	84
05/2020	Do You Have An Electric Water Heater?	Discover Ways To Save On Your Bill	67
05/2020	Save Energy. Save Money. Save Time. Shop Online!	Discover Ways To Save On Your Bill	229,150
05/2020	Save Energy. Save Money. Save Time. Shop Online!	Registers Free And Clear	34,255
05/2020	Saving $100* Is As Easy As Sun, Two Three!	Discover Ways To Save On Your Bill	2,226
05/2020	Saving $100* Is As Easy As Sun, Two Three!	Registers Free And Clear	17,713
06/2020	Access Your Usage On Your Voice Assistant	Keep It On Cold	612
06/2020	Access Your Usage On Your Voice Assistant	Discover Ways To Save On Your Bill	813,181
06/2020	Access Your Usage On Your Voice Assistant	The Simplest Savings	376,251
07/2020	Close Out The Damp	Seal For The Summer!	957,823
07/2020	Our Energy Pro Can Help You Save	Seal For The Summer!	224,909
08/2020	Not Too Warm, Not Too Cold	Low With The Flow	583
08/2020	Ready For Your Free Contractor Referral?	Not Too Warm, Not Too Cold	1,163,736
08/2020	Your Support Inspires Future Innovation	Not Too Warm, Not Too Cold	5,355

Source Month	Message 1 - Details	Message 2 - Details	Number of Homes
09/2020	Take Small Steps To A Brighter Tomorrow	Cool It Down	345
09/2020	Take Small Steps To A Brighter Tomorrow	Do You Have An Electric Water Heater?	40
09/2020	Tap Into Your Energy Usage	Do You Have An Electric Water Heater?	77,675
09/2020	Tap Into Your Energy Usage	Cool It Down	652,295
10/2020	Free Home Energy Assessment	Back In Black Friday	218,613
10/2020	Lint Free And Loving It	Set It And Forget It	530
10/2020	Set It And Forget It	Back In Black Friday	925,904
11/2020	Ready For Your Free Contractor Referral?	Power-Free Holiday Decor	720,804
11/2020	Vacation Is Better If You Unplug	Power-Free Holiday Decor	502
12/2020	Free Home Energy Assessment	Winter Ways To Vent	217,058
12/2020	Tap Into Your Energy Usage	Winter Ways To Vent	913,405

Table 3-15: DEC MF MyHER Promotional Messaging by Month

Source Month	Message 1 - Details	Message 2 - Details	Number of Homes
02/2020	Don't Sweat The Small Stuff	Dryer Best Practices	125,345
02/2020	Here's A Bright Idea! Free LED Bulbs.	Don't Sweat The Small Stuff	13
02/2020	Ready For Your Free Contractor Referral?	Don't Sweat The Small Stuff	75
03/2020	Save Energy. Save Money. Save Time. Shop Online!	Heavy And Light	44
03/2020	Spend Money To Make Money	Heavy And Light	123,842
04/2020	Turn Up To Save	Adjusting To Daylight	120,979
05/2020	Close In The Cool	Discover Ways To Save On Your Bill	87,523
05/2020	Close In The Cool	Registers Free And Clear	66
05/2020	Close In The Cool	Let LEDs Lower Your Cooling Bills	83,036
05/2020	Confirm Your Electric Water Heater!	Let LEDs Lower Your Cooling Bills	1,178
05/2020	Confirm Your Electric Water Heater!	Discover Ways To Save On Your Bill	2,045
05/2020	Do You Have An Electric Water Heater?	Discover Ways To Save On Your Bill	15
05/2020	Save Energy. Save Money. Save Time. Shop Online!	Discover Ways To Save On Your Bill	30
06/2020	Access Your Usage On Your Voice Assistant	Keep It On Cold	27,348
06/2020	Access Your Usage On Your Voice Assistant	Discover Ways To Save On Your Bill	140,407
06/2020	Access Your Usage On Your Voice Assistant	The Simplest Savings	53
07/2020	Close Out The Damp	Seal For The Summer!	164,094
07/2020	Our Energy Pro Can Help You Save	Seal For The Summer!	16
08/2020	Not Too Warm, Not Too Cold	Low With The Flow	158,655
08/2020	Ready For Your Free Contractor Referral?	Not Too Warm, Not Too Cold	173
09/2020	Tap Into Your Energy Usage	Do You Have An Electric Water Heater?	15,160
09/2020	Tap Into Your Energy Usage	Cool It Down	91,162
10/2020	Free Home Energy Assessment	Back In Black Friday	15
10/2020	Lint Free And Loving It	Set It And Forget It	104,857
10/2020	Set It And Forget It	Back In Black Friday	154
11/2020	Ready For Your Free Contractor Referral?	Power-Free Holiday Décor	116

Source Month	Message 1 - Details	Message 2 - Details	Number of Homes
11/2020	Vacation Is Better If You Unplug	Power-Free Holiday Décor	100,808
12/2020	Free Home Energy Assessment	Winter Ways To Vent	16
12/2020	Tap Into Your Energy Usage	Winter Ways To Vent	146,548

Table 3-16: DEP SF MyHER Promotional Messaging by Month

Source Month	Message 1 - Details	Message 2 - Details	Number of Homes
02/2020	Don't Sweat The Small Stuff	Dryer Best Practices	165
02/2020	Ready For Your Free Contractor Referral?	Don't Sweat The Small Stuff	393,938
03/2020	Our Energy Pro Can Help You Save	Heavy And Light	316,151
03/2020	Save Energy. Save Money. Save Time. Shop Online!	Heavy And Light	153,949
03/2020	Saving $100* Is As Easy As Sun, Two, Three!	Heavy And Light	1,284
03/2020	Spend Money To Make Money	Heavy And Light	226,043
04/2020	Turn Up To Save	Do You Have An Electric Water Heater?	7,949
04/2020	Turn Up To Save	Adjusting To Daylight	395,313
05/2020	Close In The Cool.	Discover Ways To Save On Your Bill	131,813
05/2020	Close In The Cool.	Let LEDs Lower Your Cooling Bills	153
05/2020	Close In The Cool.	Registers Free And Clear	365,871
05/2020	Confirm Your Electric Water Heater!	Registers Free And Clear	3,033
05/2020	Confirm Your Electric Water Heater!	Discover Ways To Save On Your Bill	4,670
05/2020	Do You Have An Electric Water Heater?	Discover Ways To Save On Your Bill	15
05/2020	Do You Have An Electric Water Heater?	Registers Free And Clear	30
05/2020	Save Energy. Save Money. Save Time. Shop Online!	Registers Free And Clear	21,693
05/2020	Save Energy. Save Money. Save Time. Shop Online!	Discover Ways To Save On Your Bill	142,802
05/2020	Saving $100* Is As Easy As Sun, Two Three!	Registers Free And Clear	653
05/2020	Saving $100* Is As Easy As Sun, Two Three!	Discover Ways To Save On Your Bill	435
06/2020	Access Your Usage On Your Voice Assistant	The Simplest Savings	176,279
06/2020	Access Your Usage On Your Voice Assistant	Discover Ways To Save On Your Bill	543,796
06/2020	Access Your Usage On Your Voice Assistant	Keep It On Cold	196
07/2020	Close Out The Damp	Seal For The Summer!	210,521
07/2020	Our Energy Pro Can Help You Save	Seal For The Summer!	503,606
08/2020	Not Too Warm, Not Too Cold	Low With The Flow	196
08/2020	Ready For Your Free Contractor Referral?	Not Too Warm, Not Too Cold	706,077
08/2020	Your Support Inspires Future Innovation	Not Too Warm, Not Too Cold	3,615
09/2020	Take Small Steps To A Brighter Tomorrow	Do You Have An Electric Water Heater?	640
09/2020	Take Small Steps To A Brighter Tomorrow	Cool It Down	2,709
09/2020	Tap Into Your Energy Usage	Do You Have An Electric Water Heater?	33,461
09/2020	Tap Into Your Energy Usage	Cool It Down	389,519
10/2020	Free Home Energy Assessment	Back In Black Friday	446,665

Source Month	Message 1 - Details	Message 2 - Details	Number of Homes
10/2020	Lint Free And Loving It	Set It And Forget It	161
10/2020	Set It And Forget It	Back In Black Friday	182,849
11/2020	Ready For Your Free Contractor Referral?	Power-Free Holiday Decor	420,154
11/2020	Vacation Is Better If You Unplug	Power-Free Holiday Decor	160
12/2020	Free Home Energy Assessment	Winter Ways To Vent	472,490
12/2020	Tap Into Your Energy Usage	Winter Ways To Vent	210,173

Table 3-17: DEP MF MyHER Promotional Messaging by Month

Source Month	Message 1 - Details	Message 2 - Details	Number of Homes
02/2020	Don't Sweat The Small Stuff	Dryer Best Practices	44,427
02/2020	Ready For Your Free Contractor Referral?	Don't Sweat The Small Stuff	17
03/2020	Spend Money To Make Money	Heavy And Light	43,817
04/2020	Turn Up To Save	Adjusting To Daylight	43,325
05/2020	Close In The Cool	Let LEDs Lower Your Cooling Bills	35,728
05/2020	Close In The Cool	Registers Free And Clear	15
05/2020	Close In The Cool	Discover Ways To Save On Your Bill	31,939
05/2020	Confirm Your Electric Water Heater!	Discover Ways To Save On Your Bill	443
05/2020	Confirm Your Electric Water Heater!	Let LEDs Lower Your Cooling Bills	248
06/2020	Access Your Usage On Your Voice Assistant	The Simplest Savings	16
06/2020	Access Your Usage On Your Voice Assistant	Discover Ways To Save On Your Bill	58,636
06/2020	Access Your Usage On Your Voice Assistant	Keep It On Cold	9,412
07/2020	Close Out The Damp	Seal For The Summer!	66,813
08/2020	Not Too Warm, Not Too Cold	Low With The Flow	65,079
08/2020	Ready For Your Free Contractor Referral?	Not Too Warm, Not Too Cold	49
09/2020	Tap Into Your Energy Usage	Cool It Down	35,531
09/2020	Tap Into Your Energy Usage	Do You Have An Electric Water Heater?	3,498
10/2020	Lint Free And Loving It	Set It And Forget It	36,370
10/2020	Set It And Forget It	Back In Black Friday	44
11/2020	Ready For Your Free Contractor Referral?	Power-Free Holiday Décor	31
11/2020	Vacation Is Better If You Unplug	Power-Free Holiday Décor	37,031
12/2020	Tap Into Your Energy Usage	Winter Ways To Vent	59,701
01/2021	We're All In This Together	Cold Is Best For Your Disposal	35,487

3.2 Duke Energy Carolinas Impact Findings

3.2.1 Per-home kWh and Percent Impacts

Nexant estimates the average participating DEC SF MyHER home saved 260.5 kWh of electricity from February 2020 to January 2021. This represents a 1.83% reduction in total electricity consumption compared to the control group over the same period. The average DEC MF MyHER home saved 77.0 kWh of electricity from February 2020 to January 2021, which represents a 0.74% reduction in electricity consumption. These estimates reflect both an upward adjustment to account for the intention-to-treat methodology and a downward adjustment to prevent double-counting of savings attributable to incremental participation of treatment groups in Duke Energy's energy efficiency programs.

Table 3-18: and Table 3-19: show the impact estimates in each bill month for the average home assigned to treatment in DEC MF and SF, respectively. The table also shows the subsequent adjustment to account for the fact that only a subset of homes assigned to treatment was actively participating in MyHER during the study period.

Table 3-18: DEC SF MyHER Impact Estimates with ITT Adjustment, before EE Overlap Adjustment

Month	Treatment Homes Analyzed	DEC SF Participant Count	kWh impact in Assigned Homes	% Treated	kWh Impact in Treated Homes
Feb-20	1,240,618	1,211,859	27.8	98%	28.4
Mar-20	1,232,861	1,210,755	22.0	98%	22.4
Apr-20	1,223,328	1,203,318	20.8	98%	21.2
May-20	1,215,700	1,199,355	20.1	99%	20.4
Jun-20	1,208,469	1,193,259	16.9	99%	17.2
Jul-20	1,256,262	1,221,119	15.6	97%	16.1
Aug-20	1,244,968	1,223,132	16.1	98%	16.3
Sep-20	1,234,562	1,216,836	14.6	99%	14.9
Oct-20	1,224,792	1,211,764	21.6	99%	21.8
Nov-20	1,214,988	1,201,904	24.0	99%	24.3
Dec-20	1,205,209	1,191,807	28.4	99%	28.7
Jan-21	1,195,687	1,182,251	32.8	99%	33.1
12-month Total			**260.8**	**98%**	**264.8**

Table 3-19: DEC MF MyHER Impact Estimates with ITT Adjustment, before EE Overlap Adjustment

Month	Treatment Homes Analyzed	DEC MF Participant Count	kWh impact in Assigned Homes	% Treated	kWh Impact in Treated Homes
Feb-20	197,933	197,607	9.1	100%	9.1
Mar-20	194,281	194,057	7.0	100%	7.0
Apr-20	189,715	188,944	6.0	100%	6.0
May-20	186,317	185,155	6.6	99%	6.6
Jun-20	182,876	181,900	5.6	99%	5.6
Jul-20	177,982	177,346	4.9	100%	5.0
Aug-20	173,082	173,809	6.0	100%	6.0
Sep-20	168,480	169,085	5.6	100%	5.6
Oct-20	164,697	164,134	5.8	100%	5.8
Nov-20	161,448	159,810	6.8	99%	6.9
Dec-20	158,121	156,140	8.2	99%	8.3
Jan-21	155,138	152,839	7.9	99%	8.1
12-month Total			**79.5**	**100%**	**79.9**

An adjustment factor of 4.4 kWh per home for SF customers and 2.9 kWh per home for MF customers is applied to MyHER impact estimates in Table 3-20: to arrive at the final net verified program impact per home. Section 3.2.6 provides additional detail on the calculation of the adjustment for overlapping participation in other Duke EE programs.

Table 3-20: DEC MyHER Impact Estimates Net of EE Overlap

Jurisdiction	Time Period	kWh Savings in Treated Homes	Incremental kWh from EE Programs	Net MyHER Impact Estimate	Control Group Usage (kWh)	Percent Reduction
DEC SF	February 2020 – January 2021	264.8	4.4	260.5	14,251	1.86%
DEC MF	February 2020 – January 2021	79.9	2.9	77.0	10,454	0.76%

3.2.2 Aggregate Impacts

The total impact of the MyHER program in each service territory is calculated by multiplying the per-home impacts (adjusted for ITT and incremental EE participation) for each bill month by the number of participating homes. Over the 12-month period February 2020 to January 2021, DEC SF MyHER participants conserved 313.5 GWh of electricity, while DEC MF MyHER participants conserved 13.5 GWh. The aggregate impacts presented in Table 3-21 and Table 3-22 are at the meter level so they do not reflect line losses which occur during transmission and distribution between the generator and end-use customer.

Table 3-21: DEC SF MyHER Aggregate Impacts

Month	DEC SF Participant Count	kWh Net Impact	GWh Net Impact
Feb-20	1,211,859	28.1	34.1
Mar-20	1,210,755	22.1	26.8
Apr-20	1,203,318	20.9	25.1
May-20	1,199,355	20.1	24.1
Jun-20	1,193,259	16.7	19.9
Jul-20	1,221,119	15.7	19.1
Aug-20	1,223,132	16.0	19.5
Sep-20	1,216,836	14.5	17.6
Oct-20	1,211,764	21.4	26.0
Nov-20	1,201,904	23.9	28.8
Dec-20	1,191,807	28.3	33.8
Jan-21	1,182,251	32.7	38.7
12-month Total		**260.5**	**313.5**

Table 3-22: DEC MF MyHER Aggregate Impacts

Month	DEC MF Participant Count	kWh Net Impact	GWh Net Impact
Feb-20	197,607	8.9	1.8
Mar-20	194,057	6.8	1.3
Apr-20	188,944	5.8	1.1
May-20	185,155	6.4	1.2
Jun-20	181,900	5.4	1.0
Jul-20	177,346	4.7	0.8
Aug-20	173,809	5.7	1.0
Sep-20	169,085	5.4	0.9
Oct-20	164,134	5.5	0.9
Nov-20	159,810	6.6	1.0
Dec-20	156,140	8.0	1.2
Jan-21	152,839	7.8	1.2
12-month Total		**77.0**	**13.5**

3.2.3 Precision of Findings

The margin of error of the per-home impact estimate is ± 22.7 kWh for DEC SF and ± 23.4 kWh for DEP at the 90% confidence interval. Nexant clustered the variation of the LFER model by Account ID to produce a robust estimate of the standard error associated with treatment coefficients. The standard normal z-statistic for the 90% confidence level of 1.645 was then used to estimate the uncertainty associated with each cohort estimate. This uncertainty was then aggregated across cohorts to quantify the precision of the program-level impacts estimates (Table 3-23: and Table 3-24:).

Table 3-23: 90% Confidence Intervals Associated with DEC SF MyHER Impact Estimates

Parameter	Lower Bound (90%)	Point Estimate	Upper Bound (90%)
Evaluation Period Savings per Home (kWh)	237.7	260.5	283.2
Percent Reduction	1.67%	1.83%	1.99%
Aggregate Impact (GWh)	286.1	313.5	340.9

Table 3-24: 90% Confidence Intervals Associated with DEC MF MyHER Impact Estimates

Parameter	Lower Bound (90%)	Point Estimate	Upper Bound (90%)
Evaluation Period Savings per Home (kWh)	53.6	77.0	100.4
Percent Reduction	0.51%	0.74%	0.96%
Aggregate Impact (GWh)	9.4	13.5	17.6

For DEC SF, the absolute precision of the result is ± 0.16% and the relative precision of ± 8.71% at the 90% confidence level. For DEC MF, the absolute precision of the result is ± 0.22% and the relative precision of ± 30.39% at the 90% confidence level.

3.2.4 Impact Estimates by Cohort

The per-home impact estimates shown in Table 3-18 and Table 3-19 reflect an unadjusted average impact across the thirteen cohorts of DEC SF MyHER customers analyzed and the six cohorts of DEC MF MyHER customers analyzed. The impact estimates for the individual cohorts varied across the study period. Table 3-25 and Table 3-26 show point estimates for each cohort during the period February 2020 to January 2021 for DEC SF and MF, respectively. Three released cohorts for DEC SF were added to treatment in October 2015 and began producing impacts in November 2015. The largest impacts for DEC SF customers came from cohort 2 (“2012-2013”) and cohort 8 (“2014-2015 Release”), these are both older cohorts, and continue the trend seen in the previous evaluation of mature cohorts producing some of the largest impacts in the study.

Table 3-25: DEC SF Unadjusted Monthly kWh Impact Estimates by Cohort

Month	Apr-10	2012-2013	2014-2015	Jun-16	May-17	Apr 2010 Release	2012-2013 Release	2014-2015 Release	Oct-17	May-18	Oct-18	May-19	Dec-19
Feb-20	15.5	43.7	33.1	15.6	6.4	8.3	20.1	36.5	-2.4	13.3	8.4	0.7	-0.4
Mar-20	17.4	30.1	28.9	17.1	6.7	11.9	17.4	32.3	10.4	11.4	7.9	2.1	0.8
Apr-20	17.3	30.6	22.2	17.0	7.8	10.9	16.3	27.5	15.8	12.1	9.2	4.5	1.2
May-20	23.1	28.9	17.1	17.3	13.0	10.6	16.6	27.3	23.9	12.4	8.3	11.8	5.8
Jun-20	22.7	15.5	16.9	16.3	19.9	8.0	20.3	32.0	36.1	14.4	15.2	17.8	9.4
Jul-20	21.2	9.7	16.6	15.1	22.9	10.7	24.9	36.3	42.9	17.7	14.5	22.2	8.1
Aug-20	29.8	12.0	14.0	12.2	23.7	12.8	24.5	39.0	42.8	22.8	11.6	24.1	9.7
Sep-20	22.9	7.5	22.7	10.6	15.8	13.7	21.5	35.3	28.5	16.8	7.8	16.6	7.8
Oct-20	19.1	33.7	19.4	13.4	5.2	12.5	15.3	28.5	15.0	9.3	4.7	14.2	6.4
Nov-20	20.5	37.5	22.9	18.5	7.3	18.8	14.8	28.1	7.5	12.5	4.4	10.7	7.8
Dec-20	15.7	38.8	35.3	21.4	18.9	26.5	19.1	34.1	0.3	16.3	6.0	7.6	3.4
Jan-21	14.6	47.7	38.5	22.2	21.6	21.9	20.3	33.8	-4.5	18.6	7.3	4.3	5.1
Total	**239.7**	**335.7**	**287.5**	**196.7**	**169.0**	**166.5**	**231.2**	**390.8**	**216.5**	**177.6**	**105.1**	**136.7**	**65.2**

As shown in Table 3-26, the largest impacts for DEC MF customers came from the three oldest cohorts (“November 2016”, “May 2017”, and “October 2017”) with the largest impacts of 107 kWh coming from the May 2017 cohort. The newer cohorts have considerably lower impacts, which fits expectations in the previous DEC DEP MyHER reports where the Nexant team found impacts increased as cohorts matured.

Table 3-26: DEC MF Unadjusted Monthly kWh Impact Estimates by Cohort

Month	Nov-16	May-17	Oct-17	May-18	Oct-18	Dec-19
Feb-20	10.6	12.5	7.9	3.4	8.0	6.9
Mar-20	6.9	7.9	8.1	4.7	6.7	5.9
Apr-20	7.5	6.3	8.4	2.6	2.8	4.8
May-20	11.6	4.8	10.9	1.2	4.6	4.8
Jun-20	7.8	2.3	14.5	0.4	7.3	3.2
Jul-20	4.8	3.1	13.8	2.7	6.0	2.0
Aug-20	5.7	6.1	13.6	3.5	6.2	1.9
Sep-20	1.6	5.1	13.3	6.5	3.4	4.4
Oct-20	3.9	6.4	10.7	4.2	1.9	4.4
Nov-20	0.1	11.3	6.9	5.7	3.5	6.5
Dec-20	4.2	12.8	-0.1	3.9	8.5	11.0
Jan-21	6.5	10.6	-0.9	5.7	8.4	11.7
Total	**71.1**	**89.3**	**107.0**	**44.3**	**67.3**	**67.6**

Table 3-27: and Table 3-28: show the margin of error at the 90% confidence level for each cohort’s annual impact estimate for DEC SF and MF, respectively. The combined margin of error for the entire program is lower than the error for any single cohort because the combined program impact estimate is based on a larger pool of customers. Individual cohort margins of error are high for the small cohorts due to the sizes of these groups relative to the underlying variation in consumption among the treatment and control groups constituting each cohort.

Table 3-27: DEC SF 90% Confidence Intervals Associated with Cohort Savings Estimates

Cohort	Margin of Error at 90% Confidence Level	Lower Bound (kWh)	Point Estimate (kWh)	Upper Bound (kWh)
Apr-10	211.8	27.9	239.7	451.4
2012-2013	79.9	255.9	335.7	415.6
2014-2015	84.5	202.9	287.5	372.0
Jun-16	119.8	76.9	196.7	316.5
May-17	160.4	8.7	169.0	329.4
Apr 2010 Release	182.2	-15.8	166.5	348.7
2012-2013 Release	91.2	140.1	231.2	322.4
2014-2015 Release	119.9	270.9	390.8	510.7
Oct-17	102.8	113.7	216.5	319.2
May-18	124.1	53.4	177.6	301.7
Oct-18	122.8	-17.7	105.1	228.0
May-19	142.9	-6.1	136.7	279.6
Dec-19	123.1	-57.9	65.2	188.3

Table 3-28: DEC MF 90% Confidence Intervals Associated with Cohort Savings Estimates

Cohort	Margin of Error at 90% Confidence Level	Lower Bound (kWh)	Point Estimate (kWh)	Upper Bound (kWh)
Nov-16	179.6	-108.4	71.1	250.7
May-17	117.3	-28.0	89.3	206.5
Oct-17	90.9	16.1	107.0	197.9
May-18	105.1	-60.8	44.3	149.5
Oct-18	90.1	-22.8	67.3	157.3
Dec-19	63.5	4.1	67.6	131.0

3.2.5 Seasonal Trends

There is a clear seasonal pattern to the DEC SF and MF MyHER savings profiles. SF and MF customers both consistently experience the greatest reductions in winter and the smallest, sometimes negative, reductions in summer. The blue bars in Figure 3-9 and Figure 3-10 show the average estimated monthly treatment effect for the program in each bill month from February 2020 to January 2021. The green series in Figure 3-9 and Figure 3-10 show the average control customer's load during the same time period.

Figure 3-9: DEC SF Average kWh Savings by Month

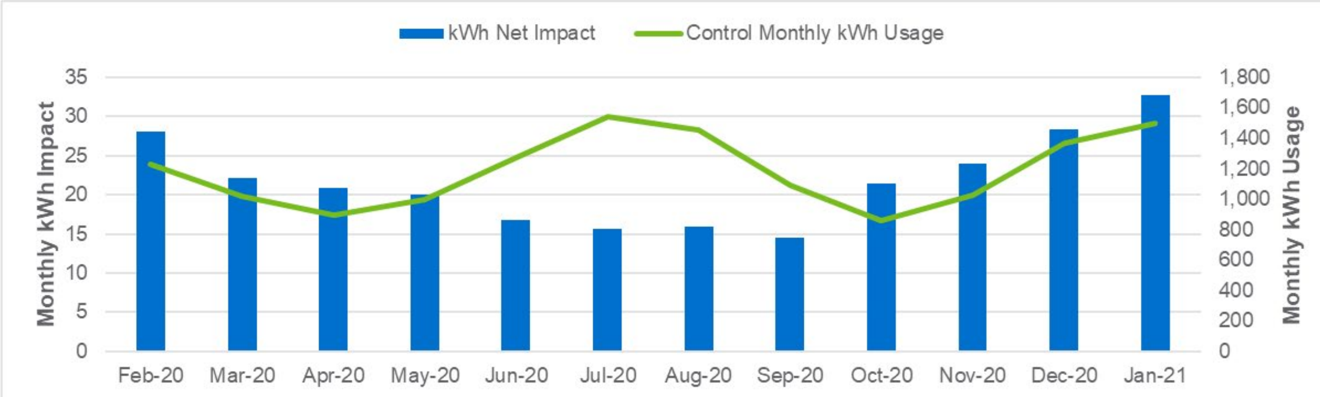
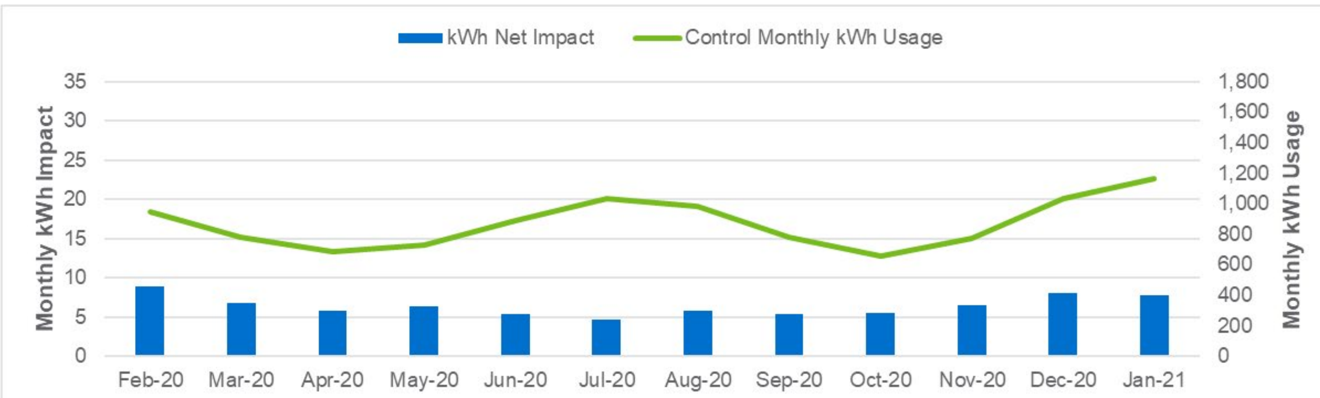


Figure 3-10: DEC MF Average kWh Savings by Month



Based on the observed savings trends, MyHER is realizing the greatest impacts in the winter. Seasonal trends in MyHER average treatment effects likely reflect customers' differing abilities to respond by season. For example, winter heating demand can be mitigated by dressing more warmly, using more blankets in the home, or shutting off lights more often (there are fewer hours of daylight in the winter than the summer). The summer impacts still occur but the conservation options, and potentially willingness to conserve on cooling, options available to customers are fewer.

3.2.6 Uplift in Other Duke Energy Programs

Section 3.1.6 outlined the methodology Nexant used to calculate the annual kWh savings attributable to increased participation in other Duke Energy programs. Table 3-29: presents the downward adjustment per home that was applied to impacts in order to avoid double-counting savings from February 2020 to January 2021. For DEC SF, the uplift was determined to be 4.35 kWh per home, or 5.3 GWh in aggregate. For DEC MF, the uplift was determined to be 2.93 kWh per home, or 0.5 GWh in aggregate.

Table 3-29: Monthly Adjustment for Overlapping Participation in Other EE Programs

Month	DEC SF Incremental kWh from Other EE Programs	DEC MF Incremental kWh from Other EE Programs
Feb-20	0.30	0.19
Mar-20	0.29	0.22
Apr-20	0.28	0.21
May-20	0.30	0.23
Jun-20	0.44	0.23
Jul-20	0.37	0.25
Aug-20	0.39	0.22
Sep-20	0.39	0.25
Oct-20	0.40	0.29
Nov-20	0.38	0.30
Dec-20	0.42	0.28
Jan-21	0.40	0.26
12-month Total	**4.35**	**2.93**

Although these additional savings must be subtracted from the MyHER effect to prevent double-counting, the MyHERs clearly played an important role in harvesting these savings.

Table 3-30 and Table 3-31 show the average daily energy savings attributable to tracked energy efficiency measures as of January 2021 by cohort and calculates an uplift percentage. In most of the cohorts the treatment group was more likely to have savings from DEC EE programs.

Table 3-30: DEC SF Uplift Percentage by Cohort

Cohort	Monthly Net kWh Savings from EE (Treatment Group)	Monthly Net kWh Savings from EE (Control Group)	Uplift Percentage
Dec 2014	7.7	7.5	1.1%
Dec 2015	7.6	7.2	3.4%
Jun 2016	7.8	7.7	2.5%
May 2017	7.6	7.0	7.5%
Oct 2017	8.0	8.2	1.6%
Dec 2014 Release	7.9	7.5	1.8%
May 2018	8.5	6.7	0.8%
Oct 2018	9.1	8.9	2.1%
May 2019	8.1	8.2	2.6%
Dec 2019	6.8	6.6	4.8%

Table 3-31: DEC MF Uplift Percentage by Cohort

Cohort	Monthly Net kWh Savings from EE (Treatment Group)	Monthly Net kWh Savings from EE (Control Group)	Uplift Percentage
Nov-16	13.7	12.5	9.6%
May-17	11.7	11.5	1.1%
Oct-17	13.7	13.6	0.7%
May-18	15.3	15.3	0.2%
Oct-18	16.0	15.3	4.4%
Dec-19	16.4	16.5	-0.4%

3.2.7 Peak Demand Impacts

Nexant estimated MyHER summer and winter demand savings using Duke Energy's DSMore load profile from 2020. The load profile data was provided to Nexant by Duke Energy for residential customers in DEC. Nexant used the peak demand definition defined by Duke Energy, which has a summer peak period of 4:00 PM to 5:00 PM on July weekdays and a winter peak period of 7:00 AM to 8:00 AM on January weekdays.

With regards to summer impacts: for single-family, Nexant applied the proportion of annual residential load in this hour to our annual MyHER impact savings estimate of 260.5 kWh; the result is an estimated MyHER residential peak demand savings of 0.048 kW. For multi-family, Nexant applied the proportion of annual residential load in this hour to our annual MyHER impact savings estimate of 77.0 kWh; the result is an estimated MyHER residential peak demand savings of 0.014 kW.

In the winter peak period, Nexant used the same method but applied the results to the proportion of annual usage during the January peak of hour ending 8:00 AM. For single family, Nexant estimated savings of 0.014 kW and for multi-family, Nexant estimated savings of 0.011 kW per customer during the winter peak hour. Demand impact results are presented in Table 3-32.

Table 3-32: DEC MyHER Summer and Winter Demand Impacts

Season	Segment	Participant Count	Per Home kW Savings	Aggregate MW
Summer	Single Family	1,205,613	0.0483	58.26
	Multi-family	175,069	0.0143	2.50
Winter	Single Family	1,205,613	0.0387	46.66
	Multi-family	175,069	0.0114	2.00

3.2.8 Duration of Exposure

Home energy report evaluations in North America consistently find a trend of increasing savings with length of treatment. For DEC SF, cohorts 1-9 have been exposed to treatment for longer than three years and provide 88% of aggregate savings, while comprising 79% of the population. For DEC MF, cohorts 2-4[11] have been in the program for longer than three years and provide 67% of aggregate savings while comprising 59% of the population. A comparison of monthly impacts between the average customer and customers in the oldest cohorts are presented in Figure 3-11 and Figure 3-12.

Figure 3-11: DEC SF Comparison of Average Customer Savings to the Savings of the Older Program Participants

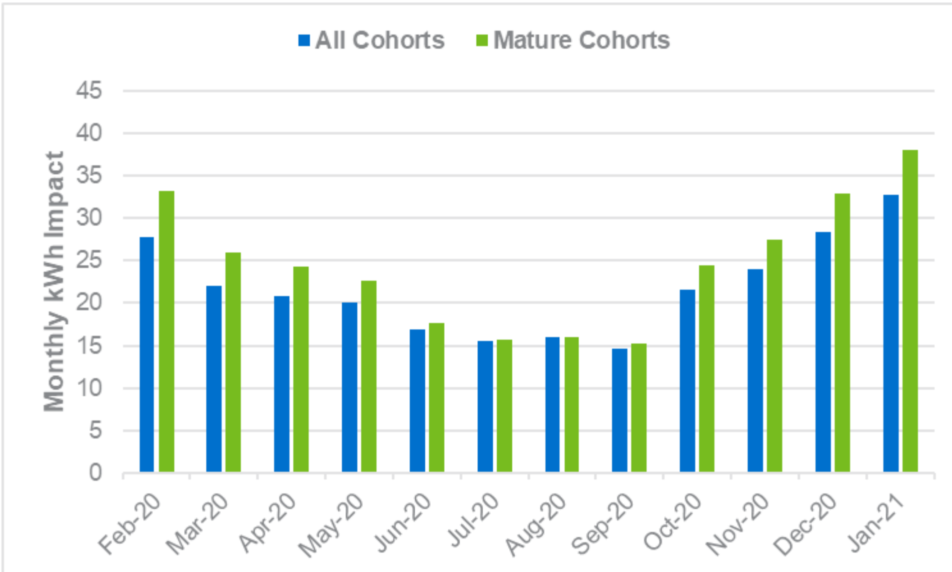
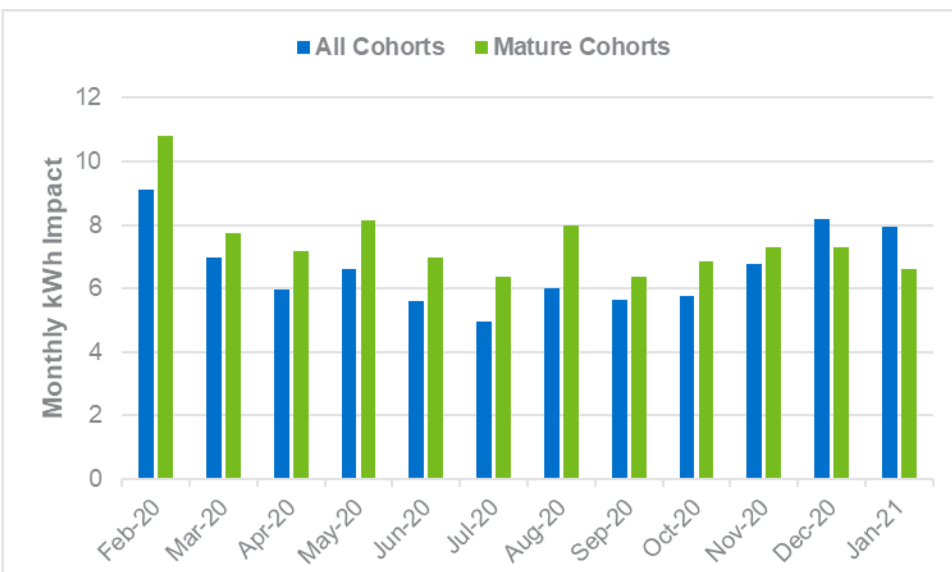


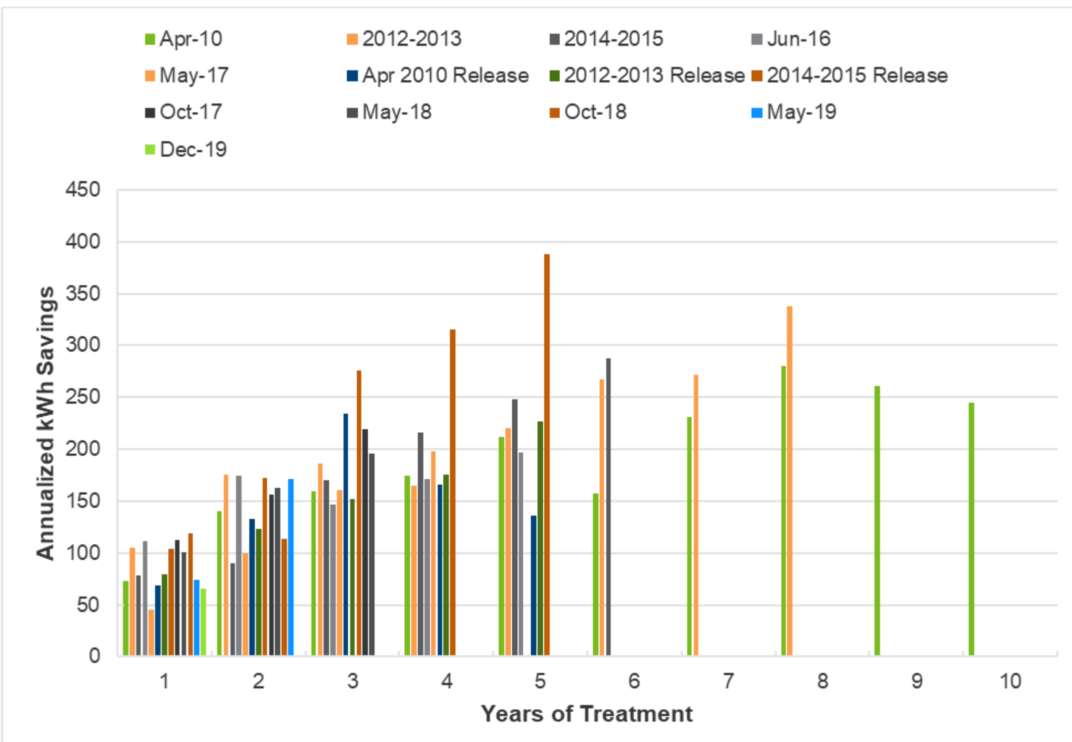
Figure 3-12: DEC MF Comparison of Average Customer Savings to the Savings of the Older Program Participants



[11] Cohort 1 is a catch all for MF customers who were assigned before Nov 2016 and did not fit a cohort criteria, results for these customers were not presented as they do not have an even pre-treatment period.

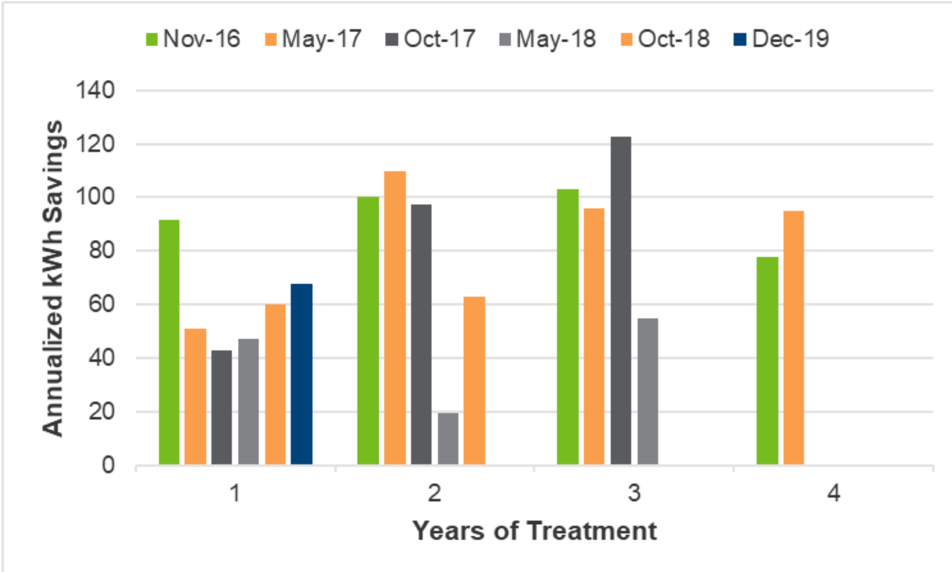
Figure 3-13 displays the annual savings by the number of years a cohort has been in the program for DEC SF MyHER participants. A general upward trend of savings occurs with longer exposure to treatment, however some exceptions are visible. The oldest cohort, which has been in treatment since 2010, shows lower impacts than those in earlier years of its treatment. It should be noted that there are few program implementations of home energy report programs with durations in excess of seven years and there is less information about what should be expected from implementations that are reaching a decade. Additionally, with less than 6,000 treatment customers in this cohort, it is now one of the smallest cohorts in DEC. It is reasonable to expect the newer cohorts' impacts to increase with maturation of the cohorts, however the "April 2010" cohort's performance may be indicative of the existence of a point peak maturation after which mature impacts cannot be sustained. Two of the clearest trends in maturation are seen in the "2013-2013" cohort and the "2014-2015 Release" cohort, where impacts have been on a clear upwards trajectory for the extent of the program.

Figure 3-13: DEC SF Annual Savings by Duration of Exposure



Duration of exposure for DEC MF customers is displayed on Figure 3-14. Like the SF customers, the results are mixed as to the impact of maturation. The two 2018 cohorts show a clear increase in savings over their three year span in the analysis period, while the two oldest cohorts, "November 2016" and "May 2017", show steady impacts across the years. This evaluation is the first one to look at DEC MF MyHER impacts, so the impact of maturation will be revisited in the next DEC DEP evaluation as the cohorts mature to lengths seen in the SF customers.

Figure 3-14: DEC MF Annual Savings by Duration of Exposure



3.3 Duke Energy Progress Impact Findings

3.3.1 Per-home kWh and Percent Impacts

Nexant estimates the average participating DEP SF MyHER home saved 243.2 kWh of electricity from February 2020 to January 2021. This represents a 1.61% reduction in total electricity consumption compared to the control group over the same period. The average DEP MF MyHER home saved 64.1 kWh of electricity from February 2020 to January 2021, which represents a 0.64% reduction in electricity consumption. These estimates reflect an upward adjustment to account for the intention-to-treat methodology and a downward adjustment to prevent double-counting of savings attributable to incremental participation of treatment groups in Duke Energy's energy efficiency programs.

Table 3-33 and Table 3-34 show the impact estimates in each bill month for the average home assigned to treatment in DEP MF and SF, respectively. The table also shows the subsequent adjustment to account for the fact that only a subset of homes assigned to treatment was actively participating in MyHER during the study period.

Table 3-33: DEP SF MyHER Impact Estimates with ITT Adjustment, before EE Overlap Adjustment

Month	Treatment Homes Analyzed	DEP SF Participant Count	kWh impact in Assigned Homes	% Treated	kWh Impact in Treated Homes
Feb-20	740,536	725,283	24.4	98%	24.9
Mar-20	735,142	725,212	20.3	99%	20.6
Apr-20	728,397	719,344	15.1	99%	15.3
May-20	724,174	716,929	16.2	99%	16.4
Jun-20	720,002	714,581	19.0	99%	19.1
Jul-20	750,040	737,309	20.1	98%	20.4
Aug-20	742,628	738,331	21.3	99%	21.5
Sep-20	736,292	734,948	18.3	100%	18.3
Oct-20	729,724	731,763	14.7	100%	14.6
Nov-20	723,593	711,645	19.5	98%	19.8
Dec-20	717,862	705,104	25.8	98%	26.2
Jan-21	711,773	700,447	28.8	98%	29.3
12-month Total			**243.4**	**99%**	**246.4**

Table 3-34: DEP MF MyHER Impact Estimates with ITT Adjustment, before EE Overlap Adjustment

Month	Treatment Homes Analyzed	DEP MF Participant Count	kWh impact in Assigned Homes	% Treated	kWh Impact in Treated Homes
Feb-20	79,939	77,591	5.1	97%	5.3
Mar-20	78,360	76,233	6.7	97%	6.8
Apr-20	76,748	74,236	4.5	97%	4.7
May-20	75,535	72,746	2.9	96%	3.0
Jun-20	74,263	72,110	2.1	97%	2.2
Jul-20	72,580	70,702	3.3	97%	3.4
Aug-20	70,606	69,398	5.7	98%	5.8
Sep-20	69,096	67,637	5.6	98%	5.8
Oct-20	67,636	65,929	6.7	97%	6.9
Nov-20	66,307	64,486	6.1	97%	6.2
Dec-20	65,030	63,061	7.1	97%	7.4
Jan-21	63,741	61,710	7.5	97%	7.7
12-month Total			**63.3**	**100%**	**65.1**

An adjustment factor of 3.2 kWh per home for SF customers and 1.0 kWh per home for MF customers is applied to MyHER impact estimates in Table 3-35 to arrive at the final net verified program impact per home. Section 3.2.6 provides additional detail on the calculation of the adjustment for overlapping participation in other Duke EE programs.

Table 3-35: DEP MyHER Impact Estimates Net of EE Overlap

Jurisdiction	Time Period	kWh Savings in Treated Homes	Incremental kWh from EE Programs	Net MyHER Impact Estimate	Control Group Usage (kWh)	Percent Reduction
DEP SF	February 2020 – January 2021	246.4	3.2	243.2	15,061	1.61%
DEP MF	February 2020 – January 2021	65.1	1.0	64.1	10,058	0.64%

3.3.2 Aggregate Impacts

The total impact of the MyHER program in each service territory is calculated by multiplying the per-home impacts (adjusted for ITT and incremental EE participation) for each bill month by the number of participating homes. Over the 12-month period February 2020 to January 2021, DEP SF MyHER participants conserved 175.2 GWh of electricity, while DEP MF MyHER participants conserved 4.4 GWh. The aggregate impacts presented in Table 3-36 and Table 3-37 are at the meter level so they do not reflect line losses which occur during transmission and distribution between the generator and end-use customer.

Table 3-36: DEP SF MyHER Aggregate Impacts

Month	DEP SF Participant Count	kWh Net Impact	GWh Net Impact
Feb-20	725,283	24.7	17.9
Mar-20	725,212	20.4	14.8
Apr-20	719,344	15.1	10.9
May-20	716,929	16.2	11.6
Jun-20	714,581	18.8	13.4
Jul-20	737,309	20.2	14.9
Aug-20	738,331	21.2	15.7
Sep-20	734,948	18.0	13.3
Oct-20	731,763	14.4	10.5
Nov-20	711,645	19.5	13.9
Dec-20	705,104	25.9	18.2
Jan-21	700,447	28.9	20.2
12-month Total		**243.2**	**175.2**

Table 3-37: DEP MF MyHER Aggregate Impacts

Month	DEP MF Participant Count	kWh Net Impact	GWh Net Impact
Feb-20	77,591	5.2	0.4
Mar-20	76,233	6.8	0.5
Apr-20	74,236	4.6	0.3
May-20	72,746	2.9	0.2
Jun-20	72,110	2.1	0.1
Jul-20	70,702	3.3	0.2
Aug-20	69,398	5.7	0.4
Sep-20	67,637	5.7	0.4
Oct-20	65,929	6.8	0.5
Nov-20	64,486	6.1	0.4
Dec-20	63,061	7.3	0.5
Jan-21	61,710	7.6	0.5
12-month Total		**64.1**	**4.4**

3.3.3 Precision of Findings

The margin of error of the per-home impact estimate is ± 24.0 kWh for DEP SF and ± 32.9 kWh for DEP MF at the 90% confidence interval. Nexant clustered the variation of the LFER model by Account ID to produce a robust estimate of the standard error associated with treatment coefficients. The standard normal z-statistic for the 90% confidence level of 1.645 was then used to estimate the uncertainty associated with each cohort estimate. This uncertainty was then aggregated across cohorts to quantify the precision of the program-level impacts estimates (Table 3-38 and Table 3-39).

Table 3-38: 90% Confidence Intervals Associated with DEP SF MyHER Impact Estimates

Parameter	Lower Bound (90%)	Point Estimate	Upper Bound (90%)
Evaluation Period Savings per Home (kWh)	219.2	243.2	267.2
Percent Reduction	1.46%	1.61%	1.77%
Aggregate Impact (GWh)	157.9	175.2	192.6

Table 3-39: 90% Confidence Intervals Associated with DEP MF MyHER Impact Estimates

Parameter	Lower Bound (90%)	Point Estimate	Upper Bound (90%)
Evaluation Period Savings per Home (kWh)	31.2	64.1	97.0
Percent Reduction	0.31%	0.64%	0.96%
Aggregate Impact (GWh)	2.1	4.4	6.7

For DEP SF, the absolute precision of the result is ± 0.16% and the relative precision of ± 9.87% at the 90% confidence level. For DEP MF, the absolute precision of the result is ± 0.32% and the relative precision of ± 51.33% at the 90% confidence level.

3.3.4 Impact Estimates by Cohort

The per-home impact estimates shown in Table 3-33 and Table 3-34 reflect an unadjusted average impact across the ten cohorts of DEP SF MyHER customers analyzed and the six cohorts of DEP MF MyHER customers analyzed. The impact estimates for the individual cohorts varied across the study period. Table 3-40 and Table 3-41 show point estimates for each cohort during the period February 2020 to January 2021 for DEC SF and MF, respectively. One release cohort for DEP was added to treatment in October 2015 and began producing impacts in November 2015. The largest DEP SF impacts are found in the first cohort (“December 2014”).

Table 3-40: DEP SF Unadjusted Monthly kWh Impact Estimates by Cohort

Month	Dec-14	Dec-15	Jun-16	May-17	Oct-17	Dec 2014 Release	May-18	Oct-18	May-19	Dec 2019
Feb-20	34.2	3.4	12.3	14.1	-20.6	24.0	17.7	2.8	4.2	12.8
Mar-20	26.5	3.9	21.9	9.9	2.1	18.5	19.7	5.5	8.1	10.2
Apr-20	18.0	2.3	25.9	3.9	22.3	13.9	25.9	11.1	-2.0	9.2
May-20	19.6	6.0	26.1	3.0	34.1	12.1	26.3	10.7	-1.5	7.6
Jun-20	22.8	7.8	23.8	8.2	37.8	11.5	27.4	10.5	3.5	9.8
Jul-20	24.6	7.6	21.0	8.9	37.5	11.2	27.5	13.5	4.3	8.2
Aug-20	26.5	4.3	20.1	13.9	36.2	11.3	23.1	8.6	7.3	9.5
Sep-20	21.9	1.6	18.0	15.6	31.7	11.3	24.5	11.2	3.9	4.7
Oct-20	17.2	-0.1	20.1	7.6	24.2	12.1	21.5	14.8	5.0	1.9
Nov-20	25.4	9.6	21.7	3.3	5.3	18.7	23.8	9.9	5.3	4.5
Dec-20	36.5	18.1	9.0	0.0	-15.5	24.1	24.0	7.3	10.3	5.9
Jan-21	39.8	14.4	11.0	6.6	-22.1	28.1	23.3	6.6	15.1	9.9
Total	**312.8**	**79.1**	**230.7**	**94.9**	**173.0**	**196.8**	**284.7**	**112.4**	**63.5**	**94.1**

Table 3-41: DEP MF Unadjusted Monthly kWh Impact Estimates by Cohort

Month	Nov-16	May-17	Oct-17	May-18	Oct-18	Dec-19
Feb-20	8.9	7.5	3.7	-4.1	7.3	0.6
Mar-20	14.9	6.1	7.1	5.0	5.8	2.3
Apr-20	15.5	2.0	5.7	4.6	5.3	0.4
May-20	8.0	0.4	6.4	9.6	1.1	0.7
Jun-20	0.0	3.1	6.9	11.5	-7.0	-0.2
Jul-20	-0.8	9.4	-0.4	14.5	-9.8	-2.1
Aug-20	5.0	11.1	1.0	15.0	-5.0	-0.8
Sep-20	8.2	7.4	6.2	12.4	-2.4	0.4
Oct-20	14.1	6.8	10.3	5.1	1.7	0.2
Nov-20	10.6	8.4	4.2	0.8	4.0	0.4
Dec-20	5.5	15.0	-2.0	-6.8	12.6	-1.4
Jan-21	1.6	13.6	2.1	-3.1	14.4	2.6
Total	**91.5**	**90.9**	**51.2**	**64.4**	**27.9**	**2.9**

Table 3-42 and Table 3-43 show the margin of error at the 90% confidence level for each cohort's annual impact estimate for DEP SF and MF, respectively. The combined margin of error for the entire program is lower than the error for any single cohort because the combined program impact estimate is based on a larger pool of customers. Individual cohort margins of error are high for the small cohorts due to the sizes of these groups relative to the underlying variation in consumption among the treatment and control groups constituting each cohort. This is especially relevant when looking at the DEP MF cohorts, which have the smallest customer counts in the MyHER program.

Table 3-42: DEP SF 90% Confidence Intervals Associated with Cohort Savings Estimates

Cohort	Margin of Error at 90% Confidence Level	Lower Bound (kWh)	Point Estimate (kWh)	Upper Bound (kWh)
Dec-14	60.6	252.2	312.8	373.4
Dec-15	216.5	-137.4	79.1	295.6
Jun-16	160.8	69.9	230.7	391.5
May-17	195.0	-100.0	94.9	289.9
Oct-17	168.4	4.6	173.0	341.4
Dec 2014 Release	82.3	114.5	196.8	279.2
May-18	185.6	99.1	284.7	470.3
Oct-18	171.0	-58.6	112.4	283.5
May-19	196.1	-132.6	63.5	259.6
Dec 2019	144.7	-50.7	94.1	238.8

Table 3-43: DEP MF 90% Confidence Intervals Associated with Cohort Savings Estimates

Cohort	Margin of Error at 90% Confidence Level	Lower Bound (kWh)	Point Estimate (kWh)	Upper Bound (kWh)
Nov-16	236.5	-145.0	91.5	328.1
May-17	155.0	-64.1	90.9	245.9
Oct-17	141.9	-90.7	51.2	193.0
May-18	153.5	-89.2	64.4	217.9
Oct-18	136.3	-108.4	27.9	164.2
Dec-19	80.2	-77.4	2.9	83.1

3.3.5 Seasonal Trends

There is a clear seasonal pattern to the DEP SF and MF MyHER savings profiles. SF and MF customers both consistently experience the greatest reductions in winter and the smallest, sometimes negative, reductions in summer. The blue bars in Figure 3-15 and Figure 3-16 show the average estimated monthly treatment effect for the program in each bill month from February 2020 to January 2021. The green series in Figure 3-15 and Figure 3-16 show the average control customer's load during the same time period. Annual electricity consumption for SF and MF customers is bimodal, with peaks in both summer and winter, and the results for DEP SF customers are also bimodal, unlike the DEC SF customers. DEP MF customers follow a different trend, with their highest impacts in the fall and winter months.

Figure 3-15: DEP SF Average kWh Savings by Month

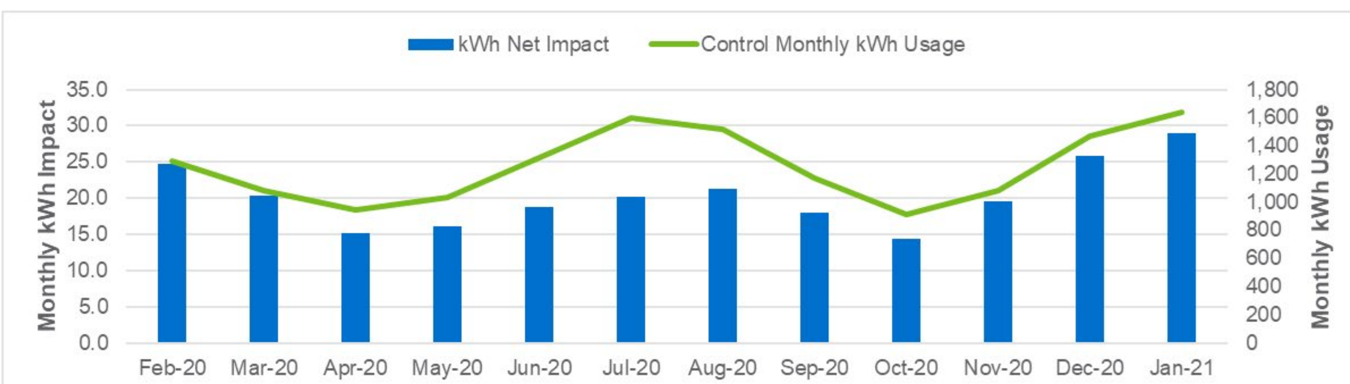
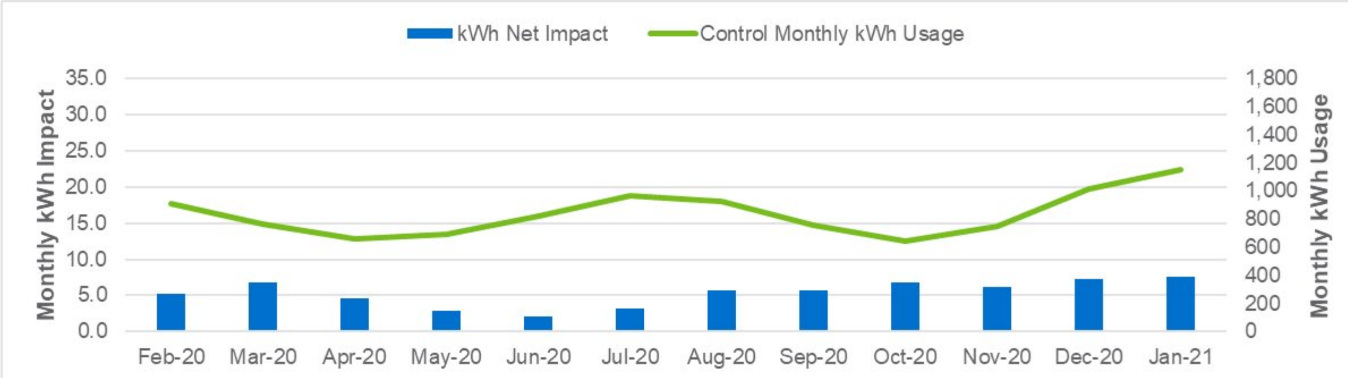


Figure 3-16: DEP MF Average kWh Savings by Month



Based on the observed savings trends among DEP MF and SF customers, MyHER is generally realizing the greatest impacts in the winter months, but DEP MyHER participants do relatively better in the summer months than the DEC MyHER participants.

3.3.6 Uplift in Other Duke Energy Programs

Section 3.1.6 outlined the methodology Nexant used to calculate the annual kWh savings attributable to increased participation in other Duke Energy programs. Table 3-44 presents the downward adjustment per home that was applied to impacts in order to avoid double-counting savings from February 2020 to January 2021. For DEP SF, the uplift was determined to be 3.19 kWh per home, or 2.31 GWh in aggregate. For DEP MF, the uplift was determined to be 1.00 kWh per home, or 0.07 GWh in aggregate.

Table 3-44: Monthly Adjustment for Overlapping Participation in Other EE Programs

Month	DEP SF Incremental kWh from Other EE Programs	DEP MF Incremental kWh from Other EE Programs
Feb-20	0.17	0.04
Mar-20	0.17	0.04
Apr-20	0.18	0.08
May-20	0.19	0.11
Jun-20	0.33	0.13
Jul-20	0.25	0.10
Aug-20	0.25	0.13
Sep-20	0.27	0.05
Oct-20	0.29	0.06
Nov-20	0.32	0.10
Dec-20	0.38	0.06
Jan-21	0.38	0.09
12-month Total	**3.19**	**1.00**

Although these additional savings must be subtracted from the MyHER effect to prevent double-counting, the MyHERs played an important role in harvesting these savings.

Table 3-45 and Table 3-46 show the average daily energy savings attributable to tracked energy efficiency measures as of January 2021 by cohort and calculates an uplift percentage. In all but two SF and one MF cohort the treatment group showed a higher propensity to adopt measures through Duke Energy programs than the control group.

Table 3-45: DEP SF Uplift Percentage by Cohort

Cohort	Monthly Net kWh Savings from EE (Treatment Group)	Monthly Net kWh Savings from EE (Control Group)	Uplift Percentage
Dec 2014	7.7	7.5	3.0%
Dec 2015	7.6	7.2	4.7%
Jun 2016	7.8	7.7	0.4%
May 2017	7.6	7.0	8.2%
Oct 2017	8.0	8.2	-2.5%
Dec 2014 Release	7.9	7.5	4.9%
May 2018	8.5	6.7	27.4%
Oct 2018	9.1	8.9	2.0%
May 2019	8.1	8.2	-1.1%
Dec 2019	6.8	6.6	2.4%

Table 3-46: DEP MF Uplift Percentage by Cohort

Cohort	Monthly Net kWh Savings from EE (Treatment Group)	Monthly Net kWh Savings from EE (Control Group)	Uplift Percentage
Nov-16	6.2	5.8	9%
May-17	4.5	4.5	0%
Oct-17	7.7	7.4	5%
May-18	7.9	6.6	21%
Oct-18	8.9	8.9	0%
Dec-19	7.4	8.0	-8%

3.3.7 Peak Demand Impacts

Nexant estimated MyHER summer and winter demand savings using Duke Energy's DSMore load profile from 2020. The load profile data was provided to Nexant by Duke Energy for residential customers in DEP. Nexant used the peak demand definition defined by Duke Energy, which has a summer peak period of 4:00 PM to 5:00 PM on July weekdays and a winter peak period of 7:00 AM to 8:00 AM on January weekdays.

With regards to summer impacts: for single-family, Nexant applied the proportion of annual residential load in this hour to our annual MyHER impact savings estimate of 243.2 kWh; the result is an estimated MyHER residential peak demand savings of 0.047 kW. For multi-family, Nexant applied the proportion of annual residential load in this hour to our annual MyHER impact savings estimate of 64.1 kWh; the result is an estimated MyHER residential peak demand savings of 0.012 kW.

In the winter peak period, Nexant used the same method but applied the results to the proportion of annual usage during the January peak of hour ending 8:00 AM. For single family, Nexant estimated savings of 0.043 kW and for multi-family, Nexant estimated savings of 0.011 kW per customer during the winter peak hour.

Table 3-47: DEP MyHER Summer and Winter Demand Impacts

Season	Segment	Participant Count	Per Home kW Savings	Aggregate MW
Summer	Single Family	721,741	0.0468	33.77
	Multi-family	69,653	0.0123	0.86
Winter	Single Family	721,741	0.0432	31.19
	Multi-family	69,653	0.0114	0.79

3.3.8 Duration of Exposure

Home energy report evaluations in North America consistently find a trend of increasing savings with length of treatment. For DEP SF, Cohorts 1-6 have been exposed to treatment for longer than three years and provide 87% of aggregate savings, while comprising 79% of the population. For DEP MF, Cohorts 2-4[12] have been in the program for longer than three years and provide 68% of aggregate savings while comprising 68% of the population. A comparison of monthly impacts between the average customer and customers in the oldest cohorts are presented in Figure 3-17 and Figure 3-18.

[12] Cohort 1 is a catchall cohort for MF customers who were assigned before Nov 2016 and did not fit a reasonable definition of a cohort.

Figure 3-17: DEP SF Comparison of Average Customer Savings to the Savings of the Older Program Participants

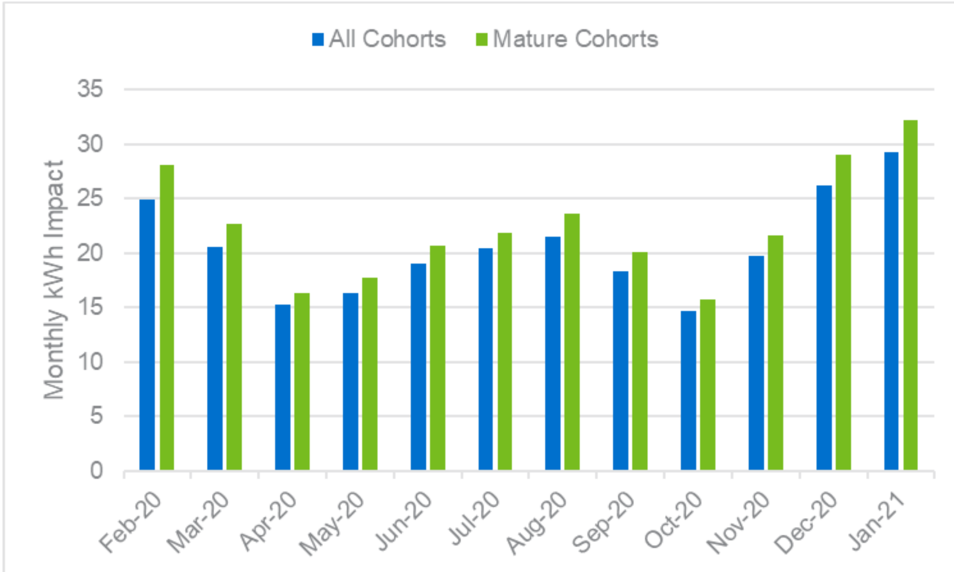


Figure 3-18: DEP MF Comparison of Average Customer Savings to the Savings of the Older Program Participants

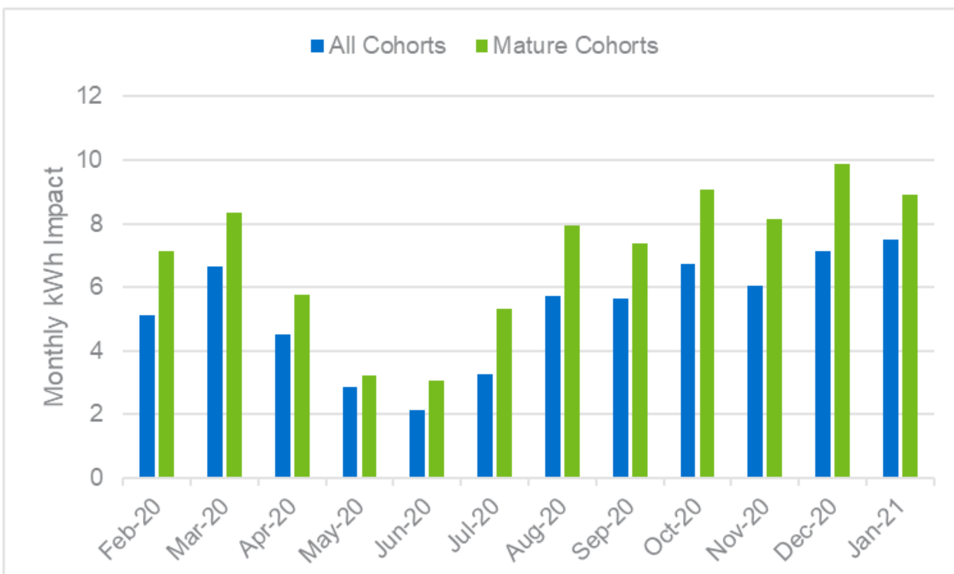


Figure 3-19 displays the annual savings for each year of treatment among the DEP SF MyHER cohorts. Like DEC SF, there is a general increase in savings across the first few years of the program, followed by a leveling out in some of the later years. This trend holds for some of the older cohorts who see continued increases in impacts before leveling out in year four or five. The same information for DEP MF customers is displayed in Figure 3-20, where the oldest cohorts see a large increase in savings between year three and year four. The other cohorts do not show a clear trend but are still in their infancy, results for MF customers will be revisited in future reports on the DEP MyHER program.

Figure 3-19: DEP SF Annual Savings by Duration of Exposure

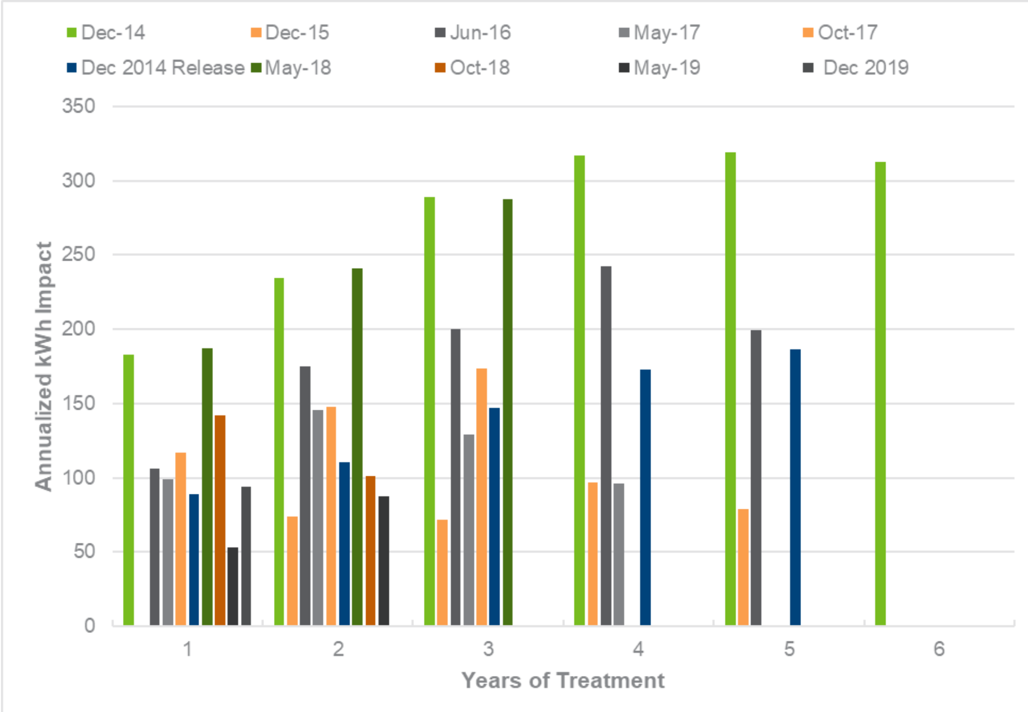
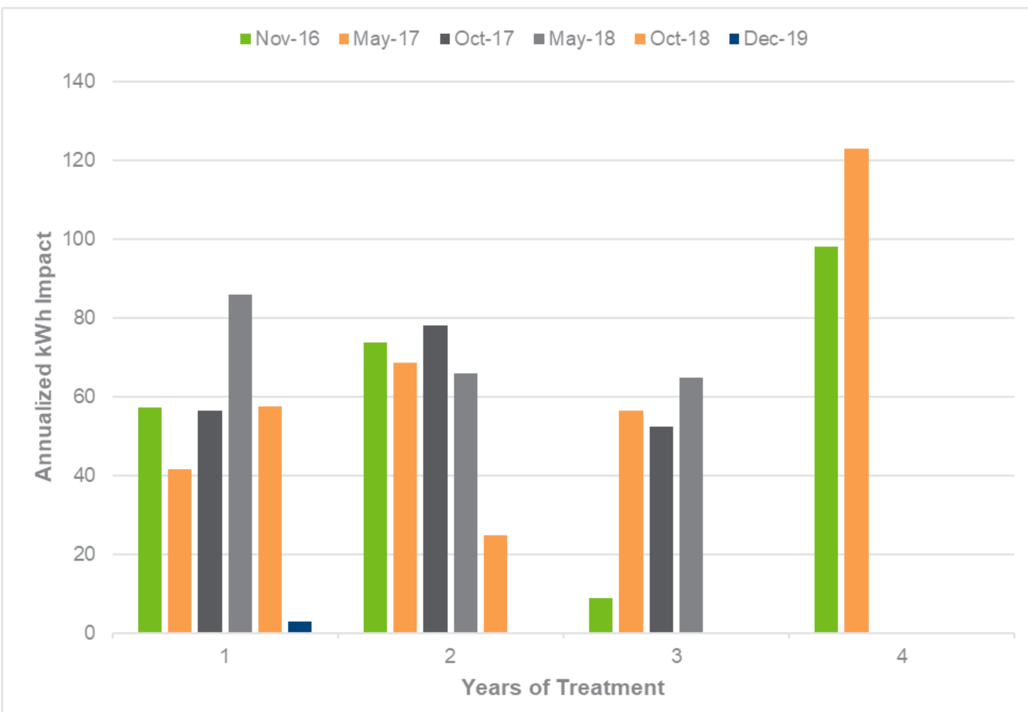


Figure 3-20: DEP MF Annual Savings by Duration of Exposure



3.1 DEC MyHER Interactive Portal

Nexant also evaluated the incremental energy savings generated by Duke Energy's online enhancement to the standard MyHER report, which has been available to Duke Energy MyHER treatment customers since 2015. The portal offers additional means for customers to customize or update Duke Energy's data on their premises, demographics, and other characteristics that affect consumption and MyHER's classification of each customer.

The portal provides additional custom tips based on updated data provided by the customer. MyHER Interactive also sends weekly email challenges that seek to engage customers in active energy management, additional efficiency upgrades, and conservation behaviors. Nexant evaluated the impacts of the MyHER Interactive Portal using a matched comparison group because MyHER Interactive is not deployed as a randomized controlled trial (RCT).

3.1.1 Estimation Procedures for MyHER Interactive

A matched comparison group is an accepted approach for establishing a counterfactual baseline when there is no random assignment to treatment and control. The goal of matching estimators is to estimate impacts by matching treatment customers to similar customers that did not participate in the program. The key assumption to matched comparison approaches is that MyHER Interactive participants closely resemble non-participants, except for the fact that one of these two groups participated in the program while the other did not. When a strong comparison group is established, evaluators can reliably conclude that any differences observed after enrollment are due to program's stimulus. In using a matched comparison group to estimate energy savings due to exposure to MyHER Interactive, the same statistical modeling approach is used to estimate energy savings impacts as was used for estimating energy savings for the program overall (i.e., with linear fixed effects regression (LFER) estimation).

Duke Energy provided Nexant with MyHER participant enrollment information for the Interactive portal. A total of 126,485 DEC SF and 15,202 DEC MF MyHER treatment customers signed up to use the portal. For DEC SF, 12.7% of Interactive users signed into the portal more than once, and 6.1% signed in more than twice between February 2020 and January 2021. For DEC MF, 14.7% of Interactive users signed into the portal more than once, and 6.6% signed in more than twice between February 2020 and January 2021. The average DEC SF interactive user logged in 0.8 times and the average DEC MF interactive user logged in to interactive 0.9 times – about 64% of registered users recorded no sessions logged in. Excluding customers that never logged in, single family Interactive users logged in on average 2.4 times, and multi-family users logged in on average 2 times.

In order for the LFER regression model to generate monthly energy savings attributable to Interactive, the customer data that the regression model uses to make the estimates must use a year of pre-treatment data. For DEC SF, 92,250 of the Interactive users (73%) had sufficient data available for the LFER analysis before their enrollment in MyHER. In the DEC MF segment, 13,690 Interactive users (90%) had sufficient data to be included in the LFER analysis. Figure 3-21 and Figure 3-22: DEC MF MyHER Interactive Portal Enrollment plot the total number of customers enrolled in MyHER Interactive as well as the subset in the analysis for each month of the 12-month period February 2020 to January 2021 for DEC SF and MF, respectively.[13]

Figure 3-21: DEC SF MyHER Interactive Portal Enrollment

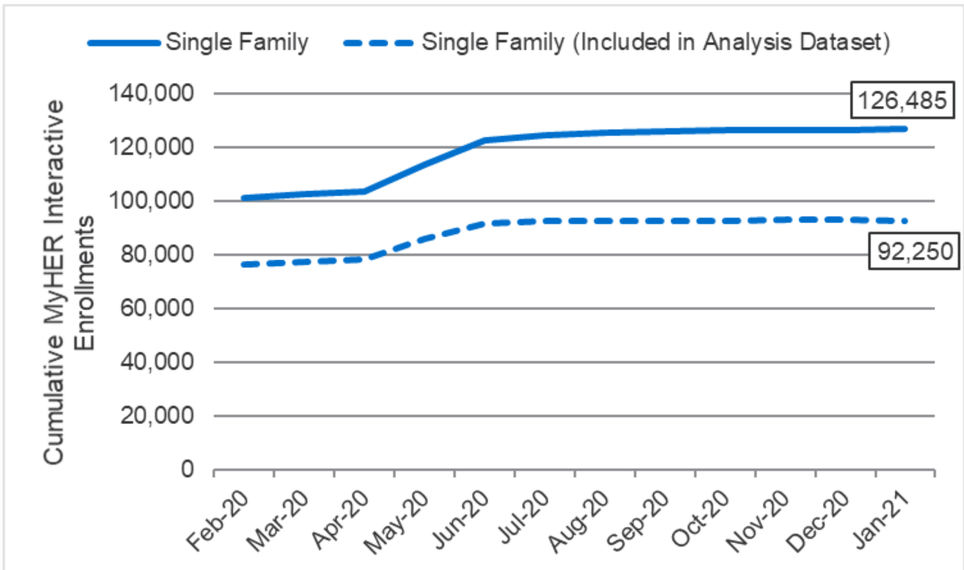
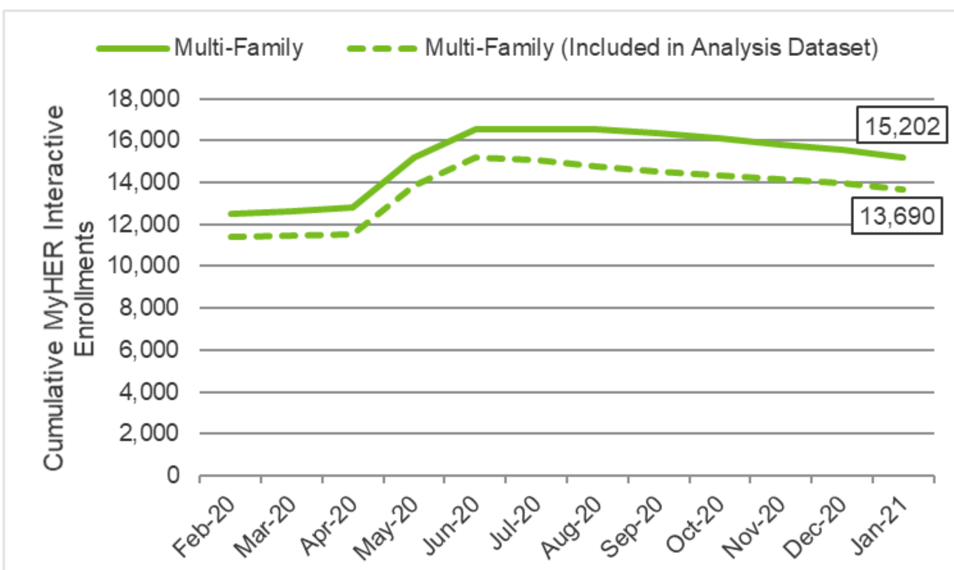


Figure 3-22: DEC MF MyHER Interactive Portal Enrollment

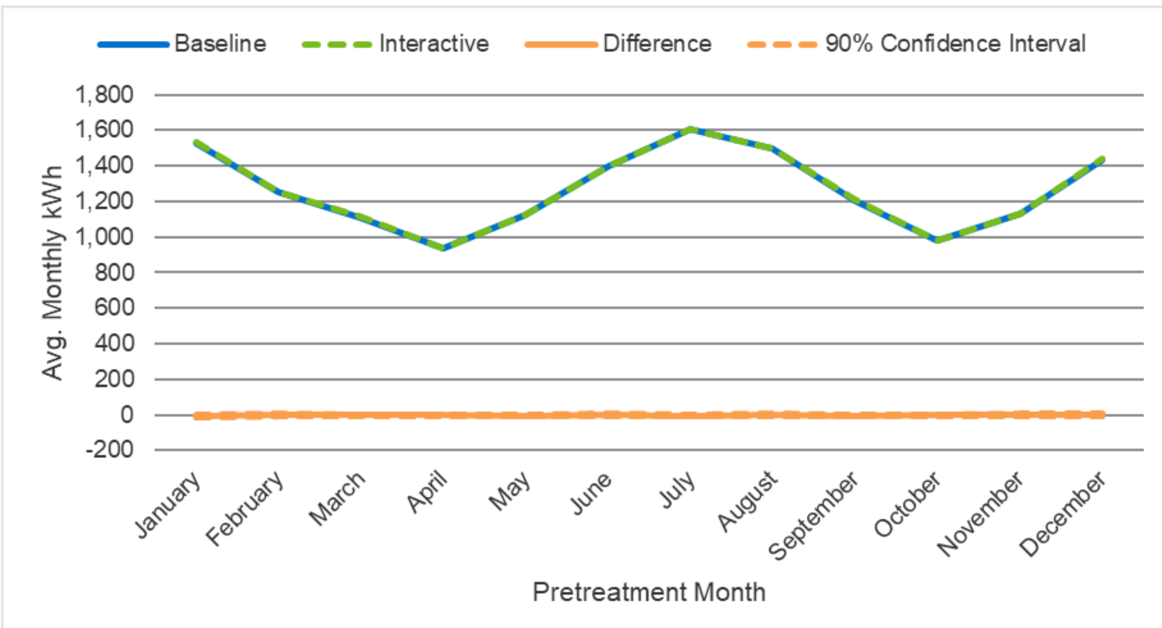


[13] A total of 26,443 interactive customers were excluded from analysis due to incomplete pretreatment data (missing 12 full months) ; the totals in Figure 3-21 and Figure 3-22: DEC MF MyHER Interactive Portal Enrollment

additionally exclude Interactive users who enrolled after the evaluation period ended, a total of 1,658 customers.

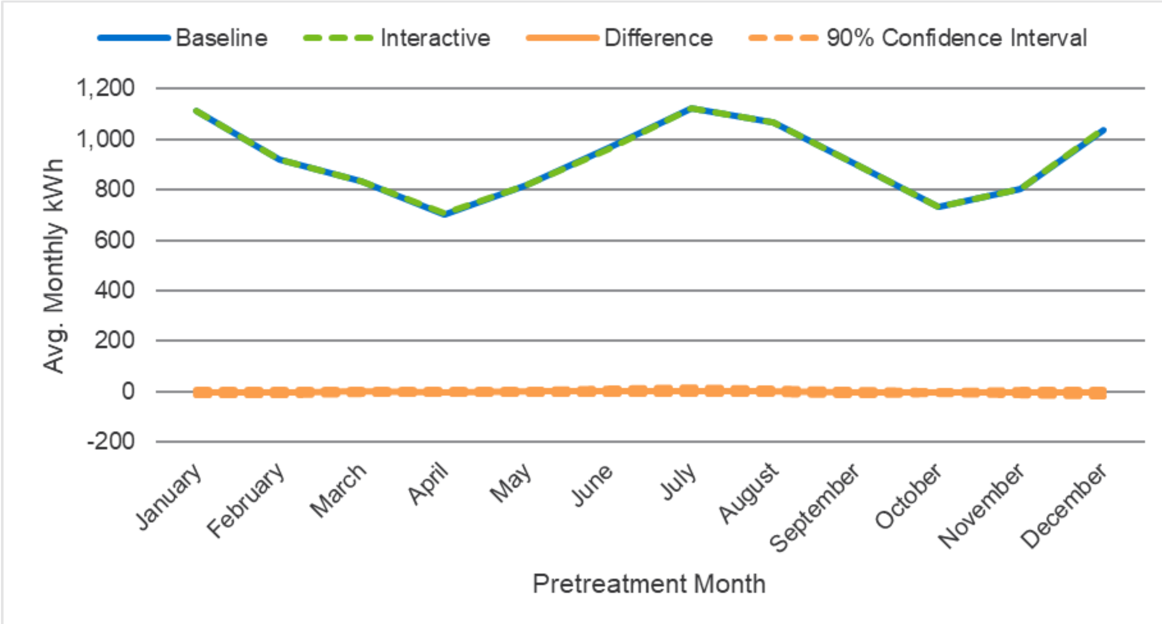
For DEC SF, the Interactive customers used in the estimation analysis were matched on pre-interactive usage based on their cohort and segment. Figure 3-23 presents the pre-treatment consumption for MyHER Interactive customers and a matched comparison group comprised of MyHER customers that have not enrolled in Interactive for the DEC and had complete pretreatment data. The matching approach generates two groups with nearly identical consumption patterns over the time period prior to customers' enrollment in MyHER Interactive. On average, the difference in monthly usage between the matched control group and the DEC SF Interactive treatment group is -0.2%. The fixed effects model specification Nexant applies controls for these pre-treatment differences, as discussed earlier in Section 3.1.5.

Figure 3-23: DEC SF MyHER Interactive Portal Customers and Matched Comparison Group Pretreatment Enrollment Periods



For DEC MF, the Interactive customers used in the estimation analysis were also matched on their pretreatment usage depending on their treatment cohort. Note that as in the primary MyHER impact analysis, customers in DEC MF Cohort 1 were removed from the analysis due to their being no consistent pre-treatment period across that group. Figure 3-24 presents the pre-treatment consumption for MyHER Interactive customers and a matched comparison group comprised of MyHER that were not enrolled in Interactive and share the same treatment cohort. The matching approach generates two groups with nearly identical consumption patterns over the time period prior to customers' enrollment in MyHER Interactive. On average, the difference in monthly usage between the matched control group and the DEP Interactive treatment group is -0.1% The fixed effects model specification Nexant applies controls for these pre-treatment differences, as discussed earlier in Section 3.1.5.

Figure 3-24: DEC MF MyHER Interactive Portal Customers and Matched Comparison Group –Pre-Interactive Enrollment Periods



3.1.2 Results and Precision

For DEC SF, the average monthly impact across the 12-month period February 2020 to January 2021 was 0.9 kWh or 10.5 kWh annually per customer, representing the uplift in savings that MyHER Interactive produces over and above the savings produced by the paper MyHER, although this impact is not statistically significant at the 90% level of confidence. In aggregate, the DEC SF MyHER Interactive Portal would equal 0.92 GWh of annual savings, incremental to the MyHER reports, however, the treatment effect is not distinguishable from zero. These high-level findings are summarized in Table 3-48.

Table 3-48: 90% Confidence Intervals Associated with DEC SF MyHER Interactive Annual Impact Estimates

Parameter	Lower Bound (90%)	Point Estimate	Upper Bound (90%)
Evaluation Period Savings per Home (kWh)	-94.6	10.5	115.5
Percent Reduction	-0.64%	0.07%	0.79%
Aggregate Impact (GWh)	-8.33	0.92	10.18

On a month-to-month basis, energy impacts were statistically significant and positive during the months of February, March, and April and range from 0.7% to 1.1% or from 6 to 13 kWh on an absolute basis. There were also statistically significant increases in electric usage of about 0.5% during the summer from August to October.

Figure 3-25 illustrates the estimated impact and 90% confidence band (the orange lines and orange dashed lines) by month. Also shown as blue bars are counts of Interactive user sessions. During earlier years of the Interactive deployment, there was a correlation between statistically significant impacts and times of high Interactive usage, but there is currently no evidence of that relationship.

Figure 3-25: DEC SF MyHER Interactive Portal Energy Impacts

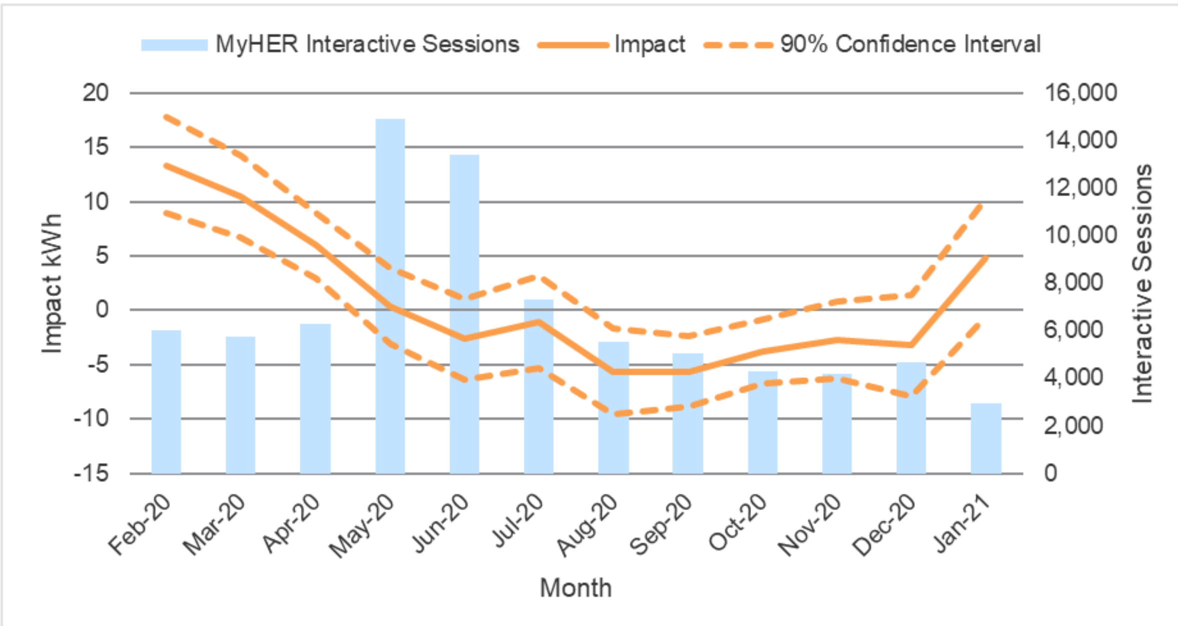


Table 3-49: provides impact model results for DEC SF, along with the margin of error for estimated impacts. The column at the right side of the table shows asterisks for those months where the energy savings are statistically significant at the 90% level of confidence.

Table 3-49: DEC SF MyHER Interactive Monthly Energy Savings

Month	Number of Participants Analyzed	MyHER Interactive Signups	Monthly kWh			90% Conf. Interval		% Impact	
			Non-Participants	Participants	Impact				
Feb-20	76,284	5,998	1,194.0	1,180.6	13.4	8.9	17.8	1.1%	*
Mar-20	77,206	5,731	1,061.9	1,051.4	10.5	6.7	14.2	1.0%	*
Apr-20	78,147	6,264	911.5	905.5	6.0	2.9	9.0	0.7%	*
May-20	86,041	14,897	1,044.2	1,043.8	0.4	-3.0	3.9	0.04%	
Jun-20	91,610	13,405	1,298.9	1,301.5	-2.6	-6.4	1.1	-0.2%	
Jul-20	92,261	7,308	1,621.5	1,622.5	-1.0	-5.3	3.2	-0.1%	
Aug-20	92,531	5,550	1,525.0	1,530.6	-5.6	-9.6	-1.7	-0.4%	*
Sep-20	92,685	5,061	1,109.4	1,115.0	-5.6	-8.9	-2.4	-0.5%	*
Oct-20	92,685	4,283	898.6	902.4	-3.8	-6.8	-0.8	-0.4%	*
Nov-20	92,728	4,193	1,027.1	1,029.8	-2.7	-6.3	0.9	-0.3%	
Dec-20	92,864	4,672	1,419.7	1,422.9	-3.2	-7.9	1.5	-0.2%	
Jan-21	92,250	2,955	1,553.7	1,548.8	4.8	-0.6	10.3	0.3%	
Average	**88,108**	**6,693**	**1,222.1**	**1,221.3**	**0.9**	**-7.9**	**9.6**	**0.1%**	

For DEC MF (Table 3-50), the average monthly impact across the 12-month period February 2020 to January 2021 was 1.2 kWh, or 14.6 kWh annually, representing the uplift in savings that MyHER Interactive produces over and above the savings produced by the paper MyHER, but this estimate is not statistically significant at the 90% level of confidence. The aggregate annual impact for DEC MF interactive customers is estimated to be 0.20 GWh, which is also not statistically significant at the 90% confidence level.

Table 3-50: 90% Confidence Intervals Associated with DEC MF MyHER Interactive Annual Impact Estimates

Parameter	Lower Bound (90%)	Point Estimate	Upper Bound (90%)
Evaluation Period Savings per Home (kWh)	-123.9	14.6	153.0
Percent Reduction	-1.11%	0.13%	1.38%
Aggregate Impact (GWh)	-1.69	0.20	2.09

On a month-to-month basis, energy impacts were statistically significant only during January, February, and December, with impacts ranging from 8.8 kWh to 12.1 kWh

Figure 3-26 illustrates the estimated impact and 90% confidence band (the orange lines and orange dashed lines) by month. Also shown as blue bars are counts of Interactive sessions.

Figure 3-26: DEC MF MyHER Interactive Portal Energy Impacts

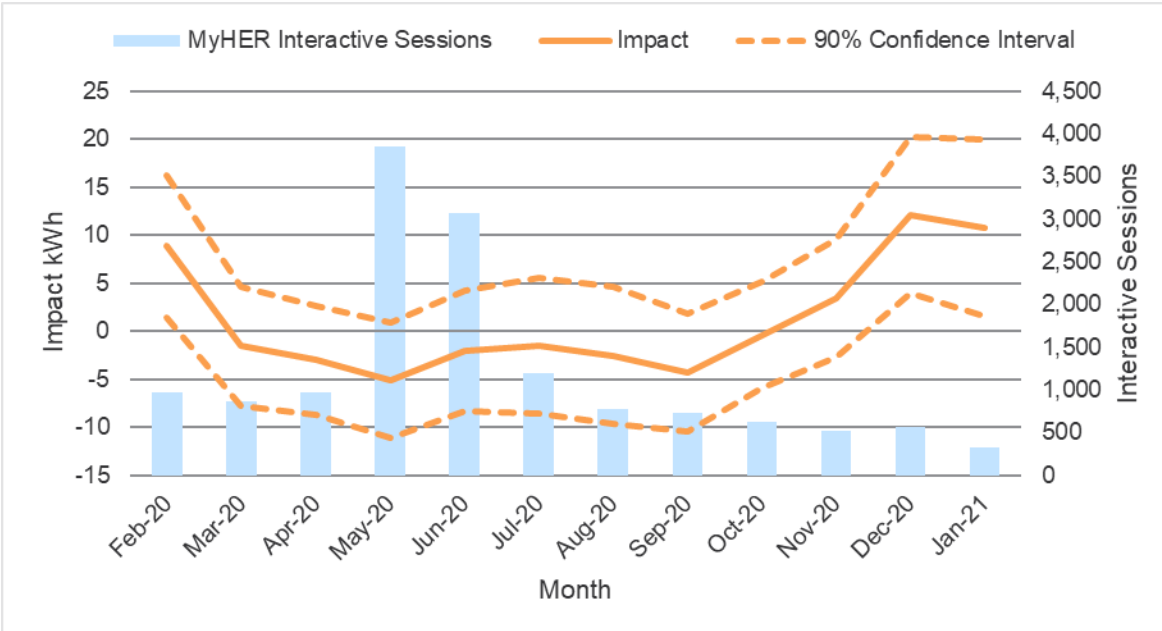


Table 3-51 provides impact model results for DEC MF, along with the margin of error for estimated impacts. The column at the right side of the table shows asterisks for those months where the energy savings are statistically significant at the 90% level of confidence.

Table 3-51: DEC MF MyHER Interactive Monthly Energy Savings

Month	Number of Participants Analyzed	MyHER Interactive Signups	Monthly kWh			90% Conf. Interval		% Impact	
			Non-Participants	Participants	Impact				
Feb-20	11,426	971	933.5	924.6	8.8	1.4	16.3	0.9%	*
Mar-20	11,483	865	829.3	830.9	-1.6	-7.8	4.7	-0.2%	
Apr-20	11,510	969	716.1	719.1	-3.0	-8.7	2.7	-0.4%	
May-20	13,841	3,853	795.9	801.0	-5.1	-11.1	0.8	-0.6%	
Jun-20	15,184	3,070	943.3	945.4	-2.1	-8.3	4.2	-0.2%	
Jul-20	15,050	1,187	1,139.3	1,140.8	-1.5	-8.6	5.6	-0.1%	
Aug-20	14,775	776	1,092.2	1,094.8	-2.5	-9.7	4.6	-0.2%	
Sep-20	14,517	727	831.8	836.1	-4.3	-10.5	1.8	-0.5%	
Oct-20	14,322	620	713.9	714.3	-0.4	-5.9	5.2	-0.1%	
Nov-20	14,153	523	804.4	801.0	3.4	-2.7	9.5	0.4%	
Dec-20	13,950	571	1,103.2	1,091.1	12.1	4.0	20.3	1.1%	*
Jan-21	13,690	331	1,225.0	1,214.3	10.7	1.5	20.0	0.9%	*
Average	**13,658**	**1,205**	**927.3**	**926.1**	**1.2**	**-10.3**	**12.8**	**0.1%**	

Nexant concludes that the DEC SF MyHER Interactive portal succeeded in generating additional statistically significant savings during some of the winter months in the time frame from February 2020 to January 2021 while observing some significant increases in usage during the summer months. The DEC MF MyHER Interactive portal only achieved additional statistically significant savings for three winter months during the evaluation period.

3.2 DEP MyHER Interactive Portal

Nexant also evaluated the incremental energy savings generated by Duke Energy's enhancement to the standard MyHER report, which has been available to MyHER treatment customers since 2015. The portal offers additional means for customers to customize or update Duke Energy's data on their premises, demographics, and other characteristics that affect consumption and MyHER's classification of each customer.

The portal additionally provides custom tips based on updated data provided by the customer. MyHER Interactive also sends weekly email challenges that seek to engage customers in active energy management, additional efficiency upgrades, and conservation behaviors. Nexant evaluated the impacts of the MyHER Interactive Portal using a matched comparison group because MyHER Interactive is not deployed as a randomized controlled trial (RCT).

3.2.1 Estimation Procedures for MyHER Interactive

A matched comparison group is a standard approach for establishing a counterfactual baseline when there is no random assignment to treatment and control. The goal of matching estimators is to estimate impacts by matching treatment customers to similar customers that did not participate in the program. The key assumption to matched comparison approaches is that MyHER Interactive participants closely resemble non-participants, except for the fact that one of these two groups participated in the program while the other did not. When a strong comparison group is established, evaluators can reliably conclude that any differences observed after enrollment are due to program's stimulus. In using a matched comparison group to estimate energy savings due to exposure to MyHER Interactive, the same statistical modeling approach is used to estimate energy savings impacts as was used for estimating energy savings for the program overall (i.e., with linear fixed effects regression (LFER) estimation).

Duke Energy provided Nexant with MyHER participant enrollment information for the Interactive portal. At the end of the evaluation period, 69,473 DEP SF and 4,896 DEP MF treatment customers were signed up to use the portal. For DEP SF, 13.3% of Interactive users signed into the portal more than once, and 6.5% signed in more than twice between February 2020 and January 2021. For DEP MF, 15.0% of Interactive users signed into the portal more than once, and 6.8% signed in more than twice between February 2020 and January 2021. The average DEP SF interactive user logged in 0.8 times and the average DEP MF interactive user logged in to interactive 0.94 times – about 65% of registered users recorded no sessions logged in. Excluding customers that never logged in, single family Interactive users logged in on average 2.5 times, and multi-family users logged in on average 2.2 times.

In order for the LFER regression model to generate monthly energy savings attributable to Interactive, the customer data that the regression model uses to make the estimates must use a year of pre-treatment data. For DEP SF, 60,519 of the Interactive users (87%) had sufficient data available for the LFER analysis before their enrollment in MyHER. In the DEP MF segment, 4,705 Interactive users (96%) had sufficient data to be included in the LFER analysis. Figure 3-27 and Figure 3-28 plot the total number of customers enrolled in MyHER Interactive as well as the subset in the analysis for each month of the 12-month period February 2020 to January 2021 for DEP SF and MF, respectively.[14]

Figure 3-27: DEP SF MyHER Interactive Portal Enrollment

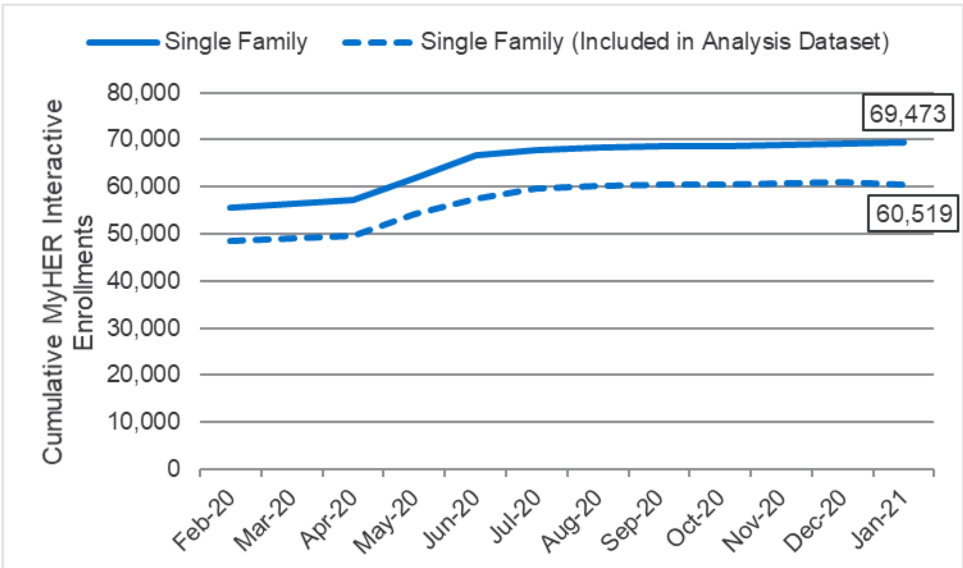
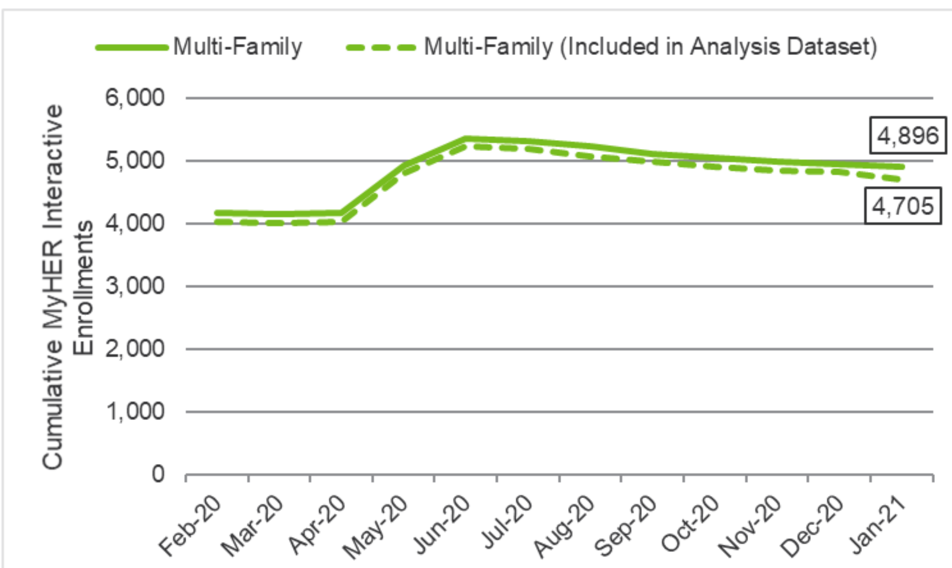


Figure 3-28: DEP MF MyHER Interactive Portal Enrollment

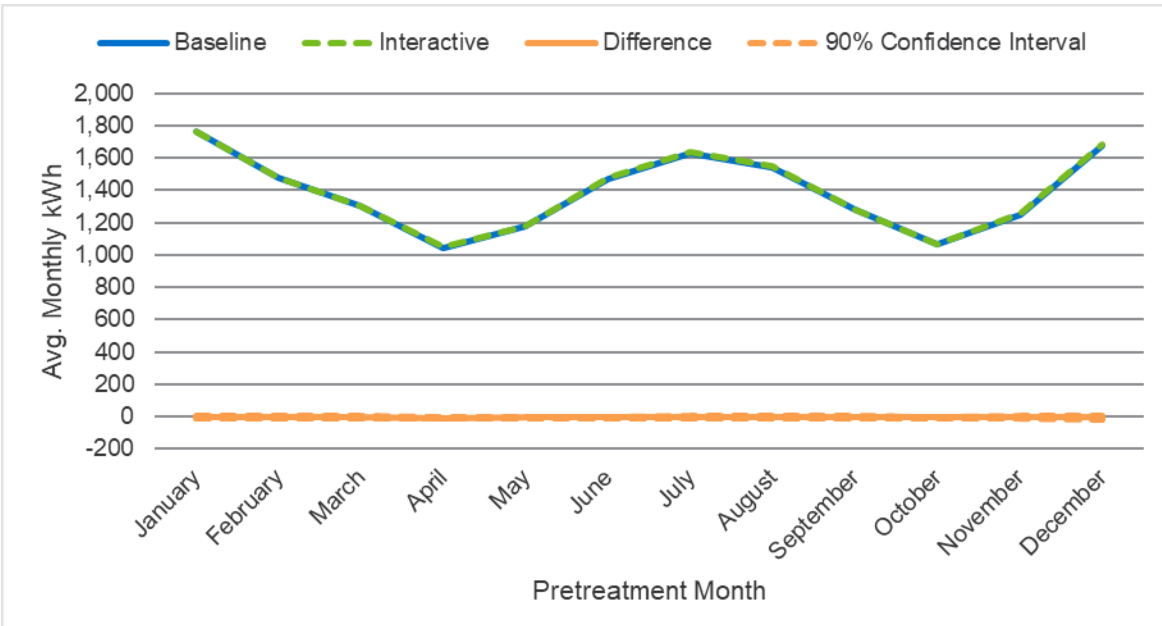


For DEP SF, the Interactive customers used in the estimation analysis were matched on pre-treatment usage based on their cohort and segment. Figure 3-29 presents the pre-treatment

[14] A total of 7,534 interactive customers were excluded from analysis due to incomplete pretreatment data; the totals in Figure 3-27 and Figure 3-28 additionally exclude Interactive users who enrolled after the evaluation period ended, a total of 1,107 customers.

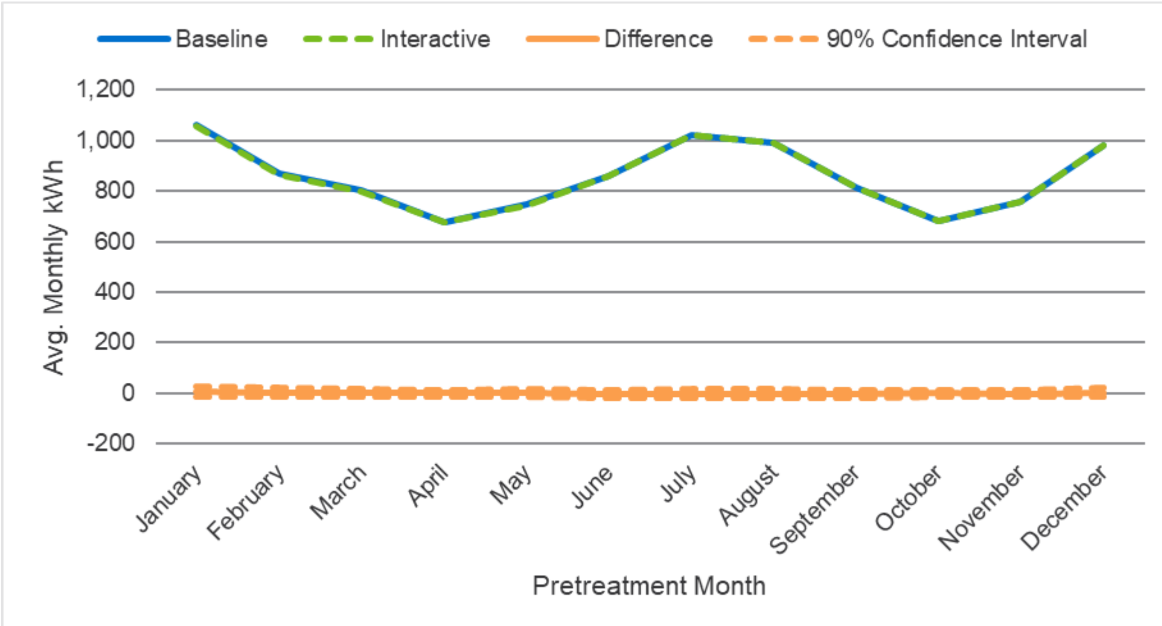
consumption for MyHER Interactive customers and a matched comparison group comprised of MyHER customers that have not enrolled in Interactive and had usage data through January 2021. The matching approach generates two groups with nearly identical consumption patterns over the time period prior to customers' enrollment in MyHER Interactive. On average, the difference in monthly usage between the matched control group and the DEP SF Interactive treatment group is -0.4%. The fixed effects model specification Nexant applies controls for these pre-treatment differences, as discussed earlier in Section 3.1.5.

Figure 3-29: DEP SF MyHER Interactive Portal Customers and Matched Comparison Group - Pre-Interactive Enrollment Periods



For DEP MF, the Interactive customers used in the estimation analysis were also matched on their pre-treatment usage depending on their treatment cohort. Note that customers in DEP MF Cohort 1 were removed from the analysis due to their being no consistent pre-treatment period across the group. Figure 3-30 presents the pre-treatment consumption for MyHER Interactive customers and a matched comparison group comprised of MyHER that were not enrolled in interactive and share the same treatment cohort. The matching approach generates two groups with nearly identical consumption patterns over the time period prior to customers' enrollment in MyHER Interactive. On average, the difference in monthly usage between the matched control group and the DEP Interactive treatment group is 0.1% The fixed effects model specification Nexant applies controls for these pre-treatment differences, as discussed earlier in Section 3.1.5.

Figure 3-30: DEP MF MyHER Interactive Portal Customers and Matched Comparison Group - Pre-Interactive Enrollment Periods



3.2.2 Results and Precision

For DEP SF, the average monthly impact across the 12-month period February 2020 to January 2021 was -5.4 kWh or -64.9 kWh annually per customer, representing the uplift in savings that MyHER Interactive produces over and above the savings produced by the paper MyHER, although this impact is not statistically significant at the 90% level of confidence. In aggregate, the DEP SF MyHER Interactive Portal resulted in -3.61 GWh of annual savings, incremental to the MyHER reports, but these savings are not differentiable from zero. These high-level findings are summarized in Table 3-52.

Table 3-52: 90% Confidence Intervals Associated with DEP MyHER Interactive Impact Estimates

Parameter	Lower Bound (90%)	Point Estimate	Upper Bound (90%)
Evaluation Period Savings per Home (kWh)	-191.8	-64.9	62.0
Percent Reduction	-1.24%	-0.42%	0.40%
Aggregate Impact (GWh)	-10.67	-3.61	3.45

On a month-to-month basis, there were statistically significant impacts in the months of February and March, ranging from 0.6% to 1.1%, with absolute impacts ranging from 7 to 13 kWh. There were statistically significant increases in electricity from May to November ranging from -0.5% to -1.5%, or -6 to -15 kWh.

Figure 3-31 illustrates the estimated impact and 90% confidence band (the orange lines and orange dashed lines) by month. Also shown as blue bars are counts of Interactive user sessions. During earlier years of the Interactive deployment, there was a correlation between statistically significant impacts and times of high Interactive usage, but there is currently no evidence of that relationship.

Figure 3-31: DEP SF MyHER Interactive Portal Energy Impacts

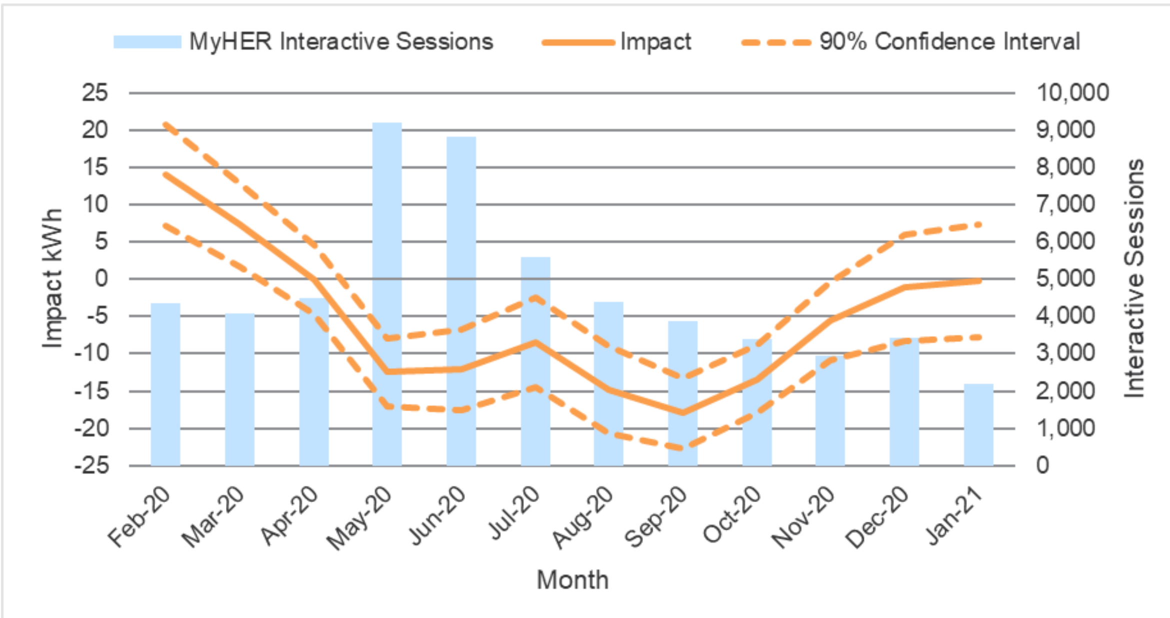


Table 3-53 provides impact model results for DEP SF, along with the margin of error for estimated impacts. The column at the right side of the table shows asterisks for those months where the energy savings are statistically significant at the 90% level of confidence.

Table 3-53: DEP SF MyHER Interactive Monthly Energy Savings

Month	Number of Participants Analyzed	MyHER Interactive Signups	Daily kWh			90% Conf. Interval		% Impact	
			Non-Participants	Participants	Impact				
Feb-20	48,512	4,364	1,247.0	1,233.1	13.9	7.2	20.7	1.1%	*
Mar-20	49,055	4,070	1,126.0	1,118.8	7.3	1.7	12.8	0.6%	*
Apr-20	49,646	4,482	961.3	961.3	0.0	-4.6	4.6	0.0%	
May-20	54,164	9,181	1,077.3	1,089.8	-12.4	-17.0	-7.9	-1.2%	*
Jun-20	57,457	8,830	1,336.4	1,348.5	-12.1	-17.6	-6.7	-0.9%	*
Jul-20	58,137	5,597	1,674.9	1,683.3	-8.5	-14.5	-2.5	-0.5%	*
Aug-20	58,343	4,381	1,588.9	1,603.6	-14.8	-20.6	-9.0	-0.9%	*
Sep-20	58,462	3,864	1,178.5	1,196.5	-18.0	-22.7	-13.3	-1.5%	*
Oct-20	58,421	3,400	956.6	970.1	-13.4	-18.0	-8.9	-1.4%	*
Nov-20	58,461	2,960	1,087.5	1,093.1	-5.6	-10.9	-0.4	-0.5%	*
Dec-20	58,748	3,418	1,517.0	1,518.1	-1.1	-8.3	6.0	-0.1%	
Jan-21	58,258	2,184	1,683.1	1,683.2	-0.2	-7.7	7.4	0.0%	
Average	**55,639**	**4,728**	**1,286.2**	**1,291.6**	**-5.4**	**-16.0**	**5.2**	**-0.4%**	

For DEP MF, the average monthly impact across the 12-month period February 2020 to January 2021 was -8.0 kWh, or -95.7 kWh annually representing the uplift in savings that MyHER Interactive produces over and above the savings produced by the paper MyHER, but this estimate is not statistically significant at the 90% level of confidence. The aggregate impact for DEP MF interactive customers was estimated to be -0.45 GWh, which was also not statistically significant at the 90% confidence level.

Table 3-54: 90% Confidence Intervals Associated with DEP MF MyHER Interactive Impact Estimates

Parameter	Lower Bound (90%)	Point Estimate	Upper Bound (90%)
Evaluation Period Savings per Home (kWh)	-276.8	-95.7	85.3
Percent Reduction	-2.75%	-0.95%	0.85%
Aggregate Impact (GWh)	-1.30	-0.45	0.40

On a month-to-month basis, there were statistically significant increases in electricity usage by Interactive customers in the months of May, June, and October, with impacts in usage ranging from -22 kWh to -31 kWh.

Figure 3-32 illustrates the estimated impact and 90% confidence band (the orange lines and orange dashed lines) by month. Also shown as blue bars are counts of Interactive user sessions.

Figure 3-32: DEP MF MyHER Interactive Portal Energy Impacts

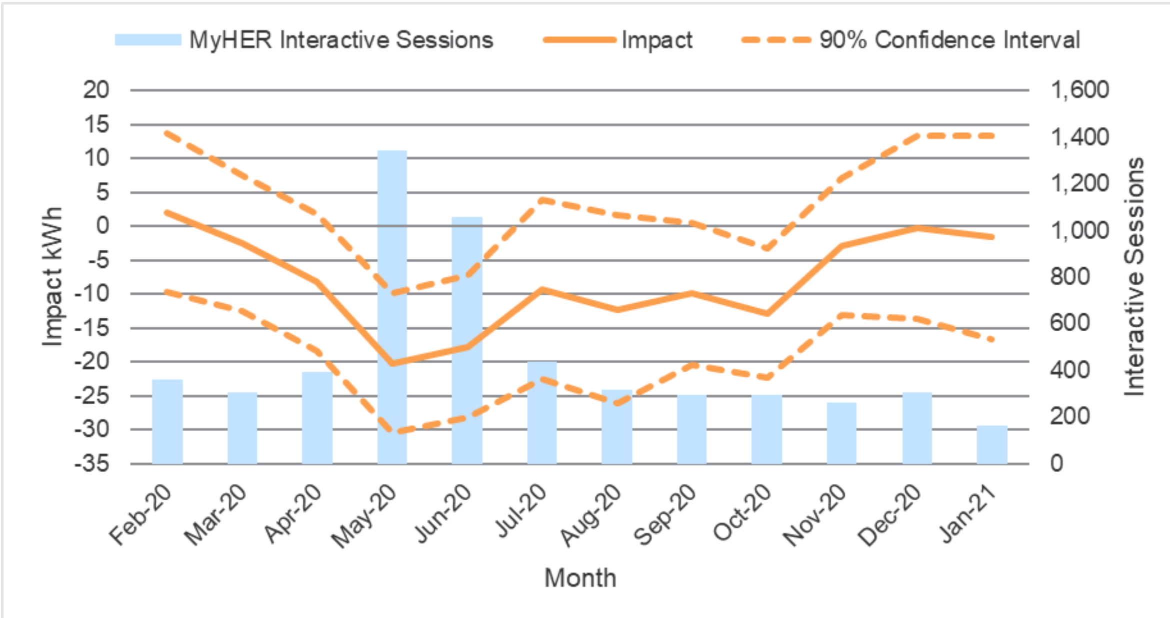


Table 3-55 provides impact model results for DEP MF, along with the margin of error for estimated impacts. The column at the right side of the table shows asterisks for those months where the energy savings are statistically significant at the 90% level of confidence.

Table 3-55: DEP MF MyHER Interactive Monthly Energy Savings

Month	Number of Participants Analyzed	MyHER Interactive Signups	Daily kWh			90% Conf. Interval		% Impact	
			Non-Participants	Participants	Impact				
Feb-20	4,018	358	846.5	844.5	2.1	-9.7	13.8	0.2%	
Mar-20	4,007	305	762.4	765.0	-2.5	-12.5	7.4	-0.3%	
Apr-20	4,022	393	650.0	658.2	-8.2	-18.3	1.9	-1.3%	
May-20	4,796	1,346	704.4	724.6	-20.2	-30.5	-9.9	-2.9%	*
Jun-20	5,226	1,056	823.9	841.7	-17.8	-28.2	-7.3	-2.2%	*
Jul-20	5,178	437	1,001.6	1,010.8	-9.3	-22.6	4.0	-0.9%	
Aug-20	5,064	319	961.5	973.8	-12.3	-26.1	1.6	-1.3%	
Sep-20	4,976	295	758.6	768.6	-10.0	-20.5	0.5	-1.3%	
Oct-20	4,905	295	661.7	674.5	-12.8	-22.4	-3.2	-1.9%	*
Nov-20	4,843	262	746.2	749.2	-3.0	-13.1	7.1	-0.4%	
Dec-20	4,824	303	1,018.2	1,018.4	-0.2	-13.7	13.4	0.0%	
Jan-21	4,705	163	1,140.1	1,141.7	-1.6	-16.6	13.3	-0.1%	
Average	**4,714**	**461**	**839.6**	**847.6**	**-8.0**	**-23.1**	**7.1**	**-1.0%**	

Nexant concludes that the DEP SF MyHER Interactive portal did succeed in generating additional statistically significant savings during some of the winter months in the time frame from February 2020 to January 2021 while observing some significant increases in usage during the summer months. The DEP MF MyHER Interactive portal did not achieve any statistically significant savings and had significant increases in usage during three of the months in the time period.

4 Process Evaluation

This section presents the results of process evaluation activities including in-depth interviews with Duke Energy staff and surveys of control and treatment households.

4.1 Methods

Process evaluations support continuous program improvement by identifying opportunities to improve the effectiveness and efficiency of program operations and services. Process evaluations also identify successful program components that should be enhanced or replicated. Process evaluation activities for MyHER sought to document program operational processes and to understand the experience of those receiving MyHER mailings. The customer survey given to MyHER recipients focused on investigating the recall and influence of MyHER messages among recipients, the extent to which MyHER affects customer engagement and satisfaction with Duke Energy, their use of MyHER Interactive, and subsequent actions taken by participants to reduce household energy consumption. A survey of control group households provided a point of comparison for estimating the effect of MyHER on behavior and attitudes of treatment households.

4.1.1 Data Collection and Sampling Plan

The process evaluation included two primary data collection activities: in-depth interviews with program management staff and surveys of a random sample of both single family and multi-family households selected to receive MyHER reports as well as surveys of a random sample of control group households (both multi-family and single family).

Nexant deployed the household surveys using a mixed-mode survey measurement protocol, the activities associated with which are summarized in Table 4-1 and Table 4-2. In this protocol, customers were contacted by letter on Duke Energy stationery (to assure recipients of the legitimacy of the survey) asking them to go online and complete the survey. The letter contained a two-dollar bill as a cost-effective measure to maximize the survey completion rates. The letter also included a personalized URL for the online survey that points the recipient to a unique location on the internet at which they were able to complete the survey. Customers for whom email addresses were available also received an email inviting them to take the survey online, which also included the same personalized URL that appeared in the letter leading to the survey website where they could complete it. After two weeks, customers who did not respond to the web survey received another mailing, this time containing a paper copy of the survey and a return postage-paid envelope for them to complete the survey by mail. Survey recipients also had the option of calling a toll-free telephone number to complete it by telephone.

Two different instruments were used in the survey deployment. A primary instrument was used to survey random samples of treatment and control customers, selected from both the single family and multi-family program populations. An additional random sample of treatment customers (selected from both the single family and multi-family program populations) received a different instrument with a battery of questions that only pertains to treatment customers (such as satisfaction with MyHER report features, recall of MyHER receipt, etc.). This treatment-only survey instrument was developed in order to prevent the primary instrument from getting too lengthy.

Table 4-1 shows that 305 DEC single family treatment customers (137 treatment only, and 168 primary treatment) and 171 DEC single family control customers completed the survey, totaling 476 responses for this group. In addition, 154 DEC multi-family treatment (87 treatment only, and 67 primary treatment) and 88 DEC multi-family control customers completed the survey, for a total of 242. In total, 718 DEC customers completed the survey.

Table 4-1: Summary of Process Evaluation Activities - DEC

Population	Approach	Population	Sample		Confidence/Precision	
			Expected	Actual	Expected	Actual
Program management and implementation	In-depth interviews	10	Up to 3	2	Not Applicable	Not Applicable
Treatment group households; Treatment only instrument	Mixed-mode; mail, web, and phone	≈ 1.1 M	68	137	90/10	90/7.0
Treatment group households; Primary instrument	Mixed-mode; mail, web, and phone		68	168	90/10	90/6.3
Control group households; Primary instrument	Mixed-mode; mail, web, and phone	≈ 160,000	68	171	90/10	90/6.3
Total Single Family Survey Responses				**476**		
Treatment group households; Treatment only instrument	Mixed-mode; mail, web, and phone	≈ 65,000	68	87	90/10	90/8.8
Treatment group households; Primary instrument	Mixed-mode; mail, web, and phone		68	67	90/10	90/10.0
Control group households; Primary instrument	Mixed-mode; mail, web, and phone	≈ 20,000	68	88	90/10	90/8.8
Total Multi-family Survey Responses				**242**		
Total Responses				**718**		

Table 4-2 shows that 327 DEP single family treatment customers (169 treatment only, and 158 primary treatment) and 181 DEP single family control customers completed the survey, totaling

508 responses for this group. In addition, 185 DEP multi-family treatment (86 treatment only, and 99 primary treatment) and 88 DEP multi-family control customers completed the survey, for a total of 273. In total, 781 DEP customers completed the survey.

Table 4-2: Summary of Process Evaluation Activities - DEP

Population	Approach	Population	Sample		Confidence/Precision	
			Expected	Actual	Expected	Actual
Program management and implementation	In-depth interviews	10	Up to 3	2	Not Applicable	Not Applicable
Treatment group households; Treatment only instrument	Mixed-mode; mail, web, and phone	≈ 725,000	68	169	90/10	90/6.3
Treatment group households; Primary instrument	Mixed-mode; mail, web, and phone		68	158	90/10	90/6.5
Control group households; Primary instrument	Mixed-mode; mail, web, and phone	≈ 155,000	68	181	90/10	90/6.1
Total Single Family Survey Responses				**508**		
Treatment group households; Treatment only instrument	Mixed-mode; mail, web, and phone	≈ 80,000	68	86	90/10	90/8.9
Treatment group households; Primary instrument	Mixed-mode; mail, web, and phone		68	99	90/10	90/8.3
Control group households; Primary instrument	Mixed-mode; mail, web, and phone	≈ 35,000	68	88	90/10	90/8.8
Total Multi-family Survey Responses				**273**		
Total Responses				**781**		

Nexant's survey instruments included demographic questions to support comparisons of the treatment and control respondents as well as to support overall comparisons to the jurisdiction's territory. We present summaries of the responses to the demographic questions in Section 4.2, after the summaries of the responses to the survey questions on customer attitudes, energy usage behaviors, energy-savings actions and purchases/investments, and experience with the MyHER program.

4.1.1.1 Interviews

Nexant conducted interviews with key contacts at Duke Energy, but not with Uplight since their engagement with Duke Energy as the MyHER implementer was concluding. The interviews built upon information obtained during previous evaluations of the Duke Energy MyHER program in multiple jurisdictions. The central objectives of the interviews were to understand program operations and the main activities required to develop and distribute the MyHER reports to DEC and DEP customers, as well as to understand any developments in program delivery.

4.1.1.2 Household Surveys

Both treatment and control groups of single family and multi-family customers were surveyed. Treatment households were surveyed as two groups that received different surveys: The first group's survey included questions about the respondents' experience of the reports themselves as well as questions to assess engagement and understanding of household energy use, awareness of Duke Energy efficiency program offers, and satisfaction with the services Duke Energy provides to help households manage their energy use. The second treatment group and control group surveys were identical, and excluded questions about the information and utility of the MyHER reports, but included identical questions on the other aspects to facilitate comparison with each other, as well as to the first treatment group sample.

Nexant analyzed the survey results to identify differences between treatment and control group households on the following:

- Levels of awareness of and interest in household energy use;
- The level of behavioral action or equipment-based upgrades;
- Satisfaction with Duke Energy communications, service, and efficiency options;
- Barriers to energy saving behaviors and purchases; and
- Inclination to seek information on managing household energy use from Duke Energy.

This survey approach is consistent with the RCT design of the program and supports both the impact and process evaluation activities by providing additional insight into potential program effects.

Survey Disposition - DEC

We mailed 908 letters to randomly selected residential customers in the treatment group and 908 letters to the randomly selected residential customers in the control group for the primary survey. We also mailed 908 letters to the treatment customers for the treatment-only survey. Of the total 2,724 customers each of these groups, 1,206 letters were mailed to multi-family customers, and 1,518 were mailed to single family customers.

The survey was completed by a total of 476 single family households and 242 multi-family households, representing an overall single family response rate of 31% and a multi-family response rate of 20%.

Among all completed surveys, 305 were completed by treatment households and 171 were completed by control households in the single family segment. About half (59% of the treatment group and 57% of the control group) of the surveys completed by single family customers were completed online. For multi-family customer surveys, 154 were completed by treatment households and 88 were completed by control households. Seventy-one percent of the treatment group and 69% of the control group of the surveys were completed online. Table 4-3 summarizes the treatment and control group survey dispositions in DEC.

Table 4-3: Survey Disposition - DEC

Mode	Treatment		Control	
Single Family	Count	Percent	Count	Percent
Completes by Mode				
Web-based Survey	179	59%	98	57%
Mail/Paper Survey	116	38%	69	40%
Inbound Phone Survey	10	3%	4	2%
Total Single Family Completes	**305**	**100%**	**171**	**100%**
Mode	**Treatment**		**Control**	
Multi-family	Count	Percent	Count	Percent
Completes by Mode				
Web-based Survey	110	71%	61	69%
Mail/Paper Survey	41	27%	25	28%
Inbound Phone Survey	3	2%	2	2%
Total Multi-family Completes	**154**	**100%**	**88**	**100%**
TOTAL	**459**		**259**	

Survey Disposition - DEP

We mailed 906 letters to randomly selected residential customers in the treatment group and 906 letters to the randomly selected residential customers in the control group for the primary survey. We also mailed 906 letters to the treatment customers for the treatment-only survey. Of the total 2,718 customers in each of these groups, 1,203 letters were mailed to multi-family customers, and 1,515 were mailed to single family customers.

The survey was completed by a total of 508 single family households and 273 multi-family households, representing an overall single family response rate of 34% and a multi-family response rate of 23%.

Among all completed surveys, 327 were completed by treatment households and 181 were completed by control households in the single family segment. More than half (60% of the treatment group and 61% of the control group) of the surveys completed by single family customers were completed online. For multi-family customer surveys, 185 were completed by treatment households and 88 were completed by control households. Sixty-six percent of the treatment group and 64% of the control group of the surveys were completed online. Table 4-4 summarizes the treatment and control group survey dispositions in DEP.

Table 4-4: Survey Disposition - DEP

Mode	Treatment		Control	
Single Family	Count	Percent	Count	Percent
Completes by Mode				
Web-based Survey	197	60%	110	61%
Mail/Paper Survey	124	38%	70	39%
Inbound Phone Survey	6	2%	1	1%
Total Single Family Completes	**327**	**100%**	**181**	**100%**
Mode	**Treatment**		**Control**	
Multi-family	Count	Percent	Count	Percent
Completes by Mode				
Web-based Survey	123	66%	56	64%
Mail/Paper Survey	57	31%	25	28%
Inbound Phone Survey	5	3%	7	8%
Total Multi-family Completes	**185**	**100%**	**88**	**100%**
TOTAL	**512**		**269**	

4.2 Findings

This section presents the findings from in-depth interviews with Duke Energy program staff and the results of the customer surveys.

4.2.1 Program Processes and Operations

As in other Duke Energy jurisdictions, MyHER at DEC and DEP is managed primarily through a core team of three Duke Energy staff members: a Program Manager in charge of the day-to-day operations of the MyHER program, a Marketing Manager that is responsible for report content, and a Data Analyst that is responsible for the substantial data tracking and cleaning tasks required to support the contracted implementation team, as well as internal program reporting to Duke Energy management.

At Uplight, Duke Energy's program implementer under contract during this evaluation period, MyHER is supported by dedicated program team members as well as shared support including a Home Energy Report Product Manager, Operations Manager (who oversees Operations Analysts and Quality Assurance Engineers), an Engineering Manager and software engineers, and an Account Manager responsible for ensuring that the Duke Energy MyHER products meet expectations for quality, timing, and customer satisfaction. Uplight staff track the number of reports sent, the quality of the reports, and the timing of when reports are mailed. Uplight's primary key performance indicators (KPIs) include in-home dates for each batch of reports sent, the percentage of eligible treatment customers actually treated, as well as report appearance and data accuracy. Customers that are eligible to receive a MyHER report are those who: have been billed for electric service in 11 of past 13 months and are billed for at least 150 kWh of monthly electricity consumption. Customers that meet these eligibility criteria are randomly assigned treatment and control status in twice-annual treatment assignment batches.

MyHER is Duke Energy's flagship behavioral energy efficiency program. Its primary goals are to achieve energy savings, increase customer satisfaction with Duke Energy, and cross-promote enrollment into Duke Energy's demand response and energy efficiency programs. Duke Energy program staff described continuous coordination with Uplight to ensure that the data behind the MyHER comparisons are accurate, the tips provided to specific households are appropriate, and that MyHERs are delivered as soon as possible after billing data is received, within the relatively short timeframe that exists between bills.

In addition to home energy reports, the MyHER program at Duke Energy also produces content for the MyHER Interactive portal, introduced to the program in 2015. The portal offers additional means for customers to customize or update Duke Energy's data on their premises, demographics, and other characteristics that affect consumption and the classification of each customer. The portal also provides additional custom tips based on updated data provided by the customer. MyHER Interactive sends email challenges to portal users that seek to engage customers in active energy management, additional efficiency upgrades, and conservation behavior.

Customers enrolled in MyHER that have also installed the Duke Energy mobile application (app) on their mobile devices (e.g., tablets and mobile phones) can also view the information found on their MyHERs in the app.[15] MyHER content is available via a link found on the app's home screen. MyHER's home comparison charts, comparison group information, and usage disaggregation are all available through the Duke Energy app.

Program operations for the management and production of the content on all of these channels are conducted with a customer-focused orientation where the commitment to producing a high-quality product is ongoing and consistently pursued by Uplight and Duke Energy staff each month of the year.

4.2.1.1 MyHER Production

During the time period under study by this evaluation, MyHERs were mailed out to DEC and DEP single family customers on paper through the U.S. Postal service eight times a year, and 12 times a year by email to customers that have provided Duke Energy with their email address. DEC and DEP multi-family customers receive six reports a year by mail, and those who have provided their email address receive four reports a year by mail and 12 reports per year by email. During the eight Single Family U.S. Mail treatment months, paper reports are generated

[15] The Duke Energy app is available to every DEC and DEP residential customer (not just customers that receive MyHERs) that provides customers with a mobile-optimized web interface that they can use to manage their Duke Energy account, pay their bills, track billed electric usage, report outages, and view special offers.

twice per week, a cadence that is designed to facilitate meeting one of Uplight's key performance indicators: Once the batch of MyHERs is approved by Duke Energy, that it arrives at the print house within twelve days, and to the customer soon after, so as to make the information presentment as useful and timely as possible.

Additionally, any customer that has provided Duke Energy with their email address also receives their report by email, and in fact, MyHER reports are generated and emailed to those customers monthly, 12 times a year, while they continue to receive paper reports less often, as described in the above paragraph.[16] In the case of the Single Family segment, starting in late 2019, Duke Energy began sending only six paper reports a year to new enrollees, so as to make the program more cost-effective while maintaining energy savings and demand impacts.

The production process for any given treatment month begins as soon as meter reads for the first billing cycle are processed by Duke Energy's meter data management system. After processing, Uplight's HOMERS (Home Energy Reporting Service) system downloads billing data nightly, five times a week (Tuesday through Saturday) and readies the data for quality control (QC). This is an improvement on Uplight's legacy (pre-HOMERS) system which required QC to be run only when batches were being readied for report production. The ability to run multiple iterations of QC protocols allows Uplight to detect, analyze, and act on any emergent issues on a daily basis.

In addition to this functionality, HOMERS is designed as a platform that unites the data management and report production processes, and provides Duke Energy with the ability to review report data and proofs in real time.

Duke Energy program management interviewees have reported that HOMERS' launch fulfilled expectations regarding the production of reports for multiple billing cycles at once, improving the production process most notably by eliminating what were referred to as "Batch 1" problems. This class of QC exceptions stemmed from the relatively large number of reports produced for the first cycle of the month using Uplight's legacy system. With HOMERS, data transfers to Duke Energy now contain much smaller and consistent batch sizes— "Batch 1" sizes have roughly been cut in half, and batches throughout the month are relatively consistent, though dependent on the availability of billing data from Duke Energy, which tends to be the most voluminous at the beginning of the month.

Upon nightly delivery to Uplight, each account's data is passed through an overnight QC process, and a report is generated under a "rendered" status. Rendered reports are then submitted to a more complex QC framework, where data is validated and text sizing and spacing checks are carried out. Once this is complete, HOMERS produces a report detailing the results of the QC process, and this is reviewed by Uplight operations analysts and engineers each morning to assess the need for further QC reviews. These reviews include further data validation, including usage disaggregation, as well as visual checks that assure charts, text, and

[16] Duke Energy will cease delivery of paper MyHER reports, and only send email reports, if the customer requests them to do so.

general report presentment is correct. The reports with no flagged concerns are assigned a “QC pass” status, and those with which errors are found at any stage of the review process are assigned a “QC fail” status and reviewed by Uplight staff to assess whether or not the error can be addressed in the current cycle to allow for a quality HER to be produced.

Twice a week, Uplight gathers reports in “QC pass” status, and a flat file containing all the data from these reports is sent to Duke Energy for an independent quality control check by their Senior Data Analyst. These data checks have been increasingly carried out on an automated basis, though manual checks on these data are still part of the protocol. While under review, reports are changed to “QC pending” status. In addition to this data, drafts of every report are available (in HTML and PDF formats) for download and subject to visual QC checks by Duke Energy.

Approved reports are then assigned back to “QC pass” status, Uplight sends the PDFs to the print house, and the print house generates a final proof for Duke Energy approval. Finally, after the proof is approved, the print house prints and mails all the reports, Uplight emails eHERs on the specified day, and then commences the process of reporting the printing, mailing, and emailing to Duke Energy.

This production chain moves quickly: once Uplight generates a batch of reports, the time elapsed until transfer to the print house is generally three to four hours when all processes are completed according to plan. This timeframe has become the norm, but when quality control problems emerge, that elapsed time can increase significantly. Considering that the print house has one week to complete the mailing, and Standard Rate postage can take another week to deliver, making the mid-cycle in-home delivery goal requires dedicated effort to achieve.

Prior MyHER process evaluations in this and other Duke Energy jurisdictions where MyHER is also implemented have found that this fast-moving process has seen improvements over time through the adoption of various changes: recently, these have been best characterized by the adoption of HOMERS, getting free-form text (FFT) content designed, approved and ready to incorporate into reports ahead of time, and an increased attention to continuously improving QC processes at Uplight. These changes have delivered reductions in both report in-home times, as well as the number of problems found during report batch quality control checks, though Uplight has the most difficulty with accommodating last-minute requests from Duke Energy.

4.2.1.2 Quality Control

As summarized above, embedded in the early days of the MyHER production cycle is a quality control process that ensures that the reports contain accurate information and are of high quality. Duke Energy analyzes a dataset containing all of the information presented in the reports for each production cycle. This data is checked for essentially anything that could be erroneous, ranging from verifying that all the customers receiving reports are eligible to receive them, that no control customers are getting reports, that the reported electricity usage is correct, that no customers who have opted-out are getting reports, and that no one has received more than one report a month. Duke Energy also checks for unexpected cluster assignment changes, presentment of messaging and tips, and overall print quality.

In the past, these checks have proven to be crucial as they occasionally revealed significant production problems, which were subsequently reviewed in Uplight's governance sessions with Duke Energy. This visibility has typically resulted in issue resolution on a going-forward basis.

Duke Energy program staff report that the incidence of significant production problems was dramatically reduced since Uplight implemented quality control automation. Uplight's automated quality control process is described as follows, recalling that customer data is transferred to Uplight daily:

- Uplight pulls Duke Energy billing data into an Amazon Redshift database and prepares the data for presentment in the HERs. The HERs are then generated and rendered;
- A series of SQL queries against the data presented in the HERS then runs. This process delivers output into the Amazon Simple Storage Solutions (S3) environment that reports on the results of the checks and indicates any reports with errors. Reports with errors are then postfiltered;
- Reports that pass the SQL checks are then visually checked by Uplight staff to be sure nothing noticeable or significant has slipped through to final report presentment; and
- An approved file is then sent to Duke Energy, along with about 100 samples of both paper and electronic HERs.

Prior evaluations of MyHER revealed that some program processes could benefit from improved quality control performance. Duke Energy program management interviewees reported that while the implementation of HOMERS and the continued refinement and automation of QC protocols have reduced errors significantly, errors on reports do occasionally pass through to them.

Continuous improvements to quality control in these areas can reduce the risk associated with running a program with processes that too often fail quality control checks. Such issues present timing risks (reports may not be sent out on time), customer service risk (reports may be sent out with problems if problems someday are missed), and risk to the overall success of the program (if the QC process is overburdened with detecting too many problems, it can become an over-leveraged component of program operations). As such, outcomes of both Uplight and Duke Energy's QC processes are monitored to detect emergent opportunities or needs to tune report production operations.

Continuous program improvement has also been facilitated by Duke Energy and Uplight collaborative activities. Duke Energy and Uplight staff join for weekly status meetings, monthly operations meetings, and quarterly governance meetings. These meetings provide a venue for shared brainstorming and roadmapping activities and the ongoing maintenance of a product request list for Uplight. Uplight's internal HER Improvement Team serves to ensure progress is made on the product request list. This team meets quarterly to reassess the feasibility of each of the list's items and reprioritize these items, as needed, based on the priorities Duke Energy has expressed in collaborative meetings.

4.2.1.3 MyHER Components

MyHER reports include several key elements that are customized for each customer each month: bar charts, tips, trend charts, and messages. Duke Energy and Uplight implemented a general refresh of the MyHER report template in 2017, designed to improve readability and to keep the presentation fresh in the eyes of recipients. Graphics were updated and images were added to some modules (described below) that were previously text-only. A new module (also described below) was added that presents usage disaggregated by end use type. Overall, recipient response to this redesign was positive, though program staff did initially note some difficulty recipients had with interpreting the disaggregated end use presentation.

The front page includes two bar chart graphics. The first chart is a vertical bar chart (stylized in the shape of homes) comparing the subject home to the average and most efficient homes for an assigned cluster or "neighborhood" of similar homes. Previously, in Duke Energy jurisdictions with the earliest MyHER program implementations, these graphs were labeled with dollars, but this occasionally caused confusion among recipients if the dollar amount didn't exactly match their recall of a recent bill. In March 2013, Duke Energy shifted to using kWh as the unit of measurement for the bar charts; Duke Energy conducted customer focus groups in an effort to understand the level of confusion this shift might cause and found that customers reported not paying attention to unit of measurement: they were simply absorbing the shape and directionality of the bar charts (Figure 4-1).

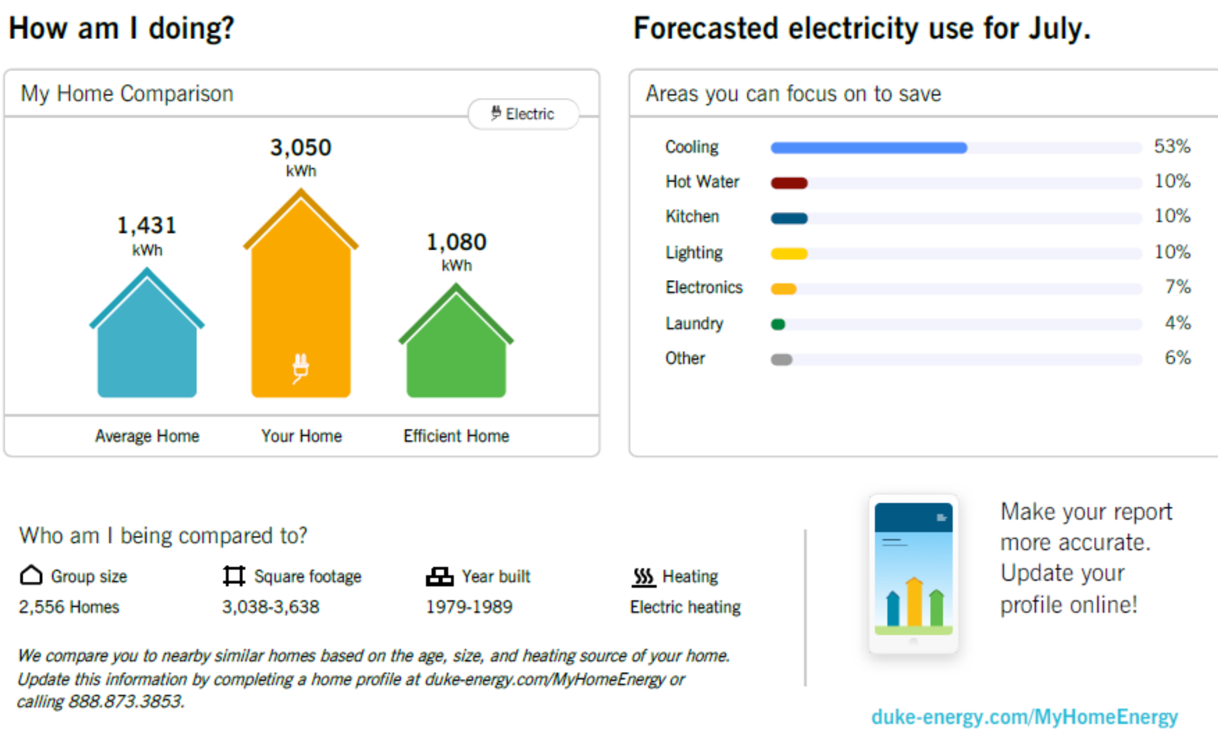
An infographic beneath the bar charts provides the size of the group of comparison homes, the assumed heating type, the approximate square footage, and the approximate age of the similar homes to which the customer's home is being compared. According to MyHER staff, a common reason for customer phone calls relating to MyHERs is simply the customer's desire to correct assumed information about a given home. For example, the MyHER could indicate that Duke Energy believes that a home has electric heat when it does not, or has assigned a home to the wrong size category. Any corrections provided in this manner are considered highly reliable and are not changed based on subsequent uploads of third party data.

To the right of the vertical bar chart is a horizontal bar chart that illustrates Uplight's forecast for the customer's home's electricity usage in the next month, disaggregated by end use type. This chart is intended to provide actionable insights to each customer as to where they might direct their energy savings efforts to make the greatest impact in their energy usage in the month ahead. Uplight staff continues to fine-tune the disaggregation in these forecasts, as a response to customer concerns about the accuracy of this component of the report.

In 2019, Uplight employed EV (electric vehicle) detection models using AMI data in order to ascertain which customers had these vehicles, and thus improve the disaggregation prediction for those customers. Similarly, an email campaign was conducted for customers who reported that they have pools, but had not specified how it was heated. These customers were encouraged to report pool heating type on the MyHER Interactive portal.

Generally, Duke Energy and Uplight continue to encourage customers to visit the Interactive portal where they can further customize or correct information about their homes that impact the accuracy of the disaggregated usage forecasts.

Figure 4-1: MyHER Electricity Usage Comparison and Forecasted Energy Use Bar Charts



In addition to the comparison graph, each MyHER includes a set of customized action tips under the heading “How can I save more?”. These tips are designed to provide information relevant to homes with similar characteristics, as presented in the box accompanying the comparison graph. These tips often are presented with monetary values (appropriately scaled to each customer receiving the tip) that estimate the bill savings that the customer might expect to realize by implementing the action tip.

The Duke Energy MyHER program has a large library of action tips, numbering between 80 and 90. Half of them were initially developed internally at Duke Energy, and Uplight’s “Ask the Expert” technical writer continued to add to them over time. The large library has enabled the program to avoid any repeats to customers over long periods of time (up to three years). Tip freshness is also managed with display rules that ensure that a diversity of tip types (both in the value of the tip and the area of the household they apply to) is shown, and this management sometimes results in the removal of tips that staff no longer deem relevant. Duke Energy validates the monetary values estimated by Uplight for each tip action for reasonableness. In addition, tips that would lead to annual customer savings of less than $5 will omit their savings figure, as it is possible that such a low amount may actually dissuade customers from participating in the action.

Duke Energy and Uplight identified an opportunity for improving action tips and developed additional targeting algorithms for tip display. Some tips are now "smart" in that they are linked to Uplight's building model that disaggregates energy use in the home, as seen in Figure 4-2, and will calculate potential savings based on the home's characteristics. However, not all of the actions and tips are amenable to being used in this fashion, as there is significant variability in their applicability: some tips are only applicable to a few segments, while others have broader customer applicability and have lower capacity to be used as a targeted action. In 2019, the size of the tips library increased by about 50%, with about half of the newest tips enhanced as smart tips.

Figure 4-2: MyHER Tips on Saving Money and Energy

How can I save more?

Every little bit helps!

Use LED decorative string lights

The energy used by decorative string lights can add up if you use a lot of strings. Use LED string lights, which use up to 90% less energy than standard string lights, last up to 25 times longer, and stay on even if bulbs burn out. You can save even more by using timers. Set the timer to turn your lights off when they won't be seen.

Save up to $13 per year.

Reduce the energy used by your entertainment devices

About 7% of the power used in a typical U.S. home is for entertainment devices like televisions, set-top boxes, DVD players, and gaming devices. Save energy and money by lowering your TV's brightness setting, limiting your movie watching on gaming devices, and unplugging set-top boxes that aren't used much.

Learn More at **duke-energy.com/MyHomeEnergy**

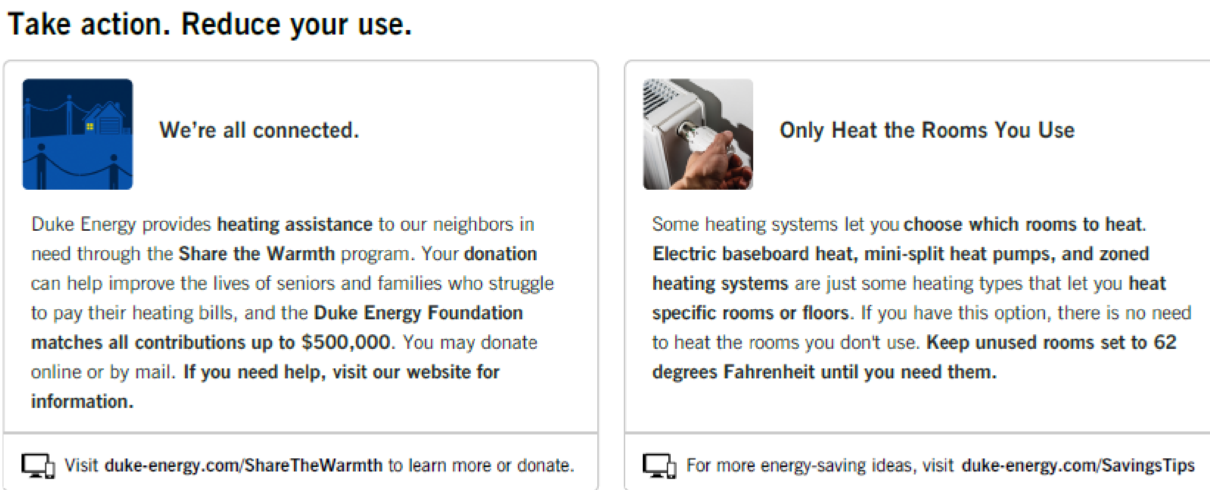
The back page of the MyHER reports includes a trend chart that displays how the recipient's home compares to average and efficient homes with respect to energy usage over a year (Figure 4-3). This trend chart can help customers identify certain months where their usage increased relative to the efficient or average home—helping them focus on the equipment and activities most likely to affect their usage. For example, if a home tracks the average home until mid-winter and then spikes well above, that could indicate the heating equipment should be checked.

Figure 4-3: MyHER 13-month Trend Chart

The back page of the MyHER report also reserves space for Duke Energy to include seasonal and programmatic messaging, referred to by program staff as free-form text (FFT), that reflects Duke Energy-specific communication objectives (Figure 4-4). Ensuring that FFT messages are relevant and do not conflict with the actions or tips provided on the front page requires ongoing coordination and monitoring. Broad targeting efforts taking advantage of seasonal relevance, program eligibility, and the presence of end uses such as pools, are used to cross-promote Duke Energy programs. Customer participation databases are cross-checked each month to ensure that customers only receive information about programs they have not already participated in; if a customer is found to have participated in the program being promoted in a given month, that customer will receive an alternate, typically more generic, message. Occasionally the action text on the front page will be disabled to accommodate priority FFT messaging.

FFT messages are developed by the MyHER team in cooperation with Duke Energy's marketing and communications group. Duke Energy staff strive to develop messages that are clever, relevant, and upbeat—some recognize events on the calendar (such as Earth Day) while others provide specific program promotional information or promote general home upgrades (even for measures outside of current programs) or behavioral suggestions. These promotions have led to significant program participation, especially for those programs that offer free energy savings products (LED programs) or low-cost enrollment (GoGreen program).

Figure 4-4: MyHER Free-form Text Modules

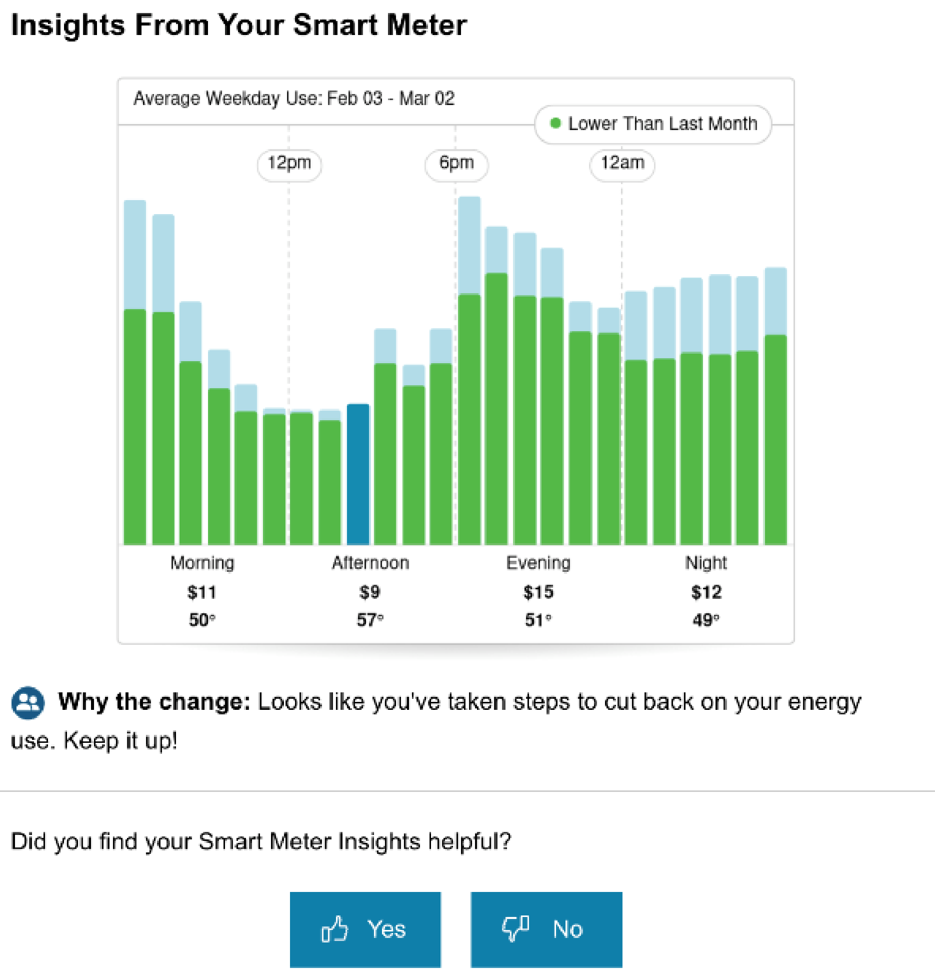


Establishing an FFT calendar early in each year and attempting to avoid last-minute changes to the messages each month has been challenging to implement. In the past, last-minute FFT changes were common due to changes during the course of the year to Duke Energy program promotions and incentive levels. In addition to developing the messages included in each MyHER, the program team must also ensure that the messages conform to expectations established to protect the customer experience. This feature of MyHER has historically been relatively resource-intensive with a lengthy revision-review-approval process with numerous stakeholders accompanying most changes to FFT messages. However, in 2019 this process was prioritized and planning strategies were implemented to prepare FFT messaging weeks, and often months, in advance to prevent the likelihood of disruption in the report production process due to last minute changes.

In addition, as part of Uplight's Program Manager (formerly Uplight 360) tool, an FFT-specific tool, called Content Manager was launched in 2019. Content Manager allows Duke Energy to directly produce FFT content and design the customer groups the messages are intended for.

Uplight also piloted an AMI usage chart for customers that receive eHERs (Figure 4-5). This chart displays hourly usage data, breaks it into segments, and shows the customer how much money they spend on electricity usage for the average weekday in each time period compared to the prior month.

Figure 4-5: Hourly Customer AMI Usage Chart



Finally, the back page of the reports also provides contact information for the MyHER program at Duke Energy. Customers occasionally contact Duke Energy with questions or concerns about MyHERs and, rarely, to opt-out. Duke Energy's efforts to maintain a high-quality MyHER customer experience is reflected by the high value that is placed on program participant satisfaction and as such, it is closely monitored. The rigorous quality control efforts described earlier have kept quality-related issues from ever reaching customers. Duke Energy reports to Nexant that, generally, 1% of MyHER customers contact Duke Energy annually. Nexant finds that 0.24% of MyHER participants opted-out of the program during the period January 2020 to December 2020.

4.2.1.4 MyHER Interactive

Enrollment in MyHER Interactive is still relatively low. The most reliably successful enrollment generators are email campaigns, sweepstakes, and cross-promotion with the High Bill Alerts program. Envelope messaging has also been used but is less successful. Email campaigns are a very successful enrollment generator because they can use personalized uniform resource locator (PURLs) to enable clicking through to the Interactive portal where the customers' account number is auto-populated. Program staff revamped the content and graphics of the email campaign in 2018.

In addition, Uplight and Duke Energy prioritized increasing MyHER Interactive enrollments in 2019, with relative success. An awareness campaign that included two sweepstakes was conducted that resulted in an increase in Interactive enrollment from about 100,000 to almost 250,000 across all Duke Energy jurisdictions.

Few quality control or process issues pertaining to Interactive were reported in our interviews. However, it should be noted that there is currently no mechanism by which Duke Energy can use or check the quality of data presented on Interactive in a systematic or bulk fashion. All checks on Interactive content are made on an individual customer basis. The bulk of quality control for Interactive is carried out by Uplight.

4.2.2 Customer Surveys - DEC

The customer surveys included questions focused specifically on the experience of and satisfaction with the information provided in MyHERs and awareness of MyHER Interactive—these questions were asked only of households in the treatment group.

Both treatment and control households answered the remaining questions, which focused on assessing:

- Awareness of Duke Energy efficiency program offers;
- Satisfaction with the Duke Energy, and services Duke Energy provides to help households manage their energy use;
- Levels of awareness of and interest in household energy use; motivations and perceived importance;
- Reported behavioral or equipment-based upgrades; and
- Barriers that prevent customers from undertaking energy savings actions.

4.2.2.1 Comparing Treatment and Control Responses - DEC

This section presents the results of responses to survey questions asked of both treatment and control households of single family and multi-family households in DEC and compares the response patterns of each. In addition, comparative analyses between single family and multi-family customers are included where pertinent. Statistically significant differences between treatment and control households, and between single family and multi-family households, are noted when they occur.

Duke Energy Customer Satisfaction

Both single family and multi-family treatment and control groups' overall satisfaction with Duke Energy are high. For single family, 82% of treatment customers and 78% of control customers are satisfied or very satisfied with Duke Energy as their electric supplier (rated 8 or higher on a 0-10 point scale). The difference is not statistically significant at the 90% level of confidence. For multi-family, 94% of treatment customers and 78% of control customers are satisfied or very satisfied with Duke Energy as their electric supplier (rated 8 or higher on a 0-10 point scale). This difference is statistically significant at the 90% level of confidence.

Respondents were asked if they “strongly disagree”, “disagree”, “neither agree nor disagree”, “agree”, or “strongly agree” that Duke Energy provides excellent customer service, respects its customers, and provides service at a reasonable cost. Single family control households are more likely to “agree” or “strongly agree” on these three aspects than treatment customers. None of these differences are statistically significant at the 90% level of confidence (Figure 4-6). Multi-family households reported similar levels of agreement with these statements (Figure 4-7).

Figure 4-6: Satisfaction with Various Aspects of Customer Service – Single Family Top-2 Box Scores (1-5 Scale)

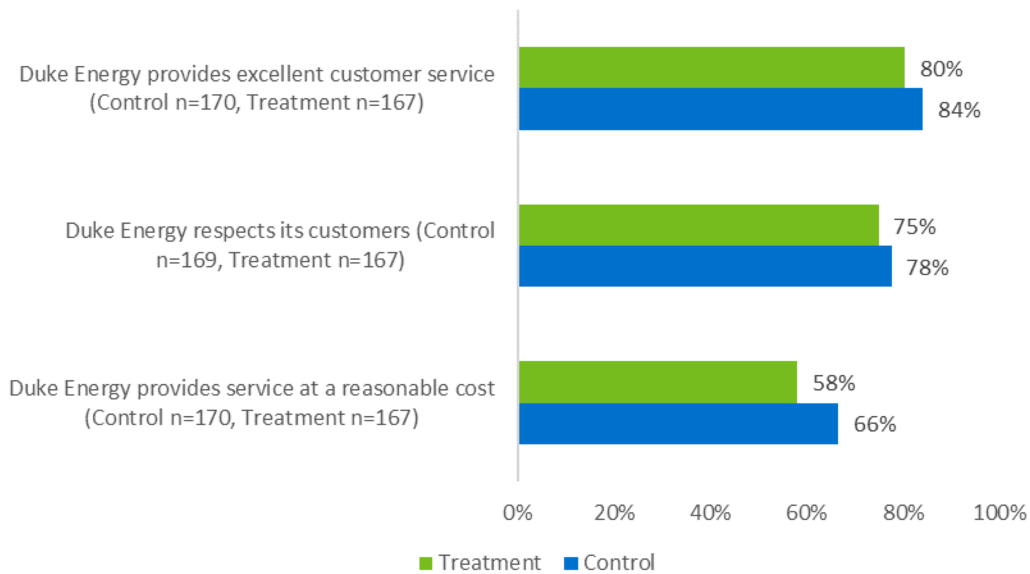
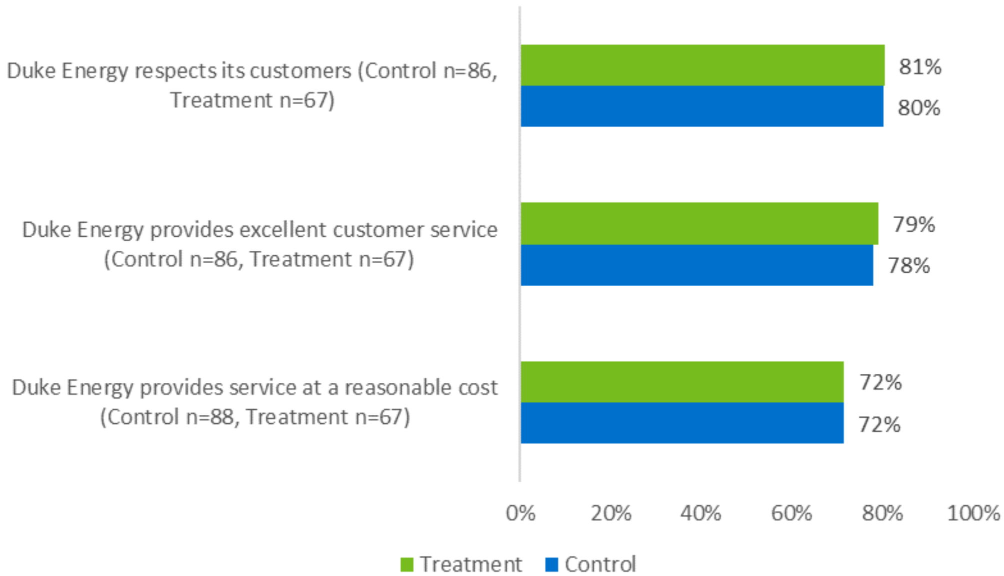


Figure 4-7: Satisfaction with Various Aspects of Customer Service – Multi-family Top-2 Box Scores (1-5 Scale)



Using a five point scale, “very dissatisfied”, “dissatisfied”, “neither dissatisfied nor satisfied”, “somewhat satisfied”, and “very satisfied”, single family treatment customers are more likely to report that they are either “somewhat satisfied” or “very satisfied” with the information available about Duke Energy’s energy efficiency programs, Duke Energy’s commitment to promoting energy efficiency and the wise use of electricity, and the information Duke Energy provides to help customers save on energy bills than control customers (Figure 4-8). However, as above, none of these differences are statistically significant at the 90% level of confidence. A new question on customer’s overall satisfaction with Duke Energy’s response to COVID-19, to help its customers dealing with financial hardship, was asked to both single family treatment and control groups. The two groups report similar levels of satisfaction. Similar patterns between single and multi-family (Figure 4-9) respondents as well as between treatment and control customers are seen for these measures of customer satisfaction. One difference to note is that significantly more multi-family respondents are satisfied with Duke Energy’s response to COVID-19 to assist customers than are single family respondents (82% and 73% for treatment and control multifamily customers and 62% and 63% for treatment and control single-family customers).

Figure 4-8: Satisfaction with Energy Efficiency Offerings and Information – Single Family Top-2 Box Scores (1-5 Scale)

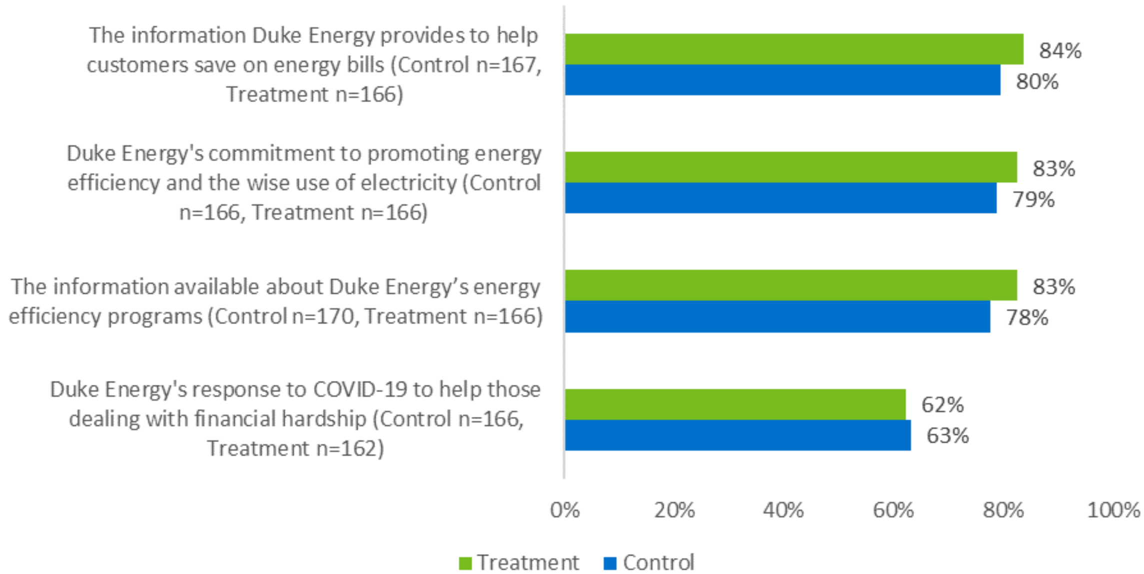
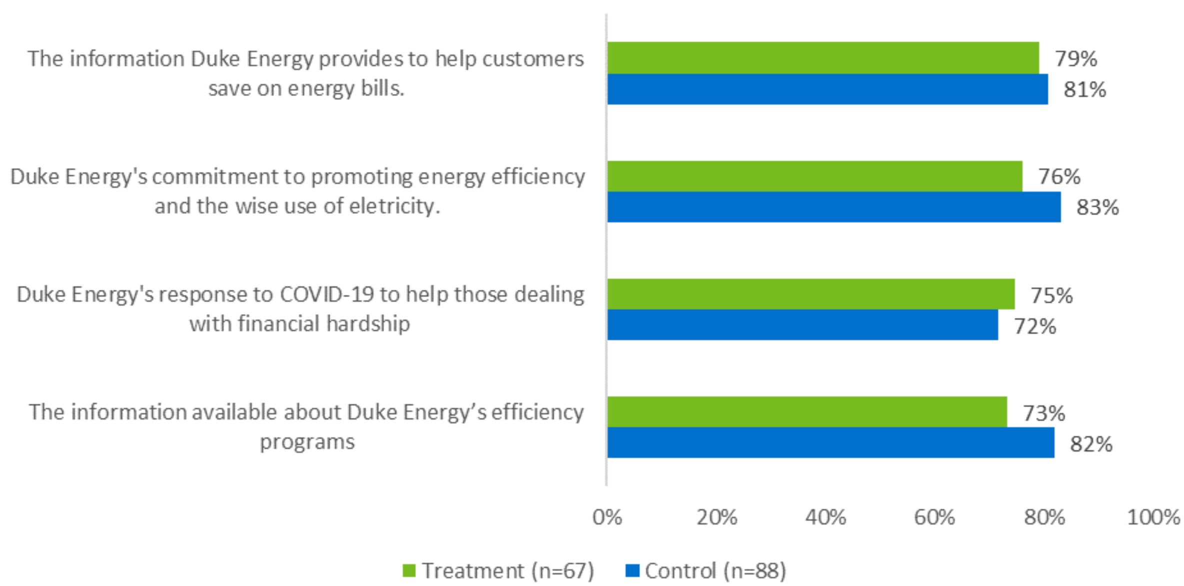


Figure 4-9: Satisfaction with Energy Efficiency Offerings and Information – Multi-family Top-2 Box Scores (1-5 Scale)



Engagement with Duke Energy's Website

Both treatment and control groups answered several questions about their use of the Duke Energy website, a proxy for overall engagement with information provided by the utility on energy efficiency and household energy use, and the results showed a significant difference on using online accounts to pay bills between multi-family treatment and control groups. Table 4-5 shows that 30% of single family treatment group and 33% of control group, and 21% of multi-family treatment group and 20% of control group reported they had never logged in to their Duke Energy accounts. Among those that had logged in, the most reported purpose was to pay their bill for both single family and multi-family respondents.

Table 4-5: Use of Duke Energy Online Account

Online Account Activity	Single Family		Multi-family	
	Treatment Group (n=168)	Control Group (n=171)	Treatment Group (n=67)	Control Group (n=88)
Never logged in	30%	33%	21%	20%
Pay my bill	40%	39%	51%*	66%*
Look for energy efficiency opportunities or ideas	14%	13%	19%	19%

*statistically significant, p=0.057

As shown in Figure 4-10, single family treatment and control group households report similarly that they accessed the Duke Energy website to search for information about rebate programs, energy efficient products, or ways to make their home more energy efficient. Multi-Family control group households are more likely to report that they accessed the Duke Energy website to search for information about rebate programs, energy efficient products, or ways to make their home more energy efficient than treatment group households (Figure 4-11). Relatively small percentages of both groups in single and multi-family report regular usage of the website for purposes other than bill payment.

Figure 4-10: Assessing Duke Energy Website for Other Information – Single Family

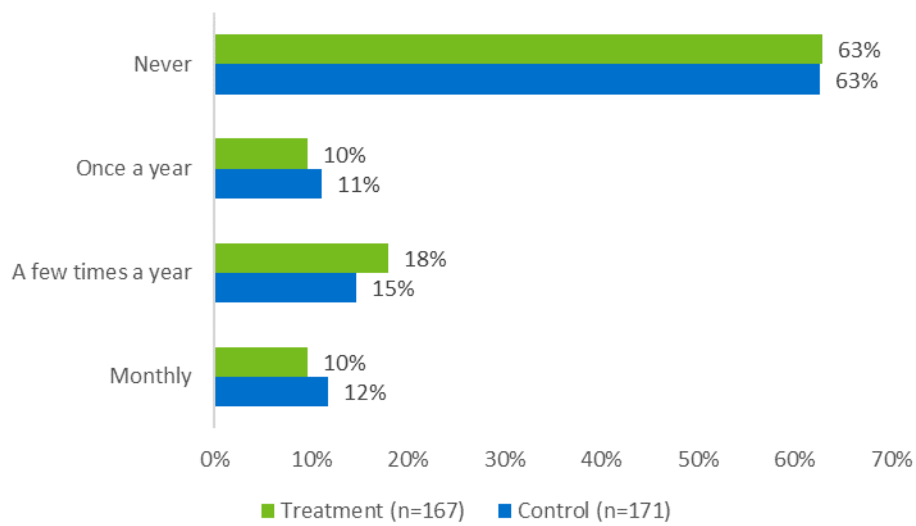
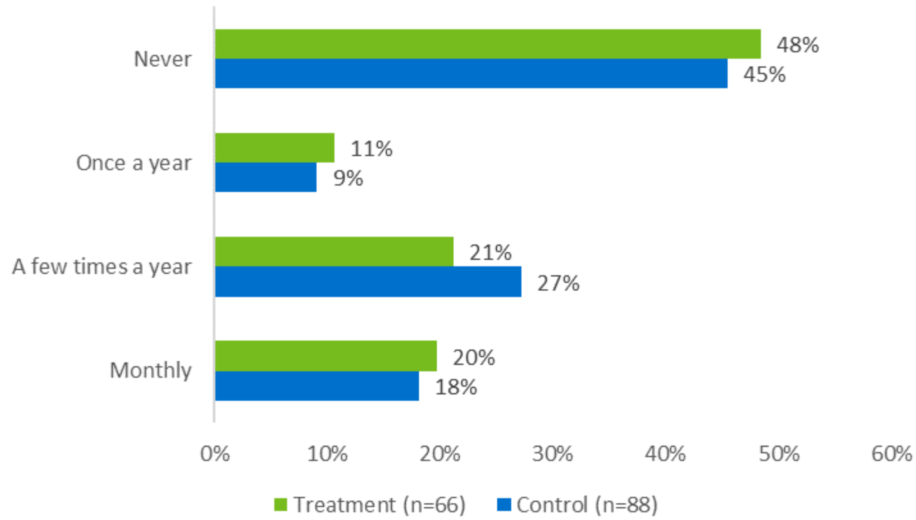


Figure 4-11: Assessing Duke Energy Website for Other Information – Multi-family



Forty-one percent of single family control group customers and 35% of treatment group customers reported they would be likely to check the Duke Energy website for information before purchasing major household equipment, while 46% of multi-family control group customers and 38% of treatment group customers reported so. The portion of respondents rating their likelihood a “7” or higher on an 11-point scale of likelihood is plotted in Figure 4-12 and Figure 4-13.

Figure 4-12: Portion Likely to Check Duke Energy Website prior to Purchasing Major Home Equipment – Single Family Split Top-4 Box Scores (0-10 Scale)

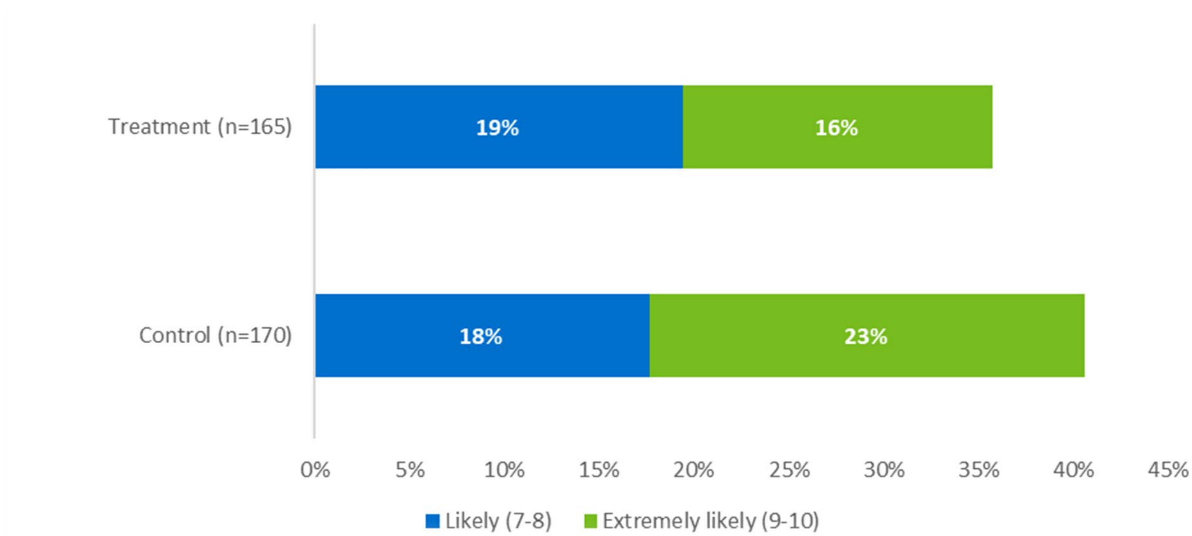
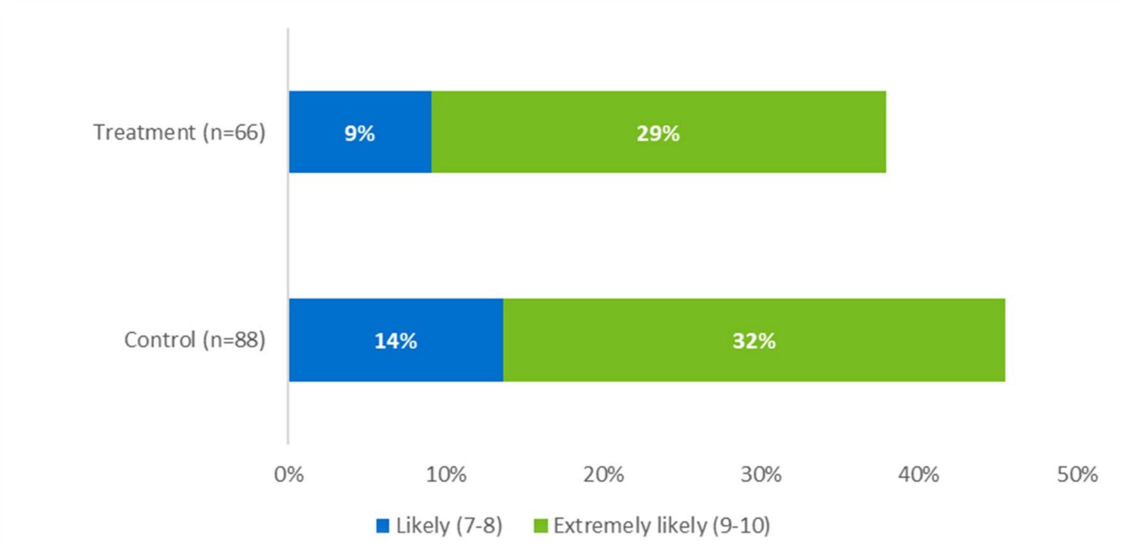


Figure 4-13: Portion Likely to Check Duke Energy Website prior to Purchasing Major Home Equipment – Multi-family Split Top-4 Box Scores (0-10 Scale)

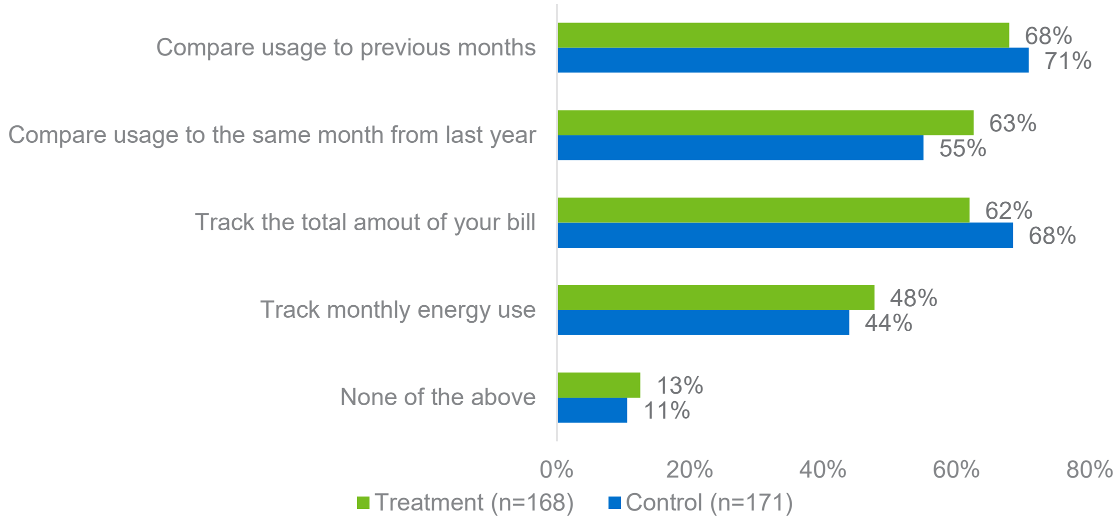


Customers' Reported Levels of Monitoring Energy Use and Energy Saving Behaviors

Single family treatment and control customers report tracking information (bills and usage) related to their household's energy usage in the following ways (Figure 4-14):

- Sixty-two percent of the treatment customers and 68% of the control customers reported tracking the total amount of the bill. The difference is not statistically significant at the 90% level of confidence.
- About two-thirds of respondents compared usage to previous months. The difference between treatment and control groups is not statistically significant.
- More than half of respondents compared usage to the same month from last year. The difference in responses here between treatment and control groups is not statistically significant at the 90% level of confidence.

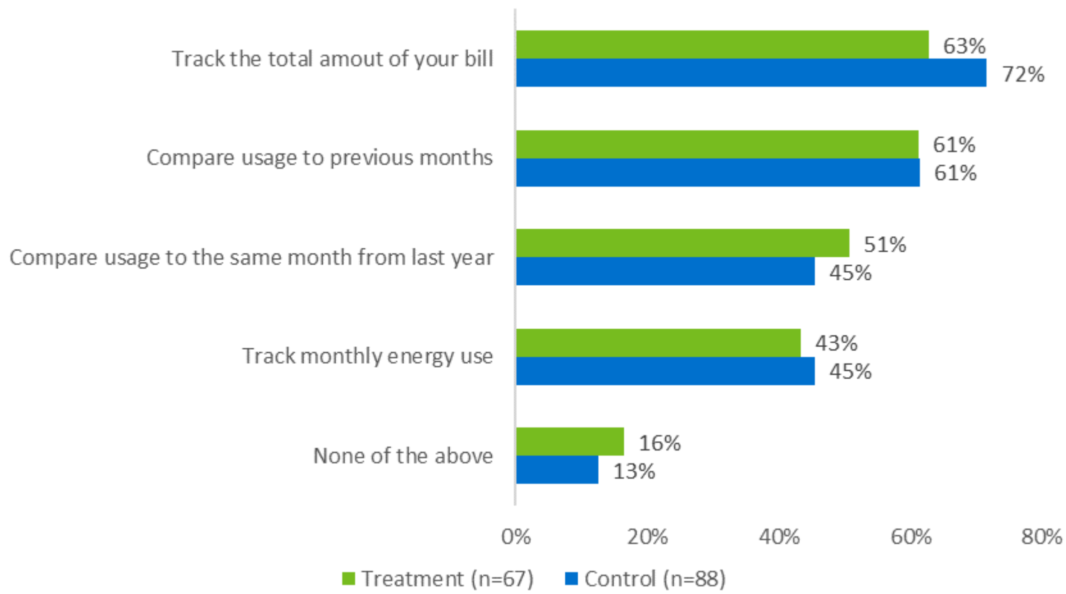
Figure 4-14: "Which of the Following Do You Do with Regard to Your Household's Energy Use?" – Single Family



Multi-family treatment and control customers report tracking information (bills and usage) related to their household's energy usage in the following ways (Figure 4-15):

- Sixty-three percent of the treatment customers and 72% of the control customers reported tracking the total amount of the bill. The difference is not statistically significant at the 90% level of confidence.
- Sixty-one percent of treatment and control respondents, respectively, compared usage to previous months.
- Fifty-one percent of treatment respondents and 45% of control respondents compared usage to the same month from last year. The difference in responses here between treatment and control groups is not statistically significant at the 90% level of confidence.

Figure 4-15: "Which of the Following Do You Do with Regard to Your Household's Energy Use?" – Multi-family



An area of significant interest in this evaluation is the identification of energy-saving behaviors that MyHERs move treatment customers to undertake. These behaviors, if they result in energy savings attributed to the reports, would be over and above what the treatment households would have done without having read or seen their MyHERs. The customer survey included a battery of questions inquiring as to whether the respondent's household has undertaken energy-savings actions. The responses to these questions are compared between the treatment and control respondents, and any statistically significant uplift in the reported behaviors undertaken can be concluded to be due to the MyHERs and may also be inferred as a driver of energy savings attributed to the program. A screening question is used to ensure that respondents answering the questions about specific behaviors only see those questions if they state that they have undertaken any energy savings actions or made energy efficiency improvements at all in the past year.[17]

For both single family and multi-family treatment and control groups, respectively, respondents reported similar levels of taking actions to save energy, as shown in Figure 4-16 and Figure 4-17. Across the nine specific behaviors and actions described by the survey, none show that treatment respondents are significantly more likely to take action to save energy than control respondents. The most cited behavior for both single family and multi-family respondents is turning off lights in unused indoor or outdoor areas, with 93-95% of single family respondents reporting taking that action and 99-100% of multi-family respondents reporting that they take the action. The least-cited action is turning down the water heater temperature – where 30-43% of

[17] Single family treatment and control customers report similar likelihood of having undertaken any behaviors to reduce household energy use or having made energy efficiency improvements to their home (66% to 67%). This is also true for treatment and control multi-family respondents (64% to 59%).

single family respondents reporting that they did that and 34-45% of the multi-family respondents reporting the same.

There are two energy-savings behaviors for which significantly more single-family control customers are reporting undertaking than treatment customers, both of which are related to conserving on water heating. The MyHER reports do not usually touch on water heating end-uses and it may be that MyHER treatment customers are taking actions that displace their interest or efforts to conserve water heating energy use.

While none of these behaviors show an uplift that can be ascribed to MyHER, that does not mean that energy savings are not coming from these behaviors. What these findings mean is that there is no evidence that MyHER has introduced new behaviors to treatment customers that they were not doing at all previously. It's quite possible that MyHER energy savings, at least in part, come from customers turning off lights in unused areas of the home – because they are doing that more than they would otherwise. The current survey instrument used by this evaluation cannot detect that change. Surveys or interviews can be designed to collect information on those more subtle differences in energy savings behaviors in the home, however they would be considerably more complicated and more expensive to field. Fewer customers would be willing to complete such a survey and non-response bias would be of greater concern. Non-response bias could be potentially overcome with completion incentives, but that would also increase the evaluation budget. Duke Energy is aware of the limitations of the customer research agenda and accepts the current resolution of the tradeoff between depth of findings, reliability of findings, and evaluation cost.

Figure 4-16: Reported Energy Savings Behaviors – Single Family

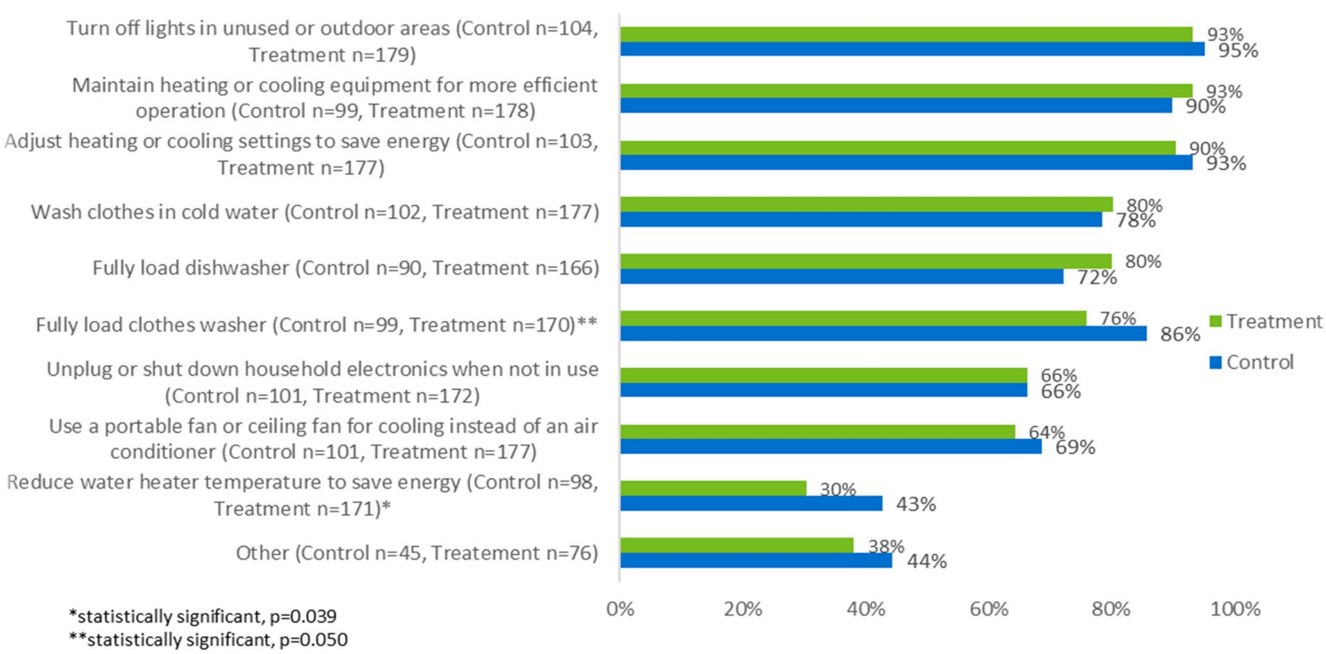
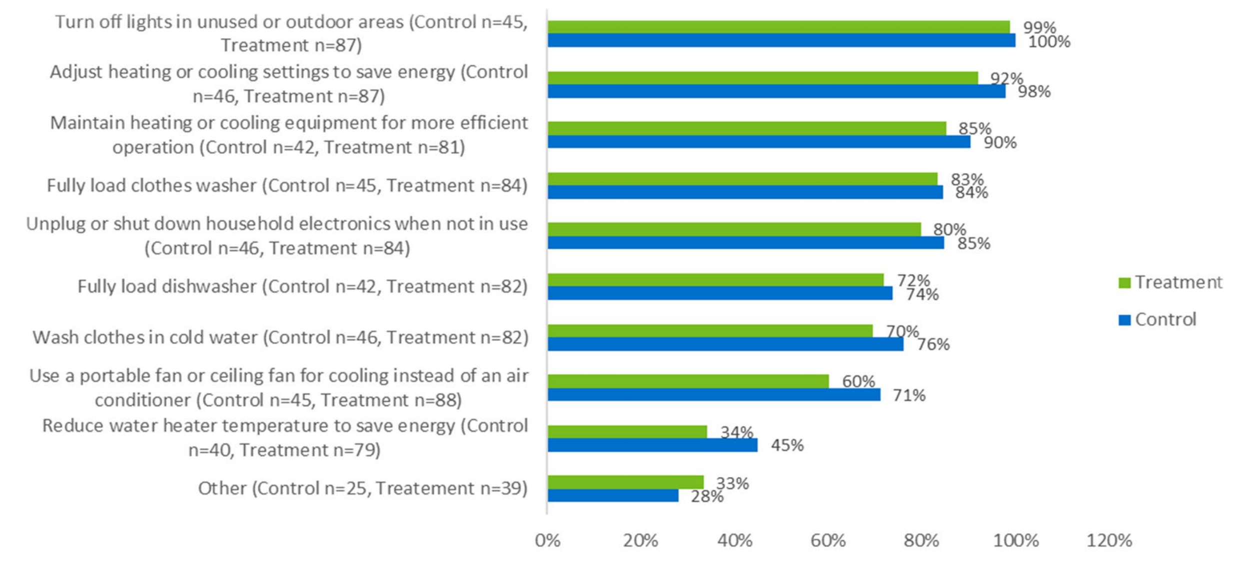


Figure 4-17: Reported Energy Savings Behaviors – Multi-family



Nexant compared the reported behaviors of single family treatment customers to those of multi-family treatment customers. Here we do see measurable differences between behaviors taken by single family customers and multi-family customers. Not surprisingly, single family treatment customers are significantly more likely to report that they "Maintain heating or cooling equipment for more efficient operation" and "Wash clothes in cold water" than multi-family treatment customers, as shown in Figure 4-18. These differences are likely due to the fact that maintenance in multi-family housing is often completed by property management companies. Additionally, the saturation of air conditioning is lower in multi-family housing units as compared to single family. Multi-family treatment customers are significantly more likely to "Turn off lights in unused or outdoor areas" and "Unplug or shut down household electronics when not in use" than single family treatment customers.

Forty-eight single family respondents (treatment and control customers in total) reported other energy savings actions. Nexant categorized these actions and the results are shown in Figure 4-19. The two most reported actions, mentioned by 15 respondents, respectively, pertain to lighting, such as switching to LED bulbs, and upgrading insulation and home sealing.

Figure 4-18: Reported Energy Savings Behaviors Single Family Treatment vs. Multi-family Treatment

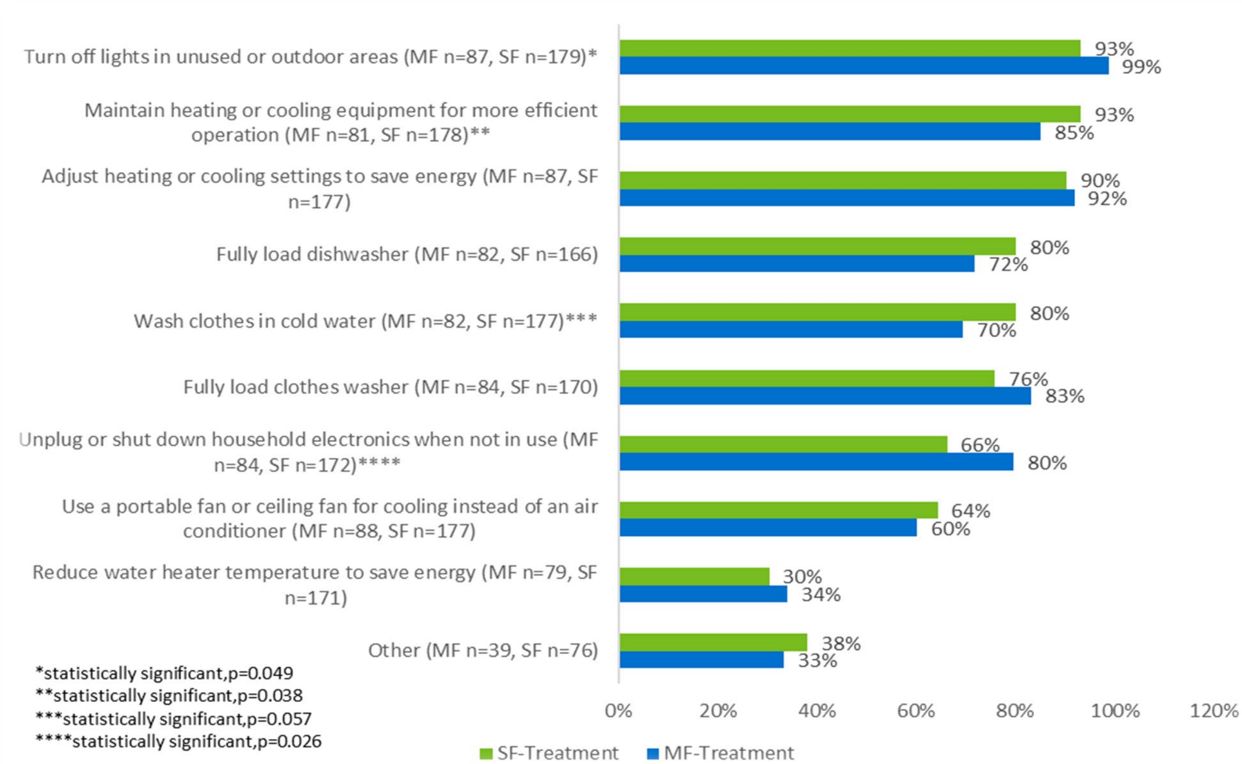
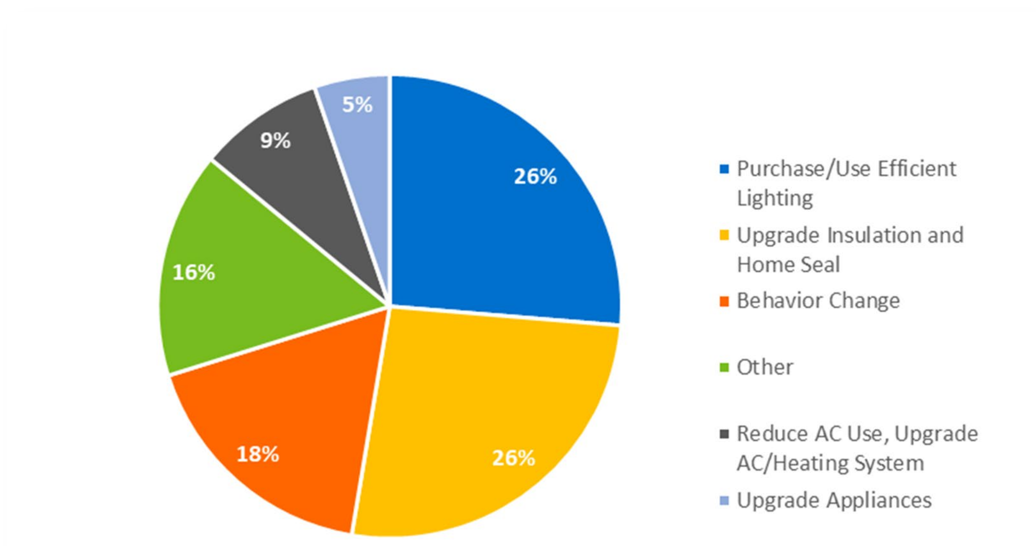
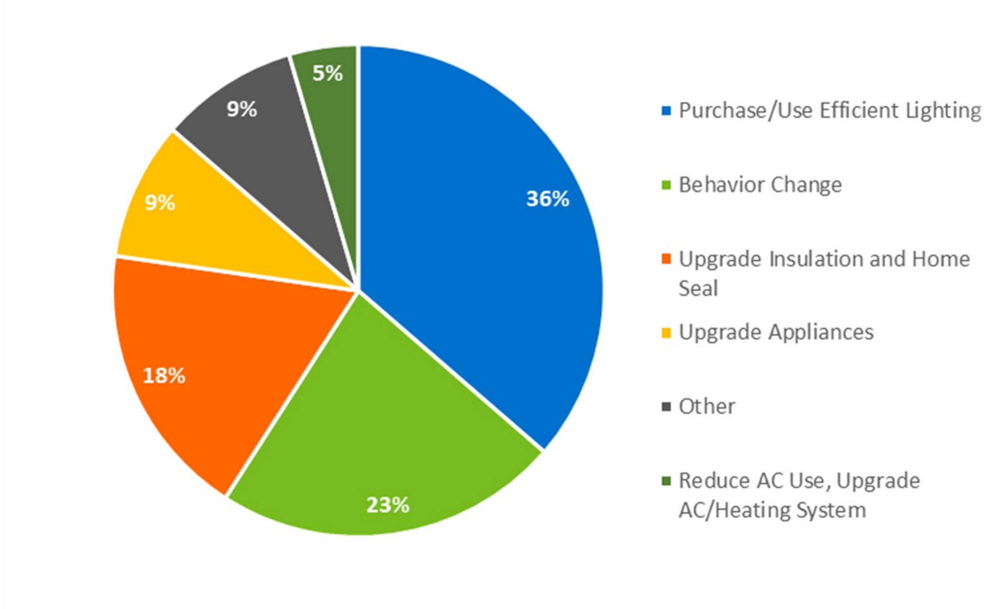


Figure 4-19: Distribution of "Other" Energy Savings Behaviors – Single Family (treatment and control n=48)



Twenty multi-family respondents (treatment and control customers in total) reported other energy savings actions. Nexant categorized these actions and the results are shown in Figure 4-20. The most reported action, mentioned by eight respondents, pertains to lighting, such as switching to LED bulbs.

Figure 4-20: Distribution of “Other” Energy Savings Behaviors – Multi-family (treatment and control n=20)



Both single family and multi-family customers were further asked a question about COVID-19’s effects on their household’s ability to take energy savings actions. Sixteen percent of single family control customers and 10% of treatment customers reported that the likelihood of COVID-19 pandemic increasing their ability to take energy savings actions a “7” or higher on an 11-point scale of likelihood, while 23% of multi-family control customers and 22% of treatment customers reported so. None of these differences in responses between treatment and control customers are statistically significant.

Reported Energy Efficiency Improvements

With respect to improvements and investments that customers might make after reading or seeing their MyHER reports, we have a similar finding to that of the behavior-related actions discussed above. Respondents were provided with a list of energy efficiency improvements and were asked if they had done each in the past year. In all cases, treatment group is not significantly more likely to report energy efficiency upgrades than control group – across both single family and multi-family respondents. Single family control group respondents are significantly more likely to report replacing windows or doors with more energy-efficient types than treatment group respondents. Significantly more multi-family control group respondents reported caulking or weatherstripping (windows or doors) and installing energy-efficient water heater than treatment group respondents (Table 4-6). On the one hand, this may be considered an unsavory result since the initial hypothesis is that MyHERs are likely to motivate customers to make upgrades like caulking and weatherstripping, or replacing windows and doors. However, this result may also indicate MyHER's success at educating customers about the power of inexpensive purchases and simple behavior changes in managing their electricity bills. Without that education from MyHERs, the control customers may have been more receptive to advertising for new water heaters, or caulking and weatherstripping. This is an interesting possibility and subtle enough that further insights would likely require focus groups, telephone interviews, or a follow up survey.

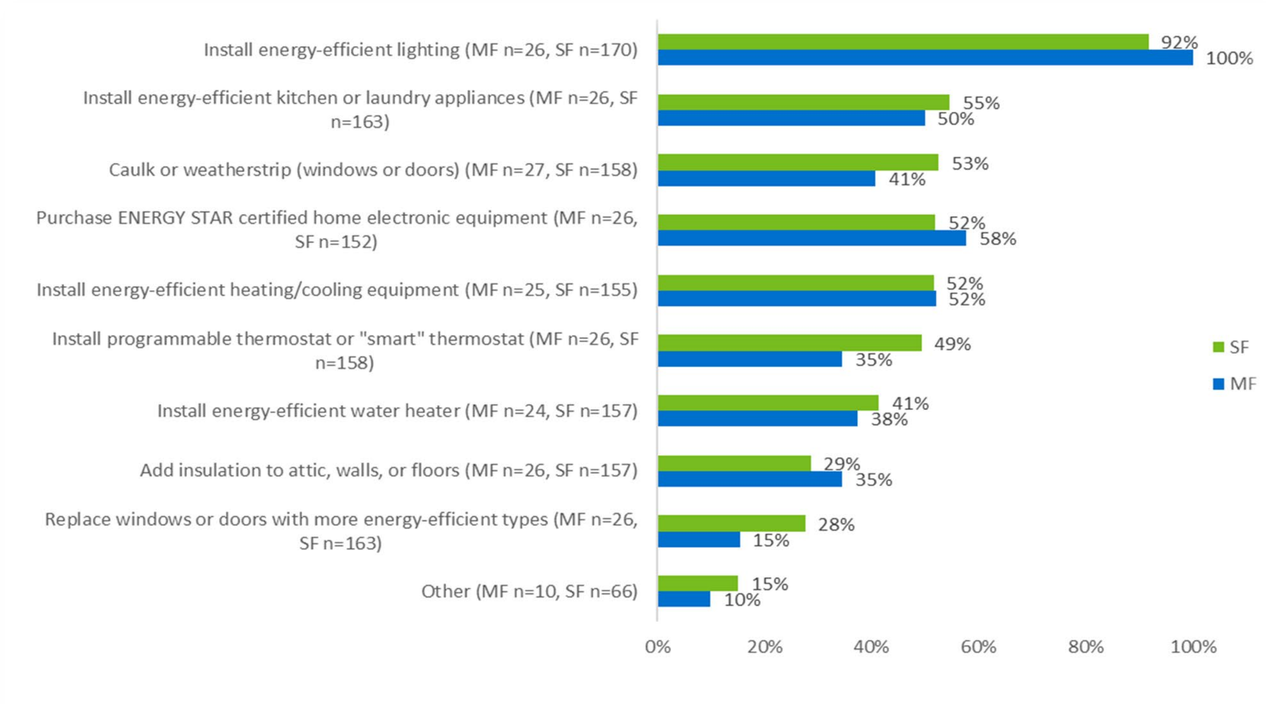
Table 4-6: Customers Indicating They Had Made Each Energy Efficiency Upgrade

Upgrade	Single Family		Multi-family	
	Treatment	Control	Treatment	Control
Install energy-efficient lighting	92% (n=179)	89% (n=104)	88% (n=80)	91% (n=44)
Install energy-efficient kitchen or laundry appliances	53% (n=171)	60% (n=97)	44% (n=75)	52% (n=42)
Purchase ENERGY STAR certified home electronic equipment	51% (n=160)	56% (n=91)	44% (n=73)	49% (n=39)
Caulk or weatherstrip (windows or doors)	51% (n=166)	50% (n=102)	38% (n=72)**	55% (n=42)**
Install energy-efficient heating/cooling equipment	51% (n=164)	51% (n=97)	37% (n=67)	48% (n=40)
Install programmable thermostat or "smart" thermostat	49% (n=166)	47% (n=100)	29% (n=79)	21% (n=43)
Install energy-efficient water heater	42% (n=166)	44% (n=95)	25% (n=68)***	45% (n=40)***
Replace windows or doors with more energy-efficient types	28% (n=172)*	42% (n=103)*	12% (n=74)	24% (n=42)
Add insulation to attic, walls, or floors	28% (n=166)	34% (n=100)	20% (n=70)	30% (n=40)

*statistically significant p=0.018
**statistically significant p=0.073
***statistically significant p=0.032

As discussed above with behavioral actions, single family treatment respondents were significantly more likely to report they had undertaken upgrades than multi-family treatment respondents on installing energy-efficient heating/cooling equipment, installing energy-efficient water heaters, replacing windows or doors with more energy-efficient types, caulking or weatherstripping (windows or doors), and installing programmable thermostat or "smart" thermostat in the survey. To control for the fact that the likelihood of renters would make these upgrades is very low, we considered the multi-family treatment responses in comparison to single family treatment responses with renters removed. When renters were removed from the analysis, five of these upgrades still emerged as higher for single family treatment respondents, as seen in Figure 4-21. None of the differences are statistically significant.

Figure 4-21: Customers Indicating They Had Made Each Energy Efficiency Upgrade Treatment Homeowners Only – Single Family vs. Multi-family



To examine broader patterns within participant responses to the behavior and upgrade questions, these questions were combined into behavior vs. upgrade categories and were also combined into end-use categories. First, as shown in Table 4-7, treatment respondents and control respondents reported very similar levels of engagement in energy efficiency behaviors and improvements generally, and also undertook a similar average number of energy efficiency behaviors across the two household types.

Table 4-7: Percent of Households That Have Undertaken Energy Efficiency Actions

Behaviors/Improvements	Single Family		Multi-family	
	Treatment	Control	Treatment	Control
Energy Efficiency Behaviors	100% (n=183)	100% (n=106)	100% (n=88)	100% (n=47)
Average Number of Behaviors	6.6	6.7	6.6	7.0
Energy Efficiency Improvements	97% (n=181)	96% (n=105)	92% (n=84)	96% (n=46)
Average Number of Improvements	4.2	4.5	3	3.8

Additionally, Table 4-8 shows the proportion of respondents that had undertaken at least one behavior or upgrade in each end use category. For those categories that have multiple behaviors or upgrades within it, these are broken out on their own for analysis. In the category “Water Heating Behaviors/Upgrades”, for example, four behaviors relevant to water heating are combined in a subcategory “Water Heating Behaviors” are broken out. Upgrades are not broken out here in that way because there is only one upgrade (“Install energy-efficient water heater”) associated with the parent category, and the proportion of respondents undertaking this upgrade is presented in Table 4-6, above. Similarly, for "Lighting Behaviors/Upgrades", there was only one upgrade and behavior, so these are not broken out. Lastly, there was only one behavior associated with the "Electronics and Appliances Behaviors/Upgrades" category ("Unplug or shut down household electronics when not in use"), so it was omitted as well. Multi-family control group members were significantly more likely to have undertaken sealing and insulation upgrades than treatment group members.

Table 4-8: Percent of Households That Had Undertaken Energy Efficiency Behaviors or Upgrades, by End Use Category

Behaviors/Improvements	Single-family		Multi-family	
	Treatment Group	Control Group	Treatment Group	Control Group
Water Heating Behaviors/Upgrades (5)	96% (n=182)	98% (n=106)	95% (n=87)	98% (n=47)
Water Heating Behaviors (4)	96% (n=182)	99% (n=105)	94% (n=87)	98% (n=47)
Space Heating Behaviors/Upgrades (5)	99% (n=183)	97% (n=106)	99% (n=88)	100% (n=47)
Space Heating Behaviors (3)	99% (n=183)	98% (n=105)	99% (n=88)	100% (n=47)
Space Heating Upgrades (2)	66% (n=173)	66% (n=103)	46% (n=81)	49% (n=43)
Lighting Behaviors/Upgrades (2)	98% (n=183)	99% (n=106)	99% (n=87)	100% (n=47)
Electronics and Appliances Behaviors/Upgrades (3)	87% (n=182)	85% (n=106)	86% (n=87)	93% (n=46)
Electronics and Appliances Upgrades (2)	65% (n=173)	69% (n=100)	55% (n=80)	63% (n=43)
Sealing and Insulation Upgrades (3)	65% (n=174)	66% (n=103)	43% (n=75)	59%* (n=44)

*statistically significant, p=0.084

Both single family and multi-family customers were further asked a question about COVID-19's effects on their households' ability to make energy efficiency improvements. Twelve percent of single family control customers and 9% of treatment customers reported that the likelihood of COVID-19 pandemic increasing their ability to make energy efficiency improvements a "7" or higher on a 0-10 point scale of likelihood, while 21% of multi-family control customers and 24% of treatment customers reported so. None of these differences in responses between treatment and control customers are statistically significant.

Customer Motivation and Awareness

Single family control and treatment groups report similar levels of motivation for saving energy. Eighty-five percent of control customers indicated that knowing they are using energy wisely is "important" or "extremely important" (rated 7 or higher on a 0-10 point scale), compared to 81% of treatment customers. This difference is not statistically significant (Figure 4-22). The same is true for multi-family. Eighty-one percent of control customers indicated that knowing they are using energy wisely is "important" or "extremely important", compared to 82% of treatment customers. This difference is not statistically significant (Figure 4-23).

Figure 4-22: "How Important Is It for You to Know if Your Household is Using Energy Wisely?"– Single Family Split Top-4 Box Scores (0-10 Scale)

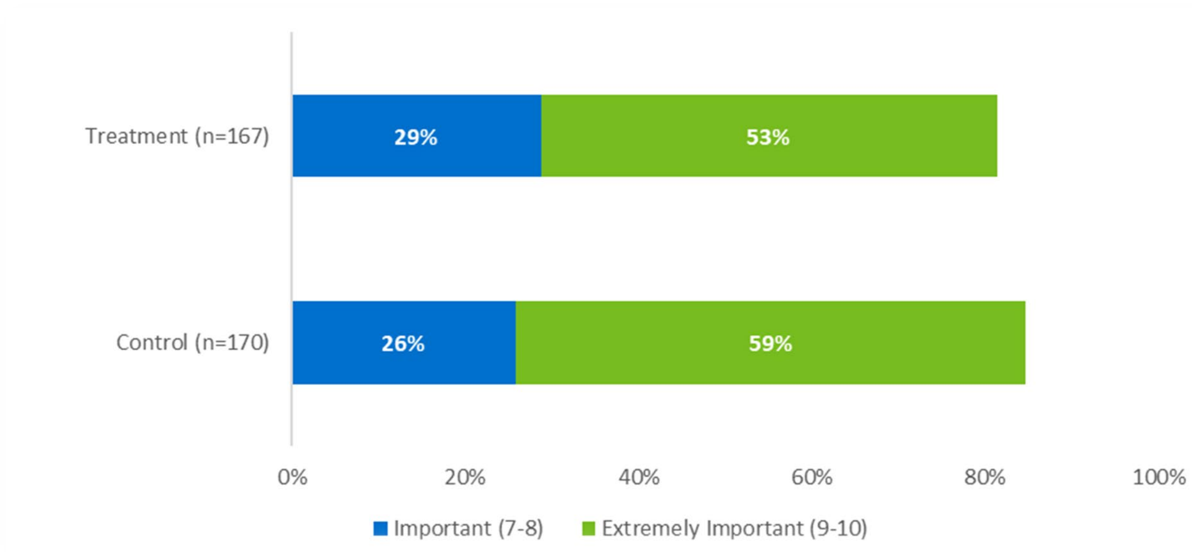
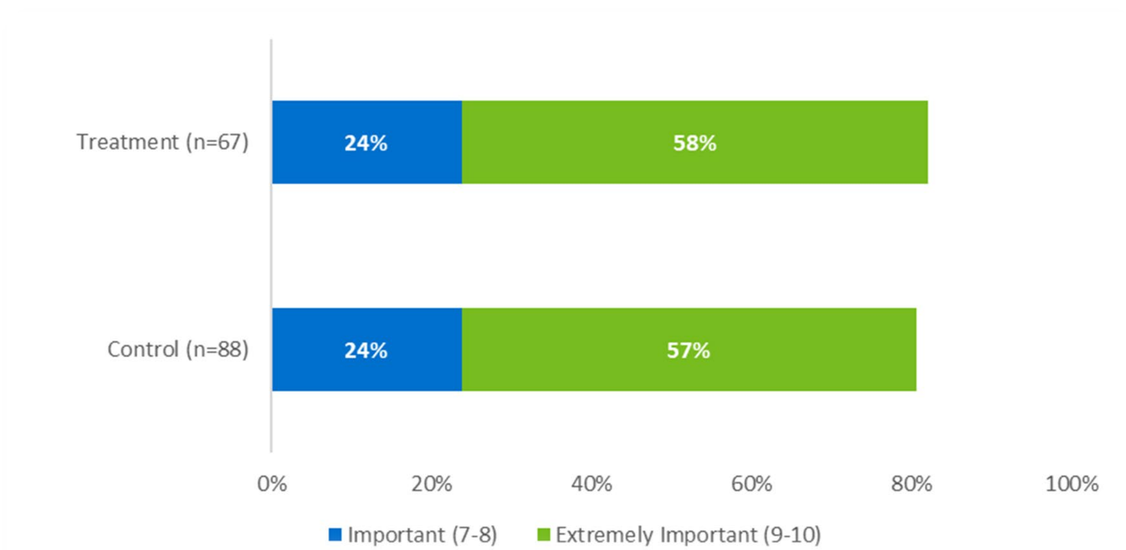
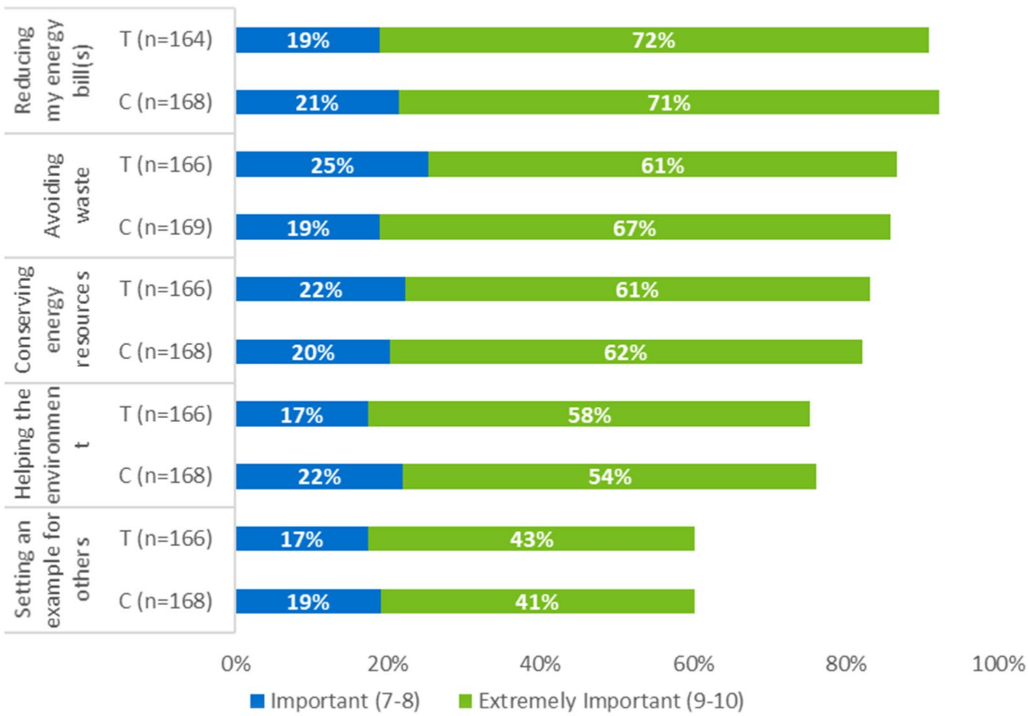


Figure 4-23: "How Important Is It for You to Know if Your Household is Using Energy Wisely?" – Multi-family Split Top-4 Box Scores (0-10 Scale)



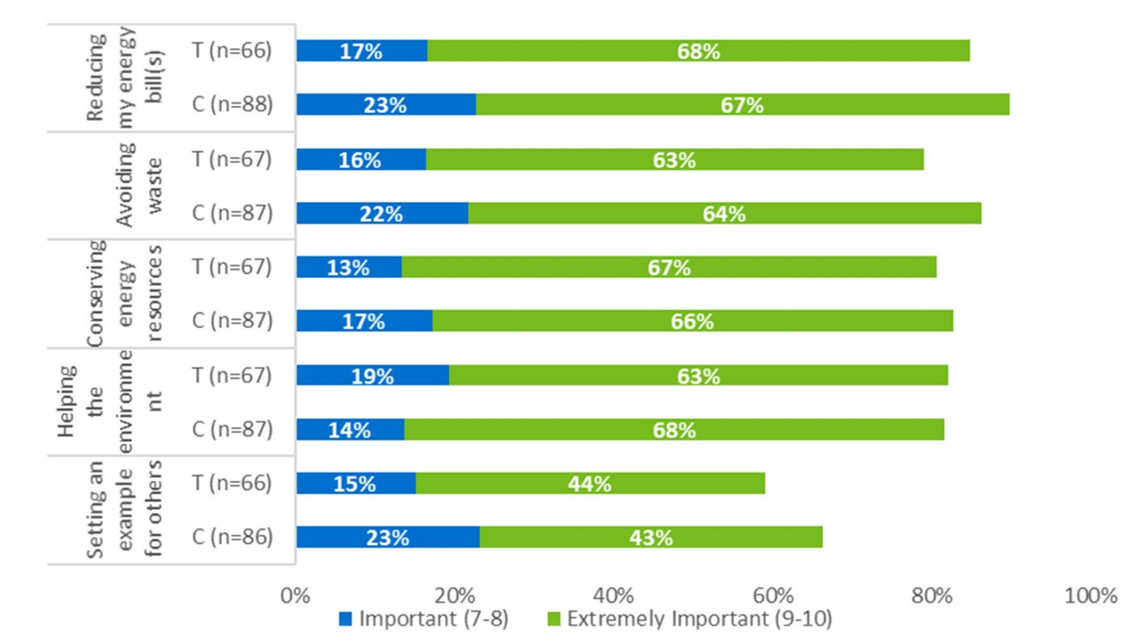
Customers were asked to rate, on a scale of 0 to 10, the importance of various reasons why they might try to reduce their home's energy use. The strongest motivation for both treatment and control groups is saving money on their energy bills. For single family, 91% of treatment respondents and 92% of control respondents reported that saving money on their energy bills was "important" or "extremely important" (rated 7 or higher on a 0-10 point scale). Eighty-six percent of treatment respondents and 86% of control respondents indicated that "avoiding waste" was "important" or "extremely important" to them. Eighty-three percent of treatment customers and 82% of control customers reported that "conserving energy resources" was "important" or "extremely important". Seventy-five percent of treatment customers and 76% of control customers reported that "helping the environment" was "important" or "extremely important". None of the differences between treatment and control groups are statistically significant. Figure 4-24 contains the frequency of responses to this question, shown as a percentage for both treatment and control groups.

Figure 4-24: "Please Indicate How Important Each Statement Is to You" – Single Family Split Top-4 Box Scores (0-10 Scale)



For multi-family, 85% of treatment respondents and 90% of control respondents reported that saving money on their energy bills was "important" or "extremely important" (rated 7 or higher on a 0-10 point scale). Seventy-nine percent of treatment customers and 86% of control customers reported that "avoiding waste" was "important" or "extremely important". Eighty percent of treatment respondents and 83% of control respondents indicated that "conserving energy resources" was "important" or "extremely important" to them. Eighty-two percent of treatment customers and control customers, respectively, reported that "helping the environment" was "important" or "extremely important". None of the differences are statistically significant at the 90% level of confidence. Figure 4-25 contains the frequency of responses to this question, shown as a percentage for both treatment and control groups.

Figure 4-25: "Please Indicate How Important Each Statement Is to You" – Multi-family Split Top-4 Box Scores (0-10 Scale)



As indicated by Figure 4-26 and Figure 4-27, among single family treatment customers, 71% of treatment group customers rated their knowledge regarding ways to save energy in the home at least seven on a 0-10 point scale (indicating they were "knowledgeable" or "extremely knowledgeable"), while 61% of control group customers rated themselves this way. The difference between treatment and control customers is statistically significant at the 90% level of confidence. Among multi-family customers, 62% of treatment respondents and 63% of control respondents rated themselves seven or higher on this scale. The difference is not statistically significant at the 90% level of confidence.

Figure 4-26: "How Would You Rate Your Knowledge of the Different Ways You Can Save Energy in Your Home?" – Single Family Split Top-4 Box Scores (0-10 Scale)

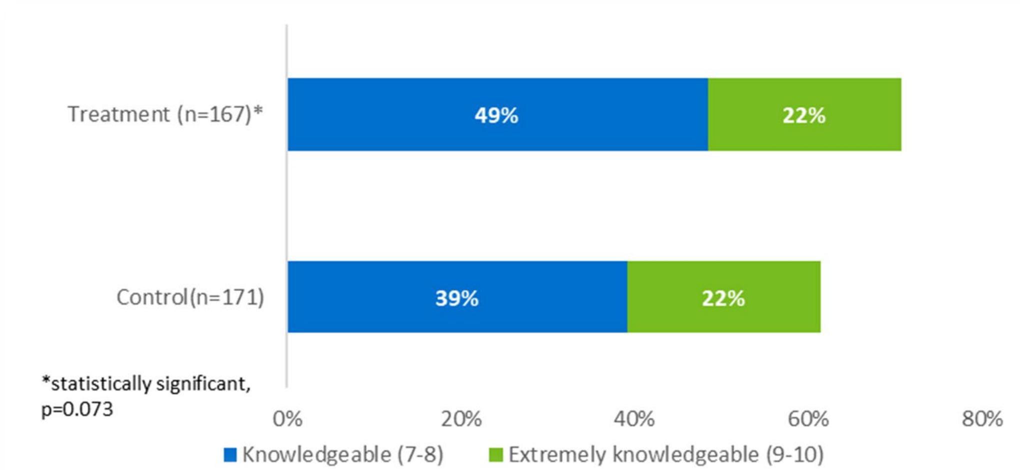
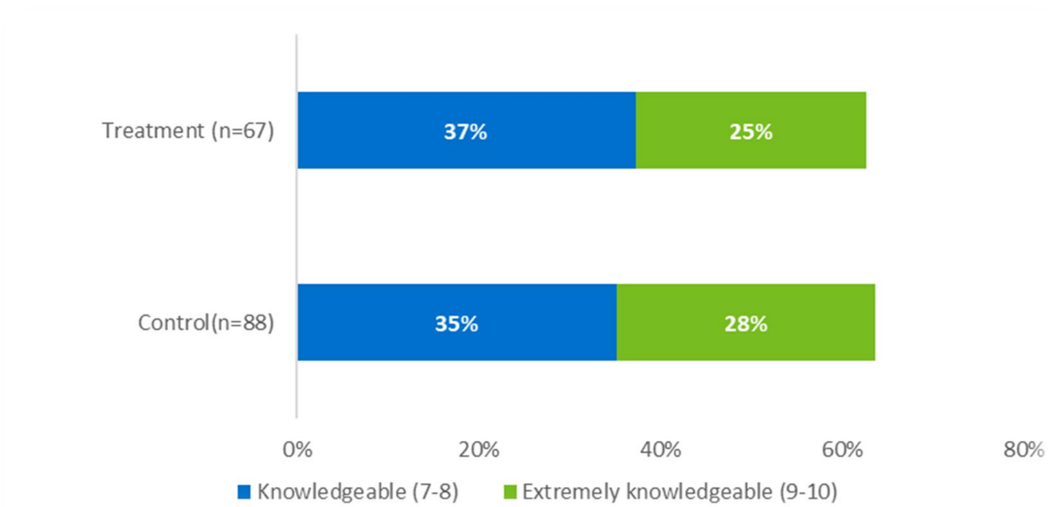


Figure 4-27: "How Would You Rate Your Knowledge of the Different Ways You Can Save Energy in Your Home?"– Multi-family Split Top-4 Box Scores (0-10 Scale)



Respondents that took the treatment-only survey were asked how useful each MyHER feature was to their homes. A similar question was asked of primary survey respondents, but rephrased to ask them how useful they might expect that information to be. Table 4-9 presents the comparison results between the actual usefulness of each item rated by treatment customers (treatment only survey) and the hypothetical usefulness rated by control customers in the primary survey for both sets of respondents who answered "7" or above on a scale from 0-10.

This table shows that among single family customers, control customers were significantly more likely to think that "Tips to help you save money and energy" and "Information about services and offers from Duke Energy" might be useful, than treatment customers actually thought they were. Among multi-family customers, control customers were significantly more likely to think that "information about services and offers from Duke Energy" might be useful, than treatment customers actually thought it was. These findings suggest that there may be an opportunity to improve the presentment of this information in MyHERs, about Duke Energy's services and offerings.

Table 4-9: Actual Usefulness versus Hypothetical Usefulness of HER Features Top-4 Box Scores (0-10 Scale)

HER Feature	Single Family		Multi-family	
	Control	Treatment Only	Control	Treatment Only
Graphs that display your home's energy use over time	67% (n=160)*	80% (n=114)*	67% (n=86)	71% (n=66)
Energy use associated with specific household items and areas	67% (n=160)	57% (n=115)	58% (n=86)****	73% (n=66)****
Tips to help you save money and energy	75% (n=165)**	54% (n=115)**	73% (n=86)	66% (n=65)
Customized suggestions for your home	56% (n=162)	53% (n=113)	56% (n=85)	57% (n=65)
Information about services and offers from Duke Energy	65% (n=164)***	50% (n=114)***	68% (n=87)*****	48% (n=66)*****
Comparison to similar homes	52% (n=160)	44% (n=115)	58% (n=85)	51% (n=65)

*statistically significant, p=0.018
**statistically significant, p=0.000
***statistically significant, p=0.015
****statistically significant, p=0.063
*****statistically significant, p=0.010

Barriers to Customers Undertaking Energy Savings Actions

When asked the reasons why customers might not be able to save as much ~~as~~ energy as they would like, statistically different response patterns between treatment and control customers were found, as shown in Figure 4-28 and Figure 4-29. On a scale of 0-10, where 0 represents "not at all important" and 10 is "extremely important", forty percent of single family control respondents reported "I do not have enough information to make a decision or understand the impacts of making energy-efficient changes or improvements" as a barrier and 30% of treatment respondents did so as well (rated this importance as 7 or higher). The difference is statistically significant at the 90% level of confidence. For multi-family, 25% of treatment respondents and 35% of control respondents reported "Getting everyone in the house to cooperate is too hard" as a barrier. The difference is statistically significant at the 90% level of confidence. When single family and multi-family treatment group responses ~~to these questions~~ were compared, roughly half of multi-family respondents and single family respondents reported "Initial cost of energy efficient equipment is too high" as a barrier. The difference between single family and multi-family respondents is statistically significant at 90% level of confidence.

Figure 4-28: Barriers to Customers Undertaking Energy Savings Actions – Single Family Top-4 Box Scores (0-10 Scale)

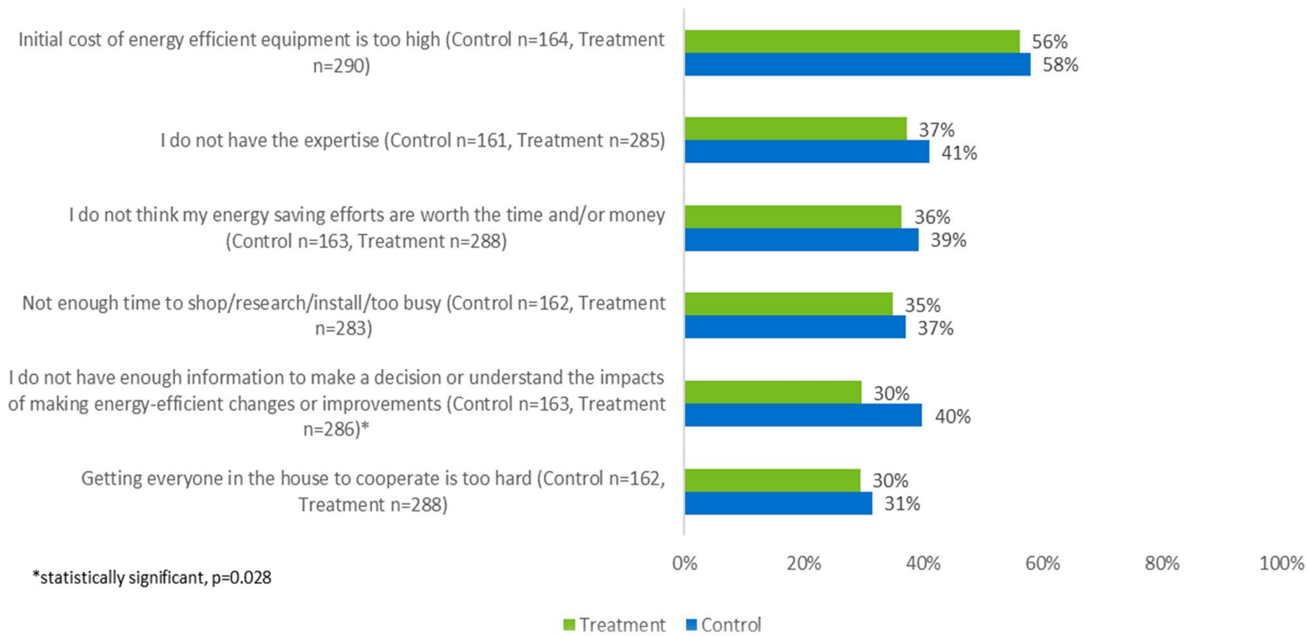
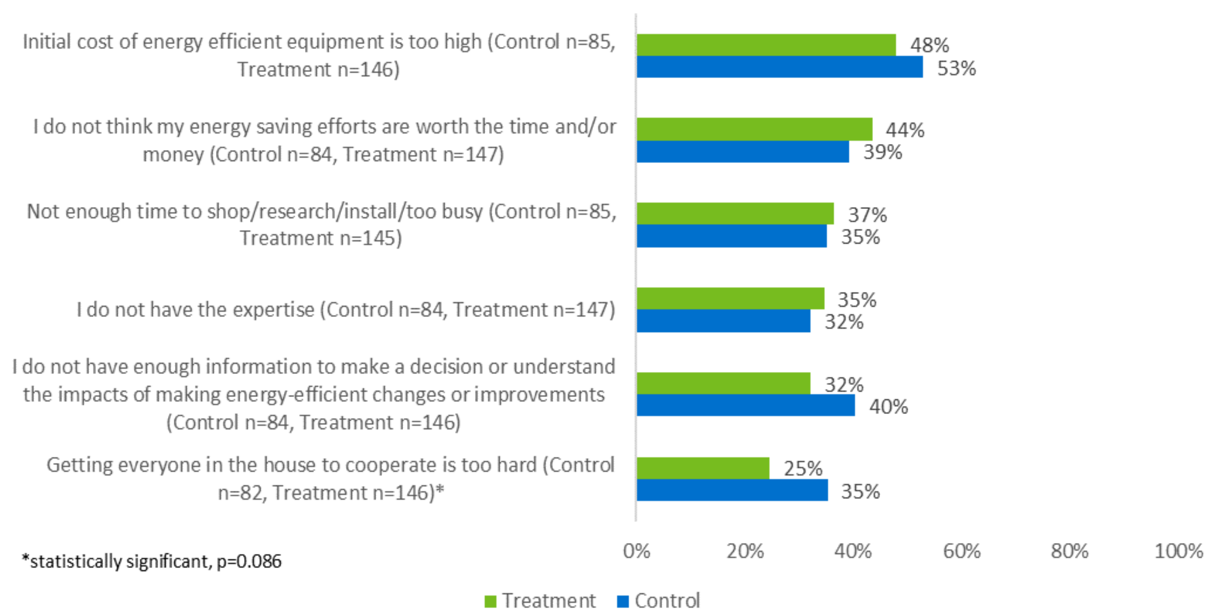


Figure 4-29: Barriers to Customers Undertaking Energy Savings Actions – Multi-family Top-4 Box Scores (0-10 Scale)



Suggestions about Duke Energy Improving Service Offerings

The survey provided an open-ended question to elicit suggestions about Duke Energy

improving its service offerings to help customers reduce energy use. Only 25% (179 of 718, treatment and control customers in total) offered suggestions, including 26 who offered only appreciative comments. Among those offering suggestions for improvement, the most common request, mentioned in 62 of the remaining 168 responses with suggestions, reflected a desire for more energy savings programs, more energy savings information, and more incentives:

- "*More options for low-cost LED bulbs. Rebates/coupons for energy efficient appliances/HVAC, fans*"
- "*Send LED light bulbs"*
- *"Offer suggestions on how to save on energy consumption"*
- *"Offer E.E. light bulbs more often. Reduce rates for low income households."*
- "*Give more energy efficient items."*

Other comments centered on other suggestions, such as reducing prices/providing senior discounts and better communication. Nexant categorized these suggestions on the general basis of their content; the results are presented in Table 4-10.

Table 4-10: Responses to Solicitation for Suggestions to Duke Energy for Improving Service Offerings

Suggestion	Single Family			Multi-family		
	Count	Percent of Respondents Mentioning (n=120)	Percent of Total Mentions (n=130)	Count	Percent of Respondents Mentioning (n=59)	Percent of Total Mentions (n=65)
Increase program offerings, incentives, or information	40	33%	31%	22	37%	34%
Appreciate current offers	20	17%	15%	7	12%	11%
Voiced frustration with Duke Energy	18	15%	14%	2	3%	3%
Reduce Price/provide senior discounts	16	13%	12%	11	19%	17%
Provide more detailed info in MyHER	15	13%	12%	8	14%	12%
Better Communication/More Emails/More mails/In-person communication	11	9%	8%	2	3%	3%
Miscellaneous	8	7%	6%	11	19%	17%
Reduce Power Outages	1	1%	1%	1	2%	2%
Improve website/app	1	1%	1%	1	2%	2%

4.2.2.2 Treatment Households: Experience and Satisfaction with MyHER

A very large majority of the single family treatment only household respondents, 95%, (124 of 131), and the multi-family treatment only household respondents, 95%, (77 of 81) recalled receiving at least one of the MyHER reports.

The survey asked those that could recall receiving at least one MyHER report if they could recall how many individual reports they had received "in the past 12 months" (Figure 4-30 and

Figure 4-31). Given Duke Energy's protocols for report delivery, respondents who receive paper HERs would receive eight reports (single family respondents) and up to six reports (multi-family respondents) in this time period, and those who receive eHERs would have received 12. Fifty percent (59 of 118) of single family customers responded that they received 12 home energy reports in the past 12 months. Twenty-nine percent (20 of 70) of multi-family customers responded that they received 12 home energy reports in the past 12 months. The scattered distribution of responses related to recall is consistent with the difficulty of recalling an exact number of reports, however the question is valuable for grounding respondents in the experience of receiving a MyHER before asking them more specific questions about the document. We note the response pattern for single family respondents is significantly different than that of multi-family respondents.

Figure 4-30: Reported Number of MyHERs Received "In the past 12 months" (n=118) Single Family

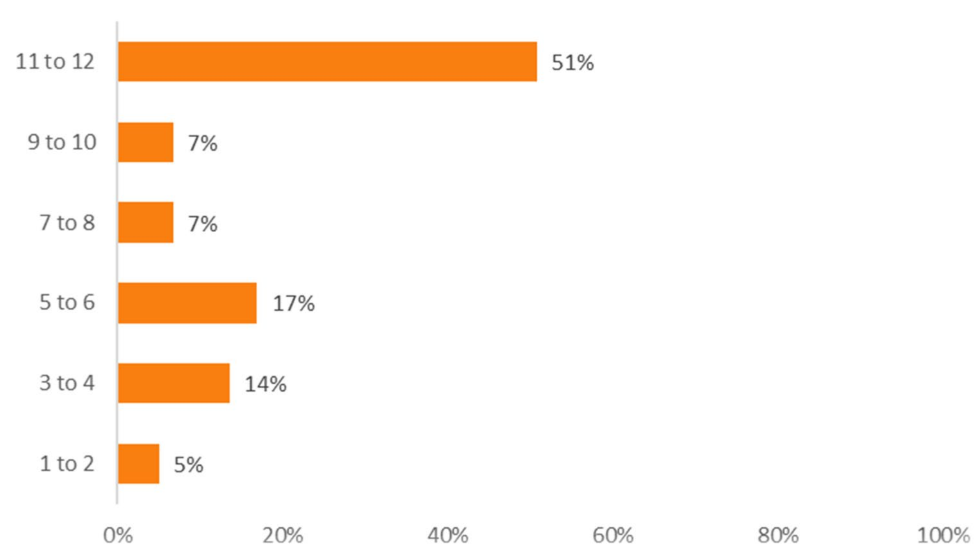
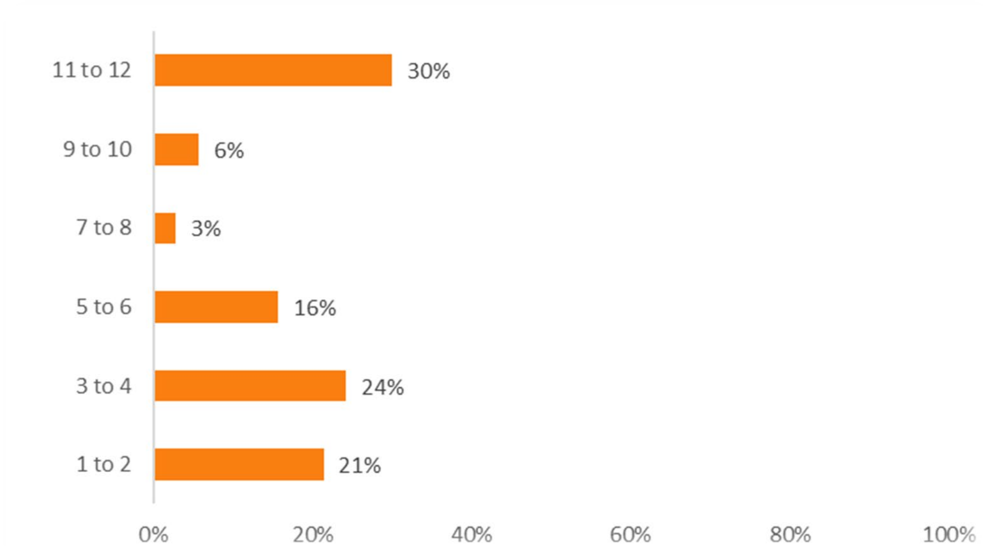


Figure 4-31: Reported Number of MyHERs Received "In the past 12 months" (n=70) Multi-family



Survey respondents indicated high interest in the MyHER reports. As shown in Figure 4-32 and Figure 4-33, when asked how often they read the reports, 98% of single family respondents indicated they "always" or "sometimes" read the reports, and 94% of multi-family respondents indicated they "always" or "sometimes" read them.

Figure 4-32: How Often Customers Report Reading the MyHER (n=117) – Single Family

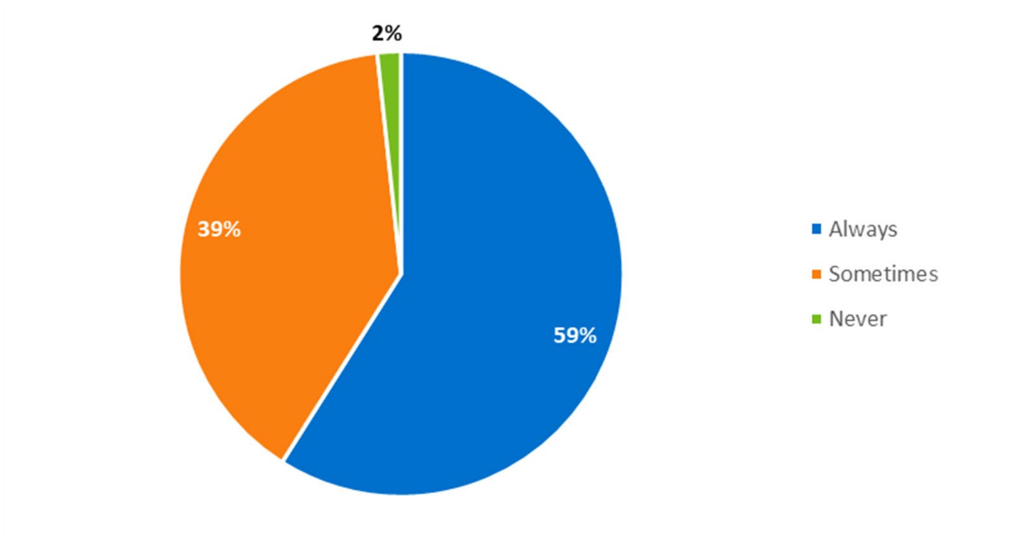
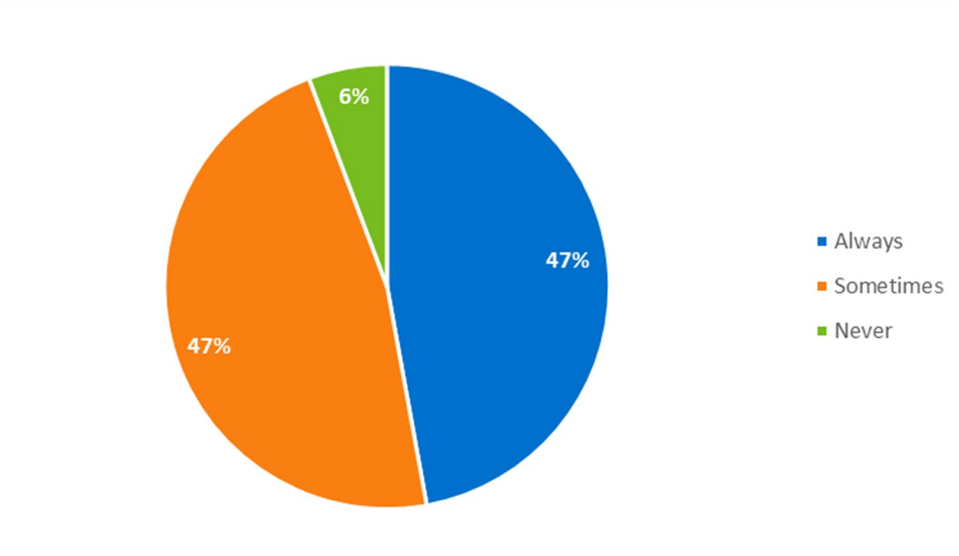


Figure 4-33: How Often Customers Report Reading the MyHER (n=70) – Multi-family



Fifty-nine percent (77 of 113) of single family respondents that provided a rating reported being “somewhat” or “very” satisfied with the information contained in the reports (Figure 4-34). Seventy-two percent (46 of 64) of multi-family respondents that provided a rating reported being “somewhat” or “very” satisfied with the information contained in the reports (Figure 4-35). The survey asked a further question to the respondents of why they said so: 8 of the satisfied single family respondents and 4 of the satisfied multi-family respondents provided reasons. Among customers who gave the highest satisfaction ratings, the most common comments on the MyHERs described the reports as “helpful.”

Figure 4-34: Satisfaction with the Information in MyHER Reports (n=113) – Single Family

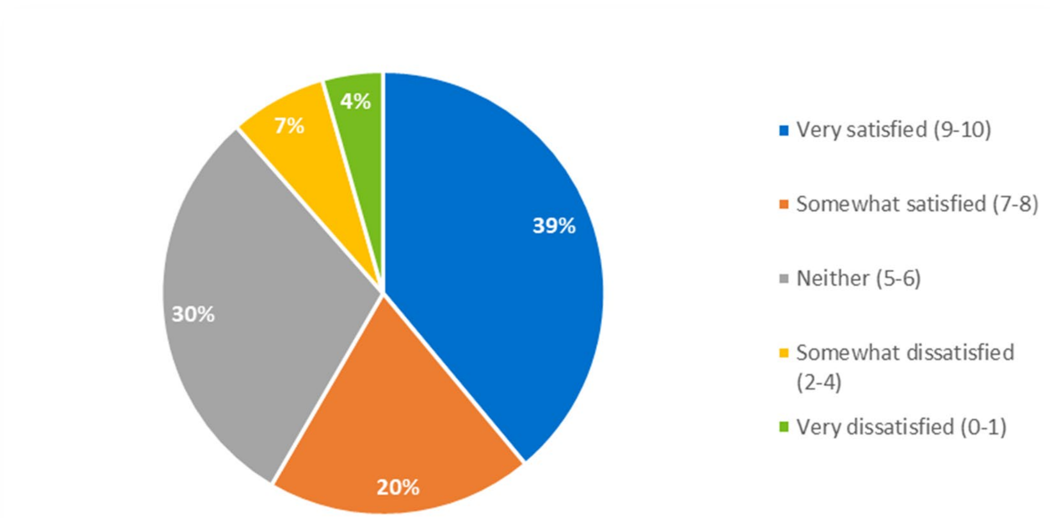
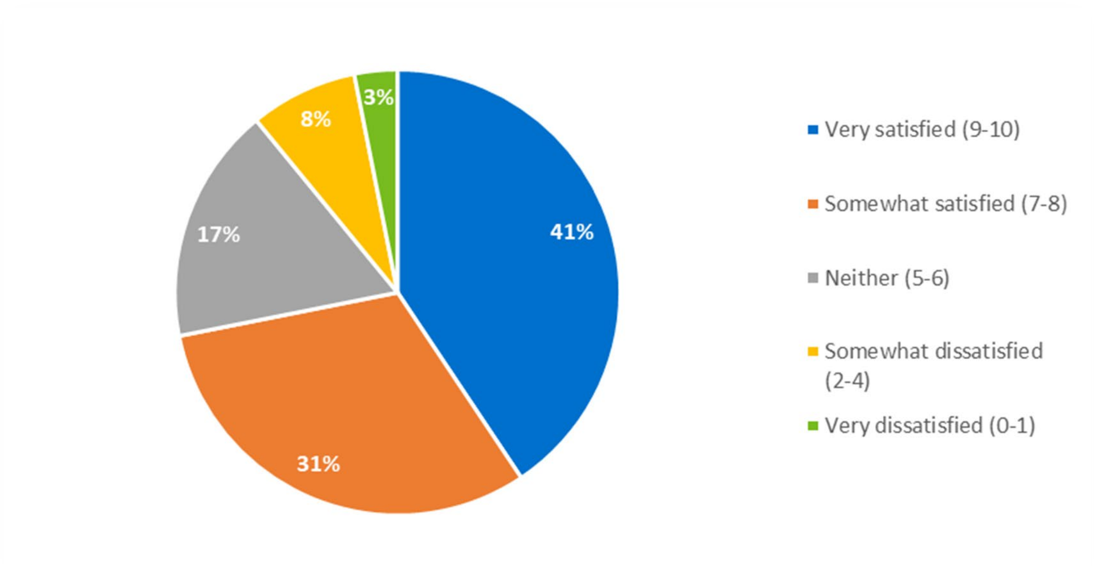


Figure 4-35: Satisfaction with the Information in MyHER Reports (n=64) – Multi-family

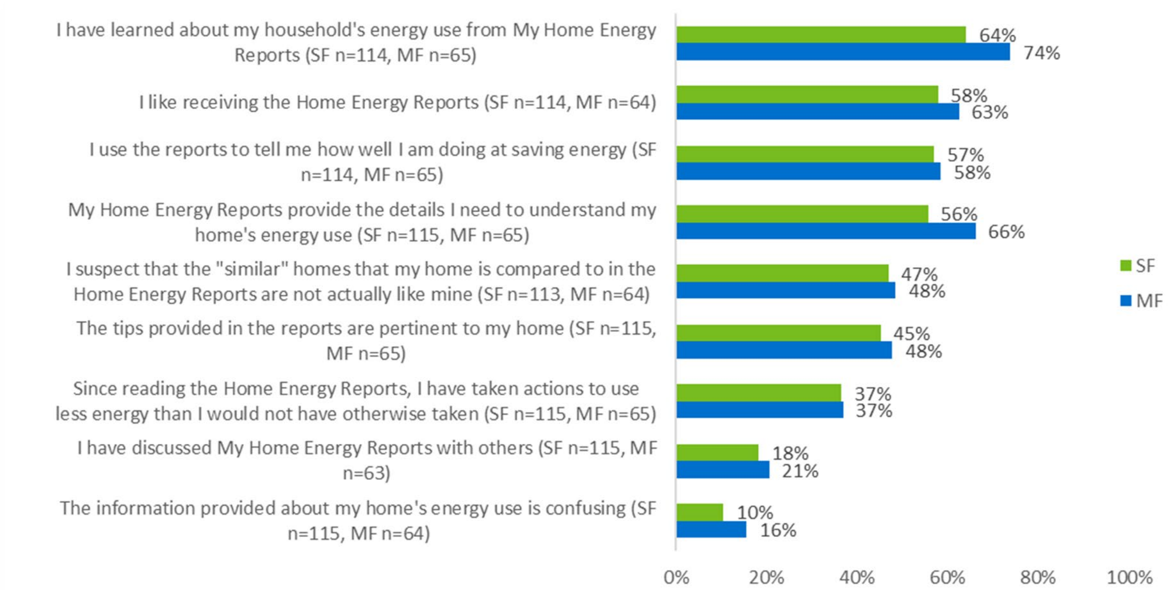


When asked to rate their agreement with a series of statements about MyHERs on a scale of 0 to 10, recipients largely agreed that the reports helped them understand their home's energy use, with 64% of single family respondents and 74% of multi-family respondents rating their agreement a seven or higher on a 0-10 point scale.

Fifty-eight percent of single family respondents and 63% of multi-family respondents agreed that they like receiving the home energy reports; this difference is not statistically significant at the 90% level of confidence.

More than half (56% of single family respondents and 66% of multi-family respondents) agreed that the reports provided the details they needed to understand their home's energy usage. The difference here between single family and multi-family respondents is not statistically significant. Respondents provided weaker agreement to statements about the pertinence of the tips provided to their homes and whether they have taken actions to use less energy than they would not have since reading MyHERs. A relatively small percentage (10% of single family respondents and 16% of multi-family respondents) agreed with the statement that the information provided is confusing; the difference is not statistically significant at the 90% level of confidence (Figure 4-36).

Figure 4-36: Level of Agreement with Statements about MyHER Top-4 Box Scores (0-10 Scale)



The survey provided an open-ended question (to customers that reported reading at least one report in the past year) to elicit suggestions for improvements to the MyHER reports. About 41% (47 of 115) of single family respondents and 26% (17 of 66) of multi-family respondents offered suggestions, including 7 single family respondents and 5 multi-family respondents who offered comments to express gratitude and appreciation of the reports only. Among those providing a response to the question, the most common response, mentioned by 17 of the 40 single family respondents with suggestions and 6 of the 12 multi-family respondents with suggestions, reflected a desire for more specific information or details about their home and specific actions they should take. Some of these requests reflected interest in understanding at a more granular level how their home uses energy and how to reduce energy consumption information:

- "*Specific Instructions on how to reduce energy consumption in the highest used category would be most useful*"
- *"Provide better more realistic tips about how I can decrease my bill"*
- "*Give improvement suggestions on each report that we could implement and save energy*"

Other comments centered on unique circumstances, such as providing relevant information for people who live in an apartment (three multi-family respondents mentioned these circumstances):

- "*I live in an apartment and I was doing all of the suggestions before I received the report. I would like suggestions on things I can control in my apartment*"

- "*I live in an apartment and some of the suggestions don't apply to me…*"

Nexant categorized these suggestions on the general basis of their content; the results are presented in Table 4-11.

Table 4-11: Suggestions for HER Improvement (Multiple Responses Allowed)

Suggestion/Comment	Single Family			Multi-family		
	Count	Percent of Respondents Mentioning (n=47)	Percent of Total Mentions (n=51)	Count	Percent of Respondents Mentioning (n=17)	Percent of Total Mentions (n=20)
Provide more specific information or details	17	36%	33%	6	35%	30%
Don't believe comparison/accuracy	12	26%	24%	1	6%	5%
Appreciate the Home Energy Report	7	15%	14%	5	29%	25%
Format/Frequency	7	15%	14%	2	12%	10%
Unique circumstances	3	6%	6%	4	24%	20%
Other	1	2%	2%	0	0%	0%
Don't see value/dislike	2	4%	4%	2	12%	10%
Expressed frustration	2	4%	4%	0	0%	0%

Treatment households were also asked questions that focused on their awareness and use of MyHER Interactive, revealing low awareness of the online Interactive platform:

- Only 31% (35 of 112) of single family treatment customers and 52% (34 of 65) of multi-family treatment customers are aware of MyHER Interactive. The difference between single family and multi-family respondents is statistically significant at the 90% level of confidence;
- Among aware customers, 91% of single family respondents and multi-family respondents, respectively, reported that they had not signed up to use MyHER Interactive; and
- When these respondents were asked why they haven't signed up to use MyHER Interactive, among the respondents who gave the answers, 29% of single family respondents and 27% of multi-family respondents reported that they were not interested in it, 21% of single family respondents and 14% of the multi-family respondents said they were too busy, 14% of single family respondents and 27% of multi-family respondents reported that they did not know about it, and 18% of multi-family respondents reported that they did not use computer.

Evidence of MyHER Effects

As noted above, while formal statistical testing found some differences among treatment and control group households for individual questions, Nexant sought to understand if the overall pattern of survey responses differed among treatment and control households. To do this, we categorized each survey question by topic area and then counted any survey item in which the treatment households provided a more positive response than the control households.

Nexant's approach consists of the following logical elements:

- Assume the number of positive responses between treatment and control customers will be equal if MyHER lacks influence;
- Count the total number of topics and questions asked of both groups – there are seven topic areas and 51 questions;
- Note any item for which the treatment group outperformed the control group:
  - Single family: The treatment group outperformed the control group in 26 questions, or 51% of the total questions;
  - Multi-family: The treatment group outperformed the control group in 14 questions, or 27% of the total questions; and
- Calculate the probability that the difference in response patterns is due to chance, rather than an underlying difference in populations – 61% in the case of single family. Since this probability is much greater than 10%, we cannot reject the null hypothesis that the number of positive responses should be equal for treatment and control customers at the 90% level of confidence.

In comparing the response patterns between the treatment and control groups, if the MyHER program did not influence customers, one would expect the treatment group to "score higher" on roughly half of the questions. In other words, if the MyHER is not influencing treatment group customers, there is a 50/50 chance that they will "outperform" the control group as many times as not. What we see in the survey data overall is the proportion of questions indicating a positive MyHER effect very near 50% in the case of single family program participants. In fact, the proportion of questions where treatment customers showed a positive MyHER effect was a little higher than 50%, however not statistically different from 50% at the 90% level of confidence.

The survey data reveal that there are specific areas where MyHER has relatively stronger and weaker positive effects. These areas of strong and weak performance are different for single family and multi-family participants, as shown in Table 4-12 and Table 4-13. In the case of single family customers, receiving the MyHER is associated with lower customer motivation, engagement and awareness of energy efficiency, lower customer-reported energy savings behaviors, and lower satisfaction with Duke Energy. These results may indicate that opportunities exist for Duke Energy to leverage the reports and website as a vehicle for delivering different or new information and opportunities to MyHER recipients that would increase their satisfaction with Duke Energy overall. On the other hand, single family MyHER recipients had a more positive view in these surveys on Duke Energy's energy efficiency offerings and customer engagement with Duke Energy website, and they reported experiencing fewer barriers to take energy savings actions.

Unlike single family customers, in the case of multi-family customers, MyHER recipients reported higher satisfaction with Duke Energy than non-recipients. Multi-family MyHER recipients reported a similar level of experiencing barriers to take energy savings actions relative to non-recipients. Multi-family MyHER survey responses also indicated lower satisfaction on Duke Energy's energy efficiency offerings and lower customer engagement with Duke Energy website.

When considering all possible areas of enhancement that the MyHERs can have on customer attitudes and actions related to satisfaction and energy savings behaviors, we observe areas of relative strength and weakness that differ between single family and multi-family customers. This result further illustrates that the messaging and approach taken in the reports delivered to multi-family customers may differ from that used in the single family reports.

Table 4-12: Survey Response Pattern Index – Single Family

Question Category	Count of Ques. where T better than C	Number of Ques. in Topic Area	Portion of Ques. where T better than C
Duke Energy's Public Stance on Energy Efficiency	3	4	75%
Customer Engagement with Duke Energy Website	3	5	60%
Customer's Reported Energy-saving Behaviors	3	11	27%
Customer's Reported Energy Efficiency Improvements Made	5	10	50%
Customer Motivation, Engagement and Awareness of Energy Efficiency	5	11	45%
Barriers of Customer Not Undertaking Energy Savings Actions	6	6	100%
Customer Satisfaction with Duke Energy	1	4	25%
Total	**26**	**51**	**51%**

Table 4-13: Survey Response Pattern Index – Multi-family

Question Category	Count of Ques. where T better than C	Number of Ques. in Topic Area	Portion of Ques. where T better than C
Duke Energy's Public Stance on Energy Efficiency	1	4	25%
Customer Engagement with Duke Energy Website	1	5	20%
Customer's Reported Energy-saving Behaviors	2	11	18%
Customer's Reported Energy Efficiency Improvements Made	2	10	20%
Customer Motivation, Engagement and Awareness of Energy Efficiency	2	11	18%
Barriers of Customer Not Undertaking Energy Savings Actions	3	6	50%
Customer Satisfaction with Duke Energy	3	4	75%
Total	**14**	**51**	**27%**

Respondent Demographics

Nearly all single family respondents—93% of treatment group customers and 90% of control group customers—own their residence. Among multi-family respondents, 69% of treatment group customers and 68% of control group customers rent their residence. More than half of households surveyed have two or fewer residents for both single family and multi-family. For single family households, about 15% of treatment households and 17% of control households have four or more residents. For multi-family households, about 18% of treatment households and 14% of control households have four or more residents. There are no statistically significant differences in the distribution of ownership or age of homes assigned to the treatment and control groups for both single family and multi-family (Figure 4-37 and Figure 4-38).

Figure 4-37: "In What Year Was Your Home Built?" – Single Family

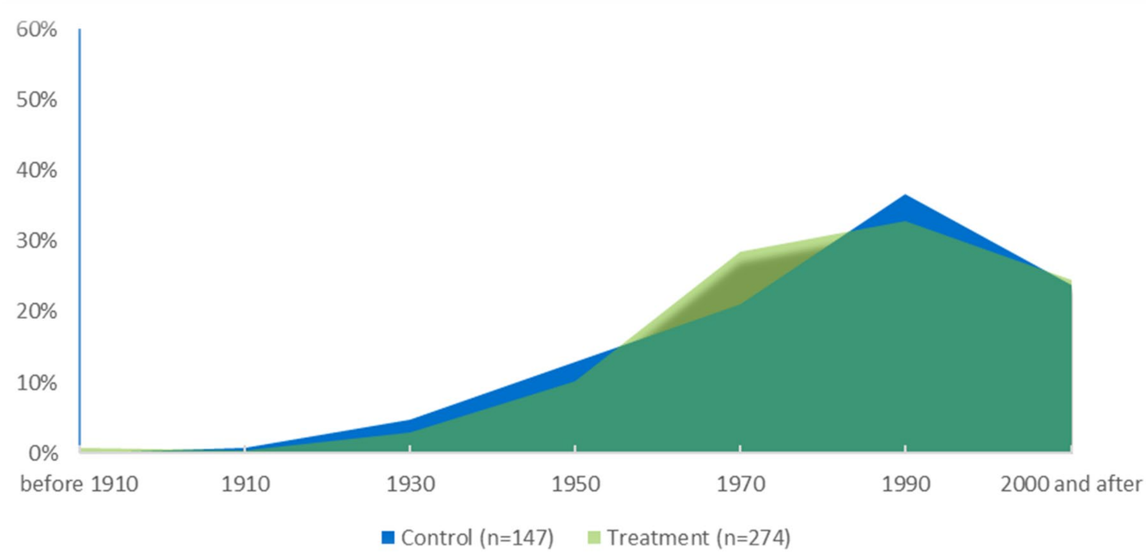


Figure 4-38: "In What Year Was Your Home Built?" – Multi-family

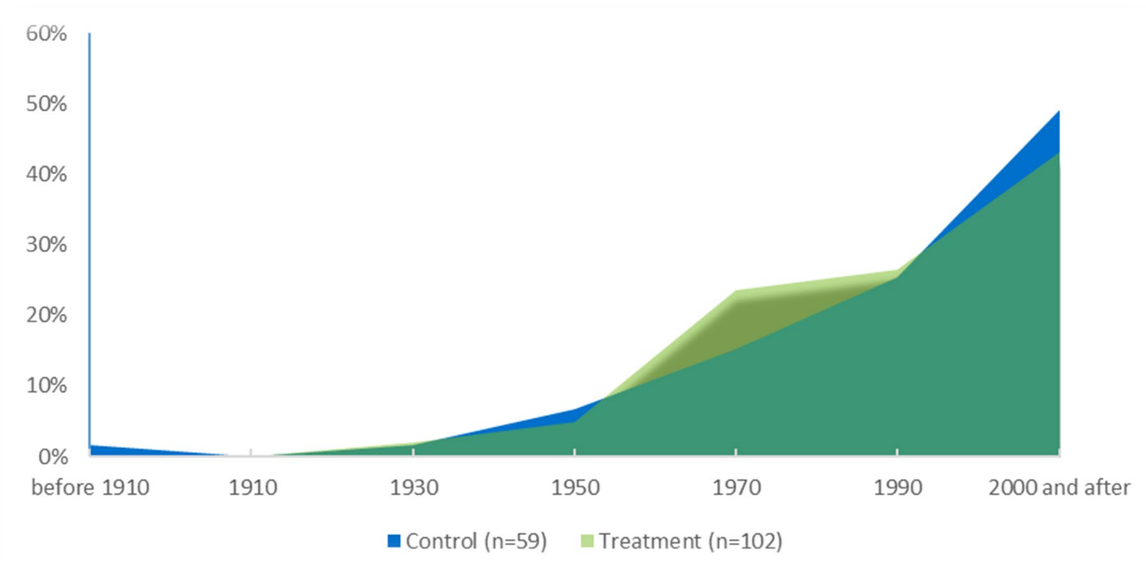


Figure 4-39 shows distribution of home square footage is similar between control and treatment group customers among single family households. The average square footage above ground is 2,055 for control households and 2,087 for treatment households, and the difference is not statistically significant. Figure 4-40 shows distribution of home square footage of control and treatment group customers among multi-family households. The average square footage above ground is 1,776 for control households and 1,419 for treatment households, and this difference is statistically significant at the 90% level of confidence. However, when the outliers in the 5,000-9,999 square feet bin are excluded, the differences in mean square footages are no longer statistically significant.

Figure 4-39: How many square feet is above ground living space? – Single Family

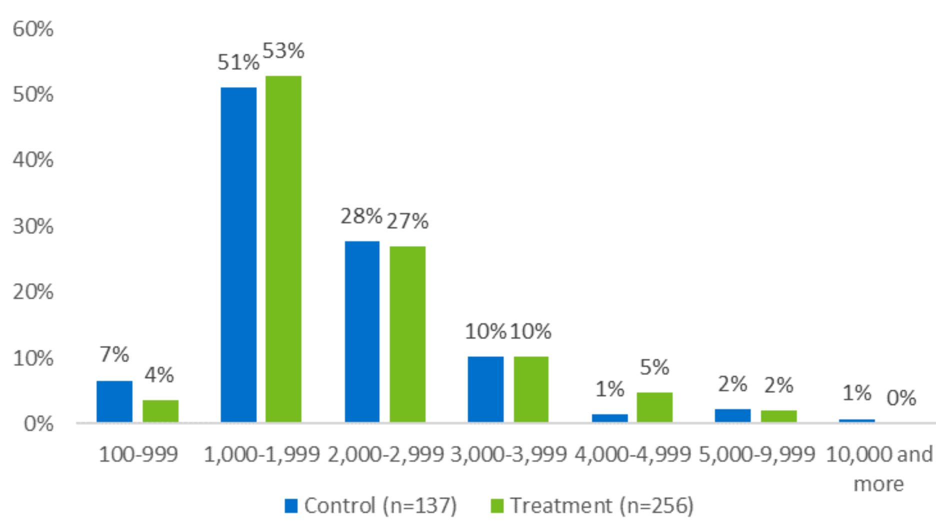
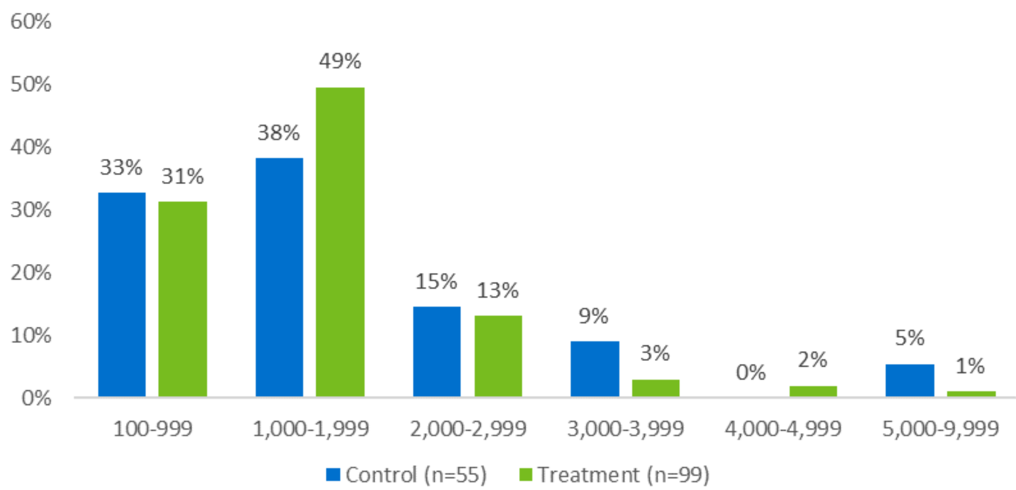


Figure 4-40: How many square feet is above ground living space? – Multi-family



The average age for single family respondents is 63 for control customers and 64 for treatment customers. For multi-family respondents it is 52 for control customers and 51 for treatment customers. The lowest age category (Younger than 25) is often underrepresented in survey studies, given that many members of that population are difficult to draw to participate in surveys. This common underrepresentation is true in this survey study, as well (see Table 4-14).

Table 4-14: Respondent Age Relative to RECS or American Housing Survey

Age	Single Family			Multi-family		
	Control Group (n=156)	Treatment Group (n=274)	EIA RECS Data_South Atlantic Census Division[18]	Control Group (n=83)	Treatment Group (n=140)	American Housing Survey[19]
Younger than 25	1%	0%	6%	0%	0%	10%
25-34	3%	3%	14%	19%	18%	30%
35-44	12%	9%	15%	25%	25%	23%
45-54	11%	12%	20%	5%	17%	19%
55-64	26%	21%	20%	23%	16%	9%
65 and over	47%	54%	26%	28%	24%	9%

Figure 4-41 shows the primary heating fuel type used in single family control and treatment households. More than half of treatment (53%) and control (53%) customers use electricity in

[18] 2015 Residential Energy Consumption Survey (RECS). https://www.eia.gov/consumption/residential/data/2015/hc/php/hc9.8.php

[19] American Housing Survey, 2011 Charlotte - Household Demographics - All Occupied Units, Charlotte-Gastonia-Rock Hill, NC-SC MSA (1993 OMB definition), Tenure Filter: Renter, https://www.census.gov/programs-surveys/ahs/data/interactive/ahstablecreator.html?s_areas=16740&s_year=2011&s_tablename=TABLE8A&s_bygroup1=1&s_bygroup2=1&s_filtergroup1=3&s_filtergroup2=1

their households for heating. Forty percent of treatment customers and 38% of control customers use natural gas for heating. The difference is not statistically significant.

Figure 4-41: Primary Heating Fuel in Households – Single Family

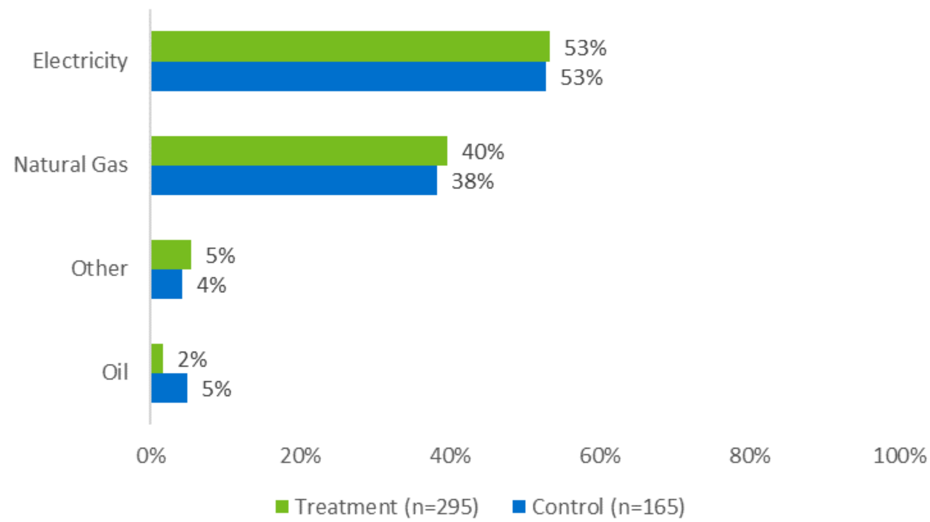


Figure 4-42 shows the primary heating fuel type used in multi-family control and treatment households. More than half of treatment (80%) and control (78%) customers use electricity in their households for heating. Sixteen percent of treatment customers and 19% of control customers use natural gas for heating. These differences are not statistically significant.

Figure 4-42: Primary Heating Fuel in Households – Multi-family

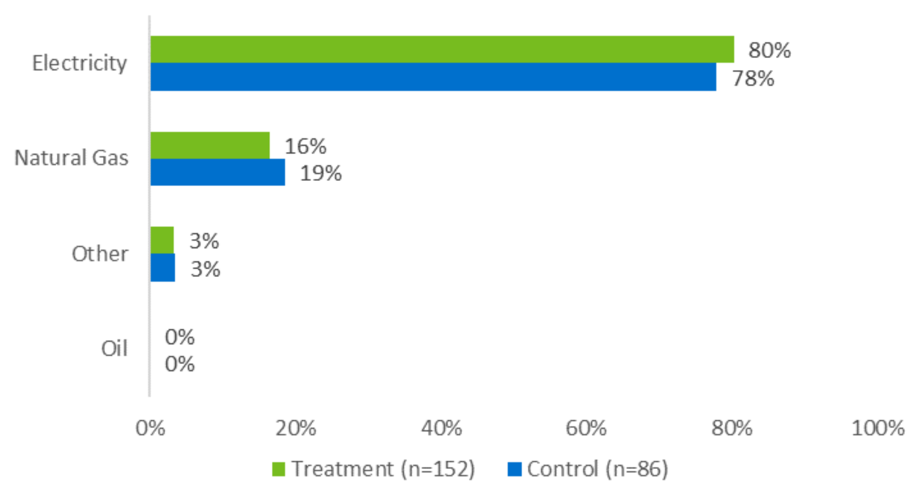


Table 4-15 shows the distribution of total annual household income in single family and multi-family households. Fifteen percent of single family treatment customers and 24% of control customers reported their household income between $50,000 and $ 75,000 in 2020. For the multi-family households, 15% of treatment and 16% of control customers reported their 2020 household income in this income bracket.

Table 4-15: 2020 Total Annual Household Income

2020 Annual Income	Single Family		Multi-family	
	Control (n=144)	Treatment (n=247)	Control (n=81)	Treatment (n=138)
Under $15,000	10%	7%	15%	17%
$15,000 to under $25,000	9%	11%	11%	12%
$25,000 to under $35,000	6%	7%	7%	12%
$35,000 to under $50,000	17%	16%	26%	21%
$50,000 to under $75,000	24%	15%	16%	15%
$75,000 to under $100,000	9%	14%	10%	10%
$100,000 to under $150,000	18%	15%	10%	6%
$150,000 to under $200,000	4%	9%	2%	1%
$200,000 or more	3%	7%	2%	7%

4.2.3 Customer Surveys – DEP

As was the case for DEC, the DEP customer surveys included questions focused specifically on the experience of and satisfaction with the information provided in MyHERs and awareness of MyHER Interactive—these questions were asked only of households in the treatment group.

Both treatment and control households answered the remaining questions, which focused on assessing:

- Awareness of Duke Energy efficiency program offers;
- Satisfaction with the Duke Energy, and services Duke Energy provides to help households manage their energy use;
- Levels of awareness of and interest in household energy use; motivations and perceived importance;
- Reported behavioral or equipment-based upgrades; and
- Barriers that prevent customers from undertaking energy savings actions.

4.2.3.1 Comparing Treatment and Control Responses - DEP

This section presents the results of responses to survey questions asked of both treatment and control households of single family and multi-family households in DEP, and compares the response patterns of each, respectively. In addition, comparative analyses between single family and multi-family customers are included where pertinent. Statistically significant differences between treatment and control households, and between single family and multi-family households, are noted when they occur.

Duke Energy Customer Satisfaction

Both single family and multi-family treatment and control groups' overall satisfaction with Duke Energy are high. For single family, 81% of treatment customers and 78% of control customers are satisfied or very satisfied with Duke Energy as their electric supplier (rated 8 or higher on a 0-10 point scale). The difference is not statistically significant at the 90% level of confidence. For multi-family, 79% of treatment customers and 89% of control customers are satisfied or very satisfied with Duke Energy as their electric supplier (rated 8 or higher on a 0-10 point scale). This difference is statistically significant at the 90% level of confidence.

Respondents were asked if they “strongly disagree”, “disagree”, “neither agree nor disagree”, “agree”, or “strongly agree” that Duke Energy provides excellent customer service, respects its customers, and provides service at a reasonable cost. Single family treatment households are more likely to “agree” or “strongly agree” that Duke Energy respects its customers and Duke Energy provides service at a reasonable cost than control households, but none of the differences are statistically significant at the 90% level of confidence (Figure 4-43). Multi-family treatment households are more likely to report that Duke Energy respects its customers, than control households. The difference is not statistically significant (Figure 4-44).

Figure 4-43: Satisfaction with Various Aspects of Customer Service – Single Family Top-2 Box Scores (1-5 Scale)

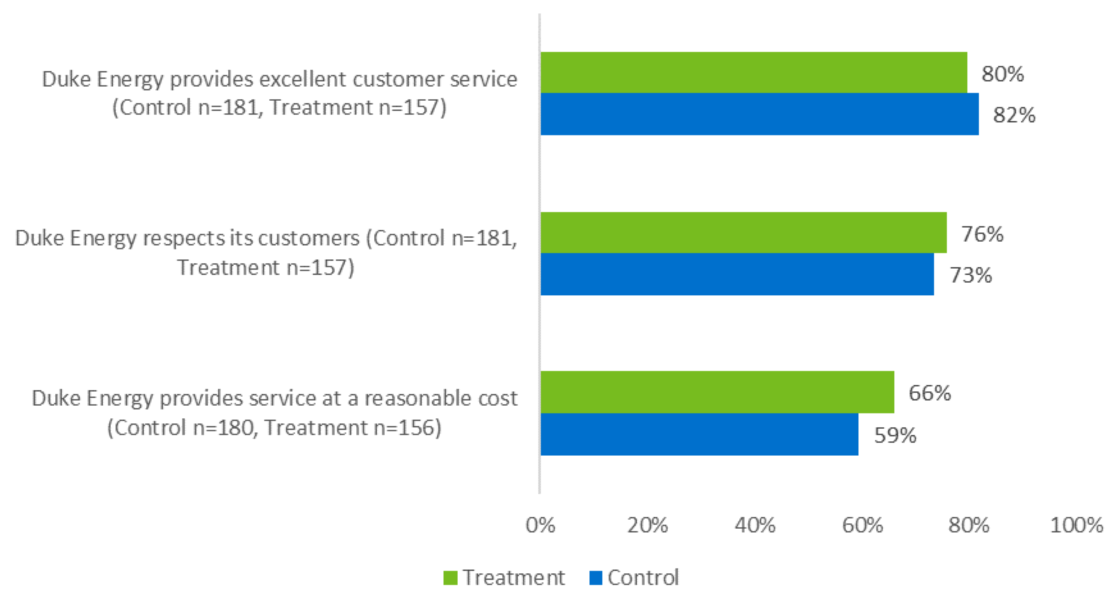
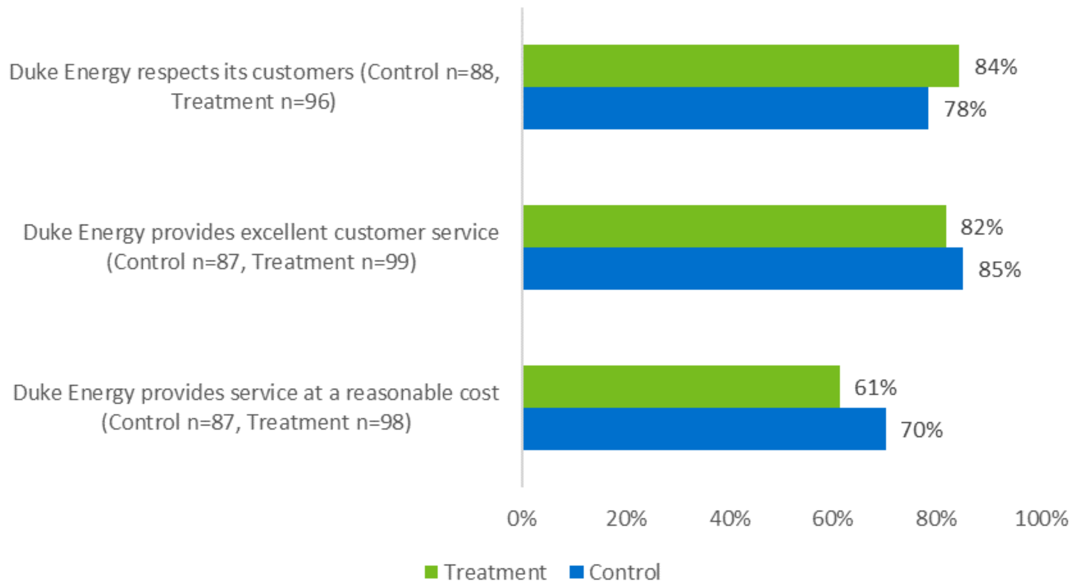


Figure 4-44: Satisfaction with Various Aspects of Customer Service – Multi-family Top-2 Box Scores (1-5 Scale)



Using a five point scale, "very dissatisfied", "dissatisfied", "neither dissatisfied nor satisfied", "somewhat satisfied", and "very satisfied", single family treatment customers are more likely to report that they are either "somewhat satisfied" or "very satisfied" with Duke Energy's commitment to promoting energy efficiency and the wise use of electricity, and the information available about Duke Energy's energy efficiency programs than control customers (Figure 4-45). These differences are not statistically significant at the 90% level of confidence. MyHER has not measurably changed single family customer satisfaction with Duke Energy's promotion of energy efficiency at DEP. Multi-family control customers are significantly more likely to report higher level of satisfaction with the Information Duke Energy provides to help customers save on energy bills than treatment customers (Figure 4-46). Like single-family, MyHER has not measurably changed multi-family customer satisfaction with Duke Energy's promotion of EE.

Figure 4-45: Satisfaction with Energy Efficiency Offerings and Information – Single Family Top-2 Box Scores (1-5 Scale)

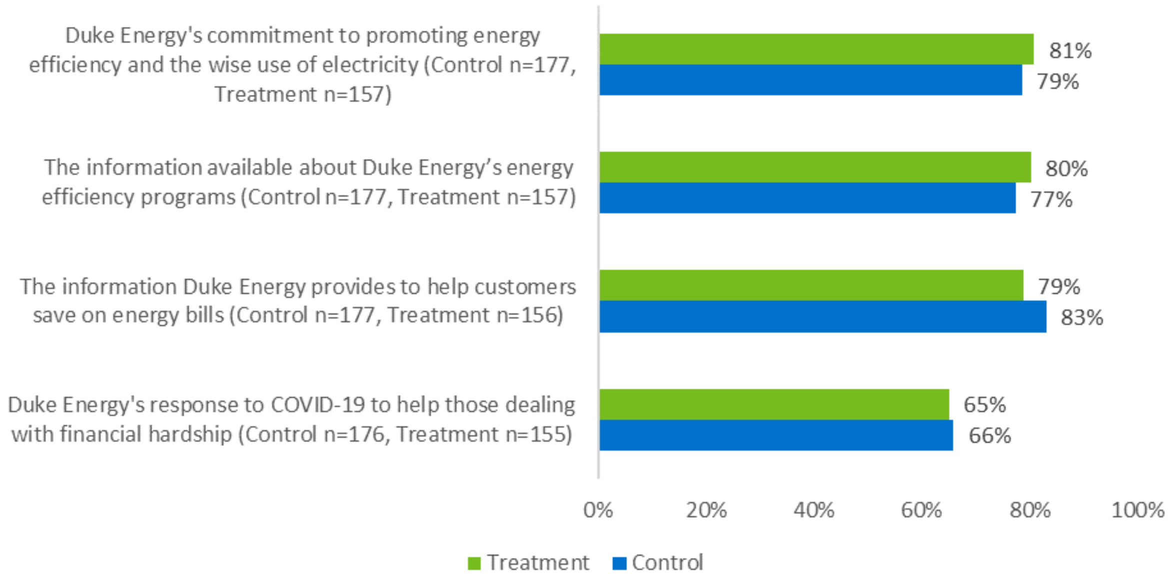
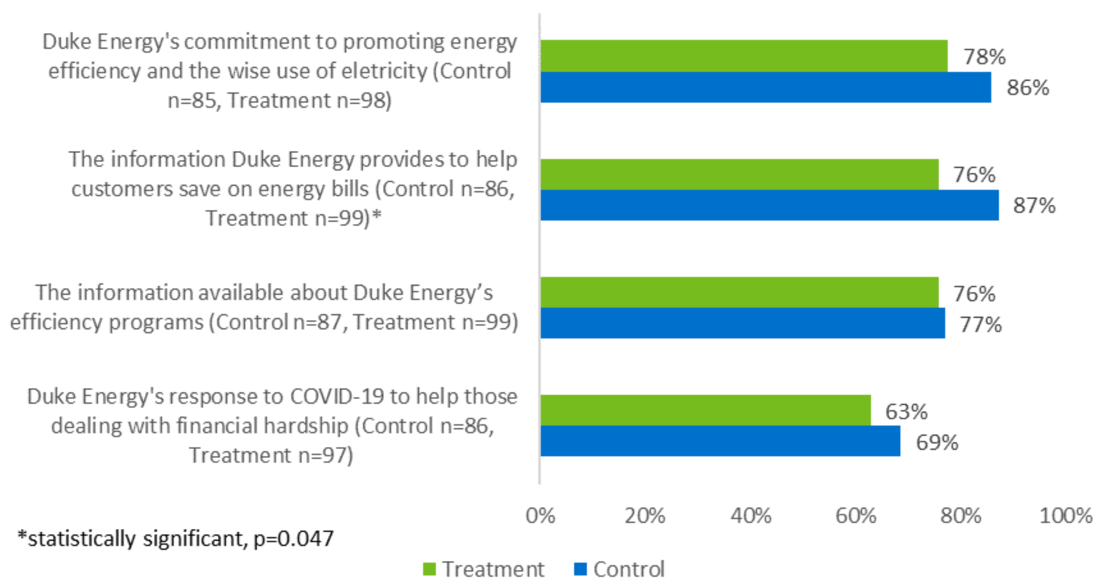


Figure 4-46: Satisfaction with Energy Efficiency Offerings and Information – Multi-family Top-2 Box Scores (1-5 Scale)



Engagement with Duke Energy's Website

Both treatment and control groups answered several questions about their use of the Duke Energy website, a proxy for overall engagement with information provided by the utility on energy efficiency and household energy use, and the results showed a similar level of using online accounts between treatment and control customers for both single and multi-family groups. Table 4-16 shows that 30% of single family treatment group and 37% of the control group, and 25% of multi-family treatment group and 25% of control group, reported they had never logged in to their Duke Energy accounts. Among those that had logged in, the most reported purpose was to pay their bill for both single family and multi-family respondents.

Table 4-16: Use of Duke Energy Online Account

Online Account Activity	Single Family		Multi-family	
	Treatment Group (n=158)	Control Group (n=181)	Treatment Group (n=99)	Control Group (n=88)
Never logged in	30%	37%	25%	25%
Pay my bill	37%	33%	56%	50%
Look for energy efficiency opportunities or ideas	15%	10%	24%	15%

As shown in Figure 4-47, single family treatment and control group households report similar levels of accessing the Duke Energy website to search for information about rebate programs, energy efficient products, or ways to make their home more energy efficient. This is also the case for multi-family control and treatment group households (Figure 4-48). Relatively small percentages of both groups in single and multi-family reported regular usage of the website for purposes other than bill payment.

Figure 4-47: Assessing Duke Energy Website for Other Information – Single Family

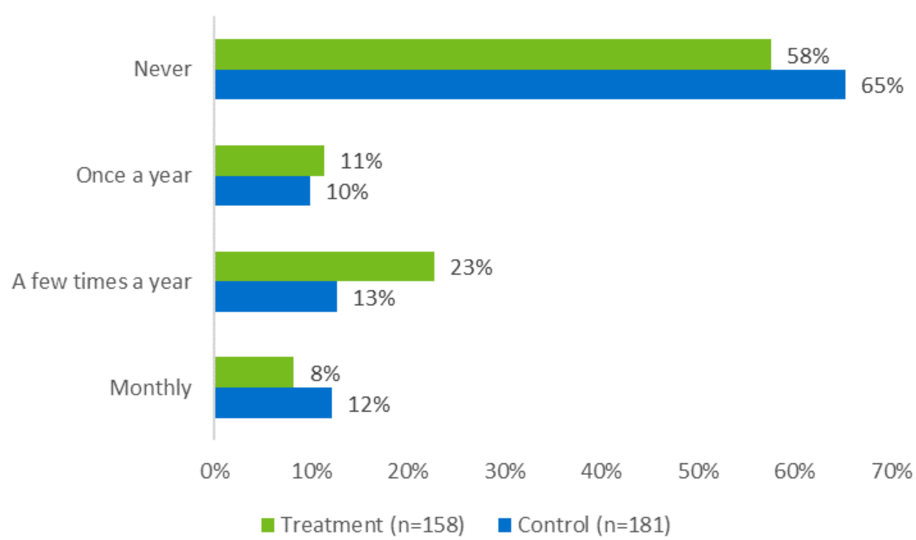
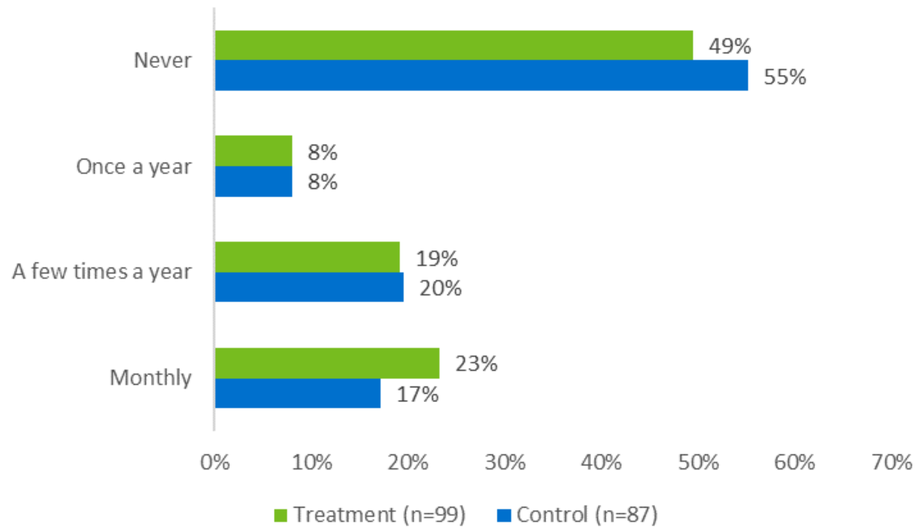


Figure 4-48: Assessing Duke Energy Website for Other Information – Multi-family



Thirty-five percent of single family control group customers and 33% of treatment group customers reported they would be likely to check the Duke Energy website for information before purchasing major household equipment, while 52% of multi-family control group customers and 51% of treatment group customers reported so. The portion of respondents rating their likelihood a “7” or higher on an 11-point scale of likelihood is plotted in Figure 4-49 and Figure 4-50.

Figure 4-49: Portion Likely to Check Duke Energy Website prior to Purchasing Major Home Equipment – Single Family – Split Top-4 Box Scores (0-10 Scale)

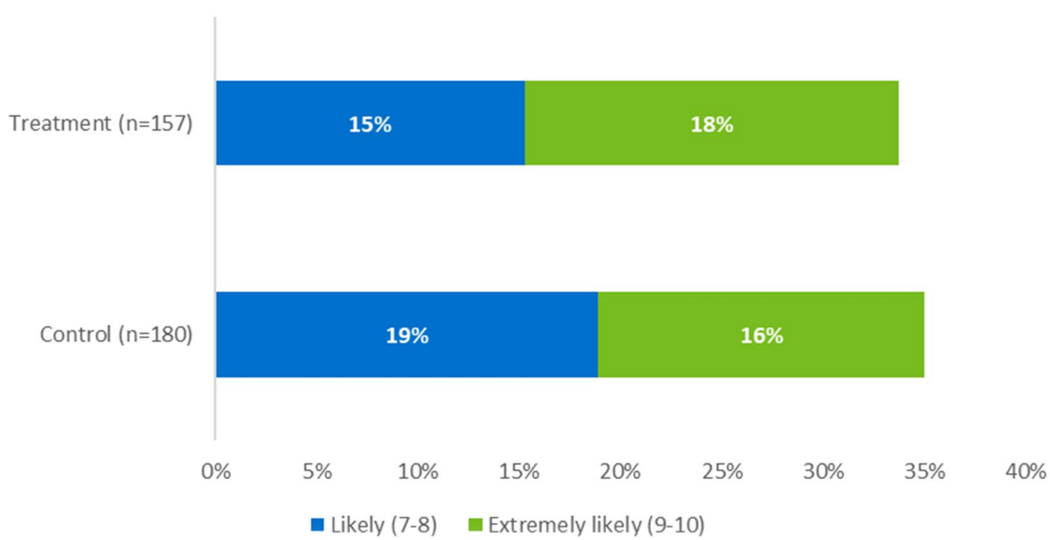
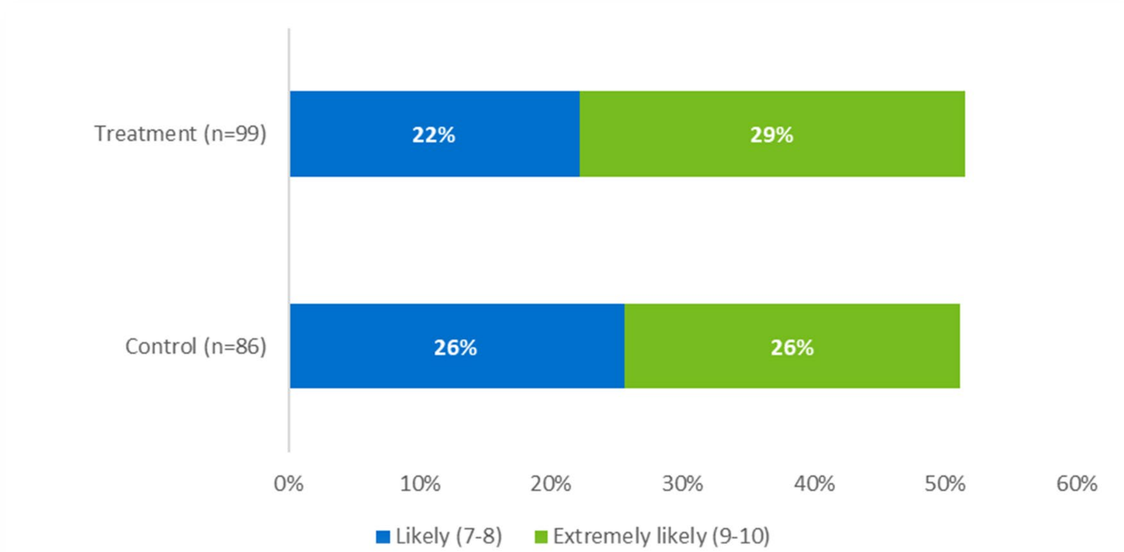


Figure 4-50: Portion Likely to Check Duke Energy Website prior to Purchasing Major Home Equipment – Multi-family – Split Top-4 Box Scores (0-10 Scale)

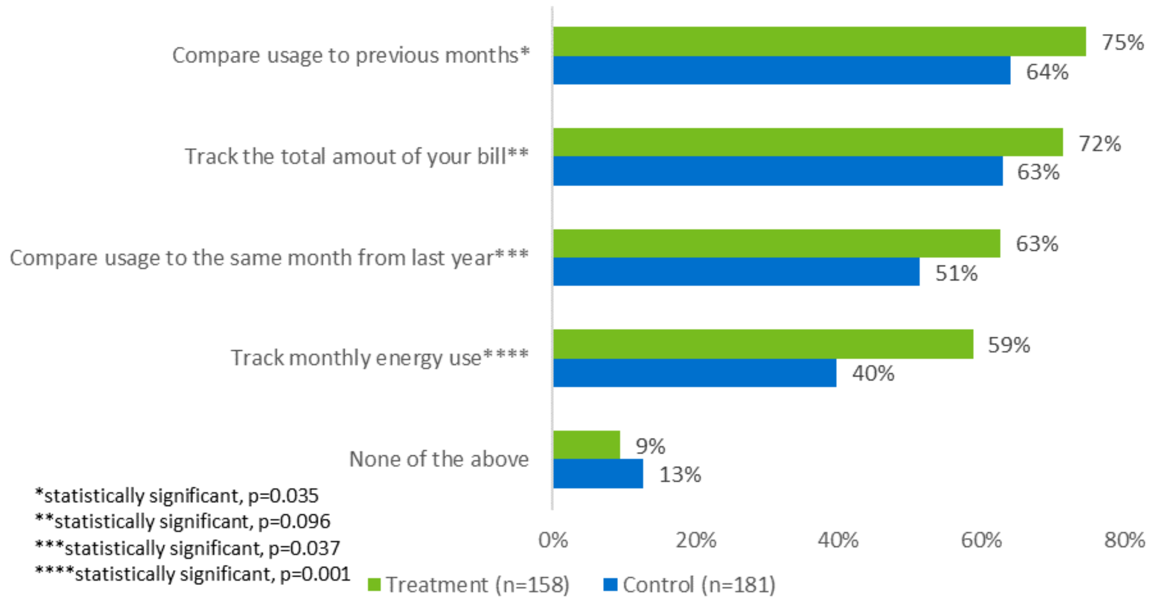


Customers' Reported Levels of Monitoring Energy Use and Energy Saving Behaviors

Single family treatment and control customers track information (bills and usage) related to their household's energy usage in the following ways (Figure 4-51):

- Seventy-five percent of the treatment customers and 64% of the control customers reported comparing usage to previous months. The difference is statistically significant at the 90% level of confidence.
- Seventy-two percent of the treatment respondents and 63% of the control respondents tracked the total amount of the bill. The difference between the treatment and control groups is statistically significant at the 90% level of confidence.
- More than half of respondents compare usage to the same month from last year, and the difference in responses here between treatment and control groups is statistically significant at the 90% level of confidence.
- Fifty-nine percent of treatment customers and 40% of control customers tracked their monthly energy use. The difference between treatment and control groups is statistically significant at the 90% level of confidence.

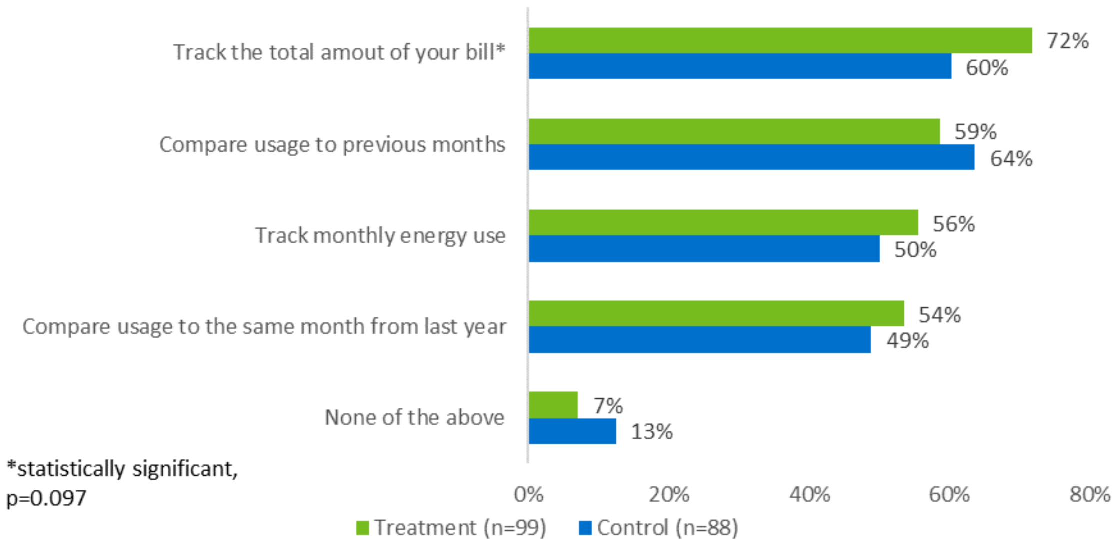
Figure 4-51: "Which of the Following Do You Do with Regard to Your Household's Energy Use?" – Single Family



Multi-family treatment and control customers track information (bills and usage) related to their household's energy usage in the following ways (Figure 4-52):

- Seventy-two percent of the treatment customers and 60% of the control customers reported tracking the total amount of the bill. The difference is statistically significant at the 90% level of confidence.
- More than half of respondents tracked monthly energy use. The difference in responses between the treatment and control groups is not statistically significant.
- Fifty-four percent of treatment respondents and 49% of control respondents compare usage to the same month from last year, and the difference in responses here between treatment and control groups is not statistically significant at the 90% level of confidence.

Figure 4-52: "Which of the Following Do You Do with Regard to Your Household's Energy Use?" – Multi-family



An area of significant interest in this evaluation is the identification of energy-saving behaviors that MyHERs move treatment customers to undertake. These behaviors, if they result in energy savings attributed to the reports, would be over and above what the treatment households would have done without having read or seen their MyHERs. The customer survey included a battery of questions inquiring as to whether the respondent's household has undertaken energy-savings actions. The responses to these questions are compared between the treatment and control respondents, and any statistically significant uplift in the reported behaviors undertaken can be concluded to be due to the MyHERs and may also be inferred as a driver of energy savings attributed to the program. A screening question is used to ensure that respondents answering the questions about specific behaviors only see those questions if they state that they have undertaken any energy savings actions or made energy efficiency improvements at all in the past year.[20]

For both single family and multi-family treatment and control groups, respectively, respondents reported similar levels of taking actions to save energy, as shown in Figure 4-53 and Figure 4-54. Across the nine specific behaviors and actions described by the survey, none show that treatment respondents are significantly more likely to take action to save energy than control respondents. The most cited behavior for single family is turning off lights in unused indoor or outdoor areas, with 95-98% of single family respondents reporting taking that action; the most two commonly cited behaviors for multi-family are turning off lights in unused indoor or outdoor areas and adjusting heating or cooling settings to save energy, with 95-98% of multi-family respondents reporting that they take that action, respectively. The least cited action for both

[20] Single family treatment and control customers report similar likelihood of having undertaken any behaviors to reduce household energy use or having made energy efficiency improvements to their home (65% to 66%). This is also true for treatment and control multi-family respondents (66% to 56%).

single and multi-family is turning down the water heater temperature, with 32-43% of single family respondents reporting that they did that and 33-38% of the multi-family respondents reporting the same.

There are two energy-savings behaviors for which significantly more single-family control customers are reporting undertaking than treatment customers, one of which is related to conserving on water heating. This is a similar finding in the DEC evaluation. The MyHER reports do not usually touch on water heating end-uses and it may be that MyHER treatment customers are taking actions that displace their interest or efforts to conserve water heating energy use.

While none of these behaviors show an uplift that can be ascribed to MyHER, that does not mean that energy savings are not coming from these behaviors. What these findings mean is that there is no evidence that MyHER has introduced new behaviors to treatment customers that they were not doing at all previously. It’s quite possible that MyHER energy savings, at least in part, come from customers turning off lights in unused areas of the home – because they’re doing that more than they would otherwise. The current survey instrument used by this evaluation cannot detect that change. Surveys or interviews can be designed to collect information on those more subtle differences in energy savings behaviors in the home, however they would be considerably more complicated and more expensive to field. Fewer customers would be willing to complete such a survey and non-response bias would be of greater concern. Non-response bias could be potentially overcome with completion incentives, but that would also increase the evaluation budget. Duke Energy is aware of the limitations of the customer research agenda and accepts the current resolution of the tradeoff between depth of findings, reliability of findings, and evaluation cost.

Figure 4-53: Reported Energy Savings Behaviors – Single Family

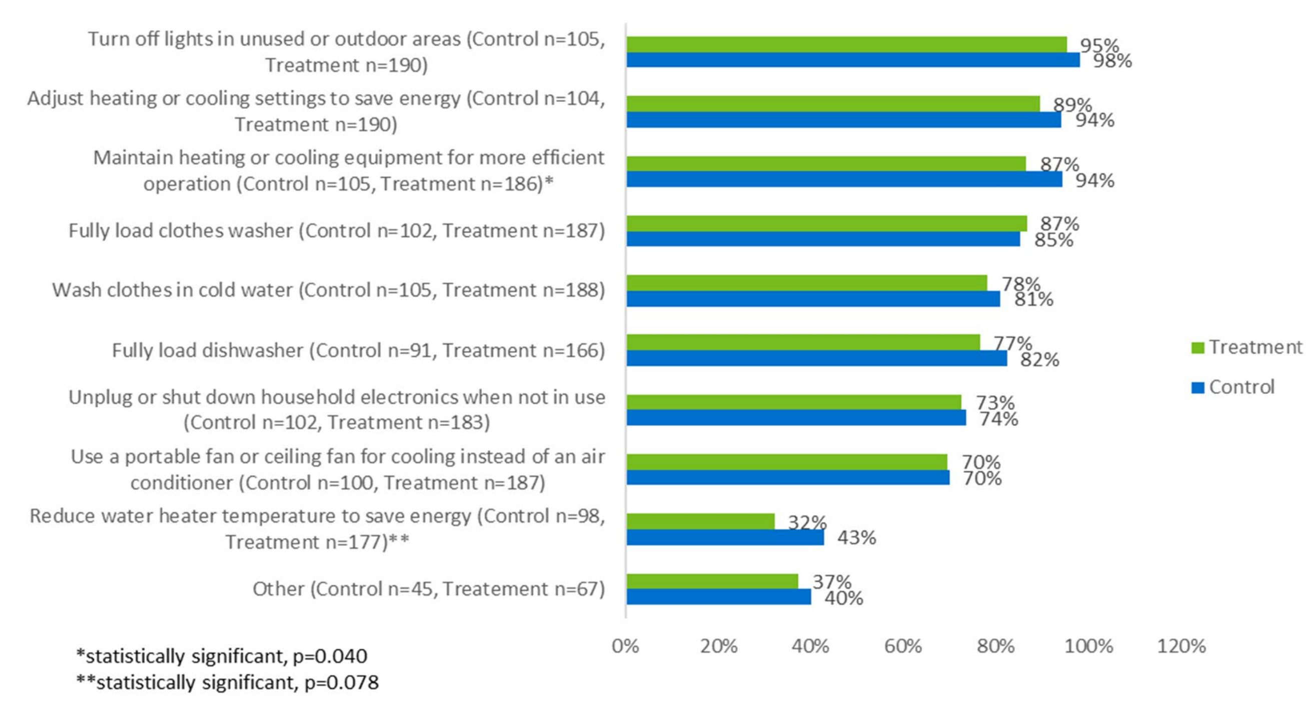
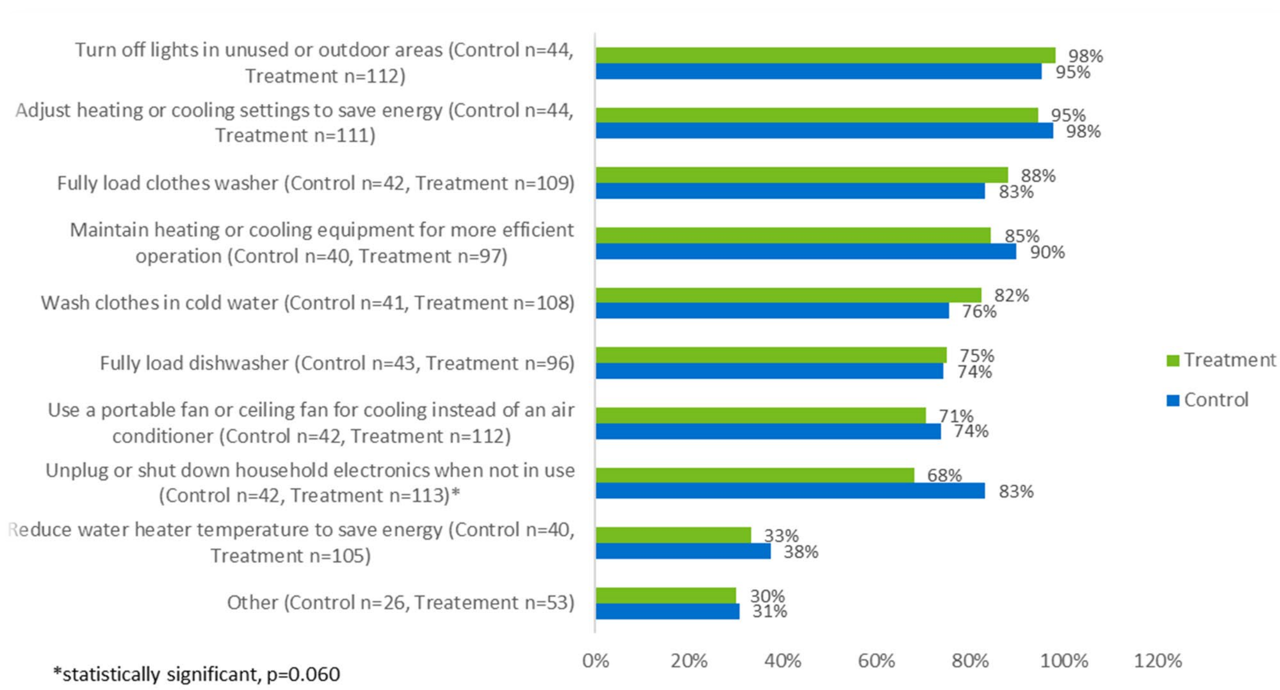


Figure 4-54: Reported Energy Savings Behaviors – Multi-family

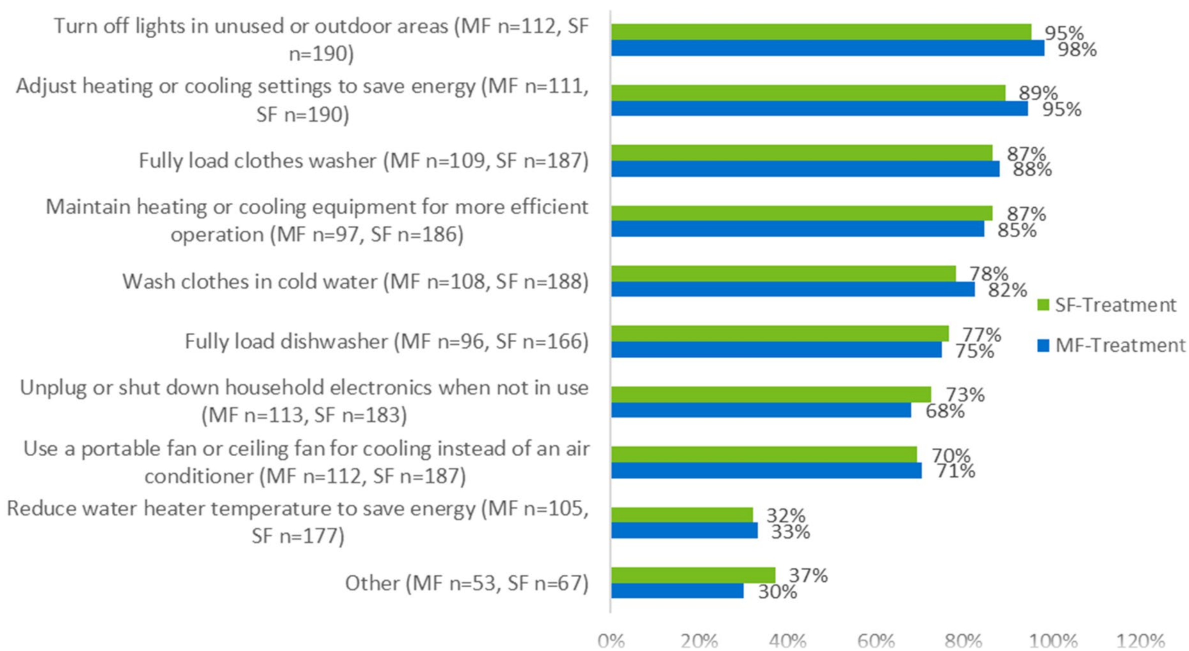


Nexant compared the reported behaviors of single family treatment customers to those of multi-family treatment customers. Here we do see differences between behaviors taken by single family customers and multi-family customers, however the differences on responses between single family treatment customers and multi-family treatment customers are not statistically significant. It is useful to consider the differences directionally:

- Single family treatment customers are more likely to report that they “Maintain heating or cooling equipment for more efficient operation”, “Fully load dishwasher”, and “Unplug or shut down household electronics when not in use” than multi-family treatment customers, as shown in Figure 4-55. Some of these differences are likely due to the fact that maintenance in multi-family housing is often completed by property management companies, or are less likely to have dishwashers.

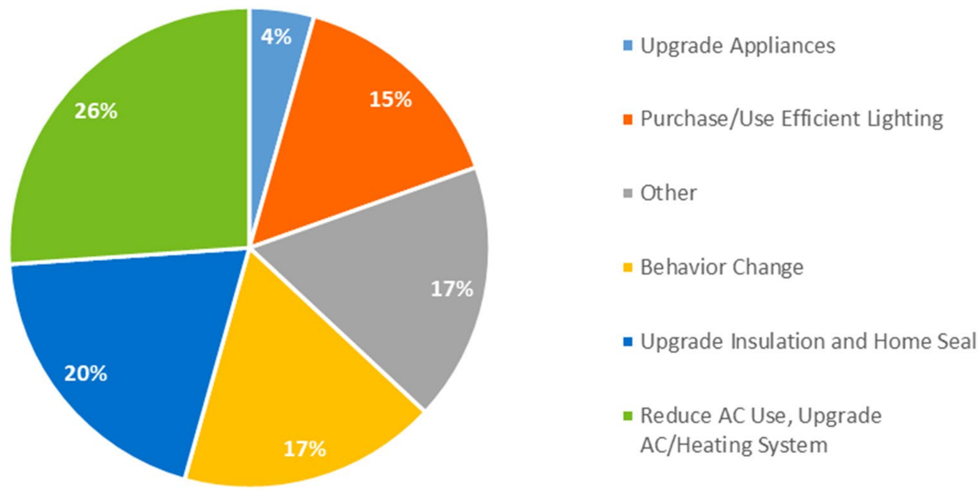
- Multi-family treatment customers are more likely to “Turn off lights in unused or outdoor areas”, “Use a portable fan or ceiling fan for cooling instead of an air conditioner”, “Reduce water heater temperature to save energy”, ”Wash clothes in cold water”, “Fully load clothes washer”, and “Adjust heating or cooling setting to save energy” than single family treatment customers.

Figure 4-55: Reported Energy Savings Behaviors
Single Family Treatment vs. Multi-family Treatment



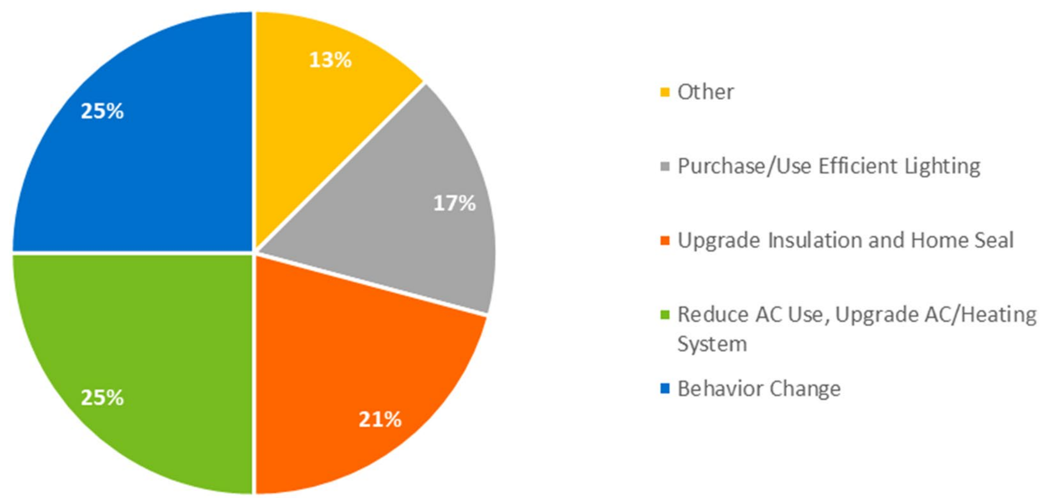
Forty-three single family respondents (treatment and control customers in total) reported “other” energy savings actions and wrote in their action(s). Nexant categorized these actions and the results are shown in Figure 4-56. The most reported action, mentioned by 12 respondents, pertains to air conditioning/heating system, such as replacing the HVAC system.

Figure 4-56: Distribution of Other Energy Savings Behaviors – Single Family (Treatment and Control n=43)



Twenty-four multi-family respondents (treatment and control customers in total) also reported "other" energy savings actions. Nexant categorized these actions and the results are shown in Figure 4-57. The most two commonly reported actions, pertain to the air conditioning/heating system (mentioned by 6 respondents, such as reducing operation of air conditioner), and behavior changes (mentioned by 6 respondents, such as washing clothes at night).

Figure 4-57: Distribution of Other Energy Savings Behaviors – Multi-family (Treatment and Control n=24)



Both single family and multi-family customers were further asked a question about COVID-19's effects on their households' ability to take energy savings actions. Sixteen percent of single family control customers and 20% of treatment customers reported that the likelihood of COVID-19 pandemic increasing their ability to take energy savings actions a "7" or higher on an 11-point scale of likelihood, while 25% of multi-family control customers and 21% of treatment customers reported so. None of these differences in responses between treatment and control customers are statistically significant.

Reported Energy Efficiency Improvements

With respect to improvements and investments that customers might make after reading or seeing their MyHER reports, we have a similar finding to that of the behavior-related actions discussed above. Respondents were provided with a list of energy efficiency improvements and were asked if they had done each in the past year. In all but one case, there are no statistically significant differences between the incidence of reporting energy efficiency upgrades between the treatment and control groups – across both single family and multi-family respondents. The one exception is that in multi-family group, significantly more control group respondents reported replacing windows or doors with more energy-efficient types than treatment group respondents (Table 4-17). As noted in the DEC reporting section above, this type of result may be indicative of MyHER's success at educating customers about the power of inexpensive purchases and behavior changes in managing their electricity bills. Without that education from MyHERs, the control customers may have been more receptive to advertising for new windows or doors.

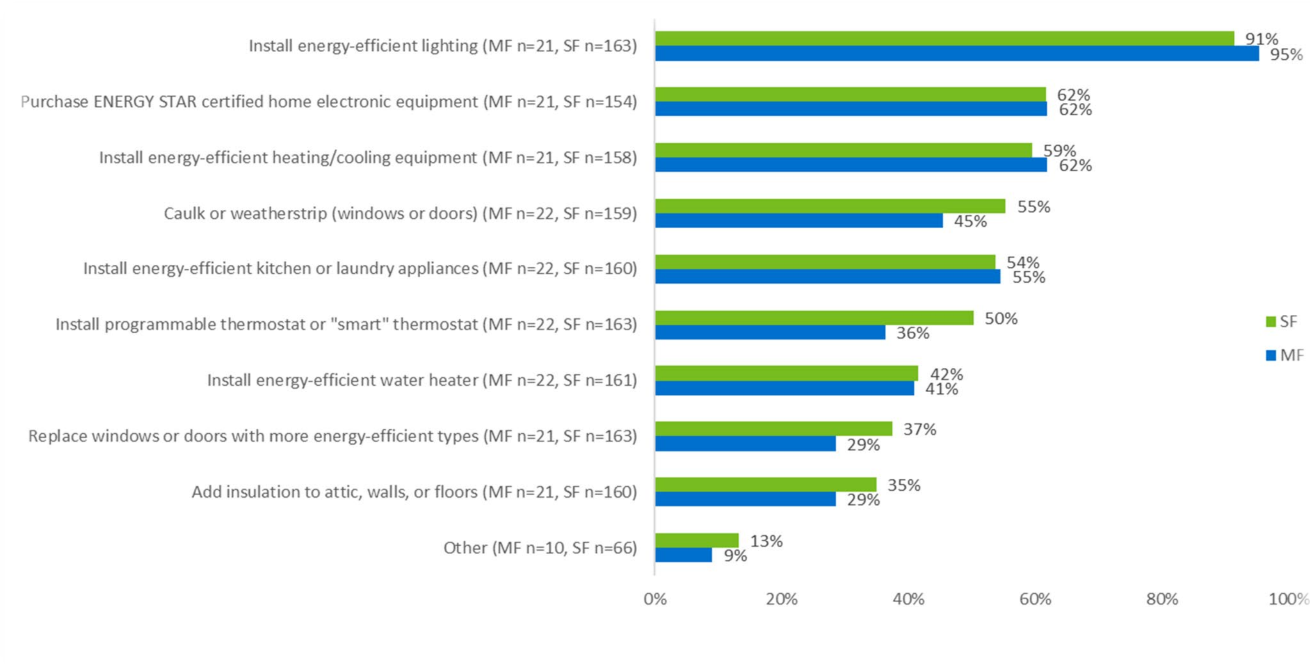
Table 4-17: Customers Indicating They Had Made Each Energy Efficiency Upgrade

Upgrade	Single Family		Multi-family	
	Treatment	Control	Treatment	Control
Install energy-efficient lighting	90% (n=184)	89% (n=106)	86% (n=103)	83% (n=40)
Install energy-efficient kitchen or laundry appliances	53% (n=182)	58% (n=97)	32% (n=102)	42% (n=36)
Purchase ENERGY STAR certified home electronic equipment	58% (n=173)	56% (n=89)	33% (n=96)	47% (n=36)
Caulk or weatherstrip (windows or doors)	53% (n=181)	54% (n=100)	38% (n=97)	39% (n=36)
Install energy-efficient heating/cooling equipment	54% (n=178)	46% (n=96)	30% (n=93)	31% (n=35)
Install programmable thermostat or "smart" thermostat	47% (n=182)	45% (n=98)	32% (n=100)	35% (n=37)
Install energy-efficient water heater	38% (n=180)	41% (n=99)	27% (n=95)	37% (n=38)
Replace windows or doors with more energy-efficient types	37% (n=183)	44% (n=100)	14% (n=97)*	29% (n=35)*
Add insulation to attic, walls, or floors	34% (n=180)	34% (n=99)	17% (n=89)	9% (n=33)

*statistically significant p=0.063

As discussed above with behavioral actions, while the differences are not significantly different at the 90% level of confidence, single family treatment respondents were more likely to report they had undertaken upgrades or made investments than multi-family treatment respondents on installing energy-efficient kitchen or laundry appliances, purchasing ENERGY STAR certified home electronic equipment, caulking or weatherstripping (windows or doors), installing energy-efficient heating/cooling equipment, installing programmable thermostat or “smart” thermostat, installing energy-efficient water heater, replacing windows or doors with more energy-efficient types, and adding insulation to attic, walks, or floors in the survey. To control for the fact that the likelihood of renters would make these upgrades is very low, we considered the multi-family treatment responses in comparison to single family treatment responses with renters removed. When renters were removed from the analysis, five of these upgrades still emerged as higher for single family treatment respondents, as seen in Figure 4-58.

Figure 4-58: Customers Indicating They Had Made Each Energy Efficiency Upgrade Treatment Homeowners Only – Single Family vs. Multi-family



To examine broader patterns within participant responses to the behavior and upgrade questions, these questions were combined into behavior vs. upgrade categories and were also combined into end-use categories. First, as shown in Table 4-18, treatment respondents and control respondents reported very similar levels of engaging in energy efficiency behaviors and improvements generally. Single family control group respondents reported significantly higher average number of energy efficiency behaviors then single family treatment group customers. This result may indicate that the MyHER treatment is encouraging customers to focus their energy saving behaviors, that are more effective, at reducing energy consumption.

Table 4-18: Percent of Households That Have Undertaken Energy Efficiency Actions

Behaviors/Improvements	Single-family		Multi-family	
	Treatment	Control	Treatment	Control
Energy Efficiency Behaviors	100% (n=195)	100% (n=106)	100% (n=113)	100% (n=44)
Average Number of Behaviors	6.6*	7.1*	6.7	7.0
Energy Efficiency Improvements	97% (n=192)	96% (n=106)	92% (n=110)	95% (n=41)
Average Number of Improvements	4.4	4.4	2.9	3.2

*statistically significant, p=0.012

Additionally, Table 4-19 shows the proportion of respondents that had undertaken at least one behavior or upgrade in each end use category. For those categories that have multiple behaviors or upgrades within it, these are broken out on their own for analysis. In the category “Water Heating Behaviors/Upgrades”, for example, four behaviors relevant to water heating are combined in a subcategory “Water Heating Behaviors” are broken out. Upgrades are not broken out here in that way because there is only one upgrade ("Install energy-efficient water heater") associated with the parent category, and the proportion of respondents undertaking this upgrade is presented in Table 4-17 above. Similarly, for "Lighting Behaviors/Upgrades", there was only one upgrade and behavior, so these are not broken out. Lastly, there was only one behavior associated with the "Electronics and Appliances Behaviors/Upgrades" category ("Unplug or shut down household electronics when not in use"), so it was omitted as well. Multi-family control group members were significantly more likely to have undertaken electronics and appliances behaviors/upgrades than treatment group members.

Table 4-19: Percent of Households That Had Undertaken Energy Efficiency Behaviors or Upgrades, by End Use Category

Behaviors/Improvements	Single-family		Multi-family	
	Treatment Group	Control Group	Treatment Group	Control Group
Water Heating Behaviors/Upgrades (5)	98% (n=195)	100% (n=106)	98% (n=112)	95% (n=44)
Water Heating Behaviors (4)	99% (n=193)	100% (n=106)	98% (n=112)	95% (n=44)
Space Heating Behaviors/Upgrades (5)	97% (n=194)	99% (n=106)	99% (n=113)	100% (n=44)
Space Heating Behaviors (3)	98% (n=192)	99% (n=106)	99% (n=113)	100% (n=44)
Space Heating Upgrades (2)	63% (n=186)	64% (n=100)	46% (n=103)	49% (n=39)
Lighting Behaviors/Upgrades (2)	97% (n=194)	99% (n=106)	98% (n=113)	98% (n=44)
Electronics and Appliances Behaviors/Upgrades (3)	88% (n=191)	90% (n=105)	81% (n=113)*	91% (n=43)*
Electronics and Appliances Upgrades (2)	69% (n=186)	69% (n=99)	41% (n=104)	54% (n=37)
Sealing and Insulation Upgrades (3)	66% (n=189)	71% (n=103)	44% (n=106)	47% (n=38)

*statistically significant, p=0.073

Both single family and multi-family customers were further asked a question about COVID-19's effects on their households' ability to make energy efficiency improvements. Thirteen percent of single family control customers and 17% of treatment customers reported that the likelihood of COVID-19 pandemic increasing their ability to make energy efficiency improvements a "7" or higher on a 0-10 point scale of likelihood, while 16% of multi-family control customers and 9% of treatment customers reported so. None of these differences in responses between treatment and control customers are statistically significant.

Customer Motivation and Awareness

Single family control and treatment groups reported similar levels of motivation for saving energy. Seventy-six percent of control customers indicated that knowing they are using energy wisely is "important" or "extremely important" (rated 7 or higher on a 0-10 point scale), compared to 79% of treatment customers. This difference is not statistically significant (Figure 4-59). The same is true for multi-family. Eighty-four percent of control customers indicated that knowing they are using energy wisely is "important" or "extremely important", compared to 83% of treatment customers. This difference is not statistically significant (Figure 4-60).

Figure 4-59: “How Important Is It for You to Know if Your Household is Using Energy Wisely?”– Single Family Split Top-4 Box Scores (0-10 Scale)

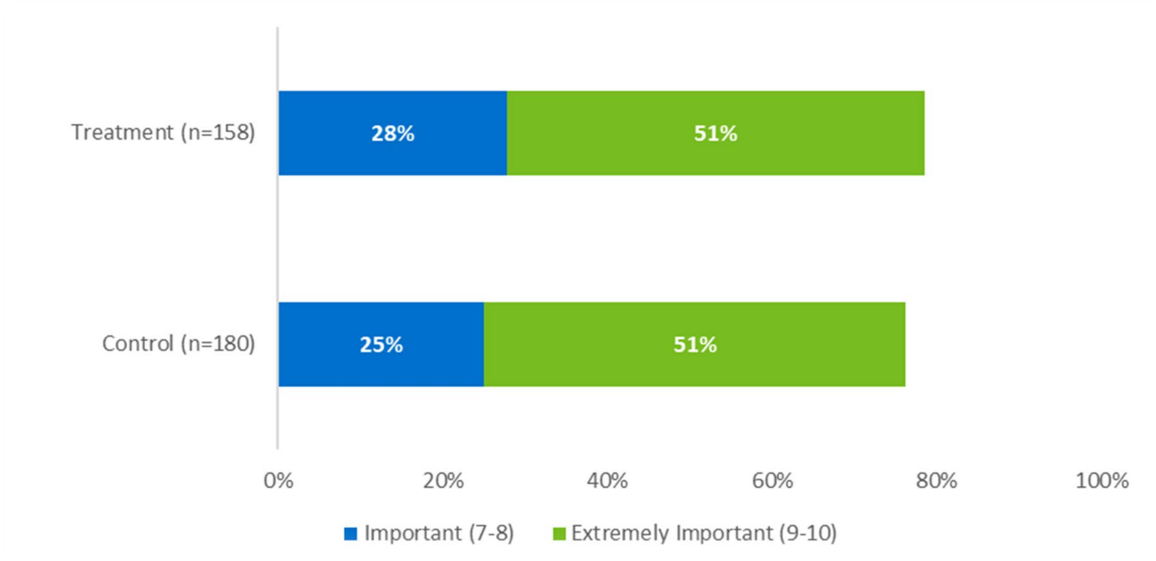
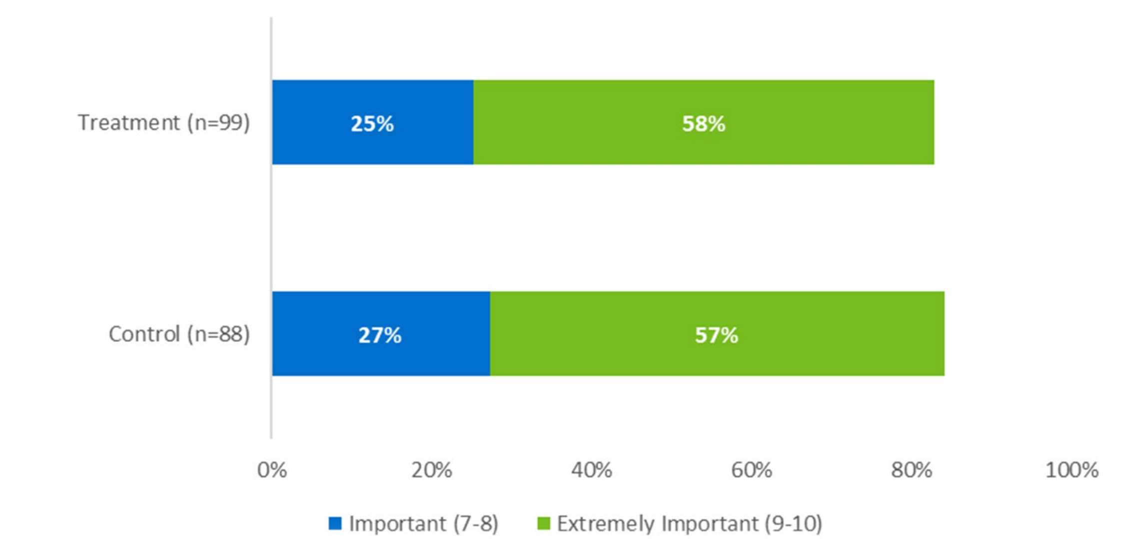
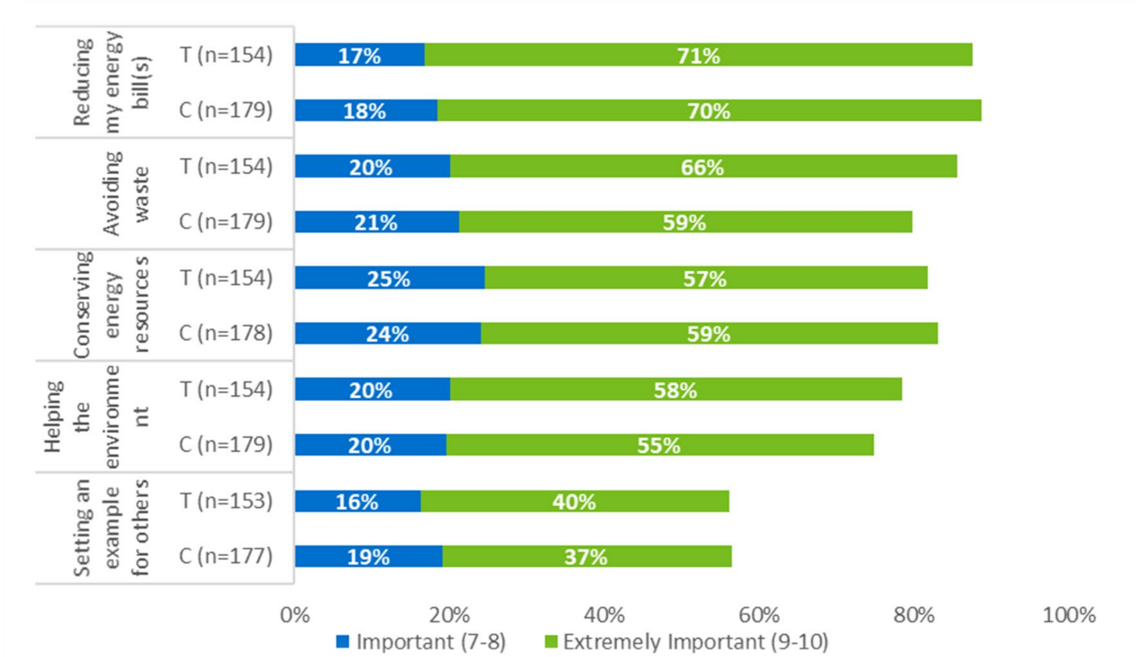


Figure 4-60: “How Important Is It for You to Know if Your Household is Using Energy Wisely?” – Multi-family Split Top-4 Box Scores (0-10 Scale)



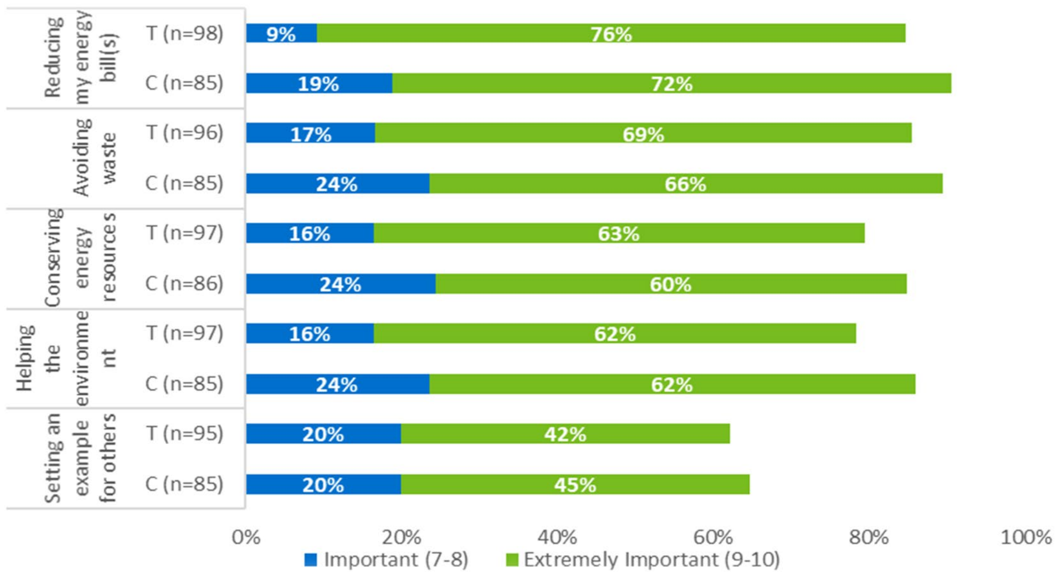
Customers were asked to rate, on a scale of 0 to 10, the importance of various reasons why they might try to reduce their home’s energy use. The strongest motivation for both treatment and control groups is saving money on their energy bills. For single family, 88% of treatment respondents and 88% of control respondents reported that saving money on their energy bills was “important” or “extremely important” (rated 7 or higher on a 0-10 point scale). Eighty-six percent of treatment respondents and 80% of control respondents indicated that “avoiding waste” was “important” or “extremely important” to them. Eighty-two percent of treatment customers and 83% of control customers reported that “conserving energy resources” was “important” or “extremely important”. Seventy-eight percent of treatment customers and 75% of control customers reported that “helping the environment” was “important” or “extremely important”. None of the differences between treatment and control groups are statistically significant. Figure 4-61 contains the frequency of responses to this question, shown as a percentage for both treatment and control groups.

Figure 4-61: “Please Indicate How Important Each Statement Is to You” – Single Family Split Top-4 Box Scores (0-10 Scale)



For multi-family, 85% of treatment respondents and 91% of control respondents reported that saving money on their energy bills was “important” or “extremely important” (rated 7 or higher on a 0-10 point scale). Eighty-six percent of treatment customers and 90% of control customers reported that “avoiding waste” was “important” or “extremely important”. Seventy-eight percent of treatment respondents and 86% of control respondents indicated that “helping the environment” was “important” or “extremely important” to them. Seventy-nine percent of treatment customers and 84% of control customers reported that “conserving energy resources” was “important” or “extremely important”. None of the differences are statistically significant at the 90% level of confidence. Figure 4-62 contains the frequency of responses to this question, shown as a percentage for both treatment and control groups.

Figure 4-62: "Please Indicate How Important Each Statement Is to You" – Multi-family Split Top-4 Box Scores (0-10 Scale)



As indicated by Figure 4-63 and Figure 4-64, among single family treatment customers, 70% of treatment group customers rated their knowledge regarding ways to save energy in the home at least seven on a 0-10 point scale (indicating they were "knowledgeable" or "extremely knowledgeable"), while 61% of control group customers rated themselves this way. The difference between treatment and control customers is statistically significant at the 90% level of confidence. Among multi-family customers, 63% of treatment respondents and 78% of control respondents rated themselves seven or higher on this scale. The difference is statistically significant at the 90% level of confidence.

Figure 4-63: "How Would You Rate Your Knowledge of the Different Ways You Can Save Energy in Your Home?" – Single Family Split Top-4 Box Scores (0-10 Scale)

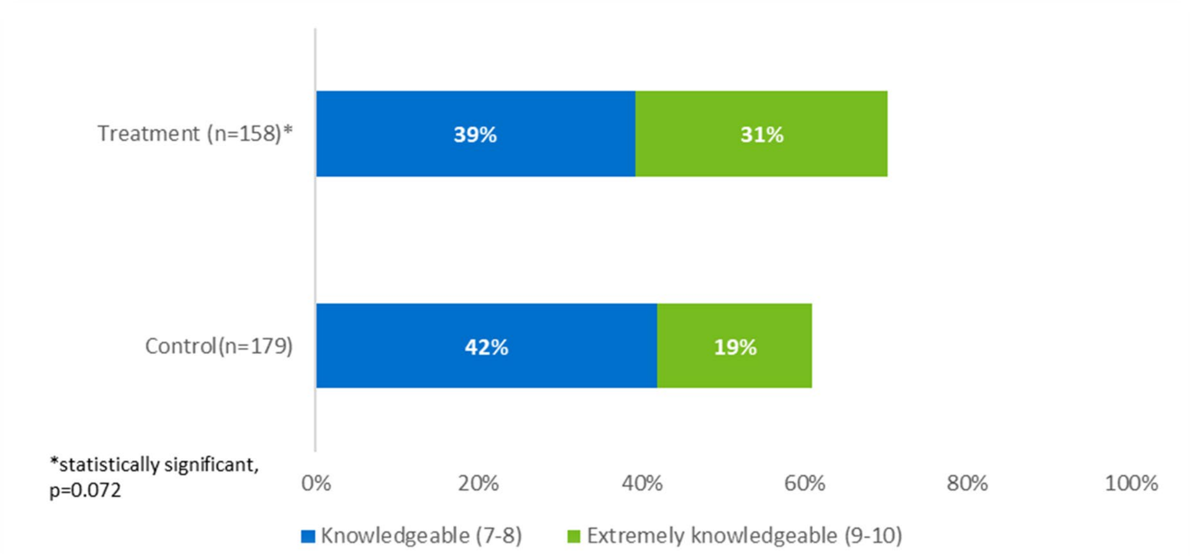
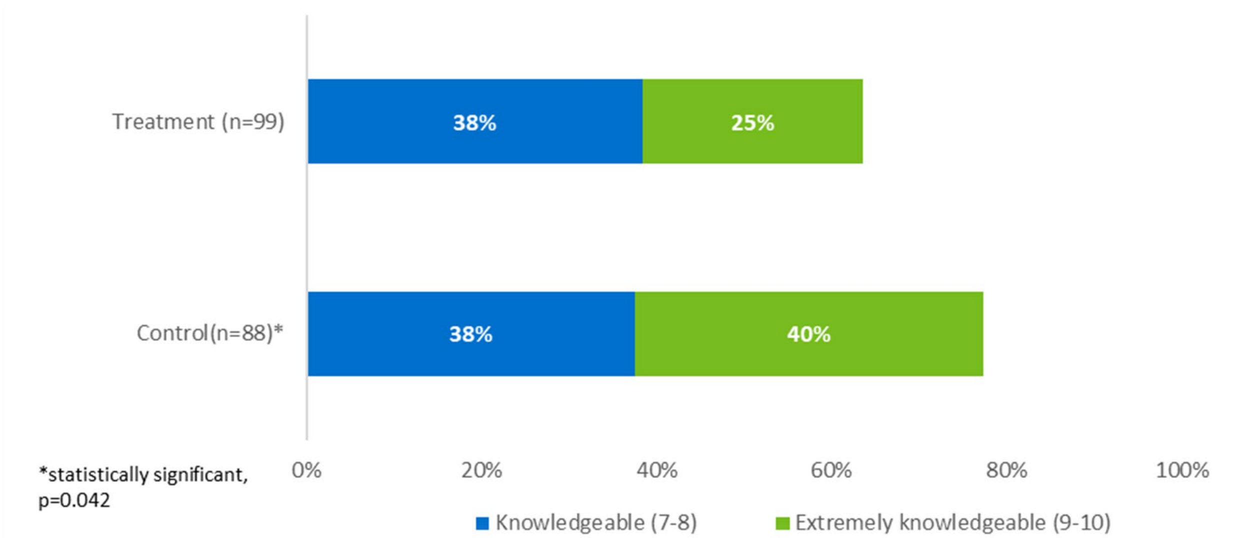


Figure 4-64: "How Would You Rate Your Knowledge of the Different Ways You Can Save Energy in Your Home?"– Multi-family Split Top-4 Box Scores (0-10 Scale)



Respondents that took the treatment-only survey were asked how useful each MyHER feature was to their homes. A similar question was asked of primary survey respondents, but rephrased to ask them how useful they might expect that information to be. Table 4-20 presents the comparison results between the actual usefulness of each item rated by treatment customers (treatment only survey) and the hypothetical usefulness rated by control customers in the primary survey for both sets of respondents who answered "7" or above on a scale from 0-10. This table shows that among single family customers, control customers were significantly more likely to think that "Tips to help you save money and energy" and "Comparison to similar homes" might be useful than treatment customers actually thought they were. These findings suggest that there is an opportunity to improve the presentment of this information to better meet customers' expectations.

Table 4-20: Actual Usefulness versus Hypothetical Usefulness of HER Features Top-4 Box Scores (0-10 Scale)

HER Feature	Single-family		Multi-family	
	Control	Treatment Only	Control	Treatment Only
Graphs that display your home's energy use over time	64% (n=174)	67% (n=135)	73% (n=83)	76% (n=59)
Energy use associated with specific household items and areas	55% (n=171)	50% (n=132)	69% (n=84)	68% (n=59)
Tips to help you save money and energy	59% (n=176)*	47% (n=133)*	73% (n=83)	68% (n=59)
Customized suggestions for your home	52% (n=174)	45% (n=132)	54% (n=81)	61% (n=59)
Information about services and offers from Duke Energy	51% (n=173)	44% (n=135)	60% (n=84)	58% (n=59)
Comparison to similar homes	51% (n=173)**	38% (n=134)**	57% (n=82)	53% (n=59)

*statistically significant, p=0.038
**statistically significant, p=0.020

Barriers to Customers Undertaking Energy Savings Actions

When asked the reasons why customers might not be able to save as much as energy as they would like, statistically different response patterns between single family control and treatment customers were found, as shown in Figure 4-65. On a scale of 0-10, where 0 represents "not at all important" and 10 is "extremely important", 41% of single family control respondents reported "I do not think my energy saving efforts are worth the time and/or money" as a barrier and 33% of treatment respondents did so as well (rated this importance as 7 or higher). The difference is statistically significant at the 90% level of confidence. For multi-family (Figure 4-66), 47% of treatment respondents and 50% of control respondents reported "Initial cost of energy efficient equipment is too high". The difference is not statistically significant at the 90% level of confidence.

When single family and multi-family responses to these questions were compared, 36% of single family respondents and 44% of multi-family respondents reported "I do not think my energy saving efforts are worth the time and/or money" as a barrier. The difference between single family and multi-family respondents is statistically significant at 90% level of confidence.

Figure 4-65: Barriers to Customers Undertaking Energy Savings Actions – Single Family Top-4 Box Scores (0-10 Scale)

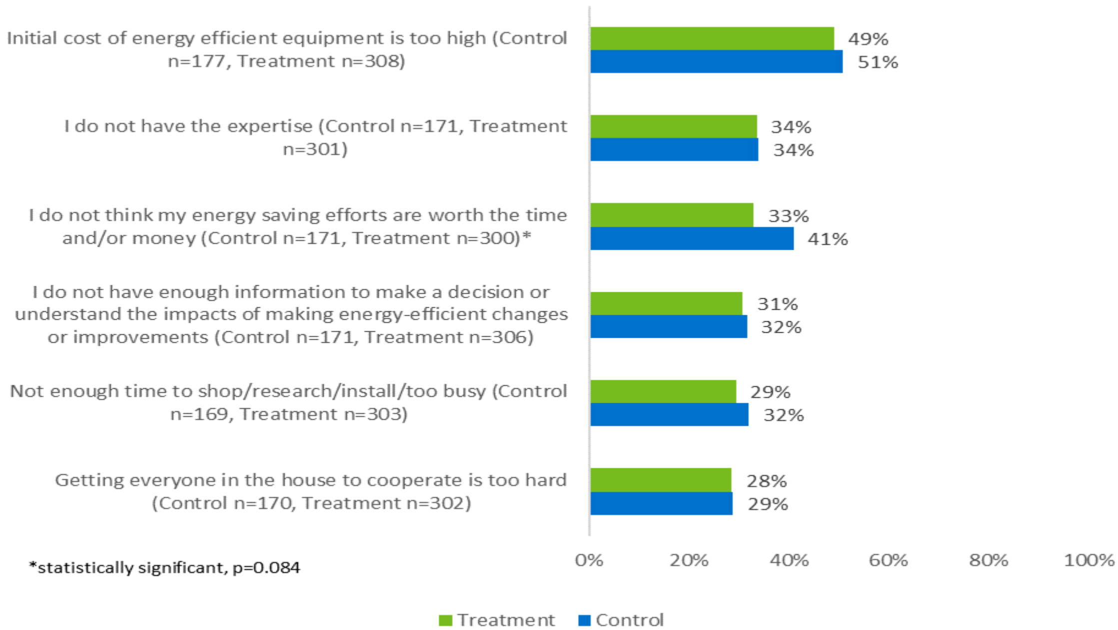
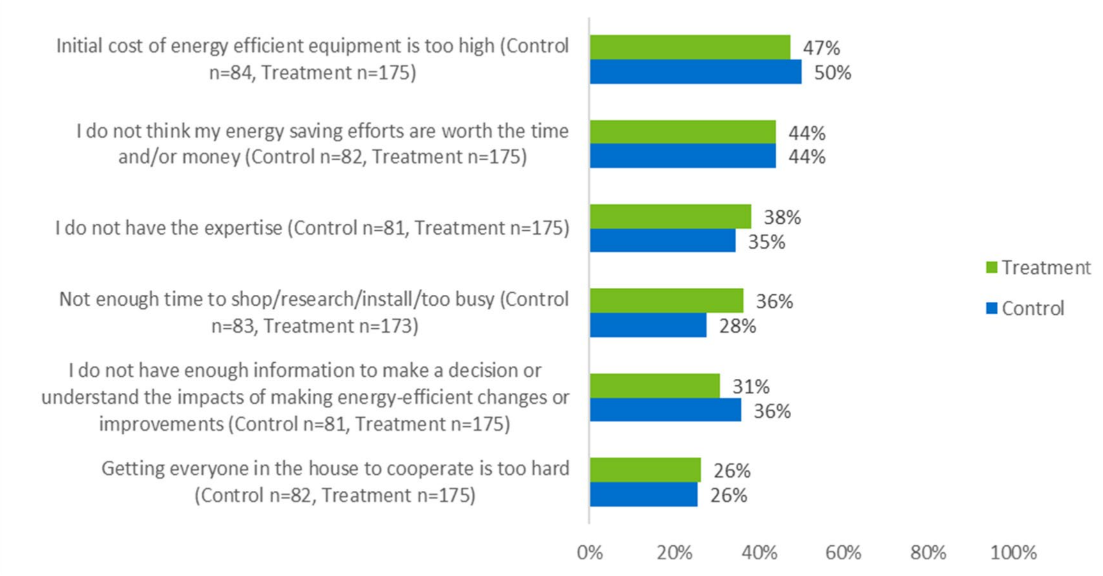


Figure 4-66: Barriers to Customers Undertaking Energy Savings Actions – Multi-family Top-4 Box Scores (0-10 Scale)



Suggestions about Duke Energy Improving Service Offerings

The survey provided an open-ended question to elicit suggestions about Duke Energy improving its service offerings to help customers reduce energy use. Only 19% (148 of 781, treatment and control customers in total) offered suggestions, including 26 who offered only appreciative comments. Among those offering suggestions for improvement, the most common request, mentioned in 38 of the remaining 127 responses with suggestions, reflected a desire for more energy savings programs, more energy savings information, and more incentives:

- "*Give me more information on how to save energy…*"
- "*Incentives for customers who do try to save energy and keep their energy bills lower.*"
- *"Provide free replacement light bulbs."*
- *"More rebate incentives."*
- "*More energy saving ideas for apartments.*"

Other comments centered on other suggestions, such as reducing prices/providing senior and disability discounts, and better communication. Nexant categorized these suggestions on the general basis of their content; the results are presented in Table 4-21.

Table 4-21: Responses to Solicitation for Suggestions to Duke Energy for Improving Service Offerings

Suggestion	Single Family			Multi-family		
	Count	Percent of Respondents Mentioning (n=104)	Percent of Total Mentions (n=107)	Count	Percent of Respondents Mentioning (n=44)	Percent of Total Mentions (n=46)
Increase program offerings, incentives, or information	24	23%	22%	14	32%	30%
Reduce price/provide senior and disability discounts	24	23%	22%	9	20%	20%
Appreciate current offers	18	17%	17%	9	20%	20%
Miscellaneous	12	12%	11%	8	18%	17%
Voiced frustration with Duke Energy	11	11%	10%	5	11%	11%
Better communication/more emails/more mails/in-person communication	9	9%	8%	1	2%	2%
Provide more detailed info in MyHER	6	6%	6%	0	0%	0%
Reduce power outages	3	3%	3%	0	0%	0%

4.2.3.2 Treatment Households: Experience and Satisfaction with MyHER

A very large majority of the single family treatment only household respondents, 95%, (158 of 166), and the multi-family treatment only household respondents, 85%, (69 of 81) recalled receiving at least one of the MyHER reports.

The survey asked those that could recall receiving at least one MyHER report if they could recall how many individual reports they had received “in the past 12 months” (respondents who receive paper HERs would receive eight reports (single family respondents) and up to six reports (multi-family respondents) in this time period, and those who receive eHERs would have received 12. Forty-five percent (65 of 146) of single family customers responded that they received 12 home energy reports in the past 12 months. Twenty percent (12 of 60) of multi-family customers responded that they received 12 home energy reports in the past 12 months. The scattered distribution of responses related to recall is consistent with the difficulty of recalling an exact number of reports, however the question is valuable for grounding respondents in the experience of receiving a MyHER before asking them more specific questions about the document. We note the response pattern for single family respondents is significantly different than that of multi-family respondents.

Figure 4-67 and Figure 4-68). Given Duke Energy’s protocols for report delivery, respondents who receive paper HERs would receive eight reports (single family respondents) and up to six reports (multi-family respondents) in this time period, and those who receive eHERs would have received 12. Forty-five percent (65 of 146) of single family customers responded that they received 12 home energy reports in the past 12 months. Twenty percent (12 of 60) of multi-family customers responded that they received 12 home energy reports in the past 12 months. The scattered distribution of responses related to recall is consistent with the difficulty of recalling an exact number of reports, however the question is valuable for grounding respondents in the experience of receiving a MyHER before asking them more specific questions about the document. We note the response pattern for single family respondents is significantly different than that of multi-family respondents.

Figure 4-67: Reported Number of MyHERs Received "In the past 12 months" (n=146) – Single Family

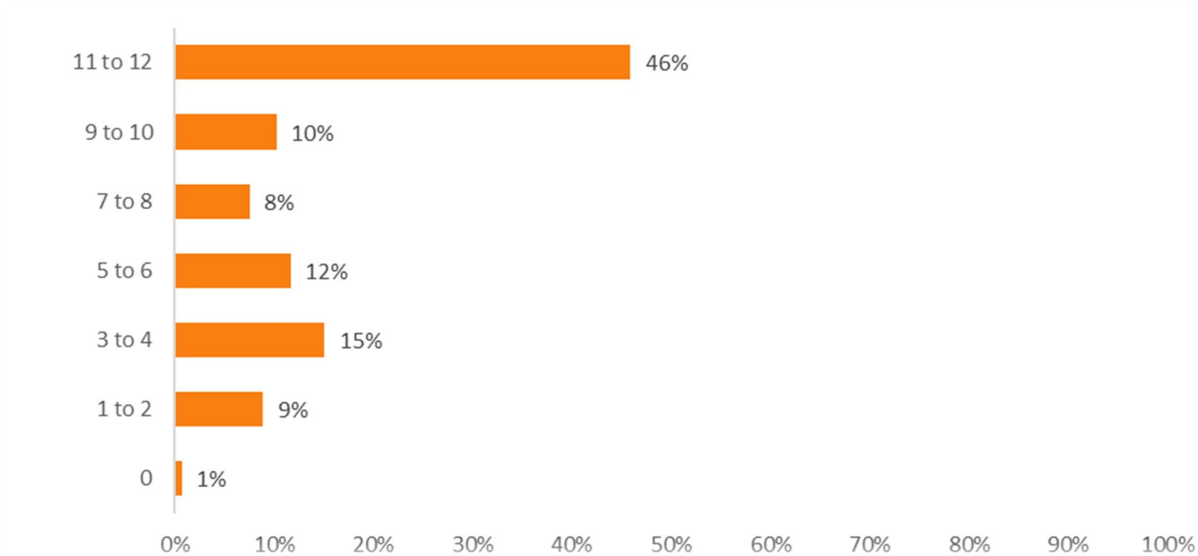
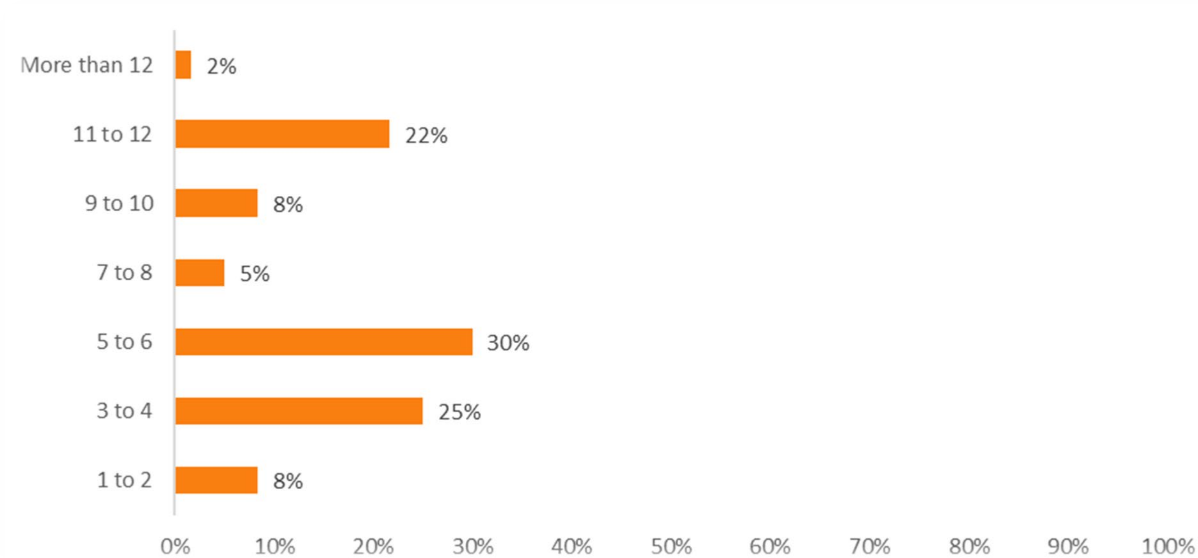


Figure 4-68: Reported Number of MyHERs Received "In the past 12 months" (n=60) – Multi-family



Survey respondents indicated high interest in the MyHER reports. As shown in Figure 4-69 and Figure 4-70, when asked how often they read the reports, 95% of single family respondents indicated they "always" or "sometimes" read the reports, and 98% of multi-family respondents indicated they "always" or "sometimes" read them.

Figure 4-69: How Often Customers Report Reading the MyHER (n=144) – Single Family

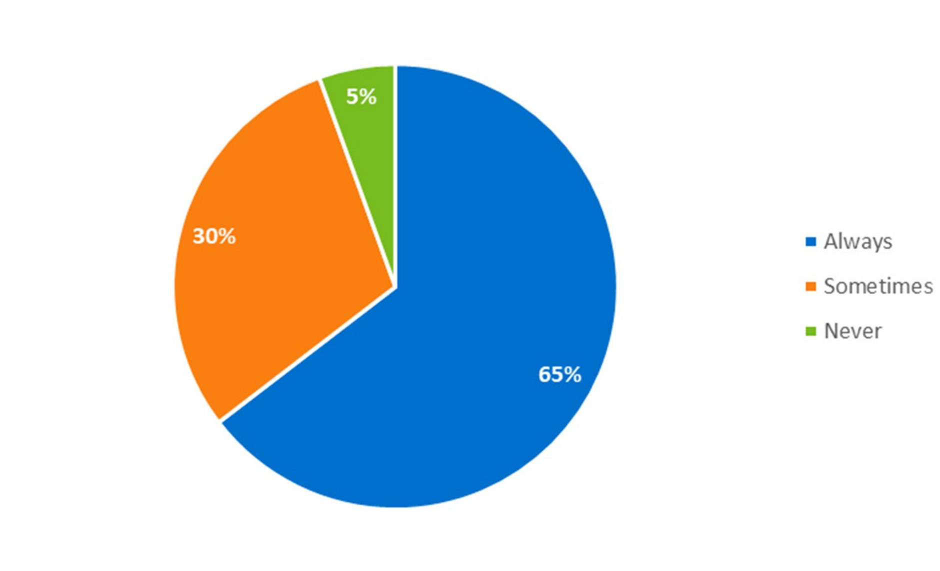
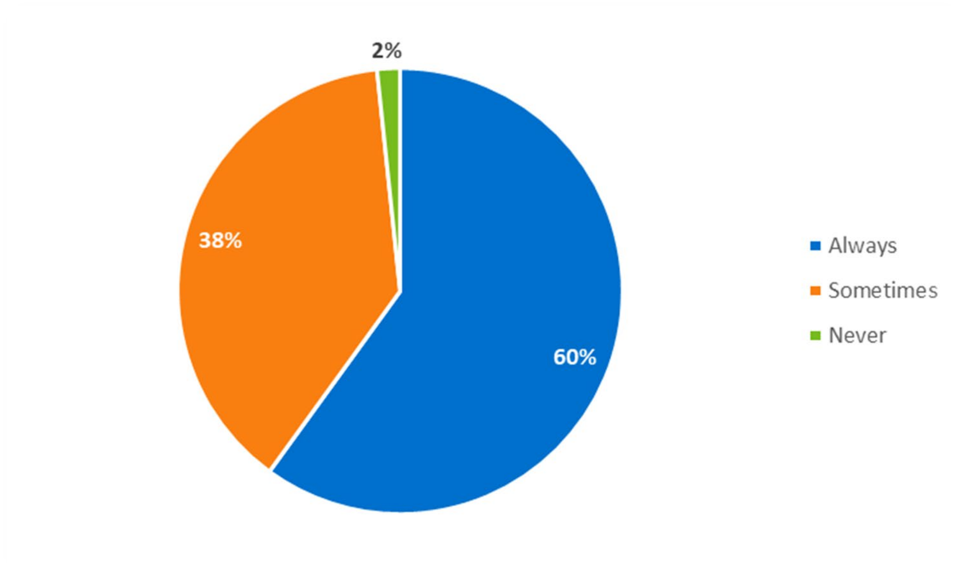


Figure 4-70: How Often Customers Report Reading the MyHER (n=60) – Multi-family



Sixty-three percent (85 of 134) of single family respondents that provided a rating reported being “somewhat” or “very” satisfied with the information contained in the reports (Figure 4-71). Seventy-three percent (43 of 59) of multi-family respondents that provided a rating reported being “somewhat” or “very” satisfied with the information contained in the reports (Figure 4-72). The survey asked a further question to the respondents of why they said so: 10 of the satisfied single family respondents and 6 of the satisfied multi-family respondents provided reasons. Among customers who gave the highest satisfaction ratings, the most common comments on the MyHERs described the reports as “helpful.”

Figure 4-71: Satisfaction with the Information in MyHER Reports (n=134) – Single Family

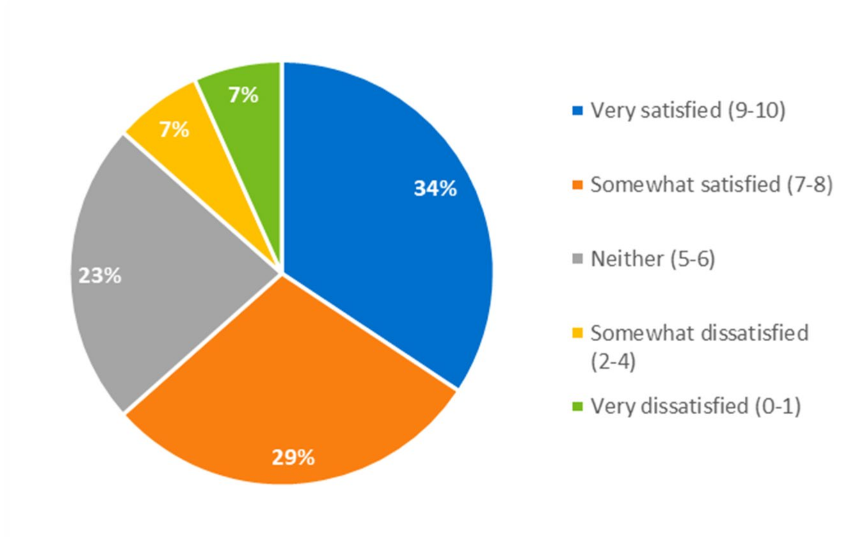
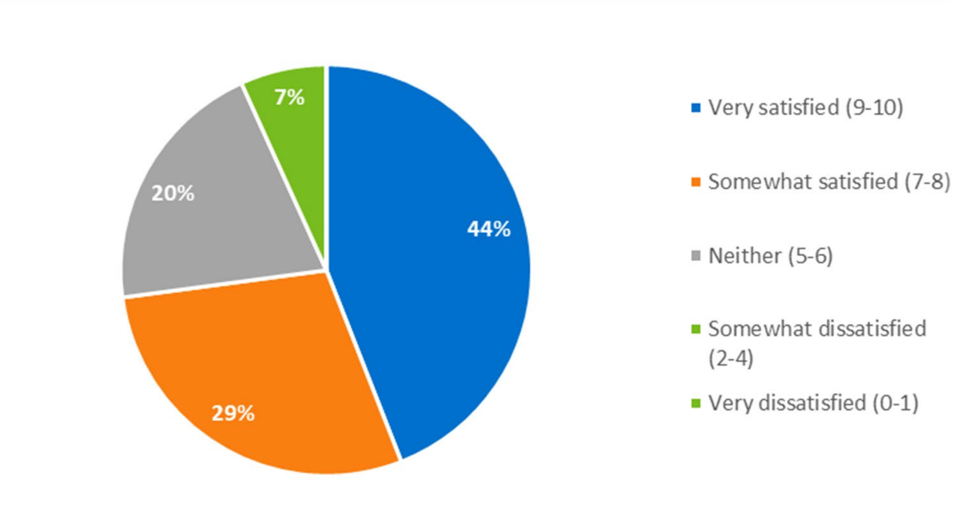


Figure 4-72: Satisfaction with the Information in MyHER Reports (n=59) – Multi-family

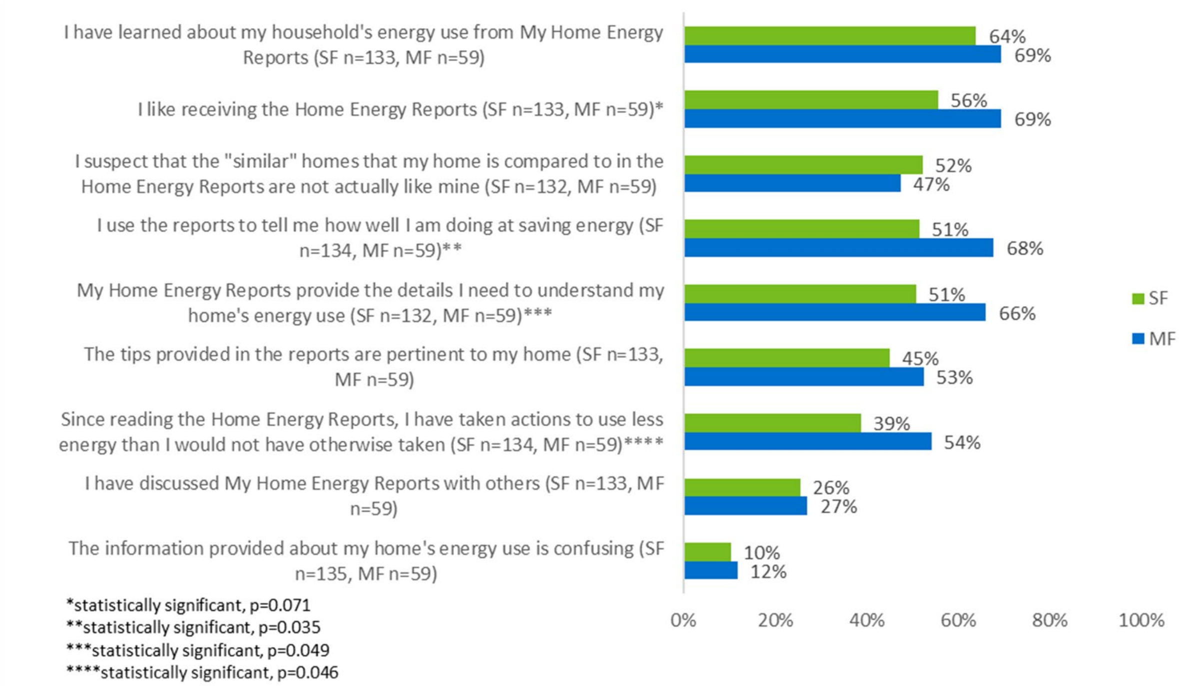


When asked to rate their agreement with a series of statements about MyHERs on a scale of 0 to 10, recipients largely agreed that the reports helped them understand their home's energy use, with 64% of single family respondents and 69% of multi-family respondents rating their agreement a seven or higher on a 0-10 point scale. The difference of responses between single family customers and multi-family customers is not statistically significant.

Fifty-six percent of single family respondents and 69% of multi-family respondents agreed that they like receiving the home energy reports; this difference is statistically significant at the 90% level of confidence.

More than half (51% of single family respondents and 68% of multi-family respondents) agreed that the reports provided the information of how well they were doing at saving energy. Fifty-one percent of single family respondents and 66% of multi-family respondents agreed that the reports provided the detailed information they needed to understand home energy use. These differences between single family and multi-family respondents are statistically significant. Respondents provided weaker agreement to statements about whether they have taken actions to use less energy than they would not have since reading MyHERs (39% of single family respondents and 54% of multi-family respondents). The difference is statistically significant at the 90% level of confidence. A relatively small percentage (10% of single family respondents and 12% of multi-family respondents) agreed with the statement that the information provided is confusing. The difference is not statistically significant at the 90% level of confidence (Figure 4-73).

Figure 4-73: Level of Agreement with Statements about MyHER Top-4 Box Scores (0-10 Scale)



The survey provided an open-ended question (to customers that reported reading at least one report in the past year) to elicit suggestions for improvements to the MyHER reports. About 32% (44 of 136) of single family respondents and 39% (23 of 59) of multi-family respondents offered suggestions, including 10 single family respondents and 4 multi-family respondents who offered comments to express gratitude and appreciation of the reports only. Among those providing a response to the question, the most common response mentioned by 15 of the 34 single family respondents with suggestions reflected a desire for more specific information or details about their home and specific actions they should take. Some of these requests reflected interest in understanding at a more granular level how their home uses energy and how to reduce energy consumption information:

- "*More suggestions on utilizing Solar Power and credible sources of obtaining solar.*"
- "*Could the report explain how Duke Energy knows how much electricity is used in laundry, cooling, heating, etc.…*"
- *"Show influence on cost per square foot…"*

The most common response mentioned by 14 of the 19 multi-family respondents with suggestions questioned the comparison/accuracy of the report, such as:

- "*Make sure all factors are current with the household.*"
- "*Well, what's strange to me is there are categories for laundry (washer and dryer) usage and a few others I can't recall that don't even apply to us. We don't HAVE a washer or dryer so that's confusing to me."*

Nexant categorized these suggestions on the general basis of their content; the results are presented in Table 4-22.

Table 4-22: Suggestions for MyHER Improvement (Multiple Responses Allowed)

Suggestion/Comment	Single Family			Multi-family		
	Count	Percent of Respondents Mentioning (n=44)	Percent of Total Mentions (n=46)	Count	Percent of Respondents Mentioning (n=23)	Percent of Total Mentions (n=25)
Provide more specific information or details	15	34%	33%	3	13%	12%
Don't believe comparison/accuracy	11	25%	24%	14	61%	56%
Appreciate the Home Energy Report	10	23%	22%	4	17%	16%
Change production (mail, paper, format)	4	9%	9%	1	4%	4%
Don't see value/dislike	4	9%	9%	0	0%	0%
Unique circumstances	2	5%	4%	3	13%	12%

Treatment households were also asked questions that focused on their awareness and use of MyHER Interactive, revealing low awareness of the online Interactive platform:

- Only 38% (51 of 133) of single family treatment customers and 38% (22 of 58) of multi-family treatment customers are aware of MyHER Interactive;
- Among aware customers, 94% of single family respondents and 82% of multi-family respondents reported that they had not signed up to use MyHER Interactive. The difference is not statistically significant at the 90% level of confidence; and
- When these respondents were asked why they haven't signed up to use MyHER Interactive, among the respondents who gave the answers, 32% of single family

respondents and 18% of multi-family respondents reported that they were not interested in it, 19% of single family respondents and 9% of the multi-family respondents said they were too busy, and 10% of single family respondents and 36% of multi-family respondents reported that they did not know about it. Ten percent of single family respondents and 9% of multi-family respondents reported they did not have a computer, and 10% of single family respondents said they did not use computer.

Evidence of MyHER Effects

As noted above, while formal statistical testing found some differences among treatment and control group households for individual questions, Nexant sought to understand if the overall pattern of survey responses differed among treatment and control households. To do this, we categorized each survey question by topic area and then counted any survey item in which the treatment households provided a more positive response than the control households.

Nexant's approach consists of the following logical elements:

- Assume the number of positive responses between treatment and control customers will be equal if MyHER lacks influence;
- Count the total number of topics and questions asked of both groups – there are seven topic areas and 51 questions;
- Note any item for which the treatment group outperformed the control group:
    - Single family: The treatment group outperformed the control group in 29 questions, or 57% of the total questions;
    - Multi-family: The treatment group outperformed the control group in 20 questions, or 39% of the total questions; and
- Calculate the probability that the difference in response patterns is due to chance, rather than an underlying difference in populations – 87% in the case of single family. Since this probability is much greater than 10%, we cannot reject the null hypothesis that the number of positive responses should be equal for treatment and control customers at the 90% level of confidence.

In comparing the response patterns between the treatment and control groups, if the MyHER program did not influence customers, one would expect the treatment group to "score higher" on roughly half of the questions. In other words, if the MyHER is not influencing treatment group customers, there is a 50/50 chance that they will "outperform" the control group as many times as not. What we see in the survey data overall is the proportion of questions indicating a positive MyHER effect near 50% in the case of single family program participants. In fact, the proportion of questions where treatment customers showed a positive MyHER effect was a little higher than 50%, however not statistically different from 50% at the 90% level of confidence.

The survey data reveal that there are specific areas where MyHER has a relatively stronger and poorer positive effect. These areas of strong and weak performance are different for single family and multi-family participants, as shown in Table 4-23 and Table 4-24. In the case of single family customers, receiving the MyHER is associated with lower customer reported energy savings behaviors. This result may indicate that opportunities exist for Duke Energy to leverage the reports and website as a vehicle for delivering different or new information and opportunities to MyHER recipients that would increase their overall energy efficiency behaviors taken. On the other hand, single family MyHER recipients had a more positive view in these surveys on customer engagement with Duke Energy website, customer motivation, engagement and awareness of energy efficiency, customer satisfaction with Duke Energy, and they reported experiencing fewer barriers to take energy savings actions.

Same as the single family customers, multi-family customers MyHER recipients reported

experiencing fewer barriers to taking energy savings actions than non-recipients and higher customer engagement with Duke Energy website. Unlike single family customers, multi-family MyHER survey responses also indicated lower satisfaction on Duke Energy's energy efficiency offerings and customer motivation, engagement and awareness of energy efficiency, and lower level of customer satisfaction with Duke Energy.

When considering all possible areas of enhancement that the MyHERs can have on customer attitudes and actions related to satisfaction and energy savings behaviors, we observe areas of relative strength and weakness that differ between single family and multi-family customers. This result further illustrates that the messaging and approach taken in the reports delivered to multi-family customers may differ from that used in the single family reports in order to optimize the desired effects of increasing satisfaction and energy savings actions across both customer groups.

Table 4-23: Survey Response Pattern Index – Single Family

Question Category	Count of Ques. where T better than C	Number of Ques. in Topic Area	Portion of Ques. where T better than C
Duke Energy's Public Stance on Energy Efficiency	2	4	50%
Customer Engagement with Duke Energy Website	4	5	80%
Customer's Reported Energy-saving Behaviors	1	11	9%
Customer's Reported Energy Efficiency Improvements Made	5	10	50%
Customer Motivation, Engagement and Awareness of Energy Efficiency	8	11	73%
Barriers of Customer Not Undertaking Energy Savings Actions	6	6	100%
Customer Satisfaction with Duke Energy	3	4	75%
Total	**29**	**51**	**57%**

Table 4-24: Survey Response Pattern Index – Multi-family

Question Category	Count of Ques. where T better than C	Number of Ques. in Topic Area	Portion of Ques. where T better than C
Duke Energy's Public Stance on Energy Efficiency	0	4	0%
Customer Engagement with Duke Energy Website	4	5	80%
Customer's Reported Energy-saving Behaviors	5	11	45%
Customer's Reported Energy Efficiency Improvements Made	3	10	30%
Customer Motivation, Engagement and Awareness of Energy Efficiency	3	11	27%
Barriers of Customer Not Undertaking Energy Savings Actions	4	6	67%
Customer Satisfaction with Duke Energy	1	4	25%
Total	**20**	**51**	**39%**

Respondent Demographics

Nearly all single family respondents—88% of treatment group customers and 90% of control group customers—own their residence. Among multi-family respondents, 81% of treatment group customers and 76% of control group customers rent their residence. More than half of households surveyed have two or fewer residents for both single family and multi-family. For single family households, about 13% of treatment households and 14% of control households have four or more residents. For multi-family households, about 7% of treatment households and 14% of control households have four or more residents. There are no statistically significant differences in the distribution of ownership or age of homes assigned to the treatment and control groups for both single family and multi-family (Figure 4-74 and Figure 4-75).

Figure 4-74: "In What Year Was Your Home Built?" – Single Family

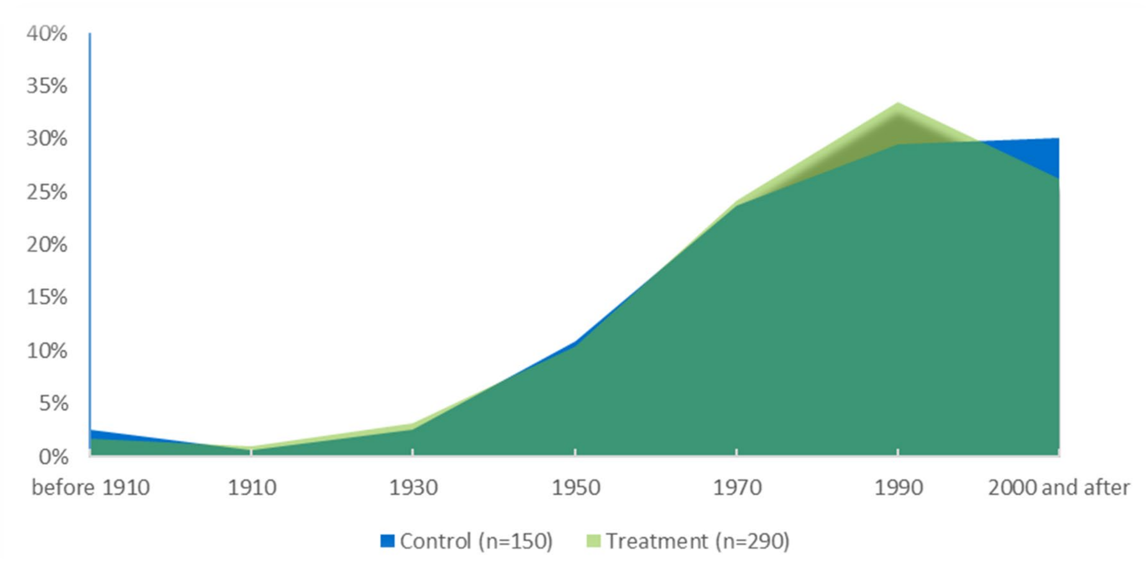


Figure 4-75: "In What Year Was Your Home Built?" – Multi-family

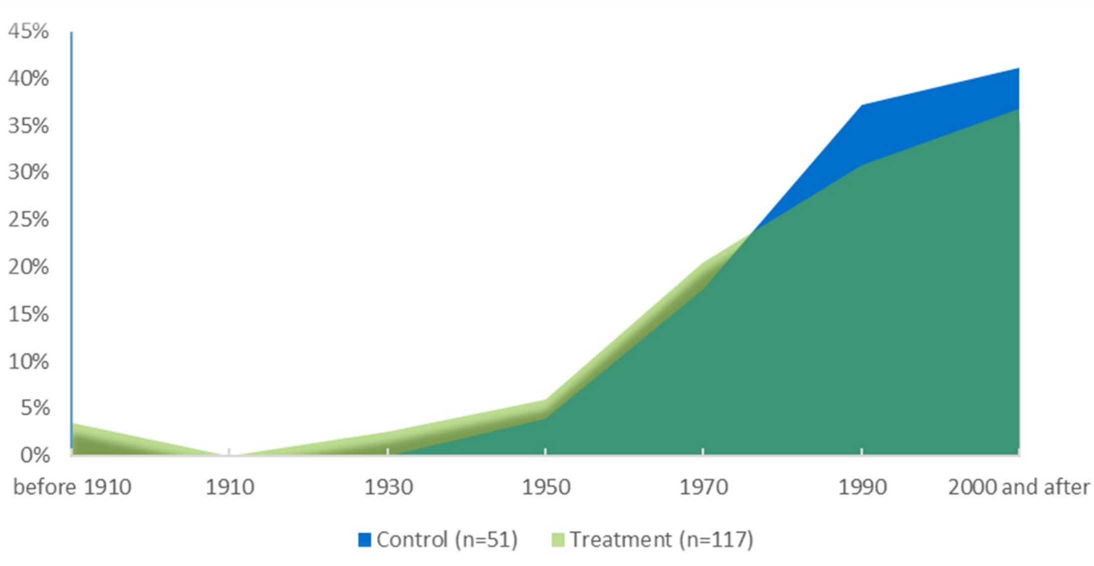


Figure 4-76 shows distribution of home square footage is similar between control and treatment group customers among single family households. The average square footage above ground is 2,152 for control households and 2,103 for treatment households, and the difference is not statistically significant. Figure 4-77 shows distribution of home square footage of control and treatment group customers among multi-family households. The average square footage above ground is 1,342 for control households and 1,323 for treatment households, and the difference is not statistically significant at the 90% level of confidence.

Figure 4-76: How many square feet is above ground living space? – Single Family

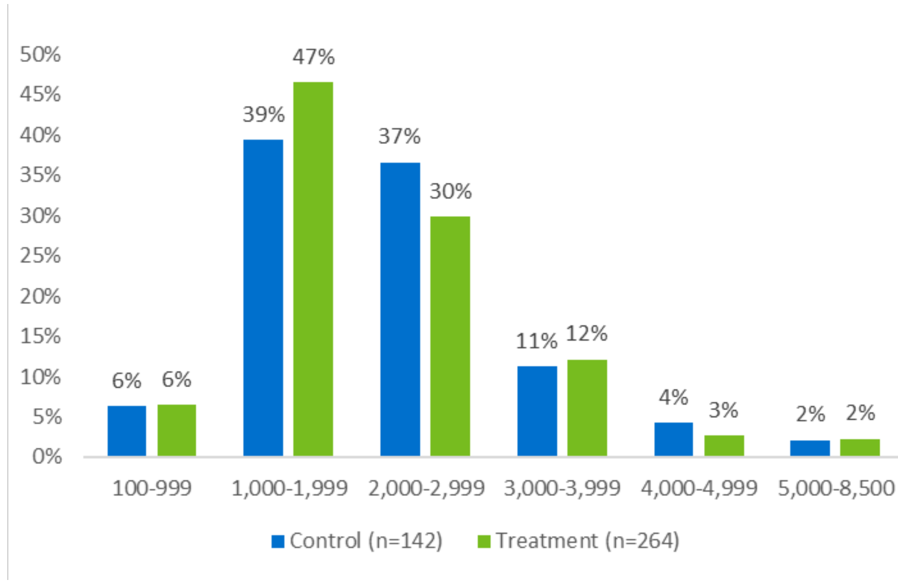
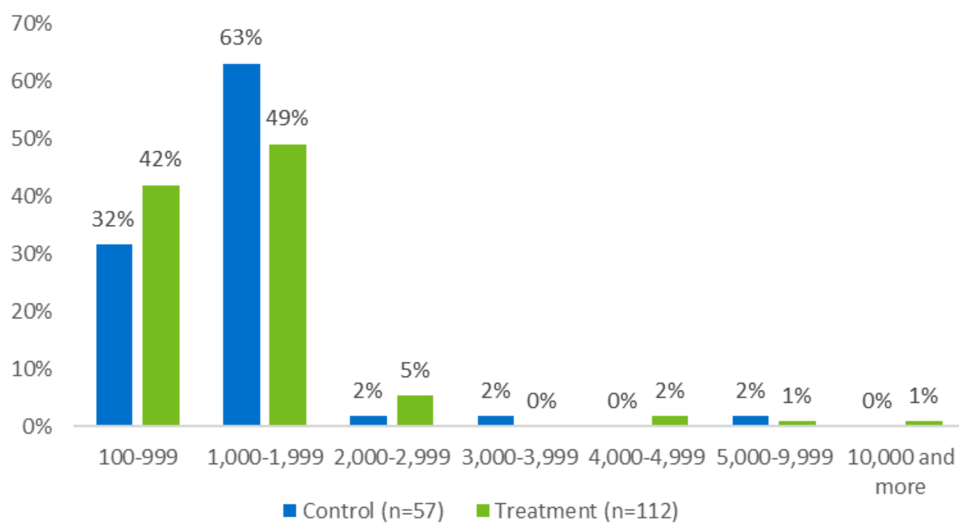


Figure 4-77: How many square feet is above ground living space? – Multi-family



The average age for single family respondents is 63 for control customers and 64 for treatment customers. For multi-family respondents it is 55 for control customers and 53 for treatment customers. The lowest age category (Younger than 25) is often underrepresented in survey studies, given that many members of that population would not participate in surveys. This common underrepresentation is true in this survey study, as well (see Table 4-25).

Table 4-25: Respondent Age Relative to RECS or American Housing Survey

Age	Single Family			Multi-family		
	Control Group (n=156)	Treatment Group (n=302)	EIA RECS Data South Atlantic Census Division[21]	Control Group (n=82)	Treatment Group (n=173)	American Housing Survey[22]
Younger than 25	0%	0%	6%	0%	1%	10%
25-34	5%	3%	14%	15%	23%	30%
35-44	7%	7%	15%	17%	14%	23%
45-54	15%	15%	20%	15%	13%	19%
55-64	23%	23%	20%	18%	14%	9%
65 and over	50%	52%	26%	35%	35%	9%

Figure 4-78 shows the primary heating fuel type used in single family control and treatment households. More than half of treatment (69%) and control (64%) customers use electricity in their households for heating. Twenty-two percent of treatment customers and 27% of control customers use natural gas for heating. These differences are not statistically significant.

Figure 4-78: Primary Heating Fuel in Households – Single Family

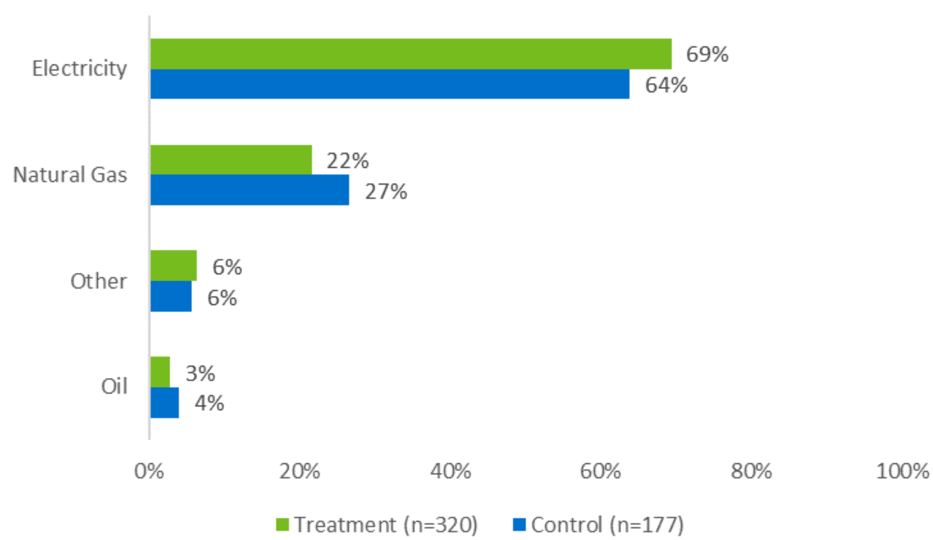


Figure 4-79 shows the primary heating fuel type used in multi-family control and treatment households. More than half of treatment (89%) and control (87%) customers use electricity in

[21] 2015 Residential Energy Consumption Survey (RECS). https://www.eia.gov/consumption/residential/data/2015/hc/php/hc9.8.php

[22] American Housing Survey, 2011 Charlotte - Household Demographics - All Occupied Units, Charlotte-Gastonia-Rock Hill, NC-SC MSA (1993 OMB definition) Tenure Filter: Renter, https://www.census.gov/programs-surveys/ahs/data/interactive/ahstablecreator.html?s_areas=16740&s_year=2011&s_tablename=TABLE8A&s_bygroup1=1&s_bygroup2=1&s_filtergroup1=3&s_filtergroup2=1"

their households for heating. The difference is not statistically significant. Ten percent of treatment customers and control customers, respectively, use natural gas for heating.

Figure 4-79: Primary Heating Fuel in Households – Multi-family

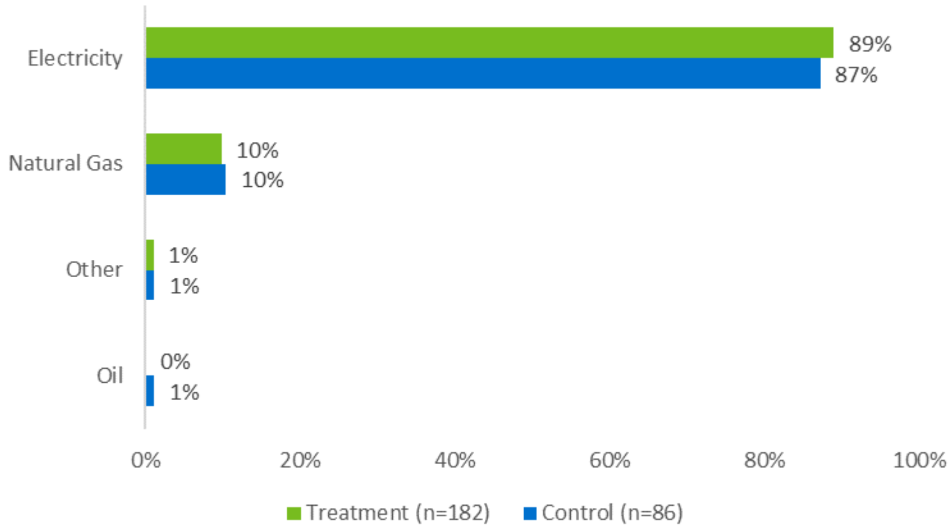


Table 4-26 shows the distribution of total annual household income in single family and multi-family households. Seventeen percent of single family treatment and control customers, respectively, reported their household income between $50,000 and $75,000 in 2020. For the multi-family households, 16% of treatment customers and 18% of control customers reported their household income in this bracket in 2020.

Table 4-26: 2020 Total Annual Household Income

2020 Annual Income	Single Family		Multi-family	
	Control (n=146)	Treatment (n=270)	Control (n=77)	Treatment (n=167)
Under $15,000	14%	13%	16%	20%
$15,000 to under $25,000	11%	10%	14%	14%
$25,000 to under $35,000	8%	10%	16%	9%
$35,000 to under $50,000	10%	12%	19%	19%
$50,000 to under $75,000	17%	17%	18%	16%
$75,000 to under $100,000	14%	10%	5%	11%
$100,000 to under $150,000	11%	16%	6%	4%
$150,000 to under $200,000	9%	6%	1%	5%
$200,000 or more	7%	5%	4%	2%

4.3 Summary of Process Evaluation Findings

In-depth interviews with Duke Energy MyHER program staff reveal that the DEC and DEP MyHER program has benefited throughout the life of the Uplight program implementation from a number of enhancements to the program and improvements in process and program management, and continues to operate effectively. A reduced number of six (from eight) paper reports are now sent to new enrollees that also receive eHERs in an effort to optimize treatment effects and program cost-effectiveness. In addition, efforts to increase enrollment for the MyHER Interactive online portal continues. In 2020, enrollment increased by nearly 30,000 customers in DEC and about 15,000 customers in DEP. The MyHER user experience is expected to be further enhanced in the future as the rollout of AMI meters recently completed in DEC and DEP and the strategic leveraging of this data continues to evolve in terms of report modeling and data presentation.

From the back office perspective, Uplight, Duke Energy's MyHER program provider, implemented a primary process improvement. Uplight launched HOMERS (Home Energy Reporting Service), which is a report management software platform that provides structure for Uplight's MyHER data management, quality control, and report production processes, while offering Duke Energy interactive management tools as well. Importantly, this shift to HOMERS has helped decrease QC errors at Uplight, and resulted in smaller and more predictable report batch sizes when reports are transferred to Duke Energy twice a week for QC purposes. In addition, the migration has reduced the amount of time reports take to get to customers. Not only did this reduction help Uplight meet their 12 day delivery SLA, customers get the report earlier in the month while their patterns of energy use from the previous month are fresher in their minds which should motivate behavioral change more effectively.

Additionally, Uplight has continued to make progress on updating the "action tips" section of the report to "smart actions", by increasing the number of these tips that are linked to the comparison housing model. In 2019, Uplight added 23 of these tips to the existing library of tips and overall have increased the size of this library by 50%. These "tips" were the latest feature to be added to the MyHER portion of the Duke Energy app, joining the home comparison chart, cohort information, and usage disaggregation.

Duke Energy and Uplight continued to collaborate for success through joint weekly status meetings, monthly operations meetings, and quarterly governance meetings for the duration of the implementation contract. Working together, monthly key performance indicators (KPIs) such as in-home dates and percentage of treated customers treated are monitored. These meetings provide the venue for brainstorming and roadmapping activities as well as monitoring Duke Energy's MyHER product request list. Uplight used an internal HER Improvement team to address the items on the list. Since the prior evaluation, Uplight has improved their performance in product quality, which is rigorously monitored by Duke Energy staff.

In general, the strong emphasis on the development of procedures and strategies to prevent problems in the MyHER production process that began in earnest in 2018 at both Uplight and

Duke Energy helped streamline the transition to the HOMERS platform that otherwise may have resulted in a more problematic and error-prone report production process and a less successful program overall.

Survey Findings – Single-family - DEC

Surveys of the single family treatment and control customers show that, among treatment group households:

- 95% recalled receiving at least one MyHER and 98% of those indicated that they "always" or "sometimes" read the reports.
- 58% reported being "very" or "somewhat" satisfied with the information provided by MyHERs.
- MyHER recipients are more likely to be satisfied with the three aspects of customer service provided by Duke Energy than non-recipients, but difference is not statistically significant.
- MyHER single family recipients are not more likely to undertake energy-saving behaviors or upgrades than non-recipients, however it is possible they do the same energy-savings behaviors with greater frequency or intensity of effort.
- Only 31% of MyHER recipients are aware of MyHER Interactive, and only 9% of the aware recipients reported that they had signed up to use it. When asked why they haven't signed up to use MyHER Interactive, 29% of respondents reported that they were not interested in it, 21% reported that they were too busy, and 14% then stated that they did not know about it.
- More than half, 64%, of respondents strongly agree with the statement "I have learned about my household's energy use from My Home Energy Reports". Very few (10%) strongly agree with the idea that the energy usage information presented by the reports is confusing.
- The most useful feature of the reports, as rated by treatment customer respondents, is the graphs that illustrate the home's energy usage over time.
- More than half (59%) of the respondents had no feedback or suggestions to improve the program. Those that made suggestions most frequently requested more specific or detailed information in their MyHERs or questioned the accuracy of the neighborhood comparisons.

Survey Findings – Multi-family – DEC

Surveys of the multi-family treatment and control customers show that, among treatment group households:

- 95% recalled receiving at least one MyHER and 94% of those indicated that they "always" or "sometimes" read the reports.
- 72% reported being "very" or "somewhat" satisfied with the information provided by MyHERs.
- MyHER recipients are more likely to be satisfied with Duke Energy's response to COVID-19 to help those dealing with financial hardship than non-recipients, but the difference is not statistically significant.

- MyHER multi-family recipients are not more likely to undertake energy-saving behaviors or upgrades than non-recipients, but as mentioned above, it is possible they undertake the behaviors with greater frequency or intensity.
- Only 52% of MyHER recipients are aware of MyHER Interactive, and only 9% of the aware recipients reported that they had signed up to use it. When those who hadn't signed up for MyHER Interactive were asked why, 27% reported that they were not interested in it, 27% of respondents then reported that they did not know about it, 18% of respondents reported that they were having technological issues or did not use computers, and another 14% reported that they were too busy.
- More than half of multi-family MyHER recipients, 74%, agree with the statement: “I have learned about my household's energy use from My Home Energy Reports”. A minority but notable proportion of respondents, 16%, strongly agree with the idea that the energy usage information presented by the reports is confusing.
- The most useful feature of the reports, as rated by treatment customer respondents, is the energy use associated with specific household items and areas.
- A majority (74%) of respondents had no feedback or suggestions to improve the program. Those that made suggestions most frequently reflected a desire for more specific information or details about their home and specific actions they should take.

Survey Findings – Single-family and Multi-family Comparison – DEC

- Both SF and MF treatment customers have about the same level of satisfaction (as measured by top-2 of 10 box scores) – MyHER did not result in a measurable uplift in satisfaction with Duke Energy during this evaluation period.
- More MF customers report being satisfied with MyHER than SF (72% vs. 58%).
- More multi-family MyHER recipients (66%) than single family MyHER recipients (56%) reported that My Home Energy Report provided the details they needed to understand their energy use, but the difference is not statistically significant.
- Multi-family customers are significantly more likely to agree that Duke Energy provides service at a reasonable cost than single family customers (72% vs. 62%).
- Multi-family treatment customers are more likely to report “Energy use associated with specific household items or areas is useful than single family treatment customers. The difference is statistically significant at the 90% level of confidence.
- Single family treatment customers were significantly more likely to have undertaken five EE upgrades than multi-family treatment customers, and this difference appears to be driven by homeownership - Single family homeowners from this group were also more likely to undertake five energy efficient upgrades than multi-family homeowners, but the differences are not statistically significant in that case.
- There is a significant differential between satisfaction among treatment customers and interest in control customers in “information about services and offers from Duke Energy”, indicating that the MyHERs could look to improve satisfaction or acceptance of this report feature. This finding holds for both SF and MF customers.

Survey Findings – Single-family – DEP

Surveys of the single family treatment and control customers show that, among treatment group households:

- 95% recalled receiving at least one MyHER and 94% of those indicated that they "always" or "sometimes" read the reports.
- 63% reported being "very" or "somewhat" satisfied with the information provided by MyHERs.
- MyHER recipients are more likely to be satisfied with Duke Energy's commitment to promoting energy efficiency and the wise use of electricity, and the information available about Duke Energy's efficiency programs than non-recipients, but these differences are not statistically significant.
- MyHER single family recipients are not more likely to undertake energy-saving behaviors than non-recipients, but may undertake these actions more often.
- Only 38% of MyHER recipients are aware of MyHER Interactive, and only 6% of the aware recipients reported that they had signed up to use it. When asked why they haven't signed up to use MyHER Interactive, 32% of respondents reported that they were not interested in it, 19% reported that they were having technological issues or they did not use computers, 19% reported that they were too busy, and 10% then stated that they did not know about it.
- More than half, 64%, of respondents strongly agree with the statement "I have learned about my household's energy use from My Home Energy Reports". Few (10%) strongly agree with the idea that the energy usage information presented by the reports is confusing.
- The most useful features of the reports, as rated by treatment customer respondents, are the graphs that illustrate the home's energy usage over time.
- Most (68%) respondents had no feedback or suggestions to improve the program. Those that made suggestions most frequently requested more specific or detailed information in their MyHERs, and questioned the accuracy of the comparison.

Survey Findings – Multi-family – DEP

Surveys of the multi-family treatment and control customers show that, among treatment group households:

- 85% recalled receiving at least one MyHER and 98% of those indicated that they "always" or "sometimes" read the reports.
- 73% reported being "very" or "somewhat" satisfied with the information provided by MyHERs.
- MyHER recipients are not more likely to be satisfied with various aspects of Duke Energy customer service than non-recipients.
- MyHER multi-family recipients are not more likely to undertake energy-saving behaviors than non-recipients, but they could be undertaking those same behaviors with greater consistency or intensity.
- Only 38% of MyHER recipients are aware of MyHER Interactive, and only 18% of the aware recipients reported that they had signed up to use it. When those who hadn't signed up for MyHER Interactive were asked why, 36% reported that they actually did

not know about it, 18% reported that they were not interested in it, and 9% reported that they were too busy.

- More than half of multi-family MyHER recipients, 69%, agree with the statement: “I like receiving the Home Energy Reports”. A minority (12%) strongly agree with the idea that the energy usage information presented by the reports is confusing.
- The most useful features of the reports, as rated by treatment customer respondents, are the graphs that illustrate the home’s energy usage over time.
- More than half (61%) of respondents had no feedback or suggestions to improve the program. Those that made suggestions most frequently questioned the accuracy of the comparison homes.

Survey Findings – Single-family and Multi-family Comparison – DEP

- As in DEC, both SF and MF DEP treatment customers have about the same level of satisfaction (as measured by top-2 of 10 box scores) – MyHER did not result in a measurable uplift in satisfaction with Duke Energy during this evaluation period.
- Significantly more multi-family MyHER recipients (69%) than single family MyHER recipients (56%) like receiving the Home Energy Reports.
- Significantly more multi-family MyHER recipients (68%) than single family MyHER recipients (51%) report using the MyHERs to tell them how well they are doing at saving energy.
- Significantly more multi-family MyHER recipients (66%) than single family MyHER recipients (51%) report “My Home Energy Reports provide the details I need to understand my home's energy use”.
- Significantly more multi-family MyHER recipients (54%) than single family MyHER recipients (39%) report “Since reading the Home Energy Reports, I have taken actions to use less energy than I would not have otherwise taken”.
- Multi-family customers are more likely to agree that Duke Energy provides excellent customer service than single family customers (83% vs. 81%). The difference is not statistically significant.
- Single family treatment customers were significantly more likely to have undertaken almost all EE upgrades than multi-family treatment customers. Homeownership is an important factor - single family homeowners from this group were more likely to undertake five energy efficient upgrades than multi-family homeowners, but the differences are not statistically significant.
- There is a significant differential between satisfaction among treatment customers and interest in control customers in “comparisons to similar homes” and “tips to help you save money and energy”, indicating that the MyHERs could look to improve satisfaction or acceptance of these report features. This finding holds for SF customers only.

5 Conclusions and Recommendations

Nexant finds that the MyHER program is an effective channel for increasing customer engagement with energy efficiency and demand side management. The RCT program design facilitates reliable estimates of program energy savings. Further, the energy savings generated by the program are corroborated by survey findings of respondent awareness of, engagement in, and focus on the importance of saving energy. As an additional benefit, Nexant finds that MyHER is a useful tool for increasing uptake in other Duke Energy efficiency programs. The MyHER program is at full deployment among Duke Energy Carolinas and Progress single-family home customers, and now multi-family home customers as well, and Nexant recommends that Duke Energy continue to focus on program processes and operations to further increase the efficiency of program delivery.

Duke Energy also launched the MyHER Interactive portal in March 2015. The portal offers additional means for customers to customize or update Duke Energy’s data on their premises, demographics, and other characteristics that affect consumption and the classification of each customer. The portal also provides additional custom tips based on updated data provided by the customer. MyHER Interactive sends email challenges to portal users that seek to engage customer in active energy management, additional efficiency upgrades, and conservation behavior. Nexant evaluated the impacts of the MyHER Interactive portal using a matched comparison group because the MyHER Interactive portal was not deployed as a randomized controlled trial (RCT).

5.1 Impact Findings

Nexant estimates that the MyHER program saved a total of 313.5 GWh at Duke Energy Carolinas among single family program participants and 13.5 GWh among multi-family program participants. At Duke Energy Progress, single family participants saved 175.2 GWh due to the MyHER reports and multi-family participants saved 4.4 GWh. The confidence and relative precision of the estimates is 90% confidence and 8.7% and 30.4%, respectively, for DEC single family and multi-family. At DEP, the relative precisions are 9.9% and 51.3%, respectively, at the same level of confidence. These impact estimates account for the fact that MyHER increases uptake of other Duke Energy programs; 4.4 and 2.9 kWh has been subtracted from the average single family and multi-family DEC household program impact to account for the MyHER uplift in other programs. At DEP, 3.2 kWh and 1.0 kWh, respectively, were subtracted from the after single family and multi-family DEP household program impact for the same reason. Without such corrections, those savings would be double counted by Duke Energy.

Nexant does not find statistically significant (at the 90% level of confidence) incremental impacts that can be attributed to some MyHER treatment customers enrollment in Interactive for either DEC or DEP during this evaluation period.

5.2 Process Findings

MyHER is one of Duke Energy's most important residential DSM programs in terms of delivered energy savings in the Carolinas jurisdictions. Program operations are data-intensive – managing and processing the large volumes of data required to generate the monthly reports and support the program delivery schedule is the primary focus of program activities. Duke Energy and its implementation contractor, Uplight, have successfully managed this process and have provided DEC and DEP customers valuable information for managing home energy consumption.

The DEC and DEP MyHER program has benefited from a number of process and product management improvements. Careful change management and a stable operations team at Uplight have been key enablers of maintaining a production process that consistently meets MyHER quality control standards.

DEC MyHER single family participants have been found, in this evaluation's customer surveys, to display higher levels of satisfaction with how Duke Energy provides excellent customer service than multi-family participants, while multi-family participants find the energy use associated with specific household items and areas significantly more useful than control customers think they might be. Overall, 58% of DEC single family and 72% of DEC multi-family recipients are very or somewhat satisfied with the information in the HERs. In addition, single family respondents were significantly more likely to report initial cost of energy efficient equipment is too high as a barrier to energy-saving actions than multi-family.

DEP MyHER single family participants have been found, in this evaluation's customer surveys, to display higher levels of satisfaction with how Duke Energy respects its customers and provides service at a reasonable cost than control customers, while multi-family participants find the graphs that display home energy use and customized suggestions for their homes more useful than control customers think they might be. Overall, 63% of DEP single family and 73% of DEP multi-family recipients are very or somewhat satisfied with the information in the HERs. In addition, multi-family respondents were significantly more likely to report "I do not think my energy saving efforts are worth the time and/or money" as a barrier to energy-saving actions than single family

5.3 Program Recommendations

Nexant has the following specific recommendations for enhancing Duke Energy's MyHER program:

- **Continue the commitment to simultaneous control and treatment assignment.** New assignments to treatment and control groups must be simultaneous and Duke Energy should always add all newly assigned treatment and control groups to their respective status in a single billing month, to the extent that is technically feasible.
- **Continue the practice of making assignments of new single family accounts to MyHER treatment and control groups at most twice a year.** The numbers of Duke Energy customers becoming eligible for the program each year do not facilitate more

frequent assignments. This is due to the fact that sufficient numbers of customers must be set aside for the control group each time a group of customers is assigned to treatment in order for the evaluator to be able to measure the energy savings delivered by the new cohort.

- **Consider using larger control groups for the multi-family program.** This is the first evaluation in the DEC and DEP service territories and Nexant finds that the 90% confidence bands around the impact estimates for multi-family are very wide. This may improve over time as the first multi-family cohorts mature, but the opportunity for maturation may be less than for single family due to the more frequent account turnover among multi-family customers; maturation also may not include less variability in impacts so Duke Energy should consider larger control groups for this program segment.
- **Build on previous successes of Interactive awareness campaigns.** The process evaluation finds that current awareness of Interactive among MyHER participants has slightly increased for single family customers since the last evaluation (DEC: 28% to 31%, DEP: 35% to 38%), but is still somewhat low.
- **Leveraging AMI data and producing content.** In 2019, this data was presented in a pilot project to a small number of eHER recipients in the form of hourly weekday usage graphs. In addition, this data was leveraged to improve the housing model to improve disaggregation modeling. Considering that AMI meters deployment has reached nearly 100% in the DEC and DEP jurisdiction, and the presentation of this data offers older cohorts novel content, Duke Energy should continue to cost-effectively leverage AMI data.
- **Work to improve satisfaction.** Compared to the previous evaluation on satisfaction with information in the reports dropped (DEC single family: from 87% to 58%; DEP single family: from 80% to 63%). In addition, single family and multi-family control customers' expectations regarding the usefulness of some features of HERs tend to be significantly higher than treatment customers' ratings of their actual usefulness, indicating an opportunity to improve these features and align customers' expectations with reality.
- **Tune in to relevant energy-saving behaviors of multi-family customers.** While multi-family customers report high levels of engagement and interest in HERs, their reported energy investments are lower than those of single family customers, even for multi-family homeowners. While some of these differences are attributable to differing equipment saturation levels between the two segments, these disparities do indicate a need to understand more fully the energy-relevant behaviors, and barriers to energy saving behavior, of multi-family customers so as to make HERs more useful to customers in this segment.
- **Work to inspire trust in report accuracy.** While Uplight has continued work to improve the model used for building comparison home groups, including refining customers' accounts who have pools and electric vehicles, in open-ended responses to questions regarding suggested improvements to the reports, 24% of DEC single family and DEP single family survey comments, respectively, and 56% of DEP multi-family survey comments reported concerns about the accuracy and applicability of the reports to their home.

- **Target Interactive customers' summertime usage as an opportunity to increase annual Interactive savings.** Currently, Interactive customers are showing statistically significant uplifts in savings, over and above the savings attributable to the report. However, on an annual basis, those savings are eroded by significant increases in energy use in the summertime. MyHER should leverage opportunities to remind Interactive users not to backslide with energy savings behaviors in the summer.

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EM&V Report for the Duke Energy Multifamily Energy Efficiency Program

Prepared for:

Duke Energy Progress, Duke Energy Carolinas

FINAL

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Table of Contents

List of Tables, Figures and Equations

1. Evaluation Summary

1.1 Program Summary

The Multifamily Energy Efficiency Program is a direct install program offering efficient lighting and water products free of charge to Duke Energy customers in the multifamily sector. The program is delivered through coordination between Duke Energy (or Franklin Energy, the program implementation contractor) and property managers or owners at qualifying multifamily sites. The program consists of the following lighting and water measures.

- **Lighting Measures:** Light-emitting diode (LED) bulbs installed in permanent fixtures, including A-lines, candelabra, globe, track and recessed lights.
- **Water Measures:** Low flow bathroom and kitchen faucet aerators, water-saving showerheads, and water heater pipe wrap (pipe wrap) are installed to reduce electric energy used for water heating.

All direct installations are overseen by Franklin Energy. Third party quality control inspections are completed on twenty percent of properties in any given month. The quantities of units that are inspected at each property are dependent upon the property size. Overall, at year end, at least 5 percent of all completed units must be inspected.

1.2 Evaluation Objectives and Methods

Guidehouse's evaluation included an independent assessment of program impacts and performance for participation that occurred in both the Duke Energy Progress (DEP) and Duke Energy Carolinas (DEC) jurisdictions between July 1, 2019 through June 30, 2021. For this Evaluation, Measurement, and Verification (EM&V) effort, Guidehouse used an engineering-based approach to calculate program impacts, similar to previous evaluation cycles with some differences pertaining to data collection activities. The sampling procedure was updated to reflect the current mix of program measures, facility characteristics like jurisdiction and year of participation, and data collection activities. In order to manage risk associated with COVID-19, Guidehouse replaced the previous onsite field study with virtual verification to collect information necessary for impact calculations. The evaluation approach and objectives can be described as follows:

- **Impact evaluation:** To quantify the net and gross energy and coincident demand savings associated with program activity at both the measure level and program level

- **Process evaluation:** To assess program delivery and customer satisfaction

- **Net-to-Gross evaluation:** To assess the net-to-gross ratio

By performing both impact and process components of the EM&V effort, Guidehouse provides Duke Energy with verified energy and demand impacts, as well as a set of recommendations that are intended to aid Duke Energy with improving or maintaining the satisfaction with program delivery while meeting energy and demand reduction targets in a cost-effective manner.

1.3 Evaluation Parameters and Sample Period

To accomplish the evaluation objectives, Guidehouse performed an engineering review of measure savings algorithms, virtual verification to assess installed quantities and characteristics, as well as surveys with tenants and property managers to assess satisfaction, decision-making processes and the net-to-gross ratio. The evaluated parameters are summarized in Table 1-1. For virtual verification the target sampling confidence and precision was 90 percent ± 10 percent and the achieved was 90 percent ± 3.0 percent.

Table 1-1. Evaluated Parameters

Evalauted Parameter	Description	Details
Efficiency Characteristics	Inputs and assumptions used to estimate energy and demand savings	1. LED Wattage 2. Baseline Lamp Wattage 3. Aerator flow rates 4. Showerhead flow rates
In-Service Rates	The percentage of program measures in use as compared to reported	1. LED, aerator, and showerhead quantities 2. Pipe wrap length
Satisfaction	Customer satisfaction	1. Satisfaction with program 2. Satisfaction with measures 3. Satisfaction with contractor
Free Ridership	Fraction of reported savings that would have occurred, even in the absence of the program	1. Property manager interviews
Spillover	Additional, non-reported savings that occurred as a result of participation in the program	1. Property manager interviews 2. Tenant phone surveys

Source: Guidehouse

This evaluation covers participation from July 1, 2019 through June 30, 2021 for both water and lighting measures. The program suspended operations in March 2020 in response to the COVID-19 pandemic and hence the program tracking data does not include participation beyond this date. Thus, the evaluation effectively covers participation from July 1, 2019 through March 16, 2020. Table 1-2 shows the start and end dates of Guidehouse's EM&V data collection activities for this evaluation..

Table 1-2. EM&V Activity Period Start and End Dates

Activity	Start Date	End Date
Virtual Verification	9/28/2021	11/10/2021
Tenant Phone Surveys	8/12/2021	9/8/2021
Property Manager Interviews	8/16/2021	9/24/2021

Source: Guidehouse

1.4 Program Level Findings

Guidehouse found that Duke Energy is successfully delivering the Multifamily Energy Efficiency Program to customers, participant satisfaction is generally favorable, and the reported measure installations are relatively accurate.

For the evaluation period covered by this report, there were a total of 12,181 housing units at 114 participating properties in the DEP jurisdiction and 24,720 housing units at 180 participating properties in the DEC jurisdiction. The program-level evaluation findings are presented in Table 1-3 through Table 1-6. For the DEP jurisdiction, Guidehouse found the realization rate for gross energy savings to be 100 percent. For the DEC jurisdiction, Guidehouse found the realization rate for gross energy savings to be 98 percent, meaning that total verified gross energy savings were found to be slightly lower than claimed in the tracking database provided by Duke Energy.

Guidehouse found the net-to-gross (NTG) ratio to be 0.96, meaning that for every 100 kWh of reported energy savings, 96 kWh can be attributed directly to the program. Guidehouse calculated the net energy and demand impacts by multiplying the gross energy and demand impacts by the NTG ratio. These findings will be discussed in greater detail throughout this report.

Table 1-3. Program Claimed and Evaluated Gross Energy Impacts

	Claimed	Evaluated	Realization Rate
DEP Gross Energy Impacts (MWh)	7,801	7,763	100%
DEC Gross Energy Impacts (MWh)	14,369	14,053	98%

Source: Guidehouse analysis, values subject to rounding.

Table 1-4. Program Claimed and Evaluated Gross Peak Demand Impacts

	Claimed	Evaluated	Realization Rate
DEP Gross Summer Peak Demand Impacts (MW)	1,027	1,089	106%
DEP Gross Winter Peak Demand Impacts (MW)	1,380	1,325	96%
DEC Gross Summer Peak Demand Impacts (MW)	1,875	1,961	105%
DEC Gross Winter Peak Demand Impacts (MW)	2,541	2,410	95%

Source: Guidehouse analysis, values subject to rounding.

Table 1-5. Program Evaluated Net Energy Impacts

	Evaluated
DEP Gross Energy Impacts (MWh)	7,454
DEC Gross Energy Impacts (MWh)	13,494

Source: Guidehouse analysis, values subject to rounding.

Table 1-6. Program Evaluated Net Peak Demand Impacts

	Evaluated
DEP Gross Summer Peak Demand Impacts (MW)	1,046
DEP Gross Winter Peak Demand Impacts (MW)	1,272
DEC Gross Summer Peak Demand Impacts (MW)	1,883
DEC Gross Winter Peak Demand Impacts (MW)	2,314

Source: Guidehouse analysis, values subject to rounding.

1.5 Evaluation Considerations and Recommendations

Guidehouse developed several recommendations during the EM&V effort. These recommendations are intended to assist Duke Energy with enhancing the program delivery and customer experience, as well as to possibly increase program impacts. Further explanation for each recommendation can be found later in this report.

1. Guidehouse recommends that Duke Energy should adopt the per unit ex post energy and demand impacts from this evaluation and use them going forward.
2. Duke Energy should consider educating participating tenants and property managers about the Duke Energy Online Store as an option to purchase additional or replacement equipment. This could involve distribution of additional marketing material to tenants during participation in this program.
3. Duke Energy should track additional existing energy efficiency opportunities (not offered through this program) at participating properties and consider channeling them through other applicable programs that offer those measures by sharing relevant leads internally.
4. Guidehouse recommends that Franklin Energy track the actual equipment type (bathroom aerator, kitchen aerator, or showerhead) for the water measures removed during installation along with the GPM value of the removed equipment already captured and provide that as part of the removed measures data going forward.

2. Program Description

2.1 Design

The Multifamily Energy Efficiency Program is designed to provide energy efficiency to a sector that is often underserved or difficult to reach via traditional, incentive-based energy efficiency programs. This market can be difficult to penetrate because multifamily housing units are often tenant-occupied rather than owner-occupied, meaning that the benefits of performing energy efficiency upgrades may be realized by the tenant whereas the incremental costs are absorbed by the property owner.

Duke Energy's Multifamily Energy Efficiency Program in both the DEP and DEC jurisdictions provides energy efficient equipment at no cost to multifamily housing property owners. The program is delivered through coordination with property managers/owners. Tenants are provided with notice and informational materials to inform them of the program and potential for reduction in their energy bills. The program consists of lighting and water measures.

- **Lighting Measures:** Light-emitting diode (LED) bulbs installed in permanent fixtures, including A-lines, candelabra, globe, track and recessed lights.

- **Water Measures:** Low flow bathroom and kitchen faucet aerators, water-saving showerheads, and water heater pipe wrap installed to reduce energy used for electric water heating.

2.2 Implementation

Franklin Energy is the implementation contractor for the program and coordinates recruiting and measure installation. Recruiting methods include primary outreach by energy advisors to identify properties, property managers, or property management companies likely to participate.

When the energy advisors have identified properties with an interest in the program, Franklin Energy then sends an outreach team to coordinate with property managers and explain the program delivery and benefits. This is considered an Energy Assessment. This is the time for energy advisors to determine the type of measures along with associated quantities that can be installed.

Once a property has been fully assessed and a service agreement has been signed, the project is handed over to a different group at Franklin Energy to schedule the installations. The installation crew performs the work as scheduled, while displaying Duke Energy branded clothing, badges, and vehicle decals as directed. The installation crews record the quantities and locations of installed measures for each housing unit via a tablet device, which are entered into a tracking database.

When energy efficient program measures are installed, Franklin Energy removes the existing or baseline equipment and generally disposes of it onsite. If the property management previously requested to keep the existing equipment, Franklin Energy will package it up and leave it behind with property management or maintenance personnel. Franklin Energy records the baseline characteristics (e.g. lamp type, wattage, aerator flow rates) for a sample of measures removed and makes that information available to Duke Energy and Guidehouse for evaluation purposes.

Franklin Energy uses internal and external quality control (QC) procedures to ensure consistent measure installation. On the internal side, a Franklin Energy supervisor may accompany installation crews to ensure quality work. On the external side, a third-party inspector, High Performance Building Solutions, conducts inspections on a least five percent of total participating housing units each year. The QC inspections are required to happen within 22 business days of installation. If a property is selected for a QC inspection, at least 20 percent of the units at the property are targeted for inspection.

During each month of QC inspections, Franklin Energy is provided with a discrepancy report that indicates when measures were missing, installed incorrectly, or if there were missed opportunities. Franklin Energy attempts to address the discrepancies, and subsequently updates the tracking data to reflect the QC findings. Franklin Energy then presents the tracking data to Duke Energy, and subsequently to Guidehouse for EM&V.

3. Evaluation Research Objectives and Methods

3.1 Research Objectives

As outlined in the Statement of Work, the key research objectives were to conduct impact and process evaluations, as well as a net-to-gross (NTG) analysis. Evaluation objectives include the following:

1. **Impact evaluation:**
    a. Verify deemed savings estimates through review of measure assumptions and calculations.
    b. Perform virtual verification of measure installations and collect data for use in an engineering analysis.
    c. Estimate the gross and net energy and peak demand savings (both summer and winter) by measure via engineering analysis.

2. **Net-to-Gross Analysis:**
    a. Assess the Net-to-Gross ratio by addressing free-ridership via property manager interviews and spillover via property manager and tenant surveys.

3. **Process evaluation:**
    a. Conduct phone interviews with program management and implementation contractor(s) to collect data for use in process analysis.
    b. Administer property manager phone or online surveys to collect data for use in process analysis. Evaluate the strengths and weaknesses of current program processes and customer perceptions, with special consideration for effects of the COVID-19 pandemic.
    c. Administer tenant survey via phone to a sample of tenants in participating multifamily units to understand tenant program satisfaction, spillover, and COVID-19 impacts.

3.2 Evaluation Methods

Guidehouse's methodology for evaluating the gross and net energy and demand impacts of the program included the following components:

1. Detailed review of deemed savings estimates including engineering algorithms, key input parameters, and supporting assumptions
2. Virtual verification to assess measure characteristics and in-service rates (ISRs)
3. Net-to-gross (NTG) analysis (discussed in Section 5).

3.2.1 Overview of Impact Methodology

3.2.1.1 Detailed Review of Ex Ante Deemed Savings

Guidehouse reviewed the ex-ante savings and supporting documentation used to estimate ex ante program impacts. For all measures, Duke Energy indicated that the deemed energy and demand impacts for this program are equivalent to the verified impacts from the most recent EM&V report, which was completed by Guidehouse (then Navigant) in 2020.[1] The deemed ex ante savings for LED measures are shown in Table 3-1 below.

Table 3-1. Deemed Ex Ante Savings for LED Measures

Measure	Annual Gross Energy Savings (kWh per lamp)	Summer Coincident Demand Savings (kWm per lamp)	Winter Coincident Demand Savings (kW per lamp)
A-Line LED	27.65	0.0046	0.0034
Globe LED	32.87	0.0042	0.0045
Candelabra LED	13.98	0.0029	0.0010
Track LED	24.08	0.0034	0.0024
Recessed LED	45.01	0.0080	0.0030

Source: EM&V Report for the Duke Energy Multifamily Energy Efficiency Program, April 16, 2020 – Table 31

The deemed ex ante savings for the LED measures are calculated using the following algorithms from the 2018 Mid-Atlantic Technical Resource Manual (TRM) Version 8 for energy and summer coincident demand savings. Guidehouse modified the summer demand savings algorithm to develop a winter demand savings algorithm since the Mid-Atlantic TRM does not provide one.

Equation 1. Energy Savings Algorithms for LED Measures

$$kWh\ Savings = \left(\frac{Watts_{BASE} - Watts_{EE}}{1000}\right) * ISR * Hours * \left(WHFe_{Heat} + (WHFe_{Cool} - 1)\right)$$

Equation 2. Summer Coincident Demand Savings Algorithm for LED Measures

$$Summer\ kW\ Savings = \left(\frac{Watts_{BASE} - Watts_{EFF}}{1000}\right) * ISR * WHFd * CF_{Summer}$$

[1] EM&V Report for the Duke Energy Multifamily Energy Efficiency Program, April 16, 2020.

Equation 3. Winter Coincident Demand Savings Algorithm for LED Measures

$$Winter\ kW\ Savings^{2} = \left(\frac{Watts_{BASE} - Watts_{EFF}}{1000}\right) * ISR * \left(1 - \left((WHFd - 1) * \%\ Electric\ Heat\right)\right) * CF_{Winter}$$

Where the parameters are defined as:

$Watts_{BASE}$ – Wattage of baseline lamp removed
$Watts_{EE}$ – Wattage of efficient lamp installed
ISR – In-Service rate
Hours – Average hours of use per year
$WHFe_{Heat}$ – Waste heat factor for energy to account for electric heating savings from reducing waste heat from efficient lighting
$WHFe_{Cool}$ – Waste heat factor for energy to account for cooling savings from reduced waste heat from efficient lighting
WHFd – Waste heat factor for demand to account for cooling savings from efficient lighting
CF_{Summer} – Summer coincidence factor
% Electric Heat – Percentage of homes with electric heating
CF_{Winter} – Winter coincidence factor

The parameters used in the calculation of deemed ex ante savings for the A-line, globe, candelabra, track and recessed LED measures are shown in Table 3-2.

Table 3-2. Impact Parameters Used in the Deemed Ex Ante Savings from Prior Evaluation – LED Measures

Parameters	A-Line LED	Globe LED	Candelabra LED	Track LED	Recessed LED	Source
$Watts_{BASE}$	60.57	41.09	35.00	40.23	65.00	Duke Energy
$Watts_{EE}$	9.00	6.00	5.00	6.80	8.10	Guidehouse field verification
ISR	0.95	0.97	0.94	0.91	0.90	Guidehouse field verification
Hours	572	983	502	806	893	Guidehouse metering study*
$WHFe_{Heat}$	0.899	0.899	0.899	0.899	0.899	2018 Mid-Atlantic TRM
$WHFe_{Cool}$	1.087	1.087	1.087	1.087	1.087	2018 Mid-Atlantic TRM

[2] To calculate winter coincident demand savings, Guidehouse assumed that the WHFd subtracted from savings by the same proportion that it added to savings in the summer equation.

Parameters	A-Line LED	Globe LED	Candelabra LED	Track LED	Recessed LED	Source
WHFd	1.19	1.19	1.19	1.19	1.19	2018 Mid-Atlantic TRM
CF_{Summer}	0.08	0.10	0.09	0.09	0.13	Guidehouse metering study*
% Electric Heat	55%	55%	55%	55%	55%	EIA RECs Study[3]
CF_{Winter}	0.08	0.15	0.04	0.09	0.07	Guidehouse metering study*

* Duke Energy Multifamily EMV Report DEC-DEP 16Apr2020

Source: EM&V Report for the Duke Energy Multifamily Energy Efficiency Program, April 16, 2020 – Table 23, Table 24 and Footnote 7

Similar to the LED measures, the source for the deemed ex ante savings for water measures is the prior evaluation report, and they are shown in Table 3-3.

Table 3-3. Deemed Ex Ante Savings for Water Measures

Measure	Unit Basis	Annual Gross Energy Savings (kWh)	Summer Coincident Demand Savings (kW)	Winter Coincident Demand Savings (kW)
Bathroom Aerator – 0.5 GPM	Per aerator	75.11	0.0099	0.0087
Bathroom Aerator – 1.0 GPM	Per aerator	55.09	0.0073	0.0064
Kitchen Aerator	Per aerator	114.61	0.0151	0.0133
Showerhead	Per showerhead	281.09	0.0232	0.0906
Pipe Wrap	Per linear foot	19.20	0.0022	0.0022

Source: EM&V Report for the Duke Energy Multifamily Energy Efficiency Program, April 16, 2020 – Table 31

The deemed ex ante savings for the water measures are calculated using the following algorithms from the 2018 Mid-Atlantic TRM.

Equation 4. Energy Savings Algorithms for Aerator Measures

$$kWh\ Savings = ISR * \left((GPM_{BASE} * Throttle_{BASE} - GPM_{LOW} * Throttle_{LOW}) * Time_{FAUCET} * \#People * \frac{Days}{Year} * DR \right) * \left(\frac{8.3 * (Temp_{FT} - Temp_{IN})}{DHW\ Recovery\ Efficiency * 3412} \right)$$

[3] US Energy Information Administration (EIA) Residential Energy Consumption Survey (found at https://www.eia.gov/consumption/residential/data/2015/)

Equation 5. Energy Savings Algorithms for Showerhead Measure

$$kWh\ Savings = ISR * \left((GPM_{BASE} - GPM_{LOW}) * Time_{SHOWER} * \#\ People * \frac{Days}{Year} * \frac{Showers_{PERSON}}{Showerheads\ per\ Home} \right) ** \left(\frac{8.3 * (Temp_{SH} - Temp_{IN})}{DHW\ Recovery\ Efficiency * 3412} \right)$$

Equation 6. Demand Savings Algorithms for Aerator and Showerhead Measures

$$kW\ Savings = \frac{kWh\ Savings}{Hours} * CF$$

Equation 7. Energy Savings Algorithms for Pipe Wrap Measure

$$kWh\ Savings = ISR * \left(\frac{1}{R_{EXIST}} - \frac{1}{R_{NEW}} \right) * \frac{L * C * \Delta T * 8760}{\eta_{DHW} * 3412}$$

Equation 8. Demand Savings Algorithms for Pipe Wrap Measure

$$kW\ Savings = \frac{kWh\ Savings}{8760}$$

Where the parameters are defined as:

ISR – In-Service rate
GPM_{BASE} – Gallons per minute of baseline faucet aerator or showerhead
GPM_{LOW} – Gallons per minute of low-flow faucet aerator or showerhead
$Throttle_{BASE}$ – Baseline throttling factor
$Throttle_{LOW}$ – Low-flow throttling factor
$Time_{FAUCET}$ – Average daily length faucet use per capita for faucet of interest in minutes
People – Average number of people per household
Days/Year – Days faucet or showerhead used per year
DR – Percentage of water flowing down drain
8.3 – Specific weight of water in pounds per gallon multiplied by the specific heat of water ($1.0 \frac{Btu}{lb°F}$)
$Temp_{FT}$ – Temperature of water used by faucet
$Temp_{IN}$ – Temperature of water entering house
DHW Recovery efficiency – Recovery efficiency of electric hot water heater
3412 – Constant to convert Btu to kWh
Hours – Average number of hours per year spent using faucet or showerhead
CF – Coincidence factor
$Time_{SHOWER}$ – Average daily shower length in minutes
$Showers_{PERSON}$ – Average showers per person per day
Showerheads per Home – Average number of showerheads in the home
$Temp_{SH}$ – Temperature of water used by showerhead
R_{EXIST} – Pipe heat loss coefficient (R-value) of existing uninsulated piping

R_{NEW} – Pipe heat loss coefficient (R-value) of existing pipe plus installed insulation
L – Feet of pipe from water heating source covered by pipe wrap
C – Circumference of pipe in feet
ΔT – Average temperature difference between water in pipe and ambient air temperature
8760 – Hours per year
η_{DHW} – Recovery efficiency of electric hot water heater

The impact parameters used in the calculation of deemed ex ante savings for the bathroom faucet aerator, kitchen faucet aerator and low flow showerhead measures are shown in Table 3-4, while the parameters for the water heater pipe wrap measure are shown in Table 3-5.

Table 3-4. Impact Parameters Used in the Deemed Ex Ante Savings from Prior Evaluation – Aerator and Showerhead Measures

Parameter	Bath Aerator – 0.5 GPM	Bath Aerator – 1.0 GPM	Kitchen Aerator	Showerhead	Source
ISR	0.96	0.96	0.83	0.92	Guidehouse field verification and phone surveys
GPM_{BASE}	2.12	2.12	2.17	2.76	Data provided by Duke Energy from Franklin Energy sample
GPM_{LOW}	0.84	0.50	0.73	1.50	Guidehouse field verification[a]
$Throttle_{BASE}$	0.83	0.83	0.83	NA	2018 Mid-Atlantic TRM
$Throttle_{LOW}$[a]	0.95	0.95	0.95	NA	2018 Mid-Atlantic TRM
# People	2.07	2.07	2.07	2.07	EIA RECs Study 2015
Days/Year	365	365	365	365	2018 Mid-Atlantic TRM
DR	0.70	0.70	0.50	NA	2018 Mid-Atlantic TRM
$Temp_{FT}$[b] / $Temp_{SH}$	96.03	96.03	96.99	105.00	Guidehouse field verification 2018 Mid-Atlantic TRM
$Temp_{IN}$	66.34	66.34	66.34	66.34	Building America Benchmark[4]
$Time_{FAUCET}$ / $Time_{SHOWER}$	1.60	1.60	4.50	7.80	2018 Mid-Atlantic TRM

[4] https://www.energy.gov/eere/buildings/downloads/building-america-analysis-existing-homes

Parameter	Bath Aerator – 0.5 GPM	Bath Aerator – 1.0 GPM	Kitchen Aerator	Showerhead	Source
$Showers_{PERSON}$	NA	NA	NA	0.60	2018 Mid-Atlantic TRM
Faucet / Showerhead per Home	1.53	1.53	1.00	1.39	Guidehouse field verification
DHW Recovery Efficiency	0.98	0.98	0.98	0.98	2018 Mid-Atlantic TRM
Summer CF	0.003	0.003	0.007	0.005	2018 Mid-Atlantic TRM & Guidehouse calculation using data from Building America Benchmark
Witner CF	0.002	0.002	0.007	0.019	2018 Mid-Atlantic TRM & Guidehouse calculation using data from Building America Benchmark
Hours[c]	20.11	20.11	56.56	58.82	2018 Mid-Atlantic TRM & Guidehouse calculation

a. Guidehouse measured flow rates during onsite field verification. For faucet aerators, Guidehouse used the measured flow rates to calculate impacts instead of multiplying the nameplate flowrate by the throttling factor since primary data was available.

b. For faucet aerators, Guidehouse assumed that customers use water at a temperature equal to the average of the hot and cold water temperatures measures during field verification

c. The demand savings for these measures in Table 3-3 are consistent with the hours values provided in this table. The hours values provided in the previous report appear to be typos.

Source: EM&V Report for the Duke Energy Multifamily Energy Efficiency Program, April 16, 2020 – Table 26

Table 3-5. Impact Parameters Used in the Deemed Ex Ante Savings from Prior Evaluation – Pipe Wrap Measure

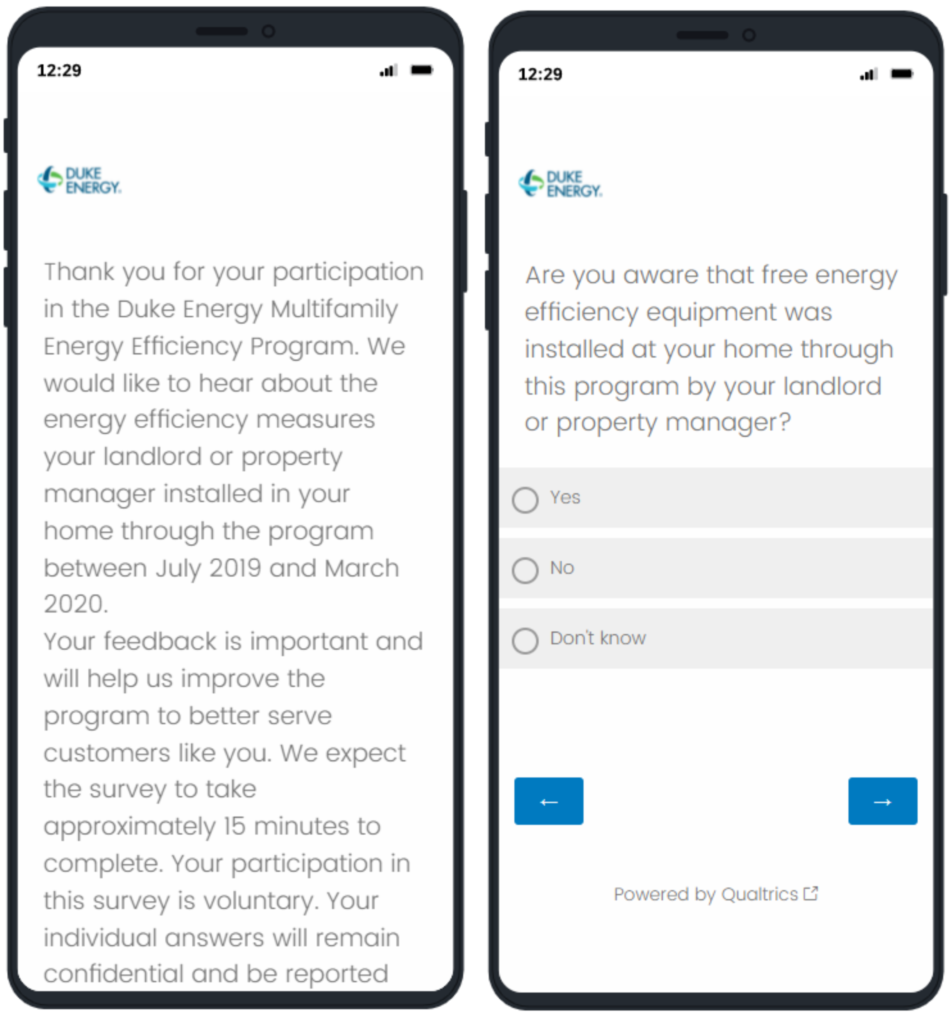
Parameter	Pipe Wrap	Source
ISR	0.91	Guidehouse field verification and phone surveys
R_{EXIST}	1.00	2018 Mid-Atlantic TRM
R_{NEW}	4.12	Guidehouse field verification
L	1	Savings are calculated per linear foot
C	0.16	Assumed as average of 0.5” and 0.75” diameter pipe
ΔT	65	2018 Mid-Atlantic TRM
η_{DHW}	0.98	2018 Mid-Atlantic TRM

Source: EM&V Report for the Duke Energy Multifamily Energy Efficiency Program, April 16, 2020 – Section 4.3.3

3.2.1.2 Virtual Verification

Guidehouse used the Qualtrics platform to create a virtual verification survey interface used by tenants to collect key project information and verify the installed equipment. The tenants also had the option to provide photo documentation of the installed equipment as part of the survey. Participants were also provided pictures of the measures to help them identify the sampled measures. Figure 1 shows an example of the Qualtrics virtual verification platform.

Figure 1. Virtual Verification Platform



Source: Guidehouse

One important consideration for the multifamily housing sector is that tenant turnover can be high, so individual customers may not have lived in the unit when program measures were installed and may not be aware that previous tenants participated in the program. In order to avoid this, Guidehouse used only a subset of program participants who were indicated in the program tracking database as “Active” at the same apartment unit in which the program measures were installed. Subsequently, Guidehouse only contacted “Active” tenants with a valid email address, and screening questions were used to further determine respondent awareness of the program. Table 3-6 shows number of total and active housing units along with the number of housing units selected as part of the impact sample for tenant virtual verification surveys based on email address availability. The remaining “Active” housing units were reserved for the tenant process evaluation survey discussed later in this report.

Table 3-6. Virtual Verification – Sampling Summary

Duke Energy Operating Area	Number of Properties	Total Number of Housing Units	Total Number of Housing Units with Active Tenants	Impact Sample Housing Units
DEP	114	12,183	5,950	2,965
DEC	180	24,720	10,704	5,335

Source: Guidehouse analysis

Table 3-7 shows the target number of program measures in the virtual verification sample order to achieve a 90/10 confidence and precision target at the program level. Guidehouse developed these targets based on prior experience evaluating this program. The target completes indicate the minimum number of measures that Guidehouse planned to assess via the virtual verification impact surveys. A total of 138[5] tenants completed the virtual verification surveys, which represented 1,978 program measures. Guidehouse reviewed tenant responses and removed some data from the analysis if respondents did not provide sufficient information. This resulted in a total of 1,011 measures in the final sample used for analysis. Table 3-7 also shows the distribution of the target and achieved representation for each measure.

Table 3-7. Virtual Verification – Target Completes and Completes Achieved

Measure	Unit Basis	Total Count Tracking Data	Target Measures in Sample	Total Achieved Measures in Sample	Measures from Usable Responses*
A-Line LED	Lamp	249,905	24	955	503
Globe LED	Lamp	64,260	16	155	94
Candelabra LED	Lamp	61,156	16	233	100
Track LED	Lamp	22,263	16	78	31
Recessed LED	Lamp	15,570	16	44	29
Bath Aerator	Aerator	30,027	12	100	48
Kitchen Aerator	Aerator	11,179	12	49	33
Showerhead	Showerhead	22,958	20	89	68
Pipe Wrap	Linear Feet	86,264	12	275	105

[5] Some responses were removed based on consistency checks when respondents provided insufficient information for Guidehouse to analyze.

Measure	Unit Basis	Total Count Tracking Data	Target Measures in Sample	Total Achieved Measures in Sample	Measures from Usable Responses*
Total		**563,582**	**144**	**1,978**	**1,011**

*Guidehouse removed some responses and measures from analysis if respondent information did not pass consistency checks.

Source: Guidehouse analysis

The distribution of the survey completes by jurisdiction and the corresponding quantity represented by them is shown in Table 3-8.

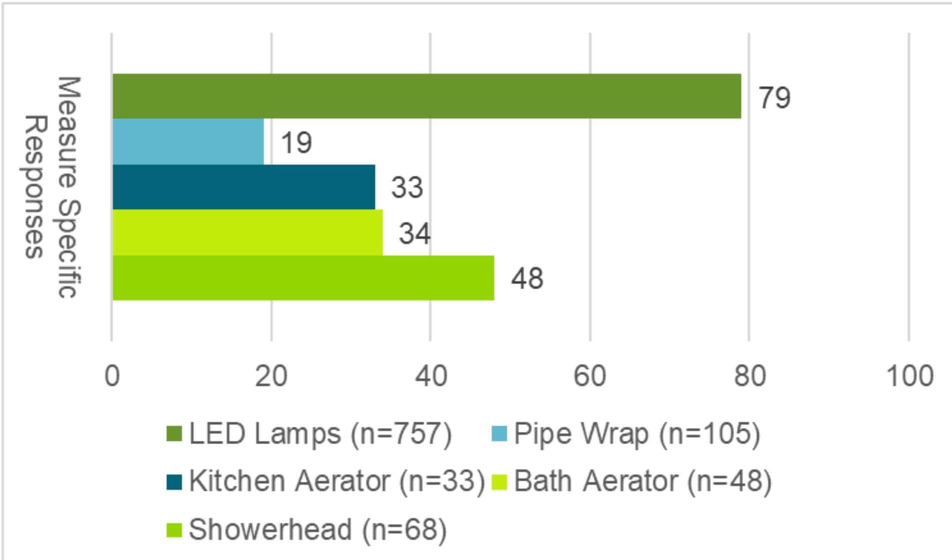
Table 3-8. Virtual Verification Survey – Completes Achieved by Jurisdiction

		DEP		DEC	
Measure	**Unit Basis**	**Survey Completes**	**Quantity of Measures**	**Survey Completes**	**Quantity of Measures**
A-Line LED	Lamp	44	340	68	615
Globe LED	Lamp	12	63	17	92
Candelabra LED	Lamp	25	111	27	122
Track LED	Lamp	10	51	6	27
Recessed LED	Lamp	10	28	13	16
Bath Aerator	Aerator	27	37	43	63
Kitchen Aerator	Aerator	22	22	27	27
Showerhead	Showerhead	23	29	42	60
Pipe Wrap	Linear Feet	25	129	27	146
Total		**55**	**810**	**83**	**1,168**

Source: Guidehouse analysis

Figure 2 shows the distribution of completed virtual verification assessments by program measure. The magnitude of each bar indicates the number of completed virtual verification surveys for each measure, and the values in parenthesis indicate the number of measures represented by the completed surveys. Respondents were able to answer questions about each measure type they received, so the total exceeds 138. Figure 3 shows the same information with a breakdown by the various LED lamp types.

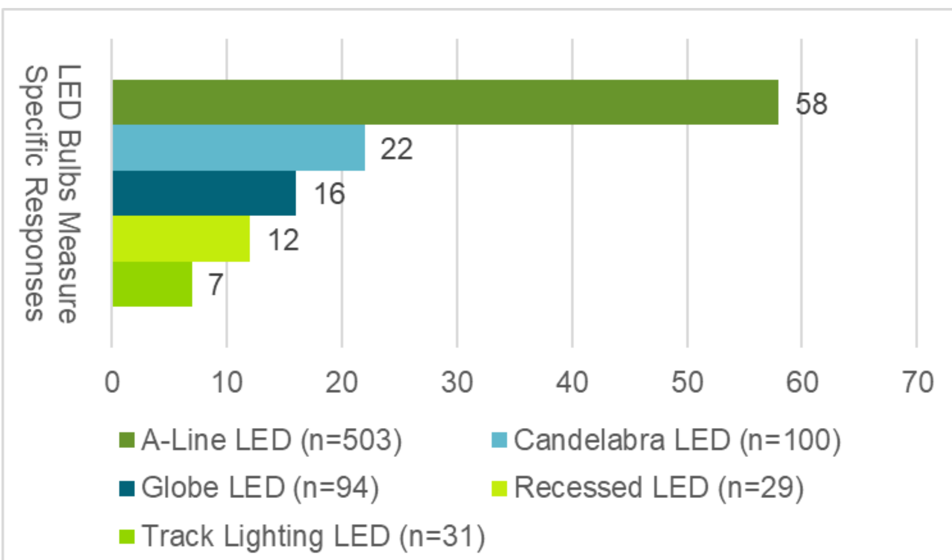
Figure 2. Virtual Verification – Survey Completes by Measure



Respondents were able to answer questions for multiple measures

Source: Guidehouse analysis

Figure 3. Virtual Verification – LED Bulbs Survey Completes by Lamp Type



Respondents were able to answer questions for multiple measures

Source: Guidehouse analysis

3.2.2 Overview of Net-to-Gross Methodology

As indicated in the evaluation plan, Guidehouse used a survey-based, self-report methodology to estimate free ridership and spillover for the program. A self-report approach is outlined in the Universal Methods Protocol (UMP) as an acceptable NTG methodology. Guidehouse primarily targeted property managers for the NTG surveys because they are the decision makers for participation in the program.[6] Guidehouse also incorporated supplemental data gathered during tenant phone surveys into the analysis.

3.2.2.1 Definitions of Free Ridership, Spillover and NTG Ratio

The methodology for assessing the energy savings attributable to a program is based on a NTG ratio. The NTG ratio has two main components: free ridership and spillover.

Free ridership is the share of the gross savings that is due to actions participants would have taken anyway (i.e., actions that were not induced by the program). This is meant to account for naturally occurring adoption of energy efficiency measures. The Multifamily Energy Efficiency Program and most other Duke Energy programs cover a wide range of energy efficiency measures and are designed to advance the overall energy efficiency market. However, it is likely that, for various reasons, some participants would have wanted to install some high-efficiency measures even if they had not participated in the program or been influenced by the program in any way.

Spillover captures program savings that go beyond the measures installed through the program. The term spillover is often used because it reflects savings that extend beyond the bounds of the program records. Spillover adds to a program's measured savings by incorporating indirect (i.e., non-incentivized) savings and effects that the program has had on the market above and beyond the directly incentivized or directly induced program measures.

The overall NTG ratio accounts for both the net savings at participating projects and spillover savings that result from the program but are not included in the program's accounting of energy savings. When the NTG ratio is multiplied by the estimated gross program savings, the result is an estimate of energy savings that are attributable to the program (i.e., savings that would not have occurred without the program). The NTG formula is shown in Equation 9.

Equation 9. Net-to-Gross Algorithm

$$NTG = 1 - Free\ Ridership + Spillover$$

The underlying concept inherent in the application of the NTG formula is that only savings caused by the program should be included in the final net program savings estimate but that this estimate should include all savings caused by the program.

3.2.2.2 Estimating Free Ridership

Data to assess free ridership was gathered through the self-report method using a series of survey questions asked to the property managers at participating properties. The survey

[6] Guidehouse recognizes that some property managers may have been instructed to participate by higher-level decision makers at the corporate level. Although we do not think this was the case very often, we do think that the local property managers were still privy to the decision-making process.

assessed free ridership using both direct questions, which aimed to obtain respondent estimates of the appropriate free ridership rate that should be applied to them, and supporting or influencing questions, which could be used to verify whether the direct responses were consistent with participants' views of the program's influence.

Each respondent to the survey provided perspectives on the measures that they had installed through the program. The core set of questions addressed the following three categories:

- **Likelihood:** To estimate the likelihood that they would have incorporated measures "of the same high level of efficiency," if not for the assistance of the program. In cases where respondents indicated that they might have incorporated some but not all of the measures, they were asked to estimate the share of measures that would have been incorporated anyway at high efficiency. This flexibility in how respondents could conceptualize and convey their views on free ridership allowed respondents to give their most informed response, thus improving the accuracy of the free ridership estimates.

- **Prior planning:** To further estimate the probability that a participant would have implemented the measures without the program. Participants were asked the extent to which they had considered installing the energy efficient measure prior to participating in the program. The general approach holds that if customers were not definitively planning to install all of the efficiency measures prior to participation then the program can reasonably be credited with at least a portion of the energy savings resulting from the high-efficiency measures. Strong free ridership is reflected by those participants who indicated they had already allocated funds for the purchase and selected the equipment and an installer.

- **Program importance:** To clarify the role that program components (e.g., information, incentives) played in decision-making and to provide supporting information on free ridership. Responses to these questions were analyzed for each respondent, not just in aggregate, and were used to identify whether the direct responses on free ridership were consistent with how each respondent rated the influence of the program.

Free ridership scores were calculated for each of the three categories.[7] Guidehouse then calculated a weighted average from each respondent based on their share of sample energy

[7] Scores were calculated by the following formulas:

- Likelihood: The overall likelihood score is calculated by multiplying the scores for the likelihood that the participant would have installed the same energy efficient equipment and the likelihood that the participant would have installed the same quantity of the same measures without the program's financial and technical assistance. The likelihood score is 0 for those that "definitely would NOT have installed the same energy efficient measure" and 1 for those that "definitely WOULD have installed the same energy efficient measure." For those that "MAY HAVE installed the same energy efficient measure," the likelihood score is their answer to the following question: "On a scale of 0 to 10, where 0 is DEFINITELY WOULD NOT have installed and 10 is DEFINITELY WOULD have installed, what is the likelihood that you would have installed the same equipment without the program?"
- Prior Planning: If participants stated they had considered installing energy efficient equipment prior to program participation, then the prior planning score is their answer to the following question: "On a scale of 0 to 10, where 0 means you 'had not yet started to plan for equipment or installation' and 10 means you 'had identified and selected specific equipment and the contractor to install it,' please tell me how far along you were in your plans to install the equipment before participating in the program." The overall prior planning score was then calculated as a weighted average of their response to this question for both the lighting and water equipment.

savings and divided by 10 to convert the scores into a free ridership percentage. Next, a timing multiplier was applied to the average of the three scores to reflect the fact that respondents indicating that their energy efficiency actions would not have occurred until far into the future may be overestimating their level of free ridership. Participants were asked when they would have installed the equipment without the program. Respondents who indicated that they would not have installed the equipment for at least two years were not considered free riders and received a timing multiplier of 0.[8] If they would have installed at the same time as they did, they received a timing multiplier of 1; within one year, a multiplier of 0.67; and between one and two years, a multiplier of 0.33.

3.2.2.3 Estimating Spillover

The basic method for assessing participant spillover was an approach that asked a set of questions to determine the following:

- **Whether spillover exists at all.** These were yes-or-no questions that asked, for example, whether the respondent incorporated energy efficiency measures or designs that were not recorded in program records and did not receive any rebates from Duke Energy.
- **The savings that could be attributed to the influence of the program.** Participants were asked to list the extra measures they installed, and the evaluation team assigned a savings value. See below for the method of assigning savings.
- **Program attribution***.* Estimates were derived from a question asking the program importance on a 0 to 10 scale. Participants were also asked how the program influenced their decisions to incorporate additional energy efficiency measures.

If respondents said no, they did not install additional measures, they were assigned a 0 score for spillover. If they said yes, then Guidehouse estimated the energy spillover savings on a case-by-case basis.

It is important to note that although free ridership questions were only asked of property managers, Guidehouse surveyed both property managers and tenants for spillover.[9]

3.2.2.4 Combining Results Across Respondents

The evaluation team determined free ridership estimates for each of the following:

- Individual respondents, by evaluating the responses to the relevant questions and applying the rules-based approach discussed above.

- Program Importance: This score was calculated by taking the response to the following question "Please rate your agreement with the following statement: My decision to install energy efficiency equipment at my property was largely motivated by Duke Energy's program" on a scale of 0-10 and subtracting from 10 (i.e., the higher the program importance, the lower the influence on free ridership).

[8] Guidehouse believes a two-year horizon is appropriate for assessing free ridership as it likely reduces certain types of bias and it becomes difficult for respondents to predict behavior beyond that horizon.

[9] The reason for not assessing free ridership at the tenant level is because tenants generally participated in the program via their property managers rather than personal choice. It is possible that tenants would have installed the same measures themselves, but Guidehouse does not believe they should be considered free riders to the program because the timing of those installations would have been difficult to evaluate and tenants would still have the ability to install LEDs in non-retrofitted fixtures. If a tenant already had equivalent measures in place, it is unlikely that the implementer would have replaced them with program measures.

- The program as a whole, by taking a weighted average of the individual results based on each respondent's share of reported energy savings.

3.2.2.5 Review of Data Collection Efforts for Attribution Analysis

Surveys were conducted with decision makers to provide the information to estimate free ridership, and thus, NTG ratios. Guidehouse completed surveys with 26 property managers. This sample represents about 8 percent of the total reported energy savings, as shown in Table 3-9.

Table 3-9. Property Manager Sample Representation

Measure Category	Program Total Reported Energy Savings (MWh)	Sample Total Energy Savings (MWh)	% Share of Program
LED Bulbs	11,113	953	9%
Bathroom Aerator	1,667	148	9%
Kitchen Aerator	1,281	101	8%
Showerhead	6,453	448	7%
Pipe Wrap	1,656	163	10%
Total	**22,170**	**1,813**	**8%**

Source: Guidehouse analysis, values subject to rounding

3.2.3 Overview of Process Methology

3.2.3.1 Tenant Surveys

Guidehouse conducted phone surveys with 149 residential tenants to assess program satisfaction. The distribution of the phone survey completes by jurisdiction are outlined in Table 3-10. The surveys contained several questions to assess satisfaction with program participation, satisfaction with new equipment, questions to assess measures removed by the tenant after participation and tenant spillover. Also included in the survey were questions to assess the impacts of COVID-19 on energy consumption at tenant units.

Table 3-10. Survey Completes by Jurisdiction – Tenant Survey

Jurisdiction	Survey Completes
DEP	72
DEC	77
Total	149

Source: Guidehouse analysis

3.2.3.2 Property Manager Surveys

Guidehouse completed surveys with property managers for 26 of the 294 participating properties. The completed surveys represented almost 50,000 measures or 8 percent of the program reported energy savings. The survey included a number of questions to assess participation experience and satisfaction, satisfaction with new equipment, as well as questions to assess free ridership and spillover. Also included in the survey were questions to assess the impacts of COVID-19 on different aspects of property management activities including energy use.

3.2.3.3 Interviews with Duke Energy Program Manager and Franklin Energy

Guidehouse interviewed Duke Energy's Program Manager and the Franklin Energy implementation staff to discuss program goals and any relevant changes to delivery or offerings since the previous evaluation.

3.2.3.4 Documentation Review

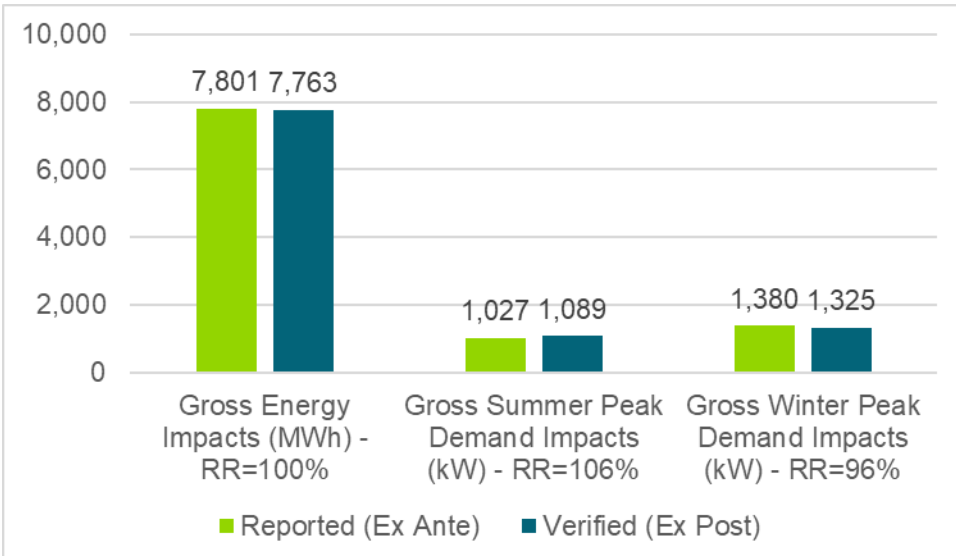
Guidehouse requested program documentation and tracking data to conduct a review of current processes. The program tracking data was sufficient to identify the measure characteristics and quantities of installed measures for each tenant at the participating properties.

4. Impact Evaluation

4.1 Impact Results

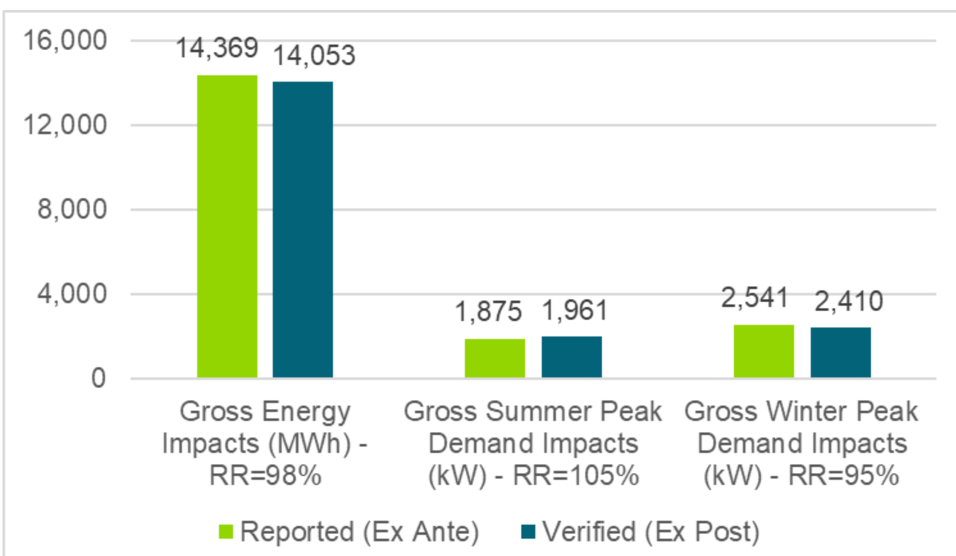
Figure 4 shows the program level results for gross energy and demand savings for DEP and Figure 5 shows the corresponding results for DEC.

Figure 4. Reported and Verified Program-Level Impacts – DEP



Source: Guidehouse analysis

Figure 5. Reported and Verified Program-Level Impacts – DEC



Source: Guidehouse analysis

Table 4-1 shows a comparison of gross and net impact findings. The evaluation team calculated the gross impact results in Table 4-1 by multiplying the measure quantities found in the tracking database by the verified energy and demand savings estimated during the EM&V process for each measure. The net impacts were found by multiplying the gross impacts by the NTG ratio of 0.96. The NTG methodology and results are discussed in detail in Section 3.2.2 and Section 5 of this report respectively.

Table 4-1. Summary of Program Impacts

	Energy (MWh)	Summer Coincident Demand (kW)	Winter Coincident Demand (kW)
DEP Verified Gross Impacts	7,763	1,089	1,325
DEP Verified Net Impacts	7,454	1,046	1,272
DEC Verified Gross Impacts	14,053	1,961	2,410
DEC Verified Net Impacts	13,494	1,883	2,314

Source: Guidehouse analysis, values subject to rounding.

A summary of each measure's contribution to program energy savings and realization rate between reported and verified savings is shown in Table 4-2 for DEP and Table 4-3 for DEC. By dividing the total verified savings by the total reported savings in the tracking data, Guidehouse calculated a gross realization rate of 100 percent and 98 percent for energy savings at the program level for the DEP and DEC jurisdictions respectively. This realization rate includes adjustments to the estimated savings for each measure discussed in the remainder of this report.

Table 4-2. Distribution of Program Gross Energy Savings by Measure (DEP)

Measure	Measure Count from Tracking Data	Total Ex Ante Savings from Tracking Data (MWh)	Share of Total Savings from Tracking Data	Total Verified Ex Post Gross Savings (MWh)	Realization Rate
A-Line LED	96,516	2,668	34%	2,588	97%
Showerhead	8,119	2,282	29%	2,018	88%
Bathroom Aerator - 1.0 GPM	11,594	639	8%	717	112%
Pipe Wrap	31,162	598	8%	668	112%
Kitchen Aerator	4,658	534	7%	660	124%
Globe LED	12,070	397	5%	326	82%
Candelabra LED	19,791	277	4%	317	115%
Track LED	7,949	191	2%	311	162%
Recessed LED	4,777	215	3%	158	74%

Measure	Measure Count from Tracking Data	Total Ex Ante Savings from Tracking Data (MWh)	Share of Total Savings from Tracking Data	Total Verified Ex Post Gross Savings (MWh)	Realization Rate
Total	**196,636**	**7,801**	**100%**	**7,763**	**100%**

Source: Guidehouse analysis, values subject to rounding.

Table 4-3. Distribution of Program Gross Energy Savings by Measure (DEC)

Measure	Measure Count from Tracking Data	Total Ex Ante Savings from Tracking Data (MWh)	Share of Total Savings from Tracking Data	Total Verified Ex Post Gross Savings (MWh)	Realization Rate
A-Line LED	153,389	4,241	30%	4,113	97%
Showerhead	14,839	4,171	29%	3,689	88%
Globe LED	52,190	1,715	12%	1,411	82%
Pipe Wrap	55,102	1,058	7%	1,181	112%
Bathroom Aerator - 1.0 GPM	17,818	982	7%	1,101	112%
Kitchen Aerator	6,521	747	5%	924	124%
Candelabra LED	41,365	578	4%	663	115%
Track LED	14,314	345	2%	560	162%
Recessed LED	10,793	486	3%	358	74%
Bathroom Aerator - 0.5 GPM	615	46	0%	54	117%
Total	**366,946**	**14,369**	**100%**	**14,053**	**98%**

Source: Guidehouse analysis, values subject to rounding.

The results for gross summer coincident demand by measure for DEP and DEC are shown in Table 4-4 and Table 4-5, respectively.

Table 4-4. Distribution of Summer Coincident Demand Savings by Measure (DEP)

Measure	Total Ex Ante Savings from Tracking Data (kW)	Share of Total Savings from Tracking Data	Total Verified Ex Post Gross Savings (kW)	Realization Rate
A-Line LED	443	43%	469	106%
Showerhead	188	18%	167	88%
Bathroom Aerator - 1.0 GPM	84	8%	95	112%
Pipe Wrap	68	7%	76	112%
Kitchen Aerator	70	7%	87	124%
Globe LED	50	5%	45	90%
Candelabra LED	58	6%	72	125%
Track LED	27	3%	47	178%
Recessed LED	38	4%	31	81%
Total	**1,027**	**100%**	**1,089**	**106%**

Source: Guidehouse analysis, values subject to rounding.

Table 4-5. Distribution of Summer Coincident Demand Savings by Measure (DEC)

Measure	Total Ex Ante Savings from Tracking Data (kW)	Share of Total Savings from Tracking Data	Total Verified Ex Post Gross Savings (kW)	Realization Rate
A-Line LED	703	38%	746	106%
Showerhead	344	18%	304	88%
Globe LED	218	12%	196	90%
Pipe Wrap	121	6%	135	112%
Bathroom Aerator - 1.0 GPM	130	7%	145	112%
Kitchen Aerator	99	5%	122	124%
Candelabra LED	120	6%	151	125%
Track LED	48	3%	85	178%
Recessed LED	86	5%	69	81%
Bathroom Aerator - 0.5 GPM	6	0%	7	117%
Total	**1,875**	**100%**	**1,961**	**105%**

Source: Guidehouse analysis, values subject to rounding.

The results for gross winter coincident demand by measure for DEP and DEC are shown in Table 4-6 and Table 4-7, respectively.

Table 4-6. Distribution of Winter Coincident Demand Savings by Measure (DEP)

Measure	Total Ex Ante Savings from Tracking Data (kW)	Share of Total Savings from Tracking Data	Total Verified Ex Post Gross Savings (kW)	Realization Rate
A-Line LED	332	24%	327	98%
Showerhead	735	53%	650	88%
Bathroom Aerator - 1.0 GPM	74	5%	83	112%
Pipe Wrap	68	5%	76	112%
Kitchen Aerator	62	5%	77	124%
Globe LED	54	4%	45	83%
Candelabra LED	21	2%	24	116%
Track LED	19	1%	31	165%
Recessed LED	14	1%	11	75%
Total	**1,380**	**100%**	**1,325**	**96%**

Source: Guidehouse analysis, values subject to rounding.

Table 4-7. Distribution of Winter Coincident Demand Savings by Measure (DEC)

Measure	Total Ex Ante Savings from Tracking Data (kW)	Share of Total Savings from Tracking Data	Total Verified Ex Post Gross Savings (kW)	Realization Rate
A-Line LED	528	21%	520	98%
Showerhead	1,344	53%	1,188	88%
Globe LED	233	9%	195	83%
Pipe Wrap	121	5%	135	112%
Bathroom Aerator - 1.0 GPM	114	4%	128	112%
Kitchen Aerator	87	3%	108	124%
Candelabra LED	43	2%	50	116%
Track LED	34	1%	56	165%
Recessed LED	32	1%	24	75%
Bathroom Aerator - 0.5 GPM	5	0%	6	117%
Total	**2,541**	**100%**	**2,410**	**95%**

Source: Guidehouse analysis, values subject to rounding.

4.2 Impact Evaluation Findings

4.2.1 LED Measures

Guidehouse updated certain impact parameters for the LED measures based on review of the information available and data collected for this evaluation period. Guidehouse used these updated impact parameters as shown in Table 4-8 with the updated energy savings algorithm (Equation 10) from the Mid-Atlantic TRM v10 as shown below and Equation 2 and Equation 3 from Section 3.2.1.1 to determine the verified energy, summer coincident and winter coincident demand impacts respectively.

Equation 10. Updated Energy Savings Algorithms for LED Measures

$$kWh\ Savings = \left(\frac{Watts_{BASE} - Watts_{EE}}{1000}\right) * ISR * Hours * WHF_e$$

Where,

> WHFe – Waste heat factor for energy to account for cooling and electric heating savings from reduced waste heat from efficient lighting

Table 4-8. Impact Parameters Used for Calculating Verified Impacts – LED Measures

Parameter	Source	A-Line LED	Globe LED	Candelabra LED	Track LED	Recessed LED
$Watts_{BASE}$[a]	Duke Energy data for removed equipment	59.89	40.99	40.09	59.88	60.17
$Watts_{EE}$	Duke Energy tracking data and specification sheets	9.00	6.00	5.00	7.00	8.49
ISR	Virtual verification survey	0.972	0.830	0.960	0.968	0.759
Hours	Guidehouse metering study from previous evaluation[b]	572	983	502	806	893
WHFe[c]	Mid-Atlantic TRM v10	0.948	0.948	0.948	0.948	0.948
WHFd[c]	Mid-Atlantic TRM v10	1.251	1.251	1.251	1.251	1.251
CF_{Summer}	Guidehouse metering study from previous evaluation[b]	0.08	0.10	0.09	0.09	0.13

Parameter	Source	A-Line LED	Globe LED	Candelabra LED	Track LED	Recessed LED
% Electric Heat	EIA RECs Study 2015[10]	50%	50%	50%	50%	50%
CF_{Winter}	Guidehouse metering study from previous evaluation[b]	0.08	0.15	0.04	0.09	0.07
Gross Energy Savings per Lamp (kWh)		**26.82**	**27.04**	**16.02**	**39.10**	**33.18**
Gross Summer Coincident Demand Savings per Lamp (kW)		**0.0049**	**0.0038**	**0.0036**	**0.0059**	**0.0064**
Gross Winter Coincident Demand Savings per Lamp (kW)		**0.0034**	**0.0037**	**0.0012**	**0.0039**	**0.0022**

a. The removed equipment data was collected by Franklin Energy for a sample of program participants and was provided to Guidehouse as part of the tracking data file by Duke Energy.

b. Duke Energy Multifamily EMV Report DEC-DEP 16Apr2020

c. Guidehouse calculated the average value using waste heat factors for all utilities (BGE, Pepco, Delmarva, PE, and SMECO) from the Mid-Atlantic TRM v10.

Source: Guidehouse analysis, values subject to rounding

4.2.1.1 In-Service Rate

There were a total of 757 reported program LEDs in the tracking database corresponding to the 79 virtual verification survey completes for the LED measure. Guidehouse found 715 of the program LEDs to be still installed and functioning based on the review of tenant responses. Guidehouse used these quantities to determine the in-service rate for the LED measures on a lamp-type basis as shown in Table 4-9.

Table 4-9. LED Measures – ISR

Measure	Completes Achieved	Tracking Data Quantity	Verified Quantity	In-Service Rate (ISR)
A-Line LED	58	503	489	97%
Globe LED	16	94	78	83%
Candelabra LED	22	100	96	96%
Track LED	7	31	30	97%
Recessed LED	12	29	22	76%
Total	**79**	**757**	**715**	**94%**

Source: Guidehouse analysis

[10] EIA Residential Energy Consumption Survey (found at https://www.eia.gov/consumption/residential/data/2015/hc/php/hc6.1.php) for Apartment (5 or more unit building) housing unit type.

The completed virtual surveys were reasonably representative of the population-wide distribution of lamp types as shown in Table 4-10. Thus, Guidehouse used the virtual verification survey responses to calculate ISR values on a lamp-type basis for all LED measures. Guidehouse performed a sensitivity analysis to calculate total ex post impacts using a single ISR for all LEDs, and the difference in total impacts was negligible.

Table 4-10. LED Measures – Tracking Data vs Virtual Verification Measure Type Distribution

Measure	Tracking Data Quantity	% Share	Virtual Verification Quantity	% Share
A-Line LED	249,905	60%	503	66%
Globe LED	64,260	16%	94	12%
Candelabra LED	61,156	15%	100	13%
Track LED	22,263	5%	31	4%
Recessed LED	15,570	4%	29	4%

Source: Guidehouse analysis

4.2.1.2 Baseline and Efficient Lamp Wattage

Duke Energy provided Guidehouse with wattage data from lamps removed during the retrofit process. This data was collected by Franklin Energy from a sample of participant sites, and included information for 9,073 removed lamps at 100 of the 294 participating properties. Guidehouse used this data to determine the baseline lamp wattage corresponding to each LED lamp type in the impact calculations as shown in Table 4-11.

Table 4-11. LED Measures – Baseline Lamp Wattage

Measure	Sum of Baseline 40W Lamps Removed	Sum of Baseline 50W Lamps Removed	Sum of Baseline 60W Lamps Removed	Sum of Baseline 75W Lamps Removed	Sum of Baseline 100W Lamps Removed	Weighted Baseline Wattage
A-Line	59	10	6,060	7	13	59.89
Globe	984	0	51	0	0	40.99
Candelabra	979	3	3	0	0	40.09
Track	4	0	666	0	0	59.88
Recessed	0	0	233	0	1	60.17

Source: Guidehouse analysis

The Energy Independence and Security Act (EISA) of 2007 established that, as of January 1, 2014, 60W and 40W incandescent bulbs could no longer be manufactured or imported. The new, EISA compliant wattage for these bulbs are 43W and 29W respectively. However, Guidehouse's experience has shown that there was considerable lag between the EISA compliance schedule and actual market activity, and potential back stocking of incandescent lamps by multifamily maintenance staff. Because Duke Energy's Multifamily Energy Efficiency

Program is a retrofit program (rather than replace on burnout), it is important to consider the actual characteristics of the lamps removed because they likely had remaining useful life.

Due to the EISA standards and changing market for lighting, the baseline wattage for energy efficiency lighting programs will continue to decrease. If Duke Energy continues to collect information about the wattage of lamps removed during the retrofit process, Guidehouse believes it is reasonable to use those values in future evaluations as necessary as this is a direct install program.

Among the installed LED measures, the track and recessed LED measures can be further characterized based on the specific LED lamp type (BR30, PAR20, PAR30 SN, etc.) as shown in Table 4-12.

Table 4-12. LED Measures – Installed Quantity Lamp Type Distribution

Measure	Lamp Type	Watts EE	Quantity Installed
A-Line LED	LED A-Line	9.00	249,905
Globe LED	LED Globe	6.00	64,260
Candelabra LED	LED Candelabra	5.00	61,156
Track LED	LED MR16 – GU10	7.00	14,827
Track LED	LED MR16 – GU5.3	7.00	350
Track LED	LED PAR20	7.00	7,086
Recessed LED	LED BR30	8.00	13,039
Recessed LED	LED PAR30 SN	11.00	2,531

Source: Guidehouse analysis

Duke Energy provided specification sheets for each of these LED lamp types and Guidehouse used the specification sheet wattage value along with the tracking data installed quantity to calculate a weighted average efficient wattage value at the measure level as shown in Table 4-13.

Table 4-13. LED Measures – Efficient Lamp Wattage

Measure	Watts EE
A-Line LED	9.00
Globe LED	6.00
Candelabra LED	5.00
Track LED	7.00
Recessed LED	8.49

Source: Guidehouse analysis

4.2.1.3 Lighting Hours of Use and Coincidence Factors

The evaluation team used the measure type specific annual operating hours and summer and winter coincidence factors from the 2018-2019 lighting logger study conducted as part of the previous evaluation for these jurisdictions to calculate the ex post verified savings for LED measures.

Guidehouse also used the tenant responses to the lighting hours of use questions in the virtual verification survey to get a preliminary understanding of the impact of COVID-19 on the lighting use pattern in tenant homes. The tenant responses indicate that the COVID-19 pandemic may have resulted in an increase in the lighting hours of use. However, Guidehouse concluded that the lighting hours of use may normalize post COVID-19 and hence does not recommend any adjustment to the lighting hours of use for the current evaluation. Guidehouse believes a lighting logger study as part of the next evaluation for this jurisdiction would be able to capture the more permanent long-term impats of the pandemic on the lighting use pattern in multifamily tenant homes.

4.2.1.4 Waste Heat Factors

Guidehouse used the Mid-Atlantic TRM v10 to gather estimates for the waste heat factors. Guidehouse calculated the waste heat factors for the current evaluation as the average of the WHFe and WHFd from the Mid-Atlantic TRM v10 for all utilities as shown in Table 4-14.

Table 4-14. LED Measures – Waste Heat Factors

Utility	WHFe	WHFd
BGE	0.959	1.241
Pepco	0.947	1.264
Delmarva Power	0.915	1.245
PE	0.956	1.266
SMECO	0.963	1.241
Average	**0.948**	**1.251**

Source: Guidehouse analysis

4.2.2 Water Flow Regulation Measures

Guidehouse updated certain impact parameters for the aerator measures based on review of the information available and data collected for this evaluation period. Guidehouse used these updated impact parameters as shown in Table 4-15 with Equation 4 and Equation 6 from Section 3.2.1.1 to determine the verified energy and demand impacts respectively.

Table 4-15. Impact Parameters Used for Calculating Verified Impacts – Aerator Measures

Parameter	Source	Bath Aerator – 0.5 GPM	Bath Aerator – 1.0 GPM	Kitchen Aerator
ISR	Virtual verification survey	0.958	0.958	0.848
GPM_{BASE}[a]	Duke Energy data for removed equipment	2.05	2.05	2.17

Parameter	Source	Bath Aerator – 0.5 GPM	Bath Aerator – 1.0 GPM	Kitchen Aerator
GPM_{LOW}[b]	Guidehouse field verification from previous evaluation and Duke Energy tracking data and specification sheets	0.50	0.84	0.73
$Throttle_{BASE}$	Mid-Atlantic TRM v10	0.83	0.83	0.83
$Throttle_{LOW}$	Mid-Atlantic TRM v10	0.95	0.95	0.95
# People	EIA RECs Study 2015	2.48	2.48	2.48
Days/Year	Mid-Atlantic TRM v10	365	365	365
DR	Mid-Atlantic TRM v10	0.70	0.70	0.50
$Temp_{FT}$	Guidehouse field verification from previous evaluation	96.03	96.03	96.99
$Temp_{IN}$	Building America Benchmark[11]	66.34	66.34	66.34
$Time_{FAUCET}$	Mid-Atlantic TRM v10	1.60	1.60	4.50
DHW Recovery Efficiency	Mid-Atlantic TRM v10	0.98	0.98	0.98
Summer CF	Mid-Atlantic TRM v10 and Guidehouse calculation using data from Building America Benchmark	0.0032	0.0032	0.0090
Witner CF	Mid-Atlantic TRM v10 and Guidehouse calculation using data from Building America Benchmark	0.0028	0.0028	0.0079
Hours	Mid-Atlantic TRM v10 and Guidehouse calculation	24.14	24.14	67.89
Gross Energy Savings per Aerator (kWh)		**87.65**	**61.81**	**141.66**
Gross Summer Coincident Demand Savings per Aerator (kW)		**0.0116**	**0.0082**	**0.0187**
Gross Winter Coincident Demand Savings per Aerator (kW)		**0.0102**	**0.0072**	**0.0165**

a. The removed equipment data was collected by Franklin Energy for a sample of program participants and was provided to Guidehouse as part of the tracking data file by Duke Energy.

[11] https://www.energy.gov/eere/buildings/downloads/building-america-analysis-existing-homes

b. For Bath Aerator – 1.0 GPM and Kitchen Aerator measures, Guidehouse used the measured flow rates to calculate impacts instead of multiplying the nameplate flowrate by the throttling factor since primary data was available from the previous evaluation.

Source: Guidehouse analysis, values subject to rounding

Guidehouse also updated certain impact parameters for the showerhead measure based on review of the information available and data collected for this evaluation period. Guidehouse used these updated impact parameters as shown in Table 4-16 with Equation 5 and Equation 6 from Section 3.2.1.1 to determine the verified energy and demand impacts respectively.

Table 4-16. Impact Parameters Used for Calculating Verified Impacts – Showerhead Measure

Parameter	Source	Showerhead
ISR	Virtual verification survey	0.971
GPM_{BASE}	Duke Energy data for removed equipment	2.40
GPM_{LOW}	Duke Energy tracking data and specification sheets	1.50
# People	EIA RECs Study 2015	2.48
Days/Year	Mid-Atlantic TRM v10	365
$Temp_{SH}$	Mid-Atlantic TRM v10	105.00
$Temp_{IN}$	Building America Benchmark	66.34
$Time_{SHOWER}$	Mid-Atlantic TRM v10	7.80
$Showers_{PERSON}$	Mid-Atlantic TRM v10	0.60
Showerhead per Home	Duke Energy tracking data	1.44
DHW Recovery Efficiency	Mid-Atlantic TRM v10	0.98
Summer CF	Mid-Atlantic TRM v10 and Guidehouse calculation using data from Building America Benchmark	0.004
Witner CF	Mid-Atlantic TRM v10 and Guidehouse calculation using data from Building America Benchmark	0.016
Hours	Mid-Atlantic TRM v10 and Guidehouse calculation	49.17
Gross Energy Savings per Showerhead (kWh)		**248.57**
Gross Summer Coincident Demand Savings per Showerhead (kW)		**0.0205**
Gross Winter Coincident Demand Savings per Showerhead (kW)		**0.0801**

Source: Guidehouse analysis, values subject to rounding

4.2.2.1 In-Service Rate

Guidehouse used the reported program quantities in the tracking database and the quantities indicated to be still installed and functioning by the tenants based on the review of tenant responses to the virtual verification survey to determine measure specific in-service rates for this evaluation period as shown in Table 4-17.

Table 4-17. Water Flow Regulation Measures – ISR

Measure	Completes Achieved	Tracking Data Quantity	Verified Quantity	In-Service Rate (ISR)
Bath Aerator	34	48	46	96%
Kitchen Aerator	33	33	28	85%
Showerhead	48	68	66	97%

Source: Guidehouse analysis

4.2.2.2 Baseline and Efficient Flow Rate (GPM)

Duke Energy provided Guidehouse with flow rate data from aerators and showerheads removed during the retrofit process. This data was collected by Franklin Energy from a sample of participant sites (data was collected at 53 out of the 205 participating properties with water flow regulation measures). Guidehouse used this data along with the tracking data installed quantity to determine the baseline flow rate corresponding to each measure in the impact calculations as shown in Table 4-18.

Table 4-18. Water Flow Regulation Measures – Baseline Flow Rate

Measure	Sum of Removed Measure – Water 2.0 GPM	Sum of Removed Measure – Water 2.2 GPM	Sum of Removed Measure – Water 2.5 GPM	Sum of Removed Measure – Water 3.0 GPM	Weighted Baseline GPM
Bath Aerator	295	91	0	0	2.05
Kitchen Aerator	15	98	0	0	2.17
Showerhead	1	90	160	6	2.40

Source: Guidehouse analysis

For the 0.5 GPM bathroom faucet aerator, in the absence of measured flow rate for the GPM_{LOW} parameter, Guidehouse used the rated flow rate of the installed unit and the low-flow throttling factor from the Mid-Atlantic TRM v10 to determine the effective flow rate of the low-flow faucet aerator as shown in Table 4-19. The 0.5 GPM bathroom faucet aerator was not part of the tracking data for the evaluation period covered by the previous evaluation and hence no measured flow rate from onsite field verification is available for this measure.

Table 4-19. Water Flow Regulation Measures – Efficient Aerator Flow Rate

Measure	Rated Flow Rate (GPM)	Low-Flow Throttling Factor	Effective Flow Rate (GPM)
Bath Aerator – 0.5 GPM	0.5	0.95	0.48

Source: Guidehouse analysis

4.2.2.3 Average Number of People per Household (# People)

Guidehouse updated the average number of people per household parameter using the EIA RECs study 2015[12] for the South Atlantic census region.

4.2.2.4 Average Number of Showerheads per Home

Guidehouse updated the average number of showerheads per home parameter for the showerhead measure using tracking data as shown in Table 4-20. This assumes that Franklin Energy attempted to replace every showerhead in the housing unit during installation.

Table 4-20. Water Flow Regulation Measures – Showerhead per Home

Measure	Quantity Installed	Number of Housing Units	Showerheads per Home
Showerhead	22,958	15,987	1.44

Source: Guidehouse analysis

4.2.2.5 Hours and Coincidence Factors

Guidehouse updated the average number of hours per year spent using each showerhead for the showerhead measure, and the corresponding summer and winter coincidence factor algorithms, to account for the average number of showerheads in the home as per the Mid-Atlantic TRM v10.

Equation 11. Updated Hours Algorithms for Showerhead Measure

$$Hours = \left(\frac{Time_{SHOWER} * \#\, People * Showers_{PERSON}}{Showerheads\ per\ Home * 60}\right) * \frac{Days}{Year}$$

4.2.3 Pipe Wrap Measure

Guidehouse updated the in-service rate and R-value of the insulation for the pipe wrap measure based on review of the information available and data collected for this evaluation period. Guidehouse used these updated impact parameters as shown in Table 4-21 with Equation 7 and Equation 8 from Section 3.2.1.1 to determine the verified energy and demand impacts respectively.

[12] https://www.eia.gov/consumption/residential/data/2015/hc/php/hc9.8.php

Table 4-21. Impact Parameters Used for Calculating Verified Impacts – Pipe Wrap Measure

Parameter	Source	Pipe Wrap
ISR	Virtual verification survey	99.9%
R_{EXIST}	Mid-Atlantic TRM v9*	1.00
R_{NEW}	Specification sheet	4.35
L	Savings are calculated per linear foot	1.00
C	Assumed as average of 0.5” and 0.75” diameter pipe	0.16
ΔT	Mid-Atlantic TRM v9	65.00
η_{DHW}	Mid-Atlantic TRM v9	0.98
Gross Energy Savings per Linear Foot (kWh)		**21.43**
Gross Summer Coincident Demand Savings per Linear Foot (kW)		**0.0024**
Gross Winter Coincident Demand Savings per Linear Foot (kW)		**0.0024**

* The DHW Pipe Insulation measure is no longer included in the Mid-Atlantic TRM v10. Guidehouse used the energy and demand savings algorithms and deemed input parameters from the Mid-Atlantic TRM v9 to calculate savings for this measure.

Source: Guidehouse analysis, values subject to rounding

4.2.3.1 In-Service Rate

Guidehouse used the reported program quantities in the tracking database and the quantities indicated to be still installed and functioning by the tenants based on the review of tenant responses to the virtual verification survey to determine pipe wrap in-service rate for this evaluation period as shown in Table 4-22.

Table 4-22. Pipe Wrap Measure – Virtual Verification ISR

Measure	Completes Achieved	Tracking Data Quantity	Verified Quantity	Virtual Verification – ISR
Pipe Wrap	19	105	105	100%

Source: Guidehouse analysis

Also, based on the tracking data review, Guidehouse found that some of the water heater pipe wrap was installed on the cold water inlet pipe to the water heater. Industry standards are to install pipe wrap on all hot water pipes, and only the first three feet of the cold water pipe because savings are minimal from insulating cold water pipes.[13] Therefore, when calculating the ISR, Guidehouse did not count savings from pipe wrap of greater than three feet installed on cold water pipes as shown in Table 4-23.

[13] https://www.energy.gov/energysaver/do-it-yourself-savings-project-insulate-hot-water-pipes

Table 4-23. Pipe Wrap Measure – Cold Water Pipe Wrap Length

Cold Water Pipe Wrap Length – Tracking Data	Number of Tenants	Total Cold Water Pipe Wrap Installed in Feet	Cold Water Pipe Wrap Length Allowed*	Total Allowed Cold Water Pipe Wrap Length in Feet
1 Feet	340	340	1 Feet	340
2 Feet	1,093	2,186	2 Feet	2,186
3 Feet	2,497	7,491	3 Feet	7,491
4 Feet	47	188	3 Feet	141
5 Feet	7	35	3 Feet	21
6 Feet	4	24	3 Feet	12
Total		**10,264**		**10,191**

*Determined as the minimum of the installed cold water pipe wrap length or 3 feet.

Source: Guidehouse analysis

Guidehouse then used the virtual verification ISR and the additional cold water pipe wrap length (10,264 – 10,191 = 73 Feet) to calculate the effective ISR for this measure as shown in Table 4-24

Table 4-24. Pipe Wrap Measure – Effective ISR

Measure	Virtual Verification – ISR	Total Installed Quantity	Additional Cold Water Pipe Wrap Length	Effective Installed Quantity*	Effective ISR**
Pipe Wrap	100.0%	86,264 Feet	73 Feet	86,191 Feet	99.9%

*Calculated as ((Total Installed Quantity * Virtual Verification ISR) – Additional Cold Water Pipe Wrap Length).

**Calculated as (Effective Installed Quantity/Total Installed Quantity).

Source: Guidehouse analysis

4.2.3.2 R-value of Installed Insulation

Guidehouse updated the R-value of the installed insulation using specification sheet provided by Franklin Energy for this measure as shown in Table 4-25.

Table 4-25. Pipe Wrap Measure – R-Value of Installed Insulation

Model #	Dimensions	R-Value
PI010	1/2” Wall for 1/2” Pipe	3.54
PI011	1/2” Wall for 3/4” Pipe	3.15
R-Value of Installed Insulation*		**3.35**

*Assumed as average of 0.5” and 0.75” diameter pipe

Source: Guidehouse analysis

5. Net-To-Gross Analysis

Guidehouse conducted an NTG analysis to estimate the share of program savings that can be attributed to participation in or influence from the program. Table 5-1 shows the results of Guidehouse's NTG analysis. Guidehouse anticipated low free ridership and spillover given that the program is structured to offer energy efficient equipment at no cost to multifamily housing units, which are typically not owner-occupied. The results shown here are in line with expectations and very similar to our previous evaluations of this program. Guidehouse chose to present a program-level NTG ratio rather than measure level due to the difficulty in estimating spillover by measure. Guidehouse believes it is more appropriate to present the NTG ratio in aggregate.

Table 5-1. NTG Results

Parameter	Value
Estimated Free Ridership	5.85%
Estimated Spillover	1.88%
Estimated NTG	0.9602

Source: Guidehouse analysis, values subject to rounding

5.1 Results of Free Ridership, Spillover and Net-to-Gross

5.1.1 Free Ridership Results

As described in Section 3.2.2.2, surveyed participants responded to a series of questions intended to elicit explicit estimates of free ridership, as well as ratings of program influence. Guidehouse estimated free ridership to be 5.9 percent.

Below are summaries by scoring component.

Prior Planning: Nine out of 24 property managers who installed energy efficient lighting equipment at their property through the program indicated they had prior plans to install the energy efficient lighting equipment. Five out of 18 property managers who installed energy efficient water equipment at their property indicated they had prior plans to install the energy efficient water equipment. However, only three (two for both lighting and water equipment and 1 for just the lighting equipment) of the nine property managers indicated their plans were well developed (greater than or equal to 8 on a scale of 0 to 10).

Program Importance: Respondents stated that the program was very important in having the measures installed. The average response for how important the Duke Energy program was in influencing respondent decision to retrofit the properties was 9.2 on a scale of 0 to 10.

Likelihood: Respondents were asked in the absence of the program, if they would have had at least some of the work done (in terms of both quantity of measures and the efficiency of measures installed). Five respondents stated they “definitely would not have” installed the same quantity of measures in the absence of the program, and seven said they “may have”. Respondents who said they may have installed some measures without the program indicated they would have only installed, on average, thirty-one percent of the measures they did install. Five respondent stated that they “definitely would not have” installed the same energy efficient equipment in the absence of the program, nine said they “may have” and indicated the likelihood of them installing the same energy efficient equipment to be 5 on a scale of 0 to 10. The respondents who answered “don’t know” to the likelihood questions were assumed to have a likelihood of 5 on a scale of 0 to 10 for installing the same energy efficient equipment and the same quantity of measures.

Timing: Four of the 12 property managers who indicated they likely would have completed some of the energy efficiency upgrades in the absence of the program, indicated they would have done so at the same time or within a year of the program. Five indicated they likely would have completed some of the upgrades between 1-2 years after the program in the absence of it. The rest of the property managers indicated they likely would have completed some of the upgrades 2 years after the program in the absence of it.

In summary, respondents indicated that the program was very important in their decisions to have the energy efficient measures installed. A few property managers indicated that they did have some prior plans to install the measures, and the free ridership estimates account for those responses.

5.1.2 Spillover Results

Four of the 26 surveyed property managers indicated that the program influenced them to install additional, non-incentivized energy efficiency measures at the property as shown in Table 5-2.

Table 5-2. Property Manager Spillover Measures

Respondent	Spillover Measure	Quantity Installed
PM 1	LED bulbs for overhead light fixtures	100
PM 1	Auto Faucet	3
PM 2	Energy efficient lights for the front doors and patios	464
PM 3	LED lights in the stairways and front doors	165
PM 4	LED overhead bulbs in the community area	30

Source: Guidehouse analysis

In addition to the property managers reporting spillover, seven tenants reported installing a small number of LEDs and one tenant reported installing a small number of LEDs and a smart thermostat as a result of program participation. As seen in Table 5-3, four of the seven tenants qualified for spillover.

Table 5-3. Tenant Spillover Measures

Respondent	Spillover Measure	Quantity Installed
Tenant 1	LED Light Bulbs	8
Tenant 1	Smart Thermostat	1
Tenant 2	LED Light Bulbs	20
Tenant 3	LED Light Bulbs	3
Tenant 4	LED Light Bulbs	10

Source: Guidehouse analysis

Guidehouse estimated spillover from the equipment reported by property managers and tenants by applying simple engineering equations along with the self-reported measure quantities and characteristics. Guidehouse calculated the total spillover to be 1.9 percent.

6. Process Evaluation

Guidehouse conducted a process evaluation of the Multifamily Energy Efficiency Program to assess program delivery and customer satisfaction. The process findings summarized in this section are based on the results of customer surveys with 149 program participants and detailed surveys with 26 property managers. The property manager and tenant surveys were also used to inform the NTG analysis as discussed previously.

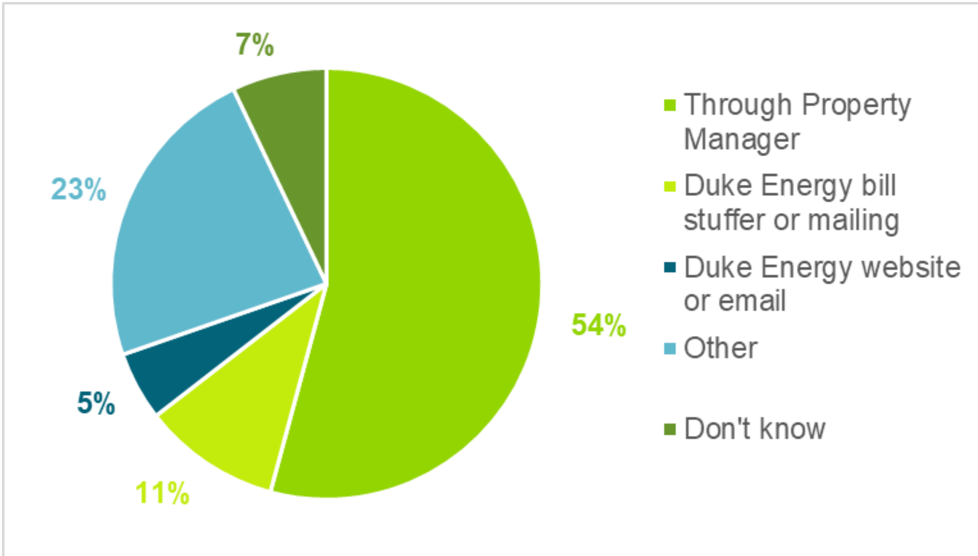
6.1 Key Findings

- Some of the key challenges inherent to delivering energy efficiency programs to non-owner-occupied multifamily housing facilities include lack of financial capital for upfront costs, multiple decision makers, limited resources to manage retrofits, time and complexity associated with distrupting tenants. The program appears to be effectively addressing these challenges.
- 54 percent of the tenants indicated that they heard about the program through their property manager as would be expected given the program model.
- 44 percent of the tenants reported that they noticed savings on their energy bills since the installation of the measures.
- Most tenants were satisfied with the program. On a scale of 0 to 10, where 0 indicates “not satisfied at all” and 10 indicates “extremely satisfied”:
  - About 74 percent of participants indicated 8-10 for satisfaction with the overall program.
  - About 85 percent of participants indicated 8-10 for satisfaction with Duke Energy.
- 30 percent of the tenants indicated that COVID-19 has impacted how they use energy at their home.
- Tenant satisfaction was higher for the lighting equipment than for the water equipment offered as part of the program.
- 14 out of 26 property managers indicated they chose to participate in the program to save money for their tenants on their utility bills. Other reasons to participate in the program included to reduce maintenance costs, and to get more efficient equipment or the latest technology.
- Most property managers were highly satisfied with the program and the installation team’s scheduling, quality of work and timely installation.

6.2 Tenant Surveys

Customer outreach is a key driver to program participation. Guidehouse recognizes the importance of marketing and outreach with regards to continued participation and satisfaction, so several questions in the tenant survey and property manager interviews were included to address these factors. Figure 6 shows how tenants learned about the program. Tenant participants were asked to indicate all the sources through which they learned about the program, and about 54 percent indicated they heard about the program through property managers as would be expected given the program model. Tenants also indicated they learned about the program though Duke Energy bill stuffer or mailing and Duke Energy's website.

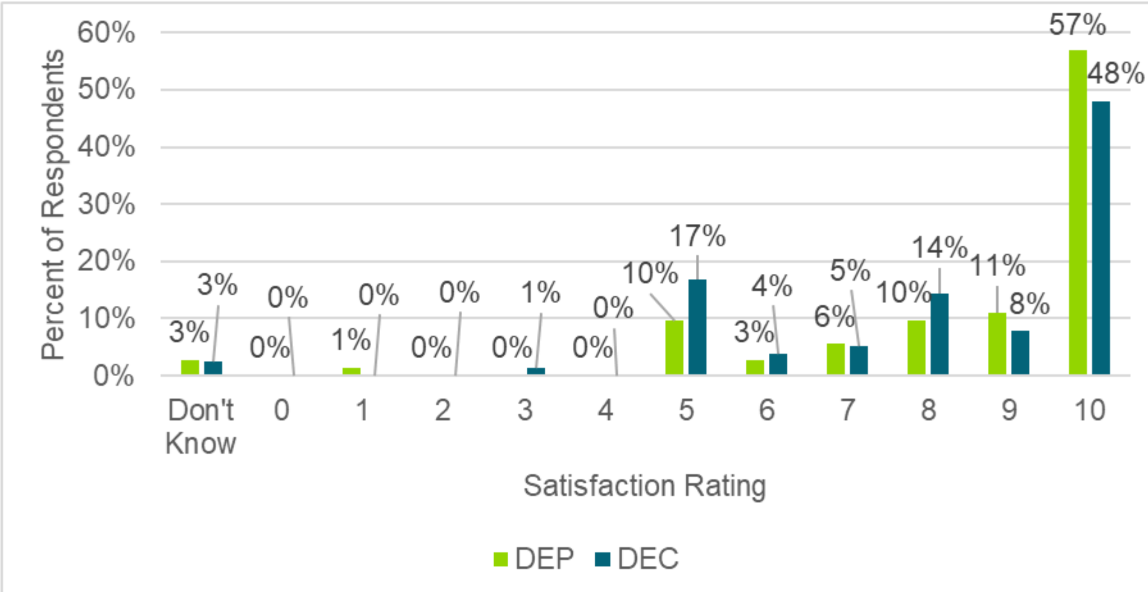
Figure 6. How Tenants Heard About the Program (n=149)



Source: Guidehouse analysis

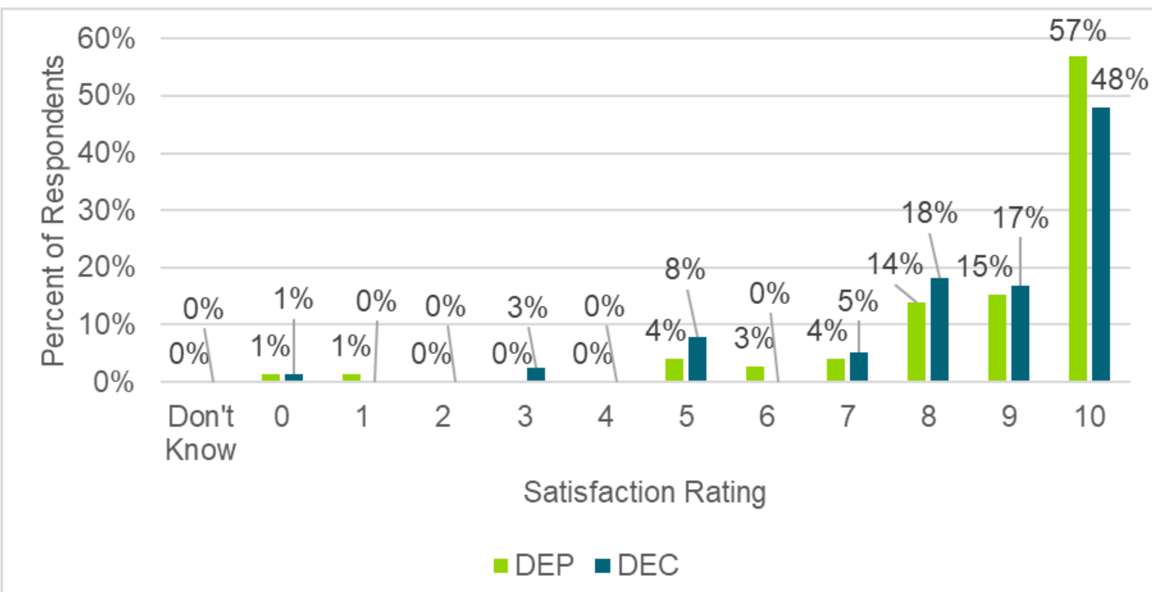
Survey results showed tenant satisfaction with the program is high. On a scale of 0 to 10, where 0 indicates "Not at all satisfied" and 10 indicates "Extremely satisfied," about three-fourths of the tenants rated satisfaction with the program as an 8-10 as shown in Figure 7. The average overall tenant satisfaction rating with the program was 8.6 out of 10. Tenants who ranked their overall satisfaction low did so largely because they did not notice any monetary savings. Survey results also show a high tenant satisfaction with Duke Energy as shown in Figure 8 with an average overall tenant satisfaction rating with Duke Energy of 8.7 out of 10.

Figure 7. Tenant Satisfaction with Duke Energy Multifamily Energy Efficiency Program (n=149)



Source: Guidehouse analysis

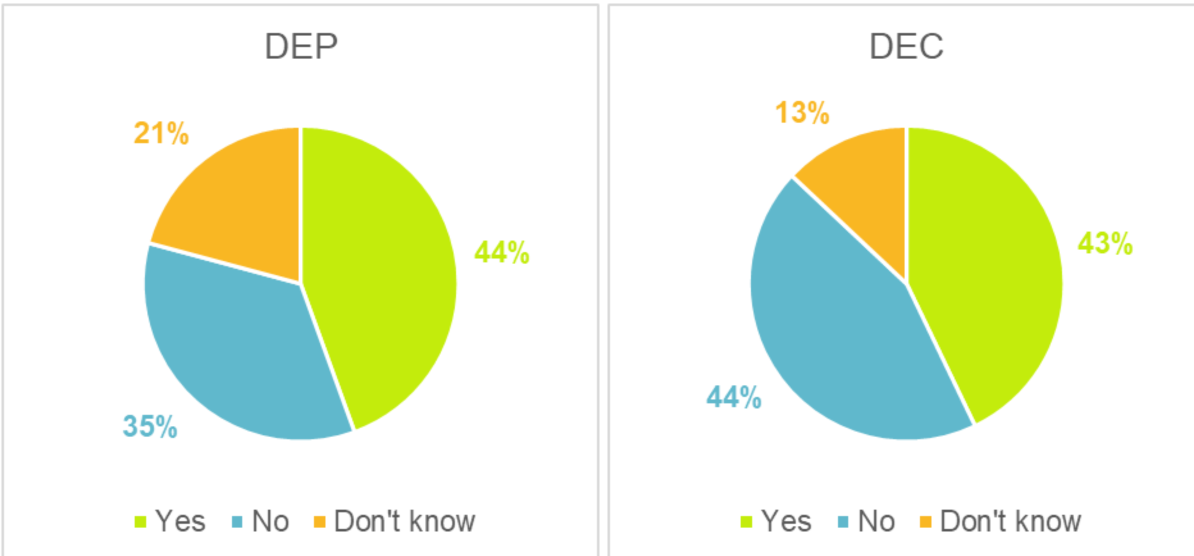
Figure 8. Tenant Satisfaction with Duke Energy (n=149)



Source: Guidehouse analysis

As shown in Figure 9, 44 percent of DEP tenants and 43 percent of DEC tenants noticed a decrease in their energy bills after the new measures were installed, 21 percent DEP and 13 percent DEC tenants are unsure if they are saving energy, while 35 percent of DEP and 44 percent of DEC tenants did not notice a decrease in their utility bills. This represents an opportunity for Duke Energy to communicate energy savings to tenants and help provide them with guidance and tips to save energy and water after the new measures have been installed in their home.

Figure 9. Tenants Who Noticed a Decrease in Their Energy Bill After Installing Program Measures

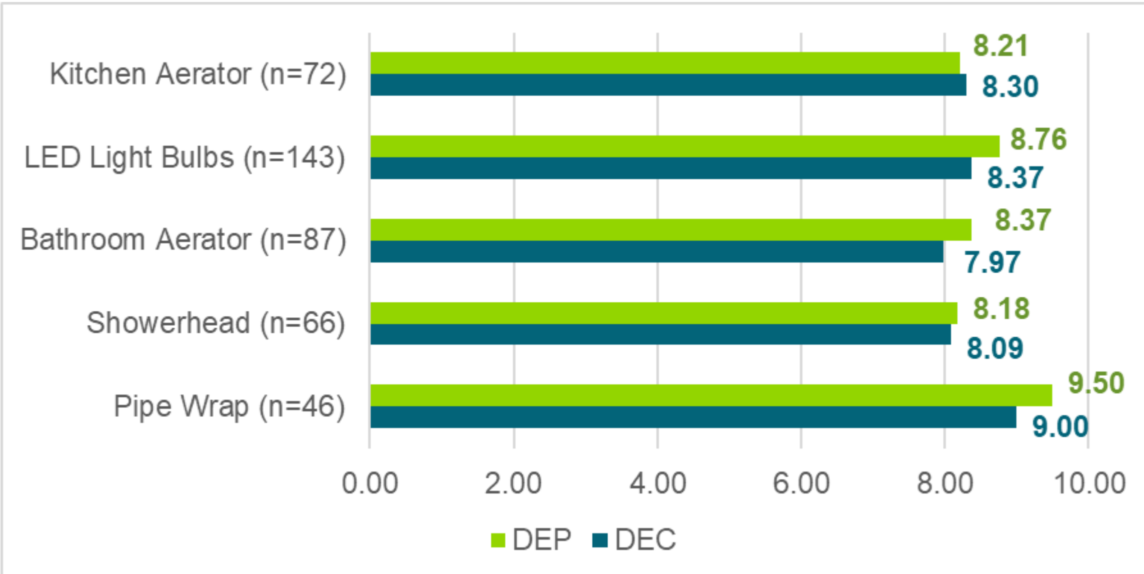


DEP – n = 72, DEC – n = 77

Source: Guidehouse analysis

While a majority of tenants were satisfied with the new measures, some were not. Guidehouse asked the participants to rate their satisfaction for each measure installed at their home. Pipe wrap had the highest average satisfaction rating, while showerhead and bathroom aerator measures had relatively lower average satisfaction ratings, as shown in Figure 10.

Figure 10. Tenant Satisfaction with Program Measures



Source: Guidehouse analysis

For tenants who received the aerators and showerheads, low satisfaction ratings were tied to the low flow rates of the devices.

Nineteen percent of tenants reported they removed some of their program measures. Twenty-eight respondents reported removing equipment and a summary of the measures removed as indicated by the tenants is shown in Table 6-1. Seventeen respondents reported removing LED bulbs largely due to lamp burn out. Eight out of the 11 respondents removed the aerator and showerhead measures due to low water pressure.

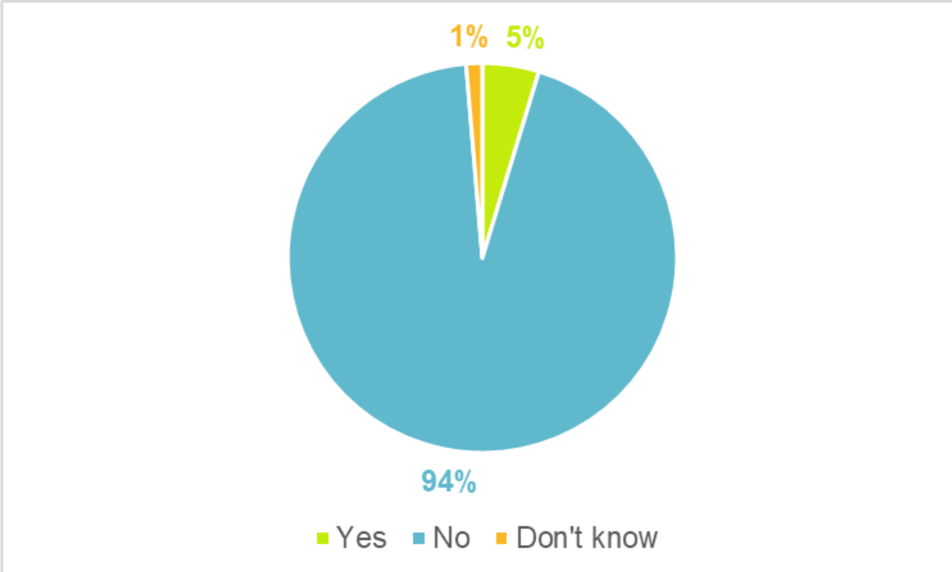
Table 6-1. Removed Measures – Tenant Survey

Measure	Total Respondents
LED Bulbs	17
Bathroom Aerator	3
Kitchen Aerator	5
Showerhead	3
Total	**28**

Source: Guidehouse analysis

As a result of the tenant's particpation in the program, some tenants (5 percent) purchased additional energy efficiency equipment that they did not receive a rebate for, as shown in Figure 11. Of the seven tenants who reported purchasing additional energy efficient equipment, four tenants qualified for spillover. All four spillover qualified tenants indicated they purchased additional LEDs, while one spillover qualified tenant also indicated that they purchased a smart thermostat.

Figure 11. Tenants Who Purchased Additional Energy Efficiency Equipment (n=149)



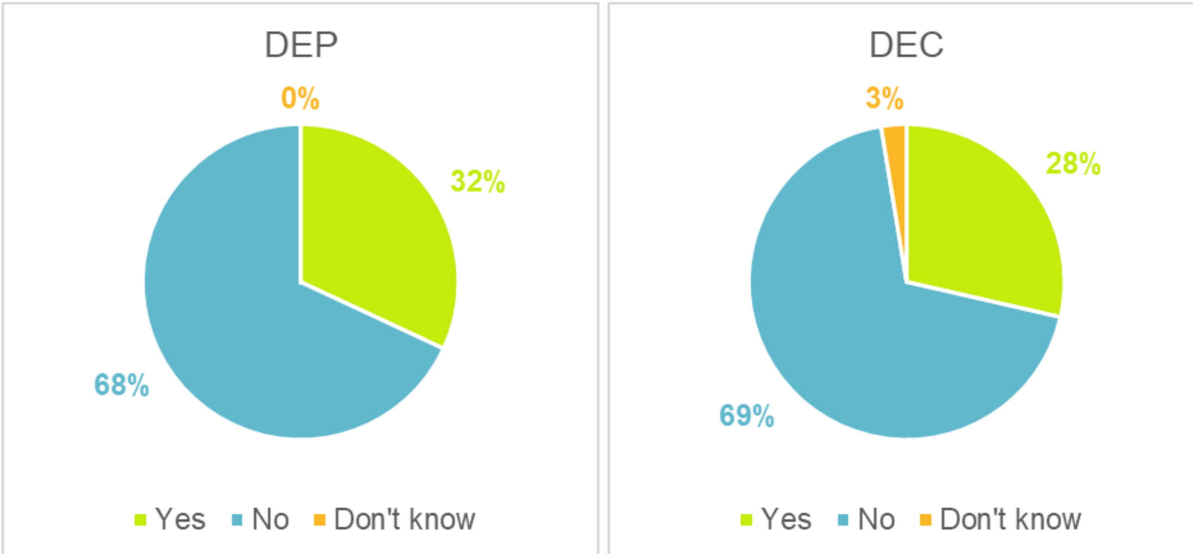
Source: Guidehouse analysis

When asked how important their participation was in their decision to install additional energy efficiency measures, the mean rating was 8.8 out of 10, indicating that the program influenced customers. As discussed previously, Guidehouse incorporated these responses into the spillover calculations used in the NTG analysis.

Tenants reported that 77 percent of the light bulbs installed in their home are LED light bulbs. Most tenants indicated regular incandescent and compact fluorescent bulbs (CFLs) as the most common light bulbs installed in the other lights (non-LED) in their home.

Thirty-two percent of the DEP tenants and 28 percent of the DEC tenants indicated that emergence of COVID-19 has changed how they use energy in their home as shown in Figure 12. Tenants who answered in the affirmative indicated they use more energy due to them being home more since COVID-19.

Figure 12. Tenants Who Indicated a Change in Their Energy Use Due to COVID-19



DEP – n = 72, DEC – n = 77

Source: Guidehouse analysis

6.2.1 Participant Suggestions

Guidehouse included a question in the tenant satisfaction survey that allowed respondents to offer suggestions for improving the program. Suggestions were offered by 23 percent of respondents, and some of the suggestions are as follows:

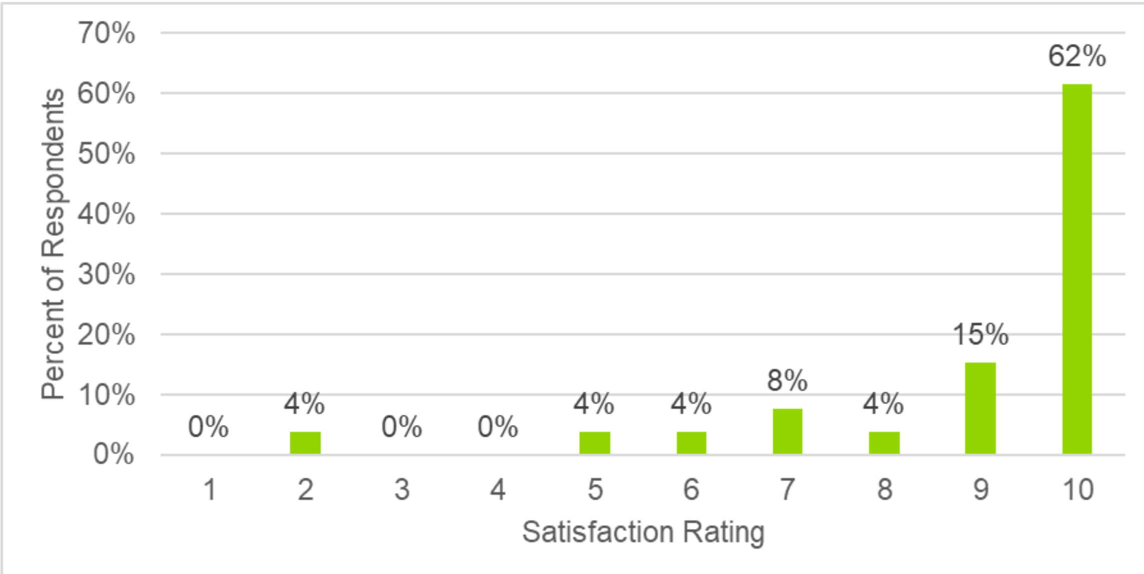
- Nine respondents recommended offering better quality equipment, specifically aerators and showerheads with stronger water pressure and longer lasting LED lamps.
- Two respondents recommended offering HVAC related measures through the program to reduce energy consumption during the cooling season. One respondent recommended offering assessment of the existing appliances at the units and making energy efficient appliance recommendations if they need to be replaced.
- Three respondents recommended offering a few options (color, wattage, brightness) on the LED bulbs installed through the program.
- One respondent recommended including additional information in the online account or energy bill for program participants to compare energy usage and track savings.

6.3 Property Manager Interviews

Guidehouse completed surveys with property managers for 26 of the 294 participating properties. This section presents details of the survey responses. Overall, property managers indicated that their experience with the program was very favorable. Some key findings from the property manager interviews are listed below:

- On a scale of 0 to 10, where 10 indicates “extremely satisfied” and 0 indicates “not at all satisfied”, the average rating from property managers for overall program experience was 8.9, with 81 percent of the property managers rating their satisfaction as an 8-10 as shown in Figure 13.

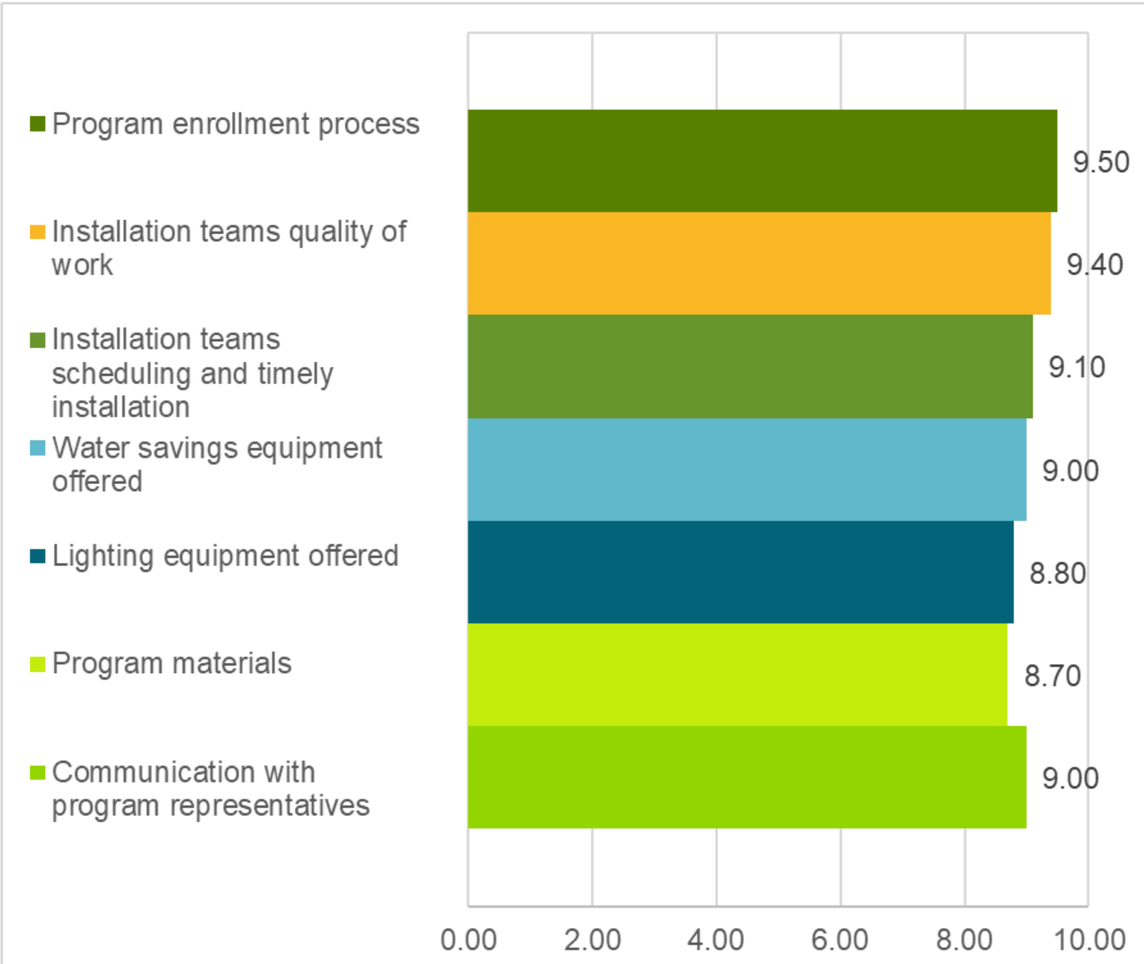
Figure 13. Property Manager Satisfaction with Overall Program Experience (n=26)



Source: Guidehouse analysis

- On a scale of 0 to 10, where 10 indicates “extremely satisfied” and 0 indicates “not at all satisfied”, the average rating from property managers for tenant satisfaction with the new lighting equipment was 8.7. Three property managers indicated that the tenant feedback about their experience with the new LED lights was that the bulbs were starting to go out and did not last as long as expected. Three property managers also reported that some of the tenants had indicated issues with the brightness of the lamps. Seven other property managers indicated that most of the tenants were satisfied with the new LED bulbs and that they reduced energy bills.
- On a scale of 0 to 10, where 10 indicates “extremely satisfied” and 0 indicates “not at all satisfied”, the average rating from property managers for tenant satisfaction with the new water equipment was also 8.7. Three property manager indicated that the tenant feedback about their experience with the new water equipment was that the aerators and showerheads produced low water flow. One other property manager reported that some tenants indicated the kitchen aerator nozzle clogged easily.
- Property managers expressed high satisfaction with the program enrollment process, the installation team’s quality of work and their scheduling and installation as shown in Figure 14.

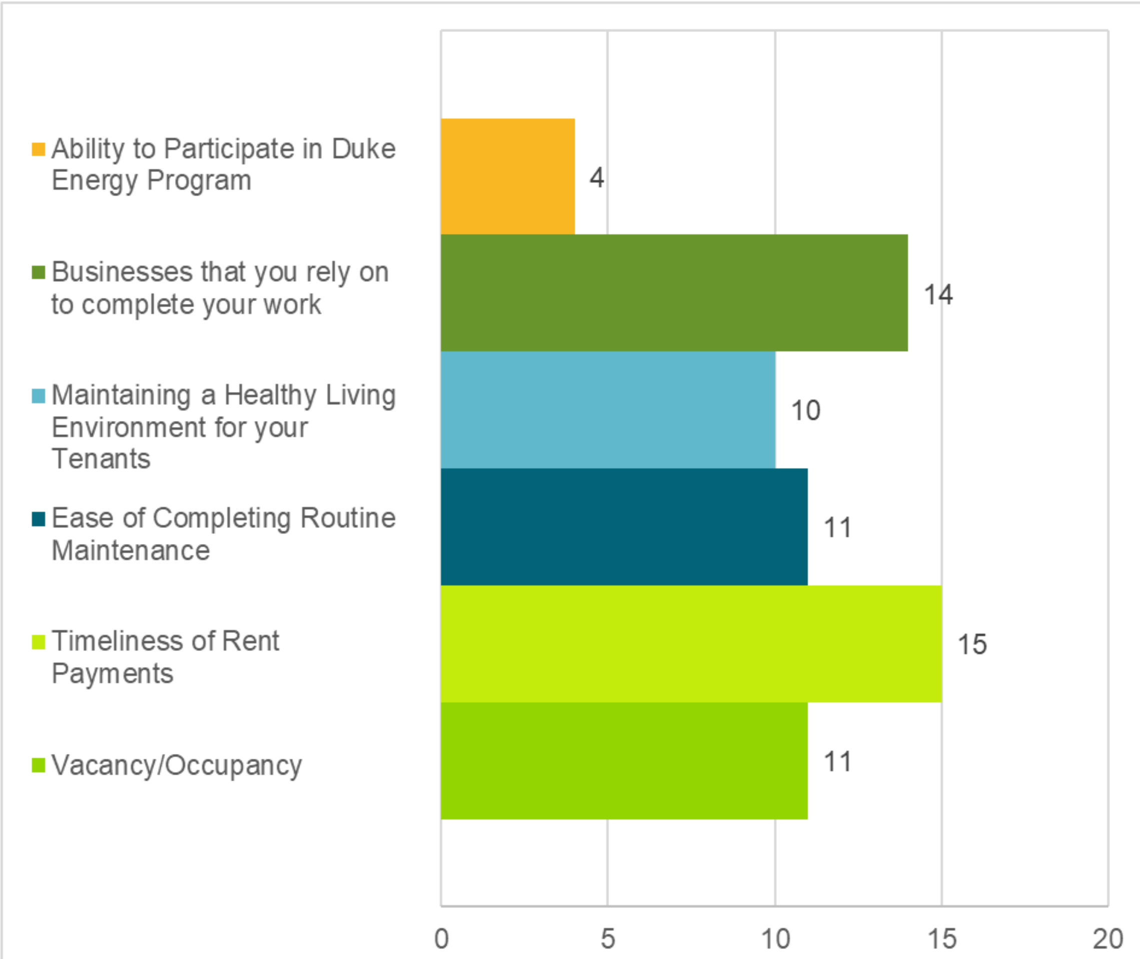
Figure 14. Property Manager Satisfaction with Program Aspects (n=26)



Source: Guidehouse analysis

- Four property managers indicated that their experience with the program influenced them to incorporate additional energy efficient equipment at their property. All four property managers indicated that they installed LED bulbs in the common areas of their property and one property manager indicated that they also installed auto faucets.
- The property manager responses to impacts of COVID-19 on various property management aspects are shown in Figure 15. Two property managers indicated that the emergence of COVID-19 has changed how the tenants use energy at the property and that people are now using more energy as they are home more. Nine property managers indicated no change, while 14 other property managers answered, “don’t know”.

Figure 15. Property Managers That Answered in the Affirmative to the Following COVID-19 Impacts (n=26)



Source: Guidehouse analysis

- Four property managers indicated that COVID-19 has affected their ability to participate in Duke Energy Programs as “people [tenants] fear opening the door” and “techs would not have access to resident’s apartments without PPE”.
- Seven property managers indicated they manage more than one property. For six of these properties, the decision to participate in the program was driven by the owner or the property management company. This indicates an opportunity for Duke Energy to encourage participation for sister properties managed by the same property management company if they haven’t already participated in the program.
- Twelve property managers recommended offering outdoor lighting measures through the program, seven property managers also recommended offering smart thermostats, while three property managers recommended considering offering electric vehicle charging stations through the program.

6.4 Interviews with Duke Energy Program Manager and Franklin Energy Implementation Staff

6.4.1 Interview with Duke Energy's Program Manager

Duke Energy indicated that program participation for 2020 and 2021 was affected by COVID-19 as the program suspended operations in March 2020 in response to the COVID-19 pandemic and did not resume prior to the end of the current evaluation period (June 30, 2021). However, the annual program goals for the current evaluation period were not adjusted and goal attainment was affected by COVID-19 shutdowns.

Duke Energy also noted that new measures like smart thermostats and ultra-low flow showerheads (1.25 GPM) are now offered through the program (post resumption after the COVID-19 shutdown). After program resumption, because of the restrictions that may be in place at the participating properties due to COVID-19, Duke Energy has made updates to the program implementation process to prioritize a culture of safety at all levels of program operation and to combat the increased risk at multifamily properties due to high number of units. These changes include a requirement for the installation team to wear PPE, gloves, masks and maintain social distancing even when working in teams. Prior to the installation site visit, property managers are now contacted about any active COVID-19 cases at the property, and installation proceeds only if the property manager reports no cases. Tenants are now asked if they are experiencing any symptoms and depending on their answer, the team may not install measures in certain units at the property. If any COVID-19 cases are reported at the property, the direction is to stop all activity and reschedule the installation site visit after 30 days. However, Duke Energy understands that the COVID-19 requirements and the situation is continuously evolving and expects to adjust their processes as needed.

Duke Energy identified the lack of resources (staffing) at the participating properties as a barrier to program participation and timely installation of measures. The installation team is highly reliant on the property managent team (property manager or maintenance staff) to escort them around the property during installation and often have to delay installation depending on the availability of the staff at the property. Duke Energy is currently considering working with the property managers to identify third-party resources to provide this service during installation to address this issue. Duke Energy also identified market saturation and lack of information on the existing and newly built multifamily properties as potential barriers to program participation.

Duke Energy is satisfied with Franklin Energy's management of the program. However, they would like Franklin Energy to track lost opportunities or opportunities at the property not currently addressed by the program measure mix as a data point. This information could be utilized to identify potential measure offerings through the program.

6.4.2 Interview with Franklin Energy Implementation Staff

Guidehouse also interviewed program implementation staff from Franklin Energy. The primary implementation steps for this program include outreach conducted by the Energy Advisor, assessment to identify and quantify opportunity, scheduling, installation of the measures based on assessment (additional measures may be installed if applicable), quality control and assessment conducted within three-weeks of installation. Since program resumption after COVID-19 shutdown, the quality assessment is now conducted virtually by calling the tenants and confirming installations.

Staff from Franklin Energy indicated that the program fell short of the annual energy savings (kWh) goal for both the DEP and DEC jurisdictions for 2019 (the only year within the evaluation period unaffected by COVID-19) due to challenges like weather concerns, which resulted in having to pull technicians out of the field, and the inability to ramp up the program as quickly in the DEP jurisdiction among others. Franklin Energy is the primary party responsible for program marketing. Marketing has typically been carried out by the Energy Advisor through cold calls and visiting the properties. However, Franklin Energy is considering reviving a few marketing initiatives like the mail campaign, outbound call campaign (dedicated persion to call property and introduce the program) and the email campaign, to promote the program and encourage participation.

Franklin Energy identified lack of resources (staffing) at the participating properties, COVID-19 and the ability to safely implement the program as the barriers to program participation. Franklin Energy also indicated that there have been no changes to eligibility for this program, but that new measures are now offered through the program including low flow water measures and smart thermostats. While all other program measures are offered at no cost to the customer, smart thermostats require a $100 co-pay. The co-pay will be charged to the property since smart thermostats are intended to be a permanent fixture and improvement to the property.

7. Conclusions and Recommendations

Guidehouse's findings suggest that Duke Energy's Multifamily Energy Efficiency Program is being delivered and tracked effectively in both the DEP and DEC jurisdictions. Customer satisfaction is generally high, and the program measure installations appear to be tracked appropriately. Guidehouse presents the following list of recommendations to help improve program delivery and impacts:

1. Guidehouse recommends that Duke Energy adopt the per-unit energy and demand impacts from this evaluation and use them going forward. The engineering analysis and data collection described in this report provide support for updating the estimated impacts for each program measure.
2. Duke Energy should consider investigating the possibility of providing property managers and tenants information about the Duke Energy Online Store as a way to order additional or replacement equipment.
3. Duke Energy should track additional existing energy efficiency opportunities (not offered through this program) at participating properties and consider channeling them through other applicable programs that offer those measures by sharing relevant leads internally.
4. Guidehouse recommends that Franklin Energy track the actual equipment type (bathroom aerator, kitchen aerator, or showerhead) for the water measures removed during installation along with the GPM value of the removed equipment already captured and provide that as part of the removed measures data going forward.

8. Summary Form

Multifamily Energy Efficiency Program

Completed EMV Fact Sheet

Description of program

Duke Energy's Multifamily Energy Efficiency Program provides energy efficient equipment to multifamily housing properties at no cost to the property managers or tenant end-users. The program is delivered through coordination with property managers and owners. Tenants are provided with notice and informational materials to inform them of the program and potential for reduction in their energy bills. Typically, measures are installed directly by the implementation contractor rather than tenants or onsite maintenance staff.

The program consists of lighting and water measures.

- **Lighting measures:** Light Emitting Diode (LED) bulbs installed in permanent fixtures
- **Water measures:** Bathroom and kitchen faucet aerators, water-saving showerheads, water heater pipe wrap

Evaluation Methods

The evaluation team used engineering analysis and a virtual impact assessment as the primary basis for estimating program impacts. Additionally, telephone surveys were conducted with tenants and multifamily housing units to assess customer satisfaction and spillover. Detailed interviews were conducted with property managers to assess their decision-making process, and ultimately to estimate a net-to-gross ratio.

Impact Evaluation Details

- **Virtual verifications surveys were completed for 138 housing units.** Tenant responses to the survey covering over 1,000 program measures were used to assess measure quantities and characteristics to be compared with the program tracking database.
- **In-Service rates (ISRs) varied by equipment type.** The evaluation team found ISRs ranging from 76 percent for Recessed LED lamps to 100 percent for pipe wrap.
- **Participants achieved an average of 637 kWh of energy savings per year in DEP, and 568 kWh in DEC.** Differences were driven by the mix and quantity of measures installed between the jurisdictions.

Date:	April 20, 2022
Region:	Duke Energy Progress Duke Energy Carolinas
Evaluation Period	7/1/19 – 6/30/21
Annual kWh Savings	DEP 7,763,174 DEC 14,053,099
Per Participant kWh Savings	DEP 637 DEC 568
Net-to-Gross Ratio	0.9602

9. Measure Level Inputs for Duke Energy Analytics

Guidehouse used the findings from virtual verification and review of Duke Energy's deemed savings to estimate an updated set of deemed savings for Duke Energy to use for tracking program activity.

Table 9-1 provides the measure-level inputs that can be used by Duke Energy Analytics for estimates of future program savings.

Table 9-1. Gross Measure Level Impacts

Measure	Unit Basis	Annual Per Unit Energy Savings (kWh)	Annual Per Unit Summer Coincident Demand Savings (kW)	Annual Per Unit Winter Coincident Demand Savings (kW)
A-Line LED	Per lamp	26.82	0.0049	0.0034
Globe LED	Per lamp	27.04	0.0038	0.0037
Candelabra LED	Per lamp	16.02	0.0036	0.0012
Track LED	Per lamp	39.10	0.0059	0.0039
Recessed LED	Per lamp	33.18	0.0064	0.0022
Bathroom Aerator – 0.5 GPM	Per aerator	87.65	0.0116	0.0102
Bathroom Aerator – 1.0 GPM	Per aerator	61.81	0.0082	0.0072
Kitchen Aerator – 1.0 GPM	Per aerator	141.66	0.0187	0.0165
Showerhead – 1.5 GPM	Per showerhead	248.57	0.0205	0.0801
Showerhead – 1.25 GPM*	Per showerhead	317.26	0.0262	0.1022
Pipe Wrap	Per linear foot	21.43	0.0024	0.0024

* Duke Energy did not offer showerheads at the 1.25 GPM flow rate for this evaluation period. The values in this table are presented for planning purposes only. The savings for these measures are calculated assuming the same input parameters as Showerhead – 1.5 GPM measure except GPM Low.

Source: Guidehouse analysis, values subject to rounding

Appendix A. Tenant Survey Guide

DUKE ENERGY MULTIFAMILY ENERGY EFFICIENCY PROGRAM
TENANT SURVEY

This survey guide will be administered to residents who have received energy efficient equipment through Duke Energy's Multifamily Energy Efficiency Program in DEP and DEC (the Carolinas) between 07/01/2019 and 06/30/2021. The goal of the tenant satisfaction survey is to collect feedback about customer experience and satisfaction with program equipment. The recruiting calls for tenant surveys will be made between 10:00am-8:30pm ET on weekdays, and 10:00am-5:00pm ET on Saturdays. No calls are to be made on Sundays.

Company: ______________________________ Telephone: ____________________________
Name: _______________________________ Cell phone: ____________________________
Title: _________________________________ Fax: ________________________________
City: ____________________________ State: __________________ Zip: __________________
Interview date: ___________ Time: __________

[PROGRAMMER: INSERTS FOR "MEASURE(S)": (add MEASURE_NAME_# to sample)
IF LED_LIGHT_BULBS_1 ≥ 1, [INSERT MEASURE(S)] = "LED LIGHT BULBS"
IF BATHROOM_FAUCET_AERATORS_2 ≥ 1, [INSERT MEASURE(S)] = "BATHROOM FAUCET AERATORS"
IF KITCHEN_FAUCET_AERATORS_3 ≥ 1, [INSERT MEASURE(S)] = "KITCHEN FAUCET AERATORS"
IF WATER_HEATER_PIPE_WRAP_4 ≥ 1, [INSERT MEASURE(S)] = "WATER HEATER PIPE WRAP"
IF LOW_FLOW_SHOWERHEADS_5 ≥ 1, [INSERT MEASURE(S)] = "LOW FLOW SHOWERHEAD"

INTRO **[IF COMPLEX_NAME = 2 USE THIS INTRO.] (individual - add "2" to sample)**
Hello, my name is (YOUR NAME) calling from Bellomy Research. I'm calling on behalf of DUKE ENERGY about the energy saving equipment that your landlord or property manager installed in your home as a part of a Duke Energy efficiency program. These may have included light bulbs, faucet aerators, pipe wrap or showerheads. Is this the **[INSERT CONTACT_NAME FROM SAMPLE]** residence? (IF NOT AVAILABLE, SCHEDULE A CALLBACK.)

INTRO 2 **[IF COMPLEX_NAME = 1 USE THIS INTRO.] (complex – add "1" to sample)**
Hello, my name is (YOUR NAME) calling from Bellomy Research. I'm calling on behalf of DUKE ENERGY about the energy saving equipment that your landlord or property manager installed in your home as a part of a Duke Energy efficiency program. These may have included light bulbs, aerators, pipe wrap or showerheads. Do you reside at a property managed by **[INSERT CONTACT_NAME FROM SAMPLE]**? (IF NOT AVAILABLE, SCHEDULE A CALLBACK.)

S1. Safety is always first at Duke Energy. Are you able to safely take this call right now?
1. Yes **[CONTINUE]**
2. No **[THANK AND TERMINATE]**
98. Don't know **[SCHEDULE A CALLBACK]**
99. Refused **[THANK AND TERMINATE]**

[FOR TERMINATIONS]: I thank you for your time.

[IF RESPONDENT ASKS HOW LONG, SAY: "APPROXIMATELY 10-12 MINUTES."]

S2. I am calling for your opinion on your experience with the Multifamily Energy Efficiency Program from Duke Energy. We will keep all of your responses confidential. For quality purposes, this call may be monitored and recorded. I just need to ask a few screening questions before we get started. Our records show that your household received new energy efficient lighting and/or water-saving equipment in 2019 or 2020. Your landlord or property manager organized your participation in this program, and a work crew or maintenance staff would have installed **[INSERT MEASURE(S)]** in your home.

Do you recall these **[INSERT MEASURE(S)]** being installed in your home?

1. Yes, respondent recalls the program **[CONTINUE TO PS1.]**
2. No **[THANK AND TERMINATE]**
98. Don't know **[ASK S3]**
99. Refused **[ASK S3]**

[FOR TERMINATIONS]: I have been asked to conduct interviews with people who are familiar with the energy efficient equipment installed as part of this Duke Energy Multifamily Energy Efficiency Program. Since you do not recall this process, these are all the questions I have at this time. Thank you for your time and have a nice day.

[IF S2 = 98 OR 99, CONTINUE to S3. OTHERWISE SKIP TO PS1.]

S3. Is there anyone available who might know? (IF NOT AVAILABLE, SCHEDULE A CALL BACK).

1. Yes **[REPEAT S1 WITH NEW RESPONDENT TO CONFIRM MEASURES INSTALLED.]**
2. No
99. Refused

[IF S3 = 2 OR 99, THANK AND TERMINATE]
[FOR TERMINATIONS]: I thank you for your time and have a nice day.

==
=========

NTG Survey: Res
Notes for Client:

- Scoring and multipliers are for FR (not NTGR).
- Text in brackets {} serve as a placeholder and will be concluded with the survey firm

==
=========

PARTICIPATION and SATISFACTION

The following survey pertains to the energy efficiency improvements you had completed in your home: **[INSERT MEASURE(S)]** This survey contains questions relating to your overall satisfaction with the Multifamily Energy Efficiency Program as well as questions about your experience with the energy efficient equipment that were installed.

PS1. How did you first hear about Duke Energy's Multifamily Energy Efficiency Program?

(DO NOT READ LIST. RECORD ALL MENTIONS.)

1. Through property manager
2. Duke Energy website

3. Participation in other Duke Energy Programs
4. I haven't heard of the program
5. Other (Please Specify)
98. Don't know
99. Refused

PS2. On a scale of 0 to 10, with 0 being "Not at all satisfied", and 10 being "Extremely satisfied", how satisfied are you with your **[INSERT MEASURE(S)]? [REPEAT FOR EACH MEASURE INSTALLED BY PARTICIPANT.]**

Not at all satisfied										Extremely satisfied	Dk	Ref
0	1	2	3	4	5	6	7	8	9	10	98	99

[IF PS2 < 5, ASK PS3]

PS3. Why did you rate your satisfaction with your equipment a [INSERT ANSWER FROM PS2]? (RECORD VERBATIM.)

____**[OPEN-END]**

[LOOP PS2/PS3 WILL BE ASKED MULTIPLE TIMES, BASED ON NUMBER OF MEASURES INSTALLED AT PS2.]

PS4. Have you noticed any savings on your electric bill since the installation of your new **[INSERT MEASURE(S)]**?

1. Yes
2. No
98. Don't know
99. Refused

PS5. Using a scale from 0 to 10, with 0 being "Not at all satisfied" and 10 being "Extremely satisfied", how satisfied are you with the Duke Energy Multifamily Energy Efficiency Program?

Not at all satisfied										Extremely satisfied	Dk	Ref
0	1	2	3	4	5	6	7	8	9	10	98	99

[IF PS5 = 0-10, ASK PS5A]

PS5a. Why did you rate your satisfaction with the program a [INSERT ANSWER FROM PS8]? (RECORD VERBATIM.)

____**[OPEN-END]**

PS6. Do you have any suggestions to improve the Multifamily Energy Efficiency Program? These could be suggestions regarding the:

a. Current equipment offered through the program
b. Additional equipment you would like to see offered as part of the program
c. Possible improvements to implementation based on your experience
d. Other

1. Yes
2. No
98. Don't know
99. Refused

[IF PS6 = 1, ASK PS6A.]
PS6a. What are those suggestions? (RECORD VERBATIM. PROBE FOR CLARIFICATION.)
____ **[OPEN-END]**

PS7. How would you rate your overall satisfaction with Duke Energy on a scale of 0 to 10, with 0 meaning "Not at all satisfied" and 10 meaning "Extremely satisfied"?

Not at all satisfied										Extremely satisfied	Dk	Ref
0	1	2	3	4	5	6	7	8	9	10	98	99

[IF PS7 < 5, ASK PS7A.]
PS7a. Why did you rate your satisfaction with Duke Energy a [INSERT ANSWER FROM PS10]? (RECORD VERBATIM.)
____ **[OPEN-END]**

MEASURES

Now I'd like to ask you a few questions about your experience with the energy efficient equipment installed through the Duke Energy Multifamily Energy Efficiency Program.

M1. Have you removed any of the **[INSERT MEASURE(S)]** that were installed in your home through this Duke Energy program?
1. Yes
2. No
98. Don't know

[IF M1 = 2 OR 98, SKIP TO IS1. OTHERWISE CONTINUE.]
M2. As I read the following measures, please tell me which ones you removed. Did you remove…(READ LIST. RECORD ALL MENTIONS)? **[INSERT MEASURE(S)] ONLY INCLUDE MEASURE INSTALLED IN THE UNIT.**
1. Bathroom faucet aerators
2. Kitchen faucet aerators
3. Low flow showerhead
4. Water heater pipe wrap
5. LED A-lamps
6. LED Globe lamps
7. LED Candelabras
8. LED Recessed lamps
9. LED Track Lighting lamps

10. (DO NOT READ) None were removed

[IF M2 = 10, SKIP TO IS1. OTHERWISE CONTINUE.]

M3. Please tell me the quantity of items you removed for each of the following. How many (READ LIST) did you remove? (INTERVIEWER: RECORD-QUANTITY FOR EACH MEASURE. USE “98” FOR DON’T KNOW AND “99” FOR REFUSED.) **[INSERT MEASURE(S)] ONLY INCLUDE MEASURE INSTALLED IN THE UNIT.**

Measure Description	Quantity Removed
M3_1. Bathroom faucet aerators	________
M3_2. Kitchen faucet aerators	________
M3_3. Low flow showerheads	________
M3_4. Water heater pipe wrap (in feet)	________
M3_5. LED A-lamps	________
M3_6. LED Globe lamps	________
M3_7. LED Candelabras	________
M3_8. LED Recessed lamps	________
M3_9. LED Track Lighting lamps	________

[IF M3_1 > “0”, CONTINUE. OTHERWISE, SKIP TO IS1.]

M3_1a. You indicated that you removed bathroom faucet aerators. Why did you remove those items?
(RECORD VERBATIM.)
____ **[OPEN-END]**

M3_1b. Did you remove an aerator from the master bathroom or another type of bathroom? (RECORD ONE ANSWER ONLY.)
1. Master bathroom
2. Another type of bathroom

[IF M3_2 > “0”, CONTINUE. OTHERWISE, SKIP TO IS1.]

M3_2a. You indicated that you removed kitchen faucet aerators. Why did you remove those items?
(RECORD VERBATIM.)
____ **[OPEN-END]**

[IF M3_3 > “0”, CONTINUE. OTHERWISE, SKIP TO IS1.]

M3_3a. You indicated that you removed low flow showerheads. Why did you remove those items?
(RECORD VERBATIM.)
____ **[OPEN-END]**

M3_3b. Did you remove a showerhead from the master bathroom or another type of bathroom? (RECORD ONE ANSWER ONLY.)
1. Master bathroom
2. Another type of bathroom

[IF M3_4 > “0”, CONTINUE. OTHERWISE, SKIP TO IS1.]

M3_4a. You indicated that you removed water heater pipe wrap. Why did you remove those items?
(RECORD VERBATIM.)
____[OPEN-END]

[IF M3_5, M3_6, M3_7, M3_8, OR M3_9 > "0", CONTINUE. OTHERWISE, SKIP TO IS1.]

M3_5a. You indicated that you removed LED light bulbs. Why did you remove those items?
(RECORD VERBATIM.)
____[OPEN-END]

M3_5b. From which rooms did you remove LEDs? (DO NOT READ LIST. RECORD ALL MENTIONS.)

1. Bathroom(s)
2. Bedroom(s)
3. Kitchen/Pantry
4. Living room/Family room/Den/Playroom
5. Home office
6. Laundry room
7. Exterior room (garage/patio/outdoor area)
8. Dining room
9. Hall
10. Other (Please Specify)

M4. How many LED light bulbs were installed in your home through the program? (USE "98" FOR DON'T KNOW AND "99" FOR REFUSED.)
1. _____[ENTER A NUMBER 1 TO 999]

M5. What types of light bulbs do you have in the other lights in your home? (RECORD ALL MENTIONS.)

M5_ 1. Regular Incandescent Bulbs (NOTE: Traditional light bulbs that look like an upside down pear. These are no longer being produced.)
M5_2. Halogen (NOTE: Usually found in outside or recessed lighting.)
M5_3. LEDs (NOTE: LEDs last longer than CFLs.)
M5_4. Compact Fluorescent Bulbs or CFLs (NOTE: These look like a spiral or "twisty.")
M5_5. Other (Please Specify)
98. Don't know

M6. What is the quantity of light bulbs you have in the other lights in your home? (RECORD QUANTITY FOR ALL
MENTIONS IN M4.)

M6_1. Regular Incandescent Bulbs ____________
M6_2. Halogen ____________
M6_3. LEDs ____________
M6_4. Compact Fluorescent Bulbs or CFLs ____________
M6_5. Other (Please Specify) ____________
98. Don't know

M7. What percent of the light bulbs installed in your home are LED light bulbs? (USE “98” FOR DON’T KNOW AND “99” FOR REFUSED.)
1. _____[ENTER A NUMBER 0% TO 100%]

SPILLOVER (INSIDE SPILLOVER)

IS1. As a result of your experience with the program, did you purchase additional energy efficiency equipment for your home or adopt any energy efficient behavior for which you did not receive a rebate/discount from any other Duke Energy program? (FOR BELOMY: AS AN EXAMPLE, THIS COULD MEAN BUYING ADDITIONAL LED LAMPS OR TURNING OFF LIGHTS.)

1. Yes **[CONTINUE]**
2. No
98. Don’t know
99. Refused

[IF IS1 = 2 OR 98, SKIP TO DA1.]

IS2. Please tell me the types of additional energy efficient items and the quantity you had installed
where you did <u>not</u> receive a program rebate. (INTERVIEWER: RECORD MEASURE DESCRIPTION
AND QUANTITY FOR EACH. AFTER EACH QUANTITY, ASK: Any others?) (USE “98” FOR DON’T
KNOW AND “99” FOR REFUSED.) (ONLY THE FIRST LINE IS REQUIRED. ENTER AS MANY
MEASURES AS THE RESPONDENT HAD INSTALLED AND LEAVE THE REST BLANK.)

	<u>Measure Description</u>	<u>Quantity</u>
IS2a.	1.___________________________________	2._______
IS2b.	3.___________________________________	4._______
IS2c.	5.___________________________________	6._______
IS2d.	7.___________________________________	8._______
IS2e.	9.___________________________________	10._______

IS3. Please briefly <u>describe how</u> the program has influenced your decisions to incorporate <u>additional</u> energy efficient items in your home that were not part of a program rebate. (RECORD VERBATIM.)
____**[OPEN-END]**

IS4. On a scale of 0 to 10, where 0 is “Not at all important” and 10 is “Extremely important,” how important was your participation in the program in your decision to install additional energy efficiency measures?

Not at all important									Extremely important	Dk	Ref
0	1	2	3	4	5	6	7	8	9	10	98	99

DEMOGRAPHICS AND ADDITIONAL FEEDBACK

Thank you for your time and patience; there are only a few more questions.

DA1. Do you consider Duke Energy a trusted resource for energy efficiency information?
1. Yes
2. No
98. Don't know
99. Refused

[IF DA1 = 1 "YES", ASK DA1a. IF DA1 = 2 "NO", ASK DA1b]

DA1a. Why do you consider Duke Energy a trusted resource?
____ **[OPEN-END]**

DA1b. Why do you not consider Duke Energy a trusted resource?
____ **[OPEN-END]**

DA2. How many bedrooms does your home have?
1. 1
2. 2
3. 3
4. More than 3
98. Don't know
99. Refused

DA3. How many people live in your home?
1. 1
2. 2
3. 3
4. More than 3
98. Don't know
99. Refused

COVID-19

C1. Has the emergence of COVID-19 changed how you use energy in your home?

1. Yes
2. No

3. Don’t know

[IF C1=1 ASK C2]
C2. Please describe how you are using energy in your home differently as a result of COVID-19 [RECORD VERBATIM]
____ **[OPEN-END]**

[IF C1=1 ASK C3]
C3. Thinking of how COVID-19 has changed your home energy use, are there any tools or resources that Duke Energy could provide to help you?
[RECORD VERBATIM]
____ **[OPEN-END]**

CLOSING: This completes the survey. Your responses are very important to Duke Energy and will help as we design future energy efficiency programs. We appreciate your participation and thank you for your time. Have a good day.

Appendix B. Property Manager Survey Guide

DUKE ENERGY MULTIFAMILY ENERGY EFFICIENCY PROGRAM
PROPERTY MANAGER SURVEY

This survey guide will be administered to property managers who participated in Duke Energy's Multifamily Energy Efficiency Program in DEP and DEC (the Carolinas) between 07/01/2019 and 06/30/2021. The goal of property manager surveys is to collect feedback about program experience, satisfaction, and to inform the net-to-gross analysis. Surveys will be conducted via phone, between 10:00am-8:30pm ET on weekdays, and 10:00am-5:00pm ET on Saturdays. No calls are to be made on Sundays. The Guidehouse interviewer will introduce himself/herself and inform the customer about the purpose of the interview.

Company: ______________________________ Telephone: ____________________________
Name: ________________________________ Cell phone: ____________________________
Title: _________________________________ Fax: _________________________________
City: ____________________________ State: __________________ Zip: _________________
Interview date: __________ Time: _________

Screening

S1. According to our records, your property participated in Duke Energy's Multifamily Energy Efficiency Program during 2019 or 2020 and received free installation of energy efficient **lighting and/or water equipment**. Is that correct?

1. Yes
2. No
98. Don't know
99. Refused

[If S1 = 2 or 98, 99, TERMINATE. Otherwise, Continue]
[***FOR TERMINATIONS]***: This survey is for people who participated in Duke Energy's Multifamily Energy Efficiency Program during 2019 or 2020. Since you did not, these are all the questions I have at this time, and I thank you for your time.

S2. Are you the primary person who was involved in making the decision to participate in Duke Energy's program and receive the installation for the energy efficient **lighting and/or water efficiency equipment** at the propery you manage?

1. Yes
2. No
98. Don't know
99. Refused

[If S2 = 1, Move to PS1. If S2 = 99, Terminate. Otherwise, Continue]
[***FOR TERMINATIONS]***: This survey is for people who participated in Duke Energy's Multifamily Energy Efficiency Program during 2019 or 2020. Since you did not, these are all the questions I have at this time, and I thank you for your time.

S2a. I understand that the decision to install the **lighting and/or water equipment** may have been driven by someone other than yourself. However, if you had some involvement in the decision process to participate in the program, your input will be helpful. Are you somewhat familiar with the program participation and installation process?

1. Yes
2. No
98. Don't know
99. Refused

[If S2a = 1, proceed to PS1. If S2 = 2 or 98, proceed to S2b. If S2a= 99, Terminate]
[*FOR TERMINATIONS]*: This survey is for people who participated in Duke Energy's Multifamily Energy Efficiency Program during 2019 or 2020. Since you did not, these are all the questions I have at this time, and I thank you for your time.

S2b. Please provide me with the contact information of the person who was involved in the decision making:

1. Yes [Gather correct contact information before terminating]
2. No [Terminate]
98. Don't know [Terminate]
99. Refused [Reassure participant prior to Terminating]

[If S2b = 1, Gather correct contact information before ending. If S2 = 2, 98 or 99, Terminate]
[*FOR ENDING*]: Thank you for providing us with this information and thank you for your time.
[*FOR TERMINATIONS]*: This survey is for people who participated in Duke Energy's Multifamily Energy Efficiency Program during 2019 or 2020. Since you did not, these are all the questions I have at this time, and I thank you for your time.

Survey Introduction

My questions are about the energy efficient **lighting and/or water equipment** installed at **[Insert Property]** through the Duke Energy Multifamily Energy Efficiency Program in 2019 or 2020. The lighting equipment refers to LED retrofits in tenant housing units, and the water equipment refers to low flow showerheads, faucet aerators, and water heater pipe wrap. I will ask about your satisfaction with the program as well as questions relating to your decision to participate in the program. Finally, I am also interested in hearing about any decisions to pursue efficiency projects at other properties your company manages.

Participation and Satisfaction

The first set of questions relate to your satisfaction with the program. Using a scale from 0 to 10, with 0 being “not at all satisfied” and 10 being “extremely satisfied”, how would you rate your satisfaction with the following aspects of Duke Energy’s Multifamily Energy Efficiency program? *(INTERVIEWER: USE “98” FOR DON’T KNOW. USE “99” FOR REFUSED.)*

Questions	Ratings and explanations												
PS1. Overall experience with the program	0	1	2	3	4	5	6	7	8	9	10	98 Don’t Know	99 Refused
PS1a. Why did you rate your overall experience with the program a [INSERT ANSWER FROM PS1]? *(RECORD VERBATIM)*													
PS2. Communication with program representatives	0	1	2	3	4	5	6	7	8	9	10	98 Don’t Know	99 Refused
[If PS2 < 5, ASK] PS2a. Why did you rate the communication with program representatives a [INSERT ANSWER FROM PS2]? *(RECORD VERBATIM)*													
PS3. Program materials to help you communicate with tenants about the program	0	1	2	3	4	5	6	7	8	9	10	98 Don’t Know	99 Refused
[If PS3 < 5, ASK] PS3a. Why did you rate the program materials a [INSERT ANSWER FROM PS3]? *(RECORD VERBATIM)*													
PS4. The lighting equipment offered in the program	0	1	2	3	4	5	6	7	8	9	10	98 Don’t Know	99 Refused
[If PS4 < 5, ASK] PS4a. Why did you rate the lighting equipment offered in the program a [INSERT ANSWER FROM PS4]? *(RECORD VERBATIM)*													
PS5. The water-saving equipment offered in the program	0	1	2	3	4	5	6	7	8	9	10	98 Don’t Know	99 Refused
[If PS5 < 5, ASK] PS5a. Why did you rate the water-saving equipment offered in the program a [INSERT ANSWER FROM PS5]? *(RECORD VERBATIM)*													

PS6. Installation team's scheduling and timely installation in tenant-units	0	1	2	3	4	5	6	7	8	9	10	98 Don't Know	99 Refused
[If PS6 < 5, ASK] PS6a. Why did you rate the installation team's scheduling and timely installation a [INSERT ANSWER FROM PS6]? *(RECORD VERBATIM)*													
PS7. Installation team's quality of work	0	1	2	3	4	5	6	7	8	9	10	98 Don't Know	99 Refused
[If PS7 < 5, ASK] PS7a. Why did you rate the installation team's quality of work a [INSERT ANSWER FROM PS7]? *(RECORD VERBATIM)*													
PS8. Program enrollment process	0	1	2	3	4	5	6	7	8	9	10	98 Don't Know	99 Refused
[If PS8 < 5, ASK] PS8a. Why did you rate the program enrollment process a [INSERT ANSWER FROM PS8]? *(RECORD VERBATIM)*													

PS9. **[If property received lighting equipment ask PS9, otherwise skip to PS10]** On a scale of 0 to 10, with 0 being "not at all satisfied", and 10 being "extremely satisfied", how satisfied would you say *your tenants* are with the new **lighting equipment**? (USE "98" FOR DON'T KNOW. USE "99" FOR REFUSED.)

Not at all Important									Extremely Important	Don't Know	Refused
0	1	2	3	4	5	6	7	8	9	10	98	99

PS9a. Why did you rate your tenants' satisfaction with the new lighting equipment a [INSERT ANSWER FROM PS9]? *(RECORD VERBATIM)*

____

PS9b. Can you tell me about any feedback that you have received from your tenants about their experience with the LED lights? [Probe to understand any improvements to aesthetics in the space, reduced energy bills, etc.) (RECORD VERBATIM)

PS10. **[If property only received lighting equipment skip to PS11]** On a scale of 0 to 10, with 0 being "not at all satisfied", and 10 being "extremely satisfied", how satisfied would you say your tenants are with the new **water equipment**? (USE "98" FOR DON'T KNOW. USE "99" FOR REFUSED.)

Not at all Important										Extremely Important	Don't Know	Refused
0	1	2	3	4	5	6	7	8	9	10	98	99

PS10a. Why did your rate your tenants' satisfaction with the new water equipment a [INSERT ANSWER FROM PS10]? *(RECORD VERBATIM)*

____

PS10b. Can you tell me about any feedback that you have received from your tenants about their experience with the water equipment? [Probe to understand any improvements to aesthetics in the space, reduced energy bills, etc.] (RECORD VERBATIM)

PS11. When speaking to prospective tenants, do you highlight the energy efficient features of your units?

1. Yes
2. No
98. Don't know
99. Refused

PS12. Are there other energy efficiency options you think the program should include? Some examples might be outdoor lighting solutions, heating and cooling solutions, programmable or smart thermostats (i.e. nests), electric vehicle charging stations, etc.? (RECORD VERBATIM)

Awareness Questions

The next set of questions relate to your decision to participate in the program.

A1. What was the <u>primary</u> reason for your decision to participate in the program? [DO NOT READ LIST. RECORD ONLY ONE MENTION.]

1. To save money on utility bills; save money on electric bills
2. Because the equipment was free to me
3. To replace old equipment
4. To replace broken equipment
5. To get more efficient equipment or the latest technology
6. To reduce maintenance costs
7. Because the program was sponsored by Duke Energy
8. Previous experience with other Duke Energy programs
9. To help protect the environment
10. To save energy
11. To improve tenant satisfaction
12. To attract new tenants
13. Part of a broader remodeling or renovation
14. Recommended by contractors/trade allies
15. Recommended by family, friend, or neighbor
16. Existing equipment was due for its regularly-scheduled checkup
17. Duke Energy Advertising

18. Advertising other than Duke Energy
19. No other reasons
20. Other [SPECIFY] ___________________________
98. Don’t know
99. Refused

A2. Are there any other reasons you decided to install **lighting and/or water equipment**? [DO NOT READ LIST. RECORD ALL MENTIONS]

1. To save money on utility bills; save money on electric bills
2. Because the equipment was free to me
3. To replace old equipment
4. To replace broken equipment
5. To get more efficient equipment or the latest technology
6. To reduce maintenance costs
7. Because the program was sponsored by Duke
8. Previous experience with other Duke programs
9. To help protect the environment
10. To save energy
11. To improve tenant satisfaction
12. To attract new tenants
13. Part of a broader remodeling or renovation
14. Recommended by contractors/trade allies
15. Recommended by family, friend, or neighbor
16. Existing equipment was due for its regularly-scheduled checkup
17. Duke Advertising
18. Advertising other than Duke.
19. Federal tax credit
20. No other reasons
21. Other [SPECIFY] ___________________________
98. Don’t know
99. Refused

A3. On a scale of 0 to 10 where 0 means “strongly disagree” and 10 means “strongly agree,” please rate your agreement with the following statements:

A3a. I consider Duke Energy to be a resource for energy efficiency information.

1. Record response 0-10
98. Don’t know
99. Refused

A3b. My decision to install energy efficient equipment at my property was largely motivated by Duke Energy’s program.

1. Record response 0-10
98. Don’t know
99. Refused

Prior Plans

[Ask if property received lighting equipment]

PP1. Prior to participating in the Duke Energy program, <u>had you considered installing</u> the energy efficient **lighting equipment** at the property?

1. Yes
2. No
98. Don't know
99. Refused

[Ask if property received water equipment]

PP2. Prior to participating in the Duke Energy program, <u>had you considered installing</u> the energy efficient **water equipment** at the property?

1. Yes
2. No
98. Don't know
99. Refused

[If PP1 OR PP2 = 1 or 98, ASK PP2A. Otherwise ASK L3]

PP2a. Please describe any plans you had to install the **lighting and/or water equipment** prior to participating in the Duke Energy program.

[Record PM Response verbatim]: ______________________

PP3. Thinking about before you decided to participate in the Duke Energy Multifamily Energy Efficiency program. On a scale of 0 to 10, where 0 means you "had not yet started to plan for equipment or installation" and 10 means you "had identified and selected specific equipment <u>and</u> the contractor to install it", please tell me how far along you were in your plans to install the equipment before participating in the program. (USE "98" FOR DON'T KNOW. USE "99" FOR REFUSED.)

Had not Yet planned for Equipment and Installation										Identified and selected specific equipment <u>and</u> the contractor to install it	Don't know	Refused
0	1	2	3	4	5	6	7	8	9	10	98	99

Own

O1. Please tell me in your own words how the program influenced your decision to install the **lighting and/or water equipment**. (RECORD VERATIM)

____

Likelihood

L1. Given everything you've just told me, what is the likelihood that you would have installed the same energy efficient **lighting and/or water equipment** without the Duke Energy program and its financial and technical assistance? Would you say you … [READ LIST]?

1. Definitely would NOT have installed the same **lighting and/or water equipment without the Duke Energy program**
2. MAY HAVE installed the same **lighting and/or water equipment**, even without the Duke Energy program
3. Definitely WOULD have installed the same **lighting and/or water equipment,** even without the Duke Energy program

98. (DO NOT READ) Don't know
99. Refused

[If L1 = 2, ASK L1A. Otherwise ASK L2]

L1a. You indicated you may have installed the same energy efficient **[INSERT MEASURES DENOTED ABOVE]**, even without the Duke Energy program. On a scale of 0 to 10 where 0 is "DEFINITELY WOULD NOT have installed" and 10 is "DEFINITELY WOULD have installed", can you tell me the likelihood that you would have installed the same **equipment** without the program?

Definitely Would Not										Definitely Would	Don't Know	Refused
0	1	2	3	4	5	6	7	8	9	10	98	99

L2. Thinking about the quantity of lighting and/or water equipment you installed through the program, what is the likelihood that you would have installed the same quantity of the same measures without the program's financial and technical assistance? Would you say you … [READ LIST]

1. Definitely would NOT have installed the same quantity of the same **lighting and/or water equipment** without the Duke Energy program
2. MAY HAVE installed the same quantity of the same energy efficient **lighting and/or water equipment**, even without the Duke Energy program
3. Definitely WOULD have installed the same quantity of the same energy efficient **lighting and/or water equipment**, even without the Duke Energy program

98. (DO NOT READ) Don't know
99. Refused

[If L2 = 2, ASK L2A. Otherwise ASK L3]

L2a. You indicated you may have installed the same quantity of the same lighting and/or water equipment even without the Duke Energy program. Using a scale of 0 to 10 where 0 is "DEFINITELY WOULD NOT have installed" and 10 is "DEFINITELY WOULD have installed", can you tell me the likelihood that you would have installed the same quantity of the same measures **without the program**?

Definitely Would Not										Definitely Would	Don't Know	Refused
0	1	2	3	4	5	6	7	8	9	10	98	99

L3. **[If L2 = 3, proceed to L3A. Otherwise, continue]**
Is there a chance you would have had at least some of the work done without the program?

1. Yes
2. No
98. Don't know

[If L3 = 2, ASK IS1. Otherwise, continue]

L3a. Could you estimate the percentage of the work that you might have had done without the program? By percentage, I mean about what portion of the total energy efficient equipment would you have installed without the program _________%

L3b. On a scale of 0 to 10 where 0 is "DEFINITELY WOULD NOT have installed" and 10 is "DEFINITELY WOULD have installed", what is the likelihood you might have installed [INSERT L3A ANSWER] percent of the **lighting and/or water equipment** without the Duke Energy program? (USE "98" FOR DON'T KNOW. USE "99" FOR REFUSED.)

Not at all Important										Extremely Important	Don't Know	Refused
0	1	2	3	4	5	6	7	8	9	10	98	99

L3c. You mentioned you might have done some work without the program, please describe what you might have had done. (RECORD VERBATIM)

____

L4. Without the program, about when would you have installed the **lighting and/or water equipment**?
Would it have been… (READ LIST)?

1. At the same time as you did
2. Within 1 year of the time you did
3. Between 1 and 2 years within the time you did
4. Between 2 and 4 years within the time you did
5. Sometime after 4 years within the time you did
6. Would have never installed without the program

Spillover

Thank you for your time and patience, we are almost done and the next few questions pertain to how the program may have influenced you to perform other energy efficiency activities are your property.

IS1. Did your experience with the program in any way influence you to incorporate additional energy efficiency equipment where you did not receive a program rebate at your property?

1. Yes
2. No

98. Don't know
99. Refused

[IF IS1 = 2, SKIP TO IS2]

IS1a. Please tell me the types of additional energy efficient equipment and the quantity you had installed where you did not receive a program rebate. [INTERVIEWER: RECORD MEASURE DESCRIPTION AND QUANTITY FOR EACH. AFTER EACH QUANTITY, ASK: Any others?]

Measure Description	Quantity
1.________________________________	________
2.________________________________	________
3.________________________________	________
4.________________________________	________
5.________________________________	________
6.________________________________	________

IS1b. Please briefly describe how the program influenced your decisions to incorporate additional energy efficiency equipment at your property that were not part of a program rebate. (RECORD VERBATIM)

____

IS1c. On a scale of 0 to 10, where 0 is "not at all important" and 10 is "extremely important," how important was your participation in the program in your decision to install the additional energy efficiency equipment? (USE "98" FOR DON'T KNOW. USE "99" FOR REFUSED.)

Not at all Important										Extremely Important	Don't Know	Refused
0	1	2	3	4	5	6	7	8	9	10	98	99

IS2. Aside from the primary property that participated in the program, did your experience with the program in any way influence you to incorporate additional energy efficiency equipment where you did not receive a program rebate at any other properties managed by your company?

1. Yes
2. No

98. Don't know

[IF IS2 = 2, SKIP TO P1]

IS2a. Please briefly describe how the program influenced your decisions to incorporate additional energy efficiency equipment at another property that were not part of a program rebate. (RECORD VERBATIM)

____

Property Characteristics

The next few questions are about the size and occupancy characteristics of your property.

P1. How many housing units does your property have?

1. Record Verbatim
98. Don't know
99. Refused

P2. Can you tell me the approximate percentage of housing units at your facility that have the following number of bedrooms?

1. One-bedroom (record percentage of units):
2. Two-bedrooms (record percentage of units):
3. Three-bedrooms (record percentage of units):
4. More than three bedrooms (record percentage of units):
98. Don't know
99. Refused

P3. Can you tell me the average number of occupants that live in a typical unit at your property?

(RECORD VERBATIM AND PROBE FURTHER IF THEY HAVE OCCUPANCY BY NUMBER OF BEDROOMS)

1. One-bedroom (enter average number of occupants)
2. Two-bedrooms (enter average number of occupants)
3. Three-bedrooms (enter average number of occupants)
4. More than three bedrooms (enter average number of occupants)
98. Don't know
99. Refused

P4. Do you manage more than one property?

1. Yes [Continue]
2. No [Skip to IS3]
99. Don't know

[IF P4 = 2, SKIP TO C1]

P4a. How many properties do you manage?

(RECORD NUMBER.)

____________________**[NUMBER]**

P4b. Was the decision to participate in this program driven by the individual properties or by the property management company?

1. Individual Properties
2. Owner or Property Management Company
98. Don't know

COVID-19

The next few questions are about COVID-19 impacts.

C1. Over the past year, have you experienced any changes to any of the following due to COVID 19? (Yes/No for each)

a. Vacancy/occupancy
b. Timeliness of rent payments
c. Ease of completing routine maintenance
d. Maintaining a healthy living environment for your tenants (e.g., increased air filtration needs, cleaning)
e. Businesses that you rely on to complete your work (e.g., contractors, suppliers)
f. Ability to participate in Duke Energy programs

For each yes, follow up and record verbatim.

C2. Has the emergence of COVID-19 changed how the tenants use energy at your multifamily property?

1. Yes
2. No
98. Don't know

[ASK IF C2=1]
C3. How are you using energy at your multifamily property differently as a result of COVID-19?

(RECORD VERBATIM)

[ASK IF C2=1]
C4. Thinking of how COVID-19 has changed your energy use at your multifamily property, what kind of energy efficiency tools or resources could Duke Energy provide to help you?

(RECORD VERBATIM)

Impact

The final few questions are about quantities of measures installed at your property.

IM1. Our records indicate that about **[Units per Property]** housing units at your property received energy efficient measures through the program. Does that sound right?

1. Yes
2. No
98. Don't know
99. Other (Record verbatim)

IM2. Our records show that the following measures were installed at your property:
[Read list of measures with quantity > 0]

- LED Lamps
- Bathroom faucet aerator

- Kitchen faucet aerator
- Showerhead
- Water heater pipe wrap

Is this information correct?

1. Yes
2. No
98. Don’t know
99. Other (Record verbatim)

IM3. I will now read out the total quantity of units installed for each measure that your property received. Could you please confirm if the quantity seems accurate based on your recollection of the program?

[Read list of measures with quantity > 0]
LED Lamps – **[Total Quantity of LED Lamps]** lamps
Bathroom faucet aerator – **[Total Quantity of Bath Aerator]** aerators
Kitchen faucet aerator – **[Total Quantity of Kitchen Aerators]** aerators
Showerhead – **[Total Quantity of Showerheads]** showerheads
Water heater pipe wrap – **[Total Quantity of Pipe Wrap]** feet
Is this information correct?

1. Yes
2. No
98. Don’t know
99. Other (Record verbatim)

[Collect response for each measure installed]

Closing

CL1. Is there anything you would suggest to improve Duke Energy’s Multifamily Energy Efficiency Program?

(RECORD VERBATIM)

____

This completes the survey. Your responses are very important to DUKE ENERGY and will help as we design future energy efficiency programs. We appreciate your participation and thank you for your time. Have a good day.

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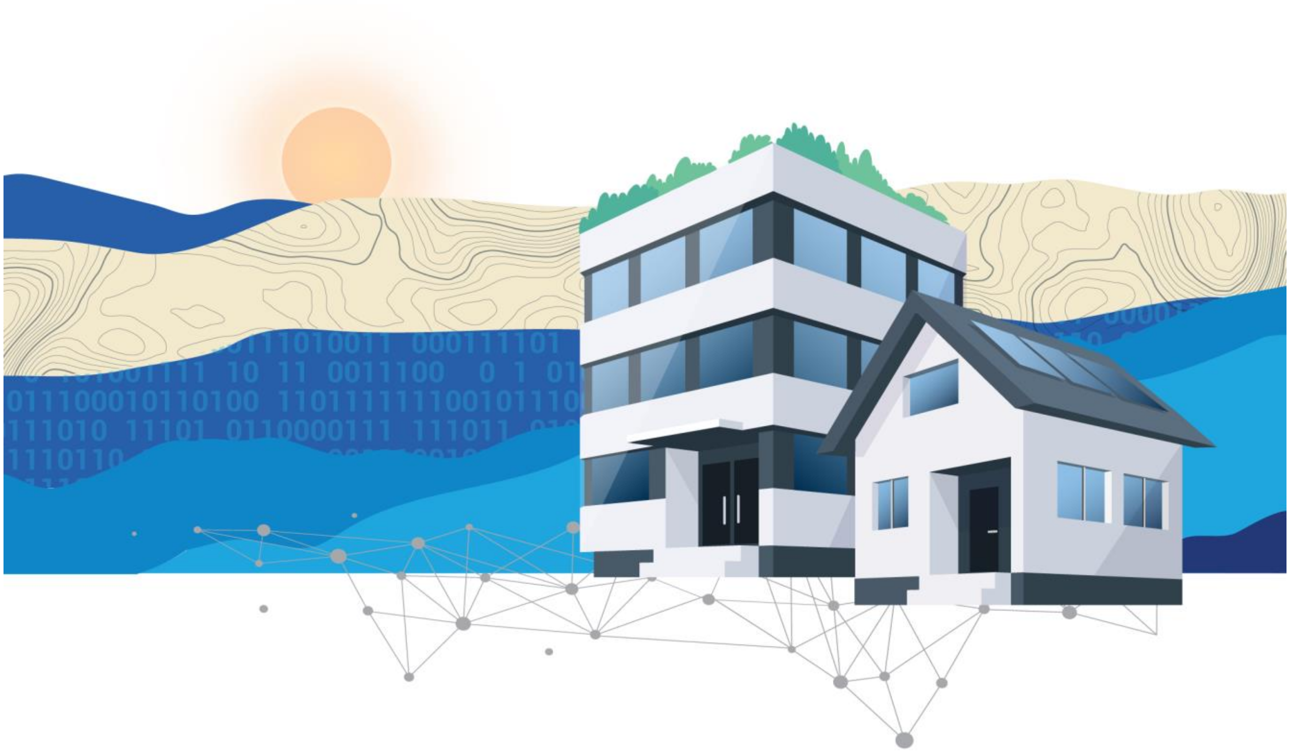


Duke Energy Progress & Duke Energy Carolinas Neighborhood Energy Saver Program

2021 Evaluation Report - FINAL

May 11, 2022

Opinion Dynamics

Table of Contents

Table of Tables

Opinion Dynamics

Table of Figures

1. Evaluation Summary

1.1 Program Summary

The Duke Energy Progress (DEP) and Duke Energy Carolinas' (DEC) Neighborhood Energy Saver (NES) program provides one-on-one energy education, on-site energy assessments, and energy conservation measures to customers in selected low-income neighborhoods. These services are offered free of charge to all active DEP/DEC account holders who are individually metered homeowners or tenants living in predetermined income-qualified communities. Qualifying neighborhoods have at least 50% of households with incomes equal to or less than 200% of the federal poverty level.

The program employs a neighborhood canvas approach to drive participation, while working with existing organizations in each community to maximize the number of customers benefitting from the program. Each year the program team has a goal of serving at least 70% of the households in each of the neighborhoods with which they engage. Based on the number of eligible households in the targeted neighborhoods, this amounts to approximately 4,500 customers in the DEP service territory and 8,900 customers in the DEC service territory throughout North and South Carolina.[1]

The program period under evaluation is July 1, 2018, through June 30, 2019.[2]

1.2 Evaluation Objectives

The objectives of the 2018–2019 NES program evaluation are below:

- Review and update, as necessary, deemed savings estimates through a review of measure assumptions and calculations.
- Verify measure installation and persistence.
- Estimate program energy (kWh) and summer and winter demand (kW) savings.
- Explore potential for participant free ridership for LEDs.
- Identify and characterize program strengths, which may include customer engagement and other non-energy benefits.
- Identify barriers to participation in the program and recommend strategies for addressing those barriers.
- Identify ways the Duke Energy program teams may be able to improve the NES program in the future.

To achieve these objectives, Opinion Dynamics completed several data collection and analytic activities, including interviews with program staff, a participant telephone survey, an analysis of survey results, an analysis of program tracking data, a deemed savings review, a consumption analysis, and an engineering analysis.

[1] The goals of jurisdiction-specific number of customers served are based on the 2019 program goals expressed by the Duke NES Program Manager during an interview conducted by our evaluation team on March 13, 2021.

[2] The evaluation period was selected to ensure that sufficient post-installation usage data was available for these customers before the COVID-19 pandemic.

1.3 High Level Findings

Overall, the NES program teams in DEP and DEC territories implemented the program effectively and achieved a high penetration rate in target neighborhoods. Program participation was strong in both service territories. Between July 1, 2018, and June 30, 2019, a total of 5,619 DEP and 10,277 DEC customers participated in the NES program. The neighborhood penetration rates are equal to 71% for the DEP jurisdiction and 75% for the DEC jurisdiction, exceeding program goal of serving at least 70% of households in targeted neighborhoods (which amounts to 4,500 DEP households and 8,900 DEC households).[3]

Impact Findings

Based on results of the consumption analysis, we estimated average annual net energy savings per household to be 539 kWh for DEP participants and 221 kWh for DEC participants. At the program level, estimated net energy savings for the evaluation period (July 1, 2018 through June 30, 2019) are 3,031 MWh for DEP and 2,276 MWh for DEC. The estimates include savings from equipment installed by program representatives, as well as savings from any additional behavioral changes and participant spillover attributable to the program. Table 1 presents these results and also shows demand savings, which are calculated by applying the ratios of engineering analysis kW to kWh savings (see Table 3 below) to the consumption analysis net energy savings.

Table 1. Net Impact Results

Service Territory	Per Household			Program Level		
	Energy Savings (kWh)	Summer Coincident Demand (kW)	Winter Coincident Demand (kW)	Energy Savings (MWh)	Summer Coincident Demand (kW)	Winter Coincident Demand (kW)
DEP	539	0.0865	0.0901	3,030.8	488.0	508.1
DEC	221	0.0402	0.0406	2,276.2	413.1	418.1

As part of the impact evaluation, we also conducted an engineering analysis to (1) provide insight into how each measure contributes to overall program savings and (2) develop kW to kWh savings ratios to determine ex-post demand savings for the program.

Table 2 presents the total ex-post gross impacts for each measure installed through the program and the estimated individual measure contribution to the overall energy (kWh) savings from the engineering analysis. Based on this information, lighting is responsible for the largest proportion of savings in the DEP jurisdiction (33%), while infiltration reduction generates the largest share of energy savings in the DEC jurisdiction (39%).

Table 2. Total Measure-Level Gross Energy Savings Results from Engineering Analysis

Measures	DEP		DEC	
	Energy (MWh)	Percent of Total MWh	Energy (MWh)	Percent of Total MWh
Lighting	1,614.7	33%	2,017.4	26%
Infiltration Reduction	1,432.0	29%	3,056.5	39%
Low Flow Showerheads	1,030.1	21%	1,349.3	17%
Efficient Aerators	361.5	7%	513.7	7%
HVAC Filters	209.0	4%	364.0	5%

[3] To determine the program penetration rates for DEP and DEC, Duke Energy provided the evaluation team with the number of eligible households in the targeted neighborhoods for the denominators, while the numerators are based on the numbers of participant account numbers shown in the tracking data.

Measures	DEP		DEC	
	Energy (MWh)	Percent of Total MWh	Energy (MWh)	Percent of Total MWh
Pipe Insulation (five-foot sections)	162.4	3%	248.8	3%
Water Heater Insulation Wrap	121.2	2%	230.0	3%
Total	**4,930.9**	**100%**	**7,779.6**	**100%**

Table 3 shows the jurisdiction-level energy and demand savings, based on the engineering analysis, and the resulting kW to kWh savings ratios. As mentioned above, these ratios were multiplied by the consumption analysis-derived energy savings to arrive at summer and winter coincident demand savings.

Table 3. Gross Annual Program Impact Results from Engineering Analysis

Jurisdiction	Energy Savings (MWh)	Summer Coincident Demand (kW)	Winter Coincident Demand (kW)	Summer Demand Ratio (kW/kWh)	Winter Demand Ratio (kW/kWh)
DEP	4,930.9	791.0	823.6	0.0001604	0.0001670
DEC	7,779.6	1,410.5	1,427.7	0.0001813	0.0001835

Process Evaluation

The research team focused the process evaluation on several questions related to energy education, non-energy impacts, NES participant satisfaction, and the overall effectiveness of the program. The full results are available in Section 5 and key findings are summarized below.

Customer satisfaction was high in both service territories; 96% of DEP and 88% of DEC respondents reported they were either completely satisfied or mostly satisfied with the program. In addition, nearly all DEP and DEC respondents were also either completely or mostly satisfied with the energy-efficient equipment they received (95% in both jurisdictions) and the NES program representatives who visited their households (96% and 97%, respectively). Most participants were also satisfied with their communication with Duke Energy staff (94% in both jurisdictions).

Overall, the educational component of the program was successful and reached most participants. Over 85% of NES respondents (87% of DEP and 86% of DEC) received in-person education during their assessments and 93% of DEP and 89% of DEC respondents thought that the information they received was either useful or very useful. Additionally, participants reported that they were more knowledgeable about ways to save energy in their homes after their NES program participation than they were beforehand.

Participants reported experiencing a variety of energy and non-energy benefits after participating in the NES program. More than one-third of NES respondents reported that their electric bills in summer (33% of DEP and 41% of DEC participants) were lower after participating in the program. Results were generally similar when participants were asked about their electric bills in the winter (30% of DEP and 42% of DEC participants). Additionally, a majority of both DEP and DEC participants felt that their home was less drafty and had better lighting after they participated in the program.

Most customers said they did not have any recommendations to improve the program, but a few did offer suggestions. The suggestions provided included increasing program outreach and communication and improve assessment scheduling and follow-up (6% of DEP participants for both suggestions and 6% for DEC participants for both suggestions).

Exploration of LED Free-Ridership

For low-income programs, it is customary to assume a net-to-gross (NTG) ratio of 1, i.e., zero free-ridership. An alternative way to frame this is that low-income program participants would not purchase and install energy-efficient equipment without receiving it for free through the NES Program. Since use of a consumption analysis with a comparison group, as employed in this evaluation, produces *net* savings, any existing free-ridership is already embedded in the savings, i.e., it is not possible to verify the zero free-ridership hypothesis using this method.

As part of this evaluation, Duke Energy was interested in exploring the potential for free-ridership for LEDs among the program's low-income customers. Based on responses to exploratory free-ridership questions included in the participant survey, we found moderate levels of LED free-ridership of 49% for DEP and 35% for DEC. We therefore do see evidence of some free-ridership, although at lower levels than what is commonly observed for lighting programs that are not targeted at low-income populations.

1.4 Evaluation Recommendations

Opinion Dynamics has the following recommendations for maintaining and improving program performance and overall savings.

- **At the time of the energy assessment, NES program teams should consider offering coupons for additional quantities of the energy-saving products to program participants.** While most participants were satisfied with the NES program, a small number offered recommendations to improve how it is implemented. Of the 39 participants who provided recommendations, 54% commented on how additional quantities would be beneficial. To meet this need, NES program teams could provide "deep discount" coupons for energy saving products that customers can redeem through Duke Energy's Online Savings Store, where the coupon could provide NES participants with discounts that are larger than what they would have received without the coupon. This could help to ensure continued energy savings in homes that have been treated through the program. Furthermore, offering coupons could increase participant satisfaction with the program and can serve to direct customers to another Duke program.
- **NES program staff should emphasize air infiltration measures, as they provide both energy and non-energy benefits.** While infiltration measures make an important contribution to overall program energy savings (29% for DEP and 39% DEC participants), NES participants who receive these measures also report other valuable non-energy benefits. Of those who received infiltration measures, 66% of DEP and 59% of DEC participants reported that their home was less drafty and about one-third reported noticing a change in the comfort of their home in both the summer and winter in both jurisdictions.
- **Duke Energy should consider lengthening the amount of time before it archives customer billing data, particularly for those who participate in programs where consumption analysis is used to estimate program savings, such as NES.** For consumption analysis purposes, the evaluation team requires at least two years of data—one year of pre-participation and one year of post-participation data. Duke's consumption data archiving practices in the DEC and DEP jurisdictions conflict with the need for an extensive period of time to accumulate a sufficient number of participants to complete a consumption analysis (for treatment and comparison groups). To ensure successful evaluation, we recommend that Duke Energy work with the evaluation team prior to starting impact evaluation activities to consider what data will be required and determine whether Duke can extend the length of time before it archives its billing data. This is especially important when evaluating programs that, due to slower participation accumulation, need to rely on a longer evaluation period to ensure sufficient numbers of participants. This is particularly true for the pre-period consumption data.

2. Program Description

2.1 Program Design

Duke Energy's NES program provides one-on-one energy education, on-site energy assessments, and appropriate packages of no-cost energy conservation measures to customers in income-qualified neighborhoods. The program is available to active DEP and DEC account holders who are individually metered homeowners or tenants living in pre-determined neighborhoods. Neighborhoods targeted for this program are eligible to participate if at least 50% of the households within the community have incomes less than or equal to 200% of the federal poverty guidelines. Participants are limited to a one-time receipt of energy efficiency measures through the NES program. The overall goal of the NES program is to offer persistent energy and demand savings to Duke Energy customers through the direct installation of energy savings measures and by providing education on other ways to reduce household energy use. The program offers equipment and education at no cost to customers, and, when possible, works with community leaders to maximize the number of customers receiving benefit from the program.

In targeted neighborhoods, the NES implementation team recruits customers via door-to-door canvassing and community events. Program staff work with community leaders and organizations to maximize the number of customers benefiting from the program. Each engaged neighborhood consists of approximately 500 to 1,500 households, and program staff aim to serve at least 70% of the households in each of the neighborhoods they engage.

2.2 Program Implementation

Honeywell Building Solutions implemented the 2018–2019 DEP/DEC NES program in partnership with Duke Energy program staff. The implementer performs all assessments and installations. DEP and DEC program staff are heavily involved in selecting specific neighborhoods based on program eligibility criteria.

Prior to participating in the program, residents in selected neighborhoods receive targeted mailings that provide introductory information about how to participate, the benefits of participation, and a notice that additional information from program staff will be circulated throughout their community, including additional mailings and a community launch event. The implementation team organizes at least one community launch event in each targeted neighborhood, both to make residents aware of the program and to provide demonstrations of the measures that the NES program offers.

The implementation team records measure installation information at each premise, which Duke Energy tracks in its program tracking database. Program representatives also record the location in which they installed lighting measures and faucet aerators (i.e., kitchen or bathroom), along with household characteristics, such as primary heating fuel type and the type of heating and cooling equipment present in each participating household. Finally, implementation teams leave behind educational materials that explain the measures they install in each home, additional recommendations for how participants could save energy through behavioral changes, and information about other Duke Energy programs that may be of interest.

2.3 Program Performance

The program period under evaluation is July 1, 2018, through June 30, 2019. Over this period, the program teams served 5,619 DEC households and 10,277 DEP households in 25 neighborhoods. The program exceeded its goal to serve at least 70% of the households in each of the neighborhoods with which they engaged, which amounts to approximately 4,500 customers in the DEP service territory and 8,900 customers in the DEC service territory throughout North and South Carolina.[4] We calculated the ratio of households served to the number of eligible households and found penetration rates of 71% and 75% for DEP and DEC territories, respectively.[5] Figure 1 shows the breakdown of NES participants by jurisdiction and state. A majority of the program's participants reside in North Carolina for both DEP and DEC jurisdictions.

Figure 1.Breakdown of Participants by Jurisdiction and State

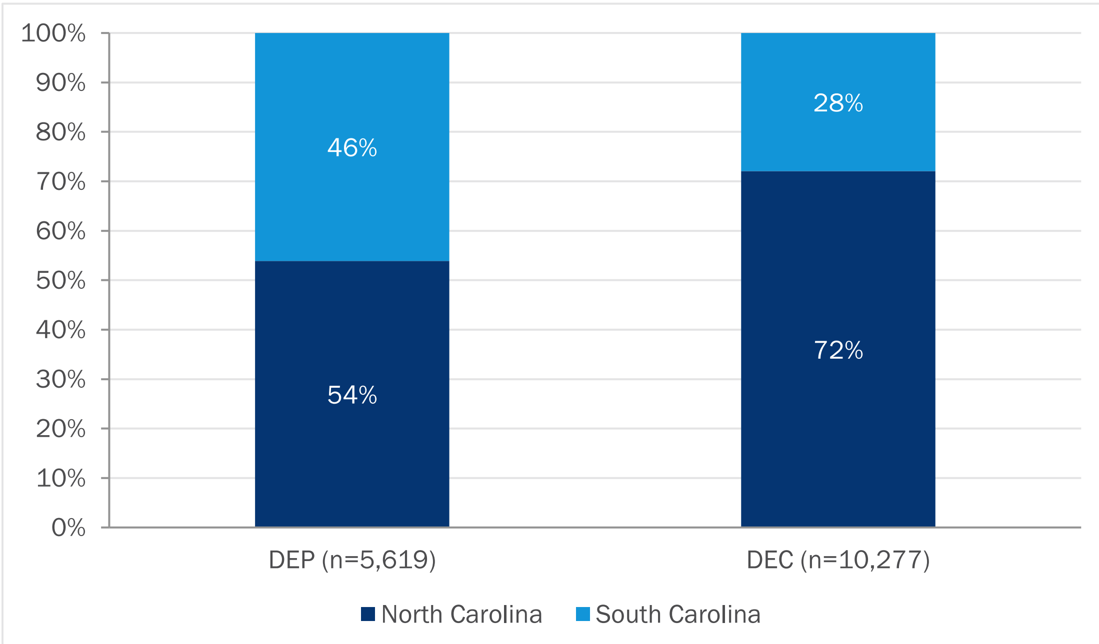


Table 4 shows a comprehensive breakdown of both DEP and DEC participants' home types by jurisdiction, state, and city based on information present in the program tracking data. A majority of the participants consist of single family households (79% of DEC and 65% of DEP participants). For both DEP and DEC, most single family and multifamily households come from North Carolina, whereas the manufactured homes are in South Carolina. Greenville in South Carolina's DEC jurisdiction has the most overall households that participated in the program, totaling 1,922. Duke served customers in 25 cities, 17 in the DEC jurisdiction and 8 in the DEP jurisdiction.

[4] The goals of jurisdiction-specific number of customers served are based on the 2019 program goals expressed by the Duke NES Program Manager during an interview conducted by our evaluation team on March 13, 2021.

[5] To determine the program penetration rates for DEP and DEC, Duke Energy provided the evaluation team with the number of eligible households in the targeted neighborhoods for the denominators, while the numerators are based on the numbers of participant account numbers shown in the tracking data.

Table 4. Breakdown of Participant Home Types by Location

Location	Single Family	Multifamily	Manufactured Home	Total Treated
Duke Energy Progress (North Carolina)				
Dunn	569	44	7	620
Spring Lake	677	271	202	1,150
Clinton	1	0	0	1
Jacksonville	813	369	15	1,197
Asheville	35	1	26	62
Total	**2,095**	**685**	**250**	**3,030**
Duke Energy Progress (South Carolina)				
Lake City	845	365	177	1,387
Sumter	649	12	490	1,151
Manning	47	0	4	51
Total	**1,541**	**377**	**671**	**2,589**
Duke Energy Carolina (North Carolina)				
Hickory	587	158	5	750
Sylva	125	22	20	167
Durham	520	7	0	527
Greensboro	896	675	0	1,571
Winston Salem	708	103	8	819
Bessemer City	408	71	4	483
Kannapolis	715	44	6	765
Spencer	1	0	0	1
Charlotte	1,054	87	1	1,142
Graham	769	247	7	1,023
Burlington	49	6	51	106
Chapel Hill	6	23	0	29
Carrboro	10	10	1	21
Total	**5,848**	**1,453**	**103**	**7,404**
Duke Energy Carolina (South Carolina)				
Greenville	1,432	304	186	1,922
Walhalla	0	1	0	1
Kershaw	728	9	49	786
Spartanburg	109	51	4	164
Total	**2,269**	**365**	**239**	**2,873**
Duke Energy Progress Total	**3,636**	**1,062**	**921**	**5,619**
Duke Energy Carolinas Total	**8,117**	**1,818**	**342**	**10,277**
Total	**11,753**	**2,880**	**1,263**	**15,896**

Based on the results from the consumption analysis, participants saved an average of 539 kWh per household per year in the DEP jurisdiction and 221 kWh per household per year in the DEC jurisdiction. Energy and demand savings by service territory are displayed in Table 5.

Table 5. Annual Energy Savings and Summer and Winter Peak Demand Reductions per Household

Jurisdiction	Energy Savings (kWh)	Summer Coincident Demand (kW)	Winter Coincident Demand (kW)
DEP	539	0.0865	0.0901
DEC	221	0.0402	0.0406

Note: Demand savings are calculated by applying the kW-to-kWh savings ratio from the engineering analysis to net energy savings from the consumption analysis.

3. Overview of Evaluation Activities

To answer the research objectives outlined in Section 1.2, Opinion Dynamics performed a range of data collection and analytic activities, including:

- Interviews with DEP and DEC program staff
- A review of program materials and program tracking data
- A participant telephone survey
- An engineering analysis of deemed savings
- A consumption analysis
- An exploratory LED free-ridership analysis

In Sections 4 and 5 we provide more details on the methods and results of the impact and process analyses, respectively. Below, we summarize the scope and approach for the staff interviews, program materials and data review, participant survey, engineering analysis, and consumption analysis. Each of these components supported either the impact or the process evaluations. In addition to the impact and process analysis, this year we also analyzed participant free-ridership for LEDs, which is expanded upon in Section 6.

3.1 Program Staff Interviews

Opinion Dynamics conducted an in-depth interview with program staff responsible for program administration in 2018/2019. The in-depth interview allowed the evaluation team to discuss implementation of the NES program in DEP and DEC territories, including differences between the DEP/DEC NES programs and program implementation in other Duke Energy territories. We also used this interview to identify program successes, to discuss any difficulties in administering the program, and to determine any risks for the program achieving its goals.

3.2 Program Materials and Data Review

DEP and DEC program administration staff provided Opinion Dynamics with information on the program, including marketing materials and program tracking databases. Review of these materials informed development of the participant survey instrument and the engineering analysis.

- **Marketing Materials.** Opinion Dynamics reviewed the leave-behind brochure, the customer survey booklet, the pre-participation program informational brochure, the leave-behind door hanger, the energy efficiency brochure about other Duke Energy programs, the introduction letter to the NES program, and postcards sent to participants with information about how to participate.
- **Program Database.** The program staff provided Opinion Dynamics with tracking data covering the evaluation period of July 1, 2018, to June 30, 2019. The database provided us with information on the quantities, location, and types of measures installed in each treated household.

3.3 Participant Survey

The purpose of the participant survey was to collect information to support the process evaluation, the development of in-service rates, and an exploratory analysis of LED free-ridership. Opinion Dynamics implemented the survey as a computer-assisted telephone interviewing (CATI) survey in August 2021. Note that we fielded the participant survey with customers who participated in the program between July 1, 2019 and March 31, 2020 (i.e., a “future” comparison group of customers who also served as the comparison group of customers in the consumption analysis) as their recollection of their participation details is likely stronger than those who participated in the program during the evaluation period.

Sample Design

The survey sample was designed to allow for the development of statistically significant in-service rate (ISR) estimates and process results (targeting 10% relative precision at 90% confidence) by jurisdiction.

To develop the survey sample, 700 participants from each of the DEP and DEC territories (1,400 participants in total) were randomly extracted from the 6,164 DEP/DEC participants who were part of the “future comparison” group. In order to achieve 144 survey completes (74 from DEP and 70 from DEC), the survey team had to increase the initial survey sample from 1,400 to 1,939 NES participants. When conducting the survey, our team removed a total of 233 records due to not-in-service phone numbers, ineligible participants, or the survey quota being reached, which left the total sample with 1,706 participants, excluding ineligibles.

We completed a total of 144 interviews and achieved a response rate of 13%; the average length of the interviews was 15 minutes.

3.4 Consumption Analysis

Opinion Dynamics conducted a consumption analysis to determine the net energy savings attributable to the NES program during the evaluation period. We specified linear fixed effects regression (LFER) models to estimate the overall net ex-post program savings for DEC North Carolina, DEC South Carolina, DEP North Carolina, and DEP South Carolina. The fixed effect in our models is the customer, allowing us to control for all household factors that do not vary over time. Treatment customers included those who participated in the program during the evaluation period (between July 1, 2018 and June 30, 2019). For the DEC jurisdiction, we leveraged a comparison group comprised of future participants—customers who participated in the program between July 2019 and June 2020. We were unable to construct a similar comparison group for the DEP jurisdiction due to differences in treatment and comparison group composition and instead constructed a matched comparison group from similar non-participants. Section 4.1.1 provides a summary of the consumption analysis approach; Appendix A contains the detailed methodology description.

3.5 Engineering Analysis

The engineering analysis was used to (1) provide a ratio of kW demand to kWh energy savings which we applied to the consumption analysis energy savings to estimate demand savings and (2) to better understand the relative contribution of each measure to overall energy savings.

The engineering analysis consisted of two components:

- **Measure verification and development of measure-specific ISRs:** We verified measures and developed measure-specific ISRs based on responses to the participant survey.
- **A deemed savings review of all program measures:** We reviewed measure-level savings algorithms and parameters and revised input assumptions, as needed. To develop ex post deemed energy and demand savings for each measure, we leveraged, in order of preference, program tracking data, participant survey results, and Technical Reference Manuals (TRMs). The *DEP and DEC NES Deemed*

Savings Review Final Memorandum developed for Duke Energy provides more detail on the sources and inputs used in the deemed savings review.[6] This document is available as part of Appendix B.

We calculated program-level savings, by jurisdiction, by applying ISRs and ex post deemed savings values to the measure quantities tracked in the program tracking database.

[6] Memorandum from Opinion Dynamics to Duke Energy's EM&V Team. February 22, 2022.

4. Impact Evaluation

4.1 Methodology

The impact analysis for the 2018–2019 NES program included a consumption analysis as well as an engineering analysis. The consumption analysis determined the net evaluated energy (kWh) impacts for the program. The engineering analysis supplemented the consumption analysis by providing (1) a kW-to-kWh savings ratio, which we applied to the consumption analysis energy savings to estimate demand savings and (2) insights into the relative contribution of each measure to overall savings.

4.1.1 Consumption Analysis

Opinion Dynamics conducted a consumption analysis to determine evaluated program savings for DEC and DEP territories. Consumption analysis is a statistical analysis of energy consumption recorded in utility billing records.[7] Because billing records reflect whole-building energy use, the method is well suited for studying the combined impact of the NES program's mix of energy efficiency measures (and any behavioral changes) per home. Total program savings from each territory are estimated by examining variation among participants' monthly electricity consumption in the pre- and post-program periods, relative to the variation in a comparison group's electricity consumption during those times. The consumption analysis was conducted by jurisdiction and state (i.e., North and South Carolina). The results were then aggregated to the jurisdiction level.

Data Cleaning and Preparation

Prior to specifying the models, we performed a thorough cleaning of the consumption and participation data. We checked data for gaps and inconsistencies as well as for sufficiency. Among other checks, we ensured the participants retained in the analysis had sufficient pre- and post-participation consumption data, participation dates were accurate, and the consumption data was free of outliers, such as bill periods with unreasonably small or unreasonably large consumption.

Comparison Group Selection

Incorporating a comparison group into the consumption analysis allows evaluators to control for changes in economic conditions and other non-program factors that might affect energy use during the study period. Like many other energy efficiency programs, the NES program was not designed as an experiment. As such, we leveraged a quasi-experimental approach to the evaluation by developing a comparison group of participants. There are multiple approaches to selecting a comparison group, including the use of future participants, past participants, or similar non-participants. When possible, it is preferable to use future program participants as a comparison group. The use of future participants—who are similar to the evaluated participants—as the comparison group allows us to effectively control for self-selection biases.

For this evaluation, we constructed a comparison group from customers who participated in the NES program between July 1, 2019, and March 31, 2020.[8] We performed equivalency checks to assess the similarity of treatment and comparison groups in terms of energy consumption, weather, and housing characteristics in

[7] Due to AMI deployment schedules, the evaluation team relied on monthly billing data to conduct the consumption analyses for the DEC and DEP NES program. We will assess the feasibility of using AMI data for future evaluations of this program.

[8] Typically, we construct a comparison group from customers who participated in the subject program sometime during the full 12 months after the evaluation period. In this case, we limited the timeframe to 9 months to avoid any confounding effects from COVID-19.

order to ensure that the comparison group could serve as a valid baseline. We performed this equivalency analysis by territory. For the DEC jurisdiction, participants in the comparison group were reasonably similar to the treatment participants across key characteristics, and we therefore proceeded with the future participant comparison group approach. The evaluation team felt confident that any differences between the treatment and comparison groups could be overcome by including additional independent variables in the consumption analysis models. For the DEP jurisdiction, however, we were unable to construct a viable comparison group from future participants due to pronounced differences in location, energy consumption, and observable housing characteristics. Upon discussion with Duke Energy, we recommended to construct a comparison group from similar non-participants using a two-stage matching approach. As part of the first stage, we obtained income, demographic, and housing U.S. Census data at the census block group level for the DEP jurisdiction and selected comparison neighborhoods for each of the participating neighborhoods using geography, income, housing type, and home ownership as key matching variables. As part of the second stage, we matched customers in the comparison neighborhoods based on their pre-participation consumption patterns using statistical distance matching techniques. Matched customers formed the comparison group for DEP.

Controlling for Participation in Other Programs

Some customers participated in other Duke Energy programs after participating in the NES program. Including those customers in the consumption analysis would result in double counting of savings from other programs and artificially inflating the estimate of savings from the NES program. To obtain the most accurate estimate of the effects of the NES program, we dropped those customers who cross-participated in the following programs from the analysis: Residential Energy Efficient Products & Services, Smart Saver Residential, Residential Energy Assessments, Save Energy & Water Kit, and Home Energy Improvement.

Table 6 summarizes final participant counts used to develop the consumption analysis models.

Table 6. Accounts Included in the Consumption Analysis Model

Territory	Treatment Group	Comparison Group	Total
DEP North Carolina	1,191	217	1,408
DEP South Carolina	1,413	211	1,624
DEC North Carolina	3,967	3,196	7,163
DEC South Carolina	1,510	1,315	2,825

Modeling

We used a Linear Fixed Effects Regression (LFER) model for this analysis. Fixed effects models capture the effect of time invariant household-specific characteristics and are the best practice approach to modeling program savings in the industry. We specified a variety of models ranging from simple pre-post models to more complex models incorporating a variety of terms to control for known sources of variation. We specified distinct models for each jurisdiction and state with consideration of unique characteristics of participant populations and integration of additional terms in the models to control for variation. Consumption analyses typically include a series of additional variables to explain non-program variation in monthly energy use pre- and post-participation. Our final model specifications across all jurisdictions and states included weather (heating degree days and cooling degree days) in the model as well as monthly dummies to further control for seasonal differences in energy consumption. All models also contained a control for electricity usage, which was interacted with the weather term so as not to be absorbed by the fixed effect. The final models produced savings associated with installed measures and any behavioral changes from energy efficiency knowledge gained during their participation process.

Appendix A contains a detailed discussion of the consumption analysis methodology, including data cleaning steps, comparison group selection and assessment of equivalency, modeling process, and the final model specification and outputs.

4.1.2 Engineering Analysis

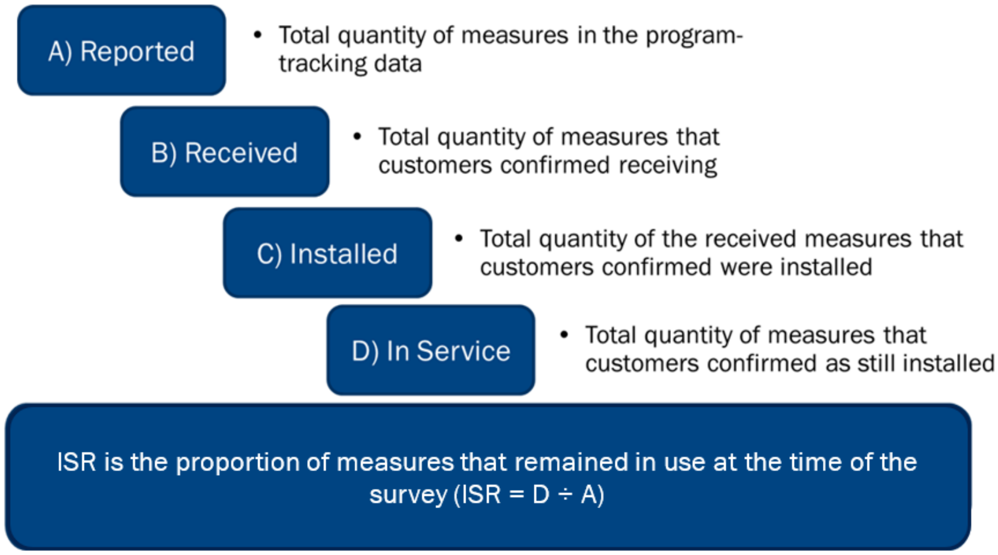
The engineering analysis consisted of two distinct steps: (1) verification of measure installation and continued operation and (2) review of per-unit deemed savings values for program measures.

Measure Verification Methodology

The participant survey included questions designed to verify that participants received and installed program measures and that those measures remained in place and operational. The ISR for each measure represents the share of measures in the program tracking data that were still in service at the time of the survey, based on responses from surveyed participants who were able to complete the ISR survey battery.

Figure 2 outlines the method for deriving the ISR for each measure. During the survey, we asked participants to confirm that they received the quantity of measures recorded in Duke Energy's program tracking data and, when necessary, to provide the correct quantity. We also asked participants to confirm the quantity of measures that were installed and remained in service at the time of the survey.

Figure 2. In-Service Rate Components



Based on the survey responses, we calculated the verification, installation, and persistence rates, as well as the resulting ISR—using the equations shown below—for each participant and each measure they received. We then developed jurisdiction-specific averages of all four rates for each measure group.

$$Verification\ Rate = \frac{(B)Received\ Quantity}{(A)Reported\ Quantity}$$

$$Installation\ Rate = \frac{(C)Installed\ Quantity}{(B)Received\ Quantity}$$

$$Persistence\ Rate = \frac{(D)In\ Service\ Quantity}{(C)Installed\ Quanhtity}$$

$$ISR = In\ Service\ Measures\ (D) \div Reported\ Measures\ (A)$$

In previous evaluations of the NES program, Opinion Dynamics found that participants were unable to verify certain measures (e.g., water heater tank wraps and pipe wraps). For these measures, we assumed 100% for all four rates. Additionally, for some air infiltration measures, such as caulking or glass patch tape, participants were unable to verify installation and persistence of individual measures. As such, we asked participants to verify installation of the entire package of air infiltration measures and assumed that 100% of those treatments remain installed. As NES measures are installed directly by program staff and infiltration measures specifically are difficult to remove, we feel these assumptions are reasonable for this type of program.

Deemed Savings Review

To develop ex post per-unit savings for each program measure, we reviewed measure-level savings algorithms and parameters and revised input assumptions, as needed. We leveraged the following sources in our review:

- **Program tracking data:** Where available, we used program tracking data to update household characteristics such as the percentage of homes with electric heat, central cooling, and electric water heating. Since program tracking data is available for the population, it is the most reliable and evaluation-specific source of information.

- **Participant survey data:** Where not available from program tracking data, we used survey data to update household characteristics such as the number of people per household. Since survey data is specific to the program's participants, it is preferable over deemed assumptions from TRMs.
- **Technical Reference Manual (TRM) assumptions:** We used algorithms and parameters from various TRMs. The preferred TRM was version 9.0 of the Mid-Atlantic TRM. We leveraged other TRM, including the Illinois TRM and the Indiana TRM, if a parameter was not available from the Mid-Atlantic TRM or if other TRMs were deemed to have more recent or more rigorous parameters.

The previously mentioned *DEP and DEC NES Deemed Savings Review Final Memorandum* developed for Duke Energy (see Appendix B) provides more detail on the methods used in the deemed savings review and engineering analysis.

Total Program Gross Savings

We developed total program gross savings, by jurisdiction, by applying the measure-specific ISRs and the ex post deemed values to the measure quantities provided in the program tracking database, using the following formula:

Equation 1

$$Sav = \sum_{i=1}^{n} Q_{dbi} \times ISR_i \times EST_i$$

Where:

i	=	Program measures 1…n, where n = 14
Sav	=	Total program savings
Q_{dbi}	=	Database quantity of measure i
ISR_i	=	In-service rate for measure i
EST_i	=	Per unit deemed savings estimate for measure i (KW or kWh)

Where savings for certain measures rely on electric heating equipment, electric water heating equipment, or the presence of cooling equipment, our engineering team developed fuel-specific deemed values and applied them based on the HVAC equipment specified within the program tracking database. For example, NES implementation teams provide domestic hot water measures to all participants, regardless of the fuel they use to heat water in their homes. However, as Duke Energy only provides electricity to DEP and DEC customers, when developing total program savings, our team only applied savings for domestic hot water measures to participants that received them and heated their water with electricity.

We then calculated per household savings by dividing total program savings by the number of participating households, by jurisdiction.

4.2 Results

4.2.1 Consumption Analysis

This section provides average per-participant consumption analysis results. Appendix A contains the complete results of the models. Table 7 summarizes modeling results and presents key model fit metrics. Final models for all jurisdictions incorporated the use of a comparison group.[9] All models showed positive statistically significant participation coefficients, indicating that the models established a statistically significant relationship between participation in the program and energy consumption. Furthermore, savings estimates from the final models that leverage comparison groups were similar to alternative model specifications, including ones without the use of the comparison group, indicating stability of the savings signal and limited effect on the final savings estimates of incorporating comparison groups.

Table 7. Summary of Modeling Results

Model Output Component	DEP North Carolina	DEP South Carolina	DEC North Carolina	DEC South Carolina
Modeled customers (treatment and comparison)	1,408	1,624	7,163	2,825
Modeled baseline (kwh/day)	37.77	45.15	33.95	34.94
Modeled savings (kwh/day)	1.33	1.65	0.69	0.39
Standard error	0.29	0.29	0.06	0.10
Statistically significant participation coefficient	Yes	Yes	Yes	Yes
Akaike Information Criterion	444,267	513,633	2,688,050	1,096,543
Bayesian Information Criterion	456,972	528,498	2,765,157	1,124,442
Adjusted R Squared	0.68	0.71	0.64	0.63

Table 8 contains annual savings with associated confidence bounds for each jurisdiction and state. Savings vary from 1.1% to 3.7% of the baseline consumption.

Table 8. Results of Consumption Analysis Models

Jurisdiction and State	Modeled Treatment Participants	Average Annual Baseline Energy Consumption per Participant (kWh)	Average Per Participant Ex Post Net Annual Savings (kWh)	Average Per Participant Savings Percentage	90% Confidence Interval	
					Lower	Upper
DEP North Carolina	1,191	13,786	485	3.5%	310	661
DEP South Carolina	1,413	16,481	603	3.7%	430	775
DEC North Carolina	3,967	12,390	252	2.0%	219	286
DEC South Carolina	1,510	12,753	142	1.1%	82	201

Based on these results, we developed average per participant ex-post net annual savings at the jurisdiction level by weighting the state-level estimates for each jurisdiction by the number of participants in each state. Table 9 presents the net savings results of the consumption analysis for both the household and program levels. We developed summer and winter peak demand savings by multiplying the consumption analysis-derived energy savings by the ratio of kW to kWh from the engineering analysis. These too are shown below. Multiplying the per household values by the number of households that participated in DEP and DEC jurisdictions provided the program level energy and demand savings as well.

[9] As described in the methodology section, the comparison groups consisted of future NES program participants for DEC and of matched non-participants for DEP.

Table 9. Net Impact Results from Consumption Analysis

Service Territory	Per Household			Program Level		
	Energy Savings (kWh)	Summer Coincident Demand (kW)	Winter Coincident Demand (kW)	Energy Savings (MWh)	Summer Coincident Demand (kW)	Winter Coincident Demand (kW)
DEP	539	0.0865	0.0901	3,030.8	488.0	508.1
DEC	221	0.0402	0.0406	2,276.2	413.1	418.1

One of the key drivers of savings differences by jurisdiction is lower baseline energy consumption of DEC participants, which limits the opportunity for savings. DEP participants also have a higher share of electric water heating systems in their homes as compared to DEC participants, which can help achieve higher electric savings resulting from program measures. Finally, based on our analysis of program participation data, more DEP participants received LEDs and showerheads than DEC participants. On the other hand, DEC participants have a higher share of infiltration measures (see Table 10).

Table 10. Drivers of Savings Differences

Characteristic	DEP North Carolina	DEP South Carolina	DEC North Carolina	DEC South Carolina
Average Annual Baseline Energy Consumption/Participant (kWh)	13,786	16,481	12,390	12,753
Percent of participants with electric water heating system	96%	94%	70%	77%
Percent of participants receiving LED measures	94%	92%	87%	87%
Percent of participants receiving faucet aerators	88%	92%	89%	88%
Percent of participants receiving showerheads	72%	81%	74%	59%
Percent of participants receiving infiltration measures	78%	58%	82%	81%

4.2.2 Engineering Analysis

Measure Verification Results

The results of the measure verification analysis showed high ISRs for measures in both DEP and DEC service territories, as shown in Table 11. Overall, both DEP and DEC participants reported that most measures were still in service at the time of the participant survey. Except for the DEC ISRs for faucet aerators and low flow showerheads, all results are significant at the 90% confidence level with +/-10% relative precision.[10]

The evaluation team calculated overall ISRs by computing a savings-weighted value for each jurisdiction. We found an overall ISR of 88% for DEP and 85% for DEC.

[10] The relative precision of the DEC ISRs for faucet aerators and low flow showerheads were 11.5% and 11.7%, respectively.

Table 11. Measure In-Service Rates

Measure Category	DEP				DEC			
	Verification Rate	Installation Rate	Persistence Rate	ISR	Verification Rate	Installation Rate	Persistence Rate	ISR
LEDs	97%	99%	93%	88%	100%	90%	96%	87%
Faucet Aerators	94%	100%	88%	83%	92%	100%	87%	80%
Low Flow Showerheads	92%	100%	96%	88%	96%	100%	87%	84%
HVAC Filters	100%	96%	N/A	96%	96%	94%	N/A	91%
Infiltration Measures	93%	N/A	N/A	93%	92%	N/A	N/A	92%
Pipe Insulation Wrap	100%	100%	100%	100%	100%	100%	100%	100%
Tank Insulation Wrap	100%	100%	100%	100%	100%	100%	100%	100%

Note: We assume 100% for the verification, installation, persistence, and in-service rates for pipe and tank insulation wrap for the engineering analysis.

Ex-Post Deemed Savings Estimates

Table 12 provides the estimated gross per-unit energy and demand savings for all measures installed through the NES program. As described in Section 4.1.2, we based the measure-level savings on program tracking data, survey results, and TRMs. The estimates shown below are for households with the appropriate mix of heating and cooling equipment, and electric heat or hot water. For example, savings from kitchen faucet aerators would only be realized by households with an electric water heater.

Table 12. Ex Post Per-Unit Deemed Savings Estimates

Measure	Energy Savings (kWh)		Summer Peak Demand (kW)		Winter Peak Demand (kW)	
	DEP	DEC	DEP	DEC	DEP	DEC
Lighting						
LEDs (75W equivalent)	42	42	0.0061	0.0061	0.0030	0.0030
LEDs (60W equivalent)	33	33	0.0049	0.0049	0.0024	0.0024
LEDs 5 W or similar - Candelabra Bulbs	36	36	0.0054	0.0054	0.0026	0.0026
LED 5 W or similar - Globes	36	36	0.0053	0.0053	0.0026	0.0026
LEDs (40W equivalent)	24	24	0.0035	0.0035	0.0017	0.0017
Domestic Hot Water						
Low Flow Showerhead	226	248	0.0106	0.0108	0.0212	0.0216
Water Heater Insulation Wrap	105	104	0.0120	0.0119	0.0120	0.0119
Pipe Insulation (5 feet sections)	90	90	0.0103	0.0103	0.0103	0.0103
Kitchen Faucet Aerator	84	90	0.0044	0.0045	0.0088	0.0090
Bathroom Faucet Aerator	13	14	0.0013	0.0013	0.0026	0.0027
Air Sealing						
Infiltration Reduction	118	122	0.0365	0.0359	0.0424	0.0415
HVAC						

Measure	Energy Savings (kWh)		Summer Peak Demand (kW)		Winter Peak Demand (kW)	
	DEP	DEC	DEP	DEC	DEP	DEC
HVAC Filters	54	55	0.0226	0.0240	0.0125	0.0115

Total Program Savings

Our team calculated total program savings by applying the per-unit estimates shown in Table 12 to each participant who received the corresponding measure.[11] We then applied the ISRs shown in Table 11 and, where applicable, multiplied the per-unit estimate by the measure quantity installed in each participating household. Table 13 summarizes total gross program energy and demand savings, by jurisdiction and measure, for the 2018–2019 evaluation period.

Table 13. Total Gross Program Savings

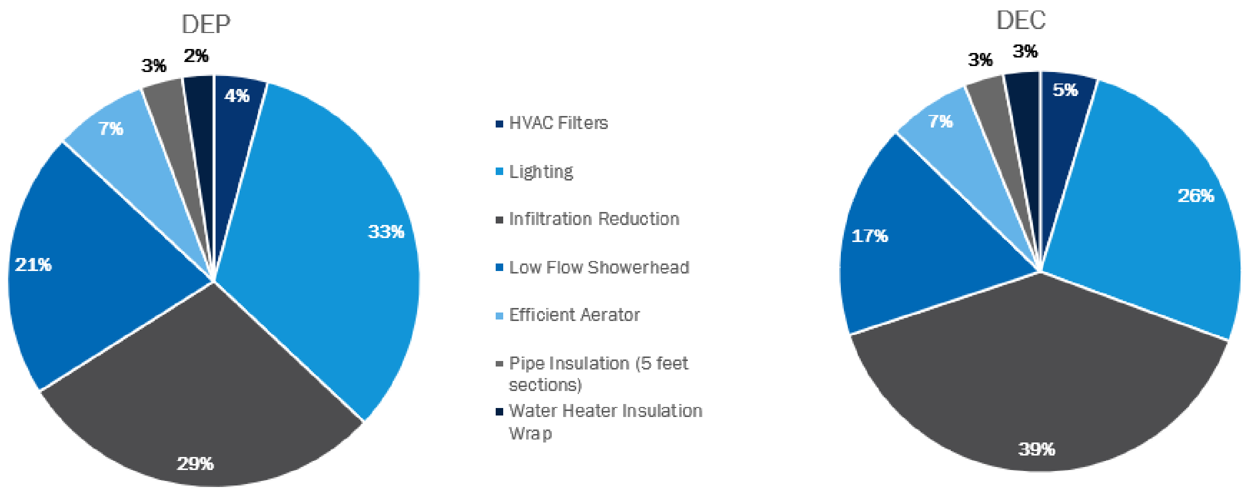
Measure	Energy Savings (MWh)		Summer Peak Demand (kW)		Winter Peak Demand (kW)	
	DEP	DEC	DEP	DEC	DEP	DEC
Lighting						
LEDs (75W equivalent)	37.5	21.9	5.6	3.2	2.7	1.6
LEDs (60W equivalent)	1,196.0	1,310.2	176.9	193.8	85.6	93.8
LEDs 5W or similar - Candelabra Bulbs	294.8	504.1	43.6	74.6	21.1	36.1
LEDs 5W or similar - Globes	79.6	163.5	11.8	24.2	5.7	11.7
LEDs (40W equivalent)	6.8	17.7	1.0	2.6	0.5	1.3
Domestic Hot Water						
Low Flow Showerhead	1,030.1	1,349.2	48.3	58.7	96.6	117.4
Water Heater Insulation Wrap	121.2	230.0	13.8	26.2	13.8	26.2
Pipe Insulation (five-foot sections)	162.4	248.8	18.5	28.4	18.5	28.4
Kitchen Faucet Aerator	308.4	441.0	16.2	22.1	32.3	44.3
Bathroom Faucet Aerator	53.0	72.6	5.4	7.1	10.9	14.3
Air Sealing						
Infiltration Reduction	1,432.0	3,056.5	364.7	811.7	492.9	983.8
HVAC						
HVAC Filters	209.0	364.0	85.2	157.9	43.0	69.0
Total Program Savings	**4,930.9**	**7,779.6**	**791.0**	**1,410.5**	**823.6**	**1,427.7**
Savings per Household	**877.5**	**757.0**	**0.141**	**0.137**	**0.147**	**0.139**

Using the total gross savings values from Table 13 and the total number of participants, we calculated per household energy savings of 878 kWh for DEP and 757 kWh for DEC neighborhoods. The majority of these savings are attributable to infiltration reduction and lighting. As shown in Figure 3, infiltration reduction accounted for 1,432 MWh (29%) and 3,056 MWh (39%) of savings in DEP and DEC territories, respectively.

[11] Certain measures only generate electric savings in households with electric space or water heating, or central cooling (i.e., domestic hot water, infiltration reduction, and HVAC filters). For these measures, we only applied savings to those households with the appropriate mix of electric heating, hot water, or cooling equipment. In cases where individual participants did not have space or water heating fuel type information in the program tracking data, we weighted per-unit savings by the share of participating households with the appropriate fuel type.

Lighting accounted for 1,615 MWh (33%) of overall savings in DEP territory and 2,017 MWh (26%) of savings in DEC territory.

Figure 3. Measure Contribution to Total Energy (kWh) Savings



5. Process Evaluation

5.1 Researchable Questions

Based on prior evaluations of this program and discussions with DEP and DEC program staff, Opinion Dynamics developed the following process-related research questions:

- What are the major strengths of the program? Are there specific ways the program could be improved to be more effective in the future?
- What are the barriers to implementing this program—that is, are there limiting factors to achieving greater participation and realizing additional program attributable savings?
- Is there potential participant free ridership for LEDs?[12]
- Do NES participants realize other non-energy benefits as a result of their participation, and, if so, which are most common?

5.2 Methodology

The process evaluation relied on the following tasks:

- An in-depth interview with DEP and DEC NES program staff
- A review of secondary materials (i.e., NES marketing materials, data associated with neighborhood populations, and program evaluations from previous years)
- A telephone survey of program participants
- An analysis of program tracking data

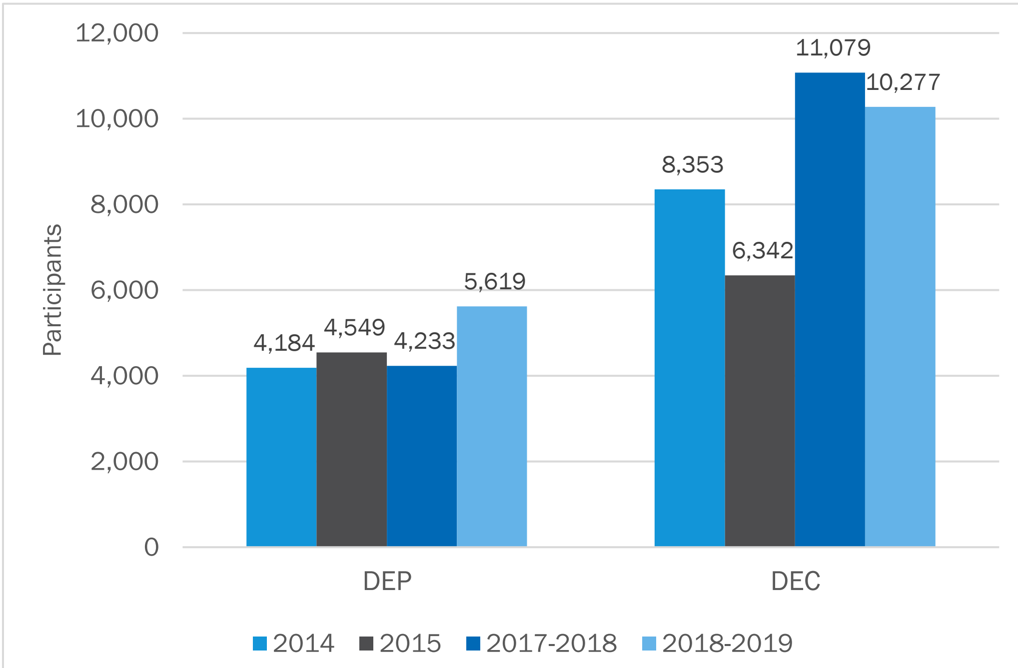
5.3 Key Findings

5.3.1 Program Participation

The NES program has operated for numerous years in both the DEC and DEP jurisdictions. Between July 1, 2018, and June 30, 2019, the NES program teams reached customers that reside in 25 cities in total, 8 in DEP territory and 17 in DEC territory (see Table 4). The NES program team served 5,619 DEP and 10,277 DEC customers, 15,896 in total. Figure 4 provides a comparison of program participation over the past five years, which shows a general increase in the number of participants. Overall, staff reached 74% of customers across all neighborhoods served during the 2018–2019 evaluation period (71% for the DEP jurisdiction and 75% for the DEC jurisdiction).

[12] This research question is addressed in Section 6. Free-Ridership Analysis.

Figure 4. NES Program Participation 2014–2019



Note: The evaluation periods for 2014 and 2015 were from January 1 to December 31, whereas the evaluation periods for the 2017–2018 and 2018–2019 years were from July 1 to June 30 of the following year.

Measure Provided to NES Participants

To evaluate the success of the program in providing energy-saving measures to participants, and to determine if there were missed savings opportunities or measures that were being provided less frequently than in past years, Opinion Dynamics examined the number of measures provided to each home. Table 14 shows the share of homes that received at least one of each measure and the average quantity provided per home (including homes that did not receive the measure). DEP and DEC territories had similar measure mixes overall, although homes in DEC territory had fewer LEDs installed on average than homes in DEP territory (9.5 compared to 6.6).

Table 14. Measure Installation Rates from Program Tracking Data

Measure Category	Measure	DEP		DEC	
		Percent of Projects with Measure	Average Qty Per HH	Percent of Projects with Measure	Average Qty Per HH
Lighting	LEDs (60W equivalent)	88%	7.2	78%	4.4
	LEDs 5W or similar - Globes	10%	0.4	12%	0.5
	LEDs 5W or similar - Candelabra Bulbs	33%	1.6	32%	1.6
	LEDs (75W equivalent)	3%	0.2	2%	0.1
	LEDs (40W equivalent)	2%	0.1	3%	0.1
Hot Water	Kitchen Faucet Aerator	82%	0.8	77%	0.8
	Bathroom Faucet Aerator	70%	0.9	68%	0.9
	Low Flow Showerhead	76%	1.0	70%	0.8

Measure Category	Measure	DEP		DEC	
		Percent of Projects with Measure	Average Qty Per HH	Percent of Projects with Measure	Average Qty Per HH
	Pipe Insulation (five-foot sections)	19%	0.3	21%	0.3
	Water Heater Insulation Wrap	99%	0.2	96%	0.2
Infiltration Reduction	Door Sweep	39%	0.6	38%	0.5
	Caulking	64%	0.6	77%	0.8
	Weatherstripping per door	61%	0.9	74%	1.1
	Foam Insulation	59%	0.6	54%	0.5
	Cover for A/C Installed	31%	0.6	21%	0.3
	Poly Tape	0%	<0.1	1%	<0.1
HVAC	HVAC Filters	74%	0.7	73%	0.7
Education/Other	Refrigerator thermometer	98%	2.3	95%	2.2
	Water Heater Temperature Check	96%	1.0	96%	1.0
	Switch Plate Wall Thermometer	97%	1.0	96%	1.0

Cross Participation

There were high levels of cross participation in other Duke Energy programs after customers had participated in the NES program during the evaluation period. As shown in Table 15, 526 of DEP and 3,448 of DEC participants also participated in another Duke Energy program. Note that participants are non-unique in these counts since a single customer can participate in multiple programs. The largest number of DEP cross participants also enrolled in the Save Energy and Water Kit program, while the largest number of DEC participants also enrolled in the Smart Saver Residential program. The difference in the number of cross participants across the jurisdictions may partially be due to the difference in the total number of NES participants in the two jurisdictions (5,619 in DEP and 10,227 in DEC).

Table 15. Count of NES Cross Participants by Program

Program	DEP	DEC
Save Energy and Water Kit	350	0
Home Energy Improvement	10	0
Residential Energy Assessment	176	107
Smart Saver Residential	48	2,903
Residential EE Products & Services	0	438
Total Cross Participants	**526**	**3,448**

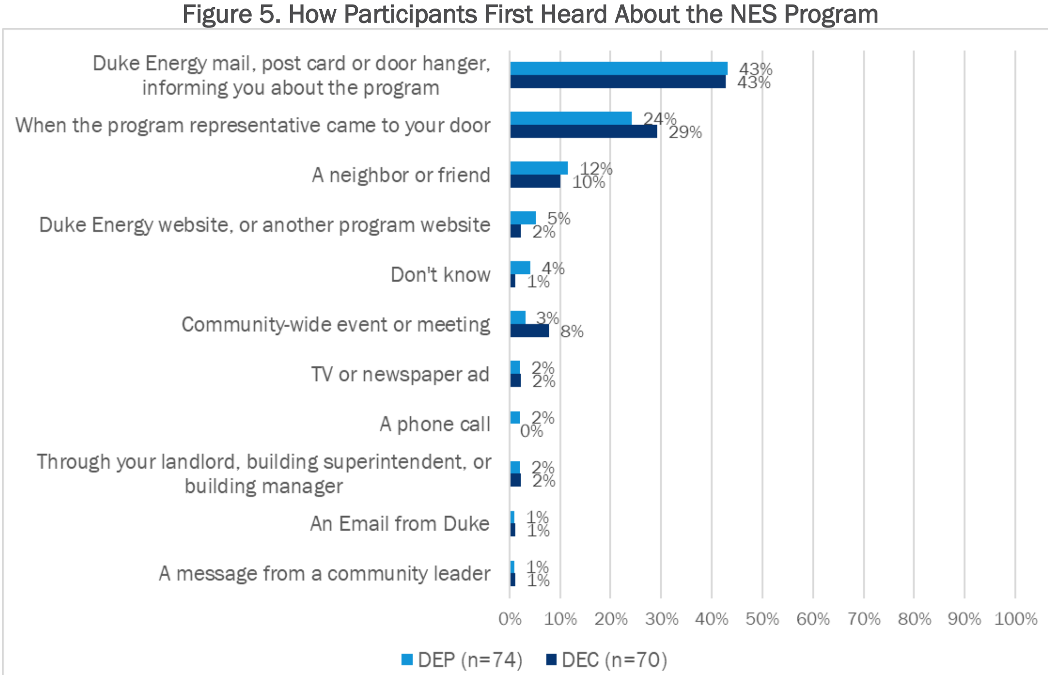
Note: Participants can be counted more than once if they cross-participating. in more than one additional Duke program.

5.3.2 Marketing and Outreach

For each neighborhood, Duke program staff and implementation teams conducted both broad and targeted outreach aimed at encouraging program participation and educating communities about energy efficiency. Program teams first sent customized introductory letters to neighborhood residents, providing information on the measures the program offers, the monetary savings that participants can achieve by enrolling, and information about how to participate. The introductory letter also noted any local community organizations program teams had partnered with and provided information about the community launch event for their neighborhood. In coordination with the implementation teams, program staff conducted a community launch event for each neighborhood, introducing the NES program, the implementation teams, and showing residents the types of energy efficiency measures offered through the NES program. Program teams also sent follow-up postcards reminding residents about the NES program and, for those not home when an implementation team knocked on their door, crews left behind door hangers that provided an option to schedule an appointment to have measures installed.

Figure 5 shows participant survey responses about how they first heard about the NES program. In both service territories, the most common way that participants heard about the program was though a direct mailer, post card, or door hanger (43% for both DEP and DEC). The second most common method was from a program representative who visited the home (24% for DEP and 29% for DEC). These responses indicate that the initial contacts made by program teams are an effective form of outreach and contribute to how a majority of NES participants were introduced to the program. Duke Energy should continue to rely on these outreach methods. Additionally, Duke Energy could consider using additional methods of communication, such as opt-out text messages if mobile phone numbers are available for customers.

Figure 5. How Participants First Heard About the NES Program

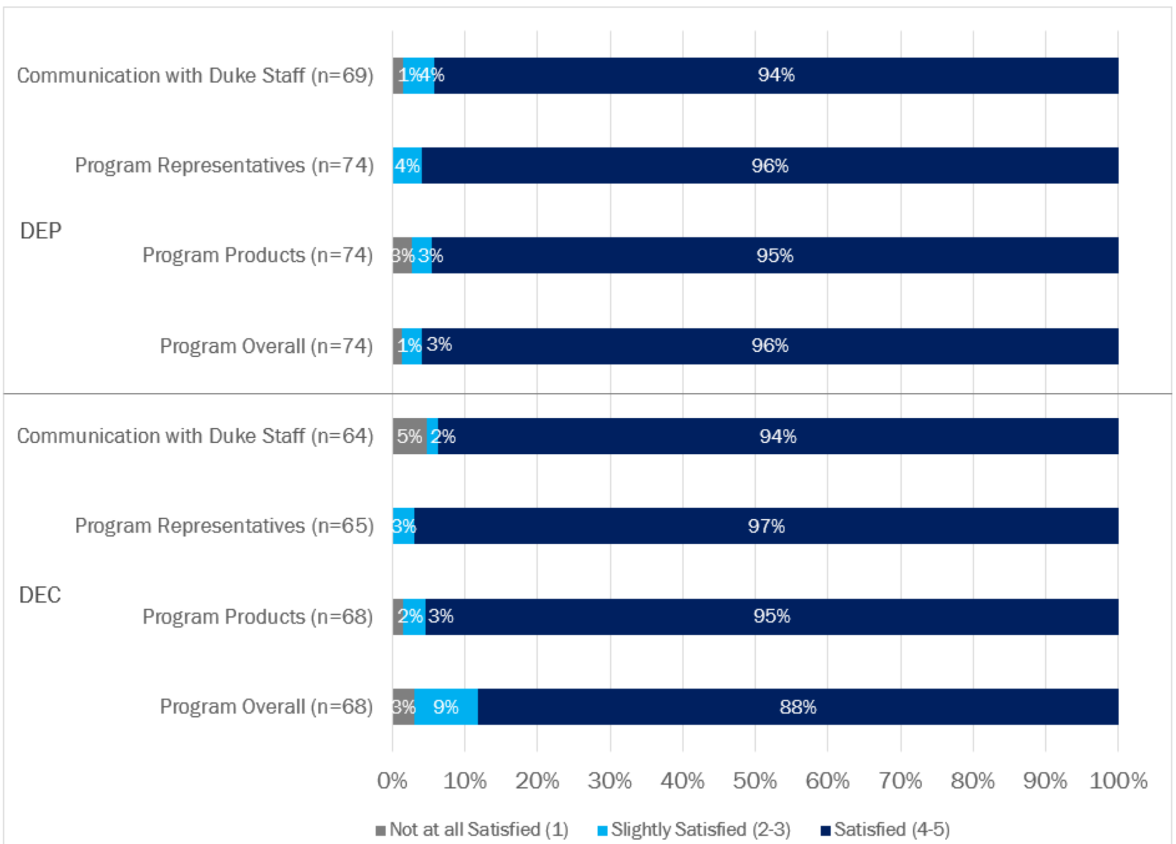


5.3.3 Program Satisfaction

Participants from both territories were generally satisfied with all components of the program. As shown in Figure 6, on a five-point scale where 5 is “completely satisfied” and 1 is “not at all satisfied,” 96% of DEP and

88% of DEC participants reported that they were either “completely satisfied” or “mostly satisfied” with the program overall. Participants were also very satisfied with program representatives who installed energy-efficient equipment. Ninety-six percent of DEP and 97% of DEC participants reported they were either “completely satisfied” or “mostly satisfied” with their NES program representatives and their performance. Ninety-five percent of DEP and DEC participants reported that they either “completely satisfied” or “mostly satisfied” with the products they received through the program. Very few participants expressed any dissatisfaction with program elements. In fact, no participants expressed any dissatisfaction with their program representatives. Only 1% of DEP and 5% of DEC participants reported being “not at all satisfied” with their communications with Duke Energy or program staff, which can be a potential avenue for program process improvement. When asked why these customers were dissatisfied, a couple respondents noted that it was difficult to get in touch with a representative. Another mentioned that he only received mailed communications.

Figure 6. Satisfaction with NES Program Overall and Program Components



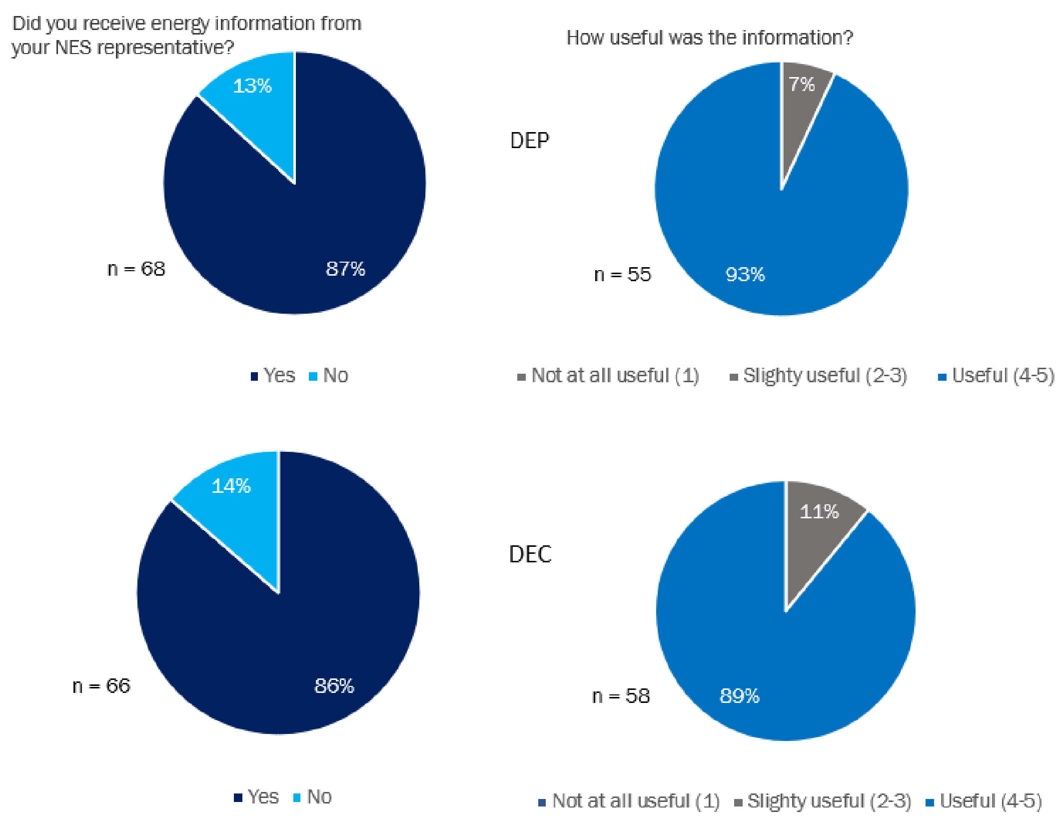
5.3.4 Additional Benefits

Energy Education

An important customer benefit of the NES program is the energy education that customers receive during home visits. Prior to scheduling visits by program representatives to install energy-efficient equipment, customers receive some information about ways to save energy through mailings and flyers either left at their home or provided at community launch events. Additionally, program staff discuss the energy-saving measures offered through the NES program and how each measure saves energy in participants' homes when Duke Energy hosts neighborhood launch events. Implementation teams also provide important education to participants while on-site. During measure installation, implementation teams provide more detail on energy-saving measures, discuss other ways participants might change their behavior to save more energy, and answer participant questions. Implementation teams then leave behind information to reinforce the energy education, provide other tips for saving energy in their homes and information about other Duke Energy programs for which participants may be eligible.

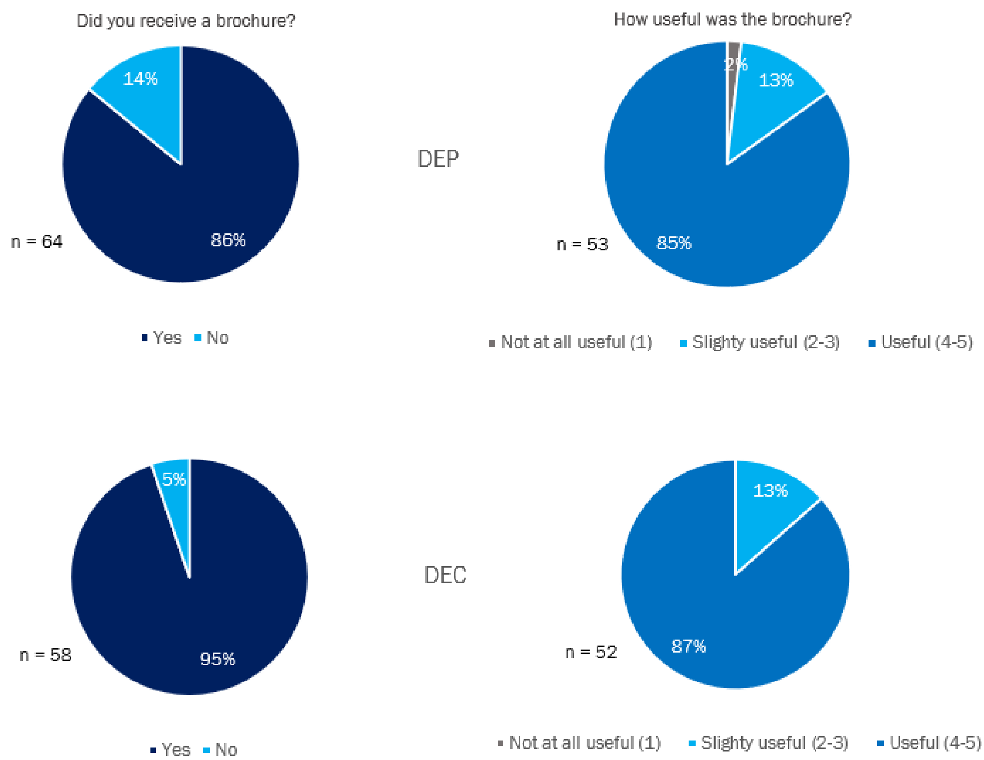
As shown in the pie charts on the left in Figure 7, 87% percent of DEP and 86% of DEC participants reported receiving energy saving tips from the implementation teams. Every participant found this information at least slightly useful, and the vast majority of these participants found the information either "useful" or "very useful" in helping them save energy (93% for DEP and 89% for DEC,). The pie charts on the right of Figure 7 show how useful participants felt the information provided by the implementation teams were. In addition, 86% of DEP participants and 95% of DEC participants said that they received educational materials during their home visit (see Figure 8). Of those who received these educational materials, most found them either "useful" or "very useful" in helping save energy in their homes (85% for DEP and 87% for DEC).

Figure 7. Energy Information from Program Representatives Received and Its Usefulness



Note: Zero percent of participants said that the energy information that they received was "not at all useful"

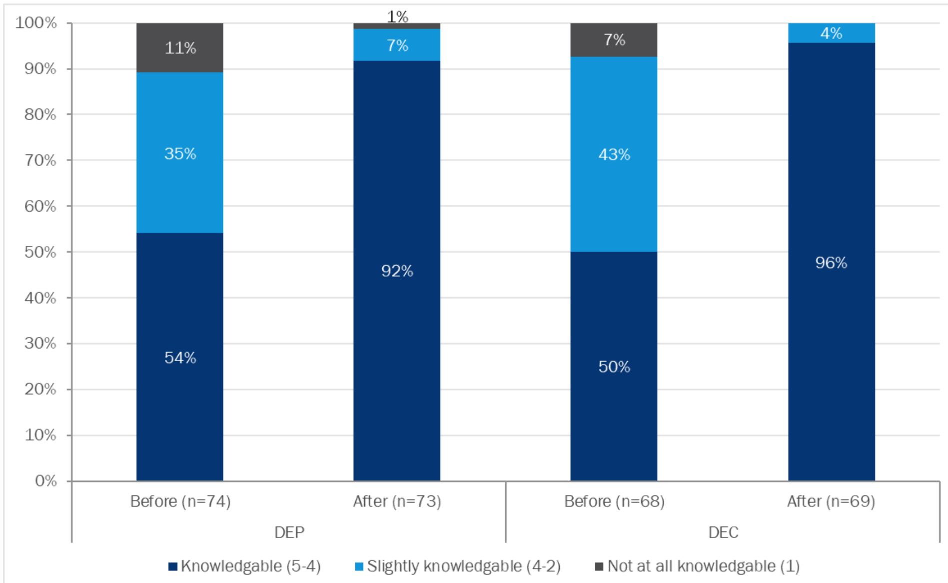
Figure 8. Receipt of Energy Efficiency Brochure and Its Usefulness



Participants across both service territories reported their knowledge increased after their enrollment in the NES program. Prior to participation, 54% of DEP participants and 50% of DEC participants reported that they were either “very knowledgeable” or “knowledgeable” about ways to reduce energy usage in their homes.[13] After participation, however, these numbers jumped up to 92% of DEP participants and 96% of DEC participants being at least “knowledgeable,” showing the influence the NES program has on participants’ energy usage knowledge (see Figure 9).

[13] Asked on a scale from 1 to 5, where 1 means “not at all knowledgeable” and 5 means “very knowledgeable,”

Figure 9. Participant Knowledge of Ways to Save Energy



Non-Energy Impacts

A large body of research, dating back decades, supports the existence of non-energy impacts from energy efficiency programs, particularly those offering low-income weatherization services.[14] In fact, according to the Department of Energy's Office of Energy Efficiency and Renewable Energy, "weatherization returns $2.78 in non-energy benefits for every $1.00 invested in the program.[15] NEIs include a range of occupant health, safety, and economic outcomes that participants may realize beyond the energy and cost savings of energy-efficient upgrades. NEIs can provide significant additional benefits to participants and can be a powerful motivator for program participation. The participant survey included questions about changes in electricity bills and in different aspects of the home's comfort following program participation. As seen in the summary of non-energy benefits (Table 16), a larger proportion of participants from both DEP and DEC jurisdictions experienced a positive change rather than a negative change for all the non-energy benefits that were attributed to the NES program.

Specifically, more NES program participants reported that their summer home comfort was improved for a larger percentage of participants (DEP 40% and DEC 41%) than for those who said they were less comfortable for both jurisdictions (DEP 5% and DEC 3%). Similarly, more participants reported being more comfortable in the winter after participation than those who noted being less comfortable. While we do see positive changes for a larger share of DEP and DEC customers than those who reported negative changes, for some of the non-energy impacts, the proportion of customers who reported no change was larger (for example, home comfort in the summer and winter, amount of noise heard from outside when windows are closed, and home maintenance costs).

[14] Oak Ridge National Laboratory (2014). *Health and Household-Related Benefits Attributable to the Weatherization Assistance Program*. https://weatherization.ornl.gov/wp-content/uploads/pdf/WAPRetroEvalFinalReports/ORNL_TM-2014_345.pdf

[15] US Department of Energy, Office of Energy Efficiency and Renewable Energy, *Weatherization Works! Weatherization Assistance Program Fact Sheet*. Accessed on April 5, 2022. https://www.energy.gov/sites/prod/files/2019/07/f64/WAP-Fact-Sheet-2019.pdf.

Additionally, we found that home draftiness improved for a larger percentage of participants (DEP 66% and DEC 59%) than those who reported that their homes had become draftier (DEP 10% and DEC 2%) and 59% of DEP and 68% of DEC participants noticed better lighting in their households.

Table 16. Summary of Non-Energy Benefits

Impact Category	Positive Change		No Change		Negative Change	
Energy Impacts	DEP	DEC	DEP	DEC	DEP	DEC
Summer electricity bills (DEP n=61, DEC n =58)[a]	33%	41%	41%	41%	26%	17%
	Bills are lower				Bills are higher	
Winter electricity bills (DEP n=64, DEC n=57)[a]	30%	42%	44%	49%	27%	9%
	Bills are lower				Bills are higher	
Non-Energy Impacts						
Home comfort in the summer (DEP n=73, DEC n = 69)	40%	41%	55%	56%	5%	3%
	More comfortable				Less comfortable	
Home comfort in the winter (DEP n = 74, DEC n = 69)	35%	38%	59%	61%	5%	1%
	More comfortable				Less comfortable	
Home draftiness (DEP n = 61, DEC n = 56)	66%	59%	25%	39%	10%	2%
	Less drafty				More drafty	
Lighting (DEP n = 61, DEC n = 53)[b]	59%	68%	39%	28%	2%	4%
	Better				Worse	
Amount of outdoor noise heard when all windows are closed (DEP n = 60, DEC n = 54)	30%	30%	67%	69%	3%	2%
	Less noise				More noise	
Home maintenance costs (DEP n = 71, DEC n = 66)	18%	20%	73%	79%	8%	2%
	Lower costs				Higher costs	

[a]Asked only of those who pay their own electric bill.
[b]Asked only of those who received LEDs.

Recommendations to Improve the NES Program

Most customers did not offer any recommendations to improve the program when asked, though a few did provide suggestions. The suggestions included increasing program outreach and communication (6% for DEP and 6% for DEC) and improve assessment scheduling and follow-up (5% for DEP and 6% for DEC) (see Figure 10). Additionally, 7% of DEP participants recommended that Duke provide higher quality products.

Participants were also asked about products they would like to see offered through the NES program. Most respondents did not provide any feedback about other products, but of those who did (n=39), the most common response was to provide additional quantities of the free energy efficiency products received during their assessments (see Figure 11). We recognize that customers may reach their cap on the quantities of free products they receive through Duke Energy programs, so we recommend providing NES participants with coupons to purchase energy efficiency products through the Online Savings Store. These coupons would result in discounts on top of the already discounted prices of products available through the store.

Figure 10. Recommendations to Improve the NES Program

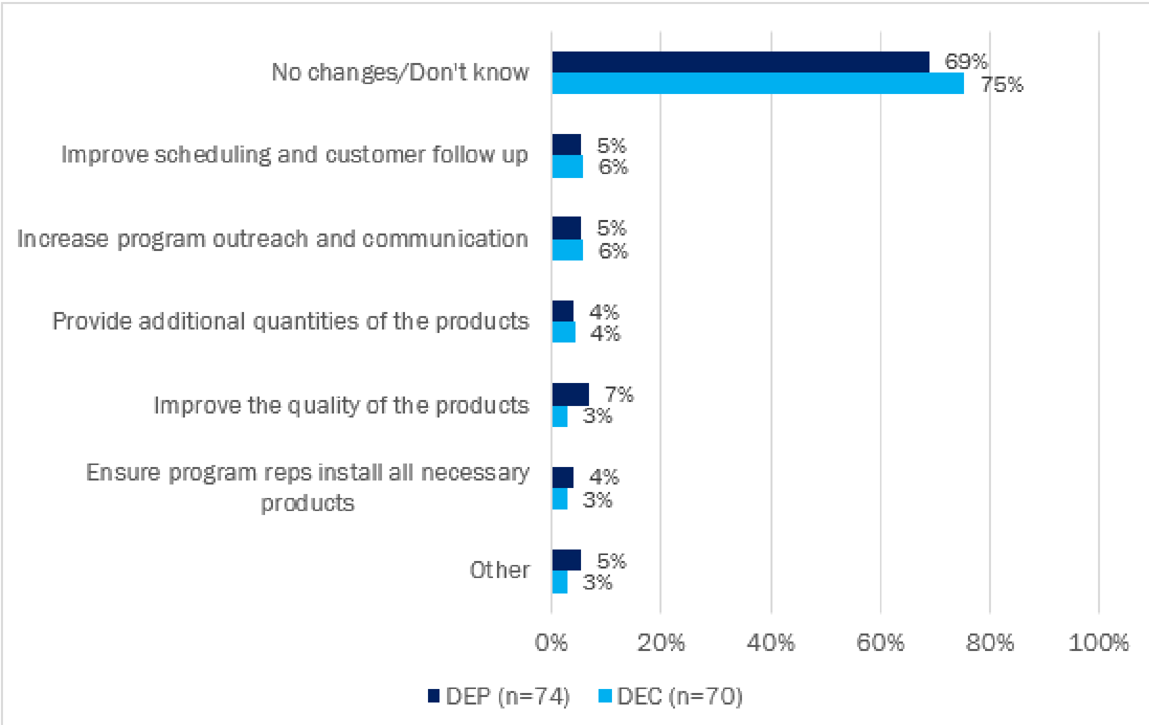
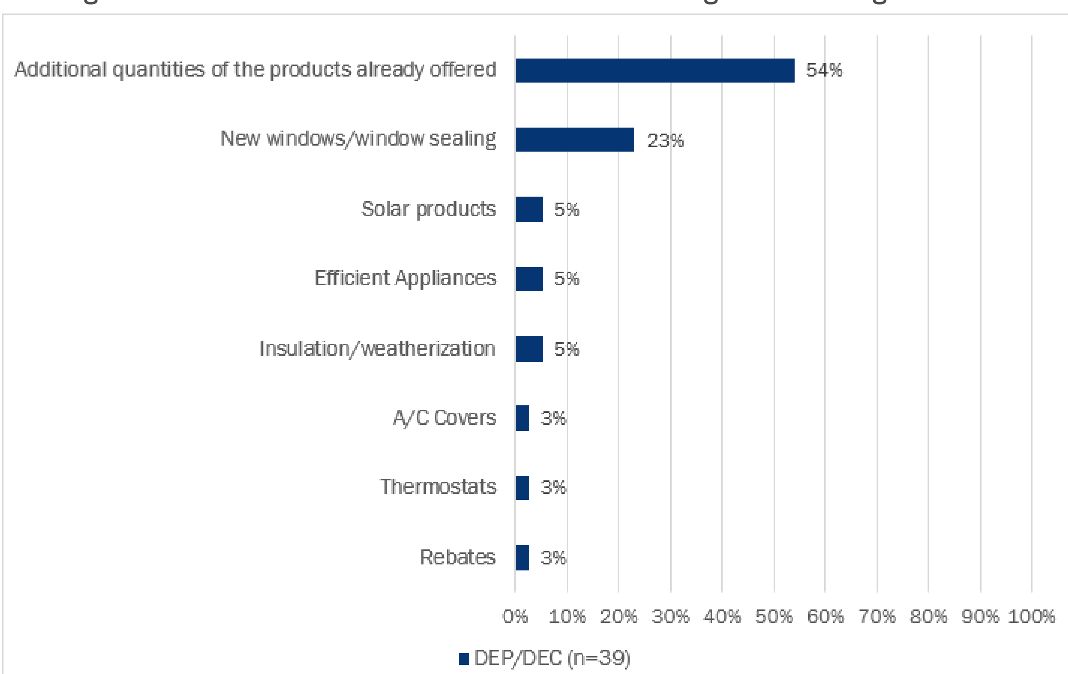


Figure 11. Products Customers Would Like Offered Through the NES Program



6. Free-Ridership Analysis

For low-income programs, it is customary to assume a net-to-gross (NTG) ratio of 1, i.e., zero free-ridership. An alternative way to frame this is that low-income program participants would not purchase and install energy-efficient equipment without receiving it for free through the NES Program. Since use of a consumption analysis with a comparison group, as employed in this evaluation, produces *net* savings, any existing free-ridership is already embedded in the savings, i.e., it is not possible to verify the zero free-ridership hypothesis using this method.

As part of this evaluation, Duke Energy was interested in exploring the potential for free-ridership for LEDs. This section describes the methodology and results of this exploration.

6.1 Free-Ridership Methodology

Program participants who would have paid for energy efficiency products on their own, (i.e., without the program) yet still received the program's free products are called program free-riders. Participants who would not have purchased LEDs in the absence of the program are 0% free-riders whereas participants who would have purchased LEDs without the program are 100% free-riders. Customers who would have waited to replace their bulbs with LED light bulbs are partial free-riders, because while they would have eventually purchased LEDs in the absence of the program, the program caused them to do so sooner.

The participant survey included questions to assess two aspects of program influence:

- **Influence on efficiency**: Knowing the price of LED bulbs, what type of light bulb would participants have purchased the next time they buy bulbs?
- **Influence on timing**: If participants had not received free LED bulbs from the program, would they have still replaced their working light bulbs with LED bulbs or would they have waited until the working bulbs burnt out?

We checked survey data for item non-responses and calculated respondent-level FR values per the algorithm presented below. We included in the analysis respondents who were able to verify receiving LEDs through the NES program and knew whether the bulbs they replaced with the free LEDs were still working or had all burnt out.[16] FR scores represent the percentage of savings that would have been achieved in the absence of the program.

Equation 2. Free Ridership Value

$$FR\,Value_{measure} = FR\,Efficiency_{measure} * TimingAdjustment_{measure}$$

We then aggregated respondent-level FR values to the program-level, by jurisdiction, weighting by measure quantities.

6.2 Free-Ridership Results

As shown in Table 17, the overall LED free-ridership was 44%, while the territory specific free-ridership for DEP and DEC was 51% and 38%, respectively. While the exploratory analysis of LED free-ridership shows that it is not zero for either jurisdiction, the free-ridership results from comparable non-low income programs is generally the same or higher. For example, LED free-ridership rates for the DEP and DEC Residential Energy Assessments program

[16] Participant survey responses were considered for the LED free-ridership percentage if the respondent verified receiving at least one or more LEDs and was able to offer a valid response to the entire free-ridership survey battery of questions.

evaluation are 47% and 50%.[17] For the Online Savings Store, the rates are 70% and 78% for DEP and DEC, respectively.[18] It should also be noted that the timing of the survey (fielded in August of 2021) relative to receipt of the LEDs through the program (between mid-2019 and mid-2020) might have affected participant perceptions of their likely actions without the program and thus their responses to the FR questions.

Table 17. LEDs Free-Ridership

Territory	FR
DEP (n=57)	51%
DEC (n=48)	38%
Overall	**44%**

Table 18 shows a breakdown of the percentage of respondents who received a 0%, 50%, or 100% free-rider score. The 46% of DEP respondents that are considered 100% free-riders (they would have bought the LEDs they received without the program) compared to the 23% of DEC respondents, contributes to its higher free-ridership score.

Table 18. Percentage of Respondents Free-Ridership

Percentage of Respondents who were:			
Territory	0% Free Rider	50% Free Rider	100% Free Rider
DEP (n=57)	37%	18%	46%
DEC (n=48)	40%	38%	23%

[17] *Duke Energy Progress Residential Energy Assessments Program Evaluation Report – Final*. October 18, 2018. Prepared by Opinion Dynamics for Duke Energy. Duke Energy Carolinas Residential Energy Assessments Program Evaluation Report – Final. October 12, 2018. Prepared by Opinion Dynamics for Duke Energy.
[18] Duke Energy Carolinas & Duke Energy Progress Online Savings Store Program 2021 Evaluation Report – Final. November 30, 2021. Prepared by Opinion Dynamics for Duke Energy.

7. Conclusions and Recommendations

7.1 Conclusions

Overall, the NES program teams in DEP and DEC territories implemented the program effectively and achieved a high penetration rate in target neighborhoods. The program team served 15,896 participants across both territories and achieved a 74% overall penetration rate. Based upon unique account numbers in the program tracking data, 5,619 participants were DEP customers while 10,277 were DEC customers.

Using consumption analysis, the evaluation team found annual ex-post net program savings of 3,031 kWh for the DEP jurisdiction and 2,276 kWh for the DEC jurisdiction, despite the NES program serving fewer customers in the DEP jurisdiction. The annual household energy savings were 539 kWh for the DEP jurisdiction and 221 for the DEC jurisdiction. The estimates include savings from equipment installed by program representatives, as well as savings from any additional behavioral changes and participant spillover attributable to the program.

Based on engineering analysis, which explains the relative contribution of each measure type to program savings, lighting is responsible for the largest proportion of savings in the DEP jurisdiction (33%), while infiltration reduction generates the largest share of energy savings in the DEC jurisdiction (39%).

The evaluation team found high levels of program satisfaction; 96% of DEP and 88% of DEC participants reported they were either “mostly satisfied” or “completely satisfied” with the program overall. In addition, a majority of both DEP and DEC respondents were also either “completely” or “mostly satisfied” with the energy-efficient equipment they received (95% in both territories) and the NES program representatives who visited their households (96% and 97%, respectively).

For this evaluation, Duke Energy asked us to explore whether there was free-ridership for LEDs. Based on responses to free-ridership questions included in the participant survey, we estimated LED free-ridership at 51% for DEP and 38% for DEC. The overall free-ridership estimate is 44%. We therefore do see evidence of some free-ridership; however, the consumption analysis generates an ex-post net energy savings value that accounts for free-ridership.

Participants reported experiencing a variety of additional energy benefits after participating in the NES program. A fraction of NES respondents reported that their electric bills in summer (33% of DEP and 41% of DEC) and winter (30% of DEP and 42% of DEC) were lower after participating in the program. Additionally, a majority of both DEP and DEC participants felt that their home was less drafty and had better lighting after they participated in the program.

Overall, the educational component of the program was successful. Most NES respondents (87% of DEP and 86% of DEC) received in-person education and 93% of DEP and 89% of DEC respondents thought that the information they received was either useful or very useful. Additionally, participants reported that they were more knowledgeable about ways to save energy in their homes after their NES program participation than they were beforehand.

7.2 Recommendations

Based upon the evaluation of the NES program and our above conclusions, we provide the following recommendations to potentially enhance the program’s performance and energy savings in the future.

- **At the time of the energy assessment, NES program teams should consider offering coupons for additional quantities of the energy-saving products to program participants.** While most participants were satisfied with the NES program, a small number offered recommendations to improve how it is implemented. Of the 39 participants who provided recommendations, 54% commented on how additional quantities would be

/A

beneficial. To meet this need, NES program teams could provide “deep discount” coupons for energy saving products that customers can redeem through Duke Energy’s Online Savings Store, where the coupon could provide NES participants with discounts that are larger than what they would have received without the coupon. This could help to ensure continued energy savings in homes that have been treated through the program. Furthermore, offering coupons could increase participant satisfaction with the program and can serve to direct customers to another Duke program.

- **NES program staff should emphasize air infiltration measures, as they provide both energy and non-energy benefits.** While infiltration measures make an important contribution to overall program energy savings (29% for DEP and 39% DEC participants), NES participants who receive these measures also report other valuable non-energy benefits. Of those who received infiltration measures, 66% of DEP and 59% of DEC participants reported that their home was less drafty and about one-third reported noticing a change in the comfort of their home in both the summer and winter in both jurisdictions.
- **Duke Energy should consider lengthening the amount of time before it archives customer billing data, particularly for those who participate in programs where consumption analysis is used to estimate program savings, such as NES.** For consumption analysis purposes, the evaluation team requires at least two years of data—one year of pre-participation and one year of post-participation data. Duke's consumption data archiving practices in the DEC and DEP jurisdictions conflict with the need for an extensive period of time to accumulate a sufficient number of participants to complete a consumption analysis (for treatment and comparison groups). To ensure successful evaluation, we recommend that Duke Energy work with the evaluation team prior to starting impact evaluation activities to consider what data will be required and determine whether Duke can extend the length of time before it archives its billing data. This is especially important when evaluating programs that, due to slower participation accumulation, need to rely on a longer evaluation period to ensure sufficient numbers of participants. This is particularly true for the pre-period consumption data.

8. Summary Forms

DUKE ENERGY PROGRESS NEIGHBORHOOD ENERGY SAVER PROGRAM

COMPLETED EM&V FACT SHEET

PROGRAM DESCRIPTION

The DEP Neighborhood Energy Saver (NES) program provides one-on-one energy education, on-site energy assessments, and energy conservation measures to customers in selected low-income neighborhoods. These services are offered free of charge to all active DEP account holders who are individually metered homeowners and tenants living in predetermined income-qualified communities.

Date:	May 11, 2022
Region(s):	Duke Energy Progress
Evaluation Period:	July 1, 2018 – June 30, 2019
Annual MWh Savings (ex post net):	3,031 MWh
Coincident MW Impact (ex post net):	0.488 MW (Summer), 0.508 MW (Winter)
Measure Life:	Not Evaluated
Net-to-Gross Ratio:	N/A
Process Evaluation:	Yes
Previous Evaluation(s):	Duke Energy Progress Neighborhood Energy Saver Program, November 30, 2019

EVALUATION METHODOLOGY

To evaluate the strengths, barriers, and non-energy related benefits of the program, the evaluation team performed a range of data collection and analytic activities, including (1) interviews with DEP program staff, (2) a review of program materials and program tracking data, (3) participant telephone survey, (4) an engineering analysis of deemed savings, (5) a consumption analysis, (6) an LED free-ridership analysis.

EVALUATION FINDINGS

- A total of 96% of DEP participants reported that they were either completely satisfied or mostly satisfied with the program overall.
- DEP participants reported that most measures were still in service at the time of the participant survey, with an overall ISR of 88%.
- For the consumption analysis, a Linear Fixed Effects Regression (LFER) model was used which established a statistically significant relationship between participation in the program and energy consumption.
- NES participants reported several non-energy benefits including less drafty homes, increased comfort in summertime, and better home lighting. Additionally, 33% of DEP participants reported that their summer electric bill had gone down after participating in the NES program.

DUKE ENERGY CAROLINAS
NEIGHBORHOOD ENERGY SAVER PROGRAM
COMPLETED EM&V FACT SHEET

PROGRAM DESCRIPTION

The DEC Neighborhood Energy Saver (NES) program provides one-on-one energy education, on-site energy assessments, and energy conservation measures to customers in selected low-income neighborhoods. These services are offered free of charge to all active DEP account holders who are individually metered homeowners and tenants living in predetermined income-qualified communities.

Date:	May 11, 2022
Region(s):	Duke Energy Carolinas
Evaluation Period:	July 1, 2018 – June 30, 2019
Annual MWh Savings (ex post net):	2,276 MWh
Coincident MW Impact (ex post net):	0.413 MW (Summer), 0.418 MW (Winter)
Measure Life:	Not Evaluated
Net-to-Gross Ratio:	N/A
Process Evaluation:	Yes
Previous Evaluation(s):	Duke Energy Progress Neighborhood Energy Saver Program, November 30, 2019

EVALUATION METHODOLOGY

To evaluate the strengths, barriers, and non-energy related benefits of the program, the evaluation team performed a range of data collection and analytic activities, including (1) interviews with DEP program staff, (2) a review of program materials and program tracking data, (3) participant telephone survey, (4) an engineering analysis of deemed savings, (5) a consumption analysis, (6) an LED free-ridership analysis.

EVALUATION FINDINGS

- A total of 88% of DEC participants reported that they were either completely satisfied or mostly satisfied with the program overall.
- DEP participants reported that most measures were still in service at the time of the participant survey, with an overall ISR of 85%.
- For the consumption analysis, a Linear Fixed Effects Regression (LFER) model was used which established a statistically significant relationship between participation in the program and energy consumption.
- NES participants reported several non-energy benefits including less drafty homes, increased comfort in summertime, and better home lighting. Additionally, 41% of DEP participants reported that their summer electric bill had gone down after participating in the NES program.

9. DS More Table

An Excel spreadsheet containing measure-level inputs for Duke Energy Analytics is provided as a separate file. Per-measure savings values in the spreadsheet are based on the net impact analyses reported above. The evaluation scope did not include updates to measure life assumptions.

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EM&V Report for the Duke Energy Small Business Energy Saver Program 2019-2020

Prepared for:

DUKE ENERGY®

Duke Energy Carolinas and Duke Energy Progress

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June 9, 2022~~November 23, 2021~~

Table of Contents

Contents

List of Tables

List of Figures

1. Evaluation Summary

1.1 Program Summary

The Small Business Energy Saver (SBES) program is a direct install program offered to qualifying commercial customers with an average annual demand of 180 kW or less. Participating customers receive an energy assessment at their facility, and subsequently a set of recommended energy efficient measure retrofits. Customers receive information about the proposed measure installation and project costs including utility incentives of up to 80 percent for lighting and refrigeration, and HVAC measures. Once approved, the direct installation is scheduled and completed with minimal disruption to business operations.

The following measures are currently included in the SBES program:

1. Lighting Measures: LED interior and exterior lighting solutions.
2. Refrigeration Measures: lighting, motors, and controls for refrigeration cases.
3. HVAC Measures: HVAC controls, thermostats, and tune-ups

Lime Energy is the current Implementation Contractor that administers the SBES program in the Duke Energy Carolinas (DEC) and Duke Energy Progress (DEP) jurisdictions. Lime Energy provides integrated energy audits, equipment procurement, and payment services to participating customers. Measure installation is performed by Lime Energy or a subcontractor of Lime Energy.

1.2 Evaluation Objectives and Program Level Findings

This evaluation provides an independent assessment of program impacts and performance for participation that occurred between 1/1/2019 and 6/30/2020. Guidehouse used an engineering-based approach to calculate program impacts, similar to previous evaluation cycles with some differences pertaining to data collection activities. Due to the ongoing COVID-19 pandemic, Guidehouse replaced the previous onsite field study activities with virtual verification to collect information necessary for impact calculations.

Evaluation objectives include the following:

1. Impact Evaluation:
    a. Verify deemed savings estimates through review of measure assumptions and calculations.
    b. Perform virtual verification of measure installations and collect data for use in an engineering analysis.
    c. Estimate the amount of observed energy and peak demand savings (both summer and winter) by measure via engineering analysis.

2. Net-to-Gross Analysis:
    a. Assess the Net-to-Gross ratio by addressing spillover and free-ridership via customer online surveys.

3. Process Evaluation:
    a. Conduct phone interviews with program management and implementation contractor(s) and to collect data for use in process analysis.

b. Administer customer online surveys to collect data for use in process analysis. Evaluate the strengths and weaknesses of current program processes and customer perceptions, with special consideration for effects of the COVID-19 pandemic.

By performing both impact and process components of the EM&V effort, Guidehouse provides Duke Energy with verified energy and demand impacts, as well as a set of recommendations that are intended to aid Duke Energy with improving or maintaining the satisfaction with program delivery while meeting energy and demand reduction targets in a cost-effective manner. Guidehouse found that Duke Energy is successfully delivering the SBES Program to customers, participant satisfaction is generally favorable, and the reported measure installations are relatively accurate.

For the evaluation period covered by this report, there were a total of 1,964 projects comprised of roughly 21,909 measures installed through the program in the DEC jurisdiction and a total of 1,583 projects with roughly 16,853 measures installed through the program in the DEP jurisdiction. The program-level evaluation findings are presented in Table 1-1 and Figure 1-1 for DEC, and Table 1-2 and Figure 1-2 for DEP.

Guidehouse found the realization rate for gross energy savings to be 92~~100 and 101~~ percent for both DEC and DEP~~, respectively~~, meaning that total verified gross energy savings were found to be 0.92 ~~similar~~ to the claimed savings in the tracking database provided by Duke Energy. Virtual impact assessments found the measure installation rate (ISR) to be 96 percent for both jurisdictions, meaning participants self-reported small differences between the measures indicated in the tracking data and those received or currently operating at their facilities. The adjustment of savings by applying ~~However,~~ the ISR and ~~was offset by the addition of~~ HVAC interactive effects during the engineering analysis, ~~which was~~were the main drivers for the final realization rates for energy. The realization rate for DEC and DEP jurisdictions' gross demand savings ~~however~~ were found to both be 97~~9~~ percent for summer coincident peak demand and 96~~8~~ percent for winter coincident peak demand. The addition of coincidence factors and demand interactive factors to demand savings calculations were~~is~~ the main drivers of the ~~slightly~~ lowered realization rate.

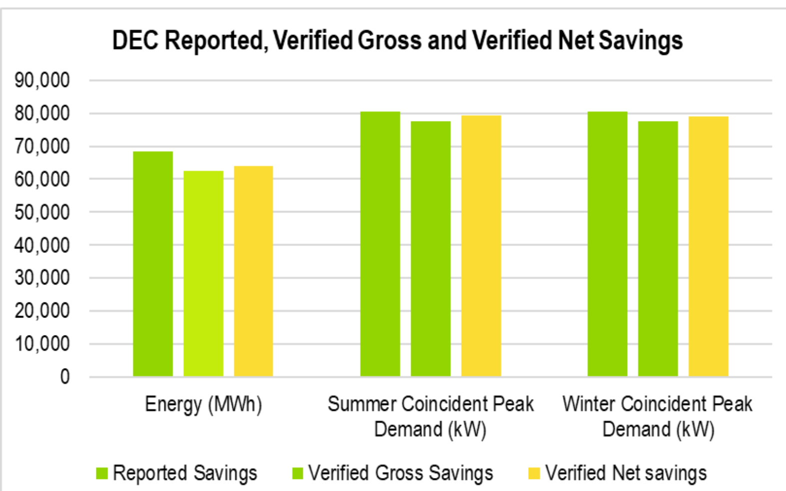
Guidehouse found the net-to-gross (NTG) ratio to be 1.02 for both DEC and DEP jurisdictions, meaning that for every 100 kWh of reported energy savings, 102 kWh can be attributed directly to the program. By multiplying the verified gross energy and demand savings by the NTG ratio, Guidehouse calculated the net energy and demand impacts shown in Table 1-1 for DEC and Table 1-2 for DEP. These findings will be discussed in greater detail throughout this report.

Table 1-1. SBES Reported, Verified Gross and Verified Net Savings - DEC

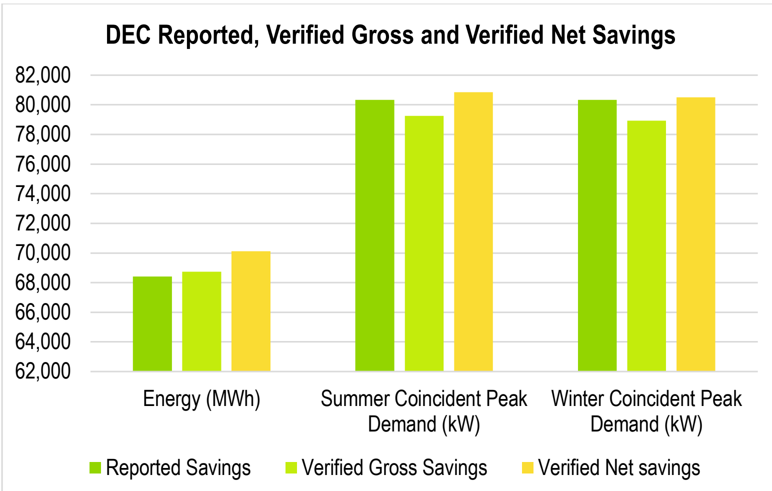
Parameter	Energy (MWh)	Summer Coincident Peak Demand (kW)	Winter Coincident Peak Demand (kW)
Reported Savings	68,413	80,343	80,343
Realization Rate	92%~~100%~~	97%~~99%~~	96%~~98%~~
Verified Gross Savings	62,613~~68,738~~	77,601~~79,256~~	77,523~~78,936~~
Net-to-Gross	102%	102%	102%
Verified Net savings	63,865~~70,113~~	79,153~~80,841~~	79,074~~80,515~~

Source: Guidehouse analysis, values subject to rounding.

Figure 1-1 Reported, Verified Gross and Net Energy and Demand Savings ~~–~~- DEC



Source: Guidehouse analysis, values subject to rounding.



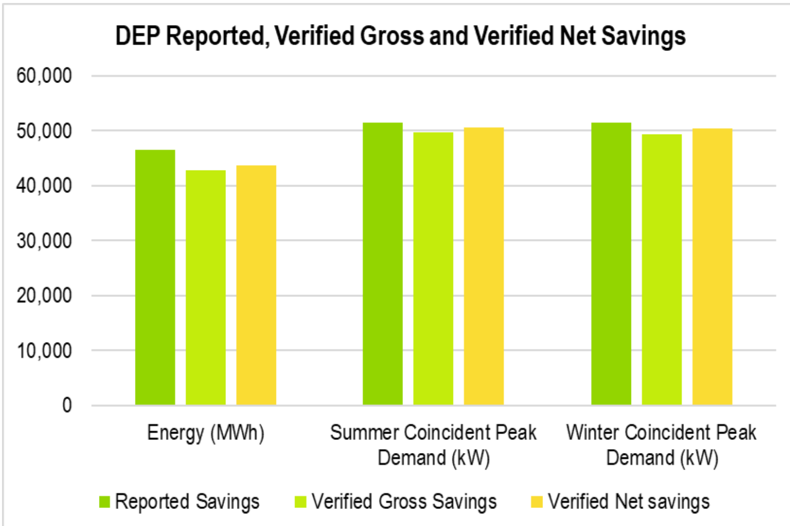
~~Source: Guidehouse analysis, values subject to rounding.~~

Table 1-2 SBES Reported, Verified Gross and Verified Net Savings – DEP

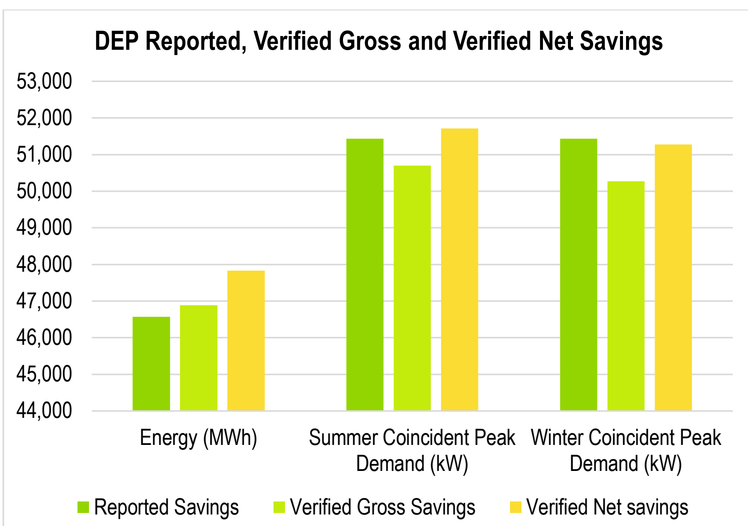
Parameter	Energy (MWh)	Summer Coincident Peak Demand (kW)	Winter Coincident Peak Demand (kW)
Reported Savings	46,571	51,433	51,433
Realization Rate	92%~~101%~~	97%~~99%~~	96%~~98%~~
Verified Gross Savings	42,852~~46,889~~	49,640~~50,696~~	49,383~~50,267~~
Net-to-Gross	102%	102%	102%
Verified Net savings	43,709~~47,827~~	50,633~~51,710~~	50,370~~51,272~~

Source: Guidehouse analysis, values subject to rounding.

Figure 1-2 Reported, Verified Gross and Net Energy and Demand Savings – DEP



Source: Guidehouse analysis, values subject to rounding.



~~Source: Guidehouse analysis, values subject to rounding.~~

1.3 Evaluation Parameters and Sample Period

To accomplish the evaluation objectives, Guidehouse performed a variety of research and analysis activities, including:

- Engineering review of measure savings algorithms
- Virtual verification to assess installed measure quantities and characteristics
- Participant surveys with customers to evaluate satisfaction and decision-making.

Table 1-3 summarizes the evaluated parameters. The targeted sampling confidence and precision was 90 percent ± 10 percent, and the achieved was 90 percent ± 2.5 percent.

Table 1-3. Evaluated Parameters

Evaluated Parameter	Description	Details
In-Service Rates	The percentage of program measures in use as compared to reported	Virtual verification assessments completed by participants
Satisfaction	Customer satisfaction	Process Surveys (Satisfaction with program elements Satisfaction with implementation contractor)
Free Ridership	Fraction of reported savings that would have occurred anyway, even in the absence of the program	NTG surveys
Spillover	Additional, non-reported savings that occurred as a result of participation in the program	NTG surveys

Source: Guidehouse

The evaluation covers program participation from 1/1/2019 and 6/30/2020. Table 1-4 shows the start and end dates of Guidehouse' s sample period for evaluation activities.

Table 1-4. EM&V Sample Period Start and End Dates

Activity	Start Date	End Date
Virtual Verification	2/8/2021	3/05/2021
Process and NTG surveys	2/1/2021	2/26/2021

Source: Guidehouse

1.4 Evaluation Considerations and Recommendations

The evaluation team recommends a few actions for improving the SBES Program, based on insights gained through the evaluation effort. These recommendations are intended to assist Duke Energy with enhancing the program delivery and customer experience, as well as to possibly increase program impacts. Further explanation for each recommendation can be found later in this report.

1. **Consider introducing additional equipment choices in the program.** There were a subset of customers reporting that the program was unable to provide all the energy efficiency equipment they wanted. Duke Energy should consider introducing more equipment choices in the program to include additional outdoor lighting and HVAC measures. This also presents an opportunity for channeling to other Duke Energy programs or education about measures that are not offered through the SBES program.
2. **Increase and improve program communications.** This is the most common challenge or drawback received from participants, indicating that customers were sometimes unclear about the various stages of the program process and did not receive proper communication and guidance from the implementer and/or Duke Energy. Additional education from both Lime Energy and Duke Energy account managers should help customers better understand the program participation process.
3. **Consider using TRM algorithms for HVAC measures.** Lime Energy and Duke Energy developed deemed savings estimates using regional data for HVAC measures. Although the methodology for developing these estimates was accurate, Guidehouse recommends Duke Energy consider using TRM algorithms too and substituting the variables in these algorithms using regional values to estimate savings. This may enhance the transparency of the impact estimates for these measures.
4. **The Program Net-to-Gross Ratio is high**. This indicates that the program is providing a key service to small business customers in helping them manage their energy use.

2. Program Description

2.1 Program Design

The SBES Program is available to qualifying commercial customers with average demand less than 180 kilowatts (kW) demand service. After completing the program application to assess participation eligibility, customers receive a free energy assessment to identify equipment for upgrade. Lime Energy reviews the energy assessment results with the customer, who then chooses which equipment upgrades to perform. Qualified contractors complete the equipment installations at the convenience of the customer.

The SBES Program recognizes that customers with lower savings potential may benefit from a streamlined, one-stop, turnkey delivery model and relatively high incentives to invest in energy efficiency. Additionally, small businesses may lack internal staffing dedicated to energy management and can benefit from energy audits and installations performed by an outside vendor.

The program offers incentives in the form of a discount for the installation of measures, including high-efficiency lighting, refrigeration and HVAC equipment. These incentives increase adoption of efficient technologies beyond what would occur naturally in the market. During the period included in this evaluation, the SBES Program achieved the majority of program savings from lighting measures, which tend to be the most cost-effective and easiest to market to potential participants. The SBES program also achieved program savings from HVAC and refrigeration measures.

The program offers a performance-based incentive up to 80 percent of the total project cost, inclusive of both materials and installation. Multiple factors drive the total project cost, including selection of equipment and unique installation requirements.

2.2 Reported Program Participation and Savings

Duke Energy and the implementation contractor maintain a tracking database that identifies key characteristics of each project, including participant data, installed measures, and estimated energy and peak demand reductions based on assumed ("deemed") savings values. In addition, this database contains measure level details that are useful for EM&V activities. Table 2-1 provides a summary of the gross reported energy and demand savings and participation for 2019-2020.

Table 2-1. Reported Participation and Gross Savings Summary

Reported Metrics	DEC	DEP
Projects	1,964	1,583
Measures Installed	21,909	16,853
Gross Annual Energy Savings (MWh)	68,413	46,571
Average Quantity of Measures per Project	11	10
Average Gross Savings Per Project (MWh)	34.83	29.41

Source: SBES Tracking Database

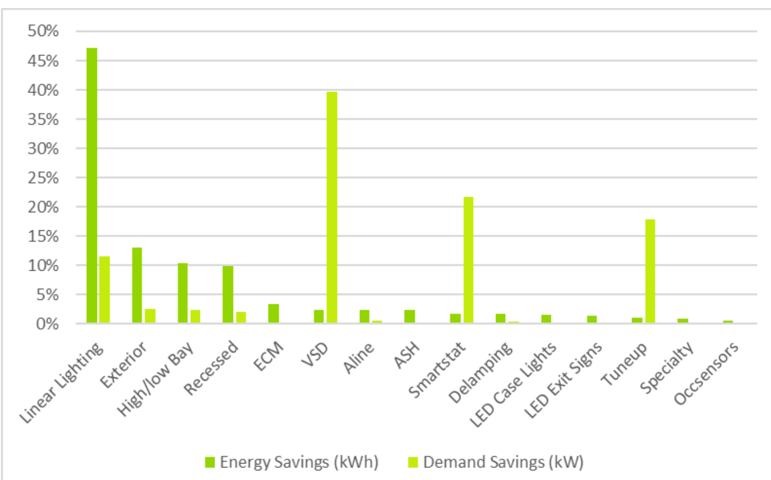
/A

Duke Energy uses assumptions and algorithms primarily from the New York Technical Resource Manual[1] (TRM) as the basis for energy and demand savings calculations[2] for lighting and refrigeration measures. This TRM is robust, well-established, and follows industry best practices for the measures found in the SBES program. The evaluation team believes the NY TRM is an appropriate basis for estimating savings in the DEC and DEP jurisdictions based on Guidehouse' s assessment of the underlying energy savings assumptions. Lime Energy worked with Duke Energy to develop the HVAC measures' deemed savings using regional data, Guidehouse reviewed the methodology for developing deemed savings estimates for these measures and think the deemed savings values are appropriate and agree with their use.

2.2.1 Program Summary by Measure

Efficient LED linear lighting retrofits were the highest contributor to program energy savings in 2019 -2020, followed by exterior lighting measures and a variety of LED lighting measures for DEC and DEP as seen in Figure 2-1 and Figure 2-2. However, HVAC measures such as VSD, Smart Thermostats and HVAC tune-ups contributed the most to demand savings for both jurisdictions. In addition, refrigeration measures (including EC motors, LED case lighting, and anti-sweat heaters) also contributed to savings. Overall, lighting measures contribute 86 percent of reported program energy savings, refrigeration measures contribute 9 percent and HVAC measures contribute the remaining 5 percent.

Figure 2-1. DEC Reported Gross Energy and Demand Savings by Measure Category

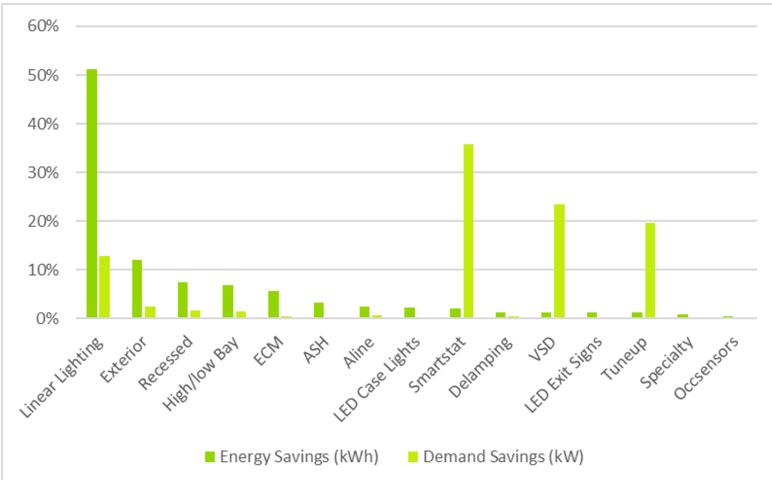


Source: SBES Tracking Database

[1] New York Standard Approach for Estimating Energy Savings from Energy Efficiency Programs - Residential, Multi-Family, and Commercial/Industrial, known as the Technical Resource Manual (TRM), Version 7, April 15, 2019

[2] The Pennsylvania Technical Reference Manual, 2016 is used for the anti-sweat heater control measure's algorithms and assumptions

Figure 2-2. DEP Reported Gross Energy and Demand Savings by Measure Category



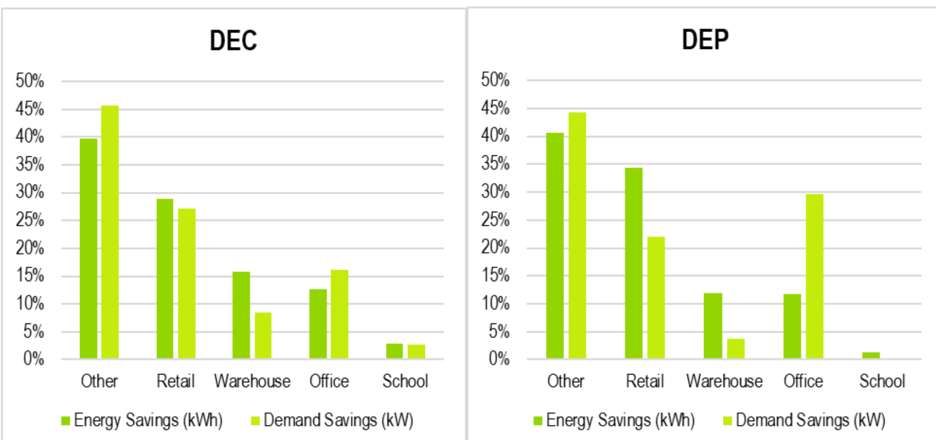
Source: SBES Tracking Database

2.2.2 Savings by Facility Type

Guidehouse reviewed the business type information in the tracking database to understand the participant demographics. The tracking data included SIC codes for each project, resulting in many unique detailed building types. As part of the engineering analysis for this evaluation, Guidehouse used the NEEP Mid-Atlantic TRM[3] to make impact adjustments to account for factors such as HVAC interactive effects and coincidence factors. -To accomplish this, Guidehouse mapped the SIC codes from the tracking data to the facility types detailed in the TRM. The TRM HVAC interactive factors by facility fuel type are weighted by heating fuel multiplier factors determined from the participant virtual verification survey.

These facility types are shown below in Figure 2-3. Note that the largest category is "other", which indicates either the SIC code was not populated or a suitable TRM facility type was not found. The distribution of facility types is representative of a large variety of small business customers, indicating that the program is successfully recruiting participants across several sectors. The "other", retail, restaurant and warehouse facilities represent the largest contributors of energy and demand savings in both jurisdictions.

Figure 2-3. Reported Energy Savings by Facility Type



Source: SBES Tracking Database

[3]NEEP TRM (April 2020, v10), https://neep.org/sites/default/files/media-files/trmv10.pdf

3. Impact Evaluation

3.1 Impact Results

Table 3-1 shows the program-level results for gross energy and demand savings for DEC and DEP. The subsequent tables, Table 3-2, Table 3-3, and Table 3-4 show the end use level results for gross energy and demand savings for DEC and DEP. Guidehouse estimates gross realization rates of ~~100~~92%, ~~99~~97% and ~~98~~96% for DEC energy, summer coincident demand, and winter coincident demand, respectively. The gross realization rates for DEP are estimated as ~~101~~92%, ~~99~~97% and ~~98~~96% for energy, summer coincident demand, and winter coincident demand, respectively. The realization rates in these tables have been determined according to the in-service rates calculated based on the findings of the virtual verification survey as well as an engineering/deemed savings review of the algorithms.

Table 3-1 Reported and Verified Program-Level Impacts

Program	Parameter	Energy (kWh)	Summer Coincident Peak Demand (kW)	Winter Coincident Peak Demand (kW)
DEC	Reported Savings	68,413,344	80,343	80,343
	Realization Rate	92%~~100.4%~~	97%~~98.6%~~	96%~~98.2%~~
	Verified Gross Savings	62,612,654~~68,737,750~~	77,601~~79,256~~	77,523~~78,936~~
DEP	Reported Savings	46,571,185	51,433	51,433
	Realization Rate	92%~~100.7%~~	97%~~98.6%~~	96%~~97.7%~~
	Verified Gross Savings	42,852,171~~46,888,802~~	49,640~~50,696~~	49,383~~50,267~~

Source: Guidehouse analysis, values subject to rounding

Table 3-2 Reported and Verified Lighting Impacts

Program	Parameter	Energy (kWh)	Summer Coincident Peak Demand (kW)	Winter Coincident Peak Demand (kW)
DEC	Reported Savings	59,789,384	16,221	16,221
	Realization Rate	90%~~100.5%~~	83%~~93.3%~~	83%~~91.3%~~
	Verified Gross Savings	53,988,695~~60,113,791~~	13,479~~15,134~~	13,401~~14,814~~
DEP	Reported Savings	39,117,872	10,390	10,390
	Realization Rate	90%~~100.8%~~	83%~~92.9%~~	80%~~88.8%~~
	Verified Gross Savings	35,398,859~~39,435,490~~	8,596~~9,652~~	8,339~~9,223~~

Source: Guidehouse analysis, values subject to rounding

Table 3-3 Reported and Verified HVAC Impacts

Program	Parameter	Energy (kWh)	Summer Coincident Peak Demand (kW)	Winter Coincident Peak Demand (kW)
DEC	Reported Savings	3,666,767	63,700	63,700
	Realization Rate	100~~.8~~%	~~92.9~~100%	~~88.8~~100%
	Verified Gross Savings	3,666,767	63,700	63,700
DEP	Reported Savings	2,197,861	40,590	40,590
	Realization Rate	100~~.0~~%	100~~.0~~%	100~~.0~~%
	Verified Gross Savings	2,197,861	40,590	40,590

Source: Guidehouse analysis, values subject to rounding

Table 3-4 Reported and Verified Refrigeration Impacts

Program	Parameter	Energy (kWh)	Summer Coincident Peak Demand (kW)	Winter Coincident Peak Demand (kW)
DEC	Reported Savings	4,957,192	422	422
	Realization Rate	100.~~0~~%	100.~~0~~%	100.~~0~~%
	Verified Gross Savings	4,957,192	422	422
DEP	Reported Savings	5,255,451	453	453
	Realization Rate	100.~~0~~%	100.~~0~~%	100.~~0~~%
	Verified Gross Savings	5,255,451	453	453

Source: Guidehouse analysis, values subject to rounding

Table 3-5 below presents the energy, summer peak and winter peak impacts by the different measure categories in the DEC SBES program. Table 3-6 presents the same impacts by measure category for the DEP SBES program.

Table 3-5 Reported and Verified Measure-Level Impacts - DEC

Measure Category	Reported Savings (kWh)	Verified Energy Savings (kWh)	Energy Realization Rate	Reported Savings (kW)	Verified Demand Savings (Summer kW)	Summer Demand Realization Rate	Verified Demand Savings (Winter kW)	Winter Demand Realization Rate
A-Line Lamps	1,605,753	1,494,574~~1,697,337~~	93%~~106%~~	482	517~~580~~	107%~~120%~~	526~~591~~	109%~~123%~~
Anti Sweat Heater	1,602,710	1,597,708~~1,597,708~~	100%~~100%~~	38	38~~38~~	100%~~100%~~	38~~38~~	100%~~100%~~
De-lamping	1,137,371	974,296~~1,105,993~~	86%~~97%~~	390	370~~416~~	95%~~107%~~	273~~306~~	70%~~79%~~
ECM	2,302,550	2,302,550~~2,302,550~~	100%~~100%~~	263	263~~263~~	100%~~100%~~	263~~263~~	100%~~100%~~
Exterior Lights	8,886,092	8,440,067~~8,440,067~~	95%~~95%~~	2,007	0~~0~~	0%~~0%~~	1,896~~1,896~~	94%~~94%~~
Bay Lights	7,146,435	6,072,846~~6,898,134~~	85%~~97%~~	1,909	2,009~~2,256~~	105%~~118%~~	2,009~~2,256~~	105%~~118%~~
LED Tubes	32,263,196	29,055,981~~32,956,441~~	90%~~102%~~	9,349	8,435~~9,471~~	90%~~101%~~	6,513~~7,312~~	70%~~78%~~
LED Case Lighting	1,084,809	1,084,809~~1,084,809~~	100%~~100%~~	121	121~~121~~	100%~~100%~~	121~~121~~	100%~~100%~~

LED Exit Signs	955,181	873,985~~991,480~~	91%~~104%~~	110	125~~140~~	114%~~128%~~	125~~140~~	114%~~128%~~
Occupancy Sensors	356,876	304,386~~346,393~~	85%~~97%~~	89	64~~72~~	72%~~80%~~	64~~72~~	72%~~80%~~
Recessed Lighting	6,729,790	6,120,312~~6,941,007~~	91%~~103%~~	1,706	1,769~~1,986~~	104%~~116%~~	1,802~~2,024~~	106%~~119%~~
Smart Thermostat	1,199,650	1,199,650~~1,199,650~~	100%~~100%~~	17,415	17,415~~17,415~~	100%~~100%~~	17,415~~17,415~~	100%~~100%~~
Specialty Lights	675,811	624,371~~709,064~~	92%~~105%~~	178	190~~213~~	106%~~119%~~	193~~217~~	108%~~122%~~
Tune-up	786,372	786,372~~786,372~~	100%~~100%~~	14,425	14,425~~14,425~~	100%~~100%~~	14,425~~14,425~~	100%~~100%~~
VSD	1,680,745	1,680,745~~1,680,745~~	100%~~100%~~	31,860	31,860~~31,860~~	100%~~100%~~	31,860~~31,860~~	100%~~100%~~
Grand Total	**68,413,344**	**62,612,654~~68,737,750~~**	**92%~~100%~~**	**80,343**	**77,601~~79,256~~**	**97%~~99%~~**	**77,523~~78,936~~**	**96%~~98%~~**

Source: Guidehouse analysis, values subject to rounding

Table 3-6 Reported and Verified Measure-Level Impacts – DEP

Measure Category	Reported Savings (kWh)	Verified Energy Savings (kWh)	Energy Realization Rate	Reported Savings (kW)	Verified Demand Savings (Summer kW)	Summer Demand Realization Rate	Verified Demand Savings (Winter kW)	Winter Demand Realization Rate
A-Line Lamps	1,161,239	1,077,446~~1,223,170~~	93%~~105%~~	372	398~~446~~	107%~~120%~~	405~~455~~	109%~~122%~~
Anti Sweat Heater	1,571,502	1,571,502~~1,571,502~~	100%~~100%~~	35	35~~35~~	100%~~100%~~	35~~35~~	100%~~100%~~
De-lamping	644,442	506,604~~577,129~~	79%~~90%~~	226	197~~221~~	87%~~98%~~	145~~163~~	64%~~72%~~
ECM	2,636,283	2,636,283~~2,636,283~~	100%~~100%~~	302	302~~302~~	100%~~100%~~	302~~302~~	100%~~100%~~
Exterior Lights	5,579,037	5,156,972~~5,156,972~~	92%~~92%~~	1,237	0~~0~~	0%~~0%~~	1,139~~1,139~~	92%~~92%~~
Bay Lights	3,188,803	2,723,220~~3,088,653~~	85%~~97%~~	815	849~~953~~	104%~~117%~~	849~~953~~	104%~~117%~~
LED Tubes	23,850,441	21,627,147~~24,499,920~~	91%~~103%~~	6,650	6,017~~6,755~~	90%~~102%~~	4,645~~5,216~~	70%~~78%~~
LED Case Lighting	1,047,666	1,047,666~~1,047,666~~	100%~~100%~~	117	117~~117~~	100%~~100%~~	117~~117~~	100%~~100%~~
LED Exit Signs	603,599	558,875~~634,030~~	93%~~105%~~	69	79~~89~~	115%~~129%~~	79~~89~~	115%~~129%~~
Occupancy Sensors	228,693	187,035~~212,761~~	82%~~93%~~	57	42~~47~~	73%~~82%~~	42~~47~~	73%~~82%~~

/A

Recessed Lighting	3,466,657	3,195,299~~3,626,739~~	92%~~105%~~	845	888~~997~~	105%~~118%~~	904~~1,016~~	107%~~120%~~
Smart Thermostat	1,008,250	1,008,250~~1,008,250~~	100%~~100%~~	18,439	18,439~~18,439~~	100%~~100%~~	18,439~~18,439~~	100%~~100%~~
Specialty Lights	394,961	366,260~~416,116~~	93%~~105%~~	119	128~~143~~	107%~~120%~~	130~~146~~	109%~~122%~~
Tune-up	563,167	563,167~~563,167~~	100%~~100%~~	10,137	10,137~~10,137~~	100%~~100%~~	10,137~~10,137~~	100%~~100%~~
VSD	626,444	626,444~~626,444~~	100%~~100%~~	12,014	12,014~~12,014~~	100%~~100%~~	12,014~~12,014~~	100%~~100%~~
Grand Total	**46,571,185**	**42,852,171~~46,888,802~~**	**92%~~101%~~**	**51,433**	**49,640~~50,696~~**	**97%~~99%~~**	**49,383~~50,267~~**	**96%~~98%~~**

Source: Guidehouse analysis, values subject to rounding

The following sections provide more details on the results, the methodology, and findings for the DEC and DEP impact evaluation.

3.2 Impact Evaluation Methodology

Guidehouse conducted an engineering-based analysis using standard savings algorithms to estimate the energy and demand impacts achieved by the program. The analysis was informed by virtual verification to validate measure quantities and characteristics as compared with information in the program tracking data. Additionally, Guidehouse reviewed relevant engineering parameters, such as HVAC interactive effects, and incorporated updates using the NEEP Mid-Atlantic TRM, participant virtual verification of heating fuel types, ~~-~~and 2016 Guidehouse logger analysis. The following subsections describe the methodology used for each element of this process, and the results are discussed in detail in Section 3.3.

3.2.1 Deemed Savings Review

Guidehouse conducted a deemed savings review to evaluate the energy and demand impacts reported in the tracking database for each measure type and category. Guidehouse evaluated all program measures and supporting data parameters. During the time period covered by this evaluation cycle, Lime Energy was the implementation contractor.

Guidehouse conducted a detailed review of the tracking data and impact estimates included within the documents provided by Duke Energy. Guidehouse replicated impact estimates using engineering calculations based on algorithms provided by Lime Energy and using measure parameters from the tracking data where available. Guidehouse also calculated preliminary ex post impacts for lighting measures that included basic modifications to include HVAC interactive effects and coincidence factors[4]. Based on these ex post impacts, Guidehouse calculated an "Engineering Review (ER)" verified realization rate which is the ratio of the savings calculated through the deemed savings review and the reported savings. See Section 3.3.1 for more information and findings from the deemed savings review.

[4] HVAC interactive effects in the savings calculations for indoor lighting measures were sourced from the NEEP Mid-Atlantic TRM and were based on building type and heating fuel type. The TRM interactive factors are weighted by the heating system fuel type multipliers derived from the participant virtual verification survey.~~, with an assumption of AC and non-electric heating to be conservative~~

3.2.2 Sample Design

The participation data provided by Duke Energy indicated that the vast majority of energy savings are from lighting measures, with a small contribution of energy savings from refrigeration and HVAC measures. Guidehouse analyzed the program tracking data to characterize the trends in equipment and project size. Similar to previous evaluation cycles, Guidehouse stratified the evaluation sample by project size for lighting and grouped together refrigeration and HVAC measures. This allowed for a proper assessment of a range of projects while maximizing the proportion of total program savings that is represented by the evaluation. It should be noted that for calculations and reporting, HVAC and refrigeration measures were separated out of their combined strata.

Guidehouse used a combined sampling approach but considered strata-level characteristics of each jurisdiction. The combined sample design for both jurisdictions can be seen in Table 3-7 below. The original launch of the virtual verification did not produce the adequate amount of responses to fit the sample design, so more projects were needed to be added to the sample.

In addition to working with the Lime Energy database to create the sample population, the file was analyzed to create reported quantity totals for the lighting, HVAC, and refrigeration measures. This allowed the virtual verification to ask customers to confirm the quantity installed or provide a reason for a different verified quantity value.

Guidehouse targeted a 90/10 sampling confidence and relative precision for virtual verification at the program level. This expected sample size was approximately 107 projects for verification, seen in the tables below. This was based on a coefficient of variation of 0.5 for all strata, found in past field verification activities for this program. Guidehouse received a total of 90 completed impact surveys back from the sample, representing approximately 6,000 measures. The targeted sampling confidence and precision was 90 percent ± 10 percent, and the achieved was 90 percent ± 2.5 percent

Table 3-7 DEC Expected Sampling Summary

Stratum	Population Project Count	Verification Sample Size
Lighting Large	118	15
Lighting Medium	396	20
Lighting Small	1,969	21
HVAC and Refrigeration	1,065	51
Total	**3,548**	**107**

Source: Guidehouse analysis of DEC-DEP program tracking data

3.2.3 Virtual Verification

Guidehouse conducted verification for a sample of program participants to evaluate the consistency of measure characteristics with the program tracking database. Data collection was structured to gather the information necessary to inform the engineering algorithms used to estimate program impacts.

Guidehouse sent email invitations to a sample of participants. The virtual verification link was personalized so each participant only filled in the information relevant to their project. The virtual verification survey was designed to take about 15-20 minutes for a participant to complete while present at their project location. Participants received an incentive of $25-$50 to compensate them for the time required to complete the virtual verification.

Guidehouse conducted a soft launch of the virtual assessment for a smaller sample of customers to test the process and determine response rates. Early feedback allowed for adjustments to maximize responses. Participants received reminders to complete the assessment. Guidehouse monitored the progress of completes relative to targets and designed a back-up sample to receive invitations when targets were not being met by the initial sample.

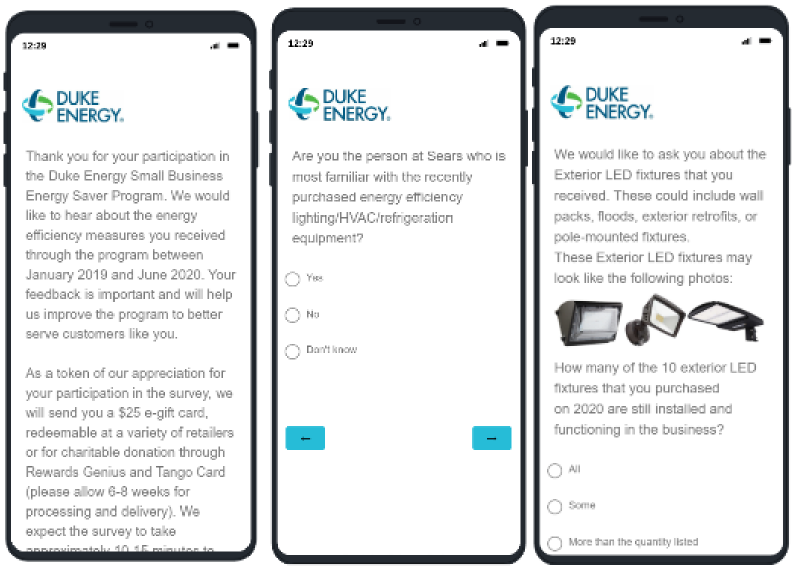
Guidehouse used the Qualtrics platform to create the virtual verification interface that participants used to collect key project information. The virtual verification requested photo documentation of certain project characteristics. Customers used a mobile device, such as a smartphone or tablet, to complete the verification process. The virtual verification included general questions about facility features and detailed questions about selected equipment.

Guidehouse asked questions about building HVAC characteristics, operating schedules, measure quantity, lamp/fixture wattage, and efficiency characteristics during the virtual verification. Due to the response rates for these various questions, Guidehouse only used verified measure quantities to update project savings. Guidehouse compared responses associated with heating and cooling system types and hours of operation to the database for consistency checks.

Figure 3-1 shows an example of the Qualtrics virtual verification platform. Participants used their mobile device to access the personalized link and open the interface in a web browser. In the equipment section, participants were prompted to upload pictures of the installed equipment using the camera on their mobile device. Guidehouse used a combination of participant-reported and documentation-based information to inform the verified energy and demand impact calculations.

/A

Figure 3-1 Virtual Verification Platform Example



Source: Guidehouse Virtual Verification Qualtrics Survey

Survey invitations were sent to 2,202 participants between 2/08/2021 and 3/05/2021, with multiple reminders and escalating incentives. This includes all participants who did not receive invites for the process survey. Guidehouse also contacted 150 customers via phone which resulted in 7 additional customers taking the virtual verification survey. Ultimately, 302 participants began the survey, and 90 participants completed the questions in entirety. The 90 completed virtual impact surveys represented almost 6,000 individual measures.

Table 3-8 shows the virtual verification response summary by measure and includes the reported and verified measure quantities.

Table 3-8 Virtual Verification Response Summary by Measure

Measure	Number of Responses by Measure*	Reported Measure Quantity	Verified Measure Quantity
Specialty Lamps	6	56	56
LED Tubes	76	5,127	5,115
Tune-up	9	28	28
Bay Lights	3	91	26
Lighting Controls and Exit Signs	18	116	115
A-Line Lamps	20	167	156
Exterior Lights	14	75	75
Recessed Lights	10	236	233
VSD	3	12	12
De-lamping	1	8	8
Anti-Sweat Heaters	1	5	5
ECM	7	49	49
LED Case Lighting	4	9	9
Total	**172**	**5,979**	**5,887**

Source: Guidehouse Virtual Verification
**Respondents often had multiple measure categories in their projects*

3.3 Impact Evaluation Findings

This section examines findings from the deemed savings review and discusses the main drivers of the savings realization rates. Guidehouse calculates the realization rate as the verified savings divided by the reported savings by measure, which is driven by a combination of the in-service rate, the HVAC interactive effects, and the coincidence factors, described as follows:

1. In-Service Rate (ISR) is the ratio of the verified (i.e., installed) quantity to the reported quantity from the program tracking data.

2. HVAC Interactive Effects are multipliers that reflect effects on space heating and cooling loads caused by a reduction in heat output from efficient lighting. HVAC interactive effects only impact lighting measures. Note that the implementer did not apply HVAC interactive effects for any measures, so this adjustment is equal to the average HVAC interactive effect itself. There are separate adjustments for energy savings and demand savings.

3. Coincidence Factor (CF) represents the portion of installed lighting that is on during the peak utility hours. This affects only demand reductions, not energy savings.

Overall, in-service rates tend to result in minor decreases to the verified energy savings, while HVAC interactive effects result in an increase in savings for lighting measures. Generally, the application of coincidence factor results in decreased demand savings for lighting measures.

3.3.1 Deemed Savings Review

Guidehouse reviewed the program tracking data provided by Duke Energy to assess program activity and the availability of key data fields necessary to support the evaluation. The pre- and post-retrofit measure descriptions summarize the equipment details for each line item in the database, and Guidehouse was able to identify the fields that correspond to ex ante (i.e., reported) energy and demand impacts.

The lighting controls, anti-sweat heater controls, LED case lighting, and refrigeration ECM motor measures were initially lacking information in the Lime Energy tracking data. Lime Energy then provided additional documentation to assist in the review of the program tracking data. Guidehouse used this to confirm that the Lime Energy lighting and refrigeration measure savings in the tracking data align with the algorithms from the New York and Pennsylvania Technical Reference Manuals, as in prior evaluations of this program.

Lime Energy also provided their HVAC measure deemed savings table and provided some background on how those values were developed.

3.3.1.1 Anti-Sweat Heater Controls

Lime Energy calculated the anti-sweat heater controls measure savings using the algorithms from the Pennsylvania TRM.

Refrigerator/Cooler

$$\mathrm{D}kWh_{per\ unit} = \frac{kW_{coolerbase}}{DoorFt} \times (8{,}760 \times CHA_{off}) \times \left(1 + \frac{R_h}{COP_{cool}}\right)$$

$$\Delta kW_{peak\ per\ unit} = \frac{kW_{coolerbase}}{DoorFt} \times CHP_{off} \times \left(1 + \frac{R_h}{COP_{cool}}\right) \times DF$$

Freezer

$$\mathrm{D}kWh_{per\ unit} = \frac{kW_{freezerbase}}{DoorFt} \times (8{,}760 \times FHA_{off}) \times \left(1 + \frac{R_h}{COP_{freeze}}\right)$$

$$\Delta kW_{peak\ per\ unit} = \frac{kW_{freezerbase}}{DoorFt} \times FHP_{off} \times \left(\frac{R_h}{COP_{freeze}}\right) \times DF$$

where:

N	= Number of doors or case length in linear feet having ASH controls installed
R_h	= Residual heat fraction; estimated percentage of the heat produced by the heaters that remains in the freezer or cooler case and must be removed by the refrigeration unit
$Unit$	= Refrigeration unit

8,760	= Hours in a year
$kW_{cooler\ base}$	= Per door power consumption of cooler case ASHs without controls
CHP_{off}	= Percent of time cooler case ASH with controls will be off during the peak period
CHA_{off}	= Percent of time cooler case ASH with controls will be off annually
DF_{cool}	= Demand diversity factor of cooler, accounting for the fact that not all anti-sweat heaters in all buildings in the population are operating at the same time.
COP_{cool}	= Coefficient of performance of cooler
$kW_{freezerbase}$	= Per door power consumption of freezer case ASHs without controls
FHP_{off}	= Percent of time freezer case ASH with controls will be off during the peak period
FHA_{off}	= Percent of time freezer case ASH with controls will be off annually
DF_{freeze}	= Demand diversity factor of freezer, accounting for the fact that not all anti-sweat heaters in all buildings in the population are operating at the same time.
COP_{freeze}	= Coefficient of performance of freezer

3.3.1.2 Electronically Commutated Motors

Lime Energy calculated the electronically commutated motor for Walk-In/Reach-In units measure savings using the algorithms from the New York TRM.

Annual Electric Energy Savings

$$\Delta kWh = \Delta kWh_{EFan} + \Delta kWh_{RH}$$

$$\Delta kWh_{EFan} = units \times \left(\frac{A_{EFan} \times V_{EFan} \times \sqrt{Phase_{EFan}}}{1{,}000}\right) \times F_{PA} \times F_{EFan} \times hrs_{EFan}$$

$$\Delta kWh_{RH} = \Delta kWh_{EFan} \times Comp_{Eff} \times 0.284$$

Summer Peak Coincident Demand Savings

$$\Delta kW = \Delta kW_{EFan} + \Delta kW_{RH}$$

$$\Delta kW_{EFan} = units \times \left(\frac{A_{EFan} \times V_{EFan} \times \sqrt{Phase_{EFan}}}{1{,}000}\right) \times F_{PA} \times F_{EFan} \times CF$$

$$\Delta kW_{RH} = \Delta kW_{EFan} \times Comp_{Eff} \times 0.284$$

where:

ΔkWh = Annual electric energy savings
ΔkW = Peak coincident demand electric savings
$\Delta therms$ = Annual gas energy savings
ΔkWh_{EFan} = Annual electric savings due to evaporator fan motor replacement
ΔkWh_{RH} = Annual electric savings due to reduced heat from evaporator fan motor replacement
ΔkW_{EFan} = Summer Peak Coincident Demand Savings due to evaporator fan motor replacement
ΔkW_{RH} = Summer Peak Coincident Demand Savings due to reduced heat from evaporator fan motor replacement
units = Number of measures installed under the program
A_{EFan} = Nameplate amperage of existing evaporator fan motor
V_{EFan} = Nameplate voltage of existing evaporator fan motor
$Phase_{EFan}$ = Phase of existing evaporator fan
1,000 = Conversion factor, one kW equals 1,000 W
F_{PA} = Power factor
F_{EFan} = Reduction of load by replacing evaporator fan motor
hrs_{EFan} = Evaporator fan annual operating hours
$Comp_{Eff}$ = Efficiency of the cooler/freezer compressor (kW/Ton)
0.284 = Conversion factor from kW to Tons of refrigeration (Tons/kW)
CF = Coincidence factor

3.3.1.3 Refrigerated LED Case Lighting

Lime Energy calculated the refrigerated LED case lighting measure savings using the algorithms from the New York TRM.

Annual Electric Energy Savings

$$\Delta kWh = \left(\frac{(W \times units)_{baseline} - (W \times units)_{ee}}{1,000}\right) \times hrs \times (1 + (Comp_{eff} \times 0.284))$$

Summer Peak Coincident Demand Savings

$$\Delta kW = \left(\frac{(W \times units)_{baseline} - (W \times units)_{ee}}{1,000}\right) \times CF \times (1 + (Comp_{Eff} \times 0.284))$$

where:

ΔkWh	= Annual electricity energy savings
ΔkW	= Peak coincident demand electric savings
Δtherms	= Annual gas energy savings
units	= Number of measures installed under the program
W	= Rated wattage of lamp or fixture (Watts)
baseline	= Baseline condition or measure
ee	= Energy efficient condition or measure
1,000	= Conversion factor, one kW equals 1,000 Watts
hrs	= Lighting operating hours
CF	= Coincidence factor
$Comp_{Eff}$	= Efficiency of the cooler/freezer compressor (kW/Ton)
0.284	= Conversion factor from kW to Tons of refrigeration (Tons/kW)

3.3.1.4 HVAC Measures Deemed Savings

Lime Energy worked with Duke Energy to determine the deemed savings for the HVAC measures: fan motor VSDs, HVAC tune-ups, and smart thermostats. For VSDs, Lime Energy provided engineering algorithm(s) used to calculate the energy savings values to support the determination of deemed savings values. For smart thermostats and HVAC tune-ups, deemed savings values were provided to Lime Energy. Lime Energy's regional adjustment methodology for smart thermostats and HVAC tune-ups used 5 years of cooling degree day comparisons with a base temperature of 60 degrees Fahrenheit. There was no adjustment for the VSD measure since VSDs have very little weather dependence.

Since Lime Energy worked with Duke Energy to develop the HVAC measures' deemed savings using regional data, we think the deemed savings values are appropriate and agree with their use.

3.3.1.5 Lighting Controls

Lime Energy also shared the following algorithm used to calculate the lighting control measure energy savings:

$$kWh = \left[kW_{before} * Qty_{before} * \left(Hours * (1 - ReductionFactor)\right)\right] - \left[kW_{after} * Qty_{after} * \left(Hours * (1 - ReductionFactor)\right)\right]$$

The ReductionFactor variable Lime Energy used is equal to 0.3. Guidehouse was unable to replicate the lighting control savings since baseline wattage data was not provided.

3.3.1.6 Lighting Measures

As outlined in previous EM&V reports and in following the best practices for commercial lighting impact verification, Table 3-9 shows the algorithms used by Guidehouse to calculate the savings for the lighting measures. These algorithms are similar to those commonly found in technical reference manuals for commercial lighting measures and match the methodology outlined in the New York TRM. Lime Energy followed similar algorithms to calculate lighting measure savings but did not include HVAC interactive effects or coincidence factors (for demand savings only). A discussion on each impact parameter is included after the table.

Table 3-9 Engineering Algorithms for Lighting Measures

Measure	Energy Savings Algorithm	Coincident Peak Demand Savings Algorithm
Lighting Measures	$kWh = ISR * \frac{(W_b * Qty_b) - (W_{ee} * Qty_{ee})}{1000} * HOU * IF\_Energy$	$kW = ISR * \frac{(W_b * Qty_b) - (W_{ee} * Qty_{ee})}{1000} * CF * IF\_Demand$
ISR = in-service rate*		
Qty_b = baseline quantity of equipment		
Qty_ee = efficient quantity of equipment		
HOU = operating hours		
Watts_b = baseline watts		
Watts_ee = efficient watts		
CF = coincidence factor		
IF_Energy = heating, ventilating, and air conditioning (HVAC) interaction factor for energy savings calculations		
IF_Demand = interaction factor for demand savings calculations		

**Guidehouse did not apply an ISR to the preliminary ex post impacts. ISRs were applied based on findings from evaluation activities. Source: Guidehouse analysis*

Baseline and Efficient Wattage

Based on the measure descriptions in the tracking database, estimates for baseline and efficient wattage appeared to be reasonable and are likely accurate records of project equipment and specifications. The virtual verification survey supported the wattage information provided in the tracking database, as a small subset of respondents provided wattage information.

HVAC Interactive Effects for Energy and Demand

The HVAC interactive effects represent additional HVAC impacts due to changes in heating and cooling load for lighting measures located in conditioned spaces. The tracking databases did not apply HVAC interactive effects for any lighting measures. Guidehouse applied~~, which resulted in~~ adjustments to the energy and demand savings during Guidehouse' s engineering review. The HVAC Interactive effects by building type as presented in Table 3-12~~Table 3-6~~ were applied from the NEEP Mid-Atlantic TRM to the verified savings as calculated from the engineering review and adjusted by virtual verification findings on heating and cooling system fuel types. ~~.~~

Coincidence Factor (CF)

The tracking database included a single demand savings field for lighting measures, which does not incorporate a coincidence factor. Guidehouse interpreted the demand impacts in the tracking data as non-coincident impacts, and the evaluation incorporated summer and winter coincidence factors to calculate kW impacts for reporting purposes. Table 3-13~~Table 3-7~~ and Table 3-14~~Table 3-8~~ present the summer and winter peak coincident factors that were used in the calculation of the verified demand savings stemming from the engineering review.

/A

3.3.2 HVAC Interactive Effects

HVAC interactive effects are the lighting-HVAC interaction factors that represent the reduced space cooling requirements due to the reduction of waste heat rejected by efficient lighting. Because of this, HVAC interactive effects are not applicable to exterior lighting measures. Note that the implementor did not apply HVAC interactive effects for any of the lighting measure savings~~s~~ claimed in the program year. The HVAC interactive effects shown in Table 3-10 are sourced from Appendix E (Commercial & Industrial Lighting Waste Heat Factors) in the NEEP Mid-Atlantic TRM and are based on building type[5]. The TRM interactive effects by fuel types were adjusted after analyzing participant response of their facility's heating and cooling system fuel types from the virtual verification survey (64 of the 90 respondents as shown in Table 3-11). Guidehouse then determined the multiplier factors shown in Table 3-12 and applied them to the TRM factors to get the weighted HVAC interactive effects in Table 3-13.

Field Code Changed

The evaluation team applied the weighted HVAC interactive effects to both the energy and demand savings calculations for the interior lighting measures. The HVAC interactive effects adjustment is between 0.89~~1.00~~ and 0.97~~1.10~~ for energy and 1.1~~0~~0 and 1.28~~44~~ for demand.

Table 3-10 NEEP Mid-Atlantic TRM HVAC Interactive Factors

Building Type	Demand Waste Heate Factor (WHFd)		Annual Energy Waste Heat Factor by Cooling/Heating Type (WHFe)				
	AC (Utility)	AC (PJM)	AC/Non Elec	AC/Elec Res	Heat Pump	NoAC/Ele cRes	NoAC/Non Elec
Office	1.36	1.32	1.10	0.85	0.94	0.75	1.00
Retail	1.27	1.26	1.06	0.83	0.95	0.77	1.00
School	1.44	1.44	1.10	0.81	0.96	0.71	1.00
Warehouse	1.23	1.24	1.02	0.75	0.89	0.73	1.00
Other	1.35	1.33	1.08	0.82	0.93	0.74	1.00

Source: NEEP Mid-Atlantic TRM (v10).

Table 3-11 Virtual Verification Responses on Heating and Cooling System Fuel Types

Response	Response Option	Count	97 Other - Response Count	Total Count
1	Gas Heating with AC	26		26
2	Gas Heating with no AC	3	1	4
3	Electric Heating with AC	23	1	24
4	Electric Heating with no AC	1	1	2
5	Heat Pump heating and cooling	7		7
	No heating and cooling	0	1	1

[5] NEEP TRM (April 2020, v10), https://neep.org/sites/default/files/media-files/trmv10.pdf . The HVAC interactive effects (or waste heat factors) used are for Maryland buildings.~~with AC and non-electric heat.~~

Source: DEC-DEP 2020-2021 virtual verification survey data analysis.

Table 3-12 HVAC Interactive Effects Multipliers from the Participant Virtual Verification~~NEEP Mid-Atlantic TRM~~

Heating Responses	Total	AC/NonElec	AC/ElecRes	Heat Pump	NoAC/ElecRes	NoAC/NonElec
Count	63	26	24	7	2	4
Weights	_	41%	38%	11%	3%	6%

Cooling Responses	Total	AC	No AC
Count	64	57	7
Weights	_	89%	11%

Source: DEC-DEP 2020-2021 virtual verification survey data analysis.

Table 3-13 Weighted HVAC Interactive Effects ~~Multipliers from the NEEP Mid-Atlantic TRM~~

Building Type	TRM Values Weighted by Survey Heating Fuel Type WHFe	TRM Values Weighted by Survey Cooling Fuel Type WHFd
Office	0.97	1.21
Retail	0.95	1.13
School	0.96	1.28
Warehouse	0.89	1.10
Other	0.95	1.20

Source: NEEP Mid-Atlantic TRM Lighting HVAC interactive factors weighted by participant survey HVAC interactive multipliers in Table 3-12~~1~~.

~~Building Type~~	~~WHFe~~	~~WHFd~~
~~Office~~	~~1.10~~	~~1.36~~
~~Retail~~	~~1.06~~	~~1.27~~
~~School~~	~~1.10~~	~~1.44~~
~~Warehouse~~	~~1.02~~	~~1.23~~
~~Other~~	~~1.08~~	~~1.35~~

HVAC interactive effects and coincidence factors are the main reason for discrepancy between the reported and verified savings in interior lighting measures. The addition of HVAC interactive effects to the energy savings calculations resulted in a decrease~~n increase~~ of energy savings. The addition of the HVAC interactive effects to the demand savings resulted in an increase in demand savings but the gains were offset by the application of demand coincidence factors, which resulted in overall a lower demand savings.

3.3.3 Coincidence Factors

To develop summer and winter coincidence factors for the lighting measures, Guidehouse used findings from the lighting logger measurements conducted during the 2016 DEC-DEP evaluation. Coincidence factors account for the fact that not all lights are on for the duration of the peak demand period. Coincidence factors range from 0.0 and 1.0, based on measure type, and are detailed in Table 3-14~~Table 3-11~~ below. The implementer did not apply coincidence factors to the demand savings for lighting measures. LED exit signs that are on all day receive a summer and winter coincidence factor on 1.0, while exterior lights receive a summer coincidence factor of 0.0 and winter coincidence factor of 1.0.

Lighting controls have a separate set of coincidence factors based on building type, similar to the HVAC interactive effects. There coincidence values come from the NEEP Mid-Atlantic TRM Appendix E (Commercial & Industrial Lighting Waste Heat Factors) and can be found in Table 3-15~~Table 3-12~~.

Table 3-14 Summer and Winter Coincidence Factors for Lighting Measures from DEC-DEP 2016 Logger Analysis

Measure	Summer Coincidence Factor	Winter Coincidence Factor
LED Exit Sign	1	1
A Line Lamp	0.914	0.931
Recessed Light	0.914	0.931
Specialty Light	0.914	0.931
LED Tube	0.802	0.619
High/low Bay	1	1
Delamping	0.902	0.664
Exterior Light	0	1

Source: DEC-DEP 2016 logger data analysis.

Table 3-15 Coincidence Factors for Lighting Controls from the NEEP Mid-Atlantic TRM

Building Type	Coincidence Factor
Office	0.70
Retail	0.83
School	0.35
Warehouse	0.80
Other	0.62

Source: NEEP Mid-Atlantic TRM

/A

3.3.4 Engineering Review (ER) Realization Rate

During the engineering review process, Guidehouse used the HVAC interactive effects as well as summer and winter peak coincident factors to adjust the deemed impacts.

On average the addition of HVAC energy interactive effects resulted in a~~n~~ ~~in~~decrease of ~~5~~4% in energy savings. The addition of HVAC demand interactive effects and coincidence peak demand factors resulted in a decrease of 3% in demand savings. ~~and 25% in demand savings. The addition of coincident peak demand factors resulted in an average decrease of 20% in summer peak demand savings and 25% in winter peak demand savings.~~

Table 3-16~~-~~ and Table 3-17 show the realization rates stemming from the engineering review for energy, summer peak and winter peak demand savings for each stratum.

Table 3-16 DEC Engineering Review (ER) Realization Rate

Stratum	Energy Realization Rate	Summer Peak Demand Realization Rate	Winter Peak Demand Realization Rate
Lighting Large	94%~~105%~~	86%~~97%~~	89%~~98%~~
Lighting Medium	95%~~106%~~	86%~~96%~~	88%~~97%~~
Lighting Small	95%~~106%~~	90%~~101%~~	84%~~93%~~
HVAC	100%~~100%~~	100%~~100%~~	100%~~100%~~
Refrigeration	100%~~100%~~	100%~~100%~~	100%~~100%~~
Total	**96%~~105%~~**	**97%~~100%~~**	**97%~~99%~~**

Source: Guidehouse Engineering Review

Table 3-17 DEP Engineering Review (ER) Realization Rate

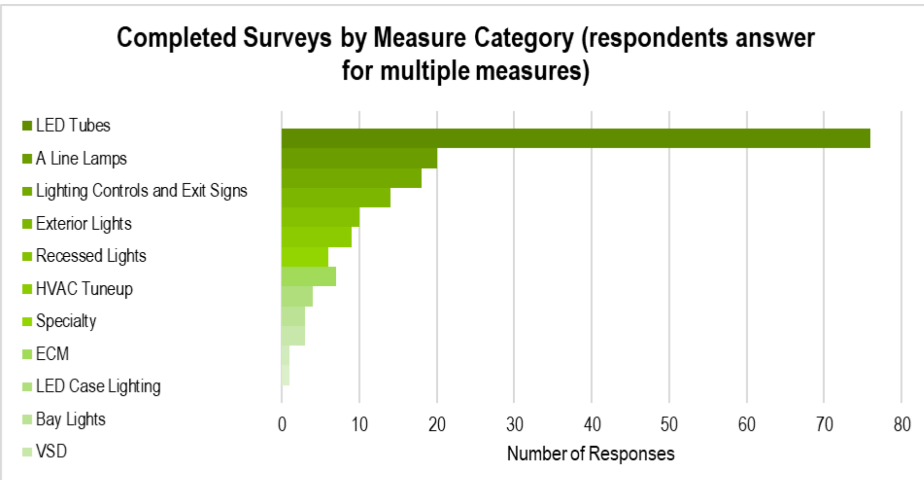
Stratum	Energy Realization Rate	Summer Peak Demand Realization Rate	Winter Peak Demand Realization Rate
Lighting Large	95%~~104%~~	78%~~88%~~	86%~~108%~~
Lighting Medium	95%~~106%~~	86%~~96%~~	87%~~99%~~
Lighting Small	95%~~107%~~	93%~~104%~~	81%~~87%~~
HVAC	100%~~100%~~	100%~~100%~~	100%~~100%~~
Refrigeration	100%~~100%~~	100%~~100%~~	100%~~100%~~
Total	**96%~~105%~~**	**97%~~99%~~**	**97%~~99%~~**

Source: Guidehouse Engineering Review

3.3.5 In-Service Rates (ISR)

Guidehouse analyzed the responses to the virtual verification survey to identify the verified quantities of equipment installed. Guidehouse calculated the ISR as a ratio between the findings from the virtual verification and the quantities reported in the program-tracking databases. As seen in Figure 3-2, Guidehouse received responses to questions representing the majority of program measure categories.

Figure 3-2 Survey Responses by Measure Category



Source: Guidehouse Virtual Verification

Table 3-18~~Table 3-15~~ shows the reported and verified quantities by stratum as collected from the virtual verification survey. Although the number of completed virtual assessments was slightly lower than Guidehouse' s target, this did not impact the precision goals of the evaluation. This is because in-service rates (ISR) at the site level were still extremely high within the sample group, with a 96% realization rate ISR from the survey alone. A table of ISR by stratum can be seen below in Table 3-19~~Table 3-16~~.

Table 3-18 Response Summary by Stratum

Stratum	Sample Size	Sample Reported Quantity	Sample Verified Quantity
Lighting Large	3	1,039	965
Lighting Medium	9	2,549	2,546
Lighting Small	53	2,288	2,273
HVAC	14	40	40
Refrigeration	11	63	63
Total	**90**	**5,979**	**5,887**

Source: Guidehouse Virtual Verification

Table 3-19 Verification Energy Realization Rate ISR

Stratum	ISR
Lighting Large	85%
Lighting Medium	100%
Lighting Small	100%
HVAC	100%
Refrigeration	100%
Total	**96%**

Source: Guidehouse Virtual Verification

As shown in Table 3-20~~Table 3-17~~ below, the ISR for each measure varied from 29% to 100%. The high/low bay lights measure had the lowest ISR of 29% while the rest of the measures had ISR between 93% and 100%. 11 out of the 13 measure categories had an ISR between 99% and 100%.

Table 3-20 Virtual Verification In-Service Rates Findings

Measure	ISR
Specialty Lamps	100%
LED Tubes	100%
Tune-up	100%
Bay Lights	29%
Lighting Controls and Exit Signs	99%
A-Line Lamps	93%
Exterior Lights	100%
Recessed Lights	99%
VSD	100%
De-lamping	100%
Anti-Sweat Heaters	100%
ECM	100%
LED Case Lighting	100%

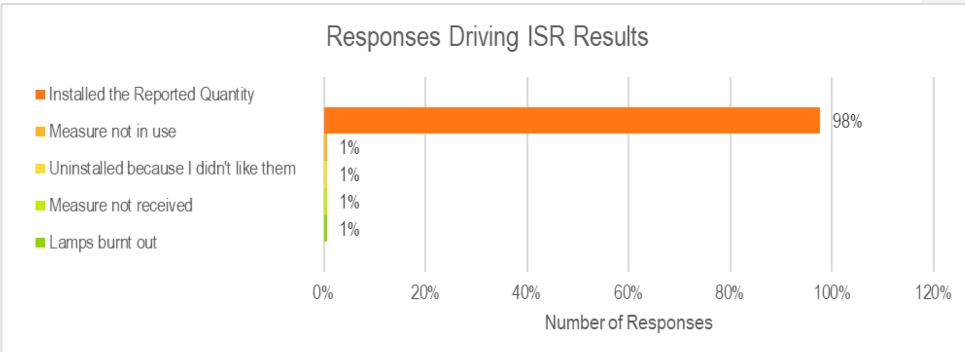
Source: Guidehouse Virtual Verification

**90 virtual verification surveys were completed, with respondents answering questions about multiple measures*

The majority of respondents (98%) reported that they installed the quantity of their measure that was reported in the program tracking data, as shown in Figure 3-3. Four percent of the respondents said that the quantities reported in the program tracking data for their measure were either no longer installed or were never installed. One percent of respondents said the measure is no longer in use, with no further explanation. One percent of respondents said they uninstalled the measure because they didn't like it. One percent said they never received the measure and the last 1% said their lamps burnt out, so they are no longer installed.

Overall, the ISR values are high and indicate the program is accurately tracking installed measures. Additionally, even though the ISRs decreased for some measures, overall energy savings increased through the application of HVAC interactive effects that were added in during the engineering review. The lighting large strata was the only strata that saw an overall decrease in energy savings due to the ISR.

Figure 3-3 Responses Driving ISR Results



Source: Guidehouse Virtual Verification

3.1 Verified Realization Rates based on ISR and ER

This section presents the overall realization rates based on verified gross savings, separated out by jurisdiction. This process includes merging the realization rates calculated based on the engineering review and in-service rates from the virtual verification assessments.

Table 3-21~~Table 3-18~~ presents the overall realization rates for DEC, and Table 3-23~~Table 3-20~~ presents the DEP overall realization rates. Table 3-22~~Table 3-19~~ and Table 3-24~~Table 3-21~~ present the realization rates by end use for DEC and DEP respectively. As mentioned in earlier sections, the virtual verification assessments were used to determine in-service rates (ISRs) for each category. Guidehouse calculated separate impacts using an engineering review (ER) process that included applying algorithms from the New York and Pennsylvania TRMs and measure characteristics from the program tracking data. The total realization rates were obtained using both the verified quantity from the surveyed customers and the engineering review calculations. The ER energy realization rate was ~~105~~96% for DEC and DEP and the ISRs was 96%.

These realization rates were impacted by the interactive effects in the engineering review calculations. For both programs, these interactive effects ~~increased~~ decreased the verified savings below~~above~~ the reported savings, and the ISR from the virtual verification decreased the verified savings slightly to bring both realization rates to their final values of ~~100~~92% for both DEC and DEP~~and 101%~~. Figure 3-4 and Figure 3-5 show how each calculation method impacted the realization rate for each stratum, as well as the jurisdictions' overall realization rate.

Table 3-21 Energy Installation Rate by Strata – DEC

Stratum	ER	ISR	Total Energy Realization Rate
Lighting Large	94%~~105%~~	85%~~85%~~	80%~~89%~~
Lighting Medium	95%~~106%~~	100%~~100%~~	95%~~106%~~
Lighting Small	95%~~106%~~	100%~~100%~~	95%~~106%~~
HVAC	100%~~100%~~	100%~~100%~~	100%~~100%~~
Refrigeration	100%~~100%~~	100%~~100%~~	100%~~100%~~
Total	**96%~~105%~~**	**96%~~96%~~**	**92%~~100%~~**

Source: Guidehouse analysis, values subject to rounding.

Table 3-22 Energy Installation Rate by End Use – DEC

End Use	ER	ISR	Total Energy Realization Rate
Lighting Large	95%~~106%~~	96%~~96%~~	90%~~101%~~
HVAC	100%~~100%~~	100%~~100%~~	100%~~100%~~
Refrigeration	100%~~100%~~	100%~~100%~~	100%~~100%~~
Total	**96%~~105%~~**	**96%~~96%~~**	**92%~~100%~~**

Source: Guidehouse analysis, values subject to rounding.

Table 3-23. Energy Realization Rate by Strata – DEP

Stratum	ER	ISR	Total Energy Realization Rate
Lighting Large	95%~~104%~~	85%~~85%~~	80%~~89%~~
Lighting Medium	95%~~106%~~	100%~~100%~~	95%~~106%~~
Lighting Small	95%~~107%~~	100%~~100%~~	95%~~107%~~
HVAC	100%~~100%~~	100%~~100%~~	100%~~100%~~
Refrigeration	100%~~100%~~	100%~~100%~~	100%~~100%~~
Total	**96%~~105%~~**	**96%~~96%~~**	**92%~~101%~~**

Source: Guidehouse analysis, values subject to rounding.

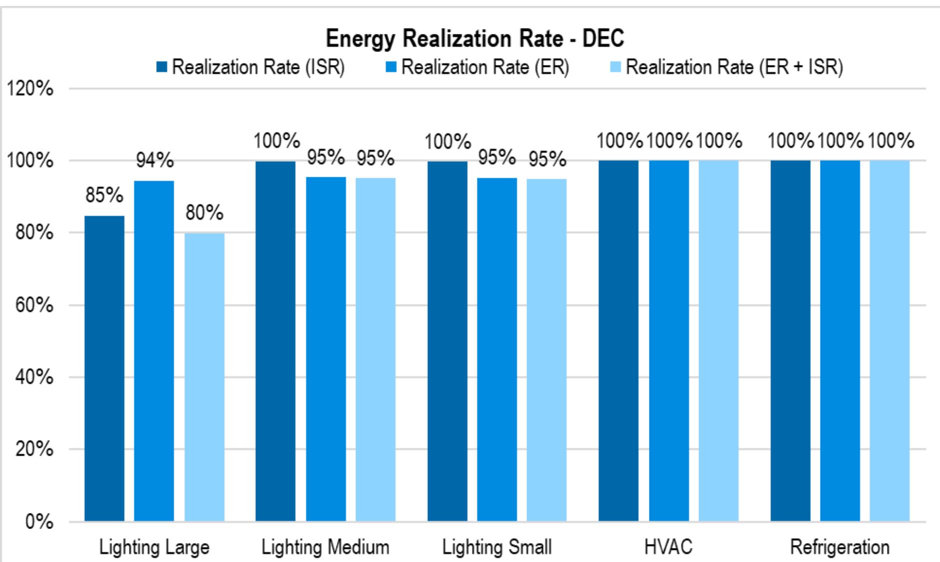
/A

Table 3-24 Energy Installation Rate by End Use – DEP

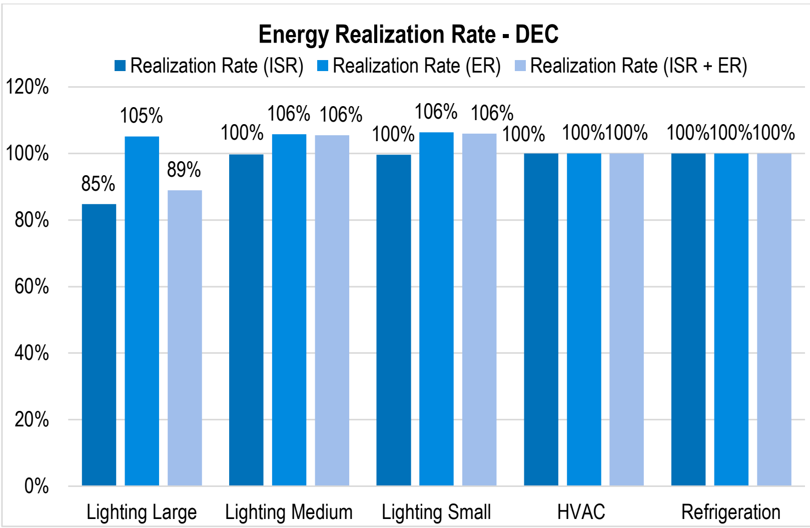
End Use	ER	ISR	Total Energy Realization Rate
Lighting	95%~~106%~~	96%	90%~~101%~~
HVAC	100%~~100%~~	100%~~100%~~	100%~~100%~~
Refrigeration	100%~~100%~~	100%~~100%~~	100%~~100%~~
Total	**96%~~105%~~**	**96%~~96%~~**	**92%~~101%~~**

Source: Guidehouse analysis, values subject to rounding.

Figure 3-4 Comparison of Energy Savings Realization Rates by Strata – DEC

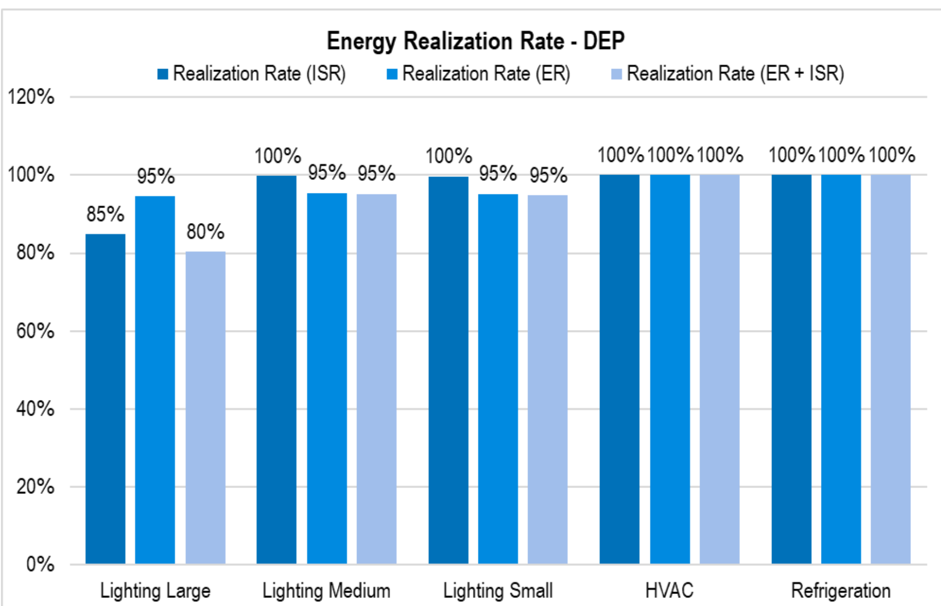


Source: Guidehouse analysis, values subject to rounding.

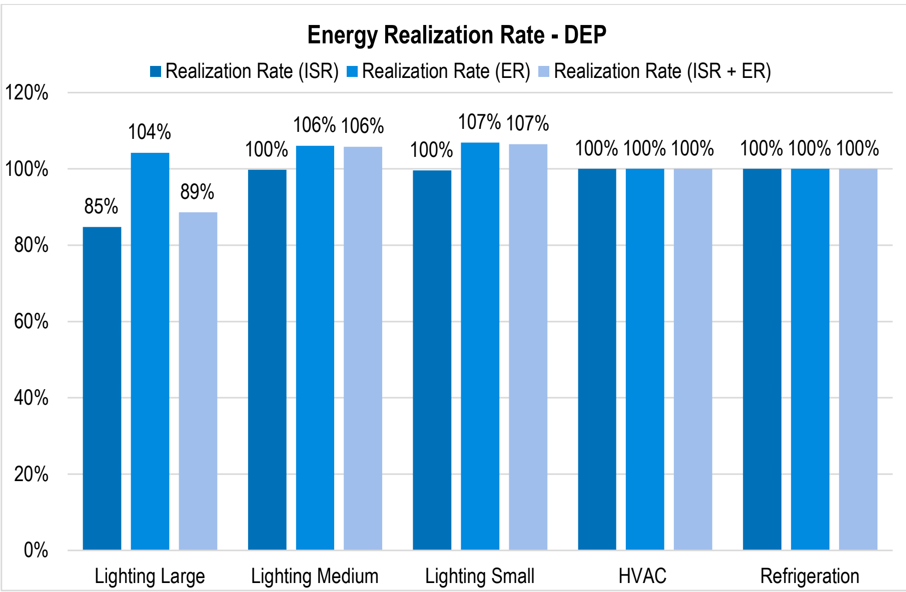


~~*Source: Guidehouse analysis, values subject to rounding.*~~

Figure 3-5 Comparison of Energy Savings Realization Rates by Strata – DEP



Source: Guidehouse analysis, values subject to rounding.



~~*Source: Guidehouse analysis, values subject to rounding.*~~

The summer and winter peak overall realization rates are shown in the tables below, broken out by jurisdiction. The in-service rates for DEC and DEP demand savings were relatively high at 99% for both summer and winter. The ER realization rates for summer and winter peak are impacted by the HVAC interactive effects and coincidence factors (summer and winter).The total realization rate combines these two verification savings methods. Table 3-25~~Table 3-22~~ to Table 3-32~~Table 3-29~~ below lay out the jurisdictions' realization rates by season, strata and end use.

For the DEC jurisdiction, the overall summer demand realization rate is ~~99~~97%. This is because the interactive effects and summer coincidence factors ~~increased~~ decreased ~~or held~~ the realization rate ~~close to 100%~~ while the verified quantities significantly reduced the Lighting Large realization rate, so the factors balanced each other out in the final realization rate. The jurisdiction's overall winter demand realization rate was ~~slightly~~ lower at 98% due to a stronger impact on the Lighting Small strata in addition to the summer realization rate's reasoning, resulting in an overall winter peak realization rate of ~~98~~96%. Figure 3-6 and Figure 3-8 show how each calculation method impacted the summer and winter realization rate for each of DEC's stratum, respectively.

The DEP jurisdiction has an overall summer demand realization rate of ~~99~~97% because the interactive effects, summer coincidence factors, and verified quantities once again balanced one another out. The ~~99~~97% comes from those interactive effects and coincidence factors having a slightly higher influence on the realization rates than the verified quantities. The jurisdiction's overall winter demand realization rate was ~~98~~96% because the winter demand coincidence factors decreased the Lighting strata's realization rates, producing a slightly lower overall winter

/A

peak realization rate. Figure 3-7 and Figure 3-9 show how the calculation methods impacted DEP's summer and winter realization rate for each stratum, respectively.

Table 3-25 Summer Peak Demand Realization Rates by Strata – DEC

Stratum	ER	ISR	Total Summer Demand Realization Rate (ER +ISR)
Lighting Large	86%~~97%~~	83%~~83%~~	72%~~80%~~
Lighting Medium	86%~~96%~~	100%~~100%~~	86%~~96%~~
Lighting Small	90%~~101%~~	100%~~100%~~	90%~~101%~~
HVAC	100%~~100%~~	100%~~100%~~	100%~~100%~~
Refrigeration	100%~~100%~~	100%~~100%~~	100%~~100%~~
Total	**97%~~100%~~**	**99%~~99%~~**	**97%~~99%~~**

Source: Guidehouse analysis, values subject to rounding.

Table 3-26 Summer Peak Demand Realization Rates by End Use – DEC

Stratum	ER	ISR	Total Summer Demand Realization Rate (ER +ISR)
Lighting	87%~~98%~~	96%~~96%~~	83%~~93%~~
HVAC	100%~~100%~~	100%~~100%~~	100%~~100%~~
Refrigeration	100%~~100%~~	100%~~100%~~	100%~~100%~~
Total	**97%~~100%~~**	**99%~~99%~~**	**97%~~99%~~**

Source: Guidehouse analysis, values subject to rounding.

Table 3-27 Summer Peak Demand Realization Rates by Strata - DEP

Stratum	ER	ISR	Total Winter Demand Realization Rate (ER +ISR)
Lighting Large	78%~~88%~~	83%~~83%~~	65%~~73%~~
Lighting Medium	86%~~96%~~	100%~~100%~~	85%~~96%~~
Lighting Small	93%~~104%~~	100%~~100%~~	92%~~104%~~
HVAC	100%~~100%~~	100%~~100%~~	100%~~100%~~
Refrigeration	100%~~100%~~	100%~~100%~~	100%~~100%~~
Total	**97%~~99%~~**	**99%~~99%~~**	**97%~~99%~~**

Source: Guidehouse analysis, values subject to rounding.

/A

Table 3-28 Summer Peak Demand Realization Rates by End Use – DEP

End Use	ER	ISR	Total Summer Demand Realization Rate (ER +ISR)
Lighting	86%~~97%~~	96%~~96%~~	83%~~93%~~
HVAC	100%~~100%~~	100%~~100%~~	100%~~100%~~
Refrigeration	100%~~100%~~	100%~~100%~~	100%~~100%~~
Total	**97%~~99%~~**	**99%~~99%~~**	**97%~~99%~~**

Source: Guidehouse analysis, values subject to rounding.

Table 3-29 Winter Peak Demand Realization Rates by Strata – DEC

Stratum	ER	ISR	Total Winter Demand Realization Rate (ER +ISR)
Lighting Large	89%~~98%~~	83%~~83%~~	74%~~81%~~
Lighting Medium	88%~~97%~~	100%~~100%~~	88%~~97%~~
Lighting Small	84%~~93%~~	100%~~100%~~	84%~~93%~~
HVAC	100%~~100%~~	100%~~100%~~	100%~~100%~~
Refrigeration	100%~~100%~~	100%~~100%~~	100%~~100%~~
Total	**97%~~99%~~**	**99%~~99%~~**	**96%~~98%~~**

Source: Guidehouse analysis, values subject to rounding.

Table 3-30 Winter Peak Demand Realization Rates by End Use – DEC

End Use	ER	ISR	Total Winter Demand Realization Rate (ER +ISR)
Lighting	87%~~96%~~	96%~~96%~~	83%~~91%~~
HVAC	100%~~100%~~	100%~~100%~~	100%~~100%~~
Refrigeration	100%~~100%~~	100%~~100%~~	100%~~100%~~
Total	**97%~~99%~~**	**99%~~99%~~**	**96%~~98%~~**

Source: Guidehouse analysis, values subject to rounding

Table 3-31 Winter Peak Demand Realization Rates by Strata – DEP

Stratum	ER	ISR	Total Winter Demand Realization Rate (ER +ISR)
Lighting Large	86%~~94%~~	83%~~83%~~	72%~~79%~~
Lighting Medium	87%~~95%~~	100%~~100%~~	86%~~95%~~
Lighting Small	81%~~91%~~	100%~~100%~~	81%~~90%~~
HVAC	100%~~100%~~	100%~~100%~~	100%~~100%~~
Refrigeration	100%~~100%~~	100%~~100%~~	100%~~100%~~
Total	**97%~~99%~~**	**99%~~99%~~**	**96%~~98%~~**

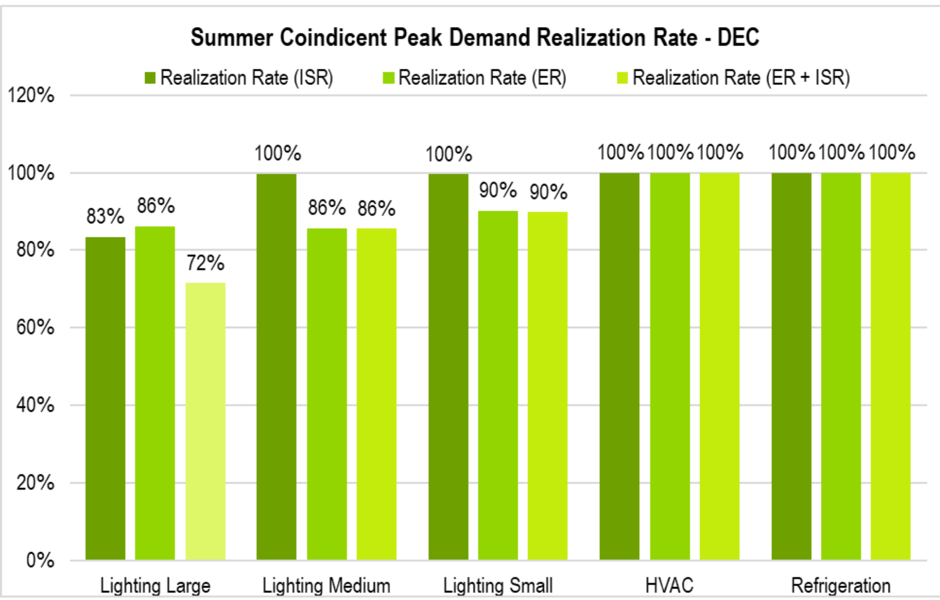
Source: Guidehouse analysis, values subject to rounding.

Table 3-32 Winter Peak Demand Realization Rates by End Use – DEP

End Use	ER	ISR	Total Winter Demand Realization Rate (ER +ISR)
Lighting	84%~~93%~~	96%~~96%~~	80%~~89%~~
HVAC	100%~~100%~~	100%~~100%~~	100%~~100%~~
Refrigeration	100%~~100%~~	100%~~100%~~	100%~~100%~~
Total	**97%~~99%~~**	**99%~~99%~~**	**96%~~98%~~**

Source: Guidehouse analysis, values subject to rounding

Figure 3-6 Comparison of Summer Peak Demand Savings Realization Rates by Strata – DEC



Source: Guidehouse analysis, values subject to rounding.

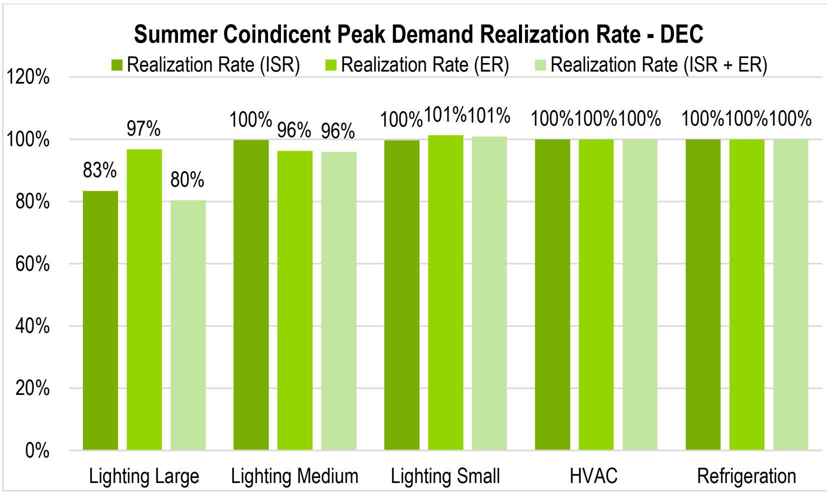
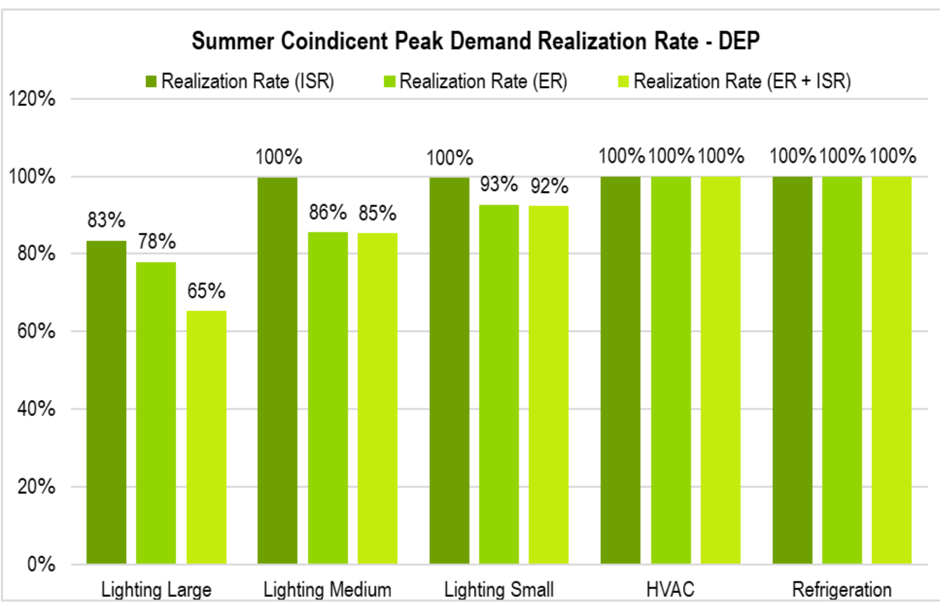


Figure 3-7 Comparison of Summer Peak Demand Savings Realization Rates by Strata – DEP



Source: Guidehouse analysis, values subject to rounding.

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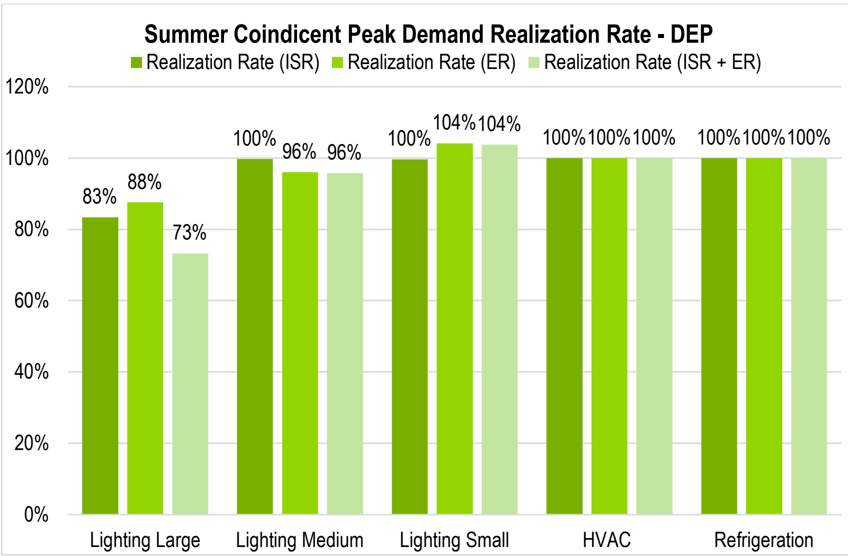
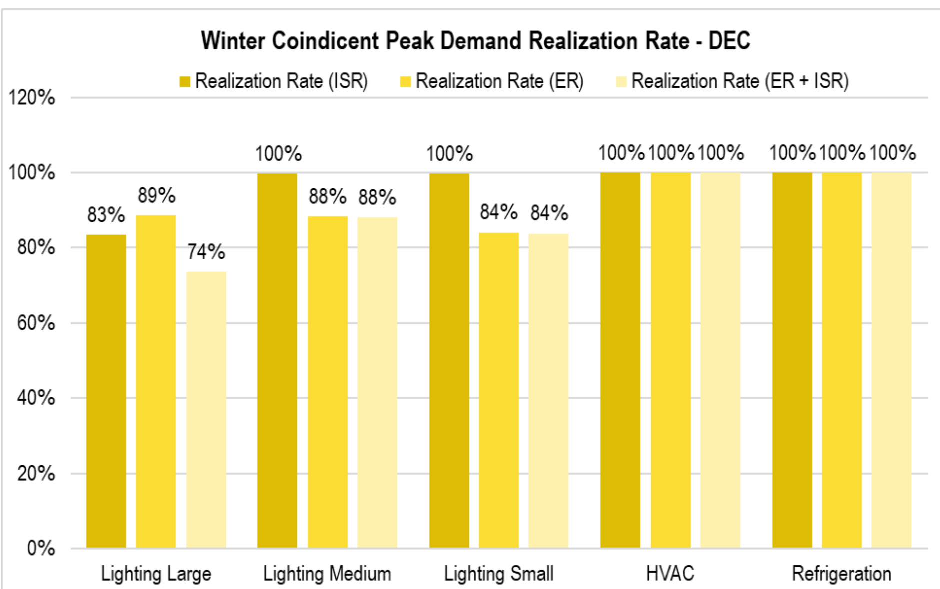
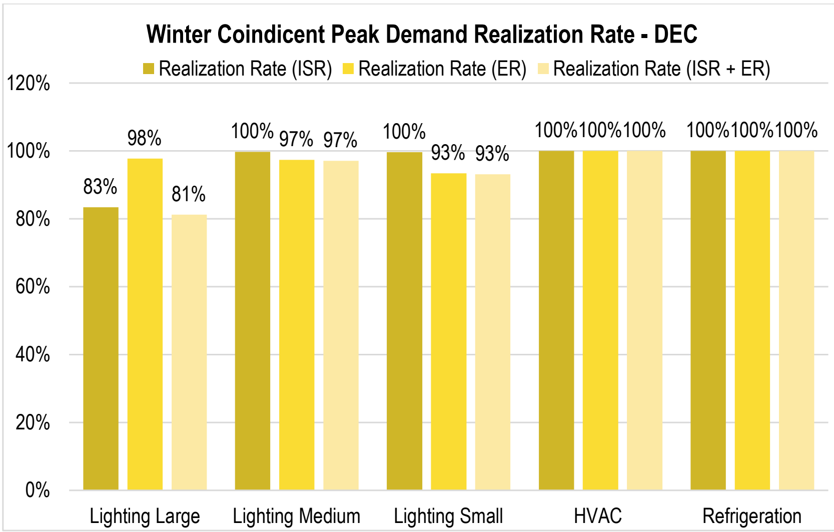


~~*Source: Guidehouse analysis, values subject to rounding.*~~

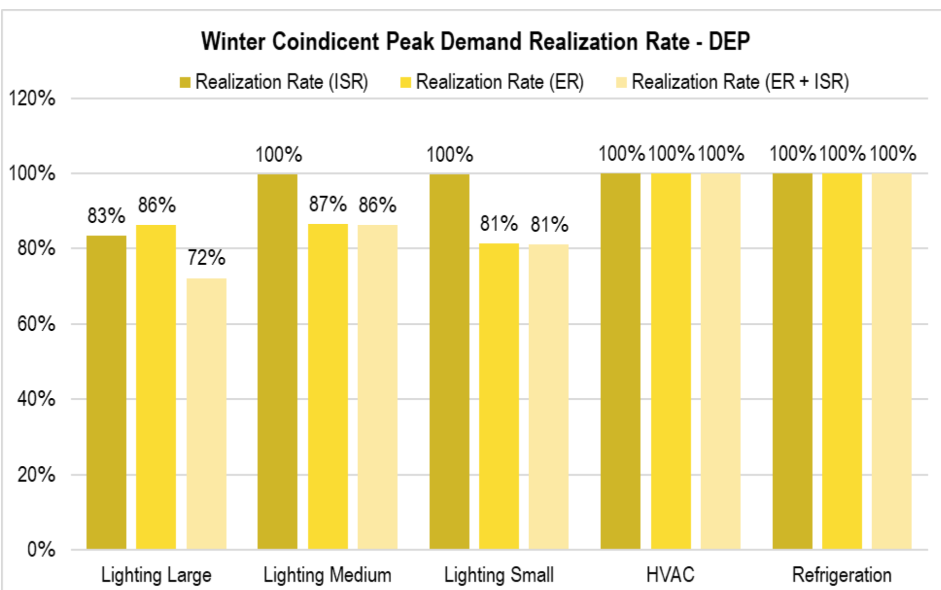
Figure 3-8 Comparison of Winter Peak Demand Savings Realization Rates by Strata – DEC





Source: Guidehouse analysis, values subject to rounding.

Figure 3-9 Comparison of Winter Peak Demand Savings Realization Rates by Strata – DEP



Source: Guidehouse analysis, values subject to rounding.

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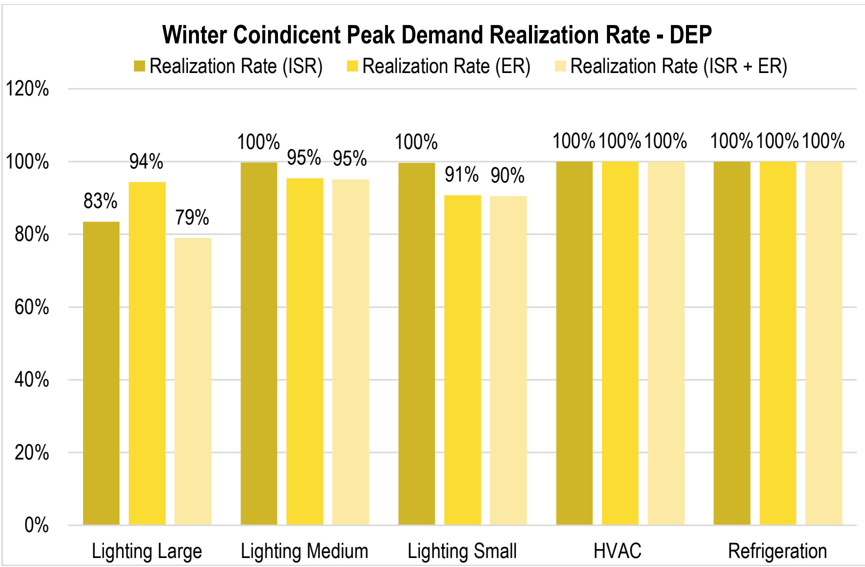


~~*Source: Guidehouse analysis, values subject to rounding.*~~

4. Process Evaluation

The purpose of the process evaluation is to understand, document and provide feedback on the program implementation components and customer experience.

4.1 Process Methodology

The evaluation team conducted in-depth interviews with SBES Program staff and implementation contractor (IC) staff as well as conducting customer participant surveys, as noted previously. The process findings summarized in this document are based on the results of:

- Participant surveys with 97 program participants.
- Program review, including interviews with the Duke Energy Program Manager and the IC staff; and a review of the program documentation.

Due to the COVID-19 pandemic, Guidehouse performed both the impact and process evaluation activities using online survey platforms, rather than prior evaluations where onsite field verification was used for the impact assessment. To accomplish the virtual assessments, Guidehouse randomly divided the population of participants into separate groups to receive invitations for process and impact-related surveys, such that participants would not be inundated with multiple requests. Email addresses were also not available for all participants. The response status of all process survey participants is outlined in Table 4-1.

Table 4-1. Response Status – Process Survey

Status	Number of Responses
Email Failed	325
Email Hard Bounce	11
Email Not Sent	35
Email Opened	1
Email Sent	536
Email Soft Bounce	15
Survey Finished	97
Survey Partially Finished	25
Survey Started	300
Total	**1,345**

Source: Guidehouse

4.2 Participant Survey

Guidehouse designed the surveys to ask specific questions about the program measure categories. The measure families as a part of this evaluation period are lighting, HVAC, and refrigeration. Participants received an email invitation to complete an online survey that was designed to collect detailed information about program experience and satisfaction. The survey was 15-20 minutes long and participants received an incentive of $10-$40 based on the timing of participation.

The survey effort successfully completed surveys with 97 customers to assess:

- Participation experience and satisfaction
- Participant channel and awareness
- Feedback about program components
- Program improvements
- Program benefits and challenges
- Satisfaction associated with implementation contractors
- Free-ridership, Inside and Outside Spillover

4.3 Program Review

The evaluation team designed the program review task to understand changes and updates to the program design, implementation and energy and demand savings assumptions. Guidehouse reviewed program literature and Duke Energy's website, interviewed the Duke Energy program team, and had several conversations with Lime Energy regarding the energy and demand savings included in the program tracking database. The key program characteristics include the following:

- **Program Design** – The SBES program is designed to offer high incentives (up to 80 percent of the total cost of the project) on efficient equipment to reduce energy use and peak demand. It specifically targets small business customers that are difficult to reach and often do not pursue energy efficiency on their own.
- **Program Implementation** – A third-party contractor, Lime Energy administers the SBES program on Duke Energy's behalf. The IC handles all aspects of the program, including customer recruitment, facility assessments, equipment installation (through independent installers contracted by the IC), and payment and incentive processing. The IC reports energy and peak demand reduction estimates to Duke Energy. The IC has continued to refine their processes to ensure that savings estimates are reasonable and customer complaints are handled in a timely manner.
- **Incentive Model** – The IC offers potential participants a recommended package of energy efficiency measures along with equipment pricing and installation costs. The incentive is proportional to estimated energy savings and can be as high as 80 percent of the total cost of the project.
- **Savings Estimates** – Energy and peak demand savings are estimated on a per-measure basis, considering existing equipment, proposed equipment, and operational characteristics unique to each customer.

4.4 Participant Survey Findings

The following sections detail the process findings from all relevant sources of program information, including interviews with Duke Energy and IC staff and the results of the customer surveys, organized by topic. The feedback received indicates that the SBES Program serves Duke Energy's customers well and represents an important component of Duke Energy's portfolio of business energy efficiency programs. Key findings are as follows:

- A majority of SBES participants were satisfied with the program. On a scale of 0 to 10, where 0 indicates “not satisfied at all” and 10 indicates “extremely satisfied”:
    - 82 percent of respondents indicated 8-10 for satisfaction with overall program experience.
    - 90 percent of respondents indicated 8-10 for satisfaction with Lime Energy
- Sixty-six percent of respondents stated that equipment offered through the program allowed them to upgrade all of the equipment they wanted at the time.
- Eighty-two percent of respondents mentioned that they are extremely likely to participate in this program or a similar Duke Energy program again.
- Sixty-three percent of respondents mentioned that that their attitude towards Duke Energy is more positive after participating in the program.
- Over Fifty percent of respondents stated that they had recommended the program to other businesses. On average, respondents recommended the program to an average of three other businesses.

The following sections details the process findings and addresses the following topics:

1. Overall customer experience.
2. Implementation contractor.
3. Program challenges.
4. Program benefits.
5. Suggested improvements.

4.4.1 Customer Experience

Customers reported very high satisfaction with their overall program experience as shown in Figure 4-1. Only four percent of the participants rated their overall satisfaction as less than 5, and 82% rated their satisfaction as an 8, 9, or 10.

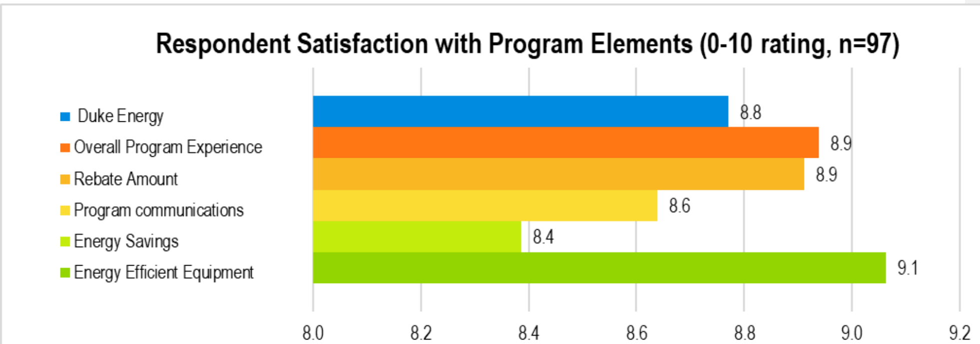
Guidehouse identified some correlations with overall program satisfaction that provide insight into drivers of high satisfaction:

- Customers with overall high program satisfaction were more satisfied on average with every program element, but the difference was particularly noticeable on two program elements:
    - **The energy savings resulting from the new equipment**: highly satisfied customers gave an average rating of 9.4 vs 4.9 among less satisfied customers. Five respondents mentioned that they have not seen any significant savings from the new equipment which is why they provided a lower rating.
    - **Program communications**: highly satisfied customers gave an average rating of 9.4 vs 5.7 among less satisfied customers. Three respondents mentioned that there could be clearer communication between their internal team and Duke Energy.

Around **63%** respondents mentioned that their attitude towards Duke Energy is more positive after participating in the program. These findings indicate both high program satisfaction and an opportunity to continue to market energy efficiency programs to previous participants to achieve deeper savings.

Participation in the SBES program generally served to improve customers' satisfaction with Duke Energy overall.

Figure 4-1. Program Satisfaction (n=97)



Source: Guidehouse analysis

4.4.2 Implementation Contractor

As mentioned in the previous section, customers are highly satisfied with the services provided by the implementation contractor, Lime Energy and that high satisfaction translates to high overall program satisfaction.

Nearly all (97%) said that the proposal was clear about the scope of work to be performed, and 99% of customers said that the proposal was clear about their share of project costs.

A large majority (89%) of customers said they knew who to contact if they had any questions or concerns about their project or any aspect of the program.

Respondents report high level of satisfaction with all different aspects of project implementation from the first assessment of energy efficiency at the project site to post installation clean-up as shown in Figure 4-2. 90% of respondents rated their satisfaction with different aspects of the project implementation at an 8 or higher, on a scale of 0 to 10.

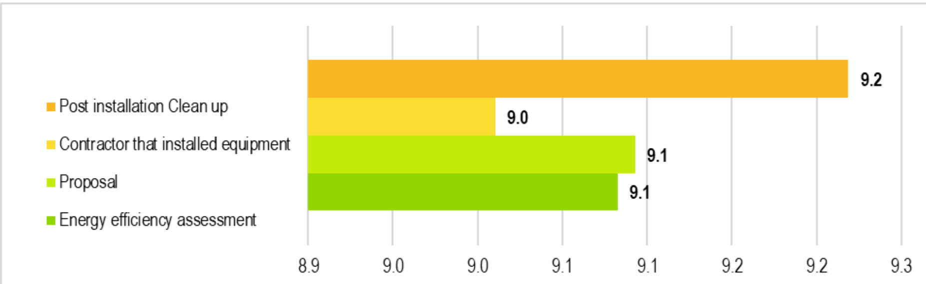
Some verbatim responses from the respondents supporting the high satisfaction:

"The program was excellent and allowed me to afford
the upgrade of lighting in my store. It has cut my monthly bill by every bit of the projection I was given. I am very thankful. Thank you!"

"They worked very well during COVID19 restrictions"

“It was fantastic. I recommended this service to a friend who is also a business owner and he did it as well and was equally thrilled.”

Figure 4-2. Implementer and Contractor Satisfaction (n=97)



Source: Guidehouse analysis

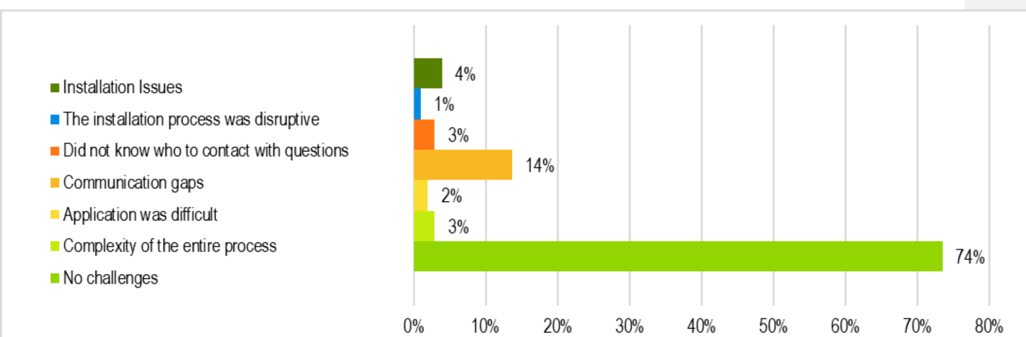
Customers are highly satisfied with the energy efficiency assessment conducted by Lime Energy as well as the proposal prepared by Lime Energy, with 90% rating their satisfaction as an 8 or higher for both program elements.

A similar percentage of customers, 89% rated their satisfaction with the inspection as an 8 or higher with the post installtion cleanup conducted by Lime Energy. Only one customer rated this aspect less than 5 out of 10.

4.4.3 Program Challenges

As seen in Figure 4-3, almost 74% of respondents did not experience any challenges with different program components. Fourteen respondents mentioned that there were communication gaps between Duke Energy, the implementation team and their internal team. Four respondents mentioned that installations of measures was not correct or incomplete. Five respondents mentioned that the application was difficult, and the process was too complex. Only one respondent mentioned that that the installation process was disruptive to their work.

Figure 4-3:Program Challenges/Drawbacks, (n=97)



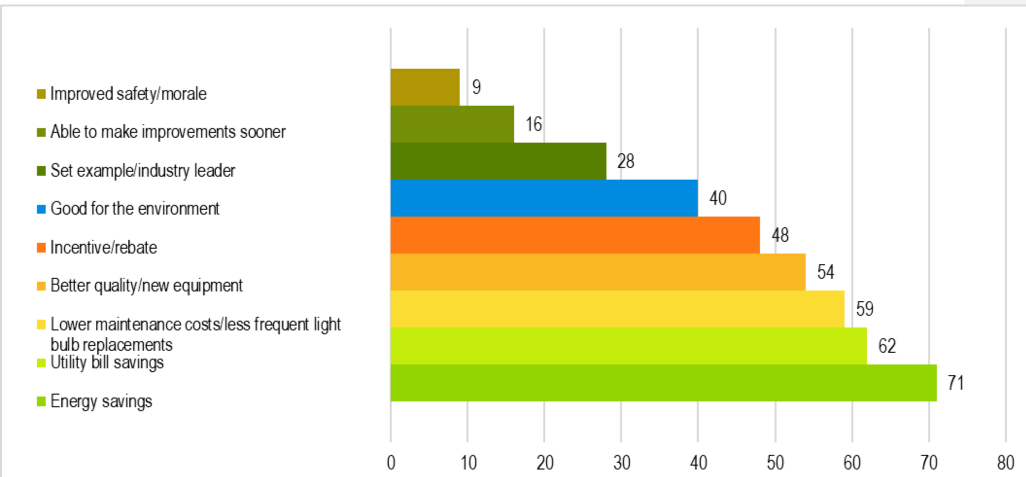
Source: Guidehouse analysis

4.4.4 Program Benefits

As shown in Figure 4-4, a majority of customers identified the energy savings and associated utility bill savings as the top benefit of participating in the SBES program. Better quality equipment and lower maintenance hassle were also significant benefits to many customers. Another important survey finding was that 66 percent of customers stated that the equipment offered through the program allowed them to upgrade all of the equipment they wanted at the time of the project, rather than piecing together the upgrades in multiple phases.

Majority of respondents (82%) mentioned that they are extremely likely to participate in this program or a similar Duke Energy program again.

Figure 4-4:Program Benefits, (n=97)

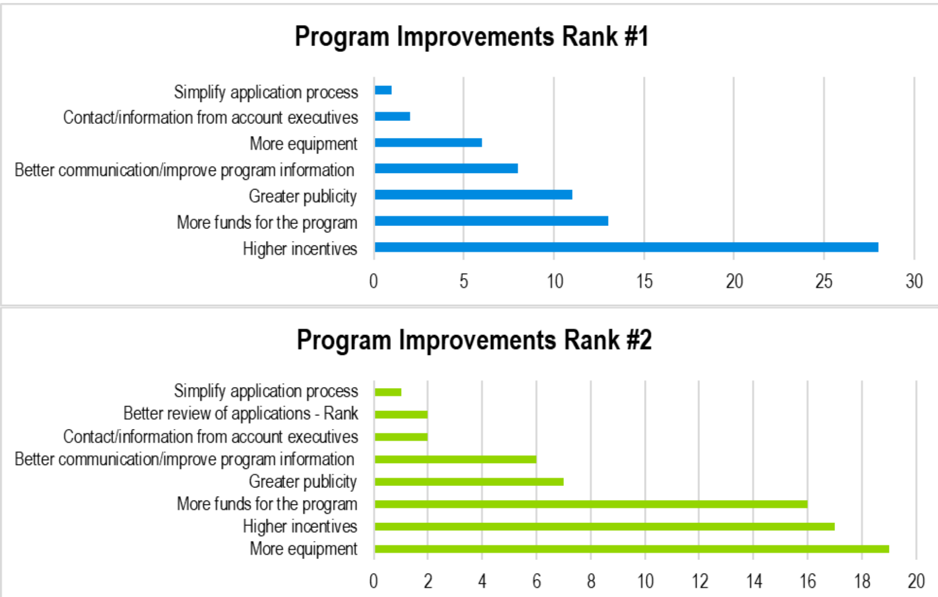


Source: Guidehouse analysis

4.4.5 Suggested Improvements

Overall program satisfaction is very high, but some customers had minor complaints or identified drawbacks of the program. Guidehouse asked respondents to rank the top 3 program improvements they would like to see in future programs. The two charts in Figure 4-5 show the different program improvements and how they were ranked by the respondents. As expected, higher incentive was ranked as the #1 program improvement requested by the majority of the respondents. More choice of equipment/measures and more funds for the program was the second and third highest ranked improvement requested by majority of the respondents.

Figure 4-5:Program Improvements



Source: Guidehouse analysis

5. Net-to-Gross Analysis

The impact analysis described in the preceding sections addresses *gross program savings*, based on program records, modified by an engineering review and virtual verification of measure installations. *Net savings* incorporate the influence of free ridership (savings that would have occurred even in the absence of the program) and spillover (additional savings influenced by the program, but not captured in program records) and are commonly expressed as a NTG ratio applied to the verified gross savings values.

Table 5-1 shows the results of Guidehouse' s NTG analysis. In aggregate, the NTG results are very similar to findings from the prior evaluation.

Table 5-1. 2019-2020 Net-to-Gross Results

	Lighting	Refrigeration	HVAC	Lighting, HVAC & Refrigeration
Estimated Free Ridership	0.06	0.14	0.01	0.06
Estimated Spillover	0.08	0.08	0.06	0.07
Estimated NTG	**1.02**	**0.94**	**1.05**	**1.02**

Source: Guidehouse analysis, totals subject to rounding.

This report provides definitions, methods, and further detail on the analysis and findings of the net savings assessment. The discussion is divided into the following three sections:

- Defining free ridership, spillover, and net-to-gross (NTG) ratio
- Methods for estimating free ridership and spillover
- Results for free ridership, spillover, and NTG ratio

5.1 Defining Free Ridership, Spillover, and Net-to-Gross Ratio

The methodology for assessing the energy savings attributable to a program is based on a NTG ratio. The NTG ratio has two main components: free ridership and spillover.

Free ridership is the share of the gross savings that is due to actions participants would have taken even in the absence of the program (i.e., actions that the program did not induce). This is meant to account for naturally occurring adoption of energy efficient technology. The SBES program covers a range of energy efficient lighting and refrigeration measures and is designed to move the overall market for energy efficiency forward. However, it is likely that some participants would have wanted to install, for various reasons, some high efficiency equipment (possibly a subset of those installed under the SBES Program), even if they had not participated in the program or been influenced by the program in any way.

Spillover captures program savings that go beyond the measures installed through the program. Spillover adds to a program's measured savings by incorporating indirect (i.e., non-incentivized) savings and effects that the program has had on the market above and beyond the directly incentivized or directly induced program measures.

Total spillover is a combination of non-reported actions to be taken at the project site itself (*within-facility spillover*) and at other sites (*outside-facility spillover*). Each type of spillover is meant to capture a different aspect of the energy savings caused by the program, but not included in program records.

The **overall NTG ratio** accounts for both the net savings at participating projects and spillover savings that result from the program but are not included in the program's accounting of energy savings. When the NTG ratio is multiplied by the estimated gross program savings, the result is an estimate of energy savings that are attributable to the program (i.e., savings that would not have occurred without the program).

The basic equation is shown in Equation 1.

Equation 1. Net-to-Gross Ratio

$$NTG = 1 - Free\ Ridership + Spillover$$

The underlying concept inherent in the application of the NTG formula is that *only* savings caused by the program should be included in the final net program savings estimate but that this estimate should include *all* savings caused by the program.

5.2 Methods for Estimating Free Ridership and Spillover

5.2.1 Estimating Free Ridership

Data to assess free ridership were gathered through the self-report method—a series of survey questions asked of SBES participants. Free ridership was asked in both direct questions, which aimed at obtaining respondent estimates of the appropriate free ridership rate that should be applied to them, and in supporting or influencing questions, which could be used to verify whether the direct responses are consistent with participants' views of the program's influence.

Respondents were asked three categories of program-influence questions:

- **Likelihood:** to estimate the likelihood that they would have incorporated lighting measures "of the same high level of efficiency," if not for the assistance of the SBES Program. In cases where respondents indicated that they might have incorporated some, but not all, of the measures, they were asked to estimate the share of measures that would have been incorporated anyway at high efficiency. This flexibility in how respondents could conceptualize and convey their views on free ridership allowed respondents to give their most informed response, thus improving the accuracy of the free-ridership estimates.
- **Prior planning:** to further estimate the probability that a participant would have implemented the measures without the program. Participants were asked the extent to which they had considered installing the same level of energy-efficient lighting prior to participating in the program. The general approach holds that if customers were not definitively planning to install all of the efficiency lighting prior to participation, then the program can reasonably be credited with at least a portion of the energy savings resulting from the high-efficiency lighting. Strong free ridership is reflected by those participants who indicated they had already allocated funds for the purchase and selected the lighting and an installer.

- **Program importance:** to clarify the role that program components (e.g., information, incentives) played in decision-making, and to provide supporting information on free ridership. Responses to these questions were analyzed for each respondent, not just in aggregate, and were used to identify whether the direct responses on free ridership were consistent with how each respondent rated the “influence” of the program.

Free-ridership scores were calculated for each of these categories[6] and then averaged and divided by 100 to convert the scores into a free-ridership percentage. Next, a timing multiplier was applied to the average of the three scores to reflect the fact that respondents indicating that their energy efficiency actions would not have occurred until far into the future may be overestimating their level of free ridership. Participants were asked, without the program, when they would have installed the equipment. Respondents who indicated that they would not have installed the lighting for at least two years were not considered free riders and had a timing multiplier of 0. If they would have installed at the same time as they did, they had a timing multiplier of 1; within one year, 0.67; and between one and two years, 0.33. Participants were also asked when they learned about the financial incentive; if they learned about it after the equipment was installed, then they had a free ridership ratio of 1.

5.2.2 Estimating Spillover

The basic method for assessing participant spillover (both within-facility and outside-facility) was an approach that asked a set of questions to determine the following:

- **Whether spillover exists at all.** These were yes/no questions that asked, for example, whether the respondent incorporated energy efficiency measures or designs that were not recorded in program records. Questions related to extra measures installed at the project site (within-facility spillover) and to measures installed in non-program projects (outside-facility spillover) within the service territory.

- **The share of those savings that could be attributed to the influence of the program.** Participants were asked if they could estimate the energy savings from these additional extra measures to be less than, similar to, or more than the energy savings from the SBES program equipment.

[6] Scores were calculated by the following formulas:

» Likelihood: The likelihood score is 0 for those that “definitely would NOT have installed the same energy efficient measure” and 1 for those that “definitely WOULD have installed the same energy efficient measure.” For those that “MAY HAVE installed the same energy efficient measure,” the likelihood score is their answer to the following question: “On a scale of 0 to 10 where 0 is DEFINITELY WOULD NOT have installed and 10 is DEFINITELY WOULD have installed the same energy efficient measure, can you tell me the likelihood that you would have installed the same energy efficient measure?” If more than one measure was installed in the project, then this score was also multiplied by the respondent’s answer to what share they would have done.

» Prior planning: If participants stated they had considered installing the measure prior to program participation, then the prior planning score is the average of their answers to the following two questions: “On a scale of 0 to 10, where 0 means you ‘Had not yet planned for equipment and installation’ and 10 means you ‘Had identified and selected specific equipment and the contractor to install it’, please tell me how far along your plans were” and “On a scale of 0 to 10, where 0 means ‘Had not yet budgeted or considered payment’ and 10 means ‘Already had sufficient funds budgeted and approved for purchase’, please tell me how far along your budget had been planned and approved.”

» Program importance: This score was calculated by taking the maximum importance on a 0 to 10 scale of the four program importance questions and subtracting from 10 (i.e., the higher the program importance, the lower the influence on free ridership).

- **Program importance.** Estimates were derived from a question asking the program importance, on a 0 to 10 scale. Participants were also asked how the program influenced their decisions to incorporate additional energy efficiency measures.

If respondents said no, they did not install additional measures, they received a zero score for spillover. If they said yes, then the individual's spillover was estimated as the self-reported savings as a share of project savings, multiplied by the program-influence score. Then, a 50 percent discount was applied to reflect uncertainty in the self-reported savings and divided by 10 to convert the score to a spillover percentage.

5.2.3 Combining Results across Respondents

The evaluation team determined free ridership and spillover estimates for each of the following:

- Individual respondents, by evaluating the responses to the relevant questions and applying the rules-based approach discussed above
- Measure categories:
    - For free ridership: by taking the average of each respondent's score within each category, weighted by the respondent's share of savings within the measure category
    - For spillover: by taking the sum of the individual spillover results (in kWh) for each measure category and dividing by the category's total program savings in the sample
- The program as a whole, by combining measure-level results:
    - For free ridership: measure category results were subsequently weighted by each category's share of total program savings
    - For spillover: similarly, measure category results were subsequently weighted by each category's share of total program savings

5.3 Results for Free Ridership, Spillover, and Net-to-Gross

This section presents the results of the attribution analysis for the SBES Program. Specifically, results are presented for free ridership and spillover (within-facility and outside-facility), which are used collectively to calculate an NTG ratio.

5.3.1 Review of Data Collection Efforts for Attribution Analysis

Guidehouse conducted 96[7] surveys with SBES participants to estimate free ridership, spillover, and NTG ratios. Table 5-2 shows the number of completions, by measure group.

Table 5-2. Participant Survey Completes by Project Type

Measure Category	Surveys
Lighting	64
Refrigeration	16
HVAC	16
Total	**96**

Source: Guidehouse analysis

5.3.2 Free-Ridership Results

Guidehouse asked participants a series of questions regarding the likelihood, scope, and timing of the investments in energy-efficient lighting if the respondent had not participated in the program. The purpose of the surveys was to elicit explicit estimates of free ridership and perspectives on the influence of the program. Guidehouse estimates free-ridership for the SBES Program at six percent of program-reported savings.

Guidehouse developed the free ridership estimate presented above based on responses to a variety of questions that related to survey respondents' intentions prior to participating in the program and to the influence of the program itself. Below are summaries by scoring component.

Prior Planning: Fifty out of 96 respondents indicated they had **prior plans to install energy efficient** equipment at their facilities before participating in the program. However, only 12 of the 50 respondents indicated their plans were **well-developed** (7 or higher on a scale of 0 to 10) in terms of identifying equipment for installation and 9 out of 28 respondents had budgeted for installing the equipment.

Program Importance: Respondents provided an average rating of 9 out of 10 for how important the financial incentive offered through the SBES program was in **influencing their decision** to upgrade their equipment.

Likelihood: Respondents were asked in the absence of the program, if they would have had at least some of the work done (in terms of both quantity of measures and the efficiency of measures installed). Five respondents indicated they would have installed about **32%** of the same energy efficiency equipment in the absence of the program.

Timing: Without the program, 29 respondents said that they would have installed the measures at the **same time or within 1-2 years, and the remainder would have delayed longer**.

[7]The survey was combined with process and NTG sections. One respondent did not complete the NTG section of the combined survey.

5.3.3 Spillover Results

The SBES Program influenced approximately five percent of participants to install additional energy efficiency measures on-site and influenced two percent of participants to install additional measures at other locations. Based on the survey findings, the evaluation team estimates the overall program spillover to be seven percent of program-reported savings. Participants reported a variety of spillover measures installed, including lighting (most common) and HVAC.

5.3.3.1 Inside Spillover

Table 5-3 shows the inside (within facility) spillover by measure type. The inside spillover for the program was estimated at **six** percent.

Program Importance: 32 out of 96 respondents indicated the program influenced them to install additional measures or change their behavior to be more energy efficient.

Qualified for Spillover: 19 out of the 32 respondents qualified for inside spillover based on information provided.

Spillover Savings Measures: Most respondents indicated retrofits to LED lights but a select few upgraded HVAC equipment like ductless mini split heat pumps and packaged HVAC units due to the program's influence. Their main rationale for not applying for an incentive was lack of awareness of incentives through the program or the measures not qualifying for an incentive through the program.

Table 5-3. Inside Spillover by Measure Type

Measure Family	Inside Spillover
Lighting	5.5%
Refrigeration	7.9%
HVAC	6.0%
Total	**5.7%**

Source: Guidehouse analysis, totals subject to rounding

5.3.3.2 Outside Spillover

Table 5-4 shows the outside (outside facility) spillover by measure type. The outside spillover for the program was estimated at two percent.

Program Importance: Only ten out of 97 respondents indicated the program influenced them to install additional measures or change their behavior to be more energy efficient, but the resulting impacts were relatively small.

Qualified for Spillover: Only five out of the ten respondents qualified for outside spillover based on information provided**.**

Spillover Savings Measures: All respondents contributing to spillover indicated retrofits to LEDs due to the program's influence. Their main rationale for not applying for an incentive was lack of awareness of incentives through the program or the measures not qualifying for an incentive through the program.

Table 5-4. Outside Spillover by Measure Type

Measure Family	Outside Spillover
Lighting	2.3%
Refrigeration	0.0%
HVAC	0.0%
Total	**2.0%**

Source: Guidehouse analysis, totals subject to rounding

5.3.3.3 Total Spillover

Total spillover is the sum of inside and outside spillover. Adding the result of 5.4% for inside spillover and 2.0% for outside spillover, Guidehouse found a total spillover of 7.4%.

5.3.4 Net-to-Gross Ratio

As stated above, the NTG ratio is defined as follows in Equation 2 below.

Equation 2. Net-to-Gross Ratio

NTG = 1 – free ridership + spillover

Using the overall free ridership value of two percent and the overall spillover value of nine percent, the NTG ratio is 1 – 0.06 + 0.07 = 1.02[8]. The estimated NTG ratio of 1.02 implies that for every 100 megawatt-hours (MWh) of realized savings recorded in SBES records, 102 MWh is attributable to the program. Table 5-5 shows the final NTG results.

Table 5-5. SBES Free Ridership, Spillover, and NTG Ratio

	Free Ridership	Spillover	NTG Ratio
SBES Program Total	0.06	0.07	1.02

Source: Guidehouse analysis, totals subject to rounding.

Table 5-6 and Table 5-7 shows the verified net savings after applying the impact realization rate as well as the NTG ratio for energy and demand savings DEC and DEP respectively.

[8] The total is subject to rounding. The weighted average calculation of the overall NTG value is causing the rounding error.

/A

Table 5-6. DEC SBES Reported, Verified Gross and Verified Net Savings

Parameter	Energy (MWh)	Summer Coincident Peak Demand (kW)	Winter Coincident Peak Demand (kW)
Reported Savings	68,413	80,343	80,343
Realization Rate	92%~~100%~~	97%~~99%~~	96%~~98%~~
Verified Gross Savings	62,613~~68,738~~	77,601~~79,256~~	77,523~~78,936~~
Net-to-Gross	102%	102%	102%
Verified Net savings	63,865~~70,113~~	79,153~~80,841~~	79,074~~80,515~~

Source: Guidehouse analysis, totals subject to rounding.

Table 5-7. DEP SBES Reported, Verified Gross and Verified Net Savings

Parameter	Energy (MWh)	Summer Coincident Peak Demand (kW)	Winter Coincident Peak Demand (kW)
Reported Savings	46,571	51,433	51,433
Realization Rate	92%~~101%~~	97%~~99%~~	96%~~98%~~
Verified Gross Savings	42,852~~46,889~~	49,640~~50,696~~	49,383~~50,267~~
Net-to-Gross	102%	102%	102%
Verified Net savings	43,709~~47,827~~	50,633~~51,710~~	50,370~~51,272~~

Source: Guidehouse analysis, totals subject to rounding.

6. Conclusions and Recommendations

Guidehouse' s findings suggest that Duke Energy's SBES program is being delivered and tracked effectively in the DEC and DEP jurisdictions. Customer satisfaction is generally high, and the program measure installations appear to be tracked appropriately. Guidehouse presents the following list of recommendations to help improve program delivery and impacts:

1. **Consider introducing additional equipment choices in the program.** A subset of customers reported that the program was unable to provide all the energy efficiency equipment they wanted. Duke Energy should consider introducing more equipment choices in the program to include outdoor lighting and HVAC measures. This also presents an opportunity for channeling to other Duke Energy programs or education about measures that are not offered through the SBES program.
2. **Increase and improve program communications.** This is the most common challenge or drawback received from participants, indicating that customers were sometimes unclear about the various stages of the program process and did not receive proper communication and guidance from the implementer and/or Duke Energy. Additional education from both Lime Energy and Duke Energy account managers should help customers better understand the program participation process.
3. **Consider using TRM algorithms for HVAC measures.** Lime Energy and Duke Energy developed deemed savings estimates using regional data for HVAC measures. Although the methodology for developing these estimates was accurate, Guidehouse recommends Duke Energy consider using TRM algorithms too and substituting the variables in these algorithms using regional values to estimate savings. This may enhance the transparency of the impact estimates for these measures.
4. **The Program Net-to-Gross Ratio is high**. This indicates that the program is providing a key service to small business customers in helping them manage their energy use.

7. Summary Form

Small Business Energy Saver

Completed EMV Fact Sheet

Description of program

Duke Energy's Small Business Energy Saver Program provides energy efficient equipment to eligible small business customer at up to an 80 percent discount. The program is delivered through an implementation contractor that coordinates all aspects of the program, from the initial audit, ordering equipment, coordinating installation, and invoicing.
The program consists of lighting, HVAC, and refrigeration measures.

- **Lighting measures:** LED lamps and fixtures, LED exit signs, occupancy sensors.
- **Refrigeration measures:** LED case lighting, EC motor upgrades, anti-sweat heater controls,
- **HVAC Measures:** HVAC controls, thermostats, and tune-ups

Evaluation Methodology

The evaluation team used engineering analysis and virtual impact assessments as the primary basis for estimating program impacts. Additionally, online surveys were conducted with participants to assess customer satisfaction and determine a net-to-gross ratio.

Impact Evaluation Details

- **Virtual verification surveys were completed by 90 participants.** Guidehouse designed the virtual impact assessment survey tool to collect data about project and measure characteristics for comparison to tracking records and for engineering analysis.
- **In-Service rates (ISRs) varied by equipment type.** The evaluation team found ISRs ranging from 0.29 to 1.00 depending on the equipment type.
- **Participants achieved an average of 35 MWh and 29 MWh of energy savings per year for DEC and DEO respectively.** The program is accurately characterizing energy and demand impacts.

Date	July 07, 2021
Region(s)	Duke Energy Progress Duke Energy Carolinas
Evaluation Period	DEC 1/1/2019 – 6/30/2020 DEP 1/1/2019 – 6/30/2020
Annual net MWh Savings	DEC 70,113 MWh DEP 47,827 MWh
Per Participant net MWh Savings	DEC 34.83 MWh DEP 29.41 MWh
Coincident MW Impact	DEC 79.25MW DEP 50.69 MW
Net-to-Gross Ratio	1.02
Previous Evaluation(s)	2016, 2015, 2014, 2013

8. Measure Level Inputs for Duke Energy Analytics

The SBES program estimates deemed savings on a per-fixture basis that takes into account specific operational characteristics. This approach differs from a more traditional prescriptive approach that applies deemed parameters by measure type and building type.

For the lighting measures, the EM&V team applied HVAC interactive effects and coincident factors in the analysis that differed from those used by the IC; the values used are shown in Table 8-1, Table 8-2 and Table 8-3. Note that for this evaluation the EM&V team applied the coincidence factors for both summer and winter peak demand reductions by lamp type from the logger data analysis completed in 2016. For lighting controls, these values were taken from the NEEP Mid-Atlantic TRM, v10[9].

Table 8-1 HVAC Interactive Effects Multipliers from the NEEP Mid-Atlantic TRM[10]

Building Type	WHFe	WHFd
Office	0.97~~1.10~~	1.21~~1.36~~
Retail	0.95~~1.06~~	1.13~~1.27~~
School	0.96~~1.10~~	1.28~~1.44~~
Warehouse	0.89~~1.02~~	1.10~~1.23~~
Other	0.95~~1.08~~	1.20~~1.35~~

Source: NEEP Mid-Atlantic TRM, V10

Table 8-2 Summer and Winter Coincidence Factors for Lighting Measures from DEC-DEP 2016 Logger Analysis

Measure	Summer Coincidence Factor	Winter Coincidence Factor
LED Exit Sign	1	1
A Line Lamp	0.914	0.931
Recessed Light	0.914	0.931
Specialty Light	0.914	0.931
LED Tube	0.802	0.619
High/low Bay	1	1
Delamping	0.902	0.664
Exterior Light	0	1

Source: DEC-DEP 2016 logger data analysis.

[9] NEEP TRM (April 2020, v10), https://neep.org/sites/default/files/media-files/trmv10.pdf

[10] The TRM interactive factors are weighted by the heating system fuel type multipliers derived from the participant virtual verification survey.

/A

Table 8-3 Coincidence Factors for Lighting Controls from the NEEP Mid-Atlantic TRM

Building Type	Coincidence Factor
Office	0.70
Retail	0.83
School	0.35
Warehouse	0.80
Other	0.62

Source: NEEP Mid-Atlantic TRM, V10

Additionally, the Duke Energy DSMore table is embedded below for reference.

Appendix A. Process and NTG Survey Guide

DEC/DEP Small Business Energy Saver (SBES) Program
Commercial & Industrial (C&I)

Introduction and Confirmation

Guidehouse is evaluating Duke Energy's Small Business Energy Saver program, and our records show your business participated in this program during this past one or two years. This survey will help Duke Energy better understand the experience and impacts this program had on your business . Your responses are completely confidential.

Landing Page

Thank you for your willingness to complete this survey! Before you get started, just a few notes:

- This survey will ask about your experience with Duke Energy's Small Business Energy Saver program and the different type of energy efficiency equipment installed in your business.
- We are offering a $10 e-gift card for completing the survey. This gift card will be emailed to you within two weeks of completing the survey.

S1. Thanks in advance for your time. Our records indicate your business received **[INSERT SAMPLE_MEASURE_FAMILY]** from the Small Business Energy Saver program on [INSERT INSTALLDATE) , at **[INSERT SAMPLE_CUSTOMER_ADDR1, "in" SAMPLE_CUSTOMER_CITY]**. Is this correct?

Yes	1	**[SKIP TO S3]**
No	2	**[CONTINUE]**
Don't know	3	**[CONTINUE]**

S1a. Is there anyone available who might know about your company's participation in the program and the energy efficiency **[INSERT SAMPLE_MEASURE_FAMILY]** done at **[INSERT SAMPLE_CUSTOMER_ADDR1, "in" SAMPLE_CUSTOMER_CITY]**?

Yes	1	**[CONTINUE]**
No	2	**[THANK AND TERMINATE]**

S2. Can you provide an email address for that person?

Yes, Please enter email address	1	**[GO BACK TO S1]**
No	2	**[THANK AND TERMINATE]**
Don't know	3	**[THANK AND TERMINATE]**

[FOR TERMINATIONS]: These are all the questions we have for you. Thank you for your time.

S3. Our records show that you had the following energy efficiency improvements installed AT THIS SITE: **[INSERT SAMPLE_MEASURE(S)]**. Is this correct?

Yes 1 **[GO TO S4]**

No 2 **[GO TO S3a]**

Don't know 3 **[THANK AND TERMINATE]**

S3a. Was any other energy efficiency equipment installed at this site?

Yes 1 **[GO TO S3b]**

No 2 **[THANK AND TERMINATE]**

Don't know 3 **[THANK AND TERMINATE]**

[FOR TERMINATIONS. These are all the questions we have for you. Thank you for your time.

S3b. Please tell me what energy efficiency equipment was installed at your facility through the DUKE ENERGY program

____**[OPEN END]**

For the purposes of this survey, the questions will focus on just the **[INSERT MEASURE_FAMILY] which you had installed and not the other measures, and we will just refer to them as "energy efficient equipment."**

S4. How did you learn about the Small Business Energy Saver program? (LIST OPTIONS; ACCEPT MULTIPLE RESPONSES.)

Contacted by my DUKE ENERGY account representative or other DUKE ENERGY staff 1

I contacted my DUKE ENERGY account representative to find out about possible programs 2

Contacted by a LIME ENERGY representative............................. 3

Contacted by a trade ally, vendor, or contractor 4

Energy efficiency conference or workshop 5

Advertising by vendor or contactor 6

Word of mouth through a business colleague............................... 7

Word of mouth through a family, friend, or neighbor 8

Through a trade organization or professional organization/association 9

Mailer or other print materials sent by the program......................10

At a trade show 11
Participation in other DUKE ENERGY programs 12
Internet research/DUKE ENERGY website..................................13
Social media/online ad 14
Duke Energy call center 15
Email/e-newsletter from Duke Energy..16
Print material/flyer dropped off at my business 17
Other (Please specify) 18
Don't know 19

S5. Prior to participating in the Small Business Energy Saver program, what concerns did you have about participation, if any?

Cost of project 1
Access to financing/loan for project 2
Disruption to business during installation...................................... 3
Quality/performance of new equipment 4
Other (Please specify) 5
Don't know 6

Contractor and Proposal Module

The next few questions will be about your experiences with the program implementer, Lime Energy, and the equipment installer.

CP1. On a scale of 0 to 10, with 0 being "Not at all satisfied" and 10 being "Extremely satisfied", how satisfied would you say you are with …? [MATRIX STYLE QUESTION]

Items	Not at all satisfied (0)	1	2	3	4	5	6	7	8	9	Completely satisfied (10)	Don't know
CP1a. The energy efficiency assessment conducted by Lime Energy at your business site												
CP1b. The proposal prepared for you by Lime Energy												

CP2. Was the proposal clear about the scope of work to be performed?

Yes 1 **[SKIP TO CP3]**

No 2

Don't know ....3 **[SKIP TO CP3]**

CP2a. Why not?

____**[OPEN END]**

CP3. Was the proposal clear about your share of the project's final cost?

Yes 1

No 2

Don't know 3

CP4. If you had any questions or concerns about any aspect of your project or the DUKE ENERGY program, did you know who to contact?

Yes 1

No 2

Don't know 3

CP5. On a scale of 0 to 10, with 0 being "Not at all satisfied" and 10 being "Extremely satisfied", how satisfied would you say you are with …? [MATRIX STYLE QUESTION]

Items	Not at all satisfied (0)	1	2	3	4	5	6	7	8	9	Completely satisfied (10)	Don't know
CP5a. The contractor that installed the equipment												
CP5b. The post-installation cleanup												

CP6. Do you have any comments to share, good or bad, about the installation contractor or the post-installation cleanup?
____ **[OPEN END]**

Net to Gross Module

Next are questions relating to your decision to purchase energy efficient equipment for this site.

Free Ridership/Prior Plans

P1. Prior to participating in the program, had you considered installing energy efficient **[INSERT SAMPLE_MEASURE_FAMILY]**?

Yes 1

No .... 2 **[SKIP TO RC1]**

Don't know 3

P1a. Please describe any plans that you had to install the efficient **[INSERT SAMPLE_MEASURE_FAMILY]** prior to participating in the program.
____ **[OPEN END]**

P2a. Again, please think about before your involvement with the program. On a scale of 0 to 10, where 0 means you "Had not yet planned for equipment and installation" and 10 means you "Had identified and selected specific equipment and the contractor to install it", please tell me how far along your plans were.

Had not yet planned for equipment and installation										Identified and selected specific equipment and the contractor to install it	Don't know
0	1	2	3	4	5	6	7	8	9	10	98

P2b. Still thinking about your plans prior to program participation, on a scale of 0 to 10, where 0 means "Had not yet budgeted or considered payment" and 10 means "Already had sufficient funds budgeted and approved for purchase", please tell me how far along your budget had been planned and approved?

Had not yet budgeted or considered payment										Already had sufficient funds budgeted and approved for purchase
0	1	2	3	4	5	6	7	8	9	10

Role of Contractor

RC1. Did Lime Energy help you with your choice of the energy efficient **[INSERT SAMPLE_MEASURE_FAMILY]** equipment installed?

Yes 1

No .... 2 **[SKIP TO IC1]**

Don't know .... 3**[SKIP TO IC1]**

RC1a. On a scale of 0 to 10, where 0 is "Not at all important" and 10 is "Extremely important," how important was the recommendation from Lime Energy in your decision to install the energy efficient **[INSERT SAMPLE_MEASURE_FAMILY]**?

Not at all important										Extremely important	Don't know
0	1	2	3	4	5	6	7	8	9	10	98

Importance: Categories

IC1. Please tell me in your own words how the program influenced your decision to install the energy-efficient **[INSERT SAMPLE_MEASURE_FAMILY]**?

____**[OPEN END]**

Now I want to ask you a few questions about the importance of two different elements of the program to your decision to install the new equipment. Both questions ask you to rate the importance using a 0 to 10 scale where 0 means "Not at all important" and 10 means "Extremely important".

IC2. How important was the program's <u>financial incentive or project discount</u> in your decision to install the energy efficient **[INSERT SAMPLE_MEASURE_FAMILY]**?

Not at all important										Extremely important	Don't know
0	1	2	3	4	5	6	7	8	9	10	98

IC3. How important were the program's advertising and information resources (including the energy efficiency assessment itself) in your decision to install the energy efficient **[INSERT SAMPLE_MEASURE_FAMILY]**?

Not at all important										Extremely important	Don't know
0	1	2	3	4	5	6	7	8	9	10	98

Likelihood

[IF SAMPLE_MEASURE_FAMILY = "Lighting" THEN ASK L1, ELSE SKIP TO L2.]

L1. Given everything you've just said about the program, what is the likelihood that you **would have installed the same energy-efficient lighting** (in the same quantity and the same level of efficiency) without the program and its financial and technical assistance.

Definitely would NOT have installed the same energy efficient lighting..1

MAY HAVE installed the same energy efficient lighting, even without the program 2

Definitely WOULD have installed the same energy efficient lighting anyway 3

Don't know 4

[IF L1 = 2, 3, or 4, CONTINUE. OTHERWISE, SKIP TO IO1.]

L1a. As best you can, please estimate the percent of the Lighting you think you would have installed at the same high level of efficiency had the program not been available. (USE "998" FOR DON'T KNOW.)

___ % **[RECORD 0-100 OR 998 FOR DON'T KNOW]**

[IF SAMPLE_MEASURE_FAMILY = "Refrigeration" THEN ASK L2, OTHERWISE, SKIP TO IO1.]

L2. Given everything you've just said about the program, on a scale of 0 to 10 where 0 is definitely would not have installed and 10 is definitely would have installed, what is the likelihood that you would have installed the same energy-efficient **[INSERT SAMPLE_MEASURE_FAMILY]** equipment had the program not been available?

__________ **[RECORD 0-10 OR 98 FOR DON'T KNOW]**

[IF SAMPLE_MEASURE_FAMILY = "HVAC and Refrigeration" THEN ASK L3, OTHERWISE, SKIP TO IO1.]

L3. Given everything you've just said about the program, on a scale of 0 to 10 where 0 is definitely would not have installed and 10 is definitely would have installed, what is the likelihood that you would have installed the same energy-efficient **[INSERT SAMPLE_MEASURE_FAMILY]** equipment had the program not been available?

__________ **[RECORD 0-10 OR 98 FOR DON'T KNOW]**

Importance: Overall

IO1. Given everything you've just told me about the program, please tell me how important the program was in your decision to install the energy efficient **[INSERT SAMPLE_MEASURE_FAMILY] equipment**? Please use a 0 to 10 scale where 0 is "Not at all important" and 10 is "Extremely important".

Not at all important										Extremely important	Don't know
0	1	2	3	4	5	6	7	8	9	10	98

Timing

T1. Without the program, when would you have installed the efficient **[INSERT SAMPLE_MEASURE_FAMILY]**? Would it have been…(READ LIST)?

At the same time as you did 1

Within 1 year of the time you did 2

Between 1 and 2 years 3

Sometime after 2 years 4

Would have never installed without the program 5

Spillover (Inside Spillover)

Now we have a few questions concerning any **non-incentivized equipment** you may have also installed at this location.

IS1. Did your experience with the program in any way influence you to incorporate additional energy efficiency equipment where you did not receive a program incentive <u>at this site</u>?

Yes 1 **[CONTINUE]**

No 2 **[SKIP TO OS1]**

Don't know 3 **[SKIP TO OS1]**

IS2. Please briefly <u>describe how</u> the program has influenced your decisions to incorporate <u>additional</u> energy efficiency equipment that were not part of a program incentive.

____**[OPEN END]**

IS3. On a scale of 0 to 10, where 0 is "Not at all important" and 10 is "Extremely important", how important was your participation in the program in your decision to install additional energy efficiency equipment?

Not at all important										Extremely important	Don't know
0	1	2	3	4	5	6	7	8	9	10	98

[IF IS3 >5, CONTINUE, ELSE SKIP TO OS1]

IS4. What type of energy-efficient equipment did you install without program incentives, and what were the approximate quantities and project costs? Estimates are fine.

	Energy-Efficient Equipment Types	Equipment Characteristics	
	(Please describe the equipment as specifically as possible.) (1)	Quantity (1)	Project Cost ($) (2)
Equipment Type 1 (1)			
Equipment Type 2 (if applicable) (2)			
Equipment Type 3 (if applicable) (3)			
Equipment Type 4 (if applicable) (4)			

IS5. Now, please think only about the additional energy efficiency equipment not installed through the program (which received no incentives). Would you estimate the energy savings from these additional non-incentivized equipment to be less than, similar to, or more than the energy savings from the SBES program equipment?

Less than the SBES project 1

Similar to the savings from the SBES project 2

More than the SBES project 3

Don't know 4

IS6. Why didn't you apply for a program incentive for the additional energy efficiency equipment?
____**[OPEN END]**

Outside Spillover

This next set of questions asks about any **non-incentivized energy efficiency equipment** you may have installed at **other** locations within the Duke Energy service territory.

OS1. Did your experience with the program in any way influence you to incorporate energy efficiency equipment at other facilities that did not receive program rebates yet are also served by DUKE ENERGY? Do not include projects that participated in any DUKE ENERGY program.

Yes 1

No 2

Don't know 3

[IF OS1 = 1, CONTINUE, OTHERWISE, SKIP TO BB1.]

OS1a. About how many other facilities were influenced that did not participate in the program? (USE 98 FOR DON'T KNOW.)

INSERT NUMBER OF FACILITIES **[RECORD 1-100]** ___

OS2. Please briefly describe how the program has influenced your decisions to incorporate additional high-efficiency equipment at other facilities that did not participate in the program.
____**[OPEN END]**

OS3. On a scale of 0 to 10, where 0 is "Not at all important" and 10 is "Extremely important," how important was your participation in the program in your decision to install additional energy efficiency equipment at other facilities

Not at all important										Extremely important	Don't know
0	1	2	3	4	5	6	7	8	9	10	98

[IF OS3 > 5, CONTINUE. OTHERWISE, SKIP TO BB1]

OS4. What type of energy-efficient equipment did you install without program incentives, and what were the approximate quantities and project costs? Estimates are fine.

	Energy-Efficient Equipment Types	Equipment Characteristics	
	(Please describe the equipment as specifically as possible.) (1)	Quantity (1)	Project Cost ($) (2)
Equipment Type 1 (1)			
Equipment Type 2 (if applicable) (2)			
Equipment Type 3 (if applicable) (3)			
Equipment Type 4 (if applicable) (4)			

OS5. On average, would you estimate the energy savings from these other non-program facilities to be less than, similar to or more than the energy savings from the energy efficiency equipment installed through the program?

Less than the SBES project 1

Similar to savings from the SBES project 2

More than the SBES project 3

Don't know ..4

OS6. Why didn't you apply for a program incentive for the additional energy efficiency equipment?
____ **[OPEN END]**

Benefits and Barriers

Before wrapping up, we have a few more questions related to participation and satisfaction.

BB1. Did you experience any problems, delays or difficulties with the program, and if so what were they? (OPEN ENDED – CODED IN ANALYSIS)

The process took too long 1

Too many delays between steps in the process 2

The process was too complex 3

The application materials were difficult to understand 4

Lack of coordination and communication among program staff 5

Did not know who to contact with questions 6

The program staff was not responsive/unable to get needed information or status updates 7

The program staff was not knowledgeable 8

The incentives were less than I expected 9

I do not like the equipment installed 10

I was not given a choice on the specific equipment installed 11

The installation process was disruptive 12

Things were damaged during the installation 13

The post-installation clean-up took too long 14

The equipment failed/required repairs/did not work well 15

The equipment installed was sized incorrectly 16

Energy savings were not as significant as expected 17

I don't know where to buy replacement bulbs 18

Other (Please specify) 19

Don't know 20

No problems experienced **[EXCLUSIVE]** 22

[Ask if BB1<> 21]

BB1a. How easy or difficult was it to resolve the problem(s) that you experienced? Please rate on a scale of 0 to 10 in which 0 means very difficult and 10 means very easy.

Very difficult (0)	1	2	3	4	5	6	7	8	9	Very easy (10)	Don't know	Problems were not resolved

BB2. If you could change anything about the entire program process, from the audit to signoff to payment, what would you change?

____**[OPEN END]**

BB3. On a scale of 0 to 10, with 0 being "Not at all satisfied" and 10 being "Extremely satisfied", how satisfied would you say you are with …? **[MATRIX STYLE QUESTION; RANDOMIZE a-e]**

Items	Not at all satisfied (0)	1	2	3	4	5	6	7	8	9	Completely satisfied (10)	Don't know
BB3a. The energy efficiency equipment installed through the program												
BB3b. The energy savings resulting from the new equipment												
BB3c. **[If lighting]** The quality of the light produced by the new light fixtures/bulbs												
BB3d. Program communications												
BB3e. The amount of the rebate												
BB3f. The overall program experience												
BB3g. Duke Energy												

[IF ANY RESPONSE TO BB3a-g < 5, CONTINUE. OTHERWISE, SKIP TO BB4]

BB3h. Why did you rate [BB3a-BB3g] as you did?

____**[OPEN END]**

BB4. How did participation in the Small Business Energy Saver program affect your attitude toward Duke Energy? Relative to before the program, is your attitude toward Duke Energy?

.... Much more positive 1

Somewhat more positive 2

About the same 3

Somewhat more negative, or 4

Much more negative 5

Other (Please specify) 6

Don't know 7

BB5. On a scale of 0 to 10, with 0 being "Not at all likely and 10 being "Extremely likely", given the chance, how likely would you be to participate in this or a similar program again?

Not at all likely										Extremely likely	Don't know
0	1	2	3	4	5	6	7	8	9	10	98

[IF BB4 < 7, ASK BB5a. OTHERWISE, SKIP TO BB6]

BB5a. What—if anything—would persuade you to definitely participate in the program again? ____**[OPEN END]**

BB7. Have you recommended the program to other businesses?
Yes; how many? [ENTER NUMBER] 1

No 2

Don't know 3

BB8. What do you see as the main benefits to participating in the Small Business Energy Saver program? (OPEN ENDED – CODED IN ANALYSIS)
Energy savings 1

Utility bill savings 2

Lower maintenance costs/less frequent light bulb replacements 3

Better quality/new equipment 4

Incentive/rebate 5

Good for the environment 6

Improved safety/morale 7

Set example/industry leader 8

Able to make improvements sooner 9

Other (Please specify) 10

Don't know 11

Feedback and Recommendations

FR1. Do you have any suggestions on how the Small Business Energy Saver program could be improved? (RANK IN ORDER BY IMPORTANCE FOR YOUR ORGANIZATION) (OPEN ENDED – CODED IN ANALYSIS.)

Higher incentives 1

More equipment 2

Greater publicity 3

Better communication/improve program information 4

Contact/information from account executives 5

Longer time period to complete project 6

Better review of applications 7

Simplify application process 8

Electronic applications 9

More funds for the program 10

Other (Please specify) 11

No recommendations **[EXCLUSIVE]** 12

Don't know 13

FR2. Did the equipment offered through the program allow you to upgrade all of the energy efficiency equipment you wanted at the time?

Yes 1 **[SKIP TO FG1]**

No 2

Don't know 3 **[SKIP TO FG1]**

[IF FR2 < 7, ASK FR2a. OTHERWISE, SKIP TO BB6]

FR2a. What other energy efficiency equipment did you want to upgrade?
____**[OPEN END]**

Firmographics

Finally, I'd like to ask you a few general questions about your company, specifically the facility at **[INSERT SAMPLE_CUSTOMER_ADDR1, "in" SAMPLE_CUSTOMER_CITY]**.

FG1. Does your organization own or lease the space located at **[INSERT SAMPLE_CUSTOMER_ADDR1, "in" SAMPLE_CUSTOMER_CITY]**?

Own 1

Lease 2

Own part and lease part 3

Don't know 4

FG2. Who in your company makes decisions about how energy is managed at this facility?
I DO (describe role) **[OPEN END]**...... 14

Proprietor/Owner 1

President/CEO 2

Facilities Manager 3

Building/Store Manager 4

Energy Manager 5

Facilities Management/Maintenance Position 6

Chief Financial Officer 7

Other Financial/Administrative Position 8

Sales Staff 9

Lessor 10

Other (Please specify) 11

Don't know 12

FG3. What is the principal activity or type of business that is conducted at this location? This may not be the main activity of your organization, but should be the main activity that occurs at this location. For example, is it an office, a warehouse, a store?

Office 1

Retail (non-food) 2

School 3

Grocery Store 4

Convenience Store 5

Restaurant 6

Health Care/Hospital 7

Hotel or Motel 8

Warehouse 9

Personal Service 10

Community Service/Church/Temple/Municipality.......................... 11

Industrial Electronic & Machinery... 12

Other Industrial 13

Agricultural 14

Condo Association/Apartment Management................................. 15

Other (Please specify) 16

Don't know 17

FG 4. Please enter your preferred email address so that we can send you your $10 e-gift card through TangoCard Rewards Genius. You can select from a variety of retailers or donate your incentive to charity. Please allow 4-6 weeks to receive the incentive email.

- ◯ Email address: (1) ____
- ◯ No thanks - I do not wish to receive the e-gift card incentive (2)

Closing

Those are all of the questions we have for you. Your responses are very important to Duke Energy and will help as we design future energy efficiency programs. Thank you for participating in this survey!

EM&V Report for the Duke Energy 2020/2021 EnergyWise Business Program

Prepared for:

Duke Energy Progress, Duke Energy Carolinas

July 7, 2022

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Table of Contents

List of Tables

List of Figures

Executive Summary

Guidehouse Inc. (Guidehouse) conducted an impact evaluation to estimate demand response (DR) impacts from events occurring in the 2020/2021 season, using participant and non-participant advanced metering infrastructure (AMI) interval data. Guidehouse also performed a separate evaluation in 2020 to estimate energy impacts contributed by participants that received the thermostat between January 2018 and February 2019, using monthly energy consumption data, included in Appendix B

The EnergyWise® Business ("EnergyWise Business") program in the Duke Energy Progress (DEP) and Duke Energy Carolinas (DEC) territories, provides small and medium business customers that consume an average of at least 1,000 kWh per month and have one or more central air conditioning or heat pump units at their facility, with an opportunity to earn bill credits by allowing DEP and DEC to periodically cycle their HVAC equipment during conservation periods (i.e. curtailment or DR events).

In the summer, participating devices may be controlled by DEP and DEC from May through September for up to four hours per event. Events occur on non-holiday weekdays, and in 2021 occurred between 4pm and 7pm. During the curtailment events, the HVAC compressors are typically cycled in 30-minute intervals for the duration of the event. Participants may opt out of up to two events per season. Additional opt-outs may result in the forfeiture of the annual bill credit. Participants who have electric heat pumps with electric resistance auxiliary heat strips can also participate in the winter DR season for an additional $25 bill credit. For the winter 2020/2021 season, events occurred in the morning from 6:30am to 8:30am, around the peak demand hour of 7-8am.

Participants may elect to have curtailment dispatched via thermostat or switch. Participants equipped with the thermostat (the majority) can access the EnergyWise Business portal using a smartphone, tablet, or computer. The portal allows users to monitor and modify their facility HVAC runtimes, change the temperature setpoints, and program customized cooling and heating schedules. The purpose of the portal is to facilitate the adoption of energy efficiency behaviors by participants, specifically the practice of adjusting HVAC setpoints to reduce space heating and cooling energy consumption. The portal includes tips to help participants optimize energy use, including tutorials and preset features for energy efficiency, away times, and vacations.

Over the course of the 2020/2021 DR season, the program had more than 9,000 participants (accounts), in four distinct groups, defined by season (winter or summer) and combinations of selected control strategy (30%, 50%, or 75% cycling) and control device type (thermostat or switch). DEP and DEC called ten DR events, five in winter and five in summer. On average, there were 528 participants (accounts) in winter events and 8,927 in summer events.

Table 1 and Table 2 show average per participant impacts for each of the ten events, by energy provider, for the winter and summer seasons respectively. These estimated impacts correspond to actually-observed curtailment events – the "ex-post" impacts. In addition to showing per participant impacts, the table also lists event temperatures, relative precision, and total number of participating accounts.

Table 1. Average Per Participant Demand Response Event Impacts, Winter

Event Date	Energy Provider	Avg. Event Temperature (°F)	Impact Per Participant (kW)	Relative Precision +/-% (90% Confidence)	Participants (Accounts)
1/11/2021	DEC	33.7	0.88	26.4%	445
1/29/2021	DEC	24.8	1.10	26.4%	448
2/2/2021	DEC	32.7	0.88	26.4%	448
2/4/2021	DEC	25.8	1.07	26.4%	449
3/8/2021	DEC	31.4	0.96	26.4%	463
Average	**DEC**	**29.7**	**0.98**	**26.4%**	**451**
1/11/2021	DEP	33.7	0.88	26.4%	77
1/29/2021	DEP	24.8	1.10	26.4%	77
2/2/2021	DEP	32.7	0.88	26.4%	77
2/4/2021	DEP	25.8	1.07	26.4%	77
3/8/2021	DEP	31.4	0.96	26.4%	77
Average	**DEP**	**29.7**	**0.98**	**26.4%**	**77**

Source: Guidehouse analysis. Values subject to rounding.

Table 2. Average Per Participant Demand Response Event Impacts, Summer

Event Date	Energy Provider	Avg. Event Temperature (°F)	Impact Per Participant (kW)	Relative Precision +/-% (90% Confidence)	Participants (Accounts)
5/26/2021	DEC	87.6	1.03	4.9%	6,937
7/28/2021	DEC	89.1	1.10	4.7%	6,281
7/30/2021	DEC	91.4	1.16	4.7%	6,258
8/12/2021	DEC	86.7	1.06	4.7%	6,155
8/24/2021	DEC	91.3	1.18	4.7%	6,137
Average	**DEC**	**89.2**	**1.11**	**4.7%**	**6,354**
5/26/2021	DEP	87.6	1.11	4.4%	2,970
7/28/2021	DEP	89.1	1.21	4.3%	2,520
7/30/2021	DEP	91.4	1.27	4.3%	2,502
8/12/2021	DEP	86.7	1.17	4.3%	2,444
8/24/2021	DEP	91.3	1.30	4.3%	2,432
Average	**DEP**	**89.2**	**1.21**	**4.3%**	**2,574**

Source: Guidehouse analysis. Values subject to rounding.

The estimated total program impacts for each energy provider and event season are shown in Table 3. Average total event impacts are calculated by multiplying the per-participant impacts by the average number of participants across all events, per energy provider and season. Since

Guidehouse used a pooled regression model with DEC and DEP consumption data, impacts are identical by cycling strategy and device type. Therefore, impacts for the winter season are identical for the two energy providers because only one participant group exists in winter (thermostat, complete curtailment). For summer events, results differ by energy provider as a result of differing distributions of customers among cycling strategies and device types. The number of participants in each event varies due to new enrollments, withdrawals, and opt-outs.

Table 3. Aggregate Demand Response Event Impacts by Energy Provider

Event Season	Energy Provider	Avg. Event Temperature (°F)	Impact Per Participant (kW)	Relative Precision +/-% (90% Confidence)	Avg # Participants	Total Program Impact (MW)
Winter	DEC	29.7	0.98	26.4%	451	0.4
	DEP	29.7	0.98	26.4%	77	0.1
Summer	DEC	89.2	1.11	4.7%	6,354	7.0
	DEP	89.2	1.21	4.3%	2,574	3.1

Source: Guidehouse analysis. Values subject to rounding.

The estimated per device program impacts by technology type, cycling strategy, and event season (winter/summer) are shown in Table 4. Estimated impacts are identical for the two energy providers because this analysis uses a regression model applied to pooled DEC and DEP consumption data.

Table 4. Average Per Device Demand Response Event Impacts by Technology Type and Cycling Strategy

Event Season	Energy Provider	Technology Type	Cycling Strategy	Impact Per Device (kW)	Relative Precision +/-% (90% Confidence)	Avg # Devices
Winter	DEC	Thermostat	-	0.59	26%	1.66
	DEP	Thermostat	-	0.59	26%	1.66
Summer	DEC	Thermostat	30%	0.49	7%	1.74
			50%	0.92	7%	1.77
			75%	1.06	8%	2.29
		Switch	30%	0.34	45%	1.61
			50%	0.55	31%	1.99
			75%	0.35	96%	2.05
	DEP	Thermostat	30%	0.49	7%	1.74
			50%	0.92	7%	1.77
			75%	1.06	8%	2.29
		Switch	30%	0.34	45%	1.61
			50%	0.55	31%	1.99
			75%	0.35	96%	2.05

Source: Guidehouse analysis. Values subject to rounding.

This report also includes projections of the program's demand response capability under a variety of different temperatures, assuming no change in the composition of the program participants (e.g., no change in the proportion that subscribe to 30% cycling, that use switches, etc.)

Evaluation Methods

Guidehouse's evaluation approach for this report focuses on demand impacts.

Demand Response Impact Evaluation Approach

Guidehouse estimated demand reduction and snapback impacts using a lagged dependent variable regression analysis applied to interval consumption, weather (dry-bulb temperatures), and program tracking data. To maximize the number of participants in each group of device type and cycling strategy, Guidehouse analyzed DEP and DEC customers together.

Guidehouse used a matched comparison group (MCG) to estimate savings. In this approach, non-event days with similar temperatures to the event days are selected. Consumption data on non-event days are used for selecting a comparison group of non-participants that are similar to participants. The underlying assumption is that consumption of similar non-participants informs the baseline demand of participants on event days.

Guidehouse calculated program impacts by multiplying estimated per participant impacts by the average number of participants across all events in a season. Impacts per device were calculated by dividing the per participant results by the average number of devices at each participant site. Similarly, impacts per energy provider were calculated by multiplying estimated per participant impacts by the average number of participants per energy provider across events.

Based upon the regression estimated relationships between DR impacts and outdoor temperature from which the above impacts were developed, Guidehouse estimated an ex-ante forecast of event impacts. Ex-ante estimates are Guidehouse's projection of how much DR the program could offer under a range of different possible temperatures at different cycling levels, for the different technologies and event day types. This forecast of capability provides an estimate of a given DR program's value as a system resource and how much of a demand reduction the program may be counted on to deliver in future system peak conditions.

Findings and Recommendations

The principal EM&V findings and recommendations regarding the estimated demand impacts are as follows:

- **On average, the program delivered approximately 0.5 MW of load curtailment during winter events, and approximately 10.1 MW of load curtailment during summer events.** For DEC, this amounts to 0.4 MW of estimated load curtailment in winter and 7 MW of estimated load curtailment from in summer. Estimated load curtailment for DEP is approximately 0.1 MW in winter and 3.1 MW in summer. The program-level impacts for each event vary depending on the number of participants, the temperature, and other factors.

- **On average, the program delivered nearly 1 kW of demand response per participant during winter events, and over 1.1 kW of demand response per participant during summer events.** For DEC, this amounts to 0.6 kW of demand response per device in both winter and summer. Estimated curtailment per device for DEP is approximately 0.6 kW per device in winter and 0.7 kW per device in summer.

- The results of the ex-post evaluation informed the development of ex-ante forecast of program capability across a range of temperatures at different cycling levels, which can be used for calculating benefits for cost-effectiveness tests. For summer events at an assumed temperature of 95°F, ex-ante impacts are estimated to be 0.8 kW per thermostat device and 0.5 kW per switch device. During winter events at an assumed temperature of 20°F, thermostats are estimated to deliver 0.7 kW of curtailment per device.

- **Thermostats deliver greater relative impacts for events in both seasons compared to load control switches. While no switch impacts were measured for winter events, thermostat impacts are materially higher than switch impacts during summer events.** On average across cycling strategies, thermostats delivered demand reductions during summer events of 13% of total facility baseline load, and switches 8%. During winter events, thermostats deliver demand reductions of approximately 14% of total facility baseline load. According to Duke program staff, this may be because participants with switches tend to have smaller HVAC equipment.

- **Participants that have selected the 75% cycling strategy deliver the highest per participant impacts for summer events.** During summer events, 75% cycling strategy participants deliver an average impact equivalent to 27% of their estimated facility baseline demand. In contrast, 30% and 50% cycling strategy participants delivered an average impact of approximately 9% and 19% of their baseline demand, respectively.

Based on the impact findings above, Guidehouse recommends that Duke Energy consider the following recommendations:

- **Consider using future process evaluations to better understand differences in businesses that enroll in each cycling strategy.** Consistent with expectations, Guidehouse estimated significantly greater savings for participants enrolled in the 75% cycling strategy during demand response events than for the 30% and 50% cycling strategies. Because of the high impact being delivered, Duke Energy may want to further explore characteristics of this group of participants to better target similar businesses in the future, through participant surveys or interviews.

- **Continuing to evaluate the program on an annual basis, particularly if enrollment changes in any material way.** The total number of enrolled participants is over 9,000, and the energy use at commercial facilities is generally more heterogeneous than at residential facilities. This means that the average participant (and aggregate program) impacts and capability could change materially as a result of relatively modest changes in the absolute number of participants enrolled, or if the distribution of participants across cycling strategies shifts. Duke Energy should carefully consider this when using the capability estimates provided above for any planning exercises.

1. Introduction

The EnergyWise® Business ("EnergyWise Business") program in the Duke Energy Progress (DEP) and Duke Energy Carolinas (DEC) territories, provides small and medium business customers that consume an average of at least 1,000 kWh per month and have one or more central air conditioning or heat pump units at their facility, with an opportunity to earn bill credits by allowing DEP and DEC to periodically cycle their HVAC equipment during conservation periods (i.e. curtailment or demand response events).

Upon enrollment, eligible participants select to receive either: (1) a "smart" Wi-Fi communicating thermostat[1] capable of remote set-point adjustment, (2) or a switch device, to allow DEP and DEC to cycle the participant's HVAC during DR events. The switch device may be either Wi-Fi connected or cellular. Participants may select one of three options for participating:

- 30% Cycling - Participants receive an annual bill credit of $50 per device controlled for the summer season.
- 50% Cycling - Participants receive an annual bill credit of $85 per device controlled for the summer season.
- 75% Cycling - Participants receive an annual bill credit of $135 per device controlled for the summer season.

In the summer, participating devices may be controlled by DEP and DEC from May through September, for up to four hours per event. Events occur on non-holiday weekdays and in 2022, occurred between 4pm and 7pm. During the curtailment events, the HVAC compressors are cycled in 30-minute intervals for the duration of the event. Participants may opt out of up to two events per season. Additional opt-outs may result in the forfeiture of the annual bill credit. Participants with electric heat pumps or electric resistance heating can also participate in the winter DR season for an additional $25 bill credit. For the winter season, events occurred in the morning from 6:30am to 8:30am, around the peak demand hour of 7 to 8am.

Participants with the thermostat can access the EnergyWise Business portal using a smartphone, tablet, or computer. The portal allows users to monitor and modify their facility HVAC runtimes, change the temperature setpoints, and program customized cooling and heating schedules. The purpose of the portal is to facilitate the adoption of energy efficiency behaviors by participants, specifically the practice of adjusting HVAC setpoints to reduce space heating and cooling energy consumption. The portal includes tips to help participants optimize energy use, including tutorials and preset features for energy efficiency, away times, and vacations.

1.1 Objectives of the Evaluation

The key objectives for the impact analysis of this evaluation, as identified in Guidehouse Inc.'s (Guidehouse) evaluation plan, include:

- **Demand Response Impacts:** estimate the demand response impacts for events called by the program during 2020/2021 DR season and provide estimates of curtailment capability

[1] Note that this is not an "adaptive" thermostat.

for a range of temperatures (with emphasis on impacts coincident with DEC/DEP seasonal system peaks).

- **Energy Efficiency Impacts:** estimate the annual energy efficiency impacts for participants who have a thermostat and enrolled in the program between January 2018 and February 2019 (included in this report as Appendix B).

1.2 Reported Program Participation

1.2.1 Demand Response Enrollment

Enrollment for the demand response program extended from 2016 into 2021, as participants are eligible to enroll at any time, upon installation of a thermostat or switch device. Over 9,000 accounts participated in at least one event in the 2020/2021 season. Of these, close to 550 accounts also opted into the winter event season. Most participants enrolled in the 30% cycling strategy with the smart thermostat control technology. All winter participants and 94% of summer participants have the smart thermostat. The distribution of the average number of participants included in the analysis by energy provider, technology type, and cycling strategy is summarized in Table 1-1.

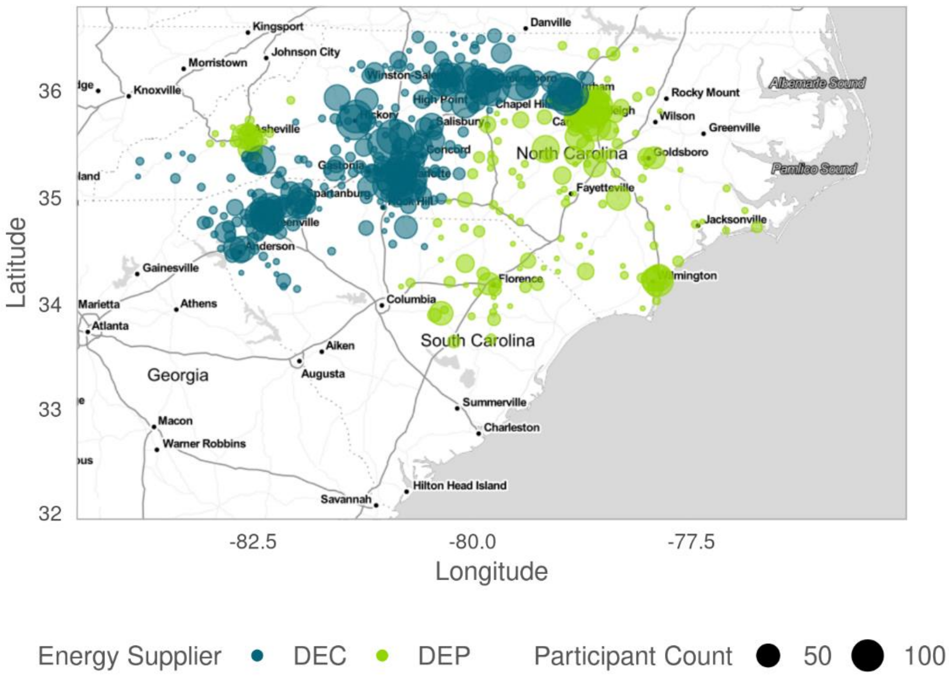
Table 1-1. Distribution of Participants by Cycling Strategy and Technology

Event Season	Energy Provider	Device Type	Cycling Strategy	Participants (Accounts)
Winter	DEC	Thermostat	-	463
	DEP	Thermostat	-	77
Summer	DEC	Thermostat	30% Cycling	5,232
		Thermostat	50% Cycling	928
		Thermostat	75% Cycling	601
	DEP	Thermostat	30% Cycling	248
		Thermostat	50% Cycling	92
		Thermostat	75% Cycling	72
	DEC	Switch	30% Cycling	1,898
		Switch	50% Cycling	653
		Switch	75% Cycling	280
	DEP	Switch	30% Cycling	130
		Switch	50% Cycling	40
		Switch	75% Cycling	27

Source: Guidehouse analysis of Duke Energy data

Figure 1-1 shows the geographic distribution of participants. Most installations occurred around cities including Charlotte and Raleigh, although participation was achieved throughout the service territories.

Figure 1-1. Geographic Distribution of Participants



Source: Guidehouse Analysis of Duke Energy data

2. Evaluation Methods

2.1 Demand Response Impact Methodology

Guidehouse estimated demand reduction and snapback impacts using a lagged dependent variable regression analysis applied to interval consumption, weather (dry-bulb temperatures), and program tracking data. To maximize the amount of participants in each group of device type and cycling strategy, Guidehouse analyzed DEP and DEC customers together.

Guidehouse used a matched comparison group (MCG) to estimate savings. In this approach, non-event days with similar temperatures to the event days are selected. Consumption data on non-event days are used for selecting a comparison group of non-participants that are similar to participants. The underlying assumption is that consumption of similar non-participants informs the baseline demand of participants on event days.

Guidehouse estimated both ex-post and ex-ante impacts. Ex-post impacts are the average impacts of observed (historical) events. Ex-ante impacts are projections of the program's capability at a range of different temperatures. This forecast of capability provides the truest estimate of a given DR program's value as a system resource because it provides DEC and DEP staff with an understanding of how much of a demand reduction the program may be counted on to deliver in future system peak conditions.

2.1.1 Participant, Event, and Weather Data

For the demand response evaluation, Guidehouse used the following data provided by Duke Energy:

- AMI consumption (kWh) data in 30 minute intervals, for DEC and DEP participants and non-participants
- A list of participants, including enrollment dates, technology, cycling strategy, and changes over the season
- Event reports for all 2020/2021 events, including cycling strategy, and event times
- Opt-out reports for each event, indicating which customers did not participate in each event
- Program disenrollment data for all participants

In total, Duke Energy called ten events, including five events in winter and five events in summer. Listed in Table 2-1, all events were on weekdays and included the hour coincident with the seasonal system peaks for the DEP and DEC territories (7 – 8 AM in winter, 4 – 5 PM in summer).

Table 2-1. 2020/2021 Events and Average Temperatures

Event Date	Season	Start	End	Average Event Temperature (°F)
1/11/2021	Winter	6:30 AM	8:30 AM	33.7
1/29/2021	Winter	6:30 AM	8:30 AM	24.8
2/2/2021	Winter	6:30 AM	8:30 AM	32.7
2/4/2021	Winter	6:30 AM	8:30 AM	25.8
3/8/2021	Winter	6:30 AM	8:30 AM	31.4
5/26/2021	Summer	4:30 PM	6:30 PM	87.6
7/28/2021	Summer	4:00 PM	6:00 PM	89.1
7/30/2021	Summer	4:00 PM	6:00 PM	91.4
8/12/2021	Summer	4:00 PM	6:00 PM	86.7
8/24/2021	Summer	4:00 PM	6:00 PM	91.3

Source: NOAA

Guidehouse collected hourly dry-bulb temperature data for the period of November 2020 through September 2021 from eight weather stations across the Carolinas and developed a weighted average hourly time series for the analysis based on the number of participants closest to each station, per season. This time series was then used in subsequent matching and modeling to estimate demand response event impacts. The stations and corresponding weights are listed in Table 2-2.

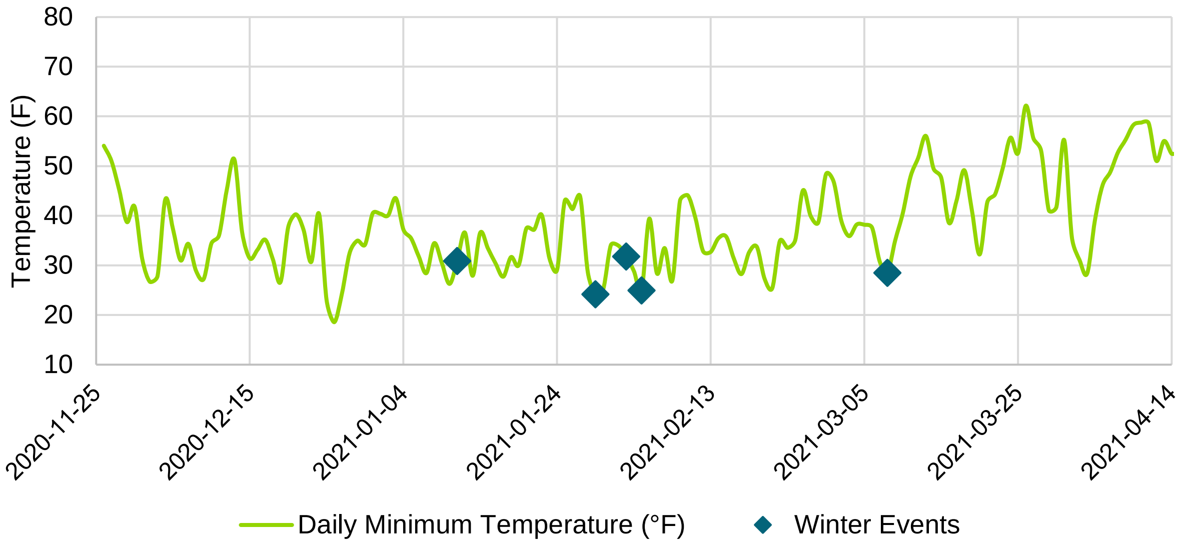
Table 2-2. Weather Stations and Weighting Used for Demand Response Analysis

Weather Station	Weight (Winter Events)	Weight (Summer Events)
Charlotte Douglas International Airport	32%	25%
Raleigh-Durham International Airport	7%	22%
Piedmont Triad International Airport	26%	17%
Spartanburg Downtown Memorial Airport	15%	15%
Hickory Regional Airport	11%	6%
Asheville Regional Airport	3%	6%
Fayetteville Regional Airport	2%	5%
Wilmington International Airport	2%	4%

Source: Guidehouse analysis of Duke Energy data and NOAA data

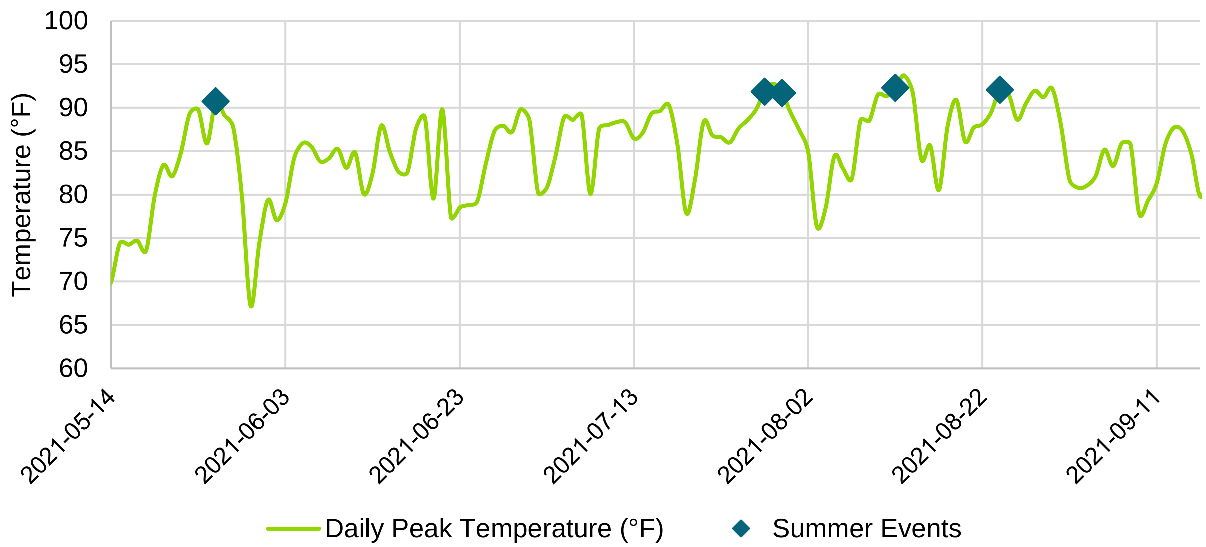
For winter events, daily minimum temperatures were similar for all event days, between 24°F and 32°F. Daily peak temperatures for summer event days ranged from 90°F to 93°F. As illustrated in Figure 2-1 and Figure 2-2, events took place on days with some of the most extreme temperatures of the season.

Figure 2-1. Daily Minimum Temperatures for the 2021 Winter Demand Response Season



Source: Guidehouse analysis and NOAA data

Figure 2-2. Daily Peak Temperatures for the 2021 Summer Demand Response Season



Source: Guidehouse analysis and NOAA data

For DR Impacts, Guidehouse used a single model combining both DEP and DEC participants. This method was used to maximize the number of participants – and therefore confidence and precision of estimates – for certain groups with few participants (e.g. those with a switch in the 75% cycling strategy). Table 2-3 lists the number of participants who participated in at least one event for each event type, technology, and cycling strategy. Most participants were in the thermostat, 30% cycling group. A small number of participants switched cycling strategies or withdrew from the program, and participants may have opted-out of as many as two events during the season without penalty. The most opt-outs occurred on August 12, specifically 123 out of 8,193 thermostat participants and 1 out of 583 switch participants.

Table 2-3. Participants by Event Season, Technology, and Cycling Strategy

Season	Technology	Cycling Strategy	Participants* (Accounts)
Winter	Thermostat	-	540
Summer	Switch	30%	378
		50%	132
		75%	99
	Thermostat	30%	7,130
		50%	1,581
		75%	881

Source: Guidehouse analysis of Duke Energy data

* The number of participants that participated in at least one event for a given event type, technology, and cycling strategy. Participation varies between events due to different enrollment dates, opt-outs, drop-outs, deactivations, or changes in cycling strategy and/or technology. Forty-seven participants had a mix of both thermostats and switches and were excluded from the analysis as impacts could not be distinguished between the different technologies.

Guidehouse reviewed the data to ensure its completeness, identifying any gaps or potential outlier data, and addressing any issues accordingly. After review of the AMI data provided by Duke Energy, Guidehouse found that interval data was not available for all customers on all days. Table 2-4 lists the number of participants that were found to be missing some data (e.g. one or more days in the season) for each technology, cycling strategy, and event type. Generally, these participants were missing data for one event, and so were still included in Guidehouse's analysis for all other events. Across all groups, 707 customers lacked AMI data throughout the entire period of analysis; however, around 80% of these 707 accounts deactivated after the first event, so are only missing data for a single day of analysis.

Table 2-4. Participants with Some Missing ~~Some~~ Interval Data

Event Season	Technology	Cycling Strategy	Participant Accounts with Missing Usage Data	% of Accounts
Winter	Thermostat	-	10	2%
Summer	Thermostat	30%	709	10%
		50%	64	4%
		75%	37	4%
	Switch	30%	37	10%
		50%	11	8%
		75%	15	15%

Source: Guidehouse analysis of Duke Energy data

The vast majority of missing data is attributed to a lack of AMI data. Participants also may have been missing data on specific event days and/or the corresponding matched non-event day. Missing data could occur for different reasons, for example: a participant may not have an AMI meter installed (i.e., missing data for the entire season); or if database or meter read errors occurred for some days. Customers that were missing data were not included when estimating average per participant impacts; however, Guidehouse included these participants when scaling per participants impacts by total participation in each event to calculate aggregate per participant impacts. This method assumes that those participants with AMI data (the majority) are representative of those without.

2.1.2 Selecting a Matched Control Group

Selecting an appropriate matched control group for participants in the program involves two steps: (1) selecting matched non-event days; and (2) selecting a non-participant match for each participant based on a comparison of participant and non-participant demand patterns on the matched non-event days.

Guidehouse first selected a matched non-event day for each event day. This process involves finding the non-holiday, non-event weekday in the DR season that most closely matches the 24 hour temperature profile of each event day. Guidehouse calculated the Euclidean distance in temperature for all 24 hours between each event day and all potential non-event day candidates. Guidehouse then selected the top three non-event days associated with the lowest values. Matches are selected with replacement, meaning that a given non-event day could be matched to multiple event days. Under the circumstance that a customer is missing data for the best match for a given event day, the next best match day was used.

Table 2-5 lists the top matched non-event date selected for each 2021 event date. Figure 2-3 shows an example for the event occurring on August 24, 2021, which was matched to August 30, 2021. The similarity in weather profile across all 24 hours suggests that the demand of participants would be similar between both days in absence of a DR event. Therefore, the selected non-event day serves two purposes: (1) serving as a predictor of demand on event days; and (2) providing an “event-like” non-event day with which to select appropriate non-participants that are most like participants.

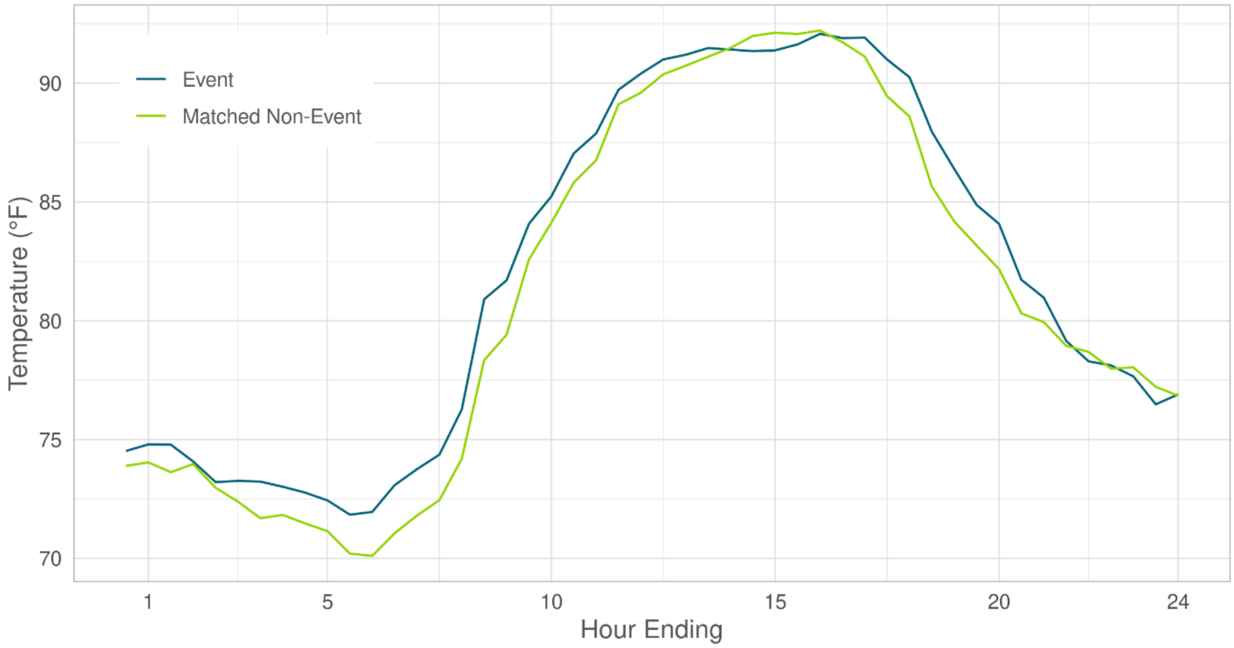
Table 2-5. Top Matched Non-Event Date for Each 2021 Demand Response Event Date

Event Season	Event Date	Top Matched Non-Event Date
	1/11/2021	12/15/2020
	1/29/2021	12/8/2020
Winter	2/2/2021	1/28/2021
	2/4/2021	2/8/2021
	3/8/2021	2/23/2021
	5/26/2021	5/27/2021*
	7/28/2021	8/30/2021
Summer	7/30/2021	7/29/2021
	8/12/2021	8/10/2021
	8/24/2021	8/30/2021

Source: Guidehouse analysis and NOAA data

* For the event on May 26, 2021, match days were limited to other days in May to ensure a more representative match was selected. Although the most similar weather to this event day occurred in later months, behavioral changes occur in usage patterns from early to late summer. As a result, selecting another day in May more accurately controls for unobserved factors that may impact demand.

Figure 2-3. Hourly Temperatures for Event (2021-08-24) and Matched Non-Event (2021-08-30)



Source: Guidehouse analysis of Duke Energy data

After identifying matched non-event dates, Guidehouse identified a non-participant match for each program participant. Selecting a match for a given participant means finding the non-participant whose usage across all selected non-event days is most like the participants usage. For each participant, the process includes the following steps:

1. Calculate the average 24-hour usage profile across all matched non-event days.

2. Calculate the average 24-hour usage profile for each non-participant across all matched non-event days.

3. Calculate the Euclidean distance[2] between the participant usage profile and each non-participant usage profile.

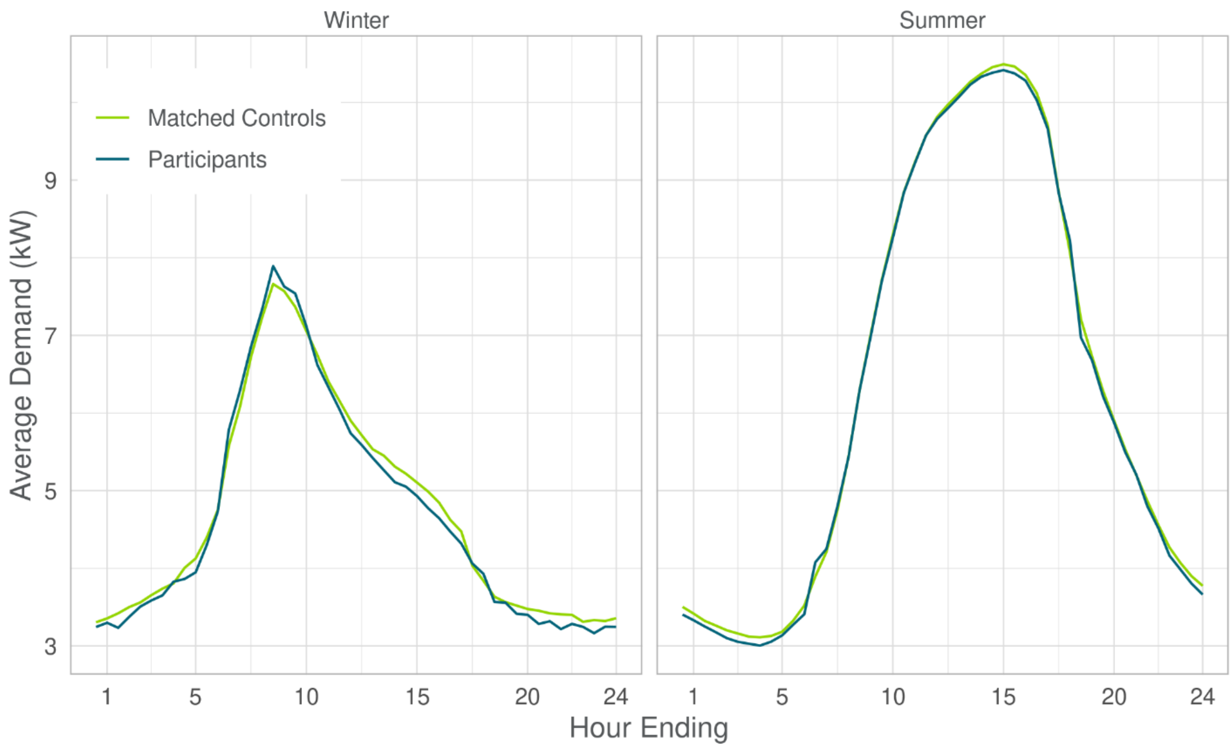
4. Select the non-participant associated with the lowest value (i.e., the one whose profile is most similar to the participant being matched).

Matches are selected with replacement, meaning that a non-participant may be matched to multiple participants.

[2] Euclidean distance is calculated by taking the square root of the sum of squared differences between the two vectors (participant and non-participant demand over 24 hours).

Figure 2-4 shows a comparison in average usage profiles between all participants and their selected matches for all winter and summer selected non-event days. Overall, the matches and participants showed similar usage profiles in both event seasons. For example, for summer events, the participants and matches have very similar profiles over all hours. The matching process does not (and is not expected to) deliver an exact match between participant and control group demand on non-event days – some deviations between average participant and control demand patterns are inevitable. For example, for winter events, participants show consistent, slightly lower usage between hours ending 10 and 18.

Figure 2-4. Average Demand for Participants and Matched Controls by Event Season



Source: Guidehouse analysis of Duke Energy data

The process of matching is not expected to produce perfect controls, but instead to find the closest non-participants possible. Small businesses tend to exhibit heterogenous usage patterns, meaning that very few customers will have an exact match among the non-participant population. To account for any remaining differences between participants and their matched controls, Guidehouse employed a lagged dependent variable model in the regression analysis described in Section 2.1.3. This method relies on the assumption that any differences between participants and matched controls on non-event days is consistent with the differences that would be expected on event days, precisely the reason why the most weather-similar non-event days are selected for matching.

2.1.3 Estimating Ex-Post and Ex-Ante DR Impacts

Guidehouse estimated 7 sets of ex-post impacts: one set for winter and one set for each summer event combination of technology (thermostat and switch); and cycling strategy (30%, 50%, and 75%). Guidehouse aggregated these granular impacts to present impacts by event season, by technology, and by cycling strategy[3]. To maximize the sample size, Guidehouse used a pooled regression model combining both DEC and DEP data. As a result, at the per participant level by technology and cycling strategy, impacts are identical for the two energy providers. To estimate impacts, Guidehouse used a lagged dependent variable model, that estimates customer load on a per participant basis as a function of the event hours, snapback in post-event hours, lagged non-event day usage, temperature, humidity, and hourly fixed effects. Only event day data is included in the regression model, although matched non-event day data informs the baseline through the lagged usage variable.

Lagged non-event day usage refers to including directly in the regression equation usage for each customer (participants and non-participants) and event day from the corresponding matched non-event day. For example, for a given customer in half-hour-ending 13 on the first event day, then this variable would take the value of that same customer's consumption in half-hour-ending 13 of the corresponding non-event day used for matching purposes.

Guidehouse used six different temperature variables in the current analysis, dependent upon the event season impacts being estimated. For winter events, the following weather variables were used:

- Heating degree hours, base 65°F (HDH65) – accounts for the contemporaneous temperature during each interval (i.e. half hour) of an event;

- 3-hour exponential moving average of HDH65 – accounts for short-term temperature history and mitigates the effect of rapid temperature variations, such as storms;

- 72-hour cold buildup term – accounts for long-term temperature history, and incorporates the effect of consistently low temperatures, such as a cold spell, that increase heating demand.

For summer events, the following weather variables were used:

- Cooling degree hours, base 65°F (CDH65) – accounts for the contemporaneous temperature during each interval (i.e. half hour) of an event;

- 3-hour exponential moving average of CDH65 – accounts for short-term temperature history and mitigates the effect of rapid temperature variations, such as storms;

- 72-hour heat buildup term – accounts for long-term temperature history, and incorporates the effect of consistently high temperatures, such as a heat wave, that increase cooling demand.

Formal model specifications with additional input variable detail may be found in Appendix A.

All estimates of uncertainty presented in this report are derived from standard errors that have been clustered at the individual participant level. Since the current analysis includes estimating impacts relative to baseline usage on matched non-event days, the DR impacts can be considered as incremental relative to any demand savings realized through consistent shifts in

[3] Cycling strategy is not relevant for winter analysis, as all customers are controlled in the same way.

participant behavior (e.g., changes in programmed setpoints) associated with the installation of the technology.

For winter events, Guidehouse estimated ex-ante impacts for the temperature range of 20°F to 40°F based on the range of observed minimum temperatures on event days which were between 24°F and 32°F. For summer events, Guidehouse estimated ex-ante impacts for the temperature range of 85°F to 95°F based on the range of observed peak temperatures on event days which were between 90°F and 93°F. The ex-ante estimates leverage this temperature range and the impact parameter estimates from the ex-post impact regression analysis for hour ending 8 and hour ending 17, for winter and summer events, respectively. Finally, the ex-ante estimate for a given temperature X assumes that temperature has remained constant for at least the previous 3 hours. This assumption is a construction of the regression model that uses the 3-hour exponential moving average of CDH65 or HDH65 which mitigates sudden changes in temperature.

Ex-ante estimates will be highly sensitive to the range of event temperatures and the characteristics of participant, so should be considered prudently. The range of event day temperatures for this evaluation was relatively narrow, particularly for summer events. There were also several technology and cycling strategy groups (e.g. switches in all cycling groups) where the number of enrolled participants was small with fewer than 150 participants. These small sample sizes mean that there is higher uncertainty in these impact estimates. Finally, impacts could be altered by future enrollment. A considerable portion of participants were medium-size customers with peak demand greater than 30 kW. Since most customers have peak demand around 10 kW, these larger customers can influence results. Enrollment of additional large customers could also generate different impacts.

3. Impact Findings

This chapter provides a detailed summary of the impact findings, and is divided into five sections:

- **Demand Response Events – Ex Post Impacts.** This section provides the estimated impacts of A/C curtailment during the ten demand response events observed in 2020/2021.

- **Forecast Curtailment Capability – Ex-Ante Impacts.** This section provides the estimated DR capability of load curtailment across a variety of different temperatures.

- **Net to Gross.** This section describes the assumptions informing the net-to-gross ratio applied in this evaluation.

3.1 Demand Response Events – Ex Post Impacts

The ex-post impacts are the estimated impacts for the actual events that were called during the 2020/2021 winter and summer DR seasons. This section is divided into 2 sub-sections.

1. **Winter Event Impacts.** Provides a summary of the estimated impacts for winter events.

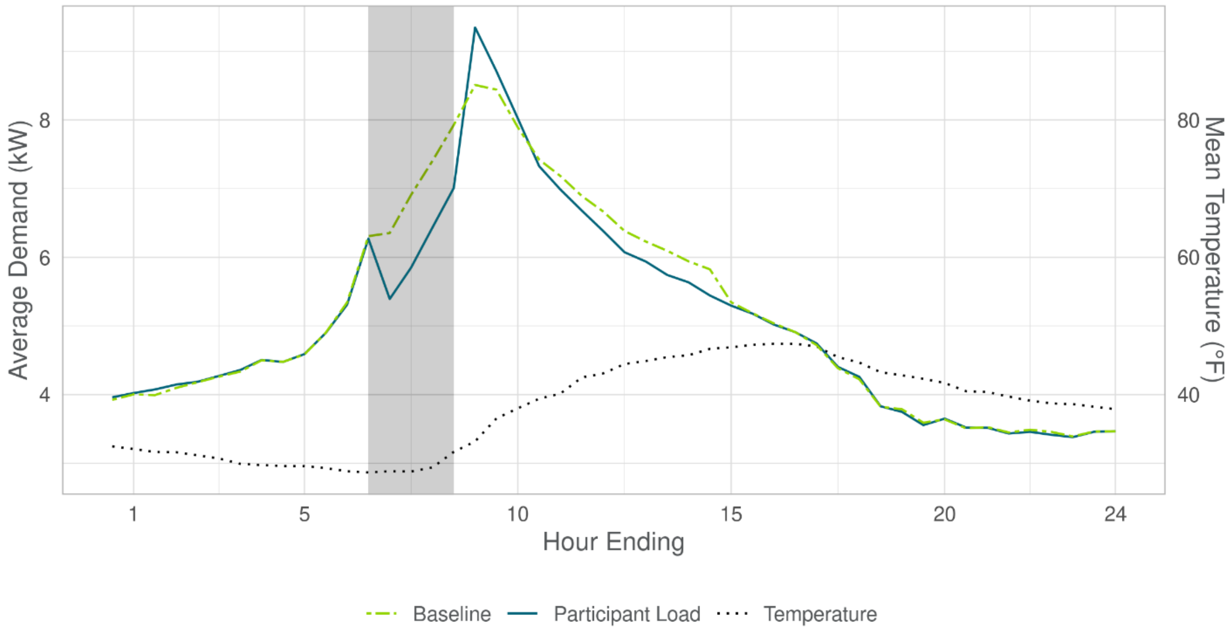
2. **Summer Event Impacts.** Provides a summary of the estimated impacts for summer events overall, as well by the two types of control technology (thermostat and switch) and three cycling strategies (30%, 50%, and 75%)

3.1.1 Winter Event Impacts

During the 2020/2021 winter DR season, five events were called. Because all participants enrolled with the same load control technology (thermostat) and same cycling strategy (i.e. complete curtailment of auxiliary electric resistance heat), impacts do not require summarization by technology type or cycling strategy.

Figure 3-1 illustrates the average hourly load and average participant in winter. In this figure, average observed demand is represented by the dark blue solid line. The dashed green line represents the regression-estimated baseline. A clear reduction in load occurs during event hours, as represented by the light gray shading.

Figure 3-1. Event Day Load Profiles – Winter



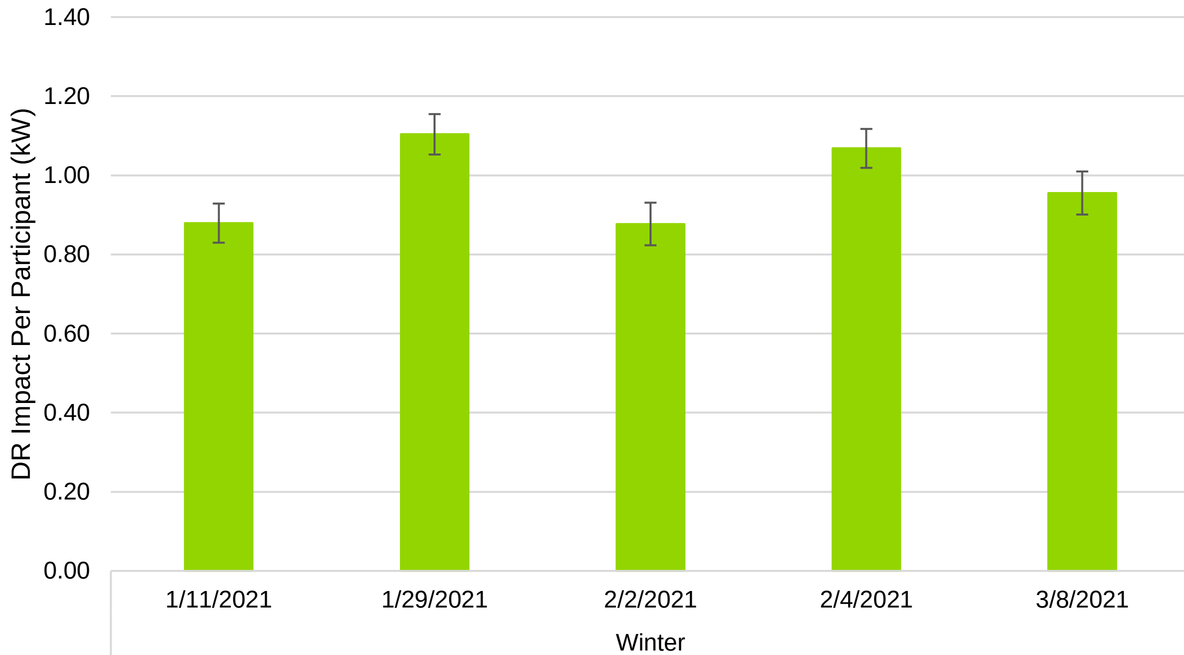
Source: Guidehouse analysis of Duke Energy data

In addition to the depth and shape of the DR impact, the snapback is noteworthy. “Snapback” is the term typically applied in demand response evaluation to the increase in loads observed in the period immediately following a curtailment event.

As visible in Figure 3-1, observable snapback occurs following winter events. In electric heat pump or electric resistance heating curtailment programs, this effect is driven by the indoor temperature falling below the thermostat setpoint during the event, leading to increased heating demand when the event is over.

Figure 3-2 shows the average DR impact per participant by event. In addition to showing the average impact per participant on each date, this plot shows the 90% confidence interval, represented by the whiskers straddling to top of each column.

Figure 3-2. Average Impact Per Participant Per Event - Winter



Source: Guidehouse analysis of Duke Energy data

Per participant and aggregate impacts are presented in Table 3-1 and Table 3-2. These impacts are identical for the two energy providers for winter events, because there is only one technology and control strategy, and the regression model includes both energy providers, described in Section 2.1.3. In addition to the per-participant impacts and the aggregate program impact for each event, these tables also show relative precision, as well as the average impact across events. Total program impacts reflect the larger number of DEC participants than DEP participants, who deliver average load curtailment of 0.4 MW and 0.1 MW per event, respectively.

Table 3-1. Impact by Event – Per Participant and in Aggregate, DEC

Event Date	Avg. Event Temperature (°F)	Impact Per Participant (kW)	Relative Precision +/-% (90% Confidence)	Participants (Accounts)	Total Program Impact (MW)
1/11/2021	33.7	0.88	26.4%	445	0.39
1/29/2021	24.8	1.10	26.4%	448	0.49
2/2/2021	32.7	0.88	26.4%	448	0.39
2/4/2021	25.8	1.07	26.4%	449	0.48
3/8/2021	31.4	0.96	26.4%	463	0.44
Average	**29.7**	**0.98**	**26.4%**	**451**	**0.44**

Source: Guidehouse analysis of Duke Energy data

Table 3-2. Impact by Event – Per Participant and in Aggregate, DEP

Event Date	Avg. Event Temperature (°F)	Impact Per Participant (kW)	Relative Precision +/-% (90% Confidence)	Participants (Accounts)	Total Program Impact (MW)
1/11/2021	33.7	0.88	26.4%	77	0.07
1/29/2021	24.8	1.10	26.4%	77	0.08
2/2/2021	32.7	0.88	26.4%	77	0.07
2/4/2021	25.8	1.07	26.4%	77	0.08
3/8/2021	31.4	0.96	26.4%	77	0.07
Average	**29.7**	**0.98**	**26.4%**	**77**	**0.08**

Source: Guidehouse analysis of Duke Energy data

Impacts are also presented on a per device basis in Table 3-3, below. Per device impacts are computed as estimated impact divided by the average number of devices per participant. The average number of devices, in this case thermostats, per participant was 1.66. The maximum number of devices observed for any participant in the winter season was 23.

Table 3-3. Impact by Energy Provider Per Device

Event Season	Energy Provider	Impact Per Participant (kW)	Relative Precision +/-% (90% Confidence)*	Impact Per Device (kW)	Avg. # Devices
Winter	DEC	0.98	26%	0.59	1.66
	DEP	0.98	26%	0.59	1.66

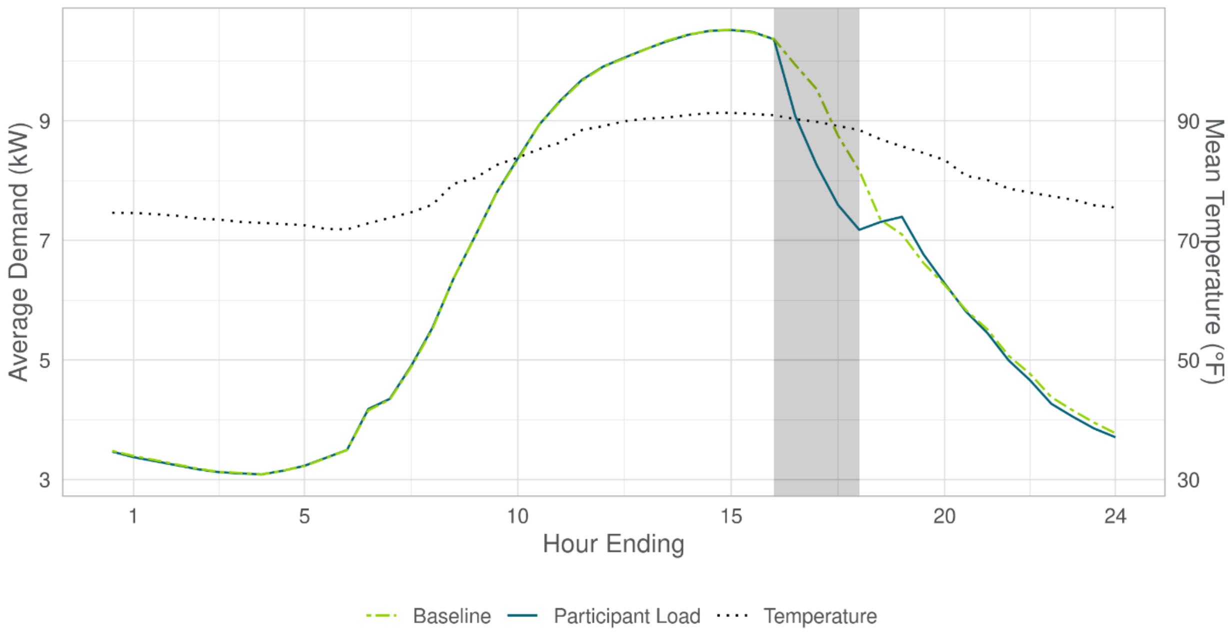
Source: Guidehouse Analysis of Duke Energy data
** Relative precision applies to impact per participant.*

3.1.2 Summer Event Impacts

Guidehouse estimated summer event impacts for each combination of device type (thermostat or switch) and cycling strategy (30%, 50%, or 75%), using a pooled regression model including both DEP and DEC participants. The results are therefore identical across energy providers at the participant, device type and cycling strategy level.

Figure 3-3 illustrates the average hourly load and average participant in summer. In this figure, average observed demand is represented by the dark blue solid line. The dashed green line represents the regression-estimated baseline. A clear reduction in load occurs during event hours, as represented by the light gray shading.

Figure 3-3. Event Day Load Profiles – Summer



Source: Guidehouse analysis of Duke Energy data

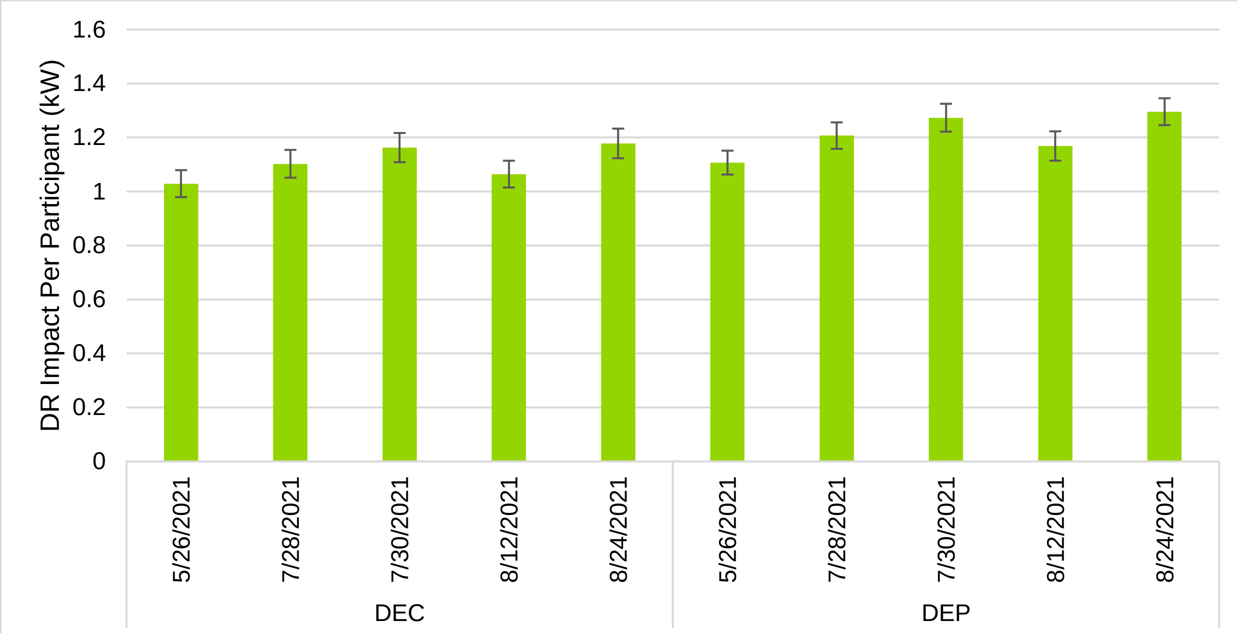
In addition to the depth and shape of the DR impact, the snapback, or lack thereof is noteworthy here. In air-conditioning curtailment programs, this effect is driven by the increased indoor temperature rising above the thermostat setpoint requiring the compressor to run more than it usually would when the event is over.

As may be seen in the plot above, almost no snapback occurs following summer events. This is a commonly observed phenomenon in A/C direct load control programs for small and medium businesses[4] and is typically because curtailment events tend to end as most businesses start to close for the day. In addition, summer event temperatures were relatively low compared to past evaluation years, which may have prevented indoor temperature from rising as far above the thermostat or switch setpoint during events as it would have given higher outdoor temperatures.

Figure 3-4, below, plots the average DR impact per participant by event and energy supplier. In addition to showing the average impact per participant on each date, this plot shows the 90% confidence interval, represented by the whiskers straddling to top of each column. Impacts differ slightly for the two energy providers, due to differing distributions of participants across cycling strategies and device types.

[4] See for example
Navigant, prepared for Southern California Edison, *2014 Load Impact Evaluation of Southern California Edison's Residential and Commercial Summer Discount Plan (SDP) Programs*, March 2015

Figure 3-4. Average Impact Per Participant Per Event - Summer



Source: Guidehouse analysis of Duke Energy data

The impacts presented above are also presented below in tabular form in Table 3-4 and Table 3-5. In addition to the per-participant impacts and relative precision, these tables show the aggregate program impact for each event, as well as the average impact across events. On average, impacts per participant are slightly lower for DEC than DEP, which is attributed to the higher proportion of participants at lower cycling levels (30% cycling and 50% cycling). Total program impacts however, are more than twice as high on average for DEC than DEP, due to higher enrollment numbers for DEC.

Table 3-4. Impact by Event – Per Participant and in Aggregate, DEC

Event Date	Avg. Event Temperature (°F)	Impact Per Participant (kW)	Relative Precision +/-% (90% Confidence)	Participants (Accounts)	Total Program Impact (MW)
5/26/2021	87.6	1.03	4.9%	6,937	7.14
7/28/2021	89.1	1.10	4.7%	6,281	6.93
7/30/2021	91.4	1.16	4.7%	6,258	7.28
8/12/2021	86.7	1.06	4.7%	6,155	6.55
8/24/2021	91.3	1.18	4.7%	6,137	7.23
Average	**89.2**	**1.11**	**4.7%**	**6,354**	**7.03**

Source: Guidehouse analysis of Duke Energy data

Table 3-5. Impact by Event – Per Participant and in Aggregate, DEP

Event Date	Avg. Event Temperature (°F)	Impact Per Participant (kW)	Relative Precision +/- % (90% Confidence)	Participants (Accounts)	Total Program Impact (MW)
5/26/2021	87.6	1.11	4.4%	2,970	3.29
7/28/2021	89.1	1.21	4.3%	2,520	3.04
7/30/2021	91.4	1.27	4.3%	2,502	3.19
8/12/2021	86.7	1.17	4.3%	2,444	2.86
8/24/2021	91.3	1.30	4.3%	2,432	3.15
Average	**89.2**	**1.21**	**4.3%**	**2,574**	**3.11**

Source: Guidehouse analysis of Duke Energy data

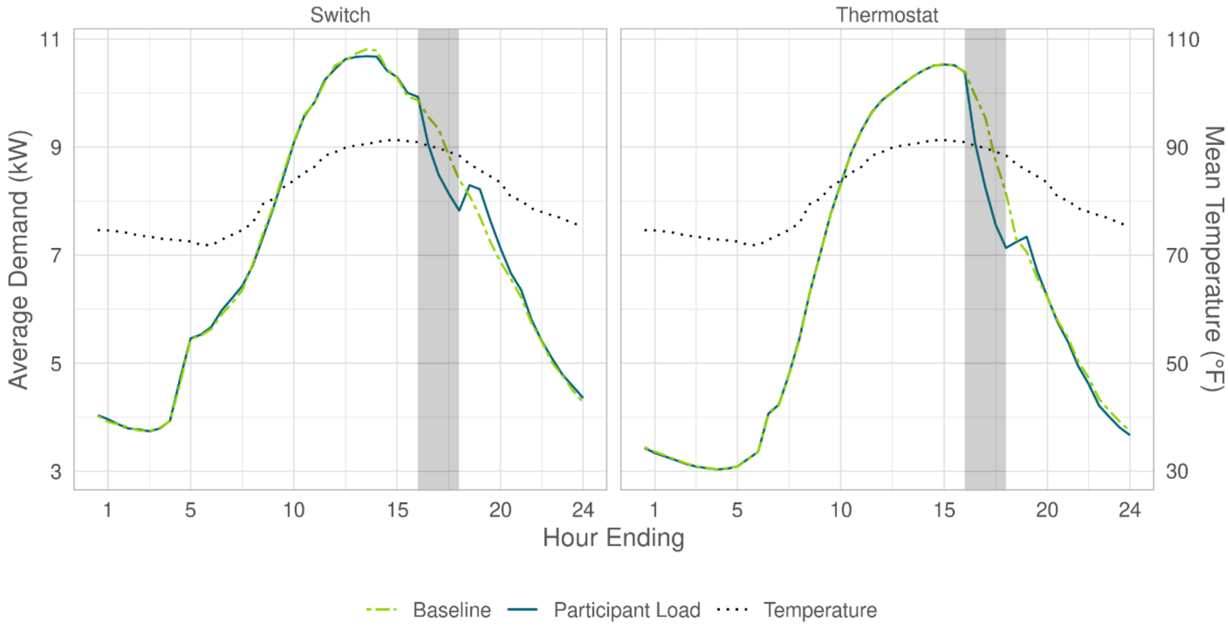
3.1.2.1 Ex-Post Impacts by Technology Type

Participants enrolling in the EnergyWise for Business program for the summer season may select one of two control technologies: a load switch or a smart thermostat. Only customers with a password-protected wireless network may select the thermostat. Overall, far more participants are controlled by thermostat than by switch. As shown in Section 1.2.1, almost 95% of participants in the estimation data set are controlled by thermostat, rather than load switch.

This difference in sample sizes is evident when comparing average load plots of participants, split by device type, during summer events, as shown in Figure 3-5. Specifically, the average demand of the thermostat group is relatively smooth compared with the switch group, reflecting the difference in number of participants (over 8,000 participants have thermostats vs approximately 600 have switches).

Businesses with load switches tend to have a load profile that extends slightly later into the evening than those with thermostats. This is a possible reason why snapback is more apparent for businesses equipped with switches than it is for businesses equipped with thermostats. Even so, snapback for both technologies is relatively low in magnitude.

Figure 3-5. Event Day Load Profiles – Summer Events by Technology Type



Source: Guidehouse analysis of Duke Energy data

The smaller size of the switch sample compared to the thermostat sample for summer events is equally evident in the relative precision of the estimated impacts by technology type as shown in Table 3-6. In addition to presenting the average impact per participant, this table shows the average temperature per event type, the average number of participants that did not opt out of the event, and the aggregate program impact. Differences in per participant impacts across the two energy providers are attributed to the proportion of participants in each cycling strategy group per device type, per energy provider.

Table 3-6. Impact by Technology Type – Per Participant and in Aggregate

Energy Provider	Technology Type	Impact Per Participant (kW)	Relative Precision +/-% (90% Confidence)	Avg. Participants (Accounts)	Total Program Impact (MW)
DEC	Thermostat	1.13	5%	5,958	6.75
	Switch	0.71	29%	396	0.28
DEP	Thermostat	1.25	4%	2,383	2.98
	Switch	0.69	29%	190	0.13

Source: Guidehouse analysis of Duke Energy data

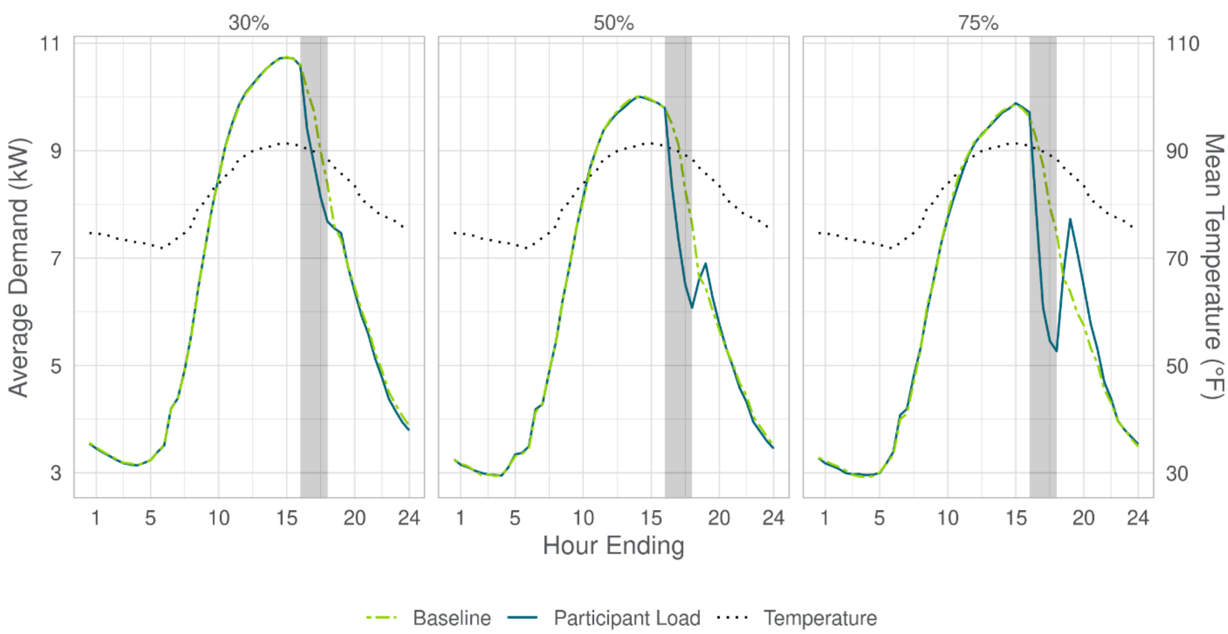
The standard error of an estimated impact – the statistic which delivers the relative precision, or confidence interval, around an impact – is a direct function of the number of observations available. The fewer the observations, the less certain the estimated impact and the wider the confidence interval.

Average impact per switch is lower than that of thermostats for summer events. There is a statistically significant difference between the switch and thermostat impacts for summer events (the confidence interval of the switch impact does not overlap with that of the thermostat). Moreover, the average DR impact of switches during summer events is an 8% reduction of the total facility estimated baseline, whereas the average impact of the thermostats is a 13% reduction. On average, participants enrolled with a switch device have lower baseline demand than participants enrolled with thermostats. This may result in reduced potential for demand savings, particularly if indoor temperatures did not rise far above the switch setpoint during some events. Feedback from Duke program staff indicates that participants with switches tend to have smaller HVAC units.

3.1.2.2 Ex-Post Impacts by Cycling Strategy

Impacts by cycling strategy show that the more aggressive the cycling strategy, the greater the impact. For summer events, differences in impacts do not appear to be linear in cycling strategy: the estimated impact from 75% cycling participants is more than 2.5 times the estimated impact from 30% cycling participants (see Table 3-7, below). This differential in impacts is also not related to baseline demand – in fact, as is evident from Figure 3-6 below, the participants that select the 75% cycling strategy (plot on far right) have, on average, the *lowest* daily peak demand of the three groups.

Figure 3-6. Event Day Load Profiles – Summer Events by Cycling Strategy



Source: Guidehouse analysis of Duke Energy data

There are a variety of possible explanations for why the impact is relatively larger for the most aggressive cycling strategy. The smaller baseline load overall suggests this group contains smaller businesses where A/C is likely a much higher proportion of their overall load, so aggressive curtailment leads a larger relative impact. It may seem counterintuitive that a business for which A/C is so important would select the most aggressive curtailment strategy. One possibility is that these are small businesses looking for opportunities to reduce costs and so are attracted by the larger incentive offered for the more aggressive cycling strategy, but that are using relatively inefficient cooling equipment. Entrepreneurs with smaller businesses may not realize the potential bill savings achievable through improved A/C efficiency or may lack the access to capital to make the required replacement investment. In either case, Guidehouse would recommend that Duke Energy consider targeting these participants with marketing for other program opportunities.

These impacts (along with the count of the average number of participants that did not opt out, and the overall system impact, in MW) are shown in tabular format in Table 3-7 below. The estimated impacts for summer events are much more precise than those in the winter season, primarily due to a larger sample size and larger magnitude impacts. The estimated impacts for the 75% cycling strategy participants are only incrementally less precise than for the 30% and 50% participants in the summer season, despite being the smallest of the three groups. This suggests a greater consistency in impacts for these customers and implicitly suggests that a much higher proportion of these customers' loads is A/C (compared to the 30% and 50% cycling participants). Per participant impacts are nearly identical for the two energy suppliers, due to similar proportions of participants using each device type.

Table 3-7. Impact by Cycling Strategy – Per Participant and in Aggregate

Energy Provider	Cycling Strategy	Impact Per Participant (kW)	Relative Precision +/-% (90% Confidence)	Avg. Participants (Accounts)	Total Program Impact (MW)
DEC	30%	0.84	7%	4,690	3.95
	50%	1.59	7%	1,004	1.60
	75%	2.24	8%	660	1.48
DEP	30%	0.83	7%	1,591	1.33
	50%	1.61	7%	679	1.09
	75%	2.27	8%	303	0.69

Source: Guidehouse analysis of Duke Energy data

3.1.2.3 Ex-Post Impacts by Technology Type and Cycling Strategy – Per Device

Most participants in the 2020/2021 demand response season had 2 load control devices, but the number of devices per participant ranged from 1 to 40. Estimated impacts from switches are lower, consistent with results per participant. This is evident in Table 3-8, which presents estimated impact per device for each event season, technology type, and cycling strategy. The average number of devices per participant in each group is also included. By construction of the regression model, estimated impacts are the same for both energy providers.

Table 3-8. Impact by Energy Provider, Cycling Strategy, and Technology Type

Energy Provider	Device Type	Cycling Strategy	Impact Per Participant (kW)	Relative Precision +/- % (90% Confidence)*	Impact Per Device (kW)	Avg. Devices
DEC	Thermostat	30%	0.86	7%	0.49	1.74
		50%	1.64	7%	0.92	1.77
		75%	2.43	8%	1.06	2.29
	Switch	30%	0.55	45%	0.34	1.61
		50%	1.10	31%	0.55	1.99
		75%	0.72	96%	0.35	2.05
DEP	Thermostat	30%	0.86	7%	0.49	1.74
		50%	1.64	7%	0.92	1.77
		75%	2.43	8%	1.06	2.29
	Switch	30%	0.55	45%	0.34	1.61
		50%	1.10	31%	0.55	1.99
		75%	0.72	96%	0.35	2.05

Source: Guidehouse Analysis of Duke Energy data
** Relative precision applies to impact per participant.*

Interestingly, for participants with thermostats during summer events, estimated impacts per device increase as cycling strategy increases, despite that the average number of devices for participants with a higher cycling strategy is also greater. One potential explanation is that participants with a greater number of devices have a larger baseline load and can therefore deliver a deeper impact. While this may be true for some participants, baseline load for the 75% cycling strategy group is, on average, the lowest of the three cycling strategies, which suggests that businesses selecting into this cycling strategy may be of a smaller size. Because of the high impact being delivered, Duke Energy may want to further explore characteristics of this group of participants to better target similar businesses in the future.

Compared with a previous evaluation (2017) of the EnergyWise Business program, the current estimated per device impacts are lower on average by 35%. This result may be due to several reasons:

- The maximum temperature during 2021 events was on average 5°F cooler than during 2017 events; therefore, baseline demand on event days would be expected to be lower, contributing to lower demand impacts. Section 3.2.2 describes this phenomenon, showing the ex-ante relationship between outdoor temperature and estimated impacts. As temperatures become more extreme, estimated event impacts increase.

- The program has added many new participants, changing the composition of participants involved. These new participants may have different patterns of usage, leading to different baseline demand and different event impacts.

- Since the onset of the COVID-19 pandemic in 2020, many businesses have experienced changes in capacity and operations, with corresponding changes in energy usage patterns (e.g., lower demand for HVAC consumption associated with fewer operating hours). Consequently, baseline demand and associated curtailment would be expected to be lower. Guidehouse has recently observed similar results in evaluations of demand response programs in other jurisdictions, where the small and medium business sector exhibited substantially reduced demand as a result of the pandemic.

- The previous evaluation used a different set of methods, primarily estimating a percentage reduction in run time using device telemetry data, and subsequently estimating a reduction in energy based on assumed equipment sizes and full load demand. Assumptions around the conversion of runtime to energy impacts add uncertainty to estimated impacts. Whole-premise AMI consumption data was available for businesses in the current study, so Guidehouse did not have to make any such assumptions.

3.2 Forecast Curtailment Capability – Ex-Ante Impacts

This section provides the estimated EnergyWise for Business DR capability, or ex-ante impacts. These estimates are Guidehouse's projection of how much DR the program could offer under a range of different possible temperatures at different cycling levels, for the different technologies and event day types. This estimate of capability is based on the regression-estimated relationships between DR impacts and outdoor temperature from which the ex-post impacts were also developed.

It is this forecast of capability that provides the truest estimate of a given DR program's value as a system resource because it provides DEC and DEP staff with an understanding of how much of a demand reduction the program may be counted on to deliver in future system peak conditions. This is also why it is the forecast DR capability that should be used to calculate the benefits for any cost-benefit ratio test (e.g., total resource cost test, or TRC).

Forecast program capability per participant is projected by applying a series of temperature values to the estimated model parameters. Guidehouse's projected capability assumes that the temperature at which the capability is estimated lasts the entire length of the event and is the same as the temperature in the 3 hours leading up to the event. This assumption is required due to the manner in which impacts are estimated. Because buildings have thermal mass, a sudden swing in outdoor temperature does not immediately provoke a concomitant swing in cooling load—it takes time for the building's indoor temperature to rise above the setpoint temperature because of that outdoor temperature swing. This is reflected in Guidehouse's estimation approach (see Appendix A for more details), where impacts are modeled as a function of a 3-hour exponential moving average of cooling or heating degree quarter-hours (outdoor temperature), dependent on event season. Therefore, projecting capability requires an assumption of what the temperature is in the 3 hours leading up to the event.

This section is divided into two sub-sections:

1. **Ex-Ante Impacts for Winter Events.**
2. **Ex-Ante Impacts for Summer Events.**

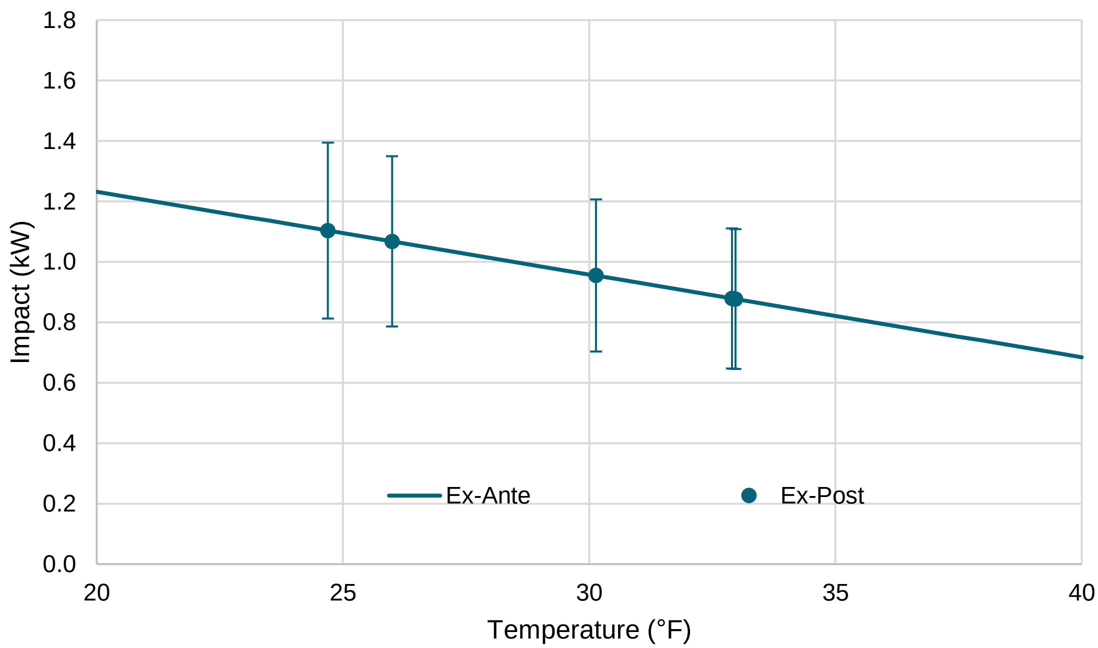
Ex-ante impacts are presented graphically in each of these sub-sections. Numerical values underlying these charts may be found in the Excel Appendix provided separately. Specific tab references for finding these values are provided in the sub-sections below.

Guidehouse would note that the observant event temperatures cover a relatively narrow band, especially for summer events. A high proportion of the range of ex-ante values occur outside of the temperature range inside which events were observed in 2021. Caution should therefore be used in working with impacts estimated outside the range of observed temperatures in the winter and summer of 2021 used to estimate the model parameters.

3.2.1 Ex-Ante Impacts for Winter Events

Ex-ante impacts for winter events were estimated using temperatures from 20°F to 40°F. Temperatures below this range are unusual and occurred on only one day throughout the event season. Total estimated impact ranges from 360 kW to 650 kW and increases steadily as temperatures become more extreme (decrease). Per participant, estimated impacts range from roughly 0.7 kW to over 1.2 kW. This is illustrated in Figure 3-7 which shows the per participant curtailment capability per event. This plot shows the ex-ante relationship between outdoor temperature and estimated impacts for winter events (blue line). Ex-post impacts (and the corresponding average event temperature) are identified by blue dots. The whiskers surrounding the ex-post impacts represent the 90% confidence interval. Since Guidehouse employed a pooled regression model, impacts are identical across energy providers by device type and cycling strategy. In the winter, there is only one device type and cycling strategy, so estimated ex-post and ex-ante impacts are identical for the two energy providers.

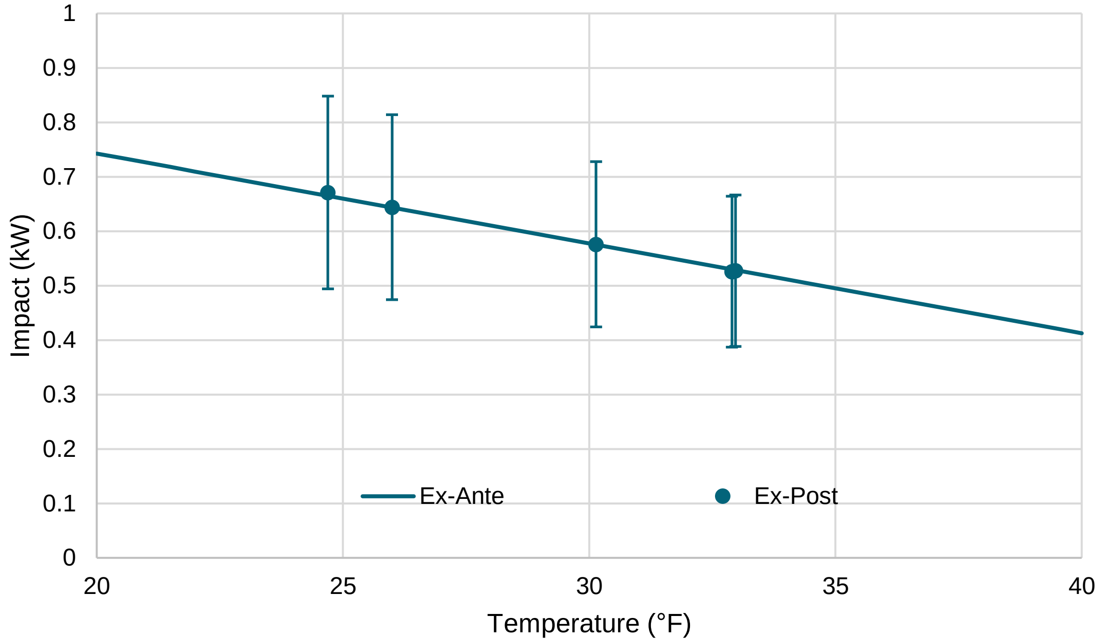
Figure 3-7. Ex-Ante Impacts, Winter Events – Per Participant



Source: Guidehouse analysis of Duke Energy data

Figure 3-8 shows ex-ante impacts on a per device basis. Per device, estimated impacts range from approximately 0.4 kW to 0.75 kW. Ex-post impacts (and the corresponding average event temperature) are identified by blue dots. The whiskers surrounding the ex-post impacts represent the 90% confidence interval.

Figure 3-8. Ex-Ante Impacts, Winter Events – Per Device

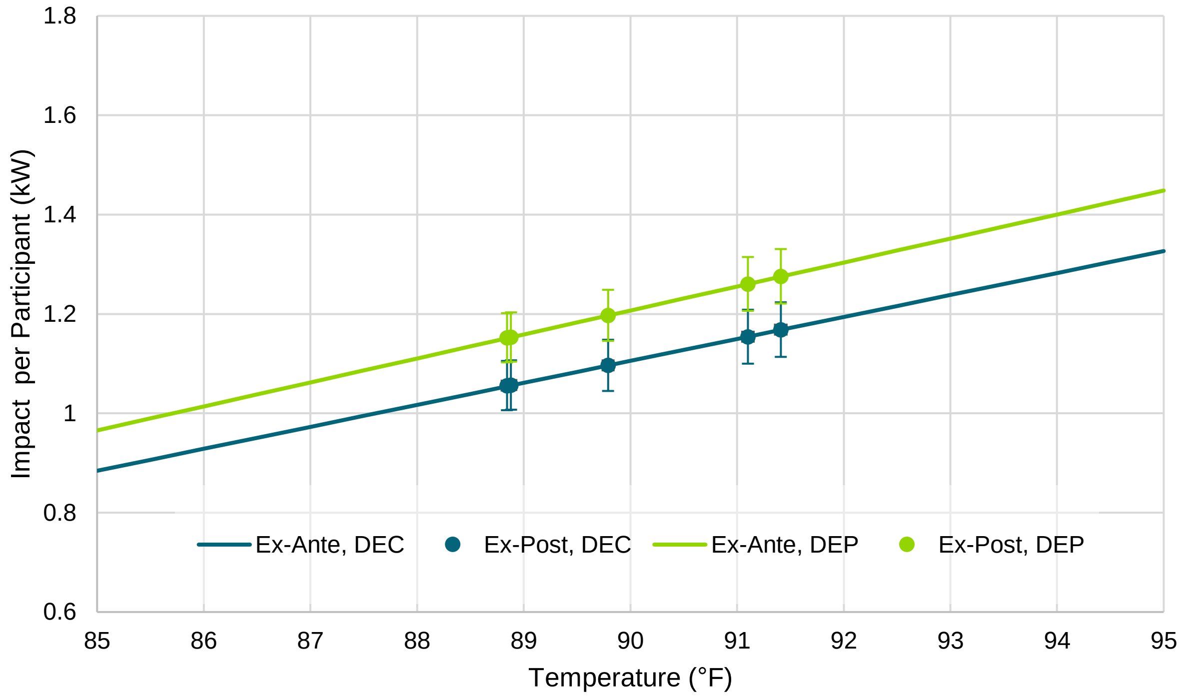


The kW values associated with ex-ante estimates above may be found in the Excel spreadsheet Appendix in the tab “03a Ex-Ante by Event Type”. As noted above, care should be taken when using ex-ante values that are outside the range of historically observed temperature values. If the true relationship between temperature and demand response impacts does not remain linear as temperatures increase or decrease, the ex-ante value may not accurately reflect the impact that could be expected at higher and lower temperatures than represented by actual events.

3.2.2 Ex-Ante Impacts for Summer Events

Ex-ante impacts for summer events were estimated using temperatures from 85°F to 95°F. Total estimated impact ranges from 8,000 kW to over 12,000 kW and increases as temperature rises. Per participant, estimated impacts range from approximately 0.9 kW to almost 1.5 kW. This can be seen in Figure 3-9 which shows the per participant curtailment capability per event. This plot shows the ex-ante relationship between outdoor temperature and estimated impacts for summer events for each energy provider (straight lines). Ex-post impacts (and the corresponding average event temperature) are identified by dots. The whiskers surrounding the ex-post impacts represent the 90% confidence interval. As noted in Section 3.1.2, estimated per participant impacts are slightly higher for DEP than DEC, due to a larger proportion of participants enrolled in the 50% and 75% cycling strategies.

Figure 3-9. Ex-Ante Impacts, Summer Events – Per Participant

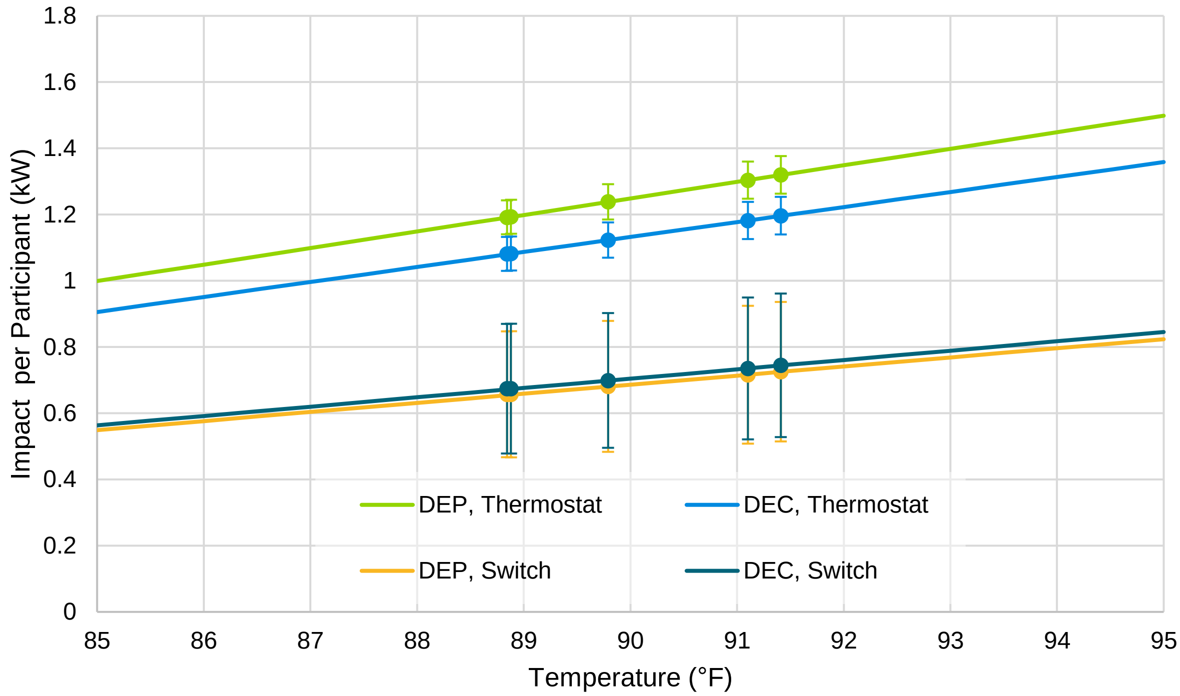


Source: Guidehouse analysis of Duke Energy data

3.2.2.1 Ex-Ante Impacts by Technology Type

As noted in Section 3.1.2.1, the point-estimate for the DR impact from thermostats is higher than that of switches and this difference is statistically significant (for summer events). This difference may reflect the fact that participants with switches tend to have smaller HVAC units, rather than an effect of the difference in device type itself. The difference in projected impacts is evident in Figure 3-10. In this plot, the actual (ex-post) impact/event temperature pairs for summer events are represented by the markers and the 90% confidence interval is captured by the whiskers. The bright green and light blue markers and lines identify the average impacts for thermostats for DEP and DEC, respectively. The orange and dark blue markers and lines identify the average impacts for switches for DEP and DEC, respectively.

Figure 3-10. Ex-Ante Impacts, Summer Events, by Technology Type – Per Participant



Source: Guidehouse analysis of Duke Energy data

The kW values associated with ex-ante estimates above may be found in the Excel spreadsheet Appendix in the tab “01b Ex-Ante by Device, Splr”.

As noted previously, actual events were only observed over a relatively narrow band of temperatures, and caution must be applied in extrapolating curtailment capability too far beyond that window. The true relationship at those unobserved temperatures may differ from that estimated in the band of temperatures observed. Additional caution should be used in applying the estimated results for switches. With fewer participants equipped with switches, the average (and aggregate) impacts of this group will be very sensitive to changes in the composition of that group over time. Additional enrollment or program withdrawals of even a small number of participants may meaningfully alter this average relationship.

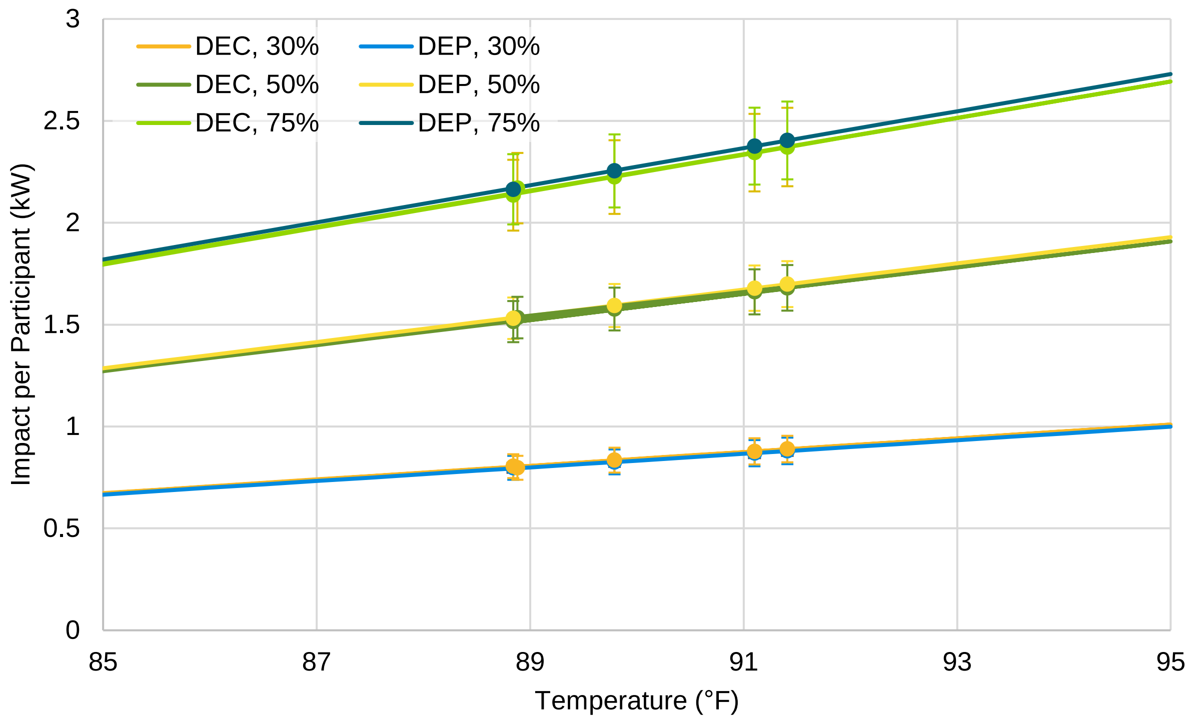
3.2.2.2 Ex-Ante Impacts by Cycling Strategy

The same patterns noted in the ex-post analysis are present in the ex-ante estimate of curtailment capability. Participants in the 75% cycling strategy deliver far more summer event DR per participant than either of the two other cycling strategies. These participants also deliver DR that is a far higher proportion of their baseline consumption compared to the other cycling strategies, indicating that DR impacts (either absolute or as a proportion of baseline) are not linear in the cycling strategy selected.

Current program incentives to some degree reflect this (the incentive for 75% cycling is $135, whereas the incentive for 30% cycling is only $50). Still, given the relationship apparent in, Figure 3-11, below, and the proportion of participants enrolled for the summer season, Duke Energy may consider whether it may be appropriate to further adjust the offered incentive to reflect the relative benefit delivered by each of the different cycling strategies.

In Figure 3-11, 75% cycling impacts are represented by the light green and dark blue line and markers, 50% cycling by the darker green and yellow line and markers, and 30% cycling by the light blue and orange line and markers.

Figure 3-11. Ex-Ante Impacts, Summer Events, by Cycling Strategy – Per Participant



Source: Guidehouse analysis of Duke Energy data

Due to similar proportions of participants per device type, per participant impacts by cycling strategy are nearly identical for the two energy providers. Duke Energy may wish to consider undertaking some additional cross-sectional analysis of the characteristics of the 75% cycling strategy participants to focus future recruitment efforts to capture higher value (higher DR potential) customers.

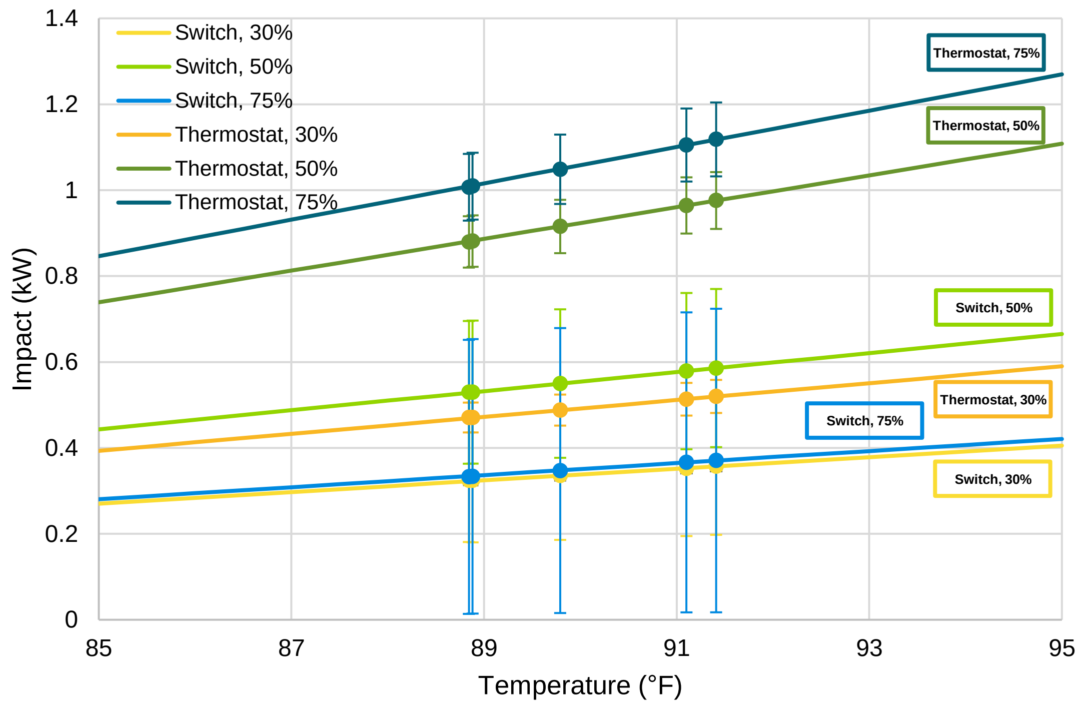
The kW values associated with ex-ante estimates above may be found in the Excel spreadsheet Appendix in the tab “02b Ex-Ante by Cyc, Splr”. Note that care should be taken when using ex-ante values that are outside the range of historically observed temperature values.

3.2.2.3 Ex-Ante Impacts by Technology Type and Cycling Strategy

Since this analysis implements a pooled regression model, estimated ex-post and ex-ante impacts for the two energy providers are identical at the technology type and cycling strategy level. Unlike the results in Sections 3.2.2.1 and 3.2.2.2, estimated impacts at this level are not dependent on the distribution of participants across technology types and cycling strategies.

Figure 3-12 illustrates estimated impacts per device for two technology types and three cycling strategies during summer events. Ex-post impacts are represented by the dots, with the surrounding whiskers representing the 90% confidence interval. The straight lines denote ex-ante impacts.

Figure 3-12. Ex-Ante Impacts for Summer Events, by Technology Type and Cycling Strategy – Per Device



Source: Guidehouse analysis of Duke Energy data

Consistent with patterns observed in the ex-post analysis, thermostats in the 75% cycling strategy group deliver the highest estimated impacts, ranging from approximately 1.95 kW to 2.9 kW per participant. Notably, these impacts are significantly larger than all other technology and cycling strategy groups (the 90% confidence intervals do not overlap). Moreover, estimated impacts from switch devices are lower than the estimated impacts for thermostats at the same cycling strategy. Even at the 75% cycling strategy level, estimated impacts from switches are not significantly different from the impacts delivered by the thermostat, 30% cycling group. Given these results, Duke Energy should continue to install thermostat devices as the default technology type, except in the case that incompatibility issues exist.

The kW values associated with ex-ante estimates above may be found in the Excel spreadsheet Appendix in the tab “04b Ex-Ante by Cyc, Dev per Dev”. Note that care should be taken when using ex-ante values that are outside the range of historically observed temperature values.

3.3 Net to Gross

Evaluations of demand-side management programs typically estimate both net and gross savings, and often present a net-to-gross (NTG) ratio based on the evaluated percentage of energy reductions that may be ascribed either to free ridership (which decreases the NTG ratio) or to program spillover (which increases the NTG ratio).

Free ridership is typically defined as the percentage of savings that would have occurred absent the presence of the program. Spillover is typically defined as incremental savings actions undertaken by a program's participants not directly incented by the program.

All savings presented in this report should be considered net.

3.3.1 Demand Response Impacts

In this analysis, demand reductions are estimated in contrast to an implied estimated baseline, the average level of behavior implied by the estimated parameter values of the regression used. Because this captures expected participant behavior absent an event, Guidehouse can state that the free ridership is 0. Absent the EnergyWise for Business program, none of the observed demand reductions would have taken place, as the events themselves would not have taken place. It is possible that there may have been some spillover resulting from the program (from participants becoming more aware of their sites' consumption profiles, for example). However, it is likely impossible to estimate such an effect in a sufficiently robust manner and the assessment of such impacts is beyond the scope of this report.

Since spillover cannot be robustly estimated and because free ridership must, by program design, be considered 0, Guidehouse considers the program to have a NTG ratio of 1.

4. Findings and Recommendations

The principal EM&V findings regarding the estimated demand impacts are as follows:

- **On average, the program delivered approximately 0.5 MW of load curtailment during winter events, and approximately 10.1 MW of load curtailment during summer events.** For DEC, this amounts to 0.4 MW of estimated load curtailment in winter and 7 MW of estimated load curtailment from in summer. Estimated load curtailment for DEP is approximately 0.1 MW in winter and 3.1 MW in summer, consistent with enrollment numbers. The program-level impacts for each event vary depending on the number of participants, the temperature, and other factors.

- **On average, the program delivered nearly 1 kW of demand response per participant during winter events, and over 1.1 kW of demand response per participant during summer events.** For DEC, this amounts to 0.6 kW of demand response per device in both winter and summer. Estimated curtailment per device for DEP is approximately 0.6 kW per device in winter and 0.7 kW per device in summer.

- The results of the ex-post evaluation informed the development of ex-ante forecast of program capability across a range of temperatures at different cycling levels, which can be used for calculating benefits for cost-effectiveness tests. For summer events at an assumed temperature of 95°F, ex-ante impacts are estimated to be 0.8 kW per thermostat device and 0.5 kW per switch device. During winter events at an assumed temperature of 20°F, thermostats are estimated to deliver 0.7 kW of curtailment per device.

- **Thermostats deliver greater relative impacts for events in both seasons compared to load control switches. While no switch impacts were measured for winter events, thermostat impacts are materially higher than switch impacts during summer events.** On average across cycling strategies, thermostats delivered demand reductions during summer events of 13% of total facility baseline load, and switches 8%. During winter events, thermostats deliver demand reductions of approximately 14% of total facility baseline load. According to Duke program staff, this may be because participants with switches tend to have smaller HVAC equipment.

- **Participants that have selected the 75% cycling strategy deliver the highest per participant impacts for summer events.** During summer events, 75% cycling strategy participants deliver an average impact equivalent to 27% of their estimated facility baseline demand. In contrast, 30% and 50% cycling strategy participants delivered an average impact of approximately 9% and 19% of their baseline demand, respectively.

Based on the impact findings above, Guidehouse recommends that Duke Energy consider the following recommendations:

- **Consider using future process evaluations to better understand differences in businesses that enroll in each cycling strategy.** Consistent with expectations, Guidehouse estimated significantly greater savings for participants enrolled in the 75% cycling strategy during demand response events than for the 30% and 50% cycling strategies. Because of the high impact being delivered, Duke Energy may want to further explore characteristics of this group of participants to better target similar businesses in the future, through participant surveys or interviews.

- **Continuing to evaluate the program on an annual basis, particularly if enrollment changes in any material way.** The total number of enrolled participants is over 9,000, and the energy use at commercial facilities is generally more heterogeneous than at residential facilities. This means that the average participant (and aggregate program) impacts and capability could change materially as a result of relatively modest changes in the absolute number of participants enrolled, or if the distribution of participants across cycling strategies shifts. Duke Energy should carefully consider this when using the capability estimates provided above for any planning exercises.

5. Summary Form

EnergyWise Business
2019-2021
Completed EMV Fact Sheet

Description of Program

EnergyWise Business is a commercial HVAC load control program that targets small and medium businesses. At the time of enrollment participants are provided either with a thermostat or a load switch, with most customers having a thermostat. Participants must have a password-protected wireless network in order to qualify for a thermostat.

Participants may elect to be controlled using one of three cycling strategies: 30%, 50%, or 75%. Incentive for participation increases commensurate with the increased aggressiveness of the cycling strategy selected.

Five events took place in each season, winter and summer. On average, there were over 500 participants in winter events and almost 9,000 participants in summer events. Most participants enrolled with the thermostat technology and 30% cycling strategy.

Date:	2022-03-11
Region:	DEC and DEP
Evaluation Period	EE: 2019 – 2020 DR: 2020 - 2021
DR Event Impact per Participant (kW)	
Average across cycling strategies and technology types.	Winter, DEC: 0.98 kW Winter, DEP: 0.98 kW Summer, DEC: 1.11 kW Summer, DEP: 1.21 kW
DR Event Impact per Device (kW)	
Average across cycling strategies and technology types.	Winter, DEC: 0.6 kW Winter, DEP: 0.6 kW Summer, DEC: 0.6 kW Summer, DEP: 0.7 kW
DR Event Program Impact (MW)	
Average across cycling strategies and technology types.	Winter, DEC: 0.4 MW Winter, DEP: 0.1 MW Summer, DEC: 7 MW Summer, DEP: 3.1 MW
Net-to-Gross Ratio	1

Impact Evaluation Methods

Guidehouse estimated DR impacts using a lagged dependent variable regression model that compares average participant demand on event days to that of a carefully selected control group. Control customers are selected by comparing the demand patterns of a large pool of non-participants to each participant and selecting the non-participant with the most similar non-event day demand patterns. The non-event days used for this comparison were selected based on a comparison of hourly temperature values, such that the non-event day used to select controls were subject to temperatures as similar as possible to those observed on event days.

Impacts were estimated separately by event season (winter and summer) using a pooled regression model with DEC and DEP data. Impacts were estimated as a function of the three-hour exponential moving average of heating degree hours in winter and cooling degree hours in summer. This allows Guidehouse to both estimate the impact of observed historical events (ex-post impacts) as well as project an estimate of program capability under a range of different temperatures (ex-ante impacts).

Impact Evaluation Details

- **On average, the program delivered approximately 0.5 MW of load curtailment during winter events, and approximately 10.1 MW of load curtailment during summer events.**
- **On average, the program delivered nearly 1 kW of demand response per participant during winter events, and over 1.1 kW of demand response per participant during summer events.** For DEC, this amounts to 0.6 kW of demand response per device in both winter and summer. Estimated curtailment per device for DEP is approximately 0.6 kW per device in winter and 0.7 kW per device in summer.
- **Thermostats deliver greater relative impacts for summer events compared to load control switches.** On average, thermostats delivered demand reductions during summer events of 13% of total facility baseline load, and switches 8%. During winter events, thermostats deliver demand reductions of approximately 14% of total facility baseline load.
- **Participants that have selected the 75% cycling strategy deliver the highest per participant impacts for summer events.** During summer events, 75% cycling strategy participants deliver an average impact equivalent to 27% of their estimated facility baseline demand. In contrast, 30% and 50% cycling strategy participants delivered an average impact of approximately 9% and 19% of their baseline demand, respectively.

Appendix A. Demand Response Regression Model Specification

This appendix provides additional technical details regarding the model specification used by Guidehouse to estimate impacts for each combination of event season (winter and summer); technology (thermostat and switch); and cycling strategy (30%, 50%, and 75%).

Equation A-1 shows the lagged dependent variable model regression equation. This model estimates customer load on a per participant basis as a function of the event hours, snapback in post-event hours, lagged non-event day usage, temperature, humidity, and hourly fixed effects. Only event day data is included in the regression model, although matched non-event day data informs the baseline through the lagged usage (prekW) variable.

This equation was estimated separately for each event season. Altogether two different estimation sets were used.

Equation A-1. Lagged Dependent Variable Regression Model

$$
\begin{aligned}
y_{i,d,t,es} = & \sum_{h=1}^{H=48} \beta_{1,h} hhour_{h,t} + \sum_{h=1}^{H=48} \beta_{2,h} hhour_{h,t} prekW_{i,t,e} \\
& + \sum_{h=1}^{H=48} \beta_{3,h} hhour_{h,t} EMA3dh_t + \sum_{h=1}^{H=48} \beta_{4,h} hhour_{h,t} NBU_t \\
& + \sum_{d}^{D} \sum_{k}^{K} \sum_{c=1}^{C} \gamma_{1,d,k,c} D_{i,d,t} K_{i,k,t} C_{i,c,t} EMA3dh_t + \sum_{d}^{D} \sum_{k}^{K} \sum_{s=1}^{S} \gamma_{2,e,s} D_{i,d,t} K_{i,k,t} SB_{i,s,t}
\end{aligned}
$$

Where:

i	=	Customer.
t	=	Half-hour ending.
$y_{i,t}$	=	Demand for customer i during half-hour-ending t.
$hhour_{h,t}$	=	A set of 48 dummy variables, each equal to one when t is the h-th half-hour of the day and zero otherwise. This is a time-wise fixed effect.
$prekW_{i,t,e}$	=	Customer i's half-hourly consumption in half-hour t of the matched non-event day for event day e. For example, if hour t is half-hour-ending 13 on the first event day, then this variable would take the value of that same customer's consumption in half-hour-ending 13 of the corresponding non-event day used for matching purposes.
$EMA3dh_t$	=	An exponential moving average of heating degree hours (base 65°F) for winter events and cooling degree hours (base 65°F) for summer events observed in the six-hour period leading up to, and including, hour t
NBU_t	=	is the normalized cold build up term (winter events) or heat buildup term (for summer events) during hour ending i. This variable captures the effect of heat or cold build up in previous hours on the current hours demand. This is a 72-hour

geometrically decaying average of heating degree half-hours in winter and cooling degree hours in summer. It is calculated in the following manner

$$CBU_t = \frac{\sum_1^{72}(0.96)^t * (HDH65_t\ halfhours\ prior)}{1{,}000} \text{ or } HBU_t = \frac{\sum_1^{72}(0.96)^t * (CDH65_t\ halfhours\ prior)}{1{,}000}$$

$D_{i,d,t}$ = A set of dummy variables that capture the technology of each customer (i.e., thermostat, switch, or no device). Since some customers may have changed devices mid-season, the variables capture a customer's device on the day containing hour t.

$K_{i,k,t}$ = A set of three dummy variables that capture the economic cycling strategy for each customer (i.e., 30%, 50%, 75%). These values also capture the corresponding Emergency cycling strategy for each customer on those event days. Since some customers may have changed cycling strategy mid-season, the variables capture a customer's cycling strategy on the day containing hour t.

$C_{i,c,t}$ = A set of C dummy variables, capturing the impacts of event curtailment. Each variable is equal to one when customer i is a DR participant and hour t is the c-th curtailment hour of the event, and zero otherwise.

$SB_{i,s,t}$ = A set of S dummy variable, capturing the impacts of snapback. Equivalent to the $C_{i,c,t}$ except that they apply to the hours following the event, rather than during the event. Guidehouse applied these variables to all hours following the end of the curtailment event up to midnight of the event day.

β, γ = Parameter estimates. These values are the estimated relationship between demand and the variable for which the beta represents.

Appendix B. Energy Efficiency Impact Evaluation Interim Report

DEP-DEC EnergyWise Business EMV Interim

/A

/A

Nexant
Reimagine tomorrow.

Smart $aver® Non-Residential Custom Program Years 2018-2019 Evaluation Report

Submitted to Duke Energy Carolinas and Duke Energy Progress
in partnership with Tetra Tech

July 14, 2022

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Contents

List of Figures

List of Tables

Equations

1 Executive Summary

1.1 Program Summary

Duke Energy's Non-Residential Smart $aver® Custom Incentive Program (NR Custom) offers financial assistance to qualifying commercial, industrial, and institutional customers in the Duke Energy Carolinas (DEC) and Duke Energy Progress (DEP) service territories to enhance their ability to adopt and install cost-effective electrical energy efficiency projects.

The program is designed to meet the needs of the Duke Energy's (the company's) non-residential customers with electrical energy saving projects involving more complicated or alternative technologies, or those measures not covered by the non-residential Smart $aver Prescriptive Program. The intent of the program is to encourage the implementation of energy efficiency projects that would not otherwise be completed without the company's technical or financial assistance.

The program engages numerous Duke Energy team members to support the program, including large account managers, business energy advisors (BEAs), energy efficiency engineers, and trade ally outreach representatives. Willdan is Duke Energy's authorized vendor for the New Construction Energy Efficiency Design Assistance (NCEEDA) portion of the Smart $aver program. Willdan acts as a client liaison with Duke Energy and discusses project technical issues with Duke Energy's energy efficiency engineers.

1.2 Evaluation Objectives and High-Level Findings

This report presents the results and findings of evaluation activities for Duke Energy Carolina's and Duke Energy Progress NR Custom program, conducted by the evaluation team, collectively Nexant Inc. and their subcontracting partner, Tetra Tech, for the period of January 2018 through December 2019.

1.2.1 Impact Evaluation Objectives

The overarching goals for the NR Custom impact evaluation were to:

- Quantify accurate and supportable energy impacts (kWh) and summer and winter demand (kW) savings for energy efficient measures and equipment implemented in the participants' facilities.
- Assess the rate of free riders from the customer and contractor perspective.
- Determine spillover effects from customer and contractor perspective.
- Consider and verify measure installation vintage aligned with measure baseline definitions, i.e. early replacement, burnout on failure, etc.

Evaluation activities included in-depth reviews and verification of a representative sample of projects including virtual or phone interviews with program participants; collecting trend, utility consumption data, and building automation system/energy management system (BAS/EMS) data, and engineering analyses to estimate gross and net savings for all implemented measures attributed to the NR Custom Program.

1.2.2 Process Evaluation Objectives

Process evaluations are designed to support continuous program improvement by identifying successful program elements that can be expanded upon and underperforming/inefficient processes that could be holding back program performance. The process evaluation for the NR Custom Program sought to:

- Assess how participant characteristics compare to segments targeted for the program
- Assess the sources of customer engagement and most effective marketing source
- Assess the influence the program has on customers' decisions to install energy-efficient (EE) measures
- Assess Duke staff involvement in setting any organization policies
- Assess persistence of program engagement with participants
- Assess satisfaction with the program and its components, including suggestions for program changes

To meet these objectives, the evaluation team conducted interviews with key program staff, reviewed program documentation, interviewed third-party vendors, and utilized telephone surveys to ask program participants and trade allies about their experiences with the program.

1.2.3 High Level Findings

1.2.3.1 Gross Impact Evaluation Key Findings – DEC

The DEC impact evaluation results indicate that program's internal processes for project review, savings estimation, and installation verification are producing quality estimates of project impacts. Energy realization rate exceed 100% for the Lighting-Small strata. The energy realization rate for the Non-lighting-Small strata was 92.85% and Non-lighting Large was 96.42%. Realization rate for summer demand was just below 100% at 99.26%, whereas winter demand was 110.53% at the program level. Findings from the gross impact evaluation are summarized in Table 1-1 Table 1-2, and Table 1-3.

Table 1-1 DEC Program Reported and Verified Gross Energy Impacts

Measure Category	Strata	Gross Reported Energy Savings (kWh)	Gross Verified Energy Savings (kWh)	RR (%)
Lighting	Small (<360 MWh)	25,107,218	26,104,266	103.97%
	Large (≥360 MWh)	41,747,348	41,723,000	99.94%
Non-lighting	Small (<537 MWh)	12,433,255	11,544,202	92.85%
	Large (≥537 MWh)	21,106,809	20,350,706	96.42%
Total		**100,394,630**	**99,722,174**	**97.62%**

Table 1-2 DEC Program Reported and Verified Gross Summer Demand Impacts

Measure Category	Strata	Gross Reported Summer Demand Savings (kW)	Gross Verified Summer Demand Savings (kW)	RR (%)
Lighting	Small (<360 MWh)	4,112	3,497	85.04%
	Large (≥360 MWh)	7,109	6,806	95.74%
Non-lighting	Small (<537 MWh)	2,081	1,610	77.37%
	Large (≥537 MWh)	3,629	3,706	102.13%
Total		**16,931**	**15,620**	**99.26%**

Table 1-3 DEC Program Reported and Verified Gross Winter Demand Impacts

Measure Category	Strata	Gross Reported Winter Demand Savings (kW)	Gross Verified Winter Demand Savings (kW)	RR (%)
Lighting	Small (<360 MWh)	3,628	3,051	84.08%
	Large (≥360 MWh)	5,899	5,735	97.22%
Non-lighting	Small (<537 MWh)	1,757	2,211	125.81%
	Large (≥537 MWh)	2,973	3,481	117.10%
Total		**14,257**	**14,478**	**110.53%**

1.2.3.2 Gross Impact Evaluation Key Findings – DEP

The DEP impact evaluation results indicate that program’s internal processes for project review, savings estimation, and installation verification are producing quality estimates of project impacts. Energy realization rates exceed 100% for the two lighting strata (Lighting – Large and Lighting - Small). The energy realization rate for the Non-lighting-Small strata was 94.06% and Non-lighting Large was 93.04%. Realization rate for summer demand was below 100% at 91.76%, whereas winter demand was 105.07% at the program level. Findings from the gross impact evaluation are summarized in Table 1-4, Table 1-5, and Table 1-6.

Table 1-4 DEP Program Reported and Verified Gross Energy Impacts

Measure Category	Strata	Gross Reported Energy Savings (kWh)	Gross Verified Energy Savings (kWh)	RR (%)
Lighting	Small (<123 MWh)	6,301,713	6,803,085	107.96%
	Large (≥123 MWh)	10,478,150	11,978,543	114.32%
Non-lighting	Small (<258 MWh)	3,617,228	3,402,256	94.06%
	Large (≥258 MWh)	6,371,065	5,927,597	93.04%
Total		**26,768,156**	**28,111,481**	**102.08%**

Table 1-5 DEP Program Reported and Verified Gross Summer Demand Impacts

Measure Category	Strata	Gross Reported Summer Demand Savings (kW)	Gross Verified Summer Demand Savings (kW)	RR (%)
Lighting	Small (<123 MWh)	1,219	1,214	99.53%
	Large (≥123 MWh)	1,448	1,523	105.14%
Non-lighting	Small (<258 MWh)	884	634	71.76%
	Large (≥258 MWh)	1,728	1,583	91.61%
Total		**5,279**	**4,954**	**91.76%**

Table 1-6 DEP Program Reported and Verified Gross Winter Demand Impacts

Measure Category	Strata	Gross Reported Winter Demand Savings (kW)	Gross Verified Winter Demand Savings (kW)	RR (%)
Lighting	Small (<123 MWh)	703	1,012	143.96%
	Large (≥123 MWh)	1,682	1,776	105.63%
Non-lighting	Small (<258 MWh)	546	772	141.39%
	Large (≥258 MWh)	1,281	1,193	93.19%
Total		**4,211**	**4,753**	**105.07%**

1.2.3.3 Net Impact Evaluation Key Findings

Duke Energy staff have a thorough process for evaluating applications. This process includes denying projects if customers already purchased equipment or, in the case of new construction, started the building process. The net impact evaluation results show that over 80% of the program's energy savings are attributable to the program's activities. A large portion of the free-ridership stemmed from the Intention score. Customers reported they planned to complete the same project and would have paid the additional incentive amount to complete the efficiency project or said the project would have been largely or moderately the same without the program. Findings from the net impact evaluation are summarized in Table 1-7.

Table 1-7 Net-to-Gross Evaluation Results

Measurement	DEC	DEP	Combined[1]
Free-ridership (FR)	29.16%	32.67%	29.99%
Net of Free-ridership (1-FR)	70.84%	67.33%	70.01%
Program-influenced Participant Spillover (PSO)	0.28%	0.01%	0.22%
Program-influenced Nonparticipant Spillover (NPSO)	12.54%	24.03%	12.95%
Net-to-Gross* (1-FR) +PSO+NPSO	**83.66%**	**91.37%**	**83.18%**

1.2.3.4 Process Evaluation Key Findings

Overall, the program is operating as intended, and customers and trade allies are generally satisfied with their experiences with the program. Participant satisfaction was slightly lower than the prior evaluation but, overall, still high. Contractors continue to play a vital role in the program by making customers aware of the program offerings. Contractors have utilized the program to encourage customers to purchase high-efficient equipment and felt the program incentive was the most influential factor in customers moving forward with projects they would not have otherwise. Participants provide similar feedback, stating they have appreciated their support from trade allies and Duke Energy.

Additional high-level findings include the following:

- The primary source of participants' program awareness continues to be from contractors.
- The application processing is quicker than the four to six-week goal and customers report being satisfied with the application process.
- Satisfaction with the program overall and its components is high among participants and trade allies. The highest-rated program component for contractors was the interaction they had with Duke Energy program staff.

[1] The combined results are weighted using the same kWh-based weights used for DEC and DEP results, since this accounts for individual project sizes as well as the relative size of the programs across the two jurisdictions.

- The contractor assistance was the most valuable program component as rated by participant respondents.
- The program-provided calculators were the lowest rated program element by participant respondents. The calculation tools had a recent overhaul and most recently moved to an online platform, which may be a reason for the lower satisfaction.
- The tracking database was missing some key customer-contact information for evaluation activities and program/project tracking.
- The COVID pandemic had a moderately negative impact on contractors' business operations, with businesses implementing social distancing procedures. Furthermore, one-third had a reduction in sales due to the pandemic. The pandemic also impacted customers, where one-third said they had plans to upgrade equipment before the pandemic. The majority of these customers indicated they had delayed those planned projects.

1.3 Evaluation Conclusions and Recommendations

Based on evaluation activities and findings, the evaluation team concluded the following and provides several recommendations for program improvement.

1.3.1 Impact Recommendations

Conclusion 1: The evaluation team saw strong evidence the Duke Program team conducts detailed reviews of the project applications, has quality control checks and revises measure parameters to refine savings estimates. Engineering reviews by AESC provides an additional level of quality control that helps to minimize most calculation errors or instances of over-claimed energy or demand savings. The strata-level realization rates indicate that an appropriate level of rigor is being applied to lighting projects and most non-lighting projects.

Recommendation 1: Continue the level of rigor being applied to projects as it goes through the NR Custom application process while considering the following recommendations to improve the program in specific areas.

Conclusion 2: Of the parameters needed to calculate lighting project savings, verified lighting operating schedules, or annual hours of use, were more often found to be different than the hours used to calculate reported savings. Applicants are asked to provide the operating schedules as part of the application process and participants, not trade allies, may have the best insights into what the schedule will be for each installed fixture.

Recommendation 2: Improve the level of detail collected in the application on the hours of operation. Weekly schedules should be defined and/or verified by the participant. Holidays and seasonal changes should also be captured in the annual hours of use.

Conclusion 3: Project reviews, both during the application process and the evaluation, benefit from documentation of all underlying assumptions and worksheets used for the calculations of savings. Photos serve as a valuable verification of the installed equipment and provide essential information regarding the condition and operating parameters of the old and new equipment. This applies to primarily small and larger non-lighting projects where trend data and manufacturer's specification sheets would allow more detailed analyses of the proposed measures. Lighting projects are very well documented but pictures of baseline equipment prior to it being removed would be useful to refine savings calculations.

Recommendation 3: Collect and document enough information and photos of the project so the calculations of savings could be independently repeated.

Conclusion 4: Measurement and verification (M&V) plans help confirm measures are installed and resulting in the expected energy and demand savings. Differences between expected savings and measured savings can help identify measures that are not performing or have been disabled and thus lead to refined savings estimates for the project. M&V plans for large non-lighting projects can greatly assist the review of the program applications and projects being evaluated, in some cases years after the project is implemented.

Recommendation 4: Require M&V plans that are consistent with recognized protocols for large non-lighting projects involving a large portion of the program savings or measures with high uncertainty. Establish a threshold in kWh savings or incentives dollars above which an M&V plan is required.

Conclusion 5: The Duke NCEEDA protocol defines how savings from new, high performance buildings shall be modeled and estimated. Assumptions on how the building is expected to be occupied and used are also required but do not always match how the new buildings are actually used or occupied. This can lead to the modeled consumption and savings not matching the actual consumption and savings.

Recommendation 5: The NCEEDA should incorporate a tiered post construction calibration requirement that uses the ASHRAE 14 tolerances to assess the level of uncertainty in the new construction models and make adjustments to the model in order to minimize the uncertainty.

1.3.2 Process Recommendations

Conclusion 6: The program continues to operate as intended. Contractor and customer respondents reported high overall satisfaction with the program and many program aspects. The most common source of program awareness from customers was their contractor, consistent with Duke Energy's primary channel to market the program. A high proportion of customers reported the contractor recommendation as an important source of influence on their decision to install high-efficient equipment. Contractor technical assistance also saw high satisfaction, underscoring the critical role. Furthermore, contractors are generally satisfied with the program and appreciate using the incentives as a sales tool.

Recommendation 6a: Continue to engage contractors in the program and keep them informed of the program to increase awareness among customers and encourage the installation of program-qualifying equipment. This engagement should include builders and architects who may be utilizing the new construction design assistance.

Recommendation 6b: Encourage contractors and architects to inform customers of the Duke Energy incentives available while considering equipment options. Early conversations may push customers to purchase program-qualifying equipment rather than standard efficiency.

Conclusion 7: The participant survey was conducted approximately 1 to 3 years after program participation. The more time passes from program participation, the more it can impact the customer recalling the details around the decision to select the specific equipment. Additionally, turnover can occur, so decision-makers may no longer be with the organization. All of which can impact free-ridership.

Recommendation 7: Conduct the free-ridership study closer to the decision-making process. This may help ensure we can talk with the decision-maker to answer questions regarding the decision to do the project through the program. By surveying customers closer to when the decision was made, they should be more likely to remember the factors that went into the decision. Surveys could be conducted on a rolling basis (i.e., quarterly) with those projects where incentives have been paid. Web surveys could be utilized if the project team collects the email address and contact details (name, address, and phone) of the decision-maker at the organization where the equipment was installed.

While customers are more likely to recall the decision process, not enough time will have passed to allow customers to install additional equipment because of the program; therefore, the program may not see any spillover. The evaluation team may consider conducting a separate spillover study, if deemed necessary, to capture any spillover from participating customers.

Conclusion 8: As part of the application process, an appropriate worksheet or calculator must be submitted. Duke Energy provides access to two calculators: Classic Custom and Custom-to-Go, which recently changed. The calculators were transitioned from Excel-based to an online tool. Indications are customers are having difficulty adjusting to the new format. One-third of customer respondents reported using the Custom-to-Go calculator.

Recommendation 8: Monitor how customers and contractors use the calculators and request feedback for any specific changes that users request. Ensure any instructions associated with the calculator are clear to assist customers in entering or completing the necessary information. Coordinate any instruction documents used by Duke Energy staff to compile a comprehensive document.

Conclusion 9: Duke Energy staff report it typically takes between three to four weeks to review applications, faster than the four to six weeks the program indicates, which has resulted in reduced use of the Fast Track option. Participant feedback supports this, with high satisfaction reported for the application process. Contractors felt that the amount of paperwork they needed to submit was an area that the program could improve. Four contractors mentioned how the custom application was too complicated, and they would instead apply for incentives through the prescriptive program and have more prescriptive incentive options.

Recommendation 9a: Continue to monitor the time it takes to review applications to maintain the expedient process Duke Energy has in place for custom measures.

Recommendation 9b: Monitor the equipment submitted for custom incentives and direct prescriptive measures to the prescriptive program for an easier application process.

Conclusion 10: A relatively new aspect to the program introduced in 2019 was an online application portal. The third-party vendors appreciate the online application portal, making tracking applications, preapproval, and incentive status easier. Still, a couple of the vendors said it does not reduce the complexity of the Custom application itself. Customers were only asked about their awareness of the portal, where one-third of customer respondents indicated they were aware.

Recommendation 10: Continue to market the online application portal to customers and contractors interested in the program. The online portal may help streamline costs and improve consistent application submittal with the necessary information.

Conclusion 11: The Duke team has an efficient and effective process for reviewing applications for preapproval to focus on eligible but not already committed projects. They offer both application and calculation assistance that provides third-party aid to customers and trade allies if needed for a fee. As part of the application, questions are included to identify projects where the customer has already identified or purchased program-qualifying equipment. The questions on the application are a great tool to use in talking with customers about their projects and plans to increase the scope and efficiency of projects. As applications are flagged, the program team can encourage customers to revise the scope to implement more than otherwise.

Recommendation 11a: Continue to discuss project scope with customers who may have already committed to a project based on question E[2] of the application. This question identifies customers who have already identified, purchased, or committed to a project or building.

Recommendation 11b: Update question G on the application to 1) require customers to answer the question and 2) revise the wording to allow more response options to be presented. By requiring customers to answer the question, the project team will better understand the type of equipment customers are selecting and if the program assistance is responsible for the project. The response to this question can provide insight into the potential free-ridership of the project. The evaluation team recommends updating the question text to the following:

G. Without the program assistance and incentive, you would…

- ❑ Purchase and install the same high efficiency equipment
- ❑ Purchase less of the high efficiency equipment
- ❑ Purchase the high efficiency equipment at a later date
- ❑ Purchase standard / code minimum efficiency
- ❑ Neither purchase nor install any part of the project

The project team can then use this question to flag applications and follow-up with customers to discuss the following: a) Would they consider more efficient equipment or more fixtures? b) How did they select the efficiency of the equipment on the application? c) Does the company have policies that encourage or require purchasing higher efficiency equipment, reducing GHGs or meeting sustainability goals? Answers to these questions will allow Duke Energy staff to determine if the project is a good candidate for an incentive and help further manage free-ridership.

The program team should carefully balance the need to minimize free-ridership with maintaining participation levels and subsequent customer satisfaction. The objective of this follow-up should

[2] Question E: Have you made any commitment to your project (signed purchase order/contract, ordered equipment, started construction)

not be to eliminate free-ridership from the program but to manage how much free-ridership is in the program. Follow-up will also optimize net savings and better understand how the program can encourage customers to achieve more savings than they would achieve on their own.

Recommendation 11c: Document changes customers make to projects from discussions with Duke Energy staff. While customers may feel that they were planning on high-efficiency equipment, conversations with Duke Energy staff can cause them to adjust their plans. The evaluation team can use details from documentation of these discussions to inform how intention is calculated, affecting the NTG score for that customer. Documentation should include the date of the conversation, original technology or efficiency plans, and new technology or efficiency plans.

Conclusion 12: The environment in the Carolinas allows customers to opt into the energy-efficiency programs for one year in DEC and three years in DEP. With customers having the option when to choose to contribute to energy efficiency programs, customers may be selective in deciding when to contribute and not. This option may impact free-ridership for those customers.

Recommendation 12: Continue to check opt-in/out status with the customer applications to identify customers doing projects to get the incentive. These discussions will allow Duke Energy staff to determine better if the project is a good candidate for an incentive.

Conclusion 13: Transformation in equipment markets drives changes to what should be considered the appropriate baseline. Additionally, program influence and/or advances in technology can shift market baselines (e.g., LEDs and new construction). As the program matures and technologies change, baselines will change as well. The evaluation team found that some of the equipment incentivized through the program could be considered close to the market baseline equipment. Incentivizing LED lighting in high end new construction buildings has the potential for high free ridership since LED technology is becoming the market baseline in these applications. The program team should continue to monitor equipment baselines and adjust them accordingly.

Recommendation 13a: Consider additional application approval criteria, if feasible. These criteria could include a question on the application to identify customers' current ROI threshold for internal project approval. Another question to consider adding to the application or in discussions with customers would be if there are other benefits the company will gain (e.g., avoided O&M costs, better reliability, faster production).

Recommendation 13b: Research market baselines and adjust project baselines and measure savings as needed.

Recommendation 13c: Identify measures replacing equipment at the end of useful service life (EUSL) and assess ROI accordingly. Other questions the program team can ask customers in the discussion include the following:

- Does the company have a preventative maintenance program? If so, when is the equipment scheduled to be replaced?
- How much remaining useful life does the existing equipment have?

2 Introduction and Program Description

2.1 Program Description

Duke Energy's Non-Residential Smart $aver® Custom Incentives program (NR Custom) offers financial assistance to qualifying commercial, industrial, and institutional customers in the Duke Energy Carolinas (DEC) and Duke Energy Progress (DEP) service territories to enhance their ability to adopt and install cost-effective electrical energy efficiency projects. Customers can opt-in to the energy efficiency programs at different rates in the Carolinas territory. Historically, DEC was a one-year opt-in period for the calendar year, and customers have a window to opt-in and opt-out. DEP customers could opt-in at any time. When customers received an incentive, they were considered opted in for three years.

The Program is designed to meet the needs of Duke Energy's (the company's) non-residential customers with electrical energy saving projects involving more complicated or alternative technologies, or those measures not covered by the non-residential Smart $aver Prescriptive Program. The intent of the Program is to encourage the implementation of energy efficiency projects that would not otherwise be completed without the company's technical or financial assistance. The program requires pre-approval prior to the project implementation. Proposed energy efficiency measures may be eligible for customer incentives if they clearly reduce electrical consumption and/or demand. As part of the preapproval process, the Duke Energy team conducts thorough reviews of applications, rejecting applications that do not meet the program requirements.

The two approaches for applying for incentives for this program are Classic Custom and Custom-to-Go. The difference between the two approaches focuses on the method by which energy savings are calculated. The documents required as part of the application process vary slightly.

The custom applications forms are located on the company's website under the Smart $aver® Incentives (Business and Large Business tabs). The application forms are offered in Microsoft Word (doc) and Adobe (pdf) format with the designated worksheet in Microsoft Excel format for projects saving more than 700,000 kWh annually. Customers can utilize provided calculation tools (Custom-to-Go, now Smart $aver Tools) for projects savings less than 700,000 kWh annually or submit worksheets in another format if preferred. Customers or their vendors submit the forms with supporting documentation. Forms are designed for multiple projects and multiple locations. The custom incentive application (doc or pdf) is submitted with one or more of the following worksheets:

Classic Custom approach (>700,000 kWh or no applicable Custom-to-Go calculator)

- Lighting worksheet (Excel)
- Variable Speed Drive (VFD) worksheet (Excel)
- Compressed Air worksheet (Excel)

- Energy Management System (EMS) worksheet (Excel)
- General worksheet (Excel), to be used for projects not addressed by or not easily submitted using one of the other worksheets

Custom-to-Go Calculators, now Smart $aver Tools (<700,000 kWh and applicable Custom-to-Go calculator)

- Lighting
- HVAC
- Compressed Air
- Fan
- Pump

The Company contracts with Alternative Energy Systems Consulting (AESC) to perform the technical review of applications. Duke Energy contractors process applications as well as train and provide technical support to the Trade Ally (TA) network. All other analysis is performed internally at Duke Energy, including DSMore runs for every custom measure that is recorded by the program to ensure the project's cost effectiveness prior to implementation.

2.1.1 Participation Summary – DEC

Table 2-1 summarizes program participation and reported energy savings for the full evaluation period of January 2018 through December 2019. There was a total of 529 projects completed during the evaluation period. For the purposes of this report a project is defined as a unique enrollment ID. These 529 projects collectively accounted for a total of 780 unique database line items. Database line items typically represent single-measure projects or an individual measure implemented as part of a multi-measure project. There are also a few instances where a line item in the tracking database represents a unique project site where a common scope of work was completed as part of a larger portfolio of sites (i.e., Speedway / Super America).

Table 2-1 DEC NR Custom Program Participation and Reported Energy Summary

Category & Strata		Database Line Items		Projects		Reported Savings	
		Custom-To-Go	Classic	Custom-To-Go	Classic	Custom-To-Go Gross kWh	Classic Custom Gross kWh
Lighting	Small (<360 MWh)	157	393	95	264	8,639,906	16,467,312
	Large (≥360 MWh)	35	59	20	38	12,811,928	28,935,421
Non-lighting	Small (<537 MWh)	32	77	28	71	4,852,361	7,580,895
	Large (≥537 MWh)	3	24	3	10	1,789,327	19,317,482
Total		**227**	**553**	**146**	**383**	**28,093,521**	**72,301,110**
Grand Total		**780**		**529**		**100,394,631**	

Table 2-2 outlines the reported summer and winter demand (kW) for the evaluation period.

Table 2-2 DEC NR Custom Program Reported Demand Savings Summary

Category & Strata		Projects		Reported Summer Demand (kW) Savings		Reported Winter Demand (kW) Savings	
		Custom-To-Go	Classic	Custom-To-Go	Classic	Custom-To-Go	Classic
Lighting	Small (<360 MWh)	95	264	1,650.0	2,462.0	1,315.1	2,313.4
	Large (≥360 MWh)	20	38	2,678.0	4,431.0	1,754.2	4,144.6
Non-lighting	Small (<537 MWh)	28	71	336.7	1,744.6	532.7	1,224.8
	Large (≥537 MWh)	3	10	33.9	3,595.0	52.4	2,920.1
Total		**146**	**383**	**4,698.6**	**12,232.6**	**3,654.4**	**10,602.9**
Grand Total		**529**		**16,931.2**		**14,257.3**	

Figure 2-1, Figure 2-2, and Figure 2-3 summarize the distribution of reported energy (kWh) and demand (kW) savings at the program level by technology category.

Figure 2-1 Distribution of DEC Reported Energy Savings from NR Custom Program Projects by Technology

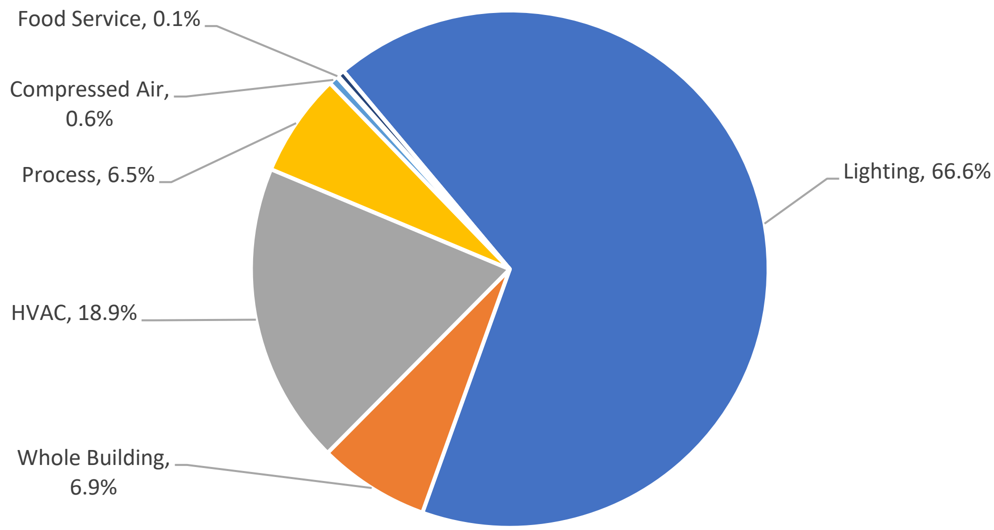


Figure 2-2 Distribution of DEC Reported Summer Demand Savings from NR Custom Projects by Technology

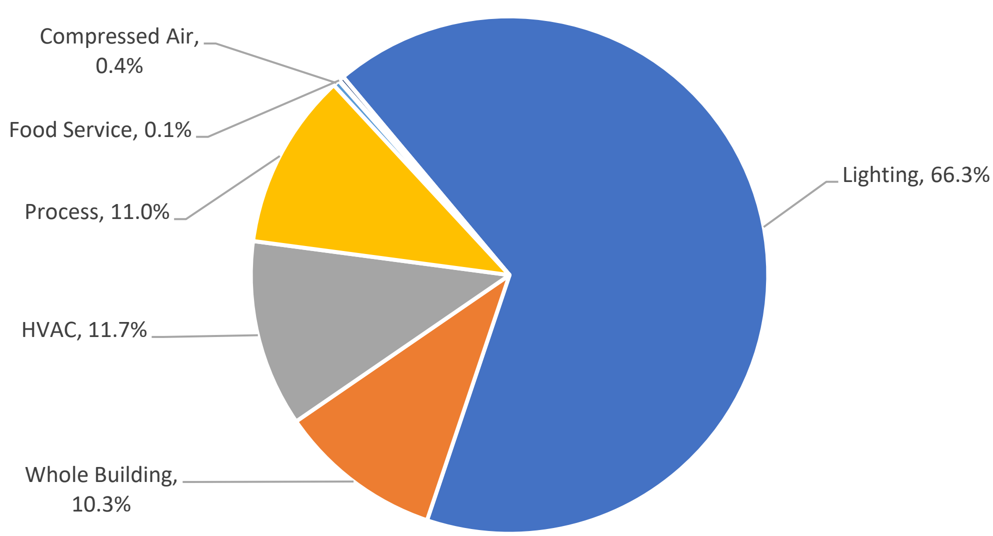
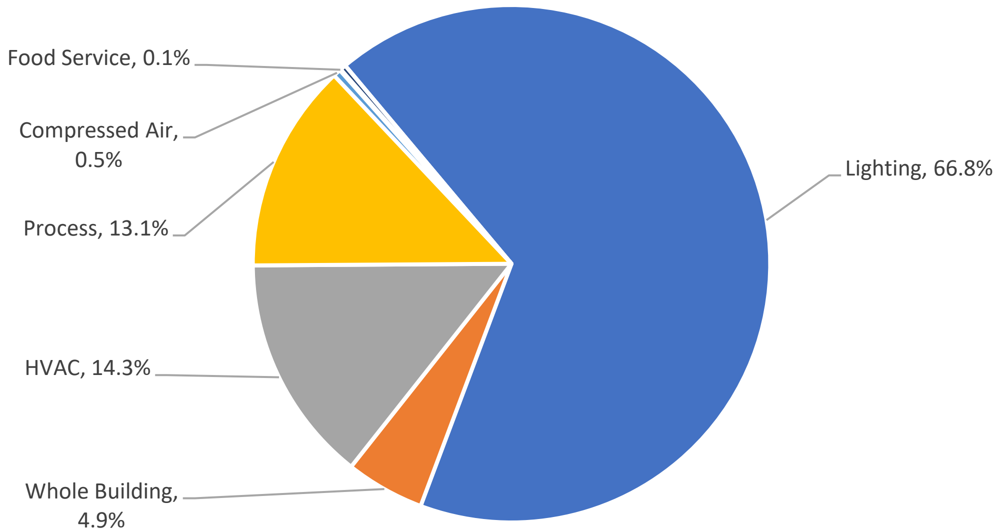


Figure 2-3 Distribution of DEC Reported Winter Demand Savings (kW) from NR Custom Projects by Technology



2.1.2 Participation Summary – DEP

Table 2-3 summarizes program participation and reported energy savings for the full evaluation period of January 2018 through December 2019. There was a total of 292 projects completed during the evaluation period. For the purposes of this report a project is defined as a unique enrollment ID. These 292 projects collectively accounted for a total of 407 unique database line items. Database line items typically represent single-measure projects, or an individual measure implemented as part of a multi-measure project. There are also a few instances where a line item in the tracking database represents a unique project site where a common scope of work was completed as part of a larger portfolio of sites (i.e., Speedway / Super America).

Table 2-3 DEP NR Custom Program Participation and Reported Energy Summary

Category & Strata		Database Line Items		Projects		Reported Savings	
		Custom-To-Go	Classic	Custom-To-Go	Classic	Custom-To-Go Gross kWh	Classic Custom Gross kWh
Lighting	Small (<123 MWh)	92	210	72	139	1,588,705	4,713,008
	Large (≥123 MWh)	28	26	9	24	2,811,286	7,666,864
Non-lighting	Small (<258 MWh)	5	33	5	30	589,553	3,027,675
	Large (≥258 MWh)	-	13	-	13	-	6,371,065
Total		**125**	**282**	**86**	**206**	**4,989,544**	**21,778,612**
Grand Total		**407**		**292**		**26,768,156**	

Table 2-4 outlines the reported summer and winter demand (kW) for the evaluation period.

Table 2-4 DEP NR Custom Program Reported Demand Savings Summary

Category & Strata		Projects		Reported Summer Demand (kW) Savings		Reported Winter Demand (kW) Savings	
		Custom-To-Go	Classic	Custom-To-Go	Classic	Custom-To-Go	Classic
Lighting	Small (<123 MWh)	72	139	391.0	828.4	266.1	436.6
	Large (≥123 MWh)	9	24	529.3	919.1	535.2	1,146.3
Non-lighting	Small (<258 MWh)	5	30	30.2	853.6	48.6	497.4
	Large (≥258 MWh)	0	13	-	1,727.9	-	1,280.5
Total		**86**	**206**	**950.5**	**4,329.0**	**850.0**	**3,360.8**
Grand Total		**292**		**5,279.5**		**4,210.8**	

Figure 2-4, Figure 2-5, and Figure 2-6 summarize the distribution of reported energy (kWh) and demand (kW) savings at the program level by technology category.

Figure 2-4 Distribution of DEP Reported Energy Savings from NR Custom Program Projects by Technology

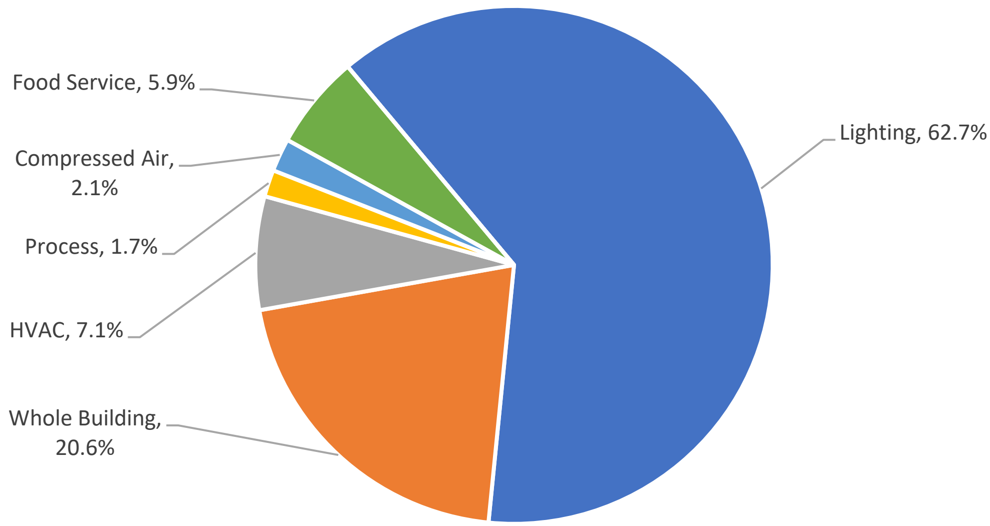


Figure 2-5 Distribution of DEP Reported Summer Demand Savings from NR Custom Projects by Technology

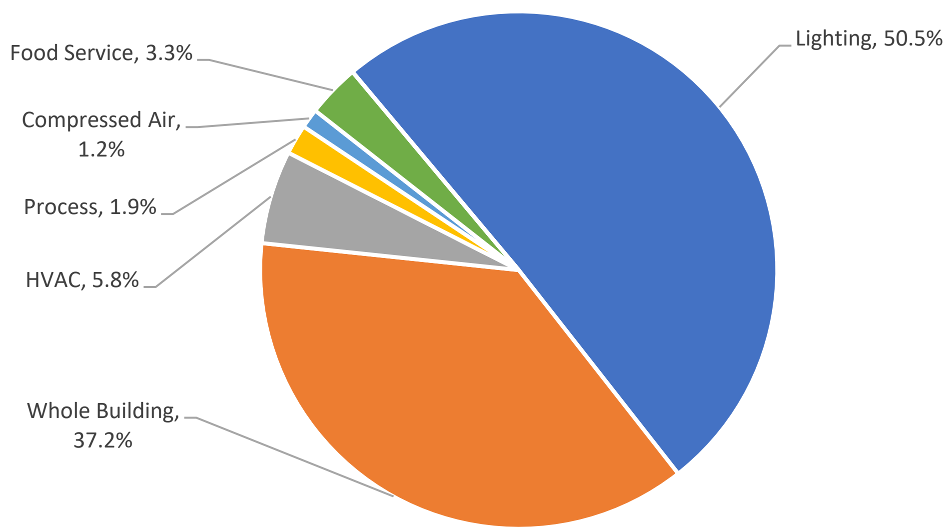
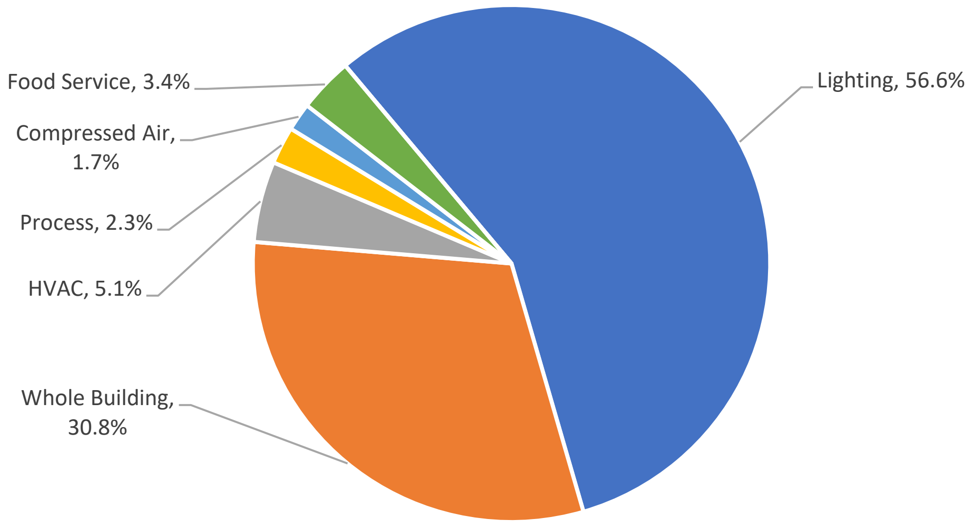


Figure 2-6 Distribution of DEP Reported Winter Demand Savings (kW) from NR Custom Projects by Technology



3 Key Research Objectives

3.1 Gross Impact

The impact evaluation processes followed standard industry protocols and definitions, where applicable, and include the Department of Energy Uniform Methods Protocol[3], as an example. The overarching goals for the NR Custom impact evaluation were to:

- Quantify accurate and supportable energy impacts (kWh) and summer and winter demand (kW) savings for energy efficient measures and equipment implemented in participants' facilities.
- Assess the rate of free riders from the customer and contractor perspective.
- Determine spillover effects from the customer and contractor perspective.
- Consider and verify measure installation vintage aligned with measure baseline definitions, i.e. early replacement, burnout on failure, etc.

3.2 Net Impact

The goal of the net impact evaluation was to estimate the overall energy impacts attributable to the program. This estimate comprises of two components: free-ridership and spillover.

Free-ridership estimates what proportion of the program's savings would have happened in the absence of the program. Free-ridership considers the customers' plans before engaging in the program and the various influences the program can have on the customer, such as incentives, the application process, and other interactions with the program staff, contractors, and marketing materials.

Spillover estimates additional energy savings for efficiency projects completed without receiving a program incentive but were influenced by the program in some other way. Spillover was captured from participants (participant spillover) and contractors (for nonparticipant spillover).

Net program results are calculated through a net-to-gross ratio, as shown in Equation 1.

Equation 1 Net Program Savings

$$Net\ Program\ Savings = \text{Net-to-gross (\%)} \times \text{Gross Verified Savings}$$

[3] The DOE's Uniform Methods Project for Determining Energy Efficiency Program Savings can be found at http://www1.eere.energy.gov/office_eere/de_ump.html.

3.3 Process

The evaluation team collected data from a variety of sources to address the researchable questions identified at the beginning of the study. Table 3-1 contains the list of research objectives and the data sources used to investigate each one.

Table 3-1 Process Evaluation Research Questions and Activities

Preliminary Research Questions	Document Review	Interviews with Key Contacts	Participant Survey	Trade Ally Survey
How is the program promoted? What role do Duke Energy account representatives (i.e., account executives, business energy advisors, energy efficiency engineers and trade ally outreach representatives) play in helping customers identify and complete projects? Are contractors or vendors identifying potential projects?	✓	✓	✓	✓
Understand participant experience. What steps are involved in identifying and scoping projects and obtaining pre-approval? What issues emerge during the process? How are these addressed?		✓	✓	✓
Why do potential projects drop out?[4] Are there opportunities to make the process simpler or more streamlined while maintaining robust quality control (QC)?		✓		✓
Is the uptake of custom vs. custom-to-go projects as expected? How do the projects and/or the customer experience differ between the two participation paths?	✓	✓	✓	✓
What is the customer's decision-making process regarding energy efficiency upgrades or equipment? How influential were various aspects of the program in their decision? How influential was the contractor they worked with?	✓		✓	✓

[4] Duke Energy determined the evaluation did not need to include data collection with drop-out customers.

4 Impact Evaluation

4.1 Impact Methodology

The primary determinants of impact evaluation costs are the sample size and the level of rigor employed in collecting the data used in the impact analysis. The accuracy of the study findings is in turn dependent on these parameters. Techniques used to conduct the evaluation measurement and verification (EM&V) activities and to meet the goals for this evaluation include measure level data collection, utility billing analysis, telephone surveys, documentation review, best practice review, and interviews with implementation staff, trade allies, program participants, and general business customers.

The evaluation team's impact analysis focused on the energy and demand savings attributable to the NR Custom Program for the period of January 2018 through December 2019. A variety of techniques were used to develop independent assessments of gross and net energy savings for each sampled project. In order to estimate gross energy savings, all sampled custom projects received a desk review; project specific data collection, measurement and/or verification; and custom data analysis of savings. Data collection involved a combination of several activities, including: verifying equipment installation and operation; interviewing site contacts; and collecting building automation system/energy management system (BAS/EMS) data. The level of rigor conducted for the data analysis reflected the level of project documentation available prior to the evaluation (such as the data collected from existing metering and monitoring equipment), the uncertainty of the savings estimate, the magnitude of the project savings and the ability to collect additional data from the program participants. Figure 4-1 provides a high-level process flow diagram of all impact evaluation activities and brief summary of each step in the process is provided below.

Figure 4-1 Flow Diagram of Impact Evaluation Activities

The evaluation team verified energy and demand savings attributable to the program by conducting the following high-level impact evaluation activities:

Sample: Conduct review of NR Custom Program participant database and draw representative sample of projects.

Soft Recruit: Attempt to reach all sampled participants by phone or email, prior to conducting an in-depth review of project documentation or developing a site specific measurement and verification plan (SSMVP), to inform participants of the ongoing evaluation and request permission to conduct data collection for the analysis of savings. Nothing would be formally scheduled during this call.

Document Review: Review all project documentation available for those sites successfully recruited.

Develop SSMVP: Develop a plan that provides a general overview of the implemented measures, reported benefits and costs, proposed level of rigor, measurement & verification (M&V) equipment, and key data to be gathered. The Duke team reviews and approves all SSMVP. The purpose of the Duke team reviews were to verify that all measures were included in the plan, reported energy and demand savings were accurate, and proposed M&V approaches were appropriate.

Data Collection: Verify equipment installation and operation; interview site contacts; and collect building automation system/energy management system (BAS/EMS) data.

Analysis: Estimate gross verified energy and demand savings for sampled measures and projects using data collected.

Measurement & Verification Report: Compare gross-verified energy and demand savings to program-reported values to determine project-level realization rates and summarize findings for each sampled site in the M&V report. The Duke team reviews and approves all M&V reports. The purpose of the Duke team reviews were to verify that all measures were included in the plan, reported energy and demand savings were accurate, and proposed M&V approaches were appropriate.

Gross Verified Savings: Summarize project-level results to stratum-level for determining program-level realization rates and verified gross energy and demand savings.

Net Verified Savings: Apply attribution survey data to estimate net-to-gross ratios and net-verified savings at the program level.

The following sections provide more details on the specific considerations made and methods used for the major evaluation activities.

4.1.1 Sampling

The gross and net verified savings estimates presented in this report were determined through the observation of key measure parameters among a sample of projects from the program population. A census evaluation would have involved surveying, measuring, or otherwise evaluating the entire population of projects. Although a census approach would eliminate any sampling uncertainty, when used effectively, the results from a sample of projects can be extrapolated to provide a reasonable and cost-effective estimate of the population parameters.

The most important sampling objective was representativeness – that is projects selected in the evaluation sample were representative of the population and would produce unbiased estimates of population parameters. To obtain a representative sample, the characteristics of the program population must be reviewed and understood. A participation database extract was requested and received that contained only projects with a Vendor Update Timestamp between January 2018 and December 2019. This database extract represented the program population for program years 2018 and 2019. The program participation database informed many of the evaluation activities including sample design, project-level savings review, and estimating program-level gross verified savings.

4.1.1.1 Stratification

The evaluation team used sample stratification with ratio estimation techniques for the NR Custom Program. Stratification is a departure from simple random sampling, where each sampling unit (customer/project/incentive/measure) has an identical likelihood of being selected in the sample. Stratified random sampling refers to the designation of two or more sub-groups (strata) from within a program population prior to the sample selection process.

The evaluation team felt that stratification was advantageous and utilized it in the sample design for a variety of reasons, including:

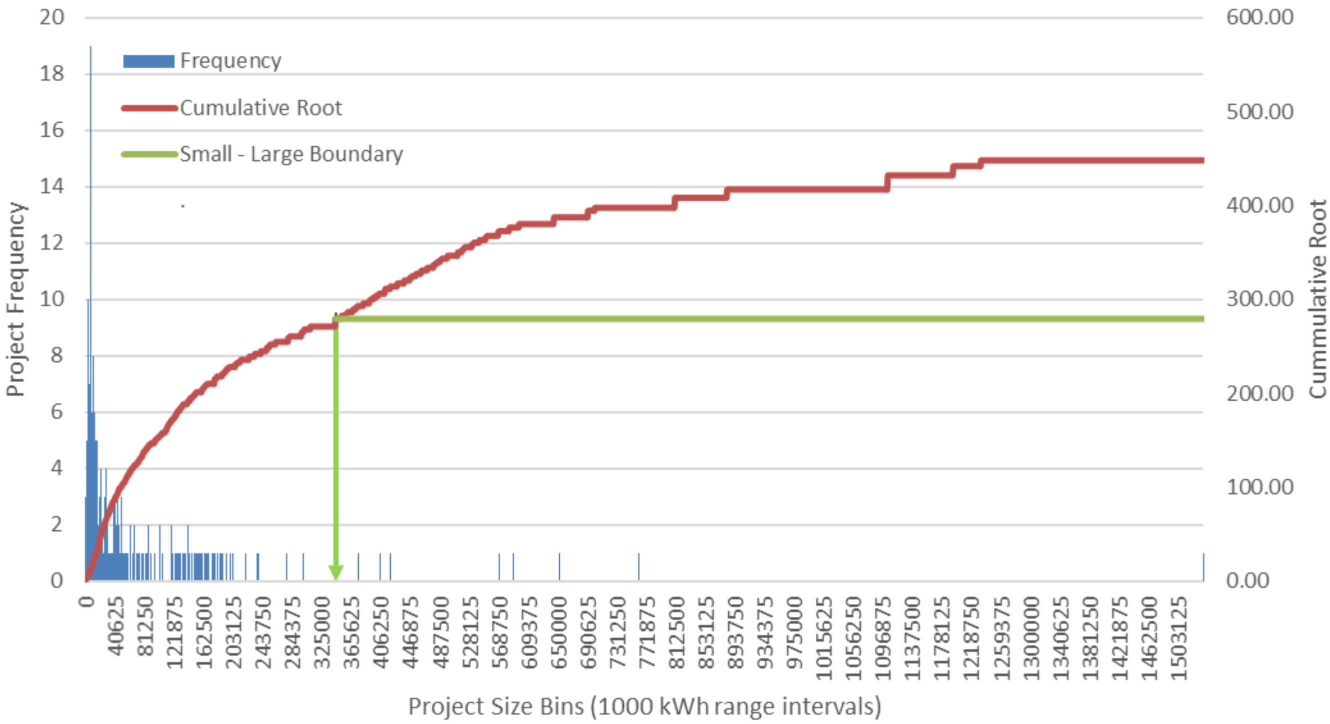
- Increased precision of the within-stratum variability was expected to be small compared to the variability of the population. Stratification in this case allows for increased precision and smaller total sample sizes.
- It enabled the evaluation team to ensure that a minimum number of projects within a particular stratum were verified.

Two different characteristics of a project were used to define which strata it would be included in, the type of measures implemented (lighting vs. non-lighting) and the relative amount of reported energy savings. A project is defined as all lighting or non-lighting measures under the same enrollment number at a single address. If a project had both lighting and non-lighting measures then the lighting measures would make up one project in the lighting strata and the non-lighting measures would make up a second project in the non-lighting strata.

To sub-stratify the lighting and non-lighting strata by the amount of reported energy savings, the evaluation team calculated the savings for each project within the lighting and non-lighting strata and studied the distribution of the project sizes. The Dalenius-Hodges method was used to define the optimal boundary between a “small” project and a “large” project. This method is the most common method of boundary determination for stratification by project size. An illustration of this method is presented in Figure 4-2 for the DEC Lighting strata.

The method uses the number of projects in specified project-size bins (frequency) along with the number of empty bins between each occupied bin (length) to assess the distribution of total strata savings. The cumulative square root of the product of the frequency and length is then used to determine the optimal strata boundaries. For the NR Custom evaluation, two sub-strata (small and large) are needed so the mid-point of the cumulative indicated which project size (kWh) would define the boundary between a small project and a large lighting project.

Figure 4-2: Dalenius-Hodges Boundary Design for DEC 2018-2019 Lighting Projects



Using this method, the evaluation team determined a savings threshold of 360 MWh for large lighting projects and 537MWh for large Non-Lighting projects. All projects with savings less than these thresholds would be considered small projects.

4.1.1.2 Targeted Sample Size – DEC

With the population stratified the impact samples were then drawn randomly from each stratum. The total number of sample projects drawn targeted a 90/10 confidence precision based on the total participation counts for the evaluation period and assuming an error ration (C_v) of 0.5. The distribution of the total sample across the four sub strata was determined using the number of projects in each strata, the amount of savings in each strata and the historical Cv values of the same strata from the 2016 - 2017 NC Custom evaluation. Our stratification approach and targeted sample sizes are summarized in Table 4-1.

Table 4-1 NR Custom Stratified Sampling Plan - Targeted

Strata	Population	Pop Reported Savings (kWh)	Targeted Sample Size
L-Small (<360 MWh)	359	5,307,346	24
L-Large (≥360 MWh)	58	12,736,521	9
NL-Small (<537 MWh)	99	4,793,389	12
NL-Large (≥537 MWh)	13	9,411,765	10
Total	**529**	**32,249,021**	**55**

4.1.1.3 Targeted Sample Size – DEP

With the population stratified, the impact samples were then drawn randomly from each stratum. The total number of sample projects drawn targeted a 90/10 confidence precision based on the total participation counts for the evaluation period and assuming an error ration (C_v) of 0.5. The distribution of the total sample across the four sub strata was determined using the number of projects in each strata, the amount of savings in each strata and the historical Cv values of the same strata from the 2016 - 2017 NC Custom evaluation. Our stratification approach and targeted sample sizes are summarized in Table 4-2.

Table 4-2 NR Custom Stratified Sampling Plan - Targeted

Strata	Population	Pop Reported Savings (kWh)	Targeted Sample Size
L-Small (<123 MWh)	211	5,307,346	21
L-Large (≥123 MWh)	33	12,736,521	8
NL-Small (<258 MWh)	35	4,793,389	13
NL-Large (≥258 MWh)	13	9,411,765	7
Total	**292**	**32,249,021**	**49**

4.1.2 Data Collection

Once a sample of projects was selected, the impact team requested detailed project documentation for each project and conducted a review of the information. This information was used to formulate any initial questions about the project that could be answered during the initial communications with the participants.

While reviewing project documentation, the evaluation team also verified whether parameters such as reported energy and demand savings, energy conservation measure (ECM) quantities, and measure descriptions matched those indicated in the tracking database. Any identified discrepancies between the two sources were then identified in the SSMVP and later resolved based on feedback provided by the Duke program team.

As outlined in prior sections, the gross impact evaluation process began with a thorough review of project documentation. This information was provided upon formal request. Documents commonly provided by the program team include:

- Smart $aver Incentive Calculation workbooks
- DSMore Summary workbooks
- Custom Incentive Application Forms
- Contractor Proposals
- Detailed project narratives
- Product specifications and invoices
- Customer utility data (monthly billing history)
- Incentive payment request forms
- Email correspondence between members of the program management team and participants

Other documents commonly provided on lighting projects include:

- Smart $aver Custom Incentive Program Lighting Calculators
- Specification sheets for retrofit lighting systems

Other documents commonly provided for non-lighting projects include:

- Customer submitted energy and demand savings calculations
- Detailed reports developed by third-party engineering consultants
- Building energy simulation model output files

After reviewing all program-supplied project documentation the evaluation team engineer assigned to each project then developed a SSMVP for each unique premise. These were developed in order to create a standardized, rigorous process for the verification of project claims. Each SSMVP was specifically tailored to verify the equipment that was installed and measures that were implemented per the provided project documentation. The SSMVP also identified baseline assumptions for verification with on-site personnel in order to validate ex-ante, forecasted savings estimates.

Each SSMVP also identified the specific parameters to be verified and gathered for each measure. These plans followed guidelines set forth in multiple Department of Energy Uniform Methods Project (DOE UMP) protocols including:

Chapter 2: Commercial and Industrial Lighting Evaluation Protocol

Chapter 8: Whole-Building Retrofit with Consumption Data Analysis Evaluation Protocol

Chapter 14: Chiller Evaluation Protocol

Chapter 15: Commercial New Construction Evaluation Protocol

Chapter 18: Variable Frequency Drive Evaluation Protocol

Chapter 19: HVAC Controls (DDC/EMS/BAS) Evaluation Protocol

Chapter 22: Compressed Air Evaluation Protocol

The plans also identified a preferred and one or two alternate analysis approaches (level of rigor) along with the critical data to be gathered for each. Table 4-3 provides a few examples of the data points typically gathered for several of the more commonly encountered ECMs.

Table 4-3 Key Data Points Gathered for Commonly Encountered ECMs

Measure Name	Baseline or Retrofit
Interior Lighting Retrofits	Quantity of existing fixtures Fixture type of existing fixtures Quantity of retrofit fixtures Fixture type of retrofit fixtures Existing fixture controls, if any New fixture controls, if any Typical schedule and hours of operation Space set point temperature Type of heating and cooling equipment/specifications
HVAC Control/EMS	Determine baseline setpoints and schedules through customer interviews Determine post-retrofit setpoints and schedules through central BAS Obtain any available trend data Verify occupancy and equipment schedules Gather nameplate information from primary heating and cooling systems
Variable Speed Drive on Pump	Determine baseline method of pump control Determine conditions that dictate the speed of the VSD Determine whether loads modulate or are fairly constant If loads modulate, determine load profile (% load bins) Nameplate information from pump Nameplate information from VSD Gather any available trend data Perform spot power measurements (kW) of pump while running under normal operating conditions
VSD Air Compressor	Determine baseline method of control Gather information on baseline air compressor system (kW/CFM, hp, CFM output, system type, etc.) Determine how loads vary daily, weekly, seasonally, annually for VSD compressor Nameplate information from new air compressor Gather any operational parameters displayed on control panels Gather any available trend data from central controls system Determine whether compressor serves central plant with multiple compressors or is stand-alone. If part of multi-compressor plant determine role and sequences of operation (primary, secondary, trim, etc.)

Once completed, each SSMVP was then submitted to the Duke EM&V Team for review and approval. Upon approval from Duke data collection activities were then scheduled with the participant.

Nexant employed alternative data collection methods during the Covid-19 pandemic to manage the risk of exposure to the virus for the safety of the Duke Energy customers and Nexant staff. These alternative data collection methods were defined as the following three tiers:

4.1.2.1 Tier 1 – In-person Site Visits

A Nexant engineer visited the project site and met with the site contact to review the project and collect data first hand. This allowed the Nexant engineer to take spot measurements, install metering equipment and visually verify the installations. This tier was reserved for projects with a large number variables and higher magnitudes of uncertainty that can be better defined and/or reduced by collecting specific information on-site that would not be available using the other two tiers.

4.1.2.2 Tier 2 – Virtual Site Visits

A virtual site visit used software to connect the site contact's mobile device to the Nexant engineer's computer. This software enabled the Nexant engineer to see live video and audio as the site contact walks through their facility. The Nexant engineer was able to direct the site contact to the specific areas and equipment associated with the efficiency project. The Nexant engineer was able to capture pictures from the participant's mobile device camera and ask questions of the site contact. This tier was used for visually verifying equipment installs over the virtual software and directing the participant to collect specific equipment information (name plate info, counts, BMS schedules, etc) that could be identified and collected with the help of the site contact.

4.1.2.3 Tier 3 – Enhanced Desk Reviews

An enhanced desk review used phone interviews and/or teleconferences (with screen sharing) with the participant or site contact to review the project documentation and collect answers to the Nexant engineer's questions. This tier was used for simple projects that could be verified using project documentation and information collected from the site participant (schedules, fixture counts, run times, etc.)

The choice of which tier is used will be based on many factors including the complexity of the efficiency project, the comfort level of the participant with conducting in-person site visits or the virtual site visit technology.

Engineers verified that measures were appropriately implemented in accordance with the SSMVP developed for the site. Engineers would request copies of equipment specifications and sequences of operation, as appropriate. Any available historic trend data (when available) was also obtained from existing HVAC control and central plant sequencing control systems.

4.1.3 Project Level Analyses

A variety of analysis approaches were utilized for the impact evaluation. The approach applied was decided based upon the methods used by the participant, trade ally, or program in generating the ex-ante[1] savings estimates, the availability of information, and the extent of interactive effects. An overview of each analysis approach applied is provided in Sections 4.1.3.1 through 4.1.3.3.

4.1.3.1 Basic Rigor: Simple Engineer Model (SEM) with On-site Measurement

Consistent with IPMVP Option A (Partially Measured Retrofit Isolation), this approach was used for the majority of lighting, custom process, and compressed air measures. This method uses engineering calculations, along with site measurements of a limited number of important parameters, to verify the savings resulting from specific measures. This was the most prevalent level of rigor applied for this evaluation.

4.1.3.2 Basic Rigor: Simple Engineer Model (SEM) with Verification Only

This approach is very similar to SEM with On-site Measurement, but without direct measurement of key parameters. This approach is generally applied to measures that are not conducive to direct measurement such as outdoor lighting or building envelope improvements but during this evaluation the restrictions on travel and health guidelines associated with the Covid-19 pandemic limited the evaluation team's ability to conduct many on-site activities. To adapt to these limitations the evaluation team used virtual site visit technology to allow engineers to directly observe the ECMs while being virtually escorted through the facilities by a site contact.

4.1.3.3 Enhanced Rigor: Billing Analysis

Consistent with IPMVP Option C (Whole Building), this approach was used for projects involving multiple HVAC control measures with interactive effects, when final ex ante building simulation models could not be obtained from the trade ally. It was also used for large industrial custom process measures involving equipment that could not be de-energized to accommodate installation of data logging equipment. This approach was only applied on projects where the reported gross energy savings exceeded 10% of annual energy consumption. This approach entailed a pre- and post-retrofit comparison of weather-normalized whole facility energy consumption. This approach adhered to guidelines set forth in the Department of Energy Uniform Methods Project Protocols for HVAC Controls (Chapter 19) and Whole-Building Retrofit with Consumption Data Analysis Evaluation Protocol (Chapter 8).

4.1.3.4 Enhanced Rigor: Whole Building Simulation

Consistent with IPMVP Option D (Calibrated Simulation), this analysis approach was used and is dependent on the evaluation team being able to obtain a complete set of the electronic files for the building energy simulation model developed by the Willdan Group, Inc. to estimate ex-ante energy savings and verification of the as-built conditions.

The evaluation process entailed reviewing the inputs of the model(s) to verify baseline and post-installation conditions are specified correctly and modeled consumption was within ASHRAE criteria. The evaluation team leveraged any available post trend data from the building control system (BAS) or utility consumption data to inform and verify the calibration of the model.

[1] The term "ex ante" represents the forecasted energy and demand savings rather than the actual results.

Nexant adhered to guidelines set forth in the Department of Energy Uniform Methods Project Protocols for Commercial New Construction (Chapter 15) when conducting this analysis.

4.1.3.5 Peak Period Definition

Demand savings were evaluated based on the definition of the peak period provided by Duke Energy, as summarized Table 4-4.

Table 4-4 Definition of Peak Demand Periods

	Summer	Winter
Month	July	January
Hour	4pm – 5pm	7am – 8am

4.1.3.6 Interactive Effects

How energy-efficiency projects change the energy use of other equipment, not associated directly with the projects themselves, should be a consideration in estimating the energy efficiency program benefits. These interactive energy changes can be challenging to quantify but should be accounted for whenever possible.

Interactive energy changes come in a number of forms and affect different fuel types. A measure that directly saves electricity may cause another building system to consume less energy. Alternatively, a measure that directly saves electricity could cause another building system to consume more energy. Sometimes, a single project can have both positive and negative interactive effects on other systems. For example, upgrading to energy efficient lighting reduces the electricity that a participant uses on lighting; the associated reduction in waste heat reduces the burden on the cooling system in the summer – but increases the burden on the heating system in the winter.

The net change in energy use for a building should be quantified and attributed to the project as an increase or decrease in savings. Calculating this net change for lighting projects depends on several factors which include:

- the type and efficiency of heating and cooling equipment,
- the number of hours the lights operate
- the physical configuration of fixtures being replaced and installed, and
- the wattages of the fixture being replaced and installed.

To calculate the net interactive savings the evaluation team used a method consistent with the algorithms outlined in Chapter 2 of the Uniform Methods Project (Commercial and Industrial Lighting Evaluation Protocol). This method defines interactive cooling and heating energy savings for interior lighting and is detailed in Equation 2.

Equation 2 Interactive Cooling Energy Savings for Interior Lighting

$$Interactive\ kWh\ Savings_{Cooling} = kWh_{Lighting\ Savings} \times IF_{kWh,Cooling}$$

Where:

kWh *Lighting Savings*	=	*savings associated with the lighting measure*
IF *kWh, Cooling*	=	*Interactive cooling factor*

The interactive cooling factor is the ratio of cooling energy reduction per unit of lighting energy reduction. This is a dimensionless ratio calculated using Equation 3.

Equation 3 Interactive Cooling Factor

$$IF_{kWh,Cooling} = \frac{(SHG_{base} - SHG_{efficient})}{1000 \times EER}$$

Where:

SHG *base*	=	*sensible heat gain associated with the operation of the base lighting equipment during the cooling season*
SHG *efficient*	=	*sensible heat gain associated with the operation of the efficient lighting equipment during the cooling season*
EER	=	*Energy Efficiency Ratio of the facilities HVAC equipment*

The sensible heat gain represents the thermal energy added to the conditioned space by the lights. It is calculated using parameters that are specific to the lighting load, hours of use, and the fixture's space fraction. The space fraction accounts for how much of thermal energy from the lamp enters the conditioned space.

Equations to calculate the interactive heating penalty, the additional heating required due to more efficient lighting, are very similar to Equation 2 and Equation 3. Instead of the EER value a Coefficient of Performance (COP) is used.

4.1.4 Measurement & Verification Reports

Once a savings analysis was complete all findings from on-site verification and each project-level savings analysis was summarized in a standalone Measurement and Verification Report. Each report contained the full contents of the original SSMVP as well as a section summarizing the data collection activities, the chosen approach for quantifying energy savings, the verified energy and demand savings, and commentary on reasons for differences between the reported and verified savings values. Each individual M&V Report was then submitted to the Duke EM&V Team for review, comment, and approval. The 104 individual M&V Reports developed as part of this evaluation were provided under separate cover.

4.1.5 Program Level Gross Verified Estimation

The evaluation team used a ratio estimation technique for this evaluation. This technique assumes that the ratio of the sum of the verified savings estimates to the sum of the reported savings estimates within the sample is representative of the program as a whole. This ratio is referred to as the realization rate and is calculated using Equation 4.

Equation 4 Realization Rate

$$Realization\ Rate = \frac{\sum_i^n Verified\ Savings}{\sum_i^n Reported\ Savings}$$

Where *n* is the number of projects in the evaluation sample. The realization rate is then applied to the claimed savings of each project in the population to calculate gross verified savings.

4.1.5.1 Presentation of Uncertainty

There is an inherent risk, or uncertainty, that accompanies sampling, because the projects selected in the evaluation sample may not be representative of the program population as a whole with respect to the parameters of interest. As the proportion of projects in the program population that are sampled increases, the amount of sampling uncertainty in the findings decreases. The amount of variability in the sample also affects the amount of uncertainty introduced by sampling. A small sample drawn from a homogeneous population will provide a more reliable estimate of the true population characteristics than a small sample drawn from a heterogeneous population. Variability is expressed using an error ratio for programs that use ratio estimation.

When ratio estimation is utilized, standard deviations will vary for each project in the population. The error ratio is an expression of this variability and is analogous to the coefficient of variation, $C_{v,}$ for simple random sampling.

Equation 5 provides the formula for estimating error ratio.

Equation 5 Error Ratio

$$Error\ Ratio = \frac{\sum_{i=1}^N \sigma_i}{\sum_{i=1}^N \mu_i}$$

Equation 6 shows the formula used to calculate the required sample size for each evaluation sample, based on the desired level of confidence and precision. Notice that the *Error Ratio* term is in the numerator, so required sample size will increase as the level of variability increases.

Equation 6 Required Sample Size

$$n_0 = (\frac{z * Error\ Ratio}{P})^2$$

Where:

n_0	=	*Required sample size before adjusting for a finite population*
z	=	*Constant based on the desired level of confidence (equal to 1.645 for 90% confidence two-tailed test)*
P	=	*Desired relative precision*

The sample size formula shown in Equation 6 assumes that the population of the program is infinite and that the sample being drawn is reasonably large. In practice, this assumption is not always met. For sampling purposes, any population greater than approximately 7,000 may be considered infinite for the purposes of sampling. For smaller, or finite, populations, a finite population correction is warranted. This adjustment accounts for the extra precision that is gained when the sampled projects make up more than about 5% of the program savings. Equation 7 calculates the required sample size for a finite population.

Equation 7 Finite Population Correction

$$n^* = \frac{N * n_0}{N + n_0}$$

Where:

n^*	=	*Required sample size for a finite population*
N	=	*Size of the population*
n_0	=	*Required sample size before adjusting for a finite population*

Verified savings estimates always represent the point estimate of total savings, or the midpoint of the confidence interval around the verified savings estimate for the program. Equation 8 shows the formula used to calculate the margin of error for a parameter estimate.

Equation 8 Error Bound of the Savings Estimate

$$Error\ Bound = SE * z$$

Where:

SE	=	*The standard error of the population parameter of interest (proportion of realization rate, total energy savings, etc.) This formula will differ according to the sampling technique utilized.*
z	=	*Constant based on the desired level of confidence (equal to 1.645 for 90% confidence two-tailed test)*

The 90% confidence level is a widely accepted industry standard for reporting uncertainty in evaluation findings. The confidence levels and precision values presented in this report are at the 90% confidence level. The z statistic constant associated with 90% confidence is 1.645.

When evaluators or regulators use the term “90/10”, the 10 refers to the relative precision of the estimate. The formula for relative precision is shown in Equation 9 and is how actual strata and program level relative precision achieved is calculated.

Equation 9 Relative Precision of the Savings Estimate

$$Relative\ Precision_{Verified\ Savings} = \frac{Error\ Bound_{(kWh\ or\ kW)}}{Verified\ Impact_{(kWh\ or\ kW)}}$$

4.2 Impact Evaluation Analysis and Findings – DEC

4.2.1 DEC Achieved Sample Size

As mentioned in Section 4.1.1.2, the initial impact sample sizes targeted a 90/10 confidence precision based on the project counts assuming an error ration (C_v) of 0.5 and the distribution of the total sample across the four sub strata was determined using the number of projects in each strata, the amount of savings in each strata and the historical Cv values of the same strata from the 2016 - 2017 NR Custom evaluation. Some participants refused to cooperate with the evaluation activities, so the evaluation team was only able to complete analyses on 12 of the 16 NL-Small sample projects. Our achieved sample sizes are summarized in Table 4-5.

Table 4-5 DEC NR Custom Stratified Sampling - Achieved

Strata	Initial Population	Initial Target Sample Size	Adjusted Population	Adjusted Target	Achieved Sample Size
L-Small (<360 MWh)	369	23	359	23	24
L-Large (≥360 MWh)	59	9	58	10	9
NL-Small (<537 MWh)	101	16	99	16	12
NL-Large (≥537 MWh)	13	10	13	9	10
Total	**542**	**58**	**529**	**58**	**55**

The evaluation team was able to achieve stratum-level sample targets for L-Small, L-Large and NL-Large strata. As will be shown in the next section, the evaluation sample was still able to achieve the targeted 10% precision at the 90% confidence level for energy since the Cv of the evaluated projects was lower than the Cv values used to determine the target sample size.

4.2.2 DEC Gross Verified Impacts

Table 4-6, Table 4-7, and Table 4-8 summarize gross impact results for energy (kWh), summer demand (kW), and winter demand (kW). Detailed results for each sampled project are provided in the standalone M&V Reports.

Table 4-6 DEC Gross Verified Energy Savings (kWh) by Stratum

Stratum	Gross Reported Energy Savings (kWh)	Gross Verified Energy Savings (kWh)	Realization Rate (%)	Relative Precision @ 90% Confidence
L-Small (<360 MWh)	25,107,218	26,104,266	103.97%	4.3%
L-Large (≥360 MWh)	41,747,348	41,723,000	99.94%	7.9%
NL-Small (<537 MWh)	12,433,255	11,544,202	92.85%	10.2%
NL-Large (≥537 MWh)	21,106,809	20,350,706	96.42%	3.0%
Program Total	**100,394,630**	**99,722,174**	**97.62%**	**4.3%**

Table 4-7 DEC Gross Verified Summer Peak Demand Savings (kW) by Stratum

Stratum	Gross Reported Summer Demand Savings (kW)	Gross Verified Summer Demand Savings (kW)	Realization Rate (%)	Relative Precision @ 90% Confidence
L-Small (<360 MWh)	4,112	3,497	85.04%	27.4%
L-Large (≥360 MWh)	7,109	6,806	95.74%	6.8%
NL-Small (<537 MWh)	2,081	1,610	77.37%	24.0%
NL-Large (≥537 MWh)	3,629	3,706	102.13%	4.7%
Program Total	**16,931**	**15,620**	**99.26%**	**6.8%**

Table 4-8 DEC Gross Verified Winter Peak Demand Savings (kW) by Stratum

Stratum	Gross Reported Winter Demand Savings (kW)	Gross Verified Winter Demand Savings (kW)	Realization Rate (%)	Relative Precision @ 90% Confidence
L-Small (<360 MWh)	3,628	3,051	84.08%	40.9%
L-Large (≥360 MWh)	5,899	5,735	97.22%	6.8%
NL-Small (<537 MWh)	1,757	2,211	125.81%	31.9%
NL-Large (≥537 MWh)	2,973	3,481	117.10%	12.5%
Program Total	**14,257**	**14,478**	**110.53%**	**17.0%**

The program achieved an overall energy realization rate of 97.62%. Generally, the overall energy realization rate was a result of the verified lighting savings, which achieved more energy savings than reported, balancing out the verified non-lighting savings, which achieved slightly less energy savings than reported. Summer peak and winter peak demand savings are 99.26% and 110.53%, respectively. The following sections provide more details and insights into the contributing factors of each strata's results.

4.2.2.1 DEC Small Lighting Projects

Twenty-four Lighting-Small projects were evaluated from the 2018-2019 NR Custom population. The Lighting-Small sample projects achieved 103.97% verified energy savings, 85.04% verified summer peak demand savings and 84.08% verified winter peak demand savings. The inclusion of interactive effects into the verified savings was the main contributing factor to the higher energy realization rates. Differences between the reported hours of use (HOU) and the verified HOU were found in the sample projects. These differences in HOU resulted in both higher than reported verified savings and lower than reported verified savings depending on if the verified HOU were higher or lower than the reported HOU.

Four of the L-Small projects were found to have used a T12 baseline for the reported savings calculation. The 2016-2017 NR Custom evaluation report recommended a T8 baseline standard based on participant and trade ally survey data, a determination that a T8 baseline had minimal impact and current industry standards. A T8 baseline was used to calculate the verified savings for these four projects. This resulted in lower than reported verified savings for these four sample projects.

4.2.2.2 DEC Large Lighting Projects

Nine Lighting-Large projects were evaluated from the 2018-2019 NR Custom population. The Lighting-Large sample projects achieved 99.94% verified energy savings, 95.74% verified summer peak demand savings and 97.22% verified winter peak demand savings. Like the Lighting-Small stratum, the inclusion of interactive effects resulted in higher verified energy savings in three of the nine projects. Some differences between the reported hours of use (HOU) and the verified HOU with the participants were found but resulted in minor adjustments. One project was found to have used a T12 baseline for the reported savings calculation and the T8 baseline was used to calculate the verified savings for this project. This resulted in significantly lower verified savings for this project.

4.2.2.3 DEC Small Non-lighting Projects

Twelve Non-lighting-Small projects were evaluated from the 2018-2019 NR Custom population. The Non-Lighting-Small sample projects achieved 92.85% verified energy savings, 77.37% verified summer peak demand savings and 125.81% verified winter peak demand savings.

Multiple projects contributed to lower than reported verified savings. There were five new construction project which had a model that was not calibrated to the building's actual utility bill consumption. The evaluation team made changes to the model inputs to calibrate the model and recalculate the verified savings. Four of these new construction projects resulted in lower than reported verified savings and one resulted in higher than reported verified savings. Three walk-in freezer projects had lower than reported electric defrost kW rating values which resulted in verified energy savings of approximately 43% of reported savings. Also, one HVAC upgrade project had lower verified equipment efficiency values, lower set points and a disabled economizer.

4.2.2.4 DEC Large Non-lighting Projects

The Non-lighting-Large sample projects achieved 96.42% verified energy savings, 102.13% verified summer peak demand savings and 117.10% verified winter peak demand savings. Ten Non-lighting-Large projects were evaluated from the 2018-2019 NR Custom population.

Seven of the ten project in this stratum achieved realization rate of 100% of greater. The largest project in the stratum was a new construction project. The model used to calculate the reported savings was found to be out of calibration with utility billing records. The calibration of the model resulted in lower than reported verified savings.

Two HVAC upgrade projects showed lower than reported verified savings. These projects used HVAC models to calculate reported savings. The documentation of these models did not provide detailed calculations or assumptions, so it was difficult to determine the exact cause of the higher reported energy savings estimates. In one case, the application estimated a 70% reduction in the facility's annual consumption. This was based on an estimated consumption of the HVAC equipment that was large then the total historical consumption of the building. A utility billing analysis was used to verify a 40% reduction in the facility's consumption. In the other case, differences in parameters (schedule, CFM, Fan hp, setpoints) between the reported values and verified values were found.

4.2.3 DEC Custom-to-Go vs. Custom Classic

This section provides a comparison of projects that used the Custom-to-Go worksheets and those that used the Classic Custom (Classic) worksheets. The following criteria determines which worksheet is used for NR Custom projects:

- Non-lighting projects with more than 700,000 annual kWh savings must use the appropriate Classic Custom worksheet.

- All lighting projects as well as other projects with less than 700,000 annual kWh savings may use the optional Custom-to-Go worksheets.

Table 4-9 presents the gross reported energy savings by worksheet and measure type. The majority (72%) of gross reported energy savings are submitted through Classic worksheets.

Table 4-9 DEC Gross Reported Energy Savings by Worksheet Type

Worksheet Type	Measure Type	Gross Reported Energy Savings (kWh)	Percent of Program
Classic	Lighting	45,402,733	45%
	Non-lighting	26,898,377	27%
Custom-to-Go	Lighting	21,451,833	21%
	Non-lighting	6,641,687	7%
Program Total		**100,394,630**	

Making up 66% of the total program savings, lighting is the one technology category with most savings from both Classic and Custom-to-Go worksheets. Figure 4-3 shows the distribution of gross reported energy savings for classic custom projects broken down by technology category. Figure 4-4 shows the distribution of gross reported energy savings for Custom-to-Go projects. The average reported energy savings of projects using the Classic worksheets is 150,340 kWh for Lighting and 332,079 for Non-lighting. This indicates that most participants are choosing the classic worksheets regardless of the option to use the Custom-to-Go worksheets.

Figure 4-3 Distribution of DEC Reported Energy Savings for Classic Custom Projects by Technology Category

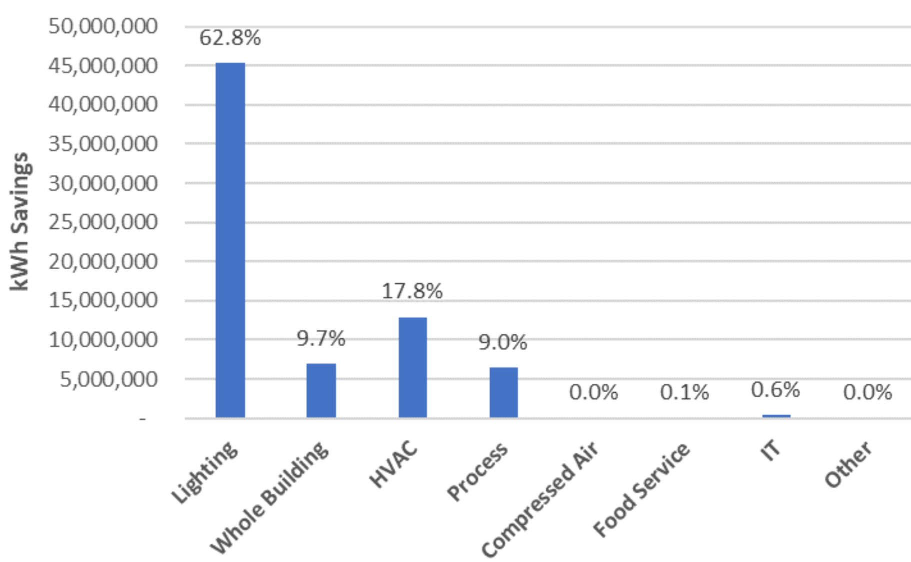


Figure 4-4 Distribution of DEC Reported Energy Savings for Custom-to-Go Projects by Technology Category

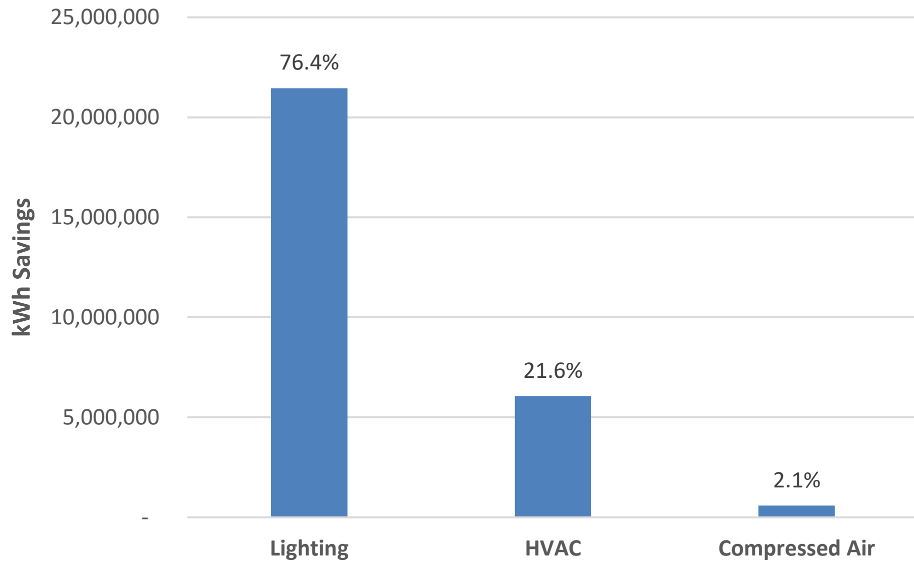


Table 4-10 indicates the reported and verified energy (kWh) savings stratified by technology category (lighting vs. non-lighting) and participation track (Classic vs. Custom-to-Go) for the evaluated sample. The impact evaluation sampling did not stratify for the attribute. These realization rates were not used to estimate the program level verified savings. They are presented here to show any differences between the worksheet types.

Table 4-10 Comparison of Strata-Level Realization Rates – DEC Classic vs. Custom-to-Go

Track	Measure Category	Population	Sample	Sample Reported (kWh)	Sample Verified (kWh)	Realization Rate (%)
Classic	Lighting	302	26	7,314,995	7,386,420	100.98%
	Non-lighting	81	17	16,843,383	16,561,881	98.33%
	Total	**383**	**43**	**24,158,378**	**23,948,302**	**99.13%**
Custom-to-Go	Lighting	115	7	1,486,844	1,468,155	98.74%
	Non-lighting	31	5	2,218,200	1,783,627	80.40%
	Total	**146**	**12**	**3,705,045**	**3,251,782**	**87.77%**

Realization rates for Classic Non-lighting projects (98.33) were higher compared to Custom-to-Go Non-lighting projects (80.40). This is due to a couple of HVAC upgrade projects in the Non-lighting-Large strata showed lower than reported verified savings based on billing analyses approach and differences in HVAC parameters.

4.3 Impact Evaluation Analysis and Findings – DEP

4.3.1 DEP Achieved Sample Size

As mentioned in Section 4.1.1.3, the initial impact sample sizes targeted a 90/10 confidence precision based on the project counts assuming an error ration (C_v) of 0.5 and the distribution of the total sample across the four sub strata was determined using the number of projects in each strata, the amount of savings in each strata and the historical Cv values of the same strata from the 2016 - 2017 NR Custom evaluation. Due to the relatively small size of the NL-Small and NL-Large populations and some participants refusing to cooperate with the evaluation activities, the evaluation team was only able to complete analyses on 13 of the 16 NL-Small sample projects and 7 of the 11 NL-Large sample projects. Our achieved sample sizes are summarized in Table 4-11.

Table 4-11 DEP NR Custom Stratified Sampling - Achieved

Strata	Initial Population	Target Sample Size	Achieved Sample Size
L-Small (<123 MWh)	211	21	21
L-Large (≥123 MWh)	33	8	8
NL-Small (<258 MWh)	35	16	13
NL-Large (≥258 MWh)	13	11	7
Total	**292**	**56**	**49**

The evaluation team was able to achieve stratum-level sample targets for both the L-Small and L-Large strata. As will be shown in the next section, the evaluation sample was still able to achieve the targeted 10% precision at the 90% confidence level for energy since the Cv of the evaluated projects was lower than the Cv values used to determine the target sample size.

4.3.2 DEP Gross Verified Impacts

Table 4-12Table 4-6, Table 4-13 and Table 4-14 summarize gross impact results for energy (kWh), summer demand (kW), and winter demand (kW). Detailed results for each sampled project are provided in the standalone M&V Reports.

Table 4-12 DEP Gross Verified Energy Savings (kWh) by Stratum

Stratum	Gross Reported Energy Savings (kWh)	Gross Verified Energy Savings (kWh)	Realization Rate (%)	Relative Precision @ 90% Confidence
L-Small (<123 MWh)	6,301,713	6,803,085	107.96%	7.7%
L-Large (≥123 MWh)	10,478,150	11,978,543	114.32%	7.4%
NL-Small (<258 MWh)	3,617,228	3,402,256	94.06%	13.6%
NL-Large (≥258 MWh)	6,371,065	5,927,597	93.04%	7.4%
Program Total	**26,768,156**	**28,111,481**	**102.08%**	**5%**

Table 4-13 DEP Gross Verified Summer Peak Demand Savings (kW) by Stratum

Stratum	Gross Reported Summer Demand Savings (kW)	Gross Verified Summer Demand Savings (kW)	Realization Rate (%)	Relative Precision @ 90% Confidence
L-Small (<123 MWh)	1,219	1,214	99.53%	13.4%
L-Large (≥123 MWh)	1,448	1,523	105.14%	3.9%
NL-Small (<258 MWh)	884	634	71.76%	25.0%
NL-Large (≥258 MWh)	1,728	1,583	91.61%	7.2%
Program Total	**5,279**	**4,954**	**91.76%**	**6.3%**

Table 4-14 DEP Gross Verified Winter Peak Demand Savings (kW) by Stratum

Stratum	Gross Reported Winter Demand Savings (kW)	Gross Verified Winter Demand Savings (kW)	Realization Rate (%)	Relative Precision @ 90% Confidence
L-Small (<123 MWh)	703	1,012	143.96%	34.1%
L-Large (≥123 MWh)	1,682	1,776	105.63%	3.3%
NL-Small (<258 MWh)	546	772	141.39%	66.8%
NL-Large (≥258 MWh)	1,281	1,193	93.19%	9.7%
Program Total	**4,211**	**4,753**	**105.07%**	**12.8%**

The program achieved an overall energy realization rate of 102.08%. Generally, the overall energy realization rate was a result of the verified lighting savings, which achieved more energy savings than reported, balancing out the verified non-lighting savings, which achieved less energy savings than reported. Summer peak and winter peak demand savings are 91.76% and 105.07% respectively. The following sections provide more details and insights into the contributing factors of each strata's results.

4.3.2.1 DEP Small Lighting Projects

Twenty-one Lighting-Small projects were evaluated from the 2018-2019 NR Custom population. The Lighting-Small sample projects achieved 107.96% verified energy savings, 91.76% verified summer peak demand savings and 105.07% verified winter peak demand savings. The inclusion of interactive effects into the verified savings was the main contributing factor to the higher realization rates. Differences between the reported hours of use (HOU) and the verified HOU were found in the sample projects. These differences in HOU mostly resulted in minor reductions in savings that were less than the interactive effects savings, so the overall project realization rates was still higher than reported. There was one project however that had significant differences in verified HOU. These differences were due to the reported HOU not considering differences in weekend and holiday hours.

One of the Lighting-Small projects were found to have used a T12 baseline for the reported savings calculation. The 2016-2017 NR Custom evaluation report recommended a T8 baseline standard based on participant and trade ally survey data, a determination that a T8 baseline had minimal impact and current industry standards. A T8 baseline was used to calculate the verified savings for these four projects. This resulted in lower than reported verified savings for this sample project.

4.3.2.2 DEP Large Lighting Projects

Eight Lighting-Large projects were evaluated from the 2018-2019 NR Custom population. The Lighting-Large sample projects achieved 114.32% verified energy savings, 105.14% verified summer peak demand savings and 105.63% verified winter peak demand savings. Like the Lighting-Small stratum, the inclusion of interactive effects into the verified savings was one of the contributing factors to the higher realization rates.

Some differences between the reported hours of use (HOU) and the verified HOU with the participants were found. Unlike the Lighting-Small stratum, these differences in HOU mostly resulted in higher than reported verified savings.

4.3.2.3 DEP Small Non-lighting Projects

Thirteen Non-lighting-Small projects were evaluated from the 2018-2019 NR Custom population. The 2018-2019 sample projects achieved 94.06% verified energy savings, 71.76% verified summer peak demand savings and 141.39% verified winter peak demand savings. Eight of the thirteen projects have realization rates equal to or greater than 100%, with the remaining five projects contributing to the overall lower than reported verified energy savings.

Five projects in the stratum were new construction projects. Two of the new construction projects were within calibration tolerances. The remaining three new construction projects had a model that was not calibrated to the building's actual utility bill consumption. The evaluation team made changes to the model inputs to calibrate the model and recalculate the verified savings.

For two HVAC projects, verified schedules were found to be different than those used to calculate the reported savings. These differences resulted in higher than reported verified savings.

Like the DEC NL-Small stratum, two walk-in freezer projects from the same applicant had lower than reported electric defrost kW rating values which resulted in lower verified energy savings.

In a chiller installation project, the chiller was no longer in operation and therefore zero energy and demand savings were verified for this project. The chiller was taken out of operation due to changes in the business' processes.

The last project involved a new refrigeration variable refrigerant flow system with new controls. This new refrigeration system was installed at the same time as another Non-lighting Large project under a different Enrollment Number. A utility billing analysis of the facility was used to evaluation the combined effect of both measures but only 36% of the reported energy savings were verified.

4.3.2.4 DEP Large Non-lighting Projects

Seven Non-lighting-Large projects were evaluated from the 2018-2019 NR Custom population. The Non-lighting-Large sample projects achieved 93.04% verified energy savings, 91.61% verified summer peak demand savings and 93.19% verified winter peak demand savings.

Five of the seven projects have realization rates equal to or greater than 100%, with the remaining three projects contributing to the overall lower than reported verified energy savings.

Like the Non-lighting-Small stratum one new construction project had a model that was not calibrated to the building's actual utility bill consumption. The evaluation team made changes to the model inputs to calibrate the model and recalculated the verified savings. This project resulted in lower than verified savings.

The last project involved installing a new refrigeration rack system. This is the same location where the Non-lighting-Small refrigeration project was installed. A utility billing analysis of the facility was used to evaluate the combined effect of both measures but only 36% of the reported energy savings were verified.

4.3.3 DEP Custom-to-Go vs. Custom Classic

This section provides a comparison of projects that used the Custom-to-Go worksheets and those that used the Classic Custom (Classic) worksheets. The following criteria determines which worksheet is used for NR Custom projects:

- Non-lighting projects with more than 700,000 annual kWh savings must use the appropriate Classic Custom worksheet.
- All lighting projects as well as other projects with less than 700,000 annual kWh savings may use the optional Custom-to-Go worksheets.

Table 4-15 presents the gross reported energy savings by worksheet and measure type. The majority (81%) of gross reported energy savings are submitted through Classic worksheets.

Table 4-15 DEP Gross Reported Energy Savings by Worksheet Type

Worksheet Type	Measure Type	Gross Reported Energy Savings (kWh)	Percent of Program
Classic	Lighting	12,379,872	46%
	Non-lighting	9,398,740	35%
Custom-to-Go	Lighting	4,399,991	16%
	Non-lighting	589,553	2%
Program Total		**26,768,156**	

Making up 62% of the total program savings, lighting is the one technology category with most savings from both Classic and Custom-to-Go worksheets. Figure 4-5 shows the distribution of gross reported energy savings for classic custom projects broken down by technology category. Figure 4-6 shows the distribution of gross reported energy savings for Custom-to-Go projects. The average energy savings of projects using the Classic worksheets is 75,950 kWh for Lighting and 218,575 for Non-lighting. This indicates that most participants are choosing the classic worksheets regardless of the option to use the Custom-to-Go worksheets.

Figure 4-5 DEP Distribution of Reported Energy Savings for Classic Custom Projects by Technology Category

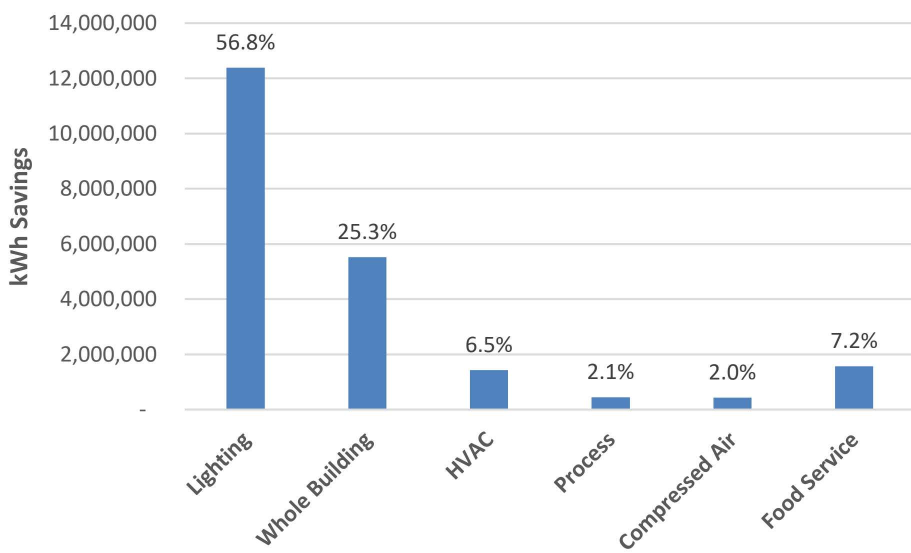


Figure 4-6 DEP Distribution of Reported Energy Savings for Custom-to-Go Projects by Technology Category

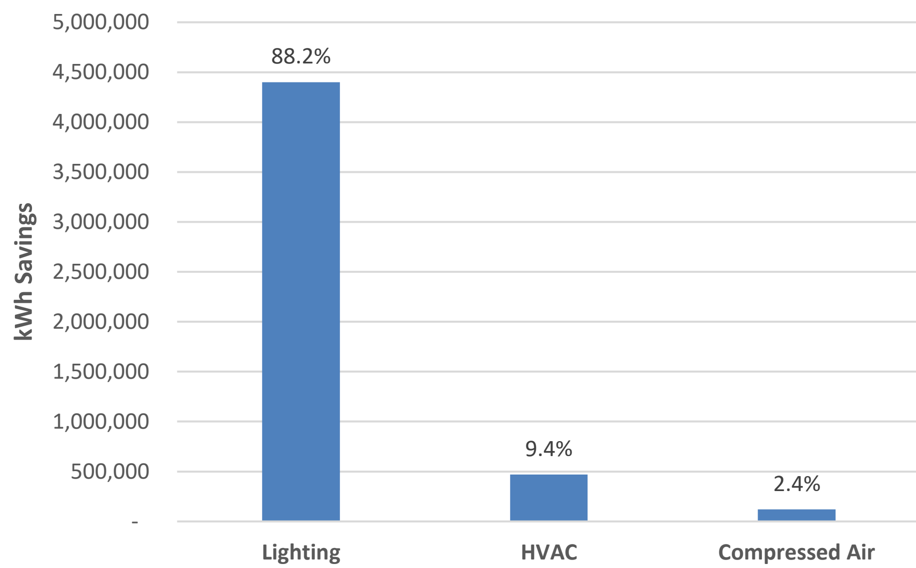


Table 4-16 indicates the reported and verified energy (kWh) savings stratified by technology category (lighting vs. non-lighting) and participation track (Classic vs. Custom-to-Go) for the evaluated sample. The impact evaluation sampling did not stratify for the attribute. These realization rates were not used to estimate the program level verified savings. They are presented here to show any differences between the worksheet types.

Table 4-16 Comparison of Strata-Level Realization Rates – DEP Classic vs. Custom-to-Go

Track	Measure Category	Population	Sample	Sample Reported (kWh)	Sample Verified (kWh)	Realization Rate (%)
Classic	Lighting	163	23	3,370,227	3,875,849	115%
	Non-lighting	43	17	4,133,632	3,840,760	92.9%
	Total	**206**	**40**	**7,503,859**	**7,716,609**	**102.83%**
Custom-to-Go	Lighting	81	6	386,819	361,143	93.4%
	Non-lighting	5	3	468,769	455,989	97.3%
	Total	**86**	**9**	**855,589**	**817,132**	**95.5%**

Realization rates for Classic lighting projects were higher compared to Custom-to-Go lighting projects. This is due to some Custom-to-Go lighting projects that had verified hours of use (HOU), less than the hours used to calculate the reported savings. Also, the inclusion of interactive effects into the verified savings was the main contributing factor to the higher realization rates for Classic lighting projects.

4.4 High Level Findings

4.4.1 Continue High Quality Reviews

The evaluation team saw strong evidence that the Duke NR Custom program team conducts detailed reviews of the project applications, quality control checks and revises measure parameters based on their engineering judgement and input from the participants or trade allies. Engineering reviews by AESC provides an additional level of quality control that helps to minimize most calculation errors or instances of over-claimed energy or demand savings.

The strata-level realization rates indicate that an appropriate level of rigor is being applied to lighting projects and most non-lighting projects. The level of rigor being applied to each project as it goes through the application process of the NR Custom Program is resulting in accurate estimates of energy and demand savings.

4.4.2 Lighting Schedules

Of the parameters needed to calculate lighting project savings, verified lighting operating schedules, or annual hours of use, were more often found to be different than what was used to calculate reported savings. Participants and/or trade allies are asked to provide the operating schedules as part of the application process and have the best insights into what the schedule will be for each installed fixture.

There were two general types of differences between the lighting operating schedule reported on the application and the schedules the evaluation team verified with the participants. The first was that the installed fixtures were found to be operating on different weekly operating schedules than captured on the applications. The second type of difference was the number of holidays accounted for in the verified savings.

For lighting projects where trade allies or third parties are estimating the operating schedules, these differences may be due to generalizations or assumptions made for the lighting schedules across different areas and stores. Differences in operating schedules were also seen due to schedules varying by different days of the week where the application indicated the lights operating the same each day of the week.

The Duke Classic lighting worksheet does have fields where a typical weekday, Saturday and Sunday schedule may be entered. The weeks of use in a year is also able to be entered. The evaluation team saw evidence that these fields are not always used and variations in the schedule that was provided by the participant created different savings. Consistent use of these worksheet fields to capture the lighting schedule would help reduce these differences.

Neither the Classic lighting worksheet nor the Custom-to-go worksheet ask specifically about observed holidays. Asking how many days a year the lights are not operating due to holiday closures and incorporating this information into the calculation of operating hours would help minimize these differences.

4.4.3 Documentation of Assumptions and Trend data

The project reviews, both during the application process and the evaluation, would benefit from more documentation of all the underlying assumptions and worksheets used for the calculations of savings. In many instances, during the evaluation of non-lighting projects, the model documentation and calculation worksheets were submitted as screenshots, which did not provide access to the algorithms or assumptions used to estimate the savings. Trend data of historical consumption and manufacturer's specification sheets that include detailed performance data would allow more detailed analyses for the proposed measures.

Moreover, project documents did not contain photos of baseline/pre-existing or retrofit equipment. Photos serve as a valuable verification of the installed equipment and provide essential information regarding the condition and operating parameters of the old and new equipment. For example, when retrofitting a pump with a VFD, providing photos of the pump nameplate, new VFD, and the VFD panel showing run speed and all other available parameters would provide valuable information and serve as proof of installation. Also, in cases of equipment replacement, photos of disposed/recycled equipment provide a proof that the inefficient equipment has been taken out of service and would not be used anymore. These photos would also provide information which the evaluator would be able to verify otherwise.

4.4.4 Measurement and Verification Requirements

There were no measurement and verifications (M&V) plans provided within the project documents. M&V plans, and the data collection they require, help confirm the measures supported by the program are installed and resulting in the expected energy and demand savings. M&V plans for large non-lighting projects can greatly assist the review of the program applications and projects being evaluated, in some cases years after the project is implemented.

M&V plans should be consistent with IPMVP Protocols, which require data logging for projects with high uncertainty. The level of data logging requirements is usually dependent on many factors, such as project size (i.e. estimated savings), project scope, incentives amount, and the type of implemented measures. The evaluation team believes that creating M&V protocols and guidelines to be followed by the implementers prior to project approval will increase the accuracy of the reported savings and provide high quality data that will later facilitate a more efficient evaluation. The M&V protocols can be designed in a tiered approach depending on measure type and estimated savings. For example, small lighting projects would not require an M&V plan or data logging but large non-lighting projects involving a large portion of the program savings or measures with high uncertainty would require an M&V plan along with logging data at a representative sample of the equipment.

4.4.5 Calibration of New Construction models

There were sixteen projects in the non-lighting sample that were implemented using the NCEEDA protocol. This protocol defines how savings from new, high-performance buildings that are built above code requirements shall be modeled and estimated. The goal of NCEEDA is to provide timely results on a wide range of design options early enough in design so that those options are still viable within the context of the project. NCEEDA in Duke's Carolinas & Duke Energy Progress Service Territories uses ASHRAE Standard 90.1-2010 for commercial buildings and multifamily buildings greater than three stories. Specifically, NCEEDA uses the methodology of Appendix G with modifications listed in the protocol for the determination of custom savings.

The models of the new buildings are developed using these standards and protocol; simulation software, design specifications and construction drawings; and site visits. The program team is doing a very good job at matching the models to the as-built conditions of the new buildings. The evaluation team found very few instances where an energy saving strategy was not implemented as it was specified in the model.

Assumptions on how the building is expected to be occupied and used are also required to be specified in the models and general values of the necessary parameters are provided by the standards and protocols. In some cases, professional judgement and information from participants is used to inform what values to use. These general occupancy and scheduling parameters do not always match how the new buildings are used or occupied and can lead to modeled consumption levels and patterns that differ from the actual new building's consumption levels and patterns.

Chapter 15 of the Uniform Methods Project (UMP), Commercial New Construction Evaluation Protocol, describes methods to quantify the uncertainty of the models used to estimate the reported savings. The evaluation team had access to additional post construction utility billing data that was not available during the development of the models. This data was used to determine the normalized mean bias error (NMBE) and the coefficient of variation of the root mean square error (CV_{RMSE}) between the modeled consumption of the new building and the actual monthly consumption of the new building. The UMP references ASHRAE 2002 acceptable tolerances for uncertainty in calibrated building models using monthly consumption data as ±5% NMBE and ±15% CV_{RSME}. The evaluation team found that the modeled consumption was outside of these tolerances for four of the five projects. Adjustments to the models were made to get revised models that produced predicted consumption that was within the ASHRAE tolerances and used those models to calculate the verified energy savings.

The realization rates for seven of these projects is 100%. The realization rates for the remaining nine project were 49%, 71%, 74%, 74%, 91%, 98%, 98%, 104% and 110%. These results show the importance of calibrating the models with sufficient post construction data to validate the model's level of uncertainty. The amount of post construction data needed to calibrate a model varies based on the type of building and the occupancy. Buildings with predictable or consistent consumption may only require as little as three to four months. Other buildings with variable loads and seasonal variability may require twelve months or more.

The evaluation team recommends that Duke incorporate a post construction calibration requirement that uses the ASHRAE 14 tolerances to assess the level of uncertainty in the new construction models and make adjustments to the model in order to minimize the uncertainty. The evaluator understands the importance of providing timely services to the participants, and the need for incentive payments as early as possible, thus it is recommended to have a tiered calibration process that depends on the project size and estimated incentives. For example, the implementer can start by using 3 months of utility data, and if the NMBE and CV_{RMSE} are within reasonable bounds (i.e. error bounds can be set be Duke Energy team or consistent with ASHRAE 14 standards) project can proceed, and if the data falls outside the error bounds, more data would need to be collected in an incremental manner (3, 6, and 9 months). Additionally, the evaluator recommends that the tiered approach consider the size of the project (i.e. estimated savings) and ensure that large projects (for example, savings greater than 1 GWh) collect at least 1 year of full data.

5 Net-to-Gross

5.1 Methodology

The evaluation team based the net-to-gross evaluation on customer self-report surveys, as described in the Uniform Methods Project, Chapter 23: Estimating Net Savings: Common Practices.[2] The survey was designed based on established methodologies outlined in the Pennsylvania Evaluation Framework.[3] This methodology was modified based on discussions with Duke Energy staff before data collection to include additional questions to better understand and incorporate the program's impact on customers' decisions.

Net-to-gross analysis for this program involved two calculations: free-ridership and spillover. The results of these calculations are combined to produce the program-level net-to-gross ratio as follows:

Equation 10 Net-to-Gross Equation

$$NTG_p = (1 - FR_p) + PSO_p + NPSO_p$$

Where:

NTG_p = *the program-level net-to-gross ratio*

FR_p = *the program-level free-ridership ratio*

PSO_p = *the program-level participant spillover ratio.*

$NPSO_p$ = *the program-level nonparticipant spillover ratio.*

The program net verified energy savings are calculated by multiplying the program net-to-gross ratio by the gross verified energy savings resulting from the impact evaluation activities described in Section 4.

Equation 11 Net Verified Energy Savings

$$kWh_{nv} = kWh_{gv} \times NTG_p$$

Where:

kWh_{nv} = *the net-verified kWh savings*

[2] https://energy.gov/sites/prod/files/2015/02/f19/UMPChapter23-estimating-net-savings_0.pdf, Section 3.2.

[3] http://www.puc.state.pa.us/Electric/pdf/Act129/SWE_PhaseIII-Evaluation_Framework082516.pdf, Appendix B.

kWh_{gv} = *the gross-verified kWh savings*

NTG_p = *the program-level net-to-gross ratio*

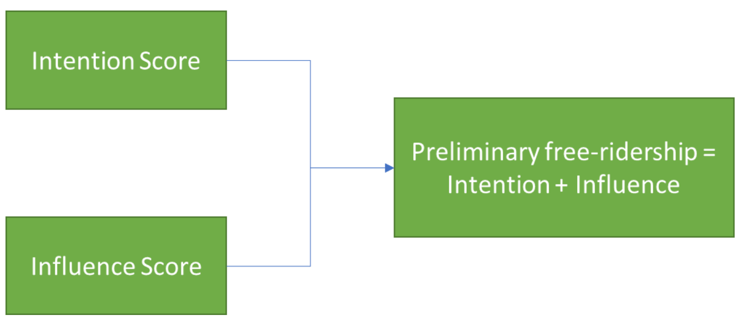
The calculations of the program-level free-ridership and spillover ratios are detailed in the following sections.

5.1.1 Free-Ridership

As mentioned above, free-ridership estimates what proportion of the program's savings would have happened in the absence of the program. Free-ridership considers the customers' plans before engaging in the program and the various influences the program can have on the customer, such as incentives and other interactions with the program staff, contractors, and marketing materials.

The evaluation calculated free-ridership for each survey respondent based on their answers to a series of questions. These questions collected information on the customers' *intention* before interacting with the program and its *influence* on changing those intentions. Each component (intention and influence) has a value ranging from zero to 50 and is then combined for a free-ridership score ranging from 0 to 100. A free-ridership value of 0 indicates that a customer would not have installed the energy-efficient equipment without the program, whereas a free-ridership value of 100 indicates that a customer would have done the same project on their own, at the same time in the absence of the program.

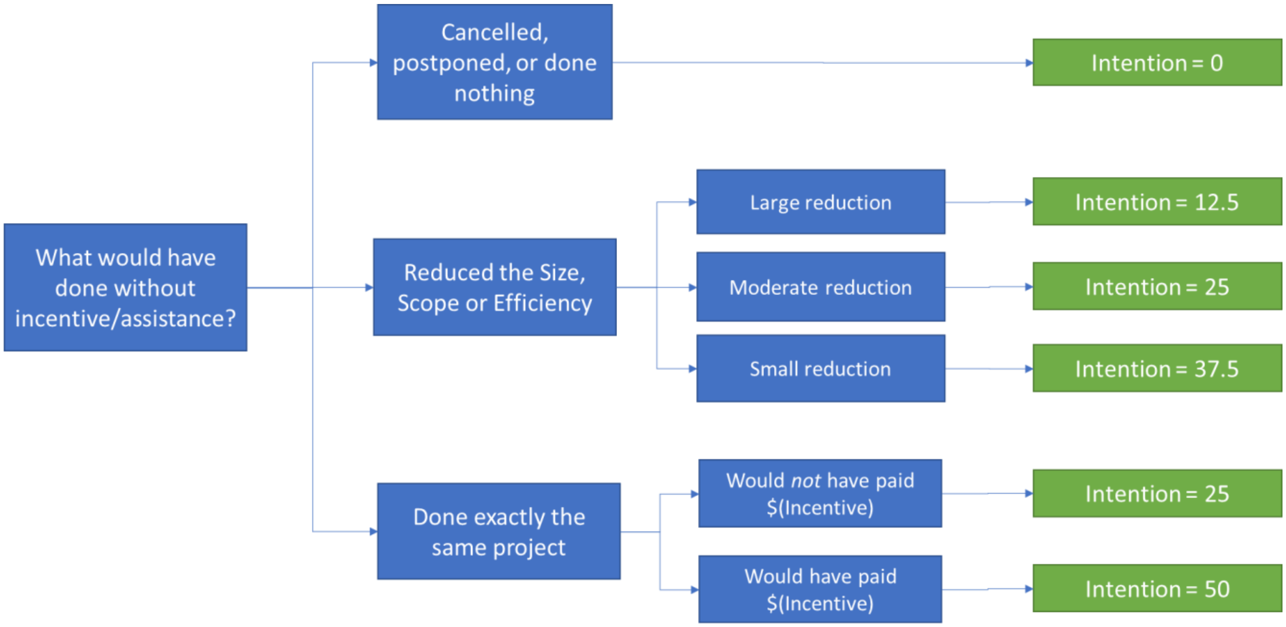
Figure 5-1 Preliminary Free-ridership Calculation



5.1.1.1 Intention

The intention score seeks to capture what most likely would have happened without the program assistance. The program assistance includes not just the incentive but any assistance from items such as audits, technical assistance, and program staff. Survey respondents were asked how the project would have changed if the incentive were not available. Responses were scored on a scale from 0 to 50, as shown in Figure 5-2.

Figure 5-2 Intention Score Flowchart



The initial question of the intention score asks respondents what they would have done without the program assistance. Respondents who indicated they would have canceled, postponed, or done nothing without the program get an immediate intention score of 0.

If the respondent indicated they would do a smaller or less efficient project, they were prompted to categorize it as a small, moderate, or large reduction in scope. This approach attempts to gather the respondent's best estimate of what would have happened without the program, or the counterfactual, recognizing that a precise estimate is not likely to be achieved. The question battery does not seek to follow-up with respondents to understand the exact change to scope or efficiency level to avoid response burden and reduce the risk of false precision.

Lastly, respondents who indicated they would have done the exact same project were asked if they would have paid the additional incentive amount. This question is added to give the program credit by reducing the intention score for customers who would not have had the funds to pay for the project on their own.

The response options and scoring for retrofit projects are outlined in Table 5-1 below.

Table 5-1 Net-to-Gross Intention Score Methodology – Retrofit Projects

Response	Intention Score
Done nothing	0
Canceled or postponed the project	0
Done a smaller or less efficient project	Small = 37.5 Moderate = 25 Large = 12.5 Don't know = 25
Done exactly the same project	Would have paid = 50 Would not have paid = 25 Don't know = 37.5

A similar but slightly different set of questions were asked for new construction projects. The question and response options reflect that a project would have occurred but worked to understand how the project would have been different without the program. Responses were scaled on the same 0 to 50 scale, as outlined in Table 5-2 below.

Table 5-2 Net-to-Gross Intention Score Methodology – New Construction Projects

Response	Intention Score
Installed all standard efficiency or code equipment	0
Installed some energy-efficient equipment, but not as much as you did through the program	Closer to standard efficiency or code = 12.5 Closer to what you ended up installing = 37.5 Somewhere in between = 25 Don't know = 25
Installed the same efficient equipment as you did with the program's assistance	Would have paid = 50 Would not have paid = 25 Don't know = 37.5

5.1.1.2 Influence

To recognize the direct points of influence that the program has on customers' decisions, survey respondents were asked to rate the influence of several program aspects. The evaluation team worked with program staff during the survey design stage to identify all the ways program staff work with customers to include all components as part of the influence question. Together, the team included ten different aspects that could have been influential for customers, as outlined in the table below.

Table 5-3 Net-to-Gross Program Influence Aspects

Program Aspect
Incentive provided by Duke Energy
The support provided by your Duke Energy business energy advisor
Smart $aver marketing materials or webinars
Previous experience with the Smart $aver program
The technical support provided by Duke Energy engineer staff
The support provided by your Duke Energy account manager
The energy design assistance provided for your new construction project
The bundle options provided for your new construction project
The calculators provided by Duke Energy
Contractor or vendor recommendation

For each aspect, respondents were asked to rate the influence of the aspect where 10 was extremely influential, and 0 was not at all influential. The highest aspect rating for each customer was scored on a scale of 0 to 50, similar to the intention score. The rationale is that if any aspect of the program is highly influential on a customer's decision, the program overall was equally influential (see Table 5-4).

Table 5-4 Net-to-Gross Influence Score Methodology

Max FR4 rating	Influence Score
9-10	0
8	6.25
7	12.5
6	18.75
5	25
4	31.25
3	37.5
2	43.75
0-1	50

If a customer indicated their contractor as influential in the project, that is, providing an influence rating of a six or higher, the evaluation team attempted to contact the contractor. We asked the contractor a similar question, asking about the influence the program had on the specific customer. The scoring of the influential vendor influence score is shown below, where contractors used a scale from one to five where one was ‘not at all influential,’ and five was ‘extremely influential.’

Table 5-5 Net-to-Gross Influence Score Methodology – Influential Vendor

<table>
<tr><th>Program Aspect</th><th>Max Rating →
Influence Score</th></tr>
<tr><td>The program incentive provided by Duke Energy</td><td rowspan="6">1 → 50
2 → 37.5
3 → 25
4 → 12.5
5 → 0</td></tr>
<tr><td>Your interactions with Duke Energy program staff, including technical assistance</td></tr>
<tr><td>The support from your Duke Energy trade ally outreach representative</td></tr>
<tr><td>The program marketing, training, or informational materials</td></tr>
<tr><td>Your firm’s past involvement in Duke Energy’s programs</td></tr>
<tr><td>The energy design assistance provided by Duke Energy</td></tr>
</table>

When a customer indicated a contractor was influential in doing the project, and the evaluation team could not complete a survey with the contractor, the customer's influence score was used. In cases where we completed the contractor survey, the methodology indicates to take the highest rating (or lowest influence score) from either the customer or the contractor.

5.1.1.3 Calculation Steps

The intention and final influence scores are added together to produce each respondent's preliminary free-ridership ratio using Equation 12.

Equation 12 Respondent Preliminary Free-ridership Ratio

$$FR_p = \frac{Intention + Influence}{100}$$

Where:

FR_p = the preliminary free-ridership score.

In 2020, the evaluation team incorporated consistency checks in the survey to follow-up when respondents gave inconsistent responses between the Intention and Influence scores. The inconsistency was defined as one score (either Intention or Influence) being greater than or equal to 37.5 and the other score being less than or equal to 12.5. The evaluation team reviewed responses to an open-ended question asking respondents to describe the impact, if any, the Duke Energy assistance had on the decision to install the amount of energy-efficient equipment at the time they did.

If the response validated a higher free-ridership score, the preliminary free-ridership ratio is adjusted using the following calculation:

Equation 13 Consistency Checks Adjustment Supporting Higher Free-ridership

$$FR_{a1} = FR_p + (\frac{1 - FR_p}{2})$$

Where:

FR_a = the adjusted free-ridership score.

If the response validated a lower free-ridership score, the preliminary free-ridership ratio is adjusted using the following calculation:

Equation 14 Consistency Checks Adjustment Supporting Lower Free-ridership

$$FR_{a1} = \frac{FR_p}{2}$$

If the response is ambiguous, the preliminary score is not adjusted. There are also no adjustments if the Intention and Influence scores were consistent and in cases where we incorporated influential vendor responses.

A second adjustment further looks at the impact of the program and incentives. Two questions are reviewed to adjust the free-ridership score. The first question asks respondents if they learned about Duke Energy's assistance before or after selecting the specific type of equipment that received the incentive. Suppose the respondent indicated they had chosen the equipment before they heard about the incentive. In that case, the free-ridership score is adjusted upwards to reflect that the customer had already selected program-eligible equipment.

Equation 15 Respondent Final Free-ridership Ratio

$$FR_{a2} = FR_{a1} + \frac{1 - FR_{a1}}{2}$$

The second question asks respondents if their experiences with Duke Energy's program caused their organization to change its purchasing policies or energy-efficient equipment guidelines. If the organization indicated their policies had changed because of Duke Energy, their free-ridership score is adjusted downwards.

Equation 16 Respondent Final Free-ridership Ratio

$$FR_{a3} = FR_{a2} * 50\ percent$$

The final participant free-ridership ratio is multiplied by that respondent's verified gross savings to result in free rider savings, or savings that would have occurred without the program. The program free-ridership ratio is the sum of free rider savings divided by the sum of verified gross savings as shown in Equation 17.

Equation 17 Program Free-ridership Ratio

$$FR_p = \frac{\sum(FR_i \times kWh_{gv})}{\sum kWh_{gv}}$$

5.1.2 Spillover

Spillover is an estimate of savings resulting from the installation of energy-efficient projects completed without a program incentive, but that still was influenced by the program. Participant spillover was calculated from program participants who reported additional installations. Nonparticipant spillover was calculated from talking with participating contractors about their sales of program-eligible equipment that did not receive Duke Energy incentives.

5.1.2.1 Participant spillover

Participant spillover attributes savings to the program for equipment that participants installed without the incentive that was influenced by the program. For participant spillover, there are two components to arriving at these program-attributable savings.

First, the survey collects information on the type of energy-efficiency equipment installed but for which an incentive was not received. This is used to estimate energy savings by applying established calculation methodologies, often a technical reference manual.

Second, the survey asks the respondent to rate the program's influence on their decision to implement the project despite not receiving an incentive. That score is used to prorate the total project savings, recognizing that the program may not have been the only influence in the completion of the project. The result of this calculation is program-attributable participant spillover, shown in Equation 18:

Equation 18 Program-Attributable Participant Spillover

$$kWh_{apso} = kWh_{gso} \times Influence$$

Where:

kWh_{apso} is the program-attributable participant spillover savings

kWh_{gso} is the gross spillover savings

Influence is the value based on the respondent's rating of the program influence, as shown in Table 5-6.

Table 5-6 Participant Spillover Program Influence Values

Reported Smart $aver Program Influence	Influence Value
0	0.0
1	0.1
2	0.2
3	0.3
4	0.4
5	0.5
6	0.6
7	0.7
8	0.8
9	0.9
10	1.0
Don't know / Refused	Sector-level measure average

This number is divided by the total verified gross energy savings for the program to produce a program spillover ratio (Equation 19):

Equation 19 Program Participant Spillover Ratio

$$Program\ Participant\ SO\ Ratio = \frac{\sum kWh_{apso}}{kWh_{gv}}$$

5.1.2.2 Nonparticipant Spillover

Nonparticipant spillover attributes savings to the program for equipment contractors install for customers without a Duke Energy incentive that was influenced by the program. Nonparticipant spillover was captured from talking with contractors who participated in the program. Similar to participant spillover, contractor spillover was calculated from two components to arrive at program-attributable savings.

The survey first asked about the sales of program-eligible projects of the same type installed through the Smart $aver program that did not receive an incentive from Duke Energy. The number of projects was used as weighting so that contractors and project sizes were weighted equally.

Contractors were also asked to rate the program's influence on their sales of projects that did not receive an incentive from Duke Energy. That score was used to adjust the spillover amount to recognize the program's impact on their program-eligible sales. The result of this calculation is program-attributable nonparticipant spillover, shown in Equation 20:

Equation 20 Program-Attributable Nonparticipant Spillover

$$Nonparticipant\ SO = Sales \times Influence$$

Where:

Sales is the percent of sales of program-eligible equipment that did not receive an incentive are the program-attributable nonparticipant spillover projects

Influence is the value based on the respondent's rating of the program influence, as shown in Table 5-7.

Table 5-7 Nonparticipant Spillover Influence Values

Reported Smart $aver Program Influence	Influence Value
1	0.0
2	0.5
3	0.5
4	1.0
5	1.0
Don't know / Refused	0.0

5.2 Sampling

Tetra Tech received program tracking data for PY2018 and PY2019 for the Duke Smart $aver Custom Program. The tracking data included 1,187 records (780 DEC and 407 DEP) for the Carolina territories. The tracking data was aggregated to the Sector, or measure-category level, summing incentive amounts and kWh savings, using the Unique Project ID variable. The detailed measure descriptions were retained for reference in the participant survey. After aggregation, the Carolina territories sample frame included 834 measure-level records (544 DEC and 290 DEP), all included in the study's sample. A total of 283 unique customer contacts were associated with the 834 projects included in the sample.

The table below reports the sample size and estimated completed surveys for the Carolina territories. Assuming a response rate of 35%, we expected to complete a total of 292 surveys.

Table 5-8 Survey Sample Design by Initiative

Measure Category	Original Tracking Data*	Number of Projects**	Estimated Completed Surveys***
Lighting	1,000	669	234
Whole Building	60	60	21
HVAC	61	54	19
Compressed Air	6	6	2
Process	33	18	6
Food Service	26	26	9
IT	1	1	1
Total	**1,187**	**834**	**292**

*Counts provided are the number of measures.

**The number of the unique customer contact totals 283.

***The number of estimated completed surveys assumes a 35 percent response rate.

5.3 Net-to-Gross Analysis and Findings

The evaluation team conducted surveys with 92 customer respondents (65 were DEC customers and 27 were DEP customers; two respondents participated in both DEC and DEP) who completed 236 different projects in the DEP and DEC territories.

5.3.1 Intention

Most responding customers (132 of 236 projects) reported they would have put off the project, canceled it entirely, or reduced the scope or efficiency of the project if they had not received their incentive. The remaining responding customers (103 projects) said they would have completed their project without the Smart $aver Custom Program. Only three of those customers said they would not have paid the upgrade cost if the incentive were not available. Note: one respondent indicated they did not know what they would have done differently without the program. The full distribution of responses is shown in Table 5-9. These responses resulted in an average, unweighted intention score of 30.7 and a weighted score of 27.7.

Table 5-9 What Would You Have Done Had You Not Received an Incentive (Intention)

Response	Intention Score	Total	DEC	DEP
Done nothing	0	10	7	3
Canceled or postponed the project (retrofit) Installed all standard efficiency or code equipment (new construction)	0	38	32	6
Done a smaller or less efficient project (retrofit) Installed some energy efficient equipment, but less (new construction)		84	63	21
	Large reduction = 12.5	*2*	*2*	*0*
	Moderate reduction = 25	*77*	*56*	*21*
	Small reduction = 37.5	*5*	*5*	*0*
	Don't know = 25			
Done exactly the same project (retrofit) Installed the same efficient equipment (new construction)		103	75	28
	Would have paid = 50	*100*	*74*	*26*
	Would not have paid = 25	*3*	*1*	*2*
	Don't know = 37.5			
Don't know	25	1	1	0

5.3.2 Influence

When asked to rate the influence of the program on their decision to complete the energy-efficiency project, nearly all respondents rated at least one program aspect a 7 or higher on a 0 to 10 scale, where 0 means "not at all influential" and 10 means "extremely influential." The average unweighted influence score was 1.1 and a weighted score of 0.8, meaning the program greatly influenced customers.

Table 5-10 Influence of the Highest Rated Program Factor

Response	Influence Score	Respondents
0-1	50.00	0
2	43.75	1
3	37.50	0
4	31.25	0
5	25.00	1
6	18.75	0
7	12.50	1
8	6.25	17
9-10	0.00	210
Don't know	25.00	0

The program factor that was rated the highest most often was the incentive, followed by the recommendation of the contractor or vendor. The table below shows how often each program factor was rated the highest. When multiple items were given the same highest rating, the evaluation team counted them in each factor.

Table 5-11 Program Factor with the Highest Influence Rating

Factor	Highest rating	Lowest rating	Mean	Times Factor was Selected as Highest Rated	Respondents
The incentive provided by Duke Energy	10	0	7.3	82	235
The recommendation from your contractor or vendor	10	0	8.9	172	215
Previous experience with the Smart $aver program	10	0	9.0	98	123
The energy design assistance provided for your new construction project (New Construction only)	10	0	7.3	8	19
The technical support provided by Duke Energy engineer staff	10	0	7.1	27	130
The calculators provided by Duke Energy	10	2	9.5	89	105
The support provided by your Duke Energy account manager	10	0	8.3	16	28

Factor	Highest rating	Lowest rating	Mean	Times Factor was Selected as Highest Rated	Respondents
The bundle options provided for your new construction project (New Construction only)	10	0	7.3	8	18
Smart $aver marketing materials or webinars	10	0	4.4	11	103
The support provided by your Duke Energy business energy advisor	NA	NA	NA	0	0

Source: Customer Survey; FR4A, FR4B, FR4C, FR4D, FR4E, FR4F, FR4G, FR4H, FR4I, FR4J

Sixty-six customers (203 projects) reported their contractor as influential, and we were able to complete 62 of those surveys. Contractors generally corroborated customer-reported influence. Two customer records had their influence score adjusted due to the contractor reporting greater program influence than what was reported by the customer.

5.3.3 Adjustments

The analysis further adjusted participant free-ridership by reviewing responses if customers provided inconsistent *Influence* and *Intention* responses. A total of 102 records were flagged as being inconsistent. After the evaluation team reviewed the open-ended responses, 12 projects (11 customers) were identified as supporting a higher free-ridership, 11 projects (9 customers) supported a lower free-ridership, and 79 remained ambiguous.

Two final adjustments were made for 1) customers who found out about the program after selecting the equipment and 2) customers who had changed their policies as a result of any Duke Energy conversations. Fourteen respondents had their free-ridership score adjusted, noting they had already selected the equipment before learning about the program. Five customers indicated they had revised their policies based on their experiences with Duke Energy programs or discussions with Duke Energy staff.

5.3.4 Net-to-Gross Results

The following table shows the progression of the free-ridership value based on each of these adjustments.

Table 5-12 Progression of Free-ridership Adjustments (weighted results)

Preliminary FR Score	Contractor adjusted FR Score	FR Score after Consistency Checks	FR Score after Adjusting for when Customer Heard about Program	FR Score after Including Policy Changes (Final FR Score)
28.46%	28.40%	28.71%	30.93%	29.99%

The evaluation team reviewed the data for customers who said they installed additional equipment without a program incentive to calculate participant spillover. If the customer indicated the program influenced the project, the team reviewed the project details to determine the amount of spillover attributable to the program. Nineteen customers indicated they installed equipment without an incentive. This resulted in a small amount of participant spillover attributable to the program, less than one percent.

The evaluation team also talked with contractors involved in projects completed by participating customers to calculate nonparticipant spillover. The evaluation team talked to these contractors about program-qualify sales that did not receive a Duke Energy incentive. Nonparticipant spillover was attributed to the program if contractors indicated their Duke program knowledge was responsible for some or all of their sales that did not receive Duke incentives. Contractors provided different reasons for completing program-qualifying projects outside the Duke Energy Custom program. The most common response was because the customer was opted out of the rebate programs (8 respondents). The second most common response (4 respondents) was that the contractor did not offer the incentive to the customer. Two of those were specifically because they were new construction projects.   Other common answers included the customer was not eligible (i.e., they have a secondary power source or purchased equipment before applying) (3 respondents) and the incentive amount compared to the paperwork was not worth the time (3 respondents). Additional responses, each mentioned by one contractor, included the following: the size of the project was too small, and the customers needed the equipment immediately, so there was no time. Responses were consistent between the DEC and DEP territories.

The resulting free-ridership, spillover, and net savings are shown in Table 5-13 below.

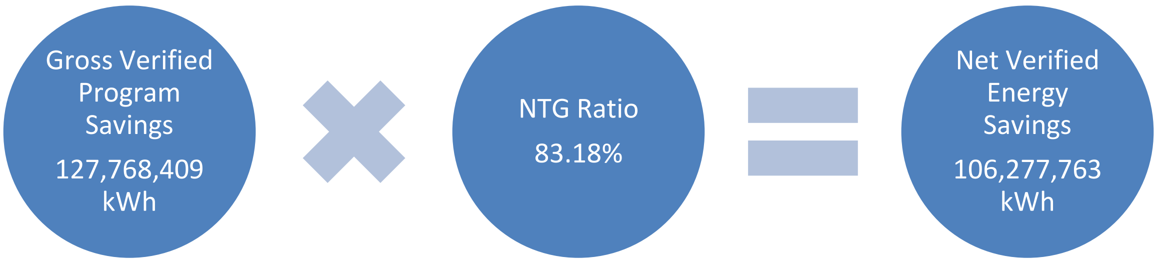
Table 5-13 Net-to-Gross Evaluation Results

Measurement	DEC	DEP	Combined[4]
Free-ridership (FR)	29.16%	32.67%	29.99%
Net of Free-ridership (1-FR)	70.84%	67.33%	70.01%
Program-influenced Participant Spillover (PSO)	0.28%	0.01%	0.22%
Program-influenced Nonparticipant Spillover (NPSO)	12.54%	24.03%	12.95%
Net-to-Gross (1-FR)+PSO+NPSO	**83.66%**	**91.37%**	**83.18%**
Precision at the 90% confidence interval	± 2.5% for FR ± 2.3% for NPSO	± 4.0% for FR ± 8.1% for NPSO	± 2.1% for FR ± 0.7% for NPSO

[4] The combined results are weighted using the same kWh-based weights used for DEC and DEP results, since this accounts for individual project sizes as well as the relative size of the programs across the two jurisdictions.

The program net verified energy savings are calculated by multiplying the program net-to-gross ratio by the gross verified energy savings resulting from the impact evaluation activities described in Section 4.

Figure 5-3 Net Verified Program Savings Calculation



The overall result of 83.18% net-to-gross reflects that the program primarily influenced customers' energy savings actions. This is an increase from the prior evaluation NTG ratio of 78.8%. Comparisons of free-ridership across the evaluation years are shown in Table 5-14 below. The program team added additional adjustments to the FR calculation for this evaluation, resulting in NAs in the table below.

Table 5-14 Free-ridership Comparison across Evaluations

Program Year	Preliminary FR Score	FR Score after Consistency Checks	FR Score after Adjusting for when Customer Heard about Program	FR Score after Including Policy Changes (Final FR Score)	Spillover	NTG
2018 – 2019	28.5%	28.7%	30.9%	30.0%	13.2%	83.2%
2015 – 2017	21.5%	NA	NA	NA	0.4%	78.8%

We reviewed the results by different elements to see if we could pinpoint any drivers. There were no differences when we looked at if the organization had previously participated in Duke's program. Appendix C shows the free-ridership scores by the different elements the evaluation team reviewed.

We also reviewed results by measure type. Lighting projects made up most program participation, which one could argue generally drove results. Care should be used when reviewing these figures as the number of respondents is low for most measure categories.

Table 5-15 Free-ridership Results by Measure Type

Measure	Gross (unverified) Population Savings (kWh)	Population Respondents (n)	Surveyed Savings	Respondents (n)	Free-ridership Ratio
Compressed Air	1,134,983	6	177,131	1	75.0%
Food Service	1,665,624	26	279,593	1	25.0%
HVAC	20,851,033	54	7,990,912	23	9.7%
IT	445,529	1	445,529	1	25.0%
Lighting	83,634,429	669	20,982,001	186	35.3%
Process	6,933,868	18	4,763,127	4	48.9%
Whole Building	12,497,320	60	4,600,464	20	21.3%

We also reviewed stratum results, which show similar results in that the lighting stratum had higher free-ridership than the non-lighting stratum. Free-ridership rates were also higher among the small stratum than the large.

Table 5-16 Free-ridership Results by Stratum

Stratum	Gross (unverified) Population Savings (kWh)	Surveyed Savings (kWh)	Surveyed Respondents (n)	Free-ridership Ratio (%)
L-Large (>500 MWh)	52,225,498	9,215,482	22	28.4%
L-Small (<500 MWh)	31,408,931	11,766,518	164	40.8%
NL-Large (>500 MWh)	27,477,874	13,584,476	10	22.0%
NL-Small (<500 MWh)	16,050,483	4,672,280	40	30.9%
Total	**127,162,786**	**39,238,757**	**236**	**30.0%**

One other element reviewed was national chain stores that participated in the program. These include dollar stores, grocery stores, and convenience stores that typically had numerous locations participate in the program. For these customers, we were able to talk with some of the decision-makers from the store, while others we were able to talk with a third-party vendor, typically a rebate processer, whose role it was to find rebates across geographies where the stores were located. In Duke's Carolina and Progress territories, the free-ridership was slightly higher for customers who participated with multiple locations.

Qualitatively, when talking with the third-party vendors, they indicated that the rebates were a driving factor in the customers doing projects through the program. These customers tend to do more locations because of the rebates and focus on the locations where utility rebates are offered. Some of the large customers, contractors, and third-party vendors they work with have been working with DSM programs long enough to know what will qualify for rebates and what they need to do to get a project approved. These customers may use the rebates to make other projects possible, but those are unlikely to result in spillover for Duke Energy. Additional projects are more likely to be located in nearby communities where rebates are not offered or work that would not have been possible if all the available funds had been spent on the energy efficiency upgrade.

5.3.5 Benchmarking

To provide context to Duke Energy's NTG rates, the evaluation team conducted a secondary literature review, or benchmarking exercise, to examine NTG results for other custom programs and measures for other utilities. This was not meant to be a comprehensive review of all custom programs but rather a quick look into other custom programs. The evaluation team reviewed publicly available reports from different jurisdictions using the same NTG methodology (i.e., FirstEnergy and PPL Electric). All of the reports reviewed were taken from reports based upon independent, survey-based research directed at the program under consideration. **Error! Reference source not found.** contains a bibliography of sources reviewed.

The benchmarking exercise found 15 utilities with custom commercial offerings (Ameren, Black Hills Energy, Energize Connecticut, ComEd, Energy, Entergy Arkansas, Indianapolis Power & Light, Mass Save, Met-Ed, National Grid Rhode Island, Penelec, Penn Power, PPL Electric, Vectren, West Penn Power, and Xcel Energy). NTG ratios for custom commercial programs ranged from 54% (Met-Ed) to 99% (Entergy Arkansas), and free ridership (when listed) ranged from 2% (Entergy Arkansas) to 46% (Met-Ed). NTG ratios for custom commercial lighting programs varied from 73% (Xcel Energy) and 89% (Xcel Energy). Xcel Energy's custom Business HVAC+R Systems program produced an NTG ratio of 87%.

Table 5-17 Commercial Custom Program Benchmarking Summary

Category	Free Ridership Ratio	NTG Ratio
Overall	2% – 46%	54% – 99%
Lighting	NA	73% – 89%
HVAC	NA	87%

Compared with other evaluations using the same NTG calculation approach, including the PA Evaluation Framework, which the Duke algorithm was based on, the results for DEC/DEP are similar to those calculated for most of the Pennsylvania utilities.

Table 5-18 Commercial Custom Program Benchmarking Summary of Similar Algorithm

Utility	Free-ridership	Spillover	NTG Ratio	Responses
DEC/DEP	30%	13%	83%	236
Penelec	14%	4%	86%	34
Penn Power	40%	0%	60%	11
West Penn Power	43%	0%	57%	21
Met-Ed	46%	0%	54%	26
PPL	34%	0%	66%	16

6 Process Evaluation

6.1 Summary of Data Collection Activities

Process evaluation activities are designed to support continuous program improvement by identifying successful program elements that can be expanded or built upon and underperforming or inefficient program processes that are holding back program performance or participation. Because the program is delivered the same between the two territories, we report combined activities and results for DEC and DEP together for the process evaluation. The data collection activities for the process evaluation of the NR Custom Program included a database review and interviews with key contacts involved in program operations, participating customers, and contractors who assisted customers with projects.

The evaluation team developed data collection instruments to explore the identified research questions. Table 6-1 summarizes the process evaluation data collection activities.

Table 6-1 Summary of Process Evaluation Data Collection Activities

Target Group	Completes
Staff	8 In-depth interviews
Contractors	4 In-depth interviews (third-party vendors) 62 Telephone surveys (for 67 cases)
Participants	236 Telephone surveys with participant projects (92 unique participant respondents)[5]
Application Data Review	902 DEC/DEP records provided by Duke Energy, with the status of why projects were rejected or closed

6.1.1 Program Staff Interviews and Application Data Review

The evaluation team interviewed eight Duke Energy's Smart $aver Custom Incentive program staff in August 2020. To get a well-rounded perspective on the program design and implementation practices, we talked with two program management staff, an Account Executive for large account management, two Business Energy Advisors, an Energy Efficiency Engineer, and two Trade Ally Outreach Representatives.

The program staff provided valuable feedback on intended operations, processes of the program's stated (and unstated) goals and objectives, perceived barriers to program uptake, and modifications to any program components based on the previous program cycle and the rationale for those modifications. The information the team gathered assisted in designing the interview guides and surveys for customers and contractors.

The evaluation team also interviewed Willdan as the firm that handles paperwork, modeling, technical assistance, and identification of measures as part of the program's new construction energy design assistance. Willdan sees part of their role as educating the market and is

[5] 178 DEC participant projects (65 unique survey respondents); 58 DEP participant projects (27 unique survey respondents) with two respondents who participated in DEC and DEP

marketing the program by building relationships with promoters such as architects and building organizations. Willdan works with customers to put a bundle of offerings together with different levels of energy efficiency, providing the documents to the Duke Energy team for preapproval. Once a project is complete, Willdan verifies installation, gathers documentation, puts together reports, and submits applications to Duke Energy for the incentive. There is a collaborative effort between Willdan and Duke Energy to deliver the new construction projects. The two parties pass potential leads and project information between each other, so communication is frequent.

In addition to the program staff interviews, the evaluation team reviewed the application screening process and the program tracking data to ensure necessary data and information was being collected to track program progress. Results from this review are presented in the next section (Section 6.2).

6.1.2 Contractor Interviews and Surveys

Contractors are important market actors, especially in large custom programs. For these programs to succeed, contractors must access and use calculation tools, navigate preapproval processes, and communicate the steps involved to project representatives.

The evaluation team selected all the implementation contractors associated with customer projects from the tracking database provided by Duke Energy. Any contractors in the list identified through the participant survey as “influential vendors” were flagged for additional questions in the contractor survey.

General discussion topics in the survey included program awareness among customers, understanding of program guidelines and processes, interactions with customers, and suggestions for improving the program. Influential vendors were also asked questions about the specific projects if participating customers indicated the contractor influenced their decision to install energy-efficient equipment through the program.

In February 2021, surveys were completed with 67 of 199 program contractors who participated in the program (62 unique vendor respondents). Twenty-seven of the completes were from influential vendors. The average survey length was 10 minutes, and the average number of telephone attempts was 5.0. Table 6-2 outlines the contractor response rate for the evaluation.

Table 6-2 Contractor Response Rate

Disposition	Non-influential vendors	Influential vendors*	Combined**
Starting Sample	**123**	**76**	**199**
Does not recall participating	9	5	14
Incomplete surveys	3	0	3
Refusal	11	2	13
Bad phone number	4	1	5
Attempted but not completed	56	41	97
Completes	**40**	**27**	**67**
Response Rate (Complete/Starting Sample)	**32.5%**	**35.5%**	**33.7%**

*Represents 22 unique influential vendor respondents
**A total of 62 unique vendor respondents completed the survey

In addition to the contractor survey, the evaluation team sent emails and called six firms identified through email addresses and contact information in the tracking database as third-party vendors. These third-party vendors did not install or sell equipment. Instead, they often served in a consulting role to firms looking for energy-efficient recommendations and incentives. These firms typically worked with national chains or commercial customers with multiple locations. Four in-depth interviews were conducted in January and February 2021 with these third-party vendors. Three of them advise customers on projects, and the fourth only helps them apply for rebates and incentives.

6.1.3 Participant Surveys

Collecting survey data from program participants provides data suitable for quantitative analyses on participant characteristics and key aspects of the program. The evaluation team conducted a telephone survey with program participants, defined as customers who received an incentive through Duke Energy's Smart $aver Custom Incentive Program for PY2018 and PY2019. Surveys were conducted with program participants between December 14, 2020, and February 2, 2021. Surveys focused on customers' experience with the program, sources of awareness, decisions to install equipment, barriers to participation, satisfaction with various aspects of the program, and any program improvement suggestions. Surveys were completed for 236 of the 834 projects (178 DEC and 58 DEP) completed through the program (92 unique respondents). Table 6-3 outlines the participant response rate of the evaluation.

Table 6-3 Participant Response Rate

Disposition	DEC	DEP	Overall
Starting Sample	**544**	**290**	**834**
Does not recall participating	16	6	22
Refusal	18	13	31
Incompletes (partial surveys)	2	0	2
Wrong number	3	2	5
Not completed	327	211	538
Completes	**178**	**58**	**236**
Response Rate* (Complete/Starting Sample)	**32.7%**	**20.0%**	**28.3%**

Response rates were lower compared to the 2016-2017 evaluation. This may have been due to the COVID pandemic. We attempted numerous outreach efforts to increase response, including working with account managers, third-party vendors, and Duke staff to get contact information for a people involved in the decision to implement the project.

6.2 Process Evaluation Findings

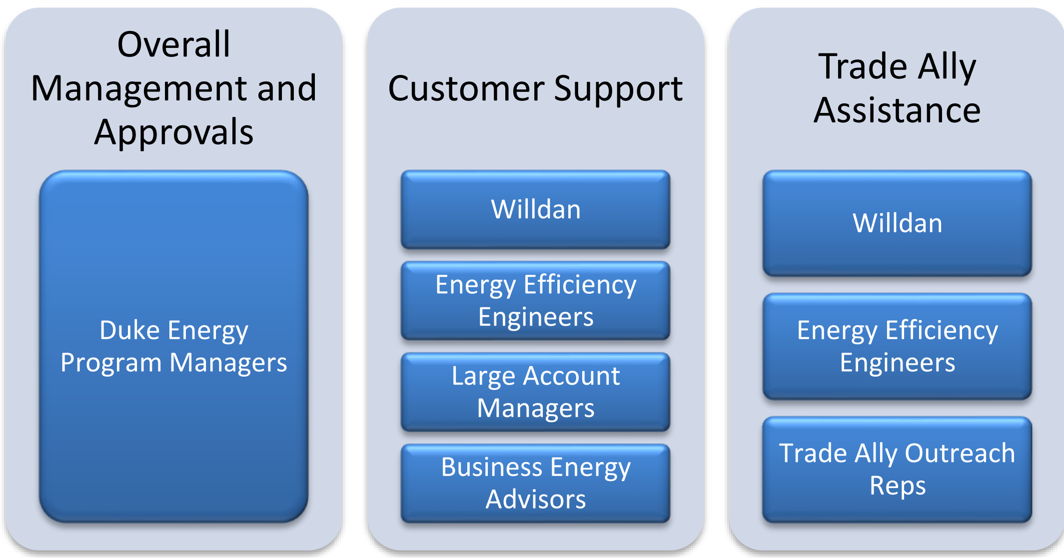
6.2.1 Program Staff

The program staff interviews were extremely useful in helping the evaluation team understand how the program operates and designing the interview guides and surveys for program participants and contractors. Throughout the findings section, some information from staff interviews has been used to add context around respondent answers. This section details key discussion topics, including the relationships between staff, marketing and outreach strategies, the application process, and the NCEEDA effort.

6.2.1.1 Roles and Relationships

Duke Energy enlists a wide range of staff to promote and deliver the Smart $aver program. In addition to Program Managers, customers will work with Large Account Managers (LAMs) or Business Energy Advisors (BEAs) who get assistance from Energy Efficiency Engineers (EEEs). Trade allies (TAs), who are critical to the program delivery, get information and assistance from the Trade Ally Outreach Representatives.

Figure 6-1 Smart $aver Custom Program Delivery Support



Large Account Managers

Large Account Managers (LAMs) are responsible for large commercial and industrial customer needs. Each LAM works with specific customer segments or types, such as hospitals, schools, manufacturing, government, grocery, etc. The number of customers assigned to each LAM varies, depending on several different factors, but generally ranges from 20-100.

Business Energy Advisors

Duke Energy has a team of 10 Business Energy Advisors (BEAs) that cover the Carolinas and the Midwest. BEAs are regionally based and assist small and medium business customers assigned to them based on usage levels. They work with a much larger group of customers than LAMs do, with each BEA assisting anywhere from 500 to 4,000 customers. BEAs characterize themselves as the liaison between the customer and Duke Energy.

BEAs can work with several hundred customers on various topics, including energy efficiency. To assist customers, BEAs must understand and access information on customer energy use and demand patterns. They look for opportunities for each facility to improve energy use, decrease cost, decrease demand, and access utility rebate programs. When BEAs cannot answer customer questions, they may enlist the help of other Duke Energy staff - particularly

Energy Efficiency Engineers. BEAs may also assist customers in identifying trade allies to implement their projects, although BEAs are careful to remain neutral when suggesting contractors. One of the Carolina BEA's makes sure to follow all steps in the process to assist if the customer has any issues.

Energy Efficiency Engineers

Energy Efficiency Engineers (EEEs) review Smart $aver custom projects that come through AESC before they go to offer or payment. If needed, EEEs will work with customers to develop projects before application when LAMs and BEAs ask for assistance. The EEEs may also respond to questions from Willdan for new construction projects and interact with Trade Ally Outreach Reps when trade allies need guidance.

Trade Ally Outreach Representatives

Trade Ally Outreach Representatives (TA Outreach Reps) work with trade allies on prescriptive and custom projects. They make sure trade allies understand program requirements, equipment eligibility and assist with the application process.

Multiple TA Outreach Reps are working with contractors, each assigned to geographic areas. The Carolinas & Progress rep we spoke with educates trade allies on rebate and incentive programs, how the programs work, and how to use them with customers. When trade allies have questions about what qualifies for the program or how to complete the application that the TA Outreach Reps cannot answer, they typically turn to EEEs to get the information they need.

There is a Trade Ally section on the Duke Energy website where trade allies can register for customers looking for trade allies.[6] TA Outreach Reps review the program rules and forms with contractors who register for the Trade Ally Network and in the process, build a relationship with those trade allies. If contractors want training on the Smart $aver tools, the TA Outreach Reps will take care of the training.

6.2.1.2 Marketing and Outreach

Program staff has tried various tactics to reach out to customers, trade allies, architects, and engineers over the years. They have used print materials, webinars, lunch and learns, emails, phone calls, and in-person visits.

Duke Energy has designed and printed handouts for staff in the field to distribute to customers and trade allies. They also ran a marketing postcard to communicate that programs were available and Duke Energy staff could help customers identify energy-efficient opportunities. Social media marketing was also reported to be an effective marketing tool.

Webinars highlighted certain technologies or ways to optimize projects and focused on trade allies and customers. BEAs contributed to webinar content, and contractors would deliver some of the webinars. An annual customer forum has also allowed customers to provide feedback on the Smart $aver program.

Most LAMs and BEAs reported direct outreach to customers through email, phone calls, and in-person visits were their primary marketing approaches. The BEAs have customers they cover

[6] Commercial Trade Allies | Duke Energy (duke-energy.com)

but may reach out to targeted groups for certain measures. The BEAs have also recently set up an online presence for easier customer interaction.

TA Outreach Reps will spend most of their time on in-person visits to recruit new trade allies and educate them on the program. The reps may drop off handouts or walk trade allies through the Smart Saver tools. The Carolina TA Outreach Reps we spoke with may be present at customer meetings as the “voice of the utility” in the room and feel that trade allies like to show an association with Duke Energy. The TA Outreach Reps feel that the trade allies need more assistance, as they often work with several utilities, which can cause confusion.

6.2.1.3 Application Process

Once LAMs and BEAs get customers to select equipment, they typically transition the project to a trade ally, and the trade ally assists the customer with the application process. Duke Energy staff will help the customer complete the application, including getting an EEE involved to check eligibility and savings when the customer has questions beyond what the trade ally can assist with.

BEAs in the Carolinas described how they facilitate the identification of a trade ally through the Trade Ally Network and Outreach Reps. The trade allies also help the customer with the application. If there is no trade ally, the BEAs will assist the customer with the application. Both BEAs said not many customers can get through the Custom application process on their own. The BEAs make sure customers have provided all the necessary information.

All applications are tracked in Salesforce. If a customer is approved and does not proceed, the record is closed out. Based on staff relationships with customers, they typically know why projects are not completed. This information is sometime captured in the tracking data, although not all projects have a reason for being closed.

One TA Rep in the Carolinas has noticed a large reduction in the application review time and feels like the online portal is helping. He thinks that some businesses may avoid the Custom program because they think the process is difficult. He tries to help people through the process and answer all the questions that come up.

6.2.1.4 New Construction - NCEEDA

Program Managers for the Smart Saver Custom program feel that NCEEDA offering has been successful and is becoming a larger part of the Custom program. Duke Energy is working with Willdan, who manages the outreach to architects and design engineers up front to incorporate energy-efficient designs in new construction. The goal is to influence better efficiency beyond code. The whole building is modeled, creating options for ‘good,’ ‘better,’ and ‘best’ energy-saving scenarios with ROI attached to each. The assistance from Duke Energy and Willdan is meant to take the burden of finding options and calculating savings off the customer.

EEEs believe that new construction projects are becoming more common and the LAM in the Carolina and Progress territory said that Willdan has been very thorough and handles all the customer’s needs. BEAs in the Carolinas & Progress send any projects they determine may be eligible through the NCEEDA option, but not all of them receive new construction incentives. A few projects revert to prescriptive rebates.

The primary challenge mentioned by the BEA regarding the new construction projects is reaching the customer at the optimal time to influence their decision with the efficiency scenarios. The BEA characterized a new partnership with Construct Connect as being very helpful in reaching out to customers at the right time by providing BEAs with information on new construction in the area. It is also a place where Duke Energy can promote the program.

6.2.1.5 Staff Influence

Respondents provided high ratings when asked to rate the influence of Duke Energy staff on their decision to complete their project. On a 0 to 10 scale, where 0 was ‘not at all influential’ and 10 was ‘extremely influential,’ respondents rated the influence of their account managers high, producing an average score of 7.1 and Duke Energy engineer staff received a higher average influence score of 8.3. No respondents indicated they worked with a BEA, and therefore there was no influence to report.

Table 6-4 Influence of Duke Staff

	Mean	Minimum	Max	Don’t know	Respondents
Account manager	7.1	0	10	7	137
Engineer staff	8.3	0	10	0	28
Business energy advisor	NA	NA	NA	0	0

Source: Participant Survey; FR4B, FR4G, FR4F

6.2.2 Data Review

Two sources of data were reviewed as part of the evaluation. The first was the data associated with the completed projects that was used for the process, NTG, and impact evaluation activities. The second was the data associated with the applications that were submitted from both hard copy and the online portal.

6.2.3 Completed Project Review

An additional part of the evaluation activities included reviewing the program tracking data to ensure the necessary information to track the program and conduct evaluation activities were available. Program staff use the tracking data to document customers who participated in the program, the details of the equipment being installed, and the project's savings. Once the application is received, this information is passed to AESC, the technical review vendor. AESC verifies the accuracy of the savings calculations and provides Duke Energy with verification in a systematic format. Duke Energy engineers also review the application information to verify savings calculations.

The evaluation team utilized this same data to select impact and process evaluation activities samples. One area that impacted the evaluation activities was that the data included contact information for third-party vendors in place of some customer contacts. The third-party vendors tend to work with corporate offices and are involved, sometimes in place of local contacts. However, the evaluation team is interested in understanding (1) how the equipment is operating and (2) the decision-making process to purchase the equipment, and therefore, needs to talk directly with the organization.

In conducting the process evaluation telephone efforts, some contact information associated with some participants was out of date. Given that evaluation activities went back to 2018, some personnel turnover at companies is expected, resulting in out-of-date contact information for people who no longer work for listed companies. The program team should ensure customer contact information is included for each record in the tracking system.

Application Review

The evaluation team reviewed the Duke Energy application and process, which found a thorough review method as part of the pre-approval process. The Duke team reviews applications to ensure the customer has not already purchased or committed to the project and meets the eligibility requirements outlined in their application.

As we heard from the program staff interviews, customers or trade allies initiate the application process, often with assistance from Duke Energy staff. The application then makes its way through the Duke Energy preapproval, installation, and payment stages.

Figure 6-2 Smart $aver Customer Program Application Process

Application Submission

- Customer sends application, calculation and supporting documents to Duke Energy
- Duke Energy staff check application for any missing pieces

Application Evaluation

- Applications progress through both an Administrative, Technical, and Engineering review for approval
- Duke Energy has committed to completing the application review within 4-6 weeks
- Any issues are communicated to the customer for clarification or resolution

Project Installation

- Once the application has Program Manager approval, Duke Energy provides the customer with an incentive offer
- The customer has one year to install the qualified equipment

Payment Request

- After project completion, the customer sends a payment request to Duke Energy
- Duke Energy screens for Administrative payment criteria

Final Evaluation

- Duke Energy staff complete another Technical and Engineering review
- Incentives are adjusted if scope has changed from initial application
- Duke estimates two weeks for the final evaluation

Payment

- Duke Energy sends the customer an incentive check
- Duke estimates two weeks for processing and delivery

During the “Application Evaluation” stage, Duke Energy reviews the application for a host of items, including missing documentation, responses to application questions, and energy-saving calculations to determine incentive levels. To better understand how this screening process works, we asked Duke staff to provide projects from the database that had not progressed through to payment and been closed out. The evaluation team received a data file with 902 North Carolina and South Carolina applications that were submitted but were not considered completed.

One hundred thirty-five of the projects appear to be still working their way through the application process, and although not completed, they are not closed or rejected. The analysis also shows that Duke's screening process for eligibility is working well. At least 243 cases were screened out, with almost half of them failing the early commitment requirement using Question E:

> *A commitment includes but is not limited to signing a purchase order/contract, ordering equipment or starting construction. Have you made any commitment to your project? (Yes or No)*

Another 274 applications were closed at the customer's request or trade ally's request and 53 were closed due to nonresponse from the customer, either for missing or additional information, or once Duke Energy extended an incentive offer.

Table 6-5 Analysis of Incomplete Projects

Closed Reason	Count of cases
Carolina Cases	**902**
Did not appear rejected (Contract approval, M&V Period, payment request received, approved for payment, ongoing)	**135**
Ineligible	***243***
Early commitment (Question E)	103
Opted out	5
Outside Duke territory	1
Payback too short - not cost-effective for Duke	61
Shifted to prescriptive incentive	27
Not DLC qualified	12
Submitted more than 90 days after equipment installation	34
Customer or TA request project close	**274**
Customer/TA request - NA	206
Customer/TA request - too much delay, incentive not enough, didn't install, went prescriptive	62
Declined Duke offer	6
Customer nonresponse	**53**
No response to Request for Information	23
No response to Offer Letter	22
Expired	3
Staff changes, unable to reach customer, business closed	5
No detailed reason	**197**
Auto close - no details	20
No reason recorded for closed lost	74
Administrative close - Application clean-up	103

While each of the above-mentioned reasons provides insights into how the preapproval process is working, there were 94 applications that were closed out without a clear reason and another 103 indicated application clean-up. This reduces the ability to understand where processes are effective, where customers are falling out of the process, and potentially what Duke Energy staff can do to shepherd more projects through the program.

Duke Energy has taken an additional step with its application to attempt to monitor and reduce the effects of free-ridership on the program. The application for preapproval has another question, Question G, that asks customers how their project would change without the program incentive. Specifically, the question states:

If an incentive was not available for your project, would you:

a) Purchase and install the entire project
b) Purchase and install some, but not all, of the high-efficiency project
c) Neither purchase nor install any part of the project
d) Don't know

This question is on the application to help the program team understand customer objectives when making the purchasing decision. While this question is on both the hard copy and online applications, it is not required. It also allows customers to select the "Don't know" option, which does not provide much information to the program team. Based on a review of a few applications compared with the survey responses, it also does not appear that the responses are used for any screening.

We reviewed the application responses provided by Duke Energy for the participants who completed the evaluation survey. The unweighted free-ridership results show some planning for all customers, regardless of their initial response. Removing the "Don't Know" option, which corresponded with an average free-ridership score of 36.98%, will allow for a better understanding of the correlation between how customers answer the application question and their responses to the self-report survey questions. Given the inconsistency between the responses, it is important to not rely on this application question alone to identify free-riders.

Table 6-6 Analysis of Application and Free-ridership Responses

Application Response	Count of cases	Unweighted Average FR
Would purchase and install the entire project	10	25.00%
Would purchase and install standard equipment	25	33.50%
Don't know	143	36.98%
Would purchase some, but not all, of the high-efficiency project	12	17.71%
Would not purchase nor install any equipment	46	28.06%

While we would not recommend screening solely on the customer response to this question, we feel that a few revisions to the response categories and flagging certain responses for a discussion with the customer could help Duke Energy manage their free-ridership for the program. Program staff could use this question to discuss project goals and encourage customers to install higher efficiency or more equipment with the program's assistance.

6.2.4 Contractors

The evaluation team surveyed 62 unique contractors involved in the installation of participating customers' projects during the evaluation period. We also include feedback from four of the third-party vendors.

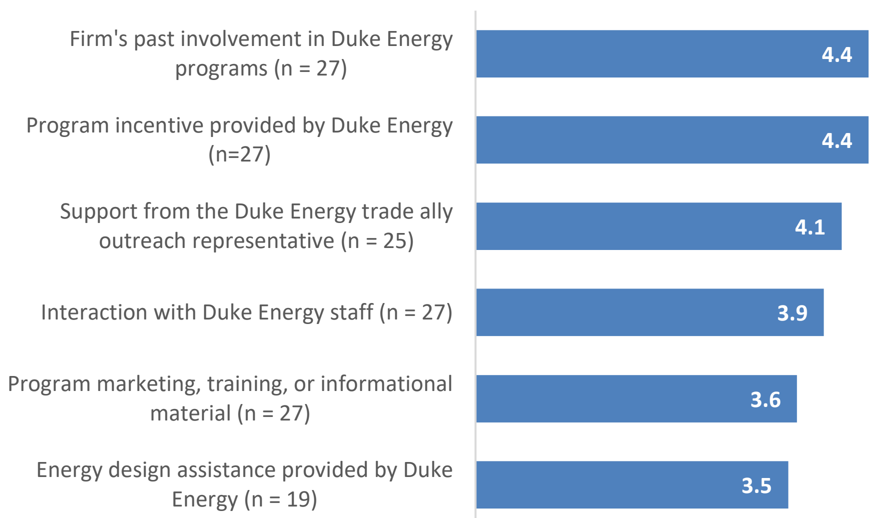
6.2.4.1 Contractor Characteristics

We spoke with a mix of contractors from small businesses to large organizations, with responding contractors reporting between zero to 900 full-time employees. Over half of the contractors interviewed (35 of 62 respondents) had between one and 10 full-time employees, 29 percent (18 of 62) had between 11 and 50, and the remaining 15 percent (9 of 62) had between 50 and 900 full-time employees. Over eighty percent of the responding contractors (50 of 62) do not use part-time staff. Ten of them have less than seven part-time staff, and two had more than 30.

6.2.4.2 Customer Interaction

Most influential vendor respondents (85 percent or 22 of 26) said they incorporate the program incentive into their pricing estimates. For the projects that went through the program, influential vendor respondents felt the program incentive and their past involvement with Duke Energy were the most influential factors on a customer's decision to complete their project. Influential vendors were asked to rate the influence of various factors on their recommendations to specific customers on a 1 to 5 scale, where 1 was 'not at all influential' and 5 was 'very influential.' As shown in Figure 6-3, the program incentive and past involvement received a score of 4.4, while the second most influential factor was support from the Duke Energy trade ally outreach representative (4.1).

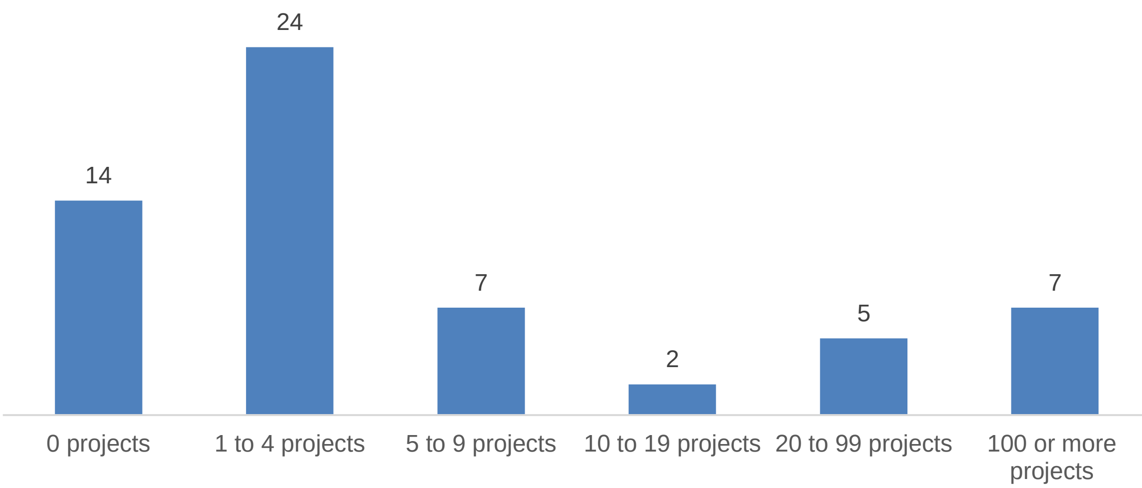
Figure 6-3 Influence of Program Components



Source: Contractor Survey; FR2

Figure 6-4 shows the number of contractors and an estimate of the number of additional, similar projects sold within the last 12 months. The most common response (14 respondents) from contractors was that they had not completed any similar projects in the last 12 months.

Figure 6-4 Number of Similar Projects Completed in Last 12 Months (n=59)



Source: Vendor Survey; P1
Don't know responses have been removed

Almost half of the vendors (22 of 46) reported that all of their high-efficiency projects received incentives through Duke's Energy program. One-third of respondents (15 of the 46) indicated 50 percent or fewer of their projects received Duke Energy incentives.

The third-party vendor interviews focused on retail customers who participated at multiple locations. These large national account customers with multiple locations often take a phased approach to implement energy efficiency, spanning several years. Planning to implementation may take anywhere from two to five years. Store prioritization is typically based on high energy users, store visibility, condition or viability, the project's return on investment, and rebates available. The rebates are usually factored into the ROI.

Equipment specification can also be more complicated for national accounts as there are typically multiple parties involved. There is staff within each company, contractors and equipment dealers, and third-party consultants providing input. One of these parties may reach out to Duke Energy and other utilities for input or assistance at any point in the process.

6.2.4.3 Application Process

As far as the application process, all four third-party vendors assist the customers with applications. Two of the third-party vendors complete the entire application process now that they can sign for the customer. Third-party vendors indicated that most of the projects they help retail customers with are rebated through the Prescriptive program, but whatever equipment is not eligible through Prescriptive is routed through Custom. This requires third-party vendors to understand the programs to get preapproval on the Custom projects early enough to keep identified projects on schedule.

The third-party vendors appreciate the online application portal, making tracking application, preapproval, and rebate/incentive status easier. While a few vendors commented that the application process was easy, and easier than what they experienced with other utility programs, they were likely talking about the Prescriptive process. A couple of vendors said it does not reduce the complexity of the Custom application process. Some specific comments include the following:

> *"The application process has dramatically improved in the last five years. Five years ago it was all paper applications, now with the online portal - it's a really nice improvement in the work flow. We can track processing status for each project. Preapproved projects can be released for installation."*

> *"I use the online portal, just in the last year or two. It works pretty well. Some built-in inefficiency for large projects with lots of different measures, those can be cumbersome via the portal. Individual measures require multiple selections for each line item."*

> *"Keep a paper option even if they offer online. Please don't go to online application only. They are harder to sign and submit transfers."*

One vendor specifically called out the issue of having to fill out two application forms for each project - one for Prescriptive and one for Custom for a customer that does 100+ projects per year. Although the vendor understands why Duke Energy may choose to follow this process, he suggested that other utilities have more flexibility. Specifically, some utilities allow them to pull all the equipment into the Custom application and measure actual wattage savings for the entire project, which is more accurate and avoids the Prescriptive assumptions. He feels the calculator is burdensome and not designed for national accounts.

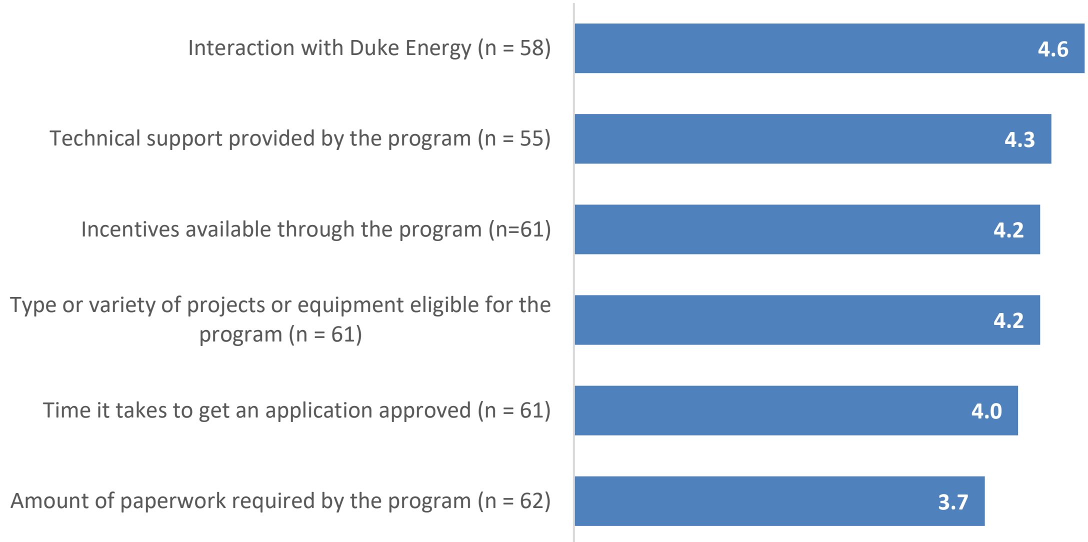
Another vendor had a different experience with the application process. They said they received guidance that the Custom program prefers to submit multiple locations as a single application. That would be easier to manage if the vendor could submit a general scope instead of site-specific.

6.2.4.4 Satisfaction

Contractor satisfaction remains high with the Smart $aver Custom Incentive program. Respondents were asked to rate their satisfaction on a 1 to 5 scale where 1 was 'not at all satisfied' and 5 was 'very satisfied.' On average, contractor respondents rated their overall satisfaction with the program 4.3.

Contractors were also asked to rate their satisfaction with different program components using the same scale. Contractors were generally satisfied with the program, with all components mean scores a 3.7 or higher. As shown in Figure 6-5, the program's highest mean score was for the contractors' interactions with Duke Energy program staff (4.6). Like the last evaluation, the lowest rated item was the amount of paperwork (3.7) the program requires. Satisfaction with the program's technical support saw a noticeable improvement from last evaluation, jumping from 3.8 to 4.3.

Figure 6-5 Contractor Satisfaction with Program Components



Source: Questions S3A, S3B, S3C, S3D, S3E, S3F
Don't know responses are excluded.

As far as improvements with the program, almost 60%, or 37 of the 62 contractor respondents, indicated they had no recommendations for program changes. This is up significantly from the last evaluation when only nine of the 21 contractors surveyed said they could not think of any improvements. For the remaining 25 respondents, 15 contractors suggested improving the application process, five wanted more types of incentives, and one respondent mentioned increasing marketing for the program.

Table 6-7 Contractor Suggestions for Program Improvements

Suggestion	Overall
Improve application process	15
Add more types of incentives	5
More marketing	1
Respondents	**25**

Source: Contractor Survey; S4o

Some specific comments from contractor respondents include the following:

> *"Make it more simple, straightforward, and easier for the customer to apply for it. Be able to apply value to a customer, a rebate value, prior to submitting it for approval. Progress Energy had a streamlined spreadsheet where a customer plugged in a value."*

> *"You need to add ductless to their rebates."*

"Probably some marketing would do well. If they would link the environment and the possibility of helping with indoor air quality (regarding Covid) and link it to the program."

"Offer greater incentives on fixtures that have more efficacy and will light better and last longer. They give as much for a tube as they do for a fixture, and that makes no sense."

"The online tools - there is an inconsistency in the tools for both the prescriptive and custom - with usability."

"They have actually enacted several of the things I've suggested over the year. The issue I'm currently having is eligibility through the portal process. There's something that is not working, and it keeps stalling."

"Midstream is extremely difficult to determine whether a customer is eligible."

While some contractors commented about the prescriptive program, most understood the differences between the two programs. Sixty percent of the responding contractors thought it was somewhat easy (18 of 60 respondents) or very easy (18 respondents) to understand the differences in equipment eligibility between Duke Energy's Custom and Prescriptive programs. Seventeen respondents found understanding the programs' eligibility somewhat difficult, and one respondent described it as very difficult.

6.2.4.5 Effects of the COVID-19 Pandemic

The process evaluation occurred during the COVID-19 pandemic. We included questions in the survey to understand the pandemic's impact on contractor business operations. When asked about how the pandemic had affected their business, most contractor respondents indicated that the pandemic had a moderately negative effect on their business (33 of 62 respondents). Nine contractors said the pandemic had little to no effect, while 13 respondents claimed their business experienced a large negative effect.

When discussing specific ways their business was affected, the most common response was that their business was forced to implement social distancing procedures (28 respondents). As shown in Table 6-8, 18 contractors said they saw a reduction in sales while 19 said they had less access to customers and their work sites.

Table 6-8 Effect of Pandemic

Effects of COVID-19	Respondents
Social distancing and PPE use	28
Less access to customers and facilities	19
Decrease in sales	18
Logistical issues	17
Workers fired or placed on leave	5
Worker shortage	1

Effects of COVID-19	Respondents
More sales of COVID mitigation equipment	1
Respondents	**53**

Source: Vendor Survey; CV2

Contractor respondents were divided on when they thought their companies would return to normal operations. Over one-third of the respondents (22 of 57 respondents) said they did not believe their operations would return to normal until after September 2021. On the other hand, ten respondents said their operations never changed significantly.

Contractors also said their sales shifted as a result of the pandemic. Seven contractors said they are selling more COVID mitigation equipment; three mentioned air quality and two mentioned UV lighting equipment. On the logistical side, four contractors said they experienced shipping delays.

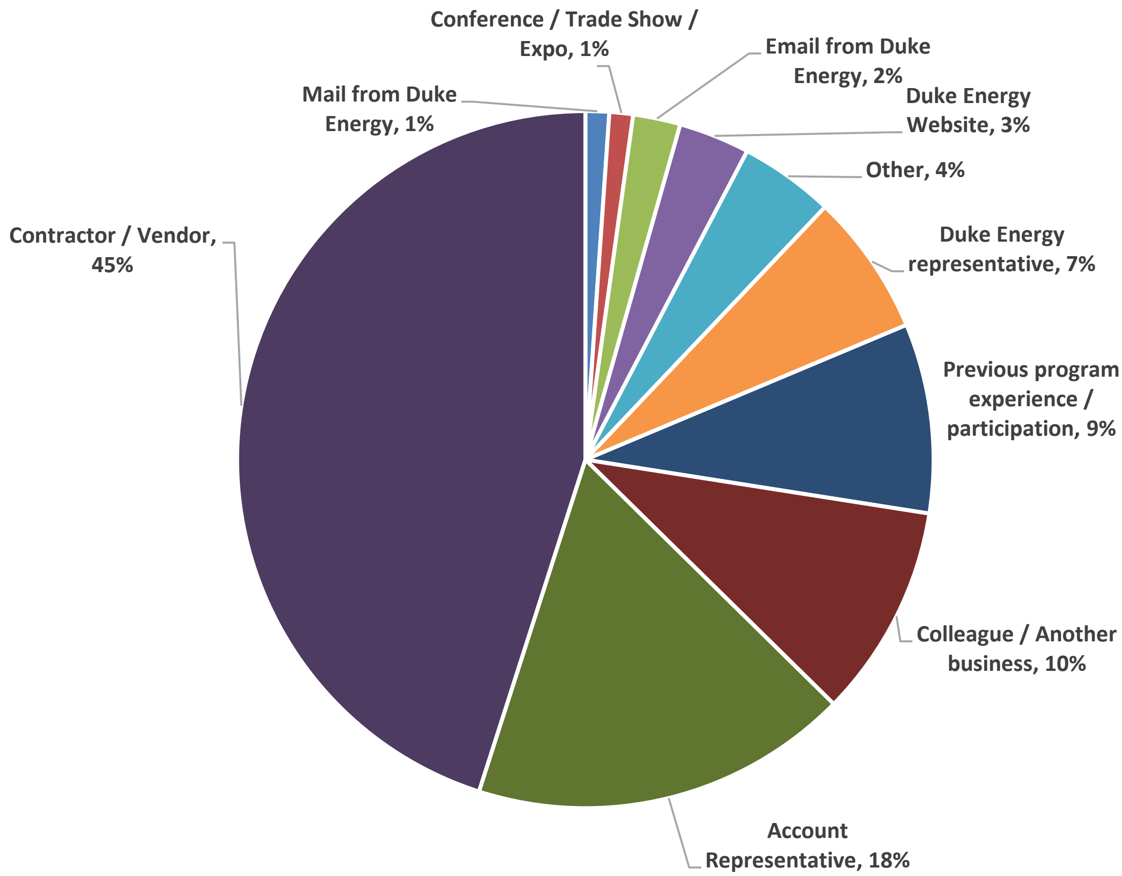
6.2.5 Participants

Surveys were conducted with program participants or customers who received an incentive through the SmartSaver Custom Program. This section provides detailed findings from 92 customer respondents who completed the surveys (65 were DEC customers and 27 were DEP customers and two respondents participated in both DEC and DEP).

6.2.5.1 Marketing Practices

Traditional marketing channels, such as direct mail, account managers, ads on social media or other websites, and emails to a subset of customers by segment have been used to promote the program. The program also reaches out to builders and architects to support the new construction portion of the program. Trade Ally Outreach Representatives market the program directly to contractors, which Duke Energy staff indicates accounts for a significant percentage of projects. When asked how they heard about the program, the three primary sources of awareness of the NR Custom program among participant respondents were their contractor or vendor (45 percent), their account representative (18 percent), or a colleague or another business (10 percent). Figure 6-6 shows breakdown of the awareness sources among customer respondents. Sources of awareness were similar between the two territories and similar to the last evaluation's results.

Figure 6-6 Participant Source of Program Awareness (n=91)



Source: Question Q1
Don't know responses are excluded.

Program website materials note that the NR Custom incentives “can help you offset up-front costs and improve your bottom line.” When respondents were asked what made them decide to apply for the NR Custom Incentive program, saving money (47%), the incentive (38%), and energy savings (35%) were most frequently mentioned by participants.

Table 6-9 Reasons for Participating in Smart $aver Custom Incentive Program

Reason	DEC	DEP	Overall Count	Overall Percent
Saving money	34	9	43	47%
The incentive	21	14	35	38%
Energy savings	23	9	32	35%
Needed new equipment	11	5	16	17%
Following a recommendation	6	3	9	10%
Better equipment for less	5	3	8	9%
Environmental concerns	3	1	4	4%
Respondents	**65**	**27**	**92**	

Source: Question Q6
Multiple responses are allowed
Don't know responses are excluded.

6.2.5.2 Application Process

The review process takes about four to six weeks, according to program staff. Staff mentioned they have been meeting this turnaround time and typically exceed it. This is corroborated by the feedback provided by customer respondents, who were generally highly satisfied with the review process (Table 6-10). When asked about their satisfaction with various aspects of the application process, respondents rated their satisfaction highly, with mean scores for each aspect of the application 8.7 or higher for participants (using a 0 to 10 scale where 0 is ‘very dissatisfied’ and 10 is ‘very satisfied’).

Table 6-10 Satisfaction with Application Process

	DEC		DEP		Overall	
Application Aspect	Mean	Respondents	Mean	Respondents	Mean	Respondents
Duke Energy's processing and preapproval of your application	9.0	65	9.0	25	9.0	90
Process to fill out and submit your application	8.7	63	9.2	25	8.9	88
Staff time it took to submit the application	8.8	63	8.9	26	8.8	89

Source: Questions Q8, Q9, Q10
Don't know responses are excluded.

About two-thirds of respondents (59 of 91) knew the online application portal. No follow-up questions were asked of this group, but when we looked at program satisfaction with customers aware of the portal and those who were not, we found people aware of the portal were slightly less satisfied (8.6 compared to 9.2). This may not indicate true satisfaction, as the question only asked about awareness of the portal and not the actual use of the portal.

Almost 70 percent of respondents (35 of 51) said they worked with a contractor or vendor to implement their project. Over 20 percent of respondents (11 of 51) said they worked with both a contractor and internal staff, while less than ten percent (5 of 51) worked only with internal staff to implement their project.

6.2.5.3 Calculators

As mentioned above, an appropriate worksheet or calculator must be submitted as part of the application process and to receive incentives through the program. In addition to the feedback contractors provided, participant respondents were also asked if they used any of the calculators provided by Duke Energy or if they used their own methods to calculate energy savings. While contractors were the most common method used to calculate energy savings, over one-third of respondents reported using the tools Duke Energy provided (Table 6-11). Results were similar between the two territories.

Table 6-11 Calculators Used by Participants

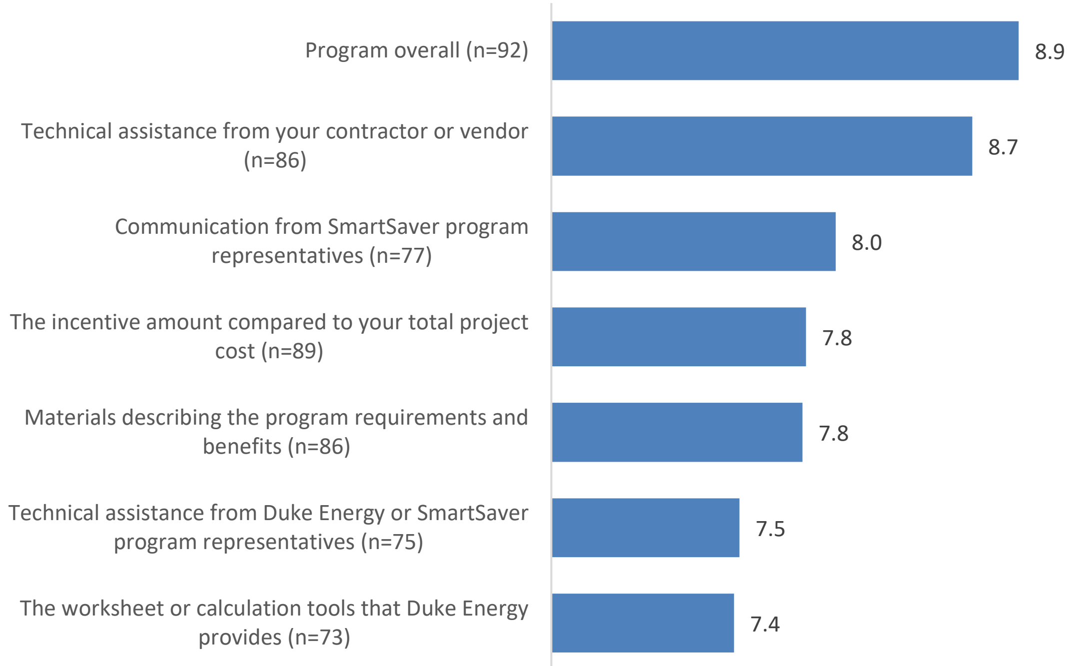
Calculators Used	DEC	DEP	Overall
Contractor calculated	42%	37%	40%
Custom-to-go	38%	30%	36%
Own methods	31%	30%	30%
Other	5%	0%	3%
Respondents	**65**	**27**	**92**

Source: Question Q12
Don't know responses are excluded.

6.2.5.4 Program Satisfaction

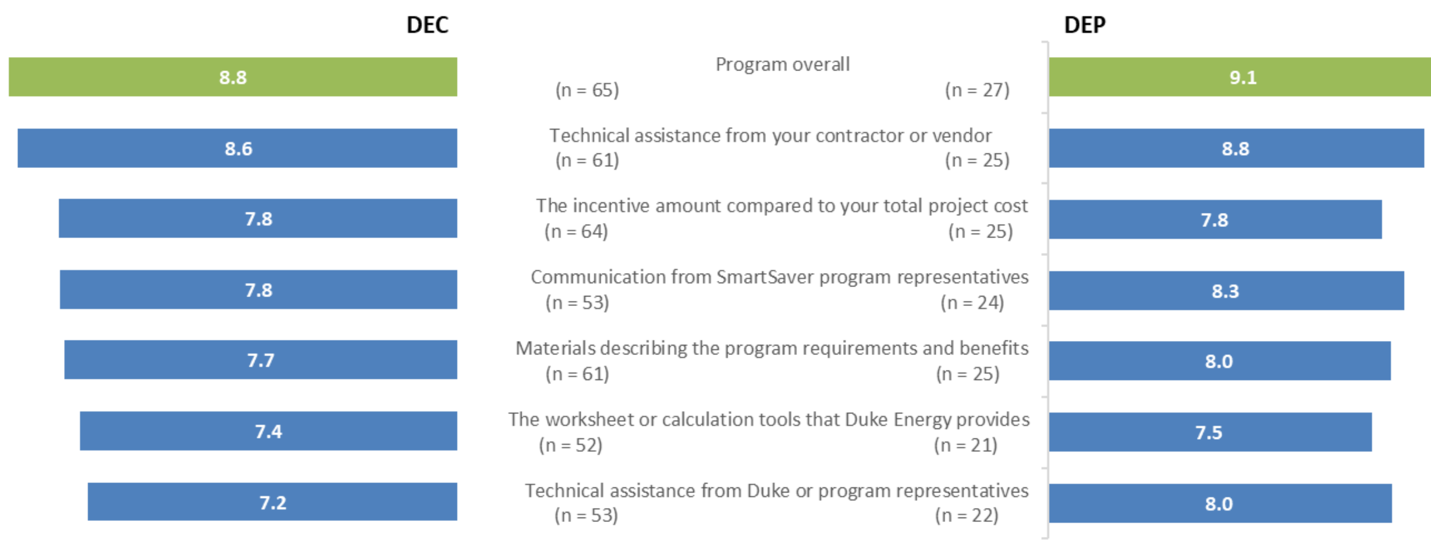
Overall, program participants were highly satisfied with the Custom program. Respondents were asked to rate their overall experience with the program and with Duke Energy on a scale of 0 to 10, where 0 is ‘very dissatisfied’ and 10 is ‘very satisfied.’ Respondents rated their overall satisfaction with the program overall highly, 8.9 overall. Respondents were also asked to rate the value of different program components on a similar 0 to 10 scale. All program aspects were rated an average of 7.4 or higher. Satisfaction scores were slightly down from the last evaluation, when all aspects of the program were rated 8.2 or higher. Overall ratings for the Carolina’s territory is shown in Figure 6-7.

Figure 6-7 Program Participant Satisfaction and Value of Program Aspects in Carolina



As shown in Figure 6-8, respondents in the DEC and DEP territories provided very similar responses. The biggest difference in responses between the territories related to the importance of technical assistance from Duke or program representatives. Respondents in the DEP territory said Duke's technical assistance was more important to them than respondents in the DEC territory (8.0 vs. 7.2).

Figure 6-8 Program Participant Satisfaction and Value of Program Aspects



Source: Customer Survey; SAT11, SAT5A, SAT5B, SAT5C, SAT5D, SATD5E, SAT5F
Don't know responses are excluded.

While average overall program satisfaction remained flat (8.9 this evaluation versus 9.0 last evaluation), it should be noted that almost all the value scores saw slight reductions. The greatest decrease was seen for the value of the worksheet or calculation tools, which dropped from 8.3 to 7.4. The only program aspect that saw an overall increase in value was the value of technical assistance from the respondent's contractor (8.5 to 8.7).

When we looked at overall satisfaction with the program between customers who mentioned using Duke Energy-provided calculators and those who did not, we found that calculator tool users had slightly higher satisfaction scores (9.2 versus 8.9).

We also looked at how important various aspects of the program were to calculator users. Somewhat expectedly, participants who mentioned using Duke's custom go calculator rated the importance of Duke's worksheets, materials, communication, and technical assistance higher than respondents who did not mention using Duke's calculators. Participants who did not mention using Duke's calculator rated the importance of the technical assistance they received from their contractor higher than participants who used the custom-to-go tool (8.9 vs. 8.4).

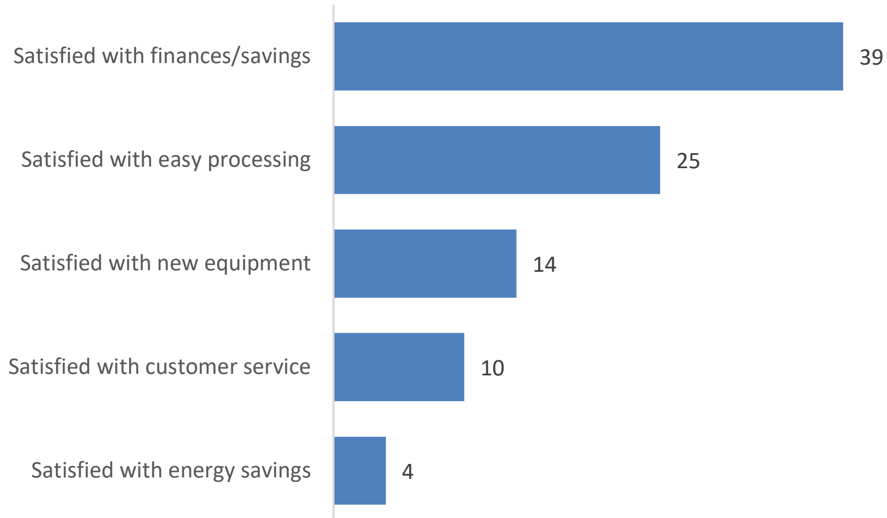
Table 6-12 Value of Program Aspects by Calculator Use

Program Aspect	Custom-to-go		Own / Contractor / Other Methods	
	Mean	Respondents	Mean	Respondents
Overall satisfaction with the program	9.2	33	8.9	50
Technical assistance from your contractor	8.4	30	8.9	47
Communication from Smart Saver program representatives	8.8	28	7.6	41
Technical assistance from Duke Energy or SmartSaver program representatives	8.5	28	7.0	39
Materials describing the program requirements and benefits	8.6	31	7.3	46
The worksheet or calculation tools that Duke Energy provides	8.8	32	6.3	35
The incentive amount compared to your total project cost	8.2	32	7.7	49

Source: Customer Survey; SAT11, SAT5A, SAT5B, SAT5C, SAT5D, SATD5E, SAT5F
Don't know responses are excluded.

Respondents reported many reasons for rating the program highly, including the program's financial incentives (39 respondents) and the easy processing (25 respondents). Also rated highly include receiving new equipment (14 respondents), Duke's customer service (10 respondents), and energy savings (4 respondents). Figure 6-9 shows the five most common responses.

Figure 6-9 Reasons for Rating the Program Highly (n=88)

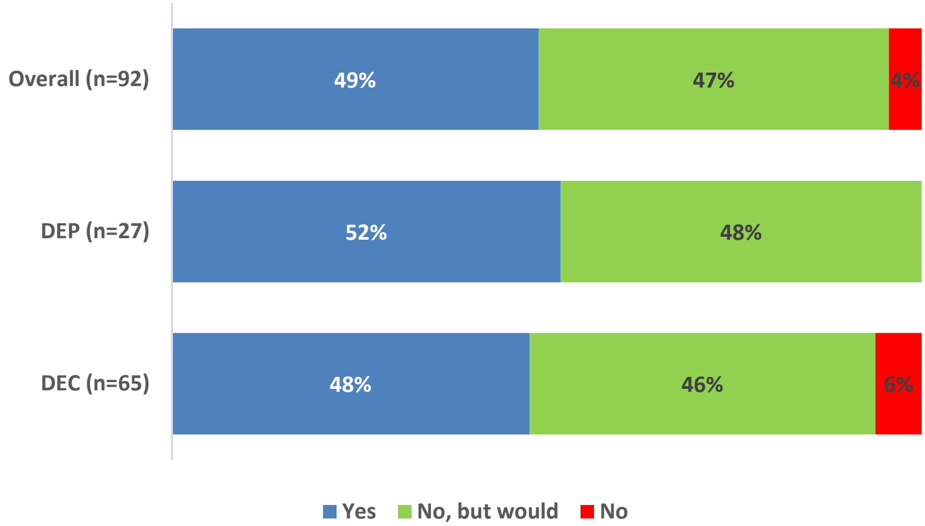


Source: Customer Survey; SAT12

Some customers provided areas of dissatisfaction. These included program processes including the finances or savings (7 respondents), application process (5 respondents), and customer service (1 respondent). One respondent indicated that “it cost me more to participate than I got in savings” and another said they did a large project but felt the incentive was small relative to the project size, specifically saying “that is not an incentive with that small of an amount.”

As another gauge of satisfaction, customers were asked if they have recommended the program to others. As shown in the figure below, almost half the participants reported that they had already recommended the program. If provided the opportunity, almost all the remaining respondents said they would recommend the program. However, it should be noted that the last evaluation of the program found no respondents saying they would not recommend the program to others.

Figure 6-10 Have You Recommended the Program to Others?



Source: Questions SAT8, SAT9

The primary reason respondents reported rating the program highly (providing a rating of an 8 or higher) was due to the program's financial savings. This was followed by easy processing and the technological improvements seen through their new equipment.

Table 6-13 Reasons for Rating the Program Highly

Reason	DEC	DEP	Overall
Financial savings	46%	40%	44%
Easy processing	25%	36%	28%
New equipment	17%	12%	16%
Customer service	8%	20%	11%
Energy savings	5%	4%	5%
Respondents	**63**	**25**	**88**

Source: Question SAT12o
Don't know responses are excluded.

Thirteen participant respondents rated their satisfaction less than an 8. While some had to do with the application process, other responses varied. Below are some specific comments respondents provided and how they rated their overall satisfaction with the program in parentheses.

> *"It cost me more to participate than I got in savings." (0)*

> *"Because it is not a very big amount. The HVAC Project we did was for $1.5 million projects, and the incentive we received was only $14,505, that is not an incentive, with that small amount." (3)*

"Because the application was not very user friendly for a layperson to use with the calculations for a neighborhood nonprofit pool." (6)

"Because you require receipts, I have to go through a general contractor to a subcontractor to a supplier to get those receipts, makes it a bureaucratic nightmare." (6)

"It's expensive – we can't participate because we don't have any big energy-saving projects at the moment" (7)

"If they could do a better job of doing rebates for more items, and make it easier to obtain rebates for known efficiency strategies" (7)

"We got a decent incentive, but we had some difficulties confirming our engineering calculations with our engineers" (7)

"We went through the process and then determined that it doesn't really apply to what we're doing." (7)

"Balancing that we really appreciate the incentive factor, but the hassle factor is so unbelievably difficult to work with." (7)

When asked what they would change about the NR Custom program, over half of the participant respondents (64 of 92) indicated they would not change anything. Of the remaining respondents, 13 respondents mentioned the rebate amount. Other suggestions included improving the initial processing time (five respondents), simplifying the application process (four respondents), updating or extending the list of eligible equipment (three respondents), and removing the pre-approval requirement, increasing awareness about the program (two respondents).

Table 6-14: Recommended Program Changes

Reason	DEC	DEP	Overall
Would not change anything	41	23	64
Increase rebate amount	12	1	13
Improve initial processing time	3	2	5
Other	5	0	5
Simplify application process	4	0	4
Cover more types of equipment	3	0	3
Remove pre-approval requirement	2	0	2
Respondents	**65**	**27**	**92**

Source: Question SAT1
Multiple responses are allowed
Don't know responses are excluded.

Some specific comments included the following:

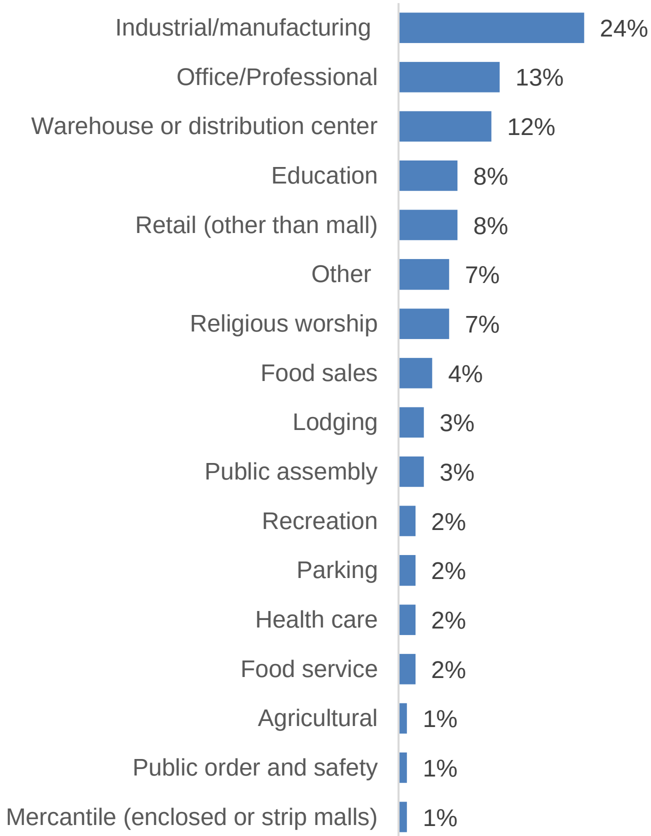
> *"Work through the bureaucracy of the receipts issue"*
>
> *"More user-friendly on the tail end when you're getting your check, getting it to the right person."*
>
> *"It would have been better if they had been more flexible with the timelines."*
>
> "*Eliminate the program or make it worthwhile. (For) smaller companies, it's very difficult to make anything out of the program, (and is) not worth the trouble."*
>
> *"Make (the program) more readily known; if it weren't for our contractor, we would not have been aware."*
>
> *"If we lease the space out and someone else pays the electric bill, they're eligible for the program, and we are not."*
>
> *"Make (the program) more customer-friendly and change it less often. My contractors are not willing to keep up with it."*

6.2.5.5 Participating Customer Characteristics

Facility types varied across participant respondents' locations. The most frequently mentioned types of businesses were industrial/manufacturing (24 percent), office or professional buildings (13 percent), warehouse or distribution centers (12 percent), and educational buildings (eight percent). The facility types are consistent with how the program was marketed, initially targeting larger industrial customers.[7]

[7] Customers are about to opt in/out of energy efficiency programs and the requirements have been different between DEC and DEP. Historically, DEC was a one year opt in period for the calendar year and customers have a window where they are able to opt in and opt out. DEP customers could opt in at any time. When a customer received an incentive, they were considered opted in for three years.

Figure 6-11 Smart $aver Custom Incentive Program Business Activities (n=92)

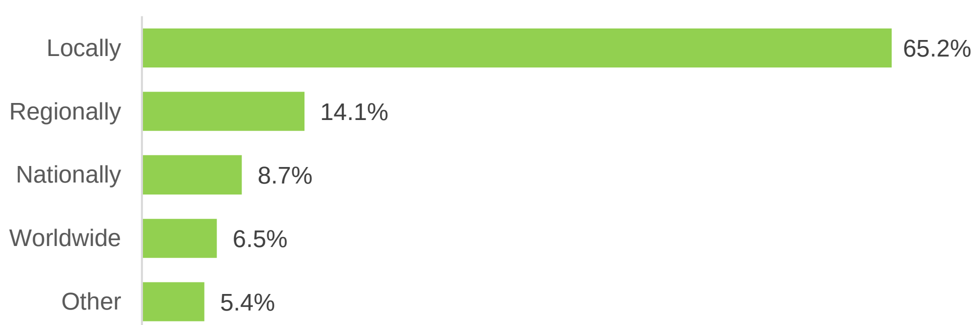


Source: Questions C1
Don't know responses are excluded.

When participants were asked how their companies make budget decisions and whether they were decided locally, regionally, nationally, worldwide, or something else, most respondents reported that decisions are made locally (65 percent). Over half of respondents tended to plan one year (33 percent) or five years (19 percent) into the future when creating a budget and financial plans. The figure below shows the participant business characteristics.

Figure 6-12 Smart $aver Custom Incentive Program Participant Characteristics

How budget decisions are made (n=92)



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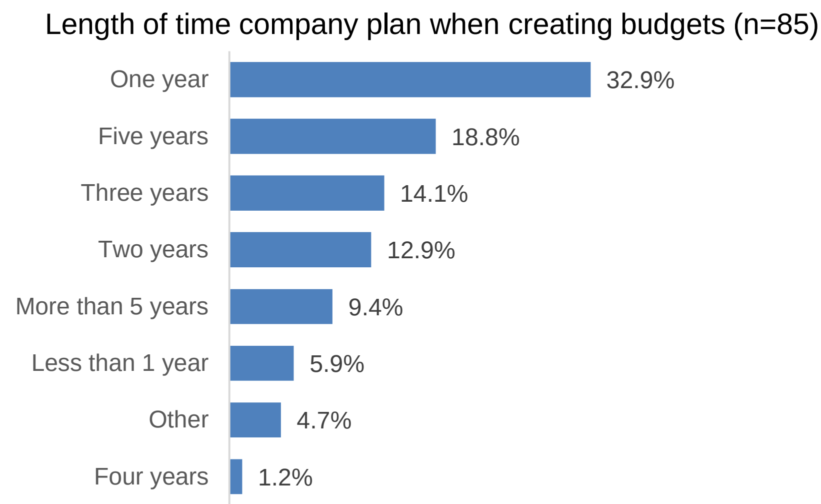


Source: Questions C2 & C3
Don't know responses are excluded.

6.2.5.6 COVID Impacts

The participant survey occurred during the COVID-19 pandemic, similar to the contractor survey. The evaluation team included a few questions in the study to understand the pandemic's impact on any upgrades to customers' energy-using equipment. About one-third of customer respondents (36%) indicated that the organization had plans to upgrade equipment before the pandemic. These customers (32 respondents) were asked how the plans had changed. The majority of respondents (20 of 32) indicated they would have delayed planned projects. Seven respondents said they would have made no changes to their planned projects, three changed their project scope, and two said they would have canceled planned projects.

Respondents were asked to think about the project done during the evaluation period and asked if they had to decide to do the project today what decision they would make. The majority (83%) indicated they would have made no changes to the project. The remaining 15 respondents indicated they would have delayed the project (8 respondents), changed the scope (4 respondents), canceled the project (2 respondents), or done something else (1 respondent).

7 Conclusions and Recommendations

7.1 Impact Evaluation

Conclusion 1: The evaluation team saw strong evidence the Duke Program team conducts detailed reviews of the project applications, has quality control checks and revises measure parameters to refine savings estimates. Engineering reviews by AESC provides an additional level of quality control that helps to minimize most calculation errors or instances of over-claimed energy or demand savings. The strata-level realization rates indicate that an appropriate level of rigor is being applied to lighting projects and most non-lighting projects.

Recommendation 1: Continue the level of rigor being applied to projects as it goes through the NR Custom application process while considering the following recommendations to improve the program in specific areas.

Conclusion 2: Of the parameters needed to calculate lighting project savings, verified lighting operating schedules, or annual hours of use, were more often found to be different than the hours used to calculate reported savings. Applicants are asked to provide the operating schedules as part of the application process and participants, not trade allies, may have the best insights into what the schedule will be for each installed fixture.

Recommendation 2: Improve the level of detail collected in the application on the hours of operation. Weekly schedules should be defined and/or verified by the participant. Holidays and seasonal changes should also be captured in the annual hours of use.

Conclusion 3: Project reviews, both during the application process and the evaluation, benefit from documentation of all underlying assumptions and worksheets used for the calculations of savings. Photos serve as a valuable verification of the installed equipment and provide essential information regarding the condition and operating parameters of the old and new equipment. This applies to primarily small and larger non-lighting projects where trend data and manufacturer's specification sheets would allow more detailed analyses of the proposed measures. Lighting projects are very well documented but pictures of baseline equipment prior to it being removed would be useful to refine savings calculations.

Recommendation 3: Collect and document enough information and photos of the project so the calculations of savings could be independently repeated.

Conclusion 4: Measurement and verification (M&V) plans help confirm measures are installed and resulting in the expected energy and demand savings. Differences between expected savings and measured savings can help identify measures that are not performing or have been disabled and thus lead to refined savings estimates for the project. M&V plans for large non-lighting projects can greatly assist the review of the program applications and projects being evaluated, in some cases years after the project is implemented.

Recommendation 4: Require M&V plans that are consistent with recognized protocols for large non-lighting projects involving a large portion of the program savings or measures with high uncertainty. Establish a threshold in kWh savings or incentives dollars above which an M&V plan is required.

Conclusion 5: The Duke NCEEDA protocol defines how savings from new, high-performance buildings shall be modeled and estimated. Assumptions on how the building is expected to be occupied and used are also required but do not always match how the new buildings are used or occupied. This can lead to the modeled consumption and savings not matching the actual consumption and savings.

Recommendation 5: The NCEEDA should incorporate a tiered post construction calibration requirement that uses the ASHRAE 14 tolerances to assess the level of uncertainty in the new construction models and adjust the model in order to minimize the uncertainty.

7.2 Process Evaluation

Conclusion 6: The program continues to operate as intended. Contractor and customer respondents reported high overall satisfaction with the program and many program aspects. The most common source of program awareness from customers was their contractor, consistent with Duke Energy's primary channel to market the program. A high proportion of customers reported the contractor recommendation as an important source of influence on their decision to install high-efficient equipment. Contractor technical assistance also saw high satisfaction, underscoring the critical role. Furthermore, contractors are generally satisfied with the program and appreciate using the incentives as a sales tool.

Recommendation 6a: Continue to engage contractors in the program and keep them informed of the program to increase awareness among customers and encourage the installation of program-qualifying equipment. This engagement should include builders and architects who may be utilizing the new construction design assistance.

Recommendation 6b: Encourage contractors and architects to inform customers of the Duke Energy incentives available while considering equipment options. Early conversations may push customers to purchase program-qualifying equipment rather than standard efficiency.

Conclusion 7: The participant survey was conducted approximately 1 to 3 years after program participation. The more time passes from program participation, the more it can impact the customer recalling the details around the decision to select the specific equipment. Additionally, turnover can occur, so decision-makers may no longer be with the organization. All of which can impact free-ridership.

Recommendation 7: Conduct the free-ridership study closer to the decision-making process. This may help ensure we can talk with the decision-maker to answer questions regarding the decision to do the project through the program. By surveying customers closer to when the decision was made, they should be more likely to remember the factors that went into the decision. Surveys could be conducted on a rolling basis (i.e., quarterly) with those projects where incentives have been paid. Web surveys could be utilized if the project team collects the email address and contact details (name, address, and phone) of the decision-maker at the organization where the equipment was installed.

While customers are more likely to recall the decision process, not enough time will have passed to allow customers to install additional equipment because of the program; therefore, the program may not see any spillover. The evaluation team may consider conducting a separate spillover study, if deemed necessary, to capture any spillover from participating customers.

Conclusion 8: As part of the application process, an appropriate worksheet or calculator must be submitted. Duke Energy provides access to two calculators: Classic Custom and Custom-to-Go, which recently changed. The calculators were transitioned from Excel-based to an online tool. Indications are customers are having difficulty adjusting to the new format. One-third of customer respondents reported using the Custom-to-Go calculator.

Recommendation 8: Monitor how customers and contractors use the calculators and request feedback for any specific changes that users request. Ensure any instructions associated with the calculator are clear to assist customers in entering or completing the necessary information. Coordinate any instruction documents used by Duke Energy staff to compile a comprehensive document.

Conclusion 9: Duke Energy staff report it typically takes between three to four weeks to review applications, faster than the four to six weeks the program indicates, which has resulted in reduced use of the Fast Track option. Participant feedback supports this, with high satisfaction reported for the application process. Contractors felt that the amount of paperwork they needed to submit was an area that the program could improve. Four contractors mentioned how the custom application was too complicated, and they would instead apply for incentives through the prescriptive program and have more prescriptive incentive options.

Recommendation 9a: Continue to monitor the time it takes to review applications to maintain the expedient process Duke Energy has in place.

Recommendation 9b: Monitor the equipment submitted for custom incentives and direct prescriptive measures to the prescriptive program for an easier application process.

Conclusion 10: A relatively new aspect to the program introduced in 2019 was an online application portal. The third-party vendors appreciate the online application portal, making tracking applications, preapproval, and incentive status easier. Still, a couple of the vendors said it does not reduce the complexity of the Custom application itself. Customers were only asked about their awareness of the portal, where one-third of customer respondents indicated they were aware.

Recommendation 10: Continue to market the online application portal to customers and contractors interested in the program. The online portal may help streamline costs and improve consistent application submittal with the necessary information.

Conclusion 11: The Duke team has an efficient and effective process for reviewing applications for preapproval to focus on eligible but not already committed projects. They offer both application and calculation assistance that provides third-party aid to customers and trade allies if needed for a fee. As part of the application, questions are included to identify projects where the customer has already identified or purchased program-qualifying equipment. The questions on the application are a great tool to use in talking with customers about their projects and plans to increase the scope and efficiency of projects. As applications are flagged, the program team can encourage customers to revise the scope to implement more than otherwise.

Recommendation 11a: Continue to discuss project scope with customers who may have already committed to a project based on question E[8] of the application. This question identifies customers who have already identified, purchased, or committed to a project or building.

Recommendation 11b: Update question G on the application to 1) require customers to answer the question and 2) revise the wording to allow more response options to be presented. By requiring customers to answer the question, the project team will better understand the type of equipment customers are selecting and if the program assistance is responsible for the project. The response to this question can provide insight into the potential free-ridership of the project. The evaluation team recommends updating the question text to the following:

G. Without the program assistance and incentive, you would…

- ❑ Purchase and install the same high efficiency equipment
- ❑ Purchase less of the high efficiency equipment
- ❑ Purchase the high efficiency equipment at a later date
- ❑ Purchase standard / code minimum efficiency
- ❑ Neither purchase nor install any part of the project

The project team can then use this question to flag applications and follow-up with customers to discuss the following: a) Would they consider more efficient equipment or more fixtures? b) How did they select the efficiency of the equipment on the application? c) Does the company have policies that encourage or require purchasing higher efficiency equipment, reducing GHGs or meeting sustainability goals? Answers to these questions will allow Duke Energy staff to determine if the project is a good candidate for an incentive and help further manage free-ridership.

The program team should carefully balance the need to minimize free-ridership with maintaining participation levels and subsequent customer satisfaction. The objective of this follow-up should not be to eliminate free-ridership from the program but to manage how much free-ridership is in the program. Follow-up will also optimize net savings and better understand how the program can encourage customers to achieve more savings than they would achieve on their own.

Recommendation 11c: Document changes customers make to projects from discussions with Duke Energy staff. While customers may feel that they were planning on high-efficiency equipment, conversations with Duke Energy staff can cause them to adjust their plans. The evaluation team can use details from documentation of these discussions to inform how intention is calculated, affecting the NTG score for that customer. Documentation should include the date of the conversation, original technology or efficiency plans, and new technology or efficiency plans.

Conclusion 12: Continue to check opt-in/out status with the customer applications to identify customers doing projects to get the incentive. These discussions will allow Duke Energy staff to determine better if the project is a good candidate for an incentive.

[8] Question E: Have you made any commitment to your project (signed purchase order/contract, ordered equipment, started construction)

Recommendation 12: Consider adding a question to the application asking customers about their opt-in/out status to identify customers doing projects to get the incentive. Answers to this question will also allow Duke Energy staff to determine better if the project is a good candidate for an incentive.

Conclusion 13: Transformation in equipment markets drives changes to what should be considered the appropriate baseline. Additionally, program influence and/or advances in technology can shift market baselines (e.g., LEDs and new construction). As the program matures and technologies change, baselines will change as well. The evaluation team found that some of the equipment incentivized through the program could be considered close to the market baseline equipment. Incentivizing LED lighting in high end new construction buildings has the potential for high free ridership since LED technology is becoming the market baseline in these applications. The program team should continue to monitor equipment baselines and adjust them accordingly.

Recommendation 13a: Consider additional application approval criteria, if feasible. These criteria could include a question on the application to identify customers' current ROI threshold for internal project approval. Another question to consider adding to the application or in discussions with customers would be if there are other benefits the company will gain (e.g., avoided O&M costs, better reliability, faster production).

Recommendation 13b: Research market baselines and adjust project baselines and measure savings as needed.

Recommendation 13c: Identify measures replacing equipment at the end of useful service life (EUSL) and assess ROI accordingly. Other questions the program team can ask customers in the discussion include the following:

- Does the company have a preventative maintenance program? If so, when is the equipment scheduled to be replaced?
- How much remaining useful life does the existing equipment have?

Appendix A Summary Forms

Duke Energy Carolinas Smart $aver NR Custom Program

Completed EMV Fact Sheet

Description of Program

Duke Energy's Non-Residential Smart $aver® Custom Incentive Program (NR Custom) offers financial assistance to qualifying commercial, industrial, and institutional customers in the Duke Energy Carolina (DEC) service territory to enhance their ability to adopt and install cost-effective electrical energy efficiency projects. The Program targets energy saving projects involving more complicated or alternative technologies, or those measures not covered by the non-residential Smart $aver Prescriptive Program. The intent of the program is to encourage the implementation of energy efficiency projects that would not otherwise be completed without the company's technical or financial assistance. The program requires pre-approval prior to the project implementation.

Summary		Strata	Verified Net Savings (kWh)
Region(s)	Carolina	L-Small (<360 MWh)	21,838,828
Evaluation Period	January 1, 2018 – Dec 31, 2019		
Annual kWh Net Savings	83,427,570	L-Large (≥360 MWh)	34,905,461
Coincident kW Net Impact - Summer	13,067		
Coincident kW Net Impact - Winter	12,111	NL-Small (<537 MWh)	9,657,879
Net-to-Gross Ratio	83.66		
Process Evaluation	Yes	NL-Large (≥537 MWh)	17,025,400

Evaluation Methodology

Impact Evaluation Activities

- *55 sample project analyses*
- *Virtual site sites and desk reviews used primarily due to COVID*

Impact Evaluation Findings

- *Energy Realization Rate: 97.62%*
- *Net-to-gross: 83.66%*

Process Evaluation Activities

- *Program Staff; 8 interviews with program staff*
- *Trade Allies; 4 in-depth interviews with high volume contractors, telephone surveys with representative sample of 62 trade allies*
- *Participants; 236 telephone surveys*
- *Application data review*

Process Evaluation Findings

- *Contractors are the primary source of program awareness, and their assistance was the most valued program component by participant respondents*
- *Participant and trade ally satisfaction with the program is high*
- *Interaction with Duke Energy program staff was the highest-rated program component for contractors*
- *Contractors value the program and use incentives to encourage customers to purchase high-efficient equipment*

Duke Energy DEP Smart $aver NR Custom Program

Completed EMV Fact Sheet

Description of Program

Duke Energy's Non-Residential Smart $aver® Custom Incentive Program (NR Custom) offers financial assistance to qualifying commercial, industrial, and institutional customers in the Duke Energy Progress (DEP) service territory to enhance their ability to adopt and install cost-effective electrical energy efficiency projects. The Program targets energy saving projects involving more complicated or alternative technologies, or those measures not covered by the non-residential Smart $aver Prescriptive Program. The intent of the program is to encourage the implementation of energy efficiency projects that would not otherwise be completed without the company's technical or financial assistance. The program requires pre-approval prior to the project implementation.

Summary		Strata	Verified Net Savings (kWh)
Region(s)	*Progress*	*L-Small (<123 MWh)*	*6,215,979*
Evaluation Period	*January 1, 2018 – Dec 31, 2019*		
Annual kWh Net Savings	*25,685,459*	*L-Large (≥123 MWh)*	*10,944,794*
Coincident kW Net Impact - Summer	*4,526*		
Coincident kW Net Impact - Winter	*4,342*	*NL-Small (<258 MWh)*	*3,108,640*
Net-to-Gross Ratio	*91.37*		
Process Evaluation	*Yes*	*NL-Large (≥258 MWh)*	*5,416,044*

Evaluation Methodology

Impact Evaluation Activities

- *49 sample project analyses*
- *Virtual site sites and desk reviews used primarily due to COVID*

Impact Evaluation Findings

- *Energy Realization Rate: 102.08%*
- *Net-to-gross: 91.37%*

Process Evaluation Activities

- *Program Staff; 8 interviews with program staff*
- *Trade Allies; 4 in-depth interviews with high volume contractors, telephone surveys with representative sample of 62 trade allies*
- *Participants; 236 telephone surveys*
- *Application data review*

Process Evaluation Findings

- *Contractors are the primary source of program awareness, and their assistance was the most valued program component by participant respondents*
- *Participant and trade ally satisfaction with the program is high*
- *Interaction with Duke Energy program staff was the highest-rated program component for contractors*
- *Contractors value the program and use incentives to encourage customers to purchase high-efficient equipment*

Appendix B DSMore Input Summary

Table B-1 Verified Impacts per Project by Technology and Project Size- DEC

Stratum	Gross Verified Energy Savings per Project (kWh)	Gross Verified Summer Coincident Demand per Project (kW)	Gross Verified Winter Coincident Demand per Project (kW)	Free Ridership	Spillover	Net to Gross Ratio
L-Small (<360 MWh)	72,714	9.7	8.5	29.16%	12.54%	83.66%
L-Large (≥360 MWh)	719,362	117.4	98.9			
NL-Small (<537 MWh)	116,608	16.3	22.3			
NL-Large (≥537 MWh)	1,565,439	285.1	267.8			

Table B-2 Verified Impacts per Project by Technology and Project Size- DEP

Stratum	Gross Verified Energy Savings per Project (kWh)	Gross Verified Summer Coincident Demand per Project (kW)	Gross Verified Winter Coincident Demand per Project (kW)	Free Ridership	Spillover	Net to Gross Ratio
L-Small (<123 MWh)	32,242.1	5.8	4.8	32.67%	24.03%	91.37%
L-Large (≥123 MWh)	362,986.2	46.1	53.8			
NL-Small (<258 MWh)	97,207.3	18.1	22.1			
NL-Large (≥258 MWh)	455,969.0	121.8	91.8			

Appendix C Free-ridership Scores Across Categories

Category	Response	n	Surveyed Savings	Verified Surveyed Savings*	Intention (weighted)	Influence (weighted)	Preliminary Free-ridership (weighted)	Free-ridership after adjustments (weighted)
Overall	Free-ridership	236	39,238,756	38,665,424	27.7%	0.8%	28.5%	30.0%
Locations (identified using contact and business names)	Single	72	19,662,000	19,248,556	12.8%	1.4%	14.3%	16.8%
	Multiple	164	19,576,756	20,063,062	42.9%	0.1%	43.0%	43.6%
Third-party (identified using email addresses)	No	235	39,177,957	39,248,386	28.2%	0.8%	28.9%	30.4%
	Yes	1	60,800	63,232	25.0%	6.3%	31.3%	31.3%
Duke Energy staff (Q1)	Account rep	90	20,795,977	20,800,873	32.9%	0.1%	33.0%	31.9%
	None	146	18,442,779	18,510,745	22.9%	1.5%	24.4%	28.8%
Formal requirements for purchasing equipment (BG3)	Yes	26	11,610,045	11,390,253	9.4%	1.2%	10.6%	8.8%
	No	66	15,593,693	15,336,566	29.1%	1.0%	30.1%	34.2%
Previous program participation (Q5)	Yes	41	17,997,146	17,647,040	24.9%	0.9%	25.7%	22.5%
	No	47	7,765,968	7,704,565	13.3%	1.6%	14.9%	28.0%
Measure type (from sample)	Compressed air	1	177,131	164,377	50.0%	0.0%	50.0%	75.0%
	Food service	1	279,593	257,505	25.0%	0.0%	25.0%	25.0%
	HVAC	23	7,990,912	7,545,362	8.9%	1.3%	10.2%	9.7%
	IT	1	445,529	429,490	50.0%	0.0%	50.0%	25.0%
	Lighting	186	20,982,001	22,010,764	32.5%	0.5%	33.0%	35.3%
	Process	4	4,763,127	4,580,010	45.9%	0.7%	46.6%	48.9%
	Whole building	20	4,600,464	4,324,109	18.3%	1.3%	19.6%	21.3%
	Yes	33	14,291,469	13,928,227	23.1%	0.6%	22.5%	21.9%

Category	Response	n	Surveyed Savings	Verified Surveyed Savings*	Intention (weighted)	Influence (weighted)	Preliminary Free-ridership (weighted)	Free-ridership after adjustments (weighted)
Work with Duke Energy staff prior to submitting application for preapproval (BG1)	No	51	12,183,239	12,034,992	17.5%	1.2%	31.3%	24.8%
Business type (C1)	Office/Professional	11	5,128,494	4,850,460	20.6%	1.6%	22.2%	13.3%
	Warehouse or distribution center	11	1,603,927	1,637,158	32.7%	4.4%	37.1%	42.4%
	Food sales	3	436,709	420,906	29.8%	0.0%	29.8%	29.8%
	Food service	2	250,146	232,383	49.5%	6.2%	55.7%	77.4%
	Retail (other than mall)	6	981,090	1,099,355	42.5%	0.0%	42.5%	40.9%
	Mercantile (enclosed or strip malls)	1	62,982	68,021	50.0%	0.0%	50.0%	25.0%
	Education	7	1,234,890	1,205,437	13.7%	0.3%	14.0%	45.2%
	Religious worship	6	411,097	410,325	9.5%	0.0%	9.5%	21.9%
	Public assembly	3	76,973	72,304	34.0%	3.3%	37.4%	55.6%
	Health care	2	574,412	533,054	5.4%	0.0%	5.4%	2.7%
	Lodging	3	63,374	67,489	45.0%	0.0%	45.0%	45.0%
	Public order and safety	1	212,936	200,160	50.0%	25.0%	75.0%	37.5%
	Industrial/manufacturing	25	12,947,213	12,723,984	20.3%	0.5%	20.8%	22.0%
	Agricultural	1	324,914	337,910	50.0%	0.0%	50.0%	87.5%
	Other	10	2,894,583	2,867,874	4.4%	0.0%	4.4%	9.0%
Where budget decision are made (C2)	Locally	60	14,482,357	14,367,205	28.0%	1.2%	29.2%	33.4%
	Regionally	13	3,409,591	3,361,308	29.4%	2.4%	31.8%	26.5%
	Nationally	8	2,949,602	2,841,651	12.4%	1.2%	13.6%	12.1%
	Worldwide	6	5,189,812	5,008,991	1.2%	0.0%	1.2%	1.2%
	Other	5	1,172,377	1,147,663	9.9%	0.0%	9.9%	14.1%

Category	Response	n	Surveyed Savings	Verified Surveyed Savings*	Intention (weighted)	Influence (weighted)	Preliminary Free-ridership (weighted)	Free-ridership after adjustments (weighted)
Lighting (from sample)	Lighting	186	20,982,001	22,010,764	32.5%	0.5%	33.0%	35.3%
	Non-Lighting	50	18,256,756	17,300,854	22.7%	1.1%	23.8%	24.2%
New construction (from sample)	No	216	34,638,293	34,987,509	29.4%	0.7%	30.1%	31.6%
	Yes	20	4,600,464	4,324,109	18.3%	1.3%	19.6%	21.3%
Strata (from sample)	Lighting-Large	22	9,215,482	9,722,701	24.6%	0.6%	25.3%	28.4%
	Lighting-Small	164	11,766,518	12,288,062	38.7%	0.5%	39.1%	40.8%
	Non-lighting-Large	10	13,584,476	12,954,724	22.3%	0.0%	22.3%	22.0%
	Non-lighting-Small	40	4,672,280	4,346,130	24.0%	4.2%	28.2%	30.9%
How far into the future company plan budgets and financial plans (C3)	Less than 1 year	5	401,186	416,765	33.3%	2.1%	32.5%	49.3%
	One year	28	4,780,388	4,752,520	16.0%	1.0%	23.8%	21.8%
	2 years	11	5,005,698	4,848,590	14.0%	2.4%	37.8%	14.8%
	3 years	12	6,540,858	6,458,524	36.6%	0.2%	20.8%	38.5%
	4 years	1	1,811,414	1,809,603	0.0%	0.0%	0.0%	0.0%
	5 years	16	5,187,830	4,940,779	14.7%	1.4%	29.9%	11.9%
	More than 5 years	8	1,231,852	1,184,263	13.3%	0.4%	37.9%	42.6%
	Other	4	317,476	312,047	18.4%	6.0%	18.8%	17.5%
Has production or business cycle that impacts energy efficiency projects (C4)	Yes	50	15,681,166	15,322,356	11.0%	0.6%	25.6%	15.4%
	No	40	11,048,531	10,930,640	35.2%	1.8%	32.4%	35.6%
Condition of old equipment (E4)	Operating with no performance issues	9	3,018,928	3,054,836	5.4%	0.4%	18.1%	5.8%
	Operating but in need of repair	16	3,591,367	3,536,179	11.6%	0.7%	21.7%	12.6%

Category	Response	n	Surveyed Savings	Verified Surveyed Savings*	Intention (weighted)	Influence (weighted)	Preliminary Free-ridership (weighted)	Free-ridership after adjustments (weighted)
How organization selected new equipment (Q4a)	We did some research on <MEASURE> efficiency and made our own choice	22	11,318,019	11,160,659	27.5%	0.5%	28.6%	30.2%
	Our contractor suggested one <MEASURE> efficiency level, and we agreed	20	2,369,621	2,294,209	18.5%	0.6%	33.9%	30.9%
	Our contractor suggested various <MEASURE> efficiency levels, and we chose one	39	10,357,862	10,315,257	16.5%	2.1%	28.1%	18.0%
	We worked with Duke staff who recommended the specific <MEASURE> efficiency	5	342,448	347,740	37.0%	0.2%	26.3%	45.0%
	Something else	5	1,781,878	1,656,721	13.3%	0.0%	18.8%	9.9%
Used Duke Energy calculators (Q12)	No	59	20,458,141	19,991,173	23.6%	1.2%	30.8%	26.8%
	Yes	33	6,745,597	6,735,646	12.2%	0.6%	24.5%	13.3%
Used own methods (Q12)	No	64	13,338,767	13,039,200	20.5%	1.7%	31.3%	24.9%
	Yes	28	13,864,971	13,687,619	21.0%	0.5%	22.4%	22.0%
Used other methods (Q12)	No	89	26,955,503	26,495,685	20.7%	1.0%	29.0%	23.4%
	Yes	3	248,235	231,134	25.4%	6.0%	16.7%	24.6%
Contractor calculated (Q12)	No	55	18,765,097	18,427,371	19.1%	0.8%	23.6%	20.9%
	Yes	37	8,438,641	8,299,448	24.3%	1.8%	36.0%	29.0%
Custom to go (from sample)	No	163	29,435,427	29,481,871	30.8%	0.7%	37.1%	32.0%
	Yes	73	9,803,330	9,829,747	20.3%	1.1%	25.2%	25.8%

Category	Response	n	Surveyed Savings	Verified Surveyed Savings*	Intention (weighted)	Influence (weighted)	Preliminary Free-ridership (weighted)	Free-ridership after adjustments (weighted)
Primary contact (from sample)	Customer	69	9,949,812	9,713,341	33.8%	0.0%	25.0%	33.6%
	Trade ally	167	29,288,945	29,598,277	26.3%	1.0%	36.9%	29.4%
FastTrack (from sample)	No	223	35,037,539	35,152,847	29.6%	0.8%	33.6%	32.2%
	Yes	13	4,201,218	4,158,771	16.5%	0.4%	29.6%	15.2%

*Savings incorporate the stratum-level realization rate with the exception of the overall category that uses the combined DEC/DEP program-level realization rate

Appendix D Survey Instruments

D.1 Participant Survey

Duke Energy Nonresidential Custom Program
Participant Survey

Sample Variables

CASEID

CONTACT_NAME Primary customer contact name

PROJECT_ID

COMPANY_NAME

ADDRESS The address of the site where the measure was installed

MEASURE Summary of project measure implemented
1 lighting
2 process equipment
3 compressed air
4 HVAC
5 food service equipment
6 whole building (NC)
7 IT equipment
8 other

MEASURE_TXT Sting version of measure

MeasureType Type of measure sampled

DESCRIPT## Detailed description of measure

MEASDESC

NC Flag for new construction project
1 New construction
0 Not new construction

NCEDA Flag for new construction energy design assistance track
1 New construction energy design assistance
0 Not new construction energy design assistance

YEAR The year the measure was completed and paid (2018 or 2019)

INCENTIVE The amount of the incentive paid for the measure

CONTRACTOR Flag that customer worked with external contractor
- 1 Worked with contractor
- 0 Implemented within company

FASTTRACK Flag that customer went through the Custom Fast Track application process
- 1 Fast track customer
- 0 Standard process customer

STRATUM
- NC North Carolina
- SC South Carolina
- IN Indiana
- KY Kentucky

Territory
- DEC Duke Energy Carolinas
- DEP Duke Energy Progress

TOTAL_KWH

MULTFLAG
MULTID
MULTQTY
PRIMARYCASE

VEND_COMPANY
VEND_CONTACT
VEND_PHONE
VEND_PHONE2
VEND_EMAIL

Introduction and Screening

INT01 Hello, my name is _______________, and I am calling on behalf of Duke Energy. May I speak with <CONTACT_NAME>?

- 01 Yes
- 02 No

MULTCHK [ASK IF MULTFLAG=1] [INTERVIEWER: Is this the first case of a multiple?

- 01 Yes, first case
- 02 No, subsequent case [SKIP TO Q1]

PREAMBLE I'm calling from Tetra Tech, an independent research firm. We were hired by Duke Energy to talk with some of their customers about their participation in the Smart $aver Custom Incentive Program.

Our records indicate that you participated in Duke Energy's Smart $aver Custom Incentive Program that included a <MEASURE> project in <YEAR> at <ADDRESS>.

Are you able to answer questions about your company's participation in this program?

01	Yes, I'm able to answer	[SKIP TO SCREEN1]
02	Yes, but information isn't quite right [SPECIFY]	[SKIP TO SCREEN1]
03	No, I'm not able to answer	[SKIP TO OTHER_R]
04	We have not participated	[THANK AND TERMINATE 82]
99	Refusal	[THANK AND TERMINATE 91]

OTHER_R Is it possible that someone else in your organization would be more familiar with the program or the project that was completed?

01	Yes	
02	No	[THANK AND TERMINATE 81]
88	Don't know	[THANK AND TERMINATE 81]
99	Refusal	[THANK AND TERMINATE 91]

AVAILABLE_R May I please speak with that person?

01	Yes	[SKIP TO INT01]
02	No (When would be a good time to call back?)	
03	We have not participated	[THANK AND TERMINATE 82]
88	Don't know	[THANK AND TERMINATE 81]
99	Refusal	[THANK AND TERMINATE 91]

SCREEN1 Were you involved in the decision to complete the <MEASURE> project?

01	Yes	
02	No	SKIP TO OTHER_R

PREAMBLE2 Great, thank you. I'd like to assure you that I'm not selling anything, I would just like to ask your opinion about this program. Your responses will be kept confidential and your name will not be revealed to anyone. For quality and training purposes, this call will be recorded.

Program Awareness and Marketing

Q1 [IF MULTCHK=2 SKIP TO MEASCHK] How did you **first** hear about the Smart $aver Custom Incentive Program? (Select one)

01	Account representative	[AcctRep=1]
02	Business energy advisor (BEA)	[BEA=1]
03	Contractor / Vendor	[CONTRACTOR = 1]
04	Email from Duke Energy	
05	Mail from Duke Energy	
06	Colleague / Another business	
07	Conference / Trade Show / Expo	
08	Duke Energy website	
09	Duke Energy representative (other than an account rep/BEA)	
10	Previous program experience / participation	
11	Other [SPECIFY]	
88	Don't know	
99	Refused	

Q2 dropped mid-field because survey length was too long

Q2 [ASK IF Q1 = 1, 2 or 3] Did the <response from Q1> provide you with enough information about the program?

01	Yes	SKIP TO Q6
02	No	

Q3 dropped mid-field because survey length was too long

Q3 [ASK IF Q1 = 1, 2 or 3] What additional information would you have liked <response from Q1> to provide?

[RECORD VERBATIM]

Q6 What made you decide to apply to the Smart $aver program?

[RECORD VERBATIM]

Q4 [ASK IF Q1<>3] Did you work with a contractor or vendor to implement the <MEASURE> project or did you only work with internal staff at your company?

01	Worked with a contractor / vendor	[CONTRACTOR = 1]
02	Internal staff at company	[CONTRACTOR = 0]
03	Both the contractor and internal staff	[CONTRACTOR = 1]
88	Don’t know	[CONTRACTOR = 0]

Q4a Which of the following best describes how your organization selected the new high efficiency equipment for the <MEASURE> project? (Select one)

[READ LIST] [rotate options 1 through 4]

01 We did some research on <MEASURE> efficiency and made our own choice
02 [IF CONTRACTOR=1] Our contractor suggested one <MEASURE> efficiency level, and we agreed
03 [IF CONTRACTOR=1] Our contractor suggested various <MEASURE> efficiency levels, and we chose one
04 We worked with Duke staff who recommended the specific <MEASURE> efficiency
05 Something else [SPECIFY]
88 Don't know

BG3 Does your company have any formal requirements or informal guidelines for the purchase, replacement or maintenance of energy-using equipment?

01 Yes
02 No
88 Don’t know
99 Refused

BG4 [IF BG3 = 1] Which of the following best describes these requirements or guidelines? [READ LIST; SELECT ONE] [rotate responses 1-3]

01 Purchase energy efficient equipment regardless of cost
02 Purchase energy efficient equipment if it meets payback or return on investment criteria
03 Purchase standard efficiency equipment that meets code
04 Or something else [SPECIFY]
88 Don’t know
99 Refused

Q5 Prior to your <MEASURE> project in <YEAR>, had you participated in the Smart $aver program before?

01 Yes
02 No
88 Don’t know

BG4a [IF BG3=1 AND Q5=1] Did your experiences with Duke Energy programs or discussions with Duke Energy staff cause you to change your purchasing policies or guidelines for energy efficient equipment?

01 Yes [SPECIFY]
02 No
88 Don’t know
99 Refused

Q12 Now I would like to ask a few questions about your energy savings calculations and the program application process. Did you use the calculators provided by Duke Energy, or did you calculate energy savings using your own methods? (Select all that apply)

01 Duke's calculators
02 Own methods
03 Other [SPECIFY]
04 Contractor / Vendor calculated
88 Don't know

Q12a [ASK IF Q12 = 4] How did the contractor/vendor calculate the energy savings? (Select all that apply)

01 Calculators provided by Duke Energy
02 Own methods
03 Other [SPECIFY]
88 Don't know

Q8 Using a scale of 0 to 10, where 0 is "very dissatisfied" and 10 is "very satisfied", how satisfied are you with the process to fill out and submit your application?

__ [RECORD RESPONSE]
77 Does not apply
88 Don't know
99 Refused

Q9 Using the same scale of 0 to 10, where 0 is "very dissatisfied" and 10 is "very satisfied", how satisfied are you with the time it took your staff to submit the application and necessary paperwork?

__ [RECORD RESPONSE]
77 Does not apply
88 Don't know
99 Refused

Q10 Using the same scale [OPTIONAL: "of 0 to 10, where 0 is "very dissatisfied" and 10 is "very satisfied"], how satisfied are you with Duke Energy's processing and preapproval of your application?

__ [RECORD RESPONSE]
88 Don't know
99 Refused

Q11 dropped mid-field because survey length was too long

Q11 [ASK IF Q8=0,1,2,3 OR Q9=0,1,2,3 OR Q10=0,1,2,3] What could the program have done differently to make the application process easier?

[RECORD VERBATIM]

Q13 dropped mid-field because survey length was too long

Q13 After submitting your initial application for preapproval, did you receive any requests for additional information while Duke Energy was processing your application?

01 Yes
02 No
88 Don't know

Q13a dropped mid-field because survey length was too long

Q13a [ASK IF Q13=1] What additional information was requested? Was it…(READ LIST)

[SELECT ALL THAT APPLY]

01 Information about your building
02 Details about the equipment installed
03 Information about prior equipment replaced
04 Your business schedule
05 Anything else requested [SPECIFY]
88 Don't know

Q25 Are you aware Duke Energy has an online application portal?

01 Yes
02 No
88 Don't know

Q17 [SKIP IF NCEDA = 1 OR NC = 0] Did you receive energy design assistance from Duke Energy for your new construction project?

01 Yes
02 No
88 Don't know

Q19 [ASK Q17=1 OR IF NCEDA = 1] Using a scale of 0 to 10, where 0 is "very dissatisfied" and 10 is "very satisfied", how satisfied are you with the energy design assistance you received through the Smart $aver program as part of your new construction project?

__ [RECORD RESPONSE]
88 Don't know
99 Refused

Q20 [ASK IF NC=1] What was most helpful about the energy design assistance you received?

[RECORD VERBATIM]

Q21 [ASK IF NC=1] Do you have any suggestions for improving the energy design assistance?

[RECORD VERBATIM]

Equipment Questions

[IF NC=1 SKIP TO NEXT SECTION]

E1 Was the high efficiency <MEASURE> installed as part of a new construction or major renovation project? (SELECT ONE)

01 Yes [SKIP TO NEXT SECTION]
02 No
88 Don't know
99 Refused

E2 Did the high efficiency <MEASURE> you installed replace any existing <MEASURE> or was it a new type of equipment that you did not have before? (select one)

01 Replaced existing equipment
02 New equipment [SKIP TO NEXT SECTION]
88 Don't know [SKIP TO NEXT SECTION]
99 Refused [SKIP TO NEXT SECTION]

E3 About how many years old was your existing <MEASURE> equipment?

____ Years
888 Don't know

E4 What condition was your existing <MEASURE> unit when you decided to purchase a new one? (Read list)

01 Operating with no performance issues
02 Operating but in need of repair
03 No longer operating (broken, did not work)
88 Don't know
99 Refused

E5 [IF E4=1 or 2] Why did you decide to replace your old equipment?

[RECORD VERBATIM RESPONSE]

Background

BG1 Did you work with anyone from Duke Energy or the Smart $aver program prior to submitting your application for preapproval?

01 Yes
02 No
88 Don't know

BG1a [ASK IF BG1=1] How did the Duke Energy program staff assist you with the project? Did they… [READ LIST] [SELECT ALL THAT APPLY]

01 Connect you with a trade ally
02 Identify potential projects to pursue
03 Identify specific equipment efficiency to install
04 Estimate project financial impacts, including incentives, energy bill savings, or payback
05 Respond to questions about participating in the program, including equipment eligibility or the application process
06 Assist you with anything else [SPECIFY]
88 [DO NOT READ] Don't know
99 [DO NOT READ] Refused

BG2 [ASK IF Q1=01,02] Using a scale of 0 to 10, where 0 is "very dissatisfied" and 10 is "very satisfied", how satisfied are you with your <IF Q1=01 SHOW "Account Representative"> <IF Q1=02 SHOW: "Business Energy Advisor">'s involvement in the <MEASURE> project?

__ [RECORD RESPONSE]
88 Don't know
99 Refused

BG2a [ASK IF BG2=0,1,2,3,4] What could the <IF Q1=01 SHOW "Account Representative"> <IF Q1=02 SHOW: "Business Energy Advisor"> have done differently?

[RECORD VERBATIM]

Net-to-Gross

MeasCHK [ASK IF MULTCHK = 2 ELSE SKIP TO FR0]
[INTERVIEWER QUESTION: Is this case's MEASURE variable the same as a previous case's MEASURE variable?]

1 Yes; Duplicate measure
2 No, New measure [SKIP TO Q4_MULT]

DecisionCHK [ASK IF MeasCHK=1]
Now, thinking about the <MEASURE> project at <ADDRESS>, was the decision making process **the same or different** from the previous <MEASURE> project we discussed?

1 Same decision making process [SKIP TO INT99]
2 Different decision making process

Q4_MULT [ASK IF MULTCHK=02] Did you work with a contractor or vendor to implement the <MEASURE> project or did you work with internal staff at your company?

01	Worked with a contractor / vendor	[CONTRACTOR = 1]
02	Internal staff at company	[CONTRACTOR = 0]
03	Both the contractor and internal staff	[CONTRACTOR = 1]
88	Don't know	[CONTRACTOR = 0]

FR0 According to our records, you received an incentive of $<INCENTIVE> from Duke Energy to complete your <MEASURE> project.

[IF NCEDA=1 OR Q1=1,2 OR BG1A=1,2,3,4,5,6 OR FASTTRACK=1 OR Q12=1 SHOW "As part of that project…"]
[IF NCEDA=1: you received energy design assistance]
[IF Q1=02: you worked with a Business Energy Advisor]
[IF Q1=01: you worked with an Account Executive]
[IF BG1A=01: program staff connected you with a trade ally]
[IF BG1A=02: program staff helped you identify potential projects to pursue]
[IF BG1A=03: program staff helped you identify specific equipment efficiency to install]
[IF BG1A=04: program staff helped you estimate project financial impacts, including incentives, energy bill savings, or payback]
[IF BG1A=05: program staff responded to questions about participating in the program, including equipment eligibility or the application process]
[IF BG1A=06: program staff helped you by… (other specify:) <BG1Ao response>]
[IF FastTrack=1: your application was reviewed under the fast track option]
[IF Q12=1 or Q12a = 1: you or your contractor used savings calculators provided by Duke Energy]

01 Continue

FN1 [IF Q5=02 OR 88] Did you learn about this assistance from Duke Energy for this project BEFORE or AFTER you selected the specific type of <MEASURE> equipment for which you received the incentive?

01 Before
02 After
88 Don't know
99 Refused

FN2 [IF FN1=02] Just to confirm, you found out about the assistance available through Duke Energy's Smart $aver program after you had already decided to implement the energy efficiency <MEASURE> project?

01 Yes, after
02 No, before
03 Other [SPECIFY]
88 Don't know
99 Refused

[IF NC=1, SKIP TO FR1NC]

FR1 Which of the following is most likely what you would have done for your <MEASURE> project if you had not received this assistance from Duke Energy? (Read list)

01 Canceled or postponed the project at least one year
02 Reduced the size, scope, or efficiency of the project
03 Done exactly the same project
04 Done nothing
88 [DO NOT READ] Don’t know
99 [DO NOT READ] Refused

FR2 [ASK IF FR1=2] By how much would you have reduced the size, scope, or efficiency of the project? Would you say a small amount, a moderate amount, or a large amount?

01 Small amount
02 Moderate amount
03 Large amount
88 Don’t know

[IF NC=0, SKIP TO FR3]

FR1NC Which of the following is most likely what you would have installed if you had not received this assistance from Duke Energy? (Read list)

01 Installed all standard efficiency or code equipment
02 Installed some energy-efficient equipment, but not as much as you did through the program
03 Installed the same efficient equipment as you did with the program’s assistance
88 [DO NOT READ] Don’t know

FR2NC [IF FR1NC=2] Without the Duke Energy design assistance and incentive, would the energy-using equipment in your building have been closer to standard efficiency or code, closer to what you ended up installing, or somewhere in between?

01 Closer to standard efficiency or code
02 Closer to what you ended up installing
03 Somewhere in between
88 [DO NOT READ] Don’t know

FR3 [ASK IF FR1=3 OR FR1NC=3] Would your business have paid the additional $<INCENTIVE> to complete the project on your own?

01 Yes
02 No
88 Don’t know

CC2 [IF FR3=1] Where would the additional $<INCENTIVE> have come from if you had not received the incentive from Duke Energy? Would the funds have come from another project, capital budget, another source or were the funds already allocated? [DO NOT READ]

01 Had the money allocated from the start
02 Transferred money from another project
03 Other [SPECIFY – what source]
04 Would have come out of our operating capital budget
88 Don’t know
99 Refused

CC3 [IF FR1=2, 3, 88, 99] In your own words, how would your project have been different without the program’s assistance?

[RECORD VERBATIM]

FR4 On a scale of 0 to 10, with 0 being “not at all influential” and 10 being “extremely influential”, how would you rate the influence of the following factors on your decision to complete the <MEASURE> project? [RANDOMIZE ORDER]

FR4a The incentive provided by Duke Energy
FR4b [IF Q1=02] The support provided by your Duke Energy business energy advisor
FR4c Smart $aver marketing materials or webinars
FR4d [IF Q5<>2] Previous experience with the Smart $aver program
FR4e [IF CONTRACTOR=1] The recommendation from your contractor or vendor
FR4f [IF NC=0] The technical support provided by Duke Energy engineer staff
FR4g [IF Q1=01] The support provided by your Duke Energy account manager
FR4h [IF NC = 1] The energy design assistance provided for your new construction project
FR4i [IF NC = 1] The bundle options provided for your new construction project
FR4j [IF NC=0 and (Q12 = 1 or Q12a = 1)] The calculators provided by Duke Energy

__ Record influence [0-10]
77 Not applicable
88 Don’t know
99 Refused

FR4O1 Were there any other interactions you had with Duke Energy or Smart $aver program representatives that influenced your decision to complete the energy efficient <MEASURE> project?

01 Yes [SPECIFY]
02 No
88 Don’t know
99 Refused

FR4O2 [ASK IF FR4O1=01] On a scale of 0 to 10, with 0 being “not at all influential” and 10 being “extremely influential”, how would you rate the influence of that interaction (if needed: <FR4O1 aspect>) on your decision to complete the <MEASURE> project?

__	Record influence [0-10]
88	Don’t know
99	Refused

CC4 [If FR3 = 1 and any in FR4 > 7 SHOW: "Earlier in the interview you said you would have done the exact same project. But you also said the <FR4 category> was influential in your decision to complete the <MEASURE> project.]

[If FR1 = 1, 4 and not any of FR4a through j = 3,4,5,6,7,8,9,10 SHOW: Earlier in the interview you said you would have cancelled or postponed the project. But you also said none of your contact with the program was influential in your decision to complete the <MEASURE> project.]

In your own words, please describe what impact, if any, all the assistance you received from Duke Energy had on your decision to install the amount of energy-efficient <MEASURE> equipment at the time you did?

[RECORD VERBATIM RESPONSE]

Spillover

[IF MULTCHK=02 SKIP TO V1]

SP1 Since your participation in the Smart $aver program, did you complete any additional energy efficiency projects at this facility or another facility served by Duke Energy that did not receive incentives through a Duke Energy program?

01	Yes	
02	No	SKIP TO NEXT SECTION
88	Don’t know	SKIP TO NEXT SECTION
99	Refused	SKIP TO NEXT SECTION

SP2 What energy efficient products, equipment, or improvements did you install or implement? (Select all that apply)

01 Lighting
02 Heating / Cooling
03 Hot Water
04 Appliances / Office
05 Insulation
06 Motor / Variable Frequency drives (VFDs)
07 Compressed Air
08 Refrigeration
09 Other1 [SPECIFY]
10 Other2 [SPECIFY]
88 Don't know SKIP TO NEXT SECTION

[START ROSTER; ASK SP3-SP4 FOR EACH MENTIONED IN SP2]

SP3 Can you describe the <SP2> equipment? For example: What was the brand or model? Efficiency rating? Dimensions? or Capacity?

[RECORD VERBATIM]

SP4 How many <SP2> units did you install?

____ [RECORD NUMBER OF UNITS (0-800]
888 Don't know
999 Refused

[END ROSTER]

SP5 On a scale of 0 to 10, with 0 meaning "not at all influential" and 10 meaning "extremely influential", how influential was your participation in the Smart $aver program on your decision to complete the additional energy efficiency project(s)?

__ [RECORD RESPONSE]

Fast Track Feedback

Section dropped mid-field because survey length was too long

FT10 [ASK IF FastTrack=0] Duke Energy offers a fast track option where customers can pay a fee to accelerate the review of a project from 4 to 6 weeks to about one week. Before today, were you aware that this is now offered?

01 Yes
02 No
88 Don't know

FT13 [IF FastTrack = 0] If you have a project under a tight timeline, would you be willing to pay the $550 fee for an accelerated review of your Smart $aver application?

01 Yes
02 No (specify: Why not?)
88 Don't know

FT15 Using a scale of 0 to 10, where 0 is "not at all valuable" and 10 is "very valuable", how valuable <if FastTrack = 1 show "was", else "is"> the fast track application option?

__ [RECORD RESPONSE]
88 Don't know
99 Refused

Customer Satisfaction

SAT11 Considering all aspects of the program, using a scale of 0 to 10, where 0 is "very dissatisfied" and 10 is "very satisfied", how would you rate your overall satisfaction with the Smart $aver Custom Incentive program?

__ Record value [0-10]
77 Not applicable
88 Don't know
99 Refused

SAT12 Why do you say that?

[RECORD VERBATIM]

SAT13 dropped mid-field because survey length was too long
SAT13 Using a scale of 0 to 10, where 0 is "very dissatisfied" and 10 is "very satisfied", how would you rate your overall satisfaction with Duke Energy?

__ Record value [0-10]
77 Not applicable
88 Don't know
99 Refused

SAT14 dropped mid-field because survey length was too long
SAT14 [ASK IF SAT13=0,1,2,3] Why do you say that?

[RECORD VERBATIM]

SAT5 Using a scale of 0 to 10, where 0 is "not at all valuable" and 10 is "very valuable", how valuable are the following Smart $aver program components to your organization? [RANDOMIZE LIST]

FOR SAT5A through SAT5F

__ Record value [0-10]
77 Not applicable
88 Don't know
99 Refused

SAT5a Materials describing the program requirements and benefits
SAT5b Communication from Smart $aver program representatives
SAT5c Technical assistance from Duke Energy or Smart $aver program representatives
SAT5d [IF CONTRACTOR=1] Technical assistance from your contractor or vendor
SAT5e The incentive amount compared to your total project cost
SAT5f The worksheet or calculation tools that Duke Energy provides

SAT1 What would you change about the Smart $aver Custom Incentive Program, if anything? (DO NOT READ, Select all that apply)

01 Would not change anything
02 Remove pre-approval requirement
03 Improve initial processing time
04 Increase rebate amount
05 Cover more types of equipment (specify: which types?)
06 Simplify application process (specify: what would you simplify?)
07 Other [SPECIFY]
88 Don't know

SAT2 [ASK IF SAT1=3] What would you consider to be a reasonable amount of time for processing the initial application?

01 [RECORD VERBATIM]

SAT3 [ASK IF SAT1=4] What percent of the project's cost do you think would be reasonable for the Smart $aver program to pay?

___ [RECORD PERCENT(0-100)]
888 Don't know
999 Refused

SAT8 Have you recommended the Smart $aver Custom Incentive Program to anyone?

01 Yes SKIP TO SAT10
02 No
88 Don't know

SAT9 If provided the opportunity, would you recommend the Smart $aver Custom Incentive Program to anyone?

01 Yes
02 No
88 Don't know

SAT10 dropped mid-field because survey length was too long
SAT10 Would you consider participating in the Smart $aver Custom Incentive Program again in the future?

01 Yes
02 No (specify: Why not?)
88 Don't know (specify: Please explain)

COVID

CV1 dropped mid-field because survey length was too long
CV1 Overall, how has your organization been affected in 2020 by the COVID-19 pandemic? Has it been a…[READ LIST]

01 Large negative effect
02 Moderate negative effect
03 Little or no effect
04 Moderate positive effect
05 Large positive effect
77 Organization is closed or closing
88 [DO NOT READ] Don't know
99 [DO NOT READ] Refused
55 [DO NOT READ] Skip to next section

CV2 dropped mid-field because survey length was too long
CV2 Please describe how your business operations changed in 2020 as a result of the pandemic.

01 [RECORD VERBATIM]
77 No change

CV3 dropped mid-field because survey length was too long

CV3 [if CV2 <> 77] In your opinion, when do you think your business will return to its usual level of operations? [READ IF NEEDED]

01 By the end of December 2020
02 By the end of March 2021
03 By the end of June 2021
04 By the end of September 2021
05 Longer than September 2021
06 I do not believe this business will return to its previous usual level of operations
07 There has been little or no effect on this business's usual level of operations
88 Don't know
99 Refused

CV4 dropped mid-field because survey length was too long

CV4 What impact has COVID-19 had on your purchasing decisions?

01 [RECORD VERBATIM]
77 No impact

In this next section, we ask a few question about how the pandemic has impacted your project planning.

CV6 Prior to the COVID-19 pandemic, did your organization have any plans to upgrade or replace any energy using equipment in 2020?

01 Yes
02 No
88 Don't know
99 Refused

CV7 [IF CV6=1] How did your plans change?

01 No changes to planned projects
02 Delayed planned projects
03 Cancelled planned projects
04 Changed the project scope or specifications [SPECIFY]
05 Other [SPECIFY]
88 Don't know
99 Refused

CV8 Thinking about the <MEASURE> project you did in <YEAR>, if you would have to make a decision today about doing that project, what decision would you make?

01 No changes to planned projects
02 Delayed planned projects
03 Cancelled planned projects
04 Changed the project scope or specifications [SPECIFY]
05 Other [SPECIFY]
88 Don't know
99 Refused

Customer Characteristics

C1 What is the main business activity at <ADDRESS> in <CITY>?

01 Office/Professional
02 Warehouse or distribution center
03 Food sales
04 Food service
05 Retail (other than mall)
06 Mercantile (enclosed or strip malls)
07 Education
08 Religious worship
09 Public assembly
10 Health care
11 Lodging
12 Public order and safety
13 Industrial/manufacturing [SPECIFY]
14 Agricultural [SPECIFY]
15 Vacant (majority of floor space is unused)
16 Other [SPECIFY]
88 Don't know

C2 Are your company's budget decisions made locally, regionally, nationally, worldwide, or something else?

01 Locally
02 Regionally
03 Nationally
04 Worldwide
05 Other [SPECIFY]
88 Don't know

C3 When creating budgets and financial plans, how far into the future does your company plan?

00 Less than 1 year
01 One year
02 Two years
03 Three years
04 Four years
05 Five years
06 More than 5 years
07 Other [SPECIFY]
88 Don’t know

C4 Does your business’ production schedule or business cycle affect when you can implement energy efficiency projects?

[PROBE: “A business cycle refers to time periods when your business’ activities might be significantly different. For example, a school might have to wait until summer to implement projects, while a manufacturing facility might wait until production is lower.”]

01 Yes (Please describe that schedule or cycle)
02 No
03 Don’t know

V1 [ASK IF FR4E = 7, 8, 9, or 10 ELSE SKIP TO C7] Earlier, you indicated that the recommendation from a contractor, vendor, or supplier influenced your decision to implement the <MEASURE> project.

Could you give me the contact information of the vendor you worked through?

[IF "Don't know": Our records show that you worked with:
Vendor Company: <VEND_COMPANY>
Vendor Contact: <VEND_CONTACT>]]

01 Yes
02 No [SKIP TO C7]

V1_ <Programming note: show Contractor, Contractor_Name, and Contractor_phone from the sample as a reference.>

[RECORD VERBATIM]

V1_COMPANY	Vendor business name
V1_CITY	Vendor city
V1_CONTACT	Vendor contact name
V1_PHONE	Vendor contact phone number
V1_EMAIL	Vendor email

V2 Which of the following assistance did your contractor or vendor provide? (Select all that apply)

Did the contractor assist with…

01 The design phase of the project
02 The selection of equipment to install
03 The completion of the rebate application
04 Any other part of the project (specify)
88 Don't know
99 Refused

[SKIP TO INT99 IF MULTCHK=2]

C7 Would you like someone from Duke Energy to contact you directly to provide more information or answer any questions you might have about their energy efficiency programs?

[PROBE: We will not share your responses to this survey, only pass along your contact information.]

01 Yes
02 No [SKIP TO C9]

C8_phone To confirm, what's the best number to reach you at?

[RECORD VERBATIM]

C8_name And who should they get in touch with? [Can you spell your name?]

[RECORD VERBATIM]

C9 Do you have any comments you would like to share with Duke Energy?

01 Yes [SPECIFY]
02 No

INT99 [SKIP IF MULTCHK=02] [IF MULTFLAG=1 SHOW: “[INTERVIEWER, If R has more surveys to complete read: Now I’d like to ask you a smaller selection of questions about another location we have on record for your firm.” OTHERWISE READ:

That completes the survey, thank you very much for your time.

CP Completed survey

INT98 [ASK IF MULTCHK=02] [INTERVIEWER, If R has more surveys to complete read: Now I’d like to ask you a smaller selection of questions about another location we have on record for your firm.” OTHERWISE READ:

That completes the survey, thank you very much for your time.

CM Completed survey

D.2 Trade Ally Survey

Duke Energy Midwest Smart $aver Custom Incentive Program
Participating Trade Ally Survey

Sample Variables

CASEID Contractor case identification number

VEND_COMPANY Contractor company name
VEND_CONTACT Contractor contact name
VEND_CITY Contractor city

PHONE_NUM Contractor contact phone number
ALTPHONE_NUM

VEND_EMAIL
Alt_email

VEND_KWH
VEND_PROG
NUMB_PROJECT

IV Flag if the contractor is an influential vendor
0 Not an influential vendor
1 Influential vendor

MEASURE Summary of project measure implemented
1 lighting
2 process equipment
3 compressed air
4 HVAC
5 food service equipment
6 new construction

MEASURETYPE Detailed description of sampled project, including specific measures installed

DESCRIPT01 to 04

MEASDesc Summary description of sampled measure category

CUST_CASEID
CUST_COMPANY
CUST_CONTACT

CUST_PHONE
CUST_EMAIL
CUST_ADDRESS
CUST_CITY
CUST_STATE
CUST_ZIP
YEAR

INSTALLDATE

NC Sampled project is a new construction project
1 New construction
2 Not new construction

Custom_flag
0 Specific equipment
1 Custom project

PART_Q17

Introduction

INT01 Hello, my name is ________, calling on behalf of Duke Energy. We are talking with design professionals and contractors participating in Duke Energy's Smart $aver energy efficiency programs for businesses. I'm not selling anything; I'd just like to ask you about your firm's recent experiences with this program.

[IF CONTACT NAME AVAILABLE] May I speak with <**VEND_CONTACT**>?

[IF CONTACT NAME NOT AVAILABLE] May I speak with the person who would be most knowledgeable about your firm's involvement with Duke Energy's programs?

01 Yes
02 No, R not knowledgeable [OTHER_R]

FAQ (**Why are you conducting this study**: Studies like this will help Duke Energy to continuously improve their business energy efficiency programs).

(**Timing:** This survey should take about 20 minutes. IF NOT A GOOD TIME, SET UP CALL BACK APPOINTMENT OR OFFER TO LET THEM CALL US BACK AT 1-800-454-5070.)

(**Sales concern**: This is not a sales call; we would simply like to learn about your organization's experiences with Duke Energy's energy efficiency programs. Your responses will be kept confidential.)

MULTCHK [ASK IF MULTFLAG=1] [INTERVIEWER QUESTION: Is this the first case of a multiple?

01 Yes, first case
02 No, subsequent case [SKIP TO C_IV_SKIP]

PREAMBLE I'm with Tetra Tech, an independent research firm. We have been hired by Duke Energy to evaluate their programs. I would like to assure you that your responses will be kept confidential and your name will not be revealed to anyone. For quality and training purposes, this call will be recorded.

01 Continue

Influential Vendor Screener

C_IV_SKIP [IF IV = 0 SKIP TO NEXT SECTION, C_MULT_SKIP1]

INF1 [ASK IF NC=0] Our records show that your firm specified, sold, or installed a <**MEASURE**> project for <**CUST_COMPANY**> at <**CUST_ADDRESS**> in **<CUST_CITY>** around <**INSTALLDATE**> that qualified for a Duke Energy incentive. This project would have included <**MEASDESC**>. Do you recall this project? (Select one)

01 Yes, does recall [SKIP TO INF4]
02 No, does not recall
88 Don't know
99 Refused

INF1NC [ASK IF NC=1] Our records show that your firm was involved with designing or specifying a new construction project for <**CUST_COMPANY**> at <**CUST_ADDRESS**> in **<CUST_CITY>** around <**INSTALLDATE**> that qualified for a Duke Energy incentive. This project would have included <**MEASURE_TYPE**>. Do you recall this project? (Select one)

01 Yes, does recall [SKIP TO INF4]
02 No, does not recall
88 Don't know
99 Refused

OTHER_R1 Is there someone else at your firm who would be more familiar with this project? (Select one)

01	Yes	[RECORD CONTACT INFO FOR CALL NOTES]
02	No	[SKIP TO C1]
88	Don't know	[SKIP TO C1]
99	Refused	[THANK AND TERMINATE 91]

AVAILABLE_R1 May I please speak with that person? (Select one)

01	Yes, currently available	[SKIP TO INT01]
02	Yes, but R is not currently available	[INT15 – CALLBACK]
03	No	[SKIP TO C1]
88	Don’t know	[INT15 – CALLBACK]
99	Refused	[THANK AND TERMINATE 91]

INF4 <**CUST_COMPANY**> indicated that you were influential in their decision to implement the <**MEASURE**> project through the program. Just to confirm, were you involved in the decision-making process at the design stage when the <**MEASURE**> project was specified and agreed upon for this facility? (Select one)

01	Yes	[SKIP TO C_MULT_SKIP2]
02	No	[SKIP TO OTHER_R1]
88	Don't know	[SKIP TO OTHER_R1]

Non-Influential Vendor Screener

C_MULT_SKIP1 [IF MULTCHK=2 SKIP SECTION, C_MULT_SKIP2]

C1 [ASK IF NC=0] Our records show that your firm specified, sold, or installed <**MEASURE**> equipment that qualified for incentives through Duke Energy’s Smart $aver Custom program.

Is that correct? (Select one)

01	Yes	
02	No	[THANK AND TERMINATE 82]
88	Don’t know	[THANK AND TERMINATE 81]
99	Refused	[THANK AND TERMINATE 91]

C1NC [ASK IF NC=1] Our records show that your firm was involved in designing or specifying new construction projects that qualified for incentives through Duke Energy's Smart $aver Custom program.

Is that correct? (Select one)

01	Yes	
02	No	[THANK AND TERMINATE 82]
88	Don't know	[THANK AND TERMINATE 81]
99	Refused	[THANK AND TERMINATE 91]

C2 Are you the person who would be most knowledgeable about your firm's <**MEASURE**> projects completed through Duke Energy's Smart $aver Custom program? (Select one)

01	Yes	[SKIP TO NEXT SECTION]
02	No	
88	Don't know	

OTHER_R2 Is there someone else at your firm who would be more familiar with your firm's involvement in <**MEASURE**> projects completed through Duke Energy's Smart $aver Custom program? (Select one)

01	Yes	[RECORD CONTACT INFO FOR CALL NOTES]
02	No	[THANK AND TERMINATE 81]
88	Don't know	[THANK AND TERMINATE 81]
99	Refused	[THANK AND TERMINATE 91]

AVAILABLER2 May I please speak with that person? (Select one)

01	Yes, currently available	[SKIP TO INT01]
02	Yes, but R is not currently available	[INT15 – CALLBACK]
03	No	[THANK AND TERMINATE 91]
88	Don't know	[THANK AND TERMINATE 81]
99	Refused	[THANK AND TERMINATE 91]

Free-Ridership (asked only of Influential Vendors)

C_MULT_SKIP2 [IF MULTCHK=2 AND INF4<>1 SKIP TO THANK AND TERMINATE 86]

COMPANYCHK [ASK IF MULTCHK=02 ELSE SKIP TO FR2] [INTERVIEWER QUESTION: Is this case's <CUST_COMPANY> variable the same as a previous case's <CUST_COMPANY> variable?]

01	Yes, Duplicate company	[SKIP TO DECISIONCHK]
02	No, New company	[SKIP TO FR2]

DECISIONCHK [ASK IF COMPANYCHK=01] Now thinking about the project at <CUST_ADDRESS> in < CUST_CITY>, were the factors that influenced your recommendations to <CUST_COMPANY> the same or different from the previous project we just discussed?

01	Same decision making process	[SKIP TO INT99]
02	Different decision making process	

FR2 [IF INF4 <> 1 SKIP TO NEXT SECTION, P1] Now on a 1 to 5 scale, where 1 is "not at all influential" and 5 is "extremely influential", how would you rate the influence of the following factors in your recommendations to <**CUST_COMPANY**> for this project? (Select one for each) [RANDOMIZE QUESTIONS]

For FR2A through FR2E:

01 Not at all influential
02
03
04
05 Extremely influential
77 Not applicable
88 Don't know
99 Refused

FR2a the program incentive provided by Duke Energy?
FR2b your interactions with Duke Energy program staff, including technical assistance?
FR2c the support from your Duke Energy trade ally outreach representative?
FR2d the program marketing, training, or informational materials?
FR2e your firm's past involvement in Duke Energy's programs?
FR2f the energy design assistance provided by Duke Energy?

FR4 Was the program incentive incorporated into your pricing estimate or proposal to <**CUST_COMPANY**> for the project? (Select one)

01 Yes
02 No
88 Don't know
99 Refused

Program Influence on Sales of Qualifying Equipment (asked for Nonparticipant Spillover)

C_MULT_SKIP3 [SKIP TO INT99 IF MULTCHK=02]

P1 [IF INF4 = 1 SHOW: **"**Next,"] I'd like you to think about ALL of the program-eligible <**MEASURE_TYPE**> projects you sold or installed for Duke Energy's nonresidential customers over the past 12 months. I'd like to focus on projects where you installed the same types of <**MEASURE_TYPE**> equipment that you installed through the Smart $aver Custom program.

Over the past 12 months, approximately how many of these <**MEASURE_TYPE**> projects have you sold or installed within the Duke Energy service territory? (Enter whole number)

___ [ENTER NUMBER OF PROJECTS 0-1000]
0 None [SKIP TO S1]
8888 Don't know
9999 Refused

P2 Thinking about all of these <**MEASURE_TYPE**> sales, approximately what percentage do they make up of your total dollar sales of high-efficiency products in Duke Energy's territory? (Enter whole number)

[Interviewer note: We are referring to projects where you installed the same types of <**MEASURE_TYPE**> equipment that you installed through the Smart $aver Custom program.]

___ [ENTER PERCENTAGE 0-100]
888 Don't know
999 Refused

P3 Now thinking about those sales, approximately what percentage of these <**MEASURE_TYPE**> sales or installations in Duke Energy's service territory involved an incentive through Duke Energy's program? (Enter whole number)

[Interviewer note: We are referring to projects where you installed the same types of <**MEASURE_TYPE**> equipment that you installed through the Smart $aver Custom program.]

___ [ENTER PERCENTAGE 0-100]
888 Don't know
999 Refused

P10 What percentage of these <**MEASURE_TYPE**> sales or installations did you offer or talk about an incentive through Duke Energy's program? (Enter whole number)

___ [ENTER PERCENTAGE 0-100]
888 Don't know
999 Refused

P4 If the incentives or other assistance from Duke Energy's program were NOT available, do you think your company's overall sales of these types of <**MEASURE_TYPE**> equipment would have been about the same, lower, or higher than what you sold in the past 12 months? (Select one)

01 About the same
02 Lower
03 Higher
88 Don't know
99 Refused

P5 [ASK IF P4 = 2] By what percentage do you estimate your company's sales of these types of <**MEASURE_TYPE**> equipment would have been lower if Duke Energy's program was NOT available? (Enter whole number)

[IF NEEDED: Your best estimate is okay]

___ [ENTER PERCENTAGE 1-100]
888 Don't know
999 Refused

Nonparticipant Spillover

NS1 [ASK IF P3 < 100 AND P3 <> 888, 999 ELSE SKIP TO S1] Earlier you indicated that some of your <**MEASURE_TYPE**> sales did not involve an incentive through Duke Energy's program. Some qualifying projects may not receive incentives for one reason or another.

What are the main reasons why your firm or the customer did not pursue or receive an incentive for this program-eligible equipment?

[RECORD RESPONSE VERBATIM]
88 Don't know
99 Refused

NS2 On a scale of 1 to 5, where 1 is "not at all influential" and 5 is "extremely influential", how influential was Duke Energy Smart $aver Custom program on your sales of energy saving <**MEASURE_TYPE**> projects that did NOT receive an incentive? (Select one)

01 Not at all influential
02
03
04
05 Extremely influential
88 Don't know
99 Refused

Program Satisfaction

S1 Next, I'd like to ask you just a few questions about your satisfaction with Duke Energy's Smart $aver Custom Incentives program.

Using a scale of 1 to 5, where 1 is "not at all satisfied" and 5 is "very satisfied", how would you rate your satisfaction with Duke Energy's Smart $aver Custom Incentives program overall? (Select one)

01 Not at all satisfied
02
03
04
05 Very satisfied
88 Don't know
99 Refused

S2 [ASK IF S1 = 1 OR 2] Why do you say that?

[RECORD RESPONSE VERBATIM]

S3 On the same scale of 1 to 5, where 1 is "not at all satisfied" and 5 is "very satisfied", how would you rate your satisfaction with… (Select one for each) [RANDOMIZE QUESTIONS]

For S3A through S3F:
01 Not at all satisfied
02
03
04
05 Very satisfied
77 Not applicable
88 Don't know
99 Refused

S3a. your interactions with Duke Energy program staff?
S3b. the technical support provided by the program?
S3c. the type or variety of projects or equipment eligible for the program?
S3d. the incentives available through the program?
S3e. the amount of paperwork required by the program?
S3f. the time it takes to get an application approved?

S5 How easy or difficult is it to understand the differences in equipment eligibility between the custom and prescriptive programs? (Select one)

01 Very easy
02 Somewhat easy
03 Neither easy nor difficult
04 Somewhat difficult
05 Very difficult
88 Don't know
99 Refused

S4 Do you have any recommendations for improvements regarding the program design or operations? (Select one)

01 Yes [SPECIFY]
02 No
88 Don't know
99 Refused

COVID

CV1 Overall, how much has your organization been affected in 2020 by the COVID-19 pandemic? Has it been a…[READ LIST]

01 Large negative effect
02 Moderate negative effect
03 Little or no effect
04 Moderate positive effect
05 Large positive effect
77 Organization is closed/closing [SKIP TO E3]
88 [DO NOT READ] Don't know
99 [DO NOT READ] Refused

CV2 Please describe how your business operations changed in 2020 as a result of the pandemic.

[RECORD VERBATIM]
77 No change
88 Don't know
99 Refused

CV3 In your opinion, when do you think your business will return to its usual level of operations? [READ IF NEEDED]

01 By the end of March 2021
02 By the end of June 2021
03 By the end of September 2021
04 Longer than September 2021
05 I do not believe this business will return to its previous usual level of operations
06 There has been little or no effect on this business's usual level of operations
07 Already did
88 Don't know
99 Refused

CV4 What impact, if any, has COVID-19 had on your equipment recommendations?

01 No effect
02 Effect (specify)

Wrap-Up

E1 Just for classification purposes, approximately how many full time and part time staff does your firm employ at your location?

E1a. ___ Full-time [0-750]
E1b. ___ Part-time (includes seasonal employees) [0-750]
888 Don't know

E3 Do you have any additional comments that you would like to share with Duke Energy about their Smart $aver Custom Incentives program?

01 Yes [SPECIFY]
02 No

INT99 [SKIP IF MULTCHK=2] I'd like to thank you for your time with this important study. Have a good day.

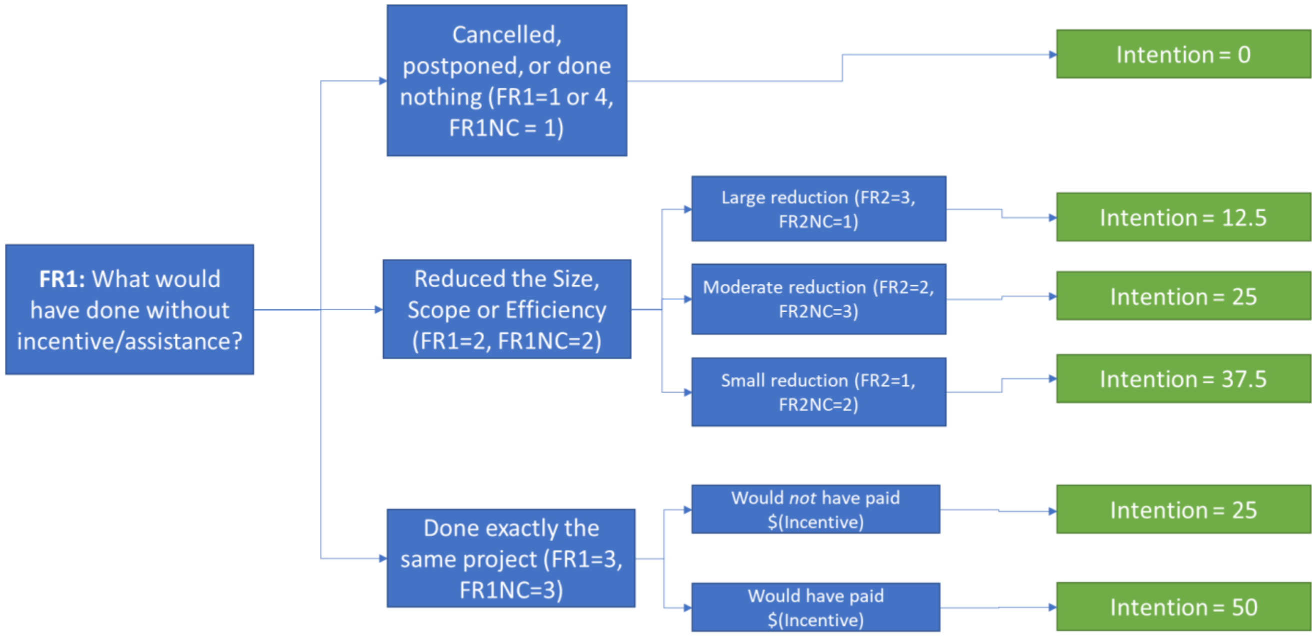
CP Completed

INT98 [ASK IF MULTCHK=2] I'd like to thank you for your time with this important study. Have a good day.

CM Completed

Appendix E Algorithms

E.1 Intention Score



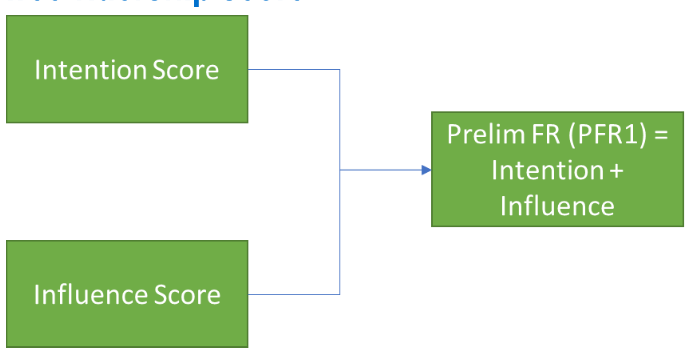
E.2 Influence Score

Max FR4 rating	Influence Score
9-10	0
8	6.25
7	12.5
6	18.75
5	25
4	31.25
3	37.5
2	43.75
0-1	50

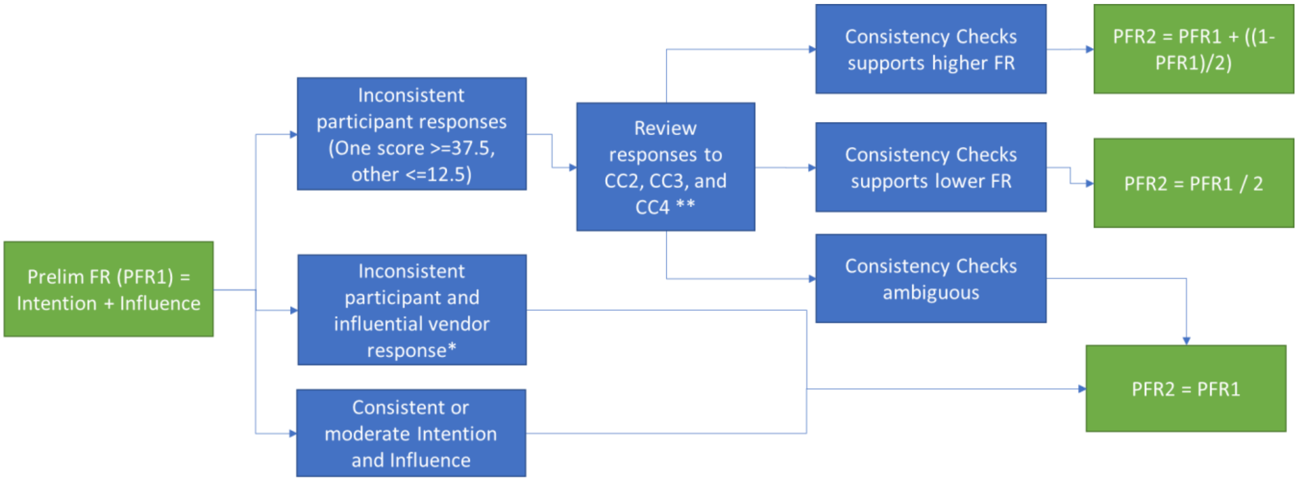
E.3 Vendor Influence Reconciliation

Customer rating of vendor influence	Vendor survey?	Vendor Program Influence Score (max vendor FR2)	Customer Program Influence Score (max customer FR4)	Final Program Influence Score
<=5	No	n/a	0-50	0-50
>=6	Not completed	n/a	12.5	12.5
>=6	Yes	12.5	31.25	12.5
>=6	Yes	25	18.75	18.75

E.4 Preliminary free-ridership score



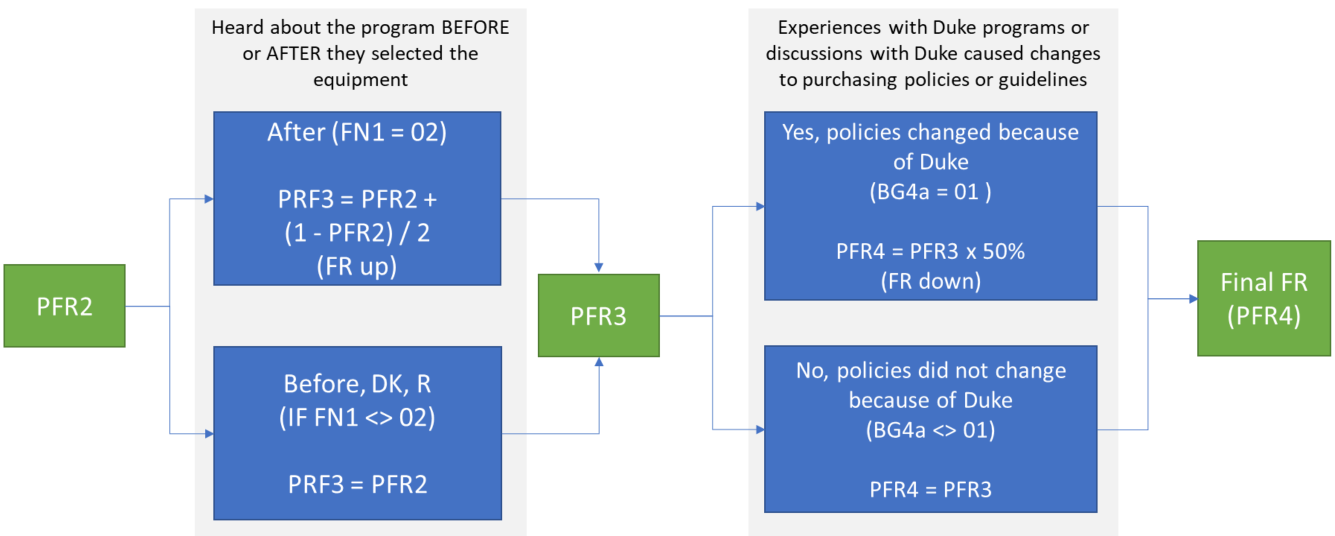
E.5 Consistency check reconciliation



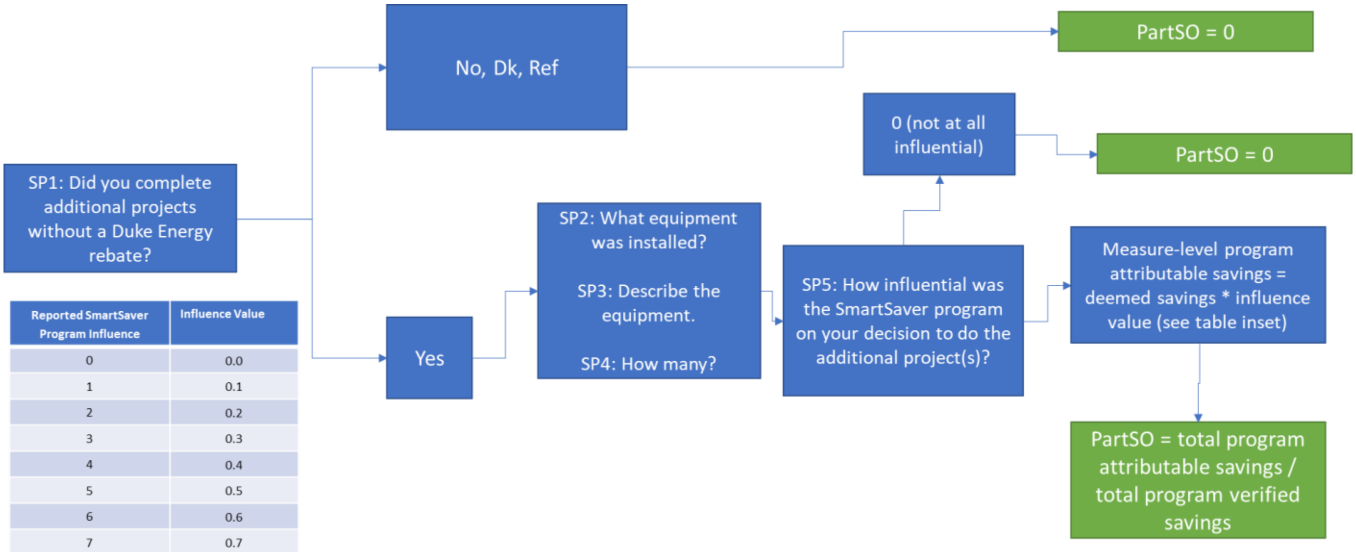
* If inconsistency is due to incorporation of vendor influence, consistency check questions will not be applied since individuals' responses are not inconsistent

** Consistency questions were reviewed (CC2, CC3, CC4) and determined if (1) they were consistent and (2) if it supported either higher or lower FR.

E.6 Free-ridership adjustments



E.7 Participant Spillover



Reported SmartSaver Program Influence	Influence Value
0	0.0
1	0.1
2	0.2
3	0.3
4	0.4
5	0.5
6	0.6
7	0.7
8	0.8
9	0.9
10	1.0
Don't know / Refused	Sector-level measure average

Appendix F Benchmarking Bibliography

Below are the reports reviewed as part of the benchmarking activity.

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2021 Power Manager Evaluation Report

Submitted to Duke Energy Carolinas

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Contents

Tables

Figures

Equations

1 Executive Summary

This report presents the results and key findings of Resource Innovations' impact and process evaluations of the 2021 Power Manager program in the Duke Energy Carolinas service territory for the event season spanning May 1, 2021, through September 2021, referenced throughout the report as the Summer 2021 program.

1.1 Background

Power Manager is a voluntary demand response program that offers incentives to residential customers who allow Duke Energy to reduce the use of their central air conditioner's outdoor compressor and fan during summer days with high energy usage. Through the program, events may be called to help lessen electricity use during times of high demand. Demand response events are called by Duke Energy on hot summer days between May and September and are designed to reduce loads during times with the greatest system-wide energy demands. Participating customers are provided incentives in the form of monthly utility bill credits. During normal shed events, a remote signal is sent to participating load control devices that reduce customers' air conditioner use. During emergency shed operations, all devices are initiated to quickly shed loads and deliver larger demand reductions.

Beginning in late 2019, Duke Energy introduced a new Power Manager offering to DEC customers that enables them to participate in demand response events through their home's qualifying smart thermostat. By enrolling their thermostats in the Smart Thermostat option (also referred to as Bring-Your-Own-Thermostat (BYOT)), customers agree to let Duke Energy make brief, small adjustments to their thermostat during times of peak electric demand. Participating customers are notified prior to events and provided incentives in the form of pre-paid gift cards. Events called under the BYOT option may vary by duration of the event period, the degree setpoint adjustment implemented during the event period, as well as the duration setpoint adjustment and duration of the pre-cooling period. During the pre-cooling period, the setpoints of participating thermostats are automatically adjusted downward to lower the interior temperature of the home during the period immediately prior to the event in order to help maintain comfort levels during the event period.

1.2 Impact Evaluation Key Findings

The impact analyses – for both the traditional DLC offering and the new BYOT offering – were performed using a randomized control trial (RCT) approach. Prior to the event season, Power Manager program participants within each branch were randomly assigned to one of three groups. During each event, at least one group was withheld as the control group in order to provide an estimated load profile absent curtailment, i.e., the baseline. The average loads among control group customers are used to compare against the average event day loads of the treatment group to calculate the event impacts.

1.2.1 Direct Load Control Analysis Key Findings

Key findings of the Summer 2021 DLC impact analysis include:

- Average demand reductions across all events were 0.76 kW per household
- Emergency shed events produced greater load impacts compared to normal shed events
- The magnitude of demand impacts are larger when temperatures are higher

The table below presents summary results of the 2021 program year.

Table 1-1: Summary of 2021 DLC Event Impacts

Event Date	Start Time	End Time	Event Type	Load w/o DR	Load w/ DR	Impact	% Impact	System Temperature
6/30/2021	5:30 PM	5:58 PM	Full shed	3.28	2.38	0.90	27.5%	86°F
7/16/2021	4:00 PM	4:28 PM	Full shed	3.26	2.19	1.06	32.7%	89°F
7/28/2021	3:55 PM	5:00 PM	64%	3.38	2.68	0.70	20.7%	92°F
8/11/2021	4:00 PM	4:28 PM	Full shed	3.36	2.35	1.01	30.2%	89°F
8/11/2021	4:00 PM	4:28 PM	64%	3.36	2.91	0.45	13.4%	89°F
8/12/2021	4:00 PM	4:28 PM	Full shed	3.42	2.40	1.02	29.8%	91°F
8/13/2021	3:55 PM	5:00 PM	64%	3.57	2.89	0.68	19.0%	94°F
8/23/2021	4:00 PM	4:28 PM	Full shed	3.23	2.27	0.97	29.9%	91°F
8/27/2021	3:55 PM	5:00 PM	50%	3.32	2.74	0.58	17.5%	90°F
8/30/2021	2:55 PM	5:00 PM	64%	3.36	2.68	0.68	20.4%	92°F
8/30/2021	3:55 PM	6:00 PM	64%	3.48	2.81	0.67	19.2%	91°F
9/13/2021	3:55 PM	5:00 PM	50%	2.76	2.37	0.39	14.2%	87°F
Average Full Shed Event				**3.31**	**2.31**	**1.00**	**30.0%**	**89.2°F**
Average 64% Cycling Event				**3.43**	**2.79**	**0.64**	**18.5%**	**91.6°F**
Average 50% Cycling Event				**3.04**	**2.55**	**0.49**	**15.9%**	**88.5°F**
Average Event				**3.31**	**2.56**	**0.76**	**22.8%**	**90.1°F**

1.2.2 Bring-Your-Own-Thermostat Analysis Key Findings

Key findings of the Summer 2021 BYOT impact analysis include:

- The average load reduction across all BYOT events in 2021 was 1.32 kW
- The magnitude of baseline loads and load impacts tend to increase with temperature
- There does not appear to be any significant difference in program performance due to pre-cooling and event period offset conditions

Table 1-2: Summary of 2021 BYOT Event Impacts

Date	Start Time	End Time	Pre-Cool	Offset	Load w/o DR	Load w/ DR	Impact	% Impact	Temperature
7/1/2021	3:00 PM	5:00 PM	60 min 1°F	3°F	2.95	1.78	1.17	39.5%	88°F
7/30/2021	3:55 PM	5:00 PM	None	3°F	3.34	2.04	1.30	38.8%	91°F
8/11/2021	3:55 PM	5:00 PM	90 min 2°F	4°F	3.29	1.86	1.43	43.6%	89°F
8/12/2021	3:55 PM	5:00 PM	90 min 2°F	4°F	3.33	1.94	1.39	41.7%	91°F
8/13/2021	3:55 PM	5:00 PM	60 min 1°F	3°F	3.48	2.14	1.34	38.4%	94°F
8/23/2021	3:55 PM	5:00 PM	90 min 2°F	4°F	3.10	1.84	1.25	40.5%	91°F
8/24/2021	4:55 PM	6:00 PM	90 min 2°F	4°F	3.54	2.20	1.35	38.0%	93°F
8/30/2021	3:55 PM	5:00 PM	90 min 2°F	3°F	3.33	2.01	1.32	39.7%	92°F
Average BYOT Event					**3.30**	**1.98**	**1.32**	**40.0%**	**91.1°F**

1.3 Demand Reduction Capability

A key objective of the impact evaluation is to quantify the relationship between demand reductions, temperature, hour-of-day, and event settings. This objective is achieved by estimating loads under historical weather conditions and applying observed percent load reductions from the Summer 2021 events. The resulting tool, referred to as the time-temperature matrix, allows users to predict the program's load reduction capability under a wide range of temperature and event conditions.

1.3.1 Direct Load Control Demand Reduction Capability Key Findings

Key findings discovered during the development of the Time-Temperature Matrix include:

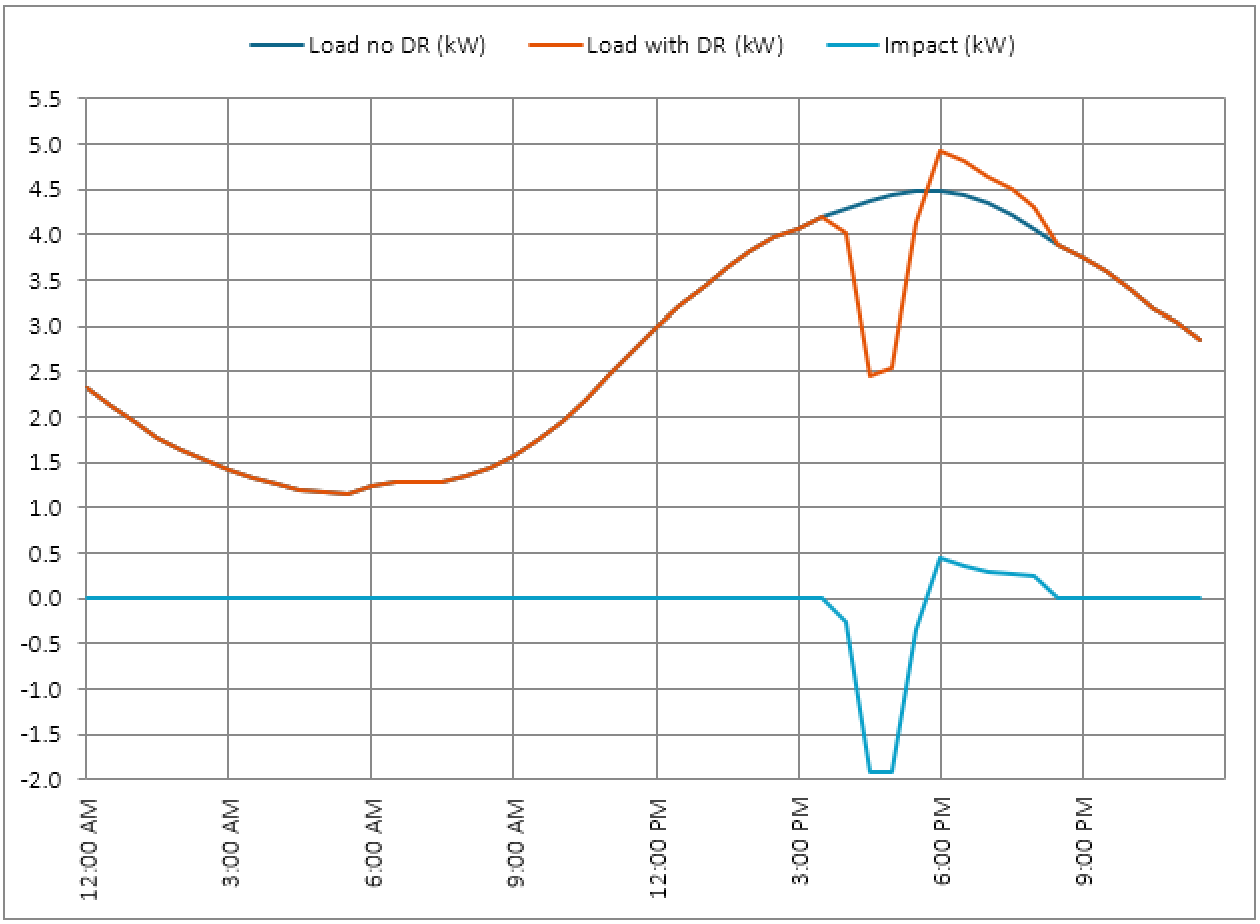
- Impacts increase later in the day and as the temperature goes up
- Estimating reference loads and load impacts under extreme, hypothetical conditions is routinely difficult because such conditions have not occurred since 2012.

- The Time-Temperature Matrix predicted that for a 1-hour event called at 4:00pm under 100° conditions the average impacts would be 1.92 kW per customer, or 431 MW of aggregate impacts across the region

Figure 1-1: Load Reduction Capability for Extreme DLC Event

Inputs	
Dispatch Type	Emergency Dispatch
Event Start Time	4 PM
Event Duration	1
Event Period Max Temp	100
# Customers	239,700

Event Window Average Impacts		
Load without DR	4.41	kW per customer
Load with DR	2.49	kW per customer
Impact per Customer	-1.92	kW per customer
Program Impact	-459.1	MW
% Impact	-43.4	%



1.3.2 BYOT Demand Reduction Capability Key Findings

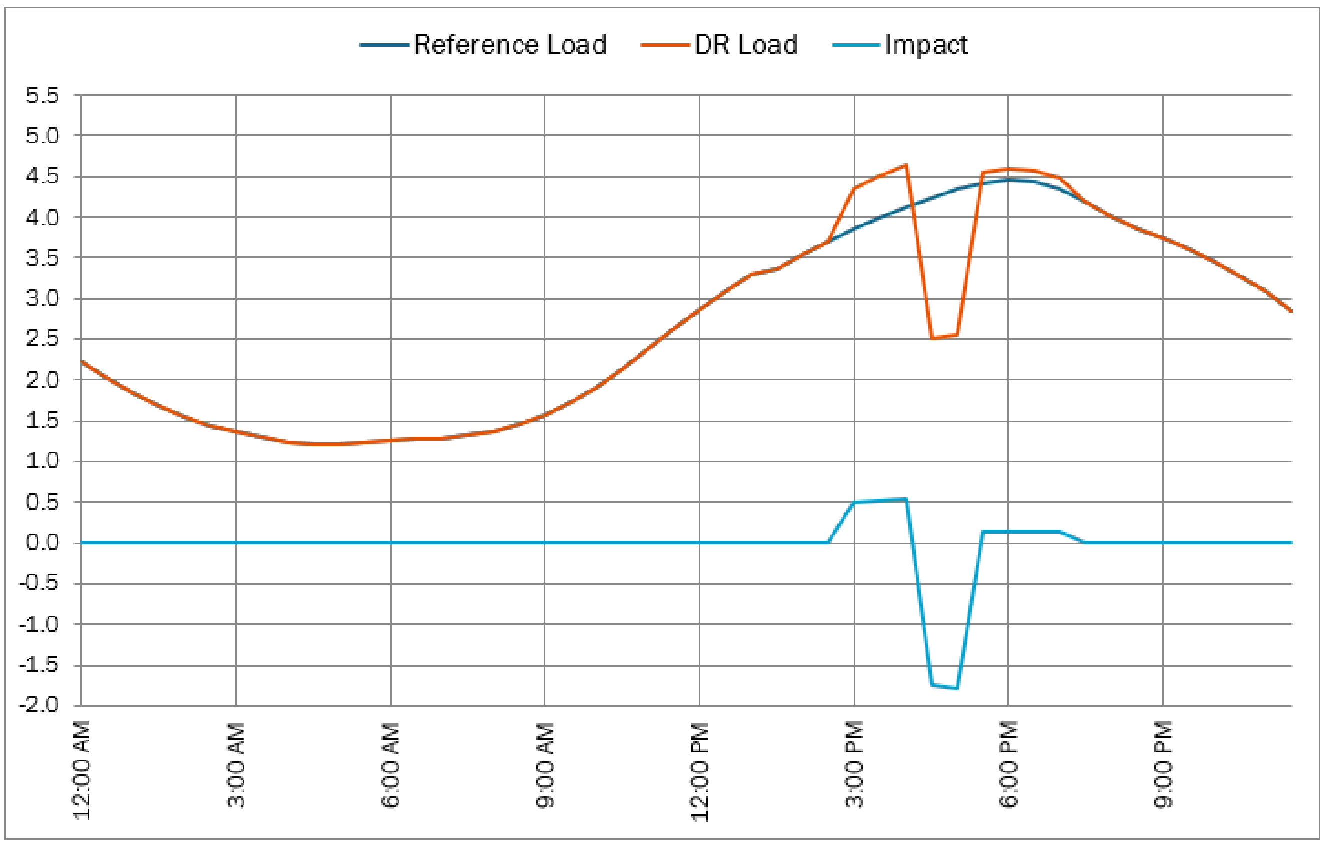
Key findings of the BYOT Time-Temperature Matrix tool include:

- Per household impacts grow larger as the event period temperature offset increases
- The duration and degree of the pre-cooling did not significantly affect event impacts
- Estimating load impacts for extreme, hypothetical conditions is difficult due to the lack of observed data and because such conditions have not occurred since 2012
- The Time-Temperature Matrix predicted that for a 1-hour event called at 4:00pm under 100° conditions, with a 90-minute 2°F pre-cool and a 4°F event offset, the average impacts would be 1.76 kW per household.

Figure 1-2: Load Reduction Capability for Extreme BYOT Event

INPUTS		
Event Start Time	4 PM	▼
Event Duration	1	▼
Event Option	90 min 2 deg precool / 4 deg offset	▼
Event Temperature	100	▼
# Customers	33,900	

OUTPUTS		
Reference Load	4.29	kW
Curtailed Load	2.53	kW
Impact per Customer	-1.76	kW
Program Impact	-59.7	MW
% Impact	-41.0	%



1.4 Process Evaluation Key Findings

The process evaluation is designed to inform efforts to continuously improve the program by identifying strengths and weaknesses, opportunities to improve program operations, adjustments likely to increase overall effectiveness, and sources of satisfaction or dissatisfaction among participating customers. The process evaluation consisted of telephone interviews with key program managers and implementers, a post-event survey of participants implemented after an event, and a nonevent survey of participants implemented on a nonevent day with similar temperature profile to an event day.

Key findings from the process evaluation include:

- Participants of Duke Energy Carolinas Power Manager program for both DLC and BYOT technologies do not experience a statistically significant increases in thermal discomfort during events, as evidenced by similar responses across post-event and nonevent surveys.
- Power Manager is a well-received program, with most participants willing to stay in the program, recommend it to others and reporting the program is easy to enroll in.
- Program areas with the lowest participant satisfaction include communications from Duke Energy, and incentive amounts (bill credits for DLC and e-gift cards for BYOT). Participants most frequently suggested increase in transparency and communication from Duke Energy and increased program incentives.
- Duke Energy leads and manages three partner vendors to operate and maintain the DLC option of Power Manager as a reliable resource for the Carolinas electric system.
- In-depth interviews reveal two areas of process improvement for the DLC option. First, that EM&V programming each year should be kept as simple and should reflect as few changes as possible from the prior year to mitigate risks of programming errors. Second, Duke Energy should resume normal QA inspections as soon as possible following the completion of the enrollment database reconciliation.
- In-depth interviews with BYOT option stakeholders show that Duke Energy's implementer EnergyHub delivers value by managing the BYOT implementation, which relieves Duke Energy program staff of much of the effort that is expended in managing the DLC option.
- The typical BYOT option participant is in a higher-than-average income bracket. EnergyHub recommends that the Duke Energy Online Savings Store would be an effective way to get smart thermostats into lower income households and enrolled in Power Manager through discounts and promotional messaging.

1.5 Recommendations

The 2021 Summer season Power Manager evaluation provided insights into program performance from both a load impact and a customer experience perspective for the DLC and BYOT program offerings. The following recommendations have been developed based on the key findings from the evaluation.

- Continue to promote both the DLC and BYOT Power Manager program options to DEC residential customers who exhibit high peak load consumption. Customers with higher-than-average peak loads remain the best candidates for program participation and have the greatest potential to contribute to demand savings.
- Revisit the time-temperature matrix requirements and consider developing a model of program capabilities across a relatively modest band of temperatures, reflecting the current dispatch strategy. For example, reporting estimated impacts under a range of temperatures regularly observed during most event seasons for a 1-hour event starting at 4:00PM.
- For planning purposes, apply more extreme event offsets for BYOT curtailment strategies to generate greater load impacts during events.
- Continue to prioritize participant comfort and satisfaction during BYOT and DLC events. Overall, customers experiencing BYOT and DLC events do not report feeling uncomfortable during Power Manager events any more than they do on comparable non-event days.
- Increase engagement and communication with Power Manager participants through notifications on the program website and emails to participants that request them.
- Return to AMI data analysis-based QA inspections as soon as possible; consider increasing the number of inspections scheduled given the 2021 hiatus.
- Continue to prioritize inter-organizational communications with Spring Trainings, weekly and monthly calls, and other existing approaches.
- Test locational dispatch capabilities in 2022 or 2023 once the final upgrades to the Yukon system Assets module are complete.
- Drive enrollment of households from income brackets lower than that of the current typical BYOT customer by continuing to offer discounted BYOT-eligible thermostats on the Duke Energy-sponsored online storefront.

2 Introduction

This report presents the results the Summer 2021 Power Manager program impact and process evaluations for the Duke Energy Carolinas (DEC) jurisdiction. Power Manager is a voluntary demand response program that provides incentives to residential customers who allow Duke Energy to reduce their electricity usage on summer or winter days with high energy usage. In 2021, the DEC Power Manager program includes two offerings: traditional direct load control (DLC) and a new option for homes with qualifying smart thermostats. Customers participating in the DLC option agree to allow Duke Energy to remotely cycle their air conditioner's outdoor compressor on and off during periods of peak load demand. Participants in the thermostat option – referred to as the Bring Your Own Thermostat or "BYOT" option – allow Duke Energy to remotely adjust their thermostat setpoints during and prior to events in order to reduce household cooling or heating loads. Events called under the DLC and BYOT options are separate and distinct from one another; however, they may be called at the same time.

Because Duke Energy has full deployment of smart meters in DEC territory and has access to Power Manager customers' interval meter data, the impact evaluation is predominantly based on a randomized control trial involving the random assignment of customers into three different groups each for the DLC and BYOT options prior to the 2021 event season. During each event, at least one of the groups is withheld to serve as a control group and to provide an estimate of customer's load usage profiles absent a Power Manager event. The randomized control trial approach was applied to all Power Manager operations where a valid control group was available, as well as to test events designed to address a set of specific research questions. The RCT approach is consistent across both program offerings (DLC and BYOT).

In addition to estimating load impacts during 2021 events, this study enables the estimation of the program's demand reduction capability under a range of weather and dispatch conditions. Average customer load reductions, as well as aggregate system capacity, is estimated as a function of event type, event start time, event duration, and event temperature. Program-level load reduction capability is estimated similarly, but independently, for each program offering (DLC and BYOT).

The process evaluation uses survey data from both treatment and control customers, as assigned for impact analysis, gathered during a non-emergency event and similar nonevent day for control customers. As in the impact analysis, responses from control group customers served as a baseline from which treatment effects on the customer experience may be measured. In addition, the evaluation uses interview data and analyses of program documentation and the program database to offer analytic context for evaluating survey results, as well as to offer insight into program operations.

2.1 Key Research Questions

The data collection and analysis activities are designed to address the following research questions and objectives.

2.1.1 Impact Evaluation Research Questions

- What demand reductions were achieved during each event called in 2021?
- Do impacts vary based on the hours of dispatch?
- Do impacts vary based on temperature conditions?
- For the DLC option, do impacts differ for full shed events compared to normal cycling events?
- For the BYOT option, do event conditions, such as pre-cooling duration, pre-cooling offset, event period offset, result in different impacts?
- What is the magnitude of the program's aggregate load reduction capability during extreme conditions?

2.1.2 Process Evaluation Research Questions

- What is the extent to which participants are aware of events, program incentives, and other key program features?
- What is the participant experience during events, particularly relating to thermal comfort?
- What actions do participants take in response to events?
- What are the motivations and potential barriers for participation?
- What are the processes associated with operations and program delivery?
- What are the program's strengths and areas for potential improvement?

2.2 Program Description

Power Manager is a voluntary demand response program that provides incentives to residential customers who allow Duke Energy to reduce their cooling and/or heating energy use on days with high energy usage.

All Power Manager DLC participants have a load control device installed on the outdoor unit of their qualifying air conditioner. If customers have more than one air conditioner, all units must be equipped with a load control device. The device enables the customer's air conditioner compressor to be cycled off and on to reduce load when a Power Manager event is called or turned off completely in the case of a grid emergency. Duke Energy initiates DLC events by sending a signal to participating devices through the Duke Energy paging network, which instructs the DLC devices to reduce air conditioner runtime during events.

All customers participating in the BYOT option must have a qualifying smart thermostat installed in their home. Duke Energy initiates summer BYOT events by remotely adjusting participating thermostats upward, thereby reducing the cooling load required. To help maintain comfort levels during the event period, BYOT events may also involve a pre-cooling period, when thermostats are remotely adjusted downward during the period immediately preceding the event, lowering the interior temperature of the home before the event begins.

Power Manager events typically occur from June through September in DEC territory but are not limited to these months. DLC participants receive financial incentives for their participation in the form of $8 credits applied to their July through October electric bills ($32 in annual credits). BYOT participants receive financial incentives for their participation in the form of pre-paid gift cards.

In DEC territory, Duke Energy uses a cycling algorithm known as TrueCycle to reduce DLC customers' system runtimes during events. The algorithm uses stored data on the air conditioner's runtime to calculate the off and on cycle times to achieve a specific percentage of reduced runtime during each event. In general, DLC events fall into two categories: regular shed events, during which customers are cycled at 64% or the less frequently used 50%, and emergency full-shed events, during which customers are shed at 100%. For purposes of regulatory reporting, emergency full-shed is used to estimate program capability.

During BYOT events, Duke Energy may remotely adjust customers' home thermostats by up to 4°F for up to four hours. Event pre-cooling ranges from 0°F to 2°F for up to 90 minutes. Duke Energy may apply different combinations of pre-cooling and event period offsets that may result in varying changes in load demanded during each phase of the event. For purposes of regulatory reporting, a 90-minute pre-cool of 2°F, followed by a 4°F offset for one hour is used to estimate program capability.

2.3 Participant Characteristics

Duke Energy serves approximately 2.25 million residential customers in its DEC service territory, which spans a large portion of the western half of North Carolina and northwestern South Carolina. During the 2021 summer season, approximately 239,700 customers were enrolled in the DLC option of Power Manager and approximately 33,900 customers were enrolled in the BYOT option. Figure 2-1 and Figure 2-2 show the program enrollment growth by number of households and number of devices installed for the DLC and BYOT programs, respectively. In 2021, the number of devices per household are approximately 1.2 devices per household for DLC and approximately 1.3 thermostats per household for BYOT.

Figure 2-1: DLC Participation Growth (2010-2021)

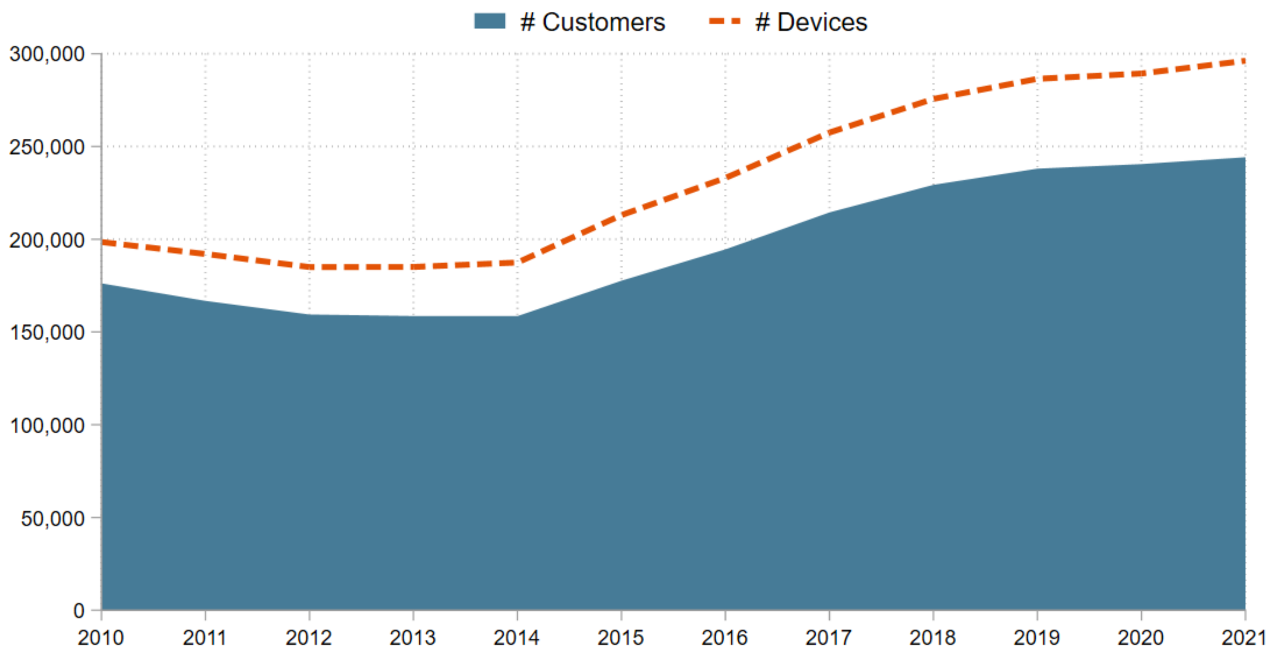
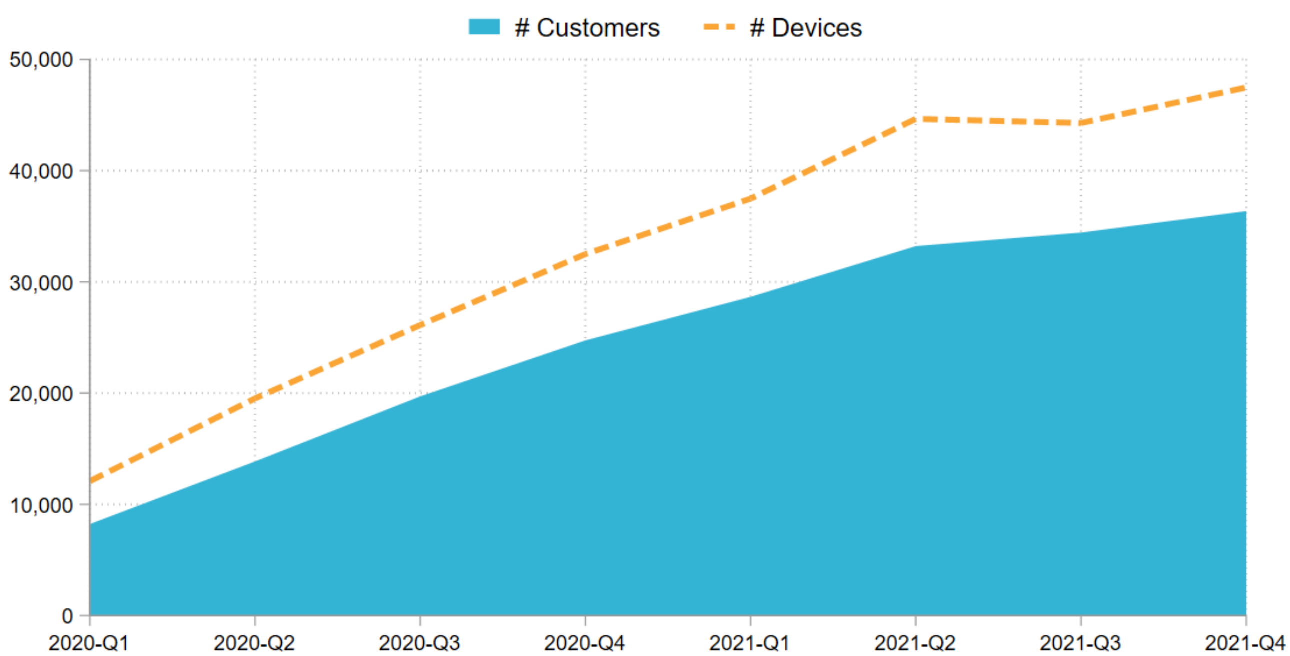


Figure 2-2: BYOT Thermostat Installations (2020-2021)



2.4 Event Characteristics

2.4.1 Direct Load Control Events

Duke Energy dispatched DLC Power Manager events 12 times in 2021. All events occurred between the hours of 3:00 PM and 6:00 PM and were between 30 minutes and 2 hours in duration. Emergency full shed events were dispatched five times, each lasting 28 minutes in duration. Regular shed events made up the remaining 7 dispatches, where 64% cycling was called five times and 50% cycling was called twice. System temperatures observed during events ranged from 86°F to 94°F, with an average event period temperature of 90°F.

The table below summarizes 2021 DLC event conditions.

Table 2-1: Summary of 2021 DLC Events

Date	Start	End	Event Type	Dispatch Group*	Control Group*	System Temperature
6/30/2021	5:30PM	5:58PM	Full shed	GP+A+B	None	86°F
7/16/2021	4:00PM	4:28PM	Full shed	GP+A+B	None	89°F
7/28/2021	3:55PM	5:00PM	64%	GP+A	B	92°F
8/11/2021	4:00PM	4:28PM	Full shed	A	GP	89°F
	4:00PM	4:28PM	64%	B	GP	89°F
8/12/2021	4:00PM	4:28PM	Full shed	B	GP+A	91°F
8/13/2021	3:55PM	5:00PM	64%	A	GP+B	94°F
8/23/2021	4:00PM	4:28PM	Full shed	A	GP+B	91°F
8/27/2021	3:55PM	5:00PM	50%	B	GP+A	90°F
8/30/2021	2:55PM	5:00PM	64%	A	GP	92°F
	3:55PM	6:00PM	64%	B	GP	91°F
9/13/2021	3:55PM	5:00PM	50%	A	GP+B	87°F

* General Population (GP), Group A (A), and Group B (B)

2.4.2 BYOT Events

A total of eight BYOT Power Manager events were called in 2021. Of the eight events called, six were held from 3:55 PM to 5:00 PM. Different combinations of pre-event cooling and event period temperature offsets were applied across events. The least extreme event involved no pre-cooling and a 3°F event offset, whereas the most extreme control involved a 2°F pre-event cooling period for 90 minutes with a 4°F offset during the event. BYOT events occurred during system temperatures ranging from 88°F to 94°F. On four separate dates in 2021, a DLC event overlapped with a BYOT event. This coincidence provides an opportunity to compare program performance between the two separate offerings within the Power Manager program.

The table below summarizes BYOT event conditions in 2021.

Table 2-2: Summary of 2021 BYOT Events

Date	Start	End	Pre Cool	Offset	Dispatch Group*	Control Group*	System Temperature
7/1/2021	3:00PM	5:00PM	60 min 1°F	3°F	GP+A+B	None	88°F
7/30/2021	3:55PM	5:00PM	None	3°F	GP+A+B	None	91°F
8/11/2021	3:55PM	5:00PM	90 min 2°F	4°F	B	GP+A	89°F
8/12/2021	3:55PM	5:00PM	90 min 2°F	4°F	GP+A	B	91°F
8/13/2021	3:55PM	5:00PM	60 min 1°F	3°F	B	GA+A	94°F
8/23/2021	3:55PM	5:00PM	90 min 2°F	4°F	GP+B	A	91°F
8/24/2021	4:55PM	6:00PM	90 min 2°F	4°F	A	GP+B	93°F
8/30/2021	3:55PM	5:00PM	90 min 2°F	3°F	A	GP+B	92°F

* General Population (GP), Group A (A), and Group B (B)

3 Methodology and Data Sources

This section details the study design, data sources, sample sizes, and analysis protocols used for the impact and process evaluations.

In general, analysis methodologies and data sources were consistent for both the DLC and BYOT evaluations. For that reason, information presented in this section does not distinguish between DLC and BYOT. Any meaningful differences in methodologies, data sources, and/or analysis processes between DLC and BYOT evaluations will be noted.

3.1 Data Sources

3.1.1 Impact Evaluation Data Sources

The impact analysis relied on four primary datasets:

- Participant data identifying customer account numbers and group assignments
- Premise-level AMI data in 30-minute intervals for all participants spanning May 2021 through September 2021
- Event tracking data for all DEC Power Manager events called in 2021, including treatment and control group assignments, event scenarios, start/end times for each event
- Hourly weather data for the full event season, used to inform proxy day selection for the within-subjects analysis, as well as to establish relationships between impacts and weather conditions

With the exception of weather data, which was obtained from NOAA, all primary datasets were provided by Duke Energy following the Summer 2021 Power Manager event season. All subsequent datasets used by RI for analysis were compiled from a combination of these primary datasets.

3.1.2 Process Evaluation Data Sources

The process analysis relied on four primary datasets:

- Program tracking and documentation database
- In-depth interviews with key program stakeholders
- Post-event program participant surveys
- Nonevent program participant surveys

3.2 Data Management and Validation

All data sets were thoroughly cleaned and validated to ensure that impacts were estimated using reliable observations from customers who were properly dispatched on event days. The analysis benefitted from a full population-based approach, allowing RI to logically exclude customers who were found to have incomplete or questionable load data, while still maintaining large enough group sizes to produce highly precise estimates.

Recent evaluations of DEC Power Manager found incidence of device failure, signaling deficiency, or other technical dysfunction that prevented a portion of customers from being dispatched as planned for certain events. Most recently, the Summer 2019 evaluation found that, in some cases, large groups of customers did not respond to events as planned. Subsequent investigation and follow-up with Duke Energy suggested that some of the issues discovered were the result of programming error associated with group assignments, and likely not due to paging tower defects or technical flaws with program equipment. With this in mind, RI was deliberate to carefully monitor individual group responses to each event, and to adapt analysis techniques wherever necessary to ensure accurate and authentic results. In 2021, there were no known instances of widespread device failure, signaling deficiency, or other technical problems that jeopardized the reliability of results.

3.3 RCT Analysis Design

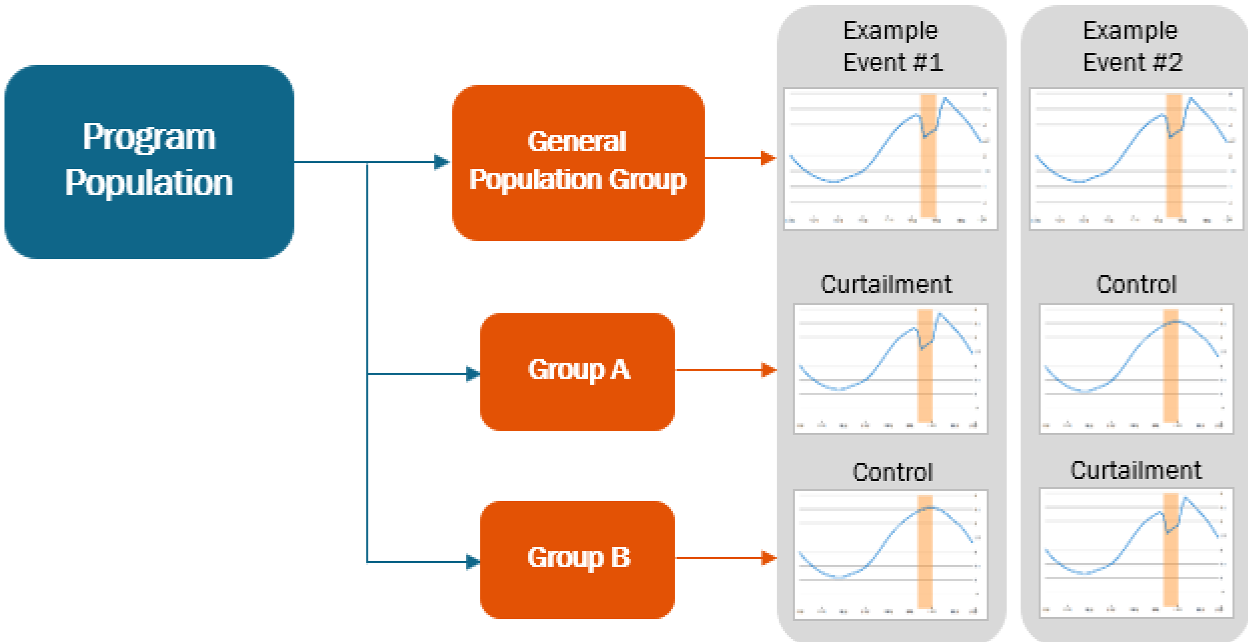
A randomized control trial (RCT) study design is well-recognized as the gold standard for obtaining accurate impact estimates. RCTs have several advantages over other analytical methods, including:

- They require fewer assumptions than engineering-based calculations
- They allow for simpler modeling procedures that are effectively immune to model specification and estimation errors
- They are guaranteed to produce accurate and precise estimates, provided proper randomization and large sample sizes

The RCT design randomly assigns the Power Manager population into three groups – a primary group consisting of a large majority of the population and two research groups, each consisting of smaller, equal shares of the remaining population. For each event, groups are assigned as either treatment or control according to Duke Energy's operational plan. All devices assigned to the treatment group are controlled during the event window, while devices assigned to the control group are withheld and continue to operate normally. As a result of random group assignment, the only systematic difference between the treatment and control groups is that one set of customers is curtailed while the other group was not.

The figure below shows the conceptual framework of the random group assignment.

Figure 3-1: Randomized Control Trial Design Framework



All customers who were enrolled in the program and had the required equipment installed at their homes by the start of the 2021 summer were randomly assigned into three groups. The table below summarizes the number of households assigned to each group for both the DLC and BYOT options.

Table 3-1: Approximate Group Sizes

Group	Approximate # DLC Households	Approximate # BYOT Households
Group A	5,000	5,000
Group B	5,000	5,000
General Population	230,000	20,000

The purpose of creating three distinctive, randomly assigned groups was twofold. First, it allowed for side-by-side testing of cycling strategies, event start times, or other operational aspects to help optimize the program. Second, it allowed Duke Energy to alternate the group being withheld as control for each event, increasing fairness and helping to avoid exhausting individual customers by dispatching them too often solely for research purposes.

For each event, at least one of the groups was withheld to serve as a control group and establish the electricity load patterns in the absence of curtailment, i.e., the baseline. Within the experimental framework of a RCT, the average usage for control group customers provides an unbiased estimate of what the average usage for treatment customers would have been if an event had not been called. Therefore, estimating event day load impacts requires simply calculating the difference in loads between the treatment and control groups during each interval of the event window, as well as for the hours immediately following the event when snapback can occur. Demand reductions calculated in this way reflect the net impacts and inherently account for offsetting factors, such as device failures, paging network communication issues, and customers' use of fans to compensate for curtailment of air conditioners.

Additional statistical metrics, such as standard error, are calculated to evaluate whether these differences are meaningful, as well as whether different cycling strategies could produce significantly different impacts. The standard error is then used to calculate 90% confidence bands, which are additional measures used to describe the statistical accuracy of the impact estimate.

Equation 3-1: Calculation of Standard Error

$$Std.Error\ of\ Difference\ between\ Means_i = \sqrt{\frac{sd_c^2}{n_c} + \frac{sd_t^2}{n_t}}$$

Where:

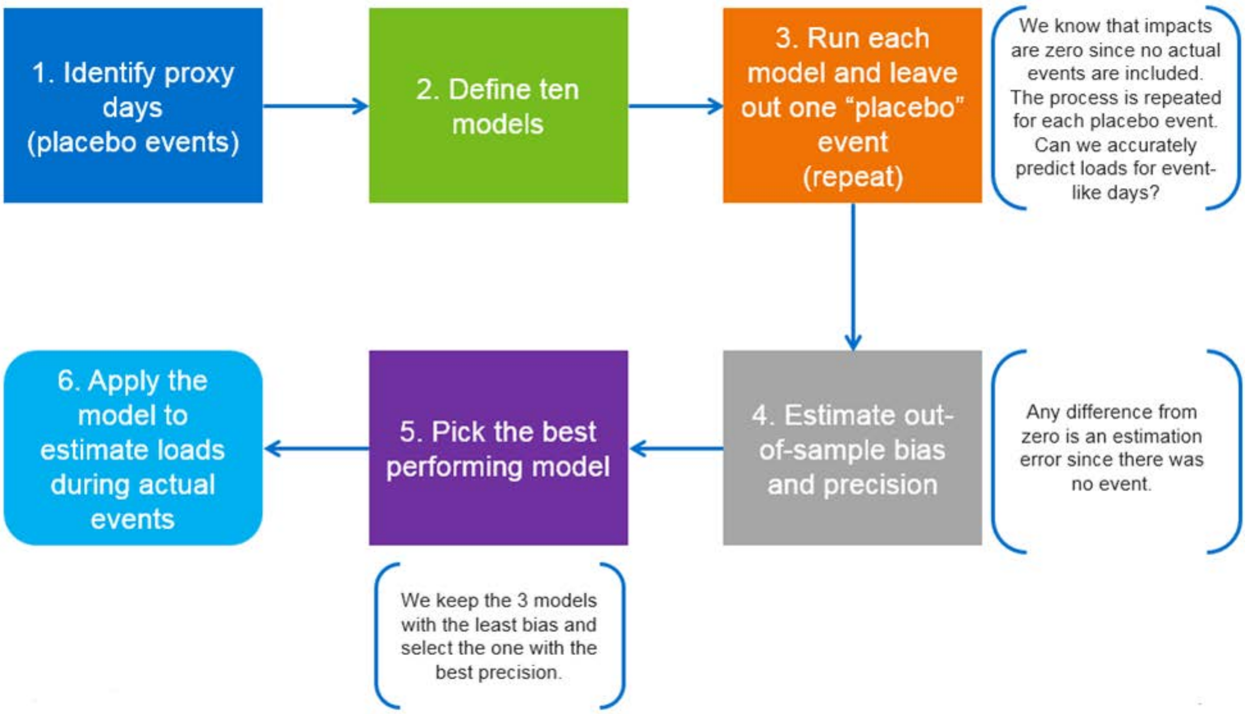
sd = standard deviation
n = sample size
t = indicator for treatment group
c = indicator for control group
i = individual time intervals

3.4 Within-Subjects Analysis Design

Although an RCT approach has many implicit advantages that make it the preferred method for estimating impacts, it is not applicable when no valid control group is available to establish the counterfactual. In these cases, when events were called absent a control group, a within-subjects approach is used, whereby customer loads observed on similar nonevent days are used to establish the counterfactual against which to compare treatment loads. This approach works because the program intervention is introduced on some days and withheld on other days that could otherwise be considered event-worthy, allowing for comparison of load patterns with and without load control.

A key consideration of the within-subjects design is how to select a model that generates the most precise and accurate counterfactual. In many cases, multiple counterfactuals may be plausible, but result in varying estimations of impacts. Using nonevent days with similar temperature conditions, regression modeling was applied to estimate the demand reduction as the difference between the predicted baseline loads and the actual event day loads. To identify the regression model that best predicts the counterfactual, a rigorous model selection process is applied, whereby ten distinct model specifications were tested and ranked using various accuracy and precision metrics. The best performing model was selected and used to estimate the counterfactual for actual event days. The figure below summarizes the regression model selection process.

Figure 3-2: Within-Subjects Regression Model Selection Process



Bias metrics measure the tendency of different approaches to over or under predict and are measured over multiple out-of-sample days. The mean percent error (MPE) describes the relative magnitude and direction of the bias. A negative value indicates a tendency to under predict, and a positive value indicates a tendency to over predict. The precision metrics describe the magnitude of errors for individual event days and are always positive. The closer they are to zero, the more precise the model prediction. The absolute value of the mean percentage error is used to select the three model candidates with the lowest bias. The coefficient of variation of the root mean square error, or CV(RMSE), metric is used to identify the most precise model from the three models with the least bias.

Equation 3-2: Measures of Bias and Precision

Type of Metric	Metric	Description	Mathematical Expression
Bias	Average Error	Absolute error, on average	$AE = \frac{1}{n}\sum_{i=1}^{n}(\hat{y}_i - y_i)$
	Mean Percentage Error (MPE)	Indicates the percentage by which the measurement, on average, over or underestimates the true demand reduction	$MPE = \frac{\frac{1}{n}\sum_{i=1}^{n}(\hat{y}_i - y_i)}{\bar{y}}$
Precision	Root Mean Squared Error	Measures how close the results are to the actual answer in absolute terms, penalizes large errors more heavily	$RMSE = \sqrt{\frac{1}{n}\sum_{i=1}^{n}(\hat{y}_i - y_i)^2}$
	CV(RMSE)	Measures the relative magnitude of errors across event days, regardless of positive or negative direction (typical error)	$CV(RMSE) = \frac{RMSE}{\bar{y}}$

3.5 Process Evaluation Methodology

The following table summarizes the primary data collection tasks and analysis objectives included in the process evaluation.

Table 3-2: Data Collection Techniques and Sample Size by Technology

Data Collection Technique	Description of Analysis Activities Using Collected Data	DLC Sample Size	BYOT Sample Size	Confidence / Precision Level
Document and database review	Review of program documentation, including program manuals, customer communications, as well as the program database. These materials provide evidence of program operations, as well as how these operations are aligned with program savings and other goals.	NA	NA	NA
Interviews of key contacts	Interviews with Duke Energy staff will document program processes, identify strengths/weaknesses and provide a foundation for understanding the customer experience.	3	2	NA
Post-event survey	Phone and web survey of Power Manager customers who experienced an event, to assess event awareness, satisfaction, customer experience and comfort during events, and motivations for participation.	94	106	DLC: 90/8 BYOT: 90/8
Nonevent survey	Phone and web survey of Power Manager customers for whom an event was not called. Nonevent survey data provide a baseline with which to compare post-event responses, to establish levels of event awareness, satisfaction, customer experience and comfort during events, and motivations for participation.	68	82	DLC: 90/10 BYOT: 90/9

3.5.1 Review program documentation and analyze program database

Process evaluation should be guided by a thorough understanding of the primary activities of any program, the marketing messages used to recruit and support participants, and any formal protocols that guide processes. For demand response programs, it is particularly important to understand the event notification procedures, any opt-out processes that exist, and how bill credits or incentives are communicated and applied or delivered. It is also important to understand how the program opportunity is communicated and the types of encouragement provided to participating households. These communications are often the source of program expectations, which can affect participant satisfaction. To support this task, Resource Innovations requested copies of internal program manuals and guidelines as well as copies of marketing materials. The program database analysis consisted of an examination of program tenure, load curtailed per household, and other variables that inform indications of program progress.

3.5.2 In-depth interviews with key program stakeholders

Program stakeholders include program staff and implementation contractors with insight into program plans and operations, emerging issues, and the expected customer experience. The interviews conducted for the Summer 2021 evaluation confirmed the evaluation team's understanding of key program components.

Goals of the interviews include:

- Understand marketing and recruitment efforts, including lessons learned about the key drivers of enrollment
- Identify "typical" Power Manager households, including characteristics of households that successfully participate for multiple years
- Describe event processes
- Understand opt-out procedures
- Confirm enrollment incentive levels and how event incentives are explained to customers
- Understand the customer experience
- Identify any numeric or other program performance goals (kW enrollment, number of households, notification timelines) established for Power Manager
- Describe the working relationship between Duke Energy and the program implementers, including the allocation of program responsibilities
- Understand emergent and future concerns, and plans to address them

3.5.3 Post-event surveys

Guided by information obtained from stakeholder interviews and a review of program guidance documents (including any notification protocols), Resource Innovations developed a survey for participating customers that was deployed immediately following a Power Manager event. The survey was designed to be deployed via phone and email to maximize response rate in the 24 to 48-hour window following an event. DEC DLC post-event surveys were deployed immediately following the event and closed within two days. DEC BYOT post-event surveys were deployed the day following the event and were closed five days after the event. The post-event survey addressed the following topics:

- Awareness of the specific event day and comfort during the event;
- Any actions taken during the event to increase household comfort: Do participants report changing AC settings, using other equipment (including window units, portable units, or ceiling fans) to mitigate heat buildup? Were participants home during the event? Are they usually home during that time period?
- Satisfaction with the Power Manager program, the event bill credits earned, and the number of events typically called;
- Expectations and motivations for enrolling: What did participants expect to gain from enrollment? To what extent are they motivated to earn incentive payments versus altruistic motivations such as helping to address electricity shortfalls during periods of high peak demand and/or reducing the environmental effects of energy production?; and
- Retention and referral: Do participants expect to remain enrolled in the program in future years? Would they recommend the program to others?

To ensure that the survey accurately assessed the experiences of customers during a curtailment event, questions were finalized and fully programmed prior to the event, to enable deployment within 24 hours after an event. Working with Duke Energy and the impact evaluation team, Resource Innovations prepared a random sample of participant households prior to event notification to receive the post-event survey. This sample was linked to the survey software and ready to deploy as soon as the event ended. Any participants for whom email addresses were available received an email invitation with a link to the survey URL. 79% percent of DLC and 71% of BYOT participants were surveyed by phone. Our mixed mode approach ensuring completes by both the telephone and web improves the representativeness of the completed surveys.

3.5.4 Nonevent program surveys

In addition to the post-event survey, the evaluation team prepared a survey to be deployed immediately following a hot nonevent day. This nonevent day survey was identical to the post-event survey to facilitate comparison with the results of the event day survey. Like the post-event survey, the nonevent survey was developed, approved, and programmed prior to the demand response season to enable immediate deployment on a sufficiently comparable nonevent day. The nonevent survey sample was developed prior to the demand response season and linked to the programmed survey. Similar to the post-event survey, a survey link was sent via email to participants with email addresses, simultaneous with the phone deployment, improving the representativeness of the data collected.

4 Randomized Control Trial Results

One of the primary goals of the impact evaluation is to understand the load impacts associated with the Power Manager program under a variety of temperature and event conditions. This section presents overall program results for all event days, including general population and emergency shed events. The section also details the results of the research events and investigates weather sensitivity of impacts for 2021 RCT events.

4.1 DLC Program Results

4.1.1 Event Impacts

The load impact estimates resulting from the RCT analysis for the 2021 DLC events are presented in the table below. The load impacts presented for each event are the average per household changes in load during the indicated dispatch windows. The two rows highlighted in yellow indicate program-wide events, which were analyzed via within-subjects approach described in Section 3.4.

Table 4-1: Direct Load Control Event Impacts

Event Date	Start Time	End Time	Event Type	Load w/o DR	Load w/ DR	Impact	% Impact	System Temperature
6/30/2021	5:30 PM	5:58 PM	Full shed	3.28	2.38	0.90	27.5%	86°F
7/16/2021	4:00 PM	4:28 PM	Full shed	3.26	2.19	1.06	32.7%	89°F
7/28/2021	3:55 PM	5:00 PM	64%	3.38	2.68	0.70	20.7%	92°F
8/11/2021	4:00 PM	4:28 PM	Full shed	3.36	2.35	1.01	30.2%	89°F
8/11/2021	4:00 PM	4:28 PM	64%	3.36	2.91	0.45	13.4%	89°F
8/12/2021	4:00 PM	4:28 PM	Full shed	3.42	2.40	1.02	29.8%	91°F
8/13/2021	3:55 PM	5:00 PM	64%	3.57	2.89	0.68	19.0%	94°F
8/23/2021	4:00 PM	4:28 PM	Full shed	3.23	2.27	0.97	29.9%	91°F
8/27/2021	3:55 PM	5:00 PM	50%	3.32	2.74	0.58	17.5%	90°F
8/30/2021	2:55 PM	5:00 PM	64%	3.36	2.68	0.68	20.4%	92°F
8/30/2021	3:55 PM	6:00 PM	64%	3.48	2.81	0.67	19.2%	91°F
9/13/2021	3:55 PM	5:00 PM	50%	2.76	2.37	0.39	14.2%	87°F
Average Full Shed Event				**3.31**	**2.31**	**1.00**	**30.0%**	**89.2°F**
Average 64% Cycling Event				**3.43**	**2.79**	**0.64**	**18.5%**	**91.6°F**
Average 50% Cycling Event				**3.04**	**2.55**	**0.49**	**15.9%**	**88.5°F**
Average Event				**3.31**	**2.56**	**0.76**	**22.8%**	

Overall load impacts for the average customer ranged between 0.39 kW and 0.70 kW during normal operations. The emergency shed events produced higher load impacts compared to normal shed events, with an average per household impact of 1.00 kW.

At least one of the groups was held back as a control group during each event (excluding the two program-wide events) to establish the baseline. While withholding a control group is an essential component of the RCT research design, it adversely affects the aggregate performance of the program since customers being withheld do not contribute load reduction to the total impact. To extrapolate the total load reduction achieved by the entire program during a given event, the average per household impact is multiplied by the total number of enrolled participants.

The RCT results implicitly take into account device inoperability and other offsetting factors. Because randomized group assignment was utilized effectively, each of the individual test groups accurately represents the overall percentage of customers with inoperable devices from among the entire population. As such, the estimated load impacts are appropriately de-rated by the inherent equivalence of non-working devices included in each of the test groups, and do not require any independent adjustment to account for device inoperability.

Event impacts are displayed graphically in a series of figures that follow, with the average customer load profiles shown for the treatment and control groups. The dark blue line represents the average load from control group customers, the orange line reflects average load of the customers participating in the event, and the light blue line shows the average load impact (the difference between the control group and participant customer loads). All of the events show a clear drop in treatment group loads during the event dispatch period, as well as a small snapback in energy usage during the hours immediately following the events. Furthermore, most events show an instantaneous and prominent load drop during the first 30-minute interval of the dispatch period, underpinning the collective response of the load control devices once the event signal is received.

Figure 4-1: Per Household Event Performance, July 28 and August 12

Event Date	7/28/2021
Start Time	3:55 PM
End Time	5:00 PM
Event Strategy	64% cycling
System Temperature	92°F
Event Impact	0.70 kW

Event Date	8/12/2021
Start Time	4:00 PM
End Time	4:28 PM
Event Strategy	Full shed
System Temperature	91°F
Event Impact	1.01 kW

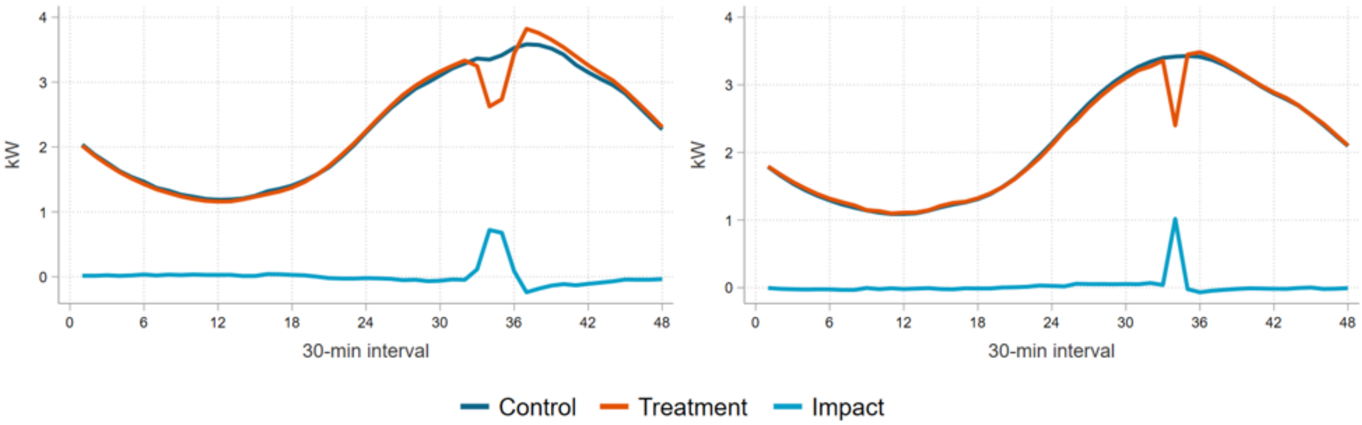


Figure 4-2: Per Household Event Performance, August 13 and August 23

Event Date	8/13/2021
Start Time	3:55 PM
End Time	5:00 PM
Event Strategy	64% cycling
System Temperature	94°F
Event Impact	0.67 kW

Event Date	8/23/2021
Start Time	4:00 PM
End Time	4:28 PM
Event Strategy	Full shed
System Temperature	91°F
Event Impact	0.96 kW

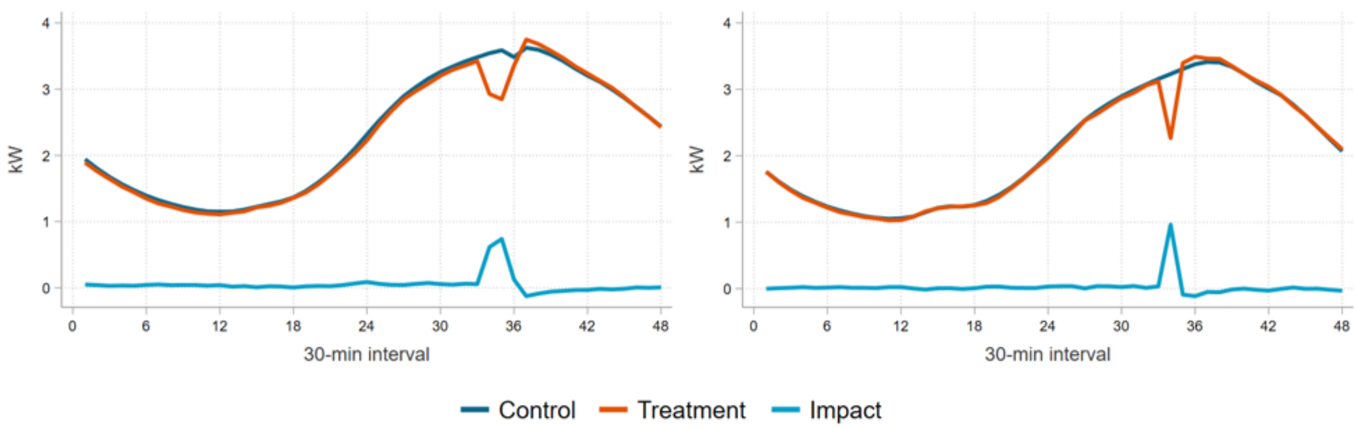
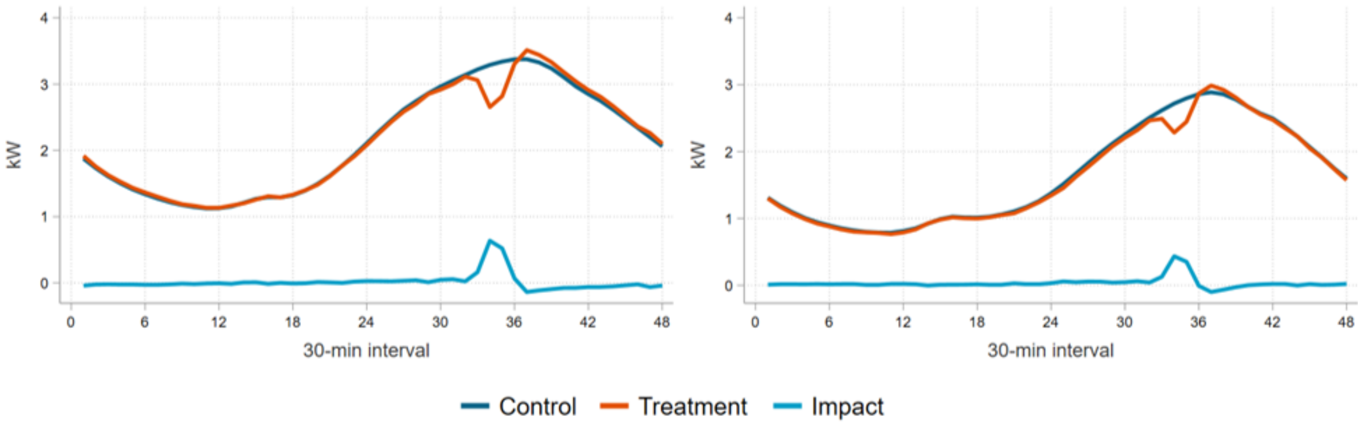


Figure 4-3: Per Household Event Performance, August 27 and September 13

Event Date	8/27/2021
Start Time	3:55 PM
End Time	5:00 PM
Event Strategy	50% cycling
System Temperature	90°F
Event Impact	0.57 kW

Event Date	9/13/2021
Start Time	3:55 PM
End Time	5:00 PM
Event Strategy	50% cycling
System Temperature	87°F
Event Impact	0.39 kW



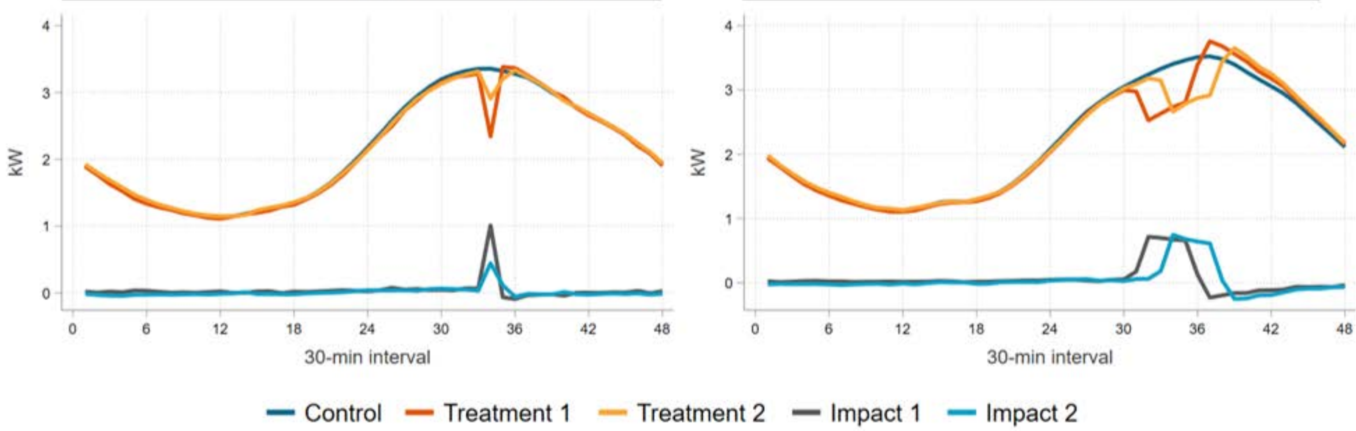
Two events in 2021 involved calling two groups under distinct conditions, i.e., at differing levels of cycling or at different times of day. The design of these events allows for a comparison of achievable impacts under different conditions.

The first such event, called on August 11, involved two groups being called simultaneously, but under different levels of shed. The first group of customers was dispatched at 100% full shed and generated 1.01 kW impact per customer, while a second group was dispatched at 64% cycling and produced smaller impacts of 0.45 kW per household. The other event, called on August 30, involved dispatching two groups under similar cycling, but at different times of day. Groups were dispatched for 125 minutes each, with start times separated by an hour, and produced almost identical per household impacts.

Figure 4-4: Per Household Event Performance, August 11 and August 30

Event Date	8/11/2021	
Start Time	4:00 PM	4:00 PM
End Time	4:28 PM	4:28 PM
Event Strategy	Full shed	64% cycling
System Temperature	89°F	89°F
Event Impact	1.01 kW	0.45 kW

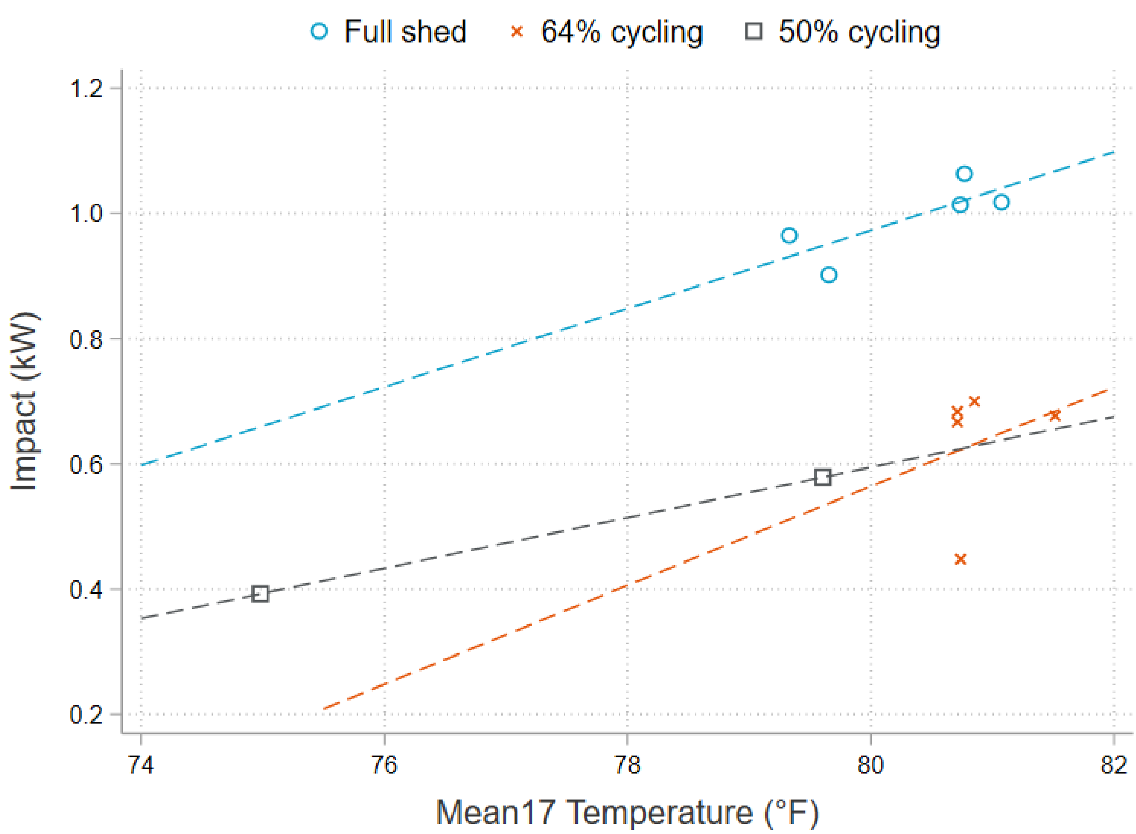
Event Date	8/30/2021	
Start Time	2:55 PM	3:55 PM
End Time	5:00 PM	6:00 PM
Event Strategy	64% cycling	64% cycling
System Temperature	92°F	91°F
Event Impact	0.68 kW	0.67 kW



4.1.2 Weather Sensitivity

The amount of load reduction during events is dependent on weather conditions. The figure below shows estimated per customer impacts for each event as a function of mean17 temperature. Mean17 is defined as the average temperature observed between 12:00 AM midnight and 5:00 PM on a given day (average across hours ending 1 through 17). There is a distinct correlation between higher temperatures and load reduction, with higher impacts on hotter days.

Figure 4-5: Weather Sensitivity of DLC Event Impacts



The key finding is simple: demand reductions grow larger in magnitude when temperatures are hotter, and resources are needed most. Because peak loads are driven by central air conditioner use, the magnitude of air conditioner loads available for curtailment grows in parallel with the need for resources. Not only are air conditioner loads higher, but the program performs at its best when it is hotter.

4.2 BYOT Program Results

4.2.1 Event Impacts

The load impact estimates resulting from the RCT analysis for the 2021 BYOT events are presented in the table below. The load impacts presented for each event are the average per household changes in load during the indicated dispatch windows. As in the DLC option, two events were called program-wide, without a control group, and were analyzed via within-subjects approach described in Section 3.4.

Table 4-2: Bring Your Own Thermostat Event Impacts

Date	Start Time	End Time	Pre-Cool	Offset	Load w/o DR	Load w/ DR	Impact	% Impact	Temperature
7/1/2021	3:00 PM	5:00 PM	60 min 1°F	3°F	2.95	1.78	1.17	39.5%	88°F
7/30/2021	3:55 PM	5:00 PM	None	3°F	3.34	2.04	1.30	38.8%	91°F
8/11/2021	3:55 PM	5:00 PM	90 min 2°F	4°F	3.29	1.86	1.43	43.6%	89°F
8/12/2021	3:55 PM	5:00 PM	90 min 2°F	4°F	3.33	1.94	1.39	41.7%	91°F
8/13/2021	3:55 PM	5:00 PM	60 min 1°F	3°F	3.48	2.14	1.34	38.4%	94°F
8/23/2021	3:55 PM	5:00 PM	90 min 2°F	4°F	3.10	1.84	1.25	40.5%	91°F
8/24/2021	4:55 PM	6:00 PM	90 min 2°F	4°F	3.54	2.20	1.35	38.0%	93°F
8/30/2021	3:55 PM	5:00 PM	90 min 2°F	3°F	3.33	2.01	1.32	39.7%	92°F
Average BYOT Event					**3.30**	**1.98**	**1.32**	**40.0%**	**91.1°F**

Overall load impacts for the average BYOT customer ranged between 1.17 kW and 1.43 kW. In general, the four events with a 4°F offset produced larger impacts compared to events with a 3°F offset.

Table 4-3: Summary of BYOT Event Impacts by Type

Pre-Cool		Event Offset	# Events	Average Impact	Maximum Impact
Duration	Offset				
None	None	3°F	1	1.30	1.30
60 min	1°F	3°F	2	1.26	1.34
90 min	2°F	3°F	1	1.32	1.32
90 min	2°F	4°F	4	1.36	1.43

Event impacts are displayed graphically in a series of figures that follow, with the average customer load profiles shown for the treatment and control groups. The dark blue line represents the average load from control group customers, the orange line reflects average load of the customers participating in the event, and the light blue line shows the average load impact (the difference between the control group and participant customer loads). All of the events show a clear drop in treatment group loads during the event dispatch period. The figures also clearly depict the increase in load during the pre-cooling phase immediately preceding the event period.

Figure 4-6: Per Household BYOT Event Performance, August 11 and August 12

Event Date	8/11/2021
Start Time	3:55 PM
End Time	5:00 PM
Pre-cool	2°F for 90 mins
Offset	4°F
System Temperature	89°F
Event Impact	1.43 kW

Event Date	8/12/2021
Start Time	3:55 PM
End Time	5:00 PM
Pre-cool	2°F for 90 mins
Offset	4°F
System Temperature	91°F
Event Impact	1.39 kW

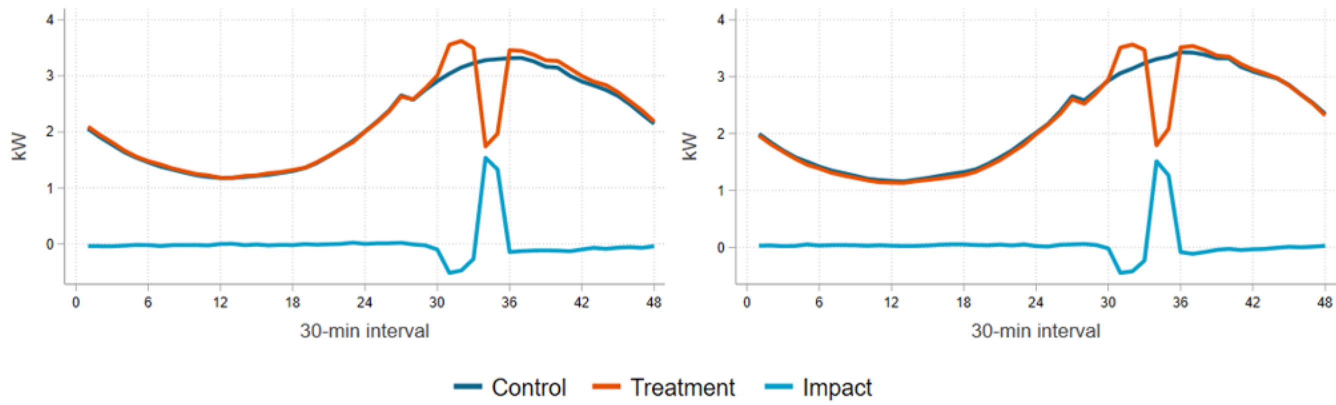


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Figure 4-7: Per Household BYOT Event Performance, August 13 and August 23

Event Date	8/13/2021
Start Time	3:55 PM
End Time	5:00 PM
Pre-cool	1°F for 60 mins
Offset	3°F
System Temperature	94°F
Event Impact	1.34 kW

Event Date	8/23/2021
Start Time	3:55 PM
End Time	5:00 PM
Pre-cool	2°F for 90 mins
Offset	4°F
System Temperature	91°F
Event Impact	1.25 kW

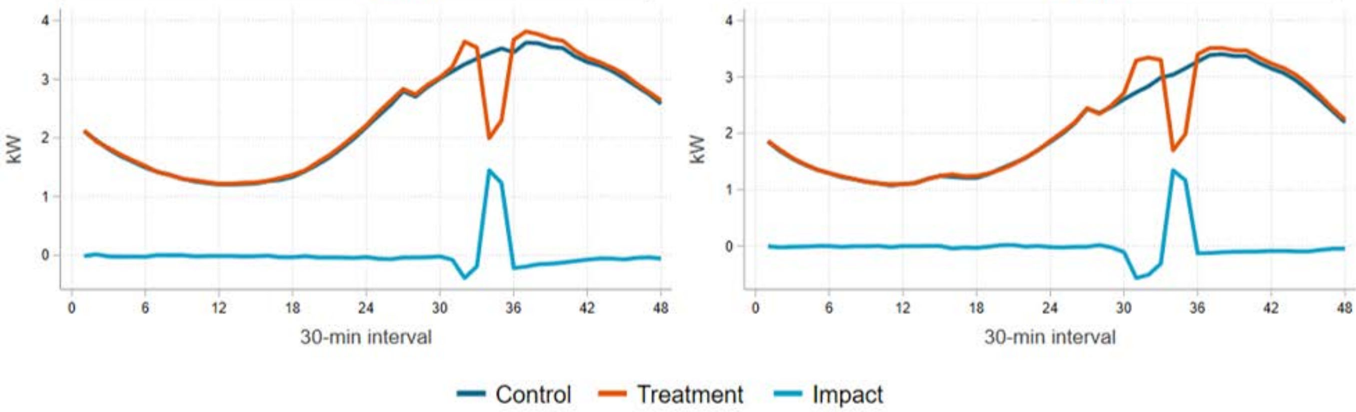
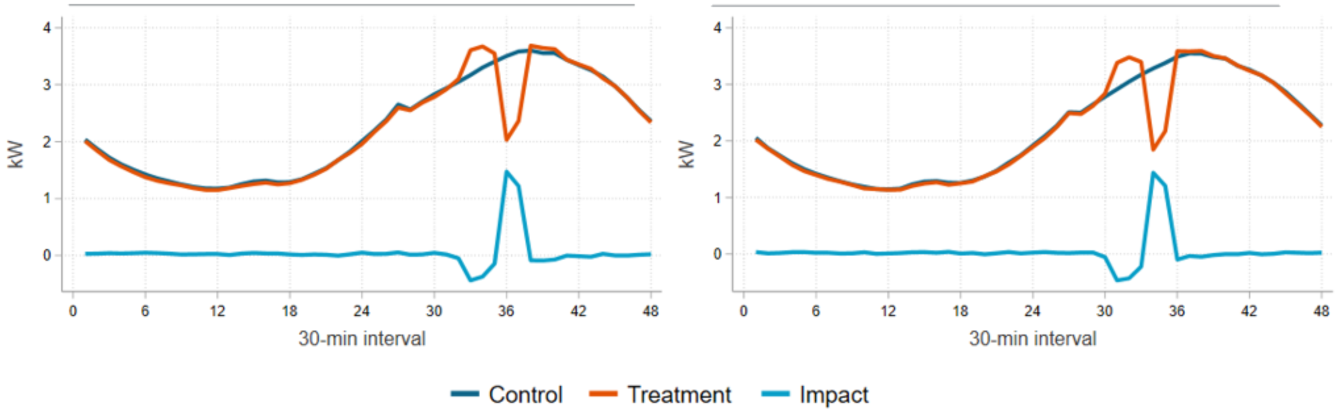


Figure 4-8: Per Household BYOT Event Performance, August 24 and August 30

Event Date	8/24/2021
Start Time	4:55 PM
End Time	6:00 PM
Pre-cool	2°F for 90 mins
Offset	4°F
System Temperature	93°F
Event Impact	1.35 kW

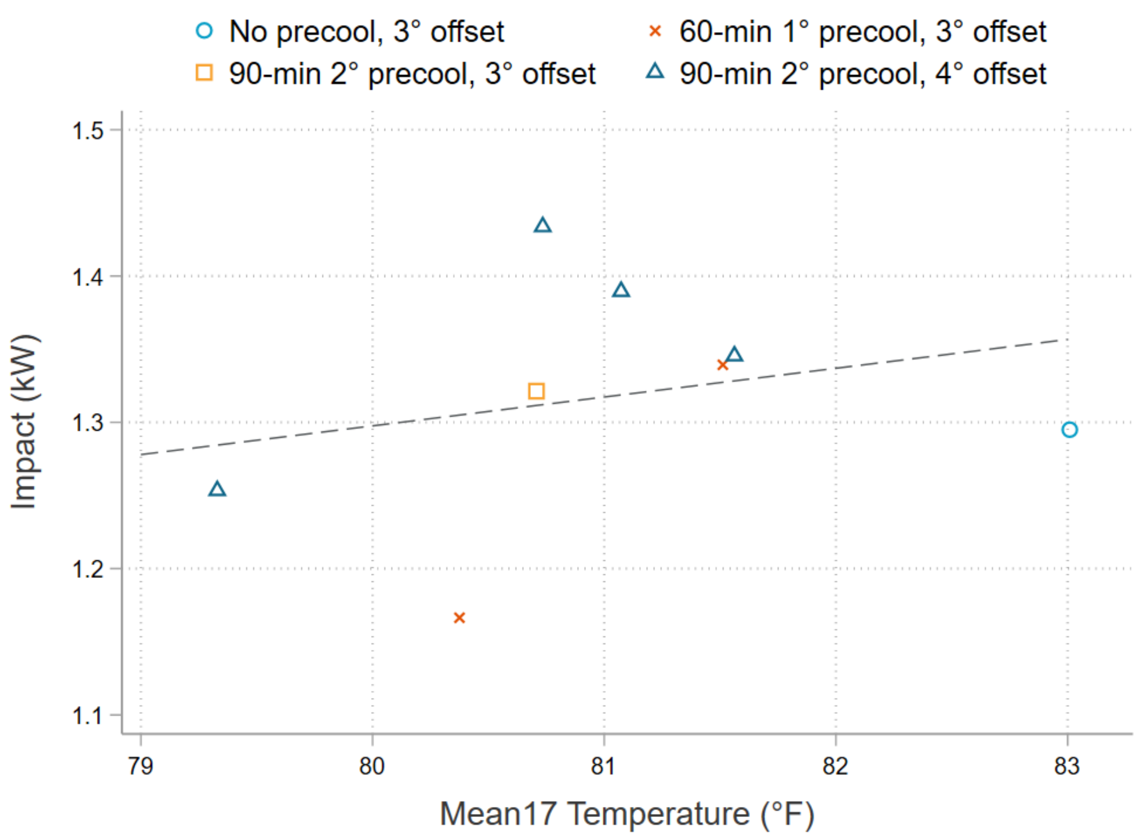
Event Date	8/30/2021
Start Time	3:55 PM
End Time	5:00 PM
Pre-cool	2°F for 90 mins
Offset	3°F
System Temperature	92°F
Event Impact	1.32 kW



4.2.2 Weather Sensitivity

As with the DLC events, there is a clear correlation between the magnitude of BYOT event impacts and the mean17 temperature variable. The figure below shows the increasing trend: as the temperature rises, impacts increase.

Figure 4-9: Weather Sensitivity of BYOT Event Impacts



4.3 Key Findings

- DLC impacts ranged between 0.39 and 0.79 kW during normal operations.
- DLC impacts under emergency conditions tended to be larger than those dispatched under normal conditions, averaging 1.0 kW per customer.
- The average BYOT load reduction across all events in was 1.32 kW
- The magnitude of baseline loads and load impacts tend to increase with temperature
- BYOT event impacts tend to grow larger as the magnitude of temperature setpoint offset increases
- There does not appear to be any significant difference in BYOT event performance due to pre-cooling and event period offset condition

5 Within-Subjects Results

In addition to the events described in the previous section, some events were called in Summer 2021 that could not be estimated using RCT approach because they were called for the full program population and did not withhold a control group.

5.1 DLC Within-Subjects Results

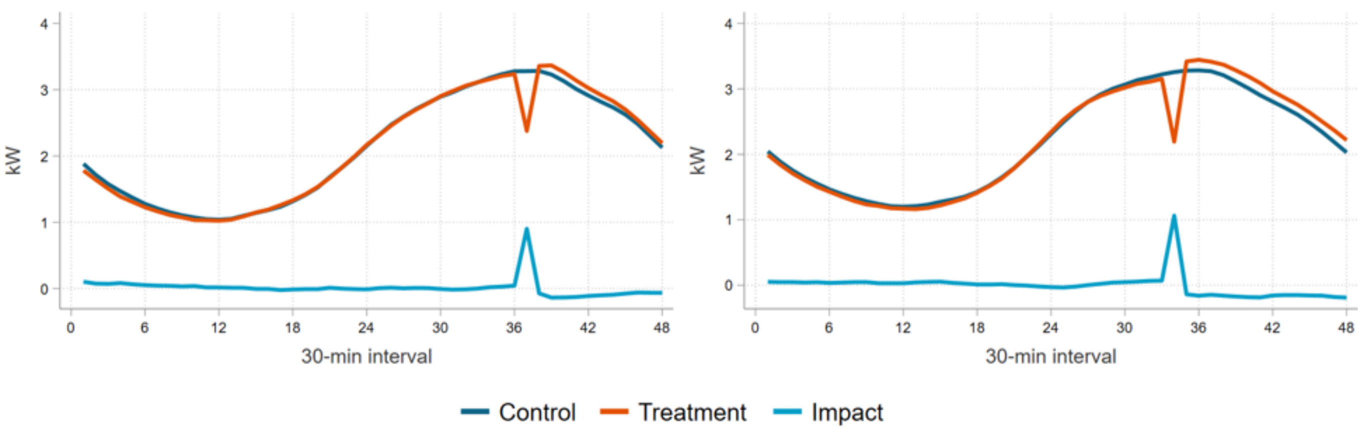
5.1.1 DLC Event Impacts

For each of the two events that were called for the full DLC population, a different set of proxy days was selected and used to generate the baseline loads through the process summarized in Section 3.4. In this way, baselines were found that closely resembled the load patterns of the treatment groups during nonevent hours, and accurately simulate the event period loads absent curtailment, i.e. the counterfactual. Both events called for the entire DLC population in 2021 were full shed events, compared to previous evaluations where at least one full shed and one normal shed event were called per year. Event day loads and impacts for the two within-subjects events are shown in Figure 5-1.

Figure 5-1: Within-Subjects DLC Event Performance, June 30 and July 16

Event Date	6/30/2021
Start Time	5:30 PM
End Time	5:58 PM
Event Strategy	Full shed
System Temperature	86°F
Event Impact	0.90 kW

Event Date	7/16/2021
Start Time	4:00 PM
End Time	4:28 PM
Event Strategy	Full shed
System Temperature	89°F
Event Impact	1.06 kW



5.1.2 Key Findings

- The within-subjects methodology produced accurate reference loads against which to compare treatment loads, leading to highly reliable impact estimates
- Average impacts for within-subjects events in 2021 were similar to analogous RCT events dispatched under emergency conditions (0.98 kW, compared to an RCT average of 1.0 kW).
- The event on July 16 produced per-customer impacts of 1.06 kW, which was the largest single event impacts of the year for the DLC program.

5.2 BYOT Within-Subjects Results

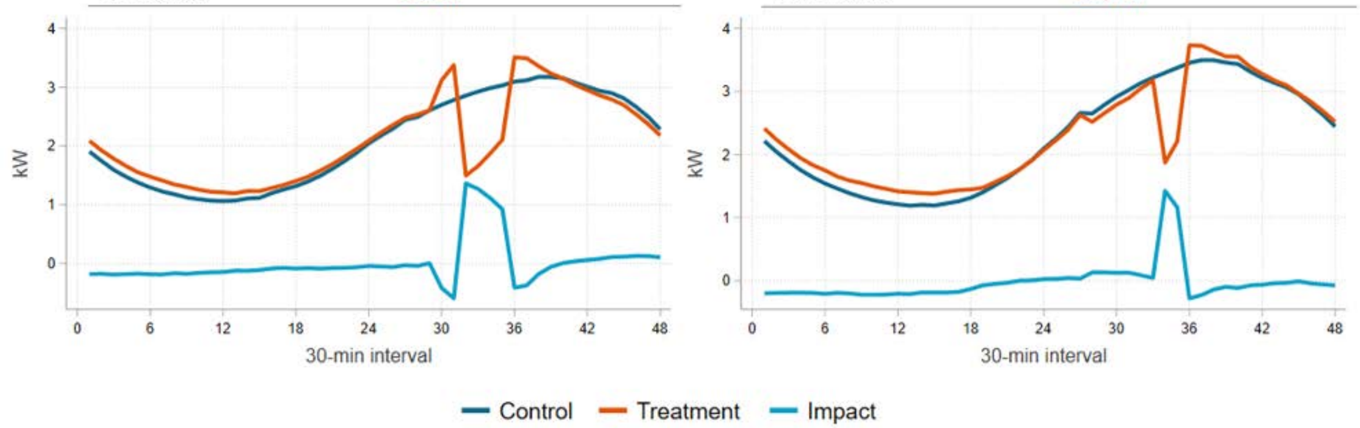
5.2.1 BYOT Event Impacts

Two BYOT events were called population-wide in 2021 and did not involve a control group. For each of these events, a set of non-event proxy days were used to construct a baseline against which to compare event day loads. The first such event was called on July 1 and involved a 3°F offset that lasted for two hours (3:00 PM to 5:00 PM). The event was preceded by a 1°F pre-cool for one hour. The second event, called on July 30, involved a 3°F offset for two hours. There was no pre-cooling for the second event. Event day loads and impacts for the two events are shown in Figure 5-2.

Figure 5-2: Within-Subjects BYOT Event Performance, July 1 and July 30

Event Date	7/1/2021
Start Time	3:00 PM
End Time	5:00 PM
Pre-cool	1°F for 60 mins
Offset	3°F
System Temperature	88°F
Event Impact	1.17 kW

Event Date	7/30/2021
Start Time	3:55 PM
End Time	5:00 PM
Pre-cool	None
Offset	3°F
System Temperature	91°F
Event Impact	1.30 kW



5.2.2 Key Findings

- Per household event impacts for the two population-wide BYOT events called on July 1 and July 30 were 1.17 kW and 1.30 kW, respectively
- The initial (first event interval) load drops were similar for each event
- Pre-cooling on July 1 produced load increases of approximately 0.7 kW during the 60-minute period prior to the event

6 Demand Reduction Capability

A key objective of the Summer 2021 impact evaluation was to quantify the relationship between demand reductions, temperature, and hour of day. This was accomplished by estimating loads under historical weather conditions and applying observed percent load reductions from the 2021 events. The resulting tool, referred to as the time-temperature matrix, allows users to predict the program's load reduction capability under a wide range of temperatures and event conditions.

Similar tools were developed for DLC and BYOT options. However, due to specific contraints in the data, the methodologies used to develop each version of the tool differed. The following sections detail the methodologies, challenges, and results of the Time-Temperature Matrix for both DLC and BYOT events.

6.1 DLC Time-Temperature Matrix

In an ideal program year, a large number of events would be called under a variety of different weather conditions, dispatch windows and cycling strategies so that demand reduction capability could be estimated for a wide range of operating and planning scenarios. In actuality, opportunities for program events can be sporadic, and based on uncertain weather projections, such that they occur infrequently and under fairly similar conditions. In 2021, events were called under a somewhat narrow range of temperature conditions, with system temperatures ranging from 86°F to 94°F. Additionally, no events reached the 100°F target used for estimating program capability. As a result, the ability to predict demand reduction capability across a broader range of conditions – particularly during extremely hot days – was somewhat inhibited.

6.1.1 Methodology

The figure below illustrates weather sensitivity trends of load impacts and peak household demand on hot, nonevent days. The figure, which is based on actual 2021 customer data, shows that Power Manager demand reductions grow on a percent basis as temperatures increase. At the same time, peak household loads available for curtailment also increase with temperatures. The implication is that larger reductions are attainable from larger loads when temperatures are higher.

Figure 6-1: Load Impact Weather Sensitivity

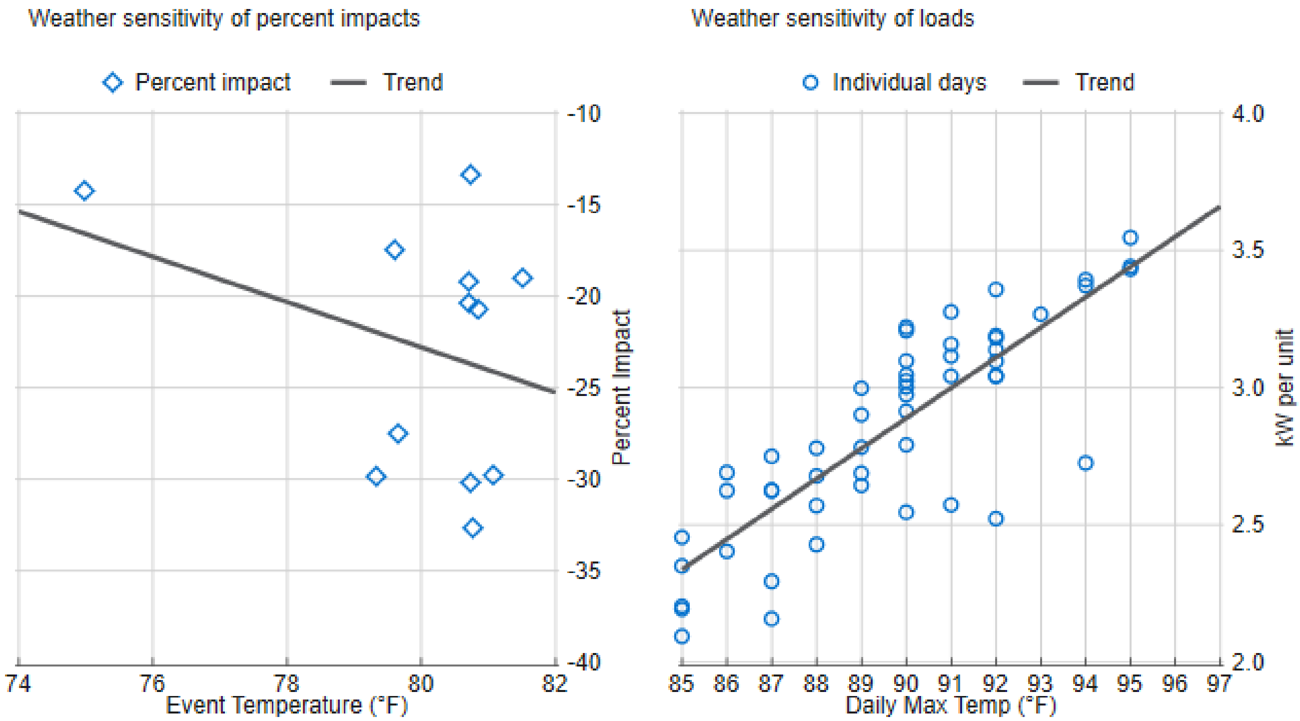
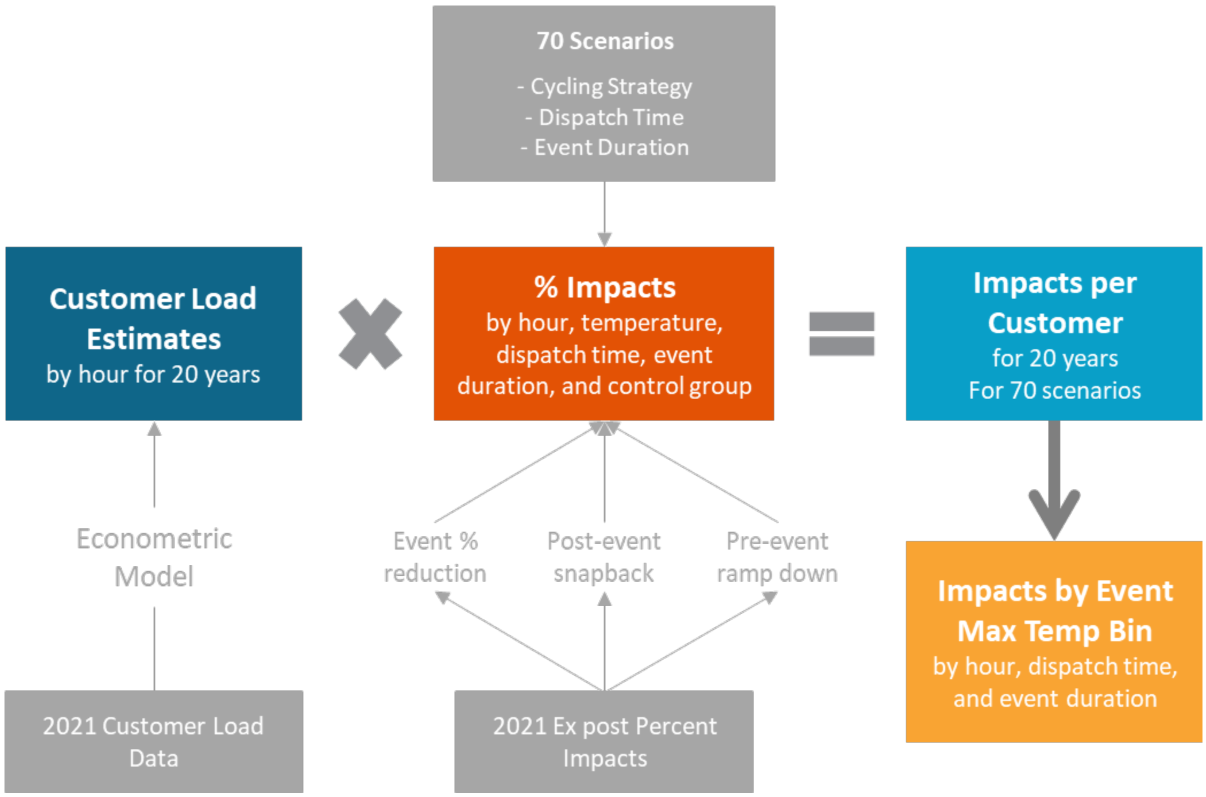


Figure 6-2: Time-Temperature Matrix Development

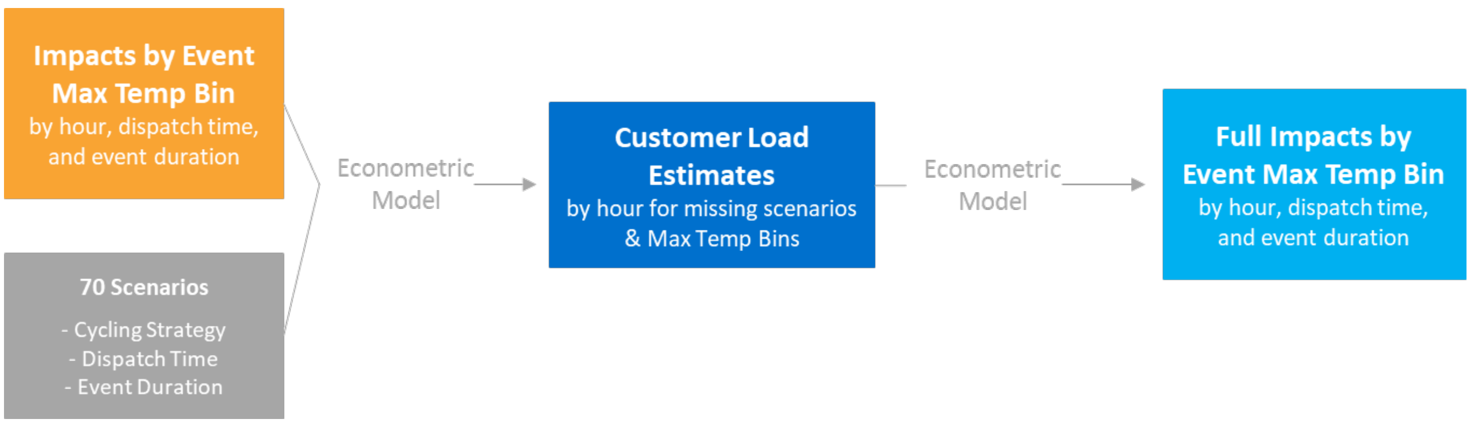


The process shown in the figure above involved the following components:

- Estimates of customer loads were developed by applying 2021 AMI data to the same regression models used to estimate impacts. All weekdays with daily average temperatures above 70˚F were included in the models. The 2021 usage patterns were applied to actual weather patterns experienced over the past ten years rather than hypothetical weather patterns.
- Estimates of the percent reductions were based on three distinct econometric models: load control phase-in, percent reductions during the event, and post-event snapback. The models were based on the percent impacts and temperatures experienced both during the event periods and throughout the event days.
- A total of 70 scenarios were developed to reflect various cycling/control strategies, event dispatch times, and event lengths .
- Estimated impacts per customer were produced by combining the estimated household loads, estimated percent reductions, and dispatch scenarios. The process produced estimated hourly impacts for each hot weekday during 2002-2021 under 70 scenarios.
- In instances where weather data didn't exist to estimate impacts, post-estimation regressions were run in order to properly estimate missing values.
- Multiple days were placed into 2-degree temperature bins and were averaged to produce an expected load reduction profile for each temperature bin.

During the development of the Summer 2021 Time-Temperature Matrix (TTM), it was discovered that the analysis dataset did not contain the data necessary to model impacts for certain scenario and temperature combinations. These combinations typically occur at higher temperatures and when the event starts later in the day. The logic behind this is relatively intuitive; temperatures at the high end of the TTM selection pool are sporadically hit, or not at all. Without historical data to apply usage patterns against, reference loads cannot be modeled nor can impacts be estimated. In order to model impacts as accurately as possible, a secondary modeling cycle was undertaken after initial impacts had been calculated. The second round of models takes the results from existing time-temperature combinations and applies the same regression in order to determine reference loads, temperature profiles and impacts for the missing time-temperature periods. This process is outlined in the figure below.

Figure 6-3: Imputing Missing Time-Temperature Period Values



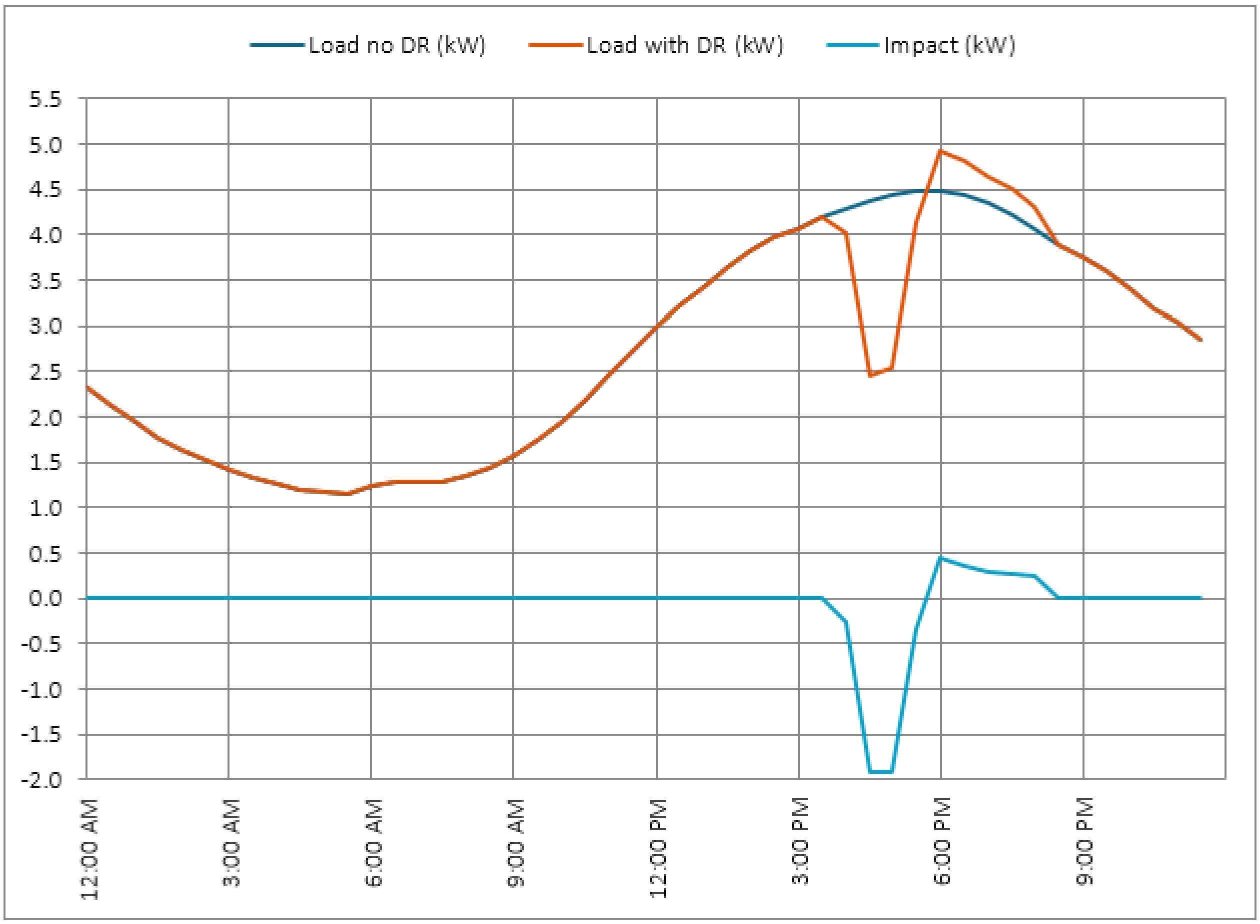
6.1.2 Demand Reduction for Emergency Conditions

While Power Manager is typically dispatched for economic or research reasons, its primary function is to deliver demand relief during extreme conditions, when demand is high and capacity is constrained. Extreme temperature conditions can trigger emergency operations, which are designated to deliver larger demand reductions than normal event cycling. During emergency conditions, all program devices are instructed to instantaneously shed loads. While emergency operations are rare and ideally avoided, they represent the full demand reduction capability of Power Manager. A 1-hour emergency event starting at 4:00 PM and with a maximum temperature of 100°F during the event is provided in the figure shown below. Under these conditions, individual customers are expected to deliver 1.92 kW of demand reduction over a one-hour event window. Because there are approximately 239,700 customers enrolled in Power Manager, the expected aggregate reduction is 459.1 MW.

Figure 6-4: Demand Reduction Capability of DLC Event

Inputs	
Dispatch Type	Emergency Dispatch
Event Start Time	4 PM
Event Duration	1
Event Period Max Temp	100
# Customers	239,700

Event Window Average Impacts		
Load without DR	4.41	kW per customer
Load with DR	2.49	kW per customer
Impact per Customer	-1.92	kW per customer
Program Impact	-459.1	MW
% Impact	-43.4	%



The table below presents estimated load reduction capability under various temperature and time-of-day event conditions, assuming a one-hour event duration.

Table 6-1: Per Customer Impacts (kW) under Emergency Conditons

Daily Max Temperature	Event Start Time 1:00 PM	2:00 PM	3:00 PM	4:00 PM	5:00 PM
88°F	0.85	0.92	0.99	1.05	1.13
90°F	0.96	1.03	1.10	1.17	1.27
92°F	1.08	1.17	1.24	1.31	1.39
94°F	1.21	1.29	1.36	1.44	1.53
96°F	1.38	1.45	1.52	1.60	1.76
98°F	1.49	1.62	1.79	1.81	1.87
100°F	1.61	1.72	1.79	1.92	1.71

The key takeaway is that impacts grow as temperatures increase and as the event starts later in the day. Impacts increase with later event start times because reference loads are generally increasing from 1:00 PM to 5:00 PM during the summer months. In practice, event day impacts may vary due to unique weather patterns.

6.1.3 Key Findings

Key findings learned from the development of the DLC time-temperature matrix include:

- Impacts generally increase as temperatures increase, and as events are called later in the day.
- The highest predicted impacts occur during 4pm under 100-degree conditions.

Due to constraints with available high temperature weather data in a 10-year period, the time frame of available weather data was expanded to 20 years. The trend in recent years of temperatures rarely exceeding 100 degrees will likely cause 20-year weather data to become the standard to model reference loads.

6.2 BYOT Time-Temperature Matrix

Similar to the DLC event season, relatively few BYOT events were called in Summer 2021. Collectively, they were held under a narrow range of pre-cooling and event conditions, which limited the ability of the Time-Temperature Matrix tool to reliably predict load reductions under the more extreme settings. Of the eight BYOT events called in 2021, four of them were held with the same pre-cooling and event settings. The other four were split between three remaining pre-cooling and event conditions, as shown in Table 4-3.

6.2.1 Methodology

The methodology used to develop the BYOT Time-Temperature Matrix differed somewhat from the one used to produce the DLC Time-Temperature Matrix, primarily because it was difficult to establish a clear correlation between event impacts and certain event settings, such a start time and temperature. This ultimately resulted in modeled impact estimates under extreme conditions that were counterintuitive, unrealistic, or otherwise unbelievable. Rather than submit a tool that is consistent with the standard methodology, but that produced spurious impact predictions, Resource Innovations modified the methodology in a way that resulted in logical estimations that follow known trends in terms of temperature and time-of-day event conditions.

The first step was consistent with the DLC methodology, where reference loads were modeled for a wide range of temperature conditions by applying the observed AMI data from 2021 to 10-year historical weather data. From there, average percent reductions observed for each type of event were applied to the modeled referend loads for each of the various combinations of event start times, maximum temperatures, event durations, and event types.[1] In this way, event impacts, as well as pre- and post-event load increases, are purely a function of the reference loads and are not subject to the modeling error observed in the original approach. Table 6-2 shows the average percent impacts for each period of the four event types.

[1] The term “event type” is used to reflect the four different scenarios, combining pre-cooling duration, pre-cool temperature offset, event period duration, and event period temperature offset, used in 2021.

Table 6-2: Average Percent Impacts by Period and Event Type

Event Type	# Events Called	Period	Average % Impact
No Pre-Cool / 3°F Event Offset	1	Pre-Event	0.0%
		Event	38.8%
		Post-Event	-6.2%
60-minute 1°F Pre-Cool / 3°F Event Offset	2	Pre-Event	-13.6%
		Event	39.3%
		Post-Event	-7.8%
90-minute 2°F Pre-Cool / 3°F Event Offset	1	Pre-Event	-12.4%
		Event	39.7%
		Post-Event	-1.7%
90-minute 2°F Pre-Cool / 4°F Event Offset	4	Pre-Event	-12.8%
		Event	41.0%
		Post-Event	-3.1%

6.2.2 Demand Reduction Capability for BYOT Events

Like DLC events, the primary purpose of BYOT is to relieve (or shift, if pre-cooling) load demand during times of system peak demand. To maintain customers' comfort, the most extreme BYOT events (i.e., those with the largest temperature offsets) are ideally used sparingly and only when needed. Collectively, the 2021 events show that per household load impacts are correlated with the event period temperature offset. Put simply, larger offsets generate greater impacts. Therefore, the most extreme event type is used for estimating the program's load reduction capability.

Figure 6-5: Load Reduction Capability for Extreme BYOT Event

INPUTS		
Event Start Time	4 PM	▼
Event Duration	1	▼
Event Option	90 min 2 deg precool / 4 deg offset	▼
Event Temperature	100	▼
# Customers	33,900	

OUTPUTS		
Reference Load	4.29	kW
Curtailed Load	2.53	kW
Impact per Customer	-1.76	kW
Program Impact	-59.7	MW
% Impact	-41.0	%

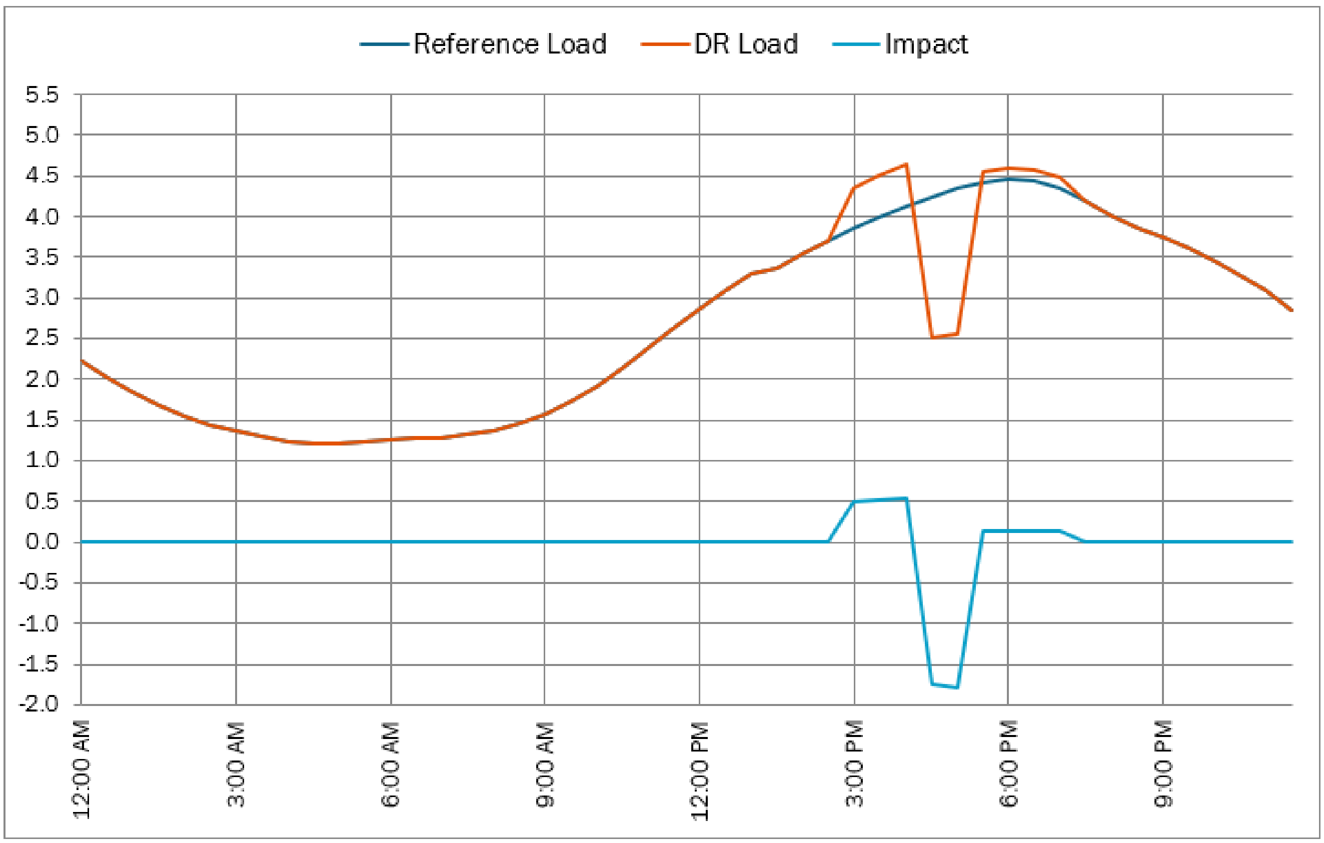


Figure 6-2 shows load impact predictions for an extreme BYOT event. Specifically, a 1-hour BYOT event beginning at 4:00 PM at 100°F that involves a 4°F offset, preceded by a 90-minute 2°F pre-cool, is expected to generate impacts of 1.76 kW per household. Assuming a program population of 33,900 accounts, this translates to approximately 60 MW of system load reduction.

6.2.3 Key Findings

Key takeaways from the BYOT Time-Temperature Matrix include:

- Impacts, which are applied as a percentage of the reference load, are correlated to temperature. As temperatures rise, both reference loads and impacts increase.
- Under the most extreme event settings observed – namely a 4°F offset with a 2°F pre-cool – a 1-hour event beginning at 4:00 PM at 100°F produces a per household impact of 1.76 kW.
- Similar to what was found during the development of the DLC TTM, relatively few events called under a narrow range of event and weather conditions led to significant challenges in modeling impacts for extreme scenarios, ultimately persuading Resource Innovations to modify the methodology used to develop the BYOT TTM.

7 Process Evaluation

Process evaluation, particularly when combined with the insight obtained from impact evaluation, informs efforts to continuously improve programs by identifying program strengths and weaknesses, opportunities to improve program operations, program adjustments likely to increase overall effectiveness, and sources of satisfaction or dissatisfaction among participating customers. The primary objectives for the process evaluation component of the evaluation include:

- Assess the extent to which particpants are aware of events, bill credits, and other key program features
- Understand the participant experience during events, including comfort, occupancy, thermostat adjustments, and strategies employed to mitigate heat
- Identify motivations and potential barriers for participation, including expectations, sources of confusion or concern, intention to stay enrolled, and likelihood of recommending the program to others
- Document the operations, recruitment, enrollment, outreach, notification, and curtailment activities associated with program delivery
- Identify program strengths and potential areas for improvement

Section 7.1 describes the survey disposition, event and nonevent days for both DLC and BYOT surveys. Section 7.2 details the results and findings of the DLC surveys, and Section 7.3 details the results and findings ofr BYOT surveys. Findings from the in-depth interviews are contained in Section 7.4. Section 0 summarizes the key findings from the process evaluation.

7.1 Survey Disposition

To evaluate the effect that Power Manager events have on DLC and BYOT participants, two surveys were sent to random samples of each program's participant population; a post-event survey immediately following a Power Manager event, and a nonevent survey immediately following a hot day where no Power Manager event was called. Table 7-1 presents summary of temperatures during the event and nonevent surveys for both DEC DLC and DEC BYOT customers.

For DLC, the post-event survey was completed by 94 customers following an event day (July 28) and the nonevent survey was completed by 68 customers following a hot nonevent day (July 15). The post-event survey was launched the evening of the event day, and the nonevent survey was launched the evening of the baseline day. For BYOT, the post-survey was completed by 106 customers following an event day (August 11) and the nonevent survey was completed by 82 customers following a hot nonevent day (July 15). The event survey was launched the morning following the event day, and the nonevent survey was launched the afternoon of the baseline day. The nonevent day, July 15, was comparable to the two event days in temperature during the event period.

Table 7-1: Summary of Event and Nonevent Surveys

Jurisdiction & Technology	Date	Event ? (Y/N)	Completes	Survey Start Time	Maximum Daily Temperature (°F)	Average Event Temperature (°F)	Maximum Daily Heat Index (°F)	Average Event Heat Index (°F)
DEC DLC	7/28/2021	Y	94	7/28 5:00 PM	91	88.6	97.3	93.6
DEC DLC	7/15/2021	N	68	7/15 4:30 PM	88.7	86.6	93.7	91.9
DEC BYOT	8/11/2021	Y	106	8/12 9:00 AM	90.3	85.2	98.7	91.7
DEC BYOT	7/15/2021	N	82	7/15 4:30 PM	88.7	86.6	93.7	91.9

Table 7-2 presents overall response rates for each program by the method of survey administered (phone/web) for event and nonevent surveys. DLC's overall response rate for the two surveys was 3.7%. Response rates were higher for customers surveyed by phone, with 7.6% of customers on event days and 5.8% of customers on nonevent days responding via phone, compared to 2.8% of customers on event days and 2.5% of customers on treatment days responding via web. The overall response rate for the two BYOT surveys was 4.0%. Response rates were higher for customers surveyed by phone, with 7.0% of customers on event days and 5.4% of customers on nonevent days responding via phone, compared to 2.9% of customers on event days and 2.5% of customers on treatment days responding via web.

Table 7-2: Response Rates by Program and Administration

Overall Response Rates					
Group	Web Treatment	Web Control	Phone Treatment	Phone Control	Total
DEC DLC (n=162)	2.8%	2.5%	7.6%	5.8%	3.7%
DEC BYOT (n=188)	2.9%	2.5%	7.0%	5.4%	4.0%

7.2 DLC Survey Results

7.2.1 Participant Background

Aside from occasional program communications to participants, the primary way that Duke Energy customers experience the Power Manager program is during load control events. A majority of survey respondents, 90.5%, stated that there is normally someone home between the hours of 1:00 pm and 7:00 pm on weekdays. Similarly, large proportions of respondents also reported that they are frequent users of their air conditioning systems. Table 7-3 shows the percentage of respondents that reported they used their air conditioners every day for four different time periods and day type combinations. Generally, between 83.3% and 89.7% of Power Manager survey respondents reported using their air conditioners every day during weekday afternoon and evenings. During the weekend, the rates of customers that use their air conditioners everyday increases; between 85.7% and 95.3% of customers stated that they run their units during weekend afternoons and evenings. Statistically significant differences in response patterns between post-event and nonevent respondents were not observed. The percentage of post and nonevent respondents that use their air conditioner during both weekdays and weekend afternoons and evenings is significantly higher than respondents in 2019, potentially due to an increase in work from home employment.

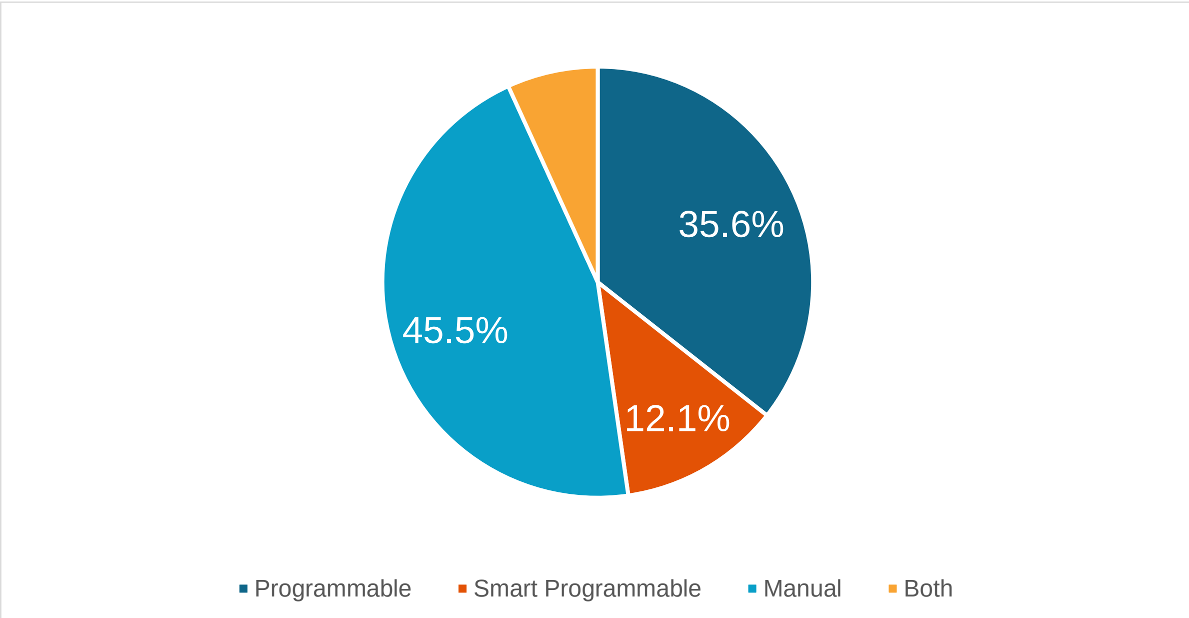
The survey responses indicate that Power Manager participants are largely at home and using their air conditioners during the times that the program is likely to be launched as a resource. As such, monitoring participant comfort levels is confirmed to be an important evaluation activity so that thermal comfort can be maintained at high enough levels to retain customer participation.

Table 7-3: Percent of Respondents that Use their AC Every Day during… – DLC

Day and Time	% of Post-event Respondents (n=94)	% of Nonevent Respondents (n=68)
Weekday Afternoons 1 PM - 7PM	89.7%	88.7%
Weekend Afternoons 1 PM - 7 PM	93.2%	95.3%
Weekday Evenings 7 PM - Midnight	83.3%	84.4%
Weekend Evenings 7 PM - Midnight	85.7%	92.1%

In addition to occupancy patterns and frequency of air conditioning usage, Power Manager participants' experience with the program is affected by how they operate their air conditioning systems. Survey responses show that there is a mix of both manual and programmable thermostats installed in the homes of DLC Power Manager participants. Figure 7-1 summarizes the types of thermostat(s) that survey respondents reported. 35.6% of customers have a programmable thermostat, while 12.1% have a smart programmable thermostat. Another 45.5% of respondents said that they have a manual thermostat installed in their home; 6.8% have both a programmable and manual thermostat in their homes. There was no significant difference in thermostat types between post-event and nonevent survey respondents.

Figure 7-1: "What type of thermostat do you have?" (n=162) – DLC



Respondents were asked which statement best describes how they use their AC system(s) during the summer. Across all respondents, 63.9% stated that they keep their thermostat set at a constant temperature, 17.7% stated that they manually adjust the temperature settings at different times of the day, 11.4% reported using the programmability feature to allow the thermostat to cool to different temperatures at different times, and a further 5.1% state that they manually turn it on and off when it gets too cool or too hot. 1.9% of respondents stated that they never use their air conditioning. There was no significant difference in thermostat use between post-event and nonevent respondents. Table 7-4 shows how DLC respondents use their AC system during the summer.

Table 7-4: "Which of the following best describes how you operate your central AC system(s) during the summer?" – DLC

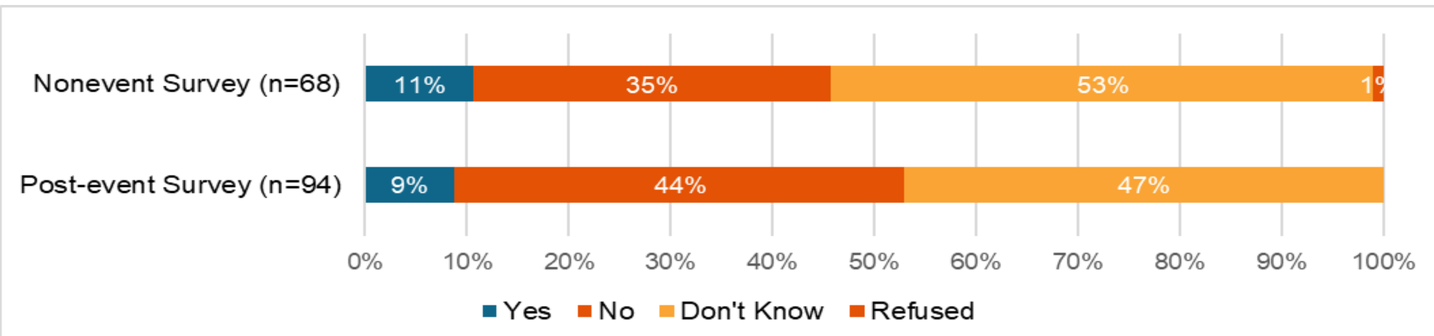
Survey	Keep it set at a constant temperature, so it runs whenever the temperature goes above it	Manually turn the AC on and off when needed	Manually adjust the temperature setting at different times such as when you leave your home or go to bed at night	Allow the program to automatically change the temperature at different times	Never use it	Total
Nonevent Survey (n=94)	62.7%	6.0%	17.9%	10.5%	3.0%	100.0%
Post-event Survey (n=68)	64.8%	4.4%	17.6%	12.1%	1.1%	100.0%
Total	**63.9%**	**5.1%**	**17.7%**	**11.4%**	**1.9%**	**100.0%**

7.2.2 Program and Event Awareness

DLC respondents across both post-event and nonevent surveys were asked if they were aware of the Power Manager program. Of all participants surveyed, 71.6% of DLC participants responded that they are familiar with Power Manager.

Both post-event and nonevent respondents were asked if they believed a Power Manager event occurred in the past few days prior to being surveyed. 10.6% of post-event respondents believed an event had occurred while 8.8% of nonevent respondents believed that an event had occurred. The responses were not significantly different between the post-event and nonevent respondents indicating that DLC participants are generally unaware of when events occur. Note that DLC participants were much less likely to state that an event had occurred in the past few days compared to BYOT participants, regardless of if an event had actually occurred.[2] Figure 7-2 displays the percentage of DLC respondents that believed an event occurred over the past few days.

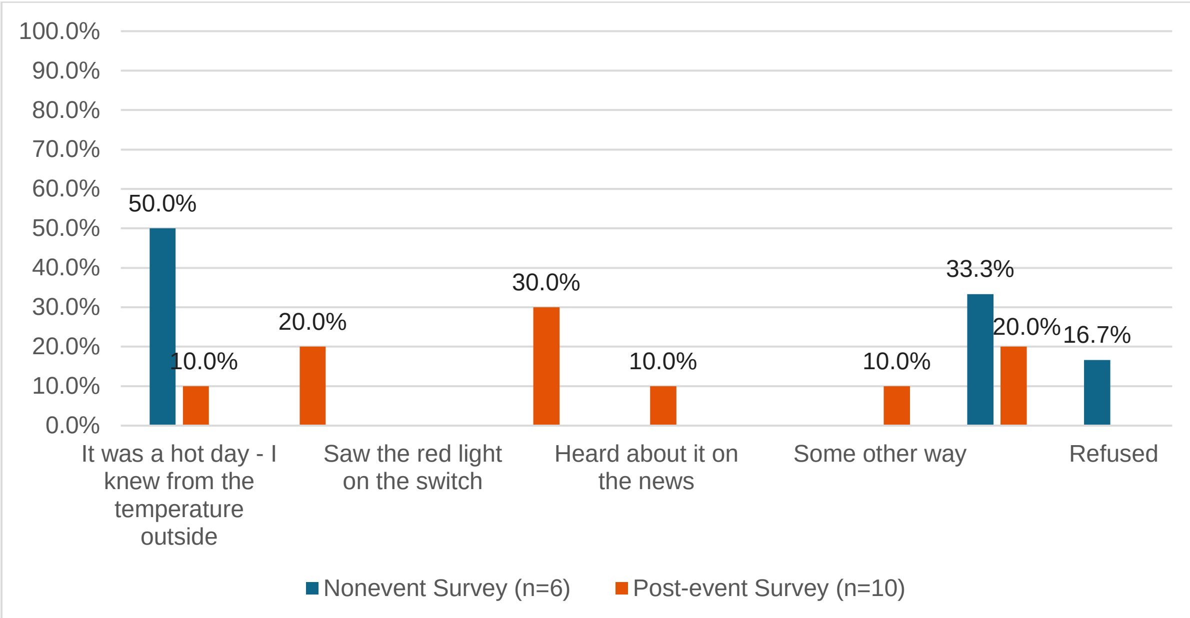
Figure 7-2: "Do you think a Power Manager event occurred in the past few days?" – DLC



Respondents that perceived an event were asked how they determined the event was occurring. Among respondents in the post-event survey, the most common reason given was participants did not hear the air conditioner running as they expected (30.0%). 50.0% of nonevent respondents stated they knew an event occurred because it was hot day outside while the remaining nonevent respondents said, "Don't Know" or "Refused." Figure 7-3 highlights the reasons that participants gave for believing an event occurred.

[2] See Section 7.3.2.

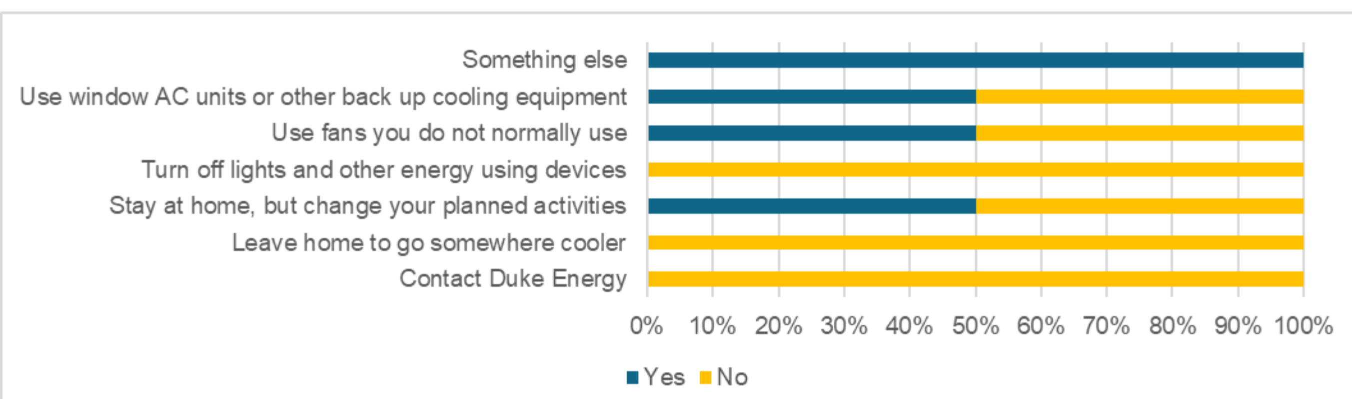
Figure 7-3: "How did you determine an event was occurring?" – DLC



Of those that believed an event had recently occurred, 40% of post-event respondents were able to correctly identify the day the event occurred on. Post-event and nonevent respondents had comparable distributions of when they believed the event occurred.

Respondents that believed an event had occurred and were home during the perceived event were asked whether they took any action in response, regardless of if an event occurred or not. 83.3% of all respondents did not take any action in response to a real or perceived event. Only one post-event and one nonevent respondent described which activities they took in response to the perceived event. DLC participants did not have the option to opt out of the event. Figure 7-4 displays actions taken by both post-event and nonevent respondents in response to a perceived event. "Something else" responses included turning down the AC and getting a cold drink.

Figure 7-4: Actions Taken due to Perceived Event: "Did you…" (n=2) – DLC



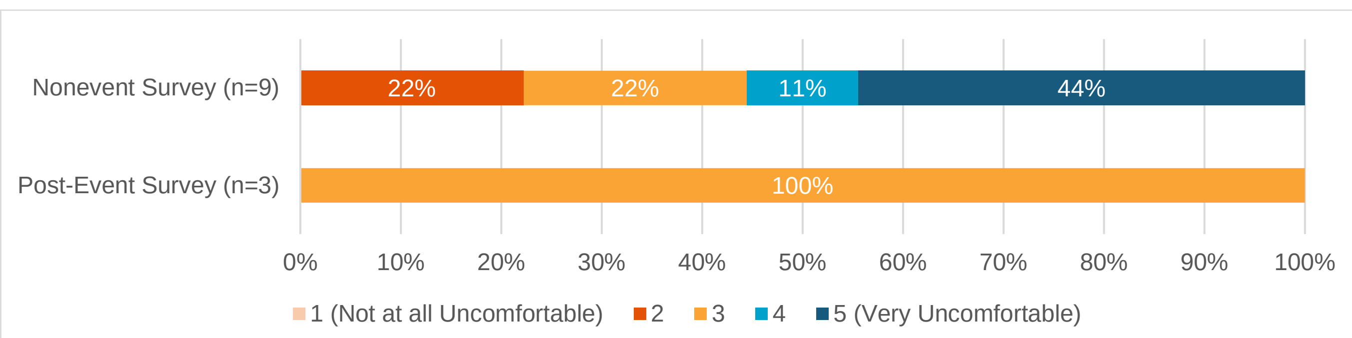
7.2.3 Program Respondent Comfort

To measure if DLC participants experience thermal discomfort during events, post and nonevent survey respondents were asked several questions about their comfort during the event day.[3] First, post-event respondents were asked if they experienced any thermal discomfort during the event day and nonevent respondents were asked if they experienced any thermal discomfort during the baseline day. Overall, 12.9% of all respondents said they were uncomfortable in their homes at any time during the day in question. 9.1% of post-event respondents and 14.7% of nonevent respondents said they were uncomfortable in their home at some point during the day in question. The difference between the percentage of respondents that reported discomfort is not statistically different at the 90% level of confidence. Put differently, the survey data presents no evidence that Power Manager events increase thermal discomfort in the home.

The respondents that reported discomfort on the day in question were asked when their discomfort started and ended. Respondents in the post-event survey did not differ significantly from those in the nonevent survey in the hours during which they reported feeling uncomfortable, indicating that the timing of thermal discomfort was not linked to the Power Manager event.

Customers that responded that they experienced discomfort on the event or non-event day were asked to rate their discomfort on a scale of 1-5. A response of 1 represented not at all uncomfortable while a response of 5 represented very uncomfortable. Figure 7-5 displays the results. No participants stated they were not at all uncomfortable. All post-event respondents that stated they were uncomfortable during the event rated their discomfort at 3. In contrast, nonevent respondents rated their discomfort from 2-5, with 44.4% stating they were very uncomfortable.

Figure 7-5: "Please rate your discomfort on a scale of one-to-five..." – DLC

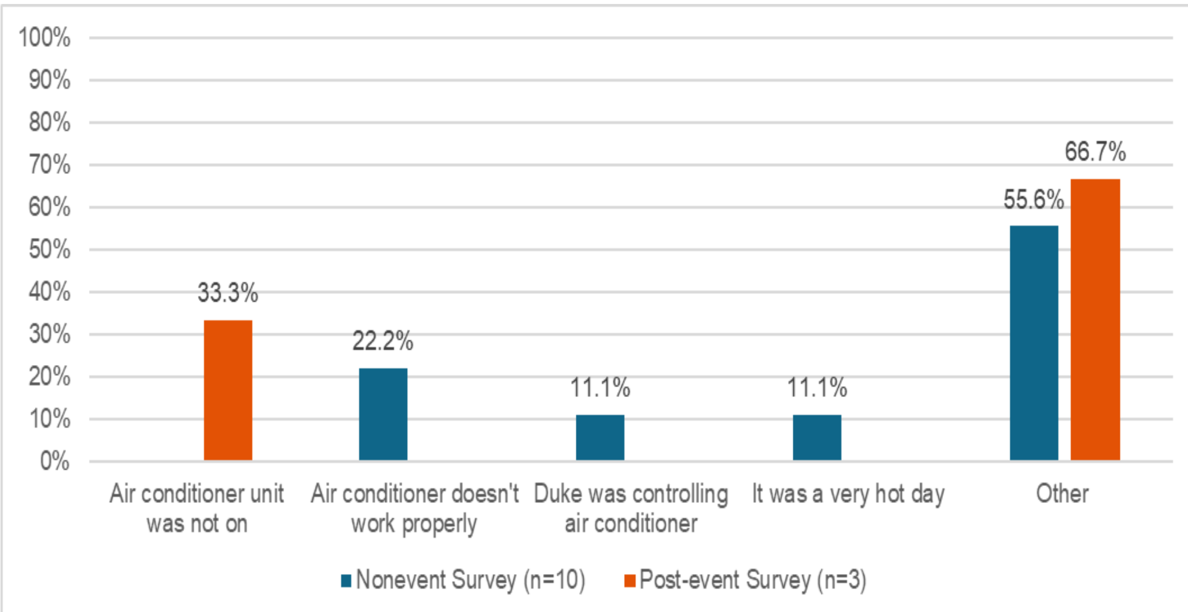


Respondents that stated they were uncomfortable during the event or nonevent day were asked to what they attributed their discomfort. This question was asked before any discussion of Power Manager events, to build an understanding of how customers perceive events. A majority of respondents did not attribute their discomfort to Duke Energy controlling their air conditioner through the Power Manager program, with this response comprising 0% of post-event responses and 11.1%

[3] Due to a survey programming error at the end of the survey deployment period, 57 post-event survey responses were dropped from analysis for the four questions pertaining to thermal discomfort.

of nonevent responses. Figure 7-6 displays respondents' attributions of thermal discomfort. 33.3% of post-event respondents stated that the air conditioner was not on while the remaining 66.7% of post-event respondents stated another reason. Of the "other" responses, most included situational reasons such as the house has poor insulation, or they had the oven on in their home. Nonevent responses were more varied.

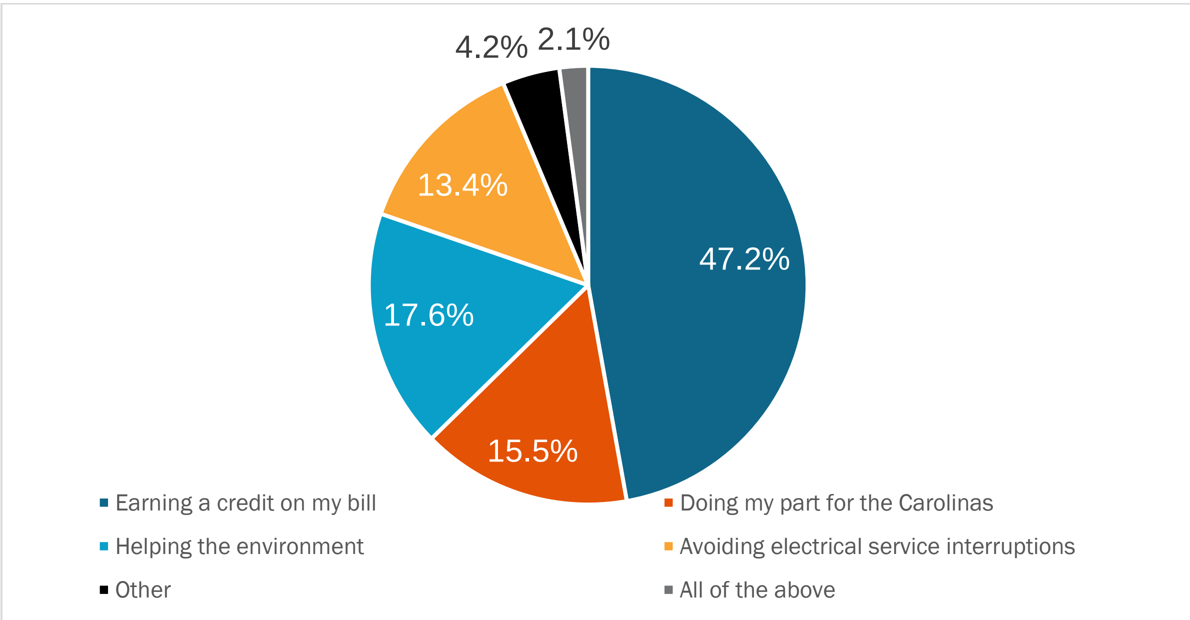
Figure 7-6: "What do you think caused your home to be uncomfortable?" – DLC



7.2.4 Motivation, Satisfaction, and Barriers

Participants in the post-event and nonevent surveys were asked to choose their primary motivation for enrolling in Power Manager from the following list: earning bill credits, helping the environment, doing their part for the Carolinas, avoiding electrical service interruptions, or an open-ended response. The most common reason stated by respondents in both surveys was "earning a bill credit" (47.2%). Other common responses included "helping the environment" (17.6%), and "doing my part for the Carolinas" (15.5%). Respondents that gave an open-ended response often stated "all of the above" which constituted 2.1% of all responses. Figure 7-7 displays the motivations for enrollment chosen by respondents.

Figure 7-7: "Which of the following reasons was most important to you when enrolling in the Power Manager program?" (n= 162) – DLC

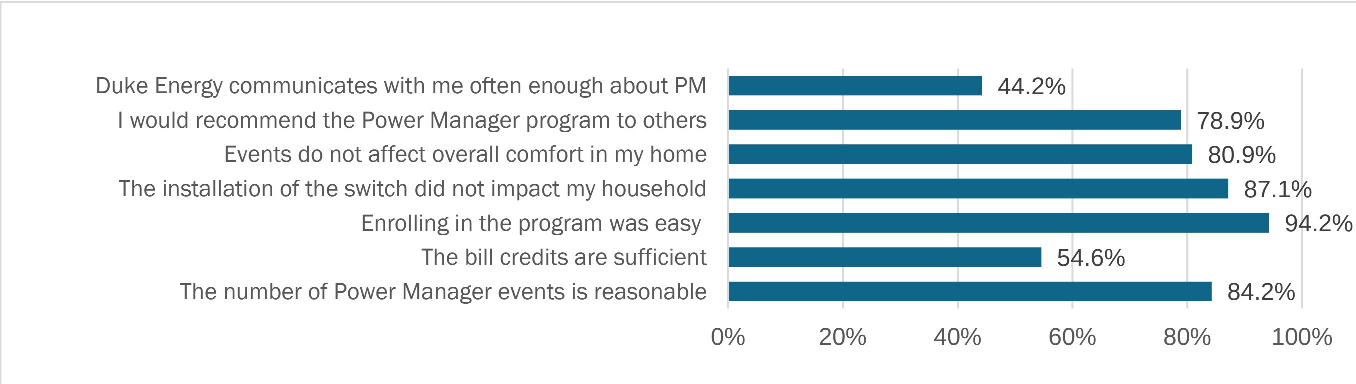


Respondents were asked about how strongly they agreed or disagreed with a series of statements pertaining to satisfaction with Power Manager. Figure 7-8 shows the percentage of respondents that agree or strongly agree with statements about satisfaction with the program.

Overall, Power Manager is very well-received among DEC DLC participants. 80.9% of participants agreed or strongly agreed that events do not affect their comfort in their home and 87.1% said that the installation of the switch did not impact their household. 94.2% agree or strongly agree that enrolling in the program was easy and 84.2% agree that the number of Power Manager events is reasonable. 78.9% of participants agree or strongly agree that they would recommend the program to others.

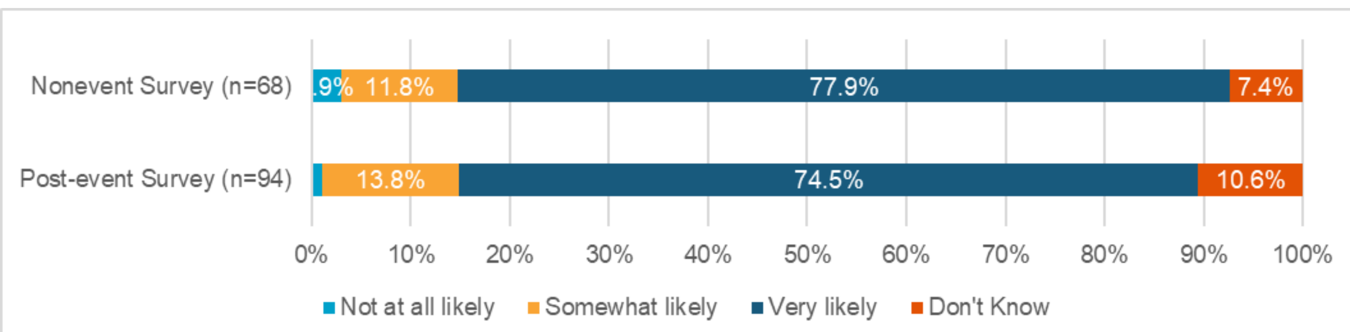
Two areas fall significantly lower in participant satisfaction: communication from Duke Energy and bill credits. 44.2% of participants agree or strongly agree that Duke Energy communicates with them often enough about the program while 34.7% slightly or strongly disagree with this statement. 21.1% of respondents were neutral to the prompt. While 54.6% stated that bill credits are sufficient, 18.2% slightly or strongly disagreed and 27.3% neither agreed nor disagreed.

Figure 7-8: Percentage of Participants that Agree or Strongly Agree with Satisfaction Statements (n=162) – DLC



Participants were asked how likely they were to stay enrolled in Power Manager. A majority (88.9%) of DLC participants were somewhat or very likely to remain enrolled in Power Manager. Of the few participants that stated they were unlikely to stay enrolled, their reasons included: recently installed solar panels, and a reluctance to granting thermostat control to Duke Energy. Figure 7-9 displays DLC survey respondents self-reported likelihood of staying enrolled by survey. Post-event and nonevent responses were very similar, showing that recently experiencing an event does not impact participants' likelihood of remaining enrolled in Power Manager.

Figure 7-9: How likely are you to stay enrolled in Power Manager? – DLC



At the end of the survey, participants were given the option to provide suggestions and feedback in an open-ended format. For DEC DLC, areas receiving the most suggestions were program communication, event notifications, and incentive levels. A significant portion of participants also suggested expansions of the program and increasing program enrollment. Table 7-5 displays the frequency of respondent suggestions. One-quarter of respondents suggested no improvements.

Table 7-5: Open-ended Respondent Suggestions (n=59) – DLC

Response	Frequency
No Suggestion[4]	23.7%
Suggestions on Communication	16.9%
Communicate Bill Credit	5.1%
Event Notifications	15.3%
Increase Bill Credit	20.3%
Increase Services/Program Reach	10.2%
Other	8.5%
Total	100.0%

Thirteen DLC participants had suggestions related to program communication. These comments and suggestions were segmented into four areas of feedback: communicate how Power Manager works, communicate about the program more frequently, alleviate customer concerns, and communicate enrollment status. Four participants suggested communication on how Power Manager works:

- “Email me the details of the program”

Two participants suggested more frequent program communications:

- “More frequent communication on this program”

Three respondents made suggestions related to their concerns, often not related to the Power Manager program; four respondents made suggestions about communication of enrollment status:

- “Needs more updates on the program and announcements would help. Email me since that’s where I get my bill. Would be a great way to know that I was on the program and just add it to the bill, so I know I’m enrolled in the program”

Some participants also stated in response to a previous question that they would not recommend Power Manager to others because they did not know they were enrolled, also indicating interest in communications on enrollment status.

Nine participants expressed that they would like event notifications, with some detailing how they should be notified:

- “Have an alert sent to the homeowner when instituting such an event.”
- “If I could know when an event is triggered, perhaps displayed on thermostat screen or beeping”
- “Alert the customer when an event takes place”

[4] These responses are where the respondent wrote in “I don’t have any suggestions”.

Eleven participants suggested increases to the incentives and three suggested increased communication around incentives.

- “Make it more of monetary incentive. It is not very much.”
- “Bigger payments and publicity.”
- “Better communication, if we do get a credit, make it more visible”

Six participants gave suggestions to expand the program and expressed a desire to see greater participation:

- “Increase the incentive to get more people on it to help the climate. That is all.”
- “If more people knew about it, they may be more apt to use it. Advertise more often.”
- “Make it mandatory instead of voluntary”
- “Provide more ways to save energy”

Overall, Power Manager is a well-received program among DEC DLC participants. While motivations for enrolling in the program vary, the majority enroll to save money on their bill. A majority of DLC participants would recommend the program to others and rate their likelihood of staying enrolled as high. Participants agreed that installation of the switch did not disrupt their home and enrolling in the program was easy. Most participants find the number of Power Manager events reasonable, and do not find their home uncomfortable during events. Survey responses show that DLC respondents were unable to identify when an event had occurred and did not experience thermal discomfort during the event. While around half of respondents were satisfied with bill credits and communications from Duke Energy, these two areas had the lowest levels of participant satisfaction. When given the chance to share feedback and suggestions on bill credits, customer requested higher bill credits – sometimes to increase enrollment – and streamlined communication around bill credits. Participants requested increased communication on how Power Manager works, more frequent communications about the program, and communication of enrollment status most often. Participants of the Power Manager program expressed environmental values. The second most common motivation for enrolling in Power Manager was to help the environment, and some participants suggested increased scope and advertising for the program to support a larger environmental impact.

7.3 BYOT Survey Results

7.3.1 Participant Background

The surveys administered to BYOT participants were very similar to those administered to DLC participants. Some differences in the instrument exist where BYOT customers experience the program differently due to the difference in enabling technology (i.e., a smart thermostat in the home rather than a switch outside on the CAC unit).

BYOT respondents were asked a series of questions regarding their current AC usage habits and behaviors. These questions included whether household members were typically home during weekdays during the summer and how frequently they used AC devices during peak hours. The large majority of respondents (88.0%) reported that a member of their household was home during weekdays, and most respondents stated that they used their air conditioning everyday both in the afternoon and evening, on both weekends and weekdays. Respondents in the post-event survey were more likely to report that they used their air conditioning systems more during weekday evenings, but there were no other statistical differences in frequency of use between the two groups.

Table 7-6 highlights the percentage of respondents that reported that they used their air conditioning system every day on weekdays and weekends during afternoons (1 PM to 7 PM) and evenings (7 PM to midnight).

Table 7-6: Percentage of Respondents that Use AC Every day during… – BYOT

Day and Time	% of Post-event Survey (n=106)	% of Nonevent Survey (n=88)
Weekday Afternoons 1 PM – 7 PM	91.8%	83.3%
Weekend Afternoons 1 PM – 7 PM	87.3%	86.3%
Weekday Evenings 7 PM – Midnight	81.2%	70.5%
Weekend Evenings 7 PM – Midnight	89.1%	77.2%

Participants must have at least one “smart” or internet connected programmable thermostat to be enrolled in the BYOT program. 92 (48.9%) respondents own a single smart thermostat and used no manual thermostats. Of those that had two thermostats, 71 (37.8%) respondents said that both of their thermostats were smart or programmable thermostats, while 12 (6.4%) owned one smart thermostat and one manual thermostat. 11 respondents (5.9%) owned more than two smart thermostats.

Respondents in both surveys were asked which of a series of possible responses describes how they typically use their air conditioning systems. Table 7-7 details how respondents in each survey described their AC use. These responses were not statistically different between the two surveys.

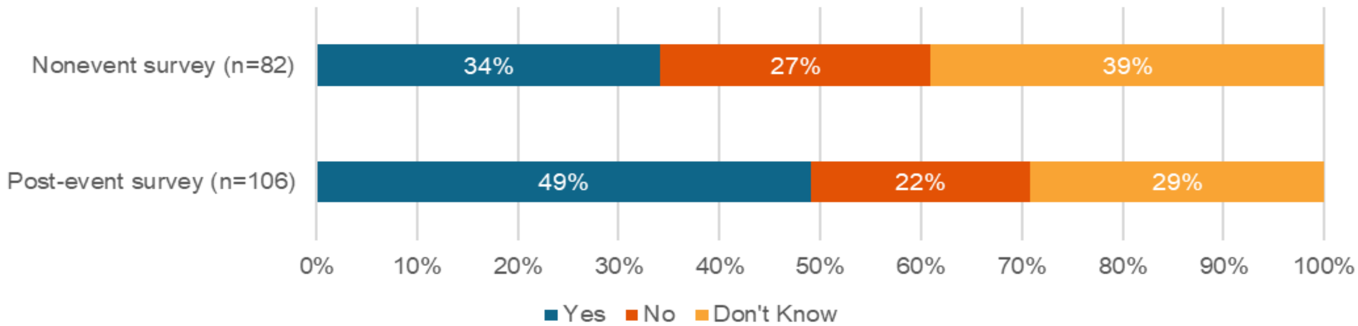
Table 7-7: "Which of the following best describes how you operate your central AC system(s) during the summer?" – BYOT

Survey	Keep it set at a constant temperature, so it runs whenever the temperature goes above it	Manually turn the AC on and off when needed	Manually adjust the temperature setting at different times such as when you leave your home or go to bed at night	Allow the program to automatically change the temperature at different times	Never use it	Total
Nonevent Survey (n=82)	29.3%	7.3%	14.6%	47.6%	0.0%	100.0%
Post-Event Survey (n=106)	26.4%	3.8%	11.3%	58.5%	0.0%	100.0%
Total	**27.7%**	**5.3%**	**12.8%**	**53.7%**	**0.0%**	**100.0%**

7.3.2 Program and Event Awareness

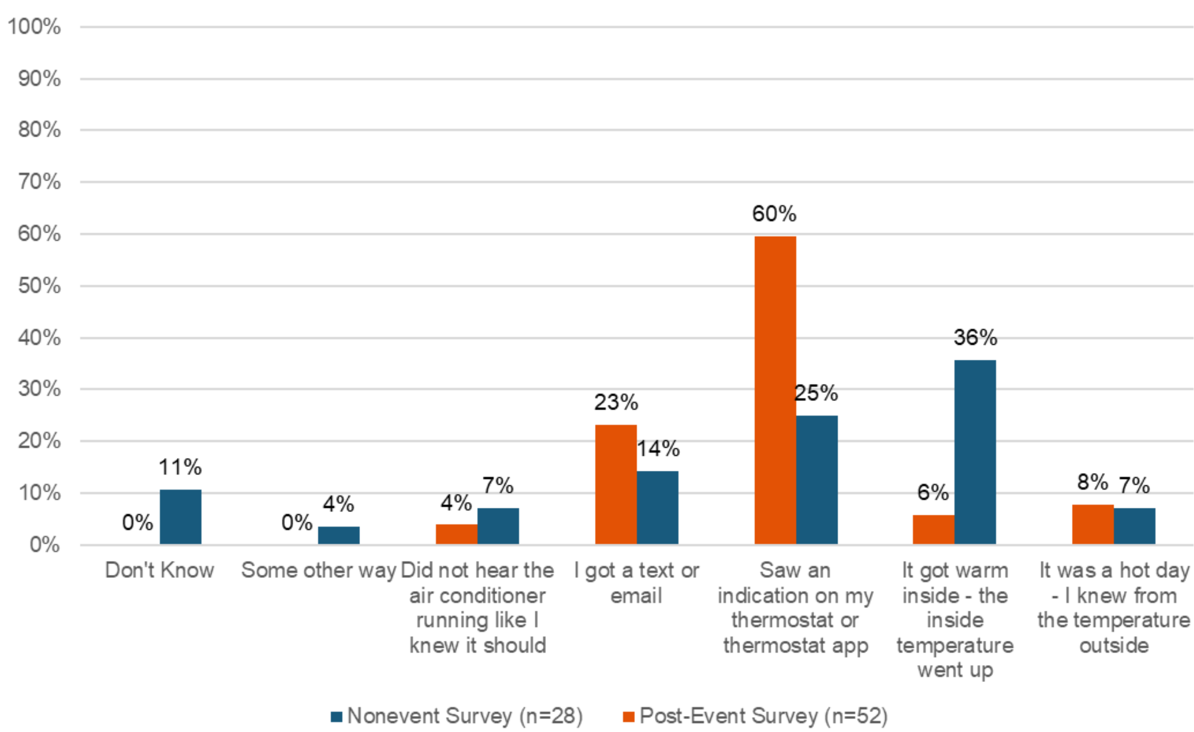
In the BYOT program, all 188 respondents in the post-event and nonevent surveys were asked if they were familiar with Power Manager. 78.2% of all respondents surveyed reported that they were familiar with the program. All respondents in the post-event and nonevent surveys were asked if they thought a Power Manager event occurred in the past few days. Of the 106 respondents in the post-event survey following the actual event on August 11, 49.1% of them correctly indicated that an event had occurred. For comparison, 34.2% of the respondents in the nonevent survey falsely believed that an event had occurred. The proportion of respondents that believed an event occurred following the actual event was not statistically different from the percentage of respondents that believed an event occurred following the nonevent day. Figure 7-10 shows the percentages of respondents that believed that an event occurred in the post-event and nonevent surveys.

Figure 7-10: "Do you think a Power Manager event occurred in the past few days?" – BYOT



Respondents that stated an event happened, whether they were correct or not, were then asked how they determined an event was occurring. Among respondents in the post-event survey, the most common reason given was participants receiving a notification on their thermostat (59.6%). In the nonevent survey, the most common reason participants believed that an event occurred was the temperature increasing in their home (35.7%). Figure 7-11 highlights the reasons that participants said led them to believe that an event occurred.

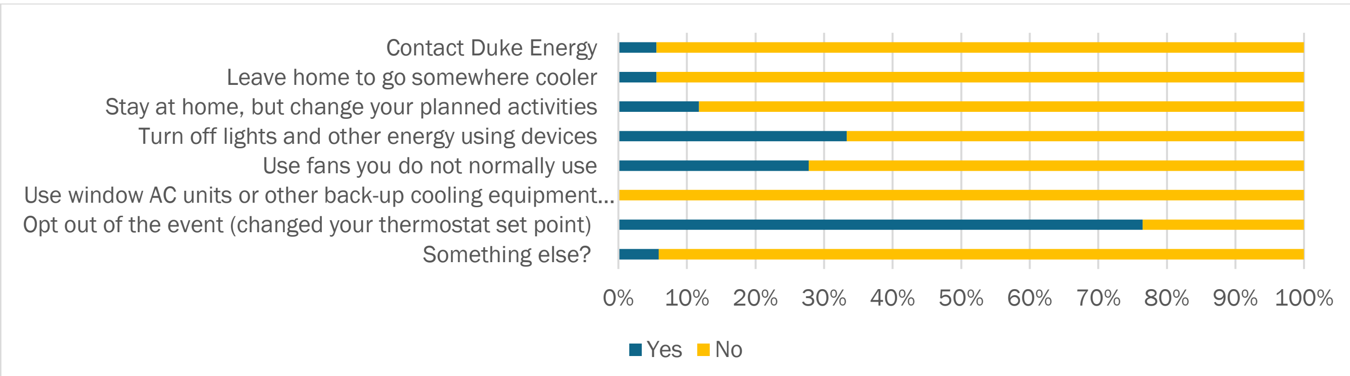
Figure 7-11: "How did you determine an event was occurring?" – BYOT



Those that believed an event occurred were asked which day they believed the event happened on. 60.0% of the respondents in the post-event survey that believed an event occurred recently correctly identified the event day (August 11).

Respondents that believe an event occurred were asked whether they took any action in response, regardless of if an event occurred. The majority of respondents (67.3%) did not take any action in response to a real or perceived event. Figure 7-12 highlights the most common responses. The most common action respondents took was opting out of the event altogether. Other common responses included turning off lights and other devices or using additional fans to keep cool. Very few respondents reported utilizing additional AC units, changing their planned activities, leaving home, or contacting Duke Energy in response to an actual or perceived event.

Figure 7-12: Actions Taken in Response to Real or Perceived BYOT Events: "Did you..." (n=18) – BYOT



Importantly, these responses indicate that participants are in some cases aware of Power Manager events, but do not drastically alter their behavior in response to a real or perceived BYOT event. The most common way that participants became aware of events is via a notification on their thermostat. In some cases, customers on nonevent days misattributed warm temperatures inside their homes to a Power Manager event. While some respondents did choose to opt out of the event, the majority of respondents took no actions when they believed an event occurred.

7.3.3 Program Respondent Comfort

Respondents in both the post-event and nonevent surveys were asked if there was any time during the event day (in the case of the post-event survey) or the nonevent day (in the case of the nonevent survey) that their home was uncomfortable.[5] The majority of respondents in both groups, 69.3%, indicated that they were not uncomfortable. The proportion of respondents that reported experiencing any discomfort was not significantly different between the post-event and nonevent surveys, indicating that the Power Manager event did not cause an increase in participant discomfort.

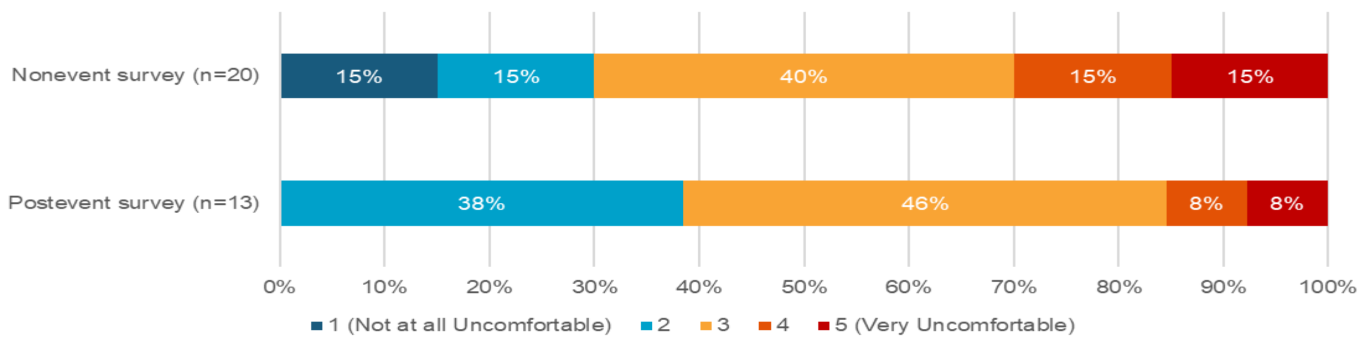
The respondents that reported any discomfort were asked when their discomfort started and ended. Respondents in the post-event survey did not differ significantly from those in the nonevent survey in

[5] Due to a survey programming error at the end of the survey deployment period, 25 post-event survey responses were dropped from analysis for the four questions pertaining to thermal discomfort.

the hours during which they reported feeling uncomfortable, indicating discomfort was not strongly tied to Power Manager event hours.

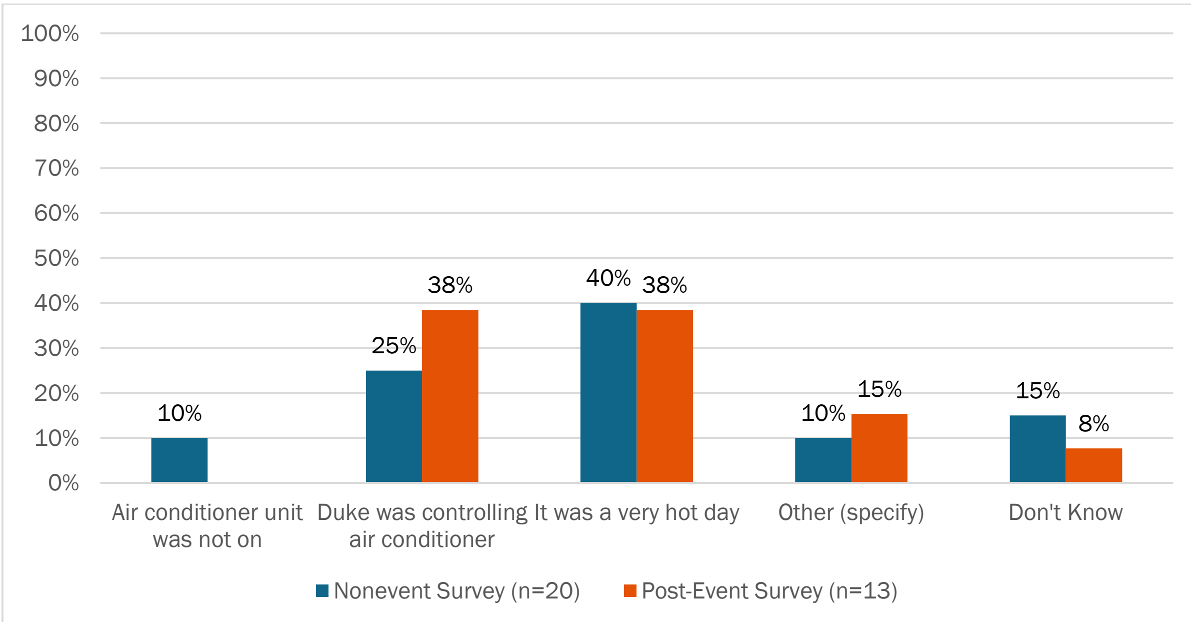
Respondents that indicated they experienced discomfort were asked to rate their discomfort on a scale from 1 (not at all uncomfortable) to 5 (very uncomfortable). The majority of respondents that reported discomfort in both surveys did not describe it as severe, with 75.8% of all respondents in both surveys describing their discomfort as between 1 (not at all uncomfortable) and 3 on the scale. The top-two box score (the percentage of respondents rating their discomfort as a 4 or 5) did not significantly differ between the two surveys, indicating that the severity of reported discomfort among customers during the actual event did not differ from levels of discomfort reported during a similar nonevent day. Figure 7-13 presents respondent ratings of discomfort by group.

Figure 7-13: "Please rate your discomfort on a scale of one-to-five" – BYOT



Lastly, respondents that indicated they felt uncomfortable were also asked what they believed caused the discomfort in their home. 38.5% of the respondents in the post-event survey attributed the discomfort to Duke Energy controlling their air conditioning. For comparison, only 25.0% of the respondents in the nonevent survey attributed their discomfort to Duke Energy controlling their air conditioning unit. These proportions were not statistically different from one another. Figure 7-14 presents reported causes of discomfort for respondents in the post-event and nonevent surveys. It is important to note that this question was asked conditional on respondents reporting discomfort in the first place; the majority of participants in both surveys did not report any discomfort.

Figure 7-14: "What do you think caused your home to be uncomfortable?" – BYOT



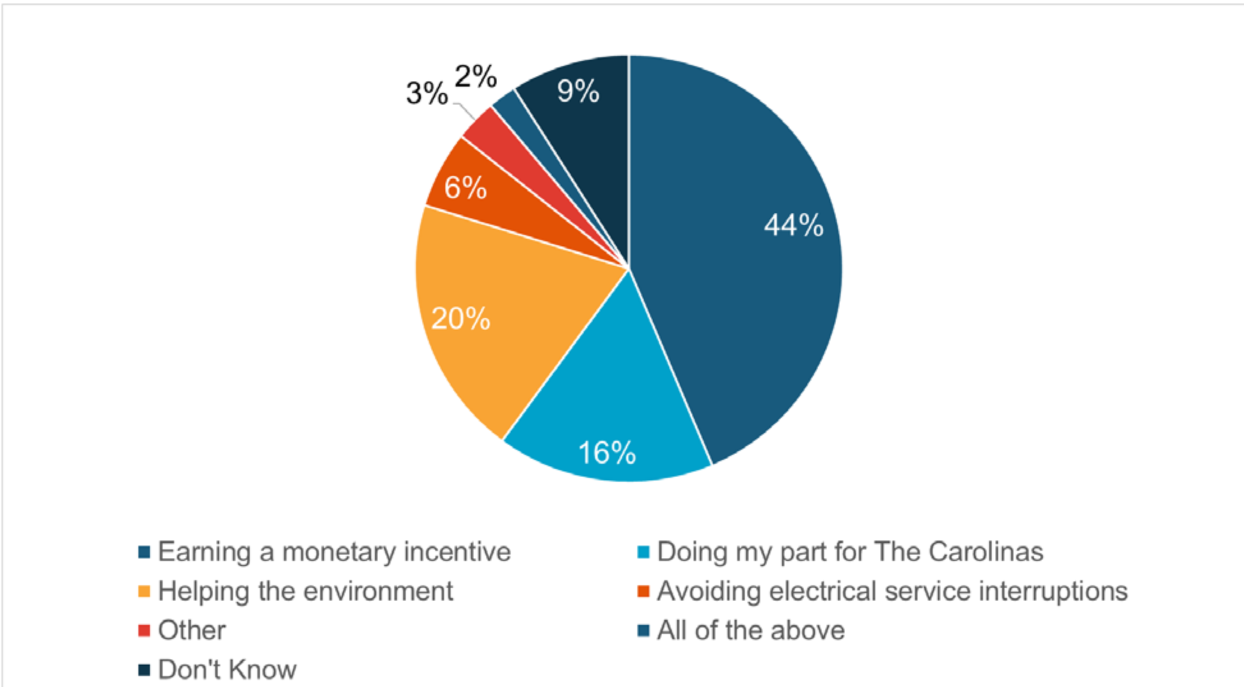
Respondent reports of thermal discomfort from the post-event and nonevent surveys indicate that reported thermal discomfort during BYOT Power Manager events is not significantly more common or more severe than reported discomfort during similar hot summer days. Importantly, this result implies that BYOT Power Manager events do not cause increased discomfort for customers. Respondents that experienced thermal discomfort during the Power Manager event were not significantly more likely to attribute this discomfort to the program than respondents reporting thermal discomfort during the nonevent day.

7.3.4 Motivation, Satisfaction, and Barriers

Participants in the post-event and nonevent surveys were asked what their primary motivation for enrolling in Power Manager was. The most common reason stated by respondents in both surveys was "earning a bill credit"[6] (43.6% of respondents). Other common responses included "helping the environment" (19.7% of respondents), and "doing my part for the Carolinas" (16.5% of respondents). Figure 7-15 showcases the most important motivations for enrollment for respondents in the BYOT program.

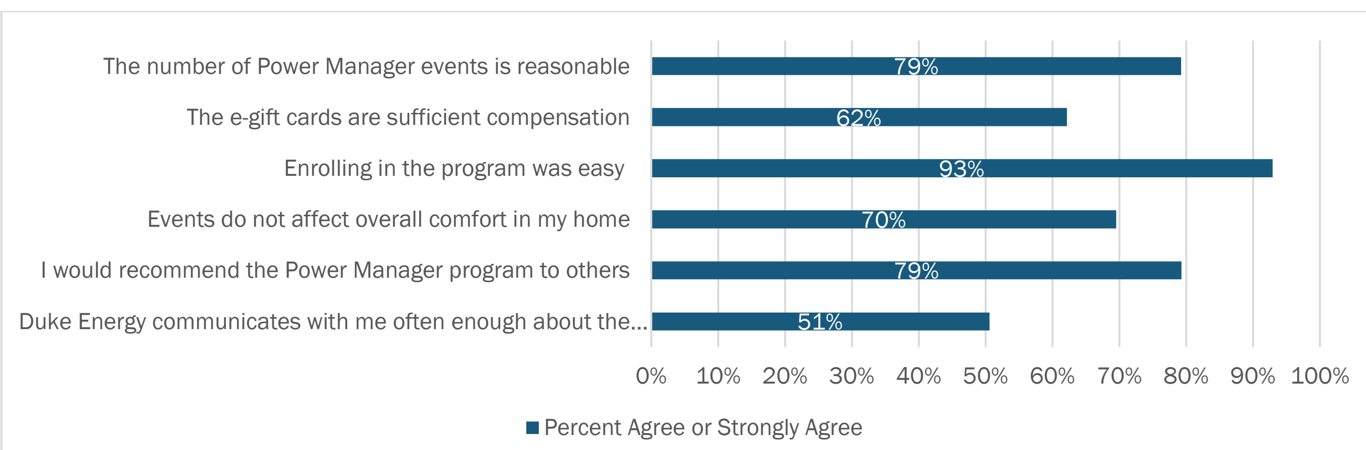
[6] DEC BYOT customers in fact receive electronic gift ("e-gift") cards rather than bill credits as a participation incentive, however BYOT survey respondents saw "earning a bill credit" on their surveys like the DEC DLC customers did, who do receive bill credits as a participation incentive.

Figure 7-15: "Which of the following reasons was most important to you when enrolling in the Power Manager program?" (n=188) - BYOT



BYOT participants were asked how strongly they agreed or disagreed with a series of statements about Power Manager. Respondents were asked to rate their agreement on a scale from 1 (strongly disagree) to 5 (strongly agree). Figure 7-16 showcases the percentage of respondents that "agreed" or "strongly agreed" with these statements.

Figure 7-16: Percentage of Participants that Agree or Strongly Agree with Satisfaction Statements (n=188) – BYOT



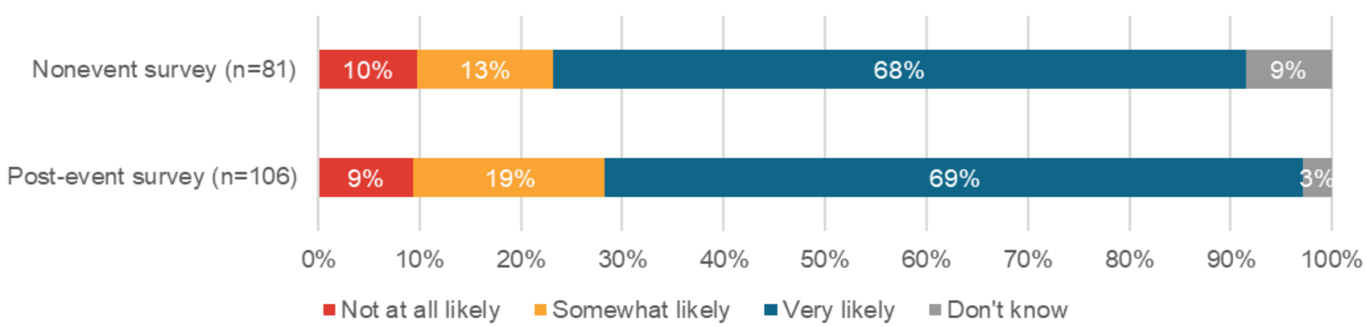
Generally, respondents were positive about Power Manager. 92.9% of respondents agreed or strongly agreed that enrolling in the program was easy. 79.2% of the respondents agreed that the number of events was reasonable. 79.3% of respondents stated that they would recommend Power Manager to others.

Of the statements to which respondents were least likely to say they agreed, 27.3% of respondents disagreed or strongly disagreed that Duke Energy did not communicate with them often enough about the program, and 16.9% of respondents disagreed or strongly disagreed that the e-gift cards were not sufficient compensation.

Both the top-two (percentage that responded “strongly agree” and “agree”) and bottom-two (percentage that responded “strongly disagree” and “disagree”) box scores were compared for respondents in the post-event and nonevent surveys. Compared to respondents in the nonevent survey, participants in the post-event survey were more likely to “disagree” or “strongly disagree” that the e-gift cards were sufficient compensation. However, there were no other statistical differences in the top-2 or bottom-2 box scores for any of the statements between the post-event and nonevent surveys.

Respondents were asked how likely they were to remain enrolled in Power Manager. 68.6% of respondents in both surveys said that they were “very likely” to remain in the program. There was no statistical difference in the likelihood of remaining enrolled between respondents in the post-event survey and the nonevent survey. Figure 7-17 presents the responses to this question by survey.

Figure 7-17: “How likely are you to stay enrolled in Power Manager?” – BYOT



Respondents that stated they were unlikely to recommend Power Manager to others (responded with a score of 1 or 2) or that they were “not at all likely” to remain in the program, were asked why they would not recommend the program. Two respondents stated that were not communicated with enough regarding the program.

> “Should be informed when there is power management. Otherwise at times people may think there is an issue with AC.”
>
> “Because on summer days it gets pretty hot and it feels like a notification would help more as opposed to it happening automatically and finding out when I'm hot.”

Two respondents who worked from home or had children felt that the program caused too much discomfort for them and their families.

> "It gets too hot in the house. Some people work from home and have to deal with the deadly heat when you change the temperature."
> "Kids that nap in afternoon are bothered by the heat."

Four participants simply stated that they did not enjoy ceding control of their AC systems during events.

> "I don't like the idea of someone else adjusting my thermostat."
> "I would like to be control of my air conditioning"

The survey concluded by allowing respondents to submit suggestions for improving the Power Manager program. 66 respondents offered suggestions for the program. Table 7-8 highlights common responses among participants.

Table 7-8: Open-ended Respondent Suggestions (n=87) – BYOT

Response	Frequency
No Response[7]	18.4%
Suggestions on Communication	21.8%
Communicate Incentive	5.7%
Event Notifications	20.7%
Increase Incentive	10.3%
Change Incentive (bill credit instead of e-gift card)	5.7%
Other	17.2%
Total	**100.0%**

The most common suggestion, offered by 35 respondents, was that Duke Energy communicate more often with participants, either regarding events, incentives, or the program in general.

> "Notify customers if there is a chance it might happen"
> "Increased communication if possible. Events, when, why"
> "Push notifications on cell before they happen"
> "A little more clarification on the rebates available"
> "I would love to know the results of how we are benefiting the environment by enrolling in this program"

Other respondents suggested greater monetary incentives or for the incentive to be offered in the form of a bill credit instead of a e-gift card.

[7] These responses are where the respondent wrote in "I don't have any suggestions".

“Get a credit on my bill instead of a gift card”
“More incentives more gift cards and bill credits”

Overall satisfaction with Power Manager remains high among BYOT participants. The majority of surveyed respondents stated that they were likely to recommend the program to others. Respondents generally agreed that BYOT events did not cause discomfort, and that the number of events was reasonable. The main motivation for enrollment in Power Manager was financial compensation, but environmental reasons also played a role in driving customers to enroll in Power Manager. Customers felt that the weakest aspects of the program were the communication they received from Duke, especially surrounding events, and the incentives offered, with many participants wanting to receive notifications regarding events and wishing to receive a bill credit rather than a gift card.

BYOT participants that stated they were less likely to stay enrolled or recommend the program to others cited lifestyle or family needs as reasons why they would not remain enrolled or recommend. Specifically, participants mentioned working from home or living with small children as motivations for leaving the program. However, it is important to stress that these customers were a minority of participants, and that most BYOT customers intend to remain enrolled.

7.4 Interview Findings

Power Manager is an established Duke Energy demand-side resource that is actively used in the course of operating the Carolinas electric system. The demand savings delivered by Power Manager are made possible through the teamwork of internal and external stakeholders that support two distinct program options, the legacy DLC option and the new BYOT program option. The team manages program budget and goals, communicates with participants, maintains the event dispatch software for the DLC option, coordinates with the BYOT implementer on event option set-up, uses the BYOT implementer software for event dispatch, and generally manages to event dispatch protocols. The Power Manager team also interacts with the customer at every stage of the program lifecycle, from enrollment, device installation, to device removal. Four primary stakeholder groups – the Duke Energy program management team, EnergyHub, Eaton Power Systems, and Franklin Energy – work together to deliver Power Manager to Duke Energy Carolinas customers. Resource Innovations interviewed four individuals from all four organizations. Through our conversations with the Power Manager team, we observe that Power Manager continues to maintain customer-focused and team-oriented program operations.

The remainder of this section will describe the Power Manager customer offering in the Carolinas and what Duke Energy’s activities are to bring in new program participants and deliver demand response load impacts to the system. A description of program operations follows immediately below, which is followed in turn by an outline of work that continues after each load control season concludes to ensure Power Manager’s continued success. This section concludes with a review of the activities that are planned or currently underway to further improve program operations and participating customer experience.

7.4.1 Program Participation Recruitment and Enrollment

Duke Energy's 2021 enrollment and operational objectives are driven by their integrated resource plan (IRP) and carbon plan. Recruitment of Duke Energy Carolinas customers into Power Manager takes place year-round in order to meet program objectives. As of year-end 2021, Duke Energy had more than 280,000 customers in the Carolinas enrolled in the DLC and BYOT program options. The recruitment approach for the legacy DLC program offer and the BYOT program offer differ – we describe both approaches below.

7.4.1.1 DLC Program Option Recruitment

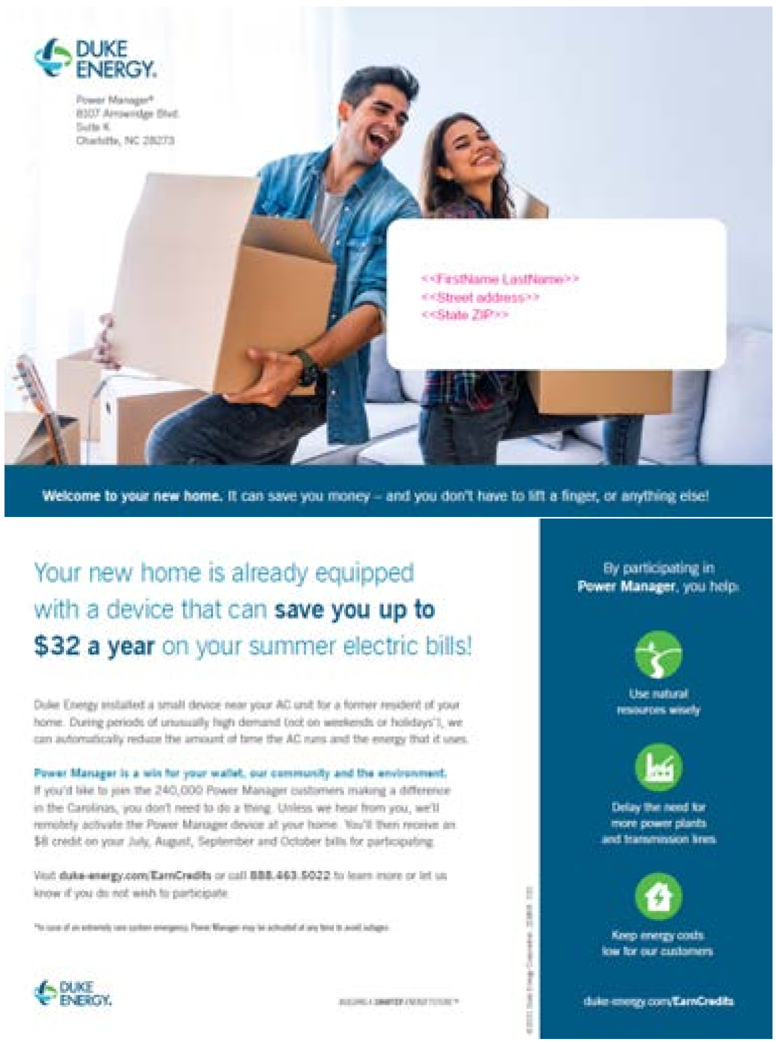
Although customers are sometimes recruited via other channels, outbound calling channel through a third-party call center provider, CustomerLink, is the predominant and most effective recruitment source for the DLC portion of the Power Manager program. The CustomerLink outbound call center is prepared to address common questions or concerns that Duke Energy customers who are not familiar with the program may have, in addition to the primary recruitment need to speak to the basic features and benefits of the program. Outbound callers are ready to explain that Power Manager's program features are friendly to the customer:

- Duke Energy's customer research has shown that the large majority of participants who are home during an event don't notice it.
- There are generally only five to seven events each summer; events typically end by 6 pm, which is when many customers are just coming home from work.
- Excepting rare emergency dispatches, air conditioning units enrolled in the program are cycled rather than completely curtailed.
- Power Manager is not called on weekends or weekday holidays, except for emergency program dispatch.
- The load control devices used by the program—switches that directly control the air conditioner's compressor—are a proven technology that do no harm to the customer's air conditioner or the home's electric distribution system. Because the device is installed on the compressor, which is typically located outside the home, as opposed installations on fans or thermostats, the program design does not require a technician to enter the customer's home—greatly reducing possible problems and subsequent reductions in participant satisfaction.

Additionally, Duke Energy provides CustomerLink with customer participation data in their other residential energy-efficiency programs. Having the ability to refer to this information during recruitment calls helps CustomerLink staff increase the effectiveness of their communications and credibility with potential Power Manager participants. Generally, Duke Energy has found that a person-to-person recruitment conversation is the most effective approach to generating enrollments. This is because most customers have questions as to how the program works and need the assurance of the right information provided in response to the right questions give them the confidence to agree to enroll.

A new enrollment pathway for Power Manager is a move-out-move-in (MOMI) process whereby DLC switches installed at participating households are not automatically removed when customers unenroll from the program. If a customer doesn't request that the DLC device be removed when unenrolling, the device is remotely deactivated. When a new customer moves in, the DLC switch remains deactivated if the former customer requested unenrollment. If the former customer was a program participant at the time of their move-out, the DLC switch is deactivated when the new customer moves in. New customers are mailed a postcard explaining the program and instructing them to call if they do not wish to participate. Figure 7-18 shows an image of the postcard sent for this communication.

Figure 7-18: Postcard for Customers Moving into Home with a Power Manager Device Installed



Power Manager provides $8 in bill credits on participating customers' July through October bills as an incentive to participate. Duke Energy also emphasizes messaging around community and environmental benefits to generate customer interest in and appreciation of the program. Duke

Energy has found that these preferences are correlated with older, higher income, and higher education demographics.

Franklin Energy is another partner, in addition to CustomerLink, that supports Power Manager. Franklin Energy manages Power Manager customer care and handles participants' inquiries about the program and requests for customer service. Franklin Energy is responsible for all Power Manager fieldwork which ranges from scheduling and routing DLC switch installations, managing an inventory of switches and preparing them for installation, training and managing a staff of device installers, responding to any device service calls, and fulfilling customer requests to remove load control devices. Installations for newly enrolled customers takes place within 45 days of the enrollment, but Franklin Energy works to complete those orders faster than that while the enrollment is fresh in the customer's mind. Franklin Energy also manages and staffs all DLC device quality assurance inspections. Duke Energy and Franklin Energy work together to develop targeted recruitment lists used by CustomerLink to allow efficient routing of installations for field technicians.

7.4.1.2 BYOT Program Option Recruitment

Recruitment into the BYOT program option takes a different pathway than the DLC program option. CustomerLink does not conduct outbound recruitment into the BYOT program option. Instead, Duke Energy relies on the smart thermostat manufacturers for most of the BYOT enrollment. Each of the participating thermostat manufacturers communicate with their customers through combinations of email, SMS text, mobile app, website, and via the thermostat itself. As an example of a typical BYOT enrollment scenario, when the customer sets up a new smart thermostat, they are prompted to enter their ZIP code. The ZIP code enables the thermostat provider to recommend enrollment in Power Manager if the ZIP code is a Duke Energy ZIP code. Most enrollments are generated through this pathway. Other enrollments occur after thermostat setup when the thermostat providers periodically email or send in-app messages their customers with invitations to sign up for Power Manager.

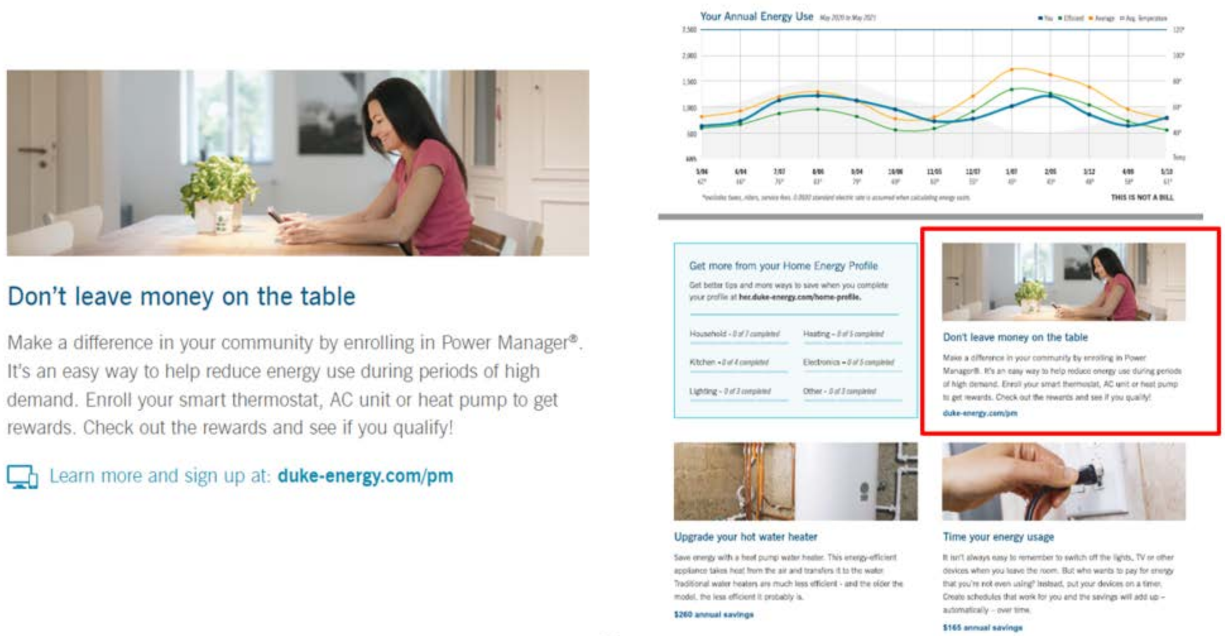
EnergyHub is a service provider engaged by Duke Energy to administer the BYOT program option. They operate a customer service center that is responsible for BYOT program option customer service – which includes providing support to Franklin Energy who serves as the first line of BYOT customer service – answering customer questions and administering program enrollment and unenrollment. EnergyHub is also responsible for aggregating the enrollments from all partner thermostat manufacturers into their program management system. Their system enables visibility into the connectivity (and dispatchability) status of nearly all enrolled thermostats.[8] After verifying connectivity, EnergyHub sends enrollments to Duke Energy for customer identification verification and eligibility verification. Identification verification is necessary because customers are not required to provide their Duke Energy account number for enrollment, which significantly increases program uptake. Duke Energy additionally verifies that the customer is not already enrolled in the DLC program option. EnergyHub is also responsible for distributing enrollment incentives. BYOT program option participants receive a $75 e-gift card upon enrollment as well as $25 annual e-gift cards for each year of enrollment thereafter.

[8] Nest thermostat connectivity status was not visible to EnergyHub in 2021 but will be in 2022.

EnergyHub observes that multiple marketing touches through different channels increase program uptake. For example, if a customer sees a Power Manager promotion from Duke Energy, followed by another promotion from Nest, they are more likely to sign up using the second prompt that appeared in the different communication channel. EnergyHub also observes that BYOT program option participants tend to be in higher income brackets. They recommend reaching customers with lower levels of income via utility-operated online stores where the thermostat is sold at a discounted price.

Duke Energy also directly promotes Power Manager (both the DLC and BYOT options) through direct mail, email, and in MyHER reports. Figure 7-19 shows the presentment of Power Manager promotions in MyHER.

Figure 7-19:: MyHER Power Manager Promotional Message



7.4.2 Power Manager Program Operations

Most Power Manager events are scheduled by the Power Manager DLC option and BYOT option program manager, mainly considering local system and weather conditions as well as EM&V testing needs. Duke Energy's Energy Control Center (ECC) also has access to dispatch Power Manager's DLC option. The ECC has the responsibility of balancing the supply and demand of electricity on the grid for Duke Energy Carolinas. Power Manager is rarely used in an emergency full-shed capacity, but the ECC uses the cycling option on occasion. Because Power Manager provides a low-cost, reliable, and quickly dispatchable asset, it is designated as a "virtual power plant" resource and contributes to the system's operating reserve margins.

Under normal operations, the Power Manager program manager includes staff from ECC and Fuel and Systems Optimization in event decision making, including discussions in anticipation of days where events are possible. Advance event discussion and preparation makes the day-of event calling process operate smoothly. The Power Manager program manager maintains control of the decision to call nonemergency events. Power Manager is viewed as an important resource for the Duke Energy Carolinas system that depends on the participating customers' willingness to remain enrolled. Therefore, all events are called with the program manager's view towards whether or not it will be a detriment to the experience of the participants and their continued participation. Considerations taken in this area are the number of events that have already been called during the current summer, during that week, at what hours events are taking place, and the depth of the load shed under consideration (i.e., thermostat setbacks, cycling level).

Apart from determining whether a given day will be a Power Manager event day, Power Manager program operations for the DLC and BYOT options are different, largely because Duke Energy manages the operations of the DLC option and outsources the operations of the BYOT option to EnergyHub.

7.4.2.1 DLC Program Option Operations

Preparations for the cooling season begin in the spring each year. Three primary activities occur in the spring to prepare the DLC option program participants and the operational team for the summer. Participants receive a reminder/thank you postcard before the summer load control season begins. Duke Energy sends these communications annually to remind and thank customers for their participation in the program, provide tips for having a comfortable experience during events, and to recognize the benefits of the program in terms of reducing system load and providing environmental benefits. The 2021 reminder postcard, with removable magnet featuring program information, is shown in Figure 7-20.

Figure 7-20: Reminder and Thank You Postcard

Beyond the monthly credits that are present on customer's bills during load control season, these cards are usually the only communication customers are provided from the program each year.

Another important springtime activity for the DLC program option is programming or addressing active DLC devices for the upcoming season. This activity is primarily undertaken to support the Resource Innovations impact evaluation, which relies on randomized control trials (RCTs) to facilitate impact estimation. A number of different randomly assigned groups of DLC devices are defined each spring so that whenever an event is launched, at least one group of devices does not experience load control and can serve as a control group in the RCT. DLC devices are programmed by Duke Energy using the Eaton Power Systems Yukon software. Duke Energy staff are responsible for device programming each year using Yukon. Consultants from Eaton Power Systems also play a role as the provider of the DLC devices and Yukon software. They serve as a resource to assist Duke Energy in maintaining the Yukon software system, managing occasional device firmware issues, addressing the DLC devices, and training Franklin Energy's device installers.

An annual all-hands Spring Training event hosted by Duke Energy brings together Eaton Power Systems, Franklin Energy, and Duke Energy to discuss the upcoming load control season. The Spring Training is cited by all stakeholders that Resource Innovations interviewed as a crucial aspect of program operations. Not only do these meetings allow for in-depth coverage of emerging issues, but they are also critical in maintaining the overall collegiality and professionalism that facilitates effective communication amongst the stakeholders, enabling quick resolution problems when they arise. Spring Training keeps stakeholders are aware of each other's responsibilities, knowledge base, and workload, and are thus able to efficiently troubleshoot and find the appropriate staff for solving problems. Weekly meetings are held between Duke Energy and Franklin Energy, with Eaton Power Systems joining once a month.

When a non-emergency DLC event is launched, the DLCs use the Eaton Power Systems TrueCycle algorithm, which uses participants' actual AC usage patterns to determine the cycling pattern needed that will yield a 64% or 50% reduction of each AC unit's expected runtime during a cycling event. During emergency full-shed events, AC units experience 100% full shed.

Duke Energy has also worked with Eaton Power Systems to implement the "Assets" dispatch feature of Yukon software. Yukon Assets ties Franklin Energy's program participation data to Duke Energy's customer information and program dispatch capabilities to provide greater flexibility in managing Power Manager events. With help of this upgrade, Duke Energy has the ability to dispatch Power Manager based on the geographic location of active DLC devices.

Duke Energy does not notify DLC option participants either in advance or during event dispatches. However, Duke Energy maintains a toll-free hotline that program participants may call to get updates on the status of whether or not the program is planning to dispatch an event or whether an event is in progress. Franklin Energy notes that the highest volume of calls come in the summertime. Their phone center operations include placing an "ambush message" at the beginning of their telephone interactive voice response (IVR) menu so as to notify callers that Power Manager has called an event. DLC option participants may opt of an event prior to or during an event via telephone call to Franklin Energy. Duke Energy also notes the pattern of most customer inquiries occurring in the early summer when customers turn on their air conditioning for the first time. If there are issues with the functionality of a customer's air conditioning unit, those issues can be conflated potential issues with the DLC device. Franklin Energy's staff helps distinguish between air conditioner issues versus DLC device issues and, if necessary, send a technician to investigate.

7.4.2.2 BYOT Program Option Operations

Duke Energy organizes and participates in fewer planning and organizational activities around preparing the BYOT program option for the cooling season. This is a result of the value that EnergyHub brings to the program as the implementer. At the outset of each cooling season, EnergyHub communicates with Duke Energy to understand their goals for enrollment and per household load impact for the year, and to affirm commitments to platform availability uptime, and the timing of delivering preliminary estimates of load impacts from the thermostat manufacturers. EnergyHub additionally advises Duke Energy on dispatch strategy (i.e., number of degrees setback, pre-cooling) that will help ensure Duke Energy meets their operational goals. The EnergyHub and Duke Energy teams meet weekly to coordinate.

As soon as Duke Energy verifies an enrolled customer's eligibility for the program, their thermostat is immediately available for dispatch by EnergyHub. Like the DLC option, however, experimental groups are set up in the spring to support RCTs that the Resource Innovations impact evaluation depends on. In this case, Resource Innovations provides the RCT group assignments to Duke Energy, and Duke Energy simply provides it to EnergyHub for implementation – Duke Energy staff are not involved in addressing thermostats enrolled in the program. The group assignments ensure that there is always a group of customers held back from each event to serve as a control group for the impact evaluation. EnergyHub reports that their system is flexible enough to accommodate programming many experimental groups. Their system can launch any of those groups with any combination of dispatch strategies. They report that programming the 2021 experimental groups was a straightforward task to carry out.

EnergyHub, per scheduling and set-up of the event by the Duke Energy program manager, dispatches BYOT events using their headend system that communicates with all enrolled thermostats via API calls to the thermostat manufacturers which in turn communicate with the thermostats. EnergyHub has the ability to dispatch events with at least 15 minutes' notice.

The BYOT program option offers the capability of pre-cooling participants' homes prior to events (so long as EnergyHub receives enough advance notice to leave time for pre-cooling). DLC devices do not offer this capability. Pre-cooling enables deeper thermostat setbacks during event hours with less impact on thermal comfort in the home. Unlike the DLC program option, BYOT option participants are informed prior to and during events through their thermostat provider's mobile apps or websites and on the thermostat itself.

BYOT program participants can opt-out of events by adjusting their thermostat setpoints. They also have an opportunity to opt-out in advance of the event if they receive or see the notification. EnergyHub reports that very few customers opt-out in advance (3%); they report that overall, opt-out rates typically range between 20-30%. EnergyHub works to minimize opt-outs through advising utilities like Duke Energy to avoid overburdening program participants with very deep setbacks or very long events, or overcommunicating with too many pre-event notifications.

7.4.3 Program Monitoring and Postseason Maintenance

7.4.3.1 DLC Program Option Monitoring and Maintenance

Franklin Energy, as the third-party contractor that manages DLC option customer service, has service level agreements in place with Duke Energy that outline service benchmarks, with both penalties for nonperformance and opportunities for incentives when benchmarks are exceeded. There are specific benchmarks in place to ensure that, during event days in particular, customer calls coming into Franklin Energy are handled quickly, efficiently, and that accurate information is provided to the customers calling in. The Duke Energy program manager monitors the number of calls coming in to the toll-free notification line. The program manager also monitors number of calls coming into the Franklin Energy call center to detect any emerging issues associated with the program experience. Device removal requests are also tracked for this purpose.

During and after the cooling season, Duke Energy and Franklin Energy work together to carry out quality assurance (QA) inspections of a number of DLC devices each year. In the past, Duke Energy would provide Franklin Energy with a random sample of DLC option participating homes. Franklin Energy would then visit each home to inspect the DLC device for connectivity and operability. In recent years, Duke Energy has moved to an AMI data-driven targeting for the homes to visit for QA. AMI data is used to identify DLC option participants that likely have non-functioning DLC devices. With this new targeted QA approach, QA visits have been reduced by about 60%, while tripling the proportion of devices reconnected and doubling the proportion of devices re-installed and also increasing the number of devices replaced. 2021 was an exception year with respect to the QA process. Duke Energy implemented a new customer information system in 2021. The DLC option QA process changed focus for the year to validate alignment between Duke Energy's customer information system, Franklin Energy's enrollment records, and Duke Energy's billing system. QA visits performed in 2021 were conducted in connection with the database alignment project.

7.4.3.2 BYOT Program Option Monitoring and Maintenance

EnergyHub performs an annual connectivity optimization activity whereby customers are removed from the program if their thermostats remain disconnected for more than 60 days. The $25 annual participation incentive helps when EnergyHub communicates with these customers prior to removal from the program – the reminder that the annual $25 incentive will be lost motivates customers to reconnect their thermostats. EnergyHub also engages with Duke Energy on strategies that have the potential to increase the load shed. EnergyHub's dispatch team often runs API test calls to make sure the platform is meeting uptime requirements with all thermostat manufacturers during the event season.

7.4.4 Upcoming Program Changes and Initiatives

Duke Energy and their partners are implementing a number of program enhancements that leverage a prior investment that maintain Power Manager as a cost-effective system resource for the Carolinas. Duke Energy's partners also offer a number of recommendations to contribute to continuous program improvement.

Eaton Power System will continue to work with Duke Energy in 2022 to complete the implementation of the Yukon module, Assets. Assets currently facilitates the mapping of all DLC devices to a location geocode in the Yukon system, through a connection to the Duke Energy customer information system. With the final implementation of Assets, Duke Energy will be able to dispatch Power Manager events to target a particular state, or part of a state aligned with Duke Energy's transmission regions.

Since annual DLC device programming is undertaken each year to support load impact evaluations, which is an effort staffed by Duke Energy, Eaton Power Systems recommends that Duke Energy and Resource Innovations work to make EM&V programming as similar as possible to the prior year. With fewer parameters to change, the programming process will have less risk of error and will require less effort to undertake.

Duke Energy will also expand the lineup of channels for sharing event-related information with DLC option participants. Starting in 2022, Duke Energy's website will include a banner that indicates a

Power Manager event is underway on event days. Also starting in 2022, Duke Energy sent the annual season reminder to slightly over half of its Power Manager DLC participants via email, in lieu of the postcard sent to the remaining participants. The email was sent to customers who had given permission for Duke Energy to send them emails.

On the BYOT side of the program, EnergyHub recommends enhancing the annual goalsetting process to include an EnergyHub-hosted survey to get feedback on the customer segments that the program option is succeeding with, and which segments could stand increased focus to increase uptake.

In the near-to medium term, Duke Energy has been working with Eaton Power Systems to include the capability to control strip heating for wintertime load control. This is because DEC has become a winter-peaking service territory. With that in mind, Eaton Power Systems, Franklin Energy, and Duke Energy have been working together in preparation for the expected Commission approval of the heat strip option. Duke Energy intends to begin enrolling strip heating load control participants in the fourth quarter of 2022. The BYOT program option has already begun winter heating load control through EnergyHub in the winter of 2021/2022.

7.5 Key Findings

7.5.1 DLC Key Findings

Key findings from the 2021 process evaluation for DEC DLC participants include:

- 162 DLC Power Manager participants were surveyed in July, on one event and one nonevent day. The event day had a maximum daily temperature of 91°F and a maximum daily heat index of 97.3°F while the nonevent day had a maximum daily temperature of 88.7°F and maximum daily heat index of 93.7°F.
- Of the 162 participants that completed the survey, 68 customers were surveyed following an event and 94 were surveyed following a similar nonevent day. The nonevent survey was used to establish a baseline for comfort, event awareness, and other key metrics.
- A majority of all DLC respondents, 71.6%, reported that they are familiar with the Power Manager program.
- About 12.9% of both sets of survey respondents—those that had and those that had not experienced an event—reported that their homes were uncomfortable during the event or nonevent day. There is no increase in customers' thermal discomfort due to Power Manager events.
- 47.2% of respondents reported that "Earning a credit on my bill" is the primary reason they are participating in Power Manager. The second-most common motivation was "helping the environment."
- Overall, 88.9% of survey respondents state that they are "very" or "somewhat" likely to remain in the program.
- 78.9% of respondents "strongly" or "somewhat" agreed that they would recommend the Power Manager program to others.

- Overall, respondents most often made suggestions around program communication and incentive levels.
- In-depth interviews reveal that Duke Energy leads and manages three partner vendors to operate and maintain the DLC option of Power Manager as a reliable resource for the Carolinas electric system. The operations team is building on the long-term success of the program by expanding it to make residential strip heating loads available for program dispatch starting in the winter of 2022/2023.
- In-depth interviews reveal two areas of process improvement for the DLC option. First, that EM&V programming each year should be kept as simple as possible and should reflect as few changes as possible from the prior year to mitigate risks of making programming errors. Second, Duke Energy should resume normal QA inspections of devices after a hiatus to support inspections related to enrollment database reconciliation.

7.5.2 BYOT Key Findings

- 188 BYOT Power Manager participants were surveyed in July and August, on a hot nonevent day and on an event day, respectively. The event day had a maximum daily temperature of 90.3°F and a maximum daily heat index of 98.7°F while the nonevent day had a maximum daily temperature of 88.7°F and maximum daily heat index of 93.7°F.
- Of the 188 participants that completed the survey, 106 customers were surveyed following an event and 82 were surveyed following a similar nonevent day. The nonevent survey was used to establish a baseline for comfort, event awareness, and other key metrics.
- A majority of respondents, 78.2%, reported that they are familiar with the Power Manager program.
- About 20.3% of both sets of survey respondents—those that had and those that had not experienced an event—reported that their homes were uncomfortable. There is no increase in customers' thermal discomfort due to Power Manager events.
- 41.5% of respondents reported that "Earning a credit on my bill" is the primary reason they are participating in Power Manager. The second-most common motivation was "helping the environment."
- Overall, 85.1% of survey respondents state that they are "very" or "somewhat" likely to remain in the program.
- 79.3% of respondents "strongly" or "somewhat" agreed that they would recommend the Power Manager program to others.
- Overall, the most common respondent suggestions for Duke were to communicate more frequently prior to and during Power Manager events and to replace the gift card incentive with a bill credit.
- In-depth interviews with BYOT option stakeholders show that Duke Energy's implementer EnergyHub delivers value by managing the BYOT implementation, which relieves Duke Energy program staff of much of the effort that is expended in managing the DLC option.
- The typical BYOT option participant is in a higher than average income bracket. EnergyHub recommends utility-run online stores as an effective way to get smart thermostats into lower income households and enrolled in Power Manager through discounts and promotional messaging.

8 Conclusions and Recommendations

8.1 Impact Evaluation Conclusions and Recommendations

8.1.1 DLC Impact Evaluation

Conclusion: Overall, the Power Manager DLC program produces significant results in reducing peak load demand for Duke Energy's residential customers. On average, Summer 2021 events achieved 30% load reduction per household for emergency dispatch events.

> **Recommendation:** Continue to promote the Power Manager program to DEC residential customers who exhibit high peak load consumption. Customers with higher-than-average peak loads remain the best candidates for program participation and have the greatest potential to contribute to demand savings.

Conclusion: The time-temperature matrix predicts demand reductions of 1.92 kW per household for a 1-hour event beginning at 4:00PM with an event period temperature of 100°F. However, the time-temperature matrix is limited by a narrow range of empirical data.

> **Recommendation:** Revisit the time-temperature matrix requirements and consider developing a model of program capabilities across a relatively modest band of temperatures, reflecting the current dispatch strategy. For example, reporting estimated impacts under a range of temperatures regularly observed during most event seasons for a 1-hour event starting at 4:00PM.

8.1.2 BYOT Impact Evaluation

Conclusion: The Power Manager BYOT program produces significant results in reducing peak load demand for Duke Energy's residential customers. On average, Summer 2021 events achieved 1.32 kW (40%) load reduction per household.

> **Recommendation:** Continue to promote the Power Manager program to DEC residential customers who exhibit high peak load consumption. Customers with higher-than-average peak loads remain the best candidates for program participation and have the greatest potential to contribute to demand savings.

Conclusion: BYOT impacts tend to increase as the event period offset and pre-cooling conditions become more intense. Event period offsets of 4°F produced greater impacts compared to events with 3°F offsets.

> **Recommendation:** For planning purposes, apply more extreme event offsets in order to generate greater load impacts during events.

Conclusion: The time-temperature matrix predicts demand reductions of 1.76 kW per household for a 1-hour event beginning at 4:00PM with 90-minute 2 degree precool with a 4 degree event offset. However, the time-temperature matrix is limited by a narrow range of empirical data.

> **Recommendation:** Revisit the time-temperature matrix requirements and consider developing a model of program capabilities across a relatively modest band of temperatures, reflecting the current dispatch strategy. For example, reporting estimated impacts under a range of temperatures regularly observed during most event seasons for a 1-hour event starting at 4:00PM.

8.2 Process Evaluation Conclusions and Recommendations

Conclusion: There were no differences in levels of agreement between event and nonevent participants with statements about whether an event had occurred recently, about thermal discomfort, or about perceptions of the cause of any discomfort for DLC and BYOT. In short, customers are not able to reliably perceive Power Manager curtailment events. However, BYOT post-event respondents were sometimes able to identify which day an event had occurred, due to the notification on their thermostat.

> **Recommendation:** Continue to prioritize participant comfort and satisfaction during curtailment events.

Conclusion: 78.9% of DLC and 79.3% of BYOT Power Manager customers are likely to recommend the program to others. 88.9% of DLC and 85.1% of BYOT Power manager customers are likely to remain enrolled. There were no differences between event and nonevent respondents for either question, nor for any other satisfaction questions. Therefore, Power Manager events do not affect customer satisfaction in either direction.

> **Recommendation:** Continue to prioritize practices that are focused on maximizing customer satisfaction in the design and implementation of the Power Manager program.

Conclusion: 71.6% of DLC participants are familiar with the Power Manager program, representing no change from the previous evaluation in PY 2019. 78.2% of BYOT participants are familiar with the Power Management program. The majority of suggestions for both DLC and BYOT for improvement from customers spoke to perceived communication gaps from Duke Energy. 22.8% of suggestions from DLC participants related to increasing communication from Duke Energy, while 5.3% specifically suggested increased communications about bill credits and 15.8% specifically suggestion increased communications around events (event notifications). 21.8% of BYOT respondents provided suggestions on communications, 5.7% suggested for increased communications around e-gift cards and 20.7% specifically suggested increased notification of events.

> **Recommendation:** Evaluate each jurisdiction's communication strategy: before, during, and after load control seasons, and consider changes. Improved communication can improve

customer satisfaction and increase positive word-of-mouth awareness. One possibility is to provide monthly summary emails to participants, highlighting bill credits or e-gift cards earned, and allowing customers a repeated opportunity to learn more about the program.

Recommendation: Prioritize making Power Manager event notifications available on the program website and via email.

Conclusion: "Targeted" QA protocols, using AMI data to identify switches that may be malfunctioning or missing, have yielded strong results in the past. QA inspections at sites identified through AMI data analysis were suspended in 2021 to accommodate QA site inspections in support of an initiative to align program enrollment and customer information databases at Duke Energy and Franklin Energy.

Recommendation: Return to AMI data analysis-based QA inspections as soon as possible, and consider increasing the number of inspections scheduled given the 2021 hiatus.

Conclusion: The current approach to communications amongst DLC option stakeholders has been effective in building professional teamwork and helps to make the program run smoothly, even when problems arise.

Recommendation: Continue to prioritize inter-organizational communications with Spring Trainings, weekly and monthly calls, and other existing approaches.

Conclusion: Duke Energy Carolinas has transitioned to winter-peaking operational conditions, and the Power Manager program will have to adapt to maintain viability as a resource to manage peak loads. The BYOT option already offers winter load reduction capability.

Recommendation: Prioritize launching the winter capability for the DLC option. Eaton Power Systems, Franklin Energy, and Duke Energy are working together in preparation for a winter-focused strip heating program option.

Conclusion: The new Assets module of the Yukon dispatch system offers opportunities to dispatch the DLC option locationally. As customer saturation becomes an increasingly pertinent issue, "Assets" may offer a way to address it.

Recommendation: Test locational dispatch capabilities in 2022 or 2023 once the final upgrades to the Assets module are complete.

Conclusion: BYOT option participants currently tend to have higher levels of income than average.

Recommendation: Drive enrollment of households from income brackets lower than that of the current typical BYOT customer by continuing to offer discounted BYOT-eligible thermostats on Duke Energy's-sponsored online storefront.

/A

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Duke Energy Carolinas & Duke Energy Progress Retail Lighting Program

2022 Evaluation Report - Final

December 5, 2022

Table of Contents

Table of Tables

Table of Figures

Table of Equations

1. Evaluation Summary

This report provides results of an impact and process evaluation of the Duke Energy Carolinas (DEC) and Duke Energy Progress (DEP) Retail Lighting Program. The program period under evaluation is January 1, 2021, through March 31, 2022. Throughout this report, we refer to this period as the evaluation period.

1.1 Program Summary

The Duke Energy Retail Lighting Program offers a range of point-of-sale (POS)-discounted LED lighting products. DEP launched its program in January 2010 with the goal of reducing energy consumption and peak demand through increased awareness and adoption of energy-efficient lighting technologies. DEC adopted the program in early 2016 to supplement its existing energy-efficient residential lighting program offerings. As part of the Retail Lighting Program, Duke Energy partners with retailers and manufacturers across the DEC and DEP service territories to provide POS price markdowns on LED products available for customers to purchase. Participating stores reflect a variety of retail channels, including big box, do-it-yourself (DIY), hardware, thrift, and dollar stores. The program discounts a wide range of ENERGY STAR® LED bulbs and fixtures.[1]

1.2 Evaluation Objectives

This evaluation included process and impact assessments and had several key objectives:

- Assess the program's performance and estimate gross and net energy (kWh) and peak summer and winter demand (kW) savings for the evaluation period.
  - Review program tracking data for completeness and accuracy and discuss implications of any errors or inconsistencies for program savings estimates
  - Review deemed savings estimates used to track program performance and provide recommendations for updates to assumptions where necessary
  - Develop updated estimates of program leakage and determine appropriate in-service rate (ISR) assumptions
  - Develop net-to-gross ratios (NTGRs) based on sales data modeling and feedback from retailers and manufacturers
  - Estimate ex post gross and net energy (kWh) and peak summer and winter demand (kW) savings and realization rates
- Gauge current and anticipated market trends to provide recommendations for how future implementation strategies can maximize customer engagement and minimize free ridership.
- Assess the program's implementation processes and marketing strategies to identify key successes and opportunities for improvement.

[1] The ENERGY STAR® name and mark are registered trademarks owned by the United States Environmental Protection Agency.

1.3 High Level Findings

From January 1, 2021, through March 31, 2022, the Duke Energy Retail Lighting Program sold over 2.5 million discounted energy-efficient bulbs and fixtures in the DEC jurisdiction and 1.8 million in the DEP jurisdiction. The DEC program achieved ex ante gross energy savings of 94.5 GWh, and the DEP program achieved 60.6 GWh of gross savings. Sales and ex ante gross savings by jurisdiction and product category are reported in Table 1.

Table 1. Retail Lighting Program Performance Summary by Jurisdiction and Product Category

Jurisdiction	Product Category	Units	% of Sales	Ex Ante Gross Savings (kWh)	% of Savings
DEC	Reflector LEDs	726,421	29%	34,645,143	37%
	Specialty LEDs	696,192	28%	21,384,591	23%
	Standard LEDs	564,965	22%	16,999,797	18%
	LED Fixtures	537,395	21%	21,447,434	23%
	All Categories	**2,524,973**	**100%**	**94,476,965**	**100%**
DEP	Reflector LEDs	495,137	27%	21,421,623	35%
	Specialty LEDs	451,764	25%	14,248,159	24%
	Standard LEDs	534,719	30%	15,341,088	25%
	LED Fixtures	323,726	18%	9,592,001	16%
	All Categories	**1,805,346**	**100%**	**60,602,872**	**100%**

Note: Specialty LEDs include globe, decorative, and three-way bulbs; reflector LEDs include both indoor and outdoor bulbs; LED fixtures include both portable and direct-wire products.

1.3.1 Impact Evaluation

The DEC program realized 104.9 GWh in ex post gross energy savings, 17.2 MW in summer peak demand savings, and 7.3 MW in winter peak demand savings during the evaluation period. In the same period, the DEP program realized 71.2 GWh in ex post gross energy savings, 11.7 MW in summer peak demand savings, and 4.9 MW in winter peak demand savings.

Gross realization rates for the DEC program were 111% for energy savings, 111% for summer peak demand savings, and 105% for winter peak demand savings. The DEP program gross realization rates were 117% for energy savings, 117% for summer peak demand savings, and 111% for winter peak demand savings.

After applying NTGRs established by the current evaluation, the DEC program achieved 63.3 GWh in ex post net energy savings, 10.4 MW in summer peak demand savings, and 4.4 MW in winter peak demand ex post net savings. The DEP program achieved 45.2 GWh in ex post net energy savings, 7.4 MW in summer peak demand savings, and 3.1 MW in winter peak demand ex post net savings.

Table 2 summarizes total ex ante, ex post gross, and ex post net savings by jurisdiction.

Table 2. Retail Lighting Program Impact Evaluation Results by Jurisdiction

Jurisdiction	Metric	Ex Ante	Gross RR	Ex Post Gross	Effective NTGR	Ex Post Net
DEC	Energy Savings (kWh)	94,476,965	111%	104,940,087	0.604	63,383,847
	Summer Peak Demand Savings (kW)	15,586	111%	17,242		10,414
	Winter Peak Demand Savings (kW)	6,915	105%	7,278		4,395
DEP	Energy Savings (kWh)	60,602,872	117%	71,205,792	0.635	45,215,699
	Summer Peak Demand Savings (kW)	9,981	117%	11,670		7,410
	Winter Peak Demand Savings (kW)	4,439	111%	4,942		3,138

Note: NTGR values were developed by retail channel and jurisdiction.

The DEC program NTGR was 0.604 and the DEP program NTGR was 0.635 based on market actor interview feedback and sales data modeling outputs. We developed separate estimates for discount (thrift and dollar stores) and non-discount (big box, DIY, and hardware stores) retail channels. Table 3 reports NTGR by jurisdiction, retail channel, and research activity.

Table 3. NTGR Results by Jurisdiction and Retail Channel

Jurisdiction	Retail Channel	Market Actor Interview NTGR	Sales Data Modeling NTGR	% of Sales	Final NTGR
DEC	Discount	0.845	N/A	66%	0.845
	Non-Discount	0.137	0.134	34%	0.135
	All Channels	**N/A**	**N/A**	**100%**	**0.604**
DEP	Discount	0.852	N/A	68%	0.852
	Non-Discount	0.215	0.130	32%	0.172
	All Channels	**N/A**	**N/A**	**100%**	**0.635**

1.3.2 Process Evaluation

The evaluation team identified the following high-level process findings based on research conducted as part of the current evaluation:

- Participating manufacturer and retailer contacts express high satisfaction with key program elements and the program overall.
- Program tracking data is clean and comprehensive, contained fully populated and internally consistent data fields, and included all necessary information to support core evaluation activities.
- The program team's ongoing efforts to prioritize dollar and thrift stores and reach low-income customer segments has been a success with these retail channels accounting for 64% of all DEC sales and 67% of DEP sales during the evaluation period.
- Several discount retailers that do not fall into traditional thrift or dollar store categories, such as Ollie's Bargain Outlet and Maxway, share key characteristics (i.e., stocking practices and customer demographics) and are therefore strong candidates for future program engagement.
- LED market share continues to increase aided by ongoing decreases in manufacturing costs and by the availability of utility program discounts. Non-ENERGY STAR LEDs, which are energy-efficient

but often have shorter lifespans and lower light quality, are emerging as a more prevalent lower-cost alternative to ENERGY STAR LEDs.

- The COVID-19 pandemic affected the residential lighting supply chain, store traffic, and customer demand, but these patterns started to subside in late 2021 and early 2022.
- Participating retailer and manufacturer staff expect to halt production of halogen and incandescent products by the end of 2022 and sell through any existing inventory of those products by the end of Q2 2023 to comply with new federal lighting efficiency standards announced in April 2022.
- In light of anticipated market developments, Duke Energy staff plan to end POS lighting discounts by July 2023 and will begin offering POS discounts for non-lighting energy-efficient consumer electronics.

1.4 Evaluation Recommendations

Based on the findings of this evaluation, the evaluation team identified the following opportunities for program improvement:

- Continue to prioritize retailers that disproportionally serve low-income customers, such as thrift, dollar, and other discount stores, given this customer segment is less likely to purchase energy-efficient lighting in the absence of incentives (i.e., exhibit lower free ridership).
- Continue to provide discounts on LED bulbs and fixtures through the end of 2022, and potentially the first half of 2023 at retailers that continue to stock incandescent or halogen lighting products. Anticipate that LED products will be the only lighting available on most store shelves by July 2023 at the latest.
- Given the new federal lighting efficiency standards and associated market changes, we support Duke Energy's plans to end POS lighting discounts by July 2023 and diversify upstream program offerings to include non-lighting energy-efficient products.

2. Program Description

This section provides an overview of the design, implementation, and performance of the DEC and DEP Retail Lighting programs. The program period under evaluation is January 1, 2021, to March 31, 2022.

2.1 Program Design

Duke Energy launched the DEP Retail Lighting Program in January 2010 with the goal of reducing electric energy consumption and peak demand through increased awareness and adoption of energy-efficient lighting technologies. The program was expanded to the DEC territory in early 2016 to supplement existing energy-efficient residential lighting program offerings there. As part of the Retail Lighting Program, Duke Energy partners with retailers and manufacturers across the DEC and DEP service territories to provide POS price markdowns on customer purchases of LED products. The program promotes customer awareness and purchase of program-discounted products through a range of marketing and outreach strategies, including in-store collateral and events, mail and email marketing, and community events. The program also provides training to store staff on current program offerings and benefits to customers.

The product mix includes a wide range of standard, specialty, and reflector ENERGY STAR LED bulbs and fixtures,[2] and participating retailers include a variety of store types. Notably, the program has made efforts in recent years to prioritize thrift and dollar stores, targeting 65% of program sales through these retailers for the 2021 calendar year. Moving forward, program staff anticipate introducing POS discounts for non-lighting energy-efficient consumer electronics at many of the same retailers and plan to end POS lighting discounts by July 2023 in acknowledgment of new federal lighting efficiency standards and associated lighting market developments discussed later in this report.

2.2 Program Implementation

Duke Energy staff manages the DEC and DEP Retail Lighting programs and is responsible for overseeing program design, marketing, and operations. CLEAResult is responsible for communicating directly with participating manufacturers and retailers, obtaining and processing program sales data, training retailer staff, and promoting program products through in-store events and point-of-purchase (POP) marketing materials. Duke Energy and CLEAResult staff maintained close communication throughout the evaluation period to monitor market changes and adjust program offerings when needed.

[2] Standard LEDs were discontinued in non-discount retailers after May 2021.

2.3 Program Performance

From January 1, 2021, to March 31, 2022, the Duke Energy Retail Lighting Program sold over 2.5 million discounted energy-efficient bulbs and fixtures in the DEC service territory and 1.8 million in the DEP territory. The DEC program achieved ex ante gross energy savings of 94.5 GWh, and the DEP program realized ex ante gross energy savings of 60.6 GWh. Over the course of the evaluation period, the DEC and DEP Retail Lighting programs discounted 231 unique products across a range of bulb types and wattages. Program staff effectively managed this large portfolio of products, as evidenced by highly accurate and consistent program sales records.

During the evaluation period, the majority of units were sold through thrift and dollar stores (67% for DEC, 68% for DEP), accounting for comparable portions of ex ante savings (68% for DEC, 66% for DEP). DIY retailers accounted for the next largest portion of program sales (29% for DEC, 23% for DEP). Table 4 summarizes sales and ex ante energy savings by retail channel for each jurisdiction.

Table 4. Retail Lighting Program Performance by Jurisdiction and Retail Channel

Jurisdiction	Retail Channel	Units	% of Sales	Ex Ante Gross Energy Savings (kWh)	% of Savings
DEC	**Discount Stores**				
	Thrift	948,332	38%	35,231,661	37%
	Dollar	720,680	29%	27,612,674	29%
	Subtotal	*1,669,012*	*67%*	*62,844,336*	*67%*
	Non-Discount Stores				
	DIY	722,128	29%	26,510,047	28%
	Big Box	132,466	5%	5,066,956	5%
	Hardware	1,367	<1%	55,626	0%
	Subtotal	*855,961*	*34%*	*31,632,629*	*33%*
	All Channels	**2,524,973**	**100%**	**94,476,965**	**100%**
DEP	**Discount Stores**				
	Thrift	739,092	41%	24,608,247	41%
	Dollar	488,552	27%	15,653,069	26%
	Subtotal	*1,227,644*	*68%*	*40,261,316*	*66%*
	Non-Discount Stores				
	DIY	417,629	23%	14,447,387	24%
	Big Box	80,206	4%	2,882,529	5%
	Hardware	79,867	4%	3,011,640	5%
	Subtotal	*577,702*	*31%*	*20,341,556*	*34%*
	All Channels	**1,805,346**	**100%**	**60,602,872**	**100%**

Reflector LEDs accounted for the most ex ante energy savings for both the DEC and DEP programs, contributing over one-third of savings. Specialty LEDs represented nearly one-fourth of savings in each jurisdiction. For the DEC program, LED fixtures accounted for another 23% of savings with standard LEDs making up the remaining 18%. For the DEP program, standard LEDs represented 25% of savings while LED fixtures made up the remaining 16%. Table 5 provides a summary of program sales and ex ante energy savings.

Table 5. Retail Lighting Program Performance by Jurisdiction and Product Category

Jurisdiction	Product Category	Units	% of Sales	Ex Ante Gross Energy Savings (kWh)	% of Savings
DEC	Reflector LEDs	726,421	29%	34,645,143	37%
	Specialty LEDs	696,192	28%	21,384,591	23%
	Standard LEDs	564,965	22%	16,999,797	18%
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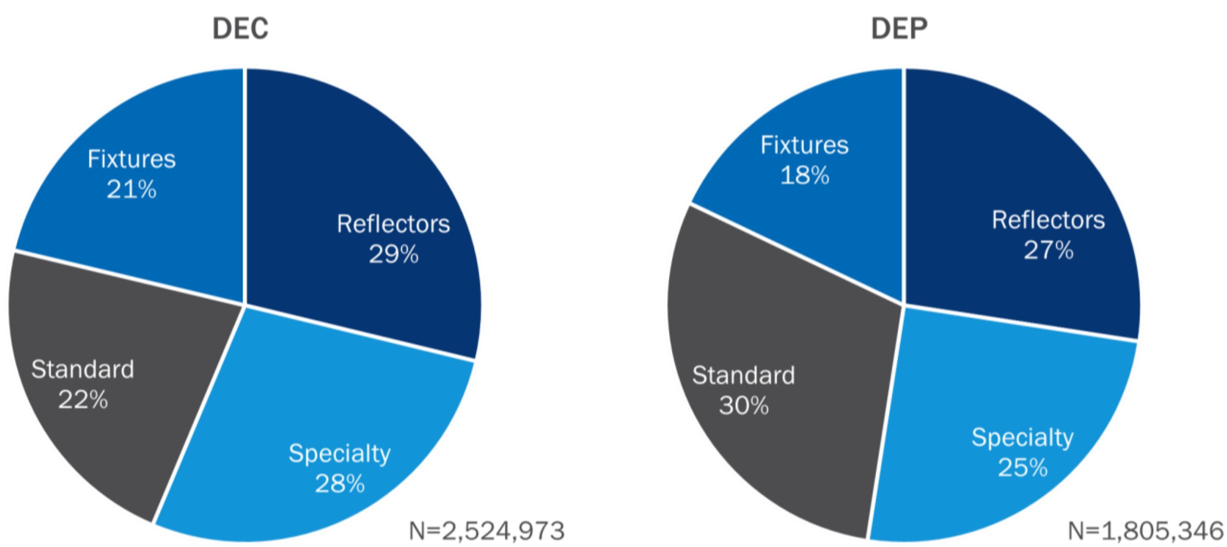
	Standard LEDs	534,719	30%	15,341,088	25%
	LED Fixtures	323,726	18%	9,592,001	16%
	All Categories	**1,805,346**	**100%**	**60,602,872**	**100%**

Note: Specialty LEDs include globe, decorative, and three-way bulbs; reflector LEDs include both indoor and outdoor bulbs; LED fixtures include both portable and direct-wire products.

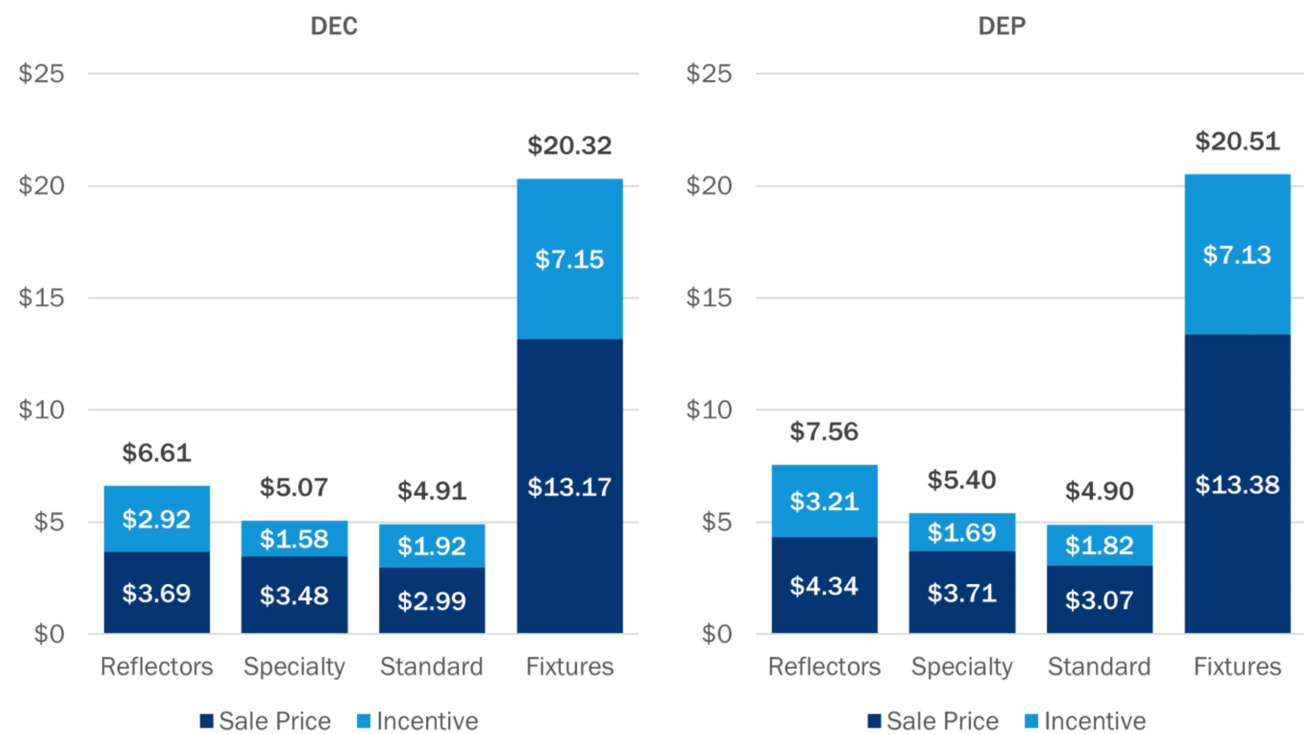
Figure 1 illustrates the relative contribution of each product category to overall program sales by jurisdiction. In each jurisdiction, reflector and specialty products made up a majority of all program sales (57% for DEC, 52% for DEP). For the DEC program, standard bulbs and LED fixtures each accounted for just over 20% of sales. For the DEP program, standard LEDs represented 30% of sales while LED fixtures made up the remaining 18%.

Figure 1. Program Sales by Jurisdiction and Product Category



Customers shopping at participating store locations were able to purchase qualifying LED products at substantially discounted price points. Average per-unit sale prices were lowest for standard bulbs ($2.99 for DEC, $3.07 for DEP) and highest for fixtures ($13.17 for DEC, $13.38 for DEP). Average per-unit incentives for products sold through the DEC program ranged from $1.58 for specialty LEDs to $7.15 for LED fixtures, and per-unit incentives for products sold through the DEP program ranged from $1.69 for specialty LEDs to $7.13 for LED fixtures. Relative to list prices, specialty LEDs received the lowest discounts (31% of list price for both DEC and DEP). Reflector LEDs received the highest discounts relative to list prices (44% of list price for DEC and 43% for DEP). Figure 2 summarizes average program discounts by product category during the evaluation period.

Figure 2. Per-Unit Pricing Summary by Jurisdiction and Product Category



3. Overview of Evaluation Activities

To address the evaluation objectives outlined in Section 1.2, Opinion Dynamics performed a range of data collection and analytic activities, including the following:

- Program staff interviews (n=1)
- Data and deemed savings review
- Leakage analysis
- Sales data modeling
- Market actor interviews (n=9)

3.1 Program Staff Interviews

The evaluation team conducted an in-depth qualitative telephone interview with Duke Energy program staff in March 2022 to (1) obtain a full understanding of the Retail Lighting Program, including implementation processes, eligibility requirements, and available program-tracked information; (2) obtain program staff's perspective on current and past program successes and challenges; and (3) identify program staff's priorities for the process evaluation, including researchable questions.

3.2 Data and Deemed Savings Review

As part of this evaluation, we reviewed program tracking data, assessed its completeness and accuracy, and sought to identify any errors or inconsistencies. We discuss our findings and their implications for program-tracked savings in Section 4.2 of this report. We also conducted a detailed review of deemed savings estimates used to track program performance, assumptions behind those values, and sources of those assumptions. We delivered a memorandum presenting the findings of this review and recommended updates to per-unit savings, which is included in Appendix B.

3.3 Leakage Analysis

Upstream lighting programs that provide POS discounts through retailers are generally unable to restrict sales to customers of the sponsoring utility. As a result, customers of neighboring utilities may purchase some of the program-discounted products. In effect, these energy savings "leak" out of the sponsoring utility's service territory. Duke Energy cannot claim savings from those products, so the savings associated with them must be excluded from the overall program impacts.

The program leakage rate reflects the percentage of program bulbs purchased by non-Duke Energy electric customers. The key factor affecting leakage for an upstream residential lighting program is the location of the participating stores in relation to DEC and DEP service territory borders. The evaluation team relied on geographic information system (GIS) analysis for leakage rate estimates.

3.4 Market Actor Interviews

Opinion Dynamics staff conducted in-depth interviews with corporate-level retailer and manufacturer contacts to inform NTG estimation. In addition, as part of the interview, we explored retailer and manufacturer perspectives on the state of the market and future trends.

The sample included a total of 11 corporate-level contacts from manufacturers and retailers producing and selling program-discounted products supplied to us by the program team.[3] We conducted interviews with nine contacts from retailers and manufacturers representing 97% of DEC and 93% of DEP program sales volume. Table 6 provides a summary of market actor interview fielding.

Table 6. Market Actor Interview Fielding Summary

Sample	Completed Interviews	Percentage of DEC Program Sales	Percentage of DEP Program Sales
11	9	97%	93%

[a] We spoke with nine contacts, eight of whom provided feedback to inform NTG estimates. The contact who declined to provide feedback informing NTG represented less than one percent of program sales.
Source: Opinion Dynamics analysis of market actor interview data.

3.5 Sales Data Modeling

The goal of the sales data modeling was to develop a net-to-gross (NTG) estimate for sales through non-discount retailers. As part of this research activity, we developed regression models of program-tracked sales data to estimate price elasticity and predict bulb sales at non-discounted prices. We calculated a NTG estimate based on the predicted sales volume in the absence of program discounts relative to the actual sales that occurred during the evaluation period. A detailed description of the sales data modeling methodology can be found in Section 5.1 of this report.

Sales data modeling uses sales data from the entire period under evaluation rather than a sample of the program sales records. In the absence of any sampling, the concept of sampling error does not apply, and there is no estimate of precision for the resulting NTG estimate.

[3] The list of contacts provided by program staff included 16 individuals representing 11 retailers and manufacturers. We attempted to interview only one contact from each organization.

4. Gross Impact Evaluation

The gross impact evaluation of the DEC and DEP Retail Lighting programs consisted of two distinct steps: (1) review of per-unit deemed savings values for incented products, and (2) application of leakage and ISR assumptions. This section describes the methodologies and results of both steps.

4.1 Gross Impact Methodology

We employed the research methods described in this section to validate program tracking data, review and update deemed savings, leakage rate, and ISR assumptions, and calculate ex post gross energy and demand savings for products sold through the program.

4.1.1 Data and Deemed Savings Review

We began by reviewing all available program tracking data, assessing it for completeness and accuracy, and identifying all available information relevant for estimation of per-unit savings. To develop ex post per-unit savings, we reviewed savings algorithms and parameters from the following sources:

- Program tracking data: We relied on program tracking data to inform product-specific parameters and measure specifications, including LED wattage and bulb shape. We utilized program tracking data as it is the most reliable and evaluation-specific source of information when available for the population.
- Technical Reference Manual (TRM) assumptions: We used algorithms and parameters from Version 10.0 of the Mid-Atlantic TRM, with the exception of lighting operation assumptions.
- Metering studies: To inform lighting operation parameters, we relied on the 2016 DEC Commercial Lighting Logger Study and 2017 DEC and DEP Residential Lighting Logger Study.

For more information on the algorithms and inputs used to develop deemed per-unit savings estimates for each product category, see Appendix B.

4.1.2 Leakage Analysis

Leakage occurs when non-Duke Energy customers purchase program-discounted products and install them in homes (or businesses) located outside of Duke Energy's service territory. The program leakage rate reflects the percentage of program bulbs purchased by non-Duke Energy electric customers. Duke Energy cannot claim savings from those products, so the savings associated with them must be excluded from the overall program impacts. The key factor affecting leakage for an upstream residential lighting program is the location of the participating stores in relation to service territory borders.

The evaluation team attempted to estimate leakage using a geographic information system (GIS) analysis for the DEC and DEP jurisdictions but found currently available data sources to have fundamental misalignments that prevented development of a defensible estimate of program leakage. Namely, US Census 2021 American Community Survey (ACS) five-year estimates[4] indicated fewer households in many block groups than 2021 Duke Energy residential customer data, resulting in anomalous (negative) leakage rates. We therefore rely on

[4] The evaluation team used Table B25003 - TENURE, which provides total occupied housing units (both owned and rented) at the block group level. US Census Bureau; American Community Survey, 2021 American Community Survey 5-Year Estimates, Table B25003; accessed via data.census.gov.

leakage results from a comparable analysis conducted as part of the most recent prior evaluation of the DEC and DEP Retail Lighting programs (Opinion Dynamics, 2018).

4.1.3 In-Service Rate

First-year ISR is estimated by technology and application. Because participants in upstream programs are generally not tracked, we leveraged secondary sources of ISRs. For bulbs in residential applications, we relied on the results from the 2021 DEC-DEP Online Store Participant Survey (Opinion Dynamics, 2021). For bulbs in commercial applications and for fixtures in both residential and commercial applications, we applied a first-year ISR of 100%, as recommended by the Mid-Atlantic TRM, Version 10.0.

Although the first-year ISR is less than 100% for bulbs in residential applications, research studies across the country have found residential customers often purchase more LED bulbs than immediately needed and continue to install these bulbs from storage in subsequent years. The two main approaches to claiming savings from these later installations are (1) staggering the savings over time and claiming some in later years, and (2) claiming the savings in the evaluation period the product was sold but discounting savings by a societal or utility discount rate. While the "staggered" approach allows program administrators to more accurately capture the timing of the realized savings, the "discounted savings" approach provides the simplicity of claiming all costs and benefits during the evaluation period and eliminates the need to track and claim savings from future installations in future evaluations.

The evaluation team used a discounted savings approach to account for savings from future installations. To allocate installations over time, we relied on the installation trajectory recommended by the Uniform Methods Project (UMP) whereby 24% of remaining bulbs are installed in each subsequent year, for a total of five years. For example, if the Year 1 ISR is 80%, an additional 4.8% of bulbs would be installed in Year 2 ([1 − 80%] × 24%; or 20% × 24%), an additional 3.6% of bulbs would be installed in Year 3 ([1 − 80% − 4.8%] × 24%; or 15.2% × 24%), and so on.

These future installations are then discounted using Equation 1 to derive the net present value (NPV) of savings associated with future installs of LED bulbs.

Equation 1. Net Present Value Formula for Future LED Bulb Savings

$$NPV = \frac{R_t}{(1+i)^t}$$

Where:

R = Savings
i = Discount rate
t = Number of years in the future that savings take place

4.2 Gross Impact Results

This section provides gross energy and demand savings estimates for each product category offered by the DEC and DEP Retail Lighting programs and program-level savings during the evaluation period.

4.2.1 Program Tracking Data Review

Opinion Dynamics received program tracking data extracts that contained pricing, quantity, date, and retailer information along with product descriptions. As a part of the analysis, we performed the following steps:

- Checked core data fields for missing values
- Checked data for temporal gaps
- Checked key data fields for reasonableness and consistency

In reviewing the data, we found that all data fields were clean and fully populated, and program tracking data included the necessary product specifications to inform TRM-based savings calculations.

4.2.2 Per-Unit Deemed Savings

Duke Energy provided per-unit ex ante savings values separately from program tracking data in a spreadsheet containing DSMore outputs for each product category and jurisdiction. Savings values included energy, summer peak demand, and winter peak demand savings across eight LED product categories.

Ex ante savings for LED lighting products are drawn directly from the most recent prior evaluation of the DEC and DEP Retail Lighting programs (Opinion Dynamics, 2018). These values reflect average per-unit ex post savings across the mix of products included in each category during that prior evaluation period and include application of ISRs and leakage rates. For the present analysis, we backed out the ISR and leakage rate to make ex ante values more directly comparable to ex post values, which do not account for ISR or leakage.[5] Differences between ex ante and ex post per-unit savings for LED lighting are primarily attributable to shifts in the mix of specific products and LED wattages within each category. Additionally, for three-way bulbs, ex post savings reflect baseline wattage assumptions assigned based on mid-level lumen output rather than maximum lumen output.

[5] The prior DEC-DEP Retail Lighting evaluation applied cumulative ISRs of 95.9% for DEC residential bulbs, 95.8% for DEP residential bulbs, and 97.9% for all commercial bulbs, along with leakage rates of 1.3% for all DEC LED products and 8.4% for all DEP LED products to develop ex post savings. Program staff then used these as ex ante per-unit savings for the current evaluation period. We therefore recalculated average per-unit savings from the previous evaluation excluding these ISR and leakage adjustments to produce revised ex ante per-unit values shown here.

Table 7 provides ex ante and ex post per-unit savings for all product categories sold through the DEC and DEP Retail Lighting programs. Additional information about the parameters and algorithms we used to develop per-unit savings is provided in Appendix B.

Table 7. Comparison of Per-Unit Deemed Savings by Jurisdiction and Product Category (Net of ISR and Leakage)

Jurisdiction	Product Category	Energy (kWh)		Summer Demand (kW)		Winter Demand (kW)	
		Ex Ante[a]	Ex Post	Ex Ante[a]	Ex Post	Ex Ante[a]	Ex Post
DEC	Standard A-Line	31.66	49.42	0.0058	0.0080	0.0022	0.0034
	Reflector Recessed	46.26	45.32	0.0085	0.0074	0.0032	0.0032
	Reflector Outdoor	56.78	63.98	0.0105	0.0104	0.0040	0.0045
	Reflector Track Lighting	33.87	42.25	0.0062	0.0069	0.0024	0.0029
	Globe LEDs	33.01	38.44	0.0061	0.0063	0.0023	0.0027
	Decorative LEDs	24.28	33.03	0.0045	0.0054	0.0017	0.0023
	Three-Way LEDs	81.35	81.21	0.0150	0.0132	0.0057	0.0056
	LED Fixtures	40.61	44.90	0.0075	0.0073	0.0028	0.0031
DEP	Standard A-Line	32.55	46.74	0.0060	0.0076	0.0023	0.0033
	Reflector Recessed	46.14	45.63	0.0085	0.0074	0.0032	0.0032
	Reflector Outdoor	53.31	60.36	0.0098	0.0098	0.0037	0.0042
	Reflector Track Lighting	33.42	42.24	0.0062	0.0069	0.0023	0.0029
	Globe	32.73	38.30	0.0060	0.0062	0.0023	0.0027
	Decorative	26.69	33.71	0.0049	0.0055	0.0019	0.0023
	Three-Way	81.59	78.65	0.0150	0.0128	0.0057	0.0055
	Fixture	32.35	45.52	0.0060	0.0074	0.0023	0.0032

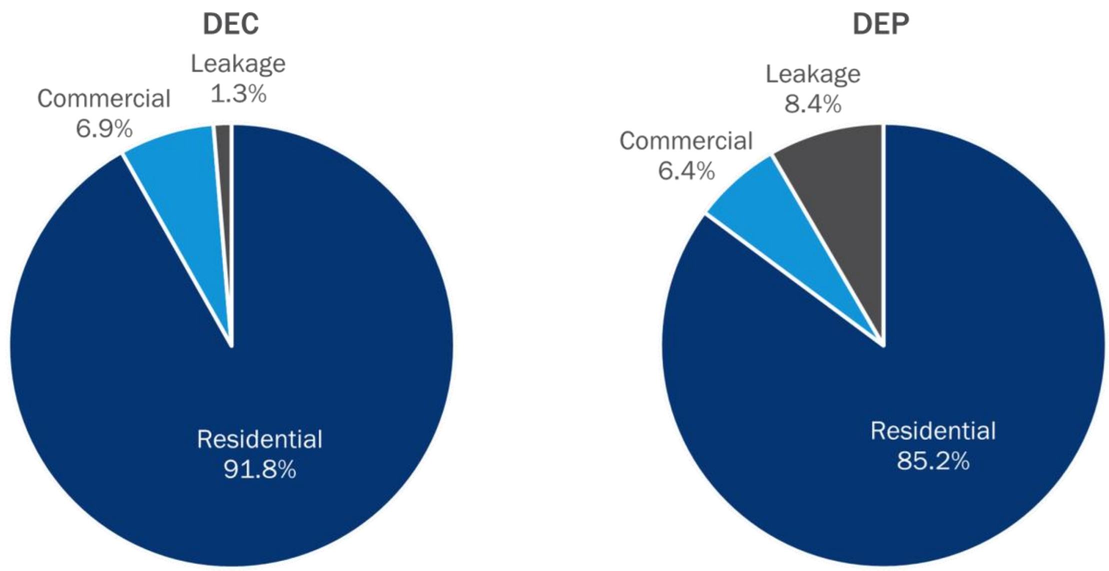
[a] For LED bulb categories, ex ante per-unit values exclude ISR and leakage to make ex ante values more directly comparable to ex post values. Ex ante values originally provided by program staff and shown elsewhere in this report include ISR and leakage.

4.2.3 Leakage Rates

To estimate leakage rates, we relied on a GIS analysis performed for the 2018 evaluation of the DEC/DEP Retail Lighting Program Evaluation (Opinion Dynamics, 2018; see also Section 4.1.2). The analysis produced a leakage rate of 1.3% for DEC and 8.4% for DEP. Based on the Mid-Atlantic TRM V10.0, we assumed 93% of sales were for residential application and 7% were for commercial application. Because program leakage represents the portion of program sales purchased by non-Duke Energy customers, it effectively detracts from the portions of sales going to Duke Energy residential or commercial customers.

Figure 3 illustrates the resulting distribution of program sales to residential customer homes, commercial customer facilities, and locations not serviced by Duke Energy (i.e., leakage).

Figure 3. Program Leakage and Application by Sector



4.2.4 In-Service Rates

Table 8 summarizes first-year ISRs by application and product type. For bulbs in residential applications, we relied on the results from the 2021 DEC-DEP Online Store Participant Survey. For bulbs in commercial applications and for fixtures in both residential and commercial applications, we applied a first-year ISR of 100%, as recommended by the Mid-Atlantic TRM, Version 10.0.

Table 8. First-Year ISR Summary

Application and Product Type	DEC	DEP
Residential Bulbs	61.8%	71.7%
Commercial Bulbs	100.0%	100.0%
Residential and Commercial Fixtures	100.0%	100.0%

Table 9 provides cumulative installations of residential LED bulbs by year, using the discounted approach detailed in Section 4.1.3 (i.e., incremental installations of 24% of bulbs that remain uninstalled for a total of five additional years). The values shown here are discounted to represent the NPV of installations that occur in each year. The resulting effective ISR for LED bulbs installed in residential applications is 86.6% for DEC and 89.7% for DEP.

Table 9. Residential LED Bulb Cumulative Discounted ISR

Year	DEC	DEP
2021 (Year 1)	61.8%	71.7%
2022 (Year 2)	70.5%	78.3%
2023 (Year 3)	76.6%	82.7%
2024 (Year 4)	80.8%	85.9%
2025 (Year 5)	83.9%	88.1%
2026 (Year 6)	86.1%	89.7%
Total	**86.1%**	**89.7%**

Table 10 summarizes effective ISR values by application and product type. The effective ISR for residential LED bulbs is reflective of discounted future installations, as outlined above. For fixtures and commercial installations, effective ISR is equivalent to the first-year ISR of 100% as there are no remaining units for customers to install in future years.

Table 10. Final Effective ISR Summary

Application and Product Type	DEC	DEP
Residential Bulbs	86.1%	89.7%
Commercial Bulbs	100.0%	100.0%
Residential And Commercial Fixtures	100.0%	100.0%

4.2.5 Ex Post Gross Savings Summary

Table 11, Table 12, and Table 13 present total ex ante and ex post gross energy, summer peak demand, and winter peak demand savings and realization rates, by product category.[6] The DEC program realized 104.9 GWh in ex post gross energy savings, 17.2 MW in summer peak demand savings, and 7.3 MW in winter peak demand savings during the evaluation period. In the same period, the DEP program achieved 71.2 GWh in ex post gross energy savings, 11.7 MW in summer peak demand savings, and 4.9 MW in winter peak demand savings.

Gross realization rates for the DEC program were 111% for energy savings, 111% for summer peak demand savings, and 105% for winter peak demand savings, while the DEP program gross realization rates were 117% for energy savings, 117% for summer peak demand savings and 111% for winter peak demand savings. Standard LEDs had the highest gross realization rate for the DEC program during the evaluation period, exceeding 135% for energy and demand savings. For the DEP program, LED fixtures had the highest gross realization rate, exceeding 130% for energy and demand savings. In each program, reflector LEDs were the only category that did not exceed 100% gross realization for energy and demand savings. Differences between ex ante and ex post per-unit savings are primarily attributable to shifts in the mix of specific products and LED

[6] All total ex post savings include leakage rate and ISR adjustments.

wattages within each category. Ex post savings also reflect slightly lower ISRs and a slightly higher share of units installed in residential applications, both of which slightly reduce gross realization rates.

Table 11. Detailed Energy Savings Gross Impacts Results by Jurisdiction and Product Category

Jurisdiction	Product Category	Ex Ante Savings (kWh)	Ex Post Gross Savings (kWh)			Gross Realization Rate
			Residential	Commercial	Total	
DEC	Reflector LEDs	34,645,143	27,914,337	5,095,516	33,009,853	95%
	Specialty LEDs	21,384,591	20,208,950	3,688,967	23,897,917	112%
	Standard LEDs	16,999,797	20,478,359	3,738,000	24,216,359	142%
	LED Fixtures	21,447,434	20,585,731	3,230,227	23,815,958	111%
	All Categories	**94,476,965**	**89,187,378**	**15,752,709**	**104,940,087**	**111%**
DEP	Reflector LEDs	21,421,623	18,200,239	3,187,227	21,387,466	100%
	Specialty LEDs	14,248,159	13,176,441	2,307,433	15,483,874	109%
	Standard LEDs	15,341,088	17,730,194	3,105,028	20,835,223	136%
	LED Fixtures	9,592,001	11,668,290	1,830,940	13,499,230	141%
	All Categories	**60,602,872**	**60,775,164**	**10,430,628**	**71,205,792**	**117%**

Table 12. Detailed Summer Peak Demand Savings Gross Impacts Results by Jurisdiction and Product Category

Jurisdiction	Product Category	Ex Ante Savings (kW)	Ex Post Gross Savings (kW)			Gross Realization Rate
			Residential	Commercial	Total	
DEC	Reflector LEDs	5,691	4,120	1,320	5,439	96%
	Specialty LEDs	3,524	2,982	955	3,938	112%
	Standard LEDs	2,825	3,022	968	3,990	141%
	LED Fixtures	3,547	3,038	837	3,875	109%
	All Categories	**15,586**	**13,162**	**4,080**	**17,242**	**111%**
DEP	Reflector LEDs	3,520	2,686	826	3,511	100%
	Specialty LEDs	2,361	1,945	598	2,542	108%
	Standard LEDs	2,513	2,617	804	3,421	136%
	LED Fixtures	1,586	1,722	474	2,196	138%
	All Categories	**9,981**	**8,969**	**2,702**	**11,670**	**117%**

Table 13. Detailed Winter Peak Demand Savings Gross Impacts Results by Jurisdiction and Product Category

Jurisdiction	Product Category	Ex Ante Savings (kW)	Ex Post Gross Savings (kW)			Gross Realization Rate
			Residential	Commercial	Total	
DEC	Reflector LEDs	2,542	1,998	290	2,287	90%
	Specialty LEDs	1,572	1,446	210	1,656	105%
	Standard LEDs	1,243	1,465	212	1,678	135%
	LED Fixtures	1,558	1,473	184	1,657	106%
	All Categories	**6,915**	**6,382**	**895**	**7,278**	**105%**
DEP	Reflector LEDs	1,566	1,303	181	1,484	95%
	Specialty LEDs	1,037	943	131	1,074	104%
	Standard LEDs	1,123	1,269	176	1,445	129%
	LED Fixtures	712	835	104	939	132%
	All Categories	**4,439**	**4,349**	**593**	**4,942**	**111%**

Table 14 summarizes per-unit ex post gross energy, summer peak demand, and winter peak demand savings by product category. These values are reflective of deemed per-unit savings presented in Section 4.2.2 adjusted to incorporate leakage and effective ISRs presented in Section 4.2.3.

Table 14. Per-Unit Ex Post Gross Impacts Results by Jurisdiction and Product Category

Jurisdiction	Product Category	Energy Savings (kWh)	Peak Demand Savings	
			Summer (kW)	Winter (kW)
DEC	Standard A-Line	42.86	0.0071	0.0030
	Reflector Recessed	39.30	0.0065	0.0027
	Reflector Outdoor	55.48	0.0091	0.0038
	Reflector Track Lighting	36.64	0.0060	0.0025
	Globe	33.34	0.0055	0.0023
	Decorative	28.64	0.0047	0.0020
	Three-Way	70.43	0.0116	0.0049
	Fixture	44.32	0.0072	0.0031
DEP	Standard A-Line	38.96	0.0064	0.0027
	Reflector Recessed	38.04	0.0062	0.0026
	Reflector Outdoor	50.32	0.0083	0.0035
	Reflector Track Lighting	35.21	0.0058	0.0024
	Globe	31.93	0.0052	0.0022
	Decorative	28.10	0.0046	0.0019
	Three-Way	65.57	0.0108	0.0045
	Fixture	41.70	0.0068	0.0029

4.3 References

Mid-Atlantic Technical Reference Manual, Version 10.0, May 2020.

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5. Net-to-Gross Analysis

This section describes our approach for estimating the net savings for the DEC and DEP Retail Lighting programs and presents the resulting NTGRs and net impacts.

5.1 NTG Methodology

The NTGR represents the portion of the gross energy savings associated with a program-supported measure or behavior change that would not have been realized in the absence of the program. In other words, the NTGR represents the share of gross savings that are attributable to the program. The NTGR generally consists of free ridership (FR) and spillover (SO) and is calculated as *(1 – FR + SO)*. FR is the proportion of the verified gross savings that would have been realized absent the program. SO reflects additional energy-saving actions that were influenced by program interventions but did not receive program support. However, the standard NTGR methodologies used for upstream lighting programs (i.e., market actor interviews and sales data modeling) only produce estimates of FR. As such, the estimates of NTGR presented in this report only include FR and are estimated as (*1 – FR)*.

The assessment of NTG for upstream residential lighting programs is especially challenging for the following reasons:

- Since customers purchase discounted bulbs in a retail setting where they do not need to provide contact information, there is not a list of participants with whom we can conduct a follow-up self-report NTG survey (i.e., customers who purchased discounted bulbs through the program). Additionally, most customers do not put extensive thought into or have reliable recall of their purchase decision because light bulbs are a low-cost commodity product. Customers may not even be aware they purchased discounted bulbs. Therefore, we cannot conduct a participant nor a general population survey in which we ask customers about their past light bulb purchases and the influence of program discounts on those purchases.
- Although we have detailed data regarding sales for the bulbs associated with the program, we lack any information about sales of other bulbs sold at the same retailers (including less efficient and non-discounted products). Thus, while we can attempt to model the relationship between bulb price and sales for the products associated with the program, we cannot account for how other factors (e.g., discounts of non-program bulbs) may have affected our results. In addition, modeling the relationship between bulb pricing and sales volumes requires substantial variation in product pricing.
- Program interventions (i.e., discounts on select products, marketing materials, field representative engagement) may affect manufacturer supply chains and retailer stocking practices, resulting in shelf space changes. Those changes are not visible to participants and therefore call for research with a range of market actors and, ultimately, triangulation of NTG estimates from multiple sources.

To understand counterfactual customer behaviors and to develop the most accurate possible estimates of program NTGRs, Opinion Dynamics relied on two distinct methods:

- Market actor interviews
- Sales data modeling

Below we discuss the methodology associated with each approach.

5.1.1 Market Actor Interviews

Opinion Dynamics staff conducted in-depth interviews with corporate-level retailer and manufacturer contacts to inform estimation of NTG. In addition, as part of the interview, we explored retailer and manufacturer perspectives on the state of the market and future trends.

The sample included a total of 11 corporate-level contacts from manufacturers and retailers producing and selling program-discounted products supplied to us by the program team. Opinion Dynamics staff conducted nine in-depth interviews with corporate-level retailer and manufacturer contacts. Of those interviews, eight informed NTGR estimates for the Retail Lighting Program, and one provided only process feedback because the interviewee declined to give quantitative estimates relating to NTG. The eight retailers and manufacturers who provided NTG feedback account for 97% of total program sales for DEC and 93% for DEP.

We asked each interviewee to estimate the percentage by which the sales of efficient bulbs would be different in the absence of the program for each bulb category. Respondents who said that sales of energy-efficient products would have decreased received a follow-up question asking to estimate the percent that would have shifted to other energy-efficient products. The percentage of energy-efficient bulb sales expected to move to non-energy-efficient products in the program's absence represents the NTGR for the respondent. As part of the interview guide, we embedded a range of validation questions to check responses for consistency and asked respondents to provide their rationale for the reported percent change in sales in the absence of the program.

We estimated a NTGR for each retail channel associated with each respondent, which we then aggregated, weighting by program sales, to produce two separate NTGRs for each jurisdiction: one for discount retailers and one for all other retail channels. As part of the analysis and aggregation process, a single manufacturer could contribute to the NTGRs across several retail channels, as long as that manufacturer was supplying its product to those retail channels.

5.1.2 Sales Data Modeling

The sales data modeling approach to estimating NTGRs is based on the simple economic principle that a change in price causes a change in product sales. This assumption is the foundation of upstream program theory, so measuring the effect of program discounts on bulb sales serves as a good indicator of a program's net impact. The sales data modeling method models this relationship between product price and sales volume using the program-tracked sales data. The model produces price elasticity curves, allowing for predictions of sales at various prices, namely, program-discounted and non-discounted price levels.

For the modeling effort to succeed, there must be sufficient price variation for identical products during the evaluation period. As the first step in our analysis, we reviewed the data and confirmed that there was sufficient price variation to support data modeling.

The program tracking data for both programs contained transaction-level sales summaries. Depending on the retailer and manufacturer, most transaction periods ranged from one week to one month. To ensure time series consistency and to maximize the potential for capturing the effect of in-store events on bulb sales, we normalized transaction periods to a monthly level.

To reach our final price elasticity estimates, we fit a series of theoretically driven models predicting sales volume from product price. We tested a range of models including varying product specifications, retailer information, and transaction periods. For each model, we examined several diagnostics to assess the model's performance in terms of efficiency, omitted variables, and heteroscedasticity of residuals.[7] We also considered model fit indices, favoring models with larger R-squared values[8] and lower Akaike's Information Criterion (AIC) values[9] relative to other models based on comparable bulb quantities or sales transactions.

A model using unique product identifiers and unique store location identifiers (inherently representative of bulb characteristics and store traffic patterns, respectively), emerged as the best performing for both DEC and DEP. Although the methodology and model design were the same for both programs, we present separate results for each.

Equation 2 contains the final sales data model specification. As is common in this type of analysis, we used the log of both price and sales quantity, which greatly improves the distributions of those variables, and allows for the interpretation of the price coefficient as the percent increase in sales given a one percent decrease in price, simplifying the process of analyzing price elasticity and NTGR.

Equation 2. Final Sales Data Model Specification

$$ln(Q_{ms}) = \alpha + \beta_x ln(P_{ms}) + \sum_{\mu}(\beta_\mu model_m) + \sum_{\gamma}(\beta_\gamma store_s)$$

Where:

ln = natural log

Q = quantity of bulbs sold

P = price per bulb[10]

m = model

s = store location

model = a vector of dummy variables equaling 1 for each unique model number, and 0 for all others

store = a vector of dummy variables equaling 1 for each unique store location, and 0 for all others

β_x = coefficient representing average price elasticity

β_μ = a vector of coefficients representing each unique model number (*m*)

β_γ = a vector of coefficients representing each unique store location (s)

α = constant

[7] Heteroscedasticity is a statistical term that describes errors in prediction that vary in size across different values of a predictor. One of the assumptions of the Ordinary Least Squares (OLS) regression is that the errors are homoscedastic (that the variance around the regression line is the same for all values of a predictor variable), so when they are heteroscedastic, an assumption of the method is violated.

[8] R-squared value is a summary statistic for many regression techniques. It shows the proportion of the total variance in the outcome variable that is correctly predicted by the model's predictor variables.

[9] AIC is a summary statistic that is based on how well the outcome variable is predicted given the number of predictor variables in the regression model. The AIC value has no inherent meaning except in comparison to the values on the same statistic produced by alternative models under consideration. Modelers seek to minimize the AIC value, along with other ways of judging the models.

[10] We received two discounted prices in the data set, one that reflects program discounts and one that reflects other retailer or manufacturer discounts. We included the other retailer or manufacturer discounts in both discounted and non-discounted pricing.

Using the modeled results, the evaluation team estimated sales at non-discounted prices using Equation 3. We used MSRP data supplied as part of the program sales data extract for estimates of non-discounted prices.

Equation 3. Estimating Sales at Non-Discounted Prices

$$\widehat{Sales}_{wo} = Sales_w * \left(\frac{Price_{wo}}{Price_w}\right)^{PC}$$

Where:

$\widehat{Sales}_{wo}$ = Estimated sales without discount (MSRP)

$Sales_w$ = Sales with discount (actual sales)

$Price_{wo}$ = Price without discount (MSRP)

$Price_w$ = Price with discount (actual price)

PC = Price coefficient

We excluded bulbs sold at thrift and dollar stores from the sales data modeling due to lack of price variation, observed in sales data during the evaluation period. We developed NTGRs by comparing the predicted sales at non-discounted prices to the actual sales at program-discounted prices using Equation 4 below.

Equation 4. Sales Data Modeling NTGR Estimation Formula

$$NTGR = \frac{\widehat{Sales}_{wo} - Sales_w}{Sales_w} = \frac{NetSales}{DiscountedSales}$$

Where:

$NTGR$ = NTGR (excluding any SO)

$\widehat{Sales}_{wo}$= Estimated sales without discount (MSRP)

$Sales_w$= Sales with discount

5.2 NTG Results

5.2.1 Market Actor Interviews

Retailer and manufacturer contacts representing sales through non-discount retailers provided widely varying estimates of the portion of ENERGY STAR LED sales that would not occur in the program's absence, ranging from 10% to 90%. However, they consistently suggested that the majority of customers who would move away from ENERGY STAR LEDs would look instead to cheaper non-ENERGY STAR LEDs, which despite being lower quality are still far more efficient than halogen or incandescent alternatives. The provided estimates result in savings-weighted NTGRs at non-discount retailers of 0.137 for DEC and 0.215 for DEP. Because we attempted a census of available retailer and manufacturer contacts, the concept of sampling error does not apply, so there is no estimate of precision for resulting NTGR estimates.

Higher NTGRs for the discount retail channel (0.845 for DEC, 0.852 for DEP) reflect feedback from interviewees that availability of energy-efficient lighting products at many of these stores is largely dependent on the Retail Lighting Program, with the exception of one contact who reported their company would still sell a small portion of their LEDs through the discount retail channel even in the absence of the program. Customers who shop at these stores, in turn, are likely to be price-sensitive and, in the absence of the energy-efficient products offered through the program, are assumed to purchase the lowest-cost alternative on the market (i.e., an incandescent or halogen product).[11]

Table 15 summarizes the savings-weighted NTGRs based on feedback from retailer and manufacturer contacts.

Table 15. Retailer and Manufacturer Interview NTGR Results

Retail Channel	DEC	DEP
Discount	0.845	0.852
Non-Discount	0.137	0.215

5.2.2 Sales Data Modeling

Using the results from the sales data model, Opinion Dynamics estimated total sales at program-discounted and non-discounted prices separately for each LED product category included in the model (specialty LEDs and reflector LEDs). To arrive at the program-wide NTGR, we weighted the bulb category-specific NTGR estimates by program sales. Because sales records across the entire evaluation period were used and there was no sampling needed, the concept of sampling error does not apply, so there is no estimate of precision for resulting NTGR estimates.

According to the results of the sales data modeling, customers would have purchased fewer LEDs in the absence of program discounts. We found that 86.6% of DEC program sales and 87.0% of DEP program sales would have occurred regardless of the program discounts (i.e., a NTGR of 0.134 for DEC and 0.130 for DEP). It should be noted that this analysis excluded discount store sales.

Table 16 summarizes NTGR results from sales data modeling.

Table 16. Sales Data Modeling NTGR Results

Jurisdiction	NTGR
DEC	0.134
DEP	0.130

Source: Opinion Dynamics sales data modeling analysis.

[11] https://consumerfed.org/wp-content/uploads/2017/11/led-light-bulb-survey-report.pdf

5.2.3 NTG Triangulation and Program-Level NTGR

Based on market actor interview feedback, we estimated a NTGR for sales through discount retailers of 0.845 for DEC and 0.852 for DEP (i.e., we rely on results from the market actor interviews without any additional triangulation). For non-discount retail channels, we developed a final NTGR by averaging the NTGRs derived through market actor interviews (0.137 for DEC; 0.215 for DEP) and sales data modeling (0.134 for DEC; 0.130 for DEP). The resulting NTGR for non-discount sales is 0.135 for DEC and 0.172 for DEP. To arrive at the program-level NTGR, we weighted the NTGRs for the discount and non-discount channels using respective shares of program sales. The resulting program-level NTGR is 0.604 for DEC and 0.635 for DEP, as shown in Table 17.

Table 17. Final Program-Wide NTG Triangulation

Jurisdiction	Retail Channel	Market Actor Interview NTG	Sales Data Modeling NTG	Percentage of Program Sales	Final NTG
DEC	Discount	0.845	N/A	66.1%	0.845
	Non-Discount	0.137	0.134	33.9%	0.135
	Total	**N/A**	**N/A**	**100.0%**	**0.604**
DEP	Discount	0.852	N/A	68.0%	0.852
	Non-Discount	0.215	0.130	32.0%	0.172
	Total	**N/A**	**N/A**	**100.0%**	**0.635**

5.3 Net Impact Results

The evaluation team applied the program-level NTGR to ex post gross energy and peak demand savings to arrive at ex post net savings, as shown in Table 18. The DEC program realized 63.4 GWh in net energy savings, 10.4 MW in net summer peak demand savings, and 4.4 MW in net winter peak demand during the evaluation period. In the same period, the DEP program achieved 45.2 GWh in net energy savings, 7.4 MW in net summer peak demand savings, and 3.1 MW in net winter peak demand.

Table 18. Ex Post Net Savings Summary by Jurisdiction

Jurisdiction	Metric	Ex Post Gross	NTGR	Ex Post Net
DEC	Energy Savings (kWh)	104,940,062	0.604	63,383,847
	Summer Peak Demand Savings (kW)	17,241		10,414
	Winter Peak Demand Savings (kW)	7,278		4,395
DEP	Energy Savings (kWh)	71,205,797	0.635	45,215,699
	Summer Peak Demand Savings (kW)	11,670		7,410
	Winter Peak Demand Savings (kW)	4,942		3,138

6. Process Evaluation

This section details research questions, evaluation activities, and key findings from the process evaluation of the DEC and DEP Retail Lighting programs.

6.1 Research Questions

The evaluation team developed the following process-oriented research questions with input from Retail Lighting Program staff.

- How effective are program implementation, marketing, and data tracking practices?
- Which types of products, retail channels, or store locations can the program target to maximize its influence and minimize free ridership?
- What are the program's strengths or key successes and in what areas are there potential opportunities for improvement?
- What are the current and anticipated future trends in the lighting market?

6.2 Methodology

The process evaluation relied on the following data collection and analytic activities:

- Market actor interviews (n=9)
- Analysis of program tracking data

6.3 Key Findings

The following sections present key findings regarding the evaluation's process-oriented research questions.

6.3.1 Program Implementation and Data Tracking

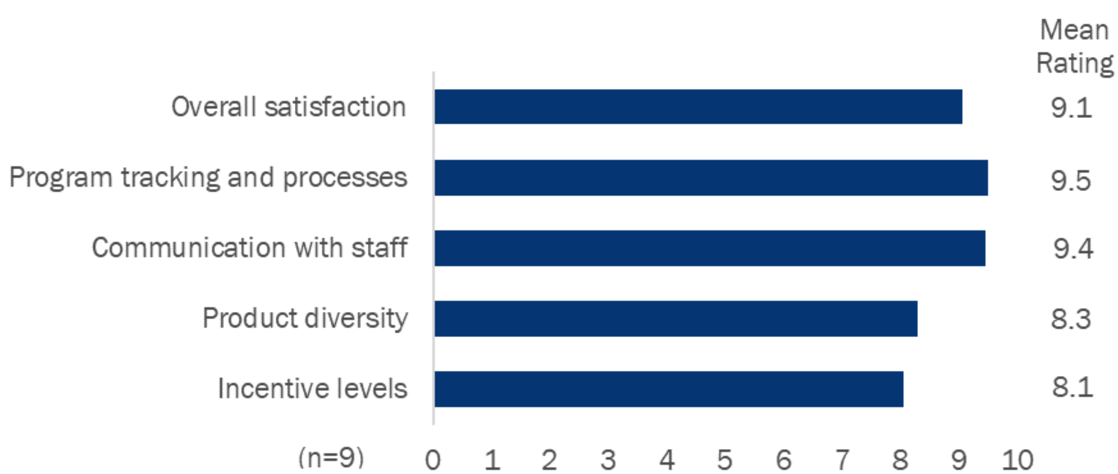
Duke Energy and CLEAResult staff continued to operate the DEC and DEP Retail Lighting programs effectively and without interruption over the course of the evaluation period, adapting on an ongoing basis to target product categories and retail channels where program incentives are most impactful. Program staff maintain clean and comprehensive program tracking data, and the evaluation team found that all data fields were fully populated, including dates, retailer information, product descriptions, pricing, quantities, and specifications. Values appeared both reasonable and internally consistent and included all necessary information to support core evaluation activities.

As part of market actor interviews, we asked contacts at participating retailers and manufacturers to rate their satisfaction and provide feedback on key program elements. Interviewees expressed high satisfaction with all elements of the DEC and DEP Retail Lighting programs, particularly with program processes and program staff engagement. We heard the following comments from interviewees discussing their satisfaction with the Program:

- "We have great communication with the [program] team and CLEAResult, and the in-store execution of their field team is really good."
- "The program is really mature and they've managed it well in the past, so we're in a very good spot where the communication we get is exactly what we need."
- "The Duke program is really well designed, and well implemented by CLEAResult. So our satisfaction is a 10 and I very rarely give that, but like I mentioned before, the Duke program is probably the best-designed program in the country."
- "The communication has been remarkable...many, many utilities don't communicate as well, and it causes issues. We work with CLEAResult staff to identify trouble points in advance, and they discuss with Duke staff and make sure we're all on the same page."

Figure 4 provides average ratings of satisfaction with key program elements from participating retailer and manufacturer staff.

Figure 4. Retailer and Manufacturer Partner Program Satisfaction



The only suggested changes came from those who would like to see a broader mix of bulb types offered at each store. Three of the nine contacts we spoke with expressed an interest in restoring discounts on standard LEDs, with one interviewee commenting, "they don't include some of the higher volume movers. The 60-watt A-line is probably our number one seller and I don't think that's being offered by the program anymore." One interviewee also suggested smart bulbs should be included.

6.3.2 Participating Retailer Coverage

Program staff have made efforts in recent years to prioritize thrift and dollar stores, targeting 65% of program sales through these retailers for the 2021 calendar year. The DEC program came within 1% this target (64%), and the DEP program slightly exceeded it (67%). In the first three months of 2022, 73% of DEC program sales and 75% of DEP program sales occurred at thrift and dollar stores, an increase which reflects the program team's ongoing efforts to reach low-income customer segments less likely to adopt LED products in the absence of program incentives.

Table 19 provides a breakdown of participating store locations and program sales across retail channels. During the evaluation period, discount stores accounted for two-thirds of sales (DEC: 66%, DEP: 68%) in both jurisdictions. DIY stores were another major retail channel for program sales, accounting for 29% of DEC sales and 23% of DEP sales.

Table 19. Program Sales by Jurisdiction, Retail Channel, and Year

Jurisdiction	Retail Channel	2021 Sales		2022 Sales		Total Sales	
		Units	%	Units	%	Units	%
DEC	**Discount Stores**						
	Thrift	759,746	37%	188,586	40%	948,332	38%
	Dollar	561,806	27%	158,874	34%	720,680	29%
	Subtotal	*1,321,552*	*64%*	*347,460*	*74%*	*1,669,012*	*67%*
	Non-Discount Stores						
	DIY	617,807	30%	104,321	22%	722,128	29%
	Big Box	110,048	5%	22,418	5%	132,466	5%
	Hardware	1,367	<1%	0	0%	1,367	<1%
	Subtotal	*729,222*	*35%*	*126,739*	*27%*	*855,961*	*34%*
	All Channels	**2,050,774**	**100%**	**474,199**	**100%**	**2,524,973**	**100%**
DEP	**Discount Stores**						
	Thrift	639,908	42%	99,184	37%	739,092	41%
	Dollar	384,977	25%	103,575	38%	488,552	27%
	Subtotal	*1,024,885*	*67%*	*202,759*	*75%*	*1,227,644*	*68%*
	Non-Discount Stores						
	DIY	365,664	24%	51,965	19%	417,629	23%
	Big Box	66,357	4%	13,849	5%	80,206	4%
	Hardware	77,242	5%	2,625	1%	79,867	4%
	Subtotal	*509,263*	*33%*	*68,439*	*25%*	*577,702*	*31%*
	All Channels	**1,534,148**	**100%**	**271,198**	**100%**	**1,805,346**	**100%**

Source: Opinion Dynamics analysis of program tracking data.

6.3.3 Non-Participating Discount Retailers

Two of the manufacturer representatives we spoke with as part of the market actor interviews work with both participating retailers and several other discount retailers not currently engaged with the program. These retailers do not fall into traditional thrift or dollar store categories, including stores like Ollie's Bargain Outlet, Maxway, Super 10, and Bargain Town. When speaking with these manufacturing contacts, we explored the potential for future sales of program-discounted LEDs at these retailers. Both interviewees confirmed these retailers would be interested in selling program-discounted bulbs and that they currently do not stock lighting products or predominantly stock halogens and incandescents. The two contacts also indicated that these retailers cater to disadvantaged customers and that the majority of their market is low-income, indicating they are strong candidates for future targeting by the Retail Lighting Program.

6.3.4 Program Marketing and Outreach

In spite of the COVID-19 pandemic, program staff continued to implement a wide range of promotions, marketing, and outreach while abiding by applicable and evolving health and safety standards throughout 2021 and Q1 2022. Program marketing focused on promoting program discounts and educating customers about the benefits of energy-efficient LED lighting. Over the course of the evaluation period, the DEC and DEP Retail Lighting programs relied on a range of marketing and outreach tactics, including direct mail and email campaigns and store visits to ensure proper placement of POP marketing:

- **Store visits and POP marketing material placement.** Over the course of the evaluation period, field staff completed a total of 3,172 store visits in DEC territory and 2,390 in DEP territory. During these visits, field staff checked for the presence and proper placement of program POP materials, updated materials as necessary, and checked for sufficient levels of inventory of program-discounted lighting products. The frequency of store visits varied by retailer based on sales volume. This enabled team members to concentrate their visits on stores that had higher sales volumes and tended to discount more products.
- **Direct mail, mass media, and other marketing.** Other sources of program marketing included targeted direct mail, email blasts, and web banners.

6.3.5 Lighting Market Dynamics

Industry professionals acknowledged an ongoing shift in market trends and customer preferences towards LED products. LED manufacturing costs continued to drop in recent years, and sale prices are further reduced by utility program discounts, allowing rapid market growth over the past decade. Many manufacturers have now halted production of CFLs; in fact, just one of the nine contacts we spoke with reported their company still manufactures CFLs. Many are producing both ENERGY STAR and non-ENERGY STAR LEDs, which often have shorter lifespans and lower light quality. Among the manufacturer contacts we interviewed, non-ENERGY STAR LEDs made up as much as 40% of shipments. Two interviewees acknowledged that utility incentives play a role in their company's decisions regarding how many products are designed to meet ENERGY STAR qualifications. The general consensus among industry experts we spoke with was that although most customers recognize the ENERGY STAR label, it does not play as big of a role in their decision-making as other considerations such as cost, brand, or utility endorsements.

Industry professionals also acknowledged impacts of the COVID-19 pandemic, which caused supply chain slowdowns that continued into 2021 and early 2022. Of the six contacts who reported supply chain challenges, five indicated that while some issues persisted, they had established stocking practices by the start of 2022 that effectively counteract any unanticipated shipping delays. Two interviewees also acknowledged that while store traffic was lower during the pandemic, lighting sales were actually higher with customers spending more time at home and perhaps utilizing certain parts of the home more regularly than they did previously. Both of these contacts acknowledged that these patterns had started to subside in late 2021 and early 2022.

6.3.6 Lighting Market Outlook

Among the three manufacturers we spoke with that still produce incandescent or halogen bulbs in 2022, all expect to cease production and shipment of those less efficient products before the end of the year to comply with new federal efficiency standards announced in April 2022. Both contacts familiar with stocking practices at participating retailers commented that their stores will continue selling incandescent and halogen bulbs in the first half of 2023 but will plan to sell through that stock in Q1 or Q2. While this feedback reflects a small sample of retailers and manufacturers, it signals industry leaders are likely to conform to new federal standards on the proposed timeline to avoid incurring financial penalties. As such, LEDs are likely to be the only products available on most store shelves by July 2023 at the latest. In light of these developments, Duke Energy staff plan to end POS lighting discounts by July 2023, and also anticipate introducing POS discounts for non-lighting energy-efficient consumer electronics at many of the same retailers currently selling program-discounted lighting.

7. Conclusions and Recommendations

7.1 Conclusions

From January 1, 2021, through March 31, 2022, the Duke Energy Retail Lighting Program sold over 2.5 million discounted energy-efficient bulbs and fixtures in the DEC jurisdiction and 1.8 million in the DEP jurisdiction. The DEC program achieved ex ante gross energy savings of 94.5 GWh, and the DEP program achieved 60.6 GWh of gross savings. Sales and ex ante gross savings by jurisdiction and product category are reported in Table 20.

Table 20. DEC & DEP Retail Lighting Program Performance

Jurisdiction	Product Category	Units	% of Sales	Ex Ante Gross Savings (kWh)	% of Savings
DEC	Reflector LEDs	726,421	29%	34,645,143	37%
	Specialty LEDs	696,192	28%	21,384,591	23%
	Standard LEDs	564,965	22%	16,999,797	18%
	LED Fixtures	537,395	21%	21,447,434	23%
	All Categories	**2,524,973**	**100%**	**94,476,965**	**100%**
DEP	Reflector LEDs	495,137	27%	21,421,623	35%
	Specialty LEDs	451,764	25%	14,248,159	24%
	Standard LEDs	534,719	30%	15,341,088	25%
	LED Fixtures	323,726	18%	9,592,001	16%
	All Categories	**1,805,346**	**100%**	**60,602,872**	**100%**

The DEC program realized 104.9 GWh in ex post gross energy savings, 17.2 MW in summer peak demand savings, and 7.3 MW in winter peak demand savings during the evaluation period. In the same period, the DEP program realized 71.2 GWh in ex post gross energy savings, 11.7 MW in summer peak demand savings, and 4.9 MW in winter peak demand savings.

Gross realization rates for the DEC program were 111% for energy savings, 111% for summer peak demand savings, and 105% for winter peak demand savings. The DEP program gross realization rates were 117% for energy savings, 117% for summer peak demand savings, and 111% for winter peak demand savings.

After applying NTGRs established by the current evaluation, the DEC program achieved 63.3 GWh in ex post net energy savings, 10.4 MW in summer peak demand savings, and 4.4 MW in winter peak demand ex post net savings. The DEP program achieved 45.2 GWh in ex post net energy savings, 7.4 MW in summer peak demand savings, and 3.1 MW in winter peak demand ex post net savings.

Table 21 summarizes total ex ante, ex post gross, and ex post net savings.

Table 21. Program Impact Evaluation Results

Jurisdiction	Metric	Ex Ante	Gross RR	Ex Post Gross	Effective NTGR	Ex Post Net
DEC	Energy Savings (kWh)	94,476,965	111%	104,940,087	0.604	63,383,847
	Summer Peak Demand Savings (kW)	15,586	111%	17,241		10,414
	Winter Peak Demand Savings (kW)	6,915	105%	7,278		4,395
DEP	Energy Savings (kWh)	60,602,872	117%	71,205,792	0.635	45,215,699
	Summer Peak Demand Savings (kW)	9,981	117%	11,670		7,410
	Winter Peak Demand Savings (kW)	4,439	111%	4,942		3,138

The evaluation team identified the following high-level process findings based on research conducted as part of the current evaluation:

- Participating manufacturer and retailer contacts express high satisfaction with key program elements and the program overall.
- Program tracking data is clean and comprehensive, contained fully populated and internally consistent data fields, and included all necessary information to support core evaluation activities.
- The program team's ongoing efforts to prioritize dollar and thrift stores and reach low-income customer segments has been a success with these retail channels accounting for 64% of all DEC sales and 67% of DEP sales during the evaluation period.
- Several discount retailers that do not fall into traditional thrift or dollar store categories, such as Ollie's Bargain Outlet and Maxway, share key characteristics (i.e., stocking practices and customer demographics) and are therefore strong candidates for future program engagement.
- LED market share continues to increase aided by ongoing decreases in manufacturing costs and by the availability of utility program discounts. Non-ENERGY STAR LEDs, which are energy-efficient but often have shorter lifespans and lower light quality, are emerging as a more prevalent lower-cost alternative to ENERGY STAR LEDs.
- The COVID-19 pandemic affected the residential lighting supply chain, store traffic, and customer demand, but these patterns started to subside in late 2021 and early 2022.
- Participating retailer and manufacturer staff expect to halt production of halogen and incandescent products by the end of 2022 and sell through any existing inventory of those products by the end of Q2 2023 to comply with new federal lighting efficiency standards announced in April 2022.
- In light of anticipated market developments, Duke Energy staff plan to end POS lighting discounts by July 2023 and will begin offering POS discounts for non-lighting energy-efficient consumer electronics.

7.2 Recommendations

Based on the findings of this evaluation, the evaluation team identified the following opportunities for program improvement:

- Continue to prioritize retailers that disproportionally serve low-income customers, such as thrift, dollar, and other discount stores, given this customer segment is less likely to purchase energy-efficient lighting in the absence of incentives (i.e., exhibit lower free ridership).
- Continue to provide discounts on LED bulbs and fixtures through the end of 2022, and potentially the first half of 2023 at retailers that continue to stock incandescent or halogen lighting products. Anticipate that LED products will be the only lighting available on most store shelves by July 2023 at the latest.
- Given the new federal lighting efficiency standards and associated market changes, we support Duke Energy's plans to end POS lighting discounts by July 2023 and diversify upstream program offerings to include non-lighting energy-efficient products.

/A

8. Summary Form

DUKE ENERGY CAROLINAS & DUKE ENERGY PROGRESS RETAIL LIGHTING PROGRAM

COMPLETED EM&V FACT SHEET

PROGRAM DESCRIPTION

The Duke Energy Carolinas (DEC) and Duke Energy Progress (DEP) Retail Lighting program provides incentives to provide price markdowns on efficient LED lighting products. The program, launched in DEP in January 2010 and expanded to DEC in early 2016, promotes customer awareness and adoption of program-discounted products through a range of marketing and outreach strategies. Product mix includes a wide range of ENERGY STAR® LED bulbs and fixtures. Participating stores represent a variety of retail channels with an emphasis on thrift and dollar stores.

Date:	December 5, 2022
Region(s):	Duke Energy Carolinas (DEC) Duke Energy Progress (DEP)
Evaluation Period:	January 1, 2021– March 31, 2022
Annual MWh Savings: (Ex Post Net)	DEC: 63,384 MWh DEP: 45,216 MWh
Coincident MW Impact: (Ex Post Net)	DEC: 10.4 MW (Summer), 4.4 MW (Winter) DEP: 7.4 MW (Summer), 3.1 MW (Winter)
Measure Life:	Not Evaluated
Net-to-Gross Ratio:	DEC: 0.604 DEP: 0.635
Process Evaluation:	Yes
Previous Evaluation(s):	DEP-DEC Energy Efficient Lighting & Retail LED Programs Evaluation. April 6, 2018.

EVALUATION METHODOLOGY

The evaluation team reviewed program tracking data and ex ante deemed savings assumptions. We then developed updated per-unit deemed savings based on review of secondary sources including Technical Reference Manuals and prior evaluations. We conducted an engineering impacts analysis, applying leakage and in-service rate assumptions from secondary sources to ex post per-unit savings to calculate ex post gross energy and demand savings estimates.

The evaluation team interviewed participating retailer and manufacturer contacts and used their feedback along with results of sales data modeling to develop channel and jurisdiction-specific net-to-gross ratios. We applied these net-to-gross ratios to ex post gross savings to determine net program impacts.

We also completed a process analysis based on interviews with retailer and manufacturer contacts, conversations with program staff, and review of program sales data extracts, marketing materials, and field reports.

9. DSMore Table

The Excel spreadsheet containing measure-level inputs for Duke Energy Analytics is provided below. Per-measure savings values in the spreadsheet are based on the gross and net impact analyses reported above. The evaluation scope did not include updates to measure life assumptions.

[DSMore Table provided as a separate file]

Appendix A. Detailed Impacts Dataset

The Excel spreadsheet provided in this appendix contains detailed analysis of program gross and net impacts. The data in the file are provided by jurisdiction, state, and unique product. The file contains ex ante, ex post gross, and net savings, and all parameters and assumptions used to calculate ex post gross and net savings.

[Detailed Impacts Dataset provided as a separate file]

Appendix B. Deemed Savings Review

This appendix contains the deemed savings review memorandum developed as part of this evaluation, which provides a detailed summary of gross impacts assumptions, their sources, and resulting per-unit savings.

[Deemed Savings Review Memorandum provided as a separate file]

Appendix C. Market Actor Interview Guide

This appendix contains the data collection instrument used for the market actor interviews conducted in support of this evaluation.

[Market Actor Interview Guide provided as a separate file]

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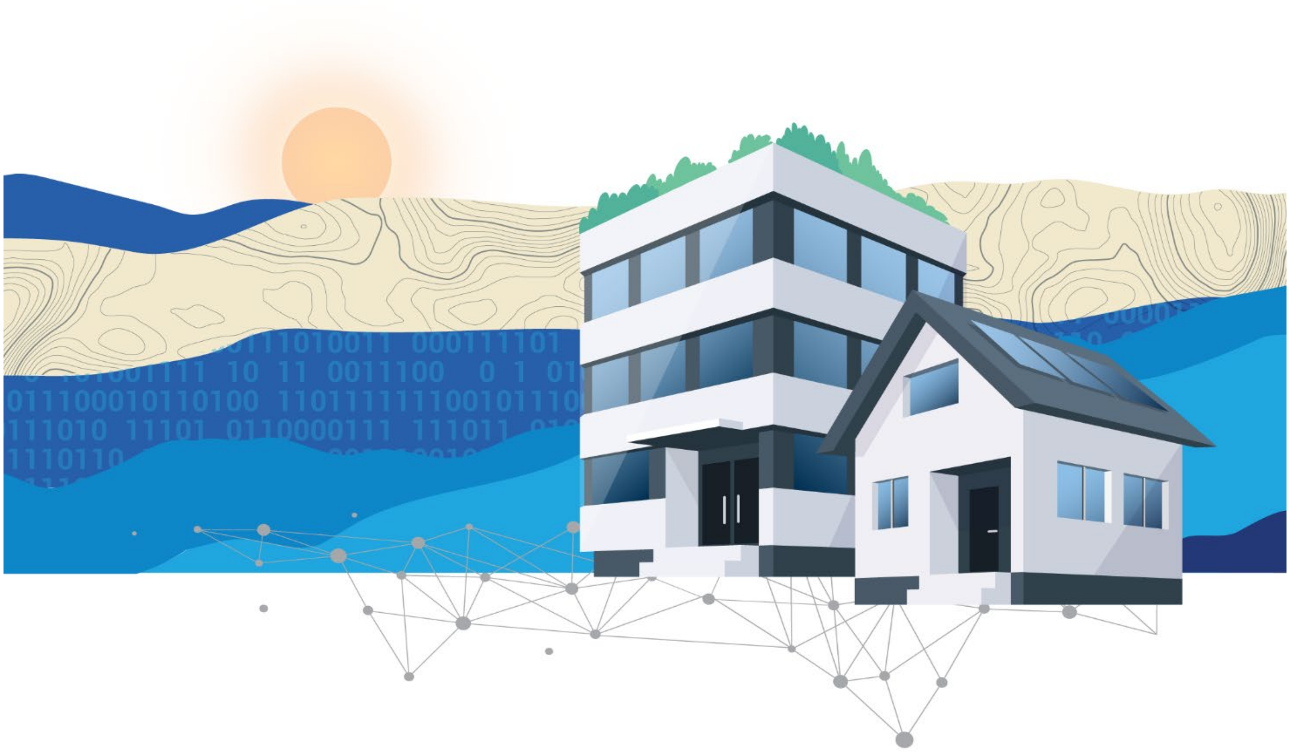


Duke Energy Carolinas

Low Income Weatherization Program (2019–2020) Evaluation Report – Draft

December 13, 2022

Table of Contents

Table of Tables

Table of Figures

1. Executive Summary

This report presents findings from our impact and process evaluation of the Duke Energy Carolinas (DEC) Low Income Weatherization Program (hereafter referred to as the Weatherization Program or the program), covering the period of January 1, 2019 to December 31, 2020. The impact evaluation results are based on a combination of consumption analysis and engineering analysis. Process evaluation results are based on a program materials review, interviews with program staff and participating providers, and a telephone survey of program participants.

This report includes a high-level description of the evaluation methodologies as well as results, findings, and recommendations. The associated appendix includes additional detail on the impact methodology and results.

1.1 Program Summary

The Weatherization Program aims to improve the health, safety, and energy efficiency of income-qualified Duke Energy customer households. Duke Energy funds a comprehensive package of electric conservation measures that increase energy efficiency and lower household energy costs. These weatherization, health, and safety benefits are provided at no cost to Duke Energy's customers. The program's secondary goal is to provide customer education on energy efficiency actions, measures, and other available Duke Energy programs. Duke Energy's implementation partners consist of the program administrator (the North Carolina Community Action Association, or NCCAA),[1] the database administrator (TRC), and a network of local implementing providers that enroll customers and complete weatherization projects (including community action providers, local governments, and other non-profit organizations).

Implementing providers can obtain Duke Energy funds in two ways: as a reimbursement for qualifying work completed under their state's federally funded state weatherization assistance program (State WAP)[2] or as a payment for new weatherization, HVAC, or refrigerator replacement projects. To be eligible, projects must be completed for Duke Energy customers who live in individually metered homes or apartments and whose household income is less than or equal to 200% of the federal poverty guideline. Providers who participate using the reimbursement model are required to apply the funds to future weatherization-related work. Duke Energy funds three types of projects through this program:

- **Tier 1**: For owner-occupied, single-family homes using less than 7 kWh per square foot annually; up to $600 for air sealing and low-cost energy efficiency upgrades such as domestic water heater tank insulation, low-flow shower heads, faucet aerators, LED bulbs, and others.
- **Tier 2**: For owner-occupied, single-family homes using at least 7 kWh per square foot annually; up to $4,000 for Tier 2 weatherization measures. Tier 2 projects can qualify for additional funds (up to

[1] The South Carolina Association of Community Action Partnerships, or SCACAP, is also an administrator in the program. However, SCACAP did not administer any projects during the evaluation period. NCCAA administered all South Carolina projects completed during the evaluation period.

[2] The State WAP programs treat this transaction as a "purchase" of savings by Duke Energy. WAP programs and Duke Energy agree that Duke Energy can claim 100% of the savings at each home for which it credits a provider, including those where Duke Energy funds cover all or part of the original project cost. US Department of Energy rulings about how providers can spend the received DEC funds differ by state. Since 2016, North Carolina does not restrict when providers can apply DEC funds, and providers do not have to spend them during the fiscal year received. South Carolina has and continues to treat DEC funds as "program income," requiring South Carolina community action providers to spend the money by the end of the fiscal year received. Historically, this has limited South Carolina provider participation.

$6,000 in total) for qualifying electric HVAC system replacements, heat pump upgrades, or heat pump system replacements.

- **Refrigerator Replacement**: For owner-occupied homes and tenants with landlord approval; replaces existing refrigerators as a standalone offering or in combination with a Tier 1 or Tier 2 project. Incentive levels depend on the old refrigerator's size and a two-hour metering test.

Duke Energy launched the Weatherization Program in January 2015. This evaluation covers implementation processes and impacts achieved from projects completed between January 1, 2019, to December 31, 2020.

1.2 Evaluation Objectives

We established the following objectives for this evaluation:

- Review and update, as necessary, deemed savings estimates through a review of measure assumptions and calculations;
- Verify measure installation and persistence;
- Estimate program energy (kWh) and summer and winter peak demand (kW) savings;
- Identify program strengths and potential ways that the program can increase average savings per household;
- Determine participants' level of satisfaction with the program and measures received;
- Identify non-energy benefits realized by participants; and
- Identify barriers to provider participation in the program and recommend strategies for addressing those barriers.

To achieve these objectives, we completed a number of data collection and analytic activities:

- Impact evaluation activities included a review of program-tracking data, a deemed savings review, development of in-service rates (ISRs), an engineering analysis, and a consumption analysis.
- Process evaluation activities included a review of program materials; interviews with Duke Energy program staff, implementing provider staff, NCCAA and TRC staff; and a survey of participating customers.

1.3 Key Findings

During the evaluation period, 1,167 households participated in the Weatherization Program, completing 1,394 projects. The majority of participants (76%) completed a Tier 2 project; only 11% of participants completed a Tier 1 project. In addition, 27% received a replacement refrigerator, either as a stand-alone measure (13%) or in combination with Tier 1 or Tier 2 services (14%).

Impact Findings

Based on our impact analysis, we estimate that the projects completed during the evaluation period generated 1,627 MWh of net annual energy savings, 217 kW of annual summer coincident demand savings, and 517 kW of annual winter coincident demand savings. Tier 2 participants accounted for the largest share of program-level savings (83%) while Tier 1 participants and refrigerator replacements accounted for 2% and 15%, respectively, of total program energy savings.

Table 1 presents annual per-household and program-level net ex post savings for the evaluation period.

Table 1. Summary of Impact Results

Project Type	Number of Participants	Net Annual Savings Per Household			Net Annual Program Savings		
		Energy (kWh)	Summer Coincident Demand (kW)	Winter Coincident Demand (kW)	Energy (MWh)	Summer Coincident Demand (kW)	Winter Coincident Demand (kW)
Tier 1	130	235	0.0773	0.0274	31	10.0	3.6
Tier 2 [a]	885	1,519	0.2012	0.5479	1,344	178.0	484.9
Tier 2 Weatherization Measures	*566*	*1,311*	*0.2469*	*0.3801*	*742*	*139.7*	*215.1*
HVAC Replacement/Upgrade	*382*	*1,577*	*0.1002*	*0.7062*	*603*	*38.3*	*269.8*
Refrigerator Replacement	315	800	0.0912	0.0912	252	28.7	28.7
Total [b]	**1,167**				**1,627**	**216.8**	**517.2**

[a] The total number of Tier 2 participants is smaller than the sum of weatherization and HVAC replacement/upgrade participants because some participants received both types of upgrade.

[b] The total number of unique participants is smaller than the sum of project types because some households received a replacement refrigerator in addition to completing a Tier 1 or Tier 2 project.

Based on program-tracking data, most Tier 1 and Tier 2 participants (98% and 61%, respectively) received air sealing, as shown in Table 2. Approximately half of Tier 2 participants also received insulation (57%) and/or duct system sealing (46%); these are measures not offered to Tier 1 participants. Larger shares of Tier 2 participants than Tier 1 participants received water heating measures,[3] weatherstripping, lighting, and heating system tune-ups. Overall, 27% of participants received a new refrigerator and 33% received an HVAC replacement or upgrade. Notably, 13% of participants only received a new refrigerator and 27% only received an HVAC replacement/upgrade.

[3] Water heating measures include water heater tank and pipe insulation, water heater temperature adjustment, low flow aerators, and low flow showerheads.

Table 2. Measure Mix

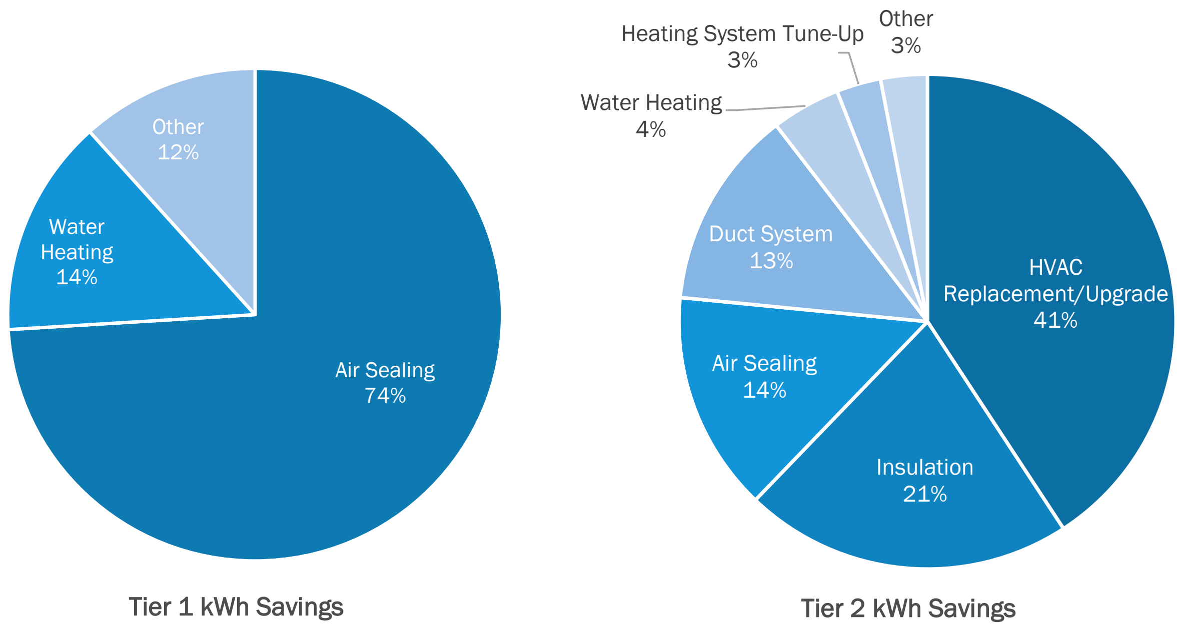
Measure Category	% of Participating Households Receiving Measure Category [a]		
	All Participants [b] (N=1,167)	Tier 1 Participants (N=130)	Tier 2 Participants (N=885)
Air Sealing	57%	98%	61%
Insulation	43%	n/a	57%
Duct System	35%	n/a	46%
Water Heating	29%	30%	34%
Weatherstripping	27%	20%	33%
Lighting	19%	18%	22%
Heating System Tune-Up	11%	7%	14%
HVAC Replacement/Upgrade	33%	n/a	43%
Refrigerator Replacement	27%	12%	17%

[a] Values are based on program-tracking data and do not incorporate ISRs.

[b] The overall N for All Participants is not the same as the sum of Tier 1 Participants and Tier 2 Participants because the overall N also includes those participants who only received refrigerator replacements.

Based on the engineering analysis, Tier 1 savings during the evaluation period came primarily from air sealing (74%). Another 14% came from water heating measures and 12% came from other Tier 1 measures (including heating system tune-ups, weatherstripping, and lighting measures). Tier 2 savings, on the other hand, were dominated by HVAC replacements/upgrades (41%) followed by insulation (21%), air sealing (14%), and duct sealing and insulation (13%). Water heating measures (such as faucet aerators and low-flow showerheads) accounted for 4% of engineering-based Tier 2 savings during the evaluation period, while heating system tune-ups and other Tier 2 measures (including lighting and weatherstripping) each contributed 3% (Figure 1).

Figure 1. Measure Contribution to Total Tier 1 and Tier 2 Energy Savings



Process Findings

The process evaluation found that the Weatherization Program continues to benefit from previously established relationships, implementation processes, and program-tracking systems. Program and implementation staff reported high satisfaction with the program. Participating providers also reported minimal changes to how they implement and participate in the Weatherization Program compared to the previous evaluation period, and many stated that the DEC funds allow them to complete more weatherization jobs than they would otherwise.

Key process findings include:

- **Program Participation & Processes.** Participation in the Weatherization Program has been increasing steadily since the program began in 2015. Although there was a decrease in projects in the spring and summer of 2020, due to barriers associated with the global COVID-19 pandemic, provider staff have since reported a return to normal participation levels. Providers continue to work hard to inform clients about the program through multiple advertising channels (newspaper ads, in-person events, agency websites, etc.) and most interviewed providers indicated the number of projects they complete each year either stayed the same or increased since they have resumed normal business operations following COVID-19 pandemic related shutdowns.
- **Satisfaction.** The process evaluation shows high satisfaction with the Weatherization Program. Interviewed provider staff often provided unprompted praise for the program and underscored the importance of the program to their clients. Providers also reported finding the logistical elements of the program—including the ease of participating—to be another key program strength. Sources of dissatisfaction included difficulty determining customer eligibility and the inability to apply program funds to all equipment. Participating customers are also highly satisfied with the program overall. A key driver of participation is to make the home more comfortable. Survey results suggest the program is helping participants in this respect, with 54% and 49% of respondents reporting higher comfort levels in the home during the summer and winter seasons, respectively, following participation in the program.
- **Non-Energy Impacts (NEIs).** In addition to lowering energy bills, the Weatherization Program provided substantial non-energy benefits to participants during the evaluation period, including improved home comfort in the summer and winter, reduced draftiness, and better lighting. To a lesser extent, survey respondents also reported lower noise levels from outdoors and reduced home maintenance costs. Almost three-fourths (72%) of participants reported experiencing at least one beneficial NEI since participating in the program.
- **South Carolina Policy Barriers.** The new participation channel, introduced in 2018, allows non-profit and other organizations to provide program services to customers who may not have been able to receive them otherwise using Weatherization Program funds. One objective of this channel is to overcome barriers in South Carolina, as state policies around funding prevent community action agencies (CAAs) from participating in the program. The Weatherization Program has made progress in serving customers in South Carolina, but there is room for improvement. Based on program-tracking data, there were three program providers in South Carolina actively completing projects during the evaluation period; all three providers are community-based organizations and they completed 10% of projects. However, the vast majority of South Carolina projects were refrigerator replacements, with a small number of HVAC upgrades/replacements and only one weatherization project submitted in South Carolina during the evaluation period.

1.4 Evaluation Recommendations

- **Increase support to providers in program marketing and outreach.** Providers note that communication and organization of the program are key strengths and frequently provide unprompted praise for staff at Duke Energy and NCCAA. One area identified for potential additional Duke Energy assistance is marketing and outreach to help increase customer awareness of the program. The program should continue to explore ways to promote participation while supporting existing providers by including information about the program alongside customer bills. This may be particularly important in South Carolina where the program has not had time to cultivate a large base of previous participants who can support word-of-mouth recruiting. Another area identified for potential additional Duke Energy assistance is supporting program providers in identifying eligible participants or confirming eligibility of customers they have identified. The program should consider providing additional data (individual or aggregated) for targeted outreach.

- **Evaluate funding required to align with changes in measure and labor costs following the COVID-19 pandemic and consider increasing per-project funding.** Program administration staff noted that during the evaluation period, they struggled to spend all program funds. At the same time, providers reported supply chain and labor shortages, and corresponding increased measure and labor costs, following the COVID-19 pandemic, with all interviewed providers indicating that they supplemented Weatherization Program funds with funding from other sources in order to meet participant needs. At the time of this evaluation, many providers cited high labor and material costs as an ongoing challenge. In fact, program-tracking data indicates fewer than half of participating households received most program measures. In addition, compared to the last evaluation period,[4] a significantly smaller share of Tier 2 households received the various program measures – the only exception are HVAC upgrades/replacements (which were a new measure in the last evaluation period and not widely provided) and refrigerator replacements (which were provided to 17% of participants in both evaluation periods). Increasing per-project funding to align with current measure and labor costs can support spending of all available program funds, help ensure providers are able to install all measures appropriate for a given project, increase per-participant savings, and maintain or increase NEIs and participant satisfaction.

- **Expand efforts to recruit and support organizations that do not face funding barriers in South Carolina, with a focus on providers that offer weatherization services.** The program should continue to explore ways to promote participation in South Carolina by recruiting more organizations that do not face funding barriers in South Carolina. The providers from South Carolina have achieved more success completing projects compared to the previous evaluation period given their non-profit status, but have focused primarily on refrigerator and HVAC replacements. Duke Energy should continue to recruit organizations that do not face barriers due to state policies around weatherization funding, with a focus on those organizations that can provide weatherization services in addition to equipment replacement.

- **Consider tracking several additional parameters within the program-tracking system to enhance the accuracy of future deemed savings estimates.** Our deemed savings review (Appendix B) identified a few parameters not currently tracked in program data: (1) pre- and post-project blower door results in units of reduced cubic feet per minute (CFM); (2) presence or type of cooling at participating homes; (3) water heating fuel of participating homes; and (4) the installed location (e.g., bathroom, kitchen) for each low-flow faucet aerator. In addition, the cooling efficiencies of existing equipment for heat pump upgrades and replacements was tracked less than 7% of the time and appeared to be incorrect.

[4] The last evaluation included participants between April 1, 2016 and December 31, 2018.

Some of this information was collected in the participant survey but including it in the program-tracking data would enhance the accuracy of future deemed savings estimates. We therefore recommend asking providers to enter this information, if already collected and available, into the program's tracking system.

2. Program Description

This section describes key elements of program design, implementation, and performance. The evaluation period addressed in this report is January 1, 2019, to December 31, 2020.

2.1 Program Design

The Weatherization Program aims to improve the health, safety, and energy efficiency of income-qualified Duke Energy customer households. The program does so by providing customers with comprehensive home weatherization services and repairs that reduce electric energy consumption. The program distributes funding through a network of CAAs, local and regional government agencies, and other non-profit organizations (collectively referred to as “providers”), which serve Duke Energy’s residential electric customers. The program reimburses providers for work completed at eligible homes.

The Weatherization Program offers two tiers of funding for weatherization upgrades to owner-occupied homes, as well as refrigerator replacements to both homeowners and renters (with landlord approval). Tier 1 covers eligible projects at homes using less than 7 kWh per square foot annually and provides up to $600 for air sealing and low-cost energy efficiency upgrades like LEDs, domestic water heater tank insulation, low-flow shower heads, faucet aerators, and others. Tier 2 covers eligible projects at homes using at least 7 kWh per square foot annually and provides up to $4,000 for Tier 1 measures plus insulation improvements. Tier 2 projects can qualify for a higher funding cap of $6,000 if they include a qualifying heat pump upgrade or a heat pump system replacement. Refrigerator replacement is available even if the home did not receive any Tier 1 or Tier 2 measures. Refrigerator replacement eligibility and incentive levels are dependent on the old refrigerator’s size and a two-hour metering test.

2.2 Program Implementation

During the evaluation period, DEC contracted with NCCAA and their subcontractor TRC to implement the Weatherization Program. In total, 18 local providers participated in the program. These providers also implement a variety of poverty relief activities, including the State Weatherization Assistance Program (WAP). NCCAA and TRC oversee provider submittals, invoicing, and program-tracking, train providers on the program and requirements, support participating providers in making the most of program funding, and conduct outreach to potential new providers.

2.3 Program Performance

During the evaluation period, the program served 1,167 unique households. Only 11% of participants completed a Tier 1 project and 76% completed a Tier 2 project. About one-quarter of participants (27%) received a replacement refrigerator, either alone or in combination with a Tier 1 or Tier 2 project. Based on the impact analysis, the program achieved average annual savings of 234 kWh per Tier 1 participant and 834 kWh per Tier 2 participant. Refrigerator recipients saved an additional 800 kWh per year. Table 3 summarizes program participation as well as per household energy and demand savings, by project type.

Table 3. Annual Per Household Savings

Project Type	Number of Participants	Net Annual Savings Per Household		
		Energy (kWh)	Summer Coincident Demand (kW)	Winter Coincident Demand (kW)
Tier 1	130	235	0.0773	0.0274
Tier 2 [a]	885	1,519	0.2012	0.5479
Tier 2 Weatherization Measures	*566*	*1,311*	*0.2469*	*0.3801*
HVAC Replacement/Upgrade	*382*	*1,577*	*0.1002*	*0.7062*
Refrigerator Replacement	315	800	0.0912	0.0912
Total [b]	**1,167**			

[a] The total number of Tier 2 participants is smaller than the sum of weatherization and HVAC replacement/upgrade participants because some participants received both types of upgrade.

[b] The total number of unique participants is smaller than the sum of project types because some households received a replacement refrigerator in addition to completing a Tier 1 or Tier 2 project.

3. Overview of Evaluation Activities

3.1 Program Staff Interviews

We conducted in-depth interviews with Duke Energy program staff and the Weatherization Program administrator. The main purpose of each interview was to gain insight into program implementation processes and to develop research objectives for the evaluation. In particular, the interviews allowed us to identify implementation consistencies and inconsistencies across providers and between North Carolina and South Carolina, to identify processes that changed within the evaluation period or compared to the previous evaluation period, processes that are working well, and processes that could be improved moving forward.

3.1.1 Duke Energy Program Staff Interview

Opinion Dynamics conducted an in-depth interview with the Weatherization Program manager in September 2021. The purpose of the interview was to gauge changes in program design and implementation since the last evaluation, Duke Energy's expectations for the Weatherization Program, and the successes and challenges the program encountered over the evaluation period. The interview also covered changes to the program's measure mix, provider participation, and barriers to program participation.

3.1.2 Program Administrator Staff Interview

We conducted one in-depth interview with NCCAA (the program administrator) and its subcontractor TRC. TRC maintains the program tracking database and serves as the day-to-day contact for providers, providing them with training and implementation support. This interview explored program-wide coordination, delivery, and enrollment processes. It provided insight into the program's reimbursement process and gauged the administrators' satisfaction with program elements. The interview also helped identify key similarities and differences across implementing providers and any barriers to provider participation.

3.2 Program Materials Review

Opinion Dynamics reviewed program guidance documentation to support our understanding of program processes and resources available to providers. We also reviewed the program's tracking database and found the program-tracking data to be complete and of high quality.

While the program-tracking data for the evaluation period was complete and of high quality, we also reviewed 2021 participant data when identifying comparison group participants for the consumption analysis. South Carolina Association of Community Action Partnerships (SCACAP), which did not have any projects during the current evaluation period, submitted projects for 2021. Based on our review, SCACAP's program tracking database lacks key participation details. To support future evaluations, we recommend that SCACAP tracks the same program participation data as NCCAA and TRC.

3.3 Implementing Provider Staff Interviews

Participating providers located in North Carolina (n=15) and in South Carolina (n=3), submitted projects to the Weatherization Program during the evaluation period. These providers each received funding for an average of 77 projects.[5] We conducted semi-structured in-depth interviews with a sample of ten of the 18 participating

[5] The number of projects per provider during the evaluation period ranged from 2 to 492.

providers selected to represent varied types of organizations and levels of program participation. We explored changes to the program since the last evaluation, feedback on implementation processes and funding structure, as well as providers' satisfaction with the program and views about successes and barriers to participation.

We completed these interviews between January and March 2022. Responding providers completed 77% of the 2019–2020 projects. Table 4 summarizes the sample and outcome.

Table 4. Provider Interview Sample

Participating Providers	Providers in Sample	Completed Interviews	Cooperation Rate
18	15	10	67%

In addition to the interviews with participating providers, we interviewed two of the three additional providers that were associated with the program but did not complete any projects during the evaluation period. We conducted semi-structured in-depth interviews with these providers and explored reasons for the lack of participation.

3.4 Participant Survey

Opinion Dynamics implemented a computer-assisted telephone interviewing (CATI) survey in February 2022. The survey gathered data to verify participation in the program, develop measure-level estimates of installation, persistence, and ISRs, and support our process evaluation.

The survey sample design and sample size were based on customers who participated during the evaluation period. Of the 1,026 participants in the database,[6] we drew a sample of 758 valid telephone numbers. We used this sample to complete 100 participant telephone interviews. The average interview length was approximately 11 minutes, and the response rate was 20%.

3.5 Consumption Analysis

Opinion Dynamics conducted a consumption analysis to determine the net energy savings attributable to the Weatherization Program during the evaluation period. We used separate linear fixed effects regression (LFER) models to estimate the overall net ex post program savings for Tier 1 and Tier 2 participants. The fixed effect in our models is the participant, which allows us to control for all household factors that do not vary over time. The consumption analysis used customers who participated from January 1, 2019, through December 31, 2020, as the treatment group and those who participated from January 1, 2021, through December 31, 2021, as the comparison group.

While we conducted consumption analysis for both Tier 1 and Tier 2 participants, this evaluation only relies on consumption analysis results for Tier 2 participants. For Tier 1 participants, we leveraged a combination of engineering analysis results and impact results from the prior evaluation to assess program savings. We were

[6] The number of participants in the survey population is slightly lower than the total referenced elsewhere in the report. Following fielding of the participant survey, 141 participants were added to the evaluation and included in the impact analysis. This was due to a change in how program participation dates were recorded between the previous and current evaluation periods.

not able to estimate Tier 1 savings via consumption analysis because the results were not statistically significant.[7]

Section 4.1.1 provides a summary of the consumption analysis approach; Appendix A contains a detailed description of methods.

3.6 Engineering Analysis

The engineering analysis served several purposes: (1) to develop demand-to-energy savings ratios for Tier 1 and Tier 2 projects; (2) to develop ex post energy and demand savings for refrigerator replacements; (3) to understand the relative contribution of different measures to Tier 1 and Tier 2 savings; and (4) to develop inputs into Tier 1 energy savings.

The engineering analysis consisted of two components:

- Measure verification and development of measure specific ISRs; and
- A deemed savings review of all program measures.

We verified measures and developed measure-specific ISRs based on responses to the participant survey. As part of the deemed savings review, we reviewed measure-level savings and revised input assumptions, as needed, to be consistent with standard industry practice and other Duke Energy Carolinas program assumptions and to align with applicable versions of reviewed TRMs (mainly the Mid-Atlantic TRM V10.0). When available, the evaluation team leveraged program tracking data as well as results from the participant survey to update certain assumptions (e.g., the share of participating households with electric domestic water heating).

Appendix B provides more detail on the methods and input assumptions used in the deemed savings review.

[7] Two factors likely contributed to the inability of the model to detect statistically significant savings: (1) the small number of Tier 1 participants and (2) the small expected savings of Tier 1 measures, relative to baseline household electricity usage.

4. Gross Impact Evaluation

4.1 Methodology

The gross impact analysis for the Weatherization Program included a consumption analysis as well as an engineering analysis. The consumption analysis determined the net evaluated energy (kWh) impacts for Tier 2. The engineering analysis supplemented the consumption analysis by:

- Providing a ratio of demand savings (kW) to energy savings (kWh), which was then applied to the consumption analysis net energy savings to calculate net evaluated demand savings;
- Developing ex post energy and demand savings for refrigerator replacements;
- Providing insight into the relative contribution of different measures to Tier 1 and Tier 2 savings; and
- Developing inputs into Tier 1 energy savings.

While we conducted consumption analysis for both Tier 1 and Tier 2 participants, this evaluation only relies on consumption analysis results for Tier 2 participants. For Tier 1 participants, we used a combination of engineering analysis results and impact results from the prior evaluation to assess program savings. We were not able to use consumption analysis to estimate Tier 1 savings because the model results were not statistically significant.

4.1.1 Consumption Analysis

Opinion Dynamics conducted a consumption analysis to determine the overall evaluated program savings from Tier 1 and Tier 2 projects. Consumption analysis is a statistical analysis of energy consumption recorded in utility billing records. Because billing records reflect whole-building energy use, the method is well suited for studying the combined impact of the Weatherization Program's mix of energy efficiency measures per home. Total program savings from Tier 1 and Tier 2 projects are estimated by examining the variation in participants' monthly electricity consumption pre- and post-program participation, relative to the variation in a comparison group's electricity consumption during those times.

Data Cleaning and Preparation

Prior to specifying the models, we performed thorough cleaning of the consumption and participation data. We checked data for gaps and inconsistencies as well as for sufficiency. Among other checks, we ensured the participants retained in the analysis had sufficient pre- and post-participation consumption data, participation dates were accurate, and the consumption data were free of outliers, such as bill periods with unreasonably small or large consumption.

Comparison Group Selection

Incorporating a comparison group into the consumption analysis allows evaluators to control for changes in economic conditions and other non-program factors that might affect energy use during the study period. Like many other energy efficiency programs, the Weatherization Program was not designed as an experiment. As such, we leveraged a quasi-experimental approach to the evaluation by developing a comparison group. There are multiple approaches to selecting a comparison group, including the use of future participants, past participants, or similar non-participants. When possible, using future program participants as a comparison group is the preferred method. The use of future participants as the comparison group allows us to effectively control for self-selection biases. We relied on a comparison group of customers who participated in the Weatherization Program between January 1 and December 31, 2021, for the Tier 2 consumption analysis.

We performed equivalency checks to assess the similarity of the treatment and comparison groups in terms of energy consumption, weather, and housing characteristics to validate that the comparison group could serve as a valid baseline. We performed equivalency analysis by tier as well as among Tier 2 HVAC replacement/upgrade recipients specifically to ensure balanced consumption among key Tier 2 subpopulations. Tier 1 treatment group participants had lower pre-period energy consumption levels than the comparison group in the pre-period, which prevented us from leveraging the comparison group for Tier 1. Pre-period consumption levels and patterns were similar between Tier 2 treatment and comparison group participants. Analysis of weather patterns indicated nearly perfect equivalency between the treatment and comparison group participants. Treatment and comparison group participants were also similar across key housing characteristics, such as home vintage, size, and type, although a slightly higher proportion of Tier 2 comparison than treatment group participants heated with electric fuel (77% vs. 70%). This slight discrepancy is controlled for in the model.

Accounting for Participation in Other Programs

Some customers participated in other Duke Energy programs after participating in the Weatherization Program. Including those customers in the consumption analysis would result in double counting of savings from other programs and artificially inflate the estimate of savings from the Weatherization Program. We dropped those customers from the analysis in order to obtain the most accurate estimate of the effects of the Weatherization Program. As part of the analysis, we reviewed Weatherization Program participants for cross participation in the following programs: the Residential Energy Efficient Products & Services Program, the Smart $avers Residential Program, the Residential Energy Assessments/Home Energy House Call Program, the My Home Energy Report Program, and the Residential Demand response Program.[8] Overall, we dropped 4.7% of Tier 1 and 2.2% of Tier 2 treatment participants due to participation in other programs.

Table 5 summarizes final participant counts used to develop consumption analysis models.

Table 5. Accounts Included in the Consumption Analysis Model

Program Component	Treatment Group	Comparison Group	Total
Tier 1 [a]	105	60	165
Tier 2 [b]	679	311	990
Tier 2 Weatherization Measures	*450*	*258*	*708*
HVAC Replacement/Upgrade	*275*	*163*	*438*

[a] The Tier 1 consumption analysis was completed using treatment participants only due to inequivalence observed between the treatment and comparison groups.

[b] The total number of Tier 2 participants is smaller than the sum of weatherization and HVAC replacement/upgrade participants because some participants received both types of upgrade.

[8] Notably, we only dropped cross participants who participated in other programs during the 12-month post-period. We retained participants who participated either prior to their Weatherization Program participation or more than a year after participating in the Weatherization Program.

Modeling

We used an LFER model for this analysis. Each tier was analyzed in a separate regression model because the tiers are expected to provide different levels of per-home savings due to differing measures, features, and customer eligibility criteria.[9] In addition, we used a pre-post model for Tier 1 treatment participants while the model for Tier 2 participants leveraged a future comparison group.

LFER models for Tier 1 included a series of explanatory variables designed to improve our estimate of savings relative to the baseline (i.e., what participants' consumption might have been during the post-program period, had they not received program services). The relationship of interest is between the dependent variable (monthly energy use) and a "dummy" variable that indicates whether an individual participated in the Weatherization Program. In alignment with Duke Energy's requests to isolate savings from refrigerator replacements separately from the package of measures provided for each tier, we included an indicator variable to capture the effect of a refrigerator replacement. In addition to excluding savings from the refrigerator measure, Duke Energy was interested in understanding savings from the HVAC replacement/upgrade measure within the Tier 2 program component as well as savings from the weatherization component. To accommodate that request, we estimated a Tier 2 model that included an indicator variable for HVAC replacement/upgrade that enabled us to separate the impact of that measure.

Consumption analyses typically include a series of additional variables to explain non-program variation in monthly energy use pre- and post-participation. Following best practice, we used a fixed-effects model, which captures the effect of household-specific characteristics that do not vary over time (as participant-specific intercepts).[10] We included weather (heating degree days and cooling degree days) in the model and monthly dummy variables to further control for seasonal differences in energy consumption. For Tier 2, we also included an interaction term for weather and heating fuel type to account for the different electricity usage that customers with electric heating fuel have in the winter. After controlling for these outside influences, the final model results for the Weatherization Program reflect savings associated with installed measures and any behavioral changes from energy efficiency knowledge gained as part of the participation process.

Appendix A contains a detailed discussion of the consumption analysis methodology, including data cleaning steps, the equivalency assessment for the comparison group, and the final model specification and outputs.

4.1.2 Engineering Analysis

As part of the impact evaluation, Opinion Dynamics conducted an engineering analysis for each Weatherization Program measure installed during the evaluation period. The engineering analysis consisted of two distinct steps: (1) measure verification and development of measure specific ISRs; and (2) a deemed savings review of all program measures. Both are described below.

[9] Note that participants who only received a refrigerator replacement were excluded from the consumption analysis.
[10] This includes factors such as building square footage, appliance stock, habitual behaviors and preferences, household size, and others.

Measure Verification

The participant survey included questions designed to verify that participants received program measures and that those measures are in place and operational. The measure-level ISRs represent the share of measures in the program-tracking data in service at the time of the survey, based on 100 completed telephone interviews. Our engineering analysis applied the ISRs to ex post deemed savings to develop total engineering savings.

Figure 2 outlines the method for deriving the ISR for each measure. During the survey, we asked participants to confirm they received the quantity of measures recorded in Duke Energy's program-tracking data and, when necessary, to provide the correct quantity. We also asked participants to confirm the quantity of measures that were in service at the time of the survey.

Figure 2. In-Service Rate Components

A) Reported
- Total quantity of measures in the program-tracking data

B) Received
- Total quantity of measures that customer confirmed receiving

C) In Service
- Total quantity of measures that customers confirmed as installed

First-year ISR is the proportion of measures that remained in use at the time of the survey (ISR = C ÷ A)

Based on the survey responses, we calculated the verification rate, the persistence rate, and the resulting ISR, using the equations shown below, for each participant and each measure they received. We then developed averages of each rate by measure group.

1) $$Verification\ Rate = \frac{(B) Received\ Quantity}{(A) Reported\ Quantity}$$

2) $$Persistence\ Rate = \frac{(C) In\ Service\ Quantity}{(B) Received\ Quantity}$$

3) $$First\ Year\ In\ Service\ Rate = \frac{(C) In\ Service\ Quantity}{(A) Reported\ Quantity}$$

In previous evaluations of the Weatherization Program and other DEC direct install programs, Opinion Dynamics found that participants had difficulty verifying certain measures, and that the nature of certain measures made verification of persistence unnecessary. As such, we made the following assumptions:

- **Water heater tank wrap, pipe wrap, duct sealing/insulation, water heater adjustments, and heating system tune-ups:** For these measures, we assumed 100% for both rates as participants are often not aware of the installation of these measures, but once installed, they are unlikely to be removed/undone.
- **HVAC upgrades/replacements, air sealing, and insulation:** We assumed that 100% of received measures remained installed as they are unlikely to be removed.

Ex Post Deemed Savings

We used several resources and assumptions to conduct our deemed savings review, including previous DEC low income program evaluations, relevant TRMs,[11] and other secondary sources (such as ASHRAE Fundamentals and the US EPA air source heat pump calculator) to examine algorithms and assumptions. Where possible, we used DEC-specific assumptions to estimate measure-specific deemed savings including program-tracking data, participant survey data, and supplemental refrigerator test data. For more information on the algorithms and inputs used to develop deemed savings estimates for each measure, see Appendix B.

Total Program Gross Savings

We developed total program gross savings, by tier, by applying the measure-specific ISRs to the ex post deemed values. We then multiplied the ex post deemed savings by the measure quantity provided in the program tracking database to arrive at total program savings. Where savings for certain measures rely on electric heating equipment or the presence of cooling equipment, we developed fuel-specific deemed values and applied them based on the HVAC equipment specified within the program tracking database. For water conservation measures, we developed weighted savings based on participant survey responses since the database does not provide water heating fuel type.

We then estimated per household savings for each tier by dividing total tier savings by the number of households participating in that tier.

4.1.3 Tier 1 Savings

Because the consumption analysis did not generate statistically significant results for Tier 1 participants, we developed per household Tier 1 savings using a combination of engineering analysis results and results from a prior evaluation. Specifically, the analysis consisted of the following steps:

- **Step 1:** Develop a ratio of per household Tier 1 savings based on (1) engineering estimates from this evaluation and (2) normalized engineering estimates from the 2015–2016 evaluation; and
- **Step 2:** Apply the Tier 1 savings ratio from Step 1 to Tier 1 consumption analysis results from the 2015–2016 evaluation.

[11] Per recent guidance from Duke Energy, this review used the Mid-Atlantic TRM v10.0 for all possible TRM-based inputs and only leveraged other TRMs when the Mid-Atlantic TRM did not have the needed information or when we judged another data source to be substantially superior to the Mid-Atlantic TRM.

The goal of this analysis was to develop a measure of Tier 1 activity during this evaluation period relative to Tier 1 activity during the 2015–2016 evaluation period that could then be applied to Tier 1 consumption analysis results from the prior evaluation.[12] The following subsections provide more detail on the two steps.

Ratio of Tier 1 Engineering-Based Savings

We developed the Tier 1 savings ratio using the following equation:

$$\textit{Tier 1 Savings Ratio} = \textit{Per HH Tier 1 Savings}_{2019\text{-}2020} \,/\, \textit{Normalized per HH Tier 1 Savings}_{2015\text{-}2016}$$

$$= 864\ kWh \,/\, 963\ kWh$$

$$= 0.90$$

The numerator in this equation (864 kWh) is the per household Tier 1 savings as estimated in the engineering analysis for this evaluation (Section 4.2.3).

The denominator (963 kWh) is estimated by multiplying, for each Tier 1 measure, the 2015–2016 ISR-adjusted quantity by the 2019–2020 average Tier 1 savings value. We “normalized” the 2015–2016 Tier 1 engineering analysis results with deemed savings values from this evaluation to isolate changes in program activity (i.e., changes in the measure mix and the average quantity of measures received by each Tier 1 participant) between the two evaluation periods. This normalization step was important because updates to deemed savings assumptions resulted in changes to deemed savings values between the two evaluations. These changes were made, in part, to develop more consistent assumptions between various Duke Energy program evaluations (as requested by regulatory staff) and are not necessarily reflective of changes in the operation or outcomes of the Weatherization Program.

Final Tier 1 Savings

We estimated the final per household Tier 1 savings for the 2019–2020 evaluation period as follows:

$$\textit{Final Per HH 2019–2020 Tier 1 Savings}$$

$$= \textit{Tier 1 Savings Ratio} * \textit{2015–2016 Tier 1 Savings}_{\textit{Consumption Analysis}}$$

$$= 0.90 * 262\ kWh$$

$$= 235\ kWh$$

The final Tier 1 per household savings thus leverage the Tier 1 consumption analysis results from the prior consumption analysis (262 kWh) but adjust those results by the change in Tier 1 activity (on a per household basis) between the two evaluation periods (90%).

[12] We selected this approach since the previous evaluation of this program found that engineering analysis results alone do not provide a good proxy for the consumption analysis. However, engineering analysis results from this evaluation, relative to those from a prior evaluation, provide a good indication of changes in program activity that can be used to adjust the consumption analysis results from a prior evaluation. We used the 2015–2016 evaluation results as a base because the 2016–2018 consumption analysis also did not generate statistically significant results for Tier 1 participants, and this approach relies on the relationship between engineering and consumption analysis values.

4.2 Gross Impact Results

4.2.1 Consumption Analysis

This section provides per-participant consumption analysis results. Appendix A contains the complete results of the models. Table 6 summarizes the results of the consumption analysis models for Tier 1 and Tier 2. The variable "Post Weatherization" represents the main effect of the treatment (i.e., the change in average daily consumption [ADC] attributable to participation in the Weatherization Program) controlling for whether the participant also received a refrigerator replacement and/or an HVAC replacement/upgrade (applicable to Tier 2 only). Local weather (expressed as cooling degree days [CDD] and heating degree days [HDD]) and having electric heating fuel also significantly impacted consumption.

As can be seen in the table, the participation coefficient for Tier 1 is not statistically significant, indicating that the model did not establish a statistically significant relationship between participation in the program and energy consumption. For Tier 2, all program-related coefficients are statistically significant and negative, indicating a negative relationship between participation and energy consumption (i.e., the presence of savings).

Table 6. Results of Tier 1 and Tier 2 Consumption Analysis Models[13]

Variable	Tier 1 Coefficients [a]	Tier 2 Coefficients
Post Weatherization (Participation Date)	-0.129	Summer: -0.502*** Winter: -0.321***
HDD (Heating Degree Days)	0.319***	0.025
CDD (Cooling Degree Days)	2.356***	1.995***
Refrigerator Replacement Indicator	-1.886**	-3.455***
HVAC Replacement Indicator	---	Summer: -0.893*** Winter: -0.334***
Electric Heating Fuel Indicator	---	1.316***
Constant (Average Intercept)	15.042	30.618
Observations (Number of Customer Bills)	2,629	24,644
Adjusted R-Squared	0.594	0.649

[a] Tier 1 consumption analysis results are shown for reference only and were not used to calculate impacts as the results were not statistically significant.

* p<0.1, ** p<0.05, *** p<0.01.

Table 7 shows the estimated annual per-home savings for the program. As noted above, the results in the Tier 1 and Tier 2 rows reflect the effect of the Weatherization Program alone (any changes in energy use due to other programs are not included) and exclude impacts of the program refrigerator installations. For Tier 2, the table isolates estimated savings for Tier 2 weatherization measures and HVAC replacement/upgrades, respectively.[14] It should be noted that the estimates of percent savings per home are based on the modeled baseline usage, including the pre-period usage of both treatment and control group participants, controlling for weather. As such, Table 7 presents a single baseline usage estimate for overall Tier 2 savings as well as savings for Tier 2 weatherization measures and the HVAC replacement/upgrade measure.

[13] The coefficients for the monthly dummies are presented in Appendix A.

[14] The category "Tier 2 weatherization measures" includes all Tier 2 measures other than HVAC Replacement/Upgrade, (i.e., it includes measures such as lighting and water heating measures installed as part of a Tier 2 project).

The savings estimate for Tier 1 participants is not statistically significant at 90% confidence, indicating that the model could not detect a savings signal. The small sample size relative to the variability in the consumption data as well as the nature and depth of Tier 1 improvements (smaller expected savings) are likely the key drivers of the model performance. Savings for Tier 2 participants, on the other hand, are meaningful and statistically significant. Tier 2 participants saved an average of 1,519 kWh per year, equivalent to 10.1% of their baseline usage. Savings from Tier 2 weatherization measures were 1,311 kWh per year, while savings from HVAC replacements/upgrades were 1,577 kWh per year.

Table 7. Annual Per-Participant Energy Savings from Consumption Analysis

Program Component	Modeled Treatment Participants	Per-Participant Baseline Energy Use (kWh/yr)	Ex Post Annual Savings per Participant (kWh)	90% Confidence Interval	
				Lower	Upper
Tier 1 [a]	105	7,848	47	(133)	228
Tier 2 [b]	679	15,100	1,519	1,349	1,689
Tier 2 Weatherization Measures	*450*		*1,311*	*1,166*	*1,455*
HVAC Replacement/Upgrade	*275*		*1,577*	*1,398*	*1,757*

[a] Savings for Tier 1 participants are not statistically significant at 90% confidence.

[b] The total number of Tier 2 participants is smaller than the sum of weatherization and HVAC replacement/upgrade participants because some participants received both types of upgrade. Tier 2 savings and associated confidence intervals were calculated as a weighted average of the sum of Tier 2 Weatherization and HVAC replacement measures.

4.2.2 Engineering Analysis

This section provides the results of the engineering analysis, including ISRs and ex post deemed energy and demand savings estimates for each measure offered by the Weatherization Program. In addition, it summarizes total program and per household savings estimates for the 2019–2020 evaluation period (by project type), provides insight into the contribution of various measures to Tier 1 and Tier 2 savings, and presents the Tier 1 and Tier 2 demand-to-energy ratios (used to develop Tier 1 and Tier 2 demand savings).

Measure Verification Results

Our measure verification analysis showed moderate to high ISRs for all measures, as shown in Table 8. DEC Weatherization Program participants reported that 98% of insulation, 92% of refrigerators, and 97% of heating systems remained in service at the time of the survey. Additionally, 91% of air sealing and 91% of door weatherstripping remained in service at the time of the survey. ISRs were slightly lower for the smaller measures: 85% of efficient showerheads, 72% of LEDs, and 63% of efficient faucet aerators remained in service at the time of the survey.

The lower ISRs for LEDs and faucet aerators were due to a combination of low verification and persistence, while the showerhead ISR was driven primarily by low persistence. Verification rates for these measures may be lower because customers do not realize the equipment has been installed. The program directly installs equipment that would help achieve energy savings, but the customer may lack awareness of just what equipment has been installed. The few participants who reported removing these measures stated either that the measure stopped working or that the measure did not meet their needs.

Table 8. First Year Measure In-Service Rates

Measure Category	Verification Rate	Persistence Rate	First-Year ISR [a]
Air Sealing , Weather Stripping, and Insulation			
Air Sealing	91%		91%
Door Weatherstripping	93%	99%	91%
Insulation	98%		98%
Water Heating			
Faucet Aerators	71%	88%	63%
Pipe Insulation [b]			100%
Showerheads	95%	89%	85%
Water Heater Insulation Wrap [b]			100%
Water Heater Temp Adjustment [b]			100%
Heating System			
Duct Sealing/Insulation [b]			100%
Heating System	97%		97%
Heating System Tune-Up [b]			100%
Other Measures			
LEDs	84%	85%	72%
Refrigerator	96%	96%	92%

[a] Note that each rate is developed as the average of respondent-level rates.

[b] Not verified through the participant survey and assumed 100% ISR.

Note: Responses of "I don't know" were removed from the analysis.

Ex Post Deemed Savings Results

Table 9 provides the estimated gross per-unit energy and demand savings for all measures installed through the Weatherization Program. As described in Section 4.1.2, we based the measure-level savings on secondary research. We then applied Weatherization Program-specific assumptions on household characteristics, where applicable per-unit savings for all measures except lighting, refrigerator replacements, and HVAC upgrades/replacements represent the fuel-weighted average based on the participant mix of heating fuel and cooling equipment during the evaluation period.

Table 9. Ex Post Per-Unit Deemed Savings Estimates

Measure	Tier	Per-Unit Energy Savings (kWh)	Per-Unit Summer peak demand (kW)	Per-Unit Winter peak demand (kW)
Water Heating				
DWH Pipe Insulation (2'–5' sections)	Tier 1	312.00	0.0356	0.0356
DWH Tank Insulation	Tier 1	165.87	0.0189	0.0189
Water Heater Temp Adjustment	Tier 1	53.49	0.0061	0.0061
Low-Flow Showerhead	Tier 1	159.61	0.0177	0.0354
Low-Flow Aerator	Tier 1	55.20	0.0037	0.0073
Lighting				
5W LED	Tier 1	20.26	0.0030	0.0015
9W LED	Tier 1	34.44	0.0051	0.0025
Air Sealing and Weatherstripping				
Air Sealing (per home)	Tier 1	861.79	0.2819	0.1617
Door Weatherstripping (per door)	Tier 1	88.14	0.0288	0.0165
Insulation				
Attic Insulation – Cellulose, Blown – R-30	Tier 2	0.98	0.0001	0.0004
Attic Insulation – Cellulose, Blown – R-38	Tier 2	1.02	0.0001	0.0004
Attic Insulation – Fiberglass, Blown – R-30	Tier 2	0.98	0.0001	0.0004
Attic Insulation – Fiberglass, Blown – R-38	Tier 2	1.02	0.0001	0.0004
Belly Fiberglass Loose	Tier 2	0.86	0.0001	0.0003
Floor Insulation – Fiberglass, Batts – R-19	Tier 2	0.86	0.0001	0.0003
Knee Wall Insulation	Tier 2	0.86	0.0001	0.0003
Wall Insulation – Fiberglass, Blown – R-13	Tier 2	0.72	0.0001	0.0003
Wall Insulation – Cellulose, Blown – R-13	Tier 2	0.72	0.0001	0.0003
Manufactured Home Roof Cavity	Tier 2	0.86	0.0001	0.0003
Heating System				
Heating System Tune-up (per system)	Tier 1	745.83	0.0223	0.1387
Duct Insulation (per system)	Tier 2	232.49	0.0313	0.0906
Duct Sealing (per system)	Tier 2	1,172.35	0.1579	0.4566
HVAC Upgrade/Replacement				
Heat Pump Upgrade (per heat pump)	Tier 2	959.51	0.0970	0.3790
Heat Pump Replacement (per heat pump)	Tier 2	6,541.72	0.3674	2.9969
Refrigerator				
ENERGY STAR® Refrigerator (15 cu. Ft.)[a]	Tier 1	679.33	0.0775	0.0775
ENERGY STAR® Refrigerator (18 cu. Ft.)	Tier 1	894.78	0.1021	0.1021
ENERGY STAR® Refrigerator (21 cu. Ft.)	Tier 1	930.66	0.1062	0.1062

[a] The ENERGY STAR® name and mark are registered trademarks owned by the US EPA.

Total Program and Per-Household Savings

We calculated engineering-based gross program savings for the evaluation period by applying the ISRs shown in Table 8 to the per-unit estimates shown in Table 9. We then multiplied these ISR-adjusted per-unit estimates by the respective measure quantities in the program tracking database.

Table 10 summarizes total engineering-based gross program energy and demand savings, by measure, for the 2019–2020 evaluation period. It also includes the average measure quantity per participating household.

Table 10. Engineering Analysis Total Gross Savings by Measure

Measure	Unit	Energy Savings (kWh)	Summer Peak Demand (kW)	Winter Peak Demand (kW)	Average Qty per Household
Water Heating					
DWH Pipe Insulation	Water heaters	77,688	8.86	8.86	0.2
DWH Tank Insulation	Water heaters	37,155	4.24	4.24	0.2
Water Heater Temp Adjustment	Water heaters	1,444	0.16	0.16	< 0.1
Low-Flow Showerhead	Showerheads	26,591	2.95	5.89	0.1
Low-Flow Aerator	Aerators	9,993	0.66	1.32	0.2
Lighting					
5W LED	Lamps	1,162	0.17	0.08	< 0.1
9W LED	Lamps	40,694	6.02	2.91	1.0
Air Sealing and Weatherstripping					
Air Sealing	Households	520,682	179.05	88.52	0.5
Door Weatherstripping	Households	56,202	20.63	8.19	0.6
Insulation					
Attic Insulation	Sq. Feet	405,795	52.50	160.33	348.9
Belly Fiberglass Loose	Sq. Feet	63,373	8.20	25.04	62.8
Floor Insulation	Sq. Feet	152,832	19.77	60.38	151.5
Wall Insulation	Sq. Feet	13,671	1.77	5.40	15.5
Manufactured Home Roof Cavity	Sq. Feet	15,350	1.99	6.06	15.2
Heating System					
Heating System Tune-up	Households	95,337	3.13	17.48	0.1
Duct Insulation	Households	1,487	0.17	0.61	< 0.1
Duct Sealing	Households	394,768	66.11	140.19	0.3
HVAC Upgrade/Replacement					
Heat Pump Upgrade	Households	204,296	20.65	80.70	0.2
Heat Pump Replacement	Households	1,036,681	58.22	474.92	0.1
Refrigerator					
ENERGY STAR Refrigerator (15 cu. Ft.)	Refrigerators	38,251	4.36	4.36	< 0.1
ENERGY STAR Refrigerator (18 cu. Ft.)	Refrigerators	114,807	13.10	13.10	0.1
ENERGY STAR Refrigerator (21 cu. Ft.)	Refrigerators	98,793	11.27	11.27	0.1

Table 11 summarizes total and per household gross program energy and demand savings by project type.

Table 11. Engineering Analysis Gross Program Savings

Project Type	Unique Participating Households	Energy Savings (kWh)	Summer Peak Demand (kW)	Winter Peak Demand (kW)
Total Program Savings				
Tier 1	130	112,350	36.9	13.1
Tier 2 [a]	885	3,042,853	418.3	1,078.2
Tier 2 Weatherization Measures	*566*	*1,801,875*	*339.5*	*522.6*
HVAC Replacement/Upgrade	*382*	*1,240,977*	*78.9*	*555.6*
Refrigerator Replacement	315	251,851	28.7	28.7
Total [b]	**1,167**	**3,407,053**	**484.0**	**1,120.1**
Average Savings per Household				
Tier 1	130	864	0.284	0.101
Tier 2 [a]	885	3,438	0.473	1.218
Tier 2 Weatherization Measures	*566*	*3,184*	*0.600*	*0.923*
HVAC Replacement/Upgrade	*382*	*3,249*	*0.206*	*1.455*
Refrigerator Replacement	315	800	0.091	0.091

[a] The total number of Tier 2 participants is smaller than the sum of weatherization and HVAC replacement/upgrade participants because some participants received both weatherization measures and an HVAC replacement/upgrade.

[b] The total number of unique participants is smaller than the sum of project types because some households received a replacement refrigerator in addition to completing a Tier 1 or Tier 2 project.

Measure Mix and Contribution to Tier 1 and Tier 2 Savings

Based on program-tracking data, the majority of Tier 1 and Tier 2 participants (98% and 61%, respectively) received air sealing. About half of Tier 2 participants also received insulation (57%) and/or duct system sealing (46%), measures not offered to Tier 1 participants. Slightly larger shares of Tier 2 participants than Tier 1 participants received water heating measures, weatherstripping, lighting, and heating system tune-ups. Overall, 27% of participants received a new refrigerator and 33% an HVAC replacement or upgrade. Notably, 13% of participants only received a new refrigerator and 27% only received an HVAC replacement/upgrade.

Table 12. Measure Mix

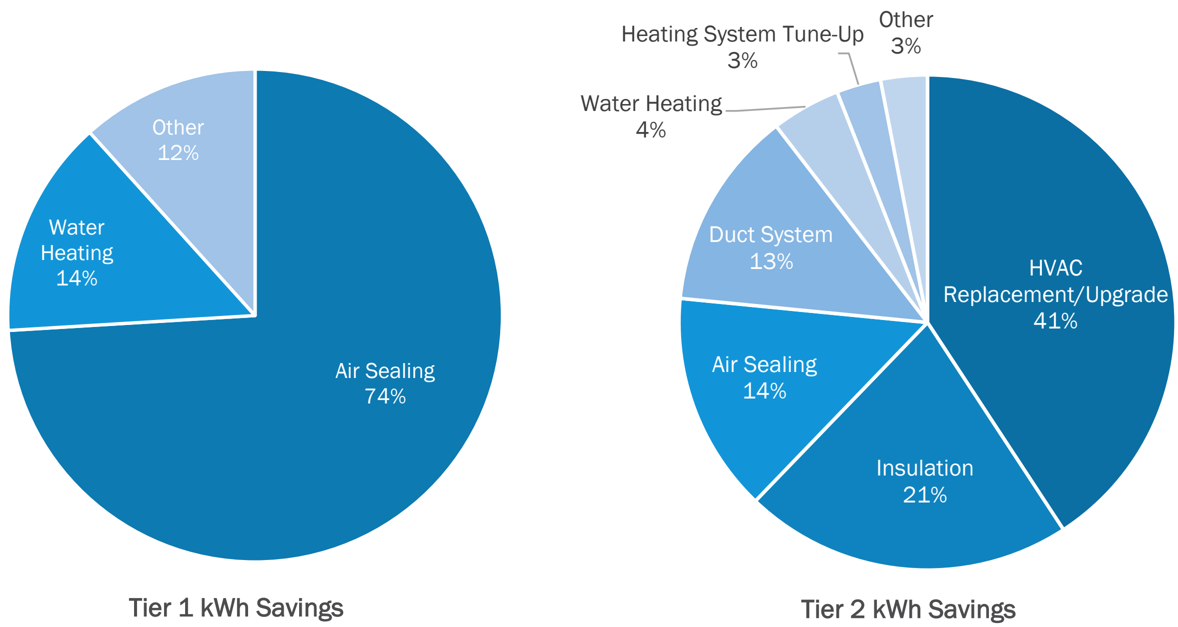
Measure Category	% of Participating Households Receiving Measure Category [a]		
	All Participants (N=1,167) [b]	Tier 1 Participants (N=130)	Tier 2 Participants (N=885)
Air Sealing	57%	98%	61%
Insulation	43%	n/a	57%
Duct System	35%	n/a	46%
Water Heating	29%	30%	34%
Weatherstripping	27%	20%	33%
Lighting	19%	18%	22%
Heating System Tune-Up	11%	7%	14%
HVAC Replacement/Upgrade	33%	n/a	43%
Refrigerator Replacement	27%	12%	17%

[a] Values are based on program-tracking data and do not incorporate ISRs.

[b] The overall N for All Participants is not the same as the sum of Tier 1 Participants and Tier 2 Participants because the overall N also includes those participants who only received refrigerator replacements.

Based on the engineering analysis, Tier 1 savings during the evaluation period came primarily from air sealing (74%). Another 14% of Tier 1 savings came from water heating measures and 12% came from other Tier 1 measures (including heating system tune-ups, weatherstripping, and lighting measures). Tier 2 savings, on the other hand, were dominated by HVAC replacements/upgrades (41%) followed by insulation (21%), air sealing (14%), and duct sealing and insulation (13%). Water heating measures (such as faucet aerators or low-flow showerheads) accounted for 4% of engineering-based Tier 2 savings during the evaluation period, while heating system tune-ups and other Tier 2 measures (including lighting, and weatherstripping) each contributed 3% (Figure 3).

Figure 3. Measure Contribution to Total Tier 1 and Tier 2 Energy Savings



4.2.3 Tier 1 Savings

A comparison of installed units (inclusive of evaluation-specific ISRs) between the two evaluation periods shows that participants during the 2019–2020 evaluation period were less likely to receive door weatherstripping, faucet aerators, and showerheads than participants during the 2015–2016 evaluation period. Similarly, the participants during the 2019–2020 evaluation period did not install any CFLs.

Applying 2019–2020 per unit savings for Tier 1 participants to installed units results in annual per household Tier 1 savings of 864 kWh during the current evaluation period, compared with 963 kWh for the prior evaluation period. The resulting Tier 1 Savings Ratio is 0.90 (864 kWh / 963 kWh), meaning that based on the measure mix and installed measure quantities, per household Tier 1 savings for the 2019–2020 evaluation period could be expected to be 90% of Tier 1 savings for the 2015–2016 evaluation period.

Table 13 summarizes the comparison between Tier 1 participants in the two evaluation periods.

Table 13. Tier 1 Savings Comparison with Participants from Prior Evaluation

Measure	Savings Unit	Installed Units / Participant [a]		2019–2020 per Unit kWh Savings [b]	Per Participant kWh Savings	
		2015–2016	2019–2020		2015–2016	2019–2020
Air Sealing and Weatherstripping						
Air Sealing	Home	0.90	0.90	710.3	637	640
Door Weatherstripping	Door	0.56	0.34	65.8	37	23
Lighting						
LED 5W	Lamp	-	0.02	20.3	-	0.4
LED 9W	Lamp	-	0.60	34.4	-	21
Heating System						
Heating System Tune Up	System	0.11	0.07	827.7	88	57
Water Heating						
DWH Pipe Insulation	10' Section	0.28	0.20	312.0	87	62
DWH Tank Insulation	System	0.26	0.25	165.9	43	42
Water Heater Temp Adjustment	System	0.10	0.04	53.5	5	2
Low-Flow Showerheads	Showerhead	0.23	0.07	159.6	37	11
Low-Flow Aerators	Aerator	0.50	0.10	55.2	28	6
Total Tier 1 Savings					**963**	**864**

[a] Inclusive of evaluation-specific ISRs

[b] Savings represent averages for Tier 1 participants only and are exclusive of ISRs

Applying the Tier 1 Savings Ratio of 0.90 to the Tier 1 consumption analysis result from the prior evaluation (262 kWh per household) results in estimated per household Tier 1 savings of 235 kWh for the 2019–2020 evaluation period:

$$\textit{Final Per Household Tier 1 Savings} = 0.90 * 262\ kWh = 235\ kWh$$

4.2.4 Demand-to-Energy Ratios

Using the estimated energy and demand savings from the engineering analysis (Table 11), we calculated overall kW-per-kWh savings ratios, by tier (Table 14).

Table 14. Engineering Demand-to-Energy Ratios

Project Type	Total Gross Energy Savings (kWh)	Summer Coincident Peak Savings (kW)	Winter Coincident Peak Savings (kW)	Summer Ratio Multiplier (summer demand/energy savings)	Winter Ratio Multiplier (winter demand/energy savings)
Tier 1	112,350	36.91	13.10	0.0003285	0.0001166
Tier 2-Wx	1,801,875	339.48	522.60	0.0001884	0.0002900
Tier 2-HVAC	1,240,977	78.86	555.62	0.0000636	0.0004477

We multiplied these ratios by the Tier 1 and Tier 2 per-household energy savings to estimate per household net demand savings per tier (Table 15).

Table 15. Net Annual Energy and Demand Savings by Project Tier

Project Type	Number of Participants	Net Annual Savings Per Household			Net Annual Program Savings		
		Energy (kWh)	Summer Coincident Demand (kW)	Winter Coincident Demand (kW)	Energy (MWh)	Summer Coincident Demand (kW)	Winter Coincident Demand (kW)
Tier 1	130	235	0.0773	0.0274	31	10.0	3.6
Tier 2[a]	885	1,519	0.2012	0.5479	1,344	178.0	484.9
Tier 2 Weatherization Measures	*566*	*1,311*	*0.2469*	*0.3801*	*742*	*139.7*	*215.1*
HVAC Replacement/Upgrade	*382*	*1,577*	*0.1002*	*0.7062*	*603*	*38.3*	*269.8*

[a] The total number of Tier 2 participants is smaller than the sum of weatherization and HVAC replacement/upgrade participants because some participants received both weatherization measures and an HVAC replacement/upgrade.

4.3 References

The following sources were used in the engineering analysis:

- ASHRAE Fundamentals. Appendix: Design Conditions for Selected Locations. June 1, 2021.
- ENERGY STAR Air Source Heat Pump Calculator. Full-load cooling and heating hours cite EPA 2002 in calculator.
- Illinois Technical Reference Manual. Version 10.0. September 25, 2020.
- Indiana Technical Reference Manual. Version 2.2. July 28, 2015.
- Michigan Evaluation Working Group Showerhead and Faucet Aerator Meter Study Memorandum. June 2013.
- Mid-Atlantic Technical Reference Manual. Version 10.0.
- Baseline refrigerator energy consumption based on test measurement data provided by Duke Energy for 60 refrigerators.
- 2019–2020 DEC LI Weatherization program tracking database.
- 2019–2020 DEC LI Weatherization participant survey conducted by Opinion Dynamics in 2022.

5. Process Evaluation

5.1 Researchable Questions

Based on discussions with DEC program staff, Opinion Dynamics developed the following process-related research questions:

- Have there been any major changes since the last evaluation, and what effects have they had on implementing provider participation levels, measure mix, and per-household savings?
- What are the major strengths of the program? Are there specific ways that the program could be improved to be more effective in the future?
- Are participating implementing providers satisfied with the program? What are their barriers to program participation (i.e., are there limiting factors to achieving greater participation)?
- What policy barriers to implementing provider participation still exist in the South Carolina portion of DEC's service area? What, if any, program process improvements can DEC make to enhance its impact in that state?
- Are participants satisfied with the program and measures received?
- What types of non-energy benefits have participants experienced since participating?

5.2 Methodology

Our process evaluation relied on (1) interviews with program staff, the program coordinators (NCCAA and TRC), and ten participating providers; (2) review of program materials and program-tracking data; and (3) analysis of the participant survey.

The full survey instrument can be found in Appendix C.

5.3 Key Findings

5.3.1 Program Participation

The 2019–2020 program comprised the fifth and sixth years of the Weatherization Program. Between January 1, 2019, and December 31, 2020, 15 participating providers in North Carolina served 1,036 households (89%) while three participating providers in South Carolina served 131 households (11%). The majority of projects (68%) were classified as Tier 2 projects while 23% of projects were refrigerator replacements and 9% of projects were classified as Tier 1 projects.

Of the 18 participating providers, 14 were already active during the prior evaluation period and four were new to the program; three of the new participating providers were from South Carolina. The 18 providers submitted between 2 and 492 weatherization projects, for an average of 77 projects per provider (Table 16).

Table 16. 2019–2020 Provider Projects by Tier

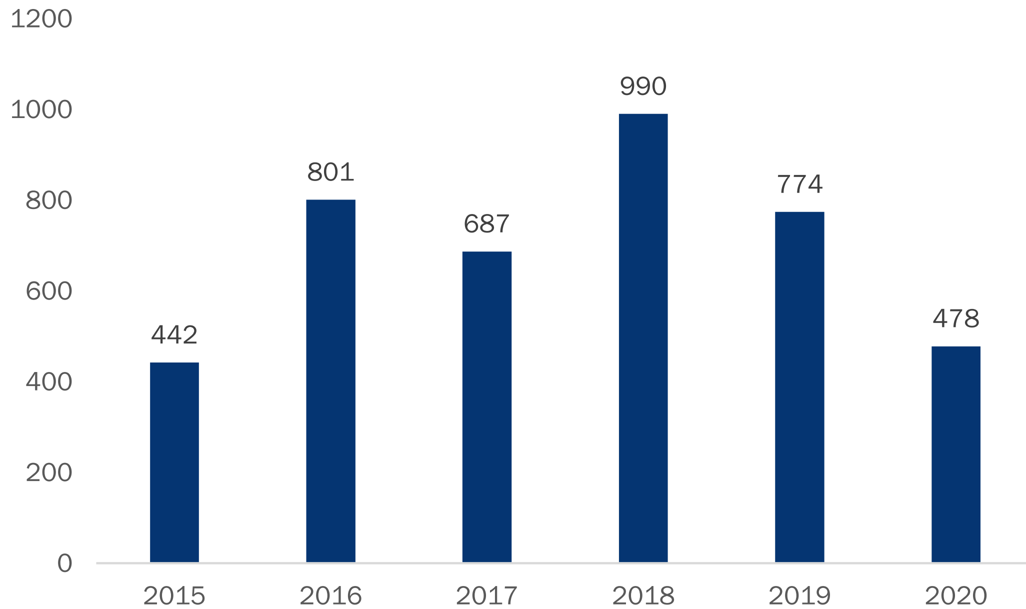
Provider	Type	Tier 1	Tier 2	Refrigerator Replacement	Total
Blue Ridge Community Action, Inc.	CAA	82	317	93	492
Piedmont Triad Regional Council	Government	0	317	39	356
Yadkin Valley Economic Development District Inc.	CAA	14	128	15	157
Community Action Opportunities	CAA	11	63	18	92
Kershaw Area Resource Exchange [a]	Non-Profit	0	15	45	60
Anderson Interfaith Ministries [a]	Non-Profit	0	7	33	40
United Way of Lancaster County Inc [a]	Non-Profit	0	0	39	39
Cabarrus County Planning & Development Services	Government	3	22	6	31
Resources for Seniors	Non-Profit	10	12	4	26
Blue Ridge Opportunity Commission	CAA	3	18	0	21
Macon County Government	Government	3	15	0	18
Charlotte Area Fund Inc	CAA	0	0	17	17
Mountain Projects Inc.	CAA	1	9	5	15
Habitat for Humanity of Charlotte [a]	Non-Profit	0	9	0	9
Four Square Community Action Inc.	CAA	1	7	1	9
Central Piedmont Community Action Inc	CAA	1	5	0	6
Rebuilding Together of the Triangle	Non-Profit	0	4	0	4
I CARE Inc.	CAA	1	1	0	2
Total Projects		**130**	**949**	**315**	**1,394**

[a] Denotes providers new to the Weatherization Program in the 2019–2020 evaluation period, based on a review of participating providers in the 2016–2018 evaluation period.

During the evaluation period, the program provided incentives for 1,394 projects at 1,167 homes across North and South Carolina.[15] On an annual basis, 2018 represented the largest number of projects (990) since program initiation in 2015. While the years 2017 and 2019 saw slight dips in project completions (687 and 774, respectively) compared to 2016 and 2018 (801 and 990, respectively), the overall trend of project completions was increasing until 2019. The program, however, experienced a substantial reduction in participation in 2020 (478), corresponding to the global pandemic during that year. In interviews, many providers noted that they paused services in spring of 2020 due to the COVID-19 pandemic, and that supply chain and staffing challenges affected their ability to complete projects at their pre-pandemic rate once services resumed. Figure 4 shows the total number of projects completed each year, from 2015 through 2020.[16]

[15] Projects are defined by project numbers found in the tracking database, which denotes HVAC and refrigerator replacements as separate projects when a participant also receives Tier 1 or Tier 2 measures.
[16] (1) 2016 includes projects from two different evaluation periods (2015–2016 and 2016–2018) and (2) 2018 includes 142 projects from the current evaluation period because the date used to define participation in the program-tracking data changed between the current and prior evaluation.

Figure 4. DEC Weatherization Projects Per Year 2015–2020

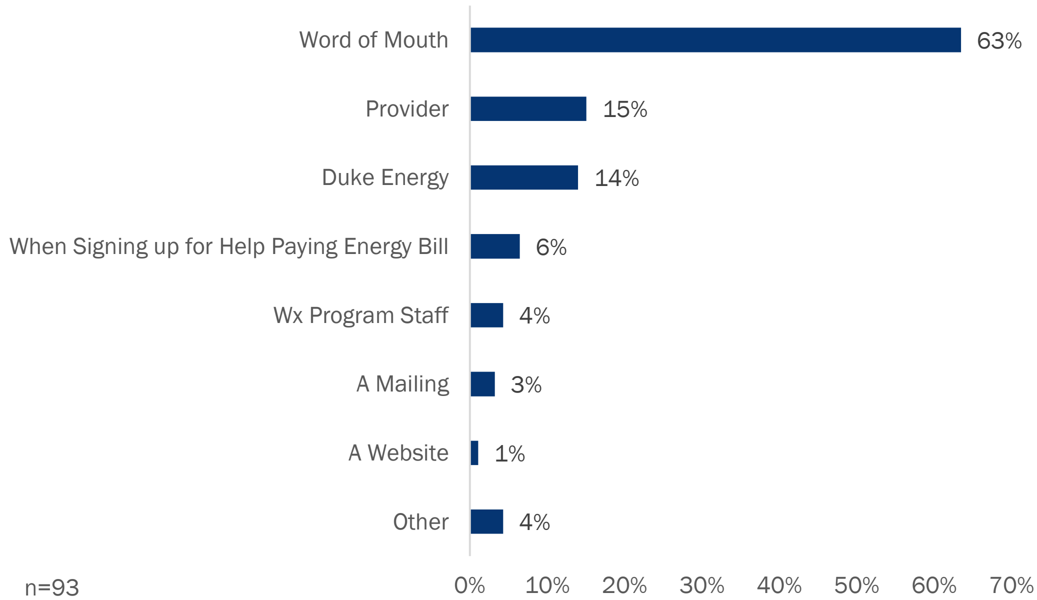


5.3.2 Program Outreach

Providers complete their own marketing and outreach to generate a local pipeline of state and DOE weatherization projects, and Duke Energy does not conduct any additional marketing. Interviewed providers (n=10) most often reported marketing the program with targeted print advertisements (7/10) and/or through a website or social media campaign (6/10). Only a few of the interviewed providers market the program through a social service provider or senior citizen center (3/10) or through newspaper ads (3/10). None of the participating providers reported much collaboration with Duke on marketing materials for the Weatherization Program, though the majority (6/10) specifically noted that they would like to see more Duke support in advertising the program, for example through the use of "bill inserts."

According to responses to the participant survey, a majority of participants (63%) learn about the Weatherization Program through word of mouth; smaller shares of participants learn about the program through social services or another provider (15%), or directly from Duke Energy (14%; Figure 5).

Figure 5. How Participants Learn About the Weatherization Program



Note: Respondent could indicate more than one source of awareness.

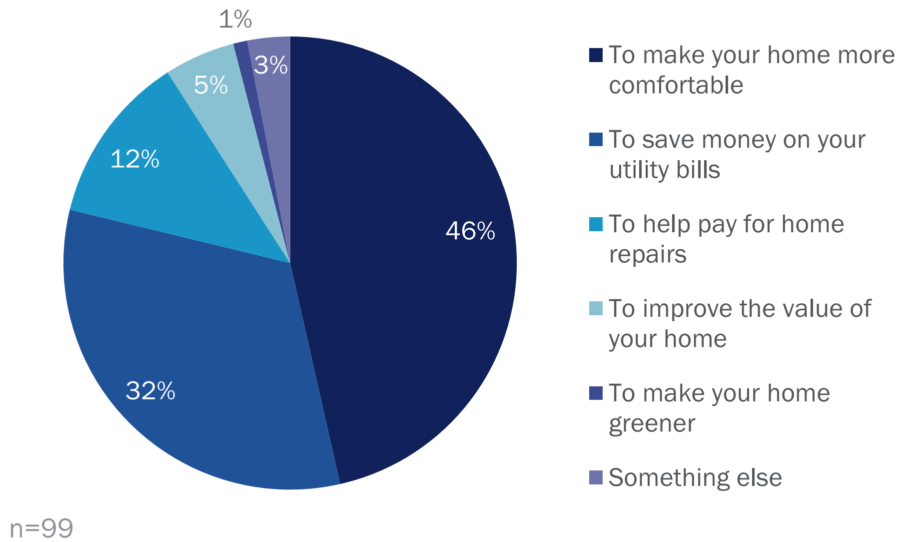
Note: Responses of “I don’t know” were removed from the analysis.

While the majority of participants first hear about the program by word of mouth (63%), it is worth noting that there are stark differences between participants in North and South Carolina: Word-of-mouth is a much more common information source for participants in North Carolina (69%) compared to participants in South Carolina (31%) who more often hear about the program from Duke directly (69%) either when they sign up for help paying their energy bill (38%) or through other communications (38%).

5.3.3 Motivators of Participation

The main drivers of customer participation are to make the home more comfortable (46%) and to save money on utility bills (32%; Figure 6). This is a change from the previous evaluation cycle, in which the main drivers of customer participation were to save money on utility bills (42%) and to help pay for home repairs (22%), with only 1% of customers who reported participating to make the home more comfortable. Notably, however, the 2016–2018 evaluation showed that the Weatherization Program provided a substantial non-energy benefit of improved home comfort. Since word of mouth is the primary channel through which customers become aware of the program, more customers may participate to achieve the goal of home comfort over time.

Figure 6. Participants' Main Motivation in Signing Up for Weatherization



Note: Responses of "I don't know" were removed from the analysis.

5.3.4 Participating Providers' Program Experience

In general, provider staff express great appreciation for the Weatherization Program and emphasize the high level of need for weatherization services among their clients.

Provider Participation Summary

All but two of the providers we interviewed (8/10) had been involved with the Weatherization Program prior to the current evaluation period; the new providers we interviewed reported joining the program in 2019. All of the interviewed providers had completed Tier 2 weatherization projects while seven were also associated with refrigerator replacements and six with Tier 1 projects. The proportions of projects that were completed by interviewed providers were comparable to that of the provider population.

DEC Weatherization projects represent a large portion of weatherization jobs completed by the providers and all providers report submitting 100% of eligible Duke projects for reimbursement. However, all providers also report supplementing Duke funds with funds from other sources on the same project, either because the participant needs more measures than the Weatherization Program funding can cover or because they need measures not covered under the Weatherization Program.

Key Services and Client Concerns

All interviewed providers offer services to their clients in addition to weatherization. Some of these services include financial assistance, nutrition programs, day care, and educational offerings. Eight of the ten interviewed providers provide health or safety upgrades to weatherized homes, either through DOE WAP or another program.

Despite the variety of additional services offered by providers, all providers report that their clients struggle with weatherization needs. The clients, according to the providers, often have the most difficulties with insulation and roofing (8/10). Their homes are often in need of repairs or upgrades, most commonly having gaps in doors and roofs, using broken heating equipment, or missing insulation. Five providers reported that their clients have trouble maintaining adequate indoor temperatures and need upgraded heating and cooling systems, while two providers reported their clients need refrigerators.

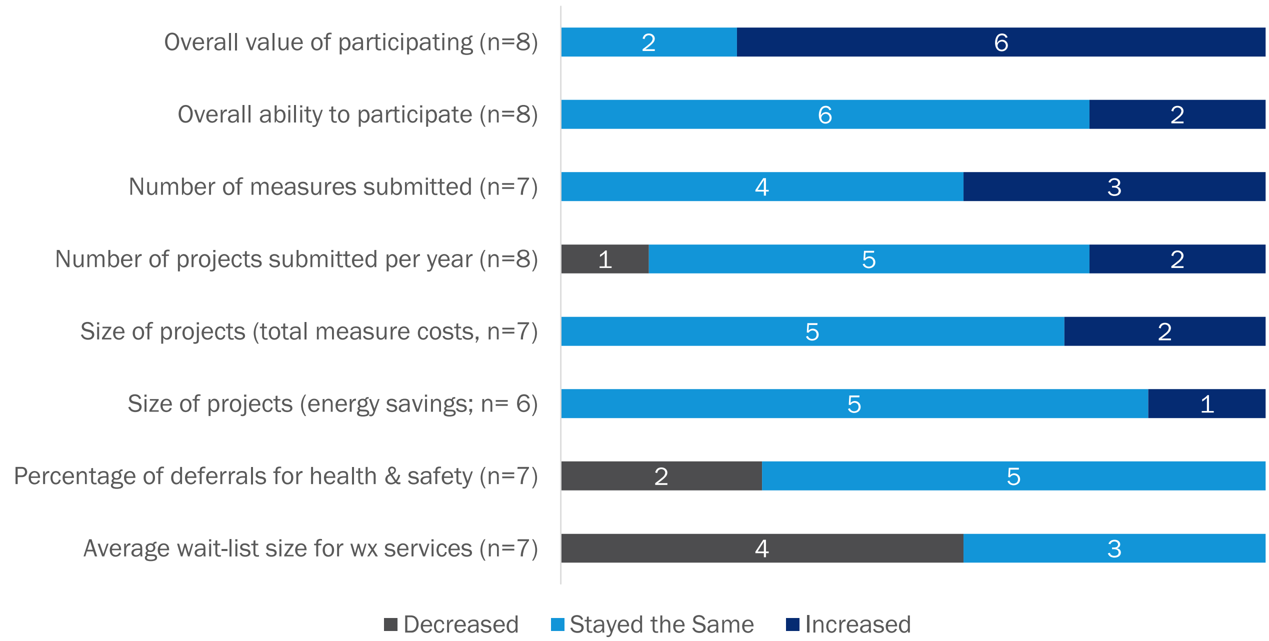
Program Changes

In 2019–2020, the Weatherization Program remained largely unchanged compared to the previous evaluation period, and all of the providers reported that they did not significantly change how they implemented or participated in the program. However, most providers reported pandemic-driven shifts in activities including a slowdown of work (such as pausing activities for a period of time or limiting the type of work that could be done, 7/10), the loss of workers (3/10), supply chain challenges (3/10), and a decrease in advertising capabilities (2/10). A couple of providers also mentioned receiving more funds from their state during the evaluation period (2/8) compared to the previous period.

The previous evaluation found that the new participation channel for the program, which was designed to overcome policy barriers preventing South Carolina agencies to participate in the Weatherization Program, had yet to encourage participation in the state. Both of the providers from South Carolina interviewed for the current evaluation were non-profit organizations and did not report policy barriers. However, program-tracking data indicates that these providers offered refrigerator replacements and HVAC upgrades/replacements rather than weatherization services, suggesting that while the new channel is making progress in South Carolina, existing program providers in the state are still unable to offer weatherization services to Duke Energy customers. Both of the newer providers expressed that participation throughout the evaluation period went smoothly, despite pandemic-related slowdowns.

To further understand specific changes to program implementation, we asked the provider staff who worked with the program prior to the current evaluation period to comment on a series of potential changes that may have occurred in a variety of program areas over the past four years. The most frequently reported changes were an increase in the overall value of the program to the providers (6/8), a decrease in the size of the waitlist providers have for their weatherization services (4/8), and an increase in the number of measures submitted for reimbursement (3/8). Figure 7 summarizes provider responses.

Figure 7. Changes to Provider Participation



Note: Responses of "I don't know" were removed from the analysis.

Inactive Providers

In addition to the interviews with participating providers, we interviewed two providers that were included in Duke Energy's list of approved providers but were not associated with any completed projects during the evaluation period. One of these providers was from North Carolina while the other was from South Carolina.

The provider from North Carolina that did not complete any projects noted being involved with the Weatherization Program since 2015. They have had very few clients apply for projects qualifying for this program during that time. They currently advertise the offering at social events in the area and at senior centers, and they also rely on a word of mouth network. The provider feels there has not been much growth in program demand because they only serve a small number of eligible customers. Similar to the active providers requesting program outreach support from Duke, this provider also inquired if (1) DEC would be able to advertise the program in bill inserts, and (2) if they could have more support identifying eligible customers.

The provider from South Carolina that did not complete any projects was much newer to the program than the North Carolina provider mentioned above but echoed many similar sentiments. For example, they also expressed needing more support from DEC in advertising the program and identifying what measures clients would be eligible to receive from the program. The support they received from DEC thus far, in terms of the webinars and DEC's availability to take questions, however, was considered very helpful. This provider mentioned they started work on several qualifying projects during the evaluation period and expect to be more active in the future.

5.3.5 Non-Energy Impacts

Non-energy impacts (NEIs) include a range of occupant health, safety, and economic outcomes that participants may realize beyond the energy and cost savings of energy-efficient upgrades. NEIs can provide significant additional benefits to participants and can be a powerful motivator for program participation.

The participant survey included questions about changes in electricity bills and in different aspects of the home's comfort following program participation. One-third of Weatherization Program participants, for example, reported that their summer or winter electricity bills were lower compared to before they participated in the program (34% and 33%, respectively; Table 17), although 26% of participants reported an increase in their bills in the winter months. Beyond bill savings, many participants said their home is more comfortable in the summer (54%) and in the winter (49%) months than it was prior to program participation. These benefits align with customers' original motivations for participation, which included making their home more comfortable (46%) and saving money on their utility bills (32%; Figure 6). Several survey respondents mentioned additional benefits they have experienced since participating in the program, including feeling more secure and noticing the air in the home is cleaner. Almost three-fourths (72%) of participants report experiencing at least one beneficial NEI since participating in the program.

Table 17. Impacts Reported by Participants

Impact Category	Positive Change	No Change/ About the Same	Negative Change
Energy Impacts [a]			
Summer Electricity Bills (n= 96)	34% *Bills are lower*	57%	8% *Bills are higher*
Winter Electricity Bills (n= 98)	33% *Bills are lower*	42%	26% *Bills are higher*
Non-Energy Impacts			
Home Comfort in the Summer (n= 84) [b]	54% *More comfortable*	46%	0% *Less comfortable*
Home Comfort in the Winter (n=85) [b]	49% *More comfortable*	42%	8% *Less comfortable*
Home Draftiness (n= 86) [b]	56% *Less drafty*	35%	9% *Draftier*
Lighting (n=15) [c]	53% *Better*	40%	7% *Worse*
Amount of Outdoor Noise Heard When All Windows are Closed (n= 85) [b]	25% *Less noise*	71%	5% *More noise*
Home Maintenance Costs (n= 96)	25% *Lower costs*	66%	9% *Higher costs*

[a] The evaluation period coincided with the global COVID-19 pandemic; it is possible that some changes in energy bills were impacted by shifts in energy usage and other habits associated with the pandemic. In addition, residential rate increases that took effect in 2019 (SC) and 2021 (NC) may impact customer bills and therefore responses to questions surrounding bill impacts.

[b] Those who only received refrigerator replacements were excluded from the analysis.

[c] Asked only of those who received LEDs.

Note: Responses of "I don't know" were removed from the analysis.

These findings suggest the Weatherization Program provides value to participants beyond energy savings. Increased home comfort and reduced draftiness could be beneficial for customer health and safety, especially as climate change alters temperature patterns. Improved lighting provides a greater sense of safety in and around the home. Lower energy bills and home maintenance costs help alleviate energy burden and allow customers to spend their money on other essential items, such as food and medicine.

DEC should consider providing information regarding improved home comfort, draftiness, and lighting quality to providers to help them market the program. Duke Energy could also use this information to recruit new providers to the program whose clients face high energy bills or uncomfortable homes in the winter and summer.

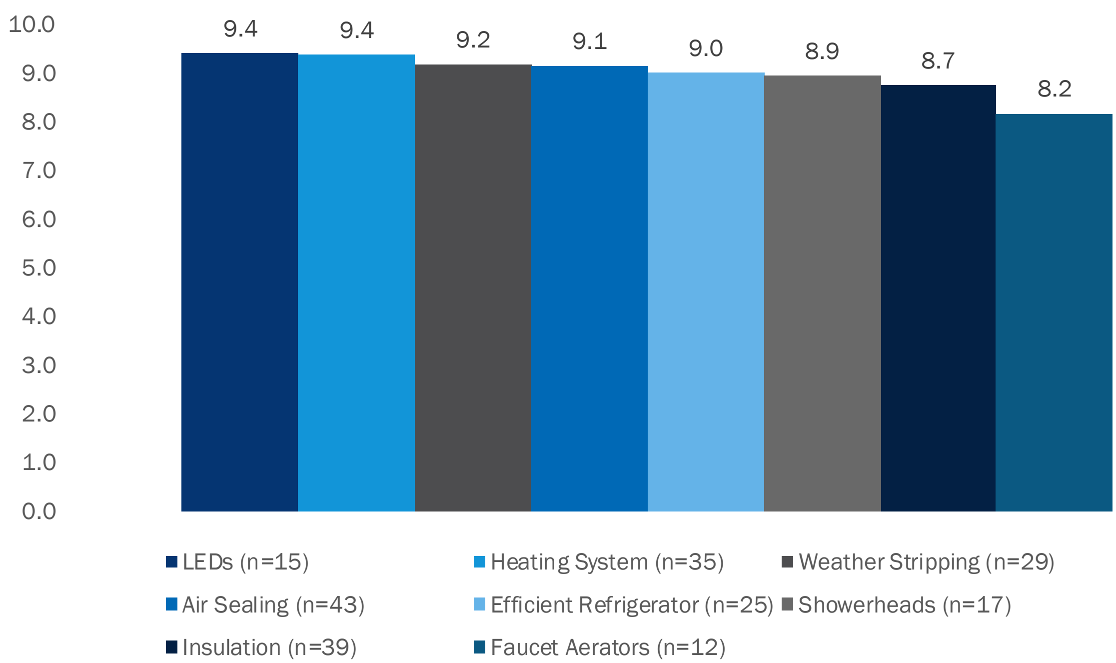
5.3.6 Program Satisfaction and Strengths

Overall, program administration staff, implementing provider staff, and participants all report being highly satisfied with the Weatherization Program:

- **NCCAA and TRC program administration staff give the program a satisfaction score of 4.5 out of 5**, saying they are very satisfied. The main areas of dissatisfaction cited relate to high administrative costs and the lack of alternate avenues to ensure that all available program funds are used. Two quotes that summarize possible areas of improvements follow:
  - *"I'd love to see us have some avenues to spend the money. I don't want to compete with agencies that are doing [this work or take anything away from community action], but [have] a way to take the money that's not being spent and go out and design a parallel program that allows that annual budget to be spent by a contractor network."*
  - *"From my understanding, there has not been an any increase in terms of administrative fees since this program launched. So I would say revisiting [the possibility of an increase annually of administrative fees] in some way [would] be helpful."*
- **Provider staff are very satisfied with the program as well, giving it an average rating of 4.4 out of 5 (n=10).** Provider staff reported few issues with implementation and underscored the value of the program to their communities. Providers are particularly satisfied with logistical elements of the program, the ease of participating (6/10), and the funding itself, which allows for the work to be done (4/10). Several respondents noted that funds cannot be applied to all equipment (5/10), they are sometimes unable to determine customer eligibility (2/10), and have encountered difficulties with billing (1/10). Still, provider staff frequently offered unprompted praise for the program, noting sentiments such as:
  - *"We are so grateful for the money; without it, a lot of this work would go undone".*
- **Half of the provider staff requested additional measures and program features to encourage deeper savings.** Several provider staff noted that they see more opportunity for increasing program savings if they were able to use program funds for measures such as roofs, windows, and floors (3/10). Other suggested program features included being able to offer more appliances (1/10), and/or duct work for gas systems (1/10).
- **Provider staff faced several difficulties due to the global COVID-19 pandemic.** Provider staff reported several pandemic-related barriers that were faced during the evaluation period including a slowdown of work (such as pausing activities for a period of time or limiting the type of work that could be done, 7/10), the loss of workers (3/10), supply chain challenges (3/10), and a decrease in advertising capabilities (2/10).

- **Participants are satisfied with all components of the program.** Overall, participants reported high satisfaction with the program, the program's staff, and the equipment they received from the program. Respondents rated their overall satisfaction with the program a 9.1 out of 10 and rated their satisfaction with the weatherization representative who installed the equipment a 9.0 out of 10.
- **Across the measures we verified, participants are highly satisfied with the equipment they received**, ranging from an 8.2 for those who received faucet aerators to a 9.4 for participants who received LEDs (Figure 8). Common reasons for dissatisfaction with equipment included participants not satisfied with the performance of the equipment and not noticing a difference in their home following installation.[17]
  - Regarding the faucet aerator: "*It gets to the point where you can't pull it down.*"
  - Regarding the weatherstripping: "*One door won't open.*"
  - Regarding the air sealing: "*I am still getting air coming into my home.*"

Figure 8. Participant Satisfaction with DEC Weatherization Equipment



[17] For all measure satisfaction questions, participants were asked to rate their satisfaction on a scale from 0 to 10, where 0 is "extremely dissatisfied" and 10 is "extremely satisfied."

6. Key Findings and Recommendations

6.1 Key Impact Findings

Based on our impact analysis, we estimate that the projects completed during the evaluation period generated 1,627 MWh of net annual energy savings, 217 kW of annual summer coincident demand savings, and 517 kW of annual winter coincident demand savings. Tier 2 participants accounted for the largest share of program-level savings (83%) while Tier 1 participants and refrigerator replacements accounted for 2% and 15%, respectively, of total program energy savings.

Table 18 presents annual per-household and program-level net ex post savings for the evaluation period.

Table 18. Summary of Impact Results

Project Type	Number of Participants	Net Annual Savings Per Household			Net Annual Program Savings		
		Energy (kWh)	Summer Coincident Demand (kW)	Winter Coincident Demand (kW)	Energy (MWh)	Summer Coincident Demand (kW)	Winter Coincident Demand (kW)
Tier 1	130	235	0.0773	0.0274	31	10.0	3.6
Tier 2 [a]	885	1,519	0.2012	0.5479	1,344	178.0	484.9
Tier 2 Weatherization Measures	*566*	*1,311*	*0.2469*	*0.3801*	*742*	*139.7*	*215.1*
HVAC Replacement/Upgrade	*382*	*1,577*	*0.1002*	*0.7062*	*603*	*38.3*	*269.8*
Refrigerator Replacement	315	800	0.0912	0.0912	252	28.7	28.7
Total [b]	**1,167**				**1,627**	**216.8**	**517.2**

[a] The total number of Tier 2 participants is smaller than the sum of weatherization and HVAC replacement/upgrade participants because some participants received both types of upgrade.

[b] The total number of unique participants is smaller than the sum of project types because some households received a replacement refrigerator in addition to completing a Tier 1 or Tier 2 project.

6.2 Key Process Findings

- **Program Participation & Processes.** Participation in the Weatherization Program has been increasing steadily since the program began in 2015. Although there was a decrease in projects in the spring and summer of 2020, due to barriers associated with the global COVID-19 pandemic, provider staff have since reported a return to normal participation levels. Providers continue to work hard to inform clients about the program through multiple advertising channels (newspaper ads, in-person events, agency websites, etc.) and most interviewed providers indicated the number of projects they complete each year either stayed the same or increased since they have resumed normal business operations following COVID-19 pandemic related shutdowns.
- **Satisfaction.** The process evaluation shows high satisfaction with the Weatherization Program. Interviewed provider staff often provided unprompted praise for the program and underscored the importance of the program to their clients. Providers also reported finding the logistical elements of the program—including the ease of participating—to be another key program strength. Sources of dissatisfaction included difficulty determining customer eligibility and the inability to apply program funds to all equipment. Participating customers are also highly satisfied with the program overall. A

key driver of participation is to make the home more comfortable. Survey results suggest the program is helping participants in this respect, with 54% and 49% of respondents reporting higher comfort levels in the home during the summer and winter seasons, respectively, following participation in the program.

- **Non-Energy Impacts (NEIs).** In addition to lowering energy bills, the Weatherization Program provided substantial non-energy benefits to participants during the evaluation period, including improved home comfort in the summer and winter, reduced draftiness, and better lighting. To a lesser extent, survey respondents also reported lower noise levels from outdoors and reduced home maintenance costs. Almost three-fourths (72%) of participants reported experiencing at least one beneficial NEI since participating in the program.

- **South Carolina Policy Barriers.** The new participation channel, introduced in 2018, allows non-profit and other organizations to provide program services to customers who may not have been able to receive them otherwise using Weatherization Program funds. One objective of this channel is to overcome barriers in South Carolina, as state policies around funding prevent community action agencies (CAAs) from participating in the program. The Weatherization Program has made progress in serving customers in South Carolina, but there is room for improvement. Based on program-tracking data, there were three program providers in South Carolina actively completing projects during the evaluation period; all three providers are community-based organizations and they completed 10% of projects. However, the vast majority of South Carolina projects were refrigerator replacements, with a small number of HVAC upgrades/replacements and only one weatherization project submitted in South Carolina during the evaluation period.

6.3 Evaluation Recommendations

- **Increase support to providers in program marketing and outreach.** Providers note that communication and organization of the program are key strengths and frequently provide unprompted praise for staff at Duke Energy and NCCAA. One area identified for potential additional Duke Energy assistance is marketing and outreach to help increase customer awareness of the program. The program should continue to explore ways to promote participation while supporting existing providers by including information about the program alongside customer bills. This may be particularly important in South Carolina where the program has not had time to cultivate a large base of previous participants who can support word-of-mouth recruiting. Another area identified for potential additional Duke Energy assistance is supporting program providers in identifying eligible participants or confirming eligibility of customers they have identified. The program should consider providing additional data (individual or aggregated) for targeted outreach.

- **Evaluate funding required to align with changes in measure and labor costs following the COVID-19 pandemic and consider increasing per-project funding.** Program administration staff noted that during the evaluation period, they struggled to spend all program funds. At the same time, providers reported supply chain and labor shortages, and corresponding increased measure and labor costs, following the COVID-19 pandemic, with all interviewed providers indicating that they supplemented Weatherization Program funds with funding from other sources in order to meet participant needs. At the time of this evaluation, many providers cited high labor and material costs as an ongoing challenge. In fact, program-tracking data indicates fewer than half of participating households received most program measures, In addition, compared to the last evaluation period,[18] a significantly smaller share of Tier 2 households received the various program measures – the only exception are HVAC

[18] The last evaluation included participants between April 1, 2016 and December 31, 2018.

upgrades/replacements (which were a new measure in the last evaluation period and not widely provided) and refrigerator replacements (which were provided to 17% of participants in both evaluation periods). Increasing per-project funding to align with current measure and labor costs can support spending of all available program funds, help ensure providers are able to install all measures appropriate for a given project, increase per-participant savings, and maintain or increase NEIs and participant satisfaction.

- **Expand efforts to recruit and support organizations that do not face funding barriers in South Carolina, with a focus on providers that offer weatherization services.** The program should continue to explore ways to promote participation in South Carolina by recruiting more organizations that do not face funding barriers in South Carolina. The providers from South Carolina have achieved more success completing projects compared to the previous evaluation period given their non-profit status, but have focused primarily on refrigerator and HVAC replacements. Duke Energy should continue to recruit organizations that do not face barriers due to state policies around weatherization funding, with a focus on those organizations that can provide weatherization services in addition to equipment replacement.
- **Consider tracking several additional parameters within the program-tracking system to enhance the accuracy of future deemed savings estimates.** Our deemed savings review (Appendix B) identified a few parameters not currently tracked in program data: (1) pre- and post-project blower door results in units of reduced cubic feet per minute (CFM); (2) presence or type of cooling at participating homes; (3) water heating fuel of participating homes; and (4) the installed location (e.g., bathroom, kitchen) for each low-flow faucet aerator. In addition, the cooling efficiencies of existing equipment for heat pump upgrades and replacements was tracked less than 7% of the time and appeared to be incorrect. Some of this information was collected in the participant survey but including it in the program-tracking data would enhance the accuracy of future deemed savings estimates. We therefore recommend asking providers to enter this information, if already collected and available, into the program's tracking system.

7. Summary Form

DUKE ENERGY CAROLINAS
LOW INCOME WEATHERIZATION PROGRAM
COMPLETED EM&V FACT SHEET

PROGRAM DESCRIPTION

The DEC Weatherization Program reimburses local implementing agencies that have recently completed qualifying weatherization projects at Duke Energy customer homes. Electric conservation measures are provided at no cost to the customer. A tiered project structure is used to allocate reimbursements to agencies: Tier 1 applies to low usage homes and offers air sealing and low-cost energy efficiency upgrades (including lighting and low-flow aerators and showerheads); Tier 2 applies to higher usage homes and offers more comprehensive energy efficiency measures (including insulation and HVAC upgrades/ replacements) in addition to Tier 1 measures. Refrigerator replacements are also provided to qualifying households as a standalone project or in addition to Tier 1 or Tier 2 measures.

Date:	December 13, 2022
Region(s):	Duke Energy Carolinas
Evaluation Period:	January 1, 2019 – December 31, 2020
Annual kWh Savings (ex post net):	1,626,724 kWh
Coincident kW Impact (ex post net):	216.8 kW (Summer) 517.2 kW (Winter)
Measure Life:	Not Evaluated
Net-to-Gross Ratio:	N/A
Process Evaluation:	Yes
Previous Evaluation(s):	Duke Energy Carolinas Low Income Weatherization Program, April 2021 and June 2018

EVALUATION METHODOLOGY

The evaluation team performed a process and gross impact evaluation.

The process evaluation included a participant survey and interviews with implementing providers.

The gross impact evaluation included an engineering analysis and a consumption analysis and leveraged results from a prior evaluation.

IMPACT EVALUATION DETAILS

- We determined annual per household energy savings for Tier 2 participants using consumption analysis.
- We determined annual per household energy savings for Tier 1 participants based on a combination of engineering analysis results and results from a prior evaluation.
- We estimated demand savings for Tier 1 and Tier 2 participants based on engineering analysis-based demand-to-energy ratios, applied to energy savings.
- We developed savings for refrigerator replacements through engineering analysis.
- The engineering analysis applied deemed savings values to measures distributed and in service. In-service rates were calculated based on information collected in the participant survey.

8. DSMore Table

The Excel spreadsheet containing measure-level inputs for Duke Energy Analytics is provided below. Per-measure savings values in the spreadsheet are based on the impact analyses reported above. The evaluation scope did not include updates to measure life assumptions.

DSMore DEC LI Wx Program 2022-12-13

/A

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Duke Energy Carolinas (DEC) and Duke Energy Progress (DEP)

Low and Moderate Income Penetration Study

December 9, 2022

Opinion Dynamics

Table of Contents

Opinion Dynamics

Table of Tables

Opinion Dynamics

Table of Figures

1. Executive Summary

This study characterizes Duke Energy's low and moderate income (LMI) customer base and examines their participation in Duke Energy's energy efficiency programs between 2013 and 2021. We consider the degree to which the LMI population is served by existing Duke Energy program offerings, barriers and drivers to participation, and impacts of participation among this population.

1.1 Study Objectives

The key objectives of the study are to

- Characterize LMI customer participation in Duke Energy's residential energy efficiency programs;
- Compare LMI customer participation to that of non-LMI customers;
- Understand participation predictors and characterize LMI participants;
- Identify drivers of and barriers to participation among LMI customers;
- Understand and characterize impacts of program participation, including changes in electric energy costs and LMI customer experiences; and
- Identify strategies to cost-effectively increase LMI customer participation through programmatic enhancements.

To achieve these objectives, Opinion Dynamics utilized multiple primary and secondary data sources including analysis of Duke Energy customer data, Duke Energy program tracking data, US census data, in-depth interviews with Duke Energy LMI customers, and surveys with Duke Energy program participants and non-participants. Our analytic activities included a descriptive and geospatial analysis of program participation, linear regression modeling of participation correlates, and modeling of participants' energy bills.

1.2 Key Findings

- LMI customers have different demographic and housing characteristics, on average, than non-LMI households. Our analysis of census, Duke participation, survey, and in-depth interview data reveals that these differences affect LMI customers' energy efficiency needs, program participation barriers and motivations, and the magnitude of program participation impacts.
- Our analysis of census data and neighborhood participation rates from 2013 through 2021 found that average annual participation in Duke Energy energy efficiency programs was slightly lower in neighborhoods that have a moderate to high percentage of LMI households compared to those with few LMI households. Program participation was lowest in neighborhoods that have a moderate percentage of low income household customers. In neighborhoods where between 40% to 50% of households are LMI, an average of 8.29% of households participated in Duke Energy programs each year compared to 8.99% in neighborhoods with a high percentage of LMI households (90% or more) and 10.48% of households in neighborhoods with few LMI households (less than 10%).
  - Both moderate and high LMI neighborhoods have lower participation rates in market rate programs (~ 8%) compared to low LMI neighborhoods (~10%). But in high LMI neighborhoods, a small but meaningful percentage of households (~1%) participate in Duke Energy's low income programs, which somewhat makes up for their lower participation in market rate programs. In

neighborhoods with a moderate percentage of LMI households, fewer participate in low income programs (less than 0.5%).

- We found a similar difference in participation rates in programs with high energy savings. We found that 2.9% of customers who live in neighborhoods with a high concentration of LMI households participate in high savings programs compared to 3.7% of customers who live in neighborhoods with few LMI households.

- Our analysis of results from participant and nonparticipant surveys finds that Duke Energy programs struggle to reach historically hard-to-reach and frequently disadvantaged populations, namely renters, residents of multifamily properties, and more transient populations. The majority of participants, both LMI and non-LMI, are homeowners and live in single family homes. Living in a rented or multifamily home compounds the participation barriers for LMI customers.
  - We found that LMI program participants were much more likely to own their homes than LMI non-participants. Just over half of LMI participants (52%) are homeowners compared to 15% of LMI non-participants. Similarly, just under two-thirds of LMI participants (64%) live in a single-family home compared to just over one-quarter of LMI non-participants (28%).
  - Non-LMI participants are also more likely to be homeowners compared to non-LMI nonparticipants (86% vs. 57%). Non-LMI participants are more likely to live in single family homes compared to non-LMI nonparticipants (81% vs. 53%).
- Nonparticipant survey results show that LMI customers have greater energy efficiency needs and concerns than non-LMI customers.
  - One-third of LMI nonparticipants (33%) said “a lot of things” in their homes could be made more energy efficient, compared to only 16% of non-LMI nonparticipants.
  - LMI nonparticipants were more concerned about their energy usage than non-LMI nonparticipants. Half of LMI nonparticipants (49%) were either “very” or “extremely concerned” about their household energy use, compared to slightly under one-third (30%) of non-LMI nonparticipants.
- Despite a greater need for energy efficiency improvements, participation barriers among LMI customers are more pronounced compared to non-LMI customers and include program awareness, knowledge, cost constraints, and being a renter. Our survey results suggests that, with the support of a program that addresses their barriers to structural upgrades, LMI nonparticipants would be likely to make energy efficiency improvements to their homes. However, barriers such as split incentives and limited financial resources may inhibit LMI customers from seeing high-savings programs as a realistic possibility for their household.
  - LMI nonparticipants are less likely to be aware of Duke Energy programs compared to non-LMI nonparticipants (40% vs. 64%). Nonparticipants had low awareness of energy efficiency opportunities in general, with LMI customers reporting lower awareness than non-LMI customers. Over half of LMI nonparticipants (55%) said they were either not at all knowledgeable or had only a little knowledge about ways to save energy in their homes compared to 45% of non-LMI nonparticipants.
  - More LMI nonparticipants say that they are “not at all likely” to make changes to their home to make it more efficient in the next year compared to non-LMI nonparticipants (43% vs. 28%).
  - When presented with specific offerings from Duke Energy, LMI nonparticipants were more likely than non-LMI nonparticipants to say they were “very” or “extremely” likely to participate in any type of Duke Energy program in the next two years. LMI nonparticipants were most interested in no-

cost or low cost upgrades such as lighting or free upgrades based on income and least interested in higher cost and higher savings opportunities such as heating and cooling system rebates.

  - LMI and non-LMI nonparticipants have different barriers to program participation. LMI nonparticipants were more likely than non-LMI nonparticipants to say that the cost of participation, their lack of authority as a renter, and the COVID-19 pandemic were barriers to their participation.

- Our modeling of LMI customer energy bills before and after participation in Duke Energy programs, revealed modest electric bill savings for customers who participated in Duke Energy programs. Following program participation, the electric bills of LMI customers fell by an average $34 per year, or about a 2% annual bill reduction ($1,600 is the average annual bill for LMI participants).
- One in five LMI participants reported a consistent reduction in their electric bills after participating in a Duke Energy program, which is somewhat lower than what non-LMI participants reported (21% vs. 29%). Survey results and in-depth interviews with LMI participants report these reductions have a greater impact on their household finances given their lower incomes.
  - LMI participants are significantly more likely than non-LMI participants to indicate that they would not have been able to afford to pay their electric bills without the savings associated with their participation (42% vs. 10%). One participant reported, "My bill is a lot lower than what it was. I've been saving about $14 a month. If Duke had not put me in the program, my kids and I would've been without lights."
- LMI customers are satisfied with their program participation experience and are more likely to report non-energy impacts (NEI) from participation than non-LMI customers.
  - The most frequent impacts that LMI participants noticed were better light quality (65%) and more comfortable home temperatures during the summer (57%) and winter (50%).

1.3 Study Recommendations

Opinion Dynamics has the following recommendations for increasing LMI customer participation in Duke Energy programs.

- **Duke Energy should continue to offer low income programs in addition to their market rate offerings.** Duke Energy's low income programs play an important role in supplementing market rate programs in in neighborhoods with a high percentage of LMI customers.
- **Duke Energy should consider expanding their low income offerings to reach more low income customers outside of neighborhoods with a high concentration of LMI customers.** The neighborhood-based low income programs are less effective at reaching customers in neighborhoods that have a moderate yet still sizable percentage of low-income customers.
- **Duke Energy should utilize existing LMI networks and leverage word-of-mouth outreach from satisfied participants to increase program awareness and participation.** LMI participants report receiving critical energy and non-energy benefits due to participating in Duke Energy programs. Duke Energy could encourage past participants to share their stories with friends, family, and neighbors. Duke Energy could also consider featuring testimonials about the benefits of participation from past participants in marketing materials.
- **To increase program participation among LMI customers, Duke Energy should enhance their low income program efforts to reach the sub-segments of LMI customers who are most underserved, focusing on renters and multifamily residents.** LMI renters and residents of multifamily properties are less likely to participate than comparable owners and single-family customers. Program

enhancements could include outreach to landlord and property owners either directly or on behalf of tenants and adding measures to existing multifamily programs that would provide greater energy savings.

- **Duke Energy should consider either adding a program specifically for moderate income customers or programs that would reduce the up-front investments required for high savings programs.** Moderate income customers could benefit from an on-bill financing program that would spread initial upgrade costs out over time.
- **Duke Energy should consider prioritizing new program offerings that provide support for measures that LMI customers report as most needed.** LMI nonparticipants report that they could most benefit from upgrades to their HVAC equipment, home weatherization, and energy efficient windows.

2. Overview of Study Activities

Table 1 summarizes how the study activities support the study objectives. We utilized a multimethod approach, addressing study objectives through both primary research and analysis of secondary data to support a nuanced understanding that reflects trends in the larger data as well as the lived experiences of actual Duke Energy customers.

Table 1. Study Objectives and Activities

Study Activity	LMI Customer Characterization	Participation Levels and Characterization	Participation Drivers and Barriers	Participation Impacts	Increasing LMI Customer Participation
Data Ingestion and Processing	✓	✓	✓	✓	
Participation Analysis	✓	✓	✓		✓
LMI Participant Interviews and Vignettes		✓	✓	✓	✓
LMI Customer Surveys	✓	✓	✓	✓	✓
Customer Payment and Cost Analysis				✓	

2.1 Data Ingestion and Processing

We utilized multiple streams of data for this project. We reviewed, cleaned, and processed all data sources and created a central analytic database that we used for all project tasks. Table 2 summarizes the data streams utilized for the study.

Table 2. Data Streams and Sources

Data Stream	Purpose	Source	Time Period [a]	Level
Program Participation	Identify Duke Energy customers who participated in energy efficiency programs, including the date of participation, program name, measures received, and anticipated ex ante savings.	Duke Energy	2013–2021	Customer
Customer Accounts and Energy Consumption	Quantify the population of Duke Energy customers eligible to participate in Duke Energy programs over time, including characteristics such as location and household energy consumption.	Duke Energy	2013–2021	Customer
Customer Billing and Payments	Identify customers who are behind on their energy bills and/or have been disconnected due to nonpayment.	Duke Energy	2017–2021	Customer
American Community Survey (ACS)	Identify average sociodemographic and housing characteristics in the neighborhoods where Duke Energy customers reside.	Census Bureau	2015–2019 5-year ACS estimates	Census block group
LMI Categorization	Assign likelihood of LMI household status by assessing the proportion of households in	Department of Housing and Urban	Based on 2011-2015 ACS data [b]	Census block group

Data Stream	Purpose	Source	Time Period [a]	Level
	each neighborhood that meet LMI criteria based on area median income.	Development (HUD)		
Energy Burden	Measure average household energy burden in the neighborhoods where Duke Energy customers reside.	Department of Energy (DOE)	Based on 2014–2018 ACS data [b]	Census Tract

[a] For each data stream, we carefully considered data availability, analytic needs, and study budget when selecting the time period covered. Because of these considerations, the time period varies by data stream.

[b] Years are the most recent data available from the respective government agencies at the time of the study.

As noted in Table 2, this analysis was conducted at multiple levels. Where household-level data was available across Duke Energy customers, we leveraged that data. The study team was unable to access key information, including household income, demographic, and housing characteristics, at the household level, and therefore leveraged US census data in these cases.[1] Where census data was used for the analysis, customers were characterized based on the prevailing social and demographic attributes of their neighborhood rather than household-level data.

2.2 Participation Analysis

The purpose of the participation analysis was to characterize Duke Energy's LMI customer population, document program participation trends among this population, and identify how sociodemographic, housing, geographic, and other attributes interact with both LMI status and Duke Energy program participation.

The descriptive analysis explored the relationship between LMI status and program participation for each of the characteristics laid out in Table 3. While the analysis was ultimately completed at the neighborhood level, the table indicates whether each variable originated from individual, customer-level data, or neighborhood-level census data. Table 3 summarizes the household- and neighborhood-level attributes analyzed.

Table 3. Variables Assessed as Part of Participation Analysis

Variable	Household	Neighborhood
LMI Status		✓
Program Participation Rate (Any)	✓	
Program Participation Rate (High Savings Potential)	✓	
Average Ex Ante Savings	✓	
Average Energy Burden		✓
% Nonwhite Households		✓
% Owner Occupied Households		✓
% Single Family Households		✓
Median Household Income		✓
% Limited English Households		✓
% Households Without Internet Access		✓
Urban/Rural Status		✓
% Households with Electric Heating Fuel		✓

[1] Census data was incorporated at the most discrete geography available. For most variables, this was at the census block group (CBG) level. Some variables are only available at the census tract level.

Descriptive Analysis

We began the analysis by characterizing Duke Energy LMI customers and program participation trends among LMI customers compared to all Duke Energy customers. The analysis leveraged several analytic techniques including review of descriptive statistics, cross-tabulations, scatterplots, and correlations.

A key component of the descriptive analysis was defining LMI customers. Because household income data was not available for individual customers and LMI definitions are also dependent on household size, which was not available, we conducted our analysis at the neighborhood level using census block group and census tract data. We first had to determine an appropriate definition of the household income that qualifies as low or moderate income. We used the Department of Housing and Urban Development (HUD) guidelines to determine the percentage of households in each block group or tract that met the HUD definition of low or moderate income. The HUD definition uses area median household income rather than state or national income to account for regional differences. Table 4 summarizes how HUD defines low- and moderate-income households.

Once we determined the percentage of low- or moderate-income households in each block group and census tract, we assigned each block group and tract an LMI status based on the proportion of households in census unit that met HUD LMI criteria. Block groups and tracts with 80% or more of households below the low- and/or moderate-income threshold were considered LMI neighborhoods. Block groups and tracts with 20% or fewer households below the low- and/or moderate-income threshold were considered non-LMI neighborhoods. This allowed us to compare the participation trends and sociodemographic characteristics of the neighborhoods where the vast majority of households were LMI with those that were not LMI.[2]

Table 4. Low and Moderate Income Definitions

Income Group	Definition
Low Income	Up to 50% of the area median income
Moderate Income	Greater than 50% and up to 80% of the area median income

Note: For more information on HUD's LMI definitions, see: https://www.hudexchange.info/programs/acs-low-mod-summary-data/.

Once we defined LMI neighborhoods, we assigned each Duke Energy customer to a census block group and tract based on their service address. We assessed neighborhood participation rates over time, by program, and based on savings potential for each neighborhood to gain a deeper understanding of how LMI customer participation is distinct from that of other Duke Energy customers. Next, we explored the relationship between a variety of sociodemographic, housing, and customer-level attributes and incidence of program participation, both for Duke Energy customers overall and among LMI customers. The descriptive analysis provided an understanding of (1) which factors are related to participation, (2) how strong the relationship is between each factor and likelihood to participate, and (3) the direction of the relationship (i.e., whether the attribute is associated with more or less participation).

Geospatial Analysis

Geospatial analysis is an important tool for understanding how LMI household prevalence, program participation rates, and related factors vary across Duke Energy's territory. It can help identify underserved LMI communities as well as communities in which Duke Energy has achieved high participation rates among

[2] Because this approach is based on neighborhood-level data rather than household-level data, some actual LMI households will live in neighborhoods designated as non-LMI neighborhoods and vice versa. We expect that stronger relationships and differences would be detected with household-level data.

LMI and other hard-to-reach populations. We used Esri ArcGIS maps, embedded in a Microsoft Power BI dashboard, to create user-friendly, interactive maps that support a deeper understanding of how various sociodemographic and housing factors contribute to program participation rates, and how Duke Energy is performing in reaching these sub-populations across their territory. For the geospatial analysis, we used the results of the descriptive analysis to provide visual displays of the characteristics most correlated with energy efficiency program participation among LMI populations. We provide images of maps covering Duke Energy's entire territory in the body of the report and additional maps that zoom in on six urban areas in Appendix A.

Modeling

We estimated a linear regression model to identify the predictors of participation in Duke Energy programs. Due to a lack of household-level data, the analysis was conducted at the census block group level and included a range of housing, demographic, and energy consumption characteristics for each neighborhood. We ran separate models for high vs. low savings offerings as determined from ex ante savings data. We provide additional detail on data cleaning and modeling in Appendix B.

2.3 LMI Participant Interviews and Vignettes

To add depth to the insights developed through the participation analysis, we conducted in-depth interviews with 40 Duke Energy customers who participated in a Duke Energy program in 2020 or 2021 and live in neighborhoods where at least 80% of households meet LMI criteria.[3] Questions we explored through the interviews included the following:

- What are the housing characteristics of LMI participants? What key energy using systems do they rely on in their day-to-day life?
- What motivates LMI customers to take part in a Duke Energy program?
- How do LMI customers experience the process of participating in a Duke Energy program?
- What are the experiences of LMI customers after participating in a Duke Energy program? How does participation affect their energy affordability, comfort, health, and other factors?
- What are the sociodemographic characteristics of LMI participants and their households?

Participant interviews were fielded in May through June 2022. Interviewers utilized an open-ended approach, starting with more general questions and probing on areas the respondent did not bring up organically. This allowed us to understand what was most salient or important to each respondent while also gaining feedback on their full experience. Interviews were transcribed and coded by theme to identify patterns among respondent experiences. Additional details on the interview approach and administration are provided in Table 5.

Table 5. Participant Interviews Overview

Attribute	
Population Frame	Participants between January 2020 and December 2021 residing in census block groups where 80% of households or more are low- or moderate-income
Sampling Approach	Stratified Random Based on savings potential, jurisdiction, homeowner/renter status

[3] We included only 2020 and 2021 participants in the interviews to enhance recall.

Attribute	
Sample Size	13,203
Fielding Dates	May 23, 2022–July 18, 2022
Outreach Method	Email and phone
Incentive	$20 e-gift card[a]
Total Number of Completed Interviews	40

[a] Mailed option was provided for respondents without email access

From the 40 interviews conducted, we highlight the stories of five LMI participants who experienced non-energy impacts due to their participation in a Duke Energy program. Participant vignettes were selected to represent a range of installed measures, participant demographics, and experiences following program participation. The vignettes are included in Appendix E. In addition to the full participant vignettes, we also draw from the participant interviews throughout the report to provide examples of how non-energy impacts observed through the participant survey and other research tasks affect real Duke Energy customers.

2.4 LMI Customer Surveys

To further characterize LMI customers and identify their needs and their unique drivers and barriers to program participation, we conducted two survey efforts: an online survey with LMI customers who recently participated in one or more of Duke Energy's energy efficiency programs, and an online survey with LMI customers who have not participated. The surveys were sequenced to follow the participation analysis and in-depth interviews to allow for maximum integration of insights to-date. This allowed us to use the survey as a tool to verify and build on insights and hypotheses developed through the study to-date. In addition, insights gained from in-depth interviews with participants allowed us to construct the participant survey questions to focus on those participation drivers and impacts most relevant to Duke Energy's LMI customer population.

The participant survey focused on the following research questions:

- What are the housing characteristics of LMI participants?
- How do LMI customers become aware of Duke Energy programs?
- What motivates LMI customers to take part in Duke Energy programs?
- How do LMI customers experience the process of participating in a Duke Energy program?
- What are the experiences of LMI customers after participating in a Duke Energy program? How does participation affect their energy affordability, comfort, health, and other factors?
- What are the sociodemographic characteristics of LMI participants and their households?

The nonparticipant survey focused on the following research questions:

- What are the housing characteristics of LMI nonparticipants?
- How aware are nonparticipating LMI customers of Duke Energy programs? What are their current and potential sources of awareness?
- Why do LMI customers choose not to participate in Duke Energy programs? What are their barriers to participation?
- What are the attitudes of nonparticipating LMI customers towards energy efficiency?
- How interested are LMI customers in participating in Duke Energy programs? What do they see as potential benefits of participating in a Duke Energy program?

- What are the sociodemographic characteristics of LMI nonparticipants and their households?

Table 6. Participant and Nonparticipant Surveys Overview

Attribute	Participant Survey	Nonparticipant survey
Target Population	Duke Energy customers who (1) participated in a program in 2020 or 2021 and (2) live in a census block group with at least 70% LMI households [a]	Duke Energy customers who (1) have not participated in an energy efficiency program since 2013; (2) have had an active account with Duke Energy for at least one year; and (3) live in a census block group where at least 80% of households are LMI
Total Completes	538	643
LMI Completes	213	307
Survey Dates	8/2/2022–8/31/2022	8/4/2022–8/31/2022
Survey Mode	Web	Web
Outreach Mode(s)	Email	Mail and email
Incentive	None	$10 e-gift card (physical gift card available for respondents without email access)
Response Rate	4.2%	6.5%

[a] We included only 2020 and 2021 participants in the surveys to enhance recall.

2.5 Customer Payment and Cost Analysis

The purpose of the payment and cost analysis was to assess the impact of program participation on LMI customer bills. To support the analysis, we leveraged monthly billing data for participants. Our analysis included program participants who participated in Duke Energy's energy efficiency programs between 2017 and March 2020 and resided in census block groups that had at least 50% LMI customers. We further refined eligibility criteria to only include participants with anticipated savings of 250 kWh and higher. These choices were driven by both data availability and statistical modeling considerations. More specifically, we chose to include participants with savings over 250 kWh to ensure that bill impacts are detectable in the monthly billing data. Furthermore, we chose to exclude participants beginning in March 2020 due to changes in customer billing processes, including a moratorium on disconnections, as well as significant changes to customer energy usage patterns due to the COVID-19 pandemic, both of which are challenging to control for in the modeling process. Using the above criteria, we narrowed the subpopulation of participants to 105,327.

We performed billing analysis, which is a statistical analysis that examines a change in customer bills before and after program participation relative to the change in a comparison group's bills during the same periods. Prior to specifying the models, we performed a thorough cleaning of the billing data. We worked closely with Duke Energy to obtain billing data and assemble it to accurately reflect customer monthly bills, arrearages, and account for any nuances in bills or rates, such as removing participants on fixed payment plans. We checked the data for gaps and inconsistencies as well as for sufficiency. Among other checks, we ensured the participants retained for the analysis had sufficient pre- and post-participation billing data, the participation dates were accurate, and the consumption data was free of outliers, such as bill periods with unreasonably small or unreasonably large dollar amounts.

We leveraged a quasi-experimental approach to the evaluation by developing a comparison group of participants. Including a comparison group allowed us to control for changes in electric rates over time and changes in economic conditions and other non-program factors that might affect customer bills during the study period. We constructed a comparison group from nonparticipants customers residing in the same census block group as participating customers. We deployed distance matching algorithms to select a subset of nonparticipants who were most like treatment participants in terms of their billing history in the pre-period to form a comparison group. We conducted an equivalency analysis to ensure equivalency between the treatment and the matched comparison customers.

We used a linear fixed effects regression model for this analysis. Fixed effects models capture the effect of time invariant household-specific characteristics and are the industry best practice approach to modeling program savings. We specified a variety of models ranging from simple pre-post models to more complex models incorporating a variety of terms to control for known sources of variation. We specified models separately for DEC and DEP, by state, and overall. We further developed separate models based on the anticipated depth of savings as well as the income characteristics of the census block groups where participants reside. Our final model specifications included weather—heating degree days (HDD) and cooling degree days (CDD)—as well as monthly dummy variables to further control for seasonal differences in bills.

Appendix C contains a detailed discussion of the billing analysis methodology, including data cleaning steps, comparison group selection and assessment of equivalency, modeling process, and the final model specifications and outputs.

3. Duke Energy Program Offerings

The study includes participation in nearly all of Duke Energy's residential low-income and market rate programs from 2013 to 2021, as outlined in Table 7.

Table 7. Duke Energy Programs Included in LMI Study

Program Names(s)	Territories Offered		Years Offered								
	DEC	DEP	2013	2014	2015	2016	2017	2018	2019	2020	2021
Market Rate Programs											
Appliance Recycling Program	✓	✓	✓	✓	✓	✓					
Free LED/CFL Program[a]	✓		✓	✓	✓	✓	✓	✓	✓	✓	
Home Energy House Call Residential Energy Assessments	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Home Energy Improvement Smart$aver HVAC	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
K12	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Multifamily Residential EE Multifamily	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Online Savings Store	✓		✓	✓	✓	✓	✓	✓	✓	✓	✓
Residential New Construction		✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Save Energy in Water Single Family Water Measures	✓	✓		✓	✓	✓	✓	✓	✓	✓	✓
Low-Income Programs											
Low-Income Weatherization	✓				✓	✓	✓	✓	✓	✓	✓
Neighborhood Energy Saver	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Weatherization Pay per kWh Pilot		✓						✓	✓	✓	✓

[a] The Free LED/CFL reached a large proportion of DEC customers between 2013 and 2020. Its wide reach contributes to discrepancies in participation rates between the DEC and DEP territories, and to a sharp decline in the participation rate among DEC customers when the program was discontinued in 2021. However, the program reached LMI and non-LMI customers at an approximately equal rate, and therefore its inclusion in the study does not contribute to differences in participation rates between these groups.

The study includes a wide range of residential programs for single family and multifamily homes, and existing and new construction. The programs included in the study include both free, low-cost, and rebated options and cover a range of measure types including lighting, water measures, envelope upgrades, and HVAC measures.

The study excludes the retail-based Residential Lighting Program due to the inability to trace lighting purchases back to individual Duke Energy customers. It also does not include Duke Energy's behavioral program, the My Home Energy Report Program due to the high rate of penetration and opt-out nature of the program (i.e., customers do not choose to participate).

4. Study Findings

4.1 Characterizing Duke LMI Customers

As of 2021, LMI households made up almost half (43%) of Duke Energy's customer base in the Carolinas. Over 2 million customers live in households that meet low- to moderate-income criteria based on their area median income and household size. The proportion of LMI customers are similar in Duke Energy Carolinas (DEC) and Duke Energy Progress (DEP) service territories. Because low-income households have access to some services and programs that moderate-income households do not, we summarize the distribution of Duke Energy customers in each group in Table 8.

Table 8. Estimated Prevalence of LMI Households in Duke Service Territory

Household Status	All Duke		DEC		DEP	
	Count	%	Count	%	Count	%
Low or Moderate Income	2,060,000	43%	1,300,000	43%	760,000	43%
Low Income	*1,250,000*	*26%*	*790,000*	*26%*	*460,000*	*26%*
Moderate Income	*810,000*	*17%*	*510,000*	*17%*	*300,000*	*17%*
Non-LMI	2,740,000	57%	1,750,000	57%	990,000	57%
Total	4,800,000	100%	3,050,000	100%	1,750,000	100%

Note: Estimated customer counts rounded to nearest ten-thousand

In the absence of household-level data on LMI status for individual Duke Energy customers, we focus much of our analysis on block groups and census tracts in which 80% or more of all households were LMI. In the rest of the report, we refer to these high concentration census block groups and tracts as LMI neighborhoods. As of 2021, 270,000 (6%) Duke Energy customers lived in neighborhoods where at least 80% of households meet LMI criteria. Based on census data, households in these LMI neighborhoods were more likely than those in non-LMI neighborhoods (i.e., those with 20% or fewer LMI households) to live in a multifamily home, rent their homes, and heat with electric fuel. On average, LMI households were more diverse than non-LMI households, and situated in neighborhoods where a higher proportion of the population is non-white. Finally, households in LMI neighborhoods, on average, were more likely to face communication and enrollment barriers such as limited English proficiency and lack of internet access than those in non-LMI neighborhoods. (Figure 1).

While our analysis leverages census data, the trends in demographic and housing characteristics observed at the neighborhood level were generally corroborated in household-level data collected from survey respondents (Appendix D). Figure 1 summarizes Duke's LMI customer characteristics as observed in both census and household data for LMI neighborhoods compared to non-LMI neighborhoods. These characteristics are explored in more detail in the remainder of this section.

Figure 1. Duke Energy LMI Customer Characteristics

43% of Duke Energy's customers in the Carolinas are LMI

270K Duke Energy customers live in neighborhoods where 80% or more of households are LMI

Identify as non-white

LMI	Non-LMI	Source
65%	16%	CENSUS

Lack internet access

LMI	Non-LMI	Source
28%	7%	CENSUS

Live in a household with limited English proficiency

LMI	Non-LMI	Source
5%	1%	CENSUS

Rent their home

LMI	Non-LMI	Source
69%	16%	CENSUS

Live in a single-family home
(NOTE – ONLY ONE LESS LIKELY)

LMI	Non-LMI	Source
51%	87%	CENSUS

Heat primarily with electric fuel

LMI	Non-LMI	Source
69%	50%	CENSUS

Have children in the household

LMI	Non-LMI	Source
3%	21%	SURVEY*

Have someone in their household who requires special medical equipment, more heating/cooling, or higher air quality

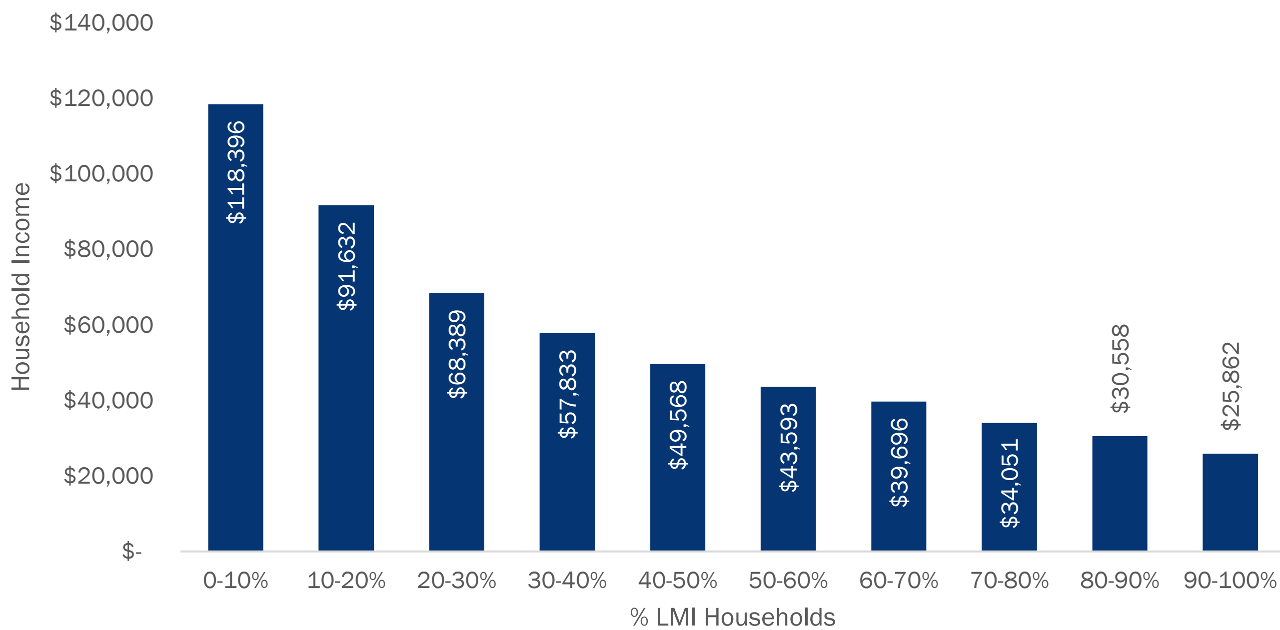
LMI	Non-LMI	Source
23%	6%	SURVEY*

- *As reported by respondents to nonparticipant survey
- Unless otherwise noted, statistics are from American Community Survey data, in which LMI values reflect Census block groups with 80% or more LMI households and non-LMI values reflect Census block groups with 20% or fewer LMI households

Social and Demographic Characteristics

By definition, the more LMI households in a neighborhood, the lower the median household income. In neighborhoods with 10% or fewer LMI households, we found the median household income was $120,000, compared to about $26,000 in neighborhoods where 90% or more of households met LMI criteria (Figure 2).[4] This has major implications both for the ability of these households to afford their energy bills as well as their ability to invest in energy efficiency upgrades that can lower their energy costs overall.

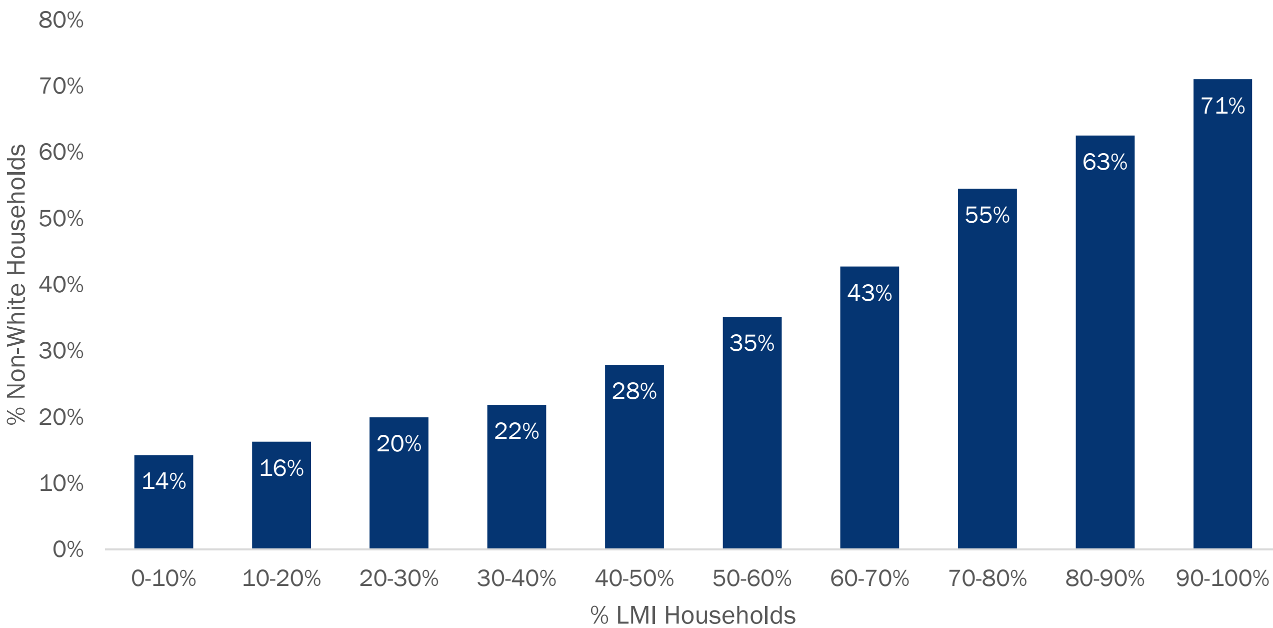
Figure 2. % LMI Households and Median Household Income



The higher the proportion of LMI households in a neighborhood, the greater representation there was from members of disadvantaged groups. Individuals who identify as non-white made up 16% of the population in neighborhoods where 20% or fewer of the households were LMI, but 65% of the population in neighborhoods where 80% or more of households were LMI (Figure 3).

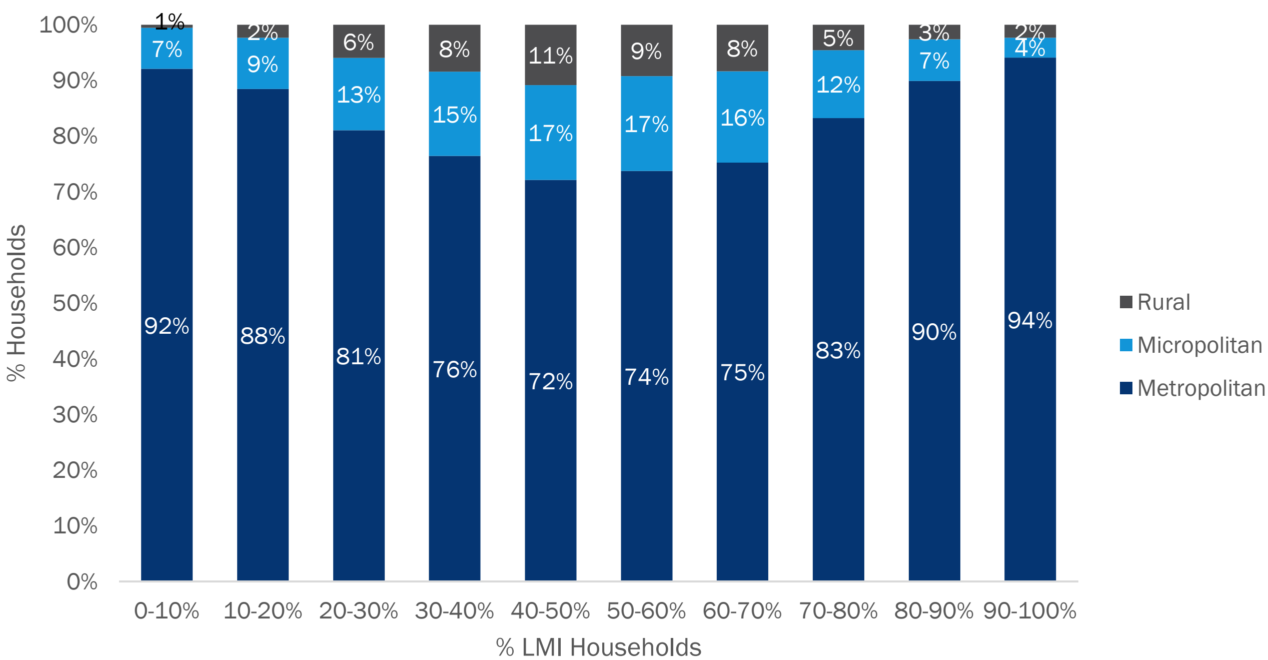
[4] We cannot characterize neighborhoods with a lower percentage of LMI households (50% to 80%) as moderate income neighborhoods. While these neighborhoods have higher median incomes than our LMI neighborhoods, at least half of the households meet this study's definition of LMI, of which some will be low and some moderate income. The remaining households in those neighborhoods exceed the LMI definition. Therefore, we chose to focus most of our analysis and comparisons on low and high LMI neighborhoods.

Figure 3. LMI Households and Percent Non-white Population



Most households in neighborhoods with a high percentage of LMI households fall within a metropolitan statistical area, which the US census defines as having at least one urbanized area with 50,000 or more inhabitants (Figure 4). High LMI neighborhoods have similar population densities to neighborhoods with few LMI households. Compared to low and high LMI neighborhoods, neighborhoods that have a moderate percentage of LMI households (30% to 70%) are more likely to have households in both micropolitan (at least one area with between 10,000 and 50,000 inhabitants) and rural areas.

Figure 4. LMI Households and Population Density



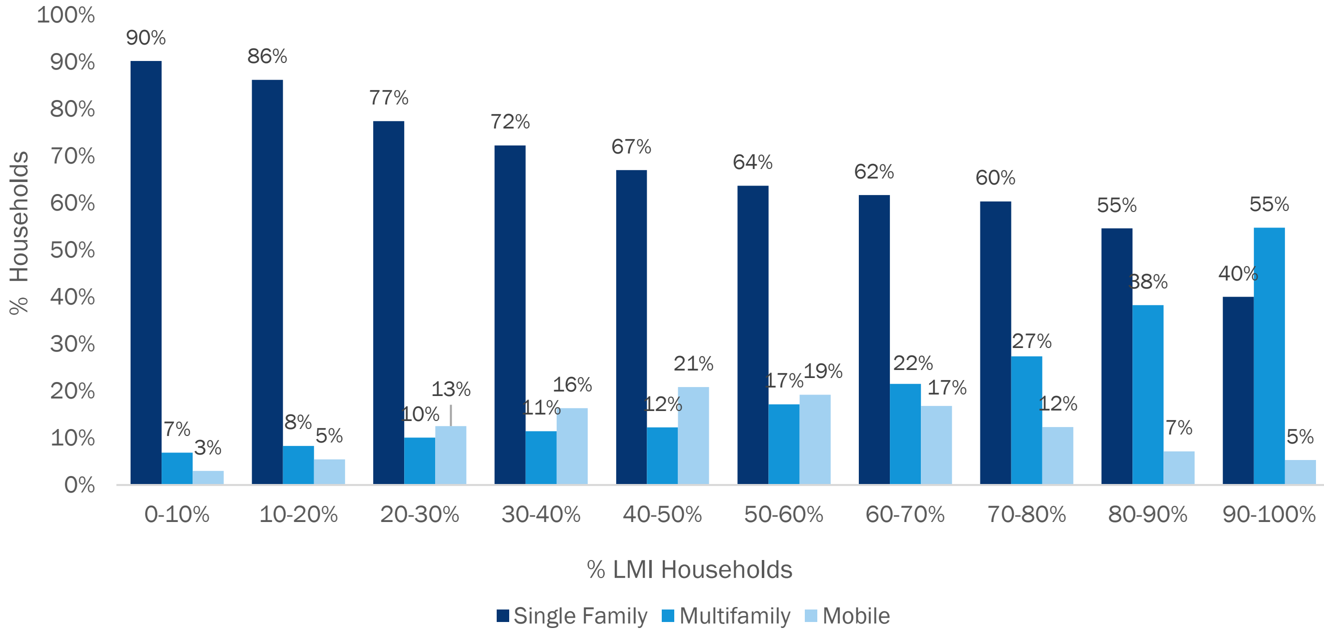
Neighborhoods with a high proportion of LMI households also tended to have a higher share of households that faced barriers to accessing resources such as social services and energy efficiency programs. These barriers included lack of internet access and limited ability to communicate in English. In neighborhoods where only 20% or fewer households were LMI, 7% of households lacked internet access, but in neighborhoods where at least 80% of households were LMI, 28% of households lacked internet access. Similarly, in neighborhoods where 20% of households were LMI, 1% of households had limited ability to communicate in English, compared to 5% of households in neighborhoods with 80% or more households that met LMI criteria.

Housing Characteristics

Neighborhoods with a high proportion of LMI households had very different housing stock and occupant characteristics than neighborhoods with fewer LMI households, suggesting that program eligibility, needs, and interest may vary in important ways between these groups.

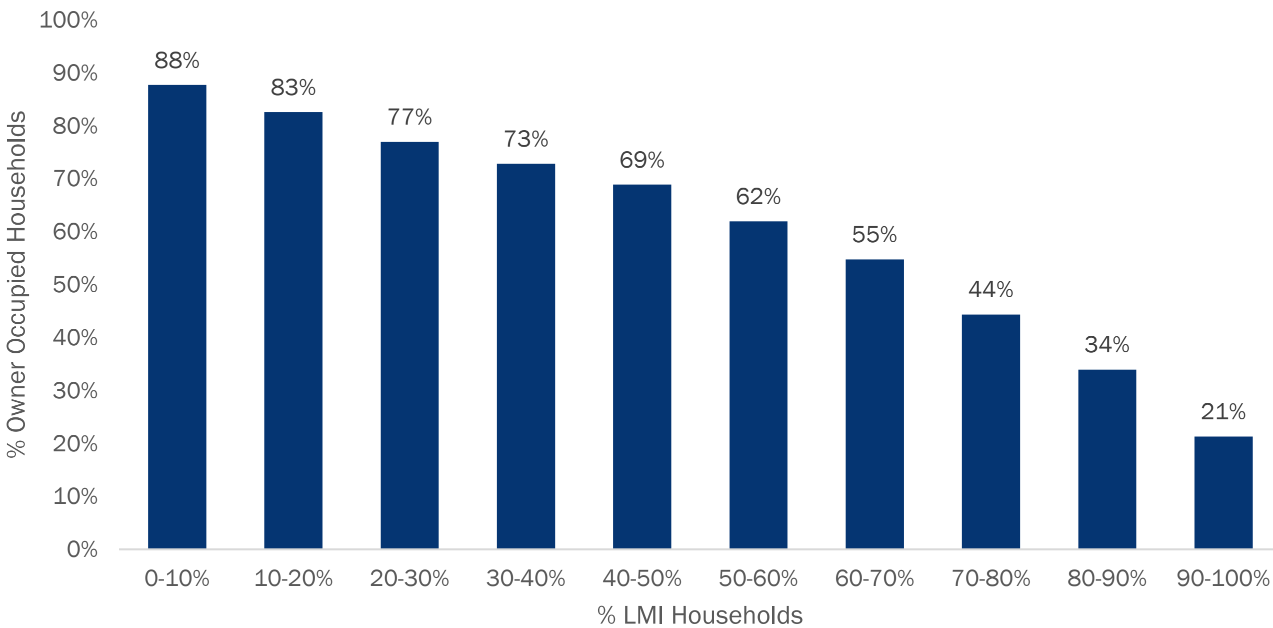
In neighborhoods where 20% or fewer of households were LMI, 87% of homes were single family, compared to 51% of homes in neighborhoods where 80% or more of households were LMI. Neighborhoods with a high proportion of LMI households had a much greater incidence of multifamily homes. Mixed-income neighborhoods had the highest proportion of mobile homes (Figure 5).

Figure 5. LMI Households and Percent Housing Units by Type



In neighborhoods where 20% or fewer of households were LMI, the vast majority (84%) of homes were owner occupied. In contrast, in neighborhoods where 80% or more of households met LMI criteria, only 31% of housing units were owner occupied (Figure 6). The split incentive problem is a well-known challenge for serving customers who rent and pay their own utility bills. Because the landlord does not receive the benefit of bill savings from energy efficiency improvements, there is little incentive to choose more expensive efficient versions of equipment or to make weatherization upgrades. Given the disproportionate representation of LMI households among renters, it will be important to have participation processes that overcome the barriers renters face to maximize support for LMI customers from Duke Energy programs.

Figure 6. LMI Households and Percent Owner Occupied Housing Units



Duke Energy's LMI customers are likely to move more frequently than non-LMI customers. Because customers open a new account whenever they move, the younger average age of Duke Energy accounts among LMI households (4 years vs. 7 years for non-LMI customers), suggests more frequent relocation, which may be associated with underlying factors such as renting rather than owning the home, housing instability, and housing affordability. The more transient nature of Duke Energy's LMI customer base may both increase their need for Duke Energy's services (since they theoretically have a new opportunity to participate in each subsequent home) while also introducing challenges such as split incentives.

Energy Use and Burden

On average, households in LMI neighborhoods within the Duke Energy service territory consumed less energy than households in non-LMI neighborhoods (Table 9). This was likely due to a combination of factors, including smaller housing units, a greater number of multifamily households, and greater efforts to reduce energy consumption among LMI customers to save money on bills.

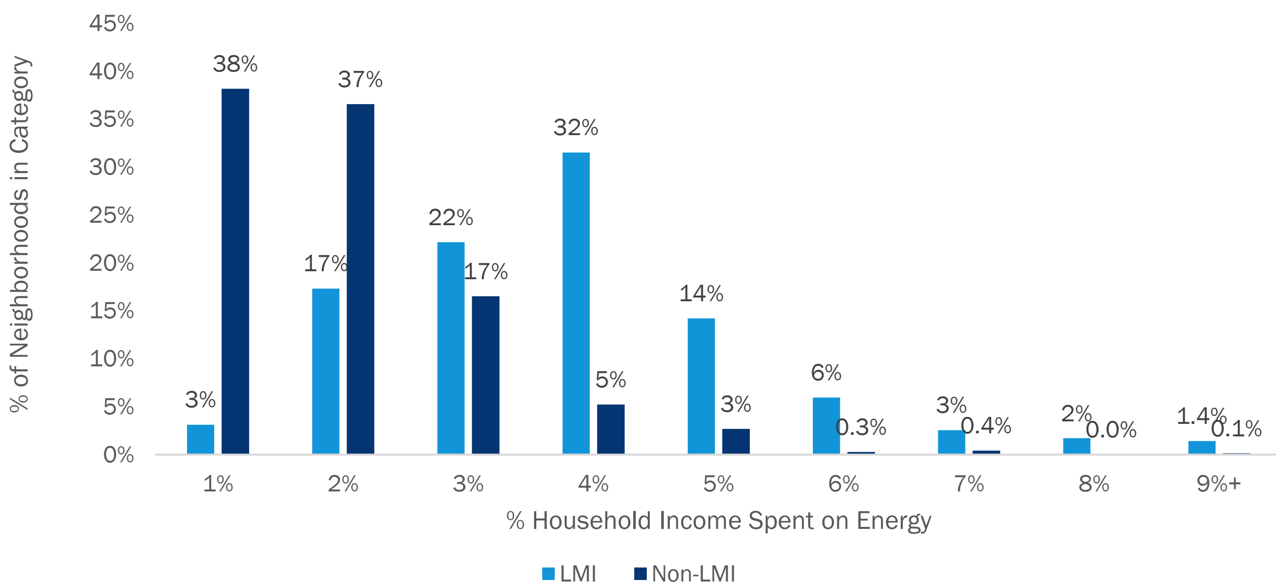
Table 9. Average Daily Consumption by Group

LMI Status of Neighborhood	Average Daily Consumption (kwh)
80% or more LMI	19.5
21 to 79% LMI	24.8
20% or less LMI	29.6

Despite the lower energy consumption observed among households in neighborhoods with a high percentatge of LMI households, Duke Energy's territory, households in LMI neighborhoods had slightly higher energy burdens, on average, than households in non-LMI neighborhoods. Energy burden is a measure of the percentage of household income spent on energy bills. The average energy burden in LMI neighborhoods was

3.8%, compared to 2.0% in non-LMI neighborhoods. More importantly, households located in neighborhoods in which 80% or more are LMI were much more likely to experience moderate to high energy burdens (over 6%) compared to households in neighborhoods fewer than 20% are LMI. In high LMI neighborhoods, it6.4% of households have an average energy burden over 6% compared to 0.5% of low LMI neighborhoods.[5] Figure 7 summarizes energy burdens in LMI and non-LMI neighborhoods.

Figure 7. Energy Burden in LMI and Non-LMI Neighborhoods



The discrepancy between LMI and non-LMI energy burden is likely to be even greater at the individual household level than what can be observed at the neighborhood level. The Home Energy Affordability Gap study found that in North Carolina in 2021, households below 50% of the Federal Poverty Level dedicated, on average, 29% of their annual household income towards home energy bills. Whereas, households between 50% and 100% of the Federal Poverty Level dedicated an average of 16% of their annual household income towards home energy bills.[6] Likewise, in South Carolina, households below 50% of the Federal Poverty Level paid 31% of their annual household income on home energy bills and households between 50% and 100% of the Federal Poverty level paid 16% of their annual household income on home energy bills.[7] This suggests that neighborhood-level data masks household-level variation in energy burden, which is likely to be a very real burden for low-income households, i particular. Data from interviews and surveys with Duke Energy's LMI customers support this hypothesis, with many respondents stating bill affordability is a major challenge and reducing energy costs is a high priority.

[5] A moderate residential energy burden is more than 6% of income and a high residential energy burden is more than 10% of income. APPRISE (Applied Public Policy Research Institute for Study and Evaluation). 2005. *LIHEAP Energy Burden Evaluation Study*. Washington, DC: HHS (Department of Health and Human Services). https://www.acf.hhs.gov/sites/default/files/documents/ocs/comm_liheap_energyburdenstudy_apprise.pdf

[6] Fisher, Sheehan & Colton. 2022. North Carolina: The Home Energy Affordability Gap 2021. http://www.homeenergyaffordabilitygap.com/03a_affordabilityData.html

[7] Fisher, Sheehan & Colton. 2022. South Carolina: The Home Energy Affordability Gap 2021. http://www.homeenergyaffordabilitygap.com/03a_affordabilityData.html

The differences observed between LMI and non-LMI neighborhoods are important for understanding the energy efficiency needs, barriers, motivations, and impacts of Duke Energy's LMI customers.

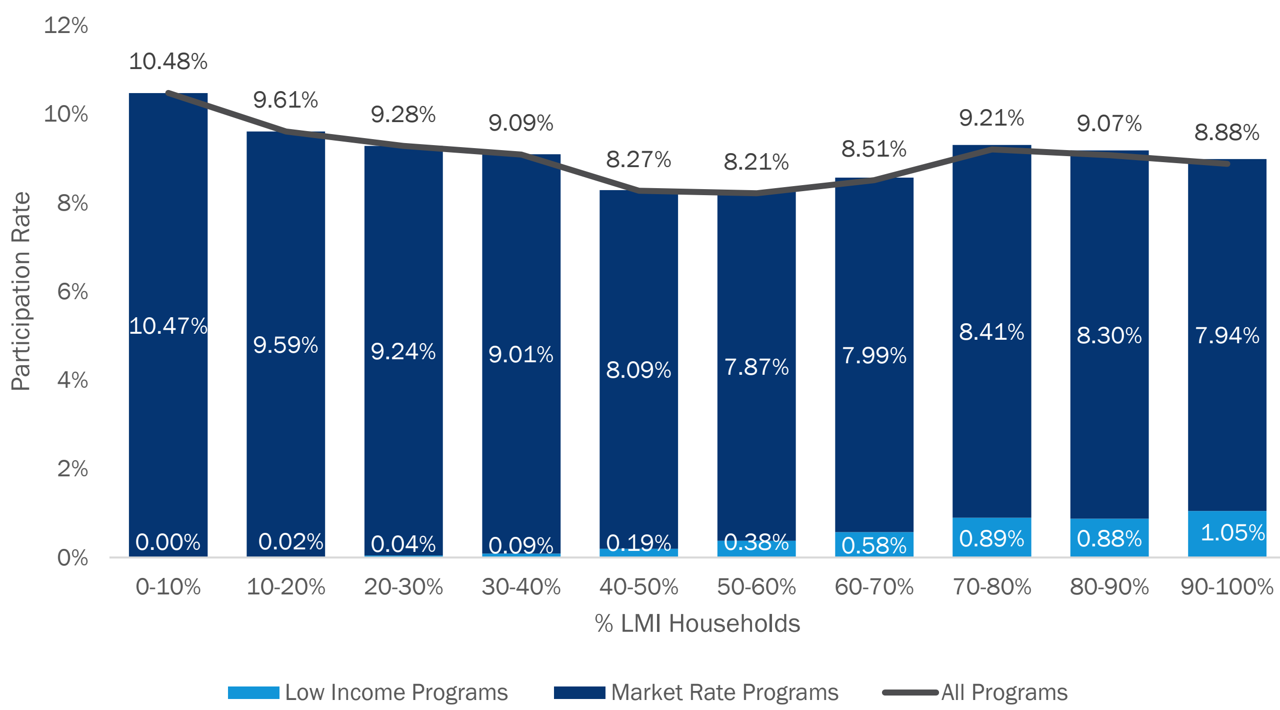
4.2 Program Participation Among LMI Customers

Program Participation Rates

Between 2013 and 2021, average annual participation in Duke Energy programs was slightly lower in neighborhoods that have a moderate to high percentage of LMI households compared to those with few LMI households.[8] Program participation was lowest in neighborhoods that have a moderate percentage of low-income households (Figure 8). In neighborhoods where between 40% to 50% of households are LMI, an average of 8.27% of households participated in Duke Energy programs each year compared to 8.88% in neighborhoods with a high percentage of LMI households (90% or more) and 10.48% of households in neighborhoods with few LMI households (less than 10%).

Both moderate and high LMI neighborhoods have lower participation rates in market rate programs (~ 8%) compared to low LMI neighborhoods (~10%). But in high LMI neighborhoods, a small but meaningful percentage of households (~1%) participate in low income programs, which somewhat makes up for their lower participation in market rate programs. In neighborhoods with a moderate percentage of LMI households, fewer participate in low income programs (less than 0.5%).

Figure 8. LMI Households and Annual Program Participation Rates by Program Type[a]



[8] Annual participation rates were calculated as the number of participating accounts in a given year divided by the number of active accounts in the same year. Participation rates for the entire study period were calculated as participating accounts divided by total accounts active at any point in the study period.

[a] Percentages reflect the percentage of customers who participated in at least one program of each type in a single year. Because customers could participate in both a low income and market rate program in a single year, the percentages for "All Programs" may be less than the sum of the percentage who participated in low income and market rate programs.

DEC had much higher participation in market rate programs than DEP due to the Free LED/CFL program offered by DEC. Comparing just those neighborhoods with a low percentage (less than 20%) and high percentage (80% or more) of LMI households, we found that while overall participation rates were lower in DEC territory than in DEP territory, the percentage point difference in participation rates between households in LMI and non-LMI neighborhoods was similar for both territories. In both DEC and DEP, customers in LMI neighborhoods are slightly less likely to participate in market rate programs and in high savings program offerings compared to customers in non-LMI neighborhoods (Table 10).[9]

Table 10. Participation Rate Summary[a]

Territory	Program Types	LMI	Non-LMI
DEC	**All Programs**	**11.96%**	**12.77%**
	Market Rate	11.12%	12.76%
	Low Income	0.99%	0.02%
	High Savings	3.00%	3.90%
DEP	**All Programs**	**3.56%**	**4.49%**
	Market Rate	2.80%	4.49%
	Low Income	0.79%	0.01%
	High Savings	2.70%	3.30%
Overall	**All Programs**	**9.03%**	**9.83%**
	Market Rate	8.21%	9.81%
	Low Income	0.92%	0.01%
	High Savings	2.90%	3.70%

[a] Percentages reflect the percentage of customers who participated in at least one program of each type in a single year. Because customers could participate in both a low income and market rate program in a single year, the percentages for "All Programs" may be less than the sum of the percentage who participated in low income and market rate programs.

Among households in both LMI and non-LMI neighborhoods, participation rates in Duke Energy programs have fluctuated over time. In the DEC territory, there was a sharp decrease in both LMI and non-LMI participation rates between 2019 and 2021 (Figure 9). In DEP territory, rates have generally increased over time, with a large jump in LMI participation rates between 2015 and 2017 before falling below non-LMI participation rates in subsequent years (Figure 10). It is possible that recent decreases are driven, at least in part, by the COVID-19 pandemic. In the DEC territory, the decrease was also affected by discontinuation of the Free LED/CFL program. In DEC territory, LMI and non-LMI customer participation rates have followed similar trends over time, whereas in DEP territory LMI participation rates tended to diverge from non-LMI rates and to vary more by year than non-LMI rates.

[9] High savings offerings are defined as those participation instances in which the ex ante savings of the household are greater than the mean ex ante savings of all households participating in that year.

Of customers who participated in one or more Duke Energy programs between 2013 and 2021, the vast majority (68%) participated in just one program. This analysis accounts for recurring participation customers who moved and opened a new account under the same customer ID. Households in LMI neighborhoods were less likely to participate in more than one program (21%) compared to households in non-LMI neighborhoods (31%).

Figure 9. DEC Participation Rates Over Time

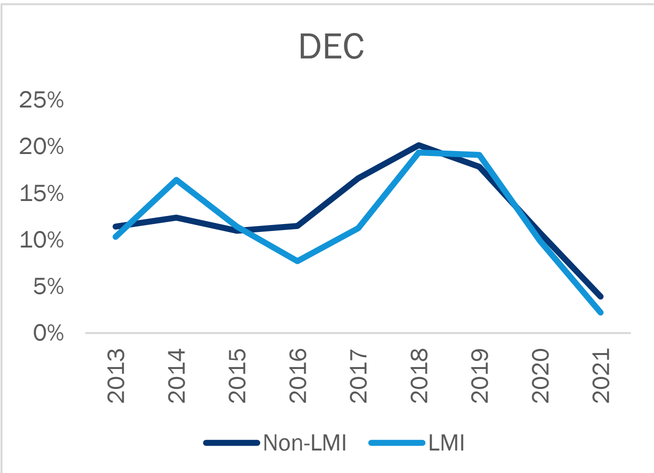
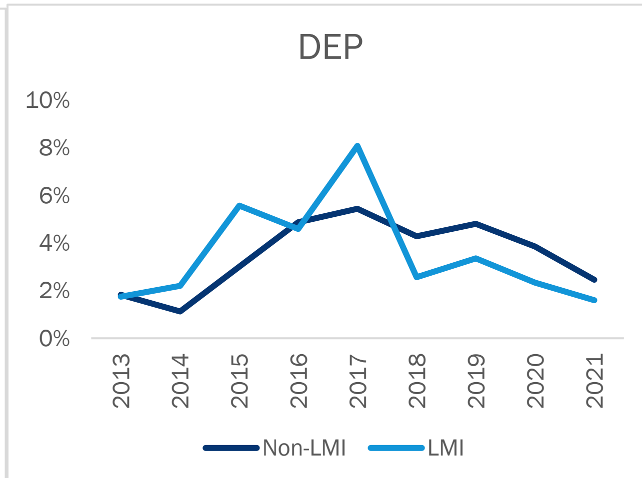
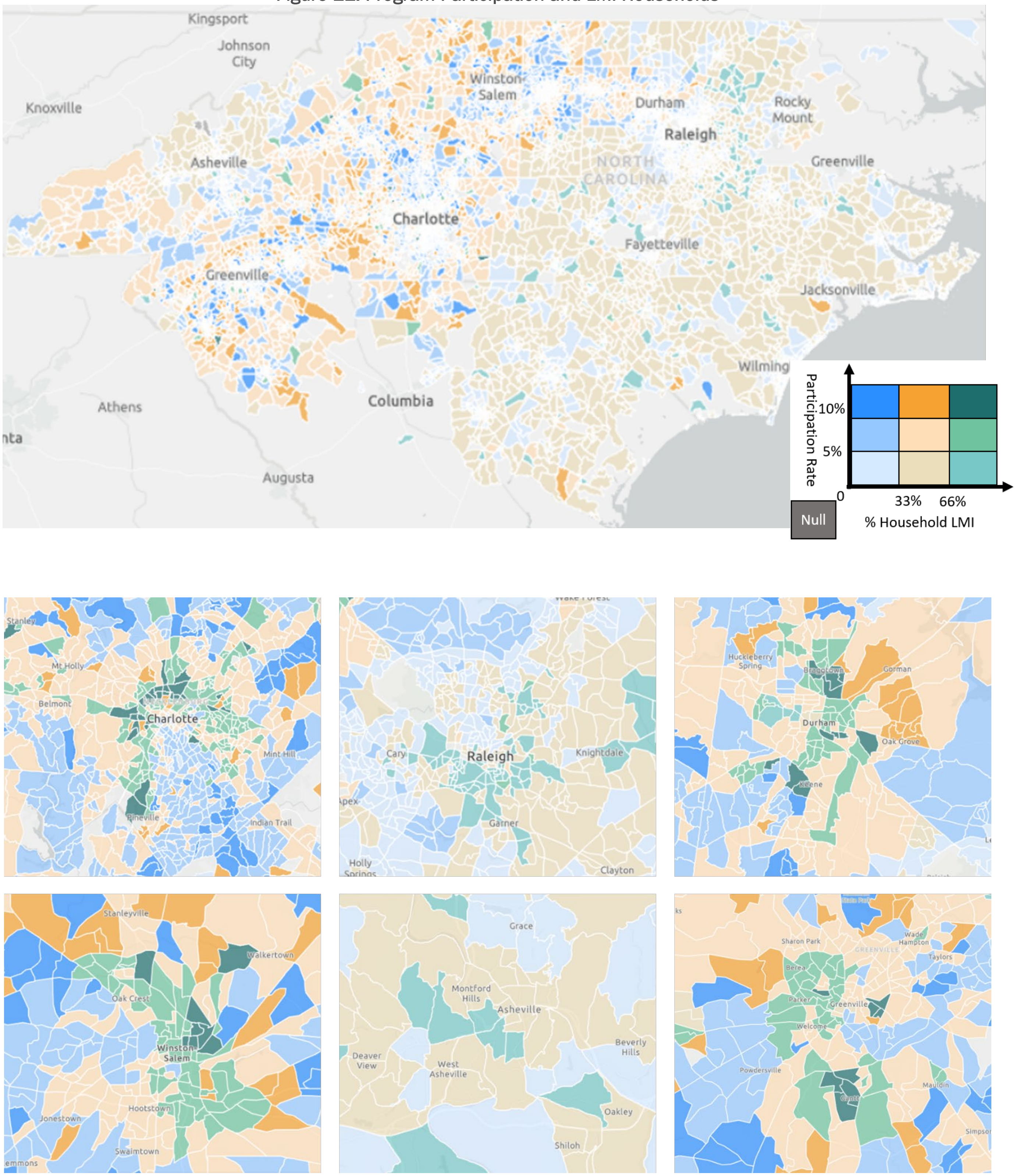


Figure 10. DEP Participation Rates Over Time



Within each jurisdiction, there was geographic variation in program participation rates. Figure 11. Program Participation and LMI Households illustrates the relationship between the proportion of LMI households in each census block group and the participation rate. Green neighborhoods had the highest proportion of LMI customers, while blue neighborhoods had the lowest proportion. Darker shaded neighborhoods within each color had higher participation rates than lighter-shaded neighborhoods. Outside of urban areas, it was rare to observe neighborhoods with a high proportion of LMI households and high rate of participation, while Duke Energy was sometimes reaching a high proportion of LMI households in urban neighborhoods. There were also large swaths of the Carolinas comprised of mixed-income neighborhoods, where about half of households were LMI, with low participation rates.

Figure 11. Program Participation and LMI Households

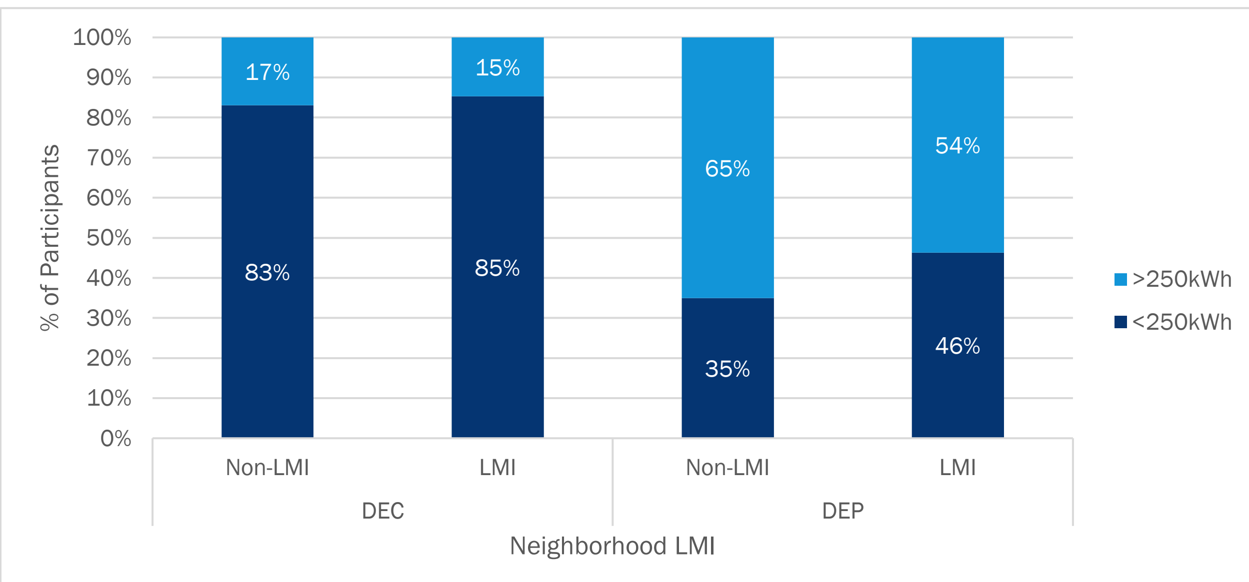


Program Types and Savings Potential

During the study period, customers in LMI neighborhoods participated at slightly lower rates in Duke Energy programs compared to those in non-LMI neighborhoods. Customers in LMI neighborhoods may also participate in different program offerings than those in non-LMI neighborhoods, which may affect their savings potential and the benefits they realize from participation.

To examine whether participation differs by program savings, we grouped programs into two categories: (1) programs with potential savings below 250 kWh and (2) those with savings above 250 kWh.[10] Figure 12 shows the percentage of participants in each program savings level for LMI and non-LMI neighborhoods. We provide results separately for DEP and DEC because of the large number of participants in DEC's free CFL/LED program, which had lower savings compared to many programs. For DEC, because the free lighting program had more participants than any other program, a majority of participants participated in a lower savings program, and there was little difference in participation rates for LMI compared to non-LMI neighborhoods. For DEP, we found that customers from non-LMI neighborhoods were more likely to participate in programs with higher savings potential than customers from LMI neighborhoods. Two-thirds of participants in non-LMI neighborhoods (65%) participated in higher savings programs compared to slightly over half in LMI neighborhoods (54%).

Figure 12. Participation by Program Savings Potential and Neighborhood LMI Composition



To dig deeper into LMI customer participation, we looked at LMI customer participation levels across specific programs. Six percent of Duke Energy customers live in neighborhoods where 80% or more of households are LMI. If a program serves LMI and non-LMI households equally, it should draw 6% of its participants from LMI neighborhoods. Programs with participation rates below 6% indicate that customers from LMI neighborhoods are underrepresented and those above 6% indicate LMI neighborhoods are overrepresented.

[10] For program savings, we used ex ante savings values from program tracking data for each program measure. A program's total savings could be based on multiple measures. Per-household savings vary based on measure mix and changes in ex ante savings projections over time.

DEC's free LED/CFL program drew 6% of its participants from LMI neighborhoods indicating that customers from LMI neighborhoods were as likely to participate as those from non-LMI neighborhoods (Table 11). However, for most programs, less than 6% of participants lived in LMI neighborhoods, suggesting that LMI customers were under-served by these offerings. LMI customer participation is lowest (2%) in those market rate offerings with the highest savings potential: Home Energy House Call/Residential Energy Assessments (average savings of 856 kWh per household) and Home Energy Improvement/Smart$aver HVAC (average savings of 498 kWh per household). These higher savings programs typically require a much greater upfront investment on the part of the customer. Among market rate offerings, LMI customer participation was highest in multifamily programs, where LMI customers comprise 15% of participants. This above-average participation helps to offset lower levels of LMI customer participation in other market rate offerings.

Table 11. Summary of Participation by Program

Program	Total Participants in Study Period [a]	% of Participants from LMI Neighborhoods			Average Ex Ante Savings (kWh) [b]
		DEC	DEP	Overall	
Market Rate Programs					
Appliance Recycling Program	38,800	3%	3%	3%	437
Free LED/CFL Program	1,988,300	6%		6%	23
Home Energy House Call Residential Energy Assessments	120,100	2%	2%	2%	856
Home Energy Improvement Smart$aver HVAC	195,900	1%	2%	2%	498
K12	223,100	5%	4%	4%	256
Multifamily Residential EE Multifamily	257,900	16%	13%	15%	260
Online Savings Store	241,900	2%	2%	2%	136
Residential New Construction	24,600		2%	2%	347
Save Energy in Water Single Family Water Measures	455,100	3%	2%	3%	337
Low-Income Programs [c]					
Low-Income Weatherization	4,100	10%		10%	2,169
Neighborhood Energy Saver	79,600	23%	14%	20%	443
Weatherization Pay per kWh Pilot	300		0.3%	0.3%	968

[a] Participant count rounded to nearest hundred.

[b] Savings based on ex ante values as provided in program tracking data. Value represents average of total per-household savings when savings from all measures are combined. Per-household savings vary based on measure mix and changes in ex ante savings projections over time.

[c] Percentage of customers coming from LMI neighborhoods is less than 100% for low-income offerings due to differences in how low-income status is qualified between the programs and this study, and because moderate-income households do not qualify for these programs but are included in the study.

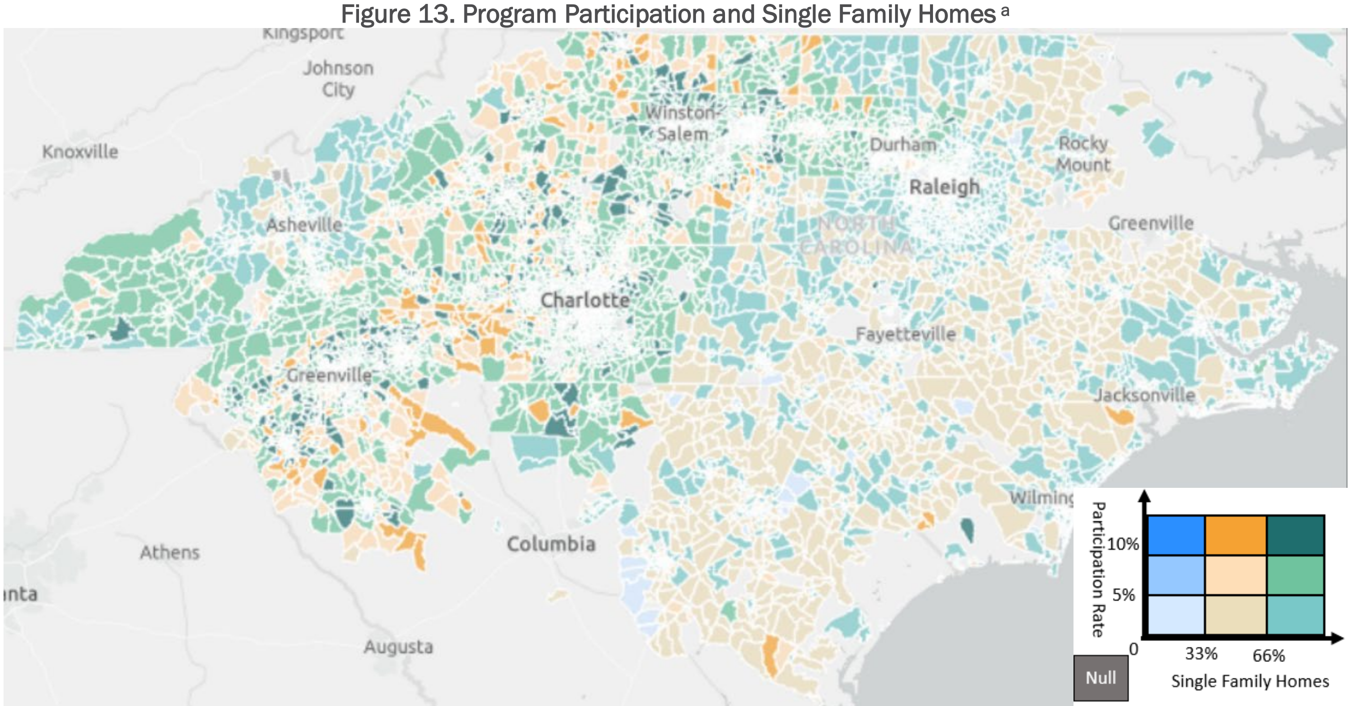
Low-income programs make up a small but meaningful percentage of participation, particularly in those neighborhoods where Duke Energy has focused efforts to reach low-income customers and can provide an opportunity for low-income households to achieve more substantial savings than typically achieved through market rate programs. For example, the Neighborhood Energy Saver program had the highest rate of LMI customer participation of all programs analyzed (20%), with moderately high per-household savings projections. The Low-Income Weatherization Program achieved the highest per-household savings of all programs included in the study but reached very few customers (Table 11). This underscores the reality that despite the importance of low-income programs to meet the needs of low-income customers, in almost all neighborhoods, the vast majority of program participation was driven by market rate programs. In addition, moderate income customers who do not qualify for low-income offerings but still struggle to pay their energy bills would benefit from greater access to market rate offerings.

Relationship Between Participation and LMI Customer Characteristics

While program participation rates do not correspond strongly with LMI status, they do fluctuate based on housing and economic characteristics related to LMI status.

In general, program participation rates were higher in neighborhoods with a greater proportion of single family homes. The average participation rate in neighborhoods where at least 80% of households reside in single family homes was 3.5%, compared to 2.1% in neighborhoods where 20% or fewer households reside in single family homes. As discussed previously, LMI customers were less likely to reside in single family homes compared to non-LMI customers. Figure 13 shows the relationship between home type and program participation across the Duke Energy territory in the Carolinas. Neighborhoods with a moderate to high proportion of single family homes were more likely to have high participation rates, whereas neighborhoods with few single family homes rarely had high participation rates.

Figure 13. Program Participation and Single Family Homes [a]



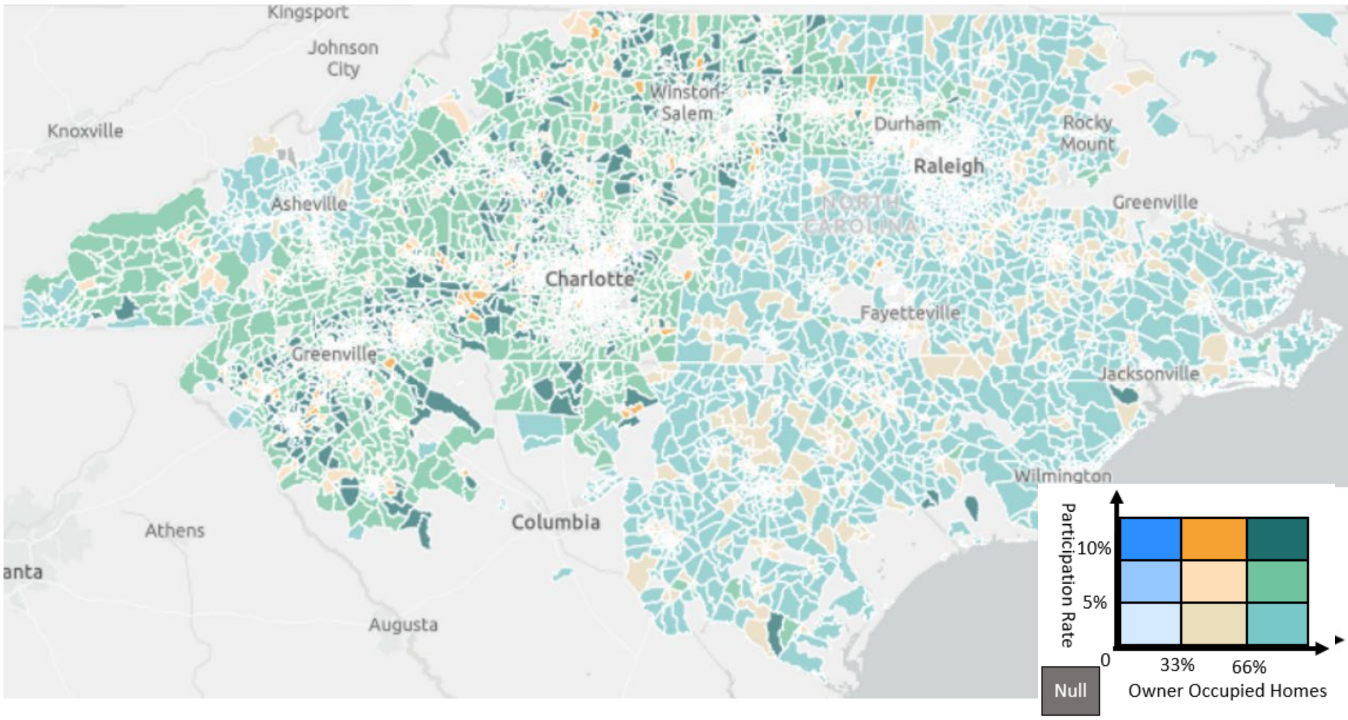
[a] Detailed maps showing participation rates in urban areas are available in Appendix A.

Program participation rates were also higher in neighborhoods with a greater proportion of owner-occupied homes.[11] The average participation rate in neighborhoods where at least 80% of customers own their homes was 3.5%, compared to 2.4% in neighborhoods where 20% or fewer households own their homes. This is important because LMI customers were less likely to own their home compared to non-LMI customers. Neighborhoods with a high proportion of single family homes were much more likely to achieve moderate to high participation rates, whereas when home ownership dipped to even moderate levels, neighborhoods were

[11] These characteristics are correlated. Homeowners are more likely to live in single family homes, while renters are more likely to reside in multifamily homes.

unlikely to reach high participation levels (Figure 14). There were some notable exceptions in the urban cores of Charlotte, Durham, and Winston-Salem, which Duke Energy may wish to explore in order to better understand how these pockets of success could be replicated and expanded.[12]

Figure 14. Program Participation and Owner Occupied Units [a]

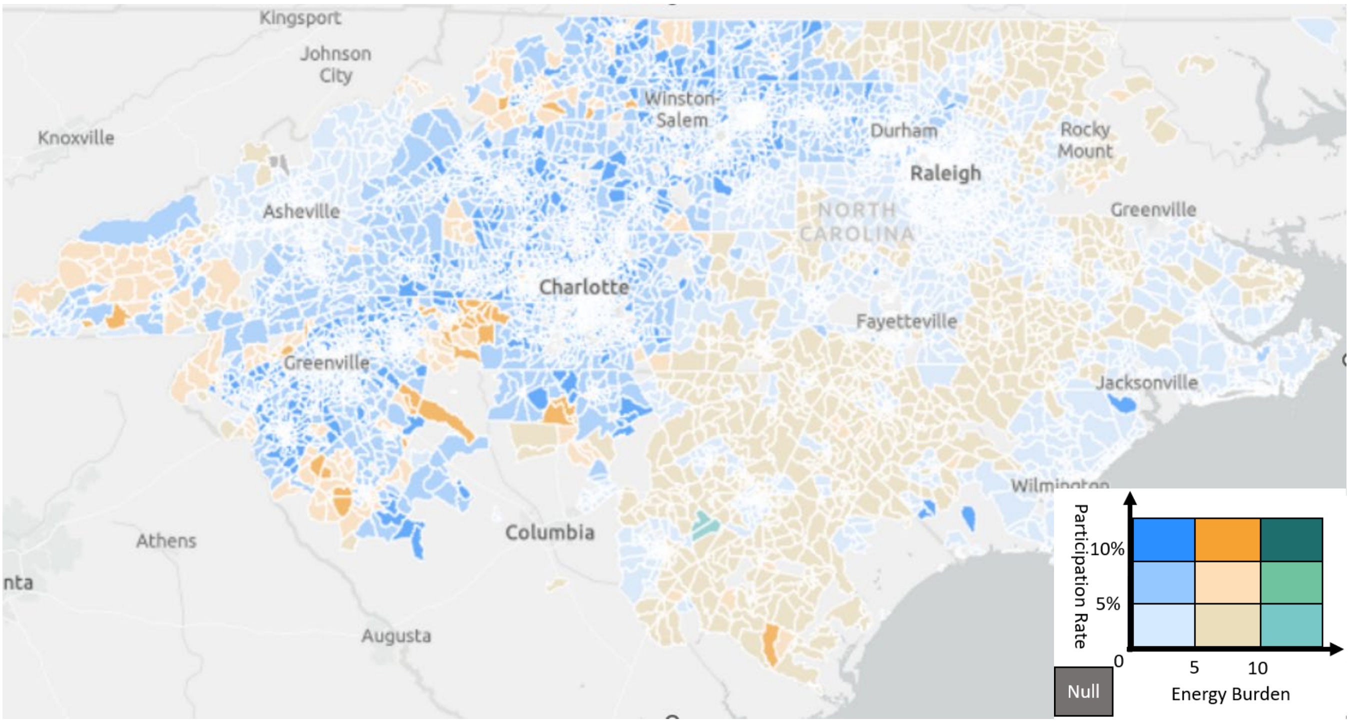


[a] Detailed maps showing participation rates in urban areas are available in Appendix A.

Program participation rates were generally lower in those neighborhoods where customers faced the highest energy burdens. The average participation rate in neighborhoods with an average energy burden of more than 6% was 2.6% compared to 3.1% in neighborhoods with an average energy burden of 6% or less. Most neighborhoods with a moderate energy burden had low participation rates, whereas neighborhoods with low energy burdens often achieved moderate to high participation rates (Figure 15). This matters because LMI customers had a higher average energy burden than non-LMI customers, although this effect is somewhat muted in the neighborhood-level data.

[12] Appendix A includes maps of the urban areas noted here.

Figure 15. Program Participation and Energy Burden [a]



[a] Detailed maps showing participation rates in urban areas are available in Appendix A.

4.3 Drivers of and Barriers to Participation Among LMI Customers

Our descriptive analysis showed that while program participation rates did not vary substantially between LMI and non-LMI households, LMI customers were different from non-LMI customers in important ways. These differences in demographic, housing, and economic characteristics result in unique barriers and motivations to program participation. We explored these barriers through both statistical analysis and primary research with Duke Energy customers, both of which are presented in this section.

Neighborhood Level Findings: Participation Model

To understand the impact of LMI status on Duke Energy program participation rates, we fit a linear regression model using census and participation data that assessed the relationship between a variety of housing, sociodemographic, and energy consumption characteristics at the neighborhood level and Duke Energy program participation rates.

There are three key insights that emerged from this analysis:

- Housing and sociodemographic characteristics are stronger predictors of program participation than is LMI status alone.
- Different factors predict participation in high savings offerings than in low savings offerings.
- There is variation within neighborhoods. Neighborhood-level analysis is likely to obscure household-level differences that would more strongly predict participation in Duke Energy programs.

We explore each of these findings in more depth below. We provide more detail on data cleaning and model specifications in Appendix B.

Importance of LMI Status vs. Other Characteristics

As we documented earlier, compared to non-LMI households, LMI households are more likely to face barriers to participation in Duke Energy programs such as renting their homes or lacking internet access. To assess the relative impact of different barriers to participation and whether there are some additional unmeasured factors associated with being an LMI household that could impact participation, we tested models that included LMI status only, sociodemographic and housing characteristics only, and models including predictors from both categories. We found that the models with the best explanatory power were those that included only the sociodemographic and housing characteristics and excluded LMI status. Model results suggests the underlying characteristics associated with LMI status, and not the fact of being an LMI household, most impacted the decision to participate in a Duke Energy program. Because LMI households faced these barriers at higher rates than other households, they likely faced barriers to accessing energy efficiency programs that non-LMI households did not. To successfully engage LMI households, it is important to address underlying differences that correlate with LMI status, rather than LMI status alone, as these differences are what drive and prevent program engagement.

Drivers of Participation in High vs. Low Savings Offerings

We ran separate models for low and high savings programs to determine if there were different drivers and barriers to participation by savings level. Like the model we ran predicting participation across all programs, we found no independent impact from LMI status in models that also included sociodemographic and housing characteristics for either low or high savings programs.

We found different factors contributed to the decision to participate in low and high savings programs (Table 12). Our analysis showed neighborhoods that were urban, had more single family homes, more homes with electric heating fuel, and higher average household energy consumption had higher participation rates in high savings offerings. Neighborhoods with lower average household energy consumption were more likely to participate in programs with low potential savings. Our analysis also showed some unexpected results.

We found that neighborhoods with a higher proportion of non-white residents were more likely to access high savings opportunities, potentially as a result of a higher concentration of non-white customers in urban areas, where participation rates also tended to be higher. Similarly, neighborhoods with a higher proportion of households without internet access participated at a higher rate in high savings opportunities. The reason for this is less clear, but these findings could be driven by Duke Energy outreach in neighborhoods with poor internet access.

The factors that correspond with participation rates in low savings offerings were less clear, suggesting that Duke Energy is reaching a more diverse customer base with these offerings. For example, the analysis shows that neighborhoods in both cities and towns, and with a high proportion of white or non-white residents, were likely to have high participation rates in these offerings. Neighborhoods with high average energy consumption, high rates of electric heating fuel, and high energy burden were less likely to participate in low savings opportunities.

Table 12. Participation Model Results

Characteristic	High Savings Model Statistic	Low Savings Model Statistic
High Proportion Homeowners	0.324	0.770
High Proportion Renters	0.051	-0.135
Neighborhood is in City	0.621*	2.820*
Neighborhood is in Town	0.358*	2.638*
High Proportion Non-White Residents	0.682*	0.876*
High Proportion White Residents	-0.016	1.168*
High Proportion Single Family Housing [a]	0.463*	-0.107
Low Average Household Energy Consumption	-0.915*	0.709*
High Average Household Energy Consumption	0.459*	-0.960*
Very High Proportion Electric Heating Fuel	0.426*	-2.180*
High Proportion Electric Heating Fuel	0.117*	-0.500*
High Average Energy Burden	0.197*	-2.546*
High Proportion Households without Internet Access	0.475*	0.022

*Statistically significant at 90% confidence level
[a] Defined as homes with five units or fewer

The drivers of participation in high-savings programs are associated with LMI status in important ways that may affect the likelihood of LMI households to engage with high savings offerings from Duke Energy. In Table 13, we summarize the different characteristics that are associated with participation, whether LMI neighborhoods have higher or lower rates of each characteristic, and the combined overall impact of each on LMI participation. The color coding reflects the overall impact with light blue indicating characteristics that are associated with increased LMI participation and purple indicating lower participation. We find that the strong correlation between single family housing and high energy consumption and participation in Duke Energy programs may translate to lower participation rates for LMI households because LMI households are much less likely to live in single family homes and have higher consumption levels. Neighborhoods with a greater share of households that are non-white or lack internet access (characteristics that are more common in LMI neighborhoods) also participate at higher rates. This result runs counter to our expectations. It is possible that once we control for characteristics like housing type or urban/rural in the model, neighborhoods with higher rates of non-white households or that lack internet access participate at greater rates than expected.

Table 13. Relationship Between High-Savings Predictors and LMI Status

Characteristic	Impact on Participation	Relationship with LMI	Overall Impact on LMI Participation
Neighborhood is in City	Positive	None	Neutral
High Proportion Non-White Residents	Positive	Much more likely	Positive
High Proportion Households Without Internet Access	Positive	Much more likely	Positive
High Proportion Electric Heating Fuel	Positive	Somewhat more likely	Positive
High Proportion Single Family Housing	Positive	Much less likely	Negative
High Average Household Energy Consumption	Positive	Much less likely	Negative

Variation Within Neighborhoods

The overall explanatory power of the models used in this analysis is low, explaining only 16% of the variation in program participation rates between census block groups. It is likely that household-level variation within neighborhoods (i.e., differences between LMI and non-LMI households, and between LMI households with different circumstances) limits the explanatory power of data once aggregated to the neighborhood level. The next section further explores the experience of LMI customers using household-level data collected through primary research.

Household-Level Findings: Customer Survey

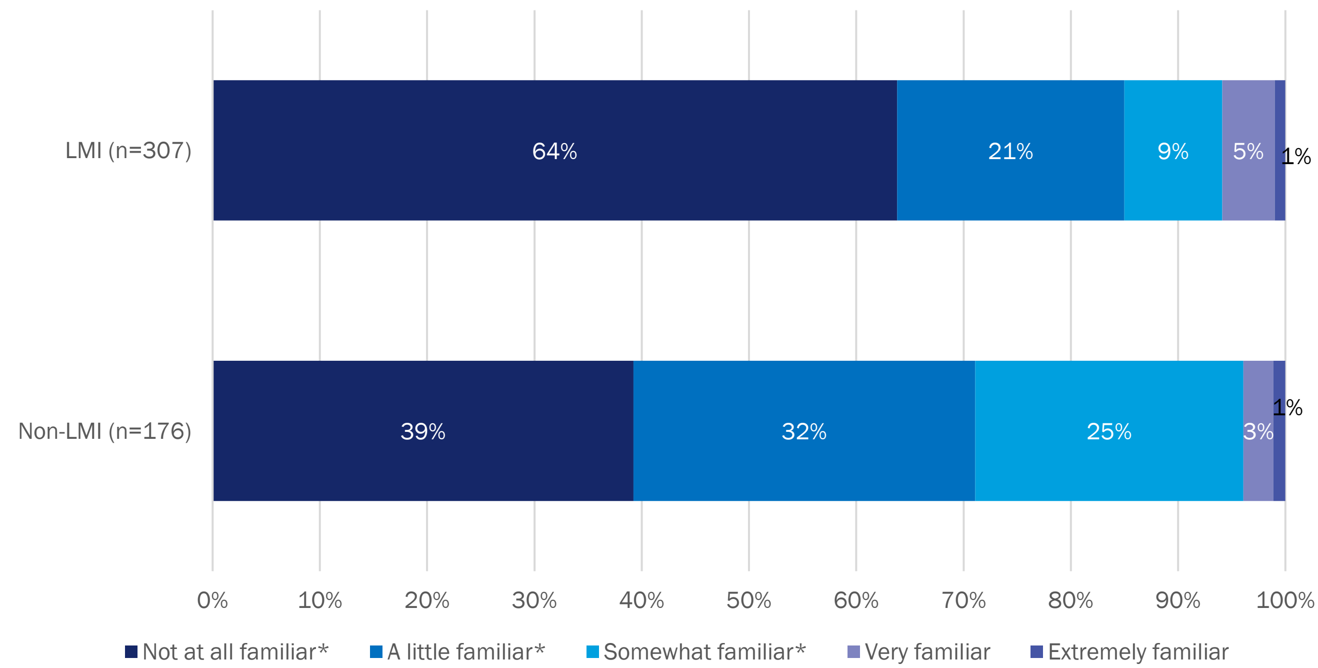
As part of our multi-level analysis, we also conducted research with participating and nonparticipating Duke Energy customers to understand their individual experiences, their motivators for and barriers to participation, and how they preferred to learn about energy efficiency offerings. This research builds on findings from the statistical model and provides additional nuance that can help Duke Energy to reach more of their customers with the greatest needs.

Awareness, Knowledge, and Control

Among LMI nonparticipants, awareness and knowledge of Duke Energy programs was low, as was knowledge and autonomy over home energy consumption, creating up front barriers to program participation among this population.[13] Two-thirds (64%) of LMI nonparticipants said they were not at all familiar with Duke Energy programs that help customers save energy in their homes, compared to 39% of non-LMI nonparticipants (Figure 16).

[13] 25% of nonparticipants (n=483) and 32% of participants (n=362) did not report their income and have been excluded from the results reported in this section.

Figure 16. Nonparticipant Familiarity with Duke Energy Programs

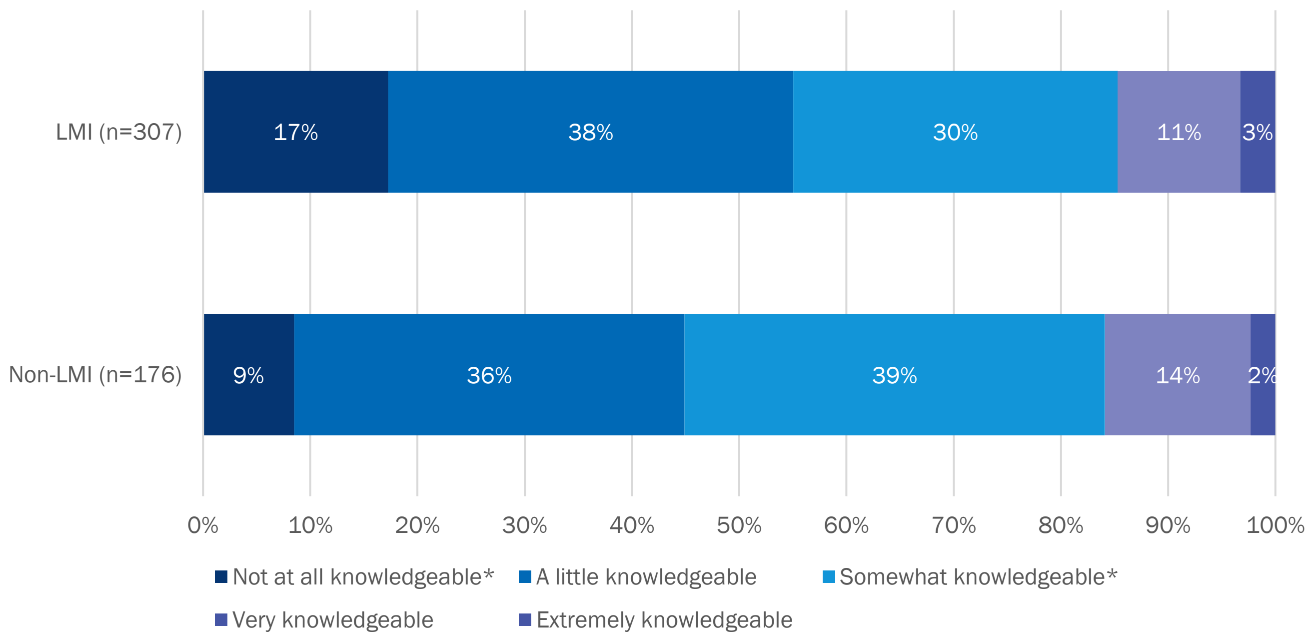


* Statistically significant difference between groups at a 90% confidence level

Of nonparticipants that were aware of Duke Energy's energy efficiency offerings, non-LMI nonparticipants were more likely to have considered participating in the past than LMI nonparticipants (43% vs. 36%, respectively). Non-LMI nonparticipants who considered participating were also more likely than their LMI counterparts to have taken any steps to begin participating such as visiting the Duke Energy website to learn more about energy efficiency programs or calling to inquire about the participation process (6% vs. 3%, respectively).

Nonparticipants had low awareness of energy efficiency opportunities in general, with LMI customers reporting even lower awareness than non-LMI customers. Over half of LMI nonparticipants (55%) said they were either not at all knowledgeable or had only a little knowledge about ways to save energy in their homes compared to 45% of non-LMI nonparticipants (Figure 17). These results suggest there is a need for education on home energy saving opportunities for all nonparticipants but especially for LMI customers.

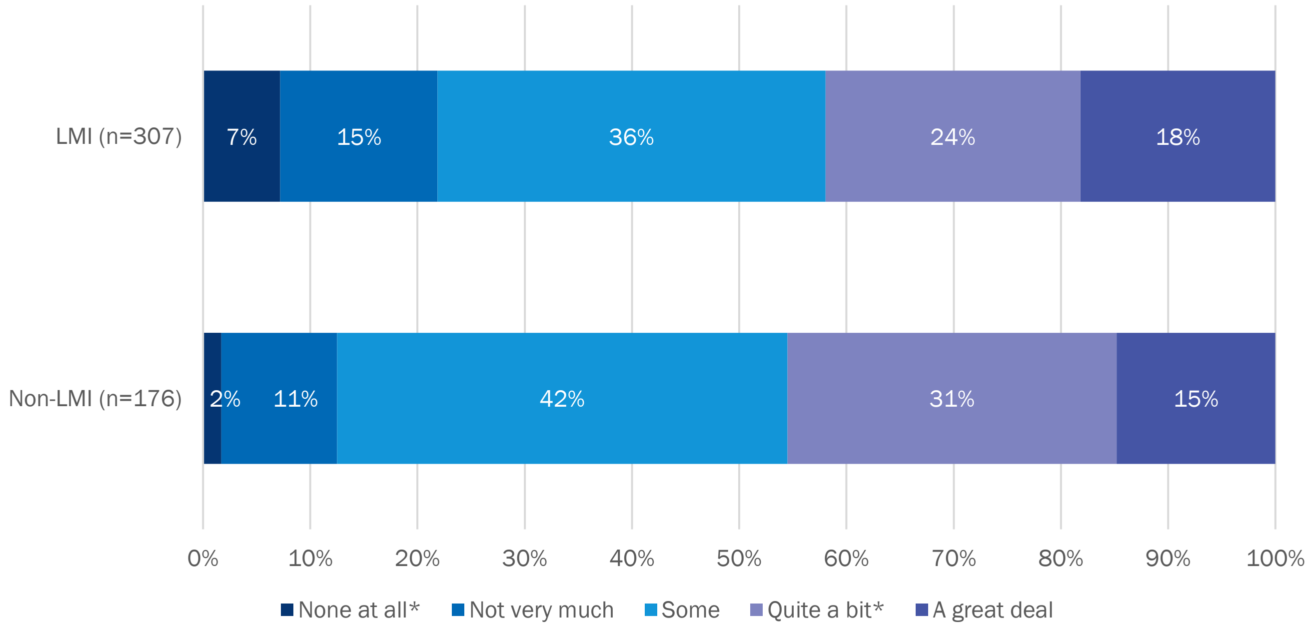
Figure 17. Nonparticipant Knowledge about Saving Energy in the Home



* Statistically significant difference between groups at a 90% confidence level

This lack of knowledge translates to low autonomy among LMI nonparticipants when it comes to reducing their energy consumption. About one in five (22%) LMI nonparticipants felt they have little or not very much control over energy consumption, compared to 13% of non-LMI nonparticipants (Figure 18). This perceived lack of control could be a barrier to entry that prevents LMI nonparticipants from taking the initial steps required to learn about program offerings and eligibility.

Figure 18. Nonparticipant Sense of Control Over Household Energy Use



* Statistically significant difference between groups at a 90% confidence level

Energy Efficiency Improvement Needs

In addition to their lower energy efficiency awareness and knowledge, LMI nonparticipants had greater energy efficiency needs than non-LMI nonparticipants. There were more opportunities for efficiency upgrades in LMI nonparticipants' homes and a need for a greater number of improvements on average compared to non-LMI nonparticipants. About one-third of LMI nonparticipants (33%) said "a lot of things" in their home could be made more energy efficient, compared to only 16% of non-LMI nonparticipants. LMI nonparticipants reported the need for 3.9 improvements on average, compared to 3.3 for non-LMI nonparticipants, when given the opportunity to indicate up to five specific improvements in their home. Specifically, LMI nonparticipants were significantly more likely than non-LMI nonparticipants to say the efficiency of their home could be improved by replacing their CFL light bulbs with LEDs, upgrading the HVAC system(s), and installing and/or replacing windows (Table 14).

Table 14. Nonparticipant Energy Efficiency Improvement Needs

Improvement†	LMI (n=265)	Non-LMI (n=149)
Replace CFL Light Bulbs with LEDs*	55%	37%
Add Air Sealing to the Windows and/or Doors	53%	51%
Upgrade the Heating and/or Cooling System(s)*	43%	34%
Upgrade Appliances (Other than Heating/Cooling Systems) to More Efficient Options	41%	37%
Install Timers or Smart Power Strips to Turn Off Lights and Appliances When Not in Use	40%	36%
Install a Smart or Programmable Thermostat	39%	40%
Install or Replace Windows*	38%	28%

Improvement†	LMI (n=265)	Non-LMI (n=149)
Add Insulation to the Walls and/or Ceilings	31%	27%
Add Faucet Aerators and/or Low-Flow Showerheads to Sinks/Showers	24%	19%
Insulate the Pipes and/or Water Heater	22%	18%
Other Change(s)*	1%	4%

Note: Results based on nonparticipant web survey data – nonparticipants who indicated that there were at least "a few" changes that could be made to make their home more energy efficient

* Statistically significant difference between groups at a 90% confidence level

† Values will not sum to 100% as multiple responses were permitted

To understand if Duke Energy was including all relevant measures in its programs, we asked participants, who are most informed about current offerings, to suggest additional offerings Duke Energy could provide to support them. About one-fifth of participants indicated they would like to see more financial assistance across offerings, indicating that even among participants, up-front cost of improvements can be a barrier. LMI participants were more interested in additional lighting-based offerings than non-LMI participants. Non-LMI participants expressed more interest than LMI participants in higher cost offerings such as those related to solar and battery power, water heating, and electric vehicles (Table 15).

Table 15. Participant Additional Program Offerings Suggested

Additional Offerings†	LMI (n=79)	Non-LMI (n=80)
Measures		
Building Shell/Envelope	14%	9%
Lighting*	13%	4%
Solar/Battery*	11%	30%
HVAC	4%	6%
Plumbing	4%	0%
Thermostat	3%	3%
Water Heating*	1%	10%
EV*	1%	6%
Other	29%	19%
Program Enhancements		
Financial Assistance	18%	16%
More Information	8%	6%

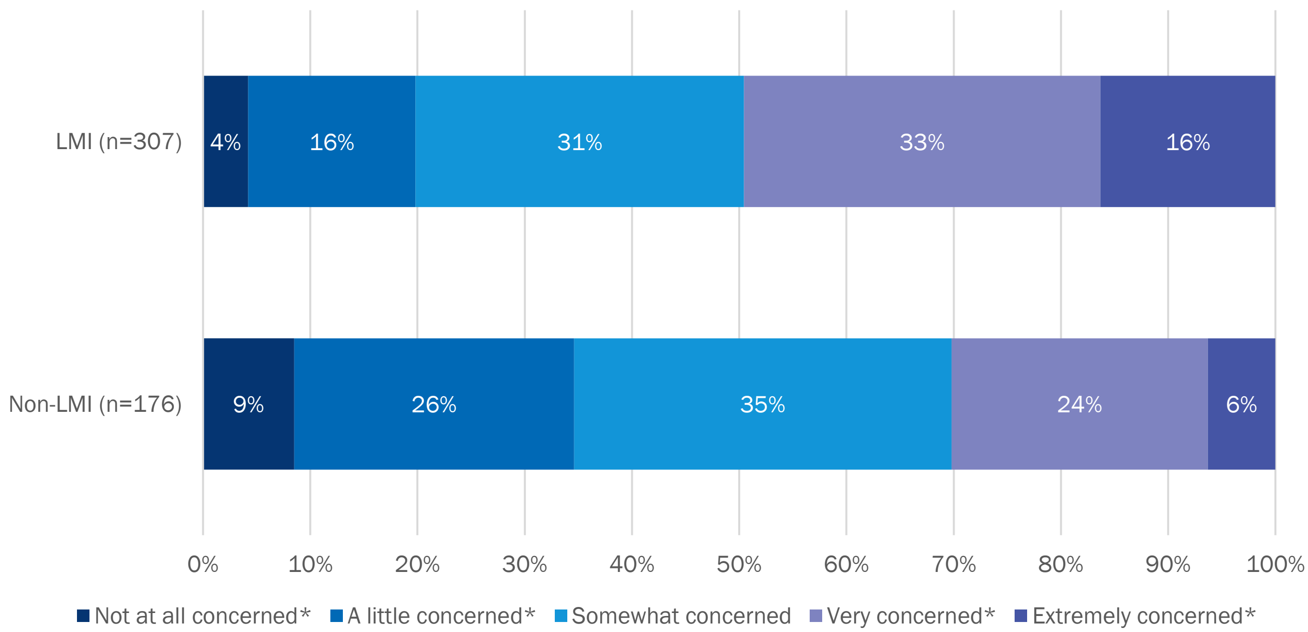
* Statistically significant difference between groups at a 90% confidence level

† Values will not sum to 100% as multiple responses were permitted

Energy Efficiency Motivations

LMI nonparticipants reported being very motivated to reduce their energy consumption by improving the energy efficiency of their homes. LMI nonparticipants were more concerned about their energy usage than non-LMI nonparticipants. Half of LMI nonparticipants (49%) were either "very" or "extremely concerned" about their household energy use, compared to slightly under one-third (30%) of non-LMI nonparticipants (Figure 19). Non-LMI customers were also more likely to be "not at all concerned" about their daily energy usage than LMI customers.

Figure 19. Nonparticipant Concern Over Daily Household Energy Use



* Statistically significant difference between groups at a 90% confidence level

LMI and non-LMI nonparticipants similarly cited saving money as a motivator to use less energy. Non-LMI customers were more likely than LMI customers to say that not being wasteful and reducing their impact on the environment motivates them to save energy (Table 16). These results suggest that, in contrast to LMI customers whose main reason for saving energy is saving money, non-LMI customers are more likely to also consider the non-financial, intangible benefits of saving energy. This has implications for messaging most likely to motivate LMI customers and further suggests that focusing messaging on bill savings is likely to motivate LMI customers without deterring non-LMI customers from participating.

Table 16. Nonparticipant Overall Motivations for Saving Energy

Motivation†	LMI (n=307)	Non-LMI (n=176)
Saving Money	86%	85%
Not Being Wasteful*	42%	53%
I Want to Be Responsible and Thoughtful about My Energy Usage	40%	47%
Reducing my Impact on the Environment*	37%	53%
It is Important that Others See Me as Environmentally Conscious	8%	7%

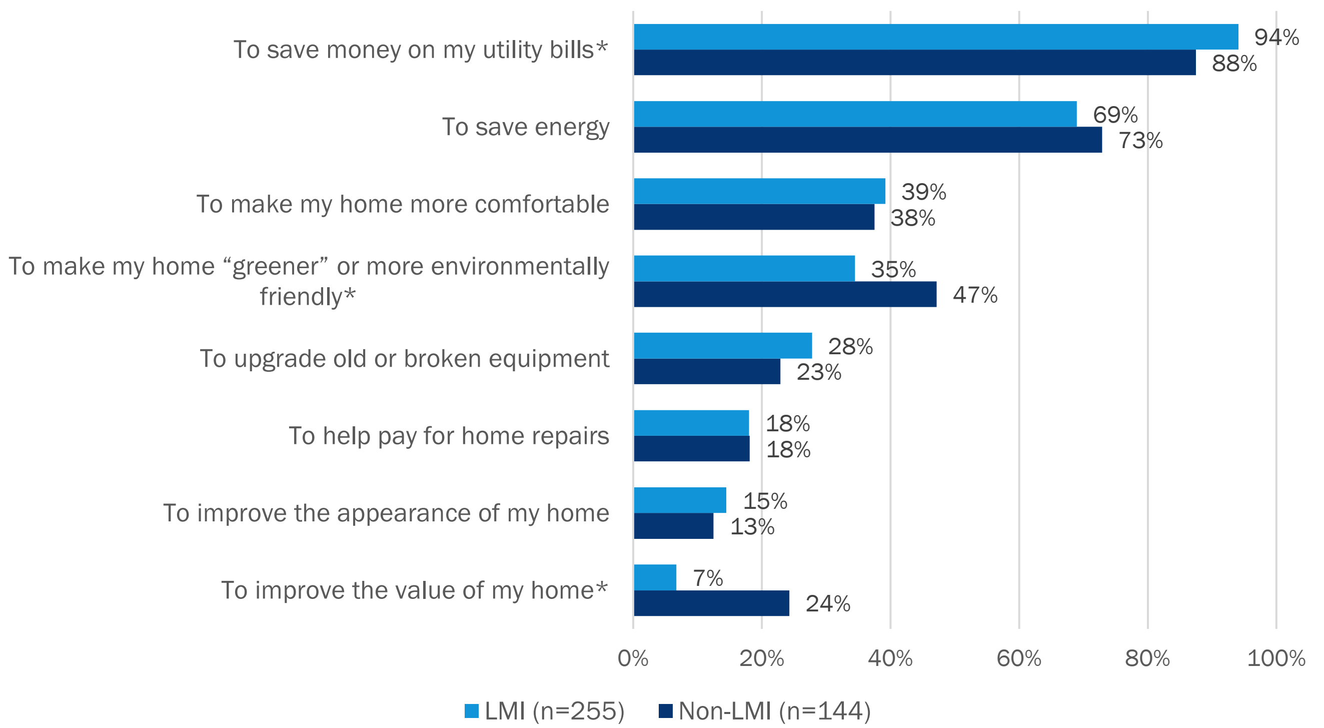
Note: Results based on nonparticipant web survey data

* Statistically significant difference between groups at a 90% confidence level

† Values will not sum to 100% as multiple responses were permitted

When asked specifically about their motivations for participating in a Duke Energy program, nonparticipants were most motivated to participate in the future by the potential utility bill savings (Figure 18). LMI nonparticipants were significantly more interested in participating to save money on utility bills than non-LMI nonparticipants, though large majorities of each group indicated they were motivated by the financial benefits of participation. Non-LMI nonparticipants were significantly more likely than LMI nonparticipants to be interested in participating to “be green” or improve the value of their home. They were also more likely than LMI nonparticipants to indicate that “being greener” was their biggest motivation to participate. This again suggests the idea that, although all nonparticipants (and all customers in general) are highly motivated to participate in Duke programs by the potential bill savings, LMI nonparticipants are most motivated by the financial benefits associated with participating, while non-LMI nonparticipants tend to have more varied motivations.[14]

Figure 20. Nonparticipant Motivations for Participating in Duke Program Offerings in the Future†



Note: Results based on nonparticipant web survey data – nonparticipants at least “a little likely” to participate in at least one offering in the next two years

* Statistically significant difference between groups at a 90% confidence level

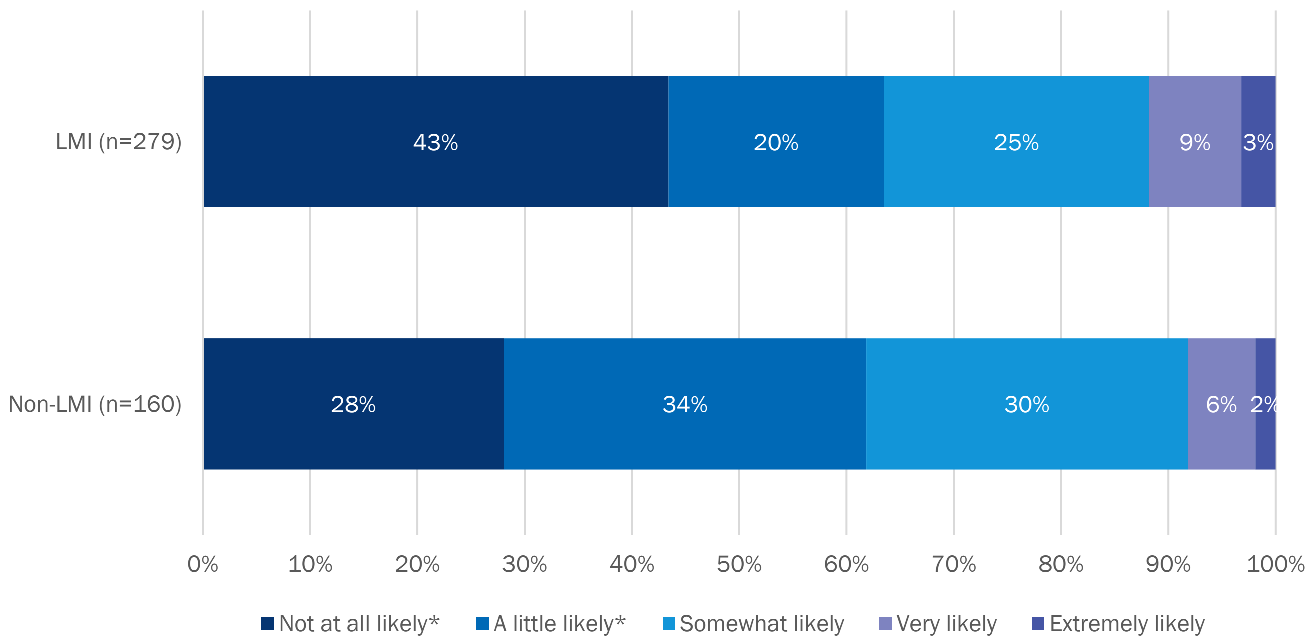
† Values will not sum to 100% as multiple responses were permitted

Likelihood of Future Improvements, Behavior Change, and Participation

Despite LMI nonparticipants indicating that many aspects of their home could be made more efficient and that they are highly concerned about their energy usage and its financial implications, 63% of LMI nonparticipants say that they are “not at all” or only “a little” likely to make changes to their home to make it more efficient in the next year (Figure 21). This suggests that, despite their need, concern, and interest, LMI nonparticipants face considerable barriers to making improvements.

[14] Participants’ motivations for participating were highly similar to nonparticipants’ motivations. The exceptions are that in addition to the same significant differences seen between the nonparticipant groups, between participant groups, LMI participants were more likely to say they were motivated by saving money on home repairs than their non-LMI counterparts and non-LMI participants were significantly more likely to say they were motivated by saving energy than their LMI counterparts.

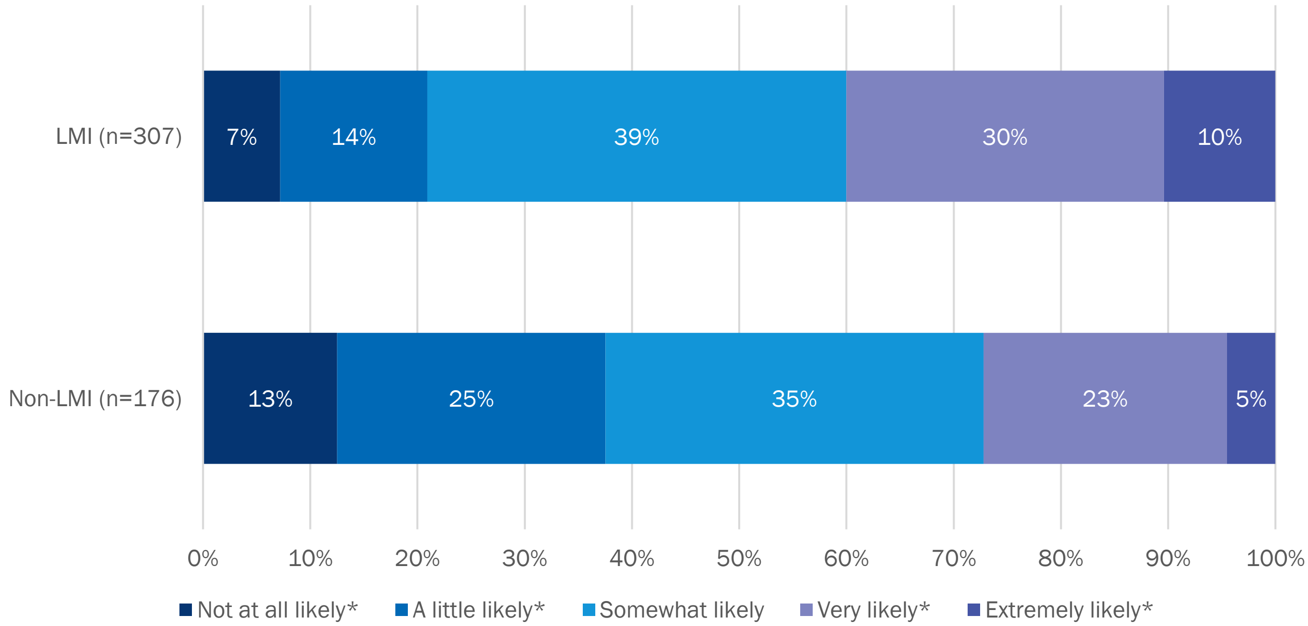
Figure 21. Nonparticipant Likelihood to Make Home More Efficient in Next Year



* Statistically significant difference between groups at a 90% confidence level

Although LMI nonparticipants said they were less likely to make changes to their home to make it efficient than their non-LMI counterparts, that is not reflective of their willingness to make behavioral changes in the next six months to reduce their energy usage. In fact, LMI nonparticipants were significantly more likely than non-LMI nonparticipants to say they are “very” or “extremely likely” to make behavioral changes to reduce their usage (Figure 22). Perhaps because behavioral changes have no financial cost, and for renters, are changes they can control as opposed to their landlords, LMI nonparticipants perceived fewer barriers to making behavioral changes than they did to making structural changes to their homes.

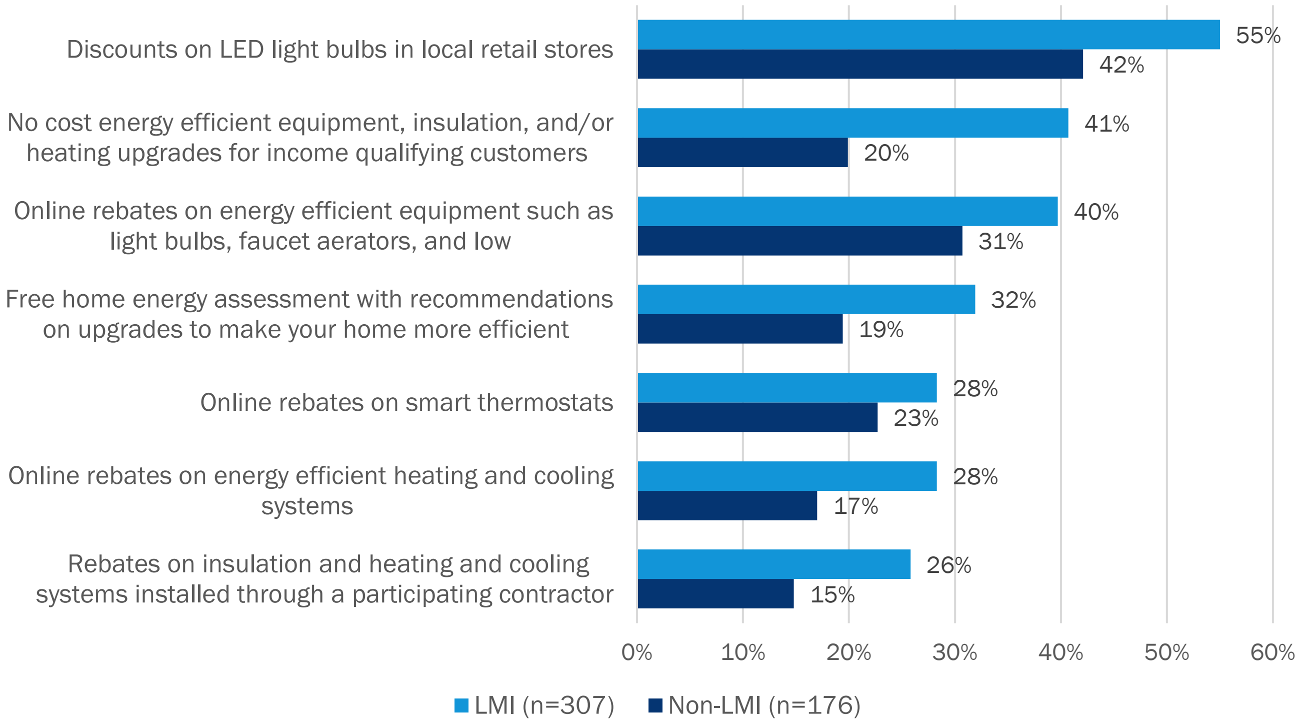
Figure 22. Nonparticipant Likelihood to Make Behavioral Changes in Energy Usage in the Next Six Months



* Statistically significant difference between groups at a 90% confidence level

Similarly, when presented with specific offerings from Duke Energy, LMI nonparticipants were more likely than non-LMI nonparticipants to say they were "very" or "extremely" likely to participate in any type of Duke Energy program in the next two years (Figure 23). LMI nonparticipants were most interested in discounted LED light bulbs in local retail stores (55%), followed by no-cost energy-efficient equipment/insulation/heating upgrades (41%), and online rebates on energy-efficient equipment (40%). They expressed less interest in higher cost and higher savings opportunities such as heating and cooling system rebates (28%) and insulation or heating cooling systems installed through a contractor (26%), despite high proportions of LMI customers indicating that their home would benefit from such upgrades. This suggests that, with the support of a program that addresses their barriers to structural upgrades, LMI nonparticipants are highly likely to make energy efficiency improvements in the next two years. However, barriers such as split incentives and limited financial resources may inhibit LMI customers from seeing high-savings programs as a realistic possibility for their household.

Figure 23. Likelihood of Nonparticipants to Participate in Offerings in Next Two Years†



† Values will not sum to 100% as multiple responses were permitted

Addressing Barriers

Given that LMI customers reported much lower awareness of Duke Energy's programs than non-LMI customers, this section starts by exploring the best ways to reach LMI customers through education and outreach. We then turn our attention to the remaining barriers that must be addressed to maximize meaningful participation among those customers with the greatest need.

Awareness and Education

Regardless of participation history or LMI status, customers who were aware of Duke Energy programs were most likely to have heard of them from a bill insert, a letter or postcard in the mail, or a website (Table 17). This suggests that further outreach should continue to focus primarily on these types of marketing. Although there were not substantive differences in the most common sources of awareness based on LMI status, LMI participants were significantly more likely than non-LMI participants to say they heard about program(s) via an advertisement on the television, a nonprofit agency or other community group, or a video advertisement on streamed online services. Given this finding, there may be potential to reach a greater number of LMI customers with targeted outreach through these channels.

Table 17. Participant and Nonparticipant Sources of Program Awareness

Source †	Participant		Nonparticipant	
	LMI (n=199)	Non-LMI (n=145)	LMI (n=119)	Non-LMI (n=112)
From a Bill Insert*	50%	48%	45%	59%
From a Letter in the Mail or Postcard*	35%	41%	26%	52%
From a Website	31%	38%	40%	33%
From Friends or Family	15%	12%	12%	13%
From an Advertisement on Television§	10%	4%	10%	13%
From a Nonprofit Agency or other community group§	9%	1%	3%	1%
From a Video Advertisement on a Streamed Online Service (e.g., YouTube, Hulu)§*	7%	1%	5%	1%
Email§*[a]	5%	17%	5%	14%
From Local Events (e.g., a Festival or Community Fair or Parade	3%	2%	1%	1%
From Advertisements on the Radio	3%	1%	3%	0%
From Articles in the Newspaper	2%	3%	3%	5%
From an Outdoor Display (e.g., a Billboard or a Bus Shelter)	2%	1%	1%	1%
Other	3%	6%	3%	5%

§ Statistically significant difference between participant groups at a 90% confidence level

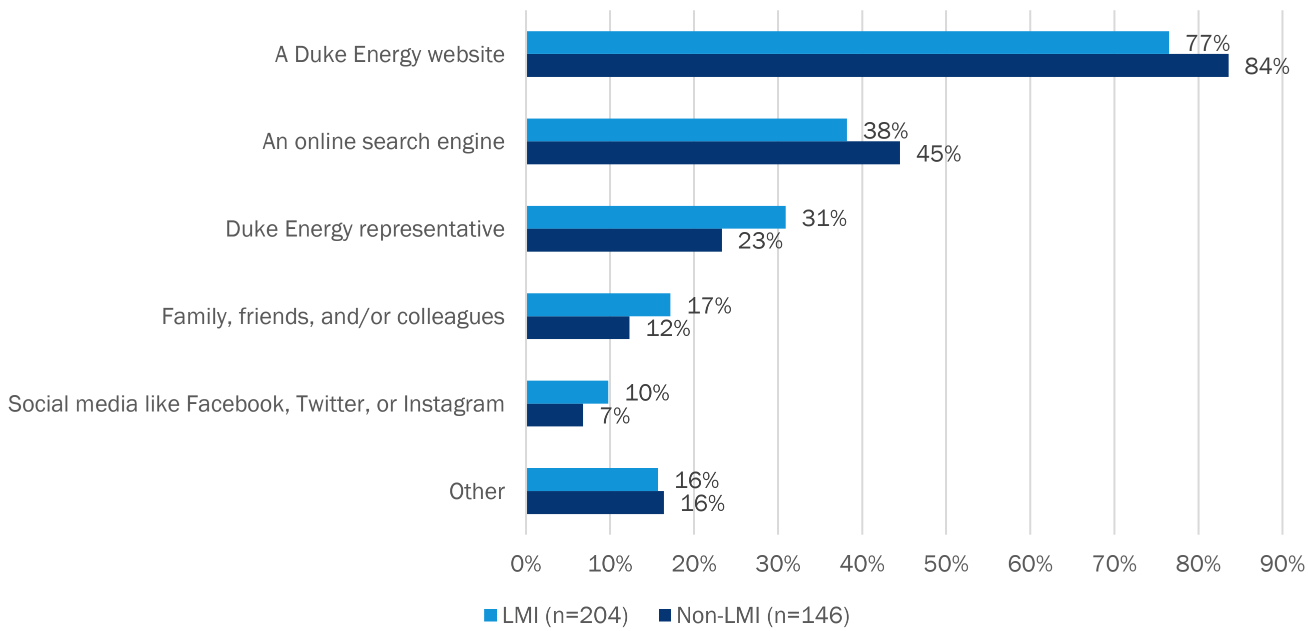
* Statistically significant difference between nonparticipant groups at a 90% confidence level

† Values will not sum to 100% as multiple responses were permitted

[a] Email was not provided as a multiple response option in the survey but was written in by respondents frequently enough to be coded as a separate category during analysis. It is possible more respondents would have selected this option if provided.

When searching for information about energy saving opportunities, both LMI and non-LMI participants indicated their preferred sources were the Duke Energy website, an online search, or a Duke Energy representative (Figure 24). Though there are some moderate differences in the sources participants use to learn more about energy saving opportunities by LMI status, these differences were not statistically significant due to the smaller sample sizes.

Figure 24. Participant Information Gathering Tendencies†

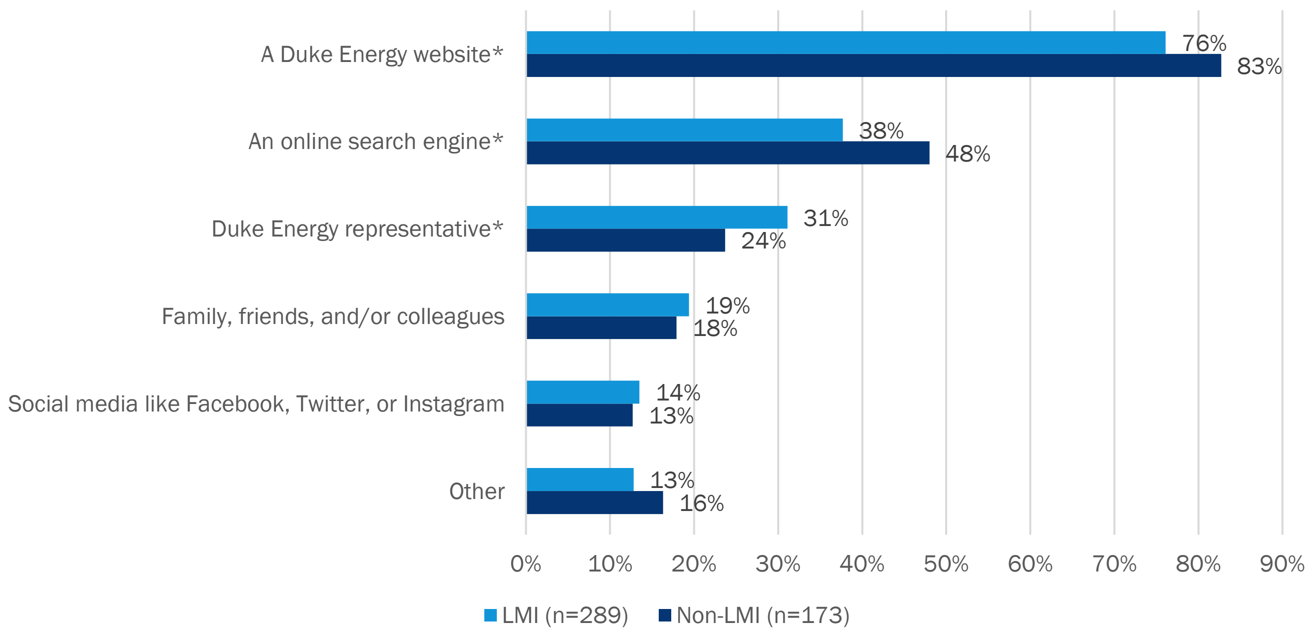


† Values will not sum to 100% as multiple responses were permitted

Although the most common place all participants say they would search for information on energy saving opportunities is a Duke Energy website, only 31% of LMI participants and 38% of non-LMI participants say they actually learned about the program via Duke's website (Table 17). It is possible that customers were only likely to reference the website if they were already highly motivated to save energy, aware of Duke Energy's offerings on at least a general level and were proactively trying to find ways to improve the efficiency of their home. This is a unique type of customer, and their preferences and actions are unlikely to translate to the nonparticipants that Duke Energy is trying to reach.

Like participants, LMI and non-LMI nonparticipants' top sources of information when they are looking for ways to save energy are the Duke Energy website, an online search, and a Duke Energy representative (Figure 25). LMI and non-LMI nonparticipants significantly differed on their preference for several potential sources of information. Notably, LMI nonparticipants were significantly more likely than non-LMI nonparticipants to say they would look for information on energy saving opportunities from a Duke Energy representative.

Figure 25. Nonparticipant Information Gathering Tendencies†



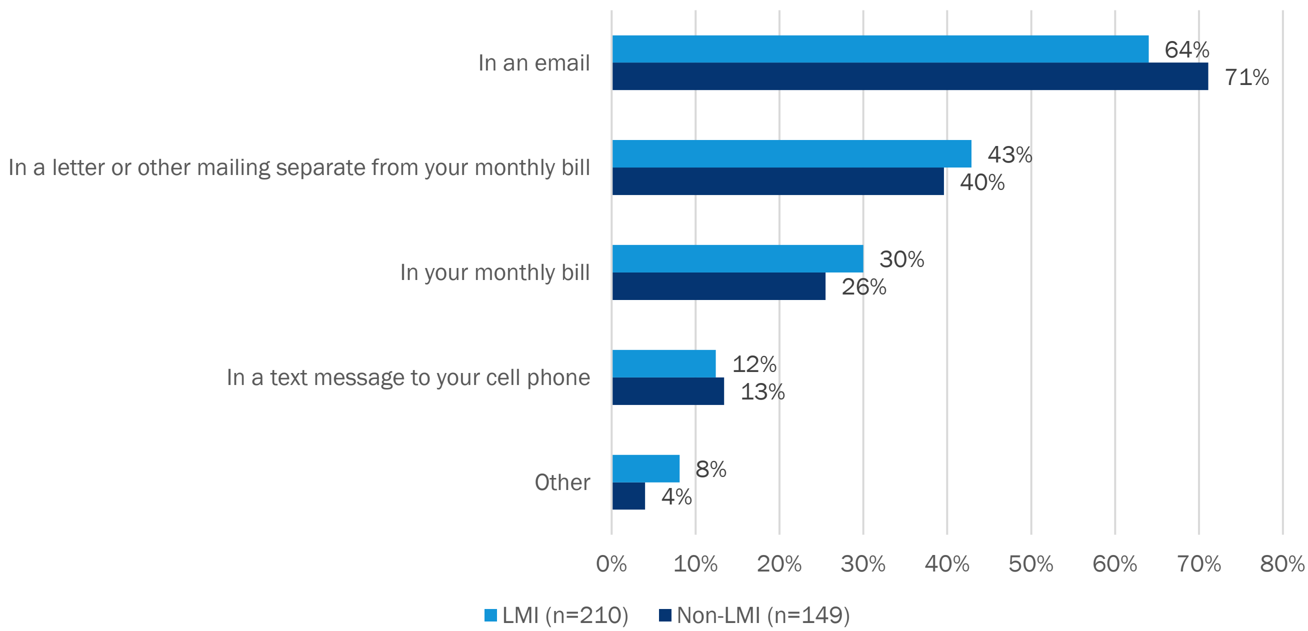
* Statistically significant difference between groups at a 90% confidence level

† Values will not sum to 100% as multiple responses were permitted

Given that the preferred information sources reported among nonparticipants were customer-initiated (i.e., conducting an internet search or visiting Duke Energy's website) and awareness was low among this group, Duke Energy may need to conduct proactive outreach regarding energy saving opportunities. By raising overall program awareness within LMI communities, word-of-mouth outreach from family, friends, and colleagues may become more common over time. Duke may also be able to encourage satisfied LMI participants to refer others in their network who would benefit from program participation. We discuss the high levels of satisfaction among LMI participants in Appendix D

When it comes to the mode of outreach that Duke Energy can leverage for these efforts, both LMI and non-LMI participants indicated they would prefer to receive information from Duke Energy about how to save energy in their home via email, followed by letters or separate mailings, bill inserts, and text messages (Figure 26). Participants' outreach preferences do not meaningfully vary by LMI status, although non-LMI participants are slightly more likely than LMI participants to prefer email outreach, which may reflect differences in age or internet access between these groups.

Figure 26. Participant Outreach Preferences†

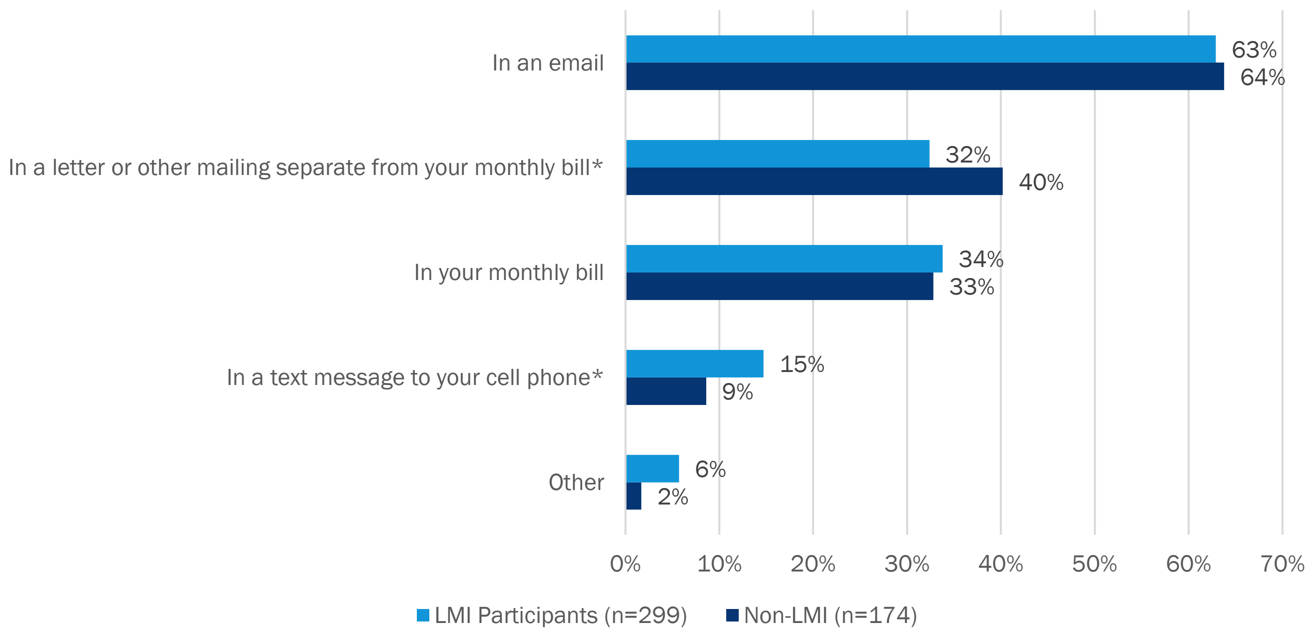


† Values will not sum to 100% as multiple responses were permitted

Like participants, both LMI and non-LMI nonparticipants indicated they would prefer to receive information from Duke Energy about how to save energy in their home via email, followed by letters or separate mailings, bill inserts, and text messages (Figure 27).[15] LMI nonparticipants were slightly more likely to prefer text message outreach compared to non-LMI nonparticipants.

[15] It is important to note that, although email is the most preferred form of outreach for both participants and nonparticipants regardless of LMI status, it is not a highly reported source of program awareness for any group (Table 17). This is at least partially due to the response options given for the associated questions. Specifically, email was not listed as a response option for how customers became aware of Duke's offerings but was entered as an open-ended "other" response with enough frequency that we coded it as a separate category during analysis. It is possible that a larger number of survey respondents would have indicated they heard about the offerings via email if it was a response option, as they would have been forced to consider/recall if they had received any email outreach. In contrast, email was a listed response option when respondents were asked about their overall outreach preferences. As such, although email is not reported commonly as a source of program awareness, it is a key channel for reaching all customers.

Figure 27. Nonparticipant Outreach Preferences†



* Statistically significant difference between groups at a 90% confidence level

† Values will not sum to 100% as multiple responses were permitted

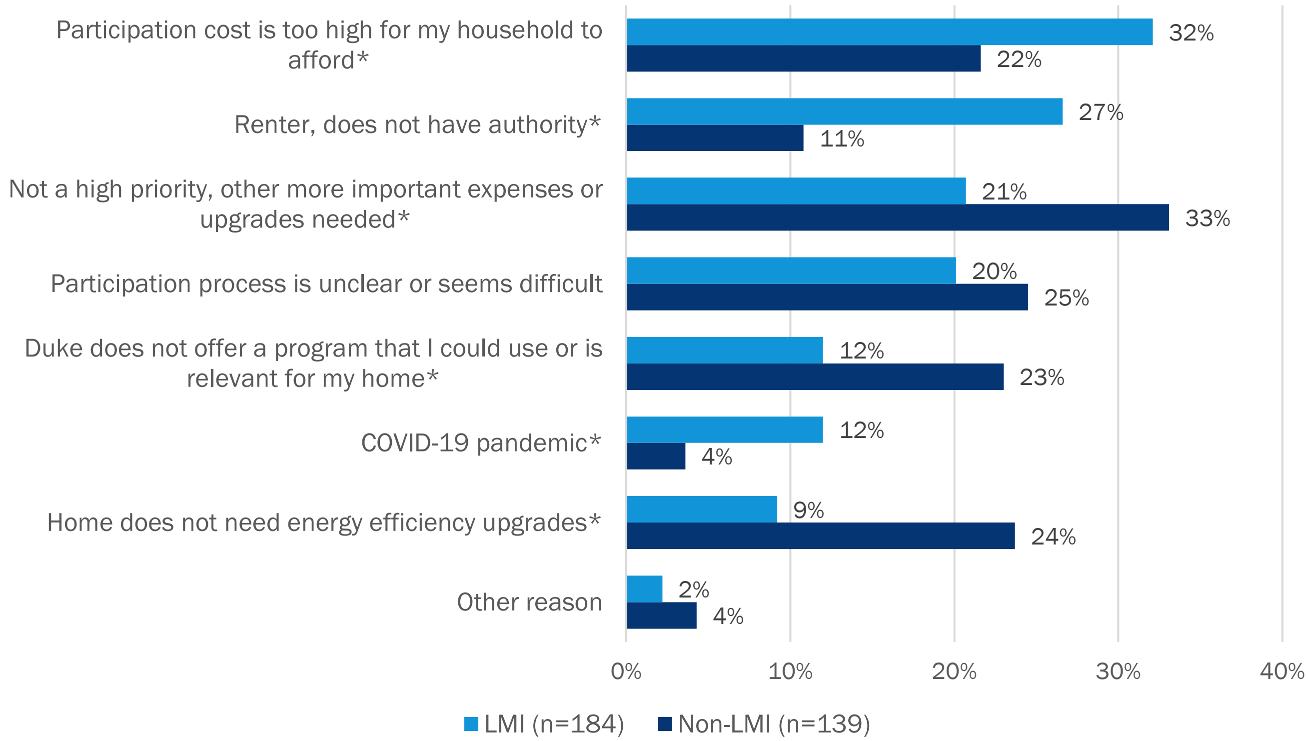
Overall, these results suggest customers' preferred methods for outreach do not vary based on LMI or participation status in a meaningful way, and that email, mailings, and bill inserts are the most preferred methods of outreach across all customers.

Ability and Decision to Participate

Given LMI nonparticipants' high need for and interest in energy efficiency program participation, this section covers the additional barriers that Duke Energy can address to support their participation once initial barriers around knowledge and awareness have been addressed.

LMI and non-LMI nonparticipants responses differed significantly on several barriers to program participation. LMI nonparticipants were more likely than non-LMI nonparticipants to say that the cost of participation, their lack of authority as a renter, and the COVID-19 pandemic were barriers to their participation (Figure 28). Non-LMI nonparticipants were more likely than LMI nonparticipants to cite that participation was not a priority compared to other household expenses and upgrades, that there were no program offerings relevant to them, and that their home did not need any energy efficiency upgrades. Notably, lack of authority due to being a renter was not presented as an option for this question but was noted so frequently in the "other" category that it became the second most prevalent barrier reported by LMI nonparticipants.

Figure 28. Nonparticipant Participation Barriers†



Note: Results based on nonparticipant web survey data – Nonparticipants that considered participating in the past

* Statistically significant difference between groups at a 90% confidence level

† Values will not sum to 100% as multiple responses were permitted

These survey findings were reinforced by participants interviewed as part of the study. Even successful participants faced obstacles in the participation process due to up-front costs and split incentives. Some interviewed participants who rent their homes explained that they were unable to access the offerings their home most needed, or would provide them the greatest impacts, due to their status as a renter (Figure 29).

Figure 29. Quotes on Barriers from Participant Interviews

Participation Barriers

Regarding upfront costs as a barrier: "My daughter is a full-time college student, and she works part-time. She pays for her own college and takes care of the household and bills. If my daughter didn't get all her hours, like during the pandemic, we would have to make payment arrangements or get help from social services."

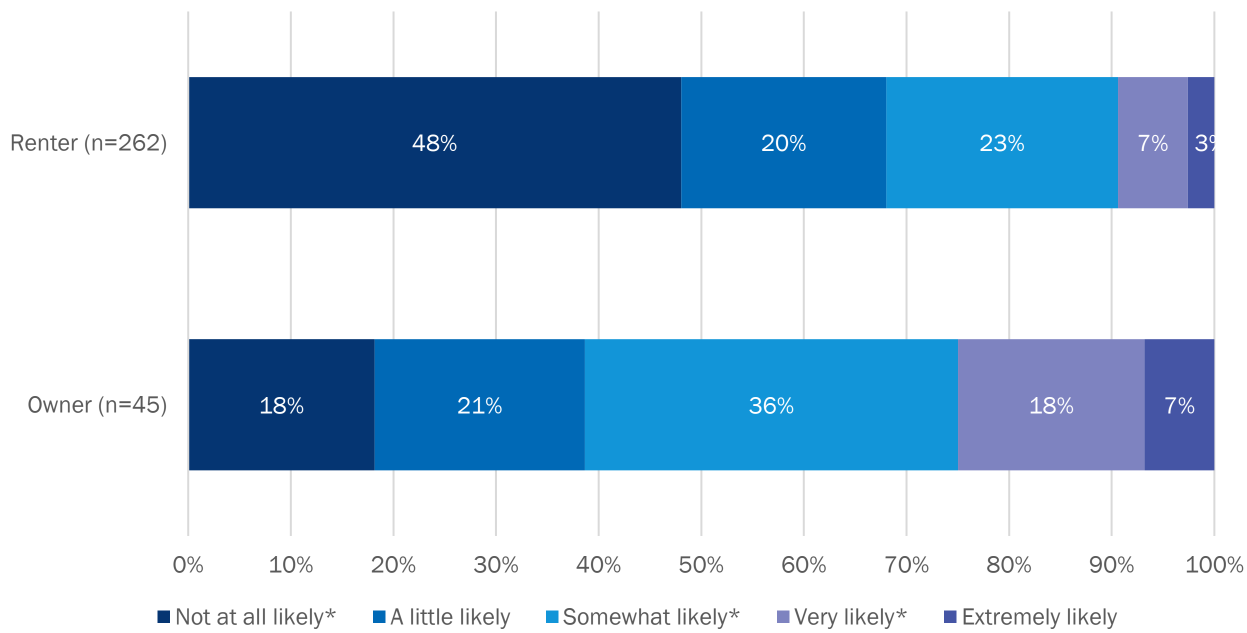
"If there is a program that is not available to renters for some reason, Duke should try to expand the availability of that program [to include more renters]."

"We had been struggling for so long in our home without heat and air. I have issues with a landlord as he doesn't want to fix things, and when he does, he'll just call somebody or basically get someone off the street."

"Duke should put a little bit of muscle into interacting with property owners to the extent that's possible. I believe it falls to Duke to advocate for greater efficiency in rental units."

Most nonparticipants who were renters, regardless of their LMI status, said that their landlord would have to be involved for some of the changes that would make their homes more efficient (96%). Given the need for landlord involvement for nearly all interested renters, landlord communication, approval, and cost sharing were all barriers to participation among this subpopulation. LMI renters were significantly more likely than LMI homeowners to say they were "not at all likely" to make improvements (Figure 30). LMI owners were significantly more likely than LMI renters to say they were "somewhat" or "very likely" to make improvements. Because LMI nonparticipants were significantly more likely to be renters than non-LMI nonparticipants (85% vs. 43%, respectively), Duke Energy will need to address the rental challenge to reach the majority of LMI nonparticipants.

Figure 30. LMI Nonparticipant Likelihood to Make Changes to Make Home More Efficient in the Next Year by Owner/Renter Status



Note: Results based on nonparticipant web survey data – LMI nonparticipants

* Statistically significant difference between groups at a 90% confidence level

Program improvements suggested by nonparticipants did not differ significantly based on LMI status, except for making process eligibility easier to understand, which LMI nonparticipants were more likely to mention than non-LMI nonparticipants. The three most frequent improvements nonparticipants mentioned were (1) making the process easier/clearer, (2) making program eligibility easier to understand/determine, and (3) offering higher/full rebates on energy-efficient products. Both LMI and non-LMI participants agreed with the recommendation of increasing rebate amounts. Slightly less than half (45%) of LMI participants suggested there should be more outreach and education on Duke Energy's program offerings, suggesting they had low program awareness before they participated or would like to learn about additional offerings (Table 18).

Table 18. Participant and Nonparticipant Suggested Program Improvements

Suggested Improvement†	Participants		Nonparticipants	
	LMI (n=173)	Non-LMI (n=130)	LMI (n=265)	Non-LMI (n=157)
Make the Process Easier and Clearer§	23%	32%	51%	44%
Make Program Eligibility Easier to Understand§*	40%	30%	49%	37%
Offer Higher/Full Rebates on Energy-Efficient Products	41%	44%	44%	52%
Increase Outreach and Education Regarding Duke Energy Program Details	45%	37%	31%	30%
Broaden the Range of Energy-Efficient Equipment Offered	36%	41%	20%	23%

Suggested Improvement†	Participants		Nonparticipants	
	LMI (n=173)	Non-LMI (n=130)	LMI (n=265)	Non-LMI (n=157)
Make More Accessible for Renters/More Outreach to Landlords [a]			6%	5%
Other Improvement	5%	6%	3%	2%

§ Statistically significant difference between participant groups at a 90% confidence level

* Statistically significant difference between nonparticipant groups at a 90% confidence level

† Values will not sum to 100% as multiple responses were permitted

[a] Coded from write-in responses in nonparticipant survey analysis; not observed among participant responses

4.4 Impacts of LMI Customer Participation in Duke Energy Programs

Given the challenges that LMI customers face around energy affordability and the need for energy saving home improvements, it is particularly important to understand the impacts of participation in Duke Energy programs among this population. In this section, we provide results from a modeling exercise that estimated the impacts of program participation on customer energy bills using actual Duke Energy customer bills before and after participation in Duke Energy programs. We also provide results of participant survey and in-depth interview questions about the energy and non-energy impacts of participation. These findings demonstrate the impact of Duke Energy programs on LMI customer electric bills and can be used to market the offerings to LMI nonparticipants.

Analysis of Electric Bill Impacts

State of Participant Bills

LMI program participants paid on average $1,600 per year for their electric bills, which averages to just over $133 per month. Electric bill amounts vary depending on participant income. More specifically, participants residing in census block groups with a higher proportion of LMI customers tend to have lower annual bills, likely because their homes are smaller in size. Table 19 summarizes participant annual bills in the year preceding their participation in Duke Energy programs.[16] The data shows average annual bills as well as the annual bills of participants based on the income status of their community grouped into quartiles. More specifically:

- LMI Quartile 1 – includes participants residing in census block groups where 50%-56% of all residents are LMI
- LMI Quartile 2 – includes participants residing in census block groups where 56%-63% of all residents are LMI
- LMI Quartile 3 – includes participants residing in census block groups where 63%-74% of all residents are LMI
- LMI Quartile 4 – includes participants residing in census block groups where 74%-100% of all residents are LMI

While these quartiles are not necessarily indicative of the income status of each participant, they help to portray the neighborhood environment of the participants.

[16] Notably, the year preceding participation is not the same for each participant and is determined by their participation date.

As can be seen in the table, annual bills decrease as the percent of LMI customers in a community increases. This is consistent with the increase of proportion of rental residencies, which also tend to be smaller, across each LMI quartile. This finding likely suggests that lower income customers have lower annual bills which is likely due, in part, to their dwelling size.

Table 19. Participant Bills

Subgroup	Annual Bill Amount ($)
Total	**$1,577**
LMI Quartile 1	$1,628
LMI Quartile 2	$1,608
LMI Quartile 3	$1,557
LMI Quartile 4	$1,515

Over half of participants (58%) were in arrearages at least once over the course of the year preceding their program participation, and a considerable percent were in arrearages for at least four months of the year preceding their program participation (41%). Being in arrearages for four or more months is more likely due to burden rather than forgetfulness to pay electric bills. Average arrears were $71 per month per participant prior to their participation in Duke Energy programs. Notably, the incidence of continuous arrearages as well as average monthly arrears increases by LMI quartile, suggesting that, as incomes in the community decrease, arrears increase in absolute as well as relative terms. In LMI Quartile 4, for instance, participant arrears were an average of $82 per month, accounting for 40% of the total bill, which is $20 per month more than in LMI Quartile 1, where arrears were an average of $62 per month, accounting for under one-third (31%) of participants' average monthly bills.

Table 20. Participant Arrearages

Subgroup	LMI Quartile 1	LMI Quartile 2	LMI Quartile 3	LMI Quartile 4	Total
Average Monthly Arrearage Amount Per Participant	$62	$64	$75	$82	**$71**
Arrearage Amount as a Percent of a Total Monthly Bill	31%	33%	37%	40%	**35%**
Percent of Participants in Arrears at Least Once in a Year Prior to Participation	51%	54%	61%	67%	**58%**
Percent of Participants in Arrears for at Least 4 Bill Periods in a Year Prior to Participation	34%	36%	44%	51%	**41%**

Service disconnections were not common among participants. Overall, few LMI participants (4%) received disconnection notices.

Impact of Program Participation on Participant Bills

Our modeling results show a modest reduction in participant bills due to participation in Duke Energy programs. Following participation, the electric bills of LMI program participants fell by an average of $35 per year or about 2% of total annual electric bill amounts (Table 21). Across 105,327 participants included in the analysis, these bill reductions amount to $3,686,445 in annual bill savings due to Duke Energy programs.

Table 21. Bill Impact Results

Metric	Result
Annual Baseline Bill Amount ($)	$1,581
Average Annual Bill Reduction (%)	$35
% Bill Reduction	2.2%
Total Number of Participants Under Analysis	105,387
Total Annual Bill Reductions Across Participant Population	$3,686,445

As part of the analysis, we explored whether bill impacts vary by the percent of LMI customers in participant census block groups as well as by the ex ante savings expected by Duke Energy from program participation. Ex ante savings serve as a strong indicator of the scope and depth of energy efficient improvements and therefore potential bill impacts. Participants residing in census block groups with a higher percent of LMI customers experienced slightly greater bill reductions (Table 22). The differences are not statistically significantly different. It is important to note, however, that given the lower baseline usage of participants residing in lower-income neighborhoods, bill reductions of the same absolute value are more impactful relative to those participants electric bill costs. This suggests that participants residing in lower income neighborhoods are benefiting from the program participation more in terms of bill reductions. Participants with higher ex ante energy savings (over 700 kWh per year) experience considerably higher bill reductions than participants with lower energy savings (700 kWh or less).

Table 22. Bill Impacts by LMI Quartile and Ex Ante Savings

Subgroup	Annual Baseline Bill Amount ($)	Annual Bill Reduction ($)	% Annual Bill Reduction	Upper Bound	Lower Bound
Total	1,581	$35	2%	$24	$47
LMI Quartile					
LMI Quartile 4	1,523	$38	3%	$53	$24
All Others	1,610	$34	2%	$46	$23
LMI Percentile					
LMI 90% Percentile	1,421	$45	3%	$63	$26
All Others	1,608	$34	2%	$46	$23
Ex Ante Energy Savings					
Ex Ante Energy Savings Quartile 4	1,659	$51	3%	$66	$36
All Others	1,382	$31	2%	$42	$19

In addition to estimating the impact of Duke Energy programs on participation, we also explored the impact of program participation on arrearages. We were unable to complete the modeling efforts due to the incidence and variation in arrearages. Instead, we pursued a descriptive analysis of arrearage trends in treatment and comparison groups before and after program participation.

Our analysis suggests that participating in Duke Energy programs provides a modest reduction in arrearages, especially as related to participants with high arrearages. More specifically, our exploration of changes in arrearages among participants in the top 85th percentile with the highest annual arrearage (referred henceforth as participants with severe arrearage issues) shows that 83% participants had reduced their arrearages and were no longer in a severe arrearage situation a year later (Table 23). Among comparable nonparticipants, slightly fewer, 78%, had reduced their arrearages. We found little difference between participants and nonparticipants who were not in arrears. Few entered into arrears a year later regardless of participation status (7% of nonparticipants compared to 8% of participants).

Table 23. Incidence of Severe Arrearages Before and After Program Participation

Customer Type	Number of Participants Prior to Participation in Duke Energy Programs	Number of Participants Following Participation in Duke Energy Programs	Difference	% Difference	Difference In Difference
Customers with Severe Arrearages Prior to Program Participation					
Participants	1,170	196	974	83%	5%
Similar Nonparticipants*	2,195	475	1,720	78%	
Customers without Severe Arrearages Prior to Program Participation					
Participants	12,445	11,409	1,036	8%	1%
Similar Nonparticipants*	12,827	11,928	899	7%	

*Note that due to being non-participants, these customers did not participate in Duke Energy programs. Periods prior to program participation and following program participation for non-participants therefore are taken from their respective participant matches in order to make relevant comparisons.

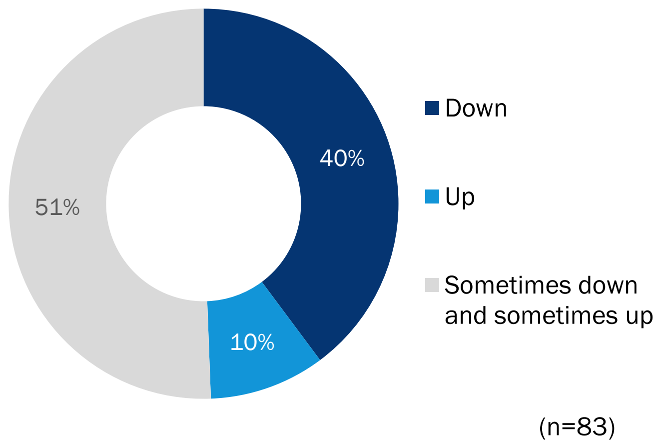
Participant Reported Impacts

Electric Bill Impacts

LMI participants were less likely to report a consistent decrease in their electric bills compared to non-LMI participants after participating in a Duke Energy program. Of all LMI participants surveyed, about one in five (21%) noted a consistent electric bill decrease after participation compared to 29% of non-LMI participants. While equal percentages of LMI and non-LMI participants observed any changes in their electric bills after participating, a greater share of non-LMI participants noticed a consistent reduction in their bills compared to LMI participants.[17] Just over half (53%) of LMI participants report any type of change in their electric bills after participating in a Duke Energy program, compared to 49% of non-LMI participants. LMI participants are more likely than non-LMI participants to indicate that their year-round electric bills *increased* or were *variable* since participating in a Duke Energy program (Figure 31), whereas non-LMI participants are more likely to report a consistent reduction in their electric bills (Figure 32).[18]

[17] Although the survey question asked respondents to reflect on bill changes due to their participation, residential rate increases that took effect in 2019 (SC) and 2021 (NC) may impact customer bills and therefore responses to questions surrounding bill impacts.
[18] Of LMI participants who report a change in their bill, over half (51%) say it was fluctuating throughout the year. LMI participants with variable bills after participation are more likely to say their bill decreased in the winter (25%) than the summer (17%). However, most LMI participants with fluctuating electric bills indicate that their bill was variable within individual seasons as well as year-round (49% and 53% for summer and winter respectively).

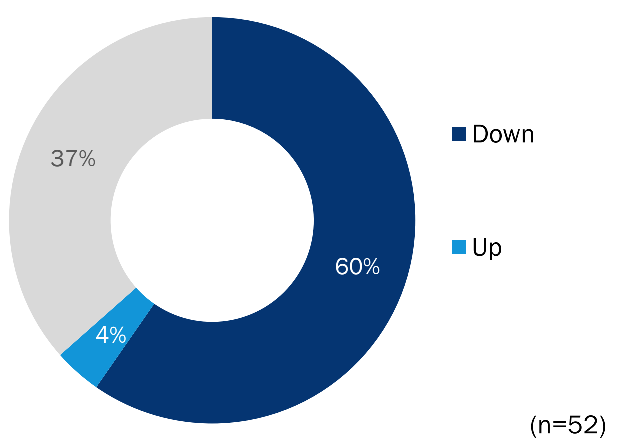
Figure 31. Direction of Electric Bill Change for LMI Participants



Note: Results based on participant web survey data – LMI participants who saw a change in their bill as a result of their participation

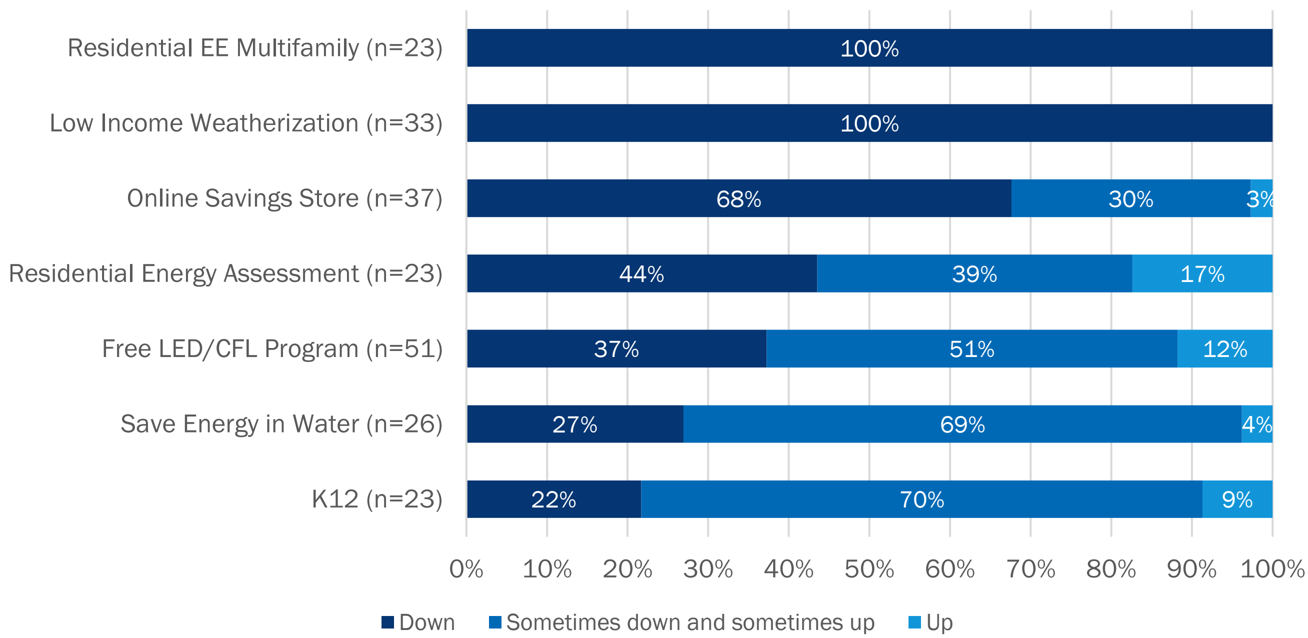
Figure 33 shows the direction of electric bill impacts reported by participants by program. Notably, all participants who reported changes in their bill as a result of their participation in the Residential EE Multifamily and Low-Income Weatherization programs reported their bills went down year-round. Over half of Online Savings Store participants who saw a change in their bill also report it being consistently lower. Participants' perceived bill impacts for the Residential Energy Assessment, Free LED/CFL Program, Save Energy in Water, and K12 program are more variable with the majority saying their bill went both up and down or consistently up throughout the year.

Figure 32. Direction of Electric Bill Change for Non-LMI Participants



Note: Results based on participant web survey data – non-LMI participants who saw a change in their bill as a result of their participation

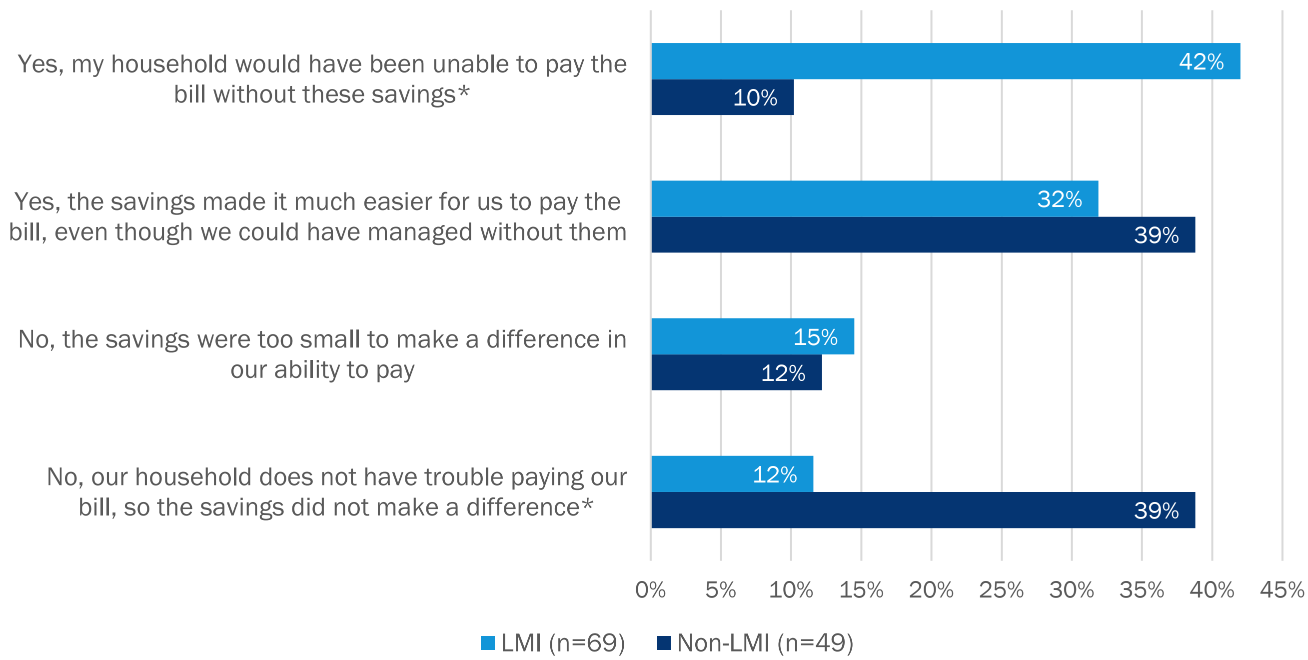
Figure 33. Direction of Reported Electric Bill Impacts by Program



Note: Figure presents direction of change in bills for those programs where n>20. Results are not broken down by LMI status as it would result in insufficient comparison group sizes. Results based on participant web survey – respondents who saw a change in their bill as a result of their participation

Despite experiencing less consistent savings, LMI participants are more likely than non-LMI participants to report that the electric bill savings they do experience affect their household's ability to pay their bills (Figure 34). Notably, LMI participants are significantly more likely than non-LMI participants to indicate that they would not have been able to afford to pay their electric bills without the savings associated with their participation (42% vs. 10%). Additionally, only 12% of LMI participants indicate that the savings did not affect their ability to pay their electric bill because they did not have any issues affording the bill already, compared to 39% of non-LMI participants. This suggests that savings associated with participating in a Duke Energy program are more financially meaningful to LMI customers than non-LMI customers.

Figure 34. Impact of Savings on Participants Ability to Pay Electric Bill



Note: Results based on participant web survey data - participants who saw a change in their bill as a result of their participation

* Statistically significant difference between groups at a 90% confidence level

LMI and non-LMI participants who experienced electric bill savings were equally satisfied with the amount of savings. On a 0 to 10 scale where 0 represents extremely dissatisfied and 10 extremely satisfied, the average satisfaction score for LMI participants was 8.3 compared to 7.9 for non-LMI participants.

In-depth interviews with participants reinforce the finding that LMI participants are more attuned to their electric bill amounts and notice even small decreases. Interviews also support the conclusion that bill savings among LMI customers, even when savings are not consistent from month to month, have meaningful impacts on customers' lives (Figure 35).

Figure 35. Quotes on Bill Savings from Participant Interviews

$ Bill Impacts

"I saw a decrease in my electrical bill when they went in the attic, and when they put the insulation around the hot water heater."

"It seemed like the electric was a little less, maybe about $10 to $15 less. Every little bit helps. Sometimes, I've had to go out on the street and stand or sit in my walker and beg for money to pay the bill."

"Even with the oxygen machine running all day the bill has gone down, because it used to be higher."

"My bill is a lot lower than what it was. I've been saving about $14 a month. If Duke had not put me in the program, my kids and I would've been without lights."

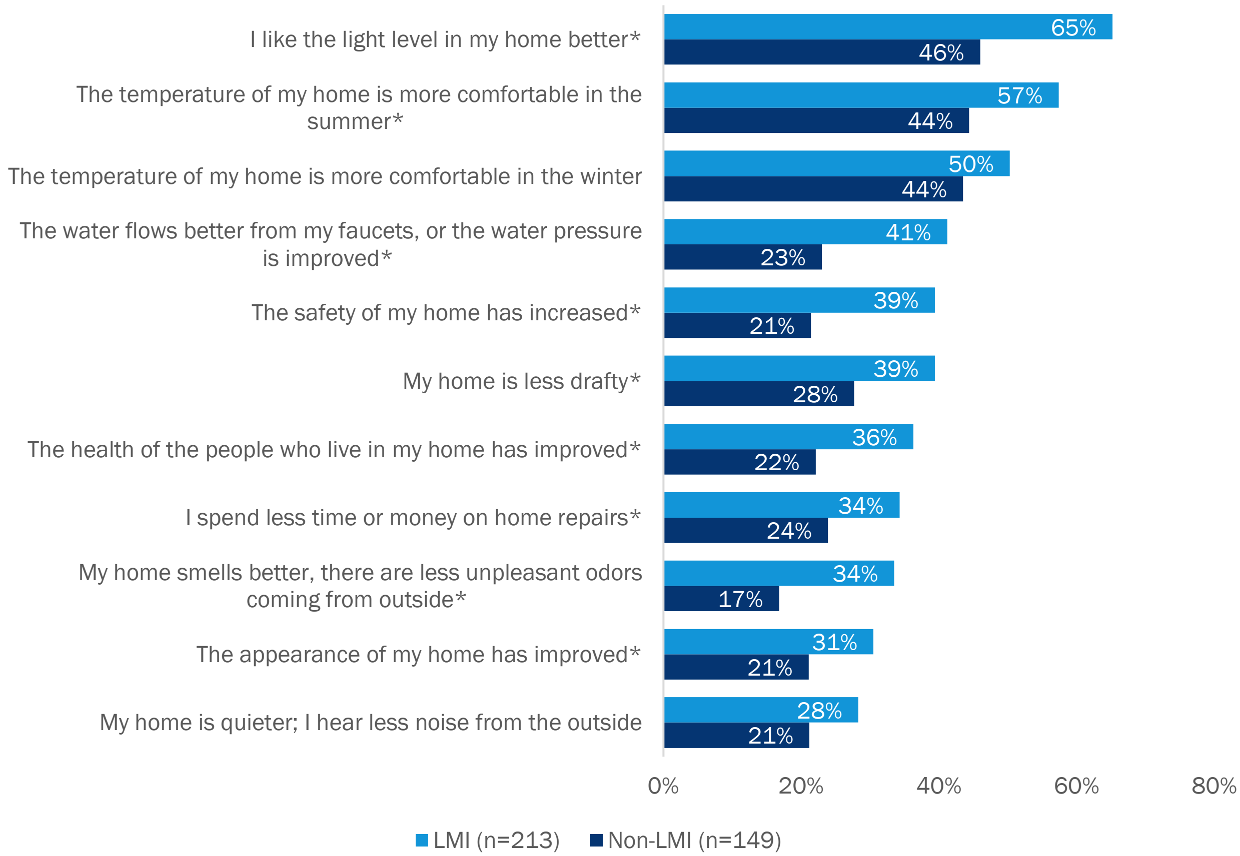
"I noticed a little difference. It was like a $10 or $15 difference. It means so much. I'm a single parent and groceries, other expenses, taking care of my little girl, it adds up, so everything really counts."

"The savings have helped me to be able to put more gas in the car."

Non-Energy Impacts

LMI participants report a greater number of non-energy impacts (NEIs) because of their participation in Duke Energy programs (5.7 on average) compared to non-LMI participants (4.6 on average). We asked about eleven possible NEIs in the participant surveys. For 9 of the 11 impacts, LMI participants were significantly more likely than non-LMI participants to say they experienced an impact (Figure 36). The most frequent impacts that LMI participants noticed were better light quality (65%) and more comfortable home temperatures during the summer (57%) and winter (50%). Most LMI participants also report intangible impacts such as increased knowledge about their energy consumption (71%) and feeling that they are helping the environment (78%).

Figure 36. Non-Energy Impacts Participants Experienced†



Note: Results based on participant web survey data – participants that provided valid NEI selections

* Statistically significant difference between groups at a 90% confidence level

† Values will not sum to 100% as multiple responses were permitted

In-depth interviews with participants support the finding that LMI customers experience meaningful NEIs beyond bill impacts due to their participation in Duke Energy's programs. While many participants reported positive benefits from measures such as lighting (Figure 37) and low-flow showerheads (Figure 38) and were satisfied with their experiences, a few were less satisfied. Some participants noted that their participation decreased maintenance projects and costs, though one participant noted that participating made him aware of additional projects and energy efficiency upgrades that are needed (Figure 39).

Figure 37. Quotes on Lighting NEIs from Participant Interviews

Lighting Impacts

"I took out all my old light bulbs and the new light bulb were brighter and used a lot less energy."	"The lighting is much better. I can see better. I do a lot of puzzles and numbers, so it's good when it comes to that. "
"The bulbs were a little bit dim. It wasn't as bright as I like it, but I knew it wasn't costing me as much, so that was a positive to me."	"The light bulbs they brought were doing great and were very efficient, but I ended up giving them away because they gave off a cold, white light."

Figure 38. Quotes on Water Measure NEIs from Participant Interviews

Water Impacts

"My daughter takes longer showers, so that's helpful because now when she takes long showers it's not pouring out as much water."	"I was happy with the showerhead, but I wanted one that had a longer, standard hose on it."
"Putting the showerheads on was easy and using them is a good experience. The water comes out better."	"The showerhead that they brought enraged me. It is low flowing and prefer something that flows a lot."

Figure 39. Quotes on Home Maintenance NEIs from Participant Interviews

Maintenance Impacts

"Because of the air filter I only need to clean the air conditioner every other year instead of every year."	"The LEDs lasted for a good while before I had to switch them out. They saved me on buying bulbs for a while."
"My participation has added additional projects to the list, some that have been done and more that are left to do. It increased my awareness of additional projects."	"I'm still using the light bulbs Duke gave us to this day. They gave us a ton and they last a long time. We haven't had to go out and buy any light bulbs for two years."

Some of the most meaningful NEIs reported by participants had to do with the comfort of their home (Figure 40) and improved health and safety (Figure 41). Participants who received measures to improve the envelope of their home or upgrade their heating or cooling systems noticed the benefits beyond energy savings and shared examples of the impact on their household, their health, and their day-to-day life.

Figure 40. Quotes on Temperature/Comfort NEIs from Participant Interviews

Temperature Impacts

"My room used to stay cold. With the new system my room stays warm now in the wintertime. In the summertime, with the old system we knew that the air was on, but it wasn't cooling our home. Now when we come home it's cool right away."

"Once Duke did the insulation it was much easier to manage the temperature. I don't have to raise my air conditioning higher at all."

"Without the weather strips the floor was always colder. So typically, that means your feet are colder and you might deal with a little sniffy nose or runny nose, but it's gotten better now."

"The weather stripping keeps the cold out. My curtains used to move when the wind would blow but they don't anymore."

"I feel more comfortable in my house. I am not sweating all the time anymore. I like to stay cool because I have high blood pressure."

"The smart thermostat helped us to keep our home at a more comfortable temperature. We were more comfortable being able to set it to a number, rather than trying to guess where the mercury was. Seeing recommendations like, "You should keep your thermostat at 76 to be eco-friendly" also helped us to realize how we should set our thermostat."

Figure 41. Quotes on Health and Safety NEIs from Participant Interviews

Health and Safety Impacts

"Because of my skin cancer and Crohn's disease, if it got too hot in our home, like it did with our old system, it would mess with my skin and make my skin itch."

"It was good that they took away the draft in my home as there were some areas in the house where it looked like mold was beginning to form."

"If there is any COVID germs inside the household, the new filters would help filter the germs."

"My daughter would always be wheezing because of her asthma and how hot her room was. With the new HVAC system her room doesn't get as hot as it did before. When it would get hot, she couldn't breathe and would have to sleep out in the living room with the ceiling fan on."

"Because of the weather stripping, I can't lock the doors unless I take one hand and pull on the door and then try to lock it with the other hand while pulling on the door."

5. Key Findings and Recommendations

5.1 Key Findings

- LMI customers have different demographic and housing characteristics, on average, than non-LMI households. Our analysis of census, Duke participation, survey, and in-depth interview data reveals that these differences affect LMI customers' energy efficiency needs, program participation barriers and motivations, and the magnitude of program participation impacts.
- Our analysis of census data and neighborhood participation rates from 2013 through 2021 found that average annual participation in Duke Energy programs was slightly lower in neighborhoods that have a moderate to high percentage of LMI households compared to those with few LMI households. Program participation was lowest in neighborhoods that have a moderate percentage of low income household customers. In neighborhoods where between 40% to 50% of households are LMI, an average of 8.29% of households participated in Duke Energy programs each year compared to 8.99% in neighborhoods with a high percentage of LMI households (90% or more) and 10.48% of households in neighborhoods with few LMI households (less than 10%).
  - Both moderate and high LMI neighborhoods have lower participation rates in market rate programs (~ 8%) compared to low LMI neighborhoods (~10%). But in high LMI neighborhoods, a small but meaningful percentage of households (~1%) participate in low income programs, which somewhat makes up for their lower participation in market rate programs. In neighborhoods with a moderate percentage of LMI households, fewer participate in low income programs (less than 0.5%).
  - We found a similar difference in participation rates in programs with high energy savings. We found that 2.9% of customers who live in neighborhoods with a high concentration of LMI households participate in high savings programs compared to 3.7% of customers who live in neighborhoods with few LMI households.
- Our analysis of results from participant and nonparticipant surveys finds that Duke Energy programs struggle to reach historically hard-to-reach and frequently disadvantaged populations, namely renters, residents of multifamily properties, and more transient populations. The majority of participants, both LMI and non-LMI, are homeowners and live in single family homes. Living in a rented or multifamily home compounds the participation barriers for LMI customers.
  - We found that LMI program participants were much more likely to own their homes than LMI non-participants. Just over half of LMI participants (52%) are homeowners compared to 15% of LMI non-participants. Similarly, just under two-thirds of LMI participants (64%) live in a single-family home compared to just over one-quarter of LMI non-participants (28%).
  - Non-LMI participants are also more likely to be homeowners compared to non-LMI nonparticipants (86% vs. 57%). Non-LMI participants are more likely to live in single family homes compared to non-LMI nonparticipants (81% vs. 53%).
- Nonparticipant survey results show that LMI customers have greater energy efficiency needs and concerns than non-LMI customers.
  - One-third of LMI nonparticipants (33%) said "a lot of things" in their homes could be made more energy efficient, compared to only 16% of non-LMI nonparticipants.

- LMI nonparticipants were more concerned about their energy usage than non-LMI nonparticipants. Half of LMI nonparticipants (49%) were either "very" or "extremely concerned" about their household energy use, compared to slightly under one-third (30%) of non-LMI nonparticipants.

- Despite a greater need for energy efficiency improvements, participation barriers among LMI customers are more pronounced compared to non-LMI customers and include program awareness, knowledge, cost constraints, and being a renter. Our survey results suggests that, with the support of a program that addresses their barriers to structural upgrades, LMI nonparticipants would be likely to make energy efficiency improvements to their homes. However, barriers such as split incentives and limited financial resources may inhibit LMI customers from seeing high-savings programs as a realistic possibility for their household.
  - LMI nonparticipants are less likely to be aware of Duke Energy programs compared to non-LMI nonparticipants (40% vs. 64%). Nonparticipants had low awareness of energy efficiency opportunities in general, with LMI customers reporting lower awareness than non-LMI customers. Over half of LMI nonparticipants (55%) said they were either not at all knowledgeable or had only a little knowledge about ways to save energy in their homes compared to 45% of non-LMI nonparticipants
  - More LMI nonparticipants say that they are "not at all likely" to make changes to their home to make it more efficient in the next year compared to non-LMI nonparticipants (43% vs. 28%).
  - When presented with specific offerings from Duke Energy, LMI nonparticipants were more likely than non-LMI nonparticipants to say they were "very" or "extremely" likely to participate in any type of Duke Energy program in the next two years. LMI nonparticipants were most interested in no-cost or low cost upgrades such as lighting or free upgrades based on income and least interested in higher cost and higher savings opportunities such as heating and cooling system rebates.
  - LMI and non-LMI nonparticipants have different barriers to program participation. LMI nonparticipants were more likely than non-LMI nonparticipants to say that the cost of participation, their lack of authority as a renter, and the COVID-19 pandemic were barriers to their participation

- Our modeling of LMI customer energy bills before and after participation in Duke Energy programs, revealed modest electric bill savings for customers who participated in Duke Energy programs. Following program participation, the electric bills of LMI customers fell by an average $34 per year, or about a 2% annual bill reduction ($1,600 is the average annual bill for LMI participants).

- One in five LMI participants reported a consistent reduction in their electric bills after participating in a Duke Energy program, which is somewhat lower than what non-LMI participants reported (21% vs. 29%). Survey results and in-depth interviews with LMI participants report these reductions have a greater impact on their household finances given their lower incomes.
  - LMI participants are significantly more likely than non-LMI participants to indicate that they would not have been able to afford to pay their electric bills without the savings associated with their participation (42% vs. 10%). One participant reported, "My bill is a lot lower than what it was. I've been saving about $14 a month. If Duke had not put me in the program, my kids and I would've been without lights."

- LMI customers are satisfied with their program participation experience and are more likely to report non-energy impacts (NEI) from participation than non-LMI customers.
  - The most frequent impacts that LMI participants noticed were better light quality (65%) and more comfortable home temperatures during the summer (57%) and winter (50%).

5.2 Study Recommendations

- **Duke Energy should continue to offer low income programs in addition to their market rate offerings.** Duke Energy's low income programs play an important role in supplementing market rate programs in neighborhoods with a high percentage of LMI customers.
- **Duke Energy should consider expanding their low income offerings to reach more low income customers outside of neighborhoods with a high concentration of LMI customers.** The neighborhood-based low income programs are less effective at reaching customers in neighborhoods that have a moderate yet still sizable percentage of low-income customers.
- **Duke Energy should utilize existing LMI networks and leverage word-of-mouth outreach from satisfied participants to increase program awareness and participation.** LMI participants report receiving critical energy and non-energy benefits due to participating in Duke Energy programs. Duke Energy could encourage past participants to share their stories with friends, family, and neighbors. . Duke Energy could also consider featuring testimonials about the benefits of participation from past participants in marketing materials.
- **To increase program participation among LMI customers, Duke Energy should enhance their low income program efforts to reach the sub-segments of LMI customers who are most underserved, focusing on renters and multifamily residents.** LMI renters and residents of multifamily properties are less likely to participate than comparable owners and single-family customers. Program enhancements could include outreach to landlord and property owners either directly or on behalf of tenants and adding measures to existing multifamily programs that would provide greater energy savings.
- **Duke Energy should consider either adding a program specifically for moderate income customers or programs that would reduce the up-front investments required for high savings programs.** Moderate income customers could benefit from an on-bill financing program that would spread initial upgrade costs out over time.
- **Duke Energy should consider prioritizing new program offerings that provide support for measures that LMI customers report as most needed.** LMI nonparticipants report that they could most benefit from upgrades to their HVAC equipment, home weatherization, and energy efficient windows.

/A

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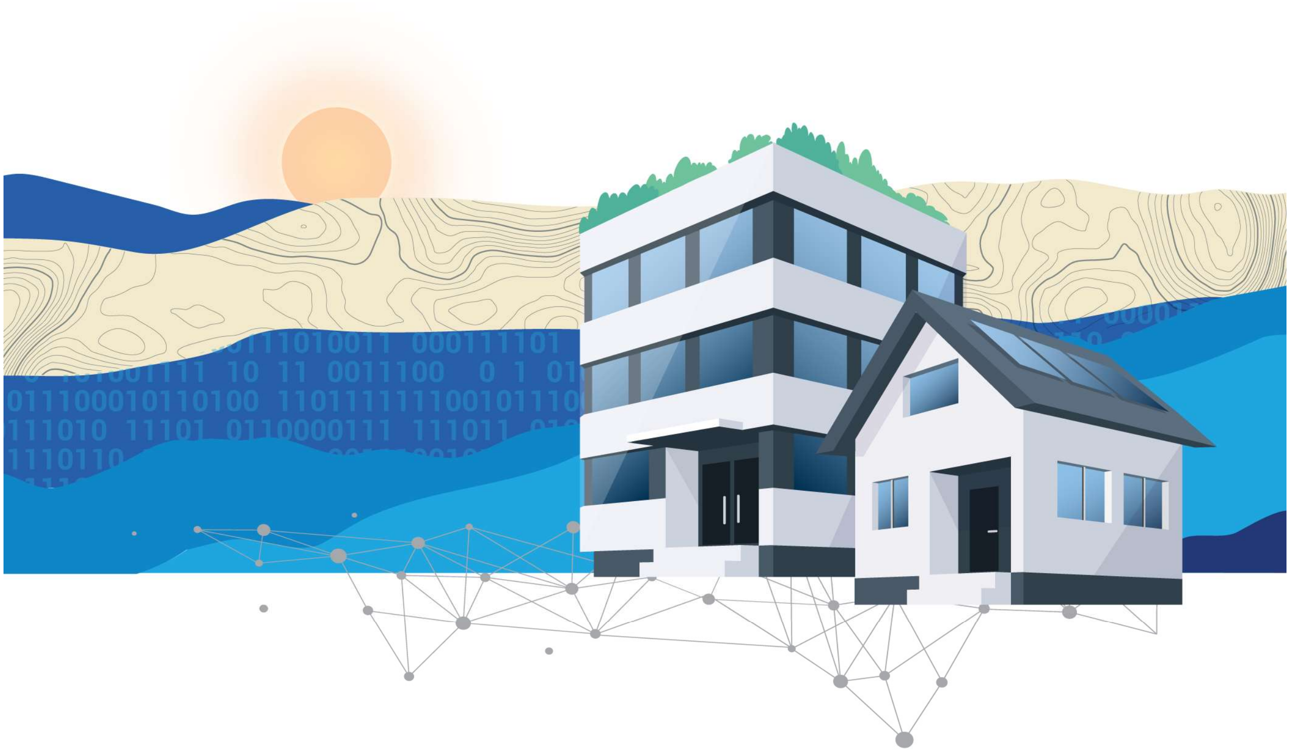


Duke Energy Carolinas (DEC) and Duke Energy Progress (DEP) Low and Moderate Income Penetration Study

Study Report – Appendices

December 9, 2022

Table of Contents

Table of Tables

Table of Figures

Appendix A. Detailed Maps

This section includes all maps produced as part of the geospatial analysis. Data is summarized at the Census block group level. Due to the small and concentrated nature of Census block groups in urban areas, we provide visuals for six major urban areas in the Carolinas following the territory-wide visual for each topic.

Figure 1. Proportion of LMI Households in Block Group

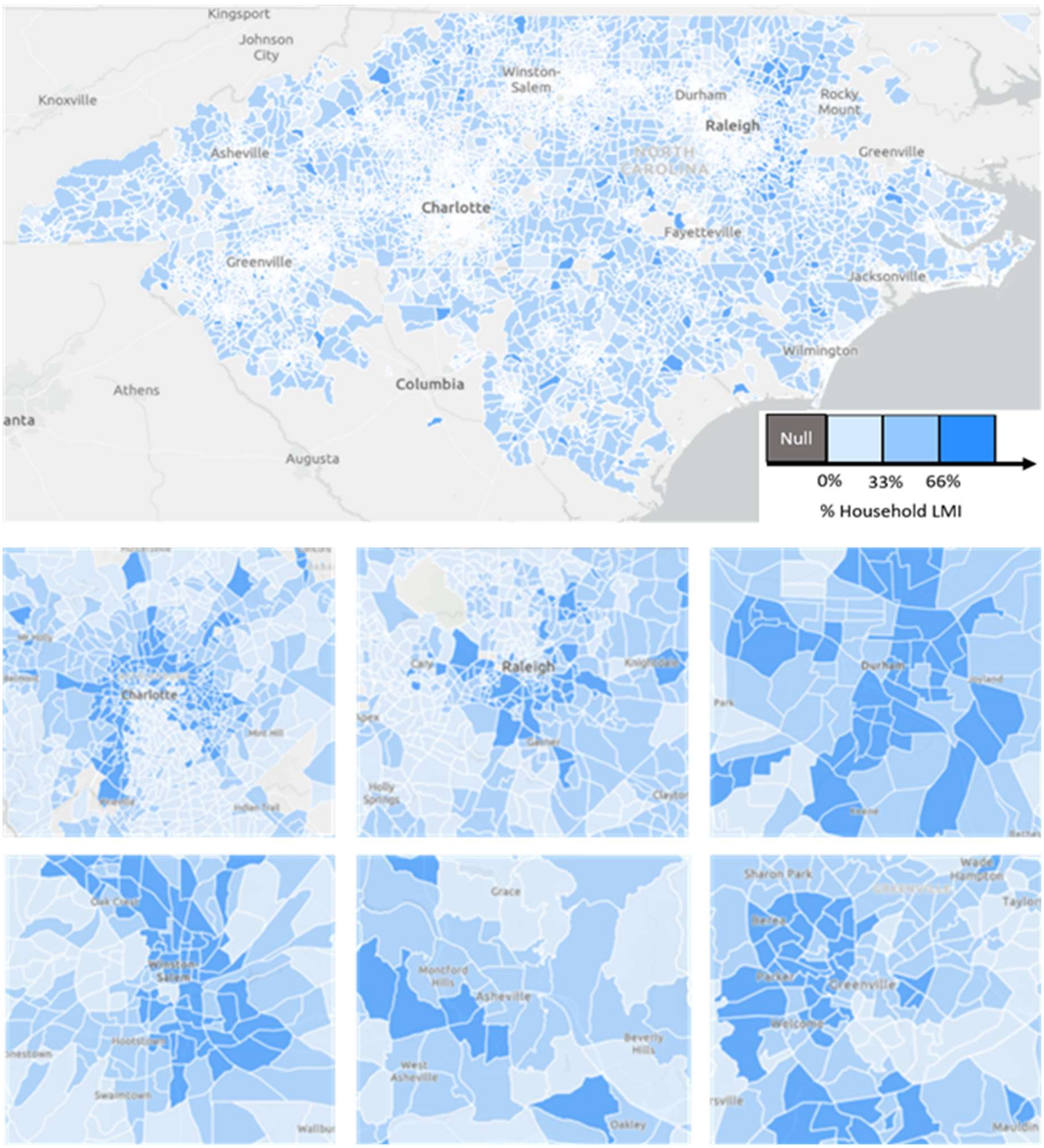
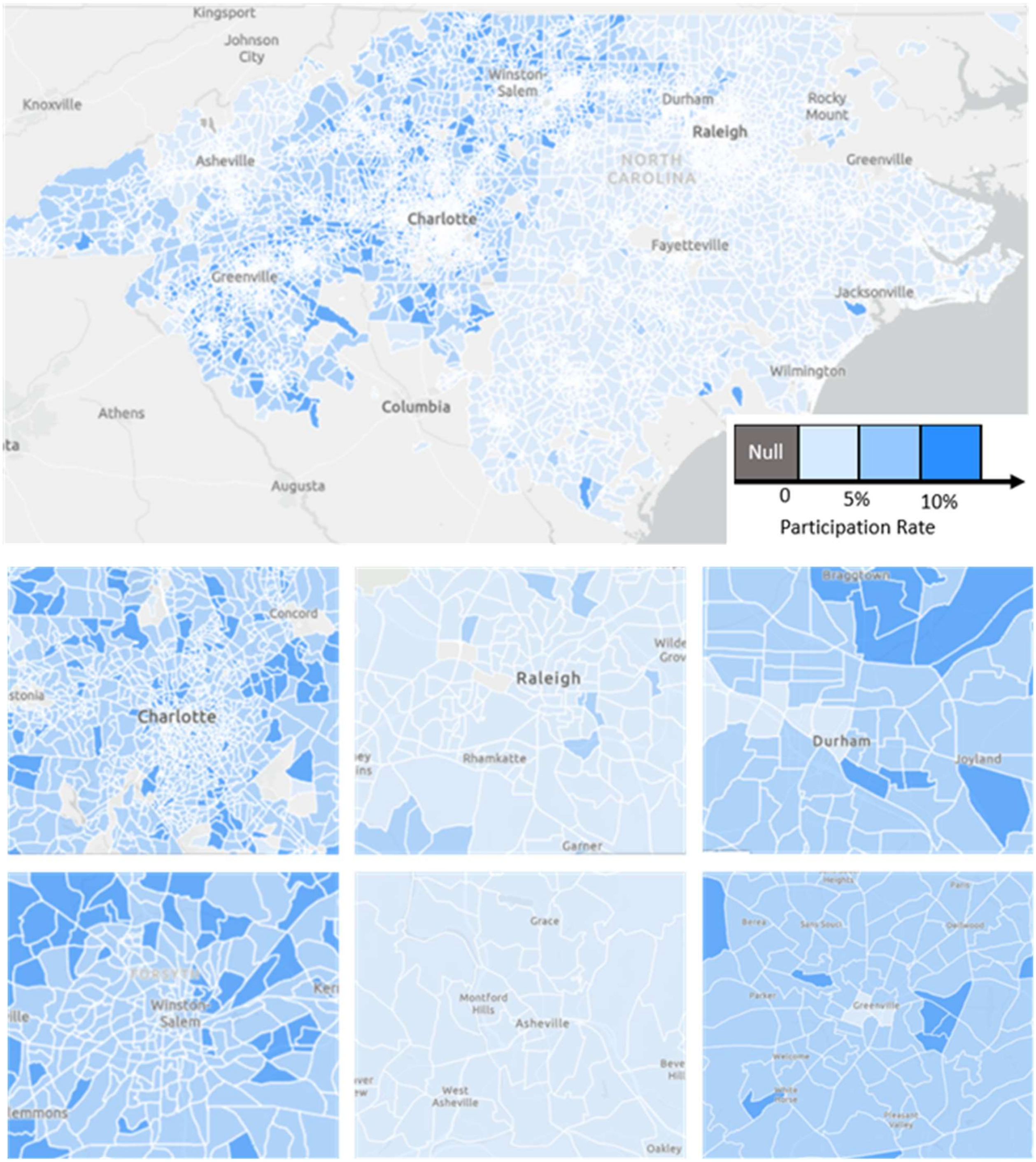
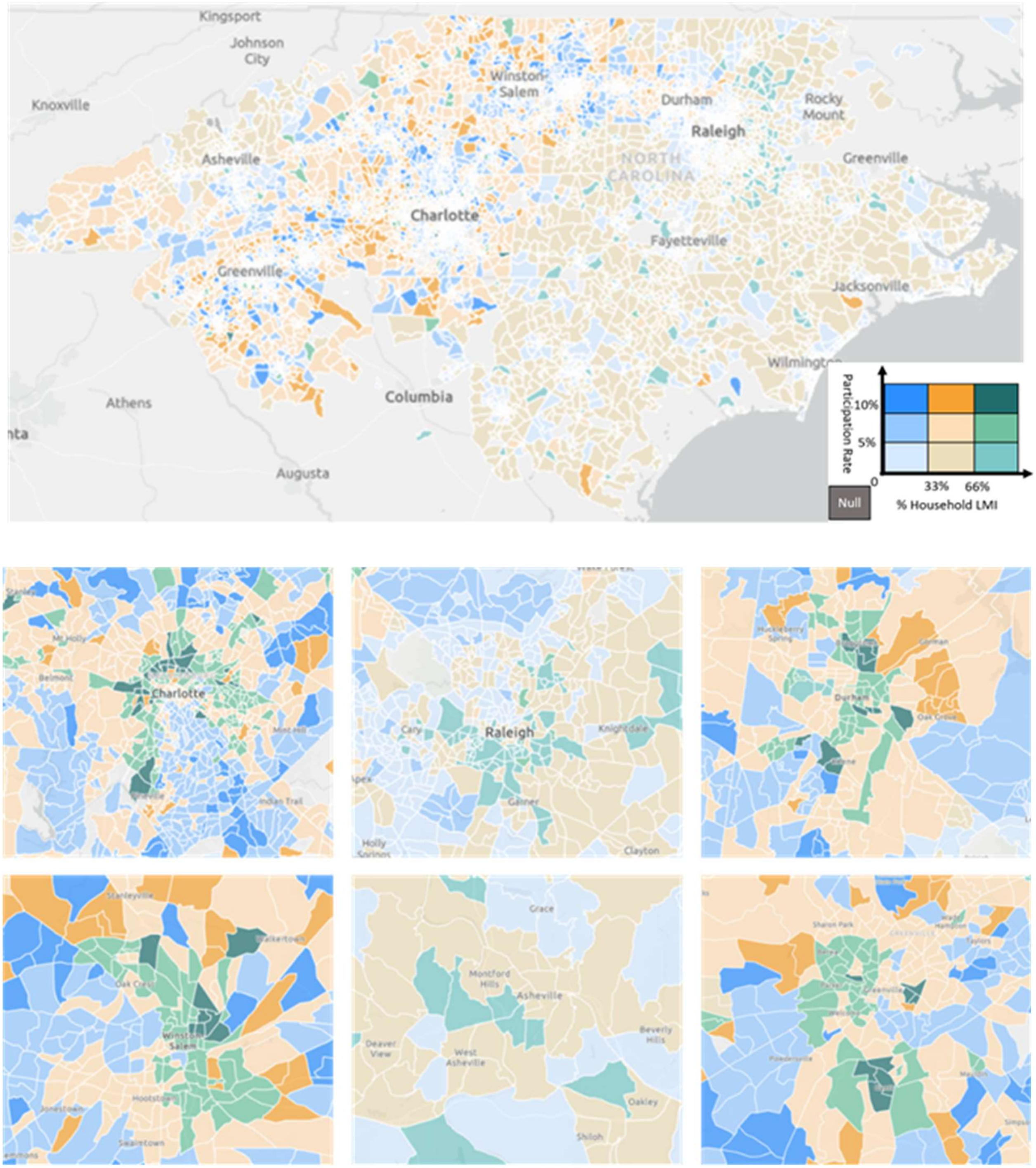


Figure 2. Duke Energy Program Participation Rate in Block Group



Detailed Maps

Figure 3. Participation Rate Compared to LMI Households



Detailed Maps

Figure 4. Participation Rate Compared to Ex Ante Savings

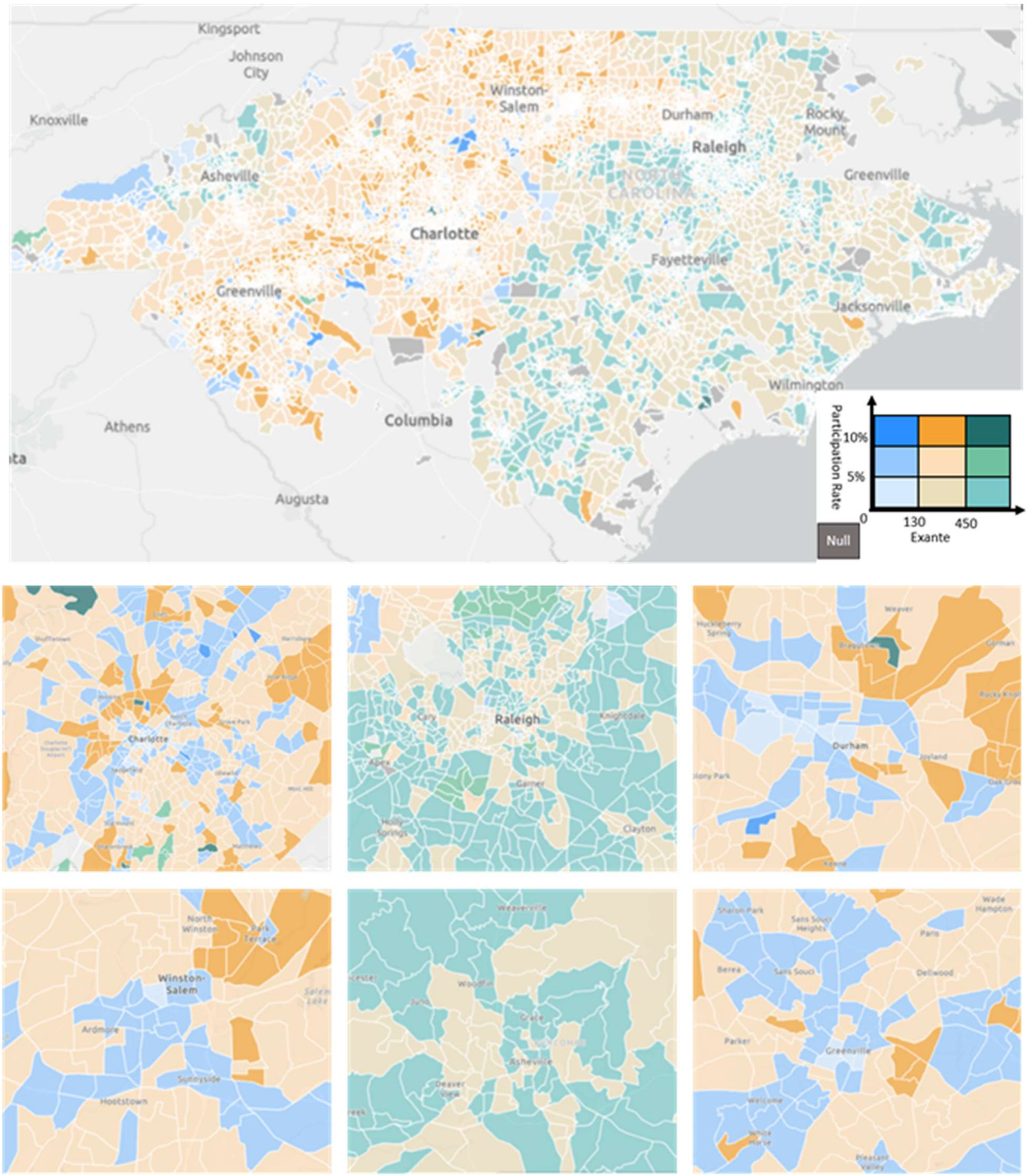


Figure 5. Participation Rate Compared to Single Family Homes

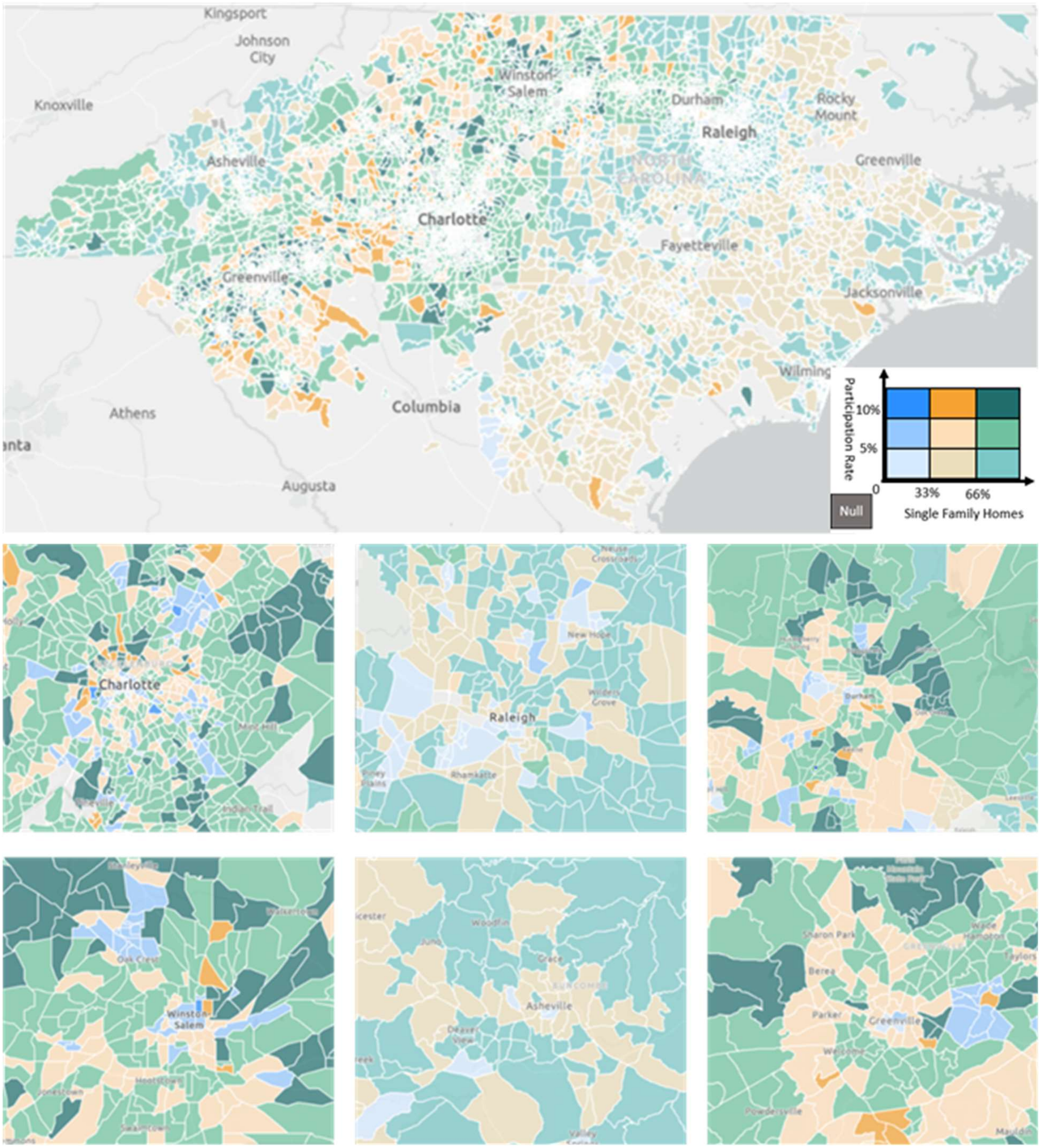


Figure 6. Participation Rate Compared to Owner Occupied Homes

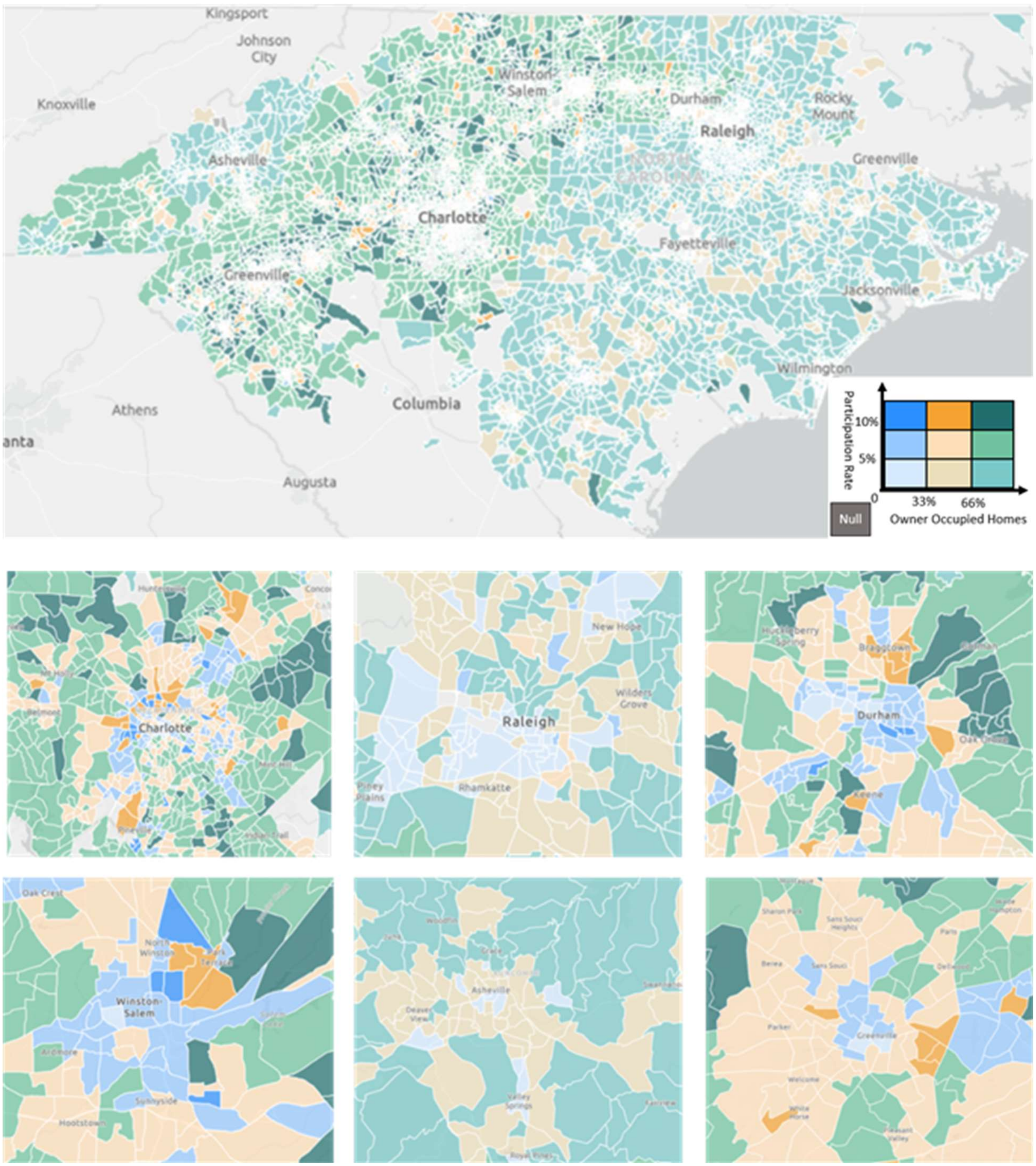


Figure 7. Participation Rate Compared to Nonwhite Population

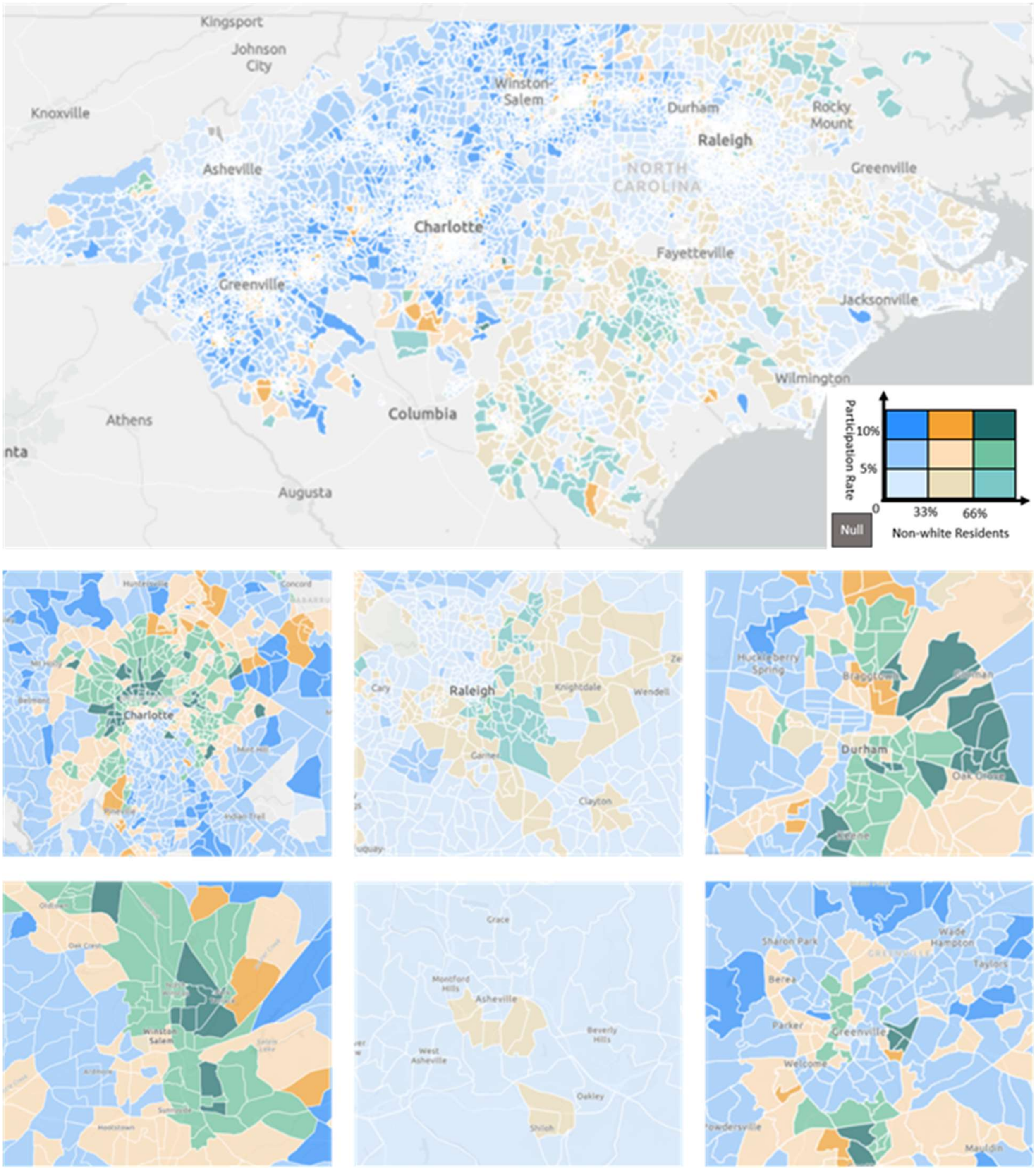


Figure 8. Participation Rate Compared to Household Energy Burden

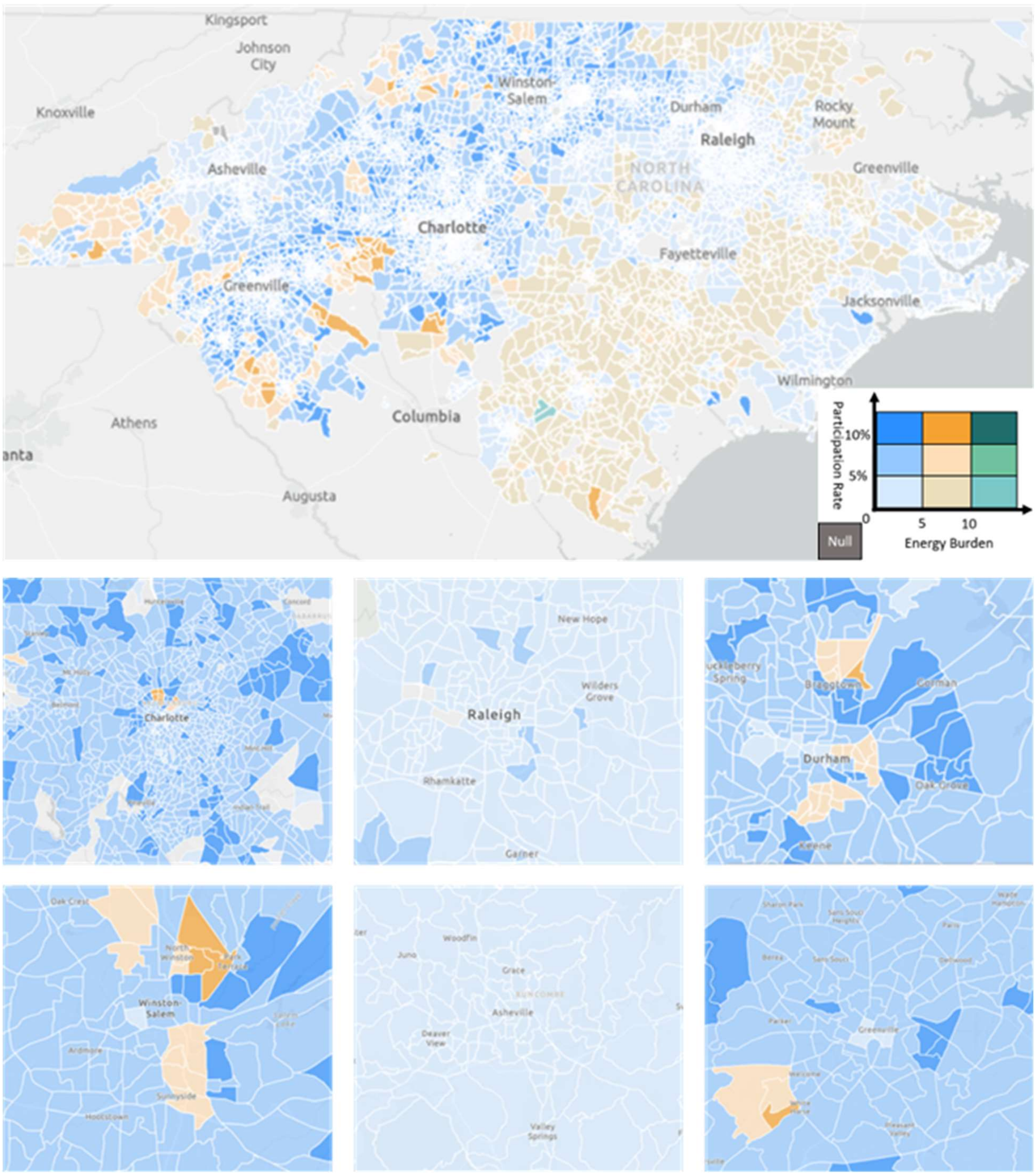


Figure 9. Participation Rate Compared to Limited English Proficiency Households

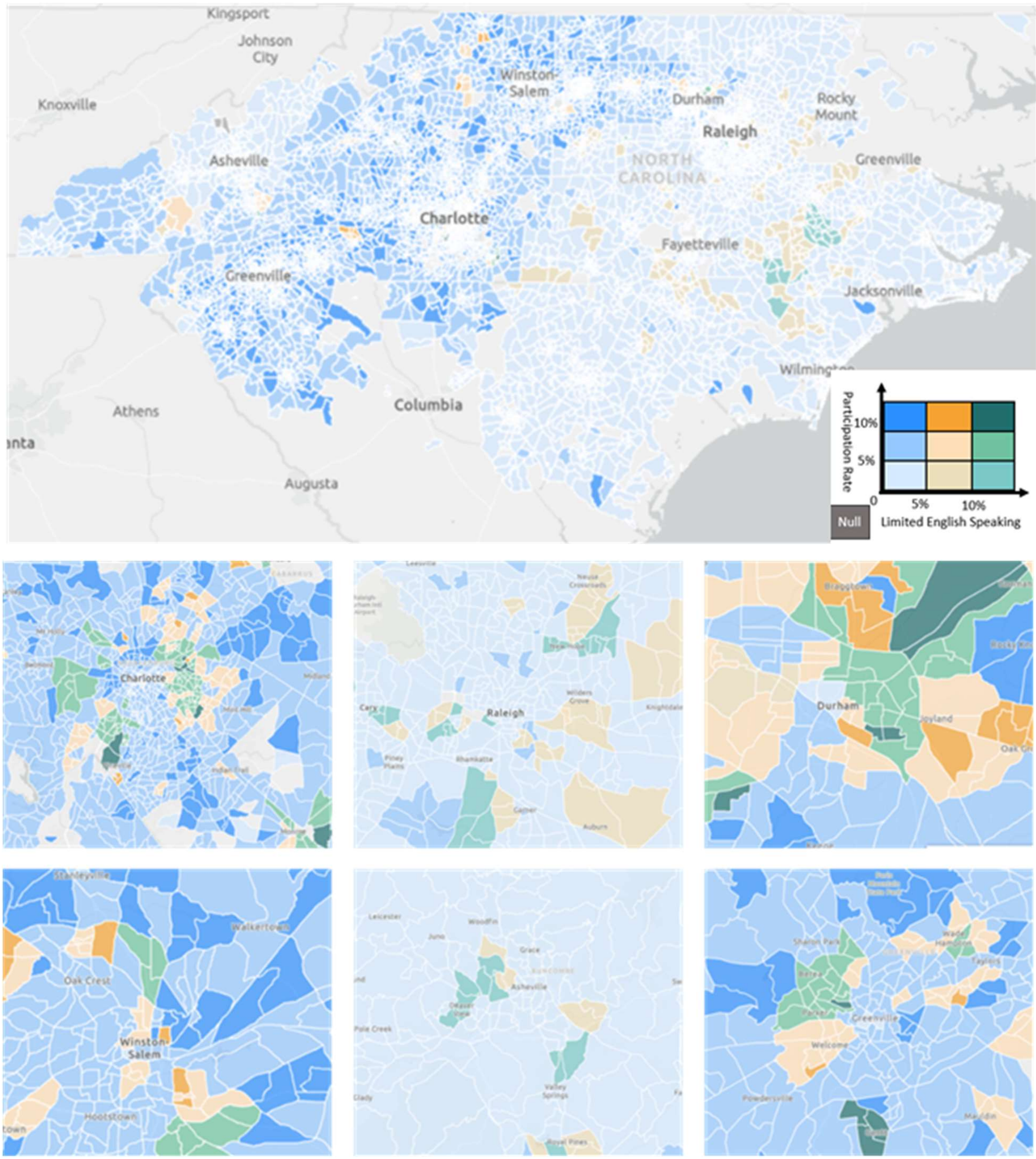
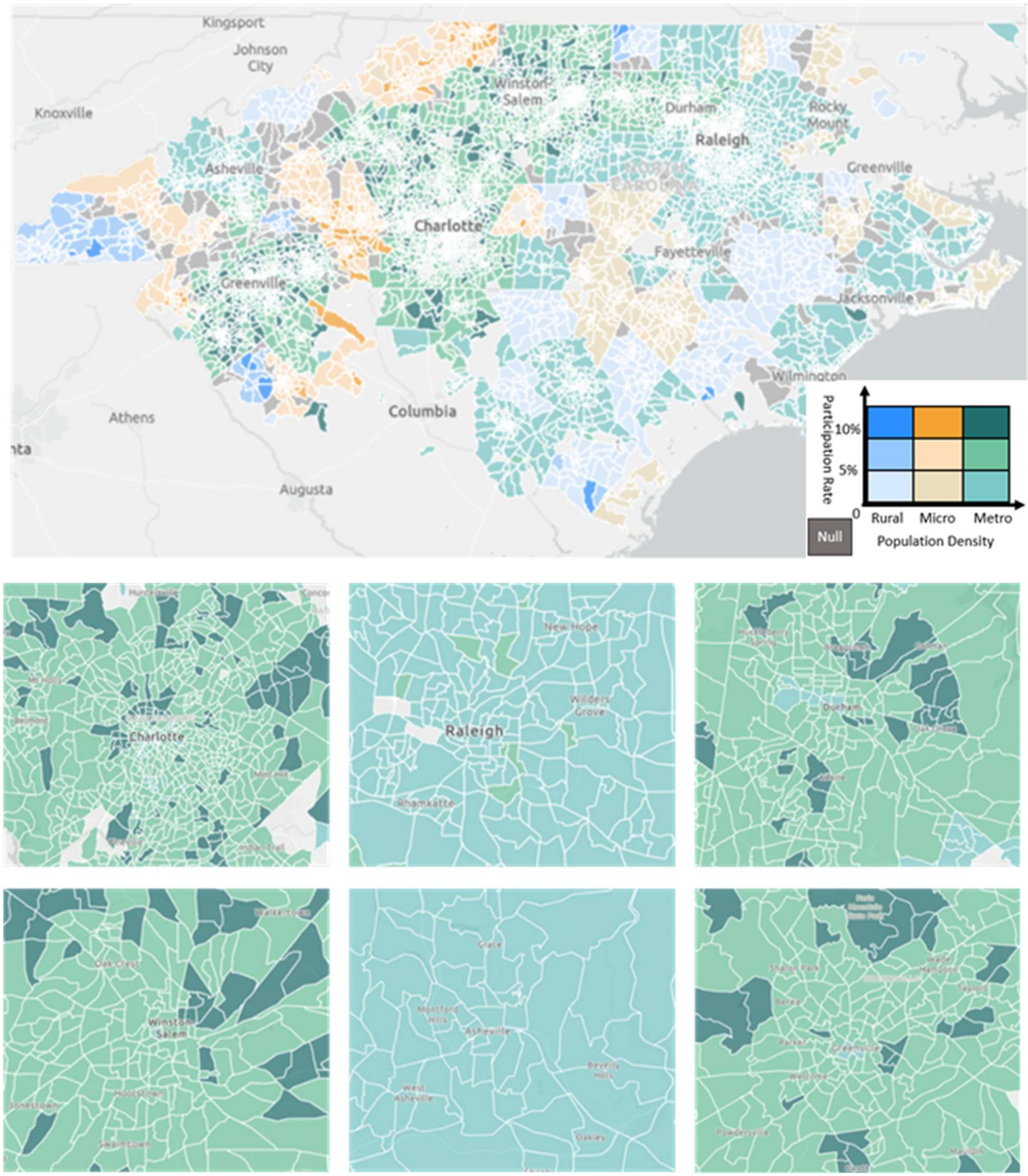


Figure 10. Participation Rate Compared to Population Density



Appendix B. Program Participation Model Detailed Methods

Data Cleaning and Preparation

The participation modeling analysis was completed with the Census block group as the unit of analysis. This unit of analysis was selected because the majority of the observed data on housing and demographic characteristics was unavailable for individual Duke Energy households.

We completed the following steps to prepare the data for analysis:

- Identified participants and nonparticipants by year. We flagged customers as having either participated or not participated in a given year and did not further identify customers who participated in more than one program.
- Aggregated household level data to the Census block group and year level. For example, we took the average per-participant ex ante savings and calculated block group level savings by year. We excluded 2021 due to much lower participation rates compared to previous years.
- Transformed all independent variables from continuous to indicator values by analyzing the distribution of the variable and setting a threshold for defining the block group as having a high or low incidence of this characteristic
  - Generally, we selected either the 75th or 90th percentile of the variable to define the indicator. For example, if the 90th percentile of Census block groups are comprised of 73% or more nonwhites; the nonwhite flag was set at 73% or higher.
  - The 90th percentile was chosen if there was a large gap between the 75th and 90th percentiles.
  - If the 75th & 90th percentiles were close, the 75th percentile was selected as the cutoff.
- The dependent variable, which was the participation rate in low or high savings offerings, respectively, was retained as a continuous variable.

The total number of Census block groups included in the analysis after data cleaning were 5,679 (86.5%).

Model Specification

The purpose of the participation model was to identify household and demographic characteristics associated with participation in Duke Energy programs at the Census block group level. The dependent variable was the average annual participation rate in the block group. We fit separate linear regression models for high savings and low savings programs (as defined by average per-household ex ante savings values) as we found that different characteristics drive participation in high vs. low savings offerings and higher savings offerings also have different impacts on participants.[1]

Independent variables were selected for inclusion in the model based on the results of descriptive analysis including examining correlations and trends between participation rate and percentage of LMI households for each variable. The independent variables were constructed as indicator variables to identify neighborhoods that stand out on sociodemographic, housing, and energy consumption characteristics. The use of indicator variables allows us to isolate the explanatory power of these characteristics by focusing on neighborhoods

[1] Due to fluctuating savings values over time, savings were defined as high savings if they were greater than or equal to average per-participant savings in that year, and as low savings if they were less than average.

where they are prevalent. The indicator variables effectively reduce "noise" in the neighborhood-level data. The models did not include any interaction terms as we found that these did not improve fit at the neighborhood level. Ultimately, we did not include the percentage of LMI households in the neighborhood as an independent variable. We tested models with and without this term and found that given the high correlation between LMI status and other sociodemographic and housing characteristics, models without LMI status provided better predictive power and allowed us to isolate the underlying characteristics that explain program participation rates.

After testing a variety of models, we selected the specification presented in Equation 1. Models were assessed on fit. The best model had an r-squared value of 0.16, meaning that it explains 16% of the variation in program participation rates between Census block groups. The low r-squared is likely due to: (1) the neighborhood analysis obscures important household-level variation and reduces predictive power and (2) unobserved characteristics and events that contribute to variation in program participation rates.

Equation 1. Participation Model Specification

$ParticipationRate_{it} = B_1 + B_2 + B_3 + B_4 + B_5 + B_6 + B_7 + B_8 + B_9 + B_{10} + B_{11} + B_{12} + B_{13} + \varepsilon_{it}$ Where:

$ParticipationRate_{it}$ = High or low savings participation rate in Census block group

B_1 = Indicator for neighborhood with high proportion of homeowners

B_2 = Indicator for neighborhood with high proportion of renters

B_3 = Indicator for neighborhood located in city

B_4 = Indicator for neighborhood located in town

B_5 = Indicator for neighborhood with high proportion of nonwhite residents

B_6 = Indicator for neighborhood with high proportion of white residents

B_7 = Indicator for neighborhood with high proportion of single family housing (up to 5 units)

B_8 = Indicator for neighborhood with low average household energy consumption

B_9 = Indicator for neighborhood with high average household energy consumption

B_{10} = Indicator for neighborhood with very high proportion of homes with electric heating fuel

B_{11} = Indicator for neighborhood with high proportion of homes with electric heating fuel

B_{12} = Indicator for neighborhood with high average energy burden

B_{13} = Indicator for neighborhood with high proportion of households lacking internet access

ε_{it} = Error term

Model Results and Interpretation

The results of the high and low savings models are presented in Table 1.

Table 1. Participation Model Results

Characteristic	High Savings Model Statistic	Low Savings Model Statistic
High proportion homeowners	0.324	0.770
High proportion renters	0.051	-0.135
Neighborhood in city	0.621*	2.820*
Neighborhood in town	0.358*	2.638*
High proportion nonwhite residents	0.682*	0.876*
High proportion white residents	-0.016	1.168*
High proportion single family housing [a]	0.463*	-0.107
Low average household energy consumption	-0.915*	0.709*
High average household energy consumption	0.459*	-0.960*
Very high proportion electric heating fuel	0.426*	-2.180*
High proportion electric heating fuel	0.117*	-0.500*
High average energy burden	0.197*	-2.546*
High proportion households without internet access	0.475*	0.022

*Statistically significant at 90% confidence level.
[a] Defined as homes with five units or fewer.

After identifying the key predictor variables (i.e., those statistically significant at a 90% confidence level), we determined the relative importance of each variable by considering its contribution to our understanding of the variation in participation rates between neighborhoods. We determined the relative importance of each predictor variable by calculating the percentage of total variation explained by each individual variable. We did separately for predictor variables with positive and negative coefficients.

The most important factors associated with participation in high savings programs are the proportion of nonwhite residents, being in a city, and a high proportion of households without internet access. These predictors all suggest that Duke Energy is reaching at least some disadvantaged populations through their current offerings. In addition, neighborhoods with single family or small multi-family housing units and very high proportions of households that heat with electric fuel achieve higher participation levels in high savings offerings. If a neighborhood has high per-household average energy consumption, this contributes to greater participation rates for high savings offerings, whereas neighborhoods with low per-household average energy consumption tend to have low participation rates in these offerings.

Table 2. Contribution of Neighborhood Characteristics to High Savings Participation Rate

Direction of Impact	Characteristic	Contribution to Explained Variation [a]
Positive	High proportion nonwhite residents	18%
	Neighborhood in city	16%
	High proportion households without internet access	13%
	High proportion single family housing [b]	12%
	High average household energy consumption	12%
	Very high proportion electric heating fuel	11%
	Neighborhood in town	9%
	High average energy burden	5%

Direction of Impact	Characteristic	Contribution to Explained Variation [a]
	High proportion electric heating fuel	3%
Negative	Low average household energy consumption	100%

a Contributions were calculated separately for characteristics with positive vs. negative influence. Contributions will add up to 100% per direction.

b Defined as homes with five units or fewer.

The most important factors associated with participation in low savings programs are both being in a city or town and having a high proportion of white or nonwhite residents. These results suggest that low savings offerings reach a very diverse range of customers, regardless of race and geographic location. Neighborhoods with low average per-household energy consumption have lower participation rates, whereas neighborhoods with high average per-household energy consumption have higher participation rates in offerings with low savings potential. Importantly, the most important negative predictor of neighborhood participation rates is energy burden. Those neighborhoods where residents have a high energy burden, on average, have lower participation rates in the low savings offerings.

Table 3. Contribution of Neighborhood Characteristics to Low Savings Participation Rate

Direction of Impact	Characteristic	Contribution to Explained Variation [a]
Positive	Neighborhood in city	34%
	Neighborhood in town	32%
	High proportion white residents	14%
	High proportion nonwhite residents	11%
	Low average household energy consumption	9%
Negative	High average energy burden	41%
	Very high proportion electric heating fuel	35%
	High average household energy consumption	16%
	High proportion electric heating fuel	8%

a Contributions were calculated separately for characteristics with positive vs. negative influence. Contributions will add up to 100% per direction.

Finally, to interpret the model results in light of our research focus on LMI customer participation, we assessed how each predictor variable that was both statistically and substantively significant corresponds with LMI status. This allows us to explain how the effect of sociodemographic, housing, and energy consumption characteristics combine with LMI status to increase or decrease participation in energy efficiency offerings. These results are presented in the main report.

Appendix C. Electric Bill Costs and Payments Detailed Methods

Data Request and Billing Data Preparation

The cost and payment analysis relied on data from multiple streams, provided separately for DEC and DEP. The data streams included the following:

- Customer bills
- Customer payments
- Accounts charged off
- Disconnections and reconnections[2]

All datasets covered the timeframe of March 1, 2017 through March 31, 2021, unless otherwise noted. The data timeframe was selected in coordination with Duke Energy based on data availability. The following customers were included in the initial data request:

- Participants in Duke Energy programs between 2013 and 2020 with accounts still active at any point between 2017 and 2020, residing in census block groups where 50% or more of households were LMI
- Nonparticipating customers were selected randomly from same Census block groups as participants to use as a point of comparison
- The analysis was limited to participants with moderate to high savings (at least 250 kWh in ex ante savings) to limit noise from low savings opportunities. Ex ante savings were calculated per customer as the total ex ante savings from all projects in the 2013 – 2020 timeframe.

We processed monthly DEC and DEP billing data including identifying customers on payment plans, calculating arrearage amounts, as well as organizing data in a format supportive of the analysis. Our analysis included program participants residing in census block groups with at least 50% of LMI customers who participated in Duke Energy efficiency programs between 2017 and March 2020. We further refined eligibility criteria to only include participants with anticipated savings of 250 kWh and higher. These choices were driven by both data availability and statistical modeling considerations. More specifically, we chose to include participants with savings over 250 kWh to ensure that bill impacts are detectable in the monthly billing data. Furthermore, we chose to exclude participants from March 2020 and onwards due to changes in customer billing processes, including moratorium on disconnections, as well as significant changes to customer energy usage patterns as a result of the COVID-19 pandemic, both of which are challenging to control for in the modeling process. Using the above criteria, we narrowed the subpopulation of participants to 105,327.

We performed the following cleaning steps on the participant data:

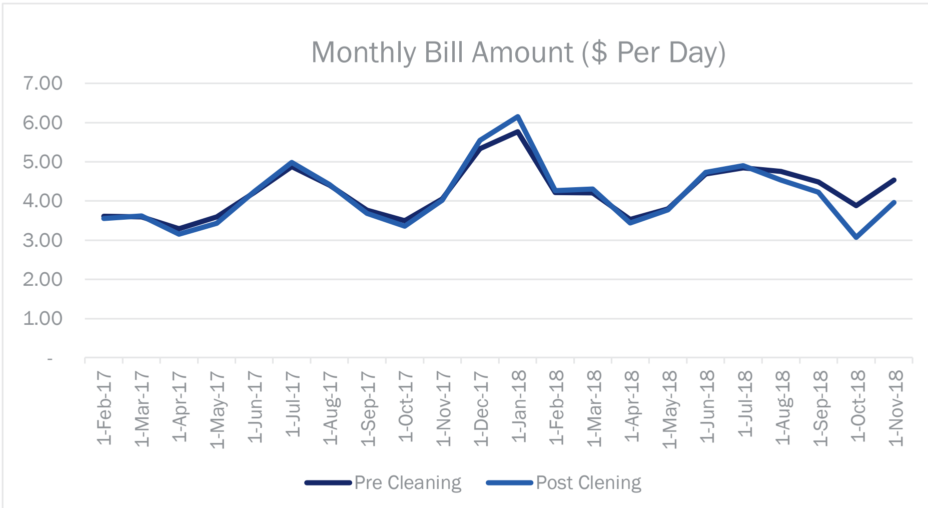
- **Duplicate records.** We explored duplicate and overlapping bill records and made adjustments to arrive at a single bill per period.
- **Extremely short or long bill periods.** We identified and dropped bill periods with a duration of zero days, a negative duration (i.e., start date is after end date), or a duration of more than 90 days.

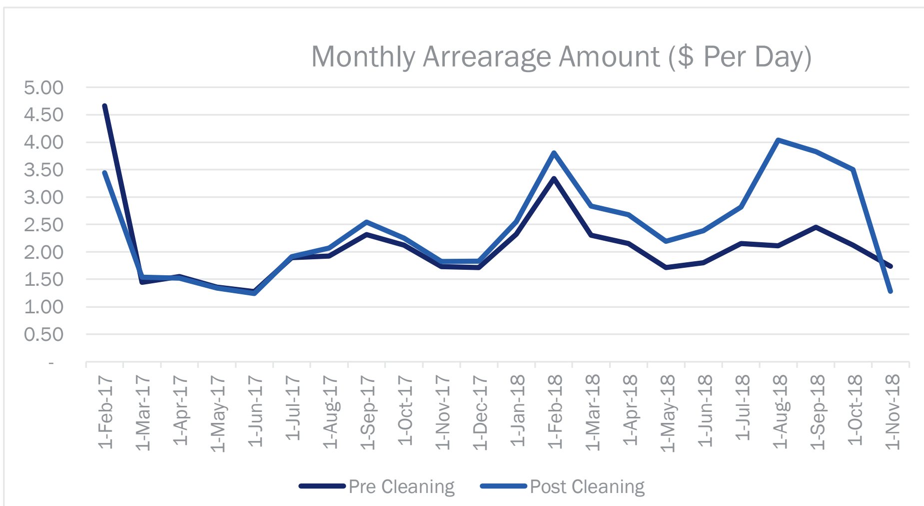
[2] This dataset only covered the period of July 2021 through October 2021 for DEP due to data limitations.

- **Missing and negative bill values.** We identified and dropped bill periods with blank or negative bill values.
- **Extremely high bills.** We checked for and removed bill periods with extremely large bills.
- **Customers on payment plan.** We identified and removed customers on a payment plan.
- **Inadequate billing history before or after program participation.** We removed participants with insufficient (less than 9 months) of billing history pre- and post-participation.
- **Deadbanding post-period.** We excluded first six months following program participation to allow participants to start accruing any bill savings as a result of the program participation

The above data cleaning steps resulted in 17,529 participants retained in the analysis. Most of the dropped accounts (85%) were due to insufficient pre- or post-period data following deadbanding of the post-participation period by six months. We conducted an assessment of the cleaned participant data against all participant data on data points of interest, namely monthly bills and arrearages. Figure 11 compares participant billing and arrearage data before and after cleaning.

Figure 11. Participant Billing Data Comparison



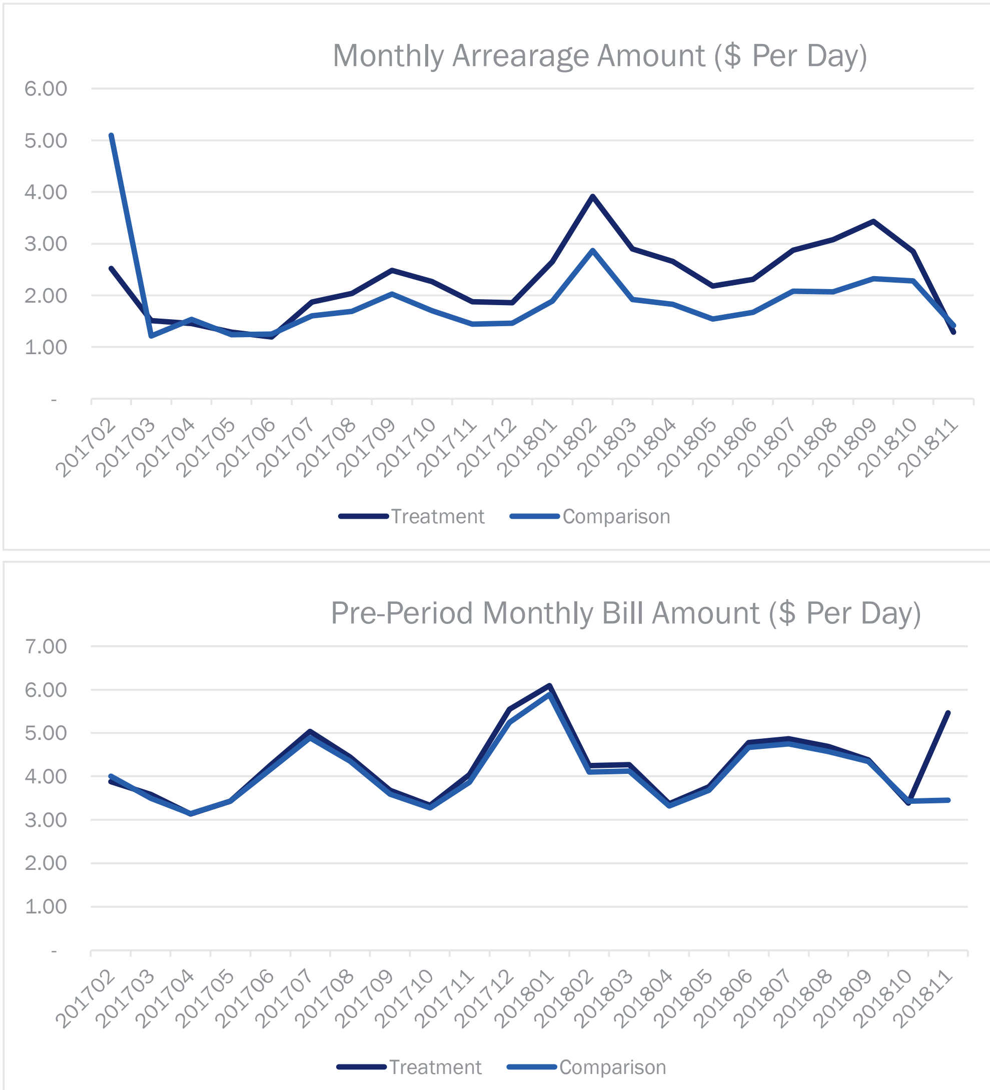


Comparison Group Selection and Equivalency Analysis

A key challenge for estimating bill impacts via a statistical analysis is the identification of an appropriate comparison group to represent a baseline for what participant bills would have been in the absence of program participation. We consider two main factors in the design of a comparison group. A comparison group must (1) have similar bill patterns (compared to participants) before participation (i.e., pre-participation period) and (2) effectively address self-selection bias (the correlation between the propensity to participate in a program and bill amounts). In an ideal experimental design, a randomized control trial (RCT) would be used, and the comparison group would be equivalent to the treatment group in all aspects, save for the treatment being evaluated (in this case, participation in the Weatherization Program). When an RCT is not feasible, we use a quasi-experimental design with a comparison group. For this analysis, we chose to comprise a comparison group from a sample of nonparticipants drawn from the same census block groups as participants. We did that to ensure that nonparticipants are as similar to participants as possible. Selecting nonparticipants from the same census block groups allows us to effectively minimize differences in bills associated with geographic proximity and therefore differences in weather, housing stock, and economic markers, such as income. Following receipt of the nonparticipant data, we further narrowed our eligible comparison group by performing a matching analysis using distance matching algorithms. We used customer monthly bills to determine closest and best matches. We matched one-to-one seeking to identify one matched non-participant for each participant. Our matching algorithm pursued matching with replacement, wherein we allowed a single non-participant to act as a match to multiple participants. We performed matching in stages, wherein we first matched participants within each state and jurisdiction and following which steadily expanded distance criteria to optimize the number of participants with matches.

Following the matching process, we reviewed matches to ascertain equivalency. We reviewed monthly bills as well as arrearages as part of the equivalency analysis. We performed equivalency assessment by jurisdiction. Following the equivalency assessment, we cleaned the nonparticipant data in a similar fashion to the participant data and reran equivalency analysis. Figure 12 shows equivalency results between participants and matched nonparticipants.

Figure 12. Equivalency Results



We were able to find strong matches for a total of 14,640 participants. We proceeded with developing models for that subpopulation of participants.

Weather Data Preparation

To include weather patterns in our model, we used daily weather data from numerous weather stations across the DEC and DEP service territory, utilizing the site closest to each account's geographic location. By using multiple sites, we increased the accuracy of the weather data being associated with each account. We obtained these data from the National Climatic Data Center (NCDC).

The daily data are based on hourly average temperature readings from each day. We calculated CDD and HDD for each day (in the analysis based on average daily temperatures, using the same formula used in weather forecasting).[3] We merged daily weather data into the billing dataset so that each billing period captures the HDD and CDD for each day within that billing period (including start and end dates).[4]

Model Specification

To estimate bill impacts, Opinion Dynamics specified a linear fixed effects model in a difference in difference approach that teases out bill impacts by modeling before and after treatment for the treatment group and the same time period for the comparison group. The comparison group controls for non-program changes (exogenous changes) over the analysis period. The fixed effect for the model is set at the account level, which allows us to control for all household factors that do not vary over time. In the process of determining the appropriate model for the analysis, we tested a multitude of possibilities. Equation 2 contains the final model specification.

Equation 2. Model Specification

$$\begin{aligned} Bill_{it} = {} & B_1 HDD_{it} + B_2 CDD_{it} + PostTreat_{it} + B_3 HDD_{it} * PostTreat_{it} + B_4 CDD_{it} * PostTreat_{it} \\ & + PostComp_{it} + B_5 HDD_{it} * PostComp_{it} + B_6 CDD_{it} * PostComp_{it} \\ & + B_{7-4}\ MonthDummies_t \ + B_h + \varepsilon_{it} \end{aligned}$$

Where:

$Bill_{it}$ = Average daily bill (in $) for the billing period

$Post$ = Indicator in post-installation period (coded “0” in the pre-participation period, coded “1” in post-installation period)

HDD = Average daily heating degree days from NCDC

CDD = Average daily cooling degree days from NCDC

Treat = Treatment group

Comp = Comparison group

B_h = Average household-specific constant

ε_{it} = Error term

Several variations of this model were specified, including LMI quartiles and percentiles, and savings quartiles as distinct terms on the models, allowing to determine bill impacts by subgroups.

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[3] A “degree-day” is a unit of measure for recording how hot or how cold it has been over a 24-hour period. The number of degree-days applied to any particular day of the week is determined by calculating the mean temperature for the day and then comparing the mean temperature to a base value of 65 (HDD) and 75 (CDD) degrees F. (The “mean” temperature is calculated by adding together the high for the day and the low for the day, and then dividing the result by 2.) If the mean temperature for the day is 5 degrees higher than 75, then there have been 5 cooling degree-days. On the other hand, if the weather has been cool, and the mean temperature is, say, 55 degrees, then there have been 10 heating degree-days (65 minus 55). “Degree Days,” National Weather Service, https://www.weather.gov/ffc/degdays.

[4] Daily weather data are merged based on the given dates of the billing period. Assigning weather this way provides a more accurate representation of the weather experienced during the billing period than does using weather for the calendar month of the bill.

Appendix D. Customer Survey Detailed Results

This section provides additional data and insights from the participant and nonparticipant surveys.

Demographic Characteristics of Respondents

Of survey respondents, 64% of nonparticipants and 59% of participants are low- or moderate-income (Table 4) based on their reported household income in 2021, relative to the size of their household and the area median income. Although the focus of our survey efforts was on understanding the LMI customer experience, the participation of non-LMI households in the survey allowed us to make comparisons between LMI and non-LMI households to better understand the unique participation experiences, barriers, and motivations of Duke Energy's LMI households[5].

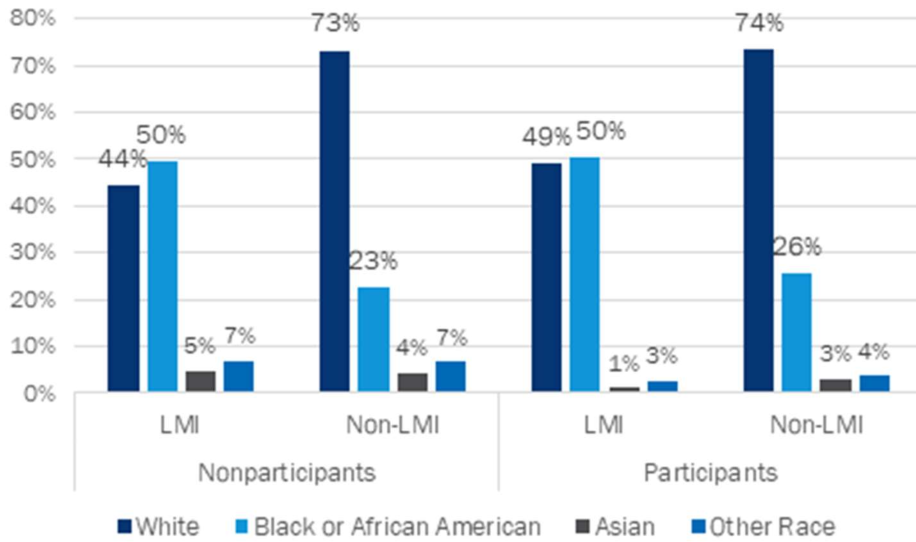
Table 4. LMI Status

LMI Status	Nonparticipants (n=483)	Participants (n=362)
Non-LMI	36%	41%
LMI	64%	59%
Low income	*40%*	*37%*
Moderate income	*23%*	*22%*

Race is related to LMI status, but not to participation status. LMI participants and nonparticipants are significantly more likely to report their race as Black or African American than their respective non-LMI counterparts (Figure 13). Non-LMI participants and nonparticipants are significantly more likely to report their race as White than their respective LMI counterparts. However, nonwhite households are similarly likely to be participants or nonparticipants

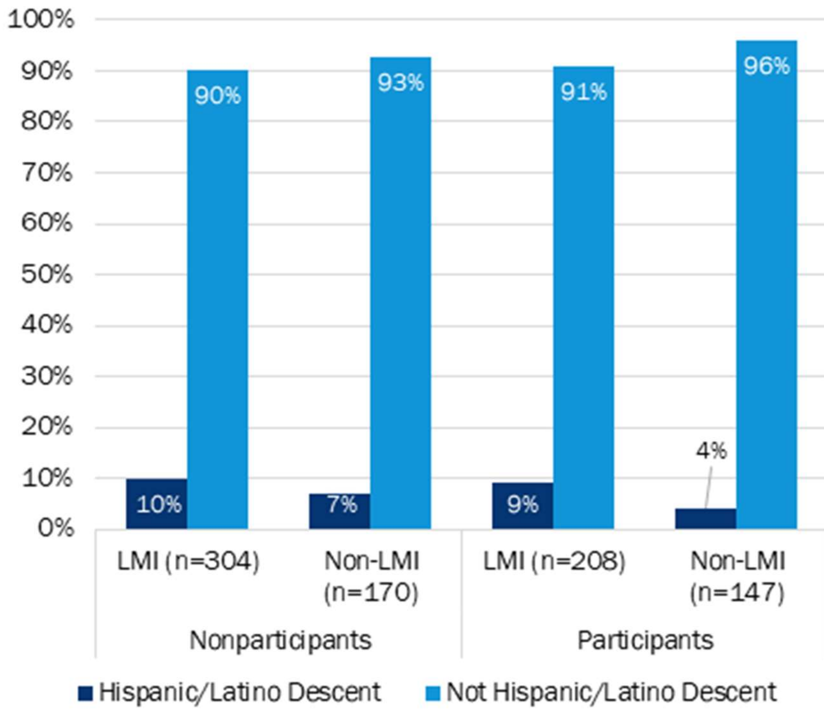
[5] 25% of nonparticipants (n=483) and 32% of participants (n=362) did not report their income and are excluded from the results reported in this section.

Figure 13. Race



Similarly, a greater proportion of LMI than non-LMI households report that they are of Hispanic, Latino, or Spanish descent than non-LMI households. This is true within both the participant and nonparticipant groups (Figure 14).

Figure 14. Ethnicity



Of all groups, LMI nonparticipants are most likely to report a language other than English as their first language, suggesting that some of these customers may face language barriers in accessing program materials and processes. While four to five percent of all other groups say that their first language is not English, this figure doubles (10%) for LMI nonparticipants (Table 5). Spanish is the most common first language, after English, among LMI respondents.

Table 5. First Language

First Language	Nonparticipants		Participants	
	LMI (n=303)	Non-LMI (n=176)	LMI (n=210)	Non-LMI (n=149)
English*	90%	96%	95%	95%
Not English*	10%	5%	5%	5%
Spanish	*7%*	*2%*	*3%*	*2%*
Other	*3%*	*1%*	*1%*	*2%*

* Statistically significant difference between nonparticipant groups at a 90% confidence level

LMI participants have significantly more people living in their home than non-LMI participants (3 vs. 2 respectively). Likewise, LMI nonparticipants have significantly more people living in their home than non-LMI nonparticipants (3 vs. 2 respectively). LMI nonparticipants and LMI participants are significantly more likely to have children in their home than their respective non-LMI counterparts (Table 6).

Table 6. Age Groups in Household

Age Groups in Household†	Nonparticipants		Participants	
	LMI (n=307)	Non-LMI (n=176)	LMI (n=213)	Non-LMI (n=149)
Children in household*§	43%	21%	43%	25%
Adults in households	87%	92%	78%	80%
Seniors in household	16%	13%	32%	30%

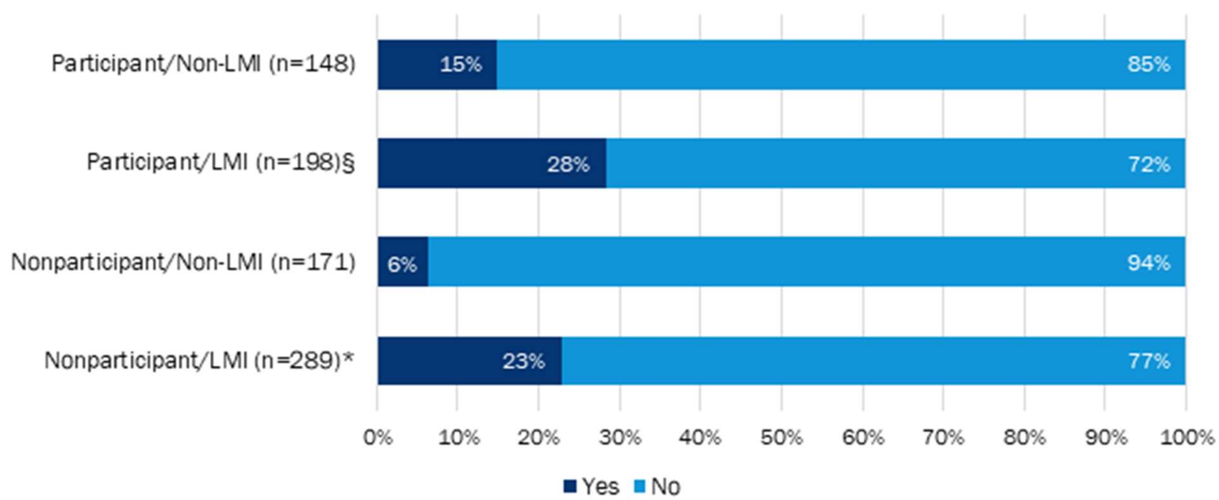
* Statistically significant difference between nonparticipant groups at a 90% confidence level

§ Statistically significant difference between participant groups at a 90% confidence level

† Values will not sum to 100% as multiple responses were permitted

LMI nonparticipants and LMI participants are significantly more likely than non-LMI households within each group to have someone in the household with conditions or disabilities that require special medical equipment, more heating and/or cooling, or higher air quality (Table 7). This suggests that LMI households are particularly likely to benefit from the non-energy impacts (NEIs) associated with participation in an energy efficiency program.

Table 7. Member of Home with Conditions or Disabilities that Require Special Medical Equipment, More Heating and/or Cooling, or Higher Air Quality



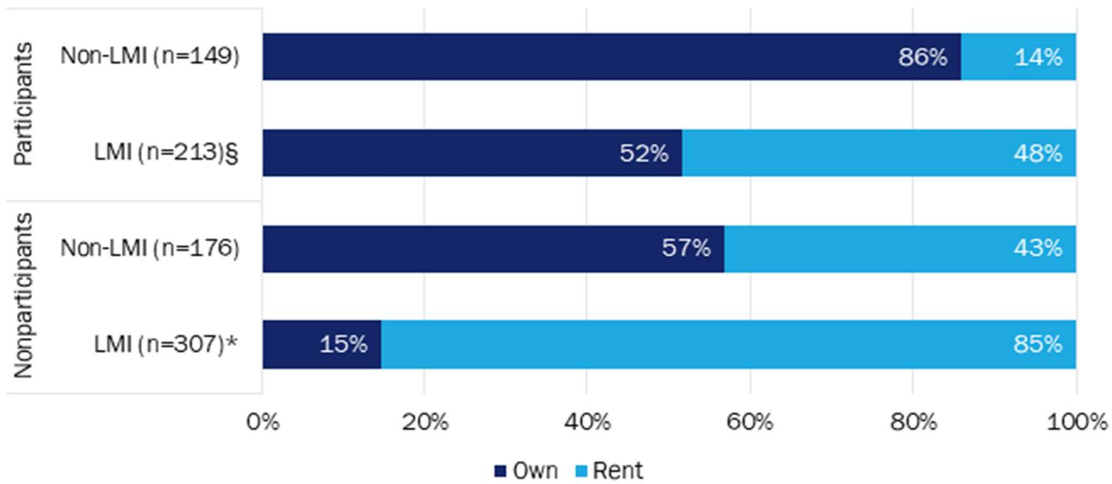
* Statistically significant difference between nonparticipant groups at a 90% confidence level

§ Statistically significant difference between participant groups at a 90% confidence level

Housing Characteristics of Respondents

LMI participants and nonparticipants are significantly more likely than non-LMI participants and nonparticipants to rent their home (Figure 15). Of all groups, LMI nonparticipants are by far most likely to be renters, while non-LMI participants are by far most likely to be homeowners.

Figure 15. Owner/Renter Status



* Statistically significant difference between nonparticipant groups at a 90% confidence level

§ Statistically significant difference between participant groups at a 90% confidence level

LMI customers tend to live in different types of housing than non-LMI customers, as do nonparticipants compared to participants. These differences in housing stock are related to owner/renter status as discussed above and affect the program eligibility. LMI participants and nonparticipants are significantly more likely than their non-LMI counterparts to live in a mobile/manufactured/trailer home or multifamily residence. Across participants and nonparticipants, non-LMI households are more likely than LMI households to live in a single family detached home (Table 8).

Table 8. Housing Type

Type of Home	Nonparticipants		Participants	
	LMI (n=284)	Non-LMI (n=173)	LMI (n=208)	Non-LMI (n=149)
Single family (detached)*§	28%	53%	64%	81%
Single family (attached)	14%	15%	8%	5%
Multifamily*§	54%	32%	20%	11%
*A duplex or two family house**	*8%*	*2%*	*3%*	*1%*
*A three-unit apartment/condo**	*6%*	*2%*	*1%*	*1%*
A four-unit apartment/condo§*	*10%*	*1%*	*6%*	*1%*
A five-unit or more apartment/condo	*30%*	*27%*	*11%*	*8%*
A mobile, manufactured, or trailer home*§	4%	1%	7%	2%
Other	0%	0%	1%	1%

* Statistically significant difference between nonparticipant groups at a 90% confidence level

§ Statistically significant difference between participant groups at a 90% confidence level

A higher proportion of LMI households than non-LMI households heat primarily with electric fuel (Table 9). Heating fuel is much more strongly associated with LMI status than with participation status and is likely driven by differences in housing type. LMI customers are more likely to live in multifamily homes, which are more likely than single-family homes to use electricity as the heating fuel source.

Table 9. Primary Heating Fuel

Primary Heating Fuel	Nonparticipants		Participants	
	LMI (n=302)	Non-LMI (n=172)	LMI (n=212)	Non-LMI (n=148)
Electric*	78%	66%	72%	65%
Natural gas*§	22%	31%	24%	33%
Propane	0%	2%	3%	1%
Other	0%	1%	1%	1%

* Statistically significant difference between nonparticipant groups at a 90% confidence level

§ Statistically significant difference between participant groups at a 90% confidence level

LMI participants and nonparticipants are less likely to have central air conditioning than their non-LMI counterparts. LMI households in both groups are more likely to rely on window units alone compared to their non-LMI households (Table 10).

Table 10. Air Conditioning in Home

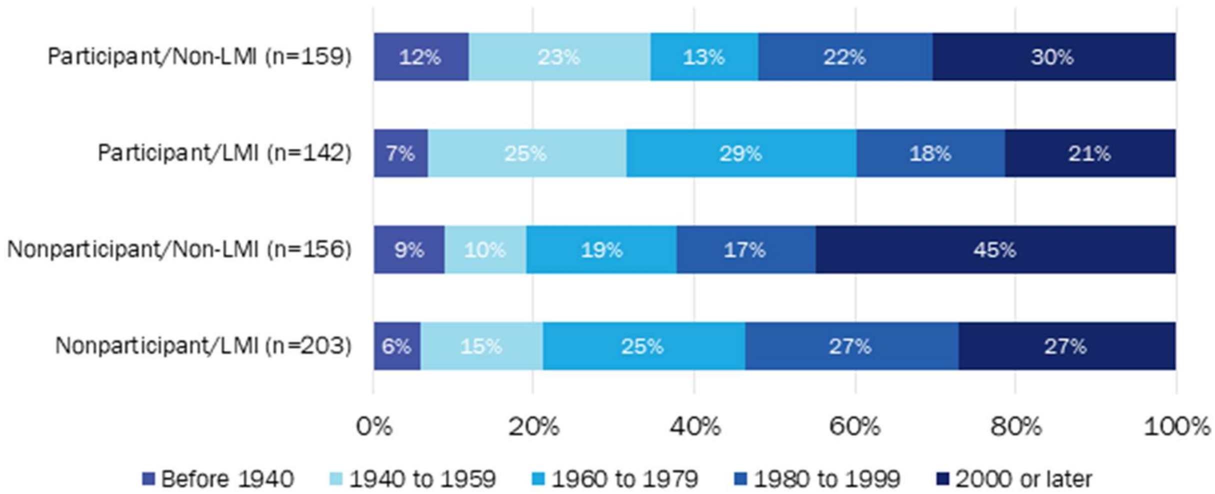
Air Conditioning	Nonparticipants		Participants	
	LMI (n=307)	Non-LMI (n=176)	LMI (n=213)	Non-LMI (n=149)
Central air conditioning*§	83%	94%	81%	93%
Window units*§	11%	1%	12%	2%
Both central air conditioning and window units	7%	5%	5%	4%
No air conditioning	3%	1%	2%	1%

* Statistically significant difference between nonparticipant groups at a 90% confidence level

§ Statistically significant difference between participant groups at a 90% confidence level

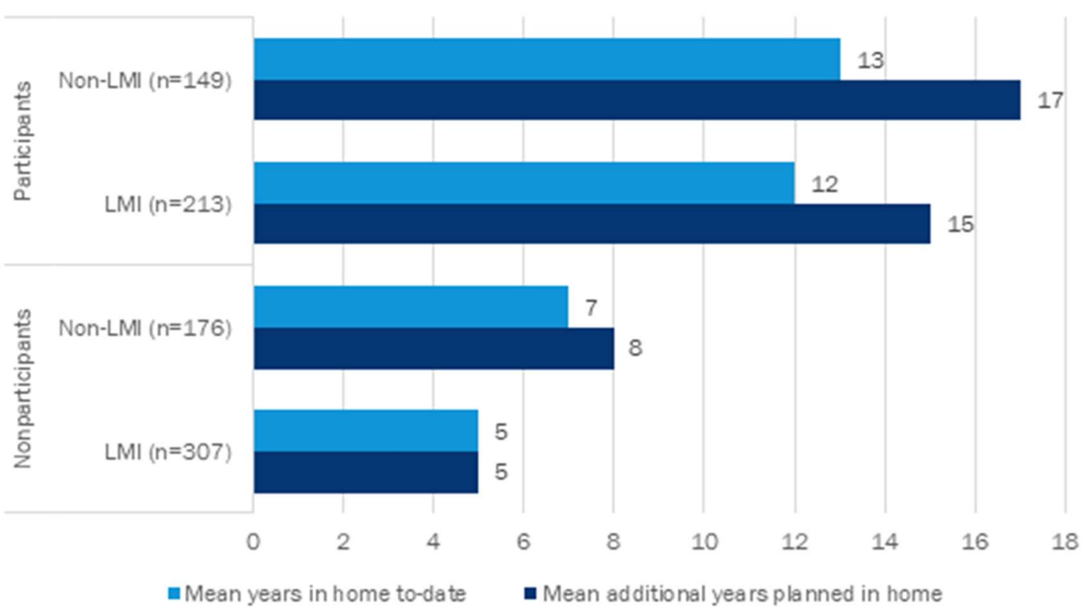
LMI households in both the participant and nonparticipant groups reside in older homes on average compared to their non-LMI counterparts. Approximately half (52%) of non-LMI participants report their home was built after 1980, compared to 39% of LMI participants. Similarly, 62% of non-LMI nonparticipants' homes were built after 1980, compared to 54% of LMI nonparticipants. In addition, nonparticipants have newer homes on average than participants, with a higher percentage of LMI and non-LMI nonparticipants' homes being built after 1980 compared to LMI and non-LMI participants' homes, respectively (Figure 16).

Figure 16. Year Home Constructed



The length of time that customers have lived in their homes and their future intentions is more related to participation than LMI status. Participants, both LMI and non-LMI, have lived in their homes and plan to continue to live in them longer than nonparticipants (Figure 17). LMI participants and nonparticipants have spent slightly fewer years in their homes than their non-LMI counterparts, and similarly intend to live in their homes for slightly fewer years.

Figure 17. Actual and Planned Years in Home



Additional Insights and Analysis

In this section, we present additional insights and analysis not included in the main report. Where available, we include quotes from in-depth interview respondents that add depth and nuance to the survey results.

Program Awareness

All survey respondents, regardless of LMI and participation status, are most familiar with Duke Energy's free home energy assessment. After home assessments, survey respondents are most familiar with Duke's online rebates for energy efficient equipment and discounts on lightbulbs in retail stores. LMI participants and nonparticipants are significantly less familiar with all of Duke Energy's energy efficiency program offerings than their non-LMI counterparts except for the recycling program for old refrigerators and freezers (Table 11). Relatively low familiarity with Duke Energy's energy efficiency program offerings amongst nonparticipants and participants alike suggests the need for continued outreach. It also presents the opportunity for cross promotion of additional offerings customers may qualify for during the participation process.

Table 11. Average Participant and Nonparticipant Familiarity with Specific Program Offerings

Program/Offering	Participant Mean Familiarity		Nonparticipant Mean Familiarity	
	LMI (n=213)	Non-LMI (n=149)	LMI (n=307)	Non-LMI (n=176)
Free home energy assessment with recommendations on upgrades to make your home more efficient§*	2.6	3.1	1.5	2.0
Online rebates on energy efficient equipment such as light bulbs, faucet aerators, and low-flow showerheads§*	2.5	3.0	1.5	1.8
Discounts on LED light bulbs in local retail stores§*	2.4	2.9	1.5	1.8
Online rebates on smart thermostats§*	2.2	3.1	1.5	1.8
No-cost energy efficient equipment, insulation, and/or heating upgrades for income qualifying customers§*	1.8	2.1	1.3	1.5
Online rebates on energy efficient heating and cooling systems§*	1.9	2.3	1.4	1.7
Rebates on insulation and heating and cooling systems installed through a participating contractor§*	1.8	2.4	1.4	1.5
Recycling program for old refrigerators and freezers	1.6	1.5	1.2	1.3

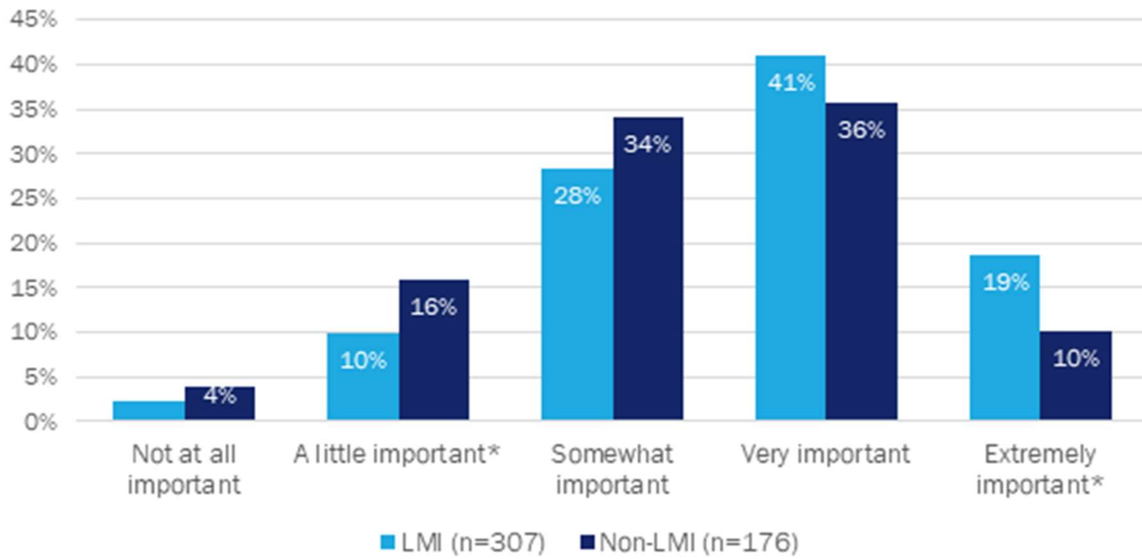
* Statistically significant difference between nonparticipant groups at a 90% confidence level

§ Statistically significant difference between participant groups at a 90% confidence level

Energy Efficiency Attitudes

LMI nonparticipants are more likely than non-LMI nonparticipants to say doing their part to make the Carolinas more efficient is "extremely important" (Figure 18). Non-LMI nonparticipants, in contrast, are more likely to say that doing their part is only "a little important" compared to their LMI counterparts, suggesting that LMI nonparticipants are more motivated by their sense of duty to their state than non-LMI nonparticipants.

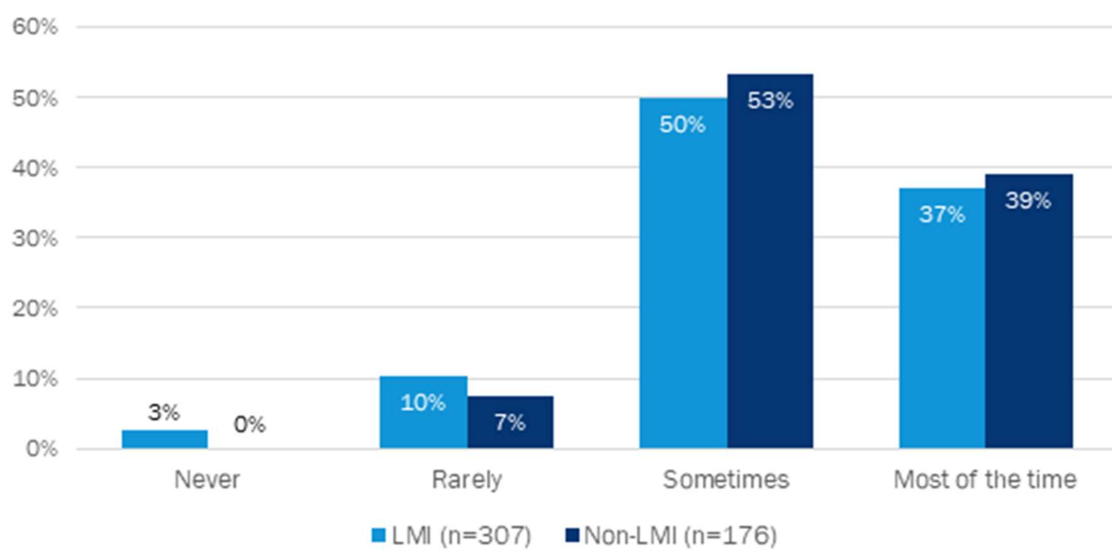
Figure 18. Nonparticipant Importance of Doing One's Part to Make the Carolinas More Energy Efficient



* Statistically significant difference between groups at a 90% confidence level

LMI nonparticipants report making a similar amount of effort as non-LMI nonparticipants to live in a way that reduces their energy usage (Figure 19).

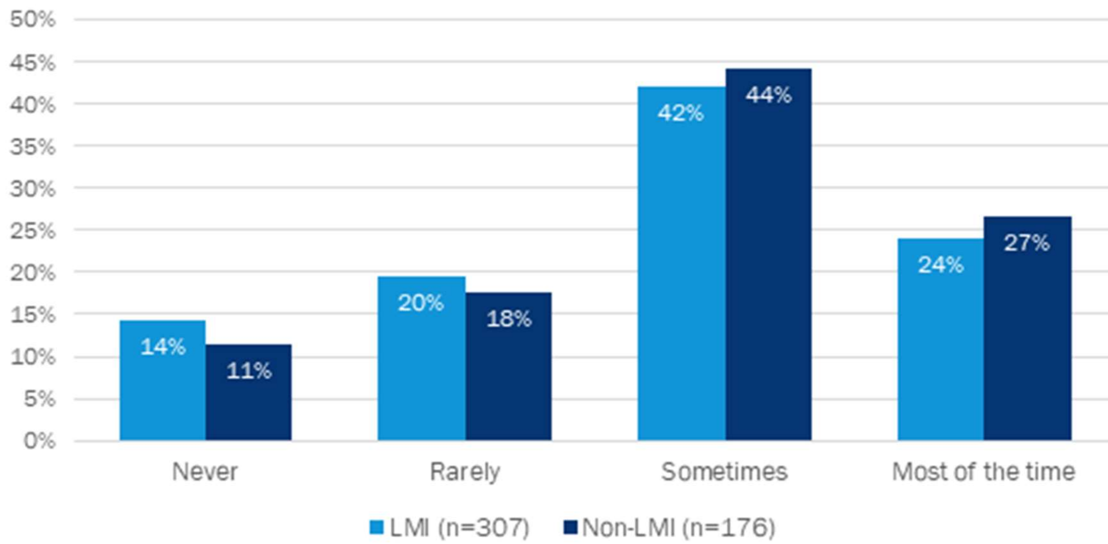
Figure 19. How often Nonparticipants Make an Effort to Live in Ways that Reduce their Home Energy Usage



Note: Results based on nonparticipant web survey data

LMI and non-LMI nonparticipants also did not significantly differ in how often the energy usage of appliances affects their purchasing decisions (Figure 20).

Figure 20. Influence of Appliance Energy Usage on Nonparticipant Purchasing Decisions



These findings highlight that how often nonparticipants actively live in a way or purchase appliances to reduce their energy usage does not vary by their income, suggesting that non-LMI customers do not actively live in a more energy conscious way than LMI customers. Additionally, LMI nonparticipants place more importance on the need to play their part in Carolina's larger efficiency goals than their non-LMI counterparts.

Participation Experience

On average, surveyed participants reported a positive experience participating in Duke Energy's programs and felt that participating benefited them, and these effects were stronger for LMI participants than for their non-LMI counterparts. LMI participants are significantly more satisfied with their experience participating in Duke Energy's energy efficiency programs than non-LMI participants (8.0 vs. 7.6 on a scale of 0, "extremely dissatisfied" to 10, "extremely satisfied"). This satisfaction was echoed by interviewed participants (Figure 21).

Figure 21. Quotes on Positive Participation Experiences from Participant Interviews

Participation Experience

"It was simple. It was easy. It was very cost efficient to me because Duke shipped all the stuff. I used every bit of it."

"The contractor gave us the quotes and told us which units would qualify for the Duke rebate. That helped us decide which unit to pick. It also helped that we got money back since it was not cheap."

"The representatives were very knowledgeable, professional, and courteous. They quickly did what they needed to do and moved on."

"The Duke representatives were very clear at the time about all the precautions they were taking with COVID. They worked to find a time that was convenient for us. The guy showed up on time for when he was scheduled to be here. He was very thoughtful and thorough; he went through the house and was able to give us a decent assessment of where we stood. I was really impressed after he was done. He mentioned some things to me here in person and wrote up a very detailed and comprehensive report."

Interviewed participants also shared suggestions for improving Duke Energy's programs (Figure 22).

Figure 22. Quotes on Suggested Improvements from Participant Interviews

Participation Difficulties

"I'm not saying there wasn't anything useful in the kit, but a lot of the efficiency issues at my unit were irresolvable just at the level of using that kit."

"I would think that there should be the option for a person to pick out exactly what they think they need in their house, instead of them being given a package of things that Duke thinks is needed for their house."

"I was supposed to get the LED light bulbs within 30 days, but I didn't. It was about four months before I got the light bulbs because they didn't have any in-stock."

"The assessment was not very useful. I thought they were going to do some measurements of energy loss and classify the home, but it was more subjective. It didn't tell me anything that I didn't know."

Average satisfaction was similar across different program offerings (Table 12), ranging from 7.5 to 8.0. The most common reasons for low satisfaction are lack of bill savings and dissatisfaction with the equipment received.

Table 12. Participant Satisfaction with Duke Energy Programs

Program	Average Satisfaction Score*
Free LED CFL Program (n=169)	8.0
Online Savings Store (n=85)	7.5

Program	Average Satisfaction Score*
Save Energy in Water (n=76)	7.8
Residential Energy Assessments (n=61)	7.9
K12 Program (n=59)	8.0
Single Family Water Measures (n=55)	7.6

Note: Results based on participant web survey data for programs where n>50

*Results are not broken down by LMI status to avoid comparison groups with n<50.

LMI and non-LMI participants did not significantly differ in how satisfied they were with their communications with Duke Energy and program staff, averaging 7.9 and 7.5 respectively on a scale of 0, “extremely dissatisfied” to 10, “extremely satisfied.” About 17% of participants indicated they never communicated with a Duke Energy representative or member of program staff during their participation.

Appendix E. In-Depth Participant Interviews

Demographic and Housing Characteristics of Respondents

Table 13 presents the number of IDI respondents in each income bucket: low-income, moderate-income, and non-LMI. Most respondents met LMI criteria.

Table 13. IDI LMI Status

LMI Status	IDI Respondents (n=37)*
Non-LMI	16
LMI	21
Low-income	13
Moderate-income	8

* Three respondents did not know or preferred not to report their income

Table 14 presents the number of IDI respondents that say their first language is or is not English.

Table 14. IDI First Language

First Language	IDI Respondents (n=40)
English	37
Other language	3

Table 15 presents the number of IDI respondents that do or do not have children in the home.

Table 15. IDI Children in Household

Presence of Children in Household	IDI Respondents (n=40)
Children in household	14
No children in household	26

Table 16 presents the number of IDI respondents by housing type.

Table 16. IDI Housing Type

Housing Type	IDI Respondents (n=40)
Single family	33
Multifamily	7
A five-unit or more apartment/condo	6
A four-unit apartment/condo	*1*

Table 17 presents the number of IDI respondents who own or rent their home.

Table 17. IDI Housing Ownership Status

Housing Ownership Status	IDI Respondents (n=40)
Own	31
Rent	9

Table 18 presents respondents' approximation of when their homes were built.

Table 18. IDI Year Home Built

Year Home Built	IDI Respondents (n=33)*
1920 - 1939	5
1940 - 1959	5
1960 - 1979	7
1980 - 1999	7
2000 or after	7

* Seven respondents did not know or preferred not to report when their home was built

Table 19 presents how long respondents said they have lived in their home at the time of the survey.

Table 19. IDI Time at Address/Tenure

Time at Address	IDI Respondents (n=39)*
Less than 5 years	14
5 to 9 years	9
10 to 19 years	6
20 to 39 years	7
40 years or more	3

* One respondent did not know or preferred not to report their time at their address

Table 20 presents the type of cooling equipment respondents report having in their home.

Table 20. IDI Cooling Equipment

Air Conditioning	IDI Respondents (n=40) †
No air conditioning	2
Central air conditioning	36
Window unit(s)	3

† Values will not sum to n=40 as multiple responses were permitted

Participant Vignettes

A selection of participant experiences are summarized in the attached vignettes. All participants featured in the vignettes meet LMI criteria based on reported income and household size.

PDF

Duke LMI Participant Vignettes FINAL 2022-

For more information, please contact:

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Duke Energy Carolinas
Fields Exhibit 1
Vintage 2016 True Up - January 1, 2016 to December 31, 2016
Docket Number E-7 Sub 1285
Load Impacts and Estimated Revenue Requirements by Program

	Residential Programs	System kW Reduction - Summer Peak	System Energy Reduction (kWh)	A System NPV of Avoided Costs	B Total Cost	C Shared Savings %	D =(A-B)*C Incentive	E = (B+D) System Revenue Requirement	F NC Retail kWh Sales Allocation Factor	G NC Allocation Factor (2)		H NC Residential Revenue Requirement	NC Residential Adjusted Revenue Requirement
	EE Programs												
1	Appliance Recycling Program	21	164,720	$ 59,758	$ (97,397)	11.5%	$ 18,073	$ (79,324)	73.0962827%		E1 * F1	$ (57,983)	
2	Energy Efficiency Education	1,512	6,441,283	$ 3,695,507	$ 2,126,509	11.5%	$ 180,435	$ 2,306,944	73.0962827%		E2 * F2	$ 1,686,290	
3	Energy Efficient Appliances and Devices	14,518	120,226,223	$ 82,262,218	$ 24,069,774	11.5%	$ 6,692,131	$ 30,761,905	73.0962827%		E3 * F3	$ 22,485,809	
4	HVAC Energy Efficiency	2,462	6,294,837	$ 7,476,100	$ 7,839,566	11.5%	$ (41,799)	$ 7,797,767	73.0962827%		E4 * F4	$ 5,699,878	
5	Low Income Energy Efficiency and Weatherization Assistance	649	4,801,478	$ 2,984,760	$ 4,792,436	0.0%	$ -	$ 4,792,436	73.0962827%		E5 * F5	$ 3,503,093	
6	Multi-Family Energy Efficiency	1,572	15,235,497	$ 8,950,706	$ 2,518,988	11.5%	$ 739,648	$ 3,258,636	73.0962827%		E6 * F6	$ 2,381,941	
7	Residential Energy Assessments	1,070	7,389,091	$ 6,822,806	$ 2,678,893	11.5%	$ 476,550	$ 3,155,443	73.0962827%		E7 * F7	$ 2,306,512	
8	Total for Residential Conservation Programs	21,804	160,553,127	$ 112,251,855	$ 43,928,769		$ 8,065,038	$ 51,993,807				$ 38,005,540	
9	My Home Energy Report	70,977	282,250,993	$ 20,409,636	$ 10,822,444	11.5%	$ 1,102,527	$ 11,924,971	73.0962827%		E9 * F9	$ 8,716,711	$ (1,204)
10	Total Residential Conservation and Behavioral Programs	92,782	442,804,121	$ 132,661,491	$ 54,751,213		$ 9,167,565	$ 63,918,778				$ 46,722,251	$ (1,204)
									NC Residential Peak Demand Allocation Factor				
11	Total DSM Programs(2)	825,492	718,623	$ 98,643,760	$ 28,406,298	11.5%	$ 8,077,308	$ 36,483,606		33.797348%	E11 * F11	$ 12,330,491	
12	Total Residential	918,274	443,522,744	$ 231,305,251	$ 83,157,511		$ 17,244,873	$ 100,402,384				$ 59,052,742	

	Non-Residential Programs	System kW Reduction - Summer Peak	System Energy Reduction (kWh)	System NPV of Avoided Costs	Total Cost	Shared Savings %	Incentive	System Revenue Requirement	NC Retail kWh Sales Allocation Factor			NC Non-Residential Revenue Requirement	
	EE Programs												
13	Non Residential Smart Saver Custom Technical Assessments	1,584	16,953,402	$ 9,572,687	$ 2,034,308	11.5%	$ 866,914	$ 2,901,222	73.0962827%		E12 * F12	$ 2,120,685	
14	Non Residential Smart Saver Custom	7,934	52,154,624	$ 39,025,086	$ 7,356,509	11.5%	$ 3,629,838	$ 10,986,347	73.0962827%		E13 * F13	$ 8,030,611	
15	Non Residential Smart Saver Energy Efficienct Food Service Products	356	3,809,316	$ 2,474,312	$ 324,117	11.5%	$ 247,272	$ 571,389	73.0962827%		E14 * F14	$ 417,664	
16	Non Residential Smart Saver Energy Efficienct HVAC Products	808	3,316,901	$ 3,344,669	$ 1,473,991	11.5%	$ 215,128	$ 1,689,119	73.0962827%		E16 * F16	$ 1,234,683	
17	Non Residential Smart Saver Energy Efficienct Lighting Products	29,268	167,342,422	$ 120,392,639	$ 39,622,944	11.5%	$ 9,288,515	$ 48,911,459	73.0962827%		E17 * F17	$ 35,752,458	
18	Non Residential Smart Saver Energy Efficienct Pumps and Drives Products	368	2,494,340	$ 1,574,965	$ 471,930	11.5%	$ 126,849	$ 598,779	73.0962827%		E18 * F18	$ 437,685	
19	Non Residential Energy Efficienct ITEE	107	2,462,027	$ 777,601	$ 285,430	11.5%	$ 56,600	$ 342,030	73.0962827%		E19 * F19	$ 250,011	
20	Non Residential Smart Saver Energy Efficienct Process Equipment Products	50	313,131	$ 279,184	$ 125,947	11.5%	$ 17,622	$ 143,569	73.0962827%		E20 * F20	$ 104,944	
21	Smart $aver(R) Non Residential Performance Incentive Program	-	-	$ -	$ 35,670	11.5%	$ (4,102)	$ 31,568	73.0962827%		E21 * F21	$ 23,075	
22	Small Business Energy Saver	16,110	85,687,928	$ 55,685,830	$ 15,360,852	11.5%	$ 4,637,372	$ 19,998,224	73.0962827%		E22 * F22	$ 14,617,959	
23	Smart Energy in Offices	3,505	16,842,267	$ 1,843,559	$ 1,061,729	11.5%	$ 89,911	$ 1,151,640	73.0962827%		E23 * F23	$ 841,806	
24	Business Energy Report	388	5,561,349	$ 302,497	$ 263,169	11.5%	$ -	$ 263,169	73.0962827%		E24 * F24	$ 192,367	
25	Total for Non-Residential Conservation Programs	60,480	356,937,707	$ 235,273,030	$ 68,416,596		$ 19,171,918	$ 87,588,514				$ 64,023,948	
									NC Non-Residential Peak Demand Allocation Factor				
26	Total DSM Programs(2)	825,492	718,623	$ 98,643,760	$ 28,406,298	11.5%	$ 8,077,308	$ 36,483,606	40.8166437%			$ 14,891,384	
27	Total Non-Residential Revenue Requirement	885,972	357,656,330	$ 333,916,790	$ 96,822,894		$ 27,249,226	$ 124,072,120				$ 78,915,332	
28	Total All Programs	1,804,245	801,179,074	$ 565,222,040	$ 179,980,405		$ 44,494,099	$ 224,474,504				$ 137,968,074	$ (1,204)

	Total DSM Program Breakdown								NC Non-Residential Peak Demand Allocation Factor				
28	Power Manager (Residential)	455,393	-	$ 54,179,776	$ 13,644,970	11.5%	$ 4,661,503	$ 18,306,473					
29	EnergyWise for Business	1,199	718,623	$ 574,590	$ 470,304	11.5%	$ 11,993	$ 482,297					
30	PowerShare®	368,900	-	$ 43,889,394	$ 14,291,024	11.5%	$ 3,403,812	$ 17,694,836					
31	Total DSM Programs	825,492	718,623	$ 98,643,760	$ 28,406,298		$ 8,077,308	$ 36,483,606	74.6139917%			$ 27,221,875	

(1) My Home Energy Report impacts reflect cumulative capability as of end of vintage year, including impacts for participants from prior vintages
(2) Total System DSM programs allocated to Residential and Non-Residential based on contribution to retail system peak

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Revised Fields Exhibit 1 page 2, v2017

Duke Energy Carolinas
Fields Exhibit 1
Vintage 2017 True Up - January 1, 2017 to December 31, 2017
Docket Number E-7 Sub 1285
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				A	B	C	D =(A-B)*C	E = (B+D)	F	G		H	
	Residential Programs	System kW Reduction - Summer Peak	System Energy Reduction (kWh)	System NPV of Avoided Costs	Total Cost	Shared Savings %	Incentive	System Revenue Requirement	NC Retail kWh Sales Allocation Factor	NC Allocation Factor (2)		NC Residential Revenue Requirement	NC Residential Adjusted Revenue Requirement
	EE Programs												
1	Appliance Recycling Program				$ 5,307	11.5%	$ (610)	$ 4,697	72.8087506%		E1 * F1	$ 3,420	
2	Energy Efficiency Education	1,393	5,932,086	$ 3,597,724	$ 2,077,611	11.5%	$ 174,813	$ 2,252,424	72.8087506%		E2 * F2	$ 1,639,962	
3	Energy Efficient Appliances and Devices	24,605	137,909,103	$ 105,352,687	$ 30,340,728	11.5%	$ 8,626,375	$ 38,967,103	72.8087506%		E3 * F3	$ 28,371,461	
4	HVAC Energy Efficiency	1,850	6,712,977	$ 7,287,263	$ 7,403,327	11.5%	$ (13,347)	$ 7,389,980	72.8087506%		E4 * F4	$ 5,380,552	
5	Income Qualified Energy Efficiency and Weatherization Assistance	771	5,341,624	$ 3,185,867	$ 5,505,992	0.0%	$ -	$ 5,505,992	72.8087506%		E5 * F5	$ 4,008,844	
6	Multi-Family Energy Efficiency	2,056	19,038,529	$ 13,539,656	$ 3,168,422	11.5%	$ 1,192,692	$ 4,361,114	72.8087506%		E6 * F6	$ 3,175,272	
7	Energy Assessments	1,040	7,720,549	$ 6,602,773	$ 2,909,098	11.5%	$ 424,773	$ 3,333,871	72.8087506%		E7 * F7	$ 2,427,350	
8	Total for Residential Conservation Programs	31,715	182,654,868	$ 139,565,970	$ 51,410,486		$ 10,404,695	$ 61,815,181				$ 45,006,861	
9	My Home Energy Report	76,632	307,515,903	$ 21,434,622	$ 13,812,250	11.5%	$ 876,573	$ 14,688,823	72.8087506%		E9 * F9	$ 10,694,748	$ (24,596)
10	Total Residential Conservation and Behavioral Programs	108,347	490,170,771	$ 161,000,592	$ 65,222,736		$ 11,281,268	$ 76,504,004				$ 55,701,609	$ (24,596)
									NC Residential Peak Demand Allocation Factor				
11	Total DSM Programs(2)	846,941	2,943,906	$ 105,087,510	$ 29,822,652	11.5%	$ 8,655,459	$ 38,478,111		33.807510%	E11 * F11	$ 13,008,491	
12	Total Residential	955,288	493,114,677	$ 266,088,102	$ 95,045,388		$ 19,936,727	$ 114,982,115				$ 68,710,100	

	Non-Residential Programs	System kW Reduction - Summer Peak	System Energy Reduction (kWh)	System NPV of Avoided Costs	Total Cost	Shared Savings %	Incentive	System Revenue Requirement	NC Retail kWh Sales Allocation Factor			NC Non-Residential Revenue Requirement	
	EE Programs												
13	Non Residential Smart Saver Custom Technical Assessments	1,627	15,791,732	$ 10,272,302	$ 2,139,875	11.5%	$ 935,229	$ 3,075,104	72.8087506%		E12 * F12	$ 2,238,945	
14	Non Residential Smart Saver Custom	6,010	40,609,855	$ 34,693,083	$ 7,304,838	11.5%	$ 3,149,648	$ 10,454,486	72.8087506%		E13 * F13	$ 7,611,781	
15	Non Residential Smart Saver Energy Efficient Food Service Products	112	1,383,542	$ 959,251	$ 306,488	11.5%	$ 75,068	$ 381,556	72.8087506%		E14 * F14	$ 277,806	
16	Non Residential Smart Saver Energy Efficient HVAC Products	894	2,954,877	$ 2,958,336	$ 1,560,769	11.5%	$ 160,720	$ 1,721,489	72.8087506%		E16 * F16	$ 1,253,395	
17	Non Residential Smart Saver Energy Efficient Lighting Products	47,322	270,572,885	$ 240,054,511	$ 66,689,770	11.5%	$ 19,936,945	$ 86,626,715	72.8087506%		E17 * F17	$ 63,071,829	
18	Non Residential Smart Saver Energy Efficienct Pumps and Drives Products	687	4,806,849	$ 3,070,044	$ 528,937	11.5%	$ 292,227	$ 821,164	72.8087506%		E18 * F18	$ 597,879	
19	Non Residential Energy Efficient ITEE	-	2,945	$ 523	$ 61,215	11.5%	$ (6,980)	$ 54,235	72.8087506%		E19 * F19	$ 39,488	
20	Non Residential Smart Saver Energy Efficienct Process Equipment Products	99	651,289	$ 530,295	$ 162,413	11.5%	$ 42,306	$ 204,719	72.8087506%		E20 * F20	$ 149,054	
21	Smart $aver(R) Non Residential Performance Incentive Program	3	12,373	$ 8,958	$ 320,559	11.5%	$ (35,834)	$ 284,725	72.8087506%		E21 * F21	$ 207,305	
22	Small Business Energy Saver	17,263	90,297,362	$ 63,169,894	$ 17,350,972	11.5%	$ 5,269,176	$ 22,620,148	72.8087506%		E22 * F22	$ 16,469,447	
23	Smart Energy in Offices	2,138	10,272,154	$ 1,067,480	$ 891,010	11.5%	$ 20,294	$ 911,304	72.8087506%		E23 * F23	$ 663,509	
24	Business Energy Report	3	42,398	$ 696	$ 126,680	11.5%	$ -	$ 126,680	72.8087506%		E24 * F24	$ 92,234	
25	Total for Non-Residential Conservation Programs	76,158	437,398,260	$ 356,785,373	$ 97,443,527		$ 29,838,800	$ 127,282,328				$ 92,672,672	
									NC Non-Residential Peak Demand Allocation Factor				
26	Total DSM Programs(2)	846,941	2,943,906	$ 105,087,510	$ 29,822,652	11.5%	$ 8,655,459	$ 38,478,111	40.0747013%			$ 15,419,988	
27	Total Non-Residential Revenue Requirement	923,098	440,342,166	$ 461,872,882	$ 127,266,180		$ 38,494,259	$ 165,760,439				$ 108,092,660	
28	Total All Programs	1,878,386	933,456,843	$ 727,960,984	$ 222,311,568		$ 58,430,986	$ 280,742,553				$ 176,802,760	$ (24,596)

	Total DSM Program Breakdown								NC Non-Residential Peak Demand Allocation Factor				
28	Power Manager (Residential)	501,118	-	$ 61,074,105	$ 14,021,500	11.5%	$ 5,411,050	$ 19,432,549					
29	EnergyWise for Business	5,453	2,943,906	$ 2,530,761	$ 2,484,618	11.5%	$ 5,306	$ 2,489,924					
30	PowerShare®	340,369	-	$ 41,482,644	$ 13,316,535	11.5%	$ 3,239,103	$ 16,555,638					
31	Total DSM Programs	846,941	2,943,906	$ 105,087,510	$ 29,822,652		$ 8,655,459	$ 38,478,111	73.8822117%			$ 28,428,479	

(1) My Home Energy Report impacts reflect cumulative capability as of end of vintage year, including impacts for participants from prior vintages
(2) Total System DSM programs allocated to Residential and Non-Residential based on contribution to retail system peak

/A

Duke Energy Carolinas
Fields Exhibit 1
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				A	B	C	D =(A-B)*C	E = (B+D)	F	G		H
	Residential Programs	System kW Reduction - Summer Peak	System Energy Reduction (kWh)	System NPV of Avoided Costs	Total Cost	Shared Savings %	Incentive	System Revenue Requirement	NC Retail kWh Sales Allocation Factor	NC Allocation Factor (2)		NC Residential Revenue Requirement
	EE Programs											
1	Energy Efficiency Education	967	5,530,707	$ 2,863,491	$ 1,992,260	11.5%	$ 100,192	$ 2,092,451	72.7130507%		E1 * F1	$ 1,521,485
2	Energy Efficient Appliances and Devices	35,125	194,356,910	$ 137,695,195	$ 42,687,244	11.5%	$ 10,925,914	$ 53,613,158	72.7130507%		E2 * F2	$ 38,983,763
3	HVAC Energy Efficiency	1,640	6,367,174	$ 7,088,494	$ 6,955,146	11.5%	$ 15,335	$ 6,970,481	72.7130507%		E3 * F3	$ 5,068,449
4	Low Income Energy Efficiency and Weatherization Assistance	888	6,845,653	$ 4,253,631	$ 6,490,735	0.0%	$ -	$ 6,490,735	72.7130507%		E4 * F4	$ 4,719,611
5	Multi-Family Energy Efficiency	2,336	20,923,363	$ 13,614,922	$ 3,604,921	11.5%	$ 1,151,150	$ 4,756,071	72.7130507%		E5 * F5	$ 3,458,285
6	Residential Energy Assessments	929	7,716,668	$ 5,756,868	$ 2,836,229	11.5%	$ 335,874	$ 3,172,102	72.7130507%		E6 * F6	$ 2,306,532
7	Total for Residential Conservation Programs	41,885	241,740,474	$ 171,272,602	$ 64,566,534		$ 12,528,465	$ 77,094,999				$ 56,058,125
8	My Home Energy Report	93,425	340,819,517	$ 22,236,642	$ 12,765,286	11.5%	$ 1,089,206	$ 13,854,492	72.7130507%		E8 * F8	$ 10,074,024
9	Total Residential Conservation and Behavioral Programs	135,309	582,559,991	$ 193,509,244	$ 77,331,820		$ 13,617,671	$ 90,949,491				$ 66,132,149
									NC Residential Peak Demand Allocation Factor			
10	Power Manager®	533,506	-	$ 61,923,998	$ 14,423,610	11.5%	$ 5,462,545	$ 19,886,154	73.6287551%	43.675154%	(E10+E26) *F10 *G10	$ 12,360,441
11	Total Residential	668,816	582,559,991	$ 255,433,242	$ 91,755,430		$ 19,080,215	$ 110,835,645				$ 78,492,590
	Non-Residential Programs	System kW Reduction - Summer Peak	System Energy Reduction (kWh)	System NPV of Avoided Costs	Total Cost	Shared Savings %	Incentive	System Revenue Requirement	NC Retail kWh Sales Allocation Factor			NC Non-Residential Revenue Requirement
	EE Programs											
12	Non Residential Smart Saver Custom Technical Assessments	13	83,588	$ 67,306	$ 407,293	11.5%	$ (39,099)	$ 368,195	72.7130507%		E12 * F12	$ 267,726
13	Non Residential Smart Saver Custom	4,054	30,333,040	$ 23,321,911	$ 6,068,902	11.5%	$ 1,984,096	$ 8,052,998	72.7130507%		E13 * F13	$ 5,855,580
14	Non Residential Smart Saver Energy Efficienct Food Service Products	59	744,066	$ 433,191	$ 235,605	11.5%	$ 22,722	$ 258,327	72.7130507%		E14 * F14	$ 187,838
15	Non Residential Smart Saver Energy Efficienct HVAC Products	893	2,908,386	$ 2,810,153	$ 1,620,748	11.5%	$ 136,782	$ 1,757,530	72.7130507%		E16 * F16	$ 1,277,953
16	Non Residential Smart Saver Energy Efficienct Lighting Products	31,548	177,845,339	$ 146,378,119	$ 25,872,380	11.5%	$ 13,858,160	$ 39,730,540	72.7130507%		E17 * F17	$ 28,889,288
17	Non Residential Smart Saver Energy Efficienct Pumps and Drives Products	421	2,669,016	$ 1,617,740	$ 277,785	11.5%	$ 154,095	$ 431,880	72.7130507%		E18 * F18	$ 314,033
18	Non Residential Energy Efficienct ITEE	-	17,639	$ 3,025	$ 36,875	11.5%	$ (3,893)	$ 32,982	72.7130507%		E19 * F19	$ 23,982
19	Non Residential Smart Saver Energy Efficienct Process Equipment Products	75	331,222	$ 226,724	$ 67,509	11.5%	$ 18,310	$ 85,819	72.7130507%		E20 * F20	$ 62,402
20	Smart $aver(R) Non Residential Performance Incentive Program	168	3,271,186	$ 1,671,783	$ 479,610	11.5%	$ 137,100	$ 616,710	72.7130507%		E21 * F21	$ 448,429
21	Small Business Energy Saver	13,374	76,696,523	$ 46,832,675	$ 15,977,993	11.5%	$ 3,548,288	$ 19,526,282	72.7130507%		E22 * F22	$ 14,198,155
22	Smart Energy in Offices	310	1,488,592	$ 143,284	$ 219,748	11.5%	$ (8,793)	$ 210,954	72.7130507%		E23 * F23	$ 153,391
23	Total for Non-Residential Conservation Programs	50,914	296,388,596	$ 223,505,910	$ 51,264,448		$ 19,807,768	$ 71,072,216				$ 51,678,777
									NC Non-Residential Peak Demand Allocation Factor			
24	EnergyWise for Business	7,999	2,599,904	$ 2,279,951	$ 3,062,816	11.5%	$ (90,029)	$ 2,972,787	73.6287551%			
25	PowerShare®	332,631	-	$ 36,012,634	$ 12,922,977	11.5%	$ 2,655,311	$ 15,578,288	73.6287551%			
26	Total for Non-Residential DSM Programs	340,629	2,599,904	$ 38,292,585	$ 15,985,794		$ 2,565,281	$ 18,551,075	73.6287551%	56.324846%	(E10+E26) *F26 *G26	$ 15,940,412
27	Total Non Residential	391,543.87415	298,988,500	$ 261,798,495	$ 67,250,242		$ 22,373,049	$ 89,623,291				$ 67,619,189
28	Total All Programs	1,060,360	881,548,492	$ 517,231,737	$ 159,005,671		$ 41,453,264	$ 200,458,936				$ 146,111,779

(1) My Home Energy Report impacts reflect cumulative capability as of end of vintage year, including impacts for participants from prior vintages
(2) Total System DSM programs allocated to Residential and Non-Residential based on contribution to retail system peak

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				A	B	C	D	E	F	G		H
							=(A-B)*C	= (B+D)				
	Residential Programs	**System kW Reduction - Summer Peak**	**System Energy Reduction (kWh)**	**System NPV of Avoided Costs**	**Total Cost**	**Shared Savings %**	**Incentive**	**System Revenue Requirement**	**NC Retail kWh Sales Allocation Factor**	**NC Allocation Factor (2)**		**NC Residential Revenue Requirement**
	EE Programs											
1	**Energy Efficiency Education**	841	6,713,787	$ 2,519,645	$ 1,644,077	11.5%	$ 100,690	$ 1,744,767	73.0903918%		E1 * F1	$ 1,275,257
2	**Energy Efficient Appliances and Devices**	31,844	187,571,870	$ 102,716,013	$ 40,433,533	11.5%	$ 7,162,485	$ 47,596,018	73.0903918%		E2 * F2	$ 34,788,116
3	**HVAC Energy Efficiency**	2,029	7,329,114	$ 7,079,940	$ 7,402,907	11.5%	$ (37,141)	$ 7,365,766	73.0903918%		E3 * F3	$ 5,383,667
4	**Low Income Energy Efficiency and Weatherization Assistance**	967	6,442,193	$ 2,800,084	$ 7,344,325	0.0%	$ -	$ 7,344,325	73.0903918%		E4 * F4	$ 5,367,996
5	**Multi-Family Energy Efficiency**	2,610	21,339,210	$ 10,815,659	$ 3,681,262	11.5%	$ 820,456	$ 4,501,718	73.0903918%		E5 * F5	$ 3,290,323
6	**Residential Energy Assessments**	946	7,886,916	$ 4,413,585	$ 3,153,757	11.5%	$ 144,880	$ 3,298,637	73.0903918%		E6 * F6	$ 2,410,987
7	**Total for Residential Conservation Programs**	39,238	237,283,091	$ 130,344,926	$ 63,659,861		$ 8,191,370	$ 71,851,232				$ 52,516,346
8	**My Home Energy Report**	89,435	325,184,686	$ 22,952,523	$ 10,558,344	11.5%	$ 1,425,331	$ 11,983,674	73.0903918%		E8 * F8	$ 8,758,914
9	**Total Residential Conservation and Behavioral Programs**	128,672	562,467,777	$ 153,297,448	$ 74,218,205		$ 9,616,701	$ 83,834,906				$ 61,275,260
									NC Residential Peak Demand Allocation Factor			
10	**Power Manager®**	568,235	-	$ 69,783,157	$ 13,386,942	11.5%	$ 6,485,565	$ 19,872,507	74.2414264%	45.955615%	(E10+E26) *F10 *G10	$ 13,609,686
11	**Total Residential**	696,908	562,467,777	$ 223,080,605	$ 87,605,147		$ 16,102,266	$ 103,707,413				$ 74,884,946

	Non-Residential Programs	**System kW Reduction - Summer Peak**	**System Energy Reduction (kWh)**	**System NPV of Avoided Costs**	**Total Cost**	**Shared Savings %**	**Incentive**	**System Revenue Requirement**	**NC Retail kWh Sales Allocation Factor**			**NC Non-Residential Revenue Requirement**
	EE Programs											
12	**Non Residential Energy Efficienct ITEE**	-	11,262	$ 1,385	$ 44,335	11.5%	$ (4,939)	$ 39,395	73.0903918%		E12 * F12	$ 28,794
13	**Non Residential Smart Saver Custom**	10,109	52,522,612	$ 35,884,367	$ 8,873,872	11.5%	$ 3,106,207	$ 11,980,079	73.0903918%		E13 * F13	$ 8,756,287
14	**Non Residential Smart Saver Custom Technical Assessments**	148	1,930,762	$ 691,285	$ 296,006	11.5%	$ 45,457	$ 341,463	73.0903918%		E14 * F14	$ 249,577
15	**Non Residential Smart Saver Energy Efficienct Food Service Products**	77	985,314	$ 406,024	$ 339,996	11.5%	$ 7,593	$ 347,589	73.0903918%		E16 * F16	$ 254,054
16	**Non Residential Smart Saver Energy Efficienct HVAC Products**	1,697	7,535,327	$ 5,519,013	$ 2,208,364	11.5%	$ 380,725	$ 2,589,088	73.0903918%		E17 * F17	$ 1,892,375
17	**Non Residential Smart Saver Energy Efficienct Lighting Products**	29,566	163,560,290	$ 105,608,459	$ 20,834,766	11.5%	$ 9,748,975	$ 30,583,741	73.0903918%		E18 * F18	$ 22,353,776
18	**Non Residential Smart Saver Energy Efficienct Process Equipment Products**	111	732,043	$ 416,343	$ 119,843	11.5%	$ 34,097	$ 153,941	73.0903918%		E19 * F19	$ 112,516
19	**Non Residential Smart Saver Energy Efficienct Pumps and Drives Products**	232	1,464,266	$ 722,433	$ 189,172	11.5%	$ 61,325	$ 250,497	73.0903918%		E20 * F20	$ 183,089
20	**Smart $aver(R) Non Residential Performance Incentive Program**	391	4,545,995	$ 2,238,186	$ 785,165	11.5%	$ 167,097	$ 952,262	73.0903918%		E21 * F21	$ 696,012
21	**Small Business Energy Saver**	10,403	57,747,534	$ 28,628,598	$ 11,421,399	11.5%	$ 1,978,828	$ 13,400,227	73.0903918%		E22 * F22	$ 9,794,278
22	**Smart Energy in Offices**	-	-	$ -	$ -	11.5%	$ -	$ -	73.0903918%		E23 * F23	$ -
23	**Total for Non-Residential Conservation Programs**	52,735	291,035,406	$ 180,116,093	$ 45,112,917		$ 15,525,365	$ 60,638,283				$ 44,320,758
									NC Non-Residential Peak Demand Allocation Factor			
24	**EnergyWise for Business**	11,714	5,135,154	$ 3,395,640	$ 3,687,462	11.5%	$ (33,560)	$ 3,653,902	74.2414264%			
25	**PowerShare®**	342,590	-	$ 42,072,382	$ 13,022,816	11.5%	$ 3,340,700	$ 16,363,516	74.2414264%			
26	**Total for Non-Residential DSM Programs**	354,304	5,135,154	$ 45,468,022	$ 16,710,278		$ 3,307,141	$ 20,017,419	74.2414264%	54.044385%	(E10+E26) *F26 *G26	$ 16,005,163
27	**Total Non Residential**	407,039	296,170,559	$ 225,584,116	$ 61,823,195		$ 18,832,506	$ 80,655,701				$ 60,325,921
28	**Total All Programs**	1,103,947	858,638,336	$ 448,664,721	$ 149,428,343		$ 34,934,771	$ 184,363,114				$ 135,210,868

(1) My Home Energy Report impacts reflect cumulative capability as of end of vintage year, including impacts for participants from prior vintages
(2) Total System DSM programs allocated to Residential and Non-Residential based on contribution to retail system peak

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Revised Fields Exhibit 1 page 5, v2020

Duke Energy Carolinas
Fields Exhibit 1
Vintage 2020 True Up - January 1, 2020 to December 31, 2020
Docket Number E-7 Sub 1285
Load Impacts and Estimated Revenue Requirements by Program

				A	B	C	D	E	F	G		H
							=(A-B)*C	= (B+D)				
	Residential Programs	**System kW Reduction - Summer Peak**	**System Energy Reduction (kWh)**	**System NPV of Avoided Costs**	**Total Cost**	**Shared Savings %**	**Incentive**	**System Revenue Requirement**	**NC Retail kWh Sales Allocation Factor**	**NC Allocation Factor (2)**		**NC Residential Revenue Requirement**
	EE Programs											
1	**Energy Efficiency Education**	(276)	4,746,423	$ 1,234,203	$ 1,113,485	11.5%	$ 13,883	$ 1,127,367	73.2212736%		E1 * F1	$ 825,473
2	**Energy Efficient Appliances and Devices**	16,975	110,986,906	$ 62,028,986	$ 22,124,101	11.5%	$ 4,589,062	$ 26,713,163	73.2212736%		E2 * F2	$ 19,559,718
3	**HVAC Energy Efficiency**	2,190	7,689,428	$ 7,811,427	$ 7,538,303	11.5%	$ 31,409	$ 7,569,712	73.2212736%		E3 * F3	$ 5,542,640
4	**Low Income Energy Efficiency and Weatherization Assistance**	214	1,238,118	$ 773,651	$ 2,787,490	0.0%	$ -	$ 2,787,490	73.2212736%		E4 * F4	$ 2,041,036
5	**Multi-Family Energy Efficiency**	522	4,042,084	$ 2,156,883	$ 1,613,839	11.5%	$ 62,450	$ 1,676,289	73.2212736%		E5 * F5	$ 1,227,400
6	**Residential Energy Assessments**	944	7,891,628	$ 4,582,748	$ 3,358,880	11.5%	$ 140,745	$ 3,499,625	73.2212736%		E6 * F6	$ 2,562,470
7	**Total for Residential Conservation Programs**	20,570	136,594,586	$ 78,587,898	$ 38,536,099		$ 4,837,548	$ 43,373,647				$ 31,758,737
8	**My Home Energy Report**	90,279	328,510,581	$ 23,467,660	$ 12,749,651	11.5%	$ 1,232,571	$ 13,982,222	73.2212736%		E8 * F8	$ 10,237,961
9	**Total Residential Conservation and Behavioral Programs**	110,849	465,105,167	$ 102,055,558	$ 51,285,750		$ 6,070,119	$ 57,355,869				$ 41,996,698
									NC Residential Peak Demand Allocation Factor			
10	**Power Manager®**	593,227	-	$ 74,785,083	$ 14,303,277	11.5%	$ 6,955,408	$ 21,258,684	74.1953449%	45.442653%	(E10+E26) *F10 *G10	$ 13,099,702
11	**Total Residential**	704,075	465,105,167	$ 176,840,640	$ 65,589,027		$ 13,025,527	$ 78,614,554				$ 55,096,400

	Non-Residential Programs	**System kW Reduction - Summer Peak**	**System Energy Reduction (kWh)**	**System NPV of Avoided Costs**	**Total Cost**	**Shared Savings %**	**Incentive**	**System Revenue Requirement**	**NC Retail kWh Sales Allocation Factor**			**NC Non-Residential Revenue Requirement**
	EE Programs											
12	**Non Residential Energy Efficienct ITEE**	-	9,917	$ 1,734	$ 15,179	11.5%	$ (1,546)	$ 13,632	73.2212736%		E12 * F12	$ 9,982
13	**Non Residential Smart Saver Custom**	4,785	21,156,703	$ 15,898,503	$ 5,771,790	11.5%	$ 1,164,572	$ 6,936,362	73.2212736%		E13 * F13	$ 5,078,893
14	**Non Residential Smart Saver Custom Technical Assessments**	76	1,413,836	$ 518,862	$ 330,629	11.5%	$ 21,647	$ 352,275	73.2212736%		E14 * F14	$ 257,941
15	**Non Residential Smart Saver Energy Efficienct Food Service Products**	33	479,609	$ 216,824	$ 533,411	11.5%	$ (36,407)	$ 497,004	73.2212736%		E16 * F16	$ 363,912
16	**Non Residential Smart Saver Energy Efficienct HVAC Products**	1,683	9,273,190	$ 7,425,418	$ 2,450,713	11.5%	$ 572,091	$ 3,022,804	73.2212736%		E17 * F17	$ 2,213,336
17	**Non Residential Smart Saver Energy Efficienct Lighting Products**	18,365	109,556,031	$ 71,995,510	$ 13,098,851	11.5%	$ 6,773,116	$ 19,871,967	73.2212736%		E18 * F18	$ 14,550,507
18	**Non Residential Smart Saver Energy Efficienct Process Equipment Products**	206	567,122	$ 236,299	$ 29,681	11.5%	$ 23,761	$ 53,442	73.2212736%		E19 * F19	$ 39,131
19	**Non Residential Smart Saver Energy Efficienct Pumps and Drives Products**	225	1,403,243	$ 758,367	$ 167,464	11.5%	$ 67,954	$ 235,418	73.2212736%		E20 * F20	$ 172,376
20	**Smart $aver(R) Non Residential Performance Incentive Program**	223	5,961,326	$ 2,035,780	$ 751,724	11.5%	$ 147,666	$ 899,391	73.2212736%		E21 * F21	$ 658,545
21	**Small Business Energy Saver**	5,718	30,315,123	$ 15,587,393	$ 6,933,130	11.5%	$ 995,240	$ 7,928,370	73.2212736%		E22 * F22	$ 5,805,254
22	**Smart Energy in Offices**	-	-	$ -	$ -	11.5%	$ -	$ -	73.2212736%		E23 * F23	$ -
23	**Total for Non-Residential Conservation Programs**	31,314	180,136,100	$ 114,674,690	$ 30,082,573		$ 9,728,094	$ 39,810,666				$ 29,149,877
									NC Non-Residential Peak Demand Allocation Factor			
24	**EnergyWise for Business**	11,854	2,602,452	$ 2,504,602	$ 2,941,282	11.5%	$ (50,218)	$ 2,891,064	74.1953449%			
25	**PowerShare®**	276,583	-	$ 34,867,428	$ 12,082,697	11.5%	$ 2,620,244	$ 14,702,941	74.1953449%			
26	**Total for Non-Residential DSM Programs**	288,437	2,602,452	$ 37,372,030	$ 15,023,979		$ 2,570,026	$ 17,594,004	74.1953449%	54.557347%	(E10+E26) *F26 *G26	$ 15,727,184
27	**Total Non Residential**	319,751	182,738,552	$ 152,046,720	$ 45,106,551		$ 12,298,119	$ 57,404,671				$ 44,877,061
28	**Total All Programs**	1,023,826	647,843,719	$ 328,887,360	$ 110,695,578		$ 25,323,646	$ 136,019,225				$ 99,973,461

(1) My Home Energy Report impacts reflect cumulative capability as of end of vintage year, including impacts for participants from prior vintages
(2) Total System DSM programs allocated to Residential and Non-Residential based on contribution to retail system peak

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Revised Fields Exhibit 1 page 6, v2021

Duke Energy Carolinas
Fields Exhibit 1
Vintage 2021 True Up - January 1, 2021 to December 31, 2021
Docket Number E-7 Sub 1285
Load Impacts and Estimated Revenue Requirements by Program

Residential Programs

		System kW Reduction - Summer Peak	System kW Reduction - Winter Peak	System Energy Reduction (kWh)	A System NPV of Avoided Costs	B Total Cost	C Shared Savings %	D =(A-B)*C Incentive	E = (B+D) System Revenue Requirement	F NC Retail kWh Sales Allocation Factor	G NC Allocation Factor (2)		H NC Residential Revenue Requirement
	EE Programs												
1	**Energy Efficiency Education**	(1,192)	40	7,013,162	$ 1,513,478	$ 1,147,501	11.5%	$ 42,087	$ 1,189,588	73.5233682%		E1 * F1	$ 874,625
2	**Energy Efficient Appliances and Devices**	8,813	6,584	51,700,635	$ 25,474,094	$ 10,824,171	11.5%	$ 1,684,741	$ 12,508,912	73.5233682%		E2 * F2	$ 9,196,973
3	**Residential Smart $aver Energy Efficiency**	2,556	2,713	9,425,675	$ 8,402,753	$ 8,156,036	11.5%	$ 28,372	$ 8,184,408	73.5233682%		E3 * F3	$ 6,017,453
4	**Low Income Energy Efficiency and Weatherization Assistance**	325	376	1,599,643	$ 1,077,736	$ 4,634,161	0.0%	$ -	$ 4,634,161	73.5233682%		E4 * F4	$ 3,407,192
5	**Multi-Family Energy Efficiency**	302	361	2,080,199	$ 1,020,435	$ 517,454	11.5%	$ 57,843	$ 575,296	73.5233682%		E5 * F5	$ 422,977
6	**Residential Energy Assessments**	748	573	6,590,951	$ 3,278,832	$ 3,326,179	11.5%	$ (5,445)	$ 3,320,734	73.5233682%		E6 * F6	$ 2,441,516
7	**Total for Residential Conservation Programs**	11,552	10,646	78,410,264	$ 40,767,328	$ 28,605,502		$ 1,807,599	$ 30,413,100				$ 22,360,736
8	**My Home Energy Report**	64,713	51,826	348,783,481	$ 18,281,223	$ 7,072,233	11.5%	$ 1,289,034	$ 8,361,267	73.5233682%		E8 * F8	$ 6,147,485
9	**Total Residential Conservation and Behavioral Programs**	76,266	62,472	427,193,746	$ 59,048,551	$ 35,677,734		$ 3,096,633	$ 38,774,367				$ 28,508,221
										NC Residential Peak Demand Allocation Factor			
10	**Power Manager®**	456,664	-	-	$ 57,584,854	$ 16,829,058	11.5%	$ 4,686,917	$ 21,515,975	74.3563771%	47.000070%	(E10+E26) *F10 *G10	$ 14,259,587
11	**Total Residential**	532,929	62,472	427,193,746	$ 116,633,405	$ 52,506,792		$ 7,783,549	$ 60,290,342				$ 42,767,808

Non-Residential Programs

		System kW Reduction - Summer Peak	System kW Reduction - Winter Peak	System Energy Reduction (kWh)	System NPV of Avoided Costs	Total Cost	Shared Savings %	Incentive	System Revenue Requirement	NC Retail kWh Sales Allocation Factor			NC Non-Residential Revenue Requirement
	EE Programs												
12	**Non Residential Energy Efficient ITEE**	-	-	2,353	$ 416	$ 74,699	11.5%	$ (8,543)	$ 66,156	73.5233682%		E12 * F12	$ 48,640
13	**Non Residential Smart Saver Custom**	6,572	4,125	30,798,533	$ 19,324,372	$ 7,505,201	11.5%	$ 1,359,205	$ 8,864,406	73.5233682%		E13 * F13	$ 6,517,410
14	**Non Residential Smart Saver Custom Technical Assessments**	110	6	921,248	$ 432,158	$ 293,539	11.5%	$ 15,941	$ 309,480	73.5233682%		E14 * F14	$ 227,540
15	**Non Residential Smart Saver Energy Efficienct Food Service Products**	82	78	1,221,948	$ 490,896	$ 203,130	11.5%	$ 33,093	$ 236,223	73.5233682%		E16 * F16	$ 173,679
16	**Non Residential Smart Saver Energy Efficient HVAC Products**	3,327	5,263	21,060,332	$ 14,904,327	$ 4,899,800	11.5%	$ 1,150,521	$ 6,050,320	73.5233682%		E17 * F17	$ 4,448,399
17	**Non Residential Smart Saver Energy Efficienct Lighting Products**	20,321	19,280	116,765,282	$ 68,937,962	$ 17,924,291	11.5%	$ 5,866,572	$ 23,790,863	73.5233682%		E18 * F18	$ 17,491,844
18	**Non Residential Smart Saver Energy Efficienct Process Equipment Products**	117	117	824,803	$ 257,010	$ 87,540	11.5%	$ 19,489	$ 107,029	73.5233682%		E19 * F19	$ 78,691
19	**Non Residential Smart Saver Energy Efficient Pumps and Drives Products**	239	244	1,522,100	$ 666,967	$ 202,615	11.5%	$ 53,401	$ 256,016	73.5233682%		E20 * F20	$ 188,231
20	**Smart $aver(R) Non Residential Performance Incentive Program**	1,039	1,014	8,247,437	$ 4,200,059	$ 342,826	11.5%	$ 443,582	$ 786,408	73.5233682%		E21 * F21	$ 578,193
21	**Small Business Energy Saver**	6,325	7,486	35,056,241	$ 16,391,449	$ 8,935,952	11.5%	$ 857,382	$ 9,793,334	73.5233682%		E22 * F22	$ 7,200,389
22	**Smart Energy in Offices**	-	-	-	$ -	$ -	11.5%	$ -	$ -	73.5233682%		E23 * F23	$ -
23	**Total for Non-Residential Conservation Programs**	38,133	37,612	216,420,278	$ 125,605,617	$ 40,469,592		$ 9,790,643	$ 50,260,235				$ 36,953,016
										NC Non-Residential Peak Demand Allocation Factor			
24	**EnergyWise for Business**	11,564	232	1,436,361	$ 1,964,689	$ 2,463,194	11.5%	$ (57,328)	$ 2,405,866	74.3563771%			
25	**PowerShare®**	335,086	311,630	-	$ 42,254,098	$ 13,583,912	11.5%	$ 3,297,071	$ 16,880,983	74.3563771%			
26	**Total for Non-Residential DSM Programs**	346,651	311,862	1,436,361	$ 44,218,787	$ 16,047,106		$ 3,239,743	$ 19,286,849	74.3563771%	52.999930%	(E10+E26) *F26 *G26	$ 16,079,915
27	**Total Non Residential**	384,784	349,474	217,856,640	$ 169,824,404	$ 56,516,699		$ 13,030,386	$ 69,547,085				$ 53,032,931
28	**Total All Programs**	917,713	411,947	645,050,386	$ 286,457,809	$ 109,023,491		$ 20,813,936	$ 129,837,426				$ 95,800,739

(1) My Home Energy Report impacts reflect cumulative capability as of end of vintage year, including impacts for participants from prior vintages
(2) Total System DSM programs allocated to Residential and Non-Residential based on contribution to retail system peak

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Duke Energy Carolinas
Fields Exhibit 1
Vintage 2022 True Up - January 1, 2022 to December 31, 2022
Docket Number E-7, Sub 1285
Load Impacts and Estimated Revenue Requirements by Program

					A	B	C	D	E	F	G	H	I
										=A*C*D*UCT Ratio	=(A-B)*C*D		
	Residential Programs	System kW Reduction - Summer Peak	System kW Reduction - Winter Peak	System Energy Reduction (kWh)	System NPV of Avoided Costs	Total Cost	Shared Savings %	NC Retail kWh Sales Allocation Factor	NC Allocated Total Cost	NC PRI	NC PPI	NC PPI Cap Reduction	NC Revenue Requirement
	EE Programs												
1	Energy Efficiency Education	(996)	33	5,862,809	$ 1,329,554	$ 1,084,925	10.6%	73.8925998%	$ 801,679		$ 19,161		$ 820,840
2	Energy Efficient Appliances and Devices	14,451	11,966	95,753,301	$ 50,016,991	$ 16,409,006	10.6%	73.8925998%	$ 12,125,041		$ 2,632,384		$ 14,757,426
3	Low Income Energy Efficiency and Weatheriza	1,053	1,006	3,553,027	$ 3,281,889	$ 7,133,288	10.6%	73.8925998%	$ 5,270,972	$ 156,298			$ 5,427,270
4	Multi-Family Energy Efficiency	737	961	5,374,930	$ 2,788,411	$ 988,815	10.6%	73.8925998%	$ 730,661		$ 140,955		$ 871,617
5	Residential Energy Assessments	581	451	5,120,221	$ 2,720,722	$ 2,479,177	10.6%	73.8925998%	$ 1,831,928		$ 18,919		$ 1,850,847
6	Residential New Construction	163	168	505,459	$ 659,766	$ 394,334	10.6%	73.8925998%	$ 291,384		$ 20,790		$ 312,174
7	Residential Smart $aver Energy Efficiency	2,563	2,626	9,382,811	$ 8,805,522	$ 7,649,994	10.6%	73.8925998%	$ 5,652,780		$ 90,508		$ 5,743,288
8	Total for Residential Conservation Programs	18,553	17,210	125,552,558	$ 69,602,854	$ 36,139,540			$ 26,704,446	$ 156,298	$ 2,922,718	$ -	$ 29,783,462
9	My Home Energy Report	67,095	53,733	361,618,365	$ 18,862,829	$ 6,299,112	10.6%	73.8925998%	$ 4,654,578		$ 984,068		$ 5,638,645
10	Total Residential Conservation and Behaviora	85,647	70,943	487,170,923	$ 88,465,683	$ 42,438,652			$ 31,359,024	$ 156,298	$ 3,906,786	$ -	$ 35,422,108
								NC Residential Peak Demand Allocation Factor					
11	Power Manager®	573,826	12,416	-	$ 73,997,721	$ 17,695,334	10.6%	72.9576004%	$ 12,910,091		$ 4,354,148		$ 17,264,239
12	Total Residential Demand Response Programs	573,826	12,416	-	$ 73,997,721	$ 17,695,334	10.6%	72.9576004%	$ 12,910,091	$ -	$ 4,354,148	$ (1,052,341)	$ 16,211,899
12	Total Residential	659,473	83,359	487,170,923	$ 162,463,404	$ 60,133,986			$ 44,269,115	$ 156,298	$ 8,260,934	$ (1,052,341)	$ 51,634,006
	Non-Residential Programs	System kW Reduction - Summer Peak	System kW Reduction - Winter Peak	System Energy Reduction (kWh)	System NPV of Avoided Costs	Total Cost	Shared Savings %	NC Retail kWh Sales Allocation Factor	NC Allocated Total Cost	NC PRI	NC PPI	NC PPI Cap Reduction	NC Revenue Requirement
	EE Programs												
13	Non Residential Energy Efficienct ITEE	-	-	97,843	$ 19,013	$ 22,448	10.6%	73.8925998%	$ 16,587		$ (269)		$ 16,318
14	Non Residential Smart Saver Custom	4,213	3,700	21,230,192	$ 14,657,385	$ 6,582,196	10.6%	73.8925998%	$ 4,863,756		$ 632,499		$ 5,496,254
15	Non Residential Smart Saver Custom Technica	60	111	822,162	$ 487,004	$ 255,963	10.6%	73.8925998%	$ 189,138		$ 18,097		$ 207,234
16	Non Residential Smart Saver Energy Efficienct	38	34	740,565	$ 297,177	$ 180,539	10.6%	73.8925998%	$ 133,405		$ 9,136		$ 142,541
17	Non Residential Smart Saver Energy Efficienct	2,489	3,018	19,522,815	$ 12,252,034	$ 3,854,304	10.6%	73.8925998%	$ 2,848,045		$ 657,762		$ 3,505,807
18	Non Residential Smart Saver Energy Efficienct	17,215	16,390	94,248,537	$ 60,136,829	$ 16,399,250	10.6%	73.8925998%	$ 12,117,832		$ 3,425,796		$ 15,543,629
	NR E-2, Sub 1180 Adjustment (AEC)					$ 468,065		100.0000000%	$ 468,065		$ -		$ 468,065
19	Non Residential Smart Saver Energy Efficienct	11	12	102,938	$ 40,207	$ 39,421	10.6%	73.8925998%	$ 29,129		$ 62		$ 29,191
20	Non Residential Smart Saver Energy Efficienct	172	176	1,163,223	$ 512,344	$ 191,769	10.6%	73.8925998%	$ 141,703		$ 25,109		$ 166,812
21	Smart $aver(R) Non Residential Performance I	5,485	5,299	3,676,020	$ 9,515,713	$ 2,345,141	10.6%	73.8925998%	$ 1,732,886		$ 561,643		$ 2,294,529
22	Small Business Energy Saver	7,573	8,301	40,074,276	$ 22,073,030	$ 9,314,994	10.6%	73.8925998%	$ 6,883,091		$ 999,288		$ 7,882,379
23	Smart Energy in Offices	-	-	-	$ -	$ -	10.6%	73.8925998%	$ -		$ -		$ -
24	Total for Non-Residential Conservation Progra	37,258	37,043	181,678,572	$ 119,990,735	$ 39,654,090			$ 29,423,638	$ -	$ 6,329,122	$ (174,423)	$ 35,578,337
								NC Non-Residential Peak Demand Allocation Factor					
24	EnergyWise for Business	7,249	464	244,116	$ 1,020,153	$ 2,272,743	10.6%	72.9576004%	$ 1,658,139		$ (96,869)		$ 1,561,270
25	PowerShare®	426,830	396,952	-	$ 54,349,652	$ 17,737,718	10.6%	72.9576004%	$ 12,941,013		$ 2,831,386		$ 15,772,399
26	Total for Non-Residential DSM Programs	434,080	397,416	244,116	$ 55,369,805	$ 20,010,461		72.9576004%	$ 14,599,152	$ -	$ 2,734,517	$ -	$ 17,333,669
27	Total Non Residential	471,338	434,459	181,922,688	$ 175,360,540	$ 59,664,551			$ 44,022,790	$ -	$ 9,063,639	$ (174,423)	$ 52,912,006
28	Total All Programs	1,130,811	517,818	669,093,611	$ 337,823,944	$ 119,798,537			$ 88,291,904	$ 156,298	$ 17,324,573	$ (1,226,764)	$ 104,546,012
		-	-	-	$ -	$ -							
									$ 82,552,868	max NC PPI	$ 16,097,809.18		

(1) My Home Energy Report impacts reflect cumulative capability as of end of vintage year, including impacts for participants from prior vintages
(2) Total System DSM programs allocated to Residential and Non-Residential based on contribution to retail system peak

/A

Duke Energy Carolinas
Fields Exhibit 1
Vintage 2024 Estimate - January 1, 2024 to December 31, 2024
Docket Number E-7, Sub 1285
Load Impacts and Estimated Revenue Requirements by Program

					A	B	C	D	E	F	G	H	I
										=A*C*D	=(A-B)*C*D		
	Residential Programs	**System kW Reduction - Summer Peak**	**System kW Reduction - Winter Peak**	**System Energy Reduction (kWh)**	**System NPV of Avoided Costs**	**Total Cost**	**Shared Savings %**	**NC Retail kWh Sales Allocation Factor**	**NC Allocated Total Cost**	**NC PRI**	**NC PPI**	**NC PPI Cap Reduction**	**NC Residential Revenue Requirement**
	EE Programs												
1	**Energy Efficiency Education**	(2,021)	67	11,893,795	$ 2,537,623	$ 2,323,870	10.6%	73.8925998%	$ 1,717,168		$ 16,742		$ 1,733,910
2	**Energy Efficient Appliances and Devices**	3,922	6,893	30,907,435	$ 20,125,871	$ 4,452,044	10.6%	73.8925998%	$ 3,289,731		$ 1,227,671		$ 4,517,401
3	**Low Income Energy Efficiency and Weatherization Assistance**	1,555	1,438	5,468,776	$ 5,893,640	$ 8,807,135	10.6%	73.8925998%	$ 6,507,821	$ 461,626			$ 6,969,447
4	**Multi-Family Energy Efficiency**	1,381	2,632	12,731,495	$ 7,926,573	$ 1,890,393	10.6%	73.8925998%	$ 1,396,861		$ 472,791		$ 1,869,651
5	**Residential Energy Assessments**	1,673	1,340	15,374,141	$ 8,782,495	$ 7,187,986	10.6%	73.8925998%	$ 5,311,389		$ 124,892		$ 5,436,281
6	**Residential New Construction**	4,729	4,940	17,649,052	$ 26,461,729	$ 12,879,538	10.6%	73.8925998%	$ 9,517,025		$ 1,063,841		$ 10,580,866
7	**Residential Smart $aver Energy Efficiency**	1,835	2,028	7,041,190	$ 8,253,222	$ 6,624,441	10.6%	73.8925998%	$ 4,894,971		$ 127,576		$ 5,022,548
8	**Total for Residential Conservation Programs**	13,073	19,338	101,065,884	$ 79,981,153	$ 44,165,406			$ 32,634,966	461,626	$ 3,033,513	-	$ 36,130,105
9	**My Home Energy Report**	69,101	55,339	372,429,514	$ 22,583,768	$ 8,168,321	10.6%	73.8925998%	$ 6,035,785		$ 1,129,107		$ 7,164,891
10	**Total Residential Conservation and Behavioral Programs**	82,174	74,677	473,495,398	$ 102,564,921	$ 52,333,726			$ 38,670,751	$ 461,626	$ 4,162,619	$ -	$ 43,294,996
								NC Residential Peak Demand Allocation Factor					
11	**Power Manager®**	593,572	65,283	-	$ 109,372,304	$ 24,875,563	10.6%	72.9576004%	$ 18,148,614		$ 6,534,560		$ 24,683,174
12	**Total Residential Demand Response Programs**	593,572	65,283	-	$ 109,372,304	$ 24,875,563	10.6%	72.9576004%	$ 18,148,614	$ -	$ 6,534,560	$ (2,855,525)	$ 21,827,649
12	**Total Residential**	675,746	139,960	473,495,398	$ 211,937,225	$ 77,209,289			$ 56,819,365	$ 461,626	$ 10,697,180	$ (2,855,525)	$ 65,122,646

	Non-Residential Programs	**System kW Reduction - Summer Peak**	**System kW Reduction - Winter Peak**	**System Energy Reduction (kWh)**	**System NPV of Avoided Costs**	**Total Cost**	**Shared Savings %**	**NC Retail kWh Sales Allocation Factor**	**NC Allocated Total Cost**	**NC PRI**	**NC PPI**	**NC PPI Cap Reduction**	**NC Non-Residential Revenue Requirement**
	EE Programs												
13	**Non Residential Energy Efficienct ITEE**	-	-	13,788	$ 2,396	$ 5,467	10.6%	73.8925998%	$ 4,040		$ (241)		$ 3,799
14	**Non Residential Smart Saver Custom**	7,867	7,867	53,822,292	$ 34,671,581	$ 10,630,183	10.6%	73.8925998%	$ 7,854,918		$ 1,883,070		$ 9,737,989
15	**Non Residential Smart Saver Custom Technical Assessments**	316	316	2,321,759	$ 1,446,398	$ 631,382	10.6%	73.8925998%	$ 466,545		$ 63,837		$ 530,382
16	**Non Residential Smart Saver Energy Efficienct Food Service Products**	97	88	1,482,462	$ 638,463	$ 307,149	10.6%	73.8925998%	$ 226,960		$ 25,951		$ 252,911
17	**Non Residential Smart Saver Energy Efficienct HVAC Products**	4,124	6,209	27,291,488	$ 25,568,132	$ 6,621,188	10.6%	73.8925998%	$ 4,892,568		$ 1,484,041		$ 6,376,609
18	**Non Residential Smart Saver Energy Efficienct Lighting Products**	26,614	25,300	156,043,327	$ 111,232,897	$ 28,716,935	10.6%	73.8925998%	$ 21,219,690		$ 6,463,158		$ 27,682,848
19	**Non Residential Smart Saver Energy Efficienct Process Equipment Products**	217	226	1,074,842	$ 481,223	$ 221,687	10.6%	73.8925998%	$ 163,811		$ 20,328		$ 184,139
20	**Non Residential Smart Saver Energy Efficienct Pumps and Drives Products**	221	226	1,423,751	$ 769,342	$ 211,472	10.6%	73.8925998%	$ 156,262		$ 43,696		$ 199,958
21	**Smart $aver(R) Non Residential Performance Incentive Program**	3,609	3,609	31,619,073	$ 17,156,413	$ 3,620,233	10.6%	73.8925998%	$ 2,675,084		$ 1,060,237		$ 3,735,321
22	**Small Business Energy Saver**	10,542	10,279	58,826,567	$ 38,068,318	$ 13,763,928	10.6%	73.8925998%	$ 10,170,524		$ 1,903,669		$ 12,074,194
23	**Smart Energy in Offices**	-	-	-	$ -	$ -	10.6%	73.8925998%	$ -		$ -		$ -
24	**Total for Non-Residential Conservation Programs**	53,607	54,119	333,919,349	$ 230,035,164	$ 64,729,623			$ 47,830,402	$ -	$ 12,947,747	$ (1,309,638)	$ 59,468,511
								NC Non-Residential Peak Demand Allocation Factor					
24	**EnergyWise for Business**	12,223	5,957	762,197	$ 3,049,486	$ 2,461,251	10.6%	72.9576004%	$ 1,795,669		$ 45,491		$ 1,841,161
25	**PowerShare®**	438,351	407,667	-	$ 77,192,656	$ 17,502,126	10.6%	72.9576004%	$ 12,769,131		$ 4,616,171		$ 17,385,302
26	**Total for Non-Residential DSM Programs**	450,574	413,623	762,197	$ 80,242,142	$ 19,963,377		72.9576004%	$ 14,564,801	$ -	$ 4,661,662	$ (2,163,611)	$ 17,062,852
27	**Total Non Residential**	504,182	467,743	334,681,546	$ 310,277,306	$ 84,693,000			$ 62,395,202	$ -	$ 17,609,409	$ (3,473,249)	$ 76,531,363
28	**Total All Programs**	1,179,928	607,703	808,176,944	$ 522,214,531	$ 161,902,290			$ 119,214,567	$ 461,626	$ 28,306,589	$ (6,328,773)	$ 141,654,009

(1) My Home Energy Report impacts reflect cumulative capability as of end of vintage year, including impacts for participants from prior vintages
(2) Total System DSM programs allocated to Residential and Non-Residential based on contribution to retail system peak

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Revised Fields Exhibit 3

Duke Energy Carolinas, LLC
For the Period January 1, 2019 - December 31, 2022
Docket Number E-7 Sub 1285
Actual Program Costs for Vintage Years 2019, 2020, 2021, 2022

		Carolinas System - 12 months Ended 12/31/2019	Carolinas System - 12 months Ended 12/31/2020	Carolinas System - 12 months Ended 12/31/2021	Carolinas System - 12 months Ended 12/31/2022
1	Appliance Recycle Program	-	-	-	-
2	Energy Efficiency Education	1,644,077	1,113,485	1,147,501	1,084,925
3	Energy Efficient Appliances and Devices	40,433,533	22,124,101	10,824,171	16,409,006
4	Energy Management Information Systems	-	-	-	-
5	Income Qualified Energy Efficiency and Weatherization Assistance	7,344,325	2,787,490	4,634,161	7,133,288
6	Multi family Energy Efficiency	3,681,262	1,613,839	517,454	988,815
7	My Home Energy Report	10,558,344	12,749,651	7,072,233	6,299,112
8	Residential Energy Assessments	3,153,757	3,358,880	3,326,179	2,479,177
9	Residential New Construction	-	-	-	394,334
10	Residential Smart $aver Energy Efficiency	7,402,907	7,538,303	8,156,036	7,649,994
11	Nonresidential Smart Saver Custom Energy Assessments	296,006	330,629	293,539	255,963
12	Non-Residential Smart Saver Custom	8,873,872	5,771,790	7,505,201	6,582,196
13	Non-Residential Smart Saver Performance Incentive	785,165	751,724	342,826	2,345,141
14	Non-Residential Energy Efficient Food Service Products	339,996	533,411	203,130	180,539
15	Non-Residential Smart Saver Energy Efficient HVAC Products	2,208,364	2,450,713	4,899,800	3,854,304
16	Non-Residential Smart Saver Energy Efficient Lighting Products	20,834,766	13,098,851	17,924,291	16,399,250
	NR E-2, Sub 1180 Adjustment (AEC, v2022)				468,065
17	Nonresidential Energy Efficient Pumps and Drives Products	189,172	167,464	202,615	191,769
18	Nonresidential Energy Efficient ITEE	44,335	15,179	74,699	22,448
19	Nonresidential Energy Efficient Process Equipment Products	119,843	29,681	87,540	39,421
20	Smart Energy In Offices	-	-	-	-
21	Small Business Energy Saver	11,421,399	6,933,130	8,935,952	9,314,994
22	Business Energy Report	-	-	-	-
23	Power Manager	13,386,942	14,303,277	16,829,058	17,695,334
24	EnergyWise for Business	3,687,462	2,941,282	2,463,194	2,272,743
25	Power Share	13,022,816	12,082,697	13,583,912	17,737,718
26					
27	**Total Energy Efficiency & Demand Side Program Costs**	**$ 149,428,343**	**$ 110,695,578**	**$ 109,023,491**	**$ 119,798,537**
28	NC Allocation Factor for EE programs	73.0903918%	73.2212736%	73.5233682%	73.8925998%
29	NC Allocation Factor for DSM programs-Residential	34.1181040%	33.7163333%	34.9475492%	34.3192361%
30	NC Allocation Factor for DSM programs-Non-Residential	40.1233224%	40.4790117%	39.4088278%	38.6383643%
31	NC Allocation Factor for DR programs	74.2414264%	74.1953449%	74.3563771%	72.9576004%

		NC Allocated - 12 Months Ended 12/31/2019	NC Allocated - 12 Months Ended 12/31/2020	NC Allocated - 12 Months Ended 12/31/2021	NC Allocated - 12 Months Ended 12/31/2022
32	Appliance Recycle Program	$ -	$ -	$ -	$ -
33	Energy Efficiency Education	$ 1,201,662	815,308	843,681	801,679
34	Energy Efficient Appliances and Devices	$ 29,553,027	16,199,549	7,958,295	12,125,041
35	Energy Management Information Systems	$ -	-	-	-
36	Income Qualified Energy Efficiency and Weatherization Assistar	$ 5,367,996	2,041,036	3,407,192	5,270,972
37	Multi family Energy Efficiency	$ 2,690,649	1,181,674	380,449	730,661
38	My Home Energy Report	$ 7,717,135	9,335,457	5,199,744	4,654,578
39	Residential Energy Assessments	$ 216,352	242,090	215,820	1,831,928
40	Residential New Construction	$ 2,305,093	2,459,415	2,445,519	291,384
41	Residential Smart $aver Energy Efficiency	$ -	-	-	5,652,780
42	Nonresidential Smart Saver Custom Energy Assessments	$ 5,410,814	5,519,641	5,996,592	189,138
43	Non-Residential Smart Saver Custom	$ 6,485,948	4,226,178	5,518,076	4,863,756
44	Non-Residential Smart Saver Performance Incentive	$ 573,880	550,422	252,057	1,732,886
45	Non-Residential Energy Efficient Food Service Products	$ 248,504	390,570	149,348	133,405
46	Non-Residential Smart Saver Energy Efficient HVAC Products	$ 1,614,102	1,794,444	3,602,498	2,848,045
47	Non-Residential Smart Saver Energy Efficient Lighting Products	$ 15,228,212	9,591,146	13,178,542	12,117,832
	NR E-2, Sub 1180 Adjustment (AEC, v2022)				468,065
48	Nonresidential Energy Efficient Pumps and Drives Products	$ 138,267	122,620	148,969	141,703
49	Nonresidential Energy Efficient ITEE	$ 32,404	11,114	54,921	16,587
50	Nonresidential Energy Efficient Process Equipment Products	$ 87,594	21,733	64,362	29,129
51	Smart Energy In Offices	$ -	-	-	-
52	Small Business Energy Saver	$ 8,347,945	5,076,526	6,570,013	6,883,091
53	Business Energy Report	$ -	-	-	-
54	Power Manager	$ 10,268,601	9,888,075	11,489,414	12,910,091
55	EnergyWise for Business	$ 2,664,815	2,324,090	1,988,733	1,658,139
56	Power Share	$ 9,411,189	9,547,293	10,967,378	12,941,013
57	**Total Energy Efficiency & Demand Side Program Costs**	**$ 109,564,190**	**$ 81,338,380**	**$ 80,431,604**	**$ 88,291,904**

Miller Exhibit 1, page 1

DSM/EE Cost Recovery Rider 15
Docket Number E-7 Sub 1285
Exhibit Summary of Rider EE Exhibits and Factors

Residential Billing Factor for Rider 15 True-up (EMF) Components

Line			
1	Year 2016 EE/DSM True-Up (EMF) Revenue Requirement	Fields Exh 1 pg 1 (2016) Line 9 + Listebarger Exh 3 pg 1 * Exh 2 pg 8	$ (4,349)
2	Year 2017 EE/DSM True-Up (EMF) Revenue Requirement	Fields Exh 1 pg 1 (2017) Line 9 + Listebarger Exh 3 pg 2 * Exh 2 pg 8	$ (289,186)
3	Year 2018 EE/DSM True-Up (EMF) Revenue Requirement	Listebarger Exhibit 2 pg 1, Line 15	(395,816)
4	Year 2019 EE/DSM True-Up (EMF) Revenue Requirement	Listebarger Exhibit 2 pg 2, Line 15	(422,560)
5	Year 2020 EE/DSM True-Up (EMF) Revenue Requirement	Listebarger Exhibit 2 pg 3, Line 15	(1,106,993)
6	Year 2021 EE/DSM True-Up (EMF) Revenue Requirement	Listebarger Exhibit 2 pg 4, Line 15	(767,503)
7	Year 2022 EE/DSM True-Up (EMF) Revenue Requirement	Listebarger Exhibit 2 pg 5, Line 15	(8,926,802)
8	Total True-up (EMF) Revenue Requirement	Sum Lines 1-7	$ (11,913,210)
9	Projected NC Residential Sales (kWh) for rate period	Listebarger Exhibit 6, Line 1	23,664,202,369
10	*EE/DSM Revenue Requirement EMF Residential Rider EE (cents per kWh)*	Line 8 / Line 9 * 100	**(0.0503)**

Residential Billing Factor for Rider 15 Prospective Components

Line			
11	Vintage 2021 Total EE/DSM Prospective Amounts Revenue Requirement	Listebarger Exhibit 2 pg 4, Line 15	1,915,275
12	Vintage 2022 Total EE/DSM Prospective Amounts Revenue Requirement	Listebarger Exhibit 2 pg 5, Line 15	4,813,237
13	Vintage 2023 Total EE/DSM Prospective Amounts Revenue Requirement	Listebarger Exhibit 2 pg 6, Line 1	6,787,155
14	Vintage 2024 Total EE/DSM Prospective Amounts Revenue Requirement	Listebarger Exhibit 2 pg 7, Line 11	88,723,534
15	Total Prospective Revenue Requirement	Sum Lines 11-14	$ 102,239,200
16	Projected NC Residential Sales (kWh) for rate period	Listebarger Exhibit 6, Line 1	23,664,202,369
17	*EE/DSM Revenue Requirement Prospective Residential Rider EE (cents per kWh)*	Line 15 / Line 16 * 100	**0.4320**

<u>Total Revenue Requirements in Rider 15 from Residential Customers</u>

Line			
18	Total True-up (EMF) Revenue Requirement	Line 8	$ (11,913,210)
19	Total Prospective Revenue Requirement	Line 15	102,239,200
20	***Total EE/DSM Revenue Requirement for Residential Rider EE***	Line 18 + Line 19	**$ 90,325,990**
21	***Total EE/DSM Revenue Requirement for Residential Rider EE (cents per kWh)***	Line 10 + Line 17	**0.3817**

Non-Residential Billing Factors for Rider 15 True-up (EMF) Components

Line			
22	*Vintage Year 2018 EE True-up (EMF) Revenue Requirement*	Listebarger Exhibit 2 pg 1, Line 25	$ (21,684)
23	*Projected Year 2018 EE Participants NC Non-Residential Sales (kwh) for rate period*	Listebarger Exhibit 6, Line 4	17,157,930,277
24	*EE Revenue Requirement Year 2018 EMF Non-Residential Rider EE (cents per kWh)*	Line 22 / Line 23 * 100	**(0.0001)**
25	*Vintage Year 2018 DSM True-up (EMF) Revenue Requirement*	Listebarger Exhibit 2 pg 1, Line 35	$ 3,086
26	*Projected Year 2018 DSM Participants NC Non-Residential Sales (kwh) for rate period*	Listebarger Exhibit 6, Line 5	18,516,675,854
27	*DSM Revenue Requirement Year 2018 EMF Non-Residential Rider EE (cents per kWh)*	Line 25 / Line 26 * 100	-
28	*Vintage Year 2019 EE True-up (EMF) Revenue Requirement*	Listebarger Exhibit 2 pg 2, Line 25	$ (235,521)
29	*Projected Year 2019 EE Participants NC Non-Residential Sales (kwh) for rate period*	Listebarger Exhibit 6, Line 6	17,136,255,406
30	*EE Revenue Requirement Year 2019 EMF Non-Residential Rider EE (cents per kWh)*	Line 28 / Line 29 * 100	**(0.0014)**
31	*Vintage Year 2019 DSM True-up (EMF) Revenue Requirement*	Listebarger Exhibit 2 pg 2, Line 35	$ (21,406)
32	*Projected Year 2019 DSM Participants NC Non-Residential Sales (kwh) for rate period*	Listebarger Exhibit 6, Line 7	18,570,220,915
33	*DSM Revenue Requirement Year 2019 EMF Non-Residential Rider EE (cents per kWh)*	Line 31 / Line 32 * 100	**(0.0001)**
34	*Vintage Year 2020 EE True-up (EMF) Revenue Requirement*	Listebarger Exhibit 2 pg 3, Line 25	$ (1,128,887)
35	*Projected Year 2020 EE Participants NC Non-Residential Sales (kwh) for rate period*	Listebarger Exhibit 6, Line 8	16,575,789,097
36	*EE Revenue Requirement Year 2020 EMF Non-Residential Rider EE (cents per kWh)*	Line 34 / Line 35 * 100	**(0.0068)**
37	*Vintage Year 2020 DSM True-up (EMF) Revenue Requirement*	Listebarger Exhibit 2 pg 3, Line 35	$ 32,287
38	*Projected Year 2020 DSM Participants NC Non-Residential Sales (kwh) for rate period*	Listebarger Exhibit 6, Line 9	18,635,398,667
39	*DSM Revenue Requirement Year 2020 EMF Non-Residential Rider EE (cents per kWh)*	Line 37 / Line 38 * 100	**0.0002**
40	*Vintage Year 2021 EE True-up (EMF) Revenue Requirement*	Listebarger Exhibit 2 pg 4, Line 25	$ (1,363,988)
41	*Projected Year 2021 EE Participants NC Non-Residential Sales (kwh) for rate period*	Listebarger Exhibit 6, Line 10	16,652,048,700
42	*EE Revenue Requirement Year 2021 EMF Non-Residential Rider EE (cents per kWh)*	Line 40 / Line 41 * 100	**(0.0082)**
43	*Vintage Year 2021 DSM True-up (EMF) Revenue Requirement*	Listebarger Exhibit 2 pg 4, Line 35	$ (1,367,038)
44	*Projected Year 2021 DSM Participants NC Non-Residential Sales (kwh) for rate period*	Listebarger Exhibit 6, Line 11	18,677,101,757
45	*DSM Revenue Requirement Year 2021 EMF Non-Residential Rider EE (cents per kWh)*	Line 43 / Line 44 * 100	**(0.0073)**
46	*Vintage Year 2022 EE True-up (EMF) Revenue Requirement*	Listebarger Exhibit 2 pg 5, Line 25	$ (29,006,401)
47	*Projected Year 2022 EE Participants NC Non-Residential Sales (kwh) for rate period*	Listebarger Exhibit 6, Line 12	16,744,193,880
48	*EE Revenue Requirement Year 2022 EMF Non-Residential Rider EE (cents per kWh)*	Line 46 / Line 47 * 100	**(0.1732)**
49	*Vintage Year 2022 DSM True-up (EMF) Revenue Requirement*	Listebarger Exhibit 2 pg 5, Line 35	$ (329,369)
50	*Projected Year 2022 DSM Participants NC Non-Residential Sales (kwh) for rate period*	Listebarger Exhibit 6, Line 13	18,855,570,769
51	*DSM Revenue Requirement Year 2022 EMF Non-Residential Rider EE (cents per kWh)*	Line 49 / Line 50 * 100	**(0.0017)**

DSM/EE Cost Recovery Rider 15
Docket Number E-7 Sub 1285
Exhibit Summary of Rider EE Exhibits and Factors

Non-Residential Billing Factors for Rider 15 Prospective Components

52	Vintage Year 2021 EE Prospective Amounts Revenue Requirement	Listebarger Exhibit 2 pg 4, Line 25	$ 5,211,948
53	Projected Vintage 2021 EE Participants NC Non-Residential Sales (kwh) for rate period	Listebarger Exhibit 6, Line 10	16,652,048,700
54	*EE Revenue Requirement Vintage 2021 Prospective Component - Non-Residential Rider EE (cents per kWh)*	Line 52 / Line 53 * 100	**0.0313**
55	Vintage Year 2022 EE Prospective Amounts Revenue Requirement	Listebarger Exhibit 2 pg 5, Line 25	$ 7,844,523
56	Projected Vintage 2022 EE Participants NC Non-Residential Sales (kwh) for rate period	Listebarger Exhibit 6, Line 12	16,744,193,880
57	*EE Revenue Requirement Vintage 2022 Prospective Component - Non-Residential Rider EE (cents per kWh)*	Line 55 / Line 56 * 100	**0.0468**
58	Vintage Year 2023 EE Prospective Amounts Revenue Requirement	Listebarger Exhibit 2 pg 6, Line 4	$ 14,155,374
59	Projected Vintage 2023 EE Participants NC Non-Residential Sales (kwh) for rate period	Listebarger Exhibit 6, Line 14	17,655,241,326
60	*EE Revenue Requirement Vintage 2023 Prospective Component - Non-Residential Rider EE (cents per kWh)*	Line 58 / Line 59 * 100	**0.0802**
61	Vintage Year 2024 EE Prospective Amounts Revenue Requirement	Listebarger Exhibit 2 pg 7, Line 18	$ 68,313,371
62	Projected Vintage 2024 EE Participants NC Non-Residential Sales (kwh) for rate period	Listebarger Exhibit 6, Line 16	17,655,241,326
63	*EE Revenue Requirement Vintage 2024 Prospective Component - Non-Residential Rider EE (cents per kWh)*	Line 61 / Line 62 * 100	**0.3869**
64	Vintage Year 2024 DSM Prospective Amounts Revenue Requirement	Listebarger Exhibit 2 pg 7, Line 25	$ 17,086,774
65	Projected Vintage 2024 DSM Participants NC Non-Residential Sales (kwh) for rate period	Listebarger Exhibit 6, Line 17	19,059,148,493
66	*DSM Revenue Requirement Vintage 2024 Prospective Component - Non-Residential Rider EE (cents per kWh)*	Line 64 / Line 65 * 100	**0.0897**
			(0.1986)
	Total Prospective Rate		**0.6349**

<u>Total Revenue Requirements in Rider 15 from Non-Residential Customers</u>

65	Vintage Year 2018 EE True-up (EMF) Revenue Requirement	Line 22	(21,684)
66	Vintage Year 2018 DSM True-up (EMF) Revenue Requirement	Line 25	3,086
67	Vintage Year 2019 EE True-up (EMF) Revenue Requirement	Line 28	(235,521)
68	Vintage Year 2019 DSM True-up (EMF) Revenue Requirement	Line 31	(21,406)
69	Vintage Year 2020 EE True-up (EMF) Revenue Requirement	Line 34	(1,128,887)
70	Vintage Year 2020 DSM True-up (EMF) Revenue Requirement	Line 37	32,287
71	Vintage Year 2021 EE True-up (EMF) Revenue Requirement	Line 40	(1,363,988)
72	Vintage Year 2021 DSM True-up (EMF) Revenue Requirement	Line 43	(1,367,038)
73	Vintage Year 2022 EE True-up (EMF) Revenue Requirement	Line 46	(29,006,401)
74	Vintage Year 2022 DSM True-up (EMF) Revenue Requirement	Line 49	(329,369)
75	Vintage Year 2021 EE Prospective Amounts Revenue Requirement	Line 52	5,211,948
76	Vintage Year 2022 EE Prospective Amounts Revenue Requirement	Line 55	7,844,523
77	Vintage Year 2023 EE Prospective Amounts Revenue Requirement	Line 58	14,155,374
78	Vintage Year 2024 EE Prospective Amounts Revenue Requirement	Line 61	68,313,371
79	Vintage Year 2024 DSM Prospective Amounts Revenue Requirement	Line 64	17,086,774
	Total Non-Residential Revenue Requirement in Rider 15	Sum (Lines 65-79)	**79,173,068**

Miller Exhibit 2, page 1

Duke Energy Carolinas, LLC
Docket Number E-7 Sub 1285
True Up of Lost Revenues for Vintage Year 2018

RESIDENTIAL
Energy Efficiency Programs

Line		Reference	E-7 Sub 1130 Rider 9 Year 1 Estimate	E-7 Sub 1164 Year 2018 Yr 2 LR Estimate	E-7 Sub 1192 Rider 11 True up	E-7 Sub 1192 Year 2018 Year 3 Estimate	E-7 Sub 1230 Rider 12 True Up	E-7 Sub 1230 Year 2018 Yr 4 LR Estimate	E-7 Sub 1249 Rider 13 True up	E-7 Sub 1265 Rider 14 True up	E-7 Sub 1285 Rider 15 True up	Year 2018
1	Residential EE Program Cost	Fields Exhibit 1 pg. 3, Line 9 * NC Alloc. Factor	41,623,609		14,606,717		$ (0)		$ -	$ -	$ -	$ 56,230,326
2	Residential EE Earned Utility Incentive	Fields Exhibit 1 pg. 3, Line 9 * NC Alloc. Factor	5,511,264		4,154,068		140,649		(22,279)	157,616	(39,495)	9,901,824
3	Return on overcollection of Residential EE Program Costs	Listebarger Exhibit 3 pg 3			244,540		1,024,850		750,744	(2,580)	(104,676)	1,912,878
4	Total EE Program Cost and Incentive Components	Line 1 + Line 2 + Line 3	47,134,873		19,005,325		1,165,498		728,465	155,036	(144,170)	68,045,027
5	Residential DSM Program Cost	Fields Exhibit 1 pg. 3, Line 10 * NC Alloc. Factor	9,903,130		(124,235)		0		-	-	-	9,778,895
6	Residential DSM Earned Utility Incentive	Fields Exhibit 1 pg. 3, Line 10 * NC Alloc. Factor	2,569,925		17,215		(5,581)		(289)	573	(297)	2,581,546
7	Return on undercollection of Residential DSM Program Costs	Listebarger Exhibit 3 pg 4			(28,626)		(40,884)		(21,193)	18,109	(17,995)	(90,588)
8	Total DSM Program Cost and Incentive Components	Line 5 + Line 6 + Line 7	12,473,055		(135,646)		(46,465)		(21,481)	18,682	(18,292)	12,269,853
9	Total EE/DSM Program Cost and Incentive Components	Line 4 + Line 8	59,607,928		18,869,679		1,119,034		706,984	173,718	(162,463)	80,314,880
10	Revenue-related taxes and regulatory fees factor **	Listebarger Exhibit 2, pg. 8	1.001402		1.001352		1.001302		1.001352	1.001402	1.001402	
11	Total EE/DSM Program Cost and Incentive Revenue Requirement	Line 9 * Line 10	59,691,498		18,895,191		1,120,491		707,940	173,962	(162,691)	80,426,391
12	Residential Net Lost Revenues	Fields Exhibit 2 pg 1-9	19,612,717	6,294,025	894,901	9,715,212	1,534,156	-	2,310,499	(86,953)	(194,096)	40,080,462
13	Total Residential EE/DSM Revenue Requirement	Line 11 + Line 12	79,304,216	6,294,025	19,790,092	9,715,212	2,654,647	-	3,018,439	87,009	(356,786)	120,506,852
14	Total Collected for Vintage Year 2018 (through estimated Rider 15)	Listebarge Exhibit 4, Line 1										120,902,668
15	**Total Residential EE/DSM Revenue Requirement**	Line 13 - Line 14										$ (395,816)

Note: No prospective Year 4 lost revenue is included in this exhibit because the rate case test period was extended for residential customers.

See Listebarger Exhibit A for rate

NON-RESIDENTIAL
Energy Efficiency Programs

Line		Reference	E-7 Sub 1130 Rider 9 Year 1 Estimate	E-7 Sub 1164 Year 2018 Yr 2 LR Estimate	E-7 Sub 1192 Rider 11 True up	E-7 Sub 1192 Year 2018 Year 3 Estimate	E-7 Sub 1230 Rider 12 True Up	E-7 Sub 1230 Year 2018 Yr 4 LR Estimate	E-7 Sub 1249 Rider 13 True up	E-7 Sub 1265 Rider 14 True up	E-7 Sub 1285 Rider 15 True up	Year 2018
16	Non- Residential EE Program Cost	Fields Exhibit 1 pg. 3, Line 23 * NC Alloc. Factor	40,592,949		(3,317,005)		0		-	-	-	37,275,944
17	Non-Residential EE Earned Utility Incentive	Fields Exhibit 1 pg. 3, Line 23 * NC Alloc. Factor	11,623,199		2,818,045		(25,396)		(2,366)	-	(10,650)	14,402,832
18	Return on undercollection of Non-residential EE Program Costs	Listebarger Exhibit 3 page 5			461,049		592,305		407,815	49,904	(54,943)	1,456,132
19	Total EE Program Cost and Incentive Components	Line 16 + Line 17 + Line 18	52,216,148		(37,911)		566,910		405,450	49,904	(65,593)	53,134,908
20	Revenue-related taxes and regulatory fees factor	Listebarger Exhibit 2, pg. 8	1.001402		1.001352		1.001302		1.001352	1.001402	1.001402	
21	Total Non-Residential EE Program Cost & Incentive Revenue Requirements	Line 19 * Line 20	52,289,355		(37,962)		567,648		405,998	49,974	(65,685)	53,209,328
22	Non-Residential Net Lost Revenues	Fields Exhibit 2 pg 1-9	5,167,253	12,285,044	2,933,863	9,507,185	(1,090,744)	2,182,027	(2,020,437)	(47,064)	(3,539,044)	25,378,082
23	Total Non-Residential EE Revenue Requirement	Line 21 + Line 22	57,456,608	12,285,044	2,895,901	9,507,185	(523,097)	2,182,027	(1,614,439)	2,910	(3,604,729)	78,587,410
24	Total Collected for Vintage Year 2018 (through estimated Rider 15)	Listebarger Exhibit 4 Line 8										78,609,094
25	Non-Residential EE Revenue Requirement	Line 23 - Line 24										(21,684)
26	Projected NC Residential Sales (kWh)	Listebarger Exhibit 6, Line 4										17,157,930,277
27	**NC Non-Residential EE billing factor (Cents/kWh)**	Line 25/Line 26*100										**(0.0001)**

DSM Programs

Line		Reference	E-7 Sub 1130 Rider 9 Year 1 Estimate		E-7 Sub 1192 Rider 11 True up		E-7 Sub 1230 Rider 12 True Up		E-7 Sub 1249 Rider 13 True up	E-7 Sub 1265 Rider 14 True up	E-7 Sub 1285 Rider 15 True up	Year 2018
28	Non-Residential DSM Program Cost	Fields Exhibit 1, pg. 3, Line 10 + Line 26 * NC Alloc. Factor	11,959,889		651,281		(0)		-	-	-	12,611,170
29	Non-Residential DSM Earned Utility Incentive	Fields Exhibit 1, pg. 3, Line 10 + Line 26 * NC Alloc. Factor	3,103,667		232,789		(7,197)		(372)	739	(384)	3,329,242
30	Return on undercollection of Non-residential DSM Program Costs	Listebarger Exhibit 3 page 6	-		37,743		76,651		54,598	40,422	(31,313)	178,101
31	Total Non-Residential DSM Program Cost and Incentive Components	Line 28 + Line 29 + Line 30	15,063,556		921,813		69,454		54,225	41,161	(31,697)	16,118,513
32	Revenue-related taxes and regulatory fees factor	Listebarger Exhibit 2, pg. 8	1.001402		1.001352		1.001302		1.001352	1.001402	1.001402	
33	Total Non-Residential DSM Revenue Requirement	Line 31 * Line 32	15,084,675		923,059		69,544		54,299	41,219	(31,741)	16,141,055
34	Total Collected for Vintage Year 2018 (through estimated Rider 15)	Listebarger Exhibit 4 Line 14										16,137,969
35	Non-Residential EE Revenue Requirement True-up Amount	Line 33 - Line 34										3,086
36	Projected NC Non-Residential Sales (kWh)	Listebarger Exhibit 6, Line 5										18,516,675,854
37	**NC Non-Residential DSM billing factor**	Line 35/Line 36*100										-

** Actual regulatory fee rate in effect in year of collection. May differ from original filed estimates.

Duke Energy Carolinas, LLC
Docket Number E-7 Sub 1285
True Up of Year 1, 2, 3 and 4 Lost Revenues for Vintage Year 2019

RESIDENTIAL
Energy Efficiency Programs

Line		Reference	E-7 Sub 1164 Rider 10 Year 1 Estimate	E-7 Sub 1192 Year 2019 Yr 2 LR Estimate	E-7 Sub 1230 Rider 12 True up	E-7 Sub 1230 Year 2019 Yr 3 LR Estimate	E-7 Sub 1249 Rider 13 True up	E-7 Sub 1249 Year 2020 Yr 4 LR Estimate	E-7 Sub 1265 Rider 14 True up	E-7 Sub 1285 Rider 15 True up	Year 2019
1	Residential EE Program Cost	Fields Exhibit 1 pg. 4, Line 9 * NC Alloc. Factor	$ 41,002,874		$ 13,243,503		$ (0)		$ 0	$ -	$ 54,246,377
2	Residential EE Earned Utility Incentive	Fields Exhibit 1 pg. 4, Line 9 * NC Alloc. Factor	3,801,819		3,296,056		(124,962)		90,385	(34,414)	7,028,884
3	Return on undercollection of Residential EE Program Costs	Listebarger Exhibit 3 pg 7			55,738		750,744		511,698	(195)	1,317,985
4	Total EE Program Cost and Incentive Components	Line 1 + Line 2 + Line 3	44,804,694		16,595,296		625,782		602,083	(34,609)	62,593,246
5	Residential DSM Program Cost	Fields Exhibit 1 pg. 4, Line 10 + Line 26 * NC Alloc. Factor	10,577,352		(308,751)		(0)		(0)	-	10,268,601
6	Residential DSM Earned Utility Incentive	Fields Exhibit 1 pg. 4, Line 10 + Line 26 * NC Alloc. Factor	2,773,086		541,821		0		26,383	(205)	3,341,085
7	Return on undercollection of Residential DSM Program Costs	Listebarger Exhibit 3 pg 8			(6,600)		(21,193)		5,935	2,555	(19,302)
8	Total DSM Program Cost and Incentive Components	Line 5 + Line 6 + Line 7	13,350,438		226,469		(21,193)		32,318	2,351	13,590,384
9	Total EE/DSM Program Cost and Incentive Components	Line 4 + Line 8	58,155,132		16,821,766		604,589		634,402	(32,258)	76,183,630
10	Revenue-related taxes and regulatory fees factor **	Listebarger Exhibit 2, pg. 8	1.001402		1.001352		1.001352		1.001402	1.001402	
11	Total EE/DSM Program Cost and Incentive Revenue Requirement	Line 9 * Line 10	58,236,665		16,844,509		605,406		635,291	(32,304)	76,289,568
12	Residential Net Lost Revenues	Fields Exhibit 2 pg 1 - 9	18,783,204	5,232,466	6,704,043	5,292,331	(1,623,869)	2,233,068	236,622	(80,649)	36,777,216
13	Total Residential EE/DSM Revenue Requirement	Line 11 + Line 12	77,019,869	5,232,466	23,548,552	5,292,331	(1,018,463)	2,233,068	871,913	(112,953)	113,066,783
14	Total Collected for Vintage Year 2019 (through estimated Rider 15)	Listebarger Exhibit 4, Line 2									113,489,344
15	**Total Residential EE/DSM Revenue Requirement**	Line 13 - Line 14									$ (422,560)

See Listebarger Exhibit A for rate

NON-RESIDENTIAL
Energy Efficiency Programs

Line		Reference	E-7 Sub 1164 Rider 10 Year 1 Estimate	E-7 Sub 1192 Year 2019 Yr 2 LR Estimate	E-7 Sub 1230 Rider 12 True up	E-7 Sub 1230 Year 2019 Yr 3 LR Estimate	E-7 Sub 1249 Rider 13 True up	E-7 Sub 1249 Year 2020 Yr 4 LR Estimate	E-7 Sub 1265 Rider 14 True up	E-7 Sub 1285 Rider 15 True up	Year 2019
16	Non- Residential EE Program Cost	Fields Exhibit 1 pg. 4, Line 23 * NC Alloc. Factor	41,671,833		(8,698,625)		-		0	(0)	32,973,208
17	Non-Residential EE Earned Utility Incentive	Fields Exhibit 1 pg. 4, Line 23 * NC Alloc. Factor	8,464,629		1,873,850		759,937		(0)	249,134	11,347,550
18	Return on undercollection of Non-residential EE Program Costs	Listebarger Exhibit 3 page 9			(553,659)		(275,034)		(228,890)	(78,141)	(1,135,724)
19	Total EE Program Cost and Incentive Components	Line 16 + Line 17 + Line 18	50,136,462		(7,378,434)		484,904		(228,890)	170,992	43,185,034
20	Revenue-related taxes and regulatory fees factor	Listebarger Exhibit 2, pg. 8	1.001402		1.001352		1.001352		1.001402	1.001402	
21	Total Non-Residential EE Program Cost and Incentive Revenue Requirements	Line 19 * Line 20	50,206,753		(7,388,410)		485,559		(229,211)	171,232	43,245,924
22	Non-Residential Net Lost Revenues	Fields Exhibit 2 pg 1 - 9	5,590,446	8,746,000	452,216	10,794,655	(8,183,962)	2,074,187	874,289	663,225	21,011,055
23	Total Non-Residential EE Revenue Requirement	Line 21 + Line 22	55,797,199	8,746,000	(6,936,194)	10,794,655	(7,698,403)	2,074,187	645,078	834,456	64,256,979
24	Total Collected for Vintage Year 2019 (through estimated Rider 15)	Listebarger Exhibit 4, Line 9									64,492,500
25	Non-Residential EE Revenue Requirement	Line 23 - Line 24									(235,521)
26	Projected NC Residential Sales (kWh)	Listebarger Exhibit 6, Line 6									17,136,255,406
27	**NC Non-Residential EE billing factor (Cents/kWh)**	Line 25/Line 26*100									**(0.0014)**

DSM Programs

Line		Reference	E-7 Sub 1164 Rider 10 Year 1 Estimate		E-7 Sub 1230 Rider 12 True up		E-7 Sub 1249 Rider 13 True up		E-7 Sub 1265 Rider 14 True up	E-7 Sub 1285 Rider 15 True up	Year 2019
28	Non-Residential DSM Program Cost	Fields Exhibit 1 pg. 4, Line 10 + Line 26 * NC Alloc. Factor	12,538,168		(462,163)		-		(0)	-	12,076,005
29	Non-Residential DSM Earned Utility Incentive	Fields Exhibit 1 pg. 4, Line 10 + Line 26 * NC Alloc. Factor	3,287,157		611,215		-		31,027	(241)	3,929,159
30	Return on undercollection of Non-residential DSM Program Costs	Listebarger Exhibit 3 page 10	-		(9,744)		7,619		2,253	(545)	(417)
31	Total Non-Residential DSM Program Cost and Incentive Components	Line 28 + Line 29 + Line 30	15,825,325		139,308		7,619		33,279	(786)	16,004,746
32	Revenue-related taxes and regulatory fees factor	Listebarger Exhibit 2, pg. 8	1.001402		1.001352		1.001352		1.001402	1.001402	
33	Total Non-Residential DSM Revenue Requirement	Line 31 * Line 32	15,847,512		139,497		7,630		33,326	(787)	16,027,178
34	Total Collected for Vintage Year 2019 (through estimated Rider 15)	Listebarger Exhibit 4 Line 15									16,048,584
35	Non-Residential EE Revenue Requirement True-up Amount	Line 33 - Line 34									(21,406)
36	Projected NC Non-Residential Sales (kWh)	Listebarger Exhibit 6, Line 7									18,570,220,915
37	**NC Non-Residential DSM billing factor**	Line 35/Line 36*100									**(0.0001)**

** Actual regulatory fee rate in effect in year of collection. May differ from original filed estimates.

Duke Energy Carolinas, LLC
Docket Number E-7 Sub 1285
True Up of Year 1, 2 and 3 Lost Revenues for Vintage Year 2020

RESIDENTIAL
Energy Efficiency Programs

Line		Reference	E-7 Sub 1192 Rider 11 Year 1 Estimate	E-7 Sub 1230 Year 2020 Yr 2 LR Estimate	E-7 Sub 1249 Rider 13 True up	E-7 Sub 1249 Year 2020 Yr 3 LR Estimate	E-7 Sub 1265 Rider 14 True up	E-7 Sub 1265 Year 2020 Yr 4 LR Estimate	E-7 Sub 1285 Rider 15 True up	Year 2020
1	Residential EE Program Cost	Fields Exhibit 1 pg. 5, Line 9 * NC Alloc. Factor	$ 33,551,578		$ 4,000,501		$ -		$ -	$ 37,552,079
2	Residential EE Earned Utility Incentive	Fields Exhibit 1 pg. 5, Line 9 * NC Alloc. Factor	3,173,534		1,218,929		90,910		(38,754)	4,444,619
3	Return on undercollection of Residential EE Program Costs	Listebarger Exhibit 3 pg 11			146,624		434,746		(256,724)	324,646
4	Total EE Program Cost and Incentive Components	Line 1 + Line 2 + Line 3	36,725,112		5,366,054		525,656		(295,478)	42,321,344
5	Residential DSM Program Cost	Fields Exhibit 1 pg. 5, Line 10 + Line 26 * NC Alloc. Factor	12,243,392		(2,355,317)		-		(0)	9,888,075
6	Residential DSM Earned Utility Incentive	Fields Exhibit 1 pg. 5, Line 10 + Line 26 * NC Alloc. Factor	3,189,876		7,301		14,471		(21)	3,211,627
7	Return on overcollection of Residential DSM Program Costs	Listebarger Exhibit 3 pg 12			(73,960)		(198,174)		(119,312)	(391,446)
8	Total DSM Program Cost and Incentive Components	Line 5 + Line 6 + Line 7	15,433,268		(2,421,975)		(183,703)		(119,333)	12,708,256
9	Total EE/DSM Program Cost and Incentive Components	Line 4 + Line 8	52,158,380		2,944,078		341,953		(414,812)	55,029,600
10	Revenue-related taxes and regulatory fees factor **	Listebarger Exhibit 2, pg. 8	1.001402		1.001352		1.001402		1.001402	
11	Total EE/DSM Program Cost and Incentive Revenue Requirement	Line 9 * Line 10	52,231,506		2,948,059		342,433		(415,393)	55,106,604
12	Residential Net Lost Revenues	Fields Exhibit 2 pg. 1-9	14,667,095	4,495,479	6,588,261	5,386,818	609,516	2,568,275	(362,420)	33,953,024
13	Total Residential EE/DSM Revenue Requirement	Line 11 + Line 12	66,898,601	4,495,479	9,536,320	5,386,818	951,949	2,568,275	(777,813)	89,059,629
14	Total Collected for Vintage Year 2020 (through estimated Rider 15)	Listebarger Exhibit 4, Line 3								90,166,622
15	**Total Residential EE/DSM Revenue Requirement**	Line13 - Line 14								$ (1,106,993)

See Listebarger Exhibit A for rate

NON-RESIDENTIAL
Energy Efficiency Programs

Line		Reference	E-7 Sub 1192 Rider 11 Year 1 Estimate	E-7 Sub 1230 Year 2020 Yr 2 LR Estimate	E-7 Sub 1249 Rider 13 True up	E-7 Sub 1249 Year 2020 Yr 3 LR Estimate	E-7 Sub 1265 Rider 14 True up	E-7 Sub 1265 Year 2020 Yr 4 LR Estimate	E-7 Sub 1285 Rider 15 True up	Year 2020
16	Non- Residential EE Program Cost	Fields Exhibit 1 pg. 5, Line 23 * NC Alloc. Factor	37,708,077		(15,681,234)		-		-	22,026,843
17	Non-Residential EE Earned Utility Incentive	Fields Exhibit 1 pg. 5, Line 23 * NC Alloc. Factor	10,010,194		(2,909,256)		98,425		(76,329)	7,123,034
18	Return on overcollection of Non-residential EE Program Costs	Listebarger Exhibit 3 page 13			(327,773)		(767,827)		(62,127)	(1,157,726)
19	Total EE Program Cost and Incentive Components	Line 16 + Line 17 + Line 18	47,718,271		(18,918,263)		(669,402)		(138,456)	27,992,151
20	Revenue-related taxes and regulatory fees factor	Listebarger Exhibit 2, pg. 8	1.001402		1.001352		1.001402		1.001402	
21	Total Non-Residential EE Program Cost and Incentive Revenue Requirements	Line 19 * Line 20	47,785,172		(18,943,841)		(670,341)		(138,650)	28,032,342
22	Non-Residential Net Lost Revenues	Fields Exhibit 2 pg. 1 - 9	5,183,193	9,376,721	(4,169,004)	6,802,676	1,081,898	3,845,961	(61,096)	22,060,349
23	Total Non-Residential EE Revenue Requirement	Line 21 + Line 22	52,968,365	9,376,721	(23,112,845)	6,802,676	411,558	3,845,961	(199,745)	50,092,691
24	Total Collected for Vintage Year 2020 (through estimated Rider 15)	Listebarger Exhibit 4 Line 10								51,221,578
25	Non-Residential EE Revenue Requirement	Line 23 - Line 24								(1,128,887)
26	Projected NC Residential Sales (kWh)	Listebarger Exhibit 6, Line 8								16,575,789,097
27	**NC Non-Residential EE billing factor (Cents/kWh)**	Line 25/Line 26*100								**(0.0068)**

DSM Programs

Line		Reference	E-7 Sub 1192 Rider 11 Year 1 Estimate		E-7 Sub 1249 Rider 13 True up		E-7 Sub 1265 Rider 14 True up		E-7 Sub 1285 Rider 15 True up	Year 2020
28	Non-Residential DSM Program Cost	Fields Exhibit 1 pg. 5, Line 10 + Line 26 * NC Alloc. Factor	15,789,462		(3,918,078)		-		(0)	11,871,383
29	Non-Residential DSM Earned Utility Incentive	Fields Exhibit 1 pg. 5, Line 10 + Line 26 * NC Alloc. Factor	4,113,764		(275,311)		17,373		(25)	3,855,801
30	Return on overcollection of Non-residential DSM Program Costs	Listebarger Exhibit 3 page 14	-		(53,705)		(4,377)		124,794	66,712
31	Total Non-Residential DSM Program Cost and Incentive Components	Line 28 + Line 29 + Line 30	19,903,226		(4,247,095)		12,996		124,769	15,793,896
32	Revenue-related taxes and regulatory fees factor	Listebarger Exhibit 2, pg. 10	1.001402		1.001352		1.001402		1.001402	
33	Total Non-Residential DSM Revenue Requirement	Line 31 * Line 32	19,931,130		(4,252,837)		13,014		124,944	15,816,251
34	Total Collected for Vintage Year 2020 (through estimated Rider 15)	Listebarger Exhibit 4 Line 14								15,783,965
35	Non-Residential EE Revenue Requirement True-up Amount	Line 33- Line 34								32,287
36	Projected NC Non-Residential Sales (kWh)	Listebarger Exhibit 6 Line 9								18,635,398,667
37	**NC Non-Residential DSM billing factor**	Line 35/Line 36*100								**0.0002**

** Actual regulatory fee rate in effect in year of collection. May differ from original filed estimates.

Duke Energy Carolinas, LLC
Docket Number E-7 Sub 1285
Estimated Year 4 Lost Revenue and True Up of Year 1 and 2 for Vintage Year 2021

RESIDENTIAL
Energy Efficiency Programs

Line		Reference	Year 2021 Yr 4 LR Estimate	E-7 Sub 1230 Rider 12 Year 1 Estimate	E-7 Sub 1249 Year 2021 Yr 2 LR Estimate	E-7 Sub 1265 Rider 14 True up	E-7 Sub 1265 Year 2021 Yr 3 LR Estimate	E-7 Sub 1285 Rider 15 True up	Year 2021
1	Residential EE Program Cost	Fields Exhibit 1 pg. 6, Line 9 * NC Alloc. Factor		$ 37,155,471		$ (10,923,999)		$ -	$ 26,231,472
2	Residential EE Earned Utility Incentive	Fields Exhibit 1 pg. 6, Line 9 * NC Alloc. Factor		2,774,995		(244,088)		(254,158)	2,276,749
3	Return on undercollection of Residential EE Program Costs	Listebarger Exhibit 3 pg 15				(427,186)		(998,375)	(1,425,561)
4	Total EE Program Cost and Incentive Components	Line 1 + Line 2 + Line 3		39,930,466		(11,595,273)		(1,252,534)	27,082,659
5	Residential DSM Program Cost	Fields Exhibit 1 pg. 6, Line 10 + Line 26 * NC Alloc. Factor		13,699,485		(2,210,071)		-	11,489,414
6	Residential DSM Earned Utility Incentive	Fields Exhibit 1 pg. 6, Line 10 + Line 26 * NC Alloc. Factor		3,521,313		(751,140)		-	2,770,173
7	Return on overcollection of Residential DSM Program Costs	Listebarger Exhibit 3 pg 16				(105,970)		(194,724)	(300,693)
8	Total DSM Program Cost and Incentive Components	Line 5 + Line 6 + Line 7		17,220,797		(3,067,180)		(194,724)	13,958,894
9	Total EE/DSM Program Cost and Incentive Components	Line 4 + Line 8		57,151,264		(14,662,453)		(1,447,257)	41,041,553
10	Revenue-related taxes and regulatory fees factor **	Listebarger Exhibit 2, pg. 8		1.001302		1.001402		1.001402	
11	Total EE/DSM Program Cost and Incentive Revenue Requirement	Line 9 * Line 10		57,225,674		(14,683,010)		(1,449,286)	41,093,378
12	Residential Net Lost Revenues	Fields Exhibit 2 pg. 1-9	$ 1,915,275	25,205,298	6,249,665	(8,091,427)	3,959,003	837,374	28,159,914
13	Total Residential EE/DSM Revenue Requirement	Line 11 + Line 12	1,915,275	82,430,973	6,249,665	(22,774,437)	3,959,003	(611,912)	69,253,292
14	Total Collected for Vintage Year 2021 (through estimated Rider 15)	Listebarger Exhibit 4, Line 4							70,020,796
15	**Total Residential EE/DSM Revenue Requirement**	Line13 - Line 14	$ 1,915,275						$ (767,503)

See Listebarger Exhibit A for rate

NON-RESIDENTIAL
Energy Efficiency Programs

Line		Reference	Year 2021 Yr 4 LR Estimate	E-7 Sub 1230 Rider 12 Year 1 Estimate	E-7 Sub 1249 Year 2021 Yr 2 LR Estimate	E-7 Sub 1265 Rider 14 True up	E-7 Sub 1265 Year 2021 Yr 3 LR Estimate	E-7 Sub 1285 Rider 15 True up	Year 2021
16	Non- Residential EE Program Cost	Fields Exhibit 1 pg. 6, Line 23 * NC Alloc. Factor		38,264,959		(8,510,352)		(2)	29,754,605
17	Non-Residential EE Earned Utility Incentive	Fields Exhibit 1 pg. 6, Line 23 * NC Alloc. Factor		8,888,527		(1,494,004)		(196,113)	7,198,410
18	Return on overcollection of Non-residential EE Program Costs	Listebarger Exhibit 3 page 17				(580,644)		(1,786,904)	(2,367,548)
19	Total EE Program Cost and Incentive Components	Line 16 + Line 17 + Line 18		47,153,486		(10,585,000)		(1,983,019)	34,585,467
20	Revenue-related taxes and regulatory fees factor	Listebarger Exhibit 2, pg. 8		1.001302		1.001402		1.001402	
21	Total Non-Residential EE Program Cost and Incentive Revenue Requirements	Line 19 * Line 20		47,214,880		(10,599,840)		(1,985,799)	34,629,241
22	Non-Residential Net Lost Revenues	Fields Exhibit 2 pg. 1-9	5,211,948	6,360,715	13,494,665	(4,819,745)	10,003,040	414,021	25,452,696
23	Total Non-Residential EE Revenue Requirement	Line 21 + Line 22	5,211,948	53,575,595	13,494,665	(15,419,585)	10,003,040	(1,571,778)	60,081,937
24	Total Collected for Vintage Year 2021 (through estimated Rider 15)	Listebarger Exhibit 4 Line 11							61,445,924
25	Non-Residential EE Revenue Requirement	Line 23 - Line 24	5,211,948						(1,363,988)
26	Projected NC Residential Sales (kWh)	Listebarger Exhibit 6, Line 10	16,652,048,700						16,652,048,700
27	**NC Non-Residential EE billing factor (Cents/kWh)**	Line 25/Line 26*100	**0.0313**						**(0.0082)**

DSM Programs

Line		Reference	E-7 Sub 1230 Rider 12 Year 1 Estimate		E-7 Sub 1265 Rider 14 True up		E-7 Sub 1285 Rider 15 True up	Year 2021
28	Non-Residential DSM Program Cost	Fields Exhibit 1 pg. 6, Line 10 + Line 26 * NC Alloc. Factor	16,110,767		(3,154,656)		-	12,956,111
29	Non-Residential DSM Earned Utility Incentive	Fields Exhibit 1 pg. 6, Line 10 + Line 26 * NC Alloc. Factor	4,141,109		(1,017,305)		-	3,123,804
30	Return on overcollection of Non-residential DSM Program Costs	Listebarger Exhibit 3 page 18	-		(77,609)		(488,760)	(566,369)
31	Total Non-Residential DSM Program Cost and Incentive Components	Line 28 + Line 29 + Line 30	20,251,876		(4,249,570)		(488,760)	15,513,545
32	Revenue-related taxes and regulatory fees factor	Listebarger Exhibit 2, pg. 8	1.001302		1.001402		1.001402	
33	Total Non-Residential DSM Revenue Requirement	Line 31 * Line 32	20,278,244		(4,255,528)		(489,446)	15,533,270
34	Total Collected for Vintage Year 2021 (through estimated Rider 15)	Listebarger Exhibit 4 Line 17						16,900,308
35	Non-Residential EE Revenue Requirement True-up Amount	Line 33- Line 34						(1,367,038)
36	Projected NC Non-Residential Sales (kWh)	Listebarger Exhibit 6 Line 11						18,677,101,757
37	**NC Non-Residential DSM billing factor**	Line 35/Line 36*100						**(0.0073)**

** Actual regulatory fee rate in effect in year of collection. May differ from original filed estimates.

/A

Duke Energy Carolinas, LLC
Docket Number E-7 Sub 1285
Estimated Year 3 Lost Revenue and True Up of Year 1 for Vintage Year 2022

RESIDENTIAL
Energy Efficiency Programs

Line		Reference	Year 2022 Yr 3 LR Estimate	E-7 Sub 1249 Rider 13 Year 1 Estimate	E-7 Sub 1265 Year 2022 Yr 2 LR Estimate	E-7 Sub 1285 Rider 15 True up	Year 2022
1	Residential EE Program Cost	Fields Exhibit 1 pg. 7, Line 10 * NC Alloc. Factor		$ 39,429,805		$ (7,839,025)	$ 31,590,780
2	Residential EE Earned Utility Incentive	Fields Exhibit 1 pg. 7, Line 10 * NC Alloc. Factor		3,287,459		755,071	4,042,529
3	Return on undercollection of Residential EE Program Costs	Listebarger Exhibit 3 pg 19				(258,641)	(258,641)
4	Total EE Program Cost and Incentive Components	Line 1 + Line 2 + Line 3		42,717,264		(7,342,595)	35,374,668
5	Residential DSM Program Cost	Fields Exhibit 1 pg. 7, Line 11 * NC Alloc. Factor		12,587,919		416,918	13,004,838
6	Residential DSM Earned Utility Incentive	Fields Exhibit 1 pg. 7, Line 11 * NC Alloc. Factor		2,954,061		485,715	3,439,776
7	Return on overcollection of Residential DSM Program Costs	Listebarger Exhibit 3 pg 20				(14,865)	(14,865)
8	Total DSM Program Cost and Incentive Components	Line 5 + Line 6 + Line 7		15,541,981		887,768	16,429,749
9	Total EE/DSM Program Cost and Incentive Components	Line 4 + Line 8		58,259,244		(6,454,828)	51,804,417
10	Revenue-related taxes and regulatory fees factor **	Listebarger Exhibit 2, pg. 8		1.001352		1.001402	
11	Total EE/DSM Program Cost and Incentive Revenue Requirement	Line 9 * Line 10		58,338,011		(6,463,877)	51,874,134
12	Residential Net Lost Revenues	Fields Exhibit 2 pg. 1-9	$ 4,813,237	21,026,409	6,791,458	(401,930)	27,415,937
13	Total Residential EE/DSM Revenue Requirement	Line 11 + Line 12	4,813,237	79,364,420	6,791,458	(6,865,807)	79,290,071
14	Total Collected for Vintage Year 2022 (through estimated Rider 15)	Listebarger Exhibit 4, Line 5					88,216,873
15	**Total Residential EE/DSM Revenue Requirement**	Line13 - Line 14	$ 4,813,237				$ (8,926,802)

See Listebarger Exhibit A for rate

NON-RESIDENTIAL
Energy Efficiency Programs

Line		Reference	Year 2022 Yr 3 LR Estimate	E-7 Sub 1249 Rider 13 Year 1 Estimate	E-7 Sub 1265 Year 2022 Yr 2 LR Estimate	E-7 Sub 1285 Rider 15 True up	Year 2022
16	Non- Residential EE Program Cost	Fields Exhibit 1 pg. 7, Line 24 * NC Alloc. Factor		49,276,542		(19,636,520)	29,640,022
17	Non-Residential EE Earned Utility Incentive	Fields Exhibit 1 pg. 7, Line 24 * NC Alloc. Factor		10,564,159		(4,395,686)	6,168,473
18	Return on overcollection of Non-residential EE Program Costs	Listebarger Exhibit 3 page 21				(730,073)	(730,073)
19	Total EE Program Cost and Incentive Components	Line 16 + Line 17 + Line 18		59,840,701		(24,762,278)	35,078,422
20	Revenue-related taxes and regulatory fees factor	Listebarger Exhibit 2, pg. 8		1.001352		1.001402	
21	Total Non-Residential EE Program Cost and Incentive Revenue Requirements	Line 19 * Line 20		59,921,605		(24,796,995)	35,124,610
22	Non-Residential Net Lost Revenues	Fields Exhibit 2 pg. 1-9	7,844,523	8,181,228	15,132,477	(9,193,461)	14,120,244
23	Total Non-Residential EE Revenue Requirement	Line 21 + Line 22	7,844,523	68,102,833	15,132,477	(33,990,456)	49,244,854
24	Total Collected for Vintage Year 2022 (through estimated Rider 15)	Listebarger Exhibit 4 Line 12					78,251,255
25	Non-Residential EE Revenue Requirement	Line 23 - Line 24	7,844,523				(29,006,401)
26	Projected NC Residential Sales (kWh)	Listebarger Exhibit 6, Line 12	16,744,193,880				16,744,193,880
27	**NC Non-Residential EE billing factor (Cents/kWh)**	Line 25/Line 26*100	**0.0468**				**(0.1732)**

DSM Programs

Line		Reference	E-7 Sub 1249 Rider 13 Year 1 Estimate		E-7 Sub 1285 Rider 15 True up	Year 2022
28	Non-Residential DSM Program Cost	Fields Exhibit 1 pg. 7, Line 26 * NC Alloc. Factor	15,112,751		(404,946)	14,707,805
29	Non-Residential DSM Earned Utility Incentive	Fields Exhibit 1 pg. 7, Line 26 * NC Alloc. Factor	3,546,574		(823,575)	2,723,000
30	Return on overcollection of Non-residential DSM Program Costs	Listebarger Exhibit 3 page 22	-		7,085	7,085
31	Total Non-Residential DSM Program Cost and Incentive Components	Line 28 + Line 29 + Line 30	18,659,325		(1,221,436)	17,437,889
32	Revenue-related taxes and regulatory fees factor	Listebarger Exhibit 2, pg. 8	1.001352		1.001402	
33	Total Non-Residential DSM Revenue Requirement	Line 31 * Line 32	18,684,553		(1,223,149)	17,461,404
34	Total Collected for Vintage Year 2022 (through estimated Rider 15)	Listebarger Exhibit 4 Line 18				17,790,773
35	Non-Residential EE Revenue Requirement True-up Amount	Line 33- Line 34				(329,369)
36	Projected NC Non-Residential Sales (kWh)	Listebarger Exhibit 6 Line 13				18,855,570,769
37	**NC Non-Residential DSM billing factor**	Line 35/Line 36*100				**(0.0017)**

** Actual regulatory fee rate in effect in year of collection. May differ from original filed estimates.

Duke Energy Carolinas, LLC
Docket Number E-7 Sub 1285
Estimated Year 2 Lost Revenues for Vintage Year 2023

RESIDENTIAL

Line		Reference	2023
1	Residential Net Lost Revenues	Fields Exhibit 2 pg 1 - 9	6,787,155
2	Projected NC Residential Sales (kWh)	Listebarger Exhibit 6, Line 1	$ 23,664,202,369
3	**NC Residential EE Billing Factor (Cents/kWh)**	Line 1/Line 2*100	**0.0287**

NON-RESIDENTIAL
Energy Efficiency Programs

		Reference	2023
4	Non-Residential Net Lost Revenues	Fields Exhibit 2 pg 1 - 9	14,155,374
5	Projected NC Non-Residential Sales (kWh)	Listebarger Exhibit 6, Line 14	17,655,241,326
6	**NC Non-Residential EE billing factor (Cents/kWh)**	Line 4/Line 5*100	**0.0802**

Duke Energy Carolinas, LLC
Docket Number E-7 Sub 1285
Estimated Program Costs, Earned Incentive and Lost Revenues for Vintage Year 2024

RESIDENTIAL

Line		Reference	2024
1	Residential EE Program Cost	Fields Exhibit 1, pg. 8, Line 10 * NC Alloc. Factor	$ 38,670,751
2	Residential EE Earned Utility Incentive	Fields Exhibit 1, pg. 8, Line 10	4,624,245
3	Total EE Program Cost and Incentive Components	Line 1 + Line 2	43,294,996
4	Residential DSM Program Cost	Fields Exhibit 1 pg. 8, Line 11 * NC Alloc. Factor	18,148,614
5	Residential DSM Earned Utility Incentive	Fields Exhibit 1 pg. 8, Line 11	3,679,035
6	Total DSM Program Cost and Incentive Components	Line 4 + Line 5	21,827,649
7	Total EE/DSM Program Cost and Incentive Components	Line 3 + Line 6	65,122,646
8	Revenue-related taxes and regulatory fees factor	Listebarger Exhibit 2, pg. 8	1.001402
9	Total EE/DSM Program Cost and Incentive Revenue Requirement	Line 7 * Line 8	65,213,948
10	Residential Net Lost Revenues	Fields Exhibit 2 pg 1 - 9	23,509,586
11	**Total Residential EE Revenue Requirement**	**Line 9 + Line 10**	**$ 88,723,534**

See Listebarger Exhibit 1 for rate

NON-RESIDENTIAL
Energy Efficiency Programs

Line		Reference	2024
12	Non- Residential EE Program Cost	Fields Exhibit 1, pg. 8, Line 24 * NC Alloc. Factor	$ 47,830,402
13	Non-Residential EE Earned Utility Incentive	Fields Exhibit 1, pg. 8, Line 24	11,638,110
14	Total EE Program Cost and Incentive Components	Line 12 + Line 13	59,468,511
15	Revenue-related taxes and regulatory fees factor	Listebarger Exhibit 2, pg. 8	1.001402
16	Total Non-Residential EE Program Cost and Incentive Revenue Requirements	Line 14 * Line 15	59,551,886
17	Non-Residential Net Lost Revenues	Fields Exhibit 2 pg 1 - 9	8,761,484
18	Total Non-Residential EE Revenue Requirement	Line 16 + Line 17	$ 68,313,371
19	Projected NC Residential Sales (kWh)	Listebarger Exhibit 6, Line 16	17,655,241,326
20	**NC Non-Residential EE billing factor (Cents/kWh)**	Line 18/Line 19*100	**0.3869**

DSM Programs

Line		Reference	2024
21	Non-Residential DSM Program Cost	Fields Exhibit 1 pg. 8, Line 26 * NC Alloc. Factor	$ 14,564,801
22	Non-Residential DSM Earned Utility Incentive	Fields Exhibit 1 pg. 8, Line 26	2,498,051
23	Total Non-Residential DSM Program Cost and Incentive Components	Line 21 + Line 22	17,062,852
24	Revenue-related taxes and regulatory fees factor	Listebarger Exhibit 2, pg. 8	1.001402
25	Total Non-Residential DSM Revenue Requirement	Line 23 * Line 24	17,086,774
26	Projected NC Non-Residential Sales (kWh)	Listebarger Exhibit 6, Line 17	19,059,148,493
27	**NC Non-Residential DSM billing factor**	Line 25/Line 26*100	**0.0897**

Duke Energy Carolinas, LLC
Docket Number E-7 Sub 1285
Gross Receipts Tax Years 2018 through estimated 2024

	Year		Actual GRT Rate In Effect
Rider 9	2018		1.001402
Rider 10	2019		1.001402
	2020	Jan - June	1.001402
	2020	July - Dec	1.001302
Rider 11	2020	Weighted Average	1.001352
Rider 12	2021		1.001302
Rider 13	2022		1.001352 [1]
Rider 14	2023		1.001402
Rider 15	2024		1.001402

Note: Per Order in Docket No. M-100 Sub 142, the regulatory fee percentage was increased effective July 1,2022. This new rate is used as the estimate for 2023. This will be subject to true-up based on actual rates in effect.

[1] 6 months on old rate/6 months on new rate

/A

Miller Exhibit 3, page 1

Duke Energy Carolinas, LLC
Docket Number E-7 Sub 1285
Estimated Return Calculation - Residential EE Programs Vintage 2016

NC Residential EE		Residential EE Program Costs Incurred	NC Allocation %	NC Allocated EE Program Costs	Program Incentives	Lost Revenues	Total Costs	NC Residential Revenue Collected	NC Residential EE Program Collection %	EE Program Costs Revenue Collected	(Over)/Under Collection
			Docket No. E-7, Sub 1192, Miller Exh 5 pg 2						100% used due to overcollection		
Beginning Balance		54,751,215		40,021,101	6,702,353	28,828,063	75,551,516	76,089,404			(47,227)
2022	January		73.0962827%	-	(100)		(100)		100.0000%	-	(100)
2022	February		73.0962827%	-	(100)		(100)		100.0000%	-	(100)
2022	March		73.0962827%	-	(100)		(100)		100.0000%	-	(100)
2022	April		73.0962827%	-	(100)		(100)		100.0000%	-	(100)
2022	May		73.0962827%	-	(100)		(100)		100.0000%	-	(100)
2022	June		73.0962827%	-	(100)		(100)		100.0000%	-	(100)
2022	July		73.0962827%	-	(100)		(100)		100.0000%	-	(100)
2022	August		73.0962827%	-	(100)		(100)		100.0000%	-	(100)
2022	September		73.0962827%	-	(100)		(100)		100.0000%	-	(100)
2022	October		73.0962827%	-	(100)		(100)		100.0000%	-	(100)
2022	November		73.0962827%	-	(100)		(100)		100.0000%	-	(100)
2022	December		73.0962827%	-	(100)		(100)		100.0000%	-	(100)
		54,751,215		40,021,101	6,701,149	28,828,063	75,550,312	76,089,404		-	(48,431)

Vintage is overcollected. Interest is calculated on all components.

100% of all revenues offset the overcollected balance.

NC Residential EE		Cumulative (Over)/Under Recovery	Current Income Tax Rate	Monthly Deferred Income Tax	Cumulative Deferred Income Tax	Net Deferred After Tax Balance	Monthly Return	Monthly A/T Return on Deferral	YTD After Tax Interest	Gross up of Return to Pretax Rate	Gross up of Return to Pretax
			1/2022 - 12/2022				6.56%			0.766497	
Beginning Balance		(47,227)			(11,028)	(36,200)					
2022	January	(47,328)	0.233503	(23)	(11,051)	(36,277)	0.005469	(198)	(198)	0.766497	(259)
2022	February	(47,428)	0.233503	(23)	(11,075)	(36,353)	0.005469	(199)	(397)	0.766497	(518)
2022	March	(47,528)	0.233503	(23)	(11,098)	(36,430)	0.005469	(199)	(596)	0.766497	(777)
2022	April	(47,629)	0.233503	(23)	(11,121)	(36,507)	0.005469	(199)	(795)	0.766497	(1,038)
2022	May	(47,729)	0.233503	(23)	(11,145)	(36,584)	0.005469	(200)	(995)	0.766497	(1,298)
2022	June	(47,829)	0.233503	(23)	(11,168)	(36,661)	0.005469	(200)	(1,195)	0.766497	(1,560)
2022	July	(47,930)	0.233503	(23)	(11,192)	(36,738)	0.005469	(201)	(1,396)	0.766497	(1,822)
2022	August	(48,030)	0.233503	(23)	(11,215)	(36,815)	0.005469	(201)	(1,597)	0.766497	(2,084)
2022	September	(48,130)	0.233503	(23)	(11,239)	(36,892)	0.005469	(202)	(1,799)	0.766497	(2,347)
2022	October	(48,231)	0.233503	(23)	(11,262)	(36,969)	0.005469	(202)	(2,001)	0.766497	(2,610)
2022	November	(48,331)	0.233503	(23)	(11,285)	(37,046)	0.005469	(202)	(2,203)	0.766497	(2,874)
2022	December	(48,431)	0.233503	(23)	(11,309)	(37,122)	0.005469	(203)	(2,406)	0.766497	(3,139)
	Checks			(281)	(281)	(11,309)		(2,406)			(3,139)

Duke Energy Carolinas, LLC
Docket Number E-7 Sub 1285
Estimated Return Calculation - Residential EE Programs Vintage 2017

NC Residential EE		Residential EE Program Costs Incurred	NC Allocation %	NC Allocated EE Program Costs	Program Incentives	Lost Revenues	Total Costs	NC Residential Revenue Collected	NC Residential EE Program Collection %	EE Program Costs Revenue Collected	(Over)/Under Collection
			Docket No. E-7, Sub 1249, Listebarger Exh 5 pg 1						100% used due to overcollection		
Beginning Balance		65,222,734		47,487,858	8,319,498	32,241,553	88,048,909	92,061,985			(4,013,074)
2022	January		72.8087506%	-	(2,050)		(2,050)		100.0000%	-	(2,050)
2022	February		72.8087506%	-	(2,050)		(2,050)		100.0000%	-	(2,050)
2022	March		72.8087506%	-	(2,050)		(2,050)		100.0000%	-	(2,050)
2022	April		72.8087506%	-	(2,050)		(2,050)		100.0000%	-	(2,050)
2022	May		72.8087506%	-	(2,050)		(2,050)		100.0000%	-	(2,050)
2022	June		72.8087506%	-	(2,050)		(2,050)		100.0000%	-	(2,050)
2022	July		72.8087506%	-	(2,050)		(2,050)		100.0000%	-	(2,050)
2022	August		72.8087506%	-	(2,050)		(2,050)		100.0000%	-	(2,050)
2022	September		72.8087506%	-	(2,050)		(2,050)		100.0000%	-	(2,050)
2022	October		72.8087506%	-	(2,050)		(2,050)		100.0000%	-	(2,050)
2022	November		72.8087506%	-	(2,050)		(2,050)		100.0000%	-	(2,050)
2022	December		72.8087506%	-	(2,050)		(2,050)		100.0000%	-	(2,050)
		65,222,734		47,487,858	8,294,902	32,241,553	88,024,313	92,061,985		-	(4,037,670)

Vintage is overcollected. Interest is calculated on all components.

100% of all revenues offset the overcollected balance.

NC Residential EE		Cumulative (Over)/Under Recovery	Current Income Tax Rate	Monthly Deferred Income Tax	Cumulative Deferred Income Tax	Net Deferred After Tax Balance	Monthly Return	Monthly A/T Return on Deferral	YTD After Tax Interest	Gross up of Return to Pretax Rate	Gross up of Return to Pretax
			1/2022 - 12/2022				6.56%			0.766497	
Beginning Balance		(4,013,074)			(937,065)	(3,076,010)					
2022	January	(4,015,124)	0.233503	(479)	(937,544)	(3,077,581)	0.005469	(16,828)	(16,828)	0.766497	(21,954)
2022	February	(4,017,174)	0.233503	(479)	(938,022)	(3,079,152)	0.005469	(16,836)	(33,664)	0.766497	(43,919)
2022	March	(4,019,223)	0.233503	(479)	(938,501)	(3,080,723)	0.005469	(16,845)	(50,508)	0.766497	(65,895)
2022	April	(4,021,273)	0.233503	(479)	(938,979)	(3,082,294)	0.005469	(16,853)	(67,362)	0.766497	(87,883)
2022	May	(4,023,323)	0.233503	(479)	(939,458)	(3,083,865)	0.005469	(16,862)	(84,224)	0.766497	(109,881)
2022	June	(4,025,372)	0.233503	(479)	(939,936)	(3,085,436)	0.005469	(16,871)	(101,094)	0.766497	(131,891)
2022	July	(4,027,422)	0.233503	(479)	(940,415)	(3,087,007)	0.005469	(16,879)	(117,973)	0.766497	(153,912)
2022	August	(4,029,472)	0.233503	(479)	(940,894)	(3,088,578)	0.005469	(16,888)	(134,861)	0.766497	(175,944)
2022	September	(4,031,521)	0.233503	(479)	(941,372)	(3,090,149)	0.005469	(16,896)	(151,757)	0.766497	(197,988)
2022	October	(4,033,571)	0.233503	(479)	(941,851)	(3,091,720)	0.005469	(16,905)	(168,662)	0.766497	(220,043)
2022	November	(4,035,620)	0.233503	(479)	(942,329)	(3,093,291)	0.005469	(16,913)	(185,576)	0.766497	(242,109)
2022	December	(4,037,670)	0.233503	(479)	(942,808)	(3,094,862)	0.005469	(16,922)	(202,498)	0.766497	(264,186)
	Checks			(5,743)	(5,743)	(942,808)		(202,498)			(264,186)

Duke Energy Carolinas, LLC
Docket Number E-7 Sub 1285
Estimated Return Calculation - Residential EE Programs Vintage 2018

NC Residential EE		Residential EE Program Costs Incurred	NC Allocation %	NC Allocated EE Program Costs	Program Incentives	Lost Revenues	Total Costs	NC Residential Revenue Collected[2]	NC Residential EE Program Collection %	EE Program Costs Revenue Collected	(Over)/Under Collection
			Listebarger Exhibit 5 pg. 1, Line 4						100% used due to overcollection		
Beginning Balance[1]		77,331,818		56,230,324	9,941,319	40,274,557	106,446,200	106,331,949		(56,790)	(111,787)
2022	January		72.7130507%	-	4,579	(16,175)	(11,596)	103,167	100.0000%	(103,167)	(114,763)
2022	February		72.7130507%	-	4,579	(16,175)	(11,596)	309,908	100.0000%	(309,908)	(321,504)
2022	March		72.7130507%	-	4,579	(16,175)	(11,596)	239,380	100.0000%	(239,380)	(250,976)
2022	April		72.7130507%	-	4,579	(16,175)	(11,596)	193,530	100.0000%	(193,530)	(205,126)
2022	May		72.7130507%	-	4,579	(16,175)	(11,596)	193,444	100.0000%	(193,444)	(205,039)
2022	June		72.7130507%	-	4,579	(16,175)	(11,596)	257,199	100.0000%	(257,199)	(268,794)
2022	July		72.7130507%	-	4,579	(16,175)	(11,596)	296,495	100.0000%	(296,495)	(308,090)
2022	August		72.7130507%	-	4,579	(16,175)	(11,596)	322,951	100.0000%	(322,951)	(334,546)
2022	September		72.7130507%	-	4,579	(16,175)	(11,596)	267,462	100.0000%	(267,462)	(279,058)
2022	October		72.7130507%	-	4,579	(16,175)	(11,596)	185,083	100.0000%	(185,083)	(196,679)
2022	November		72.7130507%	-	4,579	(16,175)	(11,596)	181,304	100.0000%	(181,304)	(192,899)
2022	December		72.7130507%	-	4,579	(16,175)	(11,596)	461,672	100.0000%	(461,672)	(473,268)
		77,331,818		56,230,324	9,996,266	40,080,462	106,307,052	109,343,543		(3,068,385)	(3,262,530)

Vintage is overcollected. Interest is calculated on all components.

100% of all revenues offset the overcollected balance.

NC Residential EE		Cumulative (Over)/Under Recovery	Current Income Tax Rate	Monthly Deferred Income Tax	Cumulative Deferred Income Tax	Net Deferred After Tax Balance	Monthly Return	Monthly A/T Return on Deferral	YTD After Tax Interest	Gross up of Return to Pretax Rate	Gross up of Return to Pretax
			1/2022 - 12/2022				6.56%			0.766497	
Beginning Balance		(111,787)			(26,103)	(85,685)					
2022	January	(226,550)	0.233503	(26,798)	(52,900)	(173,650)	0.005469	(709)	(709)	0.766497	(925)
2022	February	(548,054)	0.233503	(75,072)	(127,972)	(420,082)	0.005469	(1,624)	(2,333)	0.766497	(3,043)
2022	March	(799,030)	0.233503	(58,604)	(186,576)	(612,454)	0.005469	(2,824)	(5,156)	0.766497	(6,727)
2022	April	(1,004,156)	0.233503	(47,897)	(234,473)	(769,682)	0.005469	(3,780)	(8,936)	0.766497	(11,658)
2022	May	(1,209,195)	0.233503	(47,877)	(282,351)	(926,844)	0.005469	(4,639)	(13,575)	0.766497	(17,711)
2022	June	(1,477,989)	0.233503	(62,764)	(345,115)	(1,132,874)	0.005469	(5,632)	(19,208)	0.766497	(25,059)
2022	July	(1,786,080)	0.233503	(71,940)	(417,055)	(1,369,025)	0.005469	(6,842)	(26,049)	0.766497	(33,985)
2022	August	(2,120,626)	0.233503	(78,118)	(495,173)	(1,625,454)	0.005469	(8,189)	(34,238)	0.766497	(44,668)
2022	September	(2,399,684)	0.233503	(65,161)	(560,333)	(1,839,351)	0.005469	(9,475)	(43,713)	0.766497	(57,029)
2022	October	(2,596,363)	0.233503	(45,925)	(606,258)	(1,990,104)	0.005469	(10,472)	(54,185)	0.766497	(70,692)
2022	November	(2,789,262)	0.233503	(45,043)	(651,301)	(2,137,961)	0.005469	(11,289)	(65,473)	0.766497	(85,419)
2022	December	(3,262,530)	0.233503	(110,509)	(761,810)	(2,500,719)	0.005469	(12,685)	(78,158)	0.766497	(101,968)
	Checks			(735,708)	(735,708)	(761,810)		(78,158)			(101,968)

Adjustment to interest calculation to account for corrections as noted in Docket No. E-7, Sub 1265 Listebarger Supplemental Testimony and Exhibits filed 5/16/2022. (2,707)

Final Gross up of Return to Pretax for Vintage 2018 **(104,676)**

Note 1: Beginning Balances tie to Docket No. E-7, Sub 1265 Listebarger Supplemental Testimony and Exhibits filed 5/16/2022.
Note 2: Beginning Balance for NC Residential Revenue Collected has been adjusted to correct understatement of revenues from prior rider filing.

Duke Energy Carolinas, LLC
Docket Number E-7 Sub 1285
Estimated Return Calculation - Residential DSM Programs Vintage 2018

NC Residential DSM		Residential DSM Program Costs Incurred	NC Allocation %	NC Allocated DSM Program Costs	NC Residential Revenue Collected[2]	NC Residential DSM Program Collection %	DSM Program Costs Revenue Collected	(Over)/Under Collection
			Listebarger Exhibit 5 pg. 1, Line 4			see calc. at right		
Beginning Balance[1]		30,409,405		9,778,896	11,667,551		(9,777,529)	1,366
2022	January		32.1574721%	-	(770)	-6.5213%	(50)	(50)
2022	February		32.1574721%	-	(2,313)	-6.5213%	(151)	(151)
2022	March		32.1574721%	-	(1,786)	-6.5213%	(116)	(116)
2022	April		32.1574721%	-	(1,444)	-6.5213%	(94)	(94)
2022	May		32.1574721%	-	(1,444)	-6.5213%	(94)	(94)
2022	June		32.1574721%	-	(1,919)	-6.5213%	(125)	(125)
2022	July		32.1574721%	-	(2,213)	-6.5213%	(144)	(144)
2022	August		32.1574721%	-	(2,410)	-6.5213%	(157)	(157)
2022	September		32.1574721%	-	(1,996)	-6.5213%	(130)	(130)
2022	October		32.1574721%	-	(1,381)	-6.5213%	(90)	(90)
2022	November		32.1574721%	-	(1,353)	-6.5213%	(88)	(88)
2022	December		32.1574721%	-	(3,445)	-6.5213%	(225)	(225)
		30,409,405		9,778,896	11,645,077		(9,778,995)	(100)

Program Costs to be Recovered in Rider 13	1,366
Revenues to be Collected in Rider 13	(20,945)
% Revenue related to Program Costs	-6.5213%

NC Residential DSM		Cumulative (Over)/Under Recovery	Current Income Tax Rate	Monthly Deferred Income Tax	Cumulative Deferred Income Tax	Net Deferred After Tax Balance	Monthly Return	Monthly A/T Return on Deferral	YTD After Tax Interest	Gross up of Return to Pretax Rate	Gross up of Return to Pretax
			1/2022 - 12/2022				6.56%			0.766497	
Beginning Balance		1,366			319	1,047					
2022	January	1,316	0.233503	(12)	307	1,008	0.005469	6	6	0.766497	7
2022	February	1,165	0.233503	(35)	272	893	0.005469	5	11	0.766497	14
2022	March	1,048	0.233503	(27)	245	804	0.005469	5	15	0.766497	20
2022	April	954	0.233503	(22)	223	731	0.005469	4	20	0.766497	26
2022	May	860	0.233503	(22)	201	659	0.005469	4	23	0.766497	31
2022	June	735	0.233503	(29)	172	563	0.005469	3	27	0.766497	35
2022	July	591	0.233503	(34)	138	453	0.005469	3	30	0.766497	39
2022	August	433	0.233503	(37)	101	332	0.005469	2	32	0.766497	41
2022	September	303	0.233503	(30)	71	232	0.005469	2	33	0.766497	43
2022	October	213	0.233503	(21)	50	163	0.005469	1	34	0.766497	45
2022	November	125	0.233503	(21)	29	96	0.005469	1	35	0.766497	46
2022	December	(100)	0.233503	(52)	(23)	(76)	0.005469	0	35	0.766497	46
	Checks			(342)	(342)	(23)		35			46

Adjustment to interest calculation to account for corrections as noted in Docket No. E-7, Sub 1265 Listebarger Supplemental Testimony and Exhibits filed 5/16/2022	(18,041)
Final Gross up of Return to Pretax for Vintage 2018	**(17,995)**

Note 1: Beginning Balances tie to Docket No. E-7, Sub 1265 Listebarger Supplemental Testimony and Exhibits filed 5/16/2022
Note 2: Beginning Balance for NC Residential Revenue Collected has been adjusted to correct understatement of revenues from prior rider filing

/A

Duke Energy Carolinas, LLC
Docket Number E-7 Sub 1285
Estimated Return Calculation - Non-Residential EE Programs Vintage 2018

NC Non- Residential EE	Non-Residential EE Program Costs Incurred	NC Allocation %	NC Allocated EE Program Costs	Program Incentives	Lost Revenues	Total Costs	NC Residential Revenue Collected[2]	NC Non-Residential EE Program Collection %	Non-Residential EE Program Costs Revenue Collected	(Over)/Under Collection
		Listebarger Exhibit 5 pg 1, Line 4						100% used due to overcollection		
Beginning Balance[1]	51,264,448		37,275,944	14,405,269	25,378,082	77,059,295	78,444,148		18,901,785	(302,294)
2022 January		72.7130507%	-	6,005		6,005	33,327	100.0000000%	(33,327)	(27,322)
2022 February		72.7130507%	-	6,005		6,005	39,340	100.0000000%	(39,340)	(33,335)
2022 March		72.7130507%	-	6,005		6,005	36,379	100.0000000%	(36,379)	(30,374)
2022 April		72.7130507%	-	6,005		6,005	35,351	100.0000000%	(35,351)	(29,346)
2022 May		72.7130507%	-	6,005		6,005	37,093	100.0000000%	(37,093)	(31,088)
2022 June		72.7130507%	-	6,005		6,005	44,084	100.0000000%	(44,084)	(38,079)
2022 July		72.7130507%	-	6,005		6,005	46,292	100.0000000%	(46,292)	(40,287)
2022 August		72.7130507%	-	6,005		6,005	50,617	100.0000000%	(50,617)	(44,611)
2022 September		72.7130507%	-	6,005		6,005	46,462	100.0000000%	(46,462)	(40,457)
2022 October		72.7130507%	-	6,005		6,005	37,306	100.0000000%	(37,306)	(31,301)
2022 November		72.7130507%	-	6,005		6,005	34,238	100.0000000%	(34,238)	(28,233)
2022 December		72.7130507%	-	6,005		6,005	44,533	100.0000000%	(44,533)	(38,528)
	51,264,448		37,275,944	14,477,330	25,378,082	77,131,356	78,929,171		18,416,763	(715,255)

Vintage is overcollected. Interest is calculated on all components.

100% of all revenues offset the overcollected balance.

NC Non-Residential EE	Cumulative (Over)/Under Recovery	Current Income Tax Rate	Monthly Deferred Income Tax	Cumulative Deferred Income Tax	Net Deferred After Tax Balance	Monthly Return	Monthly A/T Return on Deferral	YTD After Tax Interest	Gross up of Return to Pretax Rate	Gross up of Return to Pretax
		1/2022 - 12/2022				6.56%			0.766497	
Beginning Balance	(302,294)			(70,587)	(231,707)					
2022 January	(329,616)	0.233503	(6,380)	(76,966)	(252,649)	0.005469	(1,325)	(1,325)	0.766497	(1,728)
2022 February	(362,951)	0.233503	(7,784)	(84,750)	(278,201)	0.005469	(1,452)	(2,776)	0.766497	(3,622)
2022 March	(393,325)	0.233503	(7,092)	(91,842)	(301,482)	0.005469	(1,585)	(4,361)	0.766497	(5,690)
2022 April	(422,671)	0.233503	(6,852)	(98,695)	(323,976)	0.005469	(1,710)	(6,072)	0.766497	(7,921)
2022 May	(453,759)	0.233503	(7,259)	(105,954)	(347,805)	0.005469	(1,837)	(7,909)	0.766497	(10,318)
2022 June	(491,838)	0.233503	(8,892)	(114,846)	(376,992)	0.005469	(1,982)	(9,891)	0.766497	(12,904)
2022 July	(532,125)	0.233503	(9,407)	(124,253)	(407,872)	0.005469	(2,146)	(12,037)	0.766497	(15,704)
2022 August	(576,736)	0.233503	(10,417)	(134,670)	(442,066)	0.005469	(2,324)	(14,361)	0.766497	(18,736)
2022 September	(617,193)	0.233503	(9,447)	(144,116)	(473,077)	0.005469	(2,503)	(16,864)	0.766497	(22,001)
2022 October	(648,494)	0.233503	(7,309)	(151,425)	(497,069)	0.005469	(2,653)	(19,517)	0.766497	(25,462)
2022 November	(676,727)	0.233503	(6,592)	(158,018)	(518,709)	0.005469	(2,778)	(22,295)	0.766497	(29,086)
2022 December	(715,255)	0.233503	(8,996)	(167,014)	(548,241)	0.005469	(2,918)	(25,212)	0.766497	(32,893)
Checks			(96,428)	(96,428)	(167,014)		(25,212)			(32,893)

Adjustment to interest calculation to account for corrections as noted in Docket No. E-7, Sub 1265 Listebarger Supplemental Testimony and Exhibits filed 5/16/2022. (22,050)

Final Gross up of Return to Pretax for Vintage 2018 (54,943)

Note 1: Beginning Balances tie to Docket No. E-7, Sub 1265 Listebarger Supplemental Testimony and Exhibits filed 5/16/2022.
Note 2: Beginning Balance for NC Residential Revenue Collected has been adjusted to correct understatement of revenues from prior rider filing.

Duke Energy Carolinas, LLC
Docket Number E-7 Sub 1285
Estimated Return Calculation -Non - Residential DSM Programs Vintage 2018

NC Non- Residential DSM		Total System NC DSM Program Costs Incurred	NC Non- Residential DSM Allocation %	NC Allocated DSM Non-Residential Program Costs	NC Non-Residential DSM Revenue Collected[2]	NC Non-Residential DSM Program Collection %	Non-Residential DSM Program Costs Revenue Collected	(Over)/Under Collection
			Listebarger Exhibit 5 pg. 1, Line 10			see calc. at right		
Beginning Balance[1]		30,409,405		12,611,170	15,860,821		(12,566,531)	44,639
2022	January	-	41.4712829%	-	1,533	12.9384608%	(198)	(198)
2022	February	-	41.4712829%	-	24,533	12.9384608%	(3,174)	(3,174)
2022	March	-	41.4712829%	-	26,127	12.9384608%	(3,380)	(3,380)
2022	April	-	41.4712829%	-	22,704	12.9384608%	(2,937)	(2,937)
2022	May	-	41.4712829%	-	24,694	12.9384608%	(3,195)	(3,195)
2022	June	-	41.4712829%	-	30,200	12.9384608%	(3,907)	(3,907)
2022	July	-	41.4712829%	-	31,156	12.9384608%	(4,031)	(4,031)
2022	August	-	41.4712829%	-	33,947	12.9384608%	(4,392)	(4,392)
2022	September	-	41.4712829%	-	31,146	12.9384608%	(4,030)	(4,030)
2022	October	-	41.4712829%	-	25,938	12.9384608%	(3,356)	(3,356)
2022	November	-	41.4712829%	-	23,820	12.9384608%	(3,082)	(3,082)
2022	December	-	41.4712829%	-	35,069	12.9384608%	(4,537)	(4,537)
		30,409,405		12,611,170	16,171,688		(12,606,753)	4,418

Program Costs to be Recovered in Rider 13	44,639
Revenues to be Collected in Rider 13	345,011
% Revenue related to Program Costs	12.9385%

NC Non-Residential DSM		Cumulative (Over)/Under Recovery	Current Income Tax Rate	Monthly Deferred Income Tax	Cumulative Deferred Income Tax	Net Deferred After Tax Balance	Monthly Return	Monthly A/T Return on Deferral	YTD After Tax Interest	Gross up of Return to Pretax Rate	Gross up of Return to Pretax
			1/2022 - 12/2022				6.56%			0.766497	
Beginning Balance		44,639			10,423	34,216					
2022	January	44,441	0.233503	(46)	10,377	34,064	0.005469	187	187	0.766497	244
2022	February	41,267	0.233503	(741)	9,636	31,631	0.005469	180	366	0.766497	478
2022	March	37,886	0.233503	(789)	8,847	29,040	0.005469	166	532	0.766497	694
2022	April	34,949	0.233503	(686)	8,161	26,788	0.005469	153	685	0.766497	894
2022	May	31,754	0.233503	(746)	7,415	24,339	0.005469	140	825	0.766497	1,076
2022	June	27,846	0.233503	(912)	6,502	21,344	0.005469	125	950	0.766497	1,239
2022	July	23,815	0.233503	(941)	5,561	18,254	0.005469	108	1,058	0.766497	1,380
2022	August	19,423	0.233503	(1,026)	4,535	14,888	0.005469	91	1,149	0.766497	1,498
2022	September	15,393	0.233503	(941)	3,594	11,799	0.005469	73	1,222	0.766497	1,594
2022	October	12,037	0.233503	(784)	2,811	9,226	0.005469	57	1,279	0.766497	1,669
2022	November	8,955	0.233503	(720)	2,091	6,864	0.005469	44	1,323	0.766497	1,726
2022	December	4,418	0.233503	(1,059)	1,032	3,386	0.005469	28	1,351	0.766497	1,763
	Checks			(9,392)	(9,392)	1,032		1,351			1,763

Adjustment to interest calculation to account for corrections as noted in Docket No. E-7, Sub 1265 Listebarger Supplemental Testimony and Exhibits filed 5/16/2022 (33,076)

Final Gross up of Return to Pretax for Vintage 2018 **(31,313)**

Note 1: Beginning Balances tie to Docket No. E-7, Sub 1265 Listebarger Supplemental Testimony and Exhibits filed 5/16/2022.

Note 2: Beginning Balance for NC Residential Revenue Collected has been adjusted to correct understatement of revenues from prior rider filing

Duke Energy Carolinas, LLC
Docket Number E-7 Sub 1285
Estimated Return Calculation - Residential EE Programs Vintage 2019

NC Residential EE		Residential EE Program Costs Incurred	NC Allocation %	NC Allocated EE Program Costs	NC Residential Revenue Collected[2]	NC Residential EE Program Collection %	EE Program Costs Revenue Collected	(Over)/Under Collection
			Listebarger Exhibit 5 pg. 2, Line 4			see calc. at right		
Beginning Balance[1]		74,218,205		54,246,377	97,819,053		(54,251,938)	(5,561)
2022	January		73.0903918%	-	42,345	-0.4607%	195	195
2022	February		73.0903918%	-	127,201	-0.4607%	586	586
2022	March		73.0903918%	-	98,253	-0.4607%	453	453
2022	April		73.0903918%	-	79,434	-0.4607%	366	366
2022	May		73.0903918%	-	79,399	-0.4607%	366	366
2022	June		73.0903918%	-	105,567	-0.4607%	486	486
2022	July		73.0903918%	-	121,696	-0.4607%	561	561
2022	August		73.0903918%	-	132,554	-0.4607%	611	611
2022	September		73.0903918%	-	109,779	-0.4607%	506	506
2022	October		73.0903918%	-	75,967	-0.4607%	350	350
2022	November		73.0903918%	-	74,416	-0.4607%	343	343
2022	December		73.0903918%	-	189,492	-0.4607%	873	873
		74,218,205		54,246,377	99,055,155		(54,246,243)	134

Program Costs to be Recovered in Rider 13	(5,561)
Revenues to be Collected in Rider 13	1,207,099
% Revenue related to Program Costs	-0.4607%

NC Residential EE		Cumulative (Over)/Under Recovery	Current Income Tax Rate	Monthly Deferred Income Tax	Cumulative Deferred Income Tax	Net Deferred After Tax Balance	Monthly Return	Monthly A/T Return on Deferral	YTD After Tax Interest	Gross up of Return to Pretax Rate	Gross up of Return to Pretax
			1/2022 - 12/2022				6.56%			0.766497	
Beginning Balance		(5,561)			(1,299)	(4,263)					
2022	January	(5,366)	0.233503	46	(1,253)	(4,113)	0.005469	(23)	(23)	0.766497	(30)
2022	February	(4,780)	0.233503	137	(1,116)	(3,664)	0.005469	(21)	(44)	0.766497	(58)
2022	March	(4,328)	0.233503	106	(1,010)	(3,317)	0.005469	(19)	(63)	0.766497	(83)
2022	April	(3,962)	0.233503	85	(925)	(3,037)	0.005469	(17)	(81)	0.766497	(105)
2022	May	(3,596)	0.233503	85	(840)	(2,756)	0.005469	(16)	(96)	0.766497	(126)
2022	June	(3,109)	0.233503	114	(726)	(2,383)	0.005469	(14)	(111)	0.766497	(144)
2022	July	(2,549)	0.233503	131	(595)	(1,954)	0.005469	(12)	(122)	0.766497	(160)
2022	August	(1,938)	0.233503	143	(453)	(1,485)	0.005469	(9)	(132)	0.766497	(172)
2022	September	(1,432)	0.233503	118	(334)	(1,098)	0.005469	(7)	(139)	0.766497	(181)
2022	October	(1,082)	0.233503	82	(253)	(830)	0.005469	(5)	(144)	0.766497	(188)
2022	November	(739)	0.233503	80	(173)	(567)	0.005469	(4)	(148)	0.766497	(193)
2022	December	134	0.233503	204	31	102	0.005469	(1)	(149)	0.766497	(195)
	Checks			1,330	1,330	31		(149)			(195)

Adjustment to interest calculation to account for corrections as noted in Docket No. E-7, Sub 1265 Listebarger Supplemental Testimony and Exhibits filed 5/16/2022.	-
Final Gross up of Return to Pretax for Vintage 2019	**(195)**

Note 1: Beginning Balances tie to Docket No. E-7, Sub 1265 Listebarger Supplemental Testimony and Exhibits filed 5/16/2022.
Note 2: Beginning Balance for NC Residential Revenue Collected has been adjusted to correct understatement of revenues from prior rider filing.

Duke Energy Carolinas, LLC
Docket Number E-7 Sub 1285
Estimated Return Calculation - Residential DSM Programs Vintage 2019

NC Residential DSM		Total System NC DSM Program Costs Incurred	NC Allocation %	NC Allocated DSM Program Costs	NC Residential Revenue Collected	NC Residential DSM Program Collection %	DSM Program Costs Revenue Collected	(Over)/Under Collection
			Listebarger Exhibit 5 pg. 2, Line 9			see calc. at right		
Beginning Balance[1]		30,097,219		10,268,601	13,524,504		(10,213,197)	55,403
2022	January		34.1181040%		(770)	-256.4535%	(1,974)	(1,974)
2022	February		34.1181040%	-	(2,313)	-256.4535%	(5,931)	(5,931)
2022	March		34.1181040%	-	(1,786)	-256.4535%	(4,581)	(4,581)
2022	April		34.1181040%	-	(1,444)	-256.4535%	(3,704)	(3,704)
2022	May		34.1181040%	-	(1,444)	-256.4535%	(3,702)	(3,702)
2022	June		34.1181040%	-	(1,919)	-256.4535%	(4,922)	(4,922)
2022	July		34.1181040%	-	(2,213)	-256.4535%	(5,674)	(5,674)
2022	August		34.1181040%	-	(2,410)	-256.4535%	(6,181)	(6,181)
2022	September		34.1181040%	-	(1,996)	-256.4535%	(5,119)	(5,119)
2022	October		34.1181040%	-	(1,381)	-256.4535%	(3,542)	(3,542)
2022	November		34.1181040%	-	(1,353)	-256.4535%	(3,470)	(3,470)
2022	December		34.1181040%	-	(3,445)	-256.4535%	(8,836)	(8,836)
		30,097,219		10,268,601	13,502,030		(10,270,834)	(2,234)

Program Costs to be Recovered in Rider 13	55,403
Revenues to be Collected in Rider 13	(21,604)
% Revenue related to Program Costs	-256.4535%

NC Residential DSM		Cumulative (Over)/Under Recovery	Current Income Tax Rate	Monthly Deferred Income Tax	Cumulative Deferred Income Tax	Net Deferred After Tax Balance	Monthly Return	Monthly A/T Return on Deferral	YTD After Tax Interest	Gross up of Return to Pretax Rate	Gross up of Return to Pretax
			1/2022 - 12/2022				6.56%			0.766497	
Beginning Balance		55,403			12,937	42,466					
2022	January	53,429	0.233503	(461)	12,476	40,953	0.005469	228	228	0.766497	298
2022	February	47,497	0.233503	(1,385)	11,091	36,407	0.005469	212	440	0.766497	574
2022	March	42,916	0.233503	(1,070)	10,021	32,895	0.005469	190	629	0.766497	821
2022	April	39,212	0.233503	(865)	9,156	30,056	0.005469	172	801	0.766497	1,045
2022	May	35,510	0.233503	(864)	8,292	27,218	0.005469	157	958	0.766497	1,250
2022	June	30,588	0.233503	(1,149)	7,142	23,445	0.005469	139	1,096	0.766497	1,431
2022	July	24,913	0.233503	(1,325)	5,817	19,096	0.005469	116	1,213	0.766497	1,582
2022	August	18,733	0.233503	(1,443)	4,374	14,358	0.005469	91	1,304	0.766497	1,702
2022	September	13,614	0.233503	(1,195)	3,179	10,435	0.005469	68	1,372	0.766497	1,790
2022	October	10,072	0.233503	(827)	2,352	7,720	0.005469	50	1,422	0.766497	1,855
2022	November	6,602	0.233503	(810)	1,542	5,060	0.005469	35	1,457	0.766497	1,900
2022	December	(2,234)	0.233503	(2,063)	(522)	(1,712)	0.005469	9	1,466	0.766497	1,912
	Checks			(13,458)	(13,458)	(522)		1,466			1,912

Adjustment to interest calculation to account for corrections as noted in Docket No. E-7, Sub 1265 Listebarger Supplemental Testimony and Exhibits filed 5/16/2022	643
Final Gross up of Return to Pretax for Vintage 2019	**2,555**

Note 1: Beginning Balances tie to Docket No. E-7, Sub 1265 Listebarger Supplemental Testimony and Exhibits filed 5/16/2022
Note 2: Beginning Balance for NC Residential Revenue Collected has been adjusted to correct understatement of revenues from prior rider filing

Duke Energy Carolinas, LLC
Docket Number E-7 Sub 1285
Estimated Return Calculation - Non- Residential EE Programs Vintage 2019

NC Non- Residential EE		Non-Residential EE Program Costs Incurred	NC Allocation %	NC Allocated EE Program Costs	NC Residential Revenue Collected[2]	NC Non-Residential EE Program Collection %	Non-Residential EE Program Costs Revenue Collected	(Over)/Under Collection
			Listebarger Exhibit 5 pg 2, Line 4			see calc. at right		
Beginning Balance[1]		45,112,919		32,973,209	68,010,665		(68,016,425)	(3,123,099)
2022	January		73.0903918%		55,760	61.10%	(34,071)	(34,071)
2022	February		73.0903918%		(369,394)	61.10%	225,711	225,711
2022	March		73.0903918%		(388,310)	61.10%	237,269	237,269
2022	April		73.0903918%		(343,348)	61.10%	209,796	209,796
2022	May		73.0903918%		(371,754)	61.10%	227,153	227,153
2022	June		73.0903918%		(442,126)	61.10%	270,152	270,152
2022	July		73.0903918%		(462,514)	61.10%	282,610	282,610
2022	August		73.0903918%		(506,015)	61.10%	309,190	309,190
2022	September		73.0903918%		(463,226)	61.10%	283,045	283,045
2022	October		73.0903918%		(374,401)	61.10%	228,770	228,770
2022	November		73.0903918%		(343,791)	61.10%	210,067	210,067
2022	December		73.0903918%		(500,218)	61.10%	305,648	305,648
		45,112,919		32,973,209	63,501,330		(65,261,085)	(367,759)

Program Costs to be Recovered in Rider 13	(3,123,099)
Revenues to be Collected in Rider 13	(5,111,203)
% Revenue related to Program Costs	61.1030%

NC Non-Residential EE		Cumulative (Over)/Under Recovery	Current Income Tax Rate	Monthly Deferred Income Tax	Cumulative Deferred Income Tax	Net Deferred After Tax Balance	Monthly Return	Monthly A/T Return on Deferral	YTD After Tax Interest	Gross up of Return to Pretax Rate	Gross up of Return to Pretax
			1/2022 - 12/2022				6.56%			0.766497	
Beginning Balance		(3,123,099)			(729,253)	(2,393,846)					
2022	January	(3,157,170)	0.233503	(7,956)	(737,209)	(2,419,961)	0.005469	(13,164)	(13,164)	0.766497	(17,174)
2022	February	(2,931,459)	0.233503	52,704	(684,504)	(2,246,954)	0.005469	(12,762)	(25,926)	0.766497	(33,824)
2022	March	(2,694,190)	0.233503	55,403	(629,101)	(2,065,088)	0.005469	(11,792)	(37,718)	0.766497	(49,208)
2022	April	(2,484,394)	0.233503	48,988	(580,113)	(1,904,280)	0.005469	(10,855)	(48,572)	0.766497	(63,369)
2022	May	(2,257,241)	0.233503	53,041	(527,073)	(1,730,168)	0.005469	(9,939)	(58,511)	0.766497	(76,335)
2022	June	(1,987,089)	0.233503	63,081	(463,991)	(1,523,098)	0.005469	(8,896)	(67,407)	0.766497	(87,942)
2022	July	(1,704,479)	0.233503	65,990	(398,001)	(1,306,478)	0.005469	(7,738)	(75,145)	0.766497	(98,037)
2022	August	(1,395,289)	0.233503	72,197	(325,804)	(1,069,485)	0.005469	(6,497)	(81,642)	0.766497	(106,513)
2022	September	(1,112,244)	0.233503	66,092	(259,712)	(852,532)	0.005469	(5,256)	(86,898)	0.766497	(113,370)
2022	October	(883,474)	0.233503	53,418	(206,294)	(677,180)	0.005469	(4,183)	(91,081)	0.766497	(118,828)
2022	November	(673,407)	0.233503	49,051	(157,243)	(516,165)	0.005469	(3,263)	(94,345)	0.766497	(123,085)
2022	December	(367,759)	0.233503	71,370	(85,873)	(281,886)	0.005469	(2,182)	(96,527)	0.766497	(125,933)
	Checks			643,380	643,380	(85,873)		(96,527)			(125,933)

Adjustment to interest calculation to account for corrections as noted in Docket No. E-7, Sub 1265 Listebarger Supplemental Testimony and Exhibits filed 5/16/2022. 47,791

Final Gross up of Return to Pretax for Vintage 2019 **(78,141)**

Note 1: Beginning Balances tie to Docket No. E-7, Sub 1265 Listebarger Supplemental Testimony and Exhibits filed 5/16/2022.

Duke Energy Carolinas, LLC
Docket Number E-7 Sub 1285
Estimated Return Calculation -Non - Residential DSM Programs Vintage 2019

NC Non- Residential DSM		Total System NC DSM Program Costs Incurred	NC Non- Residential DSM Allocation %	NC Allocated DSM Non-Residential Program Costs	NC Non-Residential DSM Revenue Collected[2]	NC Non-Residential DSM Program Collection %	Non-Residential DSM Program Costs Revenue Collected	(Over)/Under Collection
			Listebarger Exhibit 5 pg. 2, Line 10			see calc. at right		
Beginning Balance[1]		30,097,219		12,076,004	16,231,080		(12,072,831)	3,173
2022	January	-	40.1233224%	-	3,694	-1.2166824%	45	45
2022	February	-	40.1233224%	-	(19,210)	-1.2166824%	(234)	(234)
2022	March	-	40.1233224%	-	(21,073)	-1.2166824%	(256)	(256)
2022	April	-	40.1233224%	-	(17,640)	-1.2166824%	(215)	(215)
2022	May	-	40.1233224%	-	(19,520)	-1.2166824%	(237)	(237)
2022	June	-	40.1233224%	-	(23,889)	-1.2166824%	(291)	(291)
2022	July	-	40.1233224%	-	(24,640)	-1.2166824%	(300)	(300)
2022	August	-	40.1233224%	-	(26,836)	-1.2166824%	(327)	(327)
2022	September	-	40.1233224%	-	(24,578)	-1.2166824%	(299)	(299)
2022	October	-	40.1233224%	-	(20,471)	-1.2166824%	(249)	(249)
2022	November	-	40.1233224%	-	(18,800)	-1.2166824%	(229)	(229)
2022	December	-	40.1233224%	-	(27,187)	-1.2166824%	(331)	(331)
		30,097,219		12,076,004	15,990,931		(12,075,753)	252

Program Costs to be Recovered in Rider 13	3,173
Revenues to be Collected in Rider 13	(260,821)
% Revenue related to Program Costs	-1.2167%

NC Non-Residential DSM		Cumulative (Over)/Under Recovery	Current Income Tax Rate	Monthly Deferred Income Tax	Cumulative Deferred Income Tax	Net Deferred After Tax Balance	Monthly Return	Monthly A/T Return on Deferral	YTD After Tax Interest	Gross up of Return to Pretax Rate	Gross up of Return to Pretax
			1/2022 - 12/2022				6.56%			0.766497	
Beginning Balance		3,173			741	2,432					
2022	January	3,218	0.233503	10	751	2,467	0.005469	13	13	0.766497	17
2022	February	2,985	0.233503	(55)	697	2,288	0.005469	13	26	0.766497	34
2022	March	2,728	0.233503	(60)	637	2,091	0.005469	12	38	0.766497	50
2022	April	2,514	0.233503	(50)	587	1,927	0.005469	11	49	0.766497	64
2022	May	2,276	0.233503	(55)	531	1,745	0.005469	10	59	0.766497	77
2022	June	1,985	0.233503	(68)	464	1,522	0.005469	9	68	0.766497	89
2022	July	1,686	0.233503	(70)	394	1,292	0.005469	8	76	0.766497	99
2022	August	1,359	0.233503	(76)	317	1,042	0.005469	6	82	0.766497	108
2022	September	1,060	0.233503	(70)	248	813	0.005469	5	87	0.766497	114
2022	October	811	0.233503	(58)	189	622	0.005469	4	91	0.766497	119
2022	November	582	0.233503	(53)	136	446	0.005469	3	94	0.766497	123
2022	December	252	0.233503	(77)	59	193	0.005469	2	96	0.766497	125
	Checks			(682)	(682)	59		96			125

Adjustment to interest calculation to account for corrections as noted in Docket No. E-7, Sub 1265 Listebarger Supplemental Testimony and Exhibits filed 5/16/2022 (671)

Final Gross up of Return to Pretax for Vintage 2019 **(545)**

Note 1: Beginning Balances tie to Docket No. E-7, Sub 1265 Listebarger Supplemental Testimony and Exhibits filed 5/16/2022
Note 2: Beginning Balance for NC Residential Revenue Collected has been adjusted to correct understatement of revenues from prior rider filing

Duke Energy Carolinas, LLC
Docket Number E-7 Sub 1285
Estimated Return Calculation - Residential EE Programs Vintage 2020

NC Residential EE		Residential EE Program Costs[2] Incurred	NC Allocation %	NC Allocated EE Program Costs	Program Incentives	Lost Revenues	Total Costs	NC Residential Revenue Collected[2]	NC Residential EE Program Collection %	EE Program Costs Revenue Collected	(Over)/Under Collection
			Listebarger Exhibit 5 pg. 3, Line 4						100% used due to overcollection		
Beginning Balance[1]		51,310,734		37,570,373	4,483,373	31,747,169	73,800,915	56,151,769		(30,658,183)	6,912,190
2022	January	(2,082)	73.2212736%	(1,524)	1,723	(30,202)	(30,003)	636,713	100.0000%	(636,713)	(666,716)
2022	February	(2,082)	73.2212736%	(1,524)	1,723	(30,202)	(30,003)	1,912,641	100.0000%	(1,912,641)	(1,942,644)
2022	March	(2,082)	73.2212736%	(1,524)	1,723	(30,202)	(30,003)	1,477,370	100.0000%	(1,477,370)	(1,507,373)
2022	April	(2,082)	73.2212736%	(1,524)	1,723	(30,202)	(30,003)	1,194,397	100.0000%	(1,194,397)	(1,224,401)
2022	May	(2,082)	73.2212736%	(1,524)	1,723	(30,202)	(30,003)	1,193,865	100.0000%	(1,193,865)	(1,223,868)
2022	June	(2,082)	73.2212736%	(1,524)	1,723	(30,202)	(30,003)	1,587,338	100.0000%	(1,587,338)	(1,617,342)
2022	July	(2,082)	73.2212736%	(1,524)	1,723	(30,202)	(30,003)	1,829,859	100.0000%	(1,829,859)	(1,859,863)
2022	August	(2,082)	73.2212736%	(1,524)	1,723	(30,202)	(30,003)	1,993,137	100.0000%	(1,993,137)	(2,023,140)
2022	September	(2,082)	73.2212736%	(1,524)	1,723	(30,202)	(30,003)	1,650,679	100.0000%	(1,650,679)	(1,680,683)
2022	October	(2,082)	73.2212736%	(1,524)	1,723	(30,202)	(30,003)	1,142,266	100.0000%	(1,142,266)	(1,172,270)
2022	November	(2,082)	73.2212736%	(1,524)	1,723	(30,202)	(30,003)	1,118,942	100.0000%	(1,118,942)	(1,148,945)
2022	December	(2,082)	73.2212736%	(1,524)	1,723	(30,202)	(30,003)	2,849,274	100.0000%	(2,849,274)	(2,879,277)
		51,285,750		37,552,079	4,504,045	31,384,749	73,440,873	74,738,250		(49,244,664)	(12,034,332)

Vintage is overcollected. Interest is calculated on all components.

100% of all revenues offset the overcollected balance.

NC Residential EE		Cumulative (Over)/Under Recovery	Current Income Tax Rate	Monthly Deferred Income Tax	Cumulative Deferred Income Tax	Net Deferred After Tax Balance	Monthly Return	Monthly A/T Return on Deferral	YTD After Tax Interest	Gross up of Return to Pretax Rate	Gross up of Return to Pretax
			1/2022 - 12/2022				6.56%			0.766497	
Beginning Balance		6,912,190			1,614,017	5,298,173					
2022	January	6,245,474	0.233503	(155,680)	3,228,034	3,017,440	0.005469	22,740	22,740	0.766497	29,667
2022	February	4,302,830	0.233503	(453,613)	3,072,354	1,230,476	0.005469	11,616	34,356	0.766497	44,822
2022	March	2,795,456	0.233503	(351,976)	2,618,741	176,716	0.005469	3,848	38,204	0.766497	49,843
2022	April	1,571,056	0.233503	(285,901)	2,266,764	(695,709)	0.005469	(1,419)	36,785	0.766497	47,991
2022	May	347,187	0.233503	(285,777)	1,980,863	(1,633,676)	0.005469	(6,370)	30,415	0.766497	39,681
2022	June	(1,270,155)	0.233503	(377,654)	1,695,086	(2,965,241)	0.005469	(12,576)	17,839	0.766497	23,273
2022	July	(3,130,017)	0.233503	(434,284)	1,317,432	(4,447,449)	0.005469	(20,271)	(2,432)	0.766497	(3,173)
2022	August	(5,153,157)	0.233503	(472,409)	883,149	(6,036,306)	0.005469	(28,669)	(31,101)	0.766497	(40,575)
2022	September	(6,833,840)	0.233503	(392,444)	410,739	(7,244,579)	0.005469	(36,318)	(67,418)	0.766497	(87,956)
2022	October	(8,006,110)	0.233503	(273,729)	18,295	(8,024,405)	0.005469	(41,754)	(109,173)	0.766497	(142,431)
2022	November	(9,155,055)	0.233503	(268,282)	(255,434)	(8,899,622)	0.005469	(46,280)	(155,453)	0.766497	(202,810)
2022	December	(12,034,332)	0.233503	(672,320)	(523,716)	(11,510,616)	0.005469	(55,814)	(211,267)	0.766497	(275,626)
	Checks			(4,424,070)	(2,137,733)	(523,716)		(211,267)			(275,626)

Adjustment to interest calculation to account for corrections as noted in Docket No. E-7, Sub 1265 Listebarger Supplemental Testimony and Exhibits filed 5/16/2022	18,902
Final Gross up of Return to Pretax for Vintage 2020	**(256,724)**

Note 1: Beginning Balances tie to Docket No. E-7, Sub 1265 Listebarger Supplemental Testimony and Exhibits filed 5/16/2022 except for the NC Residential Revenue Collected. The interest calculation inadvertently omitted the 2021 revenue collected in Rider 14.

Note 2: Beginning Balance for NC Residential Revenue Collected has been adjusted to correct understatement of revenues from prior rider filing.

/A

Duke Energy Carolinas, LLC
Docket Number E-7 Sub 1285
Estimated Return Calculation - Residential DSM Programs Vintage 2020

NC Residential DSM		Total System NC DSM Program Costs Incurred	NC Allocation %	NC Allocated DSM Program Costs	NC Residential Revenue Collected[2]	NC Residential DSM Program Collection %	DSM Program Costs Revenue Collected	(Over)/Under Collection
			Listebarger Exhibit 5 pg. 3, Line 9			see calc. at right		
Beginning Balance[1]		29,327,255		9,888,075	15,488,514		(15,504,312)	(2,404,589)
2022	January		33.7163333%	-	(120,875)	-1.2167%	(1,471)	(1,471)
2022	February		33.7163333%	-	(363,101)	-1.2167%	(4,418)	(4,418)
2022	March		33.7163333%	-	(280,468)	-1.2167%	(3,412)	(3,412)
2022	April		33.7163333%	-	(226,748)	-1.2167%	(2,759)	(2,759)
2022	May		33.7163333%	-	(226,647)	-1.2167%	(2,758)	(2,758)
2022	June		33.7163333%	-	(301,345)	-1.2167%	(3,666)	(3,666)
2022	July		33.7163333%	-	(347,386)	-1.2167%	(4,227)	(4,227)
2022	August		33.7163333%	-	(378,383)	-1.2167%	(4,604)	(4,604)
2022	September		33.7163333%	-	(313,370)	-1.2167%	(3,813)	(3,813)
2022	October		33.7163333%	-	(216,851)	-1.2167%	(2,638)	(2,638)
2022	November		33.7163333%	-	(212,423)	-1.2167%	(2,585)	(2,585)
2022	December		33.7163333%	-	(540,914)	-1.2167%	(6,581)	(6,581)
		29,327,255		9,888,075	11,960,004		(15,547,243)	(2,447,520)

Program Costs to be Recovered in Rider 13	(2,404,589)
Revenues to be Collected in Rider 13	(3,447,632)
% Revenue related to Program Costs	-1.217%

NC Residential DSM		Cumulative (Over)/Under Recovery	Current Income Tax Rate	Monthly Deferred Income Tax	Cumulative Deferred Income Tax	Net Deferred After Tax Balance	Monthly Return	Monthly A/T Return on Deferral	YTD After Tax Interest	Gross up of Return to Pretax Rate	Gross up of Return to Pretax
			1/2022 - 12/2022				6.56%			0.766497	
Beginning Balance		(2,404,589)			(561,479)	(1,843,110)					
2022	January	(2,406,060)	0.233503	(343)	(561,822)	(1,844,238)	0.005469	(10,083)	(10,083)	0.766497	(13,155)
2022	February	(2,410,478)	0.233503	(1,032)	(562,854)	(1,847,624)	0.005469	(10,096)	(20,179)	0.766497	(26,326)
2022	March	(2,413,890)	0.233503	(797)	(563,651)	(1,850,239)	0.005469	(10,112)	(30,291)	0.766497	(39,519)
2022	April	(2,416,649)	0.233503	(644)	(564,295)	(1,852,354)	0.005469	(10,125)	(40,416)	0.766497	(52,729)
2022	May	(2,419,406)	0.233503	(644)	(564,939)	(1,854,468)	0.005469	(10,137)	(50,553)	0.766497	(65,953)
2022	June	(2,423,073)	0.233503	(856)	(565,795)	(1,857,278)	0.005469	(10,150)	(60,703)	0.766497	(79,195)
2022	July	(2,427,299)	0.233503	(987)	(566,782)	(1,860,518)	0.005469	(10,167)	(70,870)	0.766497	(92,459)
2022	August	(2,431,903)	0.233503	(1,075)	(567,857)	(1,864,046)	0.005469	(10,185)	(81,055)	0.766497	(105,747)
2022	September	(2,435,716)	0.233503	(890)	(568,747)	(1,866,969)	0.005469	(10,203)	(91,258)	0.766497	(119,058)
2022	October	(2,438,354)	0.233503	(616)	(569,363)	(1,868,991)	0.005469	(10,216)	(101,474)	0.766497	(132,387)
2022	November	(2,440,939)	0.233503	(603)	(569,967)	(1,870,972)	0.005469	(10,227)	(111,701)	0.766497	(145,729)
2022	December	(2,447,520)	0.233503	(1,537)	(571,503)	(1,876,017)	0.005469	(10,246)	(121,948)	0.766497	(159,097)
	Checks			(10,024)	(10,024)	(571,503)		(121,948)			(159,097)

Adjustment to interest calculation to account for corrections as noted in Docket No. E-7, Sub 1265 Listebarger Supplemental Testimony and Exhibits filed 5/16/2022	39,785
Final Gross up of Return to Pretax for Vintage 2020	**(119,312)**

Note 1: Beginning Balances tie to Docket No. E-7, Sub 1265 Listebarger Supplemental Testimony and Exhibits filed 5/16/2022

Note 2: Beginning Balance for NC Residential Revenue Collected has been adjusted to correct understatement of revenues from prior rider filing

Miller Exhibit 3, page 13

Duke Energy Carolinas, LLC
Docket Number E-7 Sub 1285
Estimated Return Calculation - Non- Residential EE Programs Vintage 2020

NC Non- Residential EE		Non-Residential EE Program Costs Incurred	NC Allocation %	NC Allocated EE Program Costs	Program Performance Incentives	Lost Revenues	Total Costs	NC Residential Revenue Collected[2]	NC Non-Residential EE Program Collection %	Non-Residential EE Program Costs Revenue Collected	(Over)/Under Collection
			Listebarger Exhibit 5 pg 3, Line 4						100% used due to overcollection		
Beginning Balance[1]		30,082,572		22,026,843	7,199,363	18,275,484	47,501,689	53,961,294		(53,989,132)	(6,487,442)
2022	January		73.2212736%		(3,004)	(5,091)	(8,096)	55,076	100.00%	(55,076)	(63,172)
2022	February		73.2212736%		(3,004)	(5,091)	(8,096)	(528,756)	100.00%	528,756	520,661
2022	March		73.2212736%		(3,004)	(5,091)	(8,096)	(549,551)	100.00%	549,551	541,456
2022	April		73.2212736%		(3,004)	(5,091)	(8,096)	(487,099)	100.00%	487,099	479,003
2022	May		73.2212736%		(3,004)	(5,091)	(8,096)	(530,170)	100.00%	530,170	522,074
2022	June		73.2212736%		(3,004)	(5,091)	(8,096)	(632,107)	100.00%	632,107	624,012
2022	July		73.2212736%		(3,004)	(5,091)	(8,096)	(662,226)	100.00%	662,226	654,130
2022	August		73.2212736%		(3,004)	(5,091)	(8,096)	(725,038)	100.00%	725,038	716,942
2022	September		73.2212736%		(3,004)	(5,091)	(8,096)	(663,355)	100.00%	663,355	655,260
2022	October		73.2212736%		(3,004)	(5,091)	(8,096)	(534,006)	100.00%	534,006	525,911
2022	November		73.2212736%		(3,004)	(5,091)	(8,096)	(489,645)	100.00%	489,645	481,549
2022	December		73.2212736%		(3,004)	(5,091)	(8,096)	(664,048)	100.00%	664,048	655,952
		30,082,572		22,026,843	7,163,312	18,214,388	47,404,543	47,550,369		(47,578,207)	(173,664)

Vintage is overcollected. Interest is calculated on all components.

100% of all revenues offset the overcollected balance.

NC Non-Residential EE		Cumulative (Over)/Under Recovery	Current Income Tax Rate	Monthly Deferred Income Tax	Cumulative Deferred Income Tax	Net Deferred After Tax Balance	Monthly Return	Monthly A/T Return on Deferral	YTD After Tax Interest	Gross up of Return to Pretax Rate	Gross up of Return to Pretax
			1/2022 - 12/2022				6.56%			0.766497	
Beginning Balance		(6,487,442)			(1,514,837)	(4,972,605)					
2022	January	(6,550,614)	0.233503	(14,751)	(1,529,588)	(5,021,026)	0.005469	(27,328)	(27,328)	0.766497	(35,654)
2022	February	(6,029,953)	0.233503	121,576	(1,408,012)	(4,621,941)	0.005469	(26,370)	(53,698)	0.766497	(70,056)
2022	March	(5,488,498)	0.233503	126,432	(1,281,581)	(4,206,917)	0.005469	(24,143)	(77,841)	0.766497	(101,555)
2022	April	(5,009,494)	0.233503	111,849	(1,169,732)	(3,839,762)	0.005469	(22,004)	(99,846)	0.766497	(130,262)
2022	May	(4,487,420)	0.233503	121,906	(1,047,826)	(3,439,594)	0.005469	(19,906)	(119,752)	0.766497	(156,232)
2022	June	(3,863,409)	0.233503	145,709	(902,118)	(2,961,291)	0.005469	(17,504)	(137,256)	0.766497	(179,069)
2022	July	(3,209,279)	0.233503	152,741	(749,376)	(2,459,902)	0.005469	(14,825)	(152,080)	0.766497	(198,409)
2022	August	(2,492,336)	0.233503	167,408	(581,968)	(1,910,368)	0.005469	(11,951)	(164,031)	0.766497	(214,001)
2022	September	(1,837,076)	0.233503	153,005	(428,963)	(1,408,114)	0.005469	(9,075)	(173,106)	0.766497	(225,840)
2022	October	(1,311,166)	0.233503	122,802	(306,161)	(1,005,004)	0.005469	(6,599)	(179,705)	0.766497	(234,449)
2022	November	(829,616)	0.233503	112,443	(193,718)	(635,899)	0.005469	(4,487)	(184,192)	0.766497	(240,304)
2022	December	(173,664)	0.233503	153,167	(40,551)	(133,113)	0.005469	(2,103)	(186,295)	0.766497	(243,047)
	Checks			1,474,286	1,474,286	(40,551)		(186,295)			(243,047)

Adjustment to interest calculation to account for corrections as noted in Docket No. E-7, Sub 1265 Listebarger Supplemental Testimony and Exhibits filed 5/16/2022. 180,921

Final Gross up of Return to Pretax for Vintage 2020 **(62,127)**

Note 1: Beginning Balances tie to Docket No. E-7, Sub 1265 Listebarger Supplemental Testimony and Exhibits filed 5/16/2022.
Note 2: Beginning Balance for NC Residential Revenue Collected has been adjusted to correct understatement of revenues from prior rider filing.

/A

Duke Energy Carolinas, LLC
Docket Number E-7 Sub 1285
Estimated Return Calculation -Non - Residential DSM Programs Vintage 2020

NC Non- Residential DSM		Total System NC DSM Program Costs Incurred	NC Non- Residential DSM Allocation %	NC Allocated DSM Non-Residential Program Costs	Program Incentives	Total Costs	NC Non-Residential DSM Revenue Collected[2]	NC Non-Residential DSM Program Collection %	Non-Residential DSM Program Costs Revenue Collected	(Over)/Under Collection
			Listebarger Exhibit 5 pg. 3, Line 10					100% used due to overcollection		
Beginning Balance[1]		29,327,255		11,871,383	3,855,826	15,727,210	17,752,122		(17,752,122)	(2,024,912)
2022	January		40.4790117%	-	1,846	1,846	(72,538)	100.0000000%	72,538	74,385
2022	February		40.4790117%	-	1,846	1,846	(149,090)	100.0000000%	149,090	150,937
2022	March		40.4790117%	-	1,846	1,846	(153,740)	100.0000000%	153,740	155,586
2022	April		40.4790117%	-	1,846	1,846	(140,158)	100.0000000%	140,158	142,004
2022	May		40.4790117%	-	1,846	1,846	(148,413)	100.0000000%	148,413	150,259
2022	June		40.4790117%	-	1,846	1,846	(181,069)	100.0000000%	181,069	182,916
2022	July		40.4790117%	-	1,846	1,846	(186,690)	100.0000000%	186,690	188,536
2022	August		40.4790117%	-	1,846	1,846	(203,204)	100.0000000%	203,204	205,050
2022	September		40.4790117%	-	1,846	1,846	(186,476)	100.0000000%	186,476	188,322
2022	October		40.4790117%	-	1,846	1,846	(155,557)	100.0000000%	155,557	157,403
2022	November		40.4790117%	-	1,846	1,846	(143,082)	100.0000000%	143,082	144,928
2022	December		40.4790117%	-	1,846	1,846	(215,098)	100.0000000%	215,098	216,944
		29,327,255		11,871,383	3,877,982	15,749,365	15,817,007		(15,817,007)	(67,642)

Vintage is overcollected. Interest is calculated on all components.

100% of all revenues offset the overcollected balance.

NC Non-Residential DSM		Cumulative (Over)/Under Recovery	Current Income Tax Rate	Monthly Deferred Income Tax	Cumulative Deferred Income Tax	Net Deferred After Tax Balance	Monthly Return	Monthly A/T Return on Deferral	YTD After Tax Interest	Gross up of Return to Pretax Rate	Gross up of Return to Pretax
			1/2022 - 12/2022				6.56%			0.766497	
Beginning Balance		(2,024,912)			(472,823)	(1,552,089)					
2022	January	74,385	0.233503	17,369	(455,454)	529,839	0.005469	(2,795)	(2,795)	0.766497	(3,647)
2022	February	225,321	0.233503	35,244	(420,210)	645,531	0.005469	3,214	419	0.766497	546
2022	March	380,907	0.233503	36,330	(383,880)	764,787	0.005469	3,857	4,275	0.766497	5,578
2022	April	522,912	0.233503	33,158	(350,722)	873,633	0.005469	4,480	8,756	0.766497	11,423
2022	May	673,170	0.233503	35,086	(315,636)	988,806	0.005469	5,093	13,849	0.766497	18,068
2022	June	856,086	0.233503	42,711	(272,924)	1,129,010	0.005469	5,791	19,640	0.766497	25,623
2022	July	1,044,622	0.233503	44,024	(228,901)	1,273,523	0.005469	6,570	26,210	0.766497	34,195
2022	August	1,249,673	0.233503	47,880	(181,021)	1,430,693	0.005469	7,395	33,605	0.766497	43,842
2022	September	1,437,995	0.233503	43,974	(137,047)	1,575,042	0.005469	8,219	41,824	0.766497	54,566
2022	October	1,595,398	0.233503	36,754	(100,293)	1,695,691	0.005469	8,944	50,769	0.766497	66,235
2022	November	1,740,326	0.233503	33,841	(66,452)	1,806,778	0.005469	9,578	60,346	0.766497	78,730
2022	December	1,957,270	0.233503	50,657	(15,795)	1,973,065	0.005469	10,336	70,683	0.766497	92,215
	Checks			457,028	457,028	(15,795)		70,683			92,215

Adjustment to interest calculation to account for corrections as noted in Docket No. E-7, Sub 1265 Listebarger Supplemental Testimony and Exhibits filed 5/16/2022. 32,579

Final Gross up of Return to Pretax for Vintage 2020 **124,794**

Note 1: Beginning Balances tie to Docket No. E-7, Sub 1265 Listebarger Supplemental Testimony and Exhibits filed 5/16/2022.

Note 2: Beginning Balance for NC Residential Revenue Collected has been adjusted to correct understatement of revenues from prior rider filing.

Duke Energy Carolinas, LLC
Docket Number E-7 Sub 1285
Estimated Return Calculation - Residential EE Programs Vintage 2021

NC Residential EE		Residential EE Program Costs Incurred	NC Allocation %	NC Allocated EE Program Costs	Program Incentives	Lost Revenues	Total Costs	NC Residential Revenue Collected	NC Residential EE Program Collection %	EE Program Costs Revenue Collected	(Over)/Under Collection
			Listebarger Exhibit 5 pg. 4, Line 4						100% used due to overcollection		
Beginning Balance[1]		35,677,735		26,231,472	2,568,356	23,363,537	52,163,365	64,747,858		(64,747,858)	(12,584,493)
2022	January		73.5233682%	-	(21,353)	69,781	48,429	219,423	100.0000%	(219,423)	(170,995)
2022	February		73.5233682%	-	(21,353)	69,781	48,429	659,132	100.0000%	(659,132)	(610,704)
2022	March		73.5233682%	-	(21,353)	69,781	48,429	509,130	100.0000%	(509,130)	(460,701)
2022	April		73.5233682%	-	(21,353)	69,781	48,429	411,612	100.0000%	(411,612)	(363,183)
2022	May		73.5233682%	-	(21,353)	69,781	48,429	411,429	100.0000%	(411,429)	(363,000)
2022	June		73.5233682%	-	(21,353)	69,781	48,429	547,027	100.0000%	(547,027)	(498,599)
2022	July		73.5233682%	-	(21,353)	69,781	48,429	630,604	100.0000%	(630,604)	(582,176)
2022	August		73.5233682%	-	(21,353)	69,781	48,429	686,873	100.0000%	(686,873)	(638,444)
2022	September		73.5233682%	-	(21,353)	69,781	48,429	568,856	100.0000%	(568,856)	(520,427)
2022	October		73.5233682%	-	(21,353)	69,781	48,429	393,647	100.0000%	(393,647)	(345,218)
2022	November		73.5233682%	-	(21,353)	69,781	48,429	385,609	100.0000%	(385,609)	(337,180)
2022	December		73.5233682%	-	(21,353)	69,781	48,429	981,914	100.0000%	(981,914)	(933,486)
		35,677,735		26,231,472	2,312,125	24,200,911	52,744,508	71,153,114		(71,153,114)	(18,408,605)

Vintage is overcollected. Interest is calculated on all components.

100% of all revenues offset the overcollected balance.

NC Residential EE		Cumulative (Over)/Under Recovery	Current Income Tax Rate	Monthly Deferred Income Tax	Cumulative Deferred Income Tax	Net Deferred After Tax Balance	Monthly Return	Monthly A/T Return on Deferral	YTD After Tax Interest	Gross up of Return to Pretax Rate	Gross up of Return to Pretax
			1/2022 - 12/2022				6.56%			0.766497	
Beginning Balance		(12,584,493)			(2,938,517)	(9,645,976)					
2022	January	(12,755,487)	0.233503	(39,928)	(2,978,445)	(9,777,043)	0.005469	(53,114)	(53,114)	0.766497	(69,294)
2022	February	(13,366,191)	0.233503	(142,601)	(3,121,046)	(10,245,146)	0.005469	(54,752)	(107,866)	0.766497	(140,726)
2022	March	(13,826,893)	0.233503	(107,575)	(3,228,621)	(10,598,272)	0.005469	(56,998)	(164,865)	0.766497	(215,088)
2022	April	(14,190,076)	0.233503	(84,804)	(3,313,425)	(10,876,651)	0.005469	(58,725)	(223,590)	0.766497	(291,703)
2022	May	(14,553,076)	0.233503	(84,762)	(3,398,187)	(11,154,889)	0.005469	(60,247)	(283,837)	0.766497	(370,304)
2022	June	(15,051,675)	0.233503	(116,424)	(3,514,611)	(11,537,063)	0.005469	(62,053)	(345,890)	0.766497	(451,261)
2022	July	(15,633,850)	0.233503	(135,940)	(3,650,551)	(11,983,299)	0.005469	(64,319)	(410,209)	0.766497	(535,173)
2022	August	(16,272,295)	0.233503	(149,079)	(3,799,630)	(12,472,665)	0.005469	(66,877)	(477,086)	0.766497	(622,423)
2022	September	(16,792,722)	0.233503	(121,521)	(3,921,151)	(12,871,571)	0.005469	(69,306)	(546,392)	0.766497	(712,843)
2022	October	(17,137,940)	0.233503	(80,609)	(4,001,760)	(13,136,179)	0.005469	(71,121)	(617,512)	0.766497	(805,629)
2022	November	(17,475,120)	0.233503	(78,733)	(4,080,493)	(13,394,627)	0.005469	(72,551)	(690,063)	0.766497	(900,281)
2022	December	(18,408,605)	0.233503	(217,972)	(4,298,465)	(14,110,141)	0.005469	(75,214)	(765,277)	0.766497	(998,409)
	Checks			(1,359,948)	(1,359,948)	(4,298,465)		(765,277)			(998,409)

Adjustment to interest calculation to account for corrections as noted in Docket No. E-7, Sub 1265 Listebarger Supplemental Testimony and Exhibits filed 5/16/2022 33

Final Gross up of Return to Pretax for Vintage 2021 **(998,375)**

Note 1: Beginning Balances tie to Docket No. E-7, Sub 1265 Listebarger Supplemental Testimony and Exhibits filed 5/16/2022.

Duke Energy Carolinas, LLC
Docket Number E-7 Sub 1285
Estimated Return Calculation - Residential DSM Programs Vintage 2021

NC Residential DSM	Total System NC DSM Program Costs Incurred	NC Allocation %	NC Allocated EE Program Costs	Program Incentives	Total Costs	NC Residential Revenue Collected	NC Residential EE Program Collection %	EE Program Costs Revenue Collected	(Over)/Under Collection
		Listebarger Exhibit 5 pg. 4, Line 9					100% used due to overcollection		
Beginning Balance[1]	32,876,164		11,489,414	2,788,739	14,278,153	17,245,048		(17,245,048)	(2,966,895)
2022 January		34.9475492%	-	(37)	(37)	-	100.0000%	-	(37)
2022 February		34.9475492%	-	(37)	(37)	-	100.0000%	-	(37)
2022 March		34.9475492%	-	(37)	(37)	-	100.0000%	-	(37)
2022 April		34.9475492%	-	(37)	(37)	-	100.0000%	-	(37)
2022 May		34.9475492%	-	(37)	(37)	-	100.0000%	-	(37)
2022 June		34.9475492%	-	(37)	(37)	-	100.0000%	-	(37)
2022 July		34.9475492%	-	(37)	(37)	-	100.0000%	-	(37)
2022 August		34.9475492%	-	(37)	(37)	-	100.0000%	-	(37)
2022 September		34.9475492%	-	(37)	(37)	-	100.0000%	-	(37)
2022 October		34.9475492%	-	(37)	(37)	-	100.0000%	-	(37)
2022 November		34.9475492%	-	(37)	(37)	-	100.0000%	-	(37)
2022 December		34.9475492%	-	(37)	(37)	-	100.0000%	-	(37)
	32,876,164		11,489,414	2,788,295	14,277,708	17,245,048		(17,245,048)	(2,967,339)

Vintage is overcollected. Interest is calculated on all components.

100% of all revenues offset the overcollected balance.

NC Residential DSM	Cumulative (Over)/Under Recovery	Current Income Tax Rate	Monthly Deferred Income Tax	Cumulative Deferred Income Tax	Net Deferred After Tax Balance	Monthly Return	Monthly A/T Return on Deferral	YTD After Tax Interest	Gross up of Return to Pretax Rate	Gross up of Return to Pretax
		1/2022 - 12/2022				6.56%			0.766497	
Beginning Balance	(2,966,895)			(692,779)	(2,274,116)					
2022 January	(2,966,932)	0.233503	(9)	(692,787)	(2,274,144)	0.005469	(12,438)	(12,438)	0.766497	(16,227)
2022 February	(2,966,969)	0.233503	(9)	(692,796)	(2,274,173)	0.005469	(12,438)	(24,875)	0.766497	(32,453)
2022 March	(2,967,006)	0.233503	(9)	(692,805)	(2,274,201)	0.005469	(12,438)	(37,313)	0.766497	(48,680)
2022 April	(2,967,043)	0.233503	(9)	(692,813)	(2,274,229)	0.005469	(12,438)	(49,751)	0.766497	(64,908)
2022 May	(2,967,080)	0.233503	(9)	(692,822)	(2,274,258)	0.005469	(12,438)	(62,190)	0.766497	(81,135)
2022 June	(2,967,117)	0.233503	(9)	(692,831)	(2,274,286)	0.005469	(12,438)	(74,628)	0.766497	(97,362)
2022 July	(2,967,154)	0.233503	(9)	(692,839)	(2,274,315)	0.005469	(12,439)	(87,067)	0.766497	(113,590)
2022 August	(2,967,191)	0.233503	(9)	(692,848)	(2,274,343)	0.005469	(12,439)	(99,505)	0.766497	(129,818)
2022 September	(2,967,228)	0.233503	(9)	(692,857)	(2,274,372)	0.005469	(12,439)	(111,944)	0.766497	(146,046)
2022 October	(2,967,265)	0.233503	(9)	(692,865)	(2,274,400)	0.005469	(12,439)	(124,383)	0.766497	(162,275)
2022 November	(2,967,302)	0.233503	(9)	(692,874)	(2,274,428)	0.005469	(12,439)	(136,822)	0.766497	(178,503)
2022 December	(2,967,339)	0.233503	(9)	(692,883)	(2,274,457)	0.005469	(12,439)	(149,262)	0.766497	(194,732)
Checks			(104)	(104)	(692,883)		(149,262)			(194,732)

Adjustment to interest calculation to account for corrections as noted in Docket No. E-7, Sub 1265 Listebarger Supplemental Testimony and Exhibits filed 5/16/2022. 9

Final Gross up of Return to Pretax for Vintage 2021 **(194,724)**

Note 1: Beginning Balances tie to Docket No. E-7, Sub 1265 Listebarger Supplemental Testimony and Exhibits filed 5/16/2022.

Duke Energy Carolinas, LLC
Docket Number E-7 Sub 1285
Estimated Return Calculation - Non- Residential EE Programs Vintage 2021

NC Non- Residential EE		Non-Residential EE Program Costs Incurred	NC Allocation %	NC Allocated EE Program Costs	Program Incentives	Lost Revenues	Total Costs	NC Residential Revenue Collected	NC Non-Residential EE Program Collection %	Non-Residential EE Program Costs Revenue Collected	(Over)/Under Collection
			Listebarger Exhibit 5 pg 4, Line 4						100% used due to overcollection		
Beginning Balance[1]		40,469,592		29,754,607	7,442,891	15,035,634	52,233,133	50,564,874		(50,564,874)	(20,810,267)
2022	January		73.5233682%	-	(16,517)	34,502	17,985	1,195,863	100.0000000%	(1,195,863)	(1,177,878)
2022	February		73.5233682%	-	(16,517)	34,502	17,985	1,050,375	100.0000000%	(1,050,375)	(1,032,390)
2022	March		73.5233682%	-	(16,517)	34,502	17,985	960,257	100.0000000%	(960,257)	(942,272)
2022	April		73.5233682%	-	(16,517)	34,502	17,985	939,274	100.0000000%	(939,274)	(921,289)
2022	May		73.5233682%	-	(16,517)	34,502	17,985	977,631	100.0000000%	(977,631)	(959,646)
2022	June		73.5233682%	-	(16,517)	34,502	17,985	1,162,389	100.0000000%	(1,162,389)	(1,144,404)
2022	July		73.5233682%	-	(16,517)	34,502	17,985	1,222,579	100.0000000%	(1,222,579)	(1,204,594)
2022	August		73.5233682%	-	(16,517)	34,502	17,985	1,336,738	100.0000000%	(1,336,738)	(1,318,753)
2022	September		73.5233682%	-	(16,517)	34,502	17,985	1,228,568	100.0000000%	(1,228,568)	(1,210,583)
2022	October		73.5233682%	-	(16,517)	34,502	17,985	984,466	100.0000000%	(984,466)	(966,481)
2022	November		73.5233682%	-	(16,517)	34,502	17,985	903,916	100.0000000%	(903,916)	(885,931)
2022	December		73.5233682%	-	(16,517)	34,502	17,985	1,324,818	100.0000000%	(1,324,818)	(1,306,833)
		40,469,592		29,754,607	7,244,689	15,449,656	52,448,952	63,851,749		(63,851,749)	(33,881,322)

Vintage is overcollected. Interest is calculated on all components.

100% of all revenues offset the overcollected balance.

NC Non-Residential EE		Cumulative (Over)/Under Recovery	Current Income Tax Rate	Monthly Deferred Income Tax	Cumulative Deferred Income Tax	Net Deferred After Tax Balance	Monthly Return	Monthly A/T Return on Deferral	YTD After Tax Interest	Gross up of Return to Pretax Rate	Gross up of Return to Pretax
			1/2022 - 12/2022				6.56%			0.766497	
Beginning Balance		(20,810,267)			(4,859,260)	(15,951,007)					
2022	January	(21,988,145)	0.233503	(275,038)	(5,134,298)	(16,853,847)	0.005469	(89,708)	(89,708)	0.766497	(117,036)
2022	February	(23,020,535)	0.233503	(241,066)	(5,375,364)	(17,645,171)	0.005469	(94,341)	(184,048)	0.766497	(240,116)
2022	March	(23,962,808)	0.233503	(220,023)	(5,595,387)	(18,367,420)	0.005469	(98,480)	(282,528)	0.766497	(368,596)
2022	April	(24,884,096)	0.233503	(215,124)	(5,810,511)	(19,073,585)	0.005469	(102,386)	(384,914)	0.766497	(502,173)
2022	May	(25,843,743)	0.233503	(224,080)	(6,034,591)	(19,809,151)	0.005469	(106,328)	(491,242)	0.766497	(640,892)
2022	June	(26,988,147)	0.233503	(267,222)	(6,301,813)	(20,686,334)	0.005469	(110,739)	(601,981)	0.766497	(785,366)
2022	July	(28,192,741)	0.233503	(281,276)	(6,583,090)	(21,609,652)	0.005469	(115,662)	(717,643)	0.766497	(936,263)
2022	August	(29,511,495)	0.233503	(307,933)	(6,891,023)	(22,620,472)	0.005469	(120,951)	(838,594)	0.766497	(1,094,060)
2022	September	(30,722,078)	0.233503	(282,675)	(7,173,697)	(23,548,380)	0.005469	(126,253)	(964,847)	0.766497	(1,258,774)
2022	October	(31,688,559)	0.233503	(225,676)	(7,399,374)	(24,289,185)	0.005469	(130,816)	(1,095,663)	0.766497	(1,429,442)
2022	November	(32,574,489)	0.233503	(206,867)	(7,606,241)	(24,968,248)	0.005469	(134,699)	(1,230,362)	0.766497	(1,605,175)
2022	December	(33,881,322)	0.233503	(305,149)	(7,911,390)	(25,969,932)	0.005469	(139,295)	(1,369,657)	0.766497	(1,786,904)
	Checks			(3,052,131)	(3,052,131)	(7,911,390)		(1,369,657)			(1,786,904)

Adjustment to interest calculation to account for corrections as noted in Docket No. E-7, Sub 1265 Listebarger Supplemental Testimony and Exhibits filed 5/16/2022. -

Final Gross up of Return to Pretax for Vintage 2021 **(1,786,904)**

Note 1: Beginning Balances tie to Docket No. E-7, Sub 1265 Listebarger Supplemental Testimony and Exhibits filed 5/16/2022.

Duke Energy Carolinas, LLC
Docket Number E-7 Sub 1285
Estimated Return Calculation -Non - Residential DSM Programs Vintage 2021

NC Non- Residential DSM		Total System NC DSM Program Costs Incurred	NC Non- Residential DSM Allocation %	NC Allocated DSM Non-Residential Program Costs	Program Incentives	Total Costs	NC Non-Residential DSM Revenue Collected	NC Non-Residential DSM Program Collection %	Non-Residential DSM Program Costs Revenue Collected	(Over)/Under Collection
			Listebarger Exhibit 5 pg. 4, Line 10					100% used due to overcollection		
Beginning Balance[1]		32,876,164		12,956,111	3,144,740	16,100,851	18,905,431		(18,905,431)	(2,804,580)
2022	January	-	39.4088278%	-	(44)	(44)	645,727	100.0000000%	(645,727)	(645,771)
2022	February	-	39.4088278%	-	(44)	(44)	1,373,572	100.0000000%	(1,373,572)	(1,373,616)
2022	March	-	39.4088278%	-	(44)	(44)	1,410,702	100.0000000%	(1,410,702)	(1,410,746)
2022	April	-	39.4088278%	-	(44)	(44)	1,292,406	100.0000000%	(1,292,406)	(1,292,450)
2022	May	-	39.4088278%	-	(44)	(44)	1,368,591	100.0000000%	(1,368,591)	(1,368,635)
2022	June	-	39.4088278%	-	(44)	(44)	1,669,315	100.0000000%	(1,669,315)	(1,669,359)
2022	July	-	39.4088278%	-	(44)	(44)	1,720,836	100.0000000%	(1,720,836)	(1,720,880)
2022	August	-	39.4088278%	-	(44)	(44)	1,872,277	100.0000000%	(1,872,277)	(1,872,321)
2022	September	-	39.4088278%	-	(44)	(44)	1,716,913	100.0000000%	(1,716,913)	(1,716,957)
2022	October	-	39.4088278%	-	(44)	(44)	1,431,089	100.0000000%	(1,431,089)	(1,431,133)
2022	November	-	39.4088278%	-	(44)	(44)	1,316,574	100.0000000%	(1,316,574)	(1,316,618)
2022	December	-	39.4088278%	-	(44)	(44)	1,972,770	100.0000000%	(1,972,770)	(1,972,814)
		32,876,164		12,956,111	3,144,214	16,100,325	36,696,204		(36,696,204)	(20,595,879)

Vintage is overcollected. Interest is calculated on all components.

100% of all revenues offset the overcollected balance.

NC Non-Residential DSM		Cumulative (Over)/Under Recovery	Current Income Tax Rate	Monthly Deferred Income Tax	Cumulative Deferred Income Tax	Net Deferred After Tax Balance	Monthly Return	Monthly A/T Return on Deferral	YTD After Tax Interest	Gross up of Return to Pretax Rate	Gross up of Return to Pretax
			1/2022 - 12/2022				6.56%			0.766497	
Beginning Balance		(2,804,580)			(654,878)	(2,149,702)					
2022	January	(645,771)	0.233503	(150,789)	(805,667)	159,897	0.005469	(5,441)	(5,441)	0.766497	(7,099)
2022	February	(2,019,387)	0.233503	(320,744)	(1,126,411)	(892,976)	0.005469	(2,005)	(7,446)	0.766497	(9,714)
2022	March	(3,430,133)	0.233503	(329,413)	(1,455,824)	(1,974,309)	0.005469	(7,841)	(15,287)	0.766497	(19,944)
2022	April	(4,722,583)	0.233503	(301,791)	(1,757,615)	(2,964,968)	0.005469	(13,507)	(28,794)	0.766497	(37,565)
2022	May	(6,091,218)	0.233503	(319,580)	(2,077,195)	(4,014,022)	0.005469	(19,085)	(47,878)	0.766497	(62,464)
2022	June	(7,760,576)	0.233503	(389,800)	(2,466,996)	(5,293,581)	0.005469	(25,452)	(73,331)	0.766497	(95,670)
2022	July	(9,481,456)	0.233503	(401,831)	(2,868,826)	(6,612,630)	0.005469	(32,559)	(105,889)	0.766497	(138,147)
2022	August	(11,353,777)	0.233503	(437,193)	(3,306,019)	(8,047,758)	0.005469	(40,090)	(145,980)	0.766497	(190,450)
2022	September	(13,070,734)	0.233503	(400,915)	(3,706,934)	(9,363,801)	0.005469	(47,613)	(193,593)	0.766497	(252,569)
2022	October	(14,501,867)	0.233503	(334,174)	(4,041,107)	(10,460,760)	0.005469	(54,212)	(247,805)	0.766497	(323,296)
2022	November	(15,818,485)	0.233503	(307,434)	(4,348,542)	(11,469,944)	0.005469	(59,971)	(307,777)	0.766497	(401,536)
2022	December	(17,791,299)	0.233503	(460,658)	(4,809,200)	(12,982,100)	0.005469	(66,866)	(374,643)	0.766497	(488,773)
	Checks			(4,154,322)	(4,154,322)	(4,809,200)		(374,643)			(488,773)

Adjustment to interest calculation to account for corrections as noted in Docket No. E-7, Sub 1265 Listebarger Supplemental Testimony and Exhibits filed 5/16/2022. 12

Final Gross up of Return to Pretax for Vintage 2021 **(488,760)**

Note 1: Beginning Balances tie to Docket No. E-7, Sub 1265 Listebarger Supplemental Testimony and Exhibits filed 5/16/2022.

Duke Energy Carolinas, LLC
Docket Number E-7 Sub 1285
Estimated Return Calculation - Residential EE Programs Vintage 2022

NC Residential EE		Residential EE Program Costs Incurred	NC Allocation %	NC Allocated EE Program Costs	Program Incentives	Lost Revenues	Total Costs	NC Residential Revenue Collected	NC Residential EE Program Collection %	EE Program Costs Revenue Collected	(Over)/Under Collection
			Listebarger Exhibit 5 pg. 5, Line 4						100% used due to overcollection		
2022	January	1,214,369	73.8925998%	897,329	116,185	585,834	1,599,348	2,242,737	100.0000%	(2,242,737)	(643,389)
2022	February	4,170,134	73.8925998%	3,081,420	398,980	2,011,748	5,492,149	6,737,028	100.0000%	(6,737,028)	(1,244,879)
2022	March	3,836,886	73.8925998%	2,835,175	367,096	1,850,983	5,053,255	5,203,843	100.0000%	(5,203,843)	(150,589)
2022	April	2,301,606	73.8925998%	1,700,716	220,208	1,110,336	3,031,260	4,207,109	100.0000%	(4,207,109)	(1,175,849)
2022	May	3,394,836	73.8925998%	2,508,532	324,803	1,637,730	4,471,066	4,205,234	100.0000%	(4,205,234)	265,832
2022	June	4,654,060	73.8925998%	3,439,006	445,280	2,245,203	6,129,489	5,591,193	100.0000%	(5,591,193)	538,295
2022	July	3,622,279	73.8925998%	2,676,596	346,564	1,747,453	4,770,613	6,445,441	100.0000%	(6,445,441)	(1,674,828)
2022	August	3,009,121	73.8925998%	2,223,518	287,899	1,451,654	3,963,071	7,020,565	100.0000%	(7,020,565)	(3,057,494)
2022	September	4,573,148	73.8925998%	3,379,218	437,539	2,206,169	6,022,926	5,814,303	100.0000%	(5,814,303)	208,623
2022	October	3,625,286	73.8925998%	2,678,818	346,851	1,748,903	4,774,573	4,023,485	100.0000%	(4,023,485)	751,088
2022	November	3,724,805	73.8925998%	2,752,355	356,373	1,796,913	4,905,642	3,941,327	100.0000%	(3,941,327)	964,314
2022	December	4,625,763	73.8925998%	3,418,096	442,573	2,231,552	6,092,220	10,036,196	100.0000%	(10,036,196)	(3,943,976)
		42,752,292		31,590,780	4,090,352	20,624,479	56,305,611	65,468,461		(65,468,461)	(9,162,850)

Vintage is overcollected. Interest is calculated on all components.

100% of all revenues offset the overcollected balance.

NC Residential EE		Cumulative (Over)/Under Recovery	Current Income Tax Rate	Monthly Deferred Income Tax	Cumulative Deferred Income Tax	Net Deferred After Tax Balance	Monthly Return	Monthly A/T Return on Deferral	YTD After Tax Interest	Gross up of Return to Pretax Rate	Gross up of Return to Pretax
			1/2022 - 12/2022				6.56%			0.766497	
2022	January	(643,389)	0.233503	(150,233)	(150,233)	(493,156)	0.005469	(1,349)	(1,349)	0.766497	(1,759)
2022	February	(1,888,268)	0.233503	(290,683)	(440,916)	(1,447,352)	0.005469	(5,306)	(6,655)	0.766497	(8,682)
2022	March	(2,038,857)	0.233503	(35,163)	(476,079)	(1,562,778)	0.005469	(8,231)	(14,887)	0.766497	(19,422)
2022	April	(3,214,706)	0.233503	(274,564)	(750,643)	(2,464,062)	0.005469	(11,012)	(25,898)	0.766497	(33,788)
2022	May	(2,948,874)	0.233503	62,073	(688,571)	(2,260,303)	0.005469	(12,919)	(38,817)	0.766497	(50,643)
2022	June	(2,410,579)	0.233503	125,694	(562,877)	(1,847,701)	0.005469	(11,234)	(50,051)	0.766497	(65,299)
2022	July	(4,085,407)	0.233503	(391,077)	(953,955)	(3,131,452)	0.005469	(13,616)	(63,667)	0.766497	(83,062)
2022	August	(7,142,900)	0.233503	(713,934)	(1,667,889)	(5,475,012)	0.005469	(23,535)	(87,202)	0.766497	(113,767)
2022	September	(6,934,277)	0.233503	48,714	(1,619,174)	(5,315,103)	0.005469	(29,507)	(116,709)	0.766497	(152,263)
2022	October	(6,183,189)	0.233503	175,381	(1,443,793)	(4,739,396)	0.005469	(27,495)	(144,204)	0.766497	(188,133)
2022	November	(5,218,875)	0.233503	225,170	(1,218,623)	(4,000,252)	0.005469	(23,899)	(168,103)	0.766497	(219,313)
2022	December	(9,162,850)	0.233503	(920,930)	(2,139,553)	(7,023,297)	0.005469	(30,145)	(198,248)	0.766497	(258,641)
	Checks			(2,139,553)	(2,139,553)	(2,139,553)		(198,248)			(258,641)

Duke Energy Carolinas, LLC
Docket Number E-7 Sub 1285
Estimated Return Calculation - Residential DSM Programs Vintage 2022

NC Residential DSM		Total System NC DSM Program Costs Incurred	NC Allocation %	NC Allocated EE Program Costs	NC Residential Revenue Collected	NC Residential EE Program Collection %	EE Program Costs Revenue Collected	(Over)/Under Collection
			Listebarger Exhibit 5 pg. 5, Line 8			See calc. at right		
2022	January	606,298	72.9576004%	442,340	546,633	78.9757%	(431,707)	10,633
2022	February	655,186	72.9576004%	478,008	1,642,049	78.9757%	(1,296,819)	(818,811)
2022	March	626,983	72.9576004%	457,432	1,268,359	78.9757%	(1,001,695)	(544,263)
2022	April	1,555,082	72.9576004%	1,134,551	1,025,420	78.9757%	(809,832)	324,719
2022	May	696,737	72.9576004%	508,322	1,024,963	78.9757%	(809,471)	(301,149)
2022	June	591,490	72.9576004%	431,537	1,362,769	78.9757%	(1,076,256)	(644,719)
2022	July	3,178,324	72.9576004%	2,318,829	1,570,979	78.9757%	(1,240,691)	1,078,138
2022	August	2,765,679	72.9576004%	2,017,773	1,711,157	78.9757%	(1,351,398)	666,375
2022	September	2,674,591	72.9576004%	1,951,317	1,417,149	78.9757%	(1,119,203)	832,114
2022	October	3,138,931	72.9576004%	2,290,089	980,664	78.9757%	(774,486)	1,515,603
2022	November	827,525	72.9576004%	603,743	960,639	78.9757%	(758,671)	(154,929)
2022	December	508,374	72.9576004%	370,897	2,446,172	78.9757%	(1,931,881)	(1,560,984)
		17,825,199		13,004,838	15,956,954		(12,602,111)	402,727

Program Costs to be Recovered	13,004,838
Revenue Requirement	16,466,892
% Revenue related to Program Costs	78.9757%

NC Residential DSM		Cumulative (Over)/Under Recovery	Current Income Tax Rate	Monthly Deferred Income Tax	Cumulative Deferred Income Tax	Net Deferred After Tax Balance	Monthly Return	Monthly A/T Return on Deferral	YTD After Tax Interest	Gross up of Return to Pretax Rate	Gross up of Return to Pretax
			1/2022 - 12/2022				6.56%			0.766497	
2022	January	10,633	0.233503	2,483	2,483	8,150	0.005469	22	22	0.766497	29
2022	February	(808,178)	0.233503	(191,195)	(188,712)	(619,466)	0.005469	(1,672)	(1,649)	0.766497	(2,152)
2022	March	(1,352,441)	0.233503	(127,087)	(315,799)	(1,036,642)	0.005469	(4,529)	(6,178)	0.766497	(8,060)
2022	April	(1,027,723)	0.233503	75,823	(239,976)	(787,746)	0.005469	(4,989)	(11,167)	0.766497	(14,569)
2022	May	(1,328,871)	0.233503	(70,319)	(310,295)	(1,018,576)	0.005469	(4,940)	(16,107)	0.766497	(21,013)
2022	June	(1,973,591)	0.233503	(150,544)	(460,839)	(1,512,751)	0.005469	(6,922)	(23,029)	0.766497	(30,044)
2022	July	(895,453)	0.233503	251,748	(209,091)	(686,362)	0.005469	(6,014)	(29,042)	0.766497	(37,890)
2022	August	(229,078)	0.233503	155,601	(53,490)	(175,588)	0.005469	(2,357)	(31,400)	0.766497	(40,965)
2022	September	603,036	0.233503	194,301	140,811	462,226	0.005469	784	(30,616)	0.766497	(39,942)
2022	October	2,118,639	0.233503	353,898	494,709	1,623,931	0.005469	5,705	(24,911)	0.766497	(32,500)
2022	November	1,963,710	0.233503	(36,176)	458,532	1,505,178	0.005469	8,557	(16,354)	0.766497	(21,336)
2022	December	402,727	0.233503	(364,494)	94,038	308,689	0.005469	4,960	(11,394)	0.766497	(14,865)
	Checks			94,038	94,038	94,038		(11,394)			(14,865)

Duke Energy Carolinas, LLC
Docket Number E-7 Sub 1285
Estimated Return Calculation - Non- Residential EE Programs Vintage 2022

NC Non- Residential EE		Non-Residential EE Program Costs Incurred	NC Allocation %	NC Allocated EE Program Costs	Program Incentives	Lost Revenues	Total Costs	NC Residential Revenue Collected	NC Non-Residential EE Program Collection %	Non-Residential EE Program Costs Revenue Collected	(Over)/Under Collection
			Listebarger Exhibit 5 pg 5, Line 4						100% used due to overcollection		
2022	January	3,270,770	73.8925998%	2,416,857	514,961	(83,862)	2,847,956	2,428,124	100.0000000%	(2,428,124)	419,831
2022	February	3,369,866	73.8925998%	2,490,081	530,563	(86,403)	2,934,241	4,960,670	100.0000000%	(4,960,670)	(2,026,429)
2022	March	4,658,859	73.8925998%	3,442,552	733,506	(119,453)	4,056,606	5,010,684	100.0000000%	(5,010,684)	(954,078)
2022	April	3,863,126	73.8925998%	2,854,565	608,224	(99,050)	3,363,738	4,535,727	100.0000000%	(4,535,727)	(1,171,989)
2022	May	2,785,650	73.8925998%	2,058,389	438,582	(71,424)	2,425,547	4,874,727	100.0000000%	(4,874,727)	(2,449,179)
2022	June	3,108,254	73.8925998%	2,296,769	489,374	(79,695)	2,706,448	5,794,636	100.0000000%	(5,794,636)	(3,088,188)
2022	July	3,003,595	73.8925998%	2,219,434	472,896	(77,012)	2,615,319	6,066,153	100.0000000%	(6,066,153)	(3,450,835)
2022	August	2,842,552	73.8925998%	2,100,436	447,541	(72,883)	2,475,094	6,677,888	100.0000000%	(6,677,888)	(4,202,794)
2022	September	3,191,286	73.8925998%	2,358,124	502,447	(81,824)	2,778,746	6,114,285	100.0000000%	(6,114,285)	(3,335,538)
2022	October	3,396,262	73.8925998%	2,509,586	534,719	(87,080)	2,957,226	4,912,608	100.0000000%	(4,912,608)	(1,955,383)
2022	November	2,781,223	73.8925998%	2,055,118	437,885	(71,310)	2,421,693	4,507,723	100.0000000%	(4,507,723)	(2,086,031)
2022	December	3,207,420	73.8925998%	2,370,046	504,987	(82,238)	2,792,795	7,235,553	100.0000000%	(7,235,553)	(4,442,758)
NR E-2, Sub 1180 Adjustment (AEC)[1]		468,065	100.0000000%	468,065			468,065			-	468,065
		39,946,926		29,640,022	6,215,684	(1,012,233)	34,843,473	63,118,778		(63,118,778)	(28,275,305)

Vintage is overcollected. Interest is calculated on all components.

100% of all revenues offset the overcollected balance.

NC Non-Residential EE		Cumulative (Over)/Under Recovery	Current Income Tax Rate	Monthly Deferred Income Tax	Cumulative Deferred Income Tax	Net Deferred After Tax Balance	Monthly Return	Monthly A/T Return on Deferral	YTD After Tax Interest	Gross up of Return to Pretax Rate	Gross up of Return to Pretax
			1/2022 - 12/2022				6.56%			0.766497	
2022	January	419,831	0.233503	98,032	98,032	321,799	0.005469	880	880	0.766497	1,148
2022	February	(1,606,598)	0.233503	(473,177)	(375,145)	(1,231,452)	0.005469	(2,488)	(1,608)	0.766497	(2,097)
2022	March	(2,560,675)	0.233503	(222,780)	(597,925)	(1,962,750)	0.005469	(8,735)	(10,342)	0.766497	(13,493)
2022	April	(3,732,664)	0.233503	(273,663)	(871,588)	(2,861,076)	0.005469	(13,191)	(23,534)	0.766497	(30,703)
2022	May	(6,181,843)	0.233503	(571,891)	(1,443,479)	(4,738,364)	0.005469	(20,781)	(44,315)	0.766497	(57,815)
2022	June	(9,270,031)	0.233503	(721,101)	(2,164,580)	(7,105,451)	0.005469	(32,388)	(76,703)	0.766497	(100,069)
2022	July	(12,720,865)	0.233503	(805,780)	(2,970,360)	(9,750,505)	0.005469	(46,094)	(122,797)	0.766497	(160,205)
2022	August	(16,923,660)	0.233503	(981,365)	(3,951,725)	(12,971,934)	0.005469	(62,137)	(184,933)	0.766497	(241,271)
2022	September	(20,259,198)	0.233503	(778,858)	(4,730,583)	(15,528,614)	0.005469	(77,937)	(262,871)	0.766497	(342,951)
2022	October	(22,214,581)	0.233503	(456,588)	(5,187,171)	(17,027,409)	0.005469	(89,027)	(351,898)	0.766497	(459,099)
2022	November	(24,300,611)	0.233503	(487,094)	(5,674,266)	(18,626,346)	0.005469	(97,498)	(449,396)	0.766497	(586,299)
2022	December	(28,275,305)	0.233503	(928,103)	(6,602,368)	(21,672,936)	0.005469	(110,202)	(559,598)	0.766497	(730,073)
	Checks			(6,602,368)	(6,602,368)	(6,602,368)		(559,598)			(730,073)

Note 1: AEC Yield Capital, LLC Settlement Adjustment. See Docket No. E-2, Sub 1180 for additional details

/A

Duke Energy Carolinas, LLC
Docket Number E-7 Sub 1285
Estimated Return Calculation -Non - Residential DSM Programs Vintage 2022

NC Non- Residential DSM		Total System NC DSM Program Costs Incurred	NC Non- Residential DSM Allocation %	NC Allocated DSM Non-Residential Program Costs	Program Incentives	Total Costs	NC Non-Residential DSM Revenue Collected	NC Non-Residential DSM Program Collection %	Non-Residential DSM Program Costs Revenue Collected	(Over)/Under Collection
			Listebarger Exhibit 5 pg. 5, Line 8					100% used due to overcollection		
2022	January	1,334,791	72.9576004%	973,831	228,875	1,202,707	645,727	100.0000000%	(645,727)	556,980
2022	February	1,290,558	72.9576004%	941,560	228,875	1,170,436	1,373,572	100.0000000%	(1,373,572)	(203,137)
2022	March	1,543,170	72.9576004%	1,125,860	228,875	1,354,735	1,410,702	100.0000000%	(1,410,702)	(55,967)
2022	April	1,557,950	72.9576004%	1,136,643	228,875	1,365,518	1,292,406	100.0000000%	(1,292,406)	73,112
2022	May	1,635,680	72.9576004%	1,193,353	228,875	1,422,229	1,368,591	100.0000000%	(1,368,591)	53,637
2022	June	1,783,909	72.9576004%	1,301,497	228,875	1,530,373	1,669,315	100.0000000%	(1,669,315)	(138,942)
2022	July	1,816,373	72.9576004%	1,325,182	228,875	1,554,057	1,720,836	100.0000000%	(1,720,836)	(166,779)
2022	August	1,793,959	72.9576004%	1,308,829	228,875	1,537,705	1,872,277	100.0000000%	(1,872,277)	(334,572)
2022	September	1,792,392	72.9576004%	1,307,686	228,875	1,536,561	1,716,913	100.0000000%	(1,716,913)	(180,352)
2022	October	1,769,565	72.9576004%	1,291,032	228,875	1,519,908	1,431,089	100.0000000%	(1,431,089)	88,818
2022	November	1,875,715	72.9576004%	1,368,477	228,875	1,597,352	1,316,574	100.0000000%	(1,316,574)	280,778
2022	December	1,965,324	72.9576004%	1,433,854	228,875	1,662,729	1,972,770	100.0000000%	(1,972,770)	(310,041)
		20,159,387		14,707,805	2,746,505	17,454,309	17,790,773		(17,790,773)	(336,464)

Vintage is overcollected. Interest is calculated on all components.

100% of all revenues offset the overcollected balance.

NC Non-Residential DSM		Cumulative (Over)/Under Recovery	Current Income Tax Rate	Monthly Deferred Income Tax	Cumulative Deferred Income Tax	Net Deferred After Tax Balance	Monthly Return	Monthly A/T Return on Deferral	YTD After Tax Interest	Gross up of Return to Pretax Rate	Gross up of Return to Pretax
			1/2022 - 12/2022				6.56%			0.766497	
2022	January	556,980	0.233503	130,056	130,056	426,923	0.005469	1,167	1,167	0.766497	1,523
2022	February	353,843	0.233503	(47,433)	82,623	271,220	0.005469	1,909	3,077	0.766497	4,014
2022	March	297,876	0.233503	(13,068)	69,555	228,321	0.005469	1,366	4,443	0.766497	5,796
2022	April	370,988	0.233503	17,072	86,627	284,361	0.005469	1,402	5,845	0.766497	7,625
2022	May	424,626	0.233503	12,525	99,151	325,474	0.005469	1,668	7,512	0.766497	9,801
2022	June	285,684	0.233503	(32,443)	66,708	218,976	0.005469	1,489	9,001	0.766497	11,743
2022	July	118,905	0.233503	(38,943)	27,765	91,141	0.005469	848	9,849	0.766497	12,850
2022	August	(215,667)	0.233503	(78,124)	(50,359)	(165,308)	0.005469	(203)	9,646	0.766497	12,585
2022	September	(396,019)	0.233503	(42,113)	(92,472)	(303,547)	0.005469	(1,282)	8,364	0.766497	10,912
2022	October	(307,201)	0.233503	20,739	(71,732)	(235,468)	0.005469	(1,474)	6,890	0.766497	8,989
2022	November	(26,423)	0.233503	65,563	(6,170)	(20,253)	0.005469	(699)	6,191	0.766497	8,077
2022	December	(336,464)	0.233503	(72,396)	(78,565)	(257,899)	0.005469	(761)	5,430	0.766497	7,085
	Checks			(78,565)	(78,565)	(78,565)		5,430			7,085

Miller Exhibit 4

Duke Energy Carolinas, LLC
DSM/EE Actual Revenues Collected from Years 2018-2022 (By Vintage)
and Estimated 2023 Collections from Rider 14 (by Vintage)
Docket Number E-7 Sub 1285
For Vintage Year 2018-2023 Estimate and True Up Calculations

Line		Vintage	Actual 2018 Rider 9	Actual 2019 Rider 10	Actual 2020 Rider 11	Actual 2021 Rider 12	Actual 2022 Rider 13	Estimated 2023 Rider 14 [1]	Total
	Residential								
	EE/DSM								
1		Year 2018	83,631,851	6,302,019	25,246,924	2,818,706	2,989,120	(85,952)	120,902,668
2		Year 2019		77,019,837	5,256,186	29,067,535	1,213,627	932,159	113,489,344
3		Year 2020			67,080,991	4,559,292	15,057,971	3,468,367	90,166,622
4		Year 2021				81,992,905	6,405,256	(18,377,366)	70,020,796
5		Year 2022					81,425,415	6,791,458	88,216,873
6		Year 2023						84,573,451	84,573,451
7	**Total Residential**		$ 83,631,851	$ 83,321,856	$ 97,584,101	$ 118,438,439	$ 107,091,390	$ 77,302,116	$ 567,369,753
	Non-Residential								
	EE								
8		Year 2018	51,998,801	12,546,122	12,186,589	1,712,636	485,022	(320,076)	78,609,094
9		Year 2019		52,862,599	8,227,202	6,920,864	(4,509,335)	991,170	64,492,500
10		Year 2020			43,995,402	9,965,893	(6,410,925)	3,671,208	51,221,578
11		Year 2021				50,564,874	13,286,874	(2,405,825)	61,445,924
12		Year 2022					63,118,778	15,132,477	78,251,255
13		Year 2023						65,754,588	65,754,588
	DSM								
14		Year 2018	14,074,924	777,733	1,176,239	(168,075)	310,867	(33,719)	16,137,969
15		Year 2019		15,674,069	268,398	288,613	(240,150)	57,653	16,048,584
16		Year 2020			17,715,486	36,636	(1,935,115)	(33,042)	15,783,965
17		Year 2021				18,905,431	877,592	(2,882,715)	16,900,308
18		Year 2022					17,790,773	-	17,790,773
19		Year 2023						16,408,519	16,408,519
20	**Total Non-Residential**		$ 66,073,725	$ 81,860,522	$ 83,569,317	$ 88,226,872	$ 82,774,382	$ 96,340,240	$ 498,845,058
21	**Total Revenue**		**$ 149,705,576**	**$ 165,182,379**	**$ 181,153,418**	**$ 206,665,311**	**$ 189,865,772**	**$ 173,642,356**	**$ 1,066,214,811**

[1] Rider 14 estimates are based on Order issued in Docket No. E-7 Sub 1265 dated 12/12/2022.

Duke Energy Carolinas, LLC
Vintage Year 2018 Allocation Factors for the Period January 1, 2018 - December 31, 2018
Docket Number E-7 Sub 1285
Allocation Factors

Line			MWH		
	New Mechanism Sales Allocator at Generator				
1	NC Retail MWH Sales Allocation	Company Records	58,534,269		
2	SC Retail MWH Sales Allocation	Company Records	21,966,093		
3	Total Retail	Line 1 + Line 2	80,500,362		
	Allocation 1 to state based on kWh sales				
4	NC Retail	Line 1 / Line 3	**72.7130507%**		
	Demand Allocators		**NC**	**SC**	**Total**
5	Residential	Company Records	5,078,308	1,617,566	6,695,874
6	Non Residential	Company Records	6,549,145	2,546,981	9,096,126
7	Total	Line 5 + Line 6	11,627,453	4,164,547	15,792,000
	Allocation 2 to state based on peak demand				
8	NC Retail	Line 7, NC / Line 7 Total	**73.6287551%**		
	Allocation 3 NC res vs non-res Peak Demand to retail system peak				
9	NC Residential	Line 5 NC/ Line 7 Total	**32.1574721%**		
10	NC Non-residential	Line 6 NC/ Line 7 Total	**41.4712829%**		

Duke Energy Carolinas, LLC
Vintage Year 2019 Allocation Factors for the Period January 1, 2019 - December 31, 2019
Docket Number E-7 Sub 1285
Allocation Factors

Line			MWH		
	New Mechanism Sales Allocator at Generator				
1	NC Retail MWH Sales Allocation	Company Records	62,147,533		
2	SC Retail MWH Sales Allocation	Company Records	22,880,788		
3	Total Retail	Line 1 + Line 2	85,028,321		
	Allocation 1 to state based on kWh sales				
4	NC Retail	Line 1 / Line 3	**73.0903918%**		
	Demand Allocators		**NC**	**SC**	**Total**
5	Residential	Company Records	5,420,002	1,681,673	7,101,675
6	Non Residential	Company Records	6,373,991	2,410,334	8,784,325
7	Total	Line 5 + Line 6	11,793,993	4,092,007	15,886,000
	Allocation 2 to state based on peak demand				
8	NC Retail	Line 7, NC / Line 7 Total	**74.2414264%**		
	Allocation 3 NC res vs non-res Peak Demand to retail system peak				
9	NC Residential	Line 5 NC/ Line 7 Total	**34.1181040%**		
10	NC Non-residential	Line 6 NC/ Line 7 Total	**40.1233224%**		

Duke Energy Carolinas, LLC
Vintage Year 2020 Allocation Factors for the Period January 1, 2020 - December 31, 2020
Docket Number E-7 Sub 1285
Allocation Factors

Line	New Mechanism Sales Allocator at Generator		MWH		
1	NC Retail MWH Sales Allocation	Company Records	61,250,523		
2	SC Retail MWH Sales Allocation	Company Records	22,400,744		
3	Total Retail	Line 1 + Line 2	83,651,267		
	Allocation 1 to state based on kWh sales				
4	NC Retail	Line 1 / Line 3	**73.2212736%**		
	Demand Allocators		**NC**	**SC**	**Total**
5	Residential	Company Records	5,410,460	1,632,146	7,042,606
6	Non Residential	Company Records	6,495,667	2,508,727	9,004,394
7	Total	Line 5 + Line 6	11,906,127	4,140,873	16,047,000
	Allocation 2 to state based on peak demand				
8	NC Retail	Line 7, NC / Line 7 Total	**74.1953449%**		
	Allocation 3 NC res vs non-res Peak Demand to retail system peak				
9	NC Residential	Line 5 NC/ Line 7 Total	**33.7163333%**		
10	NC Non-residential	Line 6 NC/ Line 7 Total	**40.4790117%**		

Duke Energy Carolinas, LLC
Vintage Year 2021 Allocation Factors for the Period January 1, 2021 - December 31, 2021
Docket Number E-7 Sub 1285
Allocation Factors

Line			MWH		
	New Mechanism Sales Allocator at Generator				
1	NC Retail MWH Sales Allocation	Company Records	59,254,276		
2	SC Retail MWH Sales Allocation	Company Records	21,338,163		
3	Total Retail	Line 1 + Line 2	80,592,439		
	Allocation 1 to state based on kWh sales				
4	NC Retail	Line 1 / Line 3	**73.5233682%**		
	Demand Allocators		**NC**	**SC**	**Total**
5	Residential	Company Records	5,482,921	1,710,195	7,193,116
6	Non Residential	Company Records	6,182,851	2,313,033	8,495,884
7	Total	Line 5 + Line 6	11,665,772	4,023,228	15,689,000
	Allocation 2 to state based on peak demand				
8	NC Retail	Line 7, NC / Line 7 Total	**74.3563771%**		
	Allocation 3 NC res vs non-res Peak Demand to retail system peak				
9	NC Residential	Line 5 NC/ Line 7 Total	**34.9475492%**		
10	NC Non-residential	Line 6 NC/ Line 7 Total	**39.4088278%**		

Duke Energy Carolinas, LLC
Vintage Year 2022 Allocation Factors for the Period January 1, 2022 - December 31, 2024
Docket Number E-7 Sub 1285
Allocation Factors

Line			MWH		
	New Mechanism Sales Allocator at Generator				
1	NC Retail MWH Sales Allocation	Company Records	61,896,779		
2	SC Retail MWH Sales Allocation	Company Records	21,869,091		
3	Total Retail	Line 1 + Line 2	83,765,870		
	Allocation 1 to state based on kWh sales				
4	NC Retail	Line 1 / Line 3	**73.8925998%**		
	Demand Allocators		**NC**	**SC**	**Total**
5	Residential	Company Records	5,400,475	1,733,638	7,134,113
6	Non Residential	Company Records	6,080,133	2,521,754	8,601,887
7	Total	Line 5 + Line 6	11,480,608	4,255,392	15,736,000
	Allocation 2 to state based on peak demand				
8	NC Retail	Line 7, NC / Line 7 Total	**72.9576004%**		
	Allocation 3 NC res vs non-res Peak Demand to retail system peak				
9	NC Residential	Line 5 NC/ Line 7 Total	**34.3192361%**		
10	NC Non-residential	Line 6 NC/ Line 7 Total	**38.6383643%**		

Duke Energy Carolinas, LLC
DSM/EE Cost Recovery Rider 15
Docket Number E-7 Sub 1285
Forecasted 2024 kWh Sales for Rate Period for Vintage Years 2018-2024

Line	**Fall 2022 Sales Forecast - kWhs**	**Forecasted 2024 sales**
	North Carolina Retail:	
1	Residential	**23,664,202,369**
2	Non-Residential	**36,883,342,167**
3	Total Retail	**60,547,544,537**

Line	**NC Opt Out Sales**	**Total Usage**	**Opt-Outs**	**Net Usage**
	Vintage 2018 Actual Opt Out			
4	EE	36,883,342,167	19,725,411,891	17,157,930,277
5	DSM	36,883,342,167	18,366,666,314	18,516,675,854
	Vintage 2019 Actual Opt Out			
6	EE	36,883,342,167	19,747,086,762	17,136,255,406
7	DSM	36,883,342,167	18,313,121,252	18,570,220,915
	Vintage 2020 Actual Opt Out			
8	EE	36,883,342,167	20,307,553,070	16,575,789,097
9	DSM	36,883,342,167	18,247,943,500	18,635,398,667
	Vintage 2021 Actual Opt Out			
10	EE	36,883,342,167	20,231,293,467	16,652,048,700
11	DSM	36,883,342,167	18,206,240,410	18,677,101,757
	Vintage 2022 Actual Opt Out			
12	EE	36,883,342,167	20,139,148,287	16,744,193,880
13	DSM	36,883,342,167	18,027,771,399	18,855,570,769
	Vintage 2023 Estimated Opt Out			
14	EE	36,883,342,167	19,228,100,842	17,655,241,326
15	DSM	36,883,342,167	17,824,193,674	19,059,148,493
	Vintage 2024 Estimated Opt Out			
16	EE	36,883,342,167	19,228,100,842	17,655,241,326
17	DSM	36,883,342,167	17,824,193,674	19,059,148,493

RIDER EE (NC)
ENERGY EFFICIENCY RIDER

APPLICABILITY (North Carolina Only)

Service supplied under the Company's rate schedules is subject to approved adjustments for new energy efficiency and demand-side management programs approved by the North Carolina Utilities Commission (NCUC). The Rider Adjustments are not included in the Rate Schedules of the Company and therefore, must be applied to the bill as calculated under the applicable rate.

As of January 1, 2024, cost recovery under Rider EE consists of the four-year term program, years 2014-2017, as well as rates under the continuation of that program for years 2018-2024 as outlined below. This Rider applies to service supplied under all rate schedules, except rate schedules OL, PL and NL for program years 2017-2024.

GENERAL PROVISIONS

This Rider will recover the cost of new energy efficiency and demand-side management programs beginning January 1, 2014, using the method approved by the NCUC as set forth in Docket No. E-7, Sub 1032, Order dated October 29, 2013, and as revised by Docket No. E-7, Sub 1130, Order dated August 23, 2017, and Docket No. E-7, Sub 1032, Order dated October 20, 2020.

TRUE-UP PROVISIONS

Rider amounts will initially be determined based on estimated kW and kWh impacts related to expected customer participation in the programs, and will be trued-up as actual customer participation and actual kW and kWh impacts are verified. If a customer participates in any vintage of programs, the customer is subject to the true-ups as discussed in this section for any vintage of programs in which the customer participated.

RIDER EE OPT OUT PROVISION FOR QUALIFYING NON-RESIDENTIAL CUSTOMERS

The Rider EE increment applicable to energy efficiency programs and/or demand-side management programs will not be applied to the energy charge of the applicable rate schedule for customers qualified to opt out of the programs where:

a. The customer has notified the Company that it has implemented, or has plans for implementing, alternative energy efficiency measures in accordance with quantifiable goals.
b. Electric service to the customer must be provided under:
   1. An electric service agreement where the establishment is classified as a "manufacturing industry" by the Standard Industrial Classification Manual published by the United States Government and where more than 50% of the electric energy consumption of such establishment is used for its manufacturing processes. Additionally, all other agreements billed to the same entity associated with the manufacturing industry located on the same or contiguous properties are also eligible to opt out.
   2. An electric service agreement for general service as provided for under the Company's rate schedules where the customer's annual energy use is 1,000,000 kilowatt hours or more. Additionally, all other agreements billed to the same entity with lesser annual usage located on the same or contiguous properties are also eligible to opt out.

The following additional provisions apply for qualifying customers who elect to opt out:

For customers who elect to opt out of energy efficiency programs, the following provisions also apply:

- Qualifying customers may opt out of the Company's energy efficiency programs each calendar year only during the annual two-month enrollment period between November 1 and December 31 immediately prior to a new Rider EE becoming effective on January 1. (Qualifying new customers have sixty days after beginning service to optout.)
- Customers may not opt out of individual energy efficiency programs offered by the Company. The choice to opt out applies to the Company's entire portfolio of energy efficiency programs.
- If a customer participates in any vintage of energy efficiency programs, the customer, irrespective of future opt out decisions, remains obligated to pay the remaining portion of the lost revenues for each vintage of energy efficiency programs in which the customer participated.

RIDER EE (NC)
ENERGY EFFICIENCY RIDER

- Customers who elect to opt out during the two-month annual enrollment period immediately prior to the new Rider EE becoming effective may elect to opt in to the Company's energy efficiency programs during the first 5 business days of March each calendar year. Customers making this election will be back-billed retroactively to the effective date of the new Rider EE.

For customers who elect to opt out of demand-side management programs, the following provisions also apply:

- Qualifying customers may opt out of the Company's demand-side management program during the enrollment period between November 1 and December 31 immediately prior to a new Rider EE becoming effective on January 1 of the applicable year. (Qualifying new customers have sixty days after beginning service to opt out.)
- If a customer elects to participate in a demand-side management program, the customer may not subsequently choose to opt out of demand-side management programs for three years.
- Customers who elect to opt out during the two-month annual enrollment period immediately prior to the new Rider EE becoming effective may elect to opt in to the Company's demand-side management program during the first 5 business days of March each calendar year. Customers making this election will be back-billed to the effective date of the new Rider EE.

Any qualifying non-residential customer that has not participated in an energy efficiency or demand-side management program may opt out during any enrollment period, and has no further responsibility to pay Rider EE amounts associated with the customer's opt out election for energy efficiency and/or demand-side management programs.

ENERGY EFFICIENCY RIDER ADJUSTMENTS (EEA) FOR ALL PROGRAM YEARS

The Rider EE amounts applicable to the residential and nonresidential rate schedules for the period January 1, 2024 through December 31, 2024 including utility assessments are as follows:

Residential

Vintage 2016[1], 2017[1], 2018[1], 2019[1], 2020[1], 2021[1], 2022[1]	(0.0503) ¢ per kWh
Vintage 2021[2], 2022[2], 2023[2], 2024[2]	0.4320 ¢ per kWh
Total Residential Rate	0.3817 ¢ per kWh

Nonresidential

Vintage 2018[3]	
Energy Efficiency	(0.0001) ¢ per kWh
Demand Side Management	0.0000 ¢ per kWh
Vintage 2019[3]	
Energy Efficiency	(0.0014) ¢ per kWh
Demand Side Management	(0.0001) ¢ per kWh
Vintage 2020[3]	
Energy Efficiency	(0.0068) ¢ per kWh
Demand Side Management	0.0002 ¢ per kWh
Vintage 2021[3]	
Energy Efficiency	0.0231 ¢ per kWh
Demand Side Management	(0.0073) ¢ per kWh
Vintage 2022[3]	
Energy Efficiency	(0.1264) ¢ per kWh
Demand Side Management	(0.0017) ¢ per kWh

RIDER EE (NC)
ENERGY EFFICIENCY RIDER

Vintage 2023[3]	
Energy Efficiency	0.0802 ¢ per kWh
Demand Side Management	0.0000 ¢ per kWh
Vintage 2024[3]	
Energy Efficiency	0.3869 ¢ per kWh
Demand Side Management	0.0897 ¢ per kWh
Total Nonresidential Rate	0.4363 ¢ per kWh

[1] Includes the true-up of program costs, shared savings and lost revenues from Vintages 2016, 2017, 2018, 2019, 2020, 2021 and 2022

[2] Includes prospective component of Vintages 2021, 2022, 2023 and 2024

[3] Not applicable to Rate Schedules OL, PL and NL

Each factor listed under Nonresidential is applicable to nonresidential customers who are not eligible to opt out and to eligible customers who have not opted out. If a nonresidential customer has opted out of a Vintage(s), then the applicable energy efficiency and/or demand-side management charge(s) shown above for the Vintage(s) during which the customer has opted out will not apply to the bill.

/A

Revissed Miller Exhibit 1, page 1

DSM/EE Cost Recovery Rider 15
Docket Number E-7 Sub 1285
Exhibit Summary of Rider EE Exhibits and Factors

Residential Billing Factor for Rider 15 True-up (EMF) Components

Line			
1	Year 2016 EE/DSM True-Up (EMF) Revenue Requirement	Miller Exhibit 2 2016, Line 15	$ (64,617)
2	Year 2017 EE/DSM True-Up (EMF) Revenue Requirement	Miller Exhibit 2 2017, Line 15	$ (762,210)
3	Year 2018 EE/DSM True-Up (EMF) Revenue Requirement	Miller Exhibit 2 pg 1, Line 15	(395,816)
4	Year 2019 EE/DSM True-Up (EMF) Revenue Requirement	Miller Exhibit 2 pg 2, Line 15	(422,560)
5	Year 2020 EE/DSM True-Up (EMF) Revenue Requirement	Miller Exhibit 2 pg 3, Line 15	(1,106,993)
6	Year 2021 EE/DSM True-Up (EMF) Revenue Requirement	Miller Exhibit 2 pg 4, Line 15	(767,503)
7	Year 2022 EE/DSM True-Up (EMF) Revenue Requirement	Miller Exhibit 2 pg 5, Line 15	(9,369,228)
8	Total True-up (EMF) Revenue Requirement	Sum Lines 1-7	$ (12,888,928)
9	Projected NC Residential Sales (kWh) for rate period	Miller Exhibit 6, Line 1	23,664,202,369
10	*EE/DSM Revenue Requirement EMF Residential Rider EE (cents per kWh)*	Line 8 / Line 9 * 100	**(0.0545)**

Residential Billing Factor for Rider 15 Prospective Components

11	Vintage 2021 Total EE/DSM Prospective Amounts Revenue Requirement	Miller Exhibit 2 pg 4, Line 15	1,915,275
12	Vintage 2022 Total EE/DSM Prospective Amounts Revenue Requirement	Miller Exhibit 2 pg 5, Line 15	4,813,237
13	Vintage 2023 Total EE/DSM Prospective Amounts Revenue Requirement	Miller Exhibit 2 pg 6, Line 1	6,787,155
14	Vintage 2024 Total EE/DSM Prospective Amounts Revenue Requirement	Miller Exhibit 2 pg 7, Line 11	88,723,534
15	Total Prospective Revenue Requirement	Sum Lines 11-14	$ 102,239,200
16	Projected NC Residential Sales (kWh) for rate period	Miller Exhibit 6, Line 1	23,664,202,369
17	*EE/DSM Revenue Requirement Prospective Residential Rider EE (cents per kWh)*	Line 15 / Line 16 * 100	**0.4320**
	Total Revenue Requirements in Rider 15 from Residential Customers		
18	Total True-up (EMF) Revenue Requirement	Line 8	$ (12,888,928)
19	Total Prospective Revenue Requirement	Line 15	102,239,200
20	***Total EE/DSM Revenue Requirement for Residential Rider EE***	Line 18 + Line 19	**$ 89,350,272**
21	***Total EE/DSM Revenue Requirement for Residential Rider EE (cents per kWh)***	Line 10 + Line 17	**0.3775**

Non-Residential Billing Factors for Rider 15 True-up (EMF) Components

22	*Vintage Year 2018 EE True-up (EMF) Revenue Requirement*	Miller Exhibit 2 pg 1, Line 25	$ (21,684)
23	*Projected Year 2018 EE Participants NC Non-Residential Sales (kwh) for rate period*	Miller Exhibit 6, Line 4	17,157,930,277
24	*EE Revenue Requirement Year 2018 EMF Non-Residential Rider EE (cents per kWh)*	Line 22 / Line 23 * 100	**(0.0001)**
25	*Vintage Year 2018 DSM True-up (EMF) Revenue Requirement*	Miller Exhibit 2 pg 1, Line 35	$ 3,086
26	*Projected Year 2018 DSM Participants NC Non-Residential Sales (kwh) for rate period*	Miller Exhibit 6, Line 5	18,516,675,854
27	*DSM Revenue Requirement Year 2018 EMF Non-Residential Rider EE (cents per kWh)*	Line 25 / Line 26 * 100	-
28	*Vintage Year 2019 EE True-up (EMF) Revenue Requirement*	Miller Exhibit 2 pg 2, Line 25	$ (235,521)
29	*Projected Year 2019 EE Participants NC Non-Residential Sales (kwh) for rate period*	Miller Exhibit 6, Line 6	17,136,255,406
30	*EE Revenue Requirement Year 2019 EMF Non-Residential Rider EE (cents per kWh)*	Line 28 / Line 29 * 100	**(0.0014)**
31	*Vintage Year 2019 DSM True-up (EMF) Revenue Requirement*	Miller Exhibit 2 pg 2, Line 35	$ (21,406)
32	*Projected Year 2019 DSM Participants NC Non-Residential Sales (kwh) for rate period*	Miller Exhibit 6, Line 7	18,570,220,915
33	*DSM Revenue Requirement Year 2019 EMF Non-Residential Rider EE (cents per kWh)*	Line 31 / Line 32 * 100	**(0.0001)**
34	*Vintage Year 2020 EE True-up (EMF) Revenue Requirement*	Miller Exhibit 2 pg 3, Line 25	$ (1,128,887)
35	*Projected Year 2020 EE Participants NC Non-Residential Sales (kwh) for rate period*	Miller Exhibit 6, Line 8	16,575,789,097
36	*EE Revenue Requirement Year 2020 EMF Non-Residential Rider EE (cents per kWh)*	Line 34 / Line 35 * 100	**(0.0068)**
37	*Vintage Year 2020 DSM True-up (EMF) Revenue Requirement*	Miller Exhibit 2 pg 3, Line 35	$ 32,287
38	*Projected Year 2020 DSM Participants NC Non-Residential Sales (kwh) for rate period*	Miller Exhibit 6, Line 9	18,635,398,667
39	*DSM Revenue Requirement Year 2020 EMF Non-Residential Rider EE (cents per kWh)*	Line 37 / Line 38 * 100	**0.0002**
40	*Vintage Year 2021 EE True-up (EMF) Revenue Requirement*	Miller Exhibit 2 pg 4, Line 25	$ (1,363,988)
41	*Projected Year 2021 EE Participants NC Non-Residential Sales (kwh) for rate period*	Miller Exhibit 6, Line 10	16,652,048,700
42	*EE Revenue Requirement Year 2021 EMF Non-Residential Rider EE (cents per kWh)*	Line 40 / Line 41 * 100	**(0.0082)**
43	*Vintage Year 2021 DSM True-up (EMF) Revenue Requirement*	Miller Exhibit 2 pg 4, Line 35	$ (1,367,038)
44	*Projected Year 2021 DSM Participants NC Non-Residential Sales (kwh) for rate period*	Miller Exhibit 6, Line 11	18,677,101,757
45	*DSM Revenue Requirement Year 2021 EMF Non-Residential Rider EE (cents per kWh)*	Line 43 / Line 44 * 100	**(0.0073)**
46	*Vintage Year 2022 EE True-up (EMF) Revenue Requirement*	Miller Exhibit 2 pg 5, Line 25	$ (29,236,738)
47	*Projected Year 2022 EE Participants NC Non-Residential Sales (kwh) for rate period*	Miller Exhibit 6, Line 12	16,744,193,880
48	*EE Revenue Requirement Year 2022 EMF Non-Residential Rider EE (cents per kWh)*	Line 46 / Line 47 * 100	**(0.1746)**
49	*Vintage Year 2022 DSM True-up (EMF) Revenue Requirement*	Miller Exhibit 2 pg 5, Line 35	$ (426,564)
50	*Projected Year 2022 DSM Participants NC Non-Residential Sales (kwh) for rate period*	Miller Exhibit 6, Line 13	18,855,570,769
51	*DSM Revenue Requirement Year 2022 EMF Non-Residential Rider EE (cents per kWh)*	Line 49 / Line 50 * 100	**(0.0023)**

/A

DSM/EE Cost Recovery Rider 15
Docket Number E-7 Sub 1285
Exhibit Summary of Rider EE Exhibits and Factors

Non-Residential Billing Factors for Rider 15 Prospective Components

52	Vintage Year 2021 EE Prospective Amounts Revenue Requirement	Miller Exhibit 2 pg 4, Line 25	$ 5,211,948
53	Projected Vintage 2021 EE Participants NC Non-Residential Sales (kwh) for rate period	Miller Exhibit 6, Line 10	16,652,048,700
54	*EE Revenue Requirement Vintage 2021 Prospective Component - Non-Residential Rider EE (cents per kWh)*	Line 52 / Line 53 * 100	**0.0313**
55	Vintage Year 2022 EE Prospective Amounts Revenue Requirement	Miller Exhibit 2 pg 5, Line 25	$ 7,844,523
56	Projected Vintage 2022 EE Participants NC Non-Residential Sales (kwh) for rate period	Miller Exhibit 6, Line 12	16,744,193,880
57	*EE Revenue Requirement Vintage 2022 Prospective Component - Non-Residential Rider EE (cents per kWh)*	Line 55 / Line 56 * 100	**0.0468**
58	Vintage Year 2023 EE Prospective Amounts Revenue Requirement	Miller Exhibit 2 pg 6, Line 4	$ 14,155,374
59	Projected Vintage 2023 EE Participants NC Non-Residential Sales (kwh) for rate period	Miller Exhibit 6, Line 14	17,655,241,326
60	*EE Revenue Requirement Vintage 2023 Prospective Component - Non-Residential Rider EE (cents per kWh)*	Line 58 / Line 59 * 100	**0.0802**
61	Vintage Year 2024 EE Prospective Amounts Revenue Requirement	Miller Exhibit 2 pg 7, Line 18	$ 68,313,371
62	Projected Vintage 2024 EE Participants NC Non-Residential Sales (kwh) for rate period	Miller Exhibit 6, Line 16	17,655,241,326
63	*EE Revenue Requirement Vintage 2024 Prospective Component - Non-Residential Rider EE (cents per kWh)*	Line 61 / Line 62 * 100	**0.3869**
64	Vintage Year 2024 DSM Prospective Amounts Revenue Requirement	Miller Exhibit 2 pg 7, Line 25	$ 17,086,774
65	Projected Vintage 2024 DSM Participants NC Non-Residential Sales (kwh) for rate period	Miller Exhibit 6, Line 17	19,059,148,493
66	*DSM Revenue Requirement Vintage 2024 Prospective Component - Non-Residential Rider EE (cents per kWh)*	Line 64 / Line 65 * 100	**0.0897**
			(0.2006)
	Total Prospective Rate		**0.6349**

Total Revenue Requirements in Rider 15 from Non-Residential Customers

65	Vintage Year 2018 EE True-up (EMF) Revenue Requirement	Line 22	(21,684)
66	Vintage Year 2018 DSM True-up (EMF) Revenue Requirement	Line 25	3,086
67	Vintage Year 2019 EE True-up (EMF) Revenue Requirement	Line 28	(235,521)
68	Vintage Year 2019 DSM True-up (EMF) Revenue Requirement	Line 31	(21,406)
69	Vintage Year 2020 EE True-up (EMF) Revenue Requirement	Line 34	(1,128,887)
70	Vintage Year 2020 DSM True-up (EMF) Revenue Requirement	Line 37	32,287
71	Vintage Year 2021 EE True-up (EMF) Revenue Requirement	Line 40	(1,363,988)
72	Vintage Year 2021 DSM True-up (EMF) Revenue Requirement	Line 43	(1,367,038)
73	Vintage Year 2022 EE True-up (EMF) Revenue Requirement	Line 46	(29,236,738)
74	Vintage Year 2022 DSM True-up (EMF) Revenue Requirement	Line 49	(426,564)
75	Vintage Year 2021 EE Prospective Amounts Revenue Requirement	Line 52	5,211,948
76	Vintage Year 2022 EE Prospective Amounts Revenue Requirement	Line 55	7,844,523
77	Vintage Year 2023 EE Prospective Amounts Revenue Requirement	Line 58	14,155,374
78	Vintage Year 2024 EE Prospective Amounts Revenue Requirement	Line 61	68,313,371
79	Vintage Year 2024 DSM Prospective Amounts Revenue Requirement	Line 64	17,086,774
	Total Non-Residential Revenue Requirement in Rider 15	Sum (Lines 65-79)	**78,845,535**

/A

Revised Miller Exhibit 2 2016

Duke Energy Carolinas, LLC
Docket Number E-7 Sub 1285
True Up of Lost Revenues for Vintage Year 2016

RESIDENTIAL
Energy Efficiency Programs

Line		Reference	E-7 Sub 1073 Rider 7 Original Estimate	E-7 Sub 1105 Rider 8 Year 2 Lost Revenues	E-7 Sub 1130 Rider 9 True up (Year 1)	E-7 Sub 1130 Year 2016 Yr 3 LR Estimate	E-7 Sub 1164 Rider 10 True up (Year 2)	E-7 Sub 1192 Rider 11 True Up (Year 3)	E-7 Sub 1230 Rider 12 True Up (Year 4)	E-7 Sub 1285 Rider 15 True Up	Year 2016
1	Residential EE Program Cost	Fields Exhibit 1 pg. 1, Line 10 * NC Alloc. Factor	$ 31,056,079		$ 8,965,024		$ (2)			$ -	$ 40,021,101
2	Residential EE Earned Utility Incentive	Fields Exhibit 1 pg. 1, Line 10 * NC Alloc. Factor	2,392,652		4,361,799		(52,098)			(1,204)	6,701,149
3	Return on undercollection of Residential EE Program Costs	Miller Exhibit 3 pg 1			272,476		710,786	430,926	(47,227)	(28,737)	1,338,224
4	Total EE Program Cost and Incentive Components	Line 1 + Line 2 + line 3	33,448,731		13,599,299		658,686	430,926	(47,227)	(29,940)	48,060,475
5	Residential DSM Program Cost	Fields Exhibit 1 pg. 1, Line 11 * NC Alloc. Factor	10,613,016		(1,012,441)		0			-	9,600,575
6	Residential DSM Earned Utility Incentive	Fields Exhibit 1 pg. 1, Line 11 * NC Alloc. Factor	2,887,418		(129,612)		(27,890)			-	2,729,916
7	Return on overcollection of Residential DSM Program Costs	N/A			(26,322)		(46,199)	(39,872)	(961)	-	(113,354)
8	Total DSM Program Cost and Incentive Components	Line 5 + Line 6 + Line 7	13,500,434		(1,168,375)		(74,089)	(39,872)	(961)	-	12,217,137
9	Total EE/DSM Program Cost and Incentive Components	Line 4 + Line 8	46,949,165		12,430,924		584,597	391,055	(48,188)	(29,940)	60,277,612
10	Revenue-related taxes and regulatory fees factor **	Miller Exhibit 2, pg. 10	1.001442		1.001402		1.001402	1.001352	1.001302	1.001402	
11	Total EE/DSM Program Cost and Incentive Revenue Requirement	Line 9 * Line 10	47,016,866		12,448,352		585,417	391,583	(48,251)	(29,982)	60,363,984
12	Residential Net Lost Revenues	Fields Exhibit 2 pg. 1-9	11,873,767	5,723,916	4,795,359	7,765,323	(3,299,616)	1,969,313	-	(5,839)	28,822,224
13	Total Residential EE/DSM Revenue Requirement	Line 11 + Line 12	58,890,633	5,723,916	17,243,711	7,765,323	(2,714,199)	2,360,897	(48,251)	(35,821)	89,186,209
14	Total Collected for Vintage Year 2016 (through 2021)										89,250,825
15	**Total Residential EE/DSM Revenue Requirement**	Line 11 + Line 12									$ (64,617)

See Listebarger Exhibit 1 for rate

/A

Revised MIller Exhibit 2 2017

Duke Energy Carolinas, LLC
Docket Number E-7 Sub 1285
True Up of Lost Revenues for Vintage Year 2017

RESIDENTIAL
Energy Efficiency Programs

Line		Reference	E-7 Sub 1105 Rider 8 Original Estimate	E-7 Sub 1130 Year 2017 Yr 2 LR estimate	E-7 Sub 1164 Rider 10 True up	E-7 Sub 1164 Year 2017 Yr 3 LR Estimate	E-7 Sub 1192 Rider 11 True up	E-7 Sub 1192 Year 2017 Yr 4 LR Estimate	E-7 Sub 1230 Rider 12 True Up	E-7 Sub 1249 Rider 13 True Up	E-7 Sub 1285 Rider 15 True Up	Year 2017
1	Residential EE Program Cost	Fields Exhibit 1 pg. 2, Line 10 * NC Alloc. Factor	$ 33,488,974		$ 13,998,885		$ -		$ -	$ -	$ (0)	$ 47,487,859
2	Residential EE Earned Utility Incentive	Fields Exhibit 1 pg. 2, Line 10 * NC Alloc. Factor	4,149,244		4,340,033		(250,931)		-	-	(24,596)	8,213,750
3	Return on overcollection of Residential EE Program Costs	Miller Exhibit 3 pg 2			522,611		1,226,138	-	622,205	(225,201)	(220,518)	1,925,235
4	Total EE Program Cost and Incentive Components	Line 1 + Line 2 + line 3	37,638,218		18,861,529		975,207	-	622,205	(225,201)	(245,114)	57,626,845
5	Residential DSM Program Cost	Fields Exhibit 1 pg. 2, Line 11 * NC Alloc. Factor	10,258,751		(176,455)		-			(0)	-	10,082,296
6	Residential DSM Earned Utility Incentive	Fields Exhibit 1 pg. 2, Line 11 * NC Alloc. Factor	2,837,134		89,061		-			(0)	-	2,926,195
7	Return on overcollection of Residential DSM Program Costs	N/A			15,015		12,882	-	7,019	(10,229)	-	24,687
8	Total DSM Program Cost and Incentive Components	Line 5 + Line 6 + Line 7	13,095,886		(72,379)		12,882	-	7,019	(10,230)	-	13,033,178
9	Total EE/DSM Program Cost and Incentive Components	Line 4 + Line 8	50,734,104		18,789,150		988,089	-	629,225	(235,431)	(245,114)	70,660,023
10	Revenue-related taxes and regulatory fees factor **	Miller Exhibit 2, pg. 7	1.001482		1.001402		1.001352	-	1.001302	1.001302	1.001402	
11	Total EE/DSM Program Cost and Incentive Revenue Requirement	Line 9 * Line 10	50,809,292		18,815,493		989,425	-	630,044	(235,738)	(245,457)	70,763,058
12	Residential Net Lost Revenues	Fields Exhibit 2 pg 1-9	12,699,119	4,202,002	6,456,129	8,904,587	2,572,270	1,751,061	(4,729,337)	385,723	(230,405)	32,011,149
13	Total Residential EE/DSM Revenue Requirement	Line 11 + Line 12	63,508,411	4,202,002	25,271,622	8,904,587	3,561,695	1,751,061	(4,099,293)	149,985	(475,862)	102,774,207
14	Total Collected for Vintage Year 2017 (through 2022)											103,536,417
15	**Total Residential EE/DSM Revenue Requirement**	Line 13 - Line 14										$ (762,210)

See Listebarger Exhibit A for rate

Duke Energy Carolinas, LLC
Docket Number E-7 Sub 1285
True Up of Lost Revenues for Vintage Year 2018

RESIDENTIAL
Energy Efficiency Programs

Line		Reference	E-7 Sub 1130	E-7 Sub 1164	E-7 Sub 1192	E-7 Sub 1192	E-7 Sub 1230	E-7 Sub 1230	E-7 Sub 1249	E-7 Sub 1265	E-7 Sub 1285	
			Rider 9 Year 1 Estimate	Year 2018 Yr 2 LR Estimate	Rider 11 True up	Year 2018 Year 3 Estimate	Rider 12 True Up	Year 2018 Yr 4 LR Estimate	Rider 13 True up	Rider 14 True up	Rider 15 True up	Year 2018
1	Residential EE Program Cost	Fields Exhibit 1 pg. 3, Line 9 * NC Alloc. Factor	41,623,609		14,606,717		$ (0)		$ -	$ -	$ -	$ 56,230,326
2	Residential EE Earned Utility Incentive	Fields Exhibit 1 pg. 3, Line 9 * NC Alloc. Factor	5,511,264		4,154,068		140,649		(22,279)	157,616	(39,495)	9,901,824
3	Return on overcollection of Residential EE Program Costs	Miller Exhibit 3 pg 3			244,540		1,024,850		750,744	(2,580)	(104,676)	1,912,878
4	Total EE Program Cost and Incentive Components	Line 1 + Line 2 + Line 3	47,134,873		19,005,325		1,165,498		728,465	155,036	(144,170)	68,045,027
5	Residential DSM Program Cost	Fields Exhibit 1 pg. 3, Line 10 * NC Alloc. Factor	9,903,130		(124,235)		0		-	-	-	9,778,895
6	Residential DSM Earned Utility Incentive	Fields Exhibit 1 pg. 3, Line 10 * NC Alloc. Factor	2,569,925		17,215		(5,581)		(289)	573	(297)	2,581,546
7	Return on undercollection of Residential DSM Program Costs	Miller Exhibit 3 pg 4			(28,626)		(40,884)		(21,193)	18,109	(17,995)	(90,588)
8	Total DSM Program Cost and Incentive Components	Line 5 + Line 6 + Line 7	12,473,055		(135,646)		(46,465)		(21,481)	18,682	(18,292)	12,269,853
9	Total EE/DSM Program Cost and Incentive Components	Line 4 + Line 8	59,607,928		18,869,679		1,119,034		706,984	173,718	(162,463)	80,314,880
10	Revenue-related taxes and regulatory fees factor **	Miller Exhibit 2, pg. 8	1.001402		1.001352		1.001302		1.001352	1.001402	1.001402	
11	Total EE/DSM Program Cost and Incentive Revenue Requirement	Line 9 * Line 10	59,691,498		18,895,191		1,120,491		707,940	173,962	(162,691)	80,426,391
12	Residential Net Lost Revenues	Fields Exhibit 2 pg 1-9	19,612,717	6,294,025	894,901	9,715,212	1,534,156	-	2,310,499	(86,953)	(194,096)	40,080,462
13	Total Residential EE/DSM Revenue Requirement	Line 11 + Line 12	79,304,216	6,294,025	19,790,092	9,715,212	2,654,647	-	3,018,439	87,009	(356,786)	120,506,852
14	Total Collected for Vintage Year 2018 (through estimated Rider 15)	Miller Exhibit 4, Lines 1,7,13,17										120,902,668
15	**Total Residential EE/DSM Revenue Requirement**	Line 13 - Line 14										$ (395,816)

Note: No prospective Year 4 lost revenue is included in this exhibit because the rate case test period was extended for residential customers.

See Listebarger Exhibit A for rate

NON-RESIDENTIAL
Energy Efficiency Programs

Line		Reference	E-7 Sub 1130	E-7 Sub 1164	E-7 Sub 1192	E-7 Sub 1192	E-7 Sub 1230	E-7 Sub 1230	E-7 Sub 1249	E-7 Sub 1265	E-7 Sub 1285	
			Rider 9 Year 1 Estimate	Year 2018 Yr 2 LR Estimate	Rider 11 True up	Year 2018 Year 3 Estimate	Rider 12 True Up	Year 2018 Yr 4 LR Estimate	Rider 13 True up	Rider 14 True up	Rider 15 True up	Year 2018
16	Non- Residential EE Program Cost	Fields Exhibit 1 pg. 3, Line 23 * NC Alloc. Factor	40,592,949		(3,317,005)		0		-	-	-	37,275,944
17	Non-Residential EE Earned Utility Incentive	Fields Exhibit 1 pg. 3, Line 23 * NC Alloc. Factor	11,623,199		2,818,045		(25,396)		(2,366)	-	(10,650)	14,402,832
18	Return on undercollection of Non-residential EE Program Costs	Miller Exhibit 3 page 5			461,049		592,305		407,815	49,904	(54,943)	1,456,132
19	Total EE Program Cost and Incentive Components	Line 16 + Line 17 + Line 18	52,216,148		(37,911)		566,910		405,450	49,904	(65,593)	53,134,908
20	Revenue-related taxes and regulatory fees factor	Miller Exhibit 2, pg. 8	1.001402		1.001352		1.001302		1.001352	1.001402	1.001402	
21	Total Non-Residential EE Program Cost & Incentive Revenue Requirements	Line 19 * Line 20	52,289,355		(37,962)		567,648		405,998	49,974	(65,685)	53,209,328
22	Non-Residential Net Lost Revenues	Fields Exhibit 2 pg 1-9	5,167,253	12,285,044	2,933,863	9,507,185	(1,090,744)	2,182,027	(2,020,437)	(47,064)	(3,539,044)	25,378,082
23	Total Non-Residential EE Revenue Requirement	Line 21 + Line 22	57,456,608	12,285,044	2,895,901	9,507,185	(523,097)	2,182,027	(1,614,439)	2,910	(3,604,729)	78,587,410
24	Total Collected for Vintage Year 2018 (through estimated Rider 15)	Miller Exhibit 4 Lines 22, 28										78,609,094
25	Non-Residential EE Revenue Requirement	Line 23 - Line 24										(21,684)
26	Projected NC Residential Sales (kWh)	Miller Exhibit 6, Line 4										17,157,930,277
27	**NC Non-Residential EE billing factor (Cents/kWh)**	Line 25/Line 26*100										**(0.0001)**

DSM Programs

Line		Reference	E-7 Sub 1130		E-7 Sub 1192		E-7 Sub 1230		E-7 Sub 1249	E-7 Sub 1265	E-7 Sub 1285	
		Reference	Rider 9 Year 1 Estimate		Rider 11 True up		Rider 12 True Up		Rider 13 True up	Rider 14 True up	Rider 15 True up	Year 2018
28	Non-Residential DSM Program Cost	Fields Exhibit 1, pg. 3, Line 10 + Line 26 * NC Alloc. Factor	11,959,889		651,281		(0)		-	-	-	12,611,170
29	Non-Residential DSM Earned Utility Incentive	Fields Exhibit 1, pg. 3, Line 10 + Line 26 * NC Alloc. Factor	3,103,667		232,789		(7,197)		(372)	739	(384)	3,329,242
30	Return on undercollection of Non-residential DSM Program Costs	Miller Exhibit 3 page 6	-		37,743		76,651		54,598	40,422	(31,313)	178,101
31	Total Non-Residential DSM Program Cost and Incentive Components	Line 28 + Line 29 + Line 30	15,063,556		921,813		69,454		54,225	41,161	(31,697)	16,118,513
32	Revenue-related taxes and regulatory fees factor	Miller Exhibit 2, pg. 8	1.001402		1.001352		1.001302		1.001352	1.001402	1.001402	
33	Total Non-Residential DSM Revenue Requirement	Line 31 * Line 32	15,084,675		923,059		69,544		54,299	41,219	(31,741)	16,141,055
34	Total Collected for Vintage Year 2018 (through estimated Rider 15)	Miller Exhibit 4 Lines 32, 38										16,137,969
35	Non-Residential EE Revenue Requirement True-up Amount	Line 33 - Line 34										3,086
36	Projected NC Non-Residential Sales (kWh)	Miller Exhibit 6, Line 5										18,516,675,854
37	**NC Non-Residential DSM billing factor**	Line 35/Line 36*100										-

** Actual regulatory fee rate in effect in year of collection. May differ from original filed estimates.

Duke Energy Carolinas, LLC
Docket Number E-7 Sub 1285
True Up of Year 1, 2, 3 and 4 Lost Revenues for Vintage Year 2019

RESIDENTIAL
Energy Efficiency Programs

Line		Reference	E-7 Sub 1164 Rider 10 Year 1 Estimate	E-7 Sub 1192 Year 2019 Yr 2 LR Estimate	E-7 Sub 1230 Rider 12 True up	E-7 Sub 1230 Year 2019 Yr 3 LR Estimate	E-7 Sub 1249 Rider 13 True up	E-7 Sub 1249 Year 2020 Yr 4 LR Estimate	E-7 Sub 1265 Rider 14 True up	E-7 Sub 1285 Rider 15 True up	Year 2019
1	Residential EE Program Cost	Fields Exhibit 1 pg. 4, Line 9 * NC Alloc. Factor	$ 41,002,874		$ 13,243,503		$ (0)		$ 0	$ -	$ 54,246,377
2	Residential EE Earned Utility Incentive	Fields Exhibit 1 pg. 4, Line 9 * NC Alloc. Factor	3,801,819		3,296,056		(124,962)		90,385	(34,414)	7,028,884
3	Return on undercollection of Residential EE Program Costs	Miller Exhibit 3 pg 7			55,738		750,744		511,698	(195)	1,317,985
4	Total EE Program Cost and Incentive Components	Line 1 + Line 2 + Line 3	44,804,694		16,595,296		625,782		602,083	(34,609)	62,593,246
5	Residential DSM Program Cost	Fields Exhibit 1 pg. 4, Line 10 + Line 26 * NC Alloc. Factor	10,577,352		(308,751)		(0)		(0)	-	10,268,601
6	Residential DSM Earned Utility Incentive	Fields Exhibit 1 pg. 4, Line 10 + Line 26 * NC Alloc. Factor	2,773,086		541,821		0		26,383	(205)	3,341,085
7	Return on undercollection of Residential DSM Program Costs	Miller Exhibit 3 pg 8			(6,600)		(21,193)		5,935	2,555	(19,302)
8	Total DSM Program Cost and Incentive Components	Line 5 + Line 6 + Line 7	13,350,438		226,469		(21,193)		32,318	2,351	13,590,384
9	Total EE/DSM Program Cost and Incentive Components	Line 4 + Line 8	58,155,132		16,821,766		604,589		634,402	(32,258)	76,183,630
10	Revenue-related taxes and regulatory fees factor **	Miller Exhibit 2, pg. 8	1.001402		1.001352		1.001352		1.001402	1.001402	
11	Total EE/DSM Program Cost and Incentive Revenue Requirement	Line 9 * Line 10	58,236,665		16,844,509		605,406		635,291	(32,304)	76,289,568
12	Residential Net Lost Revenues	Fields Exhibit 2 pg 1 - 9	18,783,204	5,232,466	6,704,043	5,292,331	(1,623,869)	2,233,068	236,622	(80,649)	36,777,216
13	Total Residential EE/DSM Revenue Requirement	Line 11 + Line 12	77,019,869	5,232,466	23,548,552	5,292,331	(1,018,463)	2,233,068	871,913	(112,953)	113,066,783
14	Total Collected for Vintage Year 2019 (through estimated Rider 15)	Miller Exhibit 4, Lines 2,8,14,18									113,489,344
15	**Total Residential EE/DSM Revenue Requirement**	Line 13 - Line 14									$ (422,560)

See Listebarger Exhibit A for rate

NON-RESIDENTIAL
Energy Efficiency Programs

Line		Reference	E-7 Sub 1164 Rider 10 Year 1 Estimate	E-7 Sub 1192 Year 2019 Yr 2 LR Estimate	E-7 Sub 1230 Rider 12 True up	E-7 Sub 1230 Year 2019 Yr 3 LR Estimate	E-7 Sub 1249 Rider 13 True up	E-7 Sub 1249 Year 2020 Yr 4 LR Estimate	E-7 Sub 1265 Rider 14 True up	E-7 Sub 1285 Rider 15 True up	Year 2019
16	Non- Residential EE Program Cost	Fields Exhibit 1 pg. 4, Line 23 * NC Alloc. Factor	41,671,833		(8,698,625)		-		0	(0)	32,973,208
17	Non-Residential EE Earned Utility Incentive	Fields Exhibit 1 pg. 4, Line 23 * NC Alloc. Factor	8,464,629		1,873,850		759,937		(0)	249,134	11,347,550
18	Return on undercollection of Non-residential EE Program Costs	Miller Exhibit 3 page 9			(553,659)		(275,034)		(228,890)	(78,141)	(1,135,724)
19	Total EE Program Cost and Incentive Components	Line 16 + Line 17 + Line 18	50,136,462		(7,378,434)		484,904		(228,890)	170,992	43,185,034
20	Revenue-related taxes and regulatory fees factor	Miller Exhibit 2, pg. 8	1.001402		1.001352		1.001352		1.001402	1.001402	
21	Total Non-Residential EE Program Cost and Incentive Revenue Requirements	Line 19 * Line 20	50,206,753		(7,388,410)		485,559		(229,211)	171,232	43,245,924
22	Non-Residential Net Lost Revenues	Fields Exhibit 2 pg 1 - 9	5,590,446	8,746,000	452,216	10,794,655	(8,183,962)	2,074,187	874,289	663,225	21,011,055
23	Total Non-Residential EE Revenue Requirement	Line 21 + Line 22	55,797,199	8,746,000	(6,936,194)	10,794,655	(7,698,403)	2,074,187	645,078	834,456	64,256,979
24	Total Collected for Vintage Year 2019 (through estimated Rider 15)	Miller Exhibit 4, Line 23, 29									64,492,500
25	Non-Residential EE Revenue Requirement	Line 23 - Line 24									(235,521)
26	Projected NC Residential Sales (kWh)	Miller Exhibit 6, Line 6									17,136,255,406
27	**NC Non-Residential EE billing factor (Cents/kWh)**	Line 25/Line 26*100									**(0.0014)**

DSM Programs

Line		Reference	E-7 Sub 1164 Rider 10 Year 1 Estimate		E-7 Sub 1230 Rider 12 True up		E-7 Sub 1249 Rider 13 True up		E-7 Sub 1265 Rider 14 True up	E-7 Sub 1285 Rider 15 True up	Year 2019
28	Non-Residential DSM Program Cost	Fields Exhibit 1 pg. 4, Line 10 + Line 26 * NC Alloc. Factor	12,538,168		(462,163)		-		(0)	-	12,076,005
29	Non-Residential DSM Earned Utility Incentive	Fields Exhibit 1 pg. 4, Line 10 + Line 26 * NC Alloc. Factor	3,287,157		611,215		-		31,027	(241)	3,929,159
30	Return on undercollection of Non-residential DSM Program Costs	Miller Exhibit 3 page 10	-		(9,744)		7,619		2,253	(545)	(417)
31	Total Non-Residential DSM Program Cost and Incentive Components	Line 28 + Line 29 + Line 30	15,825,325		139,308		7,619		33,279	(786)	16,004,746
32	Revenue-related taxes and regulatory fees factor	Miller Exhibit 2, pg. 8	1.001402		1.001352		1.001352		1.001402	1.001402	
33	Total Non-Residential DSM Revenue Requirement	Line 31 * Line 32	15,847,512		139,497		7,630		33,326	(787)	16,027,178
34	Total Collected for Vintage Year 2019 (through estimated Rider 15)	Miller Exhibit 4 Lines 33, 39									16,048,584
35	Non-Residential EE Revenue Requirement True-up Amount	Line 33 - Line 34									(21,406)
36	Projected NC Non-Residential Sales (kWh)	Miller Exhibit 6, Line 7									18,570,220,915
37	**NC Non-Residential DSM billing factor**	Line 35/Line 36*100									**(0.0001)**

** Actual regulatory fee rate in effect in year of collection. May differ from original filed estimates.

/A

Duke Energy Carolinas, LLC
Docket Number E-7 Sub 1285
True Up of Year 1, 2 and 3 Lost Revenues for Vintage Year 2020

RESIDENTIAL
Energy Efficiency Programs

Line		Reference	E-7 Sub 1192 Rider 11 Year 1 Estimate	E-7 Sub 1230 Year 2020 Yr 2 LR Estimate	E-7 Sub 1249 Rider 13 True up	E-7 Sub 1249 Year 2020 Yr 3 LR Estimate	E-7 Sub 1265 Rider 14 True up	E-7 Sub 1265 Year 2020 Yr 4 LR Estimate	E-7 Sub 1285 Rider 15 True up	Year 2020
1	Residential EE Program Cost	Fields Exhibit 1 pg. 5, Line 9 * NC Alloc. Factor	$ 33,551,578		$ 4,000,501		$ -		$ -	$ 37,552,079
2	Residential EE Earned Utility Incentive	Fields Exhibit 1 pg. 5, Line 9 * NC Alloc. Factor	3,173,534		1,218,929		90,910		(38,754)	4,444,619
3	Return on undercollection of Residential EE Program Costs	Miller Exhibit 3 pg 11			146,624		434,746		(256,724)	324,646
4	Total EE Program Cost and Incentive Components	Line 1 + Line 2 + Line 3	36,725,112		5,366,054		525,656		(295,478)	42,321,344
5	Residential DSM Program Cost	Fields Exhibit 1 pg. 5, Line 10 + Line 26 * NC Alloc. Factor	12,243,392		(2,355,317)		-		(0)	9,888,075
6	Residential DSM Earned Utility Incentive	Fields Exhibit 1 pg. 5, Line 10 + Line 26 * NC Alloc. Factor	3,189,876		7,301		14,471		(21)	3,211,627
7	Return on overcollection of Residential DSM Program Costs	Miller Exhibit 3 pg 12			(73,960)		(198,174)		(119,312)	(391,446)
8	Total DSM Program Cost and Incentive Components	Line 5 + Line 6 + Line 7	15,433,268		(2,421,975)		(183,703)		(119,333)	12,708,256
9	Total EE/DSM Program Cost and Incentive Components	Line 4 + Line 8	52,158,380		2,944,078		341,953		(414,812)	55,029,600
10	Revenue-related taxes and regulatory fees factor **	Miller Exhibit 2, pg. 8	1.001402		1.001352		1.001402		1.001402	
11	Total EE/DSM Program Cost and Incentive Revenue Requirement	Line 9 * Line 10	52,231,506		2,948,059		342,433		(415,393)	55,106,604
12	Residential Net Lost Revenues	Fields Exhibit 2 pg. 1-9	14,667,095	4,495,479	6,588,261	5,386,818	609,516	2,568,275	(362,420)	33,953,024
13	Total Residential EE/DSM Revenue Requirement	Line 11 + Line 12	66,898,601	4,495,479	9,536,320	5,386,818	951,949	2,568,275	(777,813)	89,059,629
14	Total Collected for Vintage Year 2020 (through estimated Rider 15)	Miller Exhibit 4, Lines 3, 9,15, 19								90,166,622
15	**Total Residential EE/DSM Revenue Requirement**	Line13 - Line 14								$ (1,106,993)

See Listebarger Exhibit A for rate

NON-RESIDENTIAL
Energy Efficiency Programs

Line		Reference	E-7 Sub 1192 Rider 11 Year 1 Estimate	E-7 Sub 1230 Year 2020 Yr 2 LR Estimate	E-7 Sub 1249 Rider 13 True up	E-7 Sub 1249 Year 2020 Yr 3 LR Estimate	E-7 Sub 1265 Rider 14 True up	E-7 Sub 1265 Year 2020 Yr 4 LR Estimate	E-7 Sub 1285 Rider 15 True up	Year 2020
16	Non- Residential EE Program Cost	Fields Exhibit 1 pg. 5, Line 23 * NC Alloc. Factor	37,708,077		(15,681,234)		-		-	22,026,843
17	Non-Residential EE Earned Utility Incentive	Fields Exhibit 1 pg. 5, Line 23 * NC Alloc. Factor	10,010,194		(2,909,256)		98,425		(76,329)	7,123,034
18	Return on overcollection of Non-residential EE Program Costs	Miller Exhibit 3 page 13			(327,773)		(767,827)		(62,127)	(1,157,726)
19	Total EE Program Cost and Incentive Components	Line 16 + Line 17 + Line 18	47,718,271		(18,918,263)		(669,402)		(138,456)	27,992,151
20	Revenue-related taxes and regulatory fees factor	Miller Exhibit 2, pg. 8	1.001402		1.001352		1.001402		1.001402	
21	Total Non-Residential EE Program Cost and Incentive Revenue Requirements	Line 19 * Line 20	47,785,172		(18,943,841)		(670,341)		(138,650)	28,032,342
22	Non-Residential Net Lost Revenues	Fields Exhibit 2 pg. 1 - 9	5,183,193	9,376,721	(4,169,004)	6,802,676	1,081,898	3,845,961	(61,096)	22,060,349
23	Total Non-Residential EE Revenue Requirement	Line 21 + Line 22	52,968,365	9,376,721	(23,112,845)	6,802,676	411,558	3,845,961	(199,745)	50,092,691
24	Total Collected for Vintage Year 2020 (through estimated Rider 15)	Miller Exhibit 4 Line 24, 30								51,221,578
25	Non-Residential EE Revenue Requirement	Line 23 - Line 24								(1,128,887)
26	Projected NC Residential Sales (kWh)	Miller Exhibit 6, Line 8								16,575,789,097
27	**NC Non-Residential EE billing factor (Cents/kWh)**	Line 25/Line 26*100								**(0.0068)**

DSM Programs

Line		Reference	E-7 Sub 1192 Rider 11 Year 1 Estimate		E-7 Sub 1249 Rider 13 True up		E-7 Sub 1265 Rider 14 True up		E-7 Sub 1285 Rider 15 True up	Year 2020
28	Non-Residential DSM Program Cost	Fields Exhibit 1 pg. 5, Line 10 + Line 26 * NC Alloc. Factor	15,789,462		(3,918,078)		-		(0)	11,871,383
29	Non-Residential DSM Earned Utility Incentive	Fields Exhibit 1 pg. 5, Line 10 + Line 26 * NC Alloc. Factor	4,113,764		(275,311)		17,373		(25)	3,855,801
30	Return on overcollection of Non-residential DSM Program Costs	Miller Exhibit 3 page 14	-		(53,705)		(4,377)		124,794	66,712
31	Total Non-Residential DSM Program Cost and Incentive Components	Line 28 + Line 29 + Line 30	19,903,226		(4,247,095)		12,996		124,769	15,793,896
32	Revenue-related taxes and regulatory fees factor	Miller Exhibit 2, pg. 10	1.001402		1.001352		1.001402		1.001402	
33	Total Non-Residential DSM Revenue Requirement	Line 31 * Line 32	19,931,130		(4,252,837)		13,014		124,944	15,816,251
34	Total Collected for Vintage Year 2020 (through estimated Rider 15)	Miller Exhibit 4 Line 34, 40								15,783,965
35	Non-Residential EE Revenue Requirement True-up Amount	Line 33- Line 34								32,287
36	Projected NC Non-Residential Sales (kWh)	Miller Exhibit 6 Line 9								18,635,398,667
37	**NC Non-Residential DSM billing factor**	Line 35/Line 36*100								**0.0002**

** Actual regulatory fee rate in effect in year of collection. May differ from original filed estimates.

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Duke Energy Carolinas, LLC
Docket Number E-7 Sub 1285
Estimated Year 4 Lost Revenue and True Up of Year 1 and 2 for Vintage Year 2021

RESIDENTIAL
Energy Efficiency Programs

Line		Reference	Year 2021 Yr 4 LR Estimate	E-7 Sub 1230 Rider 12 Year 1 Estimate	E-7 Sub 1249 Year 2021 Yr 2 LR Estimate	E-7 Sub 1265 Rider 14 True up	E-7 Sub 1265 Year 2021 Yr 3 LR Estimate	E-7 Sub 1285 Rider 15 True up	Year 2021
1	Residential EE Program Cost	Fields Exhibit 1 pg. 6, Line 9 * NC Alloc. Factor		$ 37,155,471		$ (10,923,999)		$ -	$ 26,231,472
2	Residential EE Earned Utility Incentive	Fields Exhibit 1 pg. 6, Line 9 * NC Alloc. Factor		2,774,995		(244,088)		(254,158)	2,276,749
3	Return on undercollection of Residential EE Program Costs	Miller Exhibit 3 pg 15				(427,186)		(998,375)	(1,425,561)
4	Total EE Program Cost and Incentive Components	Line 1 + Line 2 + Line 3		39,930,466		(11,595,273)		(1,252,534)	27,082,659
5	Residential DSM Program Cost	Fields Exhibit 1 pg. 6, Line 10 + Line 26 * NC Alloc. Factor		13,699,485		(2,210,071)		-	11,489,414
6	Residential DSM Earned Utility Incentive	Fields Exhibit 1 pg. 6, Line 10 + Line 26 * NC Alloc. Factor		3,521,313		(751,140)		-	2,770,173
7	Return on overcollection of Residential DSM Program Costs	Miller Exhibit 3 pg 16				(105,970)		(194,724)	(300,693)
8	Total DSM Program Cost and Incentive Components	Line 5 + Line 6 + Line 7		17,220,797		(3,067,180)		(194,724)	13,958,894
9	Total EE/DSM Program Cost and Incentive Components	Line 4 + Line 8		57,151,264		(14,662,453)		(1,447,257)	41,041,553
10	Revenue-related taxes and regulatory fees factor **	Miller Exhibit 2, pg. 8		1.001302		1.001402		1.001402	
11	Total EE/DSM Program Cost and Incentive Revenue Requirement	Line 9 * Line 10		57,225,674		(14,683,010)		(1,449,286)	41,093,378
12	Residential Net Lost Revenues	Fields Exhibit 2 pg. 1-9	$ 1,915,275	25,205,298	6,249,665	(8,091,427)	3,959,003	837,374	28,159,914
13	Total Residential EE/DSM Revenue Requirement	Line 11 + Line 12	1,915,275	82,430,973	6,249,665	(22,774,437)	3,959,003	(611,912)	69,253,292
14	Total Collected for Vintage Year 2021 (through estimated Rider 15)	Miller Exhibit 4, Line 4, 10, 16, 20							70,020,796
15	**Total Residential EE/DSM Revenue Requirement**	Line13 - Line 14	$ 1,915,275						$ (767,503)

See Listebarger Exhibit A for rate

NON-RESIDENTIAL
Energy Efficiency Programs

Line		Reference	Year 2021 Yr 4 LR Estimate	E-7 Sub 1230 Rider 12 Year 1 Estimate	E-7 Sub 1249 Year 2021 Yr 2 LR Estimate	E-7 Sub 1265 Rider 14 True up	E-7 Sub 1265 Year 2021 Yr 3 LR Estimate	E-7 Sub 1285 Rider 15 True up	Year 2021
16	Non- Residential EE Program Cost	Fields Exhibit 1 pg. 6, Line 23 * NC Alloc. Factor		38,264,959		(8,510,352)		(2)	29,754,605
17	Non-Residential EE Earned Utility Incentive	Fields Exhibit 1 pg. 6, Line 23 * NC Alloc. Factor		8,888,527		(1,494,004)		(196,113)	7,198,410
18	Return on overcollection of Non-residential EE Program Costs	Miller Exhibit 3 page 17				(580,644)		(1,786,904)	(2,367,548)
19	Total EE Program Cost and Incentive Components	Line 16 + Line 17 + Line 18		47,153,486		(10,585,000)		(1,983,019)	34,585,467
20	Revenue-related taxes and regulatory fees factor	Miller Exhibit 2, pg. 8		1.001302		1.001402		1.001402	
21	Total Non-Residential EE Program Cost and Incentive Revenue Requirements	Line 19 * Line 20		47,214,880		(10,599,840)		(1,985,799)	34,629,241
22	Non-Residential Net Lost Revenues	Fields Exhibit 2 pg. 1-9	5,211,948	6,360,715	13,494,665	(4,819,745)	10,003,040	414,021	25,452,696
23	Total Non-Residential EE Revenue Requirement	Line 21 + Line 22	5,211,948	53,575,595	13,494,665	(15,419,585)	10,003,040	(1,571,778)	60,081,937
24	Total Collected for Vintage Year 2021 (through estimated Rider 15)	Miller Exhibit 4 Line 25, 31							61,445,924
25	Non-Residential EE Revenue Requirement	Line 23 - Line 24	5,211,948						(1,363,988)
26	Projected NC Residential Sales (kWh)	Miller Exhibit 6, Line 10	16,652,048,700						16,652,048,700
27	**NC Non-Residential EE billing factor (Cents/kWh)**	Line 25/Line 26*100	**0.0313**						**(0.0082)**

DSM Programs

Line		Reference	E-7 Sub 1230 Rider 12 Year 1 Estimate		E-7 Sub 1265 Rider 14 True up		E-7 Sub 1285 Rider 15 True up	Year 2021
28	Non-Residential DSM Program Cost	Fields Exhibit 1 pg. 6, Line 10 + Line 26 * NC Alloc. Factor	16,110,767		(3,154,656)		-	12,956,111
29	Non-Residential DSM Earned Utility Incentive	Fields Exhibit 1 pg. 6, Line 10 + Line 26 * NC Alloc. Factor	4,141,109		(1,017,305)		-	3,123,804
30	Return on overcollection of Non-residential DSM Program Costs	Miller Exhibit 3 page 18	-		(77,609)		(488,760)	(566,369)
31	Total Non-Residential DSM Program Cost and Incentive Components	Line 28 + Line 29 + Line 30	20,251,876		(4,249,570)		(488,760)	15,513,545
32	Revenue-related taxes and regulatory fees factor	Miller Exhibit 2, pg. 8	1.001302		1.001402		1.001402	
33	Total Non-Residential DSM Revenue Requirement	Line 31 * Line 32	20,278,244		(4,255,528)		(489,446)	15,533,270
34	Total Collected for Vintage Year 2021 (through estimated Rider 15)	Miller Exhibit 4 Line 35, 41						16,900,308
35	Non-Residential EE Revenue Requirement True-up Amount	Line 33- Line 34						(1,367,038)
36	Projected NC Non-Residential Sales (kWh)	Miller Exhibit 6 Line 11						18,677,101,757
37	**NC Non-Residential DSM billing factor**	Line 35/Line 36*100						**(0.0073)**

** Actual regulatory fee rate in effect in year of collection. May differ from original filed estimates.

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Revised Miller Exhibit 2, page 5

Duke Energy Carolinas, LLC
Docket Number E-7 Sub 1285
Estimated Year 3 Lost Revenue and True Up of Year 1 for Vintage Year 2022

RESIDENTIAL
Energy Efficiency Programs

Line		Reference	Year 2022 Yr 3 LR Estimate	E-7 Sub 1249 Rider 13 Year 1 Estimate	E-7 Sub 1265 Year 2022 Yr 2 LR Estimate	E-7 Sub 1285 Rider 15 True up	Year 2022
1	Residential EE Program Cost	Fields Exhibit 1 pg. 7, Line 10 * NC Alloc. Factor		$ 39,429,805		$ (8,070,781)	$ 31,359,024
2	Residential EE Earned Utility Incentive	Fields Exhibit 1 pg. 7, Line 10 * NC Alloc. Factor		3,287,459		775,625	4,063,084
3	Return on undercollection of Residential EE Program Costs	Miller Exhibit 3 pg 19				(253,647)	(253,647)
4	Total EE Program Cost and Incentive Components	Line 1 + Line 2 + Line 3		42,717,264		(7,548,803)	35,168,461
5	Residential DSM Program Cost	Fields Exhibit 1 pg. 7, Line 11 * NC Alloc. Factor		12,587,919		322,172	12,910,091
6	Residential DSM Earned Utility Incentive	Fields Exhibit 1 pg. 7, Line 11 * NC Alloc. Factor		2,954,061		347,746	3,301,808
7	Return on overcollection of Residential DSM Program Costs	Miller Exhibit 3 pg 20				(17,749)	(17,749)
8	Total DSM Program Cost and Incentive Components	Line 5 + Line 6 + Line 7		15,541,981		652,169	16,194,149
9	Total EE/DSM Program Cost and Incentive Components	Line 4 + Line 8		58,259,244		(6,896,634)	51,362,610
10	Revenue-related taxes and regulatory fees factor **	Miller Exhibit 2, pg. 8		1.001352		1.001402	
11	Total EE/DSM Program Cost and Incentive Revenue Requirement	Line 9 * Line 10		58,338,011		(6,906,303)	51,431,708
12	Residential Net Lost Revenues	Fields Exhibit 2 pg. 1-9	$ 4,813,237	21,026,409	6,791,458	(401,930)	27,415,937
13	Total Residential EE/DSM Revenue Requirement	Line 11 + Line 12	4,813,237	79,364,420	6,791,458	(7,308,233)	78,847,645
14	Total Collected for Vintage Year 2022 (through estimated Rider 15)	Miller Exhibit 4, Line 5, 11					88,216,873
15	**Total Residential EE/DSM Revenue Requirement**	Line13 - Line 14	$ 4,813,237				$ (9,369,228)

See Listebarger Exhibit A for rate

NON-RESIDENTIAL
Energy Efficiency Programs

Line		Reference	Year 2022 Yr 3 LR Estimate	E-7 Sub 1249 Rider 13 Year 1 Estimate	E-7 Sub 1265 Year 2022 Yr 2 LR Estimate	E-7 Sub 1285 Rider 15 True up	Year 2022
16	Non- Residential EE Program Cost	Fields Exhibit 1 pg. 7, Line 24 * NC Alloc. Factor		49,276,542		(19,852,904)	29,423,638
17	Non-Residential EE Earned Utility Incentive	Fields Exhibit 1 pg. 7, Line 24 * NC Alloc. Factor		10,564,159		(4,409,460)	6,154,699
18	Return on overcollection of Non-residential EE Program Costs	Miller Exhibit 3 page 21				(729,929)	(729,929)
19	Total EE Program Cost and Incentive Components	Line 16 + Line 17 + Line 18		59,840,701		(24,992,293)	34,848,407
20	Revenue-related taxes and regulatory fees factor	Miller Exhibit 2, pg. 8		1.001352		1.001402	
21	Total Non-Residential EE Program Cost and Incentive Revenue Requirements	Line 19 * Line 20		59,921,605		(25,027,333)	34,894,273
22	Non-Residential Net Lost Revenues	Fields Exhibit 2 pg. 1-9	7,844,523	8,181,228	15,132,477	(9,193,461)	14,120,244
23	Total Non-Residential EE Revenue Requirement	Line 21 + Line 22	7,844,523	68,102,833	15,132,477	(34,220,794)	49,014,517
24	Total Collected for Vintage Year 2022 (through estimated Rider 15)	Miller Exhibit 4 Line 12					78,251,255
25	Non-Residential EE Revenue Requirement	Line 23 - Line 24	7,844,523				(29,236,738)
26	Projected NC Residential Sales (kWh)	Miller Exhibit 6, Line 12	16,744,193,880				16,744,193,880
27	**NC Non-Residential EE billing factor (Cents/kWh)**	Line 25/Line 26*100	**0.0468**				**(0.1746)**

DSM Programs

Line		Reference	E-7 Sub 1249 Rider 13 Year 1 Estimate		E-7 Sub 1285 Rider 15 True up	Year 2022
28	Non-Residential DSM Program Cost	Fields Exhibit 1 pg. 7, Line 26 * NC Alloc. Factor	15,112,751		(513,598)	14,599,152
29	Non-Residential DSM Earned Utility Incentive	Fields Exhibit 1 pg. 7, Line 26 * NC Alloc. Factor	3,546,574		(812,058)	2,734,517
30	Return on overcollection of Non-residential DSM Program Costs	Miller Exhibit 3 page 22	-		7,161	7,161
31	Total Non-Residential DSM Program Cost and Incentive Components	Line 28 + Line 29 + Line 30	18,659,325		(1,318,495)	17,340,830
32	Revenue-related taxes and regulatory fees factor	Miller Exhibit 2, pg. 8	1.001352		1.001402	
33	Total Non-Residential DSM Revenue Requirement	Line 31 * Line 32	18,684,553		(1,320,344)	17,364,209
34	Total Collected for Vintage Year 2022 (through estimated Rider 15)	Miller Exhibit 4 Line 18				17,790,773
35	Non-Residential EE Revenue Requirement True-up Amount	Line 33- Line 34				(426,564)
36	Projected NC Non-Residential Sales (kWh)	Miller Exhibit 6 Line 13				18,855,570,769
37	**NC Non-Residential DSM billing factor**	Line 35/Line 36*100				**(0.0023)**

** Actual regulatory fee rate in effect in year of collection. May differ from original filed estimates.

Duke Energy Carolinas, LLC
Docket Number E-7 Sub 1285
Estimated Year 2 Lost Revenues for Vintage Year 2023

RESIDENTIAL

Line		Reference	2023
1	Residential Net Lost Revenues	Fields Exhibit 2 pg 1 - 9	6,787,155
2	Projected NC Residential Sales (kWh)	Miller Exhibit 6, Line 1	$ 23,664,202,369
3	**NC Residential EE Billing Factor (Cents/kWh)**	Line 1/Line 2*100	**0.0287**

NON-RESIDENTIAL
Energy Efficiency Programs

		Reference	2023
4	Non-Residential Net Lost Revenues	Fields Exhibit 2 pg 1 - 9	14,155,374
5	Projected NC Non-Residential Sales (kWh)	Miller Exhibit 6, Line 14	17,655,241,326
6	**NC Non-Residential EE billing factor (Cents/kWh)**	Line 4/Line 5*100	**0.0802**

Duke Energy Carolinas, LLC
Docket Number E-7 Sub 1285
Estimated Program Costs, Earned Incentive and Lost Revenues for Vintage Year 2024

RESIDENTIAL

Line		Reference	2024
1	Residential EE Program Cost	Fields Exhibit 1, pg. 8, Line 10 * NC Alloc. Factor	$ 38,670,751
2	Residential EE Earned Utility Incentive	Fields Exhibit 1, pg. 8, Line 10	4,624,245
3	Total EE Program Cost and Incentive Components	Line 1 + Line 2	43,294,996
4	Residential DSM Program Cost	Fields Exhibit 1 pg. 8, Line 11 * NC Alloc. Factor	18,148,614
5	Residential DSM Earned Utility Incentive	Fields Exhibit 1 pg. 8, Line 11	3,679,035
6	Total DSM Program Cost and Incentive Components	Line 4 + Line 5	21,827,649
7	Total EE/DSM Program Cost and Incentive Components	Line 3 + Line 6	65,122,646
8	Revenue-related taxes and regulatory fees factor	Miller Exhibit 2, pg. 8	1.001402
9	Total EE/DSM Program Cost and Incentive Revenue Requirement	Line 7 * Line 8	65,213,948
10	Residential Net Lost Revenues	Fields Exhibit 2 pg 1 - 9	23,509,586
11	**Total Residential EE Revenue Requirement**	**Line 9 + Line 10**	**$ 88,723,534**

See MIller Exhibit 1 for rate

NON-RESIDENTIAL
Energy Efficiency Programs

Line		Reference	2024
12	Non- Residential EE Program Cost	Fields Exhibit 1, pg. 8, Line 24 * NC Alloc. Factor	$ 47,830,402
13	Non-Residential EE Earned Utility Incentive	Fields Exhibit 1, pg. 8, Line 24	11,638,110
14	Total EE Program Cost and Incentive Components	Line 12 + Line 13	59,468,511
15	Revenue-related taxes and regulatory fees factor	Miller Exhibit 2, pg. 8	1.001402
16	Total Non-Residential EE Program Cost and Incentive Revenue Requirements	Line 14 * Line 15	59,551,886
17	Non-Residential Net Lost Revenues	Fields Exhibit 2 pg 1 - 9	8,761,484
18	Total Non-Residential EE Revenue Requirement	Line 16 + Line 17	$ 68,313,371
19	Projected NC Residential Sales (kWh)	Miller Exhibit 6, Line 16	17,655,241,326
20	**NC Non-Residential EE billing factor (Cents/kWh)**	Line 18/Line 19*100	**0.3869**

DSM Programs

Line		Reference	2024
21	Non-Residential DSM Program Cost	Fields Exhibit 1 pg. 8, Line 26 * NC Alloc. Factor	$ 14,564,801
22	Non-Residential DSM Earned Utility Incentive	Fields Exhibit 1 pg. 8, Line 26	2,498,051
23	Total Non-Residential DSM Program Cost and Incentive Components	Line 21 + Line 22	17,062,852
24	Revenue-related taxes and regulatory fees factor	Miller Exhibit 2, pg. 8	1.001402
25	Total Non-Residential DSM Revenue Requirement	Line 23 * Line 24	17,086,774
26	Projected NC Non-Residential Sales (kWh)	Miller Exhibit 6, Line 17	19,059,148,493
27	**NC Non-Residential DSM billing factor**	Line 25/Line 26*100	**0.0897**

Duke Energy Carolinas, LLC
Docket Number E-7 Sub 1285
Gross Receipts Tax Years 2018 through estimated 2024

	Year		Actual GRT Rate In Effect
Rider 9	2018		1.001402
Rider 10	2019		1.001402
	2020	Jan - June	1.001402
	2020	July - Dec	1.001302
Rider 11	2020	Weighted Average	1.001352
Rider 12	2021		1.001302
Rider 13	2022		1.001352 [1]
Rider 14	2023		1.001402
Rider 15	2024		1.001402

Note: Per Order in Docket No. M-100 Sub 142, the regulatory fee percentage was increased effective July 1,2022. This new rate is used as the estimate for 2023. This will be subject to true-up based on actual rates in effect.

[1] 6 months on old rate/6 months on new rate

Duke Energy Carolinas, LLC
Docket Number E-7 Sub 1285
Estimated Return Calculation - Residential EE Programs Vintage 2016

NC Residential EE		Residential EE Program Costs Incurred	NC Allocation %	NC Allocated EE Program Costs	Program Incentives	Lost Revenues	Total Costs	NC Residential Revenue Collected[1]	NC Residential EE Program Collection %	EE Program Costs Revenue Collected	(Over)/Under Collection
			Docket No. E-7, Sub 1192, Miller Exh 5 pg 2						100% used due to overcollection		
Beginning Balance		54,751,215		40,021,101	6,770,575	28,828,063	75,619,739	76,089,404			(47,227)
2022	January		73.0962827%	-	(57)	(487)	(544)	32,375	100.0000%	(32,375)	(32,918)
2022	February		73.0962827%	-	(57)	(487)	(544)	77,181	100.0000%	(77,181)	(77,725)
2022	March		73.0962827%	-	(57)	(487)	(544)	66,522	100.0000%	(66,522)	(67,065)
2022	April		73.0962827%	-	(57)	(487)	(544)	57,485	100.0000%	(57,485)	(58,029)
2022	May		73.0962827%	-	(57)	(487)	(544)	53,911	100.0000%	(53,911)	(54,455)
2022	June		73.0962827%	-	(57)	(487)	(544)	67,703	100.0000%	(67,703)	(68,246)
2022	July		73.0962827%	-	(57)	(487)	(544)	90,722	100.0000%	(90,722)	(91,266)
2022	August		73.0962827%	-	(57)	(487)	(544)	94,664	100.0000%	(94,664)	(95,207)
2022	September		73.0962827%	-	(57)	(487)	(544)	77,785	100.0000%	(77,785)	(78,329)
2022	October		73.0962827%	-	(57)	(487)	(544)	53,952	100.0000%	(53,952)	(54,496)
2022	November		73.0962827%	-	(57)	(487)	(544)	56,442	100.0000%	(56,442)	(56,985)
2022	December		73.0962827%	-	(57)	(487)	(544)	168,045	100.0000%	(168,045)	(168,589)
		54,751,215		40,021,101	6,769,891	28,822,224	75,613,216	76,986,192		(896,788)	(950,538)

Vintage is overcollected. Interest is calculated on all components.

100% of all revenues offset the overcollected balance.

NC Residential EE		Cumulative (Over)/Under Recovery	Current Income Tax Rate	Monthly Deferred Income Tax	Cumulative Deferred Income Tax	Net Deferred After Tax Balance	Monthly Return	Monthly A/T Return on Deferral	YTD After Tax Interest	Gross up of Return to Pretax Rate	Gross up of Return to Pretax
			1/2022 - 12/2022				6.56%			0.766497	
Beginning Balance		(47,227)			(11,028)	(36,200)					
2022	January	(80,145)	0.233503	(7,686)	(18,714)	(61,431)	0.005469	(267)	(267)	0.766497	(348)
2022	February	(157,870)	0.233503	(18,149)	(36,863)	(121,007)	0.005469	(499)	(766)	0.766497	(999)
2022	March	(224,935)	0.233503	(15,660)	(52,523)	(172,412)	0.005469	(802)	(1,568)	0.766497	(2,046)
2022	April	(282,964)	0.233503	(13,550)	(66,073)	(216,891)	0.005469	(1,065)	(2,633)	0.766497	(3,435)
2022	May	(337,419)	0.233503	(12,715)	(78,788)	(258,631)	0.005469	(1,300)	(3,933)	0.766497	(5,131)
2022	June	(405,665)	0.233503	(15,936)	(94,724)	(310,941)	0.005469	(1,558)	(5,491)	0.766497	(7,163)
2022	July	(496,931)	0.233503	(21,311)	(116,035)	(380,896)	0.005469	(1,892)	(7,383)	0.766497	(9,632)
2022	August	(592,139)	0.233503	(22,231)	(138,266)	(453,873)	0.005469	(2,283)	(9,665)	0.766497	(12,610)
2022	September	(670,468)	0.233503	(18,290)	(156,556)	(513,911)	0.005469	(2,646)	(12,312)	0.766497	(16,063)
2022	October	(724,964)	0.233503	(12,725)	(169,281)	(555,682)	0.005469	(2,925)	(15,237)	0.766497	(19,878)
2022	November	(781,949)	0.233503	(13,306)	(182,587)	(599,361)	0.005469	(3,159)	(18,395)	0.766497	(23,999)
2022	December	(950,538)	0.233503	(39,366)	(221,953)	(728,584)	0.005469	(3,631)	(22,027)	0.766497	(28,737)
	Checks			(210,926)	(210,926)	(221,953)		(22,027)			(28,737)

Note 1: NC Residential Revenue Collected updated to account for revenue collected during 2020 and 2021.

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Revised MIller Exhibit 3, page 2

Duke Energy Carolinas, LLC
Docket Number E-7 Sub 1285
Estimated Return Calculation - Residential EE Programs Vintage 2017

NC Residential EE		Residential EE Program Costs Incurred	NC Allocation %	NC Allocated EE Program Costs	Program Incentives	Lost Revenues	Total Costs	NC Residential Revenue Collected[1]	NC Residential EE Program Collection %	EE Program Costs Revenue Collected	(Over)/Under Collection
			Docket No. E-7, Sub 1249, Listebarger Exh 5 pg 1						100% used due to overcollection		
Beginning Balance		65,222,734		47,487,858	8,319,498	32,241,553	88,048,909	92,061,985			(4,013,074)
2022	January		72.8087506%	-	(1,810)	(19,200)	(21,011)	(84,020)	100.0000%	84,020	63,009
2022	February		72.8087506%	-	(1,810)	(19,200)	(21,011)	(152,561)	100.0000%	152,561	131,550
2022	March		72.8087506%	-	(1,810)	(19,200)	(21,011)	(153,687)	100.0000%	153,687	132,676
2022	April		72.8087506%	-	(1,810)	(19,200)	(21,011)	(121,719)	100.0000%	121,719	100,708
2022	May		72.8087506%	-	(1,810)	(19,200)	(21,011)	(96,119)	100.0000%	96,119	75,109
2022	June		72.8087506%	-	(1,810)	(19,200)	(21,011)	(133,151)	100.0000%	133,151	112,141
2022	July		72.8087506%	-	(1,810)	(19,200)	(21,011)	(162,182)	100.0000%	162,182	141,171
2022	August		72.8087506%	-	(1,810)	(19,200)	(21,011)	(165,824)	100.0000%	165,824	144,813
2022	September		72.8087506%	-	(1,810)	(19,200)	(21,011)	(162,942)	100.0000%	162,942	141,931
2022	October		72.8087506%	-	(1,810)	(19,200)	(21,011)	(113,482)	100.0000%	113,482	92,471
2022	November		72.8087506%	-	(1,810)	(19,200)	(21,011)	(103,188)	100.0000%	103,188	82,178
2022	December		72.8087506%	-	(1,810)	(19,200)	(21,011)	(106,744)	100.0000%	106,744	85,733
		65,222,734		47,487,858	8,297,775	32,011,149	87,796,781	90,506,366		1,555,619	(2,709,583)

Vintage is overcollected. Interest is calculated on all components.

100% of all revenues offset the overcollected balance.

NC Residential EE		Cumulative (Over)/Under Recovery	Current Income Tax Rate	Monthly Deferred Income Tax	Cumulative Deferred Income Tax	Net Deferred After Tax Balance	Monthly Return	Monthly A/T Return on Deferral	YTD After Tax Interest	Gross up of Return to Pretax Rate	Gross up of Return to Pretax
			1/2022 - 12/2022				6.56%			0.766497	
Beginning Balance		(4,013,074)			(937,065)	(3,076,010)					
2022	January	(3,950,065)	0.233503	14,713	(922,352)	(3,027,713)	0.005469	(16,691)	(16,691)	0.766497	(21,776)
2022	February	(3,818,515)	0.233503	30,717	(891,635)	(2,926,880)	0.005469	(16,283)	(32,975)	0.766497	(43,020)
2022	March	(3,685,839)	0.233503	30,980	(860,654)	(2,825,184)	0.005469	(15,730)	(48,704)	0.766497	(63,541)
2022	April	(3,585,131)	0.233503	23,516	(837,139)	(2,747,992)	0.005469	(15,240)	(63,944)	0.766497	(83,424)
2022	May	(3,510,022)	0.233503	17,538	(819,601)	(2,690,421)	0.005469	(14,872)	(78,816)	0.766497	(102,827)
2022	June	(3,397,881)	0.233503	26,185	(793,415)	(2,604,466)	0.005469	(14,479)	(93,296)	0.766497	(121,717)
2022	July	(3,256,710)	0.233503	32,964	(760,452)	(2,496,258)	0.005469	(13,948)	(107,244)	0.766497	(139,914)
2022	August	(3,111,897)	0.233503	33,814	(726,637)	(2,385,259)	0.005469	(13,349)	(120,593)	0.766497	(157,330)
2022	September	(2,969,965)	0.233503	33,141	(693,496)	(2,276,469)	0.005469	(12,748)	(133,341)	0.766497	(173,961)
2022	October	(2,877,494)	0.233503	21,592	(671,903)	(2,205,591)	0.005469	(12,257)	(145,597)	0.766497	(189,952)
2022	November	(2,795,316)	0.233503	19,189	(652,715)	(2,142,602)	0.005469	(11,891)	(157,488)	0.766497	(205,464)
2022	December	(2,709,583)	0.233503	20,019	(632,696)	(2,076,888)	0.005469	(11,539)	(169,026)	0.766497	(220,518)
	Checks			304,369	304,369	(632,696)		(169,026)			(220,518)

Note 1: NC Residential Revenue Collected updated to account for a correction to 2020 revenue collected and the inclusion of revenue collected during 2021 and 2022.

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Revised Miller Exhibit 3, page 3

Duke Energy Carolinas, LLC
Docket Number E-7 Sub 1285
Estimated Return Calculation - Residential EE Programs Vintage 2018

NC Residential EE		Residential EE Program Costs Incurred	NC Allocation %	NC Allocated EE Program Costs	Program Incentives	Lost Revenues	Total Costs	NC Residential Revenue Collected[2]	NC Residential EE Program Collection %	EE Program Costs Revenue Collected	(Over)/Under Collection
			Listebarger Exhibit 5 pg. 1, Line 4						100% used due to overcollection		
Beginning Balance		77,331,818		56,230,324	9,941,319	40,274,557	106,446,200	106,331,949		(56,790)	(111,787)
2022	January		72.7130507%	-	4,579	(16,175)	(11,596)	103,167	100.0000%	(103,167)	(114,763)
2022	February		72.7130507%	-	4,579	(16,175)	(11,596)	309,908	100.0000%	(309,908)	(321,504)
2022	March		72.7130507%	-	4,579	(16,175)	(11,596)	239,380	100.0000%	(239,380)	(250,976)
2022	April		72.7130507%	-	4,579	(16,175)	(11,596)	193,530	100.0000%	(193,530)	(205,126)
2022	May		72.7130507%	-	4,579	(16,175)	(11,596)	193,444	100.0000%	(193,444)	(205,039)
2022	June		72.7130507%	-	4,579	(16,175)	(11,596)	257,199	100.0000%	(257,199)	(268,794)
2022	July		72.7130507%	-	4,579	(16,175)	(11,596)	296,495	100.0000%	(296,495)	(308,090)
2022	August		72.7130507%	-	4,579	(16,175)	(11,596)	322,951	100.0000%	(322,951)	(334,546)
2022	September		72.7130507%	-	4,579	(16,175)	(11,596)	267,462	100.0000%	(267,462)	(279,058)
2022	October		72.7130507%	-	4,579	(16,175)	(11,596)	185,083	100.0000%	(185,083)	(196,679)
2022	November		72.7130507%	-	4,579	(16,175)	(11,596)	181,304	100.0000%	(181,304)	(192,899)
2022	December		72.7130507%	-	4,579	(16,175)	(11,596)	461,672	100.0000%	(461,672)	(473,268)
		77,331,818		56,230,324	9,996,266	40,080,462	106,307,052	109,343,543		(3,068,385)	(3,262,530)

Vintage is overcollected. Interest is calculated on all components.

100% of all revenues offset the overcollected balance.

NC Residential EE		Cumulative (Over)/Under Recovery	Current Income Tax Rate	Monthly Deferred Income Tax	Cumulative Deferred Income Tax	Net Deferred After Tax Balance	Monthly Return	Monthly A/T Return on Deferral	YTD After Tax Interest	Gross up of Return to Pretax Rate	Gross up of Return to Pretax
			1/2022 - 12/2022				6.56%			0.766497	
Beginning Balance		(111,787)			(26,103)	(85,685)					
2022	January	(226,550)	0.233503	(26,798)	(52,900)	(173,650)	0.005469	(709)	(709)	0.766497	(925)
2022	February	(548,054)	0.233503	(75,072)	(127,972)	(420,082)	0.005469	(1,624)	(2,333)	0.766497	(3,043)
2022	March	(799,030)	0.233503	(58,604)	(186,576)	(612,454)	0.005469	(2,824)	(5,156)	0.766497	(6,727)
2022	April	(1,004,156)	0.233503	(47,897)	(234,473)	(769,682)	0.005469	(3,780)	(8,936)	0.766497	(11,658)
2022	May	(1,209,195)	0.233503	(47,877)	(282,351)	(926,844)	0.005469	(4,639)	(13,575)	0.766497	(17,711)
2022	June	(1,477,989)	0.233503	(62,764)	(345,115)	(1,132,874)	0.005469	(5,632)	(19,208)	0.766497	(25,059)
2022	July	(1,786,080)	0.233503	(71,940)	(417,055)	(1,369,025)	0.005469	(6,842)	(26,049)	0.766497	(33,985)
2022	August	(2,120,626)	0.233503	(78,118)	(495,173)	(1,625,454)	0.005469	(8,189)	(34,238)	0.766497	(44,668)
2022	September	(2,399,684)	0.233503	(65,161)	(560,333)	(1,839,351)	0.005469	(9,475)	(43,713)	0.766497	(57,029)
2022	October	(2,596,363)	0.233503	(45,925)	(606,258)	(1,990,104)	0.005469	(10,472)	(54,185)	0.766497	(70,692)
2022	November	(2,789,262)	0.233503	(45,043)	(651,301)	(2,137,961)	0.005469	(11,289)	(65,473)	0.766497	(85,419)
2022	December	(3,262,530)	0.233503	(110,509)	(761,810)	(2,500,719)	0.005469	(12,685)	(78,158)	0.766497	(101,968)
	Checks			(735,708)	(735,708)	(761,810)		(78,158)			(101,968)

Adjustment to interest calculation to account for corrections as noted in Docket No. E-7, Sub 1265 Listebarger Supplemental Testimony and Exhibits filed 5/16/2022. (2,707)

Final Gross up of Return to Pretax for Vintage 2018 **(104,676)**

Note 1: Beginning Balances tie to Docket No. E-7, Sub 1265 Listebarger Supplemental Testimony and Exhibits filed 5/16/2022.

Note 2: Beginning Balance for NC Residential Revenue Collected has been adjusted to correct understatement of revenues from prior rider filing.

Note 1: Beginning Balances tie to Docket No. E-7, Sub 1265 Listebarger Supplemental Testimony and Exhibits filed 5/16/2022.

Note 2: Beginning Balance for NC Residential Revenue Collected has been adjusted to correct understatement of revenues from prior rider filing.

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Duke Energy Carolinas, LLC
Docket Number E-7 Sub 1285
Estimated Return Calculation - Residential DSM Programs Vintage 2018

NC Residential DSM		Residential DSM Program Costs Incurred	NC Allocation %	NC Allocated DSM Program Costs	NC Residential Revenue Collected[2]	NC Residential DSM Program Collection %	DSM Program Costs Revenue Collected	(Over)/Under Collection
			Listebarger Exhibit 5 pg. 1, Line 4			see calc. at right		
Beginning Balance		30,409,405		9,778,896	11,667,551		(9,777,529)	1,366
2022	January		32.1574721%	-	(770)	-6.5213%	(50)	(50)
2022	February		32.1574721%	-	(2,313)	-6.5213%	(151)	(151)
2022	March		32.1574721%	-	(1,786)	-6.5213%	(116)	(116)
2022	April		32.1574721%	-	(1,444)	-6.5213%	(94)	(94)
2022	May		32.1574721%	-	(1,444)	-6.5213%	(94)	(94)
2022	June		32.1574721%	-	(1,919)	-6.5213%	(125)	(125)
2022	July		32.1574721%	-	(2,213)	-6.5213%	(144)	(144)
2022	August		32.1574721%	-	(2,410)	-6.5213%	(157)	(157)
2022	September		32.1574721%	-	(1,996)	-6.5213%	(130)	(130)
2022	October		32.1574721%	-	(1,381)	-6.5213%	(90)	(90)
2022	November		32.1574721%	-	(1,353)	-6.5213%	(88)	(88)
2022	December		32.1574721%	-	(3,445)	-6.5213%	(225)	(225)
		30,409,405		9,778,896	11,645,077		(9,778,995)	(100)

Program Costs to be Recovered in Rider 13	1,366
Revenues to be Collected in Rider 13	(20,945)
% Revenue related to Program Costs	-6.5213%

NC Residential DSM		Cumulative (Over)/Under Recovery	Current Income Tax Rate	Monthly Deferred Income Tax	Cumulative Deferred Income Tax	Net Deferred After Tax Balance	Monthly Return	Monthly A/T Return on Deferral	YTD After Tax Interest	Gross up of Return to Pretax Rate	Gross up of Return to Pretax
			1/2022 - 12/2022				6.56%			0.766497	
Beginning Balance		1,366			319	1,047					
2022	January	1,316	0.233503	(12)	307	1,008	0.005469	6	6	0.766497	7
2022	February	1,165	0.233503	(35)	272	893	0.005469	5	11	0.766497	14
2022	March	1,048	0.233503	(27)	245	804	0.005469	5	15	0.766497	20
2022	April	954	0.233503	(22)	223	731	0.005469	4	20	0.766497	26
2022	May	860	0.233503	(22)	201	659	0.005469	4	23	0.766497	31
2022	June	735	0.233503	(29)	172	563	0.005469	3	27	0.766497	35
2022	July	591	0.233503	(34)	138	453	0.005469	3	30	0.766497	39
2022	August	433	0.233503	(37)	101	332	0.005469	2	32	0.766497	41
2022	September	303	0.233503	(30)	71	232	0.005469	2	33	0.766497	43
2022	October	213	0.233503	(21)	50	163	0.005469	1	34	0.766497	45
2022	November	125	0.233503	(21)	29	96	0.005469	1	35	0.766497	46
2022	December	(100)	0.233503	(52)	(23)	(76)	0.005469	0	35	0.766497	46
	Checks			(342)	(342)	(23)		35			46

Adjustment to interest calculation to account for corrections as noted in Docket No. E-7, Sub 1265 Listebarger Supplemental Testimony and Exhibits filed 5/16/2022	(18,041)
Final Gross up of Return to Pretax for Vintage 2018	**(17,995)**

Note 1: Beginning Balances tie to Docket No. E-7, Sub 1265 Listebarger Supplemental Testimony and Exhibits filed 5/16/2022
Note 2: Beginning Balance for NC Residential Revenue Collected has been adjusted to correct understatement of revenues from prior rider filing
Note 2: Beginning Balance for NC Residential Revenue Collected has been adjusted to correct understatement of revenues from prior rider filing

Duke Energy Carolinas, LLC
Docket Number E-7 Sub 1285
Estimated Return Calculation - Non-Residential EE Programs Vintage 2018

NC Non- Residential EE		Non-Residential EE Program Costs Incurred	NC Allocation %	NC Allocated EE Program Costs	Program Incentives	Lost Revenues	Total Costs	NC Residential Revenue Collected[2]	NC Non-Residential EE Program Collection %	Non-Residential EE Program Costs Revenue Collected	(Over)/Under Collection
			Listebarger Exhibit 5 pg 1, Line 4						100% used due to overcollection		
Beginning Balance1		51,264,448		37,275,944	14,405,269	25,378,082	77,059,295	78,444,148		18,901,785	(302,294)
2022	January		72.7130507%	-	6,005		6,005	33,327	100.0000000%	(33,327)	(27,322)
2022	February		72.7130507%	-	6,005		6,005	39,340	100.0000000%	(39,340)	(33,335)
2022	March		72.7130507%	-	6,005		6,005	36,379	100.0000000%	(36,379)	(30,374)
2022	April		72.7130507%	-	6,005		6,005	35,351	100.0000000%	(35,351)	(29,346)
2022	May		72.7130507%	-	6,005		6,005	37,093	100.0000000%	(37,093)	(31,088)
2022	June		72.7130507%	-	6,005		6,005	44,084	100.0000000%	(44,084)	(38,079)
2022	July		72.7130507%	-	6,005		6,005	46,292	100.0000000%	(46,292)	(40,287)
2022	August		72.7130507%	-	6,005		6,005	50,617	100.0000000%	(50,617)	(44,611)
2022	September		72.7130507%	-	6,005		6,005	46,462	100.0000000%	(46,462)	(40,457)
2022	October		72.7130507%	-	6,005		6,005	37,306	100.0000000%	(37,306)	(31,301)
2022	November		72.7130507%	-	6,005		6,005	34,238	100.0000000%	(34,238)	(28,233)
2022	December		72.7130507%	-	6,005		6,005	44,533	100.0000000%	(44,533)	(38,528)
		51,264,448		37,275,944	14,477,330	25,378,082	77,131,356	78,929,171		18,416,763	(715,255)
								exhibit 4, line 22			

Vintage is overcollected. Interest is calculated on all components.

100% of all revenues offset the overcollected balance.

NC Non-Residential EE		Cumulative (Over)/Under Recovery	Current Income Tax Rate	Monthly Deferred Income Tax	Cumulative Deferred Income Tax	Net Deferred After Tax Balance	Monthly Return	Monthly A/T Return on Deferral	YTD After Tax Interest	Gross up of Return to Pretax Rate	Gross up of Return to Pretax
			1/2022 - 12/2022				6.56%			0.766497	
Beginning Balance		(302,294)			(70,587)	(231,707)					
2022	January	(329,616)	0.233503	(6,380)	(76,966)	(252,649)	0.005469	(1,325)	(1,325)	0.766497	(1,728)
2022	February	(362,951)	0.233503	(7,784)	(84,750)	(278,201)	0.005469	(1,452)	(2,776)	0.766497	(3,622)
2022	March	(393,325)	0.233503	(7,092)	(91,842)	(301,482)	0.005469	(1,585)	(4,361)	0.766497	(5,690)
2022	April	(422,671)	0.233503	(6,852)	(98,695)	(323,976)	0.005469	(1,710)	(6,072)	0.766497	(7,921)
2022	May	(453,759)	0.233503	(7,259)	(105,954)	(347,805)	0.005469	(1,837)	(7,909)	0.766497	(10,318)
2022	June	(491,838)	0.233503	(8,892)	(114,846)	(376,992)	0.005469	(1,982)	(9,891)	0.766497	(12,904)
2022	July	(532,125)	0.233503	(9,407)	(124,253)	(407,872)	0.005469	(2,146)	(12,037)	0.766497	(15,704)
2022	August	(576,736)	0.233503	(10,417)	(134,670)	(442,066)	0.005469	(2,324)	(14,361)	0.766497	(18,736)
2022	September	(617,193)	0.233503	(9,447)	(144,116)	(473,077)	0.005469	(2,503)	(16,864)	0.766497	(22,001)
2022	October	(648,494)	0.233503	(7,309)	(151,425)	(497,069)	0.005469	(2,653)	(19,517)	0.766497	(25,462)
2022	November	(676,727)	0.233503	(6,592)	(158,018)	(518,709)	0.005469	(2,778)	(22,295)	0.766497	(29,086)
2022	December	(715,255)	0.233503	(8,996)	(167,014)	(548,241)	0.005469	(2,918)	(25,212)	0.766497	(32,893)
	Checks			(96,428)	(96,428)	(167,014)		(25,212)			(32,893)

Adjustment to interest calculation to account for corrections as noted in Docket No. E-7, Sub 1265 Listebarger Supplemental Testimony and Exhibits filed 5/16/2022. (22,050)

Final Gross up of Return to Pretax for Vintage 2018 (54,943)

Note 1: Beginning Balances tie to Docket No. E-7, Sub 1265 Listebarger Supplemental Testimony and Exhibits filed 5/16/2022.

Note 2: Beginning Balance for NC Residential Revenue Collected has been adjusted to correct understatement of revenues from prior rider filing.

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Revised Miller Exhibit 3, page 6

Duke Energy Carolinas, LLC
Docket Number E-7 Sub 1285
Estimated Return Calculation -Non - Residential DSM Programs Vintage 2018

NC Non- Residential DSM		Total System NC DSM Program Costs Incurred	NC Non- Residential DSM Allocation %	NC Allocated DSM Non-Residential Program Costs	NC Non-Residential DSM Revenue Collected[2]	NC Non-Residential DSM Program Collection %	Non-Residential DSM Program Costs Revenue Collected	(Over)/Under Collection
			Listebarger Exhibit 5 pg. 1, Line 10			see calc. at right		
Beginning Balance1		30,409,405		12,611,170	15,860,821		(12,566,531)	44,639
2022	January	-	41.4712829%	-	1,533	12.9384608%	(198)	(198)
2022	February	-	41.4712829%	-	24,533	12.9384608%	(3,174)	(3,174)
2022	March	-	41.4712829%	-	26,127	12.9384608%	(3,380)	(3,380)
2022	April	-	41.4712829%	-	22,704	12.9384608%	(2,937)	(2,937)
2022	May	-	41.4712829%	-	24,694	12.9384608%	(3,195)	(3,195)
2022	June	-	41.4712829%	-	30,200	12.9384608%	(3,907)	(3,907)
2022	July	-	41.4712829%	-	31,156	12.9384608%	(4,031)	(4,031)
2022	August	-	41.4712829%	-	33,947	12.9384608%	(4,392)	(4,392)
2022	September	-	41.4712829%	-	31,146	12.9384608%	(4,030)	(4,030)
2022	October	-	41.4712829%	-	25,938	12.9384608%	(3,356)	(3,356)
2022	November	-	41.4712829%	-	23,820	12.9384608%	(3,082)	(3,082)
2022	December	-	41.4712829%	-	35,069	12.9384608%	(4,537)	(4,537)
		30,409,405		12,611,170	16,171,688		(12,606,753)	4,418
					exhibit 4, line 32			

Program Costs to be Recovered in Rider 13	44,639
Revenues to be Collected in Rider 13	345,011
% Revenue related to Program Costs	12.9385%

NC Non-Residential DSM		Cumulative (Over)/Under Recovery	Current Income Tax Rate	Monthly Deferred Income Tax	Cumulative Deferred Income Tax	Net Deferred After Tax Balance	Monthly Return	Monthly A/T Return on Deferral	YTD After Tax Interest	Gross up of Return to Pretax Rate	Gross up of Return to Pretax
			1/2022 - 12/2022				6.56%			0.766497	
Beginning Balance		44,639			10,423	34,216					
2022	January	44,441	0.233503	(46)	10,377	34,064	0.005469	187	187	0.766497	244
2022	February	41,267	0.233503	(741)	9,636	31,631	0.005469	180	366	0.766497	478
2022	March	37,886	0.233503	(789)	8,847	29,040	0.005469	166	532	0.766497	694
2022	April	34,949	0.233503	(686)	8,161	26,788	0.005469	153	685	0.766497	894
2022	May	31,754	0.233503	(746)	7,415	24,339	0.005469	140	825	0.766497	1,076
2022	June	27,846	0.233503	(912)	6,502	21,344	0.005469	125	950	0.766497	1,239
2022	July	23,815	0.233503	(941)	5,561	18,254	0.005469	108	1,058	0.766497	1,380
2022	August	19,423	0.233503	(1,026)	4,535	14,888	0.005469	91	1,149	0.766497	1,498
2022	September	15,393	0.233503	(941)	3,594	11,799	0.005469	73	1,222	0.766497	1,594
2022	October	12,037	0.233503	(784)	2,811	9,226	0.005469	57	1,279	0.766497	1,669
2022	November	8,955	0.233503	(720)	2,091	6,864	0.005469	44	1,323	0.766497	1,726
2022	December	4,418	0.233503	(1,059)	1,032	3,386	0.005469	28	1,351	0.766497	1,763
	Checks			(9,392)	(9,392)	1,032		1,351			1,763

Adjustment to interest calculation to account for corrections as noted in Docket No. E-7, Sub 1265 Listebarger Supplemental Testimony and Exhibits filed 5/16/2022 (33,076)

Final Gross up of Return to Pretax for Vintage 2018 (31,313)

Note 1: Beginning Balances tie to Docket No. E-7, Sub 1265 Listebarger Supplemental Testimony and Exhibits filed 5/16/2022.

Note 2: Beginning Balance for NC Residential Revenue Collected has been adjusted to correct understatement of revenues from prior rider filing

Revised Miller Exhibit 3, page 7

Duke Energy Carolinas, LLC
Docket Number E-7 Sub 1285
Estimated Return Calculation - Residential EE Programs Vintage 2019

NC Residential EE		Residential EE Program Costs Incurred	NC Allocation %	NC Allocated EE Program Costs	NC Residential Revenue Collected[2]	NC Residential EE Program Collection %	EE Program Costs Revenue Collected	(Over)/Under Collection
			Listebarger Exhibit 5 pg. 2, Line 4			see calc. at right		
Beginning Balance1		74,218,205		54,246,377	97,819,053		(54,251,938)	(5,561)
2022	January		73.0903918%	-	42,345	-0.4607%	195	195
2022	February		73.0903918%	-	127,201	-0.4607%	586	586
2022	March		73.0903918%	-	98,253	-0.4607%	453	453
2022	April		73.0903918%	-	79,434	-0.4607%	366	366
2022	May		73.0903918%	-	79,399	-0.4607%	366	366
2022	June		73.0903918%	-	105,567	-0.4607%	486	486
2022	July		73.0903918%	-	121,696	-0.4607%	561	561
2022	August		73.0903918%	-	132,554	-0.4607%	611	611
2022	September		73.0903918%	-	109,779	-0.4607%	506	506
2022	October		73.0903918%	-	75,967	-0.4607%	350	350
2022	November		73.0903918%	-	74,416	-0.4607%	343	343
2022	December		73.0903918%	-	189,492	-0.4607%	873	873
		74,218,205		54,246,377	99,055,155		(54,246,243)	134
					exhibit 4 line 2			

Program Costs to be Recovered in Rider 13	(5,561)
Revenues to be Collected in Rider 13	1,207,099
% Revenue related to Program Costs	-0.4607%

NC Residential EE		Cumulative (Over)/Under Recovery	Current Income Tax Rate	Monthly Deferred Income Tax	Cumulative Deferred Income Tax	Net Deferred After Tax Balance	Monthly Return	Monthly A/T Return on Deferral	YTD After Tax Interest	Gross up of Return to Pretax Rate	Gross up of Return to Pretax
			1/2022 - 12/2022				6.56%			0.766497	
Beginning Balance		(5,561)			(1,299)	(4,263)					
2022	January	(5,366)	0.233503	46	(1,253)	(4,113)	0.005469	(23)	(23)	0.766497	(30)
2022	February	(4,780)	0.233503	137	(1,116)	(3,664)	0.005469	(21)	(44)	0.766497	(58)
2022	March	(4,328)	0.233503	106	(1,010)	(3,317)	0.005469	(19)	(63)	0.766497	(83)
2022	April	(3,962)	0.233503	85	(925)	(3,037)	0.005469	(17)	(81)	0.766497	(105)
2022	May	(3,596)	0.233503	85	(840)	(2,756)	0.005469	(16)	(96)	0.766497	(126)
2022	June	(3,109)	0.233503	114	(726)	(2,383)	0.005469	(14)	(111)	0.766497	(144)
2022	July	(2,549)	0.233503	131	(595)	(1,954)	0.005469	(12)	(122)	0.766497	(160)
2022	August	(1,938)	0.233503	143	(453)	(1,485)	0.005469	(9)	(132)	0.766497	(172)
2022	September	(1,432)	0.233503	118	(334)	(1,098)	0.005469	(7)	(139)	0.766497	(181)
2022	October	(1,082)	0.233503	82	(253)	(830)	0.005469	(5)	(144)	0.766497	(188)
2022	November	(739)	0.233503	80	(173)	(567)	0.005469	(4)	(148)	0.766497	(193)
2022	December	134	0.233503	204	31	102	0.005469	(1)	(149)	0.766497	(195)
	Checks			1,330	1,330	31		(149)			(195)

Adjustment to interest calculation to account for corrections as noted in Docket No. E-7, Sub 1265 Listebarger Supplemental Testimony and Exhibits filed 5/16/2022. -

Final Gross up of Return to Pretax for Vintage 2019 **(195)**

Note 1: Beginning Balances tie to Docket No. E-7, Sub 1265 Listebarger Supplemental Testimony and Exhibits filed 5/16/2022.

Note 2: Beginning Balance for NC Residential Revenue Collected has been adjusted to correct understatement of revenues from prior rider filing.

/A

Duke Energy Carolinas, LLC
Docket Number E-7 Sub 1285
Estimated Return Calculation - Residential DSM Programs Vintage 2019

NC Residential DSM		Total System NC DSM Program Costs Incurred	NC Allocation %	NC Allocated DSM Program Costs	NC Residential Revenue Collected	NC Residential DSM Program Collection %	DSM Program Costs Revenue Collected	(Over)/Under Collection
			Listebarger Exhibit 5 pg. 2, Line 9			see calc. at right		
Beginning Balance1		30,097,219		10,268,601	13,524,504		(10,213,197)	55,403
2022	January		34.1181040%		(770)	-256.4535%	(1,974)	(1,974)
2022	February		34.1181040%	-	(2,313)	-256.4535%	(5,931)	(5,931)
2022	March		34.1181040%	-	(1,786)	-256.4535%	(4,581)	(4,581)
2022	April		34.1181040%	-	(1,444)	-256.4535%	(3,704)	(3,704)
2022	May		34.1181040%	-	(1,444)	-256.4535%	(3,702)	(3,702)
2022	June		34.1181040%	-	(1,919)	-256.4535%	(4,922)	(4,922)
2022	July		34.1181040%	-	(2,213)	-256.4535%	(5,674)	(5,674)
2022	August		34.1181040%	-	(2,410)	-256.4535%	(6,181)	(6,181)
2022	September		34.1181040%	-	(1,996)	-256.4535%	(5,119)	(5,119)
2022	October		34.1181040%	-	(1,381)	-256.4535%	(3,542)	(3,542)
2022	November		34.1181040%	-	(1,353)	-256.4535%	(3,470)	(3,470)
2022	December		34.1181040%	-	(3,445)	-256.4535%	(8,836)	(8,836)
		30,097,219		10,268,601	13,502,030		(10,270,834)	(2,234)
					exhibit 4 line 8			

Program Costs to be Recovered in Rider 13	55,403
Revenues to be Collected in Rider 13	(21,604)
% Revenue related to Program Costs	-256.4535%

NC Residential DSM		Cumulative (Over)/Under Recovery	Current Income Tax Rate	Monthly Deferred Income Tax	Cumulative Deferred Income Tax	Net Deferred After Tax Balance	Monthly Return	Monthly A/T Return on Deferral	YTD After Tax Interest	Gross up of Return to Pretax Rate	Gross up of Return to Pretax
			1/2022 - 12/2022				6.56%			0.766497	
Beginning Balance		55,403			12,937	42,466					
2022	January	53,429	0.233503	(461)	12,476	40,953	0.005469	228	228	0.766497	298
2022	February	47,497	0.233503	(1,385)	11,091	36,407	0.005469	212	440	0.766497	574
2022	March	42,916	0.233503	(1,070)	10,021	32,895	0.005469	190	629	0.766497	821
2022	April	39,212	0.233503	(865)	9,156	30,056	0.005469	172	801	0.766497	1,045
2022	May	35,510	0.233503	(864)	8,292	27,218	0.005469	157	958	0.766497	1,250
2022	June	30,588	0.233503	(1,149)	7,142	23,445	0.005469	139	1,096	0.766497	1,431
2022	July	24,913	0.233503	(1,325)	5,817	19,096	0.005469	116	1,213	0.766497	1,582
2022	August	18,733	0.233503	(1,443)	4,374	14,358	0.005469	91	1,304	0.766497	1,702
2022	September	13,614	0.233503	(1,195)	3,179	10,435	0.005469	68	1,372	0.766497	1,790
2022	October	10,072	0.233503	(827)	2,352	7,720	0.005469	50	1,422	0.766497	1,855
2022	November	6,602	0.233503	(810)	1,542	5,060	0.005469	35	1,457	0.766497	1,900
2022	December	(2,234)	0.233503	(2,063)	(522)	(1,712)	0.005469	9	1,466	0.766497	1,912
	Checks			(13,458)	(13,458)	(522)		1,466			1,912

Adjustment to interest calculation to account for corrections as noted in Docket No. E-7, Sub 1265 Listebarger Supplemental Testimony and Exhibits filed 5/16/2022	643
Final Gross up of Return to Pretax for Vintage 2019	**2,555**

Note 1: Beginning Balances tie to Docket No. E-7, Sub 1265 Listebarger Supplemental Testimony and Exhibits filed 5/16/2022
Note 2: Beginning Balance for NC Residential Revenue Collected has been adjusted to correct understatement of revenues from prior rider filing

Duke Energy Carolinas, LLC
Docket Number E-7 Sub 1285
Estimated Return Calculation - Non- Residential EE Programs Vintage 2019

NC Non- Residential EE		Non-Residential EE Program Costs Incurred	NC Allocation %	NC Allocated EE Program Costs	NC Residential Revenue Collected[2]	NC Non-Residential EE Program Collection %	Non-Residential EE Program Costs Revenue Collected	(Over)/Under Collection
			Listebarger Exhibit 5 pg 2, Line 4			see calc. at right		
Beginning Balance1		45,112,919		32,973,209	68,010,665		(68,016,425)	(3,123,099)
2022	January		73.0903918%		55,760	61.10%	(34,071)	(34,071)
2022	February		73.0903918%		(369,394)	61.10%	225,711	225,711
2022	March		73.0903918%		(388,310)	61.10%	237,269	237,269
2022	April		73.0903918%		(343,348)	61.10%	209,796	209,796
2022	May		73.0903918%		(371,754)	61.10%	227,153	227,153
2022	June		73.0903918%		(442,126)	61.10%	270,152	270,152
2022	July		73.0903918%		(462,514)	61.10%	282,610	282,610
2022	August		73.0903918%		(506,015)	61.10%	309,190	309,190
2022	September		73.0903918%		(463,226)	61.10%	283,045	283,045
2022	October		73.0903918%		(374,401)	61.10%	228,770	228,770
2022	November		73.0903918%		(343,791)	61.10%	210,067	210,067
2022	December		73.0903918%		(500,218)	61.10%	305,648	305,648
		45,112,919		32,973,209	63,501,330		(65,261,085)	(367,759)
					exhibit 4, line 23			

Program Costs to be Recovered in Rider 13	(3,123,099)
Revenues to be Collected in Rider 13	(5,111,203)
% Revenue related to Program Costs	61.1030%

NC Non-Residential EE		Cumulative (Over)/Under Recovery	Current Income Tax Rate	Monthly Deferred Income Tax	Cumulative Deferred Income Tax	Net Deferred After Tax Balance	Monthly Return	Monthly A/T Return on Deferral	YTD After Tax Interest	Gross up of Return to Pretax Rate	Gross up of Return to Pretax
			1/2022 - 12/2022				6.56%			0.766497	
Beginning Balance		(3,123,099)			(729,253)	(2,393,846)					
2022	January	(3,157,170)	0.233503	(7,956)	(737,209)	(2,419,961)	0.005469	(13,164)	(13,164)	0.766497	(17,174)
2022	February	(2,931,459)	0.233503	52,704	(684,504)	(2,246,954)	0.005469	(12,762)	(25,926)	0.766497	(33,824)
2022	March	(2,694,190)	0.233503	55,403	(629,101)	(2,065,088)	0.005469	(11,792)	(37,718)	0.766497	(49,208)
2022	April	(2,484,394)	0.233503	48,988	(580,113)	(1,904,280)	0.005469	(10,855)	(48,572)	0.766497	(63,369)
2022	May	(2,257,241)	0.233503	53,041	(527,073)	(1,730,168)	0.005469	(9,939)	(58,511)	0.766497	(76,335)
2022	June	(1,987,089)	0.233503	63,081	(463,991)	(1,523,098)	0.005469	(8,896)	(67,407)	0.766497	(87,942)
2022	July	(1,704,479)	0.233503	65,990	(398,001)	(1,306,478)	0.005469	(7,738)	(75,145)	0.766497	(98,037)
2022	August	(1,395,289)	0.233503	72,197	(325,804)	(1,069,485)	0.005469	(6,497)	(81,642)	0.766497	(106,513)
2022	September	(1,112,244)	0.233503	66,092	(259,712)	(852,532)	0.005469	(5,256)	(86,898)	0.766497	(113,370)
2022	October	(883,474)	0.233503	53,418	(206,294)	(677,180)	0.005469	(4,183)	(91,081)	0.766497	(118,828)
2022	November	(673,407)	0.233503	49,051	(157,243)	(516,165)	0.005469	(3,263)	(94,345)	0.766497	(123,085)
2022	December	(367,759)	0.233503	71,370	(85,873)	(281,886)	0.005469	(2,182)	(96,527)	0.766497	(125,933)
	Checks			643,380	643,380	(85,873)		(96,527)			(125,933)

Adjustment to interest calculation to account for corrections as noted in Docket No. E-7, Sub 1265 Listebarger Supplemental Testimony and Exhibits filed 5/16/2022.	47,791
Final Gross up of Return to Pretax for Vintage 2019	**(78,141)**

Note 1: Beginning Balances tie to Docket No. E-7, Sub 1265 Listebarger Supplemental Testimony and Exhibits filed 5/16/2022.

Duke Energy Carolinas, LLC
Docket Number E-7 Sub 1285
Estimated Return Calculation -Non - Residential DSM Programs Vintage 2019

NC Non- Residential DSM		Total System NC DSM Program Costs Incurred	NC Non- Residential DSM Allocation %	NC Allocated DSM Non-Residential Program Costs	NC Non-Residential DSM Revenue Collected[2]	NC Non-Residential DSM Program Collection %	Non-Residential DSM Program Costs Revenue Collected	(Over)/Under Collection
			Listebarger Exhibit 5 pg. 2, Line 10			see calc. at right		
Beginning Balance1		30,097,219		12,076,004	16,231,080		(12,072,831)	3,173
2022	January	-	40.1233224%	-	3,694	-1.2166824%	45	45
2022	February	-	40.1233224%	-	(19,210)	-1.2166824%	(234)	(234)
2022	March	-	40.1233224%	-	(21,073)	-1.2166824%	(256)	(256)
2022	April	-	40.1233224%	-	(17,640)	-1.2166824%	(215)	(215)
2022	May	-	40.1233224%	-	(19,520)	-1.2166824%	(237)	(237)
2022	June	-	40.1233224%	-	(23,889)	-1.2166824%	(291)	(291)
2022	July	-	40.1233224%	-	(24,640)	-1.2166824%	(300)	(300)
2022	August	-	40.1233224%	-	(26,836)	-1.2166824%	(327)	(327)
2022	September	-	40.1233224%	-	(24,578)	-1.2166824%	(299)	(299)
2022	October	-	40.1233224%	-	(20,471)	-1.2166824%	(249)	(249)
2022	November	-	40.1233224%	-	(18,800)	-1.2166824%	(229)	(229)
2022	December	-	40.1233224%	-	(27,187)	-1.2166824%	(331)	(331)
		30,097,219		12,076,004	15,990,931		(12,075,753)	252
					Exhibit 4, line 33			

Program Costs to be Recovered in Rider 13	3,173
Revenues to be Collected in Rider 13	(260,821)
% Revenue related to Program Costs	-1.2167%

NC Non-Residential DSM		Cumulative (Over)/Under Recovery	Current Income Tax Rate	Monthly Deferred Income Tax	Cumulative Deferred Income Tax	Net Deferred After Tax Balance	Monthly Return	Monthly A/T Return on Deferral	YTD After Tax Interest	Gross up of Return to Pretax Rate	Gross up of Return to Pretax
			1/2022 - 12/2022				6.56%			0.766497	
Beginning Balance		3,173			741	2,432					
2022	January	3,218	0.233503	10	751	2,467	0.005469	13	13	0.766497	17
2022	February	2,985	0.233503	(55)	697	2,288	0.005469	13	26	0.766497	34
2022	March	2,728	0.233503	(60)	637	2,091	0.005469	12	38	0.766497	50
2022	April	2,514	0.233503	(50)	587	1,927	0.005469	11	49	0.766497	64
2022	May	2,276	0.233503	(55)	531	1,745	0.005469	10	59	0.766497	77
2022	June	1,985	0.233503	(68)	464	1,522	0.005469	9	68	0.766497	89
2022	July	1,686	0.233503	(70)	394	1,292	0.005469	8	76	0.766497	99
2022	August	1,359	0.233503	(76)	317	1,042	0.005469	6	82	0.766497	108
2022	September	1,060	0.233503	(70)	248	813	0.005469	5	87	0.766497	114
2022	October	811	0.233503	(58)	189	622	0.005469	4	91	0.766497	119
2022	November	582	0.233503	(53)	136	446	0.005469	3	94	0.766497	123
2022	December	252	0.233503	(77)	59	193	0.005469	2	96	0.766497	125
	Checks			(682)	(682)	59		96			125

Adjustment to interest calculation to account for corrections as noted in Docket No. E-7, Sub 1265 Listebarger Supplemental Testimony and Exhibits filed 5/16/2022	(671)
Final Gross up of Return to Pretax for Vintage 2019	**(545)**

Note 1: Beginning Balances tie to Docket No. E-7, Sub 1265 Listebarger Supplemental Testimony and Exhibits filed 5/16/2022
Note 2: Beginning Balance for NC Residential Revenue Collected has been adjusted to correct understatement of revenues from prior rider filing

Duke Energy Carolinas, LLC
Docket Number E-7 Sub 1285
Estimated Return Calculation - Residential EE Programs Vintage 2020

NC Residential EE		Residential EE Program Costs[2] Incurred	NC Allocation %	NC Allocated EE Program Costs	Program Incentives	Lost Revenues	Total Costs	NC Residential Revenue Collected[2]	NC Residential EE Program Collection %	EE Program Costs Revenue Collected	(Over)/Under Collection
			Listebarger Exhibit 5 pg. 3, Line 4						100% used due to overcollection		
Beginning Balance1		51,310,734		37,570,373	4,483,373	31,747,169	73,800,915	56,151,769		(30,658,183)	6,912,190
2022	January	(2,082)	73.2212736%	(1,524)	1,723	(30,202)	(30,003)	636,713	100.0000%	(636,713)	(666,716)
2022	February	(2,082)	73.2212736%	(1,524)	1,723	(30,202)	(30,003)	1,912,641	100.0000%	(1,912,641)	(1,942,644)
2022	March	(2,082)	73.2212736%	(1,524)	1,723	(30,202)	(30,003)	1,477,370	100.0000%	(1,477,370)	(1,507,373)
2022	April	(2,082)	73.2212736%	(1,524)	1,723	(30,202)	(30,003)	1,194,397	100.0000%	(1,194,397)	(1,224,401)
2022	May	(2,082)	73.2212736%	(1,524)	1,723	(30,202)	(30,003)	1,193,865	100.0000%	(1,193,865)	(1,223,868)
2022	June	(2,082)	73.2212736%	(1,524)	1,723	(30,202)	(30,003)	1,587,338	100.0000%	(1,587,338)	(1,617,342)
2022	July	(2,082)	73.2212736%	(1,524)	1,723	(30,202)	(30,003)	1,829,859	100.0000%	(1,829,859)	(1,859,863)
2022	August	(2,082)	73.2212736%	(1,524)	1,723	(30,202)	(30,003)	1,993,137	100.0000%	(1,993,137)	(2,023,140)
2022	September	(2,082)	73.2212736%	(1,524)	1,723	(30,202)	(30,003)	1,650,679	100.0000%	(1,650,679)	(1,680,683)
2022	October	(2,082)	73.2212736%	(1,524)	1,723	(30,202)	(30,003)	1,142,266	100.0000%	(1,142,266)	(1,172,270)
2022	November	(2,082)	73.2212736%	(1,524)	1,723	(30,202)	(30,003)	1,118,942	100.0000%	(1,118,942)	(1,148,945)
2022	December	(2,082)	73.2212736%	(1,524)	1,723	(30,202)	(30,003)	2,849,274	100.0000%	(2,849,274)	(2,879,277)
		51,285,750		37,552,079	4,504,045	31,384,749	73,440,873	74,738,250		(49,244,664)	(12,034,332)
								exhibit 4, line 3			

Vintage is overcollected. Interest is calculated on all components.

100% of all revenues offset the overcollected balance.

NC Residential EE		Cumulative (Over)/Under Recovery	Current Income Tax Rate	Monthly Deferred Income Tax	Cumulative Deferred Income Tax	Net Deferred After Tax Balance	Monthly Return	Monthly A/T Return on Deferral	YTD After Tax Interest	Gross up of Return to Pretax Rate	Gross up of Return to Pretax
			1/2022 - 12/2022				6.56%			0.766497	
Beginning Balance		6,912,190			1,614,017	5,298,173					
2022	January	6,245,474	0.233503	(155,680)	3,228,034	3,017,440	0.005469	22,740	22,740	0.766497	29,667
2022	February	4,302,830	0.233503	(453,613)	3,072,354	1,230,476	0.005469	11,616	34,356	0.766497	44,822
2022	March	2,795,456	0.233503	(351,976)	2,618,741	176,716	0.005469	3,848	38,204	0.766497	49,843
2022	April	1,571,056	0.233503	(285,901)	2,266,764	(695,709)	0.005469	(1,419)	36,785	0.766497	47,991
2022	May	347,187	0.233503	(285,777)	1,980,863	(1,633,676)	0.005469	(6,370)	30,415	0.766497	39,681
2022	June	(1,270,155)	0.233503	(377,654)	1,695,086	(2,965,241)	0.005469	(12,576)	17,839	0.766497	23,273
2022	July	(3,130,017)	0.233503	(434,284)	1,317,432	(4,447,449)	0.005469	(20,271)	(2,432)	0.766497	(3,173)
2022	August	(5,153,157)	0.233503	(472,409)	883,149	(6,036,306)	0.005469	(28,669)	(31,101)	0.766497	(40,575)
2022	September	(6,833,840)	0.233503	(392,444)	410,739	(7,244,579)	0.005469	(36,318)	(67,418)	0.766497	(87,956)
2022	October	(8,006,110)	0.233503	(273,729)	18,295	(8,024,405)	0.005469	(41,754)	(109,173)	0.766497	(142,431)
2022	November	(9,155,055)	0.233503	(268,282)	(255,434)	(8,899,622)	0.005469	(46,280)	(155,453)	0.766497	(202,810)
2022	December	(12,034,332)	0.233503	(672,320)	(523,716)	(11,510,616)	0.005469	(55,814)	(211,267)	0.766497	(275,626)
	Checks			(4,424,070)	(2,137,733)	(523,716)		(211,267)			(275,626)

Adjustment to interest calculation to account for corrections as noted in Docket No. E-7, Sub 1265 Listebarger Supplemental Testimony and Exhibits filed 5/16/2022 — 18,902

Final Gross up of Return to Pretax for Vintage 2020 — **(256,724)**

Note 1: Beginning Balances tie to Docket No. E-7, Sub 1265 Listebarger Supplemental Testimony and Exhibits filed 5/16/2022 except for the NC Residential Revenue Collected. The interest calculation inadvertently omitted the 2021 revenue collected in Rider 14.

Note 2: Beginning Balance for NC Residential Revenue Collected has been adjusted to correct understatement of revenues from prior rider filing.

Duke Energy Carolinas, LLC
Docket Number E-7 Sub 1285
Estimated Return Calculation - Residential DSM Programs Vintage 2020

NC Residential DSM		Total System NC DSM Program Costs Incurred	NC Allocation %	NC Allocated DSM Program Costs	NC Residential Revenue Collected[2]	NC Residential DSM Program Collection %	DSM Program Costs Revenue Collected	(Over)/Under Collection
			Listebarger Exhibit 5 pg. 3, Line 9			see calc. at right		
Beginning Balance1		29,327,255		9,888,075	15,488,514		(15,504,312)	(2,404,589)
2022	January		33.7163333%	-	(120,875)	-1.2167%	(1,471)	(1,471)
2022	February		33.7163333%	-	(363,101)	-1.2167%	(4,418)	(4,418)
2022	March		33.7163333%	-	(280,468)	-1.2167%	(3,412)	(3,412)
2022	April		33.7163333%	-	(226,748)	-1.2167%	(2,759)	(2,759)
2022	May		33.7163333%	-	(226,647)	-1.2167%	(2,758)	(2,758)
2022	June		33.7163333%	-	(301,345)	-1.2167%	(3,666)	(3,666)
2022	July		33.7163333%	-	(347,386)	-1.2167%	(4,227)	(4,227)
2022	August		33.7163333%	-	(378,383)	-1.2167%	(4,604)	(4,604)
2022	September		33.7163333%	-	(313,370)	-1.2167%	(3,813)	(3,813)
2022	October		33.7163333%	-	(216,851)	-1.2167%	(2,638)	(2,638)
2022	November		33.7163333%	-	(212,423)	-1.2167%	(2,585)	(2,585)
2022	December		33.7163333%	-	(540,914)	-1.2167%	(6,581)	(6,581)
		29,327,255		9,888,075	11,960,004		(15,547,243)	(2,447,520)
					exhibit 4, Line 9			

Program Costs to be Recovered in Rider 13	(2,404,589)
Revenues to be Collected in Rider 13	(3,447,632)
% Revenue related to Program Costs	-1.217%

original revenue included	(3,528,510)
new 2023 revenue estimate	(3,454,550)
Revision to be made in 2022	73,960

NC Residential DSM		Cumulative (Over)/Under Recovery	Current Income Tax Rate	Monthly Deferred Income Tax	Cumulative Deferred Income Tax	Net Deferred After Tax Balance	Monthly Return	Monthly A/T Return on Deferral	YTD After Tax Interest	Gross up of Return to Pretax Rate	Gross up of Return to Pretax
			1/2022 - 12/2022				6.56%			0.766497	
Beginning Balance		(2,404,589)			(561,479)	(1,843,110)					
2022	January	(2,406,060)	0.233503	(343)	(561,822)	(1,844,238)	0.005469	(10,083)	(10,083)	0.766497	(13,155)
2022	February	(2,410,478)	0.233503	(1,032)	(562,854)	(1,847,624)	0.005469	(10,096)	(20,179)	0.766497	(26,326)
2022	March	(2,413,890)	0.233503	(797)	(563,651)	(1,850,239)	0.005469	(10,112)	(30,291)	0.766497	(39,519)
2022	April	(2,416,649)	0.233503	(644)	(564,295)	(1,852,354)	0.005469	(10,125)	(40,416)	0.766497	(52,729)
2022	May	(2,419,406)	0.233503	(644)	(564,939)	(1,854,468)	0.005469	(10,137)	(50,553)	0.766497	(65,953)
2022	June	(2,423,073)	0.233503	(856)	(565,795)	(1,857,278)	0.005469	(10,150)	(60,703)	0.766497	(79,195)
2022	July	(2,427,299)	0.233503	(987)	(566,782)	(1,860,518)	0.005469	(10,167)	(70,870)	0.766497	(92,459)
2022	August	(2,431,903)	0.233503	(1,075)	(567,857)	(1,864,046)	0.005469	(10,185)	(81,055)	0.766497	(105,747)
2022	September	(2,435,716)	0.233503	(890)	(568,747)	(1,866,969)	0.005469	(10,203)	(91,258)	0.766497	(119,058)
2022	October	(2,438,354)	0.233503	(616)	(569,363)	(1,868,991)	0.005469	(10,216)	(101,474)	0.766497	(132,387)
2022	November	(2,440,939)	0.233503	(603)	(569,967)	(1,870,972)	0.005469	(10,227)	(111,701)	0.766497	(145,729)
2022	December	(2,447,520)	0.233503	(1,537)	(571,503)	(1,876,017)	0.005469	(10,246)	(121,948)	0.766497	(159,097)
	Checks			(10,024)	(10,024)	(571,503)		(121,948)			(159,097)

Adjustment to interest calculation to account for corrections as noted in Docket No. E-7, Sub 1265 Listebarger Supplemental Testimony and Exhibits filed 5/16/2022	39,785
Final Gross up of Return to Pretax for Vintage 2020	**(119,312)**

Note 1: Beginning Balances tie to Docket No. E-7, Sub 1265 Listebarger Supplemental Testimony and Exhibits filed 5/16/2022
Note 2: Beginning Balance for NC Residential Revenue Collected has been adjusted to correct understatement of revenues from prior rider filing

Duke Energy Carolinas, LLC
Docket Number E-7 Sub 1285
Estimated Return Calculation - Non- Residential EE Programs Vintage 2020

NC Non- Residential EE		Non-Residential EE Program Costs Incurred	NC Allocation %	NC Allocated EE Program Costs	Program Performance Incentives	Lost Revenues	Total Costs	NC Residential Revenue Collected[2]	NC Non-Residential EE Program Collection %	Non-Residential EE Program Costs Revenue Collected	(Over)/Under Collection
			Listebarger Exhibit 5 pg 3, Line 4						100% used due to overcollection		
Beginning Balance1		30,082,572		22,026,843	7,199,363	18,275,484	47,501,689	53,961,294		(53,989,132)	(6,487,442)
2022	January		73.2212736%		(3,004)	(5,091)	(8,096)	55,076	100.00%	(55,076)	(63,172)
2022	February		73.2212736%		(3,004)	(5,091)	(8,096)	(528,756)	100.00%	528,756	520,661
2022	March		73.2212736%		(3,004)	(5,091)	(8,096)	(549,551)	100.00%	549,551	541,456
2022	April		73.2212736%		(3,004)	(5,091)	(8,096)	(487,099)	100.00%	487,099	479,003
2022	May		73.2212736%		(3,004)	(5,091)	(8,096)	(530,170)	100.00%	530,170	522,074
2022	June		73.2212736%		(3,004)	(5,091)	(8,096)	(632,107)	100.00%	632,107	624,012
2022	July		73.2212736%		(3,004)	(5,091)	(8,096)	(662,226)	100.00%	662,226	654,130
2022	August		73.2212736%		(3,004)	(5,091)	(8,096)	(725,038)	100.00%	725,038	716,942
2022	September		73.2212736%		(3,004)	(5,091)	(8,096)	(663,355)	100.00%	663,355	655,260
2022	October		73.2212736%		(3,004)	(5,091)	(8,096)	(534,006)	100.00%	534,006	525,911
2022	November		73.2212736%		(3,004)	(5,091)	(8,096)	(489,645)	100.00%	489,645	481,549
2022	December		73.2212736%		(3,004)	(5,091)	(8,096)	(664,048)	100.00%	664,048	655,952
		30,082,572		22,026,843	7,163,312	18,214,388	47,404,543	47,550,369		(47,578,207)	(173,664)
								Exhibit 4, line 24			

Vintage is overcollected. Interest is calculated on all components.

100% of all revenues offset the overcollected balance.

NC Non-Residential EE		Cumulative (Over)/Under Recovery	Current Income Tax Rate	Monthly Deferred Income Tax	Cumulative Deferred Income Tax	Net Deferred After Tax Balance	Monthly Return	Monthly A/T Return on Deferral	YTD After Tax Interest	Gross up of Return to Pretax Rate	Gross up of Return to Pretax
			1/2022 - 12/2022				6.56%			0.766497	
Beginning Balance		(6,487,442)			(1,514,837)	(4,972,605)					
2022	January	(6,550,614)	0.233503	(14,751)	(1,529,588)	(5,021,026)	0.005469	(27,328)	(27,328)	0.766497	(35,654)
2022	February	(6,029,953)	0.233503	121,576	(1,408,012)	(4,621,941)	0.005469	(26,370)	(53,698)	0.766497	(70,056)
2022	March	(5,488,498)	0.233503	126,432	(1,281,581)	(4,206,917)	0.005469	(24,143)	(77,841)	0.766497	(101,555)
2022	April	(5,009,494)	0.233503	111,849	(1,169,732)	(3,839,762)	0.005469	(22,004)	(99,846)	0.766497	(130,262)
2022	May	(4,487,420)	0.233503	121,906	(1,047,826)	(3,439,594)	0.005469	(19,906)	(119,752)	0.766497	(156,232)
2022	June	(3,863,409)	0.233503	145,709	(902,118)	(2,961,291)	0.005469	(17,504)	(137,256)	0.766497	(179,069)
2022	July	(3,209,279)	0.233503	152,741	(749,376)	(2,459,902)	0.005469	(14,825)	(152,080)	0.766497	(198,409)
2022	August	(2,492,336)	0.233503	167,408	(581,968)	(1,910,368)	0.005469	(11,951)	(164,031)	0.766497	(214,001)
2022	September	(1,837,076)	0.233503	153,005	(428,963)	(1,408,114)	0.005469	(9,075)	(173,106)	0.766497	(225,840)
2022	October	(1,311,166)	0.233503	122,802	(306,161)	(1,005,004)	0.005469	(6,599)	(179,705)	0.766497	(234,449)
2022	November	(829,616)	0.233503	112,443	(193,718)	(635,899)	0.005469	(4,487)	(184,192)	0.766497	(240,304)
2022	December	(173,664)	0.233503	153,167	(40,551)	(133,113)	0.005469	(2,103)	(186,295)	0.766497	(243,047)
	Checks			1,474,286	1,474,286	(40,551)		(186,295)			(243,047)

Adjustment to interest calculation to account for corrections as noted in Docket No. E-7, Sub 1265 Listebarger Supplemental Testimony and Exhibits filed 5/16/2022 180,921

Final Gross up of Return to Pretax for Vintage 2020 **(62,127)**

Note 1: Beginning Balances tie to Docket No. E-7, Sub 1265 Listebarger Supplemental Testimony and Exhibits filed 5/16/2022

Note 2: Beginning Balance for NC Residential Revenue Collected has been adjusted to correct understatement of revenues from prior rider filing.

Duke Energy Carolinas, LLC
Docket Number E-7 Sub 1285
Estimated Return Calculation -Non - Residential DSM Programs Vintage 2020

NC Non- Residential DSM		Total System NC DSM Program Costs Incurred	NC Non- Residential DSM Allocation %	NC Allocated DSM Non-Residential Program Costs	Program Incentives	Total Costs	NC Non-Residential DSM Revenue Collected[2]	NC Non-Residential DSM Program Collection %	Non-Residential DSM Program Costs Revenue Collected	(Over)/Under Collection
			Miller Exhibit 5 pg. 3, Line 10					100% used due to overcollection		
Beginning Balance1		29,327,255		11,871,383	3,855,826	15,727,210	17,752,122		(17,752,122)	(2,024,912)
2022	January		40.4790117%	-	1,846	1,846	(72,538)	100.0000000%	72,538	74,385
2022	February		40.4790117%	-	1,846	1,846	(149,090)	100.0000000%	149,090	150,937
2022	March		40.4790117%	-	1,846	1,846	(153,740)	100.0000000%	153,740	155,586
2022	April		40.4790117%	-	1,846	1,846	(140,158)	100.0000000%	140,158	142,004
2022	May		40.4790117%	-	1,846	1,846	(148,413)	100.0000000%	148,413	150,259
2022	June		40.4790117%	-	1,846	1,846	(181,069)	100.0000000%	181,069	182,916
2022	July		40.4790117%	-	1,846	1,846	(186,690)	100.0000000%	186,690	188,536
2022	August		40.4790117%	-	1,846	1,846	(203,204)	100.0000000%	203,204	205,050
2022	September		40.4790117%	-	1,846	1,846	(186,476)	100.0000000%	186,476	188,322
2022	October		40.4790117%	-	1,846	1,846	(155,557)	100.0000000%	155,557	157,403
2022	November		40.4790117%	-	1,846	1,846	(143,082)	100.0000000%	143,082	144,928
2022	December		40.4790117%	-	1,846	1,846	(215,098)	100.0000000%	215,098	216,944
		29,327,255		11,871,383	3,877,982	15,749,365	15,817,007		(15,817,007)	(67,642)
							Exhibit 4, page 34			

Vintage is overcollected. Interest is calculated on all components.

100% of all revenues offset the overcollected balance.

NC Non-Residential DSM		Cumulative (Over)/Under Recovery	Current Income Tax Rate	Monthly Deferred Income Tax	Cumulative Deferred Income Tax	Net Deferred After Tax Balance	Monthly Return	Monthly A/T Return on Deferral	YTD After Tax Interest	Gross up of Return to Pretax Rate	Gross up of Return to Pretax
			1/2022 - 12/2022				6.56%			0.766497	
Beginning Balance		(2,024,912)			(472,823)	(1,552,089)					
2022	January	74,385	0.233503	17,369	(455,454)	529,839	0.005469	(2,795)	(2,795)	0.766497	(3,647)
2022	February	225,321	0.233503	35,244	(420,210)	645,531	0.005469	3,214	419	0.766497	546
2022	March	380,907	0.233503	36,330	(383,880)	764,787	0.005469	3,857	4,275	0.766497	5,578
2022	April	522,912	0.233503	33,158	(350,722)	873,633	0.005469	4,480	8,756	0.766497	11,423
2022	May	673,170	0.233503	35,086	(315,636)	988,806	0.005469	5,093	13,849	0.766497	18,068
2022	June	856,086	0.233503	42,711	(272,924)	1,129,010	0.005469	5,791	19,640	0.766497	25,623
2022	July	1,044,622	0.233503	44,024	(228,901)	1,273,523	0.005469	6,570	26,210	0.766497	34,195
2022	August	1,249,673	0.233503	47,880	(181,021)	1,430,693	0.005469	7,395	33,605	0.766497	43,842
2022	September	1,437,995	0.233503	43,974	(137,047)	1,575,042	0.005469	8,219	41,824	0.766497	54,566
2022	October	1,595,398	0.233503	36,754	(100,293)	1,695,691	0.005469	8,944	50,769	0.766497	66,235
2022	November	1,740,326	0.233503	33,841	(66,452)	1,806,778	0.005469	9,578	60,346	0.766497	78,730
2022	December	1,957,270	0.233503	50,657	(15,795)	1,973,065	0.005469	10,336	70,683	0.766497	92,215
	Checks			457,028	457,028	(15,795)		70,683			92,215

Adjustment to interest calculation to account for corrections as noted in Docket No. E-7, Sub 1265 Listebarger Supplemental Testimony and Exhibits filed 5/16/2022. 32,579

Final Gross up of Return to Pretax for Vintage 2020 **124,794**

Note 1: Beginning Balances tie to Docket No. E-7, Sub 1265 Listebarger Supplemental Testimony and Exhibits filed 5/16/2022.
Note 2: Beginning Balance for NC Residential Revenue Collected has been adjusted to correct understatement of revenues from prior rider filing.

/A

Duke Energy Carolinas, LLC
Docket Number E-7 Sub 1285
Estimated Return Calculation - Residential EE Programs Vintage 2021

NC Residential EE		Residential EE Program Costs Incurred	NC Allocation %	NC Allocated EE Program Costs	Program Incentives	Lost Revenues	Total Costs	NC Residential Revenue Collected	NC Residential EE Program Collection %	EE Program Costs Revenue Collected	(Over)/Under Collection
			Miller Exhibit 5 pg. 4, Line 4						100% used due to overcollection		
Beginning Balance[1]		35,677,735		26,231,472	2,568,356	23,363,537	52,163,365	64,747,858		(64,747,858)	(12,584,493)
2022	January		73.5233682%	-	(21,353)	69,781	48,429	219,423	100.0000%	(219,423)	(170,995)
2022	February		73.5233682%	-	(21,353)	69,781	48,429	659,132	100.0000%	(659,132)	(610,704)
2022	March		73.5233682%	-	(21,353)	69,781	48,429	509,130	100.0000%	(509,130)	(460,701)
2022	April		73.5233682%	-	(21,353)	69,781	48,429	411,612	100.0000%	(411,612)	(363,183)
2022	May		73.5233682%	-	(21,353)	69,781	48,429	411,429	100.0000%	(411,429)	(363,000)
2022	June		73.5233682%	-	(21,353)	69,781	48,429	547,027	100.0000%	(547,027)	(498,599)
2022	July		73.5233682%	-	(21,353)	69,781	48,429	630,604	100.0000%	(630,604)	(582,176)
2022	August		73.5233682%	-	(21,353)	69,781	48,429	686,873	100.0000%	(686,873)	(638,444)
2022	September		73.5233682%	-	(21,353)	69,781	48,429	568,856	100.0000%	(568,856)	(520,427)
2022	October		73.5233682%	-	(21,353)	69,781	48,429	393,647	100.0000%	(393,647)	(345,218)
2022	November		73.5233682%	-	(21,353)	69,781	48,429	385,609	100.0000%	(385,609)	(337,180)
2022	December		73.5233682%	-	(21,353)	69,781	48,429	981,914	100.0000%	(981,914)	(933,486)
		35,677,735		26,231,472	2,312,125	24,200,911	52,744,508	71,153,114		(71,153,114)	(18,408,605)
								Exhibit 4, line 4			

Vintage is overcollected. Interest is calculated on all components.

100% of all revenues offset the overcollected balance.

NC Residential EE		Cumulative (Over)/Under Recovery	Current Income Tax Rate	Monthly Deferred Income Tax	Cumulative Deferred Income Tax	Net Deferred After Tax Balance	Monthly Return	Monthly A/T Return on Deferral	YTD After Tax Interest	Gross up of Return to Pretax Rate	Gross up of Return to Pretax
			1/2022 - 12/2022				6.56%			0.766497	
Beginning Balance		(12,584,493)			(2,938,517)	(9,645,976)					
2022	January	(12,755,487)	0.233503	(39,928)	(2,978,445)	(9,777,043)	0.005469	(53,114)	(53,114)	0.766497	(69,294)
2022	February	(13,366,191)	0.233503	(142,601)	(3,121,046)	(10,245,146)	0.005469	(54,752)	(107,866)	0.766497	(140,726)
2022	March	(13,826,893)	0.233503	(107,575)	(3,228,621)	(10,598,272)	0.005469	(56,998)	(164,865)	0.766497	(215,088)
2022	April	(14,190,076)	0.233503	(84,804)	(3,313,425)	(10,876,651)	0.005469	(58,725)	(223,590)	0.766497	(291,703)
2022	May	(14,553,076)	0.233503	(84,762)	(3,398,187)	(11,154,889)	0.005469	(60,247)	(283,837)	0.766497	(370,304)
2022	June	(15,051,675)	0.233503	(116,424)	(3,514,611)	(11,537,063)	0.005469	(62,053)	(345,890)	0.766497	(451,261)
2022	July	(15,633,850)	0.233503	(135,940)	(3,650,551)	(11,983,299)	0.005469	(64,319)	(410,209)	0.766497	(535,173)
2022	August	(16,272,295)	0.233503	(149,079)	(3,799,630)	(12,472,665)	0.005469	(66,877)	(477,086)	0.766497	(622,423)
2022	September	(16,792,722)	0.233503	(121,521)	(3,921,151)	(12,871,571)	0.005469	(69,306)	(546,392)	0.766497	(712,843)
2022	October	(17,137,940)	0.233503	(80,609)	(4,001,760)	(13,136,179)	0.005469	(71,121)	(617,512)	0.766497	(805,629)
2022	November	(17,475,120)	0.233503	(78,733)	(4,080,493)	(13,394,627)	0.005469	(72,551)	(690,063)	0.766497	(900,281)
2022	December	(18,408,605)	0.233503	(217,972)	(4,298,465)	(14,110,141)	0.005469	(75,214)	(765,277)	0.766497	(998,409)
	Checks			(1,359,948)	(1,359,948)	(4,298,465)		(765,277)			(998,409)

Adjustment to interest calculation to account for corrections as noted in Docket No. E-7, Sub 1265 Miller Supplemental Testimony and Exhibits filed 5/16/2022 33

Final Gross up of Return to Pretax for Vintage 2021 **(998,375)**

Note 1: Beginning Balances tie to Docket No. E-7, Sub 1265 Listebarger Supplemental Testimony and Exhibits filed 5/16/2022.

Duke Energy Carolinas, LLC
Docket Number E-7 Sub 1285
Estimated Return Calculation - Residential DSM Programs Vintage 2021

NC Residential DSM		Total System NC DSM Program Costs Incurred	NC Allocation %	NC Allocated EE Program Costs	Program Incentives	Total Costs	NC Residential Revenue Collected	NC Residential EE Program Collection %	EE Program Costs Revenue Collected	(Over)/Under Collection
			Miller Exhibit 5 pg. 4, Line 9					100% used due to overcollection		
Beginning Balance[1]		32,876,164		11,489,414	2,788,739	14,278,153	17,245,048		(17,245,048)	(2,966,895)
2022	January		34.9475492%	-	(37)	(37)	-	100.0000%	-	(37)
2022	February		34.9475492%	-	(37)	(37)	-	100.0000%	-	(37)
2022	March		34.9475492%	-	(37)	(37)	-	100.0000%	-	(37)
2022	April		34.9475492%	-	(37)	(37)	-	100.0000%	-	(37)
2022	May		34.9475492%	-	(37)	(37)	-	100.0000%	-	(37)
2022	June		34.9475492%	-	(37)	(37)	-	100.0000%	-	(37)
2022	July		34.9475492%	-	(37)	(37)	-	100.0000%	-	(37)
2022	August		34.9475492%	-	(37)	(37)	-	100.0000%	-	(37)
2022	September		34.9475492%	-	(37)	(37)	-	100.0000%	-	(37)
2022	October		34.9475492%	-	(37)	(37)	-	100.0000%	-	(37)
2022	November		34.9475492%	-	(37)	(37)	-	100.0000%	-	(37)
2022	December		34.9475492%	-	(37)	(37)	-	100.0000%	-	(37)
		32,876,164		11,489,414	2,788,295	14,277,708	17,245,048		(17,245,048)	(2,967,339)
							Exhibit 4, line 10			

Vintage is overcollected. Interest is calculated on all components.

100% of all revenues offset the overcollected balance.

NC Residential DSM		Cumulative (Over)/Under Recovery	Current Income Tax Rate	Monthly Deferred Income Tax	Cumulative Deferred Income Tax	Net Deferred After Tax Balance	Monthly Return	Monthly A/T Return on Deferral	YTD After Tax Interest	Gross up of Return to Pretax Rate	Gross up of Return to Pretax
			1/2022 - 12/2022				6.56%			0.766497	
Beginning Balance		(2,966,895)			(692,779)	(2,274,116)					
2022	January	(2,966,932)	0.233503	(9)	(692,787)	(2,274,144)	0.005469	(12,438)	(12,438)	0.766497	(16,227)
2022	February	(2,966,969)	0.233503	(9)	(692,796)	(2,274,173)	0.005469	(12,438)	(24,875)	0.766497	(32,453)
2022	March	(2,967,006)	0.233503	(9)	(692,805)	(2,274,201)	0.005469	(12,438)	(37,313)	0.766497	(48,680)
2022	April	(2,967,043)	0.233503	(9)	(692,813)	(2,274,229)	0.005469	(12,438)	(49,751)	0.766497	(64,908)
2022	May	(2,967,080)	0.233503	(9)	(692,822)	(2,274,258)	0.005469	(12,438)	(62,190)	0.766497	(81,135)
2022	June	(2,967,117)	0.233503	(9)	(692,831)	(2,274,286)	0.005469	(12,438)	(74,628)	0.766497	(97,362)
2022	July	(2,967,154)	0.233503	(9)	(692,839)	(2,274,315)	0.005469	(12,439)	(87,067)	0.766497	(113,590)
2022	August	(2,967,191)	0.233503	(9)	(692,848)	(2,274,343)	0.005469	(12,439)	(99,505)	0.766497	(129,818)
2022	September	(2,967,228)	0.233503	(9)	(692,857)	(2,274,372)	0.005469	(12,439)	(111,944)	0.766497	(146,046)
2022	October	(2,967,265)	0.233503	(9)	(692,865)	(2,274,400)	0.005469	(12,439)	(124,383)	0.766497	(162,275)
2022	November	(2,967,302)	0.233503	(9)	(692,874)	(2,274,428)	0.005469	(12,439)	(136,822)	0.766497	(178,503)
2022	December	(2,967,339)	0.233503	(9)	(692,883)	(2,274,457)	0.005469	(12,439)	(149,262)	0.766497	(194,732)
	Checks			(104)	(104)	(692,883)		(149,262)			(194,732)

Adjustment to interest calculation to account for corrections as noted in Docket No. E-7, Sub 1265 Miller Supplemental Testimony and Exhibits filed 5/16/2022 9

Final Gross up of Return to Pretax for Vintage 2021 **(194,724)**

Note 1: Beginning Balances tie to Docket No. E-7, Sub 1265 Listebarger Supplemental Testimony and Exhibits filed 5/16/2022.

Duke Energy Carolinas, LLC
Docket Number E-7 Sub 1285
Estimated Return Calculation - Non- Residential EE Programs Vintage 2021

NC Non- Residential EE		Non-Residential EE Program Costs Incurred	NC Allocation %	NC Allocated EE Program Costs	Program Incentives	Lost Revenues	Total Costs	NC Residential Revenue Collected	NC Non-Residential EE Program Collection %	Non-Residential EE Program Costs Revenue Collected	(Over)/Under Collection
			Miller Exhibit 5 pg 4, Line 4						100% used due to overcollection		
Beginning Balance1		40,469,592		29,754,607	7,442,891	15,035,634	52,233,133	50,564,874		(50,564,874)	(20,810,267)
2022	January		73.5233682%	-	(16,517)	34,502	17,985	1,195,863	100.0000000%	(1,195,863)	(1,177,878)
2022	February		73.5233682%	-	(16,517)	34,502	17,985	1,050,375	100.0000000%	(1,050,375)	(1,032,390)
2022	March		73.5233682%	-	(16,517)	34,502	17,985	960,257	100.0000000%	(960,257)	(942,272)
2022	April		73.5233682%	-	(16,517)	34,502	17,985	939,274	100.0000000%	(939,274)	(921,289)
2022	May		73.5233682%	-	(16,517)	34,502	17,985	977,631	100.0000000%	(977,631)	(959,646)
2022	June		73.5233682%	-	(16,517)	34,502	17,985	1,162,389	100.0000000%	(1,162,389)	(1,144,404)
2022	July		73.5233682%	-	(16,517)	34,502	17,985	1,222,579	100.0000000%	(1,222,579)	(1,204,594)
2022	August		73.5233682%	-	(16,517)	34,502	17,985	1,336,738	100.0000000%	(1,336,738)	(1,318,753)
2022	September		73.5233682%	-	(16,517)	34,502	17,985	1,228,568	100.0000000%	(1,228,568)	(1,210,583)
2022	October		73.5233682%	-	(16,517)	34,502	17,985	984,466	100.0000000%	(984,466)	(966,481)
2022	November		73.5233682%	-	(16,517)	34,502	17,985	903,916	100.0000000%	(903,916)	(885,931)
2022	December		73.5233682%	-	(16,517)	34,502	17,985	1,324,818	100.0000000%	(1,324,818)	(1,306,833)
		40,469,592		29,754,607	7,244,689	15,449,656	52,448,952	63,851,749		(63,851,749)	(33,881,322)
								Exhibit 4, line 25			

Vintage is overcollected. Interest is calculated on all components.

100% of all revenues offset the overcollected balance.

NC Non-Residential EE		Cumulative (Over)/Under Recovery	Current Income Tax Rate	Monthly Deferred Income Tax	Cumulative Deferred Income Tax	Net Deferred After Tax Balance	Monthly Return	Monthly A/T Return on Deferral	YTD After Tax Interest	Gross up of Return to Pretax Rate	Gross up of Return to Pretax
			1/2022 - 12/2022				6.56%			0.766497	
Beginning Balance		(20,810,267)			(4,859,260)	(15,951,007)					
2022	January	(21,988,145)	0.233503	(275,038)	(5,134,298)	(16,853,847)	0.005469	(89,708)	(89,708)	0.766497	(117,036)
2022	February	(23,020,535)	0.233503	(241,066)	(5,375,364)	(17,645,171)	0.005469	(94,341)	(184,048)	0.766497	(240,116)
2022	March	(23,962,808)	0.233503	(220,023)	(5,595,387)	(18,367,420)	0.005469	(98,480)	(282,528)	0.766497	(368,596)
2022	April	(24,884,096)	0.233503	(215,124)	(5,810,511)	(19,073,585)	0.005469	(102,386)	(384,914)	0.766497	(502,173)
2022	May	(25,843,743)	0.233503	(224,080)	(6,034,591)	(19,809,151)	0.005469	(106,328)	(491,242)	0.766497	(640,892)
2022	June	(26,988,147)	0.233503	(267,222)	(6,301,813)	(20,686,334)	0.005469	(110,739)	(601,981)	0.766497	(785,366)
2022	July	(28,192,741)	0.233503	(281,276)	(6,583,090)	(21,609,652)	0.005469	(115,662)	(717,643)	0.766497	(936,263)
2022	August	(29,511,495)	0.233503	(307,933)	(6,891,023)	(22,620,472)	0.005469	(120,951)	(838,594)	0.766497	(1,094,060)
2022	September	(30,722,078)	0.233503	(282,675)	(7,173,697)	(23,548,380)	0.005469	(126,253)	(964,847)	0.766497	(1,258,774)
2022	October	(31,688,559)	0.233503	(225,676)	(7,399,374)	(24,289,185)	0.005469	(130,816)	(1,095,663)	0.766497	(1,429,442)
2022	November	(32,574,489)	0.233503	(206,867)	(7,606,241)	(24,968,248)	0.005469	(134,699)	(1,230,362)	0.766497	(1,605,175)
2022	December	(33,881,322)	0.233503	(305,149)	(7,911,390)	(25,969,932)	0.005469	(139,295)	(1,369,657)	0.766497	(1,786,904)
	Checks			(3,052,131)	(3,052,131)	(7,911,390)		(1,369,657)			(1,786,904)

Adjustment to interest calculation to account for corrections as noted in Docket No. E-7, Sub 1265 Listebarger Supplemental Testimony and Exhibits filed 5/16/2022 -

Final Gross up of Return to Pretax for Vintage 2021 (1,786,904)

Note 1: Beginning Balances tie to Docket No. E-7, Sub 1265 Listebarger Supplemental Testimony and Exhibits filed 5/16/2022.

Duke Energy Carolinas, LLC
Docket Number E-7 Sub 1285
Estimated Return Calculation -Non - Residential DSM Programs Vintage 2021

NC Non- Residential DSM		Total System NC DSM Program Costs Incurred	NC Non- Residential DSM Allocation %	NC Allocated DSM Non-Residential Program Costs	Program Incentives	Total Costs	NC Non-Residential DSM Revenue Collected	NC Non-Residential DSM Program Collection %	Non-Residential DSM Program Costs Revenue Collected	(Over)/Under Collection
			Miller Exhibit 5 pg. 4, Line 10					100% used due to overcollection		
Beginning Balance[1]		32,876,164		12,956,111	3,144,740	16,100,851	18,905,431		(18,905,431)	(2,804,580)
2022	January	-	39.4088278%	-	(44)	(44)	645,727	100.0000000%	(645,727)	(645,771)
2022	February	-	39.4088278%	-	(44)	(44)	1,373,572	100.0000000%	(1,373,572)	(1,373,616)
2022	March	-	39.4088278%	-	(44)	(44)	1,410,702	100.0000000%	(1,410,702)	(1,410,746)
2022	April	-	39.4088278%	-	(44)	(44)	1,292,406	100.0000000%	(1,292,406)	(1,292,450)
2022	May	-	39.4088278%	-	(44)	(44)	1,368,591	100.0000000%	(1,368,591)	(1,368,635)
2022	June	-	39.4088278%	-	(44)	(44)	1,669,315	100.0000000%	(1,669,315)	(1,669,359)
2022	July	-	39.4088278%	-	(44)	(44)	1,720,836	100.0000000%	(1,720,836)	(1,720,880)
2022	August	-	39.4088278%	-	(44)	(44)	1,872,277	100.0000000%	(1,872,277)	(1,872,321)
2022	September	-	39.4088278%	-	(44)	(44)	1,716,913	100.0000000%	(1,716,913)	(1,716,957)
2022	October	-	39.4088278%	-	(44)	(44)	1,431,089	100.0000000%	(1,431,089)	(1,431,133)
2022	November	-	39.4088278%	-	(44)	(44)	1,316,574	100.0000000%	(1,316,574)	(1,316,618)
2022	December	-	39.4088278%	-	(44)	(44)	1,972,770	100.0000000%	(1,972,770)	(1,972,814)
		32,876,164		12,956,111	3,144,214	16,100,325	36,696,204		(36,696,204)	(20,595,879)
							Exhibit 4, line 64			

Vintage is overcollected. Interest is calculated on all components.

100% of all revenues offset the overcollected balance.

NC Non-Residential DSM		Cumulative (Over)/Under Recovery	Current Income Tax Rate	Monthly Deferred Income Tax	Cumulative Deferred Income Tax	Net Deferred After Tax Balance	Monthly Return	Monthly A/T Return on Deferral	YTD After Tax Interest	Gross up of Return to Pretax Rate	Gross up of Return to Pretax
			1/2022 - 12/2022				6.56%			0.766497	
Beginning Balance		(2,804,580)			(654,878)	(2,149,702)					
2022	January	(645,771)	0.233503	(150,789)	(805,667)	159,897	0.005469	(5,441)	(5,441)	0.766497	(7,099)
2022	February	(2,019,387)	0.233503	(320,744)	(1,126,411)	(892,976)	0.005469	(2,005)	(7,446)	0.766497	(9,714)
2022	March	(3,430,133)	0.233503	(329,413)	(1,455,824)	(1,974,309)	0.005469	(7,841)	(15,287)	0.766497	(19,944)
2022	April	(4,722,583)	0.233503	(301,791)	(1,757,615)	(2,964,968)	0.005469	(13,507)	(28,794)	0.766497	(37,565)
2022	May	(6,091,218)	0.233503	(319,580)	(2,077,195)	(4,014,022)	0.005469	(19,085)	(47,878)	0.766497	(62,464)
2022	June	(7,760,576)	0.233503	(389,800)	(2,466,996)	(5,293,581)	0.005469	(25,452)	(73,331)	0.766497	(95,670)
2022	July	(9,481,456)	0.233503	(401,831)	(2,868,826)	(6,612,630)	0.005469	(32,559)	(105,889)	0.766497	(138,147)
2022	August	(11,353,777)	0.233503	(437,193)	(3,306,019)	(8,047,758)	0.005469	(40,090)	(145,980)	0.766497	(190,450)
2022	September	(13,070,734)	0.233503	(400,915)	(3,706,934)	(9,363,801)	0.005469	(47,613)	(193,593)	0.766497	(252,569)
2022	October	(14,501,867)	0.233503	(334,174)	(4,041,107)	(10,460,760)	0.005469	(54,212)	(247,805)	0.766497	(323,296)
2022	November	(15,818,485)	0.233503	(307,434)	(4,348,542)	(11,469,944)	0.005469	(59,971)	(307,777)	0.766497	(401,536)
2022	December	(17,791,299)	0.233503	(460,658)	(4,809,200)	(12,982,100)	0.005469	(66,866)	(374,643)	0.766497	(488,773)
	Checks			(4,154,322)	(4,154,322)	(4,809,200)		(374,643)			(488,773)

Adjustment to interest calculation to account for corrections as noted in Docket No. E-7, Sub 1265 Listebarger Supplemental Testimony and Exhibits filed 5/16/2022. 12

Final Gross up of Return to Pretax for Vintage 2021 **(488,760)**

Note 1: Beginning Balances tie to Docket No. E-7, Sub 1265 Listebarger Supplemental Testimony and Exhibits filed 5/16/2022.

Duke Energy Carolinas, LLC
Docket Number E-7 Sub 1285
Estimated Return Calculation - Residential EE Programs Vintage 2022

NC Residential EE		Residential EE Program Costs Incurred	NC Allocation %	NC Allocated EE Program Costs	Program Incentives	Lost Revenues	Total Costs	NC Residential Revenue Collected	NC Residential EE Program Collection %	EE Program Costs Revenue Collected	(Over)/Under Collection
			Miller Exhibit 5 pg. 5, Line 4						100% used due to overcollection		
2022	January	1,214,369	73.8925998%	897,329	117,624	590,163	1,605,116	2,242,737	100.0000%	(2,242,737)	(637,621)
2022	February	4,170,134	73.8925998%	3,081,420	403,919	2,026,616	5,511,956	6,737,028	100.0000%	(6,737,028)	(1,225,072)
2022	March	3,836,886	73.8925998%	2,835,175	371,641	1,864,663	5,071,479	5,203,843	100.0000%	(5,203,843)	(132,365)
2022	April	2,301,606	73.8925998%	1,700,716	222,934	1,118,542	3,042,192	4,207,109	100.0000%	(4,207,109)	(1,164,917)
2022	May	3,394,836	73.8925998%	2,508,532	328,824	1,649,834	4,487,190	4,205,234	100.0000%	(4,205,234)	281,956
2022	June	4,654,060	73.8925998%	3,439,006	450,792	2,261,796	6,151,594	5,591,193	100.0000%	(5,591,193)	560,401
2022	July	3,622,279	73.8925998%	2,676,596	350,854	1,760,367	4,787,818	6,445,441	100.0000%	(6,445,441)	(1,657,623)
2022	August	3,009,121	73.8925998%	2,223,518	291,464	1,462,383	3,977,364	7,020,565	100.0000%	(7,020,565)	(3,043,201)
2022	September	4,573,148	73.8925998%	3,379,218	442,955	2,222,474	6,044,647	5,814,303	100.0000%	(5,814,303)	230,344
2022	October	3,625,286	73.8925998%	2,678,818	351,145	1,761,829	4,791,792	4,023,485	100.0000%	(4,023,485)	768,307
2022	November	3,724,805	73.8925998%	2,752,355	360,785	1,810,193	4,923,333	3,941,327	100.0000%	(3,941,327)	982,006
2022	December	4,312,123	73.8925998%	3,186,340	417,672	2,095,620	5,699,632	10,036,196	100.0000%	(10,036,196)	(4,336,564)
		42,438,652		31,359,024	4,110,610	20,624,479	56,094,113	65,468,461		(65,468,461)	(9,374,348)
								Exhibit 4, line 5			

Vintage is overcollected. Interest is calculated on all components.

100% of all revenues offset the overcollected balance.

NC Residential EE		Cumulative (Over)/Under Recovery	Current Income Tax Rate	Monthly Deferred Income Tax	Cumulative Deferred Income Tax	Net Deferred After Tax Balance	Monthly Return	Monthly A/T Return on Deferral	YTD After Tax Interest	Gross up of Return to Pretax Rate	Gross up of Return to Pretax
			1/2022 - 12/2022				6.56%			0.766497	
2022	January	(637,621)	0.233503	(148,886)	(148,886)	(488,735)	0.005469	(1,336)	(1,336)	0.766497	(1,744)
2022	February	(1,862,694)	0.233503	(286,058)	(434,945)	(1,427,749)	0.005469	(5,241)	(6,577)	0.766497	(8,581)
2022	March	(1,995,058)	0.233503	(30,908)	(465,852)	(1,529,206)	0.005469	(8,086)	(14,663)	0.766497	(19,130)
2022	April	(3,159,975)	0.233503	(272,012)	(737,864)	(2,422,111)	0.005469	(10,805)	(25,469)	0.766497	(33,227)
2022	May	(2,878,019)	0.233503	65,838	(672,026)	(2,205,993)	0.005469	(12,656)	(38,125)	0.766497	(49,739)
2022	June	(2,317,618)	0.233503	130,855	(541,171)	(1,776,447)	0.005469	(10,890)	(49,015)	0.766497	(63,947)
2022	July	(3,975,241)	0.233503	(387,060)	(928,231)	(3,047,010)	0.005469	(13,190)	(62,205)	0.766497	(81,155)
2022	August	(7,018,442)	0.233503	(710,597)	(1,638,827)	(5,379,615)	0.005469	(23,043)	(85,248)	0.766497	(111,218)
2022	September	(6,788,098)	0.233503	53,786	(1,585,041)	(5,203,056)	0.005469	(28,939)	(114,188)	0.766497	(148,973)
2022	October	(6,019,790)	0.233503	179,402	(1,405,639)	(4,614,151)	0.005469	(26,846)	(141,034)	0.766497	(183,998)
2022	November	(5,037,784)	0.233503	229,301	(1,176,338)	(3,861,447)	0.005469	(23,177)	(164,211)	0.766497	(214,236)
2022	December	(9,374,348)	0.233503	(1,012,601)	(2,188,938)	(7,185,410)	0.005469	(30,209)	(194,420)	0.766497	(253,647)
	Checks			(2,188,938)	(2,188,938)	(2,188,938)		(194,420)			(253,647)

/A

Revised Miller Exhibit 3, page 20

Duke Energy Carolinas, LLC
Docket Number E-7 Sub 1285
Estimated Return Calculation - Residential DSM Programs Vintage 2022

NC Residential DSM		Total System NC DSM Program Costs Incurred	NC Allocation %	NC Allocated EE Program Costs	NC Residential Revenue Collected	NC Residential EE Program Collection %	EE Program Costs Revenue Collected	(Over)/Under Collection
			Miller Exhibit 5 pg. 5, Line 8			See calc. at right		
2022	January	606,298	72.9576004%	442,340	546,633	79.5257%	(434,714)	7,626
2022	February	655,186	72.9576004%	478,008	1,642,049	79.5257%	(1,305,852)	(827,844)
2022	March	626,983	72.9576004%	457,432	1,268,359	79.5257%	(1,008,672)	(551,240)
2022	April	1,555,082	72.9576004%	1,134,551	1,025,420	79.5257%	(815,473)	319,078
2022	May	696,737	72.9576004%	508,322	1,024,963	79.5257%	(815,109)	(306,787)
2022	June	591,490	72.9576004%	431,537	1,362,769	79.5257%	(1,083,753)	(652,216)
2022	July	3,178,324	72.9576004%	2,318,829	1,570,979	79.5257%	(1,249,333)	1,069,496
2022	August	2,765,679	72.9576004%	2,017,773	1,711,157	79.5257%	(1,360,811)	656,962
2022	September	2,674,591	72.9576004%	1,951,317	1,417,149	79.5257%	(1,126,998)	824,319
2022	October	3,138,931	72.9576004%	2,290,089	980,664	79.5257%	(779,880)	1,510,208
2022	November	827,525	72.9576004%	603,743	960,639	79.5257%	(763,956)	(160,213)
2022	December	378,508	72.9576004%	276,151	2,446,172	79.5257%	(1,945,337)	(1,669,186)
		17,695,334		12,910,091	15,956,954		(12,689,887)	220,204
					Exhbit 4, line 11			

Program Costs to be Recovered	12,910,091
Revenue Requirement	16,233,851
% Revenue related to Program Costs	79.5257%

NC Residential DSM		Cumulative (Over)/Under Recovery	Current Income Tax Rate	Monthly Deferred Income Tax	Cumulative Deferred Income Tax	Net Deferred After Tax Balance	Monthly Return	Monthly A/T Return on Deferral	YTD After Tax Interest	Gross up of Return to Pretax Rate	Gross up of Return to Pretax
			1/2022 - 12/2022				6.56%			0.766497	
2022	January	7,626	0.233503	1,781	1,781	5,845	0.005469	16	16	0.766497	21
2022	February	(820,218)	0.233503	(193,304)	(191,523)	(628,695)	0.005469	(1,703)	(1,687)	0.766497	(2,201)
2022	March	(1,371,458)	0.233503	(128,716)	(320,240)	(1,051,218)	0.005469	(4,594)	(6,281)	0.766497	(8,195)
2022	April	(1,052,380)	0.233503	74,506	(245,734)	(806,646)	0.005469	(5,080)	(11,362)	0.766497	(14,823)
2022	May	(1,359,166)	0.233503	(71,636)	(317,369)	(1,041,797)	0.005469	(5,055)	(16,416)	0.766497	(21,417)
2022	June	(2,011,382)	0.233503	(152,294)	(469,664)	(1,541,718)	0.005469	(7,065)	(23,481)	0.766497	(30,634)
2022	July	(941,886)	0.233503	249,730	(219,933)	(721,953)	0.005469	(6,190)	(29,671)	0.766497	(38,710)
2022	August	(284,924)	0.233503	153,403	(66,531)	(218,393)	0.005469	(2,571)	(32,243)	0.766497	(42,065)
2022	September	539,395	0.233503	192,481	125,950	413,445	0.005469	533	(31,709)	0.766497	(41,369)
2022	October	2,049,603	0.233503	352,638	478,589	1,571,015	0.005469	5,427	(26,283)	0.766497	(34,290)
2022	November	1,889,390	0.233503	(37,410)	441,178	1,448,212	0.005469	8,256	(18,026)	0.766497	(23,518)
2022	December	220,204	0.233503	(389,760)	51,418	168,786	0.005469	4,422	(13,605)	0.766497	(17,749)
	Checks			51,418	51,418	51,418		(13,605)			(17,749)

Duke Energy Carolinas, LLC
Docket Number E-7 Sub 1285
Estimated Return Calculation - Non- Residential EE Programs Vintage 2022

NC Non- Residential EE		Non-Residential EE Program Costs Incurred	NC Allocation %	NC Allocated EE Program Costs	Program Incentives	Lost Revenues	Total Costs	NC Residential Revenue Collected	NC Non-Residential EE Program Collection %	Non-Residential EE Program Costs Revenue Collected	(Over)/Under Collection
			Miller Exhibit 5 pg 5, Line 4						100% used due to overcollection		
2022	January	3,270,770	73.8925998%	2,416,857	517,633	(84,489)	2,850,001	2,428,124	100.0000000%	(2,428,124)	421,876
2022	February	3,369,866	73.8925998%	2,490,081	533,316	(87,049)	2,936,348	4,960,670	100.0000000%	(4,960,670)	(2,024,322)
2022	March	4,658,859	73.8925998%	3,442,552	737,312	(120,345)	4,059,519	5,010,684	100.0000000%	(5,010,684)	(951,165)
2022	April	3,863,126	73.8925998%	2,854,565	611,379	(99,790)	3,366,153	4,535,727	100.0000000%	(4,535,727)	(1,169,573)
2022	May	2,785,650	73.8925998%	2,058,389	440,857	(71,957)	2,427,289	4,874,727	100.0000000%	(4,874,727)	(2,447,438)
2022	June	3,108,254	73.8925998%	2,296,769	491,913	(80,291)	2,708,392	5,794,636	100.0000000%	(5,794,636)	(3,086,244)
2022	July	3,003,595	73.8925998%	2,219,434	475,349	(77,587)	2,617,196	6,066,153	100.0000000%	(6,066,153)	(3,448,957)
2022	August	2,842,552	73.8925998%	2,100,436	449,863	(73,427)	2,476,871	6,677,888	100.0000000%	(6,677,888)	(4,201,017)
2022	September	3,191,286	73.8925998%	2,358,124	505,053	(82,436)	2,780,742	6,114,285	100.0000000%	(6,114,285)	(3,333,543)
2022	October	3,396,262	73.8925998%	2,509,586	537,493	(87,730)	2,959,349	4,912,608	100.0000000%	(4,912,608)	(1,953,259)
2022	November	2,781,223	73.8925998%	2,055,118	440,157	(71,843)	2,423,432	4,507,723	100.0000000%	(4,507,723)	(2,084,292)
2022	December	2,914,583	73.8925998%	2,153,661	461,262	(75,288)	2,539,636	7,235,553	100.0000000%	(7,235,553)	(4,695,917)
NR E-2, Sub 1180 Adjustment (AEC)[1]		468,065	100.0000000%	468,065			468,065			-	468,065
		39,654,090		29,423,638	6,201,588	(1,012,233)	34,612,992	63,118,778		(63,118,778)	(28,505,786)
								Exhibit 4, line 26			

Vintage is overcollected. Interest is calculated on all components.

100% of all revenues offset the overcollected balance.

NC Non-Residential EE		Cumulative (Over)/Under Recovery	Current Income Tax Rate	Monthly Deferred Income Tax	Cumulative Deferred Income Tax	Net Deferred After Tax Balance	Monthly Return	Monthly A/T Return on Deferral	YTD After Tax Interest	Gross up of Return to Pretax Rate	Gross up of Return to Pretax
			1/2022 - 12/2022				6.56%			0.766497	
2022	January	421,876	0.233503	98,509	98,509	323,367	0.005469	884	884	0.766497	1,154
2022	February	(1,602,446)	0.233503	(472,685)	(374,176)	(1,228,270)	0.005469	(2,475)	(1,590)	0.766497	(2,075)
2022	March	(2,553,611)	0.233503	(222,100)	(596,276)	(1,957,335)	0.005469	(8,711)	(10,302)	0.766497	(13,440)
2022	April	(3,723,184)	0.233503	(273,099)	(869,375)	(2,853,809)	0.005469	(13,157)	(23,458)	0.766497	(30,604)
2022	May	(6,170,621)	0.233503	(571,484)	(1,440,859)	(4,729,763)	0.005469	(20,738)	(44,196)	0.766497	(57,660)
2022	June	(9,256,866)	0.233503	(720,647)	(2,161,506)	(7,095,360)	0.005469	(32,337)	(76,533)	0.766497	(99,848)
2022	July	(12,705,822)	0.233503	(805,342)	(2,966,848)	(9,738,975)	0.005469	(46,035)	(122,568)	0.766497	(159,907)
2022	August	(16,906,839)	0.233503	(980,950)	(3,947,798)	(12,959,041)	0.005469	(62,070)	(184,638)	0.766497	(240,885)
2022	September	(20,240,382)	0.233503	(778,392)	(4,726,190)	(15,514,192)	0.005469	(77,863)	(262,500)	0.766497	(342,467)
2022	October	(22,193,641)	0.233503	(456,092)	(5,182,282)	(17,011,360)	0.005469	(88,944)	(351,444)	0.766497	(458,507)
2022	November	(24,277,933)	0.233503	(486,688)	(5,668,970)	(18,608,963)	0.005469	(97,407)	(448,851)	0.766497	(585,588)
2022	December	(28,505,786)	0.233503	(987,216)	(6,656,186)	(21,849,599)	0.005469	(110,638)	(559,489)	0.766497	(729,929)
	Checks			(6,656,186)	(6,656,186)	(6,656,186)		(559,489)			(729,929)

Note 1: AEC Yield Capital, LLC Settlement Adjustment. See Docket No. E-2, Sub 1180 for additional details

Duke Energy Carolinas, LLC
Docket Number E-7 Sub 1285
Estimated Return Calculation -Non - Residential DSM Programs Vintage 2022

NC Non- Residential DSM		Total System NC DSM Program Costs Incurred	NC Non- Residential DSM Allocation %	NC Allocated DSM Non-Residential Program Costs	Program Incentives	Total Costs	NC Non-Residential DSM Revenue Collected	NC Non-Residential DSM Program Collection %	Non-Residential DSM Program Costs Revenue Collected	(Over)/Under Collection
			Miller Exhibit 5 pg. 5, Line 8					100% used due to overcollection		
2022	January	1,334,791	72.9576004%	973,831	229,824	1,203,655	645,727	100.0000000%	(645,727)	557,928
2022	February	1,290,558	72.9576004%	941,560	229,824	1,171,384	1,373,572	100.0000000%	(1,373,572)	(202,188)
2022	March	1,543,170	72.9576004%	1,125,860	229,824	1,355,684	1,410,702	100.0000000%	(1,410,702)	(55,018)
2022	April	1,557,950	72.9576004%	1,136,643	229,824	1,366,467	1,292,406	100.0000000%	(1,292,406)	74,060
2022	May	1,635,680	72.9576004%	1,193,353	229,824	1,423,177	1,368,591	100.0000000%	(1,368,591)	54,586
2022	June	1,783,909	72.9576004%	1,301,497	229,824	1,531,321	1,669,315	100.0000000%	(1,669,315)	(137,993)
2022	July	1,816,373	72.9576004%	1,325,182	229,824	1,555,006	1,720,836	100.0000000%	(1,720,836)	(165,830)
2022	August	1,793,959	72.9576004%	1,308,829	229,824	1,538,653	1,872,277	100.0000000%	(1,872,277)	(333,624)
2022	September	1,792,392	72.9576004%	1,307,686	229,824	1,537,510	1,716,913	100.0000000%	(1,716,913)	(179,404)
2022	October	1,769,565	72.9576004%	1,291,032	229,824	1,520,856	1,431,089	100.0000000%	(1,431,089)	89,767
2022	November	1,875,715	72.9576004%	1,368,477	229,824	1,598,300	1,316,574	100.0000000%	(1,316,574)	281,726
2022	December	1,816,399	72.9576004%	1,325,201	229,824	1,555,025	1,972,770	100.0000000%	(1,972,770)	(417,745)
		20,010,461		14,599,152	2,757,886	17,357,038	17,790,773		(17,790,773)	(433,735)
							Exhibit 4, line 36			

Vintage is overcollected. Interest is calculated on all components.

100% of all revenues offset the overcollected balance.

NC Non-Residential DSM		Cumulative (Over)/Under Recovery	Current Income Tax Rate	Monthly Deferred Income Tax	Cumulative Deferred Income Tax	Net Deferred After Tax Balance	Monthly Return	Monthly A/T Return on Deferral	YTD After Tax Interest	Gross up of Return to Pretax Rate	Gross up of Return to Pretax
			1/2022 - 12/2022				6.56%			0.766497	
2022	January	557,928	0.233503	130,278	130,278	427,650	0.005469	1,169	1,169	0.766497	1,526
2022	February	355,740	0.233503	(47,212)	83,066	272,674	0.005469	1,915	3,085	0.766497	4,024
2022	March	300,722	0.233503	(12,847)	70,219	230,502	0.005469	1,376	4,461	0.766497	5,819
2022	April	374,782	0.233503	17,293	87,513	287,269	0.005469	1,416	5,876	0.766497	7,667
2022	May	429,368	0.233503	12,746	100,259	329,109	0.005469	1,686	7,562	0.766497	9,866
2022	June	291,375	0.233503	(32,222)	68,037	223,338	0.005469	1,511	9,073	0.766497	11,837
2022	July	125,544	0.233503	(38,722)	29,315	96,229	0.005469	874	9,947	0.766497	12,977
2022	August	(208,080)	0.233503	(77,902)	(48,587)	(159,492)	0.005469	(173)	9,774	0.766497	12,751
2022	September	(387,483)	0.233503	(41,891)	(90,479)	(297,005)	0.005469	(1,248)	8,525	0.766497	11,122
2022	October	(297,716)	0.233503	20,961	(69,518)	(228,199)	0.005469	(1,436)	7,089	0.766497	9,249
2022	November	(15,990)	0.233503	65,784	(3,734)	(12,256)	0.005469	(658)	6,431	0.766497	8,391
2022	December	(433,735)	0.233503	(97,545)	(101,279)	(332,457)	0.005469	(943)	5,489	0.766497	7,161
	Checks			(101,279)	(101,279)	(101,279)		5,489			7,161

Estimate - January 1, 2024 - December 31, 2024
Docket Number E-7, Sub 1285
Projected Program/Portfolio Cost Effectiveness - Vintage 2024
Updated To Reflect E-100, Sub 175 Avoided Cost Assumptions

Program	UCT	TRC	RIM	PCT	Percent Change Compared to Initial Filing UCT	Percent Change Compared to Initial Filing TRC
Residential Programs						
· **Energy Efficiency Education Program**	1.32	1.33	0.37	13.34	12%	12%
· **Energy Efficient Appliances & Devices**	4.86	3.41	0.89	5.42	0%	0%
· **Smart $aver Energy Efficiency Program**	1.31	2.04	0.71	2.08	-2%	84%
· **Income-Qualified EE Products & Services**	0.70	0.70	0.49	1.81	-3%	-3%
· **Multi-Family EE Products & Services**	4.52	4.62	0.85	36.08	0%	0%
· **My Home Energy Report**	3.24	2.01	0.74	7.61	9%	9%
· **Power Manager**	4.40	8.81	4.40	0.00	-7%	-7%
· **Residential Energy Assessments**	1.32	1.29	0.49	19.02	0%	0%
· **Residential New Construction**	2.12	1.47	0.81	2.27	-4%	-4%
Residential Total	**2.86**	**2.94**	**1.21**	**4.15**	**-3%**	**1%**
Non-Residential Programs						
· **Custom Energy Assessment & Incentive**	3.42	1.29	1.02	1.89	-1%	-1%
· **EnergyWise for Business**	1.25	2.25	1.12	79.51	-6%	-6%
· **Smart $aver Energy Efficient Food Service Products**	2.27	0.71	0.61	1.64	2%	1%
· **Smart $aver Energy Efficient HVAC Products**	4.10	2.66	0.90	3.93	-2%	-2%
· **Smart $aver Energy Efficient Lighting Products**	4.11	2.10	1.00	3.15	-1%	-1%
· **Smart $aver Energy Efficient Pumps & Drives**	3.92	2.68	0.90	4.61	0%	0%
· **Smart $aver Energy Efficient Information Technology**	0.51	0.55	0.30	5.03	9%	10%
· **Smart $aver Energy Efficient Process Equipment**	2.35	1.67	0.93	2.47	0%	0%
· **Smart $aver Energy Efficient Performance Incentive**	5.11	1.33	1.04	1.85	0%	0%
· **Business Energy Saver**	2.95	1.82	0.94	2.83	-1%	-1%
· **PowerShare**	4.42	260.40	4.42	0.00	-7%	-7%
Non-Residential Total	**3.84**	**2.39**	**1.20**	**2.87**	**-3%**	**-3%**
Overall Portfolio Total	**3.37**	**2.59**	**1.21**	**3.20**	**-3%**	**-1%**