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June 11, 2019

VIA ELECTRONIC FILING AND HAND DELIVERY

M. Lynn Jarvis, Chief Clerk
North Carolina Utilities Commission
4325 Mail Service Center
Raleigh, North Carolina 27699-4300

**RE: Duke Energy Progress, LLC's Application for Approval of Demand-Side Management and Energy Efficiency Cost Recovery Rider
Docket No. E-2, Sub 1206**

Dear Ms. Jarvis:

Enclosed is Duke Energy Progress, LLC's Application for Approval of Demand-Side Management and Energy Efficiency Cost Recovery Rider, together with the Direct Testimony and Exhibits of Carolyn T. Miller and Robert P. Evans, for filing in connection with the referenced matter.

I will deliver fifteen (15) paper copies of the Application, Direct Testimony, and Exhibits, as well as a flash drive containing the supporting workpapers for the filing, to the Clerk's Office by close of business on June 12, 2019.

Please do not hesitate to contact me if you have any questions or need additional information.

Sincerely,

Kendrick C. Fentress

Kendrick C. Fentress

Enclosure

cc: David T. Drooz
Lucy Edmondson
John Little

CERTIFICATE OF SERVICE

I certify that a copy of Duke Energy Progress, LLC's Application for Approval of Demand-Side Management and Energy Efficiency Cost Recovery Rider in Docket No. E-2, Sub 1206 has been served by electronic mail, hand delivery, or by depositing a copy in the United States Mail, 1st Class Postage Prepaid, properly addressed to parties of record.

This the 11th day of June, 2019.

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BEFORE THE NORTH CAROLINA UTILITIES COMMISSION

DOCKET NO. E-2, SUB 1206

In the Matter of Application of Duke Energy Progress, 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 PROGRESS, LLC FOR APPROVAL OF DEMAND-SIDE MANAGEMENT AND ENERGY EFFICIENCY COST RECOVERY RIDER**

Duke Energy Progress, LLC ("DEP" or the "Company"), pursuant to N.C. Gen. Stat. § 62-133.9 and Rule R8-69 of the Rules and Regulations of the North Carolina Utilities Commission (the "Commission"), hereby applies to the Commission for approval of its demand-side management ("DSM") and energy efficiency ("EE") cost recovery rider for 2020. In support of this Application, DEP respectfully shows the Commission the following:

1. The Applicant's general offices are located at 410 South Wilmington Street, Raleigh, North Carolina 27601, and its mailing address is Post Office Box 1551, Raleigh, North Carolina 27602-1551.

2. The attorney for the Company, to whom all communications and pleadings should be addressed, is:

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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 new DSM and 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 costs during the rate period and an Experience Modification Factor ("EMF") 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 to utilities for adopting and implementing new DSM and EE programs, including rewards based on the sharing of savings achieved by the programs.

4. 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- and EE-related costs.

5. According to Rule R8-69(e), the electric public utility is to file its application for recovery of DSM and EE costs at the same time it files the information required by Rule R8-55, and the Commission is to conduct an annual DSM/EE rider hearing as soon as practicable after the hearing required by Rule R8-55.

6. Pursuant to the provisions of N.C. Gen. Stat. § 62-133.9 and Commission Rule R8-69, the Company requests the establishment of a rider to recover its reasonable and prudent DSM and EE costs, including program costs, net lost revenues, incentives, and an EMF. All costs, including net lost revenues and Portfolio Performance Incentive, are calculated pursuant to the *Order Approving Revised Cost Recovery and Incentive Mechanism and Granting Waivers* issued by the Commission in Docket No. E-2, Sub 931 on January 20, 2015. The calculations of these costs, and the associated rider and EMF

rates, are described in the Direct Testimony and Exhibits of Carolyn T. Miller. The rider and EMF are intended to allow DEP to recover $176,806,684 of DSM and EE expenses, net lost revenues, and incentives. This amount includes the estimated under-collection of $8,787,707 associated with test period activities during the period beginning January 1, 2018 and ending December 31, 2018, and an estimated $168,018,977 for expenses, net lost revenues, and incentives to be incurred during the rate period from January 1, 2020 through December 31, 2020.

7. Pursuant to the provisions of N.C. Gen. Stat. § 62-133.9 and Commission Rule R8-69, the Company requests Commission approval of the annual billing adjustments as follows (all shown on a cents per kilowatt-hour ("kWh") basis with and without NC regulatory fee):

Excluding regulatory fee:

Rate Class	DSM Rate (¢/kWh)	EE Rate (¢/kWh)	DSM EMF (¢/kWh)	EE EMF Rate (¢/kWh)	DSM/EE Annual Rider (¢/kWh)
Residential	0.120	0.503	0.000	(0.029)	0.594
General Service EE		0.634		0.150	0.784
General Service DSM	0.070		(0.011)		0.059
Lighting		0.096		(0.002)	0.094

Including regulatory fee:

Rate Class	DSM Rate (¢/kWh)	EE Rate (¢/kWh)	DSM EMF (¢/kWh)	EE EMF Rate (¢/kWh)	DSM/EE Annual Rider (¢/kWh)
Residential	0.120	0.504	0.000	(0.029)	0.595
General Service EE		0.635		0.150	0.785
General Service DSM	0.070		(0.011)		0.059
Lighting		0.096		(0.002)	0.094

The DSM/EE rider will be in effect for the twelve-month period January 1, 2020 through December 31, 2020.

8. Pursuant to Commission Rule R8-69(b)(6), DEP requests approval to defer prudently incurred costs to FERC account 182.3, "Other Regulatory Assets," until recovered. In addition, pursuant to Commission Rule R8-69(b)(6), DEP requests approval to defer the costs it incurs in adopting and implementing new DSM and EE measures up to six months prior to DEP filing for Commission approval of such measures in accordance with Commission Rule R8-68.

9. The Company has included herewith, as required by Commission Rule R8-69, the direct testimony and exhibits of witnesses Carolyn T. Miller and Robert P. Evans in support of its filing and the requested change in rates.

WHEREFORE, the Company respectfully prays:

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

Respectfully submitted this the 11th day of June 2019.

By: ______________________
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Associate General Counsel
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ATTORNEY FOR DUKE ENERGY
PROGRESS, LLC

OFFICIAL COPY

Jun 11 2019

VERIFICATION

STATE OF NORTH CAROLINA	)	
	)	DOCKET NO. E-2, SUB 1206
COUNTY OF MECKLENBURG	)	

Carolyn T. Miller, being first duly sworn, deposes and says:

That she is MANAGER, RATES AND REGULATORY STRATEGY supporting DUKE ENERGY PROGRESS, 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 it to be true.

Carolyn T. Miller

Carolyn T. Miller

Sworn to and subscribed before me
this the 4th day of June, 2019.

Aloma M. Felder

Notary Public Aloma M. Felder

My Commission Expires: July 21, 2020

ALOMA M. FELDER
NOTARY
PUBLIC
CABARRUS COUNTY, N. C.

BEFORE THE NORTH CAROLINA UTILITIES COMMISSION

DOCKET NO. E-2, SUB 1206

In the Matter of Application of Duke Energy Progress, 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	))))))	**DIRECT TESTIMONY OF CAROLYN T. MILLER FOR DUKE ENERGY PROGRESS, LLC**

I. INTRODUCTION AND PURPOSE

Q. PLEASE STATE YOUR NAME, BUSINESS ADDRESS AND POSITION WITH DUKE ENERGY CORPORATION.

A. My name is Carolyn T. Miller, and my business address is 550 South Tryon Street, Charlotte, North Carolina. I am a Manager, Rates & Regulatory Strategy for Duke Energy Carolinas, LLC ("DEC"), supporting both Duke Energy Progress, LLC ("DEP" or the "Company") and DEC.

Q. PLEASE BRIEFLY STATE YOUR EDUCATIONAL BACKGROUND AND EXPERIENCE.

A. I graduated from the College of New Jersey in Trenton, New Jersey with a Bachelor of Science in Accountancy. I am a certified public accountant licensed in the State of North Carolina. I began my career in 1994 with Ernst & Young as a staff auditor. In 1997, I began working with Duke Energy as a senior business analyst and have held a variety of positions in the Finance organization. I joined the Rates Department in 2014 as Manager, Rates and Regulatory Strategy.

Q. HAVE YOU PREVIOUSLY PROVIDED TESTIMONY IN MATTERS BROUGHT BEFORE THIS COMMISSION?

A. Yes. I provided testimony in support of DEC's applications for approval of its demand-side management ("DSM") and energy efficiency ("EE") cost recovery rider in Docket No. E-7, Subs 1073, 1105, 1130, 1164, and 1192 as well as DEP's application for approval of its DSM/EE cost recovery rider in Docket No. E-2, Subs 1070, 1108, 1145, and 1174.

Q. WHAT ARE YOUR CURRENT RESPONSIBILITIES?

A. I am responsible for providing regulatory support for retail rates and providing guidance on DEC's and DEP's DSM/EE cost recovery process.

Q. WHAT IS THE PURPOSE OF YOUR TESTIMONY?

A. The purpose of my testimony is to explain and support DEP's proposed DSM/EE cost recovery rider and Experience Modification Factor ("EMF") and provide information required by Commission Rule R8-69.

Q. PLEASE DESCRIBE THE EXHIBITS ATTACHED TO YOUR TESTIMONY.

A. Miller Exhibit 1 provides a summary of the proposed annual rates by customer class. Miller Exhibit 2, pages 1 through 3, shows the calculation of the DSM and EE rates for the rate period, as well as the breakdown by program of the various components of the estimated revenue requirement. Miller Exhibit 2, pages 4 through 6, presents the calculation of the DSM EMF and EE EMF rates for the test period, as well as the breakdown by program of the various components of the final revenue requirement. Adjustments resulting from Evaluation, Measurement and Verification ("EM&V") of the Company's DSM/EE programs are also presented in Miller Exhibit 2, page 7. Miller Exhibit 3, pages 1 through 4, calculates the amount of interest or return due on over- and under-collections for Vintage 2018. Miller Exhibit 4 shows a summary of revenue collected during calendar year 2018 by program type and customer class. Miller Exhibit 5, pages 1 through 7, presents the allocation factors used in the development of the rider, including the energy allocation factors applicable to DSM and EE program costs, the North Carolina and South Carolina retail allocation factors, and the lighting allocation factors. Miller Exhibit 6 includes both forecasted 2020 sales from the Spring 2019forecast and the impact of opt-outs.

Q. WERE MILLER EXHIBITS 1-6 PREPARED BY YOU OR AT YOUR DIRECTION AND SUPERVISION?

A. Yes.

II. SUMMARY OF DSM/EE COSTS

Q. CAN YOU PROVIDE A SUMMARY OF THE COSTS FOR WHICH DEP IS REQUESTING RECOVERY IN THIS PROCEEDING?

A. Yes. The DSM/EE costs DEP is requesting to recover through the rates proposed in this proceeding are associated with the costs incurred during the test period, as well as the costs forecasted to be incurred during the rate period. The test period utilized in the development of the DSM/EE EMF is January 1, 2018 through December 31, 2018. The North Carolina allocated share of recoverable DSM/EE costs for the test period is $167,740,012. For the rate period of January 1, 2020 through December 31, 2020, the North Carolina allocated share of forecasted DSM/EE costs is $163,323,186. The total North Carolina allocated share of DSM/EE costs for the test period plus the rate period is $331,063,198.

A summary of the costs associated with DEP's recovery request by period and by DSM/EE program/measure is provided in the following table:

Program/Measure	Test Period **1/1/18 through 12/31/18**	Rate Period **1/1/20 through 12/31/20**
CIG DR	$1,691,101	$3,068,574
EnergyWise	$17,700,771	$20,018,110
EnergyWise for Business	$1,666,383	$2,384,804
DSDR Implementation	$23,242,626	$22,542,717
Residential Home Advantage	$176,476	$140,907
Residential Smart $aver/Home Energy Improvement	$6,874,771	$3,851,610
Residential Low Income – NES	$1,634,768	$1,824,212
CIG EE/EE For Business	$8,638,552	$6,343,437
Energy Efficient Lighting	$17,685,537	$13,312,359
Appliance Recycling	$171,919	$91,207
My Home Energy Report	$12,620,393	$13,807,504
Small Business Energy Saver	$14,088,318	$12,503,856
Residential New Construction	$12,476,136	$13,405,275
Multi-Family EE	$4,016,501	$5,202,480
Energy Education Program for Schools	$769,164	$1,103,873
Save Energy & Water Kit	$3,243,453	$5,408,415
Residential Energy Assessments	$2,363,723	$2.669.692
Smart $aver Prescriptive	$18,403,196	$15,992,469
Smart $aver Custom	$2,018,232	$4,406,197
Smart $aver Performance Incentive	$75,938	$635,617
Administrative & General Costs	$3,626,595	$5,528,049
Carrying Cost on Balances	$14,767,187	$14,145,611
Found Revenue (total)	$(211,727)	$(63,791)
Lost Revenue Decrement		$(5,000,000)
Total Cost	$167,740,012	$163,323,186

In addition to the summary table above, Miller Exhibit 2, page 3, and Miller Exhibit 2, page 6, provide additional categorizations by cost element.

Q. ARE DEP'S PROPOSED RATES DESIGNED TO RECOVER THE TOTAL NORTH CAROLINA ALLOCATED SHARE OF $331,063,198?

A. No. Because many of the expenses incurred during the current test period to develop and implement DEP's DSM/EE programs produce benefits covering several years, a significant portion of those expenses will be deferred and recovered over varying amortization periods. A summary of the amortization periods for program expenses and Program/Portfolio Performance Incentive ("PPI")[1] is shown below:

Length of Amortization Period				
Program Name	Program Cost – batches prior to 2016	Program Cost – 2016 – present	PPI – vintages prior to 2016	PPI – 2016 – present
CIG DR	10	3	10	3
EnergyWise	10	10	10	10
EnergyWise for Business	N/A	3	N/A	1
DSDR Implementation	10	10	N/A	N/A
Residential Home Advantage	10	N/A	10	N/A
Residential Smart $aver/Home Energy Improvement	10	10	10	10
Residential Low Income – NES	10	10	10	10
Energy Efficient Lighting	5	5	10	5
Appliance Recycling	10	10	10	10
My Home Energy Report	1	1	1	1
Residential New Construction	10	10	10	10
CFL Pilot	10	N/A	10	N/A
Solar Hot Water Pilot	10	N/A	10	N/A
Multi-Family EE	5	5	5	5
Energy Education	5	5	5	5
CIG EE	10	3	10	3
Save Water & Energy Kit	N/A	5	N/A	5
Residential Energy Assessments	N/A	5	N/A	5
Small Business Energy $aver	10	3	10	3
Smart $aver Prescriptive	3	3	3	3
Smart $aver Performance	3	3	3	3

[1] As explained further below, for vintages prior to 2016, incentives are calculated on a program basis. Pursuant to the Commission's *Order Approving Revised Cost Recovery Mechanism and Granting Waivers* issued January 20, 2015 in Docket No. E-2, Sub 931 ("Order Approving Revised Mechanism"), which applies to Vintages 2016 and forward, incentives under the Company's revised cost recovery mechanism are calculated on a portfolio basis. For ease of reference, I will refer to both incentives as "PPI."

Length of Amortization Period				
Program Name	Program Cost – batches prior to 2016	Program Cost – 2016 – present	PPI – vintages prior to 2016	PPI – 2016 – present
Smart $aver Custom	3	3	3	3
Admin. & General	3	3	3	N/A

In addition to the aforementioned deferrals, DEP's proposed rates include the recognition and amortization of prior period deferrals. In total, the EMF-related calculations based on test period costs reflect an estimated under-recovery of $8,787,707. The DSM/EE rate calculations associated with rate period estimates are based on a revenue requirement of $168,018,977. The rate period and EMF revenue requirements produce a combined revenue requirement of $176,806,683. Miller Exhibit 2, pages 1 and 2, and Miller Exhibit 2, pages 4 and 5, detail the calculation of these amounts.

III. EMF REVENUE REQUIREMENT

Q. HOW WAS THE DSM/EE EMF UNDER-RECOVERY OF $8,787,707DETERMINED?

A. The EMF under-recovery is a function of the sum of test period costs, including amounts relating to the amortization of deferred costs from prior periods, and credits for actual DSM/EE rider revenues for the period January 1, 2018 through December 31, 2018. The following table illustrates the relationship of these elements with respect to the determination of the DSM/EE EMF:

Rate Element	Amounts
Test Period Revenue Requirement	$171,490,556
Net DSM/EE Rate Revenue	$162,055,933
Add: Other Adjustments	$646,916
Total EMF Adjustments	$162,702,849
Adjusted DSM/EE EMF Revenue Requirement	$8,787,707

Miller Exhibit 2, pages 4 through 7, provides additional details associated with the development of these amounts.

Q. PLEASE DESCRIBE THE $646,916 THAT HAS BEEN CATEGORIZED AS "OTHER ADJUSTMENTS."

A. The $646,916 in "Other Adjustments" is the sum of lines 2 through 8 on page 7 of Miller Exhibit 2. Lines 2 and 3 are reserved for prospective uncollectible allowances in DEP's DSM/EE rates. DEP is not requesting an uncollectible adjustment as a part of its cost recovery request in this proceeding. In addition, the adjustments found on lines 4 through 7 reflect the true-up of PPI and net lost revenues for the 2016 and 2017 vintages. The last of these adjustments, found on line 8, recognizes estimated interest owed and return earned for revenue over- and under-collections during the period extending from January 1, 2018 through December 31, 2018. The Direct Testimony of Company witness Robert P. Evans provides further detail on program-specific impacts to PPI and net lost revenues.

IV. RATE PERIOD REVENUE REQUIREMENT

Q. PLEASE DESCRIBE THE BASIS FOR THE RATE PERIOD REVENUE REQUIREMENT.

A. As indicated previously, the estimated revenue requirement for the rate period is $168,018,977. This amount reflects the anticipated costs and necessary recoveries for the rate period, which extends from January 1, 2020 through December 31, 2020. The $168,018,977 revenue requirement includes: (1) $21,335,721 for anticipated rate period program expenses; (2) amortizations and carrying costs associated with deferred prior period costs totaling $76,663,150; (3) recovery of Distribution System Demand Response ("DSDR") depreciation and capital costs totaling $17,666,196; (4) net lost revenues for the rate period totaling $27,919,544 for vintage years 2018 through 2020; and (5) PPI totaling $24,434,366 associated with vintage years 2011 through 2020.

V. JURISDICTIONAL COST ALLOCATION

Q. HOW ARE DSM AND EE PROGRAM COSTS ALLOCATED TO THE NORTH CAROLINA RETAIL JURISDICTION?

A. DEP determines the total amount of recoverable costs and separates these costs into three categories: (1) DSM-related costs, (2) EE-related costs, and (3) costs that provide a system benefit in support of both DSM and EE programs. For each of these categories, different allocation methods are employed to assign those costs to the appropriate jurisdiction.

Q. HOW ARE COSTS IDENTIFIED AS EE-RELATED ALLOCATED TO NORTH CAROLINA?

A. Any program costs that are identified as being EE-related, including administrative and general ("A&G") costs, are allocated to the North Carolina retail jurisdiction based upon the ratio of North Carolina retail sales to DEP system retail sales at the point of generation. For calendar year test periods beginning in year 2016, the allocation percentage for the entire calendar year test period is based on the latest cost of service study available at the time of filing. Please note that the 2019 cost of service study has not yet been filed;

therefore, the Company is continuing to use rates set in the 2018 cost of service study.

Q. HOW ARE DSM-RELATED COSTS ALLOCATED TO NORTH CAROLINA?

A. Any program costs that are identified as being DSM-related, including A&G costs, are allocated to the North Carolina retail jurisdiction based upon the ratio of the North Carolina retail demand to the DEP system retail demand at the hour of the annual summer system peak. For calendar year test periods beginning in year 2016, the allocation percentage for the entire calendar year test period is based on the latest cost of service study available at the time of filing. Again, please note that the 2019 cost of service study has not yet been filed; therefore, the Company is continuing to use rates set in the 2018 cost of service study.

Q. PLEASE ELABORATE ON THE METHODOLOGY USED TO ALLOCATE DSM/EE COSTS THAT OFFER A SYSTEM BENEFIT.

A. Certain A&G costs provide a system benefit in support of both DSM and EE programs and, therefore, are allocated in both categories. The allocation of these costs into either the DSM or EE category is based upon the percentage of program costs for each type of expenditure anticipated during the next forecast calendar year. For example, if 30% of direct program costs in the forecast period are EE-related, then 30% of these A&G costs will be considered EE-related costs for allocation purposes. The use of a forecast period recognizes the types of new programs DEP will offer in the immediate future that will be supported by these administrative costs. The assignment of A&G costs as either DSM- or EE-related is reviewed annually based upon forecasted program costs for the next calendar year. The A&G costs in this proceeding have been assigned to these categories based upon forecasted DSM and EE costs for 2020.

Q. IN MILLER EXHIBIT 2, PAGE 3, AND MILLER EXHIBIT 2, PAGE 6, THE DSDR PROGRAM IS SEPARATED FROM THE OTHER DSM/EE PROGRAMS. HOW IS THE DSDR PROGRAM CLASSIFIED?

A. The DSDR program has been classified by the Commission, for purposes of ratemaking, as an EE program. Due to the scope and nature of DSDR, its costs are being tracked separately. This separate tracking includes both direct costs and A&G costs associated with the program.

VI. PORTFOLIO PERFORMANCE INCENTIVE AND NET LOST REVENUES

Q. HOW IS THE PPI CALCULATED?

A. The PPI is calculated pursuant to the Order Approving Revised Mechanism and is based on the savings achieved by the portfolio of PPI-eligible DSM/EE programs. Under the terms of the Order Approving Revised Mechanism, the amount of PPI to be recovered during the rate period is 11.75 percent of the net benefits produced by the portfolio of PPI-eligible programs. Estimated net savings for all periods are determined by multiplying the number of measurement units projected to be installed for a specific program or measure in a vintage year by the most current estimate of the annual per installation kilowatt ("kW") and kilowatt-hour ("kWh") savings over the measurement unit's life and by the annual kW and kWh avoided costs. DEP then subtracts the estimated utility costs over the measurement unit's life related to the projected installations in that vintage year and discounts the result to determine a net present value.

The PPI for each program vintage is converted into a stream of up to ten levelized annual payments. DEP's overall weighted average net-of-tax rate of return approved in DEP's most recent general rate case is used as the appropriate discount rate. Pursuant to the Order Approving Revised Mechanism, PPI recoveries are subject to true-up on the basis of future EM&V results. PPI calculations are based on calendar year vintages. The PPI vintage assigned to the test period in this filing encompasses calendar year 2018. These values will be trued-up on the basis of future EM&V results. The estimated PPI for the rate period used in this filing is based on calendar year 2020 and will be trued-up as a part of DEP's 2021 DSM/EE cost recovery proceeding. Please see Evans Exhibit 1 for additional detail by program.

Q. HOW WERE NET LOST REVENUES DETERMINED?

A. The Company determines net lost revenues, which are applicable to both DSM and EE programs, by multiplying the estimated reduction in kWh sales associated with a program or measure by a margin-based net lost revenue rate. The following formula illustrates the basic components of the net lost revenue calculations: Net Lost Revenues ($) = Lost Sales (kWh) x Net Lost Revenue Rate ($/kWh).

Lost Sales are those sales that do not occur as a result of implementation of DEP DSM/EE measures. These values are initially based on engineering estimates and/or past impact evaluations. Future periods are based on updated impact evaluations resulting from EM&V activities and are applied prospectively and in conjunction with applicable net lost revenue true-ups. The Net Lost Revenue rate represents the difference between the average retail rate applicable to the customer class impacted by the measure and the sum of (1) the embedded regulatory fees, (2) the related average customer charge component of that rate, (3) the average fuel component of the rate, and (4) the incremental variable operations and maintenance (O&M) rate as filed in DEP's last Cogeneration and Small Power Producer tariff. When multiple customer classes are impacted by a DSM/EE measure, as with the DSDR program, a weighted or system-wide net lost revenue rate is employed.

Pursuant to the Order Approving Revised Mechanism, DEP may only recover net lost revenues for up to 36 months of an installed measure's life, and as with the PPI, recoveries are subject to true-up on the basis of future EM&V results.

In addition, in the Commission's *Order Addressing the Impacts of the Federal Tax Cuts and Jobs Act on Public Utilities* (Docket M-100 Sub 148) issued on October 5, 2018, the Commission directed the Company to maintain all of its federal excess deferred income taxes resulting from the passage of the federal Tax Cuts and Jobs Act in a regulatory liability account pending flow back of that liability to DEP's ratepayers with interest. The Company is to file its proposal to flow back the excess deferred taxes by October 5, 2021 or in DEP's next general rate case proceeding, whichever is sooner. In DEP's *Petition for an Accounting Order to Defer Incremental Hurricanes Florence and Michael and Winter Storm Diego Storm Damage Expenses*, filed on December 21, 2018 in Docket No. E-2, Sub 1193, the Company indicated that it plans to file a general rate case in 2019. In accordance with the Commission's Docket M-100 Sub 148 Order, it is expected that the Commission will resolve the appropriate method to flow back excess deferred taxes in the next general rate case. New rates from the Company's 2019 rate case would likely be implemented in 2020 and would likely reflect a resolution of the flow back of excess deferred taxes. For purposes of this DSM/EE proceeding only, the Company has included a reduction of $5 million to Year 2020 lost revenues collected from Vintage 2017, Vintage 2018, Vintage 2019, and Vintage 2020. This will be trued up to the actual impact on the lost revenue rate in the next DSM/EE rider filing after an order is issued in DEP's upcoming base rate case. This $5 million reduction is meant to serve as a placeholder to mitigate potential overcollection with respect to the Company's DSM/EE rider and does not reflect any particular position by DEP on the appropriate methodology or timeframe for the flow back of excess deferred taxes or any other tax issues or proposals that may be raised in the Company's next general rate case.

VII. COST ALLOCATION METHODOLOGY

Q. HOW ARE DSM- AND EE-RELATED COSTS ALLOCATED TO EACH RATE CLASS?

A. Costs are assigned to customer classes based on program design and participation. In other words, residential program costs are allocated solely to residential customers, general service program costs are allocated solely to general service customers, and lighting program costs are allocated solely to lighting customers. Where programs benefit multiple customer groups, the costs are allocated directly to groups receiving benefits or by employing annual energy- and/or coincident peak demand-based allocation factors.

Miller Exhibit 2, pages 1 and 2, and Miller Exhibit 2, pages 4 and 5, demonstrate how the costs associated with a specific program have been assigned to customer groups.

Q. HOW ARE SALES AND DEMAND ADJUSTED FOR THE IMPACT OF OPT-OUT CUSTOMERS?

A. Commercial customers with annual consumption of 1,000,000 kWh or greater in the billing months of the prior calendar year and all industrial customers who implement or will implement alternative DSM/EE measures may elect not to participate in DEP's DSM and/or EE programs. DEP reviewed its customer records and identified that commercial and industrial customers choosing to opt out of EE programs consumed 11,748,716,255 kWh during the year ended December 31, 2018. In addition, DEP identified that commercial and industrial customers choosing to opt out of DSM programs consumed 11,850,797,144 kWh during the year ended December 31, 2018.

DEP developed rate class allocation factors based on the assumption that customers that have elected to opt out of the Company's DSM/EE rider will remain opted out. If customers decide to change their opt-out status, revenue gains or losses will be recognized in subsequent DSM/EE EMF calculations.

Sales for the year ended December 31, 2018 for all customers electing to opt out of the DSM/EE rate are provided in Miller Exhibit 6.

Q. THE SALES FOR OPT-OUT CUSTOMERS ARE EASILY IDENTIFIED, BUT HOW IS THE COINCIDENT PEAK OF THESE CUSTOMERS ESTIMATED?

A. Currently installed metering for a great number of opt-out customers does not provide sufficient detail to determine their contribution to the system coincident peak hour load. Instead, the impact is estimated based upon the ratio of opt-out sales to total sales for the rate class multiplied by the rate class peak demand. This approach should accurately approximate the demand of opt-out accounts. This calculation can be seen at Miller Exhibit 5, page 6.

Q. AFTER ADJUSTING ENERGY AND DEMAND FOR OPT-OUT CUSTOMERS, HOW ARE THE RESULTING ALLOCATION FACTORS THEN USED TO DETERMINE THE REVENUE REQUIREMENT FOR EACH RATE CLASS?

A. Energy- and demand-based allocators are used in cases where programs or measures directly benefit multiple rate groups. When a DSM or EE program benefits multiple rate groups, DEP multiplies EE costs by rate class energy allocation factors and multiplies any associated DSM costs by rate class demand allocation factors for purposes of cost assignment.

Since usage for opt-out customers is not forecasted, the rate class energy allocation factors were developed from the forecasted rate class usage after subtracting actual sales for opt-out customers for the year ended December 31, 2018. Miller Exhibit 5, page 5, provides the energy allocation factors applicable to each rate class based upon the forecast of rate class sales for the rate period of January 1, 2020 through December 31, 2020.

The allocation rate class demand allocation factors are based on the summer coincident peak demand for 2017 after subtracting the estimated demand for opt-out customers as discussed above. The forecast does not provide rate class coincident peak demands; therefore, the most recent historic data was deemed to be representative of future demand impacts. Miller Exhibit 5, page 6, shows the demand allocation factors applicable to each rate class for the rate period.

Q. WHICH OF DEP'S PROGRAMS OR MEASURES BENEFIT MULTIPLE CUSTOMER CLASSES?

A. The Company's DSDR program benefits all customer classes. To allocate DSDR costs, DEP employs rate class energy allocation factors. These allocation procedures are elements of Miller Exhibit 2, pages 1 and 4. In addition, DEP's Energy Efficient Lighting Program provides benefits to both the residential and general service customer classes. These costs were allocated based on the bulbs provided to those classes using EM&V results as shown in Miller Exhibit 5, page 7.

Q. HOW DOES DEP DETERMINE RATE CLASS DSM/EE RATES?

A. The calculated rate class DSM and EE revenue requirements are divided by forecasted rate class sales, after adjustment for opt-out customers, to establish the rate class DSM/EE rate. Miller Exhibit 2, page 1, provides the derivation of the EE rate. Miller Exhibit 2, page 2, provides the derivation of the DSM rate.

Q. HOW DOES DEP DETERMINE RATES FOR THE DSM/EE EMF?

A. As with DSM/EE rate determination, the calculated rate class DSM and EE EMF revenue requirements, adjusted for cost recoveries, are divided by forecasted rate class sales, after adjustment for opt-out customers, to establish the rate class DSM/EE EMF rate. Miller Exhibit 2, page 4, provides the derivation of the EE EMF rate. Miller Exhibit 2, page 5, provides the derivation of the DSM EMF rate.

VIII. PROPOSED RATES

Q. WHAT RATES ARE PROPOSED FOR EACH RATE CLASS?

A. Miller Exhibit 1 is populated with the DSM/EE rates and EMF rates proposed in this proceeding. The DSM/EE rates recover costs forecasted to be incurred from January 1, 2020 through December 31, 2020. The DSM/EE EMF is a true-up mechanism recognizing costs and recoveries for the test period of

January 1, 2018 through December 31, 2018. DEP proposes the following rates, exclusive of North Carolina regulatory fees, for each rate class:

Rate Class	DSM Rate (¢/kWh)	EE Rate (¢/kWh)	DSM EMF (¢/kWh)	EE EMF Rate (¢/kWh)	DSM/EE Annual Rider (¢/kWh)
Residential	0.120	0.503	0.000	(0.029)	0.594
General Service EE		0.634		0.150	0.784
General Service DSM	0.070		(0.011)		0.059
Lighting		0.096		(0.002)	0.094

Q. WHAT ARE THE RATES INCLUDING NORTH CAROLINA REGULATORY FEES?

A. The following table reflects the proposed billing rates, including North Carolina regulatory fees, for each rate class:

Rate Class	DSM Rate (¢/kWh)	EE Rate (¢/kWh)	DSM EMF (¢/kWh)	EE EMF (¢/kWh)	Annual DSM/EE Rider (¢/kWh)
Residential	0.120	0.504	0.000	(0.029)	0.595
General Service EE		0.635		0.150	0.785
General Service DSM	0.070		(0.011)		0.059
Lighting		0.096		(0.002)	0.094

Q. HOW WILL DEP REVISE ITS TARIFFS TO RECOVER THESE RATES?

A. The Company will update its Annual Billing Adjustment, Rider BA, to recognize these rates, adjusted for the North Carolina regulatory fees.

IX. CONCLUSION

Q. DOES THIS CONCLUDE YOUR PRE-FILED DIRECT TESTIMONY?

A. Yes.

Duke Energy Progress, LLC
Docket No. E-2, Sub 1206
Summary of 2020 DSM/EE Rates

	Source:	cents/kWh Rate	Reg Fee	Billing Rate
Residential Rate				
EMF Rate - DSM	Miller Exhibit 2, page 5	0.000	0.000	0.000
EMF Rate - EE	Miller Exhibit 2, page 4	-0.029	0.000	-0.029
Projected Rate - DSM	Miller Exhibit 2, page 2	0.120	0.000	0.120
Projected Rate - EE	Miller Exhibit 2, page 1	0.503	0.001	0.504
Total Residential Rate		0.594		0.595
General Service				
EE EMF Rate	Miller Exhibit 2, page 4	0.150	0.000	0.150
EE Projected Rate	Miller Exhibit 2, page 1	0.634	0.001	0.635
Total General Service EE Rate		0.784		0.785
DSM EMF Rate	Miller Exhibit 2, page 5	-0.011	0.000	-0.011
DSM Projected Rate	Miller Exhibit 2, page 2	0.070	0.000	0.070
Total General Service DSM Rate		0.059		0.059
Lighting EE Rate				
Lighting EE EMF Rate	Miller Exhibit 2, page 4	-0.002	0.000	-0.002
Lighting EE Projected Rate	Miller Exhibit 2, page 1	0.096	0.000	0.096
Total Lighting EE Rate		0.094		0.094

DUKE ENERGY PROGRESS, LLC
Docket No. E-2, Sub 1206
Energy Efficiency Rate Derivation

NC Rate Class	Adjusted NC Rate Class kWh Sales [1]	Rate Class Energy Allocation Factor [2]	EE Revenue Requirements: Residential Programs [3]	CIG Programs [4]	DSDR [5]	Non-DSDR Allocated A&G and Carrying Costs[6]	DSDR Allocated A&G and Carrying Costs[7]	Total of Allocated Costs	Total EE Rate
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8) = Σ (3 thru 7)	(9) = (8) / (1)
Residential	16,011,833,010	61.51%	$ 58,194,033	$ -	$ 14,493,373	$ 6,935,225	$ 932,299	$ 80,554,931	0.503
General Service	9,657,233,917	37.10%	$ -	$ 46,515,078	$ 8,741,404	$ 5,405,399	$ 562,299	$ 61,224,179	0.634
Lighting	360,095,612	1.38%	$ -	$ -	$ 325,946	$ -	$ 20,967	$ 346,913	0.096
NC Retail	26,029,162,539	100%	$ 58,194,033	$ 46,515,078	$ 23,560,723	$ 12,340,624	$ 1,515,565	$ 142,126,023	

NOTES:

(1) Rate Class Sales, excluding "Opt-Out" sales, are derived in Miller Exhibit 6.
(2) Rate Class Energy Allocation Factor is derived in Miller Exhibit 5, page 5, column (4).
(3) Residential Program costs are allocated solely to the Residential Class in compliance with Commission's Order in Docket No. E-2, Sub 931, dated 1/20/15.
(4) Non-Residential Program costs are allocated solely to the General Service Class in compliance with Commission's Order in Docket No. E-2, Sub 931, dated 1/20/15.
(5) DSDR Costs allocated using the Rate Class Energy Allocation Factor from column (2) in compliance with Commission's Order in Docket No. E-2, Sub 931, dated 1/20/15.
(6) Non-DSDR A&G and Carrying Costs are allocated on the basis of Non-DSDR revenue requirements (excluding incentives and net lost revenues).
(7) DSDR A&G Costs and Carrying Costs are allocated using the Rate Class Energy Allocation Factor from column (2).

Please note: Exhibit may not foot due to rounding.

DUKE ENERGY PROGRESS, LLC
Docket No. E-2, Sub 1206
Demand-Side Management Rate Derivation

			DSM Revenue Requirements					
NC Rate Class	Adjusted NC Rate Class kWh Sales [(1)]	Rate Class Demand Allocation Factor[(2)]	EnergyWise Program Costs[(3)]	CIG DR Program [(4)]	Allocated A&G Costs[(5)]	Allocated Carrying Costs[(5)]	Total of Allocated Costs	Total DSM Rate
	(1)	(2)	(3)	(4)	(5)	(6)	(7) = Σ (3 thru 6)	(8) = (7) / (1)
Residential	16,011,833,010	67.91%	$15,947,958	$ -	$ 686,852	$ 2,581,877	$ 19,216,687	0.120
General Service	9,555,153,028	32.09%	$ -	$ 5,157,716	$ 319,091	$ 1,199,460	$ 6,676,267	0.070
Lighting	359,358,198	0.00%	$ -	$ -	$ -	$ -	$ -	-
NC Retail	25,926,344,236	100.00%	$15,947,958	$ 5,157,716	$ 1,005,943	$ 3,781,337	$ 25,892,954	

NOTES:

(1) Rate Class Sales, excluding "Opt-Out" sales, are derived in Miller Exhibit 6.
(2) Rate Class Demand Allocation Factor is derived in Miller Exhibit 5, page 6, column (5).
(3) EnergyWise costs are directly assigned solely to the Residential Rate Class in compliance with Commission's Order in Docket No. E-2, Sub 931, dated 1/20/15.
(4) CIG DR Program costs are directly assigned solely to the General Service Class in compliance with Commission's Order in Docket No. E-2, Sub 931, dated 1/20/15.
(5) A&G and Carrying Costs are allocated on the basis of revenue requirements (excluding incentives and net lost revenues).

Please note: Exhibit may not foot due to rounding.

DUKE ENERGY PROGRESS, LLC
Docket No. E-2, Sub 1206
Rate Period Revenue Requirement Summary - NC Level
January 2020 - December 2020

NORTH CAROLINA JURISDICTIONALLY ALLOCATED RETAIL COSTS ONLY

Line			O&M	Insurance	A&G Expense	Capitalized O&M and A&G	Amortization of Capitalized O&M	Amortization of Capitalized A&G	Prior Period Amortization	DSDR Capital Costs	Income Taxes on DSDR Capital Costs	DSDR Property Taxes	DSDR Depreciation	Carrying Costs Net of Taxes	Income Taxes on Carrying Cost	Rev Reqmt Before PPI & NLR	Net Lost Revenue Recoupment	Program Performance Incentive	Rev Reqmt With PPI & NLR
			(1)	(2)	(3)	(4)	(5)	(6)		(10)	(11)	(12)	(13)	(14)	(15)	(16)	(17)	(18)	(19)
						ΣCols(1)thru(3)	((1)+(2))/10 or 5 or 3	(3)/3								ΣCols(5)thru(15)			ΣCols(16)thru(18)
	NC DSM Program Expenses																		
1	CIG DR	*Per Forecast*	2,477,371		-	2,477,371	825,790	-	1,868,050							2,693,840		591,203	3,285,043
2	EnergyWise	*Per Forecast*	14,470,796		-	14,470,796	1,447,080	-	8,953,564							10,400,644		5,547,314	15,947,958
3	EnergyWise for Business	*Per Forecast*	2,650,110		-	2,650,110	883,370	-	1,254,609							2,137,979	4,606	(269,912)	1,872,673
4	Total DSM	*Σ Lines 1 thru 2*	19,598,277	-	-	19,598,277	3,156,240	-	12,076,223	-	-	-	-	-	-	15,232,463	4,606	5,868,605	21,105,674
5	DSM Assigned A&G and CCost	*Per Forecast*	-		1,455,982	1,455,982		485,327	520,616					3,102,183	679,154	4,787,280			4,787,280
6	Total DSM and Assigned Costs	*Σ Lines 4 thru 5*	19,598,277		1,455,982	21,054,259	3,156,240	485,327	12,596,839					3,102,183	679,154	20,019,743	4,606	5,868,605	25,892,954
	NC EE Program Expenses																		
7	Res Home Advantage	*Per Forecast*	-			-	-	-	224,324							224,324	-	140,907	365,231
8	Residential Smart $aver/Home En	*Per Forecast*	2,813,600			2,813,600	281,360	-	4,393,813							4,675,173	767,585	270,425	5,713,183
9	Neighborhood Energy Saver	*Per Forecast*	1,615,854			1,615,854	161,585	-	1,436,173							1,597,758	208,358	-	1,806,116
10	Solar Hot Water Pilot	*Per Forecast*	-			-	-	-	15,912							15,912		-	15,912
11	EE Lighting (Res)*	*Per Forecast (allocated)*	3,611,482			3,611,482	722,296	-	8,291,860							9,014,156	2,811,061	3,881,545	15,706,762
12	Res Appliance Recycling	*Per Forecast*	-			-	-	-	550,144							550,144		91,207	641,351
13	My Home Energy Report*	*Per Forecast*	5,433,060			5,433,060	5,433,060	-	-							5,433,060	8,419,925	(45,480)	13,807,504
14	Residential New Construction	*Per Forecast*	10,319,275			10,319,275	1,031,928	-	5,222,110							6,254,038	2,271,693	814,307	9,340,038
15	Multi-Family	*Per Forecast*	2,319,154			2,319,154	463,831	-	1,698,069							2,161,900	2,042,340	840,986	5,045,226
16	Energy Education Program for Sch	*Per Forecast*	770,392			770,392	154,078	-	524,829							678,907	333,481	-	1,012,388
17	Save Energy and Water Kit/Applia	*Per Forecast*	781,518			781,518	156,304	-	635,533							791,837	2,987,003	1,639,895	5,418,734
18	Residential Energy Assessments	*Per Forecast*	1,533,680			1,533,680	306,736	-	1,019,452							1,326,188	821,033	314,978	2,462,200
19	Residential Found Revenue	*Per Forecast*														-	(8,353)		(8,353)
20	Lost Revenue Decrement pending Rate Case Implementation																(3,132,260)		(3,132,260)
21	Subtotal-Residential	*Σ Lines 7 thru 19*	29,198,015		-	29,198,015	8,711,178	-	24,012,219					-	-	32,723,397	17,521,866	7,948,770	58,194,033
22	CIG Energy Efficiency	*Per Forecast*						-	3,262,527							3,262,527			3,262,527
23	EE Lighting (General Service)*	*Per Forecast (allocated)*	437,719			437,719	87,544	-	1,005,745							1,093,289	1,163,782	1,406,771	3,663,841
24	Energy Efficiency for Business	*Per Forecast*	1,486,998			1,486,998	495,666		-							495,666	4,856,439		5,352,105
25	Smart Saver Prescriptive	*Per Forecast*	8,101,571			8,101,571	2,700,524		6,636,878							9,337,402	1,452,377	6,438,521	17,228,300
26	Smart Saver Custom	*Per Forecast*	3,398,552			3,398,552	1,132,851		1,118,645							2,251,496	391,253	616,392	3,259,142
27	Smart Saver Performance Incentiv	*Per Forecast*							-							-	428,984	206,633	635,617
28	Small Business Energy Saver	*Per Forecast*	6,531,766			6,531,766	2,177,255	-	6,887,379							9,064,634	4,023,416	1,948,674	15,036,724
29	Business Energy Report	*Per Forecast*	-			-	-	-	-							-	-		-
30	Lost Revenue Decrement Pending Rate Case Implementation																(1,867,740)		(1,867,740)
31	General Service Found Revenue	*Per Forecast*														-	(55,439)		(55,439)
	Subtotal-General Service	*Σ Lines 22 thru 31*	19,956,606	-	-	19,956,606	6,593,840	-	18,911,175	-	-	-	-	-	-	25,505,015	10,393,072	10,616,991	46,515,078
32	Total of EE Programs	*Σ Lines 21 + 31*	49,154,621		-	49,154,621	15,305,018	-	42,923,394					-	-	58,228,412	27,914,938	18,565,761	104,709,111
33	EE Assigned A&G and CCost	*Per Forecast*			4,072,067	4,072,067		1,357,356	2,134,559					7,259,419	1,589,290	12,340,624			12,340,624
34	Total EE and Assigned Costs	*Lines 32 + 33*	49,154,621		4,072,067	53,226,688	15,305,018	1,357,356	45,057,953					7,259,419	1,589,290	70,569,035	27,914,938	18,565,761	117,049,735
	NC DSDR Program Expenses																		
35	DSDR Program	*Per Forecast*	3,633,636	638,298		4,271,934	427,193	-	4,862,747	6,110,097	1,347,951	604,587	10,208,148			23,560,723	-	-	23,560,723
36	DSDR Assigned A&G and CCost	*Per Forecast*				-		-	-					1,243,359	272,206	1,515,565			1,515,565
37	Total DSDR and Assigned Costs	*Σ Lines 35 thru 36*	3,633,636	638,298	-	4,271,934	427,193	-	4,862,747	6,110,097	1,347,951	604,587	10,208,148	1,243,359	272,206	25,076,288	-	-	25,076,288
38	Rate Period Totals	*Lines 6 + 34 + 37*	72,386,534	638,298	5,528,049	78,552,881	18,888,451	1,842,683	62,517,539	6,110,097	1,347,951	604,587	10,208,148	11,604,961	2,540,650	115,665,066	27,919,544	24,434,366	168,018,977

*All Non-Residential programs are amortized over a 3 year period. The Residential Lighting Program, Multi-Family EE, EE Education, Save Energy and Water Kit and Residential Energy Assessments are recoverable over a 5 year period. My Home Energy Report is recoverable over a 1 year period. All other Residential EE programs are recoverable over 10 years.

Please note: Exhibit may not foot due to rounding.

DUKE ENERGY PROGRESS, LLC
Docket No. E-2, Sub 1206
Energy Efficiency Experience Modification Factor Rate Derivation

			EE EMF Revenue Requirement								
NC Rate Class	Adjusted NC Rate Class kWh Sales (1)	Rate Class Energy Allocation Factor (2)	Residential Programs(3)	CIG Programs(4)	DSDR (5)	Non-DSDR Allocated A&G and Carrying Costs(6)	DSDR Allocated A&G and Carrying Costs(5)	Total of Allocated Costs	Less: Prior Period EE Rate Adjustment(7)	Adjusted EE EMF Revenue Requirement	Total EE EMF Rate (cents/kWh)
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8) = Σ (3 thru 7)	(9)	(10)=(8)-(9)	(11) = (10) / (1)
Residential	16,011,833,010	61.51%	$ 54,799,512	$0	$ 14,807,750	$ 6,914,222	$ 989,952	$ 77,511,436	$ 82,129,683	$ (4,618,247)	(0.029)
General Service	9,657,233,917	37.10%	$0	$ 55,501,231	$ 8,931,014	$ 6,057,455	$ 597,071	$ 71,086,770	$ 56,588,824	$ 14,497,946	0.150
Lighting	360,095,612	1.38%	$0	$0	$ 333,017	$ -	$ 22,263	$ 355,280	$ 362,466	$ (7,186)	(0.002)
NC Retail	26,029,162,539	100.00%	$ 54,799,512	$ 55,501,231	$ 24,071,781	$ 12,971,677	$ 1,609,286	$ 148,953,486	$ 139,080,973	$ 9,872,513	

NOTES:

(1) Rate Class Sales, excluding "Opt-Out" sales, are derived in Miller Exhibit 6.
(2) Rate Class Energy Allocation Factor is derived in Miller Exhibit 5, page 5, column (4).
(3) Residential Program costs are allocated solely to the Residential rates in compliance with Commission's Order in Docket No. E-2, Sub 931, dated 1/20/15.
(4) Non-residential Program costs are allocated solely to the General Service rates in compliance with Commission's Order in Docket No. E-2, Sub 931, dated 1/20/15.
(5) DSDR Costs allocated using the Rate Class Energy Allocation Factor from column (2) in compliance with Commission's Order in Docket No. E-2, Sub 931, dated 1/20/15.
(6) Non-DSDR A&G and Carrying Costs are allocated on the basis of Non-DSDR revenue requirements (excluding incentives and net lost revenues) assigned in preceding columns.
(7) Amounts are derived in Miller Exhibit 2, page 7.

Please note: Exhibit may not foot due to rounding.

DUKE ENERGY PROGRESS,LLC
Docket No. E-2, Sub 1206
Demand-Side Management Experience Modification Factor Rate Derivation

			DSM EMF Revenue Requirement							
NC Rate Class	Adjusted NC Rate Class kWh Sales [1]	Rate Class Demand Allocation Factor[2]	EnergyWise Program Costs[3]	CIG DR Program [4]	Allocated A&G Costs[5]	Allocated Carrying Costs[5]	Total of Allocated Costs	Less: Prior Period DSM Rate Adjustment[6]	Adjusted DSM EMF Revenue Requirement	Total DSM EMF Rate (cents/kWh)
	(1)	(2)	(3)	(4)	(5)	(6)	(7) = Σ (3 thru 6)	(8)	(9)=(7)-(8)	(10) = (9) / (1)
Residential	16,011,833,010	67.91%	$14,654,316	$ -	$ 631,225	$ 2,504,759	$ 17,790,300	$ 17,822,007	$ (31,707)	-
General Service	9,555,153,028	32.09%	$ -	$ 3,582,289	$ 234,392	930,089	$ 4,746,769	$ 5,799,983	$ (1,053,214)	(0.011)
Lighting	359,358,198	0.00%	$ -	$ -	$ -	$ -	$ -	$ -	$ -	-
NC Retail	25,926,344,236	100%	$14,654,316	$ 3,582,289	$ 865,617	$ 3,434,848	$ 22,537,070	$ 23,621,991	$ (1,084,921)	

NOTES:

(1) Rate Class Sales, excluding "Opt-Out" sales, are derived in Miller Exhibit 6.
(2) Rate Class Demand Allocation Factor is derived in Miller Exhibit 5, page 6, column (5).
(3) EnergyWise costs are directly assigned solely to the Residential Rate Class in compliance with Commission's Order in Docket No. E-2, Sub 931, dated 1/20/15.
(4) CIG DR costs are directly assigned solely to the General Service Rate Class in compliance with Commission's Order in Docket No. E-2, Sub 931, dated 1/20/15.
(5) A&G and Carrying Costs are allocated on the basis of revenue requirements (excluding incentives and net lost revenues) assigned in preceding columns.
(6) Amounts are derived in Miller Exhibit 2, page 7.

Please note: Exhibit may not foot due to rounding.

DUKE ENERGY PROGRESS, LLC
Docket No. E-2, Sub 1206
EMF Period Revenue Requirement Summary - NC Level
January 2018 - December 2018

		O&M	Insurance	A&G Expense	Capitalized O&M and A&G	Amortization of Capitalized O&M	Amortization of Capitalized A&G	Prior Period Amortization	DSDR Capital Costs	Income Taxes on DSDR Capital Costs	DSDR Property Taxes	DSDR Depreciation	Carrying Costs Net of Taxes	Income Taxes on Carrying Cost	Rev Reqmt Before PPI & NLR	Net Lost Revenue Recoupment	Program Performance Incentive	Rev Reqmt With PPI & NLR
		(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)	(16)	(17)
					ΣCols(1)thru(3)	((1)+(2))/10	(3)/3								ΣCols(5)thru(13)			ΣCols(14)thru(1[illegible]
	NC DSM Program Expenses																	
1	CIG DR	1,399,223			1,399,223	466,408	-	1,617,836					-	-	2,084,244		291,878	2,376,1[illegible]
2	EnergyWise	12,087,626			12,087,626	1,208,763	-	7,832,408					-	-	9,041,171		5,613,145	14,654,316
3	EnergyWise for Business	1,733,219			1,733,219	577,740		695,263							1,273,003	57,289	(124,125)	1,206,1[illegible]
4	Total DSM	15,220,068			15,220,068	2,252,910	-	10,145,508					-	-	12,398,418	57,289	5,780,898	18,236,6[illegible]
5	DSM Assigned A&G and CCost	-		767,276	767,276		255,759	609,858					2,809,943	624,905	4,300,465			4,300,465
6	Total DSM and Assigned Costs	15,220,068		767,276	15,987,344	2,252,910	255,759	10,755,366					2,809,943	624,905	16,698,883	57,289	5,780,898	22,537,0[illegible]
	NC EE Program Expenses																	
7	Residential Home Advantage	-			-	-	-	380,546					-	-	380,546	-	176,476	557,022
8	Home Energy Improvem't	5,861,122			5,861,122	586,112		4,347,799					-	-	4,933,911	672,751	340,898	5,947,560
9	Neighborhood Energy Saver	1,500,588			1,500,588	150,059		1,314,427					-	-	1,464,486	134,180	-	1,598,666
10	Solar Hot Water Pilot	-			-	-		38,418					-	-	38,418	-	-	38,418
11	EE Lighting (Res)*	7,117,425			7,117,425	1,423,485		9,737,010					-	-	11,160,495	2,950,128	4,163,487	18,274,110
12	Appliance Recycling	-			-	-		633,915					-	-	633,915	52,165	119,754	805,834
13	My Home Energy Report	6,250,206			6,250,206	6,250,206		-					-	-	6,250,206	6,433,772	(63,585)	12,620,393
14	Residential New Construction	10,723,253			10,723,253	1,072,325		3,124,224					-	-	4,196,549	1,170,118	582,765	5,949,433
15	Home Depot CFL	-			-	-	-	2,495					-	-	2,495	-	-	2,495
16	Energy Education Program for Schools	550,291			550,291	110,058		390,557							500,615	218,873	-	719,488
17	Save Energy & Water Kits	670,940			670,940	134,188		254,418							388,606	1,630,652	941,861	2,961,119
18	Residential Energy Assessments	1,505,780			1,505,780	301,156		533,990							835,146	602,369	255,573	1,693,089
19	Multi-Family	1,959,175			1,959,175	391,835		1,187,627							1,579,462	1,441,342	615,984	3,636,788
20	Found Revenue															(4,903)		(4,903)
21	Subtotal-Residential	36,138,780			36,138,780	10,419,425	-	21,945,426	-	-	-	-	-	-	32,364,851	15,301,448	7,133,214	54,799,512
22	CIG Energy Efficiency	-			-	-		4,114,401					-	-	4,114,401			4,114,401
23	EE Lighting (Gen Svc)*	862,454			862,454	172,491		1,181,699							1,354,190	1,207,667	1,384,376	3,946,232
24	Non-Residential Energy Efficiency Programs				-	-		9,782,959							9,782,959	8,638,552		18,421,511
25	Smart Saver Prescriptive	9,493,158			9,493,158	3,164,386		-							3,164,386		8,910,038	12,074,424
26	Smart Saver Custom	1,767,818			1,767,818	589,239		-							589,239		250,414	839,653
27	Smart Saver Performance Incentive				-			-							-	46,133	29,805	75,938
25	Small Business Energy Saver	7,201,646			7,201,646	2,400,549		6,912,075					-	-	9,312,624	4,256,047	2,630,625	16,199,295
28	Business Energy Report	-			-	-		36,600							36,600	-	-	36,600
29	Found Revenue															(206,825)		(206,825)
30	Subtotal-General Service	19,325,076			19,325,076	6,326,665	-	22,027,734	-	-	-	-	-	-	28,354,399	13,941,574	13,205,257	55,501,231
31	Total of EE Programs	55,463,856			55,463,856	16,746,089	-	43,973,159					-	-	60,719,249	29,243,022	20,338,471	110,300,742
32	EE Assigned A&G and CCost	-		2,859,319	2,859,319		953,106	2,295,518					7,954,289	1,768,764	12,971,677			12,971,677
33	Total EE and Assigned Costs	55,463,856		2,859,319	58,323,175	16,746,089	953,106	46,268,677					7,954,289	1,768,764	73,690,927	29,243,022	20,338,471	123,272,420
	NC DSDR Program Expenses																	
34	DSDR Program	3,693,521	670,117		4,363,638	436,364	-	4,756,429	6,418,064	1,427,080	603,872	10,427,643			24,069,452	2,329		24,071,781
35	DSDR Assigned A&G and CCost			-	-		-	-					1,316,534	292,752	1,609,286			1,609,286
36	Total DSDR and Assigned Costs	3,693,521	670,117	-	4,363,638	436,364	-	4,756,429	6,418,064	1,427,080	603,872	10,427,643	1,316,534	292,752	25,678,738	2,329	-	25,681,067
37	Test Period Totals	74,377,445	670,117	3,626,595	78,674,157	19,435,363	1,208,865	61,780,472	6,418,064	1,427,080	603,872	10,427,643	12,080,766	2,686,421	116,068,548	29,302,640	26,119,369	171,490,556

*All Non-Residential programs are amortized over a 3 year period. The Residential Lighting Program, Multi-Family EE and EE Education are recoverable over a 5 year period.
My Home Energy Report is recoverable over a 1 year period. All other Residential EE programs are recoverable over 10 years.

Please note: Exhibit may not foot due to rounding.

DUKE ENERGY PROGRESS, LLC
Docket No. E-2, Sub 1206
EMF Adjustment Summary
January 2018 - December 2018

		Residential				General Service				Lighting				Totals			
Line	Description	DSM	DSDR	EE	Total	DSM	DSDR	EE	Total	DSM	DSDR	EE	Total	DSM	DSDR	EE	Total
1	Test Period DSM/EE Rate Billings [1] *Amounts from Miller Exhibit 4*	$ 17,729,490	$ 18,022,227	$ 63,559,093	$ 99,310,811	$ 5,663,182	$ 10,628,046	$ 46,092,363	$ 62,383,592	$ -	$ 361,531	$ -	$ 361,531	$ 23,392,672	$ 29,011,804	$ 109,651,457	$ 162,055,933
2	Less: Uncollectible Allowance in Rates[2]	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
3	Over or (Under) collection of Uncollectibles [3]	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
4	True up of Vintage 2016 PPI [4] *Amounts from Evans Exhibit 1 page 3*	-		(2,265)	(2,265)	-		-	-			-	-	-	-	(2,265)	(2,265)
5	True up of Vintage 2017 PPI [5] *Amounts from Evans Exhibit 1 page 5*	92,517		(9,016)	83,501	0		138,845	138,845					92,517	-	129,829	222,346
6	True up of Vintage 2016 Lost Revenue through Year 2017 [6] *Amounts from Evans Exhibit 2 page 3 -4*			(44,890)	(44,890)			0	0			-	-	-	-	(44,890)	(44,890)
7	True up of Vintage 2017 Lost Revenue through Year 2017 [7] *Amounts from Evans Exhibit 2 page 3 -4*			(8,042)	(8,042)			$ (13,296)	(13,296)				-	-	-	(21,338)	(21,338)
8	Interest on Overcollections/(Undercollections) [8] *Amounts from Miller Exhibit 3*	-	-	612,574	612,574	136,801	-	(257,135)	(120,333)	-	935	-	935	136,801	935	355,440	493,176
9	Net Adjustments to DSM/EE EMF Clause *Σ Lines 1 through 8*	$ 17,822,007	$ 18,022,227	$ 64,107,456	$ 99,951,691	$ 5,799,983	$ 10,628,046	$ 45,960,778	$ 62,388,808	$ -	$ 362,466	$ -	$ 362,466	$ 23,621,991	$ 29,012,739	$ 110,068,234	$ 162,702,964

Miller Exhibit 2 page 5

$\underbrace{\text{Residential DSDR + EE}}_{\$82{,}129{,}683}$ — *To Miller Exhibit 2 page 4*

To Miller Exhibit 2 page 5

$\underbrace{\text{General Service DSDR + EE}}_{\$56{,}588{,}824}$ — *To Miller Exhibit 2 page 4*

To Miller Exhibit 2 page 4 ***› Miller Exhibit 2 page 5***

$\underbrace{\text{Totals DSDR + EE}}_{\$139{,}080{,}973}$ — *To Miller Exhibit 2 page 4*

[1] Actual DSM/EE Rate billings for test period *(January 2018 through December 2018)* .
[2] The Company is not requesting an adjustment for uncollectibles in this proceeding.
[3] The Company is not requesting an adjustment for uncollectibles in this proceeding.
[4] See Evans Exhibit 1 page 3 for a detail list of Vintage 2016 programs impacted by EM&V true-ups
[5] See Evans Exhibit 1 page 5 for a detail list of Vintage 2017 programs impacted by EM&V true-ups
[6] See Evans Exhibit 2 page 5 for a detail list of Vintage 2016 programs impacted by EM&V true-ups
[7] See Evans Exhibit 2 page 5 for a detail list of Vintage 2017 programs impacted by EM&V true-ups
[8] Calculated interest obligation associated with test period *(January 1, 2018 through December 31, 2018).*

Please note: Exhibit may not foot due to rounding.

Duke Energy Progress, LLC
Docket No. E-2, Sub 1206
Estimated Return Calculation - Residential EE & DSM Programs Vintage 2018

		Residential EE Costs, PPI & LR	Residential DSM Costs and PPI	Residential DSDR Program Costs Incurred	Total EE and DSM to be recovered	NC Residential Revenue Collected	NC Residential EE Program Collection %	EE Program Costs Revenue Collected	(Over)/Under Collection
2017	January	8,191,124	2,346,545	2,094,614	12,632,283	13,167,598	100.00%	(13,167,598)	(535,315)
2017	February	5,621,501	1,610,415	1,437,516	8,669,431	9,036,814	100.00%	(9,036,814)	(367,382)
2017	March	4,336,018	1,242,157	1,108,796	6,686,971	6,970,343	100.00%	(6,970,343)	(283,372)
2017	April	4,197,952	1,202,605	1,073,490	6,474,046	6,748,395	100.00%	(6,748,395)	(274,349)
2017	May	3,748,350	1,073,805	958,519	5,780,674	6,025,640	100.00%	(6,025,640)	(244,966)
2017	June	5,182,007	1,484,511	1,325,130	7,991,648	8,330,308	100.00%	(8,330,308)	(338,660)
2017	July	5,852,854	1,676,691	1,496,677	9,026,222	9,408,724	100.00%	(9,408,724)	(382,502)
2017	August	5,732,354	1,642,171	1,465,863	8,840,388	9,215,015	100.00%	(9,215,015)	(374,627)
2017	September	5,180,502	1,484,080	1,324,745	7,989,327	8,327,889	100.00%	(8,327,889)	(338,562)
2017	October	4,665,110	1,336,433	1,192,950	7,194,493	7,499,373	100.00%	(7,499,373)	(304,879)
2017	November	3,954,939	1,132,988	1,011,347	6,099,274	6,357,741	100.00%	(6,357,741)	(258,468)
2017	December	5,115,236	1,465,383	1,308,055	7,888,674	8,222,971	100.00%	(8,222,971)	(334,297)
		61,777,946	17,697,783	15,797,702	95,273,431	99,310,811			(4,037,380)

DEP is overcollected on all components
Interest is calculated on the entire
balance.

Note 1: Revenue source - CIM CRY4 reports
Note 2: Program & Carrying Costs allocated on a weighted average basis based on revenues collected.

		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
			2018 tax rate				10.00%			0.768307	
2017	January	(535,315)	23.5036%	(125,818)	(125,818)	(409,497)	0.008333	(1,706)	(1,706)	0.768307	(2,221)
2017	February	(902,698)	23.5036%	(86,348)	(212,166)	(690,531)	0.008333	(4,583)	(6,290)	0.768307	(8,186)
2017	March	(1,186,070)	23.5036%	(66,603)	(278,769)	(907,301)	0.008333	(6,658)	(12,947)	0.768307	(16,852)
2017	April	(1,460,419)	23.5036%	(64,482)	(343,251)	(1,117,168)	0.008333	(8,435)	(21,383)	0.768307	(27,831)
2017	May	(1,705,385)	23.5036%	(57,576)	(400,827)	(1,304,558)	0.008333	(10,091)	(31,473)	0.768307	(40,964)
2017	June	(2,044,046)	23.5036%	(79,597)	(480,424)	(1,563,621)	0.008333	(11,951)	(43,424)	0.768307	(56,519)
2017	July	(2,426,548)	23.5036%	(89,902)	(570,326)	(1,856,222)	0.008333	(14,249)	(57,673)	0.768307	(75,065)
2017	August	(2,801,175)	23.5036%	(88,051)	(658,377)	(2,142,798)	0.008333	(16,663)	(74,336)	0.768307	(96,753)
2017	September	(3,139,737)	23.5036%	(79,574)	(737,951)	(2,401,786)	0.008333	(18,936)	(93,272)	0.768307	(121,399)
2017	October	(3,444,616)	23.5036%	(71,658)	(809,609)	(2,635,007)	0.008333	(20,987)	(114,258)	0.768307	(148,714)
2017	November	(3,703,084)	23.5036%	(60,749)	(870,358)	(2,832,726)	0.008333	(22,782)	(137,040)	0.768307	(178,367)
2017	December	(4,037,380)	23.5036%	(78,572)	(948,930)	(3,088,450)	0.008333	(24,672)	(161,712)	0.768307	(210,478)
								(161,712)			(210,478)
		Twelve months return on 2018 Year End Balance				(3,088,450)		(308,845)			(401,981)
		Total return on Residential EE& DSM Programs									(612,460)

Duke Energy Progress, LLC
Docket No. E-2, Sub 1206
Estimated Return Calculation -Non-Residential DSM Programs Vintage 2018

		Non-Residential DSM Program Costs Incurred	Non-Residential Allcoated Carrying Costs & A&G	Total Program Costs Incurred	NC Non-Residential DSM Revenue Collected	NC Non- Residential DSM Program Collection %	Non- Residential DSM Program Costs Revenue Collected	(Over)/Under Collection
2017	Januar	310,834	101,042	411,875	491,392	100.0000%	(491,392)	(79,517)
2017	Februa	286,577	93,156	379,733	453,044	100.0000%	(453,044)	(73,311)
2017	March	257,208	83,610	340,818	406,616	100.0000%	(406,616)	(65,798)
2017	April	263,801	85,753	349,553	417,038	100.0000%	(417,038)	(67,485)
2017	May	270,030	87,778	357,808	426,886	100.0000%	(426,886)	(69,078)
2017	June	335,306	108,997	444,303	530,081	100.0000%	(530,081)	(85,777)
2017	July	347,719	113,032	460,750	549,703	100.0000%	(549,703)	(88,953)
2017	August	354,633	115,279	469,912	560,634	100.0000%	(560,634)	(90,721)
2017	Septer	322,487	104,830	427,317	509,815	100.0000%	(509,815)	(82,498)
2017	Octob	318,695	103,597	422,292	503,820	100.0000%	(503,820)	(81,528)
2017	Noven	298,963	97,183	396,145	472,625	100.0000%	(472,625)	(76,480)
2017	Decem	216,036	70,226	286,262	341,528	100.0000%	(341,528)	(55,266)
		3,582,289	1,164,481	4,746,769	5,663,182		(5,663,182)	(916,412)

DEP is overcollected on all components
Interest is calculated on the entire balance.

Note 1: Revenue source - CIM CRY4 reports
Note 2: Program & Carrying Costs allocated on a weighted average basis based on revenues collected.

		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
			2018 tax rate				10.00%			0.768307	
2017	Januar	(79,517)	23.5036%	(18,689)	(18,689)	(60,827)	0.008333	(253)	(253)	0.768307	(330)
2017	Februa	(152,828)	23.5036%	(17,231)	(35,920)	(116,908)	0.008333	(741)	(994)	0.768307	(1,294)
2017	March	(218,626)	23.5036%	(15,465)	(51,385)	(167,241)	0.008333	(1,184)	(2,178)	0.768307	(2,835)
2017	April	(286,111)	23.5036%	(15,861)	(67,246)	(218,865)	0.008333	(1,609)	(3,787)	0.768307	(4,929)
2017	May	(355,190)	23.5036%	(16,236)	(83,482)	(271,707)	0.008333	(2,044)	(5,831)	0.768307	(7,589)
2017	June	(440,967)	23.5036%	(20,161)	(103,643)	(337,324)	0.008333	(2,538)	(8,368)	0.768307	(10,892)
2017	July	(529,920)	23.5036%	(20,907)	(124,550)	(405,370)	0.008333	(3,095)	(11,463)	0.768307	(14,920)
2017	August	(620,641)	23.5036%	(21,323)	(145,873)	(474,768)	0.008333	(3,667)	(15,130)	0.768307	(19,693)
2017	Septer	(703,139)	23.5036%	(19,390)	(165,263)	(537,876)	0.008333	(4,219)	(19,350)	0.768307	(25,185)
2017	Octob	(784,667)	23.5036%	(19,162)	(184,425)	(600,242)	0.008333	(4,742)	(24,092)	0.768307	(31,357)
2017	Noven	(861,147)	23.5036%	(17,976)	(202,400)	(658,746)	0.008333	(5,246)	(29,338)	0.768307	(38,185)
2017	Decem	(916,412)	23.5036%	(12,989)	(215,390)	(701,023)	0.008333	(5,666)	(35,003)	0.768307	(45,559)
								(35,003)			(45,559)
			Twelve months return on 2018 Year End Balance			(701,023)		(70,102)			(91,243)
			Total return on Non-Residential DSM								(136,801)

Duke Energy Progress, LLC
Docket No. E-2, Sub 1206
Estimated Return Calculation -Lighting DSDR Programs Vintage 2018

		Lighting DSDR Program Costs Incurred	Lighting Allocated Carrying Costs & A&G	Total Program Costs Incurred	NC Lighting Revenue Collected	NC Lighting Program Collection %	Lighting Program Costs Revenue Collected	(Over)/Under Collection
2017	Januar	28,282	1,891	30,172	30,703	100.0000%	(30,703)	(531)
2017	Febru	27,721	1,853	29,575	30,095	100.0000%	(30,095)	(520)
2017	March	27,864	1,863	29,727	30,250	100.0000%	(30,250)	(523)
2017	April	27,915	1,866	29,781	30,305	100.0000%	(30,305)	(524)
2017	May	27,854	1,862	29,716	30,239	100.0000%	(30,239)	(523)
2017	June	27,771	1,857	29,627	30,149	100.0000%	(30,149)	(521)
2017	July	27,690	1,851	29,542	30,061	100.0000%	(30,061)	(520)
2017	Augus	28,246	1,888	30,134	30,664	100.0000%	(30,664)	(530)
2017	Septer	26,997	1,805	28,802	29,309	100.0000%	(29,309)	(507)
2017	Octob	28,337	1,894	30,231	30,763	100.0000%	(30,763)	(532)
2017	Noven	27,475	1,837	29,311	29,827	100.0000%	(29,827)	(516)
2017	Decen	26,864	1,796	28,660	29,165	100.0000%	(29,165)	(504)
		333,017	22,263	355,280	361,531		(361,531)	(6,251)

DEP is overcollected on the DSDR program, therefore, interest is calculated on the total.

Note 1: Revenue source - CIM CRY4 reports
Note 2: Program & Carrying Costs allocated on a weighted average basis based on revenues collected.

		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
			2018 tax rate				10.00%			0.768307	
2017	Januar	(531)	23.5036%	(125)	(125)	(406)	0.008333	(2)	(2)	0.768307	(2)
2017	Febru	(1,051)	23.5036%	(122)	(247)	(804)	0.008333	(5)	(7)	0.768307	(9)
2017	March	(1,574)	23.5036%	(123)	(370)	(1,204)	0.008333	(8)	(15)	0.768307	(20)
2017	April	(2,098)	23.5036%	(123)	(493)	(1,605)	0.008333	(12)	(27)	0.768307	(35)
2017	May	(2,621)	23.5036%	(123)	(616)	(2,005)	0.008333	(15)	(42)	0.768307	(54)
2017	June	(3,142)	23.5036%	(123)	(739)	(2,404)	0.008333	(18)	(60)	0.768307	(78)
2017	July	(3,662)	23.5036%	(122)	(861)	(2,801)	0.008333	(22)	(82)	0.768307	(107)
2017	Augus	(4,192)	23.5036%	(125)	(985)	(3,207)	0.008333	(25)	(107)	0.768307	(139)
2017	Septer	(4,699)	23.5036%	(119)	(1,104)	(3,594)	0.008333	(28)	(135)	0.768307	(176)
2017	Octob	(5,231)	23.5036%	(125)	(1,229)	(4,001)	0.008333	(32)	(167)	0.768307	(217)
2017	Noven	(5,746)	23.5036%	(121)	(1,351)	(4,396)	0.008333	(35)	(202)	0.768307	(263)
2017	Decen	(6,251)	23.5036%	(119)	(1,469)	(4,782)	0.008333	(38)	(240)	0.768307	(313)
								(240)			(313)
			Twelve months return on 2018 Year End Balance			(4,782)		(478)			(622)
			Total return on DSDR Lighting								(935)

Duke Energy Progress, LLC
Docket No. E-2, Sub 1206
Estimated Return Calculation -Non-Residential EE & DSDR Programs Vintage 2018

		Non-Residential EE Costs Incurred	Non-Residential DSDR Costs Incurred	Total Program Costs Incurred	NC EE Non-Residential Revenue Collected	NC Non-Residential EE Program Collection %	Total EE Revenue Collected	NC DSDR Non-Residential Revenue Collected	NC Non-Residential DSDR Program Collection %	DSDR Program Costs Revenue Collected	Total EE & DSDR Revenue Collected	(Over)/Under Collection
2017	January	3,190,047	884,220	4,074,267	2,857,937	100.0000%	(2,857,937)	986,298	100.0000%	(986,298)	(3,844,235)	230,031
2017	February	2,773,340	757,036	3,530,376	2,484,613	100.0000%	(2,484,613)	844,431	100.0000%	(844,431)	(3,329,044)	201,332
2017	March	2,495,679	679,357	3,175,037	2,235,859	100.0000%	(2,235,859)	757,785	100.0000%	(757,785)	(2,993,644)	181,392
2017	April	2,468,128	697,016	3,165,143	2,211,176	100.0000%	(2,211,176)	777,482	100.0000%	(777,482)	(2,988,658)	176,486
2017	May	2,404,603	713,062	3,117,665	2,154,264	100.0000%	(2,154,264)	795,381	100.0000%	(795,381)	(2,949,645)	168,020
2017	June	3,164,730	888,214	4,052,943	2,835,256	100.0000%	(2,835,256)	990,753	100.0000%	(990,753)	(3,826,009)	226,935
2017	July	3,332,429	919,140	4,251,568	2,985,496	100.0000%	(2,985,496)	1,025,249	100.0000%	(1,025,249)	(4,010,745)	240,823
2017	August	3,470,529	938,025	4,408,554	3,109,219	100.0000%	(3,109,219)	1,046,315	100.0000%	(1,046,315)	(4,155,534)	253,020
2017	September	3,217,231	851,081	4,068,312	2,882,291	100.0000%	(2,882,291)	949,334	100.0000%	(949,334)	(3,831,625)	236,687
2017	October	3,320,668	841,986	4,162,654	2,974,959	100.0000%	(2,974,959)	939,189	100.0000%	(939,189)	(3,914,148)	248,506
2017	November	3,018,256	787,409	3,805,665	2,704,031	100.0000%	(2,704,031)	878,311	100.0000%	(878,311)	(3,582,342)	223,323
2017	December	1,556,215	571,538	2,127,754	1,394,201	100.0000%	(1,394,201)	637,519	100.0000%	(637,519)	(2,031,720)	96,034
		34,411,854	9,528,085	43,939,939	30,829,304		(30,829,304)	10,628,046		(10,628,046)	(41,457,350)	2,482,589

Note 1: Revenue source - CIM CRY4 reports
Note 2: Program & Carrying Costs allocated on a weighted average basis based on revenues collected.

		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
			2018 tax rate				7.05%			0.768307	
							6.64%				
2017	January	230,031	23.5036%	54,066	54,066	175,966	0.005874	517	517	0.768307	673
2017	February	431,363	23.5036%	47,320	101,386	329,977	0.005874	1,486	2,003	0.768307	2,607
2017	March	612,755	23.5036%	42,634	144,020	468,736	0.005702	2,277	4,280	0.768307	5,571
2017	April	789,241	23.5036%	41,480	185,500	603,741	0.005529	2,965	7,245	0.768307	9,430
2017	May	957,261	23.5036%	39,491	224,991	732,270	0.005529	3,694	10,938	0.768307	14,237
2017	June	1,184,195	23.5036%	53,338	278,329	905,867	0.005529	4,529	15,467	0.768307	20,132
2017	July	1,425,019	23.5036%	56,602	334,931	1,090,088	0.005529	5,518	20,985	0.768307	27,314
2017	August	1,678,039	23.5036%	59,469	394,400	1,283,639	0.005529	6,562	27,548	0.768307	35,855
2017	September	1,914,726	23.5036%	55,630	450,030	1,464,697	0.005529	7,598	35,146	0.768307	45,745
2017	October	2,163,232	23.5036%	58,408	508,437	1,654,795	0.005529	8,624	43,770	0.768307	56,970
2017	November	2,386,555	23.5036%	52,489	560,926	1,825,629	0.005529	9,622	53,392	0.768307	69,493
2017	December	2,482,589	23.5036%	22,571	583,498	1,899,091	0.005529	10,297	63,690	0.768307	82,896
								63,690			82,896
			Twelve months return on 2018 Year End Balance			1,899,091		133,869			174,239
			Total return on Non-Residential EE programs								257,135

DEP is under-collected on program costs and undercollected in total, therefore the Company is calculating interest on the program cost piece of the balance.

Note: the monthly return was 7.05% from January until March 15, at which point the rate changed to 6.6351% after the new rate case order went into effect.

DUKE ENERGY PROGRESS, LLC
Docket No. E-2, Sub 1206
2018 Actual Revenues

Rate Period	DSM	DSDR	EE	Total
Residential	$ 17,729,490	$ 18,022,227	$ 63,559,093	$ 99,310,811
General Service	5,663,182	10,628,046	46,092,363	62,383,592
Lighting		361,531		361,531
Total	$ 23,392,672	$ 29,011,804	$ 109,651,457	$ 162,055,933

EMF	DSM	DSDR	EE	Total
Residential	$ 776,002	$ (86,437)	$ 3,398,058	$ 4,087,623
General Service	(1,582,882)	(251,603)	1,285,046	(549,439)
Lighting		(3,176)		(3,176)
Total	$ (806,879)	$ (341,217)	$ 4,683,104	$ 3,535,008

DUKE ENERGY PROGRESS, LLC
Docket No. E-2, Sub 1206
Allocation Factor Summary through test year 2015

					DSM		EE	
					NC	SC	NC	SC
A.	**Allocation Factors**							
1	May-08	to	Apr-09	*Calendar 2007 Analysis* [1]	86.73%	13.27%	84.81%	15.19%
1	May-09	to	Apr-10	*Calendar 2008 Analysis* [1]	86.16%	13.84%	85.06%	14.94%
2	May-10	to	Apr-11	*Calendar 2009 Analysis* [2]	85.89%	14.11%	85.41%	14.59%
3	May-11	to	Apr-12	*Calendar 2010 Analysis* [3]	86.49%	13.51%	85.53%	14.47%
4	May-12	to	Apr-13	*Calendar 2011 Analysis* [4]	86.63%	13.37%	85.92%	14.08%
5	May-13	to	Apr-14	*Calendar 2012 Analysis* [5]	86.47%	13.53%	86.06%	13.94%
6	May-14	to	Apr-15	*Calendar 2013 Analysis* [6]	85.68%	14.32%	85.57%	14.43%
7	May-15	to	Apr-16	*Calendar 2014 Analysis* [7]	86.23%	13.77%	85.15%	14.85%
B.	**Custom Period Factors**							
	Test Period [4]							
8	Apr-10	to	Mar-11	*Line 1 x* $\frac{1}{12}$ *+ Line 2 x 11 x* $\frac{1}{12}$	85.91%	14.09%	85.38%	14.62%
	Prospective Period [4]							
9	Apr-11	to	Jul-11	*Line 2 x* $\frac{1}{4}$ *+ Line 3 x* $\frac{3}{4}$	86.34%	13.66%	85.50%	14.50%
	Rate Period [4]							
10	Dec-11	to	Nov-12	*Line 3*	86.49%	13.51%	85.53%	14.47%
	Calendar Year 2010 [8]							
11	Jan-10	to	Dec-10	*Line 1 x* $\frac{1}{3}$ *+ Line 2 x* $\frac{2}{3}$	85.98%	14.02%	85.29%	14.71%
	Calendar Year 2011 [8]							
12	Jan-11	to	Dec-11	*Line 2 x* $\frac{1}{3}$ *+ Line 3 x* $\frac{2}{3}$	86.29%	13.71%	85.49%	14.51%
	Calendar Year 2012 [8]							
13	Jan-12	to	Dec-12	*Line 3 x* $\frac{1}{3}$ *+ Line 4 x* $\frac{2}{3}$	86.58%	13.42%	85.79%	14.21%
	Calendar Year 2013 [8]							
14	Jan-13	to	Dec-13	*Line 4 x* $\frac{1}{3}$ *+ Line 5 x* $\frac{2}{3}$	86.52%	13.48%	86.01%	13.99%
	Calendar Year 2014 [8]							
15	Jan-14	to	Dec-14	*Line 5 x* $\frac{1}{3}$ *+ Line 6 x* $\frac{2}{3}$	85.94%	14.06%	85.73%	14.27%
	Calendar Year 2015 [8]							
16	Jan-15	to	Dec-15	*Line 6 x* $\frac{1}{3}$ *+ Line 7 x* $\frac{2}{3}$	86.05%	13.95%	85.29%	14.71%

Notes:

[1] Allocation Factors values from Docket No. E-2, Sub 951
[2] Allocation Factors values from Docket No. E-2, Sub 977
[3] Allocation Factors values from Docket No. E-2, Sub 1002
[4] Allocation Factors values from Docket No. E-2, Sub 1019
[5] Allocation Factors values from Docket No. E-2, Sub 1030
[6] Allocation Factors values from Docket No. E-2, Sub 1044
[7] Allocation Factors values from Docket No. E-2, Sub 1070
[8] Employed in the allocation of Utility Cost Test (UCT) results for PPI determination.

Duke Energy Progress, LLC
Docket No. E-2, Sub 1206
Allocation Factor For Year 2016
Allocation Factors from 2016 Filed Cost of Service Study

Line			MWh		
	Sales Allocator at Generation				
1	NC Retail MWh Sales Allocation	Company Records	38,844,804		
2	SC Retail MWh Sales Allocation	Company Records	6,620,461		
3	Total Retail	Line 1 + Line 2	45,465,264		
	Allocation 1 to state based on kWh sales				
4	NC Retail	Line 1 / Line 3	**85.4384204%**		
	Demand Allocators (kW)		**NC**	**SC**	**Total**
5	Residential	Company Records	3,530,456	484,305	4,014,761
6	Non Residential	Company Records	4,003,521	724,998	4,728,519
7	Total	Line 5 + Line 6	7,533,977	1,209,303	8,743,280
	Allocation 2 to state based on peak demand				
8	NC Retail	Line 7, NC / Line 7 Total	**86.1687719%**		
	Allocation 3 NC res vs non-res Peak Demand to retail system peak				
9	NC Residential	Line 5 NC/ Line 7 Total	**40.3790797%**		
10	NC Non-residential	Line 6 NC/ Line 7 Total	**45.7896922%**		
	Allocation 4 NC res vs non-res Peak Demand				
11	NC Residential	Line 5 NC / Line 7 NC	**46.8604563%**		
12	NC Non-residential	Line 6 NC / Line 7 NC	**53.1395437%**		

Duke Energy Progress, LLC
Docket No. E-2, Sub 1206
Allocation Factor For Year 2017
Allocation Factors from 2017 Filed Cost of Service Study

Line			MWh		
	Sales Allocator at Generation				
1	NC Retail MWh Sales Allocation	Company Records	38,923,501		
2	SC Retail MWh Sales Allocation	Company Records	6,596,650		
3	Total Retail	Line 1 + Line 2	45,520,150		
	Allocation 1 to state based on kWh sales				
4	NC Retail	Line 1 / Line 3	**85.5082864%**		
	Demand Allocators (kW)		**NC**	**SC**	**Total**
5	Residential	Company Records	3,743,750	509,212	4,252,962
6	Non Residential	Company Records	4,012,019	736,825	4,748,844
7	Total	Line 5 + Line 6	7,755,769	1,246,037	9,001,806
	Allocation 2 to state based on peak demand				
8	NC Retail	Line 7, NC / Line 7 Total	**86.1579245%**		
	Allocation 3 NC res vs non-res Peak Demand to retail system peak				
9	NC Residential	Line 5 NC/ Line 7 Total	**41.5888790%**		
10	NC Non-residential	Line 6 NC/ Line 7 Total	**44.5690455%**		
	Allocation 4 NC res vs non-res Peak Demand				
11	NC Residential	Line 5 NC / Line 7 NC	**48.2705209%**		
12	NC Non-residential	Line 6 NC / Line 7 NC	**51.7294791%**		

NOTE: These allocation factors are used for Vintage 2017 based on the Cost of Service Study filed in May 2017.

Duke Energy Progress, LLC
Docket No. E-2, Sub 1206
Allocation Factor For Year 2018 and 2019
Estimated Allocation Factor For Year 2020
Allocation Factors from 2018 Filed Cost of Service Study

Line			MWh		
	Sales Allocator at Generation				
1	NC Retail MWh Sales Allocation	Company Records	38,153,842		
2	SC Retail MWh Sales Allocation	Company Records	6,438,789		
3	Total Retail	Line 1 + Line 2	44,592,631		
	Allocation 1 to state based on kWh sales				
4	NC Retail	Line 1 / Line 3	85.5608674%		
	Demand Allocators (kW)		**NC**	**SC**	**Total**
5	Residential	Company Records	3,699,632	487,425	4,187,058
6	Non Residential	Company Records	3,915,717	698,002	4,613,719
7	Total	Line 5 + Line 6	7,615,350	1,185,427	8,800,777
	Allocation 2 to state based on peak demand				
8	NC Retail	Line 7, NC / Line 7 Total	86.5304240%		
	Allocation 3 NC res vs non-res Peak Demand to retail system peak				
9	NC Residential	Line 5 NC/ Line 7 Total	42.0375642%		
10	NC Non-residential	Line 6 NC/ Line 7 Total	44.4928598%		
	Allocation 4 NC res vs non-res Peak Demand				
11	NC Residential	Line 5 NC / Line 7 NC	48.5812530%		
12	NC Non-residential	Line 6 NC / Line 7 NC	51.4187470%		

NOTE: These allocation factors are used for vintages 2018-2020 based on the most recently filed Cost of Service Study (May 2018).
Please also note that a cost of service study was not filed before the Rider 11 filing date in 2019.

DUKE ENERGY PROGRESS, LLC
Docket No. E-2, Sub 1206
Energy Allocation Factors - Applicable to EE Program Costs

North Carolina Rate Class Energy Allocation Factors

Rate Class	Total NC Rate Class Sales (MWh) [1]	Opt-Out Sales[2]	Adjusted NC Rate Class MWh Sales	Rate Class Energy Allocation Factor
	(1)	(2)	(3) = (1) - (2)	(4) = (3) / NC Total in Column 3
Residential	16,011,833	-	16,011,833	61.51%
General Service	21,405,950	(11,748,716)	9,657,234	37.10%
Lighting	376,561	(16,466)	360,096	1.38%
NC Retail	37,794,345	(11,765,182)	26,029,163	100.00%

NOTES:

(1) Total NC Rate Class Sales (MWh) are for the forecasted year ending December 2020.

(2) Opt-Out sales are provided in Miller Exhibit 6. Since sales are not forecasted by individual customer, historic opt-out sales are assumed to be unchanged during the rate recovery period.

DUKE ENERGY PROGRESS, LLC
Docket No. E-2, Sub 1206
Demand Allocation Factors - Applicable to DSM Programs

North Carolina Rate Class Demand Allocation Factors

Rate Class	Total NC Rate Class Sales [(1)]	Sales Subject to Opt-Out [(2)]	Rate Class Demand [(3)]	Revised Rate Class Demand	Rate Class Allocation Factor
	(1)	(2)	(3)	(4) = ((1 - 2) / 1) * 3	(5) = (4)/Total of Column 4
Residential	16,011,833	-	3,699,632	3,699,632	67.91%
General Service	21,405,950	(11,850,797)	3,915,717	1,747,891	32.09%
Lighting	376,561	(17,203)	0	0	0.00%
NC Retail	37,794,345	(11,868,000)	7,615,350	5,447,524	100.00%

NOTES:

(1) Total NC Rate Class Sales (MWh) are for the forecasted year ended December 2020.

(2) Opt-Out sales are provided in Miller Exhibit 6. Since sales are not forecasted by individual customer, historic opt-out sales are assumed to be unchanged during the rate recovery period.

(3) The Coincident Peak ("CP") demands are based on the 2017 CP occurring on July 13 during the hour ended at 1700 EDT. This is the latest Cost of Service information filed at the time of the due date for the Rider 11 filing.

DUKE ENERGY PROGRESS, LLC
Docket No. E-2, Sub 1206
Determination of Lighting Allocation Factors

January through December 2018

		Bulb %s		Allocation Factors	
1	Residential	81.70%	*Per M&V*	89.19%	*Lines 1 / (1 + 2)*
2	General Service	9.90%	*Per M&V*	10.81%	*Lines 2 / (1 + 2)*
3	Leakage	8.40%	*Per M&V*	0.00%	*-NA-*
4	Totals	100.00%	*Σ Lines 1 thru 3*	100.00%	*Σ Lines 1 thru 3*

Duke Energy Progress, LLC
Docket No. E-2, Sub 1206
Forecasted 2020 kWh Sales

Line	Spring 2019 Sales Forecast - kWh	Total 2020
	North Carolina Retail:	
1	Residential	16,011,833,010
2	Non-Residential	21,405,950,172
3	Lighting	376,561,430
4	Total Retail	**37,794,344,612**

Line	Non-Residential	Gross kWh	Opt-outs	Net kWh
5	Energy Efficiency	21,405,950,172	(11,748,716,255)	**9,657,233,917**
6	DSM	21,405,950,172	(11,850,797,144)	**9,555,153,028**
7	Lighting - EE	376,561,430	(16,465,818)	**360,095,612**
8	Lighting - DSM	376,561,430	(17,203,232)	**359,358,198**

[1] Actual Opt-Out volumes for the twelve-months ending December 31, 2018.

BEFORE THE NORTH CAROLINA UTILITIES COMMISSION

DOCKET NO. E-2, SUB 1206

In the Matter of Application of Duke Energy Progress, 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	))))))	**DIRECT TESTIMONY OF ROBERT P. EVANS FOR DUKE ENERGY PROGRESS, LLC**

I. INTRODUCTION AND PURPOSE

Q. PLEASE STATE YOUR NAME, BUSINESS ADDRESS, AND POSITION WITH DUKE ENERGY.

A. My name is Robert P. Evans, and my business address is 410 S. Wilmington Street, Raleigh, North Carolina. I am employed by Duke Energy Corporation ("Duke Energy") as Senior Manager-Strategy and Collaboration for the Carolinas in the Market Solutions Regulatory Strategy and Evaluation group.

Q. PLEASE BRIEFLY STATE YOUR EDUCATIONAL BACKGROUND AND EXPERIENCE.

A. I graduated from Iowa State University ("ISU") in 1978 with a Bachelor of Science Degree in Industrial Administration and a minor in Industrial Engineering. As a part of my undergraduate work, I participated in graduate level regulatory studies programs sponsored by American Telephone and Telegraph Corporation, as well as graduate level study programs in Engineering Economics. Subsequent to my graduation from ISU, I received additional Engineering Economics training at the Colorado School of Mines, completed the National Association of Regulatory Utility Commissioners Regulatory Studies program at Michigan State, and completed the Advanced American Gas Association Ratemaking program at the University of Maryland. Upon graduation from ISU, I joined the Iowa State Commerce Commission (now known as the Iowa Utility Board ("IUB")) in the Rates and Tariffs Section of the Utilities Division. During my tenure with the IUB, I held several positions, including Senior Rate Analyst in charge of Utility Rates and Tariffs and

Assistant Director of the Utility Division. In those positions, I provided testimony in gas, electric, water, and telecommunications proceedings as an expert witness in the areas of rate design, service rules, and tariff applications. In 1982, I accepted employment with City Utilities of Springfield, Missouri, as an Operations Analyst. In that capacity, I provided support for rate-related matters associated with the municipal utility's gas, electric, water, and sewer operations. In addition, I worked closely with its load management and energy conservation programs. In 1983, I joined the Rate Services staff of the Iowa Power and Light Company, now known as MidAmerican Energy, as a Rate Engineer. In this position, I was responsible for the preparation of rate-related filings and presented testimony on rate design, service rules, and accounting issues before the IUB. In 1986, I accepted employment with Tennessee-Virginia Energy Corporation (now known as the United Cities Division of Atmos Energy) as Director of Rates and Regulatory Affairs. While in this position, I was responsible for regulatory filings, regulatory relations, and customer billing. In 1987, I went to work for the Virginia State Corporation Commission in the Division of Energy Regulation as a Utilities Specialist. In this capacity, I worked on electric and natural gas issues and provided testimony on cost of service and rate design matters brought before that regulatory body. In 1988, I joined North Carolina Natural Gas Corporation ("NCNG") as its Manager of Rates and Budgets. Subsequently, I was promoted to Director-Statistical Services in NCNG's Planning and Regulatory Compliance Department. In that position, I performed a variety of work associated with financial, regulatory, and statistical analysis and presented testimony on several issues brought before the North Carolina Utilities Commission ("Commission"). I held that position until the closing of NCNG's merger with Carolina Power and Light Company, the predecessor of Progress Energy, Inc. ("Progress"), on July 15, 1999.

From July 1999 through January 2008, I was employed in Principal and Senior Analyst roles by the Progress Energy Service Company, LLC. In these roles, I provided NCNG, Progress Energy Carolinas, Inc. (now Duke Energy Progress, LLC ("DEP" or the "Company")), and Progress Energy Florida, Inc. with rate and regulatory support in their state and federal venues. From 2008 through the merger of Duke Energy and Progress, I provided regulatory support for demand-side management ("DSM") and energy efficiency ("EE") programs. Subsequent to the Progress merger with Duke Energy, I obtained my current position.

Q. HAVE YOU PREVIOUSLY PROVIDED TESTIMONY IN MATTERS BROUGHT BEFORE THIS COMMISSION?

A. Yes. I have provided testimony to this Commission in matters concerning revenue requirements, avoided costs, cost of service, rate design, and the recovery of costs associated with DSM/EE programs and related accounting matters.

Q. WHAT ARE YOUR CURRENT RESPONSIBILITIES?

A. I am responsible for the regulatory support of DSM/EE programs in North Carolina for both DEP and Duke Energy Carolinas, LLC ("DEC").

Q. WHAT IS THE PURPOSE OF YOUR TESTIMONY IN THIS PROCEEDING?

A. The purpose of my testimony is to explain and support DEP's proposed DSM/EE Cost Recovery Rider and Experience Modification Factor ("EMF"). My testimony provides: (1) a discussion of items the Commission specifically directed the Company to address in this proceeding; (2) an overview of the Commission's Rule R8-69 filing requirements; (3) a synopsis of the DSM/EE programs included in this filing; (4) a discussion of program results; (5) an explanation of how these results have affected DSM/EE rate calculations; (6) information on DEP's Evaluation Measurement & Verification ("EM&V") activities; and (7) an overview of the calculation of the Portfolio Performance Incentive ("PPI").

Q. PLEASE DESCRIBE THE EXHIBITS ATTACHED TO YOUR TESTIMONY.

A. Evans Exhibit 1 supplies load impacts, program costs, and avoided costs for each program, which are used in the calculation of the PPI and revenue requirements by vintage. Evans Exhibit 2 contains a summary of net lost revenues for the period January 1, 2015 through December 31, 2018. Evans Exhibit 3 contains the actual program costs for North Carolina for the period January 1, 2015 through December 31, 2018. Evans Exhibit 4 contains the found revenues used in the net lost revenues calculations. Evans Exhibit 5 supplies evaluations of event-based programs. Evans Exhibit 6 contains information about the results of DEP's programs and a comparison of actual impacts to previous estimates. Evans Exhibit 7 contains the projected program and portfolio cost-effectiveness results for DEP's approved programs. Evans Exhibit 8 contains a summary of 2018 program performance and an explanation of the variances between the expected program results and the actual results. Evans Exhibit 8 is designed to create more transparency regarding the factors that have driven these variances. Evans Exhibit 9 lists DEP's industrial and large commercial customers that have opted out of participation in the Company's DSM and/or EE programs and also lists those customers that have elected to participate in new measures after having initially notified the Company that they declined to participate, as required by Commission Rule R8-69(d)(2). Evans Exhibit 10 provides a summary of the estimated activities and timeframe for completion of EM&V by program. Evans Exhibit 11 provides the actual and expected dates when the EM&V for each program or measure will become effective.

Evans Exhibits A through I provide detailed EM&V reports, completed or updated since DEP's DSM/EE Cost Recovery Rider Filing in Docket No. E-2, Sub 1174, for the following programs: Demand Response Automation – 2017 (Evans Exhibit A); Residential New Construction – 2015 & 2016 (Evans Exhibit B); EnergyWise Home Demand Response Program – Winter - 2017 & 2018 (Evans Exhibit C); Small Business Energy Saver Program – 2016 (Evans Exhibit D); Residential Energy Assessment Program – 2016 & 2017 (Evans Exhibit E); EnergyWise for Business Program – 2017 (Evans Exhibit F); Nonresidential Smart $aver EE Products & Assessment (Custom) – 2016 &

2017 (Evans Exhibit G); EnergyWise Home Demand Response Program – Summer 2018 (Evans Exhibit H); and Energy Efficiency in Education – 2017 & 2018 (Evans Exhibit I).

Q. WERE EVANS EXHIBITS 1-11 PREPARED BY YOU OR AT YOUR DIRECTION AND SUPERVISION?

A. Yes, they were.

II. ACTIONS ORDERED BY THE COMMISSION

Q. PLEASE DESCRIBE THE ACTIONS THE COMMISSION DIRECTED DEP TO TAKE IN THE COMMISSION'S ORDER IN DOCKET NO. E-2, SUB 1174.

A. In its November 29, 2018 *Order Approving DSM/EE Rider and Requiring Filing of Proposed Customer Notice* in Docket No. E-2, Sub 1174 ("Sub 1174 Order"), the Commission ordered that: (1) the Company shall propose modifications to the Residential Smart $aver EE Program no later than December 31, 2018, with the goal of restoring the Total Resource Cost ("TRC") effectiveness test score to 1.00 or greater, and the Company shall discuss the impact of these modifications and any other actions it has taken to improve cost-effectiveness in next year's DSM/EE rider proceeding; (2) in its next DSM/EE rider filing, DEP should address the continuing cost-effectiveness of the Non-Residential Smart $aver Performance Incentive Program and, if it is not cost-effective, provide details of plans to modify or close the program; (3) DEP shall address the continuing cost-effectiveness of the Residential MyHER Program and, if it is not cost-effective, provide details of plans to modify or close the program; (4) that the Company should incorporate the recommendation made by Public Staff witness Williamson that the program evaluator for the Company's EE Lighting Program should (a) include the basis for the selected weighting methodology (weightings based on bulb sales, measure savings, or other metric) when assessing program savings, and (b) indicate what other weighting methodologies were considered and why they were rejected, and why the selected methodology is preferable, in future EM&V reports for the EE Lighting Program; (5) that DEP shall leverage the DEP Collaborative to discuss the EM&V issues and program design issues raised in the testimony of NC Justice Center witness Neme, as well as the issues raised by Public Staff witness Williamson regarding the MyHER program and the impact of upcoming lighting standards. The results of these discussions, specifically including the salient points arising from the discussion of the issues raised in the testimonies of witnesses Neme and Williamson, shall be reported to the Commission in the Company's 2019 DSM/EE rider filing. In addition, the report should identify all participants in the Collaborative discussions; identify any new ideas, proposals, programs and/or program adjustments presented or arising out of the discussions; summarize the Company's analysis or evaluation of such ideas, proposals, programs or program adjustments; and provide a status update with respect to unfinished or future discussions of the Collaborative; and (6) beginning in 2019, the combined DEC/DEP Collaborative shall meet every other month.

Q. PLEASE ADDRESS THE CONTINUING COST-EFFECTIVENESS OF THE RESIDENTIAL SMART $AVER PROGRAM, THE NON-RESIDENTIAL SMART $AVER PERFORMANCE PROGRAM, AND THE RESIDENTIAL MYHER PROGRAM.

A. Residential Smart $aver EE Program:

On December 18, 2018, the Company filed proposed modifications to its Residential Smart $aver EE Program. As filed, the projected TRC score equaled 1.35. Due to concerns expressed by the Public Staff, non-HVAC related measures were removed and incorporated into a new program, Residential Energy Efficient Appliances and Devices. The remaining HVAC related measures yielded an anticipated TRC score of 1.03, which represents the present value for the period extending from 2019 through 2023. The 0.97 TRC score for 2020 represents a significant increase from last year's 2019 estimate of 0.57. This has been accomplished through: (1) the recognition of lower incremental customer costs; (2) making trade ally participation more streamlined and less costly; (3) reducing the Company's Program administrative costs; (4) recognizing a three-year transition to referral-only channels; and (5) introducing an online channel, similar to that provided through DEC's Residential Smart $aver EE Program.

While the Residential Smart $aver EE Program is not assumed to be cost-effective at this time, the Company believes that the 1.03 TRC referenced above is obtainable and reiterates that suspending or terminating the only program that assists customers in making the largest single energy user in their homes, the HVAC system, more energy efficient is not justified, especially when the customers' decision to make said investment only comes around approximately once every fifteen years. Given the significant increase in the projected TRC results from 2019 to 2020 (0.57 to 0.97), and that 2020 is only the second of the five years used in the Company's forecast, the forecasted 1.03 TRC may have been understated. A suspension of this program would also impact the Company's relationships with HVAC contractors by eroding trust and engagement, which would make it difficult to offer programs that would require trade ally support in the future.

Non-Residential Smart $aver Performance Incentive Program:

DEP's Non-Residential Smart $aver Performance Incentive Program ("Performance Incentive Program") is not expected to have a TRC score exceeding 1.0 in 2020. The forecasted 2020 TRC score is 0.99, and the UCT score is 4.05. Although the 0.99 TRC score may be viewed as slightly less than optimal in isolation, it is important to note that this program is an extension of the Non-Residential Smart $aver Program. In particular, the Performance Incentive Program encompasses energy saving measures related to new technologies, unknown building conditions, and system constraints, as well as uncertain operating circumstances, occupancy, or production schedules. In these cases, energy savings are difficult to project accurately. Due to the scope of projects envisioned, the Company also believes that the program could impact a customer's decision to opt into the EE portion of the rider; in other words, if this program were no longer offered as part of the Company's EE portfolio, additional eligible customers may elect to opt out as a result. This program also limits the prospects of overcompensating participants, at the expense of other customers, or undercompensating participants for their EE improvements. Thus, this program is an important component of the Company's non-residential portfolio of programs, and the Company believes that its cost-effectiveness results will continue to improve as more customers become familiar with it and participation increases. To ensure the program supports cost-effective projects, the Company is estimating TRC scores in advance to determine whether or not a project is appropriate for program participation. This screening of individual projects will increase the overall program's TRC score.

Residential MyHER Program:

The Company's residential MyHER program's TRC score is estimated to be 1.01 during the rate period. Given this TRC score, the program is cost effective.

Q. HAS THE COMPANY INCORPORATED THE RECOMMENDATIONS MADE BY PUBLIC STAFF WITNESS WILLIAMSON IN THE COMPANY'S PREVIOUS DSM/EE RIDER PROCEEDING FOR THE EVALUATION OF ITS EE LIGHTING PROGRAM?

A. The Company's third-party evaluator has been notified of Public Staff witness Williamson's recommendations and will incorporate them in its planning of future evaluations for the Company's EE Lighting Program. At present, no further evaluations for the Program are planned due to EISA standards which are due to take effect in 2020.

Q. PLEASE DESCRIBE THE DISCUSSIONS THE COLLABORATIVE HAD REGARDING THE ISSUES RAISED IN LAST YEAR'S DSM/EE RIDER PROCEEDING.

A. Since September 2018, the Collaborative has discussed the following issues raised in last year's proceeding: the recruitment and retention of opt-out eligible customers, the development of a technical resource manual ("TRM"), appropriate accounting for MyHER savings, strategies for boosting participation in programs that promote retrofits or require higher upfront capital investments from customers, and the effectiveness of the Collaborative itself. Below is a brief summary of each of these topics and of the Collaborative's decisions regarding them.

Opt-Outs

All members of the Collaborative, including the Company and DEC, recognize that commercial and industrial customers represent an enormous energy efficiency potential. The Company's program managers explained to the Collaborative its comprehensive approach to customer education and engagement in detail. This approach includes the services of large account managers, energy efficiency engineers, the utilization of customer analytics, and innovative programs that include project design assistance, and performance incentives. Given current opt-out guidelines, the Collaborative agreed that the Company's strategies are in line with what members would recommend. Further discussion of opt-out policy is postponed until the opt-out guidelines are modified, but the performance of programs aimed to attract commercial and industrial programs will remain part of the Collaborative's semi-annual program and EM&V reviews.

TRM

The Collaborative noted that the use of a TRM increases the likelihood that EM&V is transparent, reliable, consistent across utilities, and updated as technology changes. However, the creation and adoption of a TRM is an undertaking that must include all utilities, cooperatives and municipalities in North Carolina (and South Carolina for utilities that operate in both states) to be of greatest value. Given that the Collaborative's influence is inherently limited to DEP and DEC, the group decided it is not the appropriate venue to pursue questions related to a state-wide or multi-state TRM at this time. It should, however, ensure that the Company's EM&V is transparent, reliable, consistent with industry standards, and updated as needed.

MyHER Persistence and Savings

The MyHER program and its EM&V are designed to account for customers' automatic enrollment in MyHER, which lasts until they opt out of the program. Issues of persistence are consequently not part of EM&V testing. Additional concerns about whether savings from MyHER are being attributed to the years in which the EE treatment occurred are not immediately relevant given the absence of regulatory requirements to achieve savings targets in specific years. Rather, the focus of EM&V has been on accurately capturing savings within the continuous treatment model.

The Company acknowledges that alternative program designs may shed light on potential cost savings or energy saving projections in future filings. Accordingly, the Company agrees to investigate the feasibility of incorporating persistence testing in upcoming EM&V studies. Because any testing will require several years to complete, the Collaborative decided not to pursue this issue any further until more information is available. Additionally, new data made available through the deployment of AMI meters may represent an opportunity for enhanced personal messaging. The Collaborative will be active in contributing to all program design updates to ensure that customers receive the greatest benefit from this opportunity.

Increasing Participation in Programs Promoting Long-Term Savings

The high incremental costs of equipment, the purchasing habits of customers, the market realities facing trade allies, and the economic vulnerability of regulated programs present numerous obstacles to increasing participation in programs that promote deeper changes to a structure's energy consumption—an issue of importance to many members of the Collaborative and to the Company. Although the membership is committed to developing strategies for overcoming these obstacles, it agreed that the conversation is complex and, therefore, best located within the Collaborative's larger discussion of obstacles and opportunities that face energy efficiency investments at the portfolio level. Nevertheless, the Collaborative will continue to monitor the Company's Smart $aver programs, midstream successes, and retrofit opportunities through the semi-annual program reports and EM&V reviews.

<u>Collaborative Effectiveness</u>

In response to intervenor comments in DEP's and DEC's previous DSM/EE cost recovery rider filings in 2018, DEC and DEP have modified the Collaborative meetings. DEC and DEP meetings are now combined and held bi-monthly, pursuant to the Commission's *Order Approving DSM/EE Rider and Requiring Filing of Customer Notice*, issued in Docket No. E-2, Sub 1174 on November 29, 2018. Members of the Collaborative now help to develop the agenda, lead portions of the discussions, and set the group's priorities. Additionally, the Company is committed to allowing ample time to review information prior to meetings and to following up periodically to ensure that members' concerns and recommendations are thoroughly understood and appropriately addressed. The Collaborative members have indicated in meetings held since the modifications were implemented that they have improved the group's effectiveness.

Q. WHAT NEW IDEAS, PROPOSALS, PROGRAMS AND/OR PROGRAM ADJUSTMENTS HAVE BEEN PRESENTED OR HAVE ARISEN FROM THE COLLABORATIVE'S DISCUSSIONS?

A. The Collaborative decided at the first meeting in January 2019 to focus its attention on two areas in which it could make the greatest impact: (1) low-income program improvement and expansion and (2) a comprehensive analysis of challenges and opportunities facing DSM/EE programs at the portfolio level. Each of these priorities is ambitious and will require adequate time to reach conclusions and/or recommendations.

The Collaborative's breadth of experience in low-income programs across the Southeast provides an important reference for the Company. Last fall, the Collaborative was introduced to the Pay for Performance Pilot program in Buncombe County, and it made several suggestions related to it. One suggestion regarding the use of funds was immediately incorporated into the contractual language with the vendor. Other suggestions will be incorporated when the vendor(s) are able to include additional measures for direct install or when additional vendors are added to the list of partners. Earlier this year, program management asked members to provide suggestions for additional measures for the Neighborhood Energy Savers program. Program staff will present the results of requests for proposals to the members once they are available. Finally, Collaborative members will have a chance to weigh in on ideas the Company has to overhaul its weatherization program to ensure that funds are being utilized optimally.

To ensure that the discussion of challenges and opportunities at the portfolio level produces a tangible deliverable that all members can refer to in future deliberations within the Collaborative, members will discuss topics during the bimonthly meetings as they arise and then circulate notes for ongoing conversation between meetings. Ultimately the goal is to develop a document that accurately represents both the consensus and divergent opinions of the membership, thereby capturing the breadth of the Collaborative's expertise across the spectrum of DSM/EE issues. This document will be included as an addendum to the Collaborative's meeting minutes. The initial discussions have focused on cost-effectiveness testing, but the conversations are ongoing and far from complete.

Recently, the Company's program staff presented the Collaborative with the early stages of a program potentially building on the success of the retail lighting program by expanding midstream offerings to include larger appliances. The Collaborative encouraged the work the Company has done so far, offered an online tool currently being used in another jurisdiction as a comparison, and pledged to revisit the program once more details were hammered out.

Q. WHAT ORGANIZATIONS ARE REPRESENTED IN THE COLLABORATIVE?

A. The Collaborative is fortunate to have attracted and to continue to attract leaders in EE and DSM efforts from across the Southeast. Besides participants from Company's program management, regulatory and retail strategy, program performance and analytics, and environmental affairs teams, the Collaborative has enjoyed the participation of representatives from the following external organizations:

Advanced Energy

American Council for an Energy-Efficient Economy

Carolina Utility Customers Association

Clean Energy Technology Center at North Carolina State University

Energy Futures Group

Environmental Defense Fund

Green Built Alliance

National Housing Trust

Nicholas Institute at Duke University

North Carolina Building Performance Association

North Carolina Department of Natural Resources

North Carolina Justice Center

North Carolina Public Staff

North Carolina Sustainable Energy Association

South Carolina Coastal Conservation League

South Carolina Energy Office

South Carolina Office of Regulatory Staff

Southern Alliance for Clean Energy

Q. WHAT IS THE STATUS OF UNFINISHED OR FUTURE DISCUSSIONS OF THE COLLABORATIVE?

A. As mentioned earlier, the Collaborative will continue to support the Company's efforts to improve and expand its low-income programs and to analyze the obstacles and opportunities for the Company's future DSM/EE portfolio. The group currently plans to meet in person in July, September, and November and to hold task-specific conference calls between meetings as needed. The

Company will present the salient points of those discussions to the Commission in the future.

Q. HAS THE COMPANY ANALYZED THE COST-EFFECTIVENESS SCORES FOR ITS DSDR PROGRAM?

A. Yes. The Company has determined that the TRC and UCT cost-effectiveness scores are both 1.244. In addition, the present value of DSDR Program net benefits is approximately $70,726,000.

Q. HAS THE COMPANY MADE ANY CHANGES TO ITS ANNUAL RATIOS OF ALLOCATIONS BETWEEN NON-DSDR AND DSDR EQUIPMENT?

A. The Company reviews the allocation ratios annually each summer and implements any necessary updates the following year. The Company reviewed 2017 units during the summer of 2018 and determined that the capacitor allocation ratio should be increased from 20.36 to 21.08, and the allocation ratio applied to regulators was elevated from 77.60 to 78.50 percent. The 2018 units will be reviewed this summer, and any further changes will be communicated to the Public Staff and implemented on January 1, 2020.

III. RULE R8-69 FILING REQUIREMENTS

Q. PLEASE PROVIDE AN OVERVIEW OF THE INFORMATION DEP IS PROVIDING IN RESPONSE TO THE COMMISSION'S FILING REQUIREMENTS.

A. The information for this filing is provided pursuant to the Commission's filing requirements contained in R8-69(f)(1) and can be found in my testimony and exhibits, as well as the testimony and exhibits of Company witness Carolyn T. Miller as follows:

R8-69(f)(1)		Items	Location in Testimony
(i)		Projected NC retail sales for the rate period	Miller Exhibit 6
(ii)		For each measure for which cost recovery is requested through DSM/EE rider:	
(ii)	a.	Total expenses expected to be incurred during the rate period	Evans Exhibit 1
(ii)	b.	Total costs savings directly attributable to measures	Evans Exhibit 1
(ii)	c.	EM&V activities for the rate period	Evans Exhibit 10 and 11
(ii)	d.	Expected summer and winter peak demand reductions	Evans Exhibit 1
(ii)	e.	Expected energy reductions	Evans Exhibit 1
(iii)		Filing requirements for DSM/EE EMF rider, including:	
(iii)	a.	Total expenses for the test period in the aggregate and broken down by type of expenditure, unit, and jurisdiction	Evans Exhibit 3
(iii)	b.	Total avoided costs for the test period in the aggregate and broken down by type of expenditure, unit, and jurisdiction	Evans Exhibit 1
(iii)	c.	Description of results from EM&V activities	Testimony of Robert Evans and Evans Exhibits A-I
(iii)	d.	Total summer and winter peak demand reductions in the aggregate and broken down per program	Evans Exhibit 1
(iii)	e.	Total energy reduction in the aggregate and broken down per program	Evans Exhibit 1
(iii)	f.	Discussion of findings and results of programs	Testimony of Robert Evans and Evans Exhibit 6
(iii)	g.	Evaluations of event-based programs	Evans Exhibit 5
(iii)	h.	Comparison of impact estimates from previous year and explanation of significant differences	Testimony of Robert Evans and Evans Exhibits 6 and 8
(iv)		Determination of utility incentives	Testimony of Robert Evans and Evans Exhibit 1

(v)	Actual revenues from DSM/EE and DSM/EE EMF riders	Miller Exhibit 3
(vi)	Proposed DSM/EE rider	Testimony of Carolyn Miller and Miller Exhibit 1
(vii)	Projected NC sales for customers opting out of measures	Miller Exhibit 6
(viii)	Supporting work papers	Digital recording medium accompanying filing

IV. PROGRAM OVERVIEW

Q. WHAT ARE DEP'S CURRENT DSM AND EE PROGRAMS?

A. The Company's current DSM and EE programs are as follows:

RESIDENTIAL CUSTOMER PROGRAMS

- Appliance Recycling Program
- EE Education Program
- Multi-Family EE Program
- My Home Energy Report Program
- Neighborhood Energy Saver Program
- Residential Smart $aver EE Program
- New Construction Program
- Load Control Program (EnergyWise)
- Save Energy and Water Kit Program
- Energy Assessment Program
- Low-Income Weatherization Pay for Performance Program (Pilot implemented in January 2019)

NON-RESIDENTIAL CUSTOMER PROGRAMS

- Non-Residential Smart $aver Energy Efficient Products and

Assessment Program (formerly known as the EE for Business Program)

- Non-Residential Smart $aver Performance Incentive Program
- Small Business Energy Saver Program
- CIG Demand Response Automation Program
- EnergyWise for Business

COMBINED RESIDENTIAL/NON-RESIDENTIAL PROGRAMS

- Energy Efficient Lighting Program
- DSDR

Q. PLEASE DESCRIBE ANY UPDATES MADE TO THE UNDERLYING ASSUMPTIONS FOR DEP'S PROGRAMS THAT HAVE ALTERED PROJECTIONS FOR VINTAGE 2020.

A. EM&V results were used to update the savings impacts for those programs for which DEP received EM&V results after it prepared its application in Sub 1174. Updating programs for EM&V results changes the projected avoided cost benefits associated with the projected participation and, hence, impacts the calculation of the specific program and overall portfolio cost-effectiveness, as well as the calculation of DEP's projected shared savings incentive.

Q. AFTER FACTORING THESE UPDATES INTO DEP'S PROGRAMS FOR VINTAGE 2020, DO THE RESULTS OF DEP'S PROSPECTIVE COST-EFFECTIVENESS TESTS INDICATE THAT IT SHOULD DISCONTINUE OR MODIFY ANY OF ITS PROGRAMS?

A. DEP performed a prospective analysis of each of its programs and the aggregate portfolio for the Vintage 2020 period. The results of this prospective analysis are contained in Evans Exhibit 7. This exhibit shows that four programs do not pass the TRC and/or UCT thresholds of 1.0. These programs are: (1) the Neighborhood Energy Saver Program, which was not cost-effective at the time of Commission approval (but was approved based on its societal benefits); (2) the Residential Smart $aver EE Program, formerly known as the Home Energy Improvement Program; (3) the Non-Residential Smart $aver Performance Incentive Program; and (4) the EnergyWise for Business Program. In the aggregate, DEP's portfolio of programs continues to project cost-effectiveness.

As discussed earlier in my testimony, DEP continues its efforts to make the Residential Smart $aver EE Program cost-effective and believes it should continue to be included in the Company's portfolio.

The Non-Residential Smart $aver Performance Incentive Program was also discussed earlier in my testimony, and the Company believes that its TRC value will increase in the future, in part due to increased scrutiny in the project selection process.

The cost-effectiveness of the EnergyWise for Business Program is obviously a concern for the Company with its 0.46 TRC score. The Company is examining this program and intends to determine if program modifications can increase its cost effectiveness or if discontinuation is appropriate. The Company will provide the Commission with further information regarding the program's continuation on or before the filing of its 2020 cost recovery request.

V. DSM/EE PROGRAM RESULTS TO DATE

Q. HOW MUCH ENERGY, CAPACITY AND AVOIDED COST SAVINGS DID DEP DELIVER AS A RESULT OF ITS DSM/EE PROGRAMS DURING VINTAGE 2018?

A. During Vintage 2018, DEP's DSM/EE programs delivered over 414 million kilowatt hours ("kWh") of energy savings and over 404 megawatts ("MW") of capacity savings, which produced a net present value of avoided cost savings of close to $249 million. The 2018 performance results for individual programs are provided in Evans Exhibits 6 and 8.

Q. DID ANY PROGRAMS SIGNIFICANTLY OUT-PERFORM RELATIVE TO THEIR ORIGINAL ESTIMATES FOR VINTAGE 2018?

A. Yes. In the residential market, two programs did significantly out-perform compared to their original energy savings estimates: The Residential Energy Assessment Program and the Residential Smart $aver EE Program. When compared to estimates originally filed for Vintage 2018, the programs exceeded projections by 185.0 percent and 130.7 percent, respectively. The Residential Energy Assessment Program achieved increases through changes in participation, changes in impacts, and mix of measures. The increase in the Residential Smart $aver EE Program resulted from an increase in participation.

The non-residential program with the largest percentage increase in expected energy savings from those forecasted for 2018 is the Non-Residential Smart $aver Program. This program produced energy savings that exceeded DEP's projections by 134.3 percent and capacity savings of 274.0 percent.

Q. HAVE ANY PROGRAMS SIGNIFICANTLY UNDERPERFORMED RELATIVE TO THEIR ORIGINAL ESTIMATES FOR VINTAGE 2018?

A. Yes. In the residential market, in addition to the discontinued Residential Appliance and Recycling Program, three programs did not achieve energy savings in excess of those forecasted for 2018. These were: (1) the Residential Save Energy and Water Kit Program (these measures are now included in the Residential Energy Efficient Appliances and Devices Program); (2) the Residential New Construction Program; and (3) the Residential Multi-Family Energy Efficiency Program. These programs achieved 71 percent, 89 percent, and 98 percent of projected energy savings, respectively. The primary drivers for the underperformance of these programs are changes in estimated impacts and in the mix of program measures.

In the non-residential market, the EnergyWise for Business Program failed to meet energy savings expectations. Notably, this is both an EE and Demand Response program. The primary drivers for the underperformance of the EnergyWise for Business Program were changes to the estimated impacts.

VI. PROJECTED RESULTS

Q. PLEASE PROVIDE A PROJECTION OF THE RESULTS THAT DEP EXPECTS TO SEE FROM IMPLEMENTATION OF ITS PORTFOLIO OF PROGRAMS.

A. DEP will update the actual and projected DSM/EE achievement levels in its annual DSM/EE cost recovery filing to account for any program or measure additions based on the performance of programs, market conditions, economics, and consumer demand. The actual results for Vintage 2018 and projection of the results for the next two years, as well as the associated actual and projected program expenses, are summarized in the table below:

DEP System (NC & SC) DSM/EE Portfolio 2018 Actual Results and 2019-2020 Projected Results			
	2018	2019	2020
Annual System MW	404	376	397
Annual System Net Gigawatt-Hours	414	402	378
Annual Program Costs (Millions)	$97	$90	$99

VII. EM&V ACTIVITIES

Q. CAN YOU PROVIDE INFORMATION ON THE COMPANY'S EM&V ACTIVITIES?

A. Yes. Evans Exhibit 10 provides a summary of the estimated activities and timeframe for completion of EM&V by program. Evans Exhibit 11 provides the actual and expected dates of when the EM&V for each program or measure will become effective. Evans Exhibits A through I provide the completed EM&V reports or updates for the following programs:

Evans Exhibit	EM&V Reports	Report Finalization Date
A	Demand Response Automation – 2017	5/1/2018
B	Residential New Construction – 2015 & 2016	5/25/2018
C	EnergyWise Home Demand Response Program – Winter 2017-2018	8/6/2018
D	Small Business Energy Saver Program – 2016	9/10/2018
E	Residential Energy Assessment – 2016 & 2017	10/12/2018
F	EnergyWise for Business Program – 2017	11/9/2018

Evans Exhibit	EM&V Reports	Report Finalization Date
G	Nonresidential Smart $aver EE Products & Assessment (Custom) – 2016 & 2017	11/29/2018
H	EnergyWise Home Demand Response Program – Summer 2018	11/30/2018
I	Energy Efficiency in Education – 2017 & 2018	3/20/2019

Q. HOW WERE EM&V RESULTS UTILIZED IN DEVELOPING THE PROPOSED RATES?

A. The Company has applied EM&V in accordance with the process approved by the Commission in its *Order Approving Revised Cost Recovery Mechanism and Granting Waivers* issued January 20, 2015 in Docket No. E-2, Sub 931 ("Order Approving Revised Mechanism").

The level of EM&V required varies by program and depends upon that program's contribution to the total portfolio, the duration the program has been in the portfolio without material change, and whether the program and administration is new and different in the energy industry. DEP estimates, however, that no additional costs above five percent of total program costs will be associated with performing EM&V for all measures in the portfolio.

Q. WHICH PROGRAMS CONTAIN IMPACT RESULTS BASED ON CAROLINAS-BASED EM&V?

A. All of the impact results included in the Company's filing (Evans Exhibits A through I) are based on Carolinas-based EM&V.

VIII. <u>RATE IMPACTS</u>

Q. HAVE THE PARTICIPATION RESULTS AFFECTED THE VINTAGE 2018 EMF?

A. Yes. The EMF accounts for changes to actual participation relative to the forecasted participation levels utilized in DEP's 2018 DSM/EE rider. As DEP receives actual participation information, it is then able to update participation-driven actual avoided cost benefits and the net lost revenues derived from its DSM and EE programs. For example, with all other things being equal, for programs that underperform relative to their original participation targets, the EMF will be reduced to reflect lower costs, net lost revenues, and shared savings incentives. On the other hand, higher-than-expected participation in programs causes the EMF to reflect higher program costs, net lost revenues, and shared savings incentives. In addition, the EMF is impacted by the application of EM&V results.

Q. HOW WILL EM&V BE INCORPORATED INTO THE VINTAGE 2018 EMF COMPONENT OF ITS RATES?

A. All of the final EM&V results that were received by DEP as of December 31, 2018 have been applied prospectively from the first day of the month immediately following the month in which the study participation sample for the EM&V was completed. Accordingly, for any program for which DEP has received EM&V results, the per participant impact applied to the projected program participation in Vintage 2018 is based upon the actual EM&V results that have been received. In addition, an adjustment has been made to correct a prior misalignment between a unit of measure and a prior EM&V report for the measure in the Multi-Family Program.

Q. HAS THE OPT-OUT OF NON-RESIDENTIAL CUSTOMERS AFFECTED THE RESULTS OF APPROVED PROGRAMS?

A. Yes, the opt-out of qualifying non-residential customers has significantly impacted DEP's overall non-residential participation and the associated impacts. For Vintage 2018, DEP had 4,277 eligible customer accounts opt out of participating in DEP's non-residential portfolio of EE programs and had 4,354 eligible customer accounts opt out of participating in DEP's non-residential portfolio of DSM programs. This is an increase from the 4,165 EE accounts and 4,099 DSM opt-outs reported for 2017.

Q. IS THE COMPANY CONTINUING ITS EFFORTS TO ATTRACT THE PROGRAM PARTICIPATION OF OPT-OUT ELIGIBLE CUSTOMERS?

A. Yes. Increasing the participation of opt-out eligible customers in DSM and EE programs is very important to the Company. DEP continues to evaluate and revise its non-residential programs to accommodate new technologies, eliminate product gaps, remove barriers to participation, and make its programs more attractive. The Company also continues to leverage its Large Account Management Team to make sure customers are informed about product offerings. Twenty-four customers did opt to participate in programs during 2018.

IX. <u>NET LOST REVENUES</u>

Q. IS DEP REQUESTING RECOVERY OF NET LOST REVENUES FOR ALL OF ITS PROGRAMS?

A. No. At this time, DEP is not requesting recovery of net lost revenues for its DSDR, EnergyWise, or CIG Demand Response Automation programs.

Q. HAS THE COMPANY RECOGNIZED FOUND REVENUES IN ITS CALCULATION OF NET LOST REVENUES?

A. Yes. The recognized found revenues are provided in Evans Exhibit 4.

Q. PLEASE DESCRIBE HOW DEP DETERMINES ITS FOUND REVENUES.

A. Consistent with the Commission's Order Approving Revised Mechanism, DEP has adopted the "Decision Tree" located in Attachment C of the approved revised cost recovery mechanism. Consistent with the methodology employed by DEP, found revenue activities are identified, categorized, and netted against the net lost revenues created by DEP's EE programs. Found revenues, as calculated, result from DEP's activities that are perceived to directly or indirectly result in an increase in customer demand or energy consumption within DEP's service territory. However, revenues resulting from load-building activities would not be considered found revenues if they (1) would have occurred regardless of DEP's activity, (2) were a result of a Commission-approved economic development activity not determined to produce found revenues, or (3) were part of an unsolicited request for DEP to engage in an activity that supports efforts to grow the economy. DEP also adjusts the calculation of found revenues to account for the impacts of activities outside of its DSM/EE programs that it undertakes that reduce customer consumption – i.e., "negative found revenues." Based on the results of this work, all potential found revenue-related activities are identified and categorized in Evans Exhibit 4.

Q. PLEASE DISCUSS THE ADJUSTMENT THAT DEP MAKES TO ITS FOUND REVENUE CALCULATION TO ACCOUNT FOR NEGATIVE FOUND REVENUES.

A. DEP continues to aggressively pursue, with its outdoor lighting customers, the replacement of aging Mercury Vapor lights with Light Emitting Diode ("LED") fixtures. By moving customers past the standard High-Pressure Sodium ("HPS") fixture to an LED fixture in this replacement process, DEP is generating significant energy savings. Because they come outside of DEP's EE programs, these energy savings are not captured in DEP's calculation of lost revenues. One of the activities that DEP includes in the calculation of found revenues is the increase in consumption from new outdoor lighting fixtures added by DEP; accordingly, it is logical and symmetrical to count the energy consumption reduction realized in outdoor lighting efficiency upgrades. The Company does not take credit for the entire efficiency gain from replacing Mercury Vapor lights, but rather takes credit only from the efficiency gain from replacing HPS with LED fixtures. Also, DEP has not recognized any negative found revenues in excess of the found revenues calculated; in other words, the net found revenues number will never be negative and have the effect of increasing net lost revenue calculations.

X. PPI CALCULATION

Q. PLEASE PROVIDE AN OVERVIEW OF THE SHARED SAVINGS RECOVERY MECHANISM APPROVED IN THE ORDER APPROVING REVISED MECHANISM.

A. Pursuant to the Commission's Order Approving Revised Mechanism, for Vintage Year 2017 and subsequent vintage years, DEP's revised cost recovery mechanism allows it to (1) recover the reasonable and prudent costs incurred for adopting and implementing DSM and EE measures in accordance with N.C. Gen. Stat. § 62-133.9 and Commission Rules R8-68 and R8-69; (2) recover net lost revenues incurred for up to 36 months of a measure's life for DSM and EE programs; and (3) earn a PPI based upon the sharing of 11.75% of the net savings achieved through DEP's DSM/EE programs on an annual basis.

Q. IS DEP REQUESTING PPI FOR ALL OF ITS PROGRAMS?

A. No. The Company is not requesting PPI recovery for its Residential Low-Income Program or its EE Education Program. In addition, under the terms of the revised cost recovery mechanism, DEP is not eligible for a PPI for its DSDR Program.

Q. PLEASE EXPLAIN HOW DEP DETERMINES THE PPI.

A. First, DEP determines the net savings eligible for incentive by subtracting the present value of the annual lifetime DSM/EE program costs (excluding low-income programs or other programs with societal benefits which are explicitly approved with expected UCT results less than 1.0) from the net present value of the annual lifetime avoided costs achieved through the Company's programs (again, excluding approved low-income and societal programs). The Company then multiplies the net savings eligible for incentive by the 11.75% shared savings percentage to determine its pretax incentive.

XI. CONCLUSION

Q. DOES THIS CONCLUDE YOUR PRE-FILED DIRECT TESTIMONY?

A. Yes.

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				A	B	C	D	E	F		G	H
							=(A-B)*C	= (B+D)				=O (from page 2)
	Residential Programs	**System kW Reduction - Summer Peak**	**System Energy Reduction (kWh)**	**System NPV of Avoided Costs**	**Total Cost**	**Shared Savings %**	**Incentive**	**Unadjusted Rev Requirement (2)**	**NC Retail kWh Sales Allocation Factor**		**NC Residential Unadjusted Revenue Requirement (2)**	**NC Residential Adjusted Revenue Requirement**
	EE Programs											
1	**Appliance Recycling Program**	27	206,569	$ 76,177	$ (137,009)	11.75%	$ 25,049	$ (111,960)	85.4384204%	E1 * F1	$ (95,657)	$ -
2	**Energy Education Program for Schools**	1,081	2,553,617	$ 1,693,087	$ 827,497	0.00%	$ -	$ 827,497	85.4384204%	E2 * F2	$ 707,000	$ -
3	**Energy Efficient Lighting**	6,006	41,649,479	$ 33,998,827	$ 15,552,184	11.75%	$ 2,167,481	$ 17,719,665	85.4384204%	E3 * F3	$ 15,139,401	$ -
4	**Home Energy Improvement Program**	1,904	6,289,383	$ 6,991,688	$ 6,013,170	11.75%	$ 114,976	$ 6,128,146	85.4384204%	E4 * F4	$ 5,235,791	$ -
5	**Multi-Family**	1,480	12,462,490	$ 7,155,924	$ 2,045,220	11.75%	$ 600,508	$ 2,645,727	85.4384204%	E5 * F5	$ 2,260,468	$ -
6	**Neighborhood Energy Saver**	304	1,992,091	$ 1,167,680	$ 2,052,535	0.00%	$ -	$ 2,052,535	85.4384204%	E6 * F6	$ 1,753,654	$ -
7	**Residential Energy Assessments**	716	5,942,895	$ 4,853,362	$ 1,417,924	11.75%	$ 403,664	$ 1,821,588	85.4384204%	E7 * F7	$ 1,556,336	$ (29,272)
8	**Residential New Construction**	4,359	9,954,835	$ 19,280,066	$ 9,405,615	11.75%	$ 1,160,248	$ 10,565,863	85.4384204%	E7 * F7	$ 9,027,307	$ 27,008
9	**Save Energy and Water Kit**	5,914	17,671,857	$ 13,873,513	$ 674,538	11.75%	$ 1,550,880	$ 2,225,418	85.4384204%	E8 * F8	$ 1,901,362	$ -
10	**Residential Home Advantage**	-	-	$ -	$ -	11.75%	$ -	$ -	85.4384204%		$ -	$ -
11	**Total for Residential Conservation Programs**	21,790	98,723,216	$ 89,090,325	$ 37,851,674		$ 6,022,805	$ 43,874,479			$ 37,485,662	$ (2,265)
12	**My Home Energy Report**	16,905	102,921,181	$ 7,524,461	$ 5,890,093	11.75%	$ 192,038	$ 6,082,131	85.4384204%	E11 * F11	$ 5,196,477	$ -
13	**Total Residential Conservation and Behavioral Programs**	38,695	201,644,397	$ 96,614,785	$ 43,741,767		$ 6,214,843	$ 49,956,610			$ 42,682,139	$ (2,265)
									NC Residential Peak Demand Allocation Factor (2)	**NC Allocation Factor (2)**		
14	**EnergyWise**	34,059	-	$ 70,854,171	$ 6,887,758	11.75%	$ 7,516,054	$ 14,403,811	86.1687719%	46.8604563%	$ 6,220,487	$ -
15	**Total Residential**	72,754	201,644,397	$ 167,468,956	$ 50,629,524		$ 13,730,897	$ 64,360,421			$ 48,902,626	$ (2,265)

	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 Unadjusted Revenue Requirement (2)**	**NC Non-Residential Adjusted Revenue Requirement**
	EE Programs											
15	**Business Energy Report**	740	4,546,814	$ 309,365	$ 69,516		$ -	$ 69,516	85.4384204%	E13 * F13	$ 59,393	$ -
16	**Energy Efficiency for Business**	10,201	71,154,719	$ 47,824,935	$ 14,159,310	11.75%	$ 3,955,711	$ 18,115,021	85.4384204%	E14 * F14	$ 15,477,188	$ -
17	**Energy Efficient Lighting**	2,818	12,180,303	$ 10,884,259	$ 1,889,694	11.75%	$ 1,056,861	$ 2,946,556	85.4384204%	E16 * F16	$ 2,517,491	$ -
18	**Small Business Energy Saver**	8,675	49,979,294	$ 32,988,897	$ 9,336,274	11.75%	$ 2,779,183	$ 12,115,457	85.4384204%	E17 * F17	$ 10,351,255	$ -
19	**Total for Non-Residential Conservation Programs**	22,434	137,861,130	$ 92,007,456	$ 25,454,794		$ 7,791,755	$ 33,246,550			$ 28,405,327	$ -
20	**EnergyWise for Business**	523	412,047	$ 164,696	$ 1,112,815	11.75%	$ (111,404)	$ 1,001,411	86.1687719%	E19 * F19	$ 7,054,004	$ -
21	**Commercial, Industrial, & Governmental Demand Respon**	(5,344)	-	$ (10,684,733)	$ -	11.75%	$ -	$ -	86.1687719%	E20 * F20	$ -	$ -
22	**Total for Non-Residential DSM Programs**	(4,821)	412,047	$ (10,520,037)	$ 1,112,815		$ (111,404)	$ 1,001,411	86.1687719%	**NC Allocation Factor (2)** 53.1395437%	$ 7,054,004	$ -
23	**Total Non Residential**	17,613	138,273,177	$ 81,487,419	$ 26,567,609		$ 7,680,352	$ 34,247,961			$ 35,459,331	$ -
24	**Total All Programs**	90,366	339,917,574	$ 248,956,374	$ 77,197,134		$ 21,411,248	$ 98,608,382			$ 84,361,957	$ (2,265)

(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

24	DSDR	281,372	33,941,086		7,944,728			$ 7,944,728				
25	Total with DSDR	371,738	373,858,660	$ 248,956,374	$ 85,141,861		$ 21,411,248	$ 106,553,110			$ 84,361,957	$ (2,265)

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Residential Programs

EE Programs

	A	B	C	D	E	F	G	H	I
			=A*B	=A+C			=-PMT(E,F,D)	=1-B	
									new
	NC Incentive	Income Tax Rate	Income Taxes	Net-of-Tax PPI - Total NPV	Discount Rate	PPI Amortization Period	Vintage Year 2016 - Year 1 PPI	Income Tax Gross-Up Factor	Adjusted PPI
1 Appliance Recycling Program	$ 21,402	37.61%	$ (8,049)	$ 13,353	6.75%	10	$ 1,879	62.39%	$ 3,011
2 Energy Education Program for Schools	$ -	37.61%	$ -	$ -	6.75%	N/A	$ -	62.39%	$ -
3 Energy Efficient Lighting	$ 1,851,861	37.61%	$ (696,487)	$ 1,155,374	6.75%	5	$ 279,872	62.39%	$ 448,586
4 Home Energy Improvement Program	$ 98,234	37.61%	$ (36,946)	$ 61,288	6.75%	10	$ 8,624	62.39%	$ 13,823
5 Multi-Family	$ 513,064	37.61%	$ (192,964)	$ 320,100	6.75%	5	$ 77,539	62.39%	$ 124,282
6 Neighborhood Energy Saver	$ -	37.61%	$ -	$ -	6.75%	N/A	$ -	62.39%	$ -
7 Residential Energy Assessments	$ 344,884	37.61%	$ (129,711)	$ 215,173	6.75%	5	$ 52,122	62.39%	$ 83,543
8 Residential New Construction	$ 991,298	37.61%	$ (372,828)	$ 618,470	6.75%	10	$ 87,026	62.39%	$ 139,487
9 Save Energy and Water Kit	$ 1,325,047	37.61%	$ (498,352)	$ 826,696	6.75%	5	$ 200,255	62.39%	$ 320,973
10 Residential Home Advantage	$ -	37.61%	$ -	$ -	6.75%	10	$ -	62.39%	$ -
11 Total for Residential Conservation Programs	$ 5,145,789		$ (1,935,337)	$ 3,210,453			$ 707,317		$ 1,133,704
12 My Home Energy Report	$ 164,074	37.61%	$ (61,709)	$ 102,366	6.75%	1	$ 102,366	62.39%	$ 164,074
13 Total Residential Conservation and Behavioral Programs	$ 5,309,864		$ (1,997,045)	$ 3,312,819			$ 809,683		$ 1,297,778
14 EnergyWise	$ 6,476,491	37.61%	$ (2,435,815)	$ 4,040,676	6.75%	10	$ 568,568	62.39%	$ 911,314
15 Total Residential	$ 11,786,355		$ (4,432,860)	$ 7,353,495			$ 1,378,251		$ 2,209,092

	v2016 PPI True-Up															
	J	K	L	M	N	O	P									Q
		=J-I		=L*K	=M*L*E	=M+N										=I+P
	old															
	Original Vintage 2016 PPI	PPI Over / (Under) Collection	Years at Original PPI Level	Cumulative PPI Over / (Under) Collection	Carrying Costs	PPI Over/(Under) Collection w/CCost	Σ Prior Period PPI	Vintage 2009 PPI	Vintage 2010 PPI	Vintage 2011 PPI	Vintage 2012 PPI	Vintage 2013 PPI	Vintage 2014 PPI	Vintage 2015 PPI		PPI Values for Test Period
1 Appliance Recycling Program	$ 3,011	$ -	1	$ -	$ -	$ -	$ 116,821	$ -	$ 28,547	$ 20,592	$ 38,647	$ 17,038	$ 7,505	$ 4,492		$ 119,833
2 Energy Education Program for Schools	$ -	$ -	1	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -		$ -
3 Energy Efficient Lighting	$ 448,586	$ -	1	$ -	$ -	$ -	$ 2,844,679	$ -	$ 546,425	$ 309,670	$ 621,854	$ 636,857	$ 397,825	$ 332,048		$ 3,293,264
4 Home Energy Improvement Program	$ 13,823	$ -	1	$ -	$ -	$ -	$ 350,089	$ 10,405	$ 75,357	$ 116,481	$ 108,864	0	$ 14,647	$ 24,334		$ 363,911
5 Multi-Family	$ 124,282	$ -	1	$ -	$ -	$ -	$ 193,329	$ -	$ -	$ -	$ -	$ -	$ -	$ 193,329		$ 317,611
6 Neighborhood Energy Saver	$ -	$ -	1	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -		$ -
7 Residential Energy Assessments	$ 56,121	$ (27,422)	1	$ (27,422)	$ (1,850)	$ (29,272)	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	no 2015	$ 83,543
8 Residential New Construction	$ 164,787	$ 25,301	1	$ 25,301	$ 1,707	$ 27,008	$ 174,649	$ -	$ -	$ -	$ -	$ 47,653	$ 54,738	$ 72,258		$ 314,135
9 Save Energy and Water Kit	$ 320,973	$ -	1	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -		$ 320,973
10 Residential Home Advantage	$ -	$ -	1	$ -	$ -	$ -	$ 176,476	$ 8,018	$ 27,550	$ 79,940	$ 60,450	$ 517	$ -	$ -		$ 176,476
11 Total for Residential Conservation Programs	$ 1,131,583	$ (2,121)		$ (2,121)	$ (143)	$ (2,265)	$ 3,856,042	$ 18,424	$ 677,879	$ 526,684	$ 829,814	$ 702,066	$ 474,715	$ 626,461		$ 4,989,746
12 My Home Energy Report	$ 164,074	$ -	1	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -		$ 164,074
13 Total Residential Conservation and Behavioral Programs	$ 1,295,657	$ (2,121)		$ (2,121)	$ (143)	$ (2,265)	$ 3,856,042	$ 18,424	$ 677,879	$ 526,684	$ 829,814	$ 702,066	$ 474,715	$ 626,461		$ 5,153,820
14 EnergyWise	$ 911,314	$ -	1	$ -	$ -	$ -	$ 3,243,883	$ 135,141	$ 1,043,048	$ 781,456	$ 347,959	$ 301,384	$ 369,522	$ 265,373		$ 4,155,197
15 Total Residential	$ 2,206,971	$ (2,121)		$ (2,121)	$ (143)	$ (2,265)	$ 7,099,925	$ 153,564	$ 1,720,927	$ 1,308,140	$ 1,177,773	$ 1,003,450	$ 844,237	$ 891,833		$ 9,309,017

Non-Residential Programs

EE Programs

	NC Incentive	Income Tax Rate	Income Taxes	Net-of-Tax PPI - Total NPV	Discount Rate	PPI Amortization Period	Vintage Year 2016 - Year 1 PPI	Income Tax Gross-Up Factor	Adjusted PPI
15 Business Energy Report	$ -	37.61%	$ -	$ -	6.75%	1	$ -	62.39%	$ -
16 Energy Efficiency for Business	$ 3,379,697	37.61%	$ (1,271,107)	$ 2,108,590	6.75%	3	$ 799,757	62.39%	$ 1,281,869
17 Energy Efficient Lighting	$ 902,966	37.61%	$ (339,606)	$ 563,359	6.75%	5	$ 136,465	62.39%	$ 218,730
18 Small Business Energy Saver	$ 2,374,490	37.61%	$ (893,048)	$ 1,481,442	6.75%	3	$ 561,889	62.39%	$ 900,609
19 Total for Non-Residential Conservation Programs	$ 6,657,153		$ (2,503,762)	$ 4,153,391			$ 1,498,112		$ 2,401,209
20 EnergyWise for Business	$ (95,995)	37.61%	$ 36,104	$ (59,891)	6.75%	1	$ (63,932)	62.39%	$ (102,471)
21 Commercial, Industrial, & Governmental Demand Respc	$ -	37.61%	$ -	$ -	6.75%	3	$ -	62.39%	$ -
22 Total for Non-Residential DSM Programs	$ (95,995)		$ 36,104	$ (59,891)			$ (63,932)		$ (102,471)
23 Total Non Residential	$ 6,561,157		$ (2,467,658)	$ 4,093,500			$ 1,434,180		$ 2,298,737
24 Total All Programs	$ 18,347,512		$ (6,900,518)	$ 11,446,995			$ 2,812,430		$ 4,507,830

	Original Vintage 2016 PPI	PPI Over / (Under) Collection	Years at Original PPI Level	Cumulative PPI Over / (Under) Collection	Carrying Costs	PPI Over/(Under) Collection w/CCost	Σ Prior Period PPI	Vintage 2009 PPI	Vintage 2010 PPI	Vintage 2011 PPI	Vintage 2012 PPI	Vintage 2013 PPI	Vintage 2014 PPI	Vintage 2015 PPI	PPI Values for Test Period
15 Business Energy Report	$ -	$ -	1	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
16 Energy Efficiency for Business	$ 1,281,869	$ -	1	$ -	$ -	$ -	$ 3,481,402	$ 169,910	$ 452,376	$ 649,907	$ 722,666	$ 678,479	$ 438,885	$ 369,180	$ 4,763,272
17 Energy Efficient Lighting	$ 218,730	$ -	1	$ -	$ -	$ -	$ 803,120	$ -	$ 134,853	$ 74,572	$ 153,107	$ 171,971	$ 116,186	$ 152,430	$ 1,021,849
18 Small Business Energy Saver	$ 900,609	$ -	1	$ -	$ -	$ -	$ 539,082	$ -	$ -	$ -	$ -	$ 80,709	$ 217,323	$ 241,051	$ 1,439,692
19 Total for Non-Residential Conservation Programs	$ 2,401,209	$ -		$ -	$ -	$ -	$ 4,823,604	$ 169,910	$ 587,229	$ 724,479	$ 875,773	$ 931,159	$ 772,394	$ 762,661	$ 7,224,812
20 EnergyWise for Business	$ (102,471)	$ -	1	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ (102,471)
21 Commercial, Industrial, & Governmental Demand Respc	$ -	$ -	1	$ -	$ -	$ -	$ 150,959	$ -	$ 65,722	$ 17,655	$ 28,315	$ 9,714	$ 25,139	$ 4,414	$ 150,959
22 Total for Non-Residential DSM Programs	$ (102,471)	$ -		$ -	$ -	$ -	$ 150,959	$ -	$ 65,722	$ 17,655	$ 28,315	$ 9,714	$ 25,139	$ 4,414	$ 48,488
23 Total Non Residential	$ 2,298,737	$ -		$ -	$ -	$ -	$ 4,974,563	$ 169,910	$ 652,951	$ 742,134	$ 904,088	$ 940,873	$ 797,533	$ 767,075	$ 7,273,300
24 Total All Programs	$ 4,505,708	$ (2,121)		$ (2,121)	$ (143)	$ (2,265)	$ 12,074,488	$ 323,474	$ 2,373,878	$ 2,050,273	$ 2,081,861	$ 1,944,323	$ 1,641,770	$ 1,658,908	$ 16,582,318

(1) Energy Efficient Benchmarking 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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Residential Programs

	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) Unadjusted Rev Requirement (2)	F NC Retail kWh Sales Allocation Factor		G NC Residential Unadjusted Revenue Requirement (2)	H =O (from page 4) NC Residential Adjusted Revenue Requirement
	EE Programs											
1	**Appliance Recycling Program**	-	-	$ -	$ 5,586	11.75%	$ (656)	$ 4,930	85.5082864%	E1 * F1	$ 4,215	$ -
2	**Energy Education Program for Schools**	996	2,353,765	$ 1,376,442	$ 835,991	0.00%	$ -	$ 835,991	85.5082864%	E2 * F2	$ 714,841	$ -
3	**Energy Efficient Lighting**	4,798	29,678,583	$ 30,351,056	$ 10,904,279	11.75%	$ 2,284,996	$ 13,189,275	85.5082864%	E3 * F3	$ 11,277,923	$ (26,349)
4	**Home Energy Improvement Program**	1,975	7,357,330	$ 6,313,442	$ 6,961,463	11.75%	$ (76,142)	$ 6,885,320	85.5082864%	E4 * F4	$ 5,887,519	$ 9
5	**Multi-Family**	2,052	16,150,639	$ 10,163,052	$ 2,514,413	11.75%	$ 898,715	$ 3,413,128	85.5082864%	E5 * F5	$ 2,918,508	$ 1,926
6	**Neighborhood Energy Saver**	335	2,200,240	$ 1,117,743	$ 1,781,211	0.00%	$ -	$ 1,781,211	85.5082864%	E6 * F6	$ 1,523,083	$ -
7	**Residential Energy Assessments**	933	7,734,231	$ 5,512,365	$ 1,863,486	11.75%	$ 428,743	$ 2,292,229	85.5082864%	E7 * F7	$ 1,960,046	$ (31,407)
8	**Residential New Construction**	5,266	12,245,876	$ 21,481,837	$ 11,671,724	11.75%	$ 1,152,688	$ 12,824,412	85.5082864%	E7 * F7	$ 10,965,935	$ 46,805
9	**Save Energy and Water Kit**	8,377	25,021,451	$ 17,187,186	$ 888,869	11.75%	$ 1,915,052	$ 2,803,921	85.5082864%	E8 * F8	$ 2,397,585	$ -
10	**Residential Home Advantage**	-	-	$ -	$ -	11.75%	$ -	$ -	85.5082864%		$ -	$ -
11	**Total for Residential Conservation Programs**	24,733	102,742,114	93,503,123	37,427,021		$ 6,603,396	$ 44,030,417			$ 37,649,655	$ (9,016)
12	**My Home Energy Report**	19,964	117,851,515	$ 6,972,509	$ 6,753,153	11.75%	$ 25,774	$ 6,778,928	85.5082864%	E11 * F11	$ 5,796,545	$ -
13	**Total Residential Conservation and Behavioral Programs**	44,696	220,593,629	$ 100,475,632	$ 44,180,174		$ 6,629,171	$ 50,809,345			$ 43,446,200	$ (9,016)
									NC Residential Peak Demand Allocation Factor	**NC Allocation Factor (2)**		
14	**EnergyWise**	33,428	-	$ 56,885,706	$ 6,502,032	11.75%	$ 5,920,082	$ 12,422,114	86.1579245%	48.2705209%	$ 6,403,614	$ 92,517
15	**Total Residential**	78,124	220,593,629	$ 157,361,338	$ 50,682,206		$ 12,549,252	$ 63,231,459			$ 49,849,814	$ 83,501

Non-Residential Programs

	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 Unadjusted Revenue Requirement (2)	NC Non-Residential Adjusted Revenue Requirement
	EE Programs											
16	**Business Energy Report**	-	-	$ 737	$ 20,330		$ -	$ 20,330	85.5082864%	E13 * F13	$ 17,384	$ -
17	**Energy Efficiency for Business**	17,038	103,365,897	$ 77,891,372	$ 21,749,807	11.75%	$ 6,596,634	$ 28,346,441	85.5082864%	E14 * F14	$ 24,238,556	$ 43,892
18	**Energy Efficient Lighting**	2,024	7,872,565	$ 9,198,437	$ 1,324,943	11.75%	$ 925,136	$ 2,250,078	85.5082864%	E16 * F16	$ 1,924,003	$ (8)
19	**Non-Res SmartSaver Performance**	58	435,108	$ 335,899	$ 147,160	11.75%	$ 22,177	$ 169,337	85.5082864%	E17 * F17	$ 144,797	$ -
20	**Small Business Energy Saver**	8,500	45,011,098	$ 26,945,514	$ 8,770,755	11.75%	$ 2,135,534	$ 10,906,290	85.5082864%	E18 * F18	$ 9,325,781	$ 94,962
21	**Total for Non-Residential Conservation Programs**	27,620	156,684,668	$ 114,371,959	$ 32,012,995		$ 9,679,480	$ 41,692,475			$ 35,650,521	$ 138,845
22	**EnergyWise for Business**	2,887	983,712	$ 858,655	$ 1,390,549	11.75%	$ (62,498)	$ 1,328,052	86.1579245%	E19 * F19	$ -	$ -
23	**Commercial, Industrial, & Governmental Demand Response**	1,969	-	$ 3,551,967	$ 1,393,650	11.75%	$ 253,602	$ 1,647,252	86.1579245%	E20 * F20	$ 6,862,482	$ -
24	**Total for Non-Residential DSM Programs**	4,855	983,712	$ 4,410,622	$ 2,784,199		$ 191,105	$ 2,975,304	86.1579245%	**NC Allocation Factor (2)** 51.7294791%	$ 6,862,482	$ -
25	**Total Non Residential**	32,475	157,668,380	$ 118,782,581	$ 34,797,195		$ 9,870,585	$ 44,667,780			$ 42,513,003	$ 138,845
26	**Total All Programs**	110,600	378,262,008	$ 276,143,919	$ 85,479,401		$ 22,419,837	$ 107,899,238			$ 92,362,817	$ 222,346

(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

		System kW Reduction - Summer Peak	System Energy Reduction (kWh)	System NPV of Avoided Costs	Total Cost	Shared Savings %	Incentive	System Revenue Requirement			NC Non-Residential Unadjusted Revenue Requirement	NC Non-Residential Adjusted Revenue Requirement
24	DSDR	293,816	35,518,685		$ 11,146,179			$ 11,146,179				
25	Total with DSDR	404,416	413,780,693	$ 276,143,919	$ 96,625,580		$ 22,419,837	$ 119,045,417			$ 92,362,817	$ 222,346

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Residential Programs

EE Programs

		NC Incentive	Income Tax Rate	Income Taxes	Net-of-Tax PPI - Total NPV	Discount Rate	PPI Amortization Period	Vintage Year 2017 - Year 1 PPI	Income Tax Gross-Up Factor	Adjusted PPI	Original Vintage 2017 PPI	PPI Over / (Under) Collection
		A	B	C	D	E	F	G	H	I	J (v2017 PPI True-Up)	K
				=A*B	=A+C			=-PMT(E,F,D)	=1-B		old	=J-I
1	Appliance Recycling Program	$ (561)	37.06%	$ 208	$ (353)	6.76%	10	$ (50)	62.94%	$ (79)	$ (79)	$ -
2	Energy Education Program for Schools	$ -	37.06%	$ -	$ -	6.76%	N/A	$ -	62.94%	$ -	$ -	$ -
3	Energy Efficient Lighting	$ 1,953,861	37.06%	$ (724,101)	$ 1,229,760	6.76%	5	$ 297,985	62.94%	$ 473,444	$ 448,763	$ (24,681)
4	Home Energy Improvement Program	$ (65,108)	37.06%	$ 24,129	$ (40,979)	6.76%	10	$ (5,769)	62.94%	$ (9,166)	$ (9,158)	$ 9
5	Multi-Family	$ 768,476	37.06%	$ (284,797)	$ 483,679	6.76%	5	$ 117,201	62.94%	$ 186,211	$ 188,015	$ 1,804
6	Neighborhood Energy Saver	$ -	37.06%	$ -	$ -	6.76%	N/A	$ -	62.94%	$ -	$ -	$ -
7	Residential Energy Assessments	$ 366,611	37.06%	$ (135,866)	$ 230,745	6.76%	5	$ 55,912	62.94%	$ 88,834	$ 59,415	$ (29,419)
8	Residential New Construction	$ 985,644	37.06%	$ (365,280)	$ 620,364	6.76%	10	$ 87,340	62.94%	$ 138,767	$ 182,609	$ 43,842
9	Save Energy and Water Kit	$ 1,637,528	37.06%	$ (606,868)	$ 1,030,661	6.76%	5	$ 249,741	62.94%	$ 396,792	$ 396,792	$ -
10	Residential Home Advantage	$ -	37.06%	$ -	$ -	6.76%	10	$ -	62.94%	$ -	$ -	$ -
11	Total for Residential Conservation Programs	$ 5,646,451		$ (2,092,574)	$ 3,553,877			$ 802,361		$ 1,274,803	$ 1,266,357	$ (8,446)
12	My Home Energy Report	$ 22,039	37.06%	$ (8,168)	$ 13,871	6.76%	1	$ 13,871	62.94%	$ 22,039	$ 22,039	$ -
13	Total Residential Conservation and Behavioral Programs	$ 5,668,490		$ (2,100,742)	$ 3,567,748			$ 816,232		$ 1,296,842	$ 1,288,396	$ (8,446)
14	EnergyWise	$ 5,100,620	37.06%	$ (1,890,289)	$ 3,210,330	6.76%	10	$ 451,977	62.94%	$ 718,108	$ 804,768	$ 86,661
15	Total Residential	$ 10,769,110		$ (3,991,031)	$ 6,778,079			$ 1,268,210		$ 2,014,950	$ 2,093,165	$ 78,215

		Years at Original PPI Level	Cumulative PPI Over / (Under) Collection	Carrying Costs	PPI Over/(Under) Collection w/CCost	Σ Prior Period PPI	Vintage 2009 PPI	Vintage 2010 PPI	Vintage 2011 PPI	Vintage 2012 PPI	Vintage 2013 PPI	Vintage 2014 PPI	Vintage 2015 PPI	Vintage 2016 PPI	PPI Values for Test Period
		L	M	N	O	P									Q
			=L*K	=M*L*E	=M+N										=I+P
1	Appliance Recycling Program	1	$ -	$ -	$ -	$ 119,833	$ -	$ 28,547	$ 20,592	$ 38,647	$ 17,038	$ 7,505	$ 4,492	$ 3,011	$ 119,754
2	Energy Education Program for Schools	1	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
3	Energy Efficient Lighting	1	$ (24,681)	$ (1,668)	$ (26,349)	$ 3,293,264	$ -	$ 546,425	$ 309,670	$ 621,854	$ 636,857	$ 397,825	$ 332,048	$ 448,586	$ 3,766,708
4	Home Energy Improvement Program	1	$ 9	$ 1	$ 9	$ 363,911	$ 10,405	$ 75,357	$ 116,481	$ 108,864	0	$ 14,647	$ 24,334	$ 13,823	$ 354,745
5	Multi-Family	1	$ 1,804	$ 122	$ 1,926	$ 317,611	$ -	$ -	$ -	$ -	$ -	$ -	$ 193,329	$ 124,282	$ 503,822
6	Neighborhood Energy Saver	1	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
7	Residential Energy Assessments	1	$ (29,419)	$ (1,988)	$ (31,407)	$ 83,543	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ 83,543	$ 172,377
8	Residential New Construction	1	$ 43,842	$ 2,963	$ 46,805	$ 314,135	$ -	$ -	$ -	$ -	$ 47,653	$ 54,738	$ 72,258	$ 139,487	$ 452,902
9	Save Energy and Water Kit	1	$ -	$ -	$ -	$ 320,973	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ 320,973	$ 717,765
10	Residential Home Advantage	1	$ -	$ -	$ -	$ 176,476	$ 8,018	$ 27,550	$ 79,940	$ 60,450	$ 517	$ -	$ -	$ -	$ 176,476
11	Total for Residential Conservation Programs		$ (8,446)	$ (571)	$ (9,016)	$ 4,989,746	$ 18,424	$ 677,879	$ 526,684	$ 829,814	$ 702,066	$ 474,715	$ 626,461	$ 1,133,704	$ 6,264,549
12	My Home Energy Report	1	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ 22,039
13	Total Residential Conservation and Behavioral Programs		$ (8,446)	$ (571)	$ (9,016)	$ 4,989,746	$ 18,424	$ 677,879	$ 526,684	$ 829,814	$ 702,066	$ 474,715	$ 626,461	$ 1,133,704	$ 6,286,588
14	EnergyWise	1	$ 86,661	$ 5,856	$ 92,517	$ 4,155,197	$ 135,141	$ 1,043,048	$ 781,456	$ 347,959	$ 301,384	$ 369,522	$ 265,373	$ 911,314	$ 4,873,305
15	Total Residential		$ 78,215	$ 5,286	$ 83,501	$ 9,144,943	$ 153,564	$ 1,720,927	$ 1,308,140	$ 1,177,773	$ 1,003,450	$ 844,237	$ 891,833	$ 2,045,018	$ 11,159,892

Non-Residential Programs

EE Programs

		NC Incentive	Income Tax Rate	Income Taxes	Net-of-Tax PPI - Total NPV	Discount Rate	PPI Amortization Period	Vintage Year 2017 - Year 1 PPI	Income Tax Gross-Up Factor	Adjusted PPI	Original Vintage 2017 PPI	PPI Over / (Under) Collection
16	Business Energy Report	$ -	37.06%	$ -	$ -	6.76%	1	$ -	62.94%	$ -	$ -	$ -
17	Energy Efficiency for Business	$ 5,640,669	37.06%	$ (2,090,431)	$ 3,550,237	6.76%	3	$ 1,346,844	62.94%	$ 2,139,886	$ 2,180,999	$ 41,113
18	Energy Efficient Lighting	$ 791,068	37.06%	$ (293,170)	$ 497,898	6.76%	5	$ 120,647	62.94%	$ 191,685	$ 191,677	$ (8)
18	Non-Res SmartSaver Performance	$ 18,963	37.06%	$ (7,028)	$ 11,935	6.76%	3	$ 4,528	62.94%	$ 7,194	$ 7,194	$ -
19	Small Business Energy Saver	$ 1,826,059	37.06%	$ (676,737)	$ 1,149,322	6.76%	3	$ 436,015	62.94%	$ 692,747	$ 781,698	$ 88,951
20	Total for Non-Residential Conservation Programs	$ 8,276,758		$ (3,067,366)	$ 5,209,392			$ 1,908,034		$ 3,031,512	$ 3,161,568	$ 130,056
21	EnergyWise for Business	$ (53,847)	37.06%	$ 19,956	$ (33,891)	6.76%	1	$ (36,181)	62.94%	$ (57,486)	$ (57,486)	$ -
22	Commercial, Industrial, & Governmental Demand Response	$ 218,498	37.06%	$ (80,975)	$ 137,523	6.76%	3	$ 52,172	62.94%	$ 82,891	$ 82,891	$ -
23	Total for Non-Residential DSM Programs	$ 164,652		$ (61,020)	$ 103,632			$ 15,990		$ 25,406	$ 25,406	$ -
24	Total Non Residential	$ 8,441,410		$ (3,128,386)	$ 5,313,024			$ 1,924,024		$ 3,056,917	$ 3,186,973	$ 130,056
25	Total All Programs	$ 19,210,519		$ (7,119,417)	$ 12,091,103			$ 3,192,233		$ 5,071,867	$ 5,280,138	$ 208,271

		Years at Original PPI Level	Cumulative PPI Over / (Under) Collection	Carrying Costs	Over/(Under) Collection w/CCost	Σ Prior Period PPI	Vintage 2009 PPI	Vintage 2010 PPI	Vintage 2011 PPI	Vintage 2012 PPI	Vintage 2013 PPI	Vintage 2014 PPI	Vintage 2015 PPI	Vintage 2016 PPI	PPI Values for Test Period
16	Business Energy Report	1	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
17	Energy Efficiency for Business	1	$ 41,113	$ 2,778	$ 43,892	$ 4,763,272	$ 169,910	$ 452,376	$ 649,907	$ 722,666	$ 678,479	$ 438,885	$ 369,180	$ 1,281,869	$ 6,903,157
18	Energy Efficient Lighting	1	$ (8)	$ (1)	$ (8)	$ 1,021,849	$ -	$ 134,853	$ 74,572	$ 153,107	$ 171,971	$ 116,186	$ 152,430	$ 218,730	$ 1,213,534
18	Non-Res SmartSaver Performance	1	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ 7,194
19	Small Business Energy Saver	1	$ 88,951	$ 6,011	$ 94,962	$ 1,439,692	$ -	$ -	$ -	$ -	$ 80,709	$ 217,323	$ 241,051	$ 900,609	$ 2,132,439
20	Total for Non-Residential Conservation Programs		$ 130,056	$ 8,789	$ 138,845	$ 7,224,812	$ 169,910	$ 587,229	$ 724,479	$ 875,773	$ 931,159	$ 772,394	$ 762,661	$ 2,401,209	$ 10,256,324
21	EnergyWise for Business	1	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ (57,486)
22	Commercial, Industrial, & Governmental Demand Response	1	$ -	$ -	$ -	$ 150,959	$ -	$ 65,722	$ 17,655 `	$ 28,315	$ 9,714	$ 25,139	$ 4,414	$ -	$ 233,850
23	Total for Non-Residential DSM Programs		$ -	$ -	$ -	$ 150,959	$ -	$ 65,722	$ 17,655	$ 28,315	$ 9,714	$ 25,139	$ 4,414	$ -	$ 176,365
24	Total Non Residential		$ 130,056	$ 8,789	$ 138,845	$ 7,375,772	$ 169,910	$ 652,951	$ 742,134	$ 904,088	$ 940,873	$ 797,533	$ 767,075	$ 2,401,209	$ 10,432,689
25	Total All Programs		$ 208,271	$ 14,075	$ 222,346	$ 16,520,715	$ 323,474	$ 2,373,878	$ 2,050,273	$ 2,081,861	$ 1,944,323	$ 1,641,770	$ 1,658,908	$ 4,446,227	$ 21,592,581

(1) Energy Efficient Benchmarking 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)				=K (from page 6)
	Residential Programs	**System kW Reduction - Summer Peak**	**System Energy Reduction (kWh)**	**System NPV of Avoided Costs**	**Total Cost**	**Shared Savings %**	**Incentive**	**Unadjusted Rev Requirement (2)**	**NC Retail kWh Sales Allocation Factor**		**NC Residential Unadjusted Revenue Requirement (2)**	**NC Residential Adjusted Revenue Requirement**
	EE Programs											
1	**Appliance Recycling Program**	-	-	$ -	$ -	11.75%	$ -	$ -	85.5608674%	E1 * F1	$ -	$ 119,754
2	**Energy Education Program for Schools**	766	2,563,019	$ 1,365,918	$ 676,815	0.00%	$ -	$ 676,815	85.5608674%	E2 * F2	$ 579,089	$ -
3	**Energy Efficient Lighting**	4,227	25,642,842	$ 25,055,843	$ 8,752,062	11.75%	$ 1,915,694	$ 10,667,756	85.5608674%	E3 * F3	$ 9,127,425	$ 4,163,487
4	**Residential Service – Smart $aver**	1,805	7,228,648	$ 6,188,886	$ 7,168,833	11.75%	$ (115,144)	$ 7,053,689	85.5608674%	E4 * F4	$ 6,035,198	$ 340,898
5	**Multi-Family**	1,744	13,291,652	$ 8,052,883	$ 2,409,743	11.75%	$ 663,069	$ 3,072,812	85.5608674%	E5 * F5	$ 2,629,124	$ 615,984
6	**Multi-Family PipeWrap EMV Adjustment**						$ (103,989)	$ (103,989)	100.0000000%	E6 * F6	$ (103,989)	
7	**Neighborhood Energy Saver**	347	2,278,804	$ 1,226,687	$ 1,845,739	0.00%	$ -	$ 1,845,739	85.5608674%	E7 * F7	$ 1,579,230	$ -
8	**Residential Energy Assessments**	935	7,751,895	$ 5,270,526	$ 1,851,965	11.75%	$ 401,681	$ 2,253,646	85.5608674%	E8 * F8	$ 1,928,239	$ 255,573
9	**Residential New Construction**	5,440	14,263,235	$ 22,380,550	$ 13,189,949	11.75%	$ 1,079,896	$ 14,269,845	85.5608674%	E9 * F9	$ 12,209,403	$ 582,765
10	**Save Energy and Water Kit**	5,058	15,252,311	$ 10,033,447	$ 825,279	11.75%	$ 1,081,960	$ 1,907,239	85.5608674%	E10 * F10	$ 1,631,850	$ 941,861
11	**Residential Home Advantage**	-	-	$ -	$ -	11.75%	$ -	$ -	85.5608674%	E11 * F11	$ -	$ 176,476
12	**Total for Residential Conservation Programs**	20,322	88,272,404	79,574,741	36,720,384		$ 4,923,167	$ 41,643,550			$ 35,615,569	$ 7,196,799
13	**My Home Energy Report**	20,776	122,685,145	$ 7,055,417	$ 7,687,891	11.75%	$ (74,316)	$ 7,613,575	85.5608674%	E13*F13	$ 6,514,241	$ (63,585)
14	**Total Residential Conservation and Behavioral Programs**	41,098	210,957,549	$ 86,630,158	$ 44,408,274		$ 4,848,851	$ 49,257,126			$ 42,129,810	$ 7,133,214
									NC Residential Peak Demand Allocation Factor	**NC Allocation Factor (2)**		
15	**EnergyWise**	29,483	-	$ 57,437,080	$ 5,664,027	11.75%	$ 6,083,334	$ 11,747,361	86.5304240%	48.5812530%	$ 6,416,092	$ 5,613,145
16	**Total Residential**	70,580	210,957,549	$ 144,067,239	$ 50,072,301		$ 10,932,185	$ 61,004,486			$ 48,545,902	$ 12,746,359

	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 Unadjusted Revenue Requirement (2)**	**NC Non-Residential Adjusted Revenue Requirement**
	EE Programs											
17	**Business Energy Report**	-	-	$ -	$ -		$ -	$ -	85.5608674%	E17 * F17	$ -	$ -
18	**Energy Efficient Lighting**	1,752	6,759,940	$ 8,083,346	$ 1,063,434	11.75%	$ 824,840	$ 1,888,274	85.5608674%	E18 * F18	$ 1,615,623	$ 1,384,376
19	**Non-Residential Smart $aver Prescriptive**	14,782	85,112,310	$ 64,170,924	$ 11,515,913	11.75%	$ 6,186,964	$ 17,702,877	85.5608674%	E19 * F19	$ 15,146,735	$ 8,910,038
20	**Non-Residential Smart $aver Custom**	1,883	11,901,442	$ 8,744,334	$ 2,174,163	11.75%	$ 771,995	$ 2,946,158	85.5608674%	E20 * F20	$ 2,520,759	$ 250,414
21	**Non-Res SmartSaver Performance**	129	1,519,117	$ 794,816	$ 201,559	11.75%	$ 69,708	$ 271,267	85.5608674%	E21 * F21	$ 232,098	$ 29,805
22	**Small Business Energy Saver**	6,667	40,298,466	$ 21,929,237	$ 8,858,213	11.75%	$ 1,535,845	$ 10,394,058	85.5608674%	E22 * F22	$ 8,893,246	$ 2,630,625
23	**Total for Non-Residential Conservation Programs**	25,213	145,591,275	$ 103,722,657	$ 23,813,283		$ 9,389,351	$ 33,202,634			$ 28,408,461	$ 13,205,257
24	**EnergyWise for Business**	2,661	38,158	$ 887,204	$ 2,108,030	11.75%	$ (143,447)	$ 1,964,583	86.5304240%	E24 * F24	$ 3,795,064	$ (124,125)
25	**Commercial, Industrial, & Governmental Demand Response**	1,629	-	$ 2,879,351	$ 1,373,929	11.75%	$ 176,887	$ 1,550,816	86.5304240%	E25 * F25	$ 2,995,774	$ 291,878
										NC Allocation Factor (2)		
26	**Total for Non-Residential DSM Programs**	4,290	38,158	$ 3,766,555	$ 3,481,959		$ 33,440	$ 3,515,399	86.5304240%	51.4187470%	$ 6,790,838	$ 167,753
27	**Total Non Residential**	29,503	145,629,433	$ 107,489,212	$ 27,295,242		$ 9,422,791	$ 36,718,033		6,790,838.30	$ 35,199,299	$ 13,373,010
28	**Total All Programs**	100,083	356,586,982	$ 251,556,450	$ 77,367,543		$ 20,354,977	$ 97,722,520		0.558850594	$ 83,745,202	$ 26,119,369

(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
(3) Multi-Family PipeWrap EMV Adjustment includes ($196,164) applied to line 5 as part of EMV application to the 2018 vintage year, of which ($43,806) is Lost Revenue and ($152,357) is Incentive. The remaining ($103,989) is reflected in line 6 for a total of ($300,153).

24	DSDR	275,885	44,989,144		$ 12,886,517			$ 12,886,517				
25	Total with DSDR	375,968	401,576,126	$ 251,556,450	$ 90,254,060		$ 20,354,977	$ 110,609,036			$ 83,745,202	$ 26,119,369

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Residential Programs

	A	B	C =A*B	D =A+C	E	F	G =-PMT(E,F,D)	H =1-B	I	J										K =J+I
Residential Programs	NC Incentive	Income Tax Rate	Income Taxes	Net-of-Tax PPI - Total NPV	Discount Rate	PPI Amortization Period	Vintage Year 2018 - Year 1 PPI	Income Tax Gross-Up Factor	Adjusted PPI	Σ Prior Period PPI	Vintage 2009 PPI	Vintage 2010 PPI	Vintage 2011 PPI	Vintage 2012 PPI	Vintage 2013 PPI	Vintage 2014 PPI	Vintage 2015 PPI	Vintage 2016 PPI	Vintage 2017 PPI	PPI Values for Test Period
EE Programs																				
1 Appliance Recycling Program	$ -	23.50%	$ -	$ -	6.72%	10	$ -	76.50%	$ -	$ 119,754	$ -	$ 28,547	$ 20,592	$ 38,647	$ 17,038	$ 7,505	$ 4,492	$ 3,011	$ (79)	$ 119,754
2 Energy Education Program for Schools	$ -	23.50%	$ -	$ -	6.72%	N/A	$ -	76.50%	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
3 Energy Efficient Lighting	$ 1,639,085	23.50%	$ (385,244)	$ 1,253,840	6.72%	5	$ 303,522	76.50%	$ 396,779	$ 3,766,708	$ -	$ 546,425	$ 309,670	$ 621,854	$ 636,857	$ 397,825	$ 332,048	$ 448,586	$ 473,444	$ 4,163,487
4 Residential Service – Smart $aver	$ (98,518)	23.50%	$ 23,155	$ (75,363)	6.72%	10	$ (10,592)	76.50%	$ (13,847)	$ 354,745	$ 10,405	$ 75,357	$ 116,481	$ 108,864	0	$ 14,647	$ 24,334	$ 13,823	$ (9,166)	$ 340,898
5 Multi-Family (with PipeWrap EMV Adjustment)	$ 463,339	23.50%	$ (108,901)	$ 354,437	6.72%	5	$ 85,800	76.50%	$ 112,162	$ 503,822	$ -	$ -	$ -	$ -	$ -	$ -	$ 193,329	$ 124,282	$ 186,211	$ 615,984
6 Neighborhood Energy Saver	$ -	23.50%	$ -	$ -	6.72%	N/A	$ -	76.50%	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
7 Residential Energy Assessments	$ 343,682	23.50%	$ (80,778)	$ 262,904	6.72%	5	$ 63,642	76.50%	$ 83,196	$ 172,377	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ 83,543	$ 88,834	$ 255,573
8 Residential New Construction	$ 923,968	23.50%	$ (217,166)	$ 706,802	6.72%	10	$ 99,340	76.50%	$ 129,863	$ 452,902	$ -	$ -	$ -	$ -	$ 47,653	$ 54,738	$ 72,258	$ 139,487	$ 138,767	$ 582,765
9 Save Energy and Water Kit	$ 925,734	23.50%	$ (217,581)	$ 708,153	6.72%	5	$ 171,425	76.50%	$ 224,096	$ 717,765	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ 320,973	$ 396,792	$ 941,861
10 Residential Home Advantage	$ -	23.50%	$ -	$ -	6.72%	10	$ -	76.50%	$ -	$ 176,476	$ 8,018	$ 27,550	$ 79,940	$ 60,450	$ 517	$ -	$ -	$ -	$ -	$ 176,476
11 Total for Residential Conservation Programs	$ 4,197,289		$ (986,515)	$ 3,210,774			$ 713,137		$ 932,250	$ 6,264,549	$ 18,424	$ 677,879	$ 526,684	$ 829,814	$ 702,066	$ 474,715	$ 626,461	$ 1,133,704	$ 1,274,803	$ 7,196,799
12 My Home Energy Report	$ (63,585)	23.50%	$ 14,945	$ (48,640)	6.72%	1	$ (48,640)	76.50%	$ (63,585)	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ (63,585)
13 Total Residential Conservation and Behavioral Programs	$ 4,133,704		$ (971,570)	$ 3,162,134			$ 664,497		$ 868,665	$ 6,264,549	$ 18,424	$ 677,879	$ 526,684	$ 829,814	$ 702,066	$ 474,715	$ 626,461	$ 1,133,704	$ 1,274,803	$ 7,133,214
14 EnergyWise	$ 5,263,935	23.50%	$ (1,237,215)	$ 4,026,719	6.72%	10	$ 565,952	76.50%	$ 739,841	$ 4,873,305	$ 135,141	$ 1,043,048	$ 781,456	$ 347,959	$ 301,384	$ 369,522	$ 265,373	$ 911,314	$ 718,108	$ 5,613,145
15 Total Residential	$ 9,397,639		$ (2,208,785)	$ 7,188,853			$ 1,230,449		$ 1,608,506	$ 11,137,853	$ 153,564	$ 1,720,927	$ 1,308,140	$ 1,177,773	$ 1,003,450	$ 844,237	$ 891,833	$ 2,045,018	$ 1,992,911	$ 12,746,359

Non-Residential Programs

Non-Residential Programs	NC Incentive	Income Tax Rate	Income Taxes	Net-of-Tax PPI - Total NPV	Discount Rate	PPI Amortization Period	Vintage Year 2018 - Year 1 PPI	Income Tax Gross-Up Factor	Adjusted PPI	Σ Prior Period PPI	Vintage 2009 PPI	Vintage 2010 PPI	Vintage 2011 PPI	Vintage 2012 PPI	Vintage 2013 PPI	Vintage 2014 PPI	Vintage 2015 PPI	Vintage 2016 PPI	Vintage 2017 PPI	PPI Values for Test Period
EE Programs																				
16 Business Energy Report	$ -	23.50%	$ -	$ -	6.72%	1	$ -	76.50%	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
17 Energy Efficient Lighting	$ 705,740	23.50%	$ (165,874)	$ 539,866	6.72%	5	$ 130,687	76.50%	$ 170,841	$ 1,213,534	$ -	$ 134,853	$ 74,572	$ 153,107	$ 171,971	$ 116,186	$ 152,430	$ 218,730	$ 191,685	$ 1,384,376
18 Non-Residential Smart $aver Prescriptive	$ 5,293,620	23.50%	$ (1,244,192)	$ 4,049,428	6.72%	3	$ 1,535,191	76.50%	$ 2,006,881	$ 6,903,157	$ 169,910	$ 452,376	$ 649,907	$ 722,666	$ 678,479	$ 438,885	$ 369,180	$ 1,281,869	$ 2,139,886	$ 8,910,038
19 Non-Residential Smart $aver Custom	$ 660,526	23.50%	$ (155,247)	$ 505,278	6.72%	3	$ 191,558	76.50%	$ 250,414	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ 250,414
20 Non-Res SmartSaver Performance	$ 59,643	23.50%	$ (14,018)	$ 45,624	6.72%	3	$ 17,297	76.50%	$ 22,611	$ 7,194	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ 7,194	$ 29,805
21 Small Business Energy Saver	$ 1,314,083	23.50%	$ (308,857)	$ 1,005,226	6.72%	3	$ 381,094	76.50%	$ 498,186	$ 2,132,439	$ -	$ -	$ -	$ -	$ 80,709	$ 217,323	$ 241,051	$ 900,609	$ 692,747	$ 2,630,625
22 Total for Non-Residential Conservation Programs	$ 8,033,611		$ (1,888,189)	$ 6,145,421			$ 2,255,827		$ 2,948,933	$ 10,256,324	$ 169,910	$ 587,229	$ 724,479	$ 875,773	$ 931,159	$ 772,394	$ 762,661	$ 2,401,209	$ 3,031,512	$ 13,205,257
23 EnergyWise for Business	$ (124,125)	23.50%	$ 29,174	$ (94,951)	6.72%	1	$ (94,951)	76.50%	$ (124,125)	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ (124,125)
24 Commercial, Industrial, & Governmental Demand Response	$ 153,061	23.50%	$ (35,975)	$ 117,086	6.72%	3	$ 44,389	76.50%	$ 58,027	$ 233,850	$ -	$ 65,722	$ 17,655 `	$ 28,315	$ 9,714	$ 25,139	$ 4,414	$ -	$ 82,891	$ 291,878
25 Total for Non-Residential DSM Programs	$ 28,936		$ (6,801)	$ 22,135			$ (50,562)		$ (66,098)	$ 233,850	$ -	$ 65,722	$ 17,655	$ 28,315	$ 9,714	$ 25,139	$ 4,414	$ -	$ 82,891	$ 167,753
26 Total Non Residential	$ 8,062,546		$ (1,894,990)	$ 6,167,556			$ 2,205,265		$ 2,882,835	$ 10,490,174	$ 169,910	$ 652,951	$ 742,134	$ 904,088	$ 940,873	$ 797,533	$ 767,075	$ 2,401,209	$ 3,114,403	$ 13,373,010
27 Total All Programs	$ 17,460,185		$ (4,103,776)	$ 13,356,409			$ 3,435,713		$ 4,491,341	$ 21,628,028	$ 323,474	$ 2,373,878	$ 2,050,273	$ 2,081,861	$ 1,944,323	$ 1,641,770	$ 1,658,908	$ 4,446,227	$ 5,107,313	$ 26,119,369

(1) Energy Efficient Benchmarking 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

Duke Energy Progress
Evans Exhibit 1
Vintage 2020 Estimate - January 1, 2020 to December 31, 2020
Docket No. E-2, Sub 1206
Load Impacts and Estimated Revenue Requirements by Program

				A	B	C	D	E	F	G		H	I
							=(A-B)*C	= (B+D)					=K (from page 8)
	Residential Programs	**System kW Reduction - Summer Peak**	**System Energy Reduction (kWh)**	**System NPV of Avoided Costs**	**Total Cost**	**Shared Savings %**	**Incentive**	**Unadjusted Rev Requirement (2)**	**NC Retail kWh Sales Allocation Factor**	**NC Allocation Factor (2)**		**NC Residential Unadjusted Revenue Requirement (2)**	**NC Residential Adjusted Revenue Requirement**
	EE Programs												
1	**Appliances and Devices**	7,922	23,787,507	13,327,506	987,762	11.75%	$ 1,449,920	$ 2,437,682	85.5608674%		E1 * F1	$ 2,085,702	$ 299,664
2	**Appliance Recycling Program**	-	-	-	-	11.75%	$ -	$ -	85.5608674%		E2 * F2	$ -	$ 91,207
3	**Energy Education Program for Schools**	462	3,872,957	1,213,998	969,044	0.00%	$ -	$ 969,044	85.5608674%		E3 * F3	$ 829,122	$ -
4	**Energy Efficient Lighting**	1,480	8,977,956	7,302,951	4,558,139	11.75%	$ 322,515	$ 4,880,655	85.5608674%		E4 * F4	$ 4,175,930	$ 3,881,545
5	**Residential Smart $aver**	1,971	5,634,699	5,047,920	3,404,576	11.75%	$ 193,093	$ 3,597,668	85.5608674%		E5 * F5	$ 3,078,196	$ 270,425
6	**Multi-Family**	1,847	14,538,633	7,175,347	2,923,891	11.75%	$ 499,546	$ 3,423,437	85.5608674%		E6 * F6	$ 2,929,122	$ 840,986
7	**Neighborhood Energy Saver**	348	2,279,725	933,642	2,042,281	0.00%	$ -	$ 2,042,281	85.5608674%		E7 * F7	$ 1,747,394	$ -
8	**Residential Energy Assessments**	820	6,866,573	3,860,896	1,932,255	11.75%	$ 226,615	$ 2,158,870	85.5608674%		E8 * F8	$ 1,847,148	$ 314,978
9	**Residential New Construction**	4,606	15,992,111	18,677,081	13,018,377	11.75%	$ 664,898	$ 13,683,275	85.5608674%		E9 * F9	$ 11,707,529	$ 814,307
10	**Save Energy and Water Kit**	-	-	-	-	11.75%	$ -	$ -	85.5608674%		E10 * F10	$ -	$ 1,340,230
11	**Residential Home Advantage**	-	-	-	-	11.75%	$ -	$ -	85.5608674%		E11 * F11	$ -	$ 140,907
12	**Total for Residential Conservation Programs**	19,456	81,950,160	57,539,341	29,836,325		3,356,587	33,192,912				$ 28,400,143	$ 7,994,251
13	**My Home Energy Report (1)**	19,586	116,045,885	6,414,470	6,866,858	11.75%	$ (53,156)	$ 6,813,703	85.5608674%		E12 * F12	$ 5,829,863	$ (45,480)
14	**Total Residential Conservation and Behavioral P**	39,042	197,996,045	$ 63,953,811	$ 36,703,184		$ 3,303,432	$ 40,006,615				$ 34,230,006	$ 7,948,770
									NC Residential Peak Demand Allocation Factor				
15	**EnergyWise ® Home**	27,629	-	42,915,886	8,148,740	11.75%	$ 4,085,140	$ 12,233,879	86.5304240%	48.58%	(E13+E23) *F13 *G13	$ 9,253,541	$ 5,547,314
16	**Total Residential**	66,671	197,996,045	$ 106,869,697	$ 44,851,923		$ 7,388,571	$ 52,240,495				$ 43,483,547	$ 13,496,084

	Non-Residential Programs	**System kW Reduction - Summer Peak**	**System Energy Reduction (kWh)**	**System NPV of Avoided Costs**	**Total Cost**	**Shared Savings %**	**Incentive**	**Unadjusted Rev Requirement (2)**	**NC Retail kWh Sales Allocation Factor**			**NC Residential Unadjusted Revenue Requirement (2)**	**NC Non-Residential Adjusted Revenue Requirement**
	EE Programs												
17	**Energy Efficient Lighting**	611	2,357,624	2,211,608	552,455	11.75%	$ 194,950	$ 747,406	85.5608674%		E15 * F15	$ 639,487	$ 1,406,771
18	**Non-Residential Smart $aver Performance (Cust**	2,406	21,077,008	10,348,052	4,302,434	11.75%	$ 710,360	$ 5,012,794	85.5608674%		E16 * F16	$ 4,288,990	$ 616,392
19	**Non-Residential Smart $aver Performance (Pres**	10,443	63,750,610	38,000,115	11,355,357	11.75%	$ 3,130,759	$ 14,486,116	85.5608674%		E17 * F17	$ 12,394,447	$ 6,438,521
20	**Non-Residential Smart $aver Performance Incen**	858	7,520,191	3,692,143	991,702	11.75%	$ 317,302	$ 1,309,004	85.5608674%		E18 * F18	$ 1,119,995	$ 206,633
21	**Small Business Energy Saver**	6,642	38,401,907	19,156,040	8,304,027	11.75%	$ 1,275,112	$ 9,579,139	85.5608674%		E19 * F19	$ 8,195,994	$ 1,948,674
22	**Total for Non-Residential Conservation Program**	20,961	133,107,341	$ 73,407,958	$ 25,505,975		$ 5,628,483	$ 31,134,458				$ 26,638,913	$ 10,616,991
									NC Non-Residential Peak Demand Allocation Factor				
23	**EnergyWise ® for Business**	8,252	54,636	826,038	3,315,403	11.75%	$ (292,500)	$ 3,022,903				$ 3,027,645	$ (269,912)
24	**Commercial Industrial Governmental Demand R**	7,357	-	11,315,319	6,148,693	11.75%	$ 607,079	$ 6,755,771				$ 6,766,370	$ 591,203
25	**Total for Non-Residential DSM Programs**	15,609	54,636	$ 12,141,357	$ 9,464,095		$ 314,578	$ 9,778,674	86.5304240%	51.42%	(E13+E23) *F23 *G23	$ 9,794,014	$ 321,291
26	**Total Non Residential**	36,570	133,161,976	$ 85,549,315	$ 34,970,071		$ 5,943,061	$ 40,913,132				$ 36,432,927	$ 10,938,282
27	**Total All Programs**	103,240	331,158,021	$ 192,419,012	$ 79,821,994		$ 13,331,633	$ 93,153,627				$ 79,916,475	$ 24,434,366

	DSDR	**System kW Reduction - Summer Peak**	**System Energy Reduction (kWh)**	**System NPV of Avoided Costs**	**Total Cost**	**Shared Savings %**	**Incentive**	**Unadjusted Rev Requirement (3)**	**NC Retail kWh Sales Allocation Factor**	**NC Retail kWh Sales Allocation Factor**		**NC DSDR Unadjusted Revenue Requirement (3)**	**NC DSDR Adjusted Revenue Requirement**
1	**DSDR**	293,836	46,476,232		$ 18,774,903	N/A	$ -	$ 18,774,903				$ -	$ -
	Total All Programs with DSDR	397,076	377,634,253	$ 192,419,012	$ 98,596,897		$ 13,331,633	$ 111,928,530				$ 79,916,475	$ 24,434,366

(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

Duke Energy Progress
Evans Exhibit 1
Vintage 2020 Estimate - January 1, 2020 to December 31, 2020
Docket No. E-2, Sub 1206
Load Impacts and Estimated Revenue Requirements by Program

		A	B	C	D	E	F	G	H	I	J												K
				=A*B	=A+C			=-PMT(E,F,D)	=1-B														=J+I
	Residential Programs	NC Incentive	Income Tax Rate	Income Taxes	Net-of-Tax PPI - Total NPV	Discount Rate	PPI Amortization Period	Vintage Year 2020 - Year 1 PPI	Income Tax Gross-Up Factor	Adjusted PPI	Σ Prior Period PPI	Vintage 2009 PPI	Vintage 2010 PPI	Vintage 2011 PPI	Vintage 2012 PPI	Vintage 2013 PPI	Vintage 2014 PPI	Vintage 2015 PPI	Vintage 2016 PPI	Vintage 2017 PPI	Vintage 2018 PPI	Vintage 2019 PPI	PPI Values for Test Period
	EE Programs																						
1	Appliances and Devices	$ 1,240,564	23.17%	$ (287,430)	$ 953,134	6.64%	5	$ 230,234	76.83%	$ 299,664	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ 299,664
2	Appliance Recycling Program	$ -	23.17%	$ -	$ -	6.64%	10	$ -	76.83%	$ -	$ 91,207	$ -	$ -	$ 20,592	$ 38,647	$ 17,038	$ 7,505	$ 4,492	$ 3,011	$ (79)	$ -		$ 91,207
3	Energy Education Program for Schools	$ -	23.17%	$ -	$ -	6.64%	N/A	$ -	76.83%	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
4	Energy Efficient Lighting	$ 275,947	23.17%	$ (63,935)	$ 212,012	6.64%	5	$ 51,213	76.83%	$ 66,656	$ 3,814,889	$ -	$ -	$ 309,670	$ 621,854	$ 636,857	$ 397,825	$ 332,048	$ 448,586	$ 473,444	$ 396,779	$ 197,827	$ 3,881,545
5	Home Energy Improvement	$ 165,212	23.17%	$ (38,278)	$ 126,934	6.64%	10	$ 17,774	76.83%	$ 23,134	$ 247,291	$ -	$ -	$ 116,481	$ 108,864	$ -	$ 14,647	$ 24,334	$ 13,823	$ (9,166)	$ (13,847)	$ (7,845)	$ 270,425
6	Multi-Family	$ 427,416	23.17%	$ (99,029)	$ 328,387	6.64%	5	$ 79,323	76.83%	$ 103,244	$ 737,741	$ -	$ -	$ -	$ -	$ -	$ -	$ 193,329	$ 124,282	$ 186,211	$ 112,162	$ 121,758	$ 840,986
7	Neighborhood Energy Saver	$ -	23.17%	$ -	$ -	6.64%	N/A	$ -	76.83%	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
8	Residential Energy Assessments	$ 193,894	23.17%	$ (44,924)	$ 148,970	6.64%	5	$ 35,984	76.83%	$ 46,836	$ 268,142	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ 83,543	$ 88,834	$ 83,196	$ 12,569	$ 314,978
9	Residential New Construction	$ 568,892	23.17%	$ (131,808)	$ 437,084	6.64%	10	$ 61,204	76.83%	$ 79,661	$ 734,646	$ -	$ -	$ -	$ -	$ 47,653	$ 54,738	$ 72,258	$ 139,487	$ 138,767	$ 129,863	$ 151,881	$ 814,307
10	Save Energy and Water Kit	$ -	23.17%	$ -	$ -	6.64%	5	$ -	76.83%	$ -	$ 1,340,230	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ 320,973	$ 396,792	$ 224,096	$ 398,369	$ 1,340,230
11	Residential Home Advantage	$ -	23.17%	$ -	$ -	6.64%	10	$ -	76.83%	$ -	$ 140,907	$ -	$ -	$ 79,940	$ 60,450	$ 517	$ -	$ -	$ -	$ -	$ -	$ -	$ 140,907
12	Total for Residential Conservation Progra	2,871,925		(665,405)	2,206,520			475,733		619,196	7,375,055	-	-	526,684	829,814	702,066	474,715	626,461	1,133,704	1,274,803	932,250	874,559	7,994,251
13	My Home Energy Report	$ (45,480)	23.17%	$ 10,537	$ (34,943)	6.64%	1	$ (34,943)	76.83%	$ (45,480)	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ (45,480)
14	Total Residential Conservation and Beha	2,826,445		(654,867)	2,171,577			440,790		573,716	7,375,055	-	-	526,684	829,814	702,066	474,715	626,461	1,133,704	1,274,803	932,250	874,559	7,948,770
15	EnergyWise ® Home	$ 3,534,889	23.17%	$ (819,009)	$ 2,715,880	6.64%	10	$ 380,299	76.83%	$ 494,983	$ 5,052,331	$ -	$ -	$ 781,456	$ 347,959	$ 301,384	$ 369,522	$ 265,373	$ 911,314	$ 718,108	$ 739,841	$ 617,375	$ 5,547,314
16	Total Residential	6,361,333		(1,473,876)	4,887,457			821,088		1,068,698	12,427,386	-	-	1,308,140	1,177,773	1,003,450	844,237	891,833	2,045,018	1,992,911	1,672,091	1,491,933	13,496,084

	Non-Residential Programs	NC Incentive	Income Tax Rate	Income Taxes	Net-of-Tax PPI - Total NPV	Discount Rate	PPI Amortization Period	Vintage Year 2020 - Year 1 PPI	Income Tax Gross-Up Factor	Adjusted PPI	Σ Prior Period PPI	Vintage 2009 PPI	Vintage 2010 PPI	Vintage 2011 PPI	Vintage 2012 PPI	Vintage 2013 PPI	Vintage 2014 PPI	Vintage 2015 PPI	Vintage 2016 PPI	Vintage 2017 PPI	Vintage 2018 PPI	Vintage 2019 PPI	PPI Values for Test Period
	EE Programs																						
17	Energy Efficient Lighting	$ 166,801	23.17%	$ (38,647)	$ 128,155	6.64%	5	$ 30,956	76.83%	$ 40,292	$ 1,366,479	$ -	$ -	$ 74,572	$ 153,107	$ 171,971	$ 116,186	$ 152,430	$ 218,730	$ 191,685	$ 170,841	$ 116,957	$ 1,406,771
18	Non-Residential Smart $aver Performanc	$ 607,790	23.17%	$ (140,821)	$ 466,970	6.64%	3	$ 176,776	76.83%	$ 230,084	$ 386,308	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ 250,414	$ 135,894	$ 616,392
19	Non-Residential Smart $aver Performanc	$ 2,678,705	23.17%	$ (620,637)	$ 2,058,068	6.64%	3	$ 779,100	76.83%	$ 1,014,048	$ 5,424,473	$ -	$ -	$ 649,907	$ 722,666	$ 678,479	$ 438,885	$ 369,180	$ -	$ -	$ 2,006,881	$ 558,476	$ 6,438,521
20	Non-Residential Smart $aver Performanc	$ 271,486	23.17%	$ (62,901)	$ 208,585	6.64%	3	$ 78,962	76.83%	$ 102,774	$ 103,859	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ 22,611	$ 81,248	$ 206,633
21	Small Business Energy Saver	$ 1,090,996	23.17%	$ (252,776)	$ 838,220	6.64%	3	$ 317,316	76.83%	$ 413,007	$ 1,535,667	$ -	$ -	$ -	$ -	$ 80,709	$ 217,323	$ 241,051	$ -	$ -	$ 498,186	$ 498,399	$ 1,948,674
22	Total for Non-Residential Conservation P	4,815,779		(1,115,782)	3,699,997			1,383,109		1,800,204	8,816,787	-	-	724,479	875,773	931,159	772,394	762,661	218,730	191,685	2,948,933	1,390,973	10,616,991
23	EnergyWise ® for Business	$ (253,102)	23.17%	$ 58,642	$ (194,460)	6.64%	1	$ (207,375)	76.83%	$ (269,912)	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -		$ -	$ (269,912)
24	Commercial, Industrial, & Governmental	$ 525,308	23.17%	$ (121,710)	$ 403,598	6.64%	3	$ 152,785	76.83%	$ 198,860	$ 392,343	$ -	$ -	$ 17,655 `	$ 28,315	$ 9,714	$ 25,139	$ 4,414	$ -	$ -	$ 58,027	$ 249,078	$ 591,203
25	Total for Non-Residential DSM Programs	272,206		(63,068)	209,138			(54,590)		(71,052)	392,343	-	-	17,655	28,315	9,714	25,139	4,414	-	-	58,027	249,078	321,291
26	Total Non Residential	5,087,985		(1,178,850)	3,909,134			1,328,520		1,729,152	9,209,130	-	-	742,134	904,088	940,873	797,533	767,075	218,730	191,685	3,006,961	1,640,051	10,938,282
27	Total All Programs	11,449,318		(2,652,727)	8,796,591			2,149,608		2,797,850	21,636,516	-	-	2,050,273	2,081,861	1,944,323	1,641,770	1,658,908	2,263,748	2,184,596	4,679,052	3,131,985	24,434,366

Duke Energy Progress
For the Period January 1, 2015 - December 31, 2020
Docket Number E-2, Sub 1206
North Carolina Net Lost Revenue for Vintages 2015 - 2020

			Vintage 2015			Jan-Mar 15			
Line	**Residential**	**2014**	**2015**	**2016**	**2017**	**2018**	**2019**	**2020**	**Total**
1	Appliance Recycling Program		$ 123,909	$ 238,215	$ 246,008	$ 46,773			$ 654,905
2	Energy Education Program for Schools		$ 71,588	$ 120,886	$ 124,841	$ 24,793			$ 342,109
3	Energy Efficient Lighting		$ 1,665,788	$ 3,332,098	$ 3,441,107	$ 543,482			$ 8,982,475
4	Home Energy Improvement Program		$ 170,038	$ 347,916	$ 359,298	$ 65,837			$ 943,088
5	Multi-Family		$ 429,296	$ 909,897	$ 939,665	$ 184,586			$ 2,463,444
6	My Home Energy Report		$ 4,024,242	$ -	$ -	$ -			$ 4,024,242
7	Neighborhood Energy Saver		$ 54,534	$ 89,993	$ 92,937	$ 15,460			$ 252,924
8	Residential New Construction		$ 252,450	$ 390,785	$ 403,570	$ 55,643			$ 1,102,448
9	Save Energy and Water Kit		$ -	$ -	$ -	$ -			$ -
10	Total Lost Revenues	$ -	$ 6,791,845	$ 5,429,790	$ 5,607,426	$ 936,574			$ 18,765,635
11	Found Residential Revenues		$ -	$ -	$ -				-
12	Net Lost Residential Revenues	**$ -**	**$ 6,791,845**	**$ 5,429,790**	**$ 5,607,426**	**$ 936,574**			**$ 18,765,635**

Line	**Non-Residential**	**2014**	**2015**	**2016**	**2017**	**2018**	**2019**	**2020**	**Total**
13	Energy Efficiency for Business		$ 1,386,578	$ 2,353,629	$ 2,443,707	$ 361,644			$ 6,545,559
14	Energy Efficient Lighting		$ 420,420	$ 846,915	$ 879,329	$ 121,833			$ 2,268,497
15	Small Business Energy Saver		$ 737,092	$ 1,703,045	$ 1,768,224	$ 305,285			$ 4,513,645
16	EnergyWise for Business		$ -	$ -	$ -	$ -			$ -
17	Total Lost Revenues	$ -	$ 2,544,090	$ 4,903,589	$ 5,091,260	$ 788,762			$ 13,327,701
18	Found Non-Residential Revenues		$ -	$ -	$ -				$ -
19	Net Lost Non-Residential Revenues	**$ -**	**$ 2,544,090**	**$ 4,903,589**	**$ 5,091,260**	**$ 788,762**			**$ 13,327,701**

Line	**DSDR**		**2015**	**2016**	**2017**	**2018**	**2019**	**2020**	**Total**
20	DSDR	$ -	$ 420,831	$ 145,979	**$ -**	**$ -**			$ 566,810

			Vintage 2016						
Line	**Residential**	**2014**	**2015**	**2016**	**2017**	**2018**	**2019**	**2020**	**Total**
1	Appliance Recycling Program			$ 5,095	$ 12,308	$ 5,392	$ 3,265	$ -	$ 26,060
2	Energy Education Program for Schools			$ 59,240	$ 135,532	$ 45,380	$ 18,760	$ -	$ 258,912
3	Energy Efficient Lighting			$ 1,033,814	$ 2,116,981	$ 650,510	$ 233,337	$ -	$ 4,034,642
4	Home Energy Improvement Program			$ 163,848	$ 370,108	$ 105,628	$ 31,983	$ -	$ 671,566
5	Multi-Family			$ 332,768	$ 658,165	$ 182,400	$ 50,332	$ -	$ 1,223,664
6	My Home Energy Report			$ 5,418,524	$ -	$ -	$ -	$ -	$ 5,418,524
7	Neighborhood Energy Saver			$ 44,319	$ 105,283	$ 31,744	$ 10,875	$ -	$ 192,221
8	Residential Energy Assessments			$ 106,622	$ 320,122	$ 96,752	$ 23,120	$ -	$ 546,615
9	Residential New Construction			$ 274,821	$ 608,926	$ 167,378	$ 51,186	$ -	$ 1,102,311
10	Save Energy and Water Kit			$ 362,685	$ 987,169	$ 274,247	$ 78,992	$ -	$ 1,703,093
11	Total Lost Revenues	$ -	$ -	$ 7,801,736	$ 5,314,593	$ 1,559,431	$ 501,848	$ -	$ 15,177,608
12	Found Residential Revenues			$ -	$ -	$ -			-
13	Net Lost Residential Revenues	**$ -**	**$ -**	**7,801,736**	**5,314,593**	**1,559,431**	**501,848**	**-**	**$ 15,177,608**

Line	**Non-Residential**	**2014**	**2015**	**2016**	**2017**	**2018**	**2019**	**2020**	**Total**
14	Business Energy Reports			$ 191,245	$ -	$ -	-	-	$ 191,245
15	Energy Efficiency for Business			$ 1,638,505	$ 3,101,812	$ 1,790,225	694,350	-	$ 7,224,892
16	Energy Efficient Lighting			$ 246,438	$ 478,231	$ 276,035	125,435	-	$ 1,126,139
17	Small Business Energy Saver			$ 1,100,746	$ 2,221,654	$ 1,282,342	535,303	-	$ 5,140,045
18	EnergyWise for Business			$ 7,298	$ 19,733	$ 11,390	$ 6,032	$ -	$ 44,453
19	Total Lost Revenues	$ -	$ -	$ 3,184,232	$ 5,821,430	$ 3,359,992	$ 1,361,119	$ -	$ 13,726,774
20	Found Non-Residential Revenues			$ (68,561)	$ (113,553)	$ (69,282)		$ -	$ (251,396)
21	Net Lost Non-Residential Revenues	**$ -**	**$ -**	**$ 3,115,672**	**$ 5,707,877**	**$ 3,290,710**	**$ 1,361,119**	**$ -**	**$ 13,475,378**

Line	**DSDR**	**2014**	**2015**	**2016**	**2017**	**2018**	**2019**	**2020**	**Total**
22	DSDR	$ -	$ -	$ 115,745	$ 66,983				$ 182,728

Vintage 2017

Line	Residential	2014	2015	2016	2017	2018	2019	2020	Total
1	Appliance Recycling Program				$ -	$ -	$ -	$ -	$ -
2	Energy Education Program for Schools				$ 75,158	$ 79,788	$ 67,465	$ -	$ 222,411
3	Energy Efficient Lighting				$ 650,874	$ 1,113,237	$ 995,775	$ -	$ 2,759,885
4	Home Energy Improvement Program				$ 235,241	$ 276,922	$ 235,556	$ -	$ 747,719
5	Multi-Family				$ 458,694	$ 639,583	$ 562,483	$ -	$ 1,660,760
6	My Home Energy Report				$ 6,016,176	$ -	$ -	$ -	$ 6,016,176
7	Neighborhood Energy Saver				$ 42,581	$ 59,659	$ 51,044	$ -	$ 153,284
8	Residential Energy Assessments				$ 210,303	$ 268,902	$ 163,540	$ -	$ 642,744
9	Residential New Construction				$ 369,740	$ 507,001	$ 501,268	$ -	$ 1,378,008
10	Save Energy and Water Kit				$ 754,565	$ 916,378	$ 792,743	$ -	$ 2,463,686
11	Total Lost Revenues	$ -	$ -	$ -	$ 8,813,332	$ 3,861,470	$ 3,369,874	$ -	$ 16,044,675
12	Found Residential Revenues				$ -	$ -	$ -	$ -	-
13	Net Lost Residential Revenues	**$ -**	**$ -**	**$ -**	**$ 8,813,332**	**$ 3,861,470**	**$ 3,369,874**	**$ -**	**$ 16,044,675**

Line	Non-Residential	2014	2015	2016	2017	2018	2019	2020	Total
14	Business Energy Report				$ 577	$ -	$ -	$ -	$ 577
15	Energy Efficiency for Business				$ 2,406,056	$ 4,327,920	$ 4,466,854	$ -	$ 11,200,830
16	Energy Efficient Lighting				$ 173,544	$ 294,923	$ 314,218	$ -	$ 782,685
17	Small Business Energy Saver				$ 1,045,486	$ 1,803,999	$ 1,986,908	$ -	$ 4,836,393
18	Non-Res SmartSaver Performance				$ 8,952	$ 20,325	$ 21,017	$ -	$ 50,294
19	EnergyWise for Business				$ 29,965	$ 45,234	$ 46,773	$ -	$ 121,972
20	Total Lost Revenues	$ -	$ -	$ -	$ 3,664,580	$ 6,492,402	$ 6,835,770	$ -	$ 16,992,751
21	Found Non-Residential Revenues				$ (72,644)	$ (106,296)	$ (106,296)	$ -	$ (285,236)
22	Net Lost Non-Residential Revenues	**$ -**	**$ -**	**$ -**	**$ 3,591,936**	**$ 6,386,106**	**$ 6,729,474**	**$ -**	**$ 16,707,516**

Line	DSDR	2014	2015	2016	2017	2018	2019	2020	Total
23	DSDR	$ -	$ -	$ -	$ 65,125	$ 2,329	$ -	$ -	$ 67,453

Vintage 2018

Line	Residential	2014	2015	2016	2017	2018	2019	2020	Total
1	Appliance Recycling Program					$ -	$ -	$ -	$ -
2	Energy Education Program for Schools					$ 68,911	$ 99,626	$ 122,730	$ 291,267
3	Energy Efficient Lighting					$ 642,900	$ 1,172,842	$ 1,311,236	$ 3,126,978
4	Home Energy Improvement Program					$ 224,364	$ 193,400	$ 421,129	$ 838,893
5	Multi-Family					$ 434,773	$ 769,220	$ 803,785	$ 2,007,778
6	My Home Energy Report					$ 6,433,772	$ -	$ -	$ 6,433,772
7	Neighborhood Energy Saver					$ 27,317	$ 103,639	$ 54,412	$ 185,368
8	Residential Energy Assessments					$ 236,716	$ 140,525	$ 411,000	$ 788,241
9	Residential New Construction					$ 440,096	$ 888,107	$ 864,756	$ 2,192,959
10	Save Energy and Water Kit					$ 440,027	$ 1,495,300	$ 807,224	$ 2,742,550
11	Total Lost Revenues	$ -	$ -	$ -	$ -	$ 8,948,875	$ 4,862,660	$ 4,796,272	$ 18,607,807
12	Lost Revenue Decrement Pending Rate Case Implementation							$ (727,075)	$ (727,075)
13	Found Residential Revenues				$ -	$ (4,903)	$ -	$ (8,353)	(13,255)
14	Net Lost Residential Revenues	**$ -**	**$ -**	**$ -**	**$ -**	**$ 8,943,972**	**$ 4,862,660**	**$ 4,060,845**	**$ 17,867,477**

Line	Non-Residential	2014	2015	2016	2017	2018	2019	2020	Total
15	Business Energy Report					$ -	$ -	$ -	$ -
16	Energy Efficient Lighting					$ 169,509	$ 250,652	$ 345,637	$ 765,798
17	Non-Residential Smart $aver Prescriptive					$ 2,158,762	$ 1,771,404	$ 3,412,457	$ 7,342,624
18	Non-Residential Smart $aver Custom					$ 345,367	$ -	$ 514,343	$ 859,710
19	Non-Res SmartSaver Performance					$ 25,808	$ 71,032	$ 65,949	$ 162,788
20	Small Business Energy Saver					$ 864,421	$ 2,196,937	$ 1,612,478	$ 4,673,836
21	EnergyWise for Business					$ 665	$ 34,279	$ 1,480	$ 36,424
22	Total Lost Revenues	$ -	$ -	$ -		$ 3,564,532	$ 4,324,304	$ 5,952,343	$ 13,841,180
23	Lost Revenue Decrement Pending Rate Case Implementation							$ (902,326)	$ (902,326)
24	Found Non- Residential Revenues					$ (31,247)	$ (144,767)	$ (55,439)	$ (231,452)
25	Net Lost Non-Residential Revenues	**$ -**	**$ -**	**$ -**		**$ 3,533,286**	**$ 4,179,537**	**$ 4,994,579**	**$ 12,707,402**

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

Vintage 2019

Line	Residential	2014	2015	2016	2017	2018	2019	2020	Total
1	Appliance Recycling Program						$ -	$ -	$ -
2	Energy Education Program for Schools						$ 45,488	$ 132,191	$ 177,680
3	Energy Efficient Lighting						$ 660,301	$ 1,293,869	$ 1,954,170
4	Home Energy Improvement Program						$ 109,946	$ 206,878	$ 316,824
5	My Home Energy Report						$ 6,365,499	$ -	$ 6,365,499
6	Neighborhood Energy Saver						$ 54,545	$ 103,750	$ 158,295
7	Multi-Family Energy Efficiency						$ 456,925	$ 777,741	$ 1,234,667
8	Residential Energy Assessments						$ 77,791	$ 205,153	$ 282,944
9	Residential New Construction						$ 47,875	$ 907,966	$ 955,841
10	Save Energy and Water Kit						$ 912,388	$ 1,465,807	$ 2,378,195
11	Total Lost Revenues	$ -	$ -	$ -	$ -	$ -	$ 8,730,758	$ 5,093,355	$ 13,824,113
12	Lost Revenue Decrement Pending Rate Case Implementation							$ (772,110)	$ (772,110)
13	Found Residential Revenues	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
14	Net Lost Residential Revenues	$ -	$ -	$ -	$ -	$ -	**$ 8,730,758**	**$ 4,321,245**	**$ 13,052,003**

Line	Non-Residential	2014	2015	2016	2017	2018	2019	2020	Total
15	Business Energy Reports					$ -	$ -	$ -	$ -
16	Energy Efficiency for Business					$ -	$ 1,003,105	$ 1,443,982	$ 2,447,087
17	Energy Efficient Lighting					$ -	$ 174,071	$ 262,223	$ 436,293
18	Non-Residential Smart $aver Performance Incentive					$ -	$ 120,492	$ 224,180	$ 344,672
19	Small Business Energy Saver					$ -	$ 960,827	$ 1,602,762	$ 2,563,589
20	EnergyWise ® for Business					$ -	$ 32,780	$ 1,952	$ 34,732
21	Total Lost Revenues	$ -	$ -	$ -	$ -	$ -	$ 2,291,275	$ 3,535,099	$ 5,826,374
22	Lost Revenue Decrement Pending Rate Case Implementation							$ (535,892)	$ (535,892)
23	Found Non- Residential Revenues	$ -	$ -	$ -	$ -	$ -	$ (79,389)	$ -	$ (79,389)
24	Net Lost Non-Residential Revenues	$ -	$ -	$ -	$ -	$ -	**$ 2,211,886**	**$ 2,999,207**	**$ 5,211,093**

Vintage 2020

Line	Residential	2014	2015	2016	2017	2018	2019	2020	Total
1	Appliances and Devices						$ -	$ 713,972	$ 713,972
2	Energy Education Program for Schools						$ -	$ 78,559	$ 78,559
3	Energy Efficient Lighting						$ -	$ 205,956	$ 205,956
4	Residential Smart $aver						$ -	$ 139,579	$ 139,579
5	Multi-Family						$ -	$ 460,814	$ 460,814
6	Neighborhood Energy Saver						$ -	$ 50,196	$ 50,196
7	Residential Energy Assessments						$ -	$ 204,880	$ 204,880
8	Residential New Construction						$ -	$ 498,971	$ 498,971
9	My Home Energy Report						$ -	$ 8,419,925	$ 8,419,925
10	Total Lost Revenues	$ -	$ -	$ -	$ -	$ -	$ -	$ 10,772,852	$ 10,772,852
11	Lost Revenue Decrement Pending Rate Case Implementation							$ (1,633,075)	$ (1,633,075)
12	Found Residential Revenues	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
13	Net Lost Residential Revenues	$ -	$ -	$ -	$ -	$ -	$ -	**$ 9,139,777**	**$ 9,139,777**

Line	Non-Residential	2014	2015	2016(a)	2017	2018	2019	2020	Total
14	Non-Residential Smart $aver Performance (Custom)						$ -	$ 391,253	$ 391,253
15	Energy Efficient Lighting						$ -	$ 41,579	$ 41,579
16	Non-Residential Smart $aver Performance (Prescriptive)						$ -	$ 1,452,377	$ 1,452,377
17	Non-Residential Smart $aver Performance Incentive						$ -	$ 138,855	$ 138,855
18	Small Business Energy Saver						$ -	$ 808,177	$ 808,177
19	EnergyWise ® for Business						$ -	$ 1,175	$ 1,175
20	Total Lost Revenues	$ -	$ -	$ -	$ -	$ -	$ -	$ 2,833,415	$ 2,833,415
21	Lost Revenue Decrement Pending Rate Case Implementation							$ (429,522)	$ (429,522)
22	Found Non- Residential Revenues	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
23	Net Lost Non-Residential Revenues	$ -	$ -	$ -	$ -	$ -	$ -	**$ 2,403,893**	$ 2,403,893

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

Duke Energy Progress
For the Period January 1, 2016 - December 31, 2017
Docket Number E-2, Sub 1206
North Carolina Net Lost Revenue True Up for Vintages 2016 - 2017

		Vintage 2016 as Filed Lost Revenue kWh $				
Line	Residential	2016(a)	2017(a)	2018	2019	Total
1	Appliance Recycling Program	$ 5,095	$ 12,308	$ 5,330	$ 3,265	$ 25,998
2	Energy Education Program for Schools	$ 59,240	$ 135,532	$ 44,845	$ 18,760	$ 258,377
3	Energy Efficient Lighting	$ 1,033,814	$ 2,116,981	$ 642,767	$ 233,337	$ 4,026,900
3	Home Energy Improvement Program	$ 163,848	$ 370,108	$ 104,359	$ 31,983	$ 670,297
4	My Home Energy Report	$ 5,418,524	$ -	$ -	$ -	$ 5,418,524
5	Neighborhood Energy Saver	$ 44,319	$ 105,283	$ 31,366	$ 10,875	$ 191,842
6	Multi-Family	$ 332,768	$ 658,165	$ 180,201	$ 50,332	$ 1,221,466
7	Residential Energy Assessments	$ 74,198	$ 222,923	$ 66,506	$ 23,120	$ 386,746
8	Residential New Construction	$ 298,122	$ 670,358	$ 183,321	$ 51,186	$ 1,202,988
9	Save Energy and Water Kit	$ 362,685	$ 987,169	$ 270,943	$ 78,992	$ 1,699,788
10	Lost Residential Revenues	**$ 7,792,613**	**$ 5,278,826**	**$ 1,529,639**	**$ 501,848**	**$ 15,102,926**
11	Found Residential Revenues	$ -	$ -	$ -	$ -	$ -
12	Net Lost Residential Revenues	**$ 7,792,613**	**$ 5,278,826**	**$ 1,529,639**	**$ 501,848**	**$ 15,102,926**

	Non-Residential	2016(a)	2017(a)	2018	2019	Total
11	Business Energy Reports	$ 191,245	$ -	$ -	$ -	$ 191,245
12	Energy Efficiency for Business	$ 1,638,505	$ 3,101,812	$ 1,851,190	$ 694,350	$ 7,285,857
13	Energy Efficient Lighting	$ 246,438	$ 478,231	$ 285,436	$ 125,435	$ 1,135,539
14	Small Business Energy Saver	$ 1,100,746	$ 2,221,654	$ 1,326,012	$ 535,303	$ 5,183,715
15	EnergyWise for Business	$ 7,298	$ 19,733	$ 11,778	$ 6,032	$ 44,841
16	Net Lost Non-Residential Revenues	**$ 3,184,232**	**$ 5,821,430**	**$ 3,474,415**	**$ 1,361,119**	**$ 13,841,197**
17	Found Non- Residential Revenues	$ (68,561)	$ (113,553)	$ (113,553)	$ -	$ (295,666)
18	Net Lost Non-Residential Revenues	**$ 3,115,672**	**$ 5,707,877**	**$ 3,360,863**	**$ 1,361,119**	**$ 13,545,531**

	DSDR	2016(a)	2017(a)	2018		Total
19	DSDR	$ 115,745	$ 66,983	$ -		**$ 182,728**

		Vintage 2017 as Filed Lost Revenue kWh $				
Line	Residential	2016(a)	2017(a)	2018	2019	Total
1	Appliance Recycling Program	$ -	$ -	$ -	$ -	$ -
2	Energy Education Program for Schools	$ -	$ 75,158	$ 78,876	$ 67,465	$ 221,498
3	Energy Efficient Lighting	$ -	$ 649,785	$ 1,108,222	$ 995,775	$ 2,753,782
4	Home Energy Improvement Program	$ -	$ 235,278	$ 273,767	$ 235,556	$ 744,601
5	Multi-Family	$ -	$ 458,691	$ 632,090	$ 562,483	$ 1,653,264
6	My Home Energy Report	$ -	$ 6,016,176	$ -	$ -	$ 6,016,176
7	Neighborhood Energy Saver	$ -	$ 42,581	$ 58,972	$ 51,044	$ 152,597
8	Residential Energy Assessments	$ -	$ 147,827	$ 187,215	$ 163,540	$ 498,583
9	Residential New Construction	$ -	$ 425,229	$ 571,056	$ 501,268	$ 1,497,553
10	Save Energy and Water Kit	$ -	$ 754,565	$ 905,753	$ 792,743	$ 2,453,061
11	Lost Residential Revenues	**$ -**	**$ 8,805,290**	**$ 3,815,952**	**$ 3,369,874**	**$ 15,991,116**
12	Found Residential Revenues	$ -	$ -	$ -	$ -	$ -
13	Net Lost Residential Revenues	**$ -**	**$ 8,805,290**	**$ 3,815,952**	**$ 3,369,874**	**$ 15,991,116**

	Non-Residential	2016(a)	2017(a)	2018	2019	Total
14	Business Energy Report	$ -	$ 577	$ -	$ -	$ 577
15	Energy Efficiency for Business	$ -	$ 2,392,469	$ 4,469,059	$ 4,466,854	$ 11,328,382
16	Energy Efficient Lighting	$ -	$ 140,167	$ 327,687	$ 314,218	$ 782,073
17	Small Business Energy Saver	$ -	$ 1,079,154	$ 1,987,679	$ 1,986,908	$ 5,053,741
18	Non-Res SmartSaver Performance	$ -	$ 8,952	$ 21,025	$ 21,017	$ 50,993
19	EnergyWise for Business	$ -	$ 29,965	$ 46,791	$ 46,773	$ 123,529
20	Net Lost Non-Residential Revenues	**$ -**	**$ 3,651,284**	**$ 6,852,241**	**$ 6,835,770**	**$ 17,339,295**
21	Found Non- Residential Revenues	$ -	$ (72,644)	$ (106,296)	$ (106,296)	$ (285,236)
22	Net Lost Non-Residential Revenues	**$ -**	**$ 3,578,640**	**$ 6,745,945**	**$ 6,729,474**	**$ 17,054,059**

	DSDR	2016(a)	2017(a)	2018	2019	Total
23	DSDR	$ -	$ 65,125	$ 2,329	$ -	**$ 67,453**

Duke Energy Progress
For the Period January 1, 2016 - December 31, 2017
Docket Number E-2, Sub 1206
North Carolina Net Lost Revenue True Up for Vintages 2016 ·

Vintage 2016 True Up Lost Revenue kWh $

Line	Residential	2016(a)	2017(a)	2018	2019	Total
1	Appliance Recycling Program	$ 5,095	$ 12,308	$ 5,392	$ 3,265	$ 26,060
2	Energy Education Program for Schools	$ 59,240	$ 135,532	$ 45,380	$ 18,760	$ 258,912
3	Energy Efficient Lighting	$ 1,033,814	$ 2,116,981	$ 650,510	$ 233,337	$ 4,034,642
3	Home Energy Improvement Program	$ 163,848	$ 370,108	$ 105,628	$ 31,983	$ 671,566
4	My Home Energy Report	$ 5,418,524	$ -	$ -	$ -	$ 5,418,524
5	Neighborhood Energy Saver	$ 44,319	$ 105,283	$ 31,744	$ 10,875	$ 192,221
6	Multi-Family	$ 332,768	$ 658,165	$ 182,400	$ 50,332	$ 1,223,664
7	Residential Energy Assessments	$ 106,622	$ 320,122	$ 96,752	$ 23,120	$ 546,615
8	Residential New Construction	$ 274,821	$ 608,926	$ 167,378	$ 51,186	$ 1,102,311
9	Save Energy and Water Kit	$ 362,685	$ 987,169	$ 274,247	$ 78,992	$ 1,703,093
10	Lost Residential Revenues	**$ 7,801,736**	**$ 5,314,593**	**$ 1,559,431**	**$ 501,848**	**$ 15,177,608**
11	Found Residential Revenues	$ -	$ -	$ -	$ -	$ -
12	Net Lost Residential Revenues	**$ 7,801,736**	**$ 5,314,593**	**$ 1,559,431**	**$ 501,848**	**$ 15,177,608**
		-	-	-		

Line	Non-Residential	2016(a)	2017(a)	2018	2019	Total
11	Business Energy Reports	$ 191,245	$ -	$ -	$ -	$ 191,245
12	Energy Efficiency for Business	$ 1,638,505	$ 3,101,812	$ 1,790,225	$ 694,350	$ 7,224,892
13	Energy Efficient Lighting	$ 246,438	$ 478,231	$ 276,035	$ 125,435	$ 1,126,139
14	Small Business Energy Saver	$ 1,100,746	$ 2,221,654	$ 1,282,342	$ 535,303	$ 5,140,045
15	EnergyWise for Business	$ 7,298	$ 19,733	$ 11,390	$ 6,032	$ 44,453
16	Net Lost Non-Residential Revenues	**$ 3,184,232**	**$ 5,821,430**	**$ 3,359,992**	**$ 1,361,119**	**$ 13,726,774**
17	Found Non- Residential Revenues	$ (68,561)	$ (113,553)	$ (69,282)	$ -	$ (251,396)
18	Net Lost Non-Residential Revenues	**$ 3,115,672**	**$ 5,707,877**	**$ 3,290,710**	**$ 1,361,119**	**$ 13,475,378**

Line	DSDR	2016(a)	2017(a)	2018		Total
19	DSDR	$ 115,745	$ 66,983	$ -	$ -	**$ 182,728**

Vintage 2017 True Up Lost Revenue kWh $

Line	Residential	2016(a)	2017(a)	2018	2019	Total
1	Appliance Recycling Program	$ -	$ -	$ -	$ -	$ -
2	Energy Education Program for Schools	$ -	$ 75,158	$ 79,788	$ 67,465	$ 222,411
3	Energy Efficient Lighting	$ -	$ 650,874	$ 1,113,237	$ 995,775	$ 2,759,885
4	Home Energy Improvement Program	$ -	$ 235,241	$ 276,922	$ 235,556	$ 747,719
5	Multi-Family	$ -	$ 458,694	$ 639,583	$ 562,483	$ 1,660,760
6	My Home Energy Report	$ -	$ 6,016,176	$ -	$ -	$ 6,016,176
7	Neighborhood Energy Saver	$ -	$ 42,581	$ 59,659	$ 51,044	$ 153,284
8	Residential Energy Assessments	$ -	$ 210,303	$ 268,902	$ 163,540	$ 642,744
9	Residential New Construction	$ -	$ 369,740	$ 507,001	$ 501,268	$ 1,378,008
10	Save Energy and Water Kit	$ -	$ 754,565	$ 916,378	$ 792,743	$ 2,463,686
11	Lost Residential Revenues	**$ -**	**$ 8,813,332**	**$ 3,861,470**	**$ 3,369,874**	**$ 16,044,675**
12	Found Residential Revenues	$ -	$ -	$ -	$ -	$ -
13	Net Lost Residential Revenues	**$ -**	**$ 8,813,332**	**$ 3,861,470**	**$ 3,369,874**	**$ 16,044,675**

Line	Non-Residential	2016(a)	2017(a)	2018	2019	Total
14	Business Energy Report	$ -	$ 577	$ -	$ -	$ 577
15	Energy Efficiency for Business	$ -	$ 2,406,056	$ 4,327,920	$ 4,466,854	$ 11,200,830
16	Energy Efficient Lighting	$ -	$ 173,544	$ 294,923	$ 314,218	$ 782,685
17	Small Business Energy Saver	$ -	$ 1,045,486	$ 1,803,999	$ 1,986,908	$ 4,836,393
18	Non-Res SmartSaver Performance	$ -	$ 8,952	$ 20,325	$ 21,017	$ 50,294
19	EnergyWise for Business	$ -	$ 29,965	$ 45,234	$ 46,773	$ 121,972
20	Net Lost Non-Residential Revenues	**$ -**	**$ 3,664,580**	**$ 6,492,402**	**$ 6,835,770**	**$ 16,992,751**
21	Found Non- Residential Revenues	$ -	$ (72,644)	$ (106,296)	$ (106,296)	$ (285,236)
22	Net Lost Non-Residential Revenues	**$ -**	**$ 3,591,936**	**$ 6,386,106**	**$ 6,729,474**	**$ 16,707,516**

Line	DSDR	2016(a)	2017(a)	2018	2019	Total
23	DSDR	$ -	$ 65,125	$ 2,329	$ -	**$ 67,453**

Evans Exhibit 2, page 6

Duke Energy Progress
For the Period January 1, 2016 - December 31, 2017
Docket Number E-2, Sub 1206
North Carolina Net Lost Revenue True Up for Vintages 2016 ·

Line	Residential	Vintage 2016 Variance Lost Revenue kWh $				
		2016(a)	**2017(a)**	**2018**	**2019**	**Total**
1	Appliance Recycling Program	$ -	$ -	$ 62	$ -	$ 62
2	Energy Education Program for Schools	$ -	$ -	$ 535	$ -	$ 535
3	Energy Efficient Lighting	$ -	$ -	$ 7,742	$ -	$ 7,742
3	Home Energy Improvement Program	$ -	$ -	$ 1,268	$ -	$ 1,268
4	My Home Energy Report	$ -	$ -	$ -	$ -	$ -
5	Neighborhood Energy Saver	$ -	$ -	$ 379	$ -	$ 379
6	Multi-Family	$ -	$ -	$ 2,199	$ -	$ 2,199
7	Residential Energy Assessments	$ 32,424	$ 97,199	$ 30,246	$ -	$ 159,870
8	Residential New Construction	$ (23,301)	$ (61,433)	$ (15,943)	$ -	$ (100,677)
9	Save Energy and Water Kit	$ -	$ -	$ 3,305	$ -	$ 3,305
10	Lost Residential Revenues	**$ 9,123**	**$ 35,767**	**$ 29,792**	**$ -**	**$ 74,682**
11	Found Residential Revenues	$ -	$ -	$ -	$ -	$ -
12	Net Lost Residential Revenues	**$ 9,123**	**$ 35,767**	**$ 29,792**	**$ -**	**$ 74,682**

	Non-Residential	2016(a)	2017(a)	2018	2019	Total
11	Business Energy Reports	-	-	-	$ -	$ -
12	Energy Efficiency for Business	-	-	(60,965)	$ -	$ (60,965)
13	Energy Efficient Lighting	-	-	(9,400)	$ -	$ (9,400)
14	Small Business Energy Saver	-	-	(43,670)	$ -	$ (43,670)
15	EnergyWise for Business	-	-	(388)	$ -	$ (388)
16	Net Lost Non-Residential Revenues	**0**	**0**	**(114,423)**	**0**	**(114,423)**
17	Found Non- Residential Revenues	-	(0)	44,270	$ -	$ 44,270
18	Net Lost Non-Residential Revenues	**$ -**	**$ (0)**	**$ (70,153)**	**$ -**	**$ (70,153)**

	DSDR	2016(a)	2017(a)	2018	Total
19	DSDR	-	-	-	$ -

Line	Residential	Vintage 2017 Variance Lost Revenue kWh $				
		2016(a)	**2017(a)**	**2018**	**2019**	**Total**
1	Appliance Recycling Program	$ -	$ -	$ -	$ -	$ -
2	Energy Education Program for Schools	$ -	$ -	$ 913	$ -	$ 913
3	Energy Efficient Lighting	$ -	$ 1,089	$ 5,014	$ -	$ 6,103
4	Home Energy Improvement Program	$ -	$ (37)	$ 3,155	$ -	$ 3,118
5	Multi-Family	$ -	$ 3	$ 7,493	$ -	$ 7,496
6	My Home Energy Report	$ -	$ -	$ -	$ -	$ -
7	Neighborhood Energy Saver	$ -	$ -	$ 687	$ -	$ 687
8	Residential Energy Assessments	$ -	$ 62,475	$ 81,686	$ -	$ 144,161
9	Residential New Construction	$ -	$ (55,489)	$ (64,055)	$ -	$ (119,544)
10	Save Energy and Water Kit	$ -	$ -	$ 10,625	$ -	$ 10,625
11	Lost Residential Revenues	**$ -**	**$ 8,042**	**$ 45,518**	**$ -**	**$ 53,560**
12	Found Residential Revenues	$ -	$ -	$ -	$ -	$ -
13	Net Lost Residential Revenues	**$ -**	**$ 8,042**	**$ 45,518**	**$ -**	**$ 53,560**

	Non-Residential	2016(a)	2017(a)	2018	2019	Total
14	Business Energy Report	-	-	-	-	-
15	Energy Efficiency for Business	-	13,587	(141,139)	-	(127,552)
16	Energy Efficient Lighting	-	33,377	(32,764)	-	613
17	Small Business Energy Saver	-	(33,668)	(183,680)	-	(217,348)
18	Non-Res SmartSaver Performance	-	-	(700)	-	(700)
19	EnergyWise for Business	-	-	(1,557)	-	(1,557)
20	Net Lost Non-Residential Revenues	**0**	**13,296**	**(359,839)**	**0**	**(346,543)**
21	Found Non- Residential Revenues	-	-	-	-	-
22	Net Lost Non-Residential Revenues	**$ -**	**$ 13,296**	**$ (359,839)**	**$ -**	**$ (346,543)**

	DSDR	2016(a)	2017(a)	2018	2018	Total
23	DSDR	-	-	-	$ -	-

Evans Exhibit 3

Duke Energy Progress
Actual Program Costs for Vintage Years 2015 - 2018
Docket Number E-2 Sub 1206

			Carolinas System - 12 Months Ended 12/31/2015	Carolinas System - 12 Months Ended 12/31/2016	Carolinas System - 12 Months Ended 12/31/2017	Carolinas System - 12 Months Ended 12/31/2018
1	Appliance Recycling Program		$ 1,220,465	$ (137,009)	$ 5,586	$ -
2	Residential Service – Smart $aver		$ 5,298,232	$ 6,013,170	$ 6,961,463	$ 7,168,833
3	Residential Lighting Program		$ 14,616,136	$ 15,552,184	$ 10,904,279	$ 8,752,062
4	Neighborhood Energy Saver Program		$ 1,586,061	$ 2,052,535	$ 1,781,211	$ 1,845,739
5	Residential New Construction		$ 7,447,258	$ 9,405,615	$ 11,671,724	$ 13,189,949
6	Residential Energy Efficient Benchmarking		$ -	$ -	$ -	$ -
7	Residential Home Advantage		$ -	$ -	$ -	$ -
8	Energy Education Program for Schools		$ 703,689	$ 827,497	$ 835,991	$ 676,815
9	Multi-Family		$ 2,615,745	$ 2,045,220	$ 2,514,413	$ 2,409,743
10	My Home Energy Report		$ 5,808,941	$ 5,890,093	$ 6,753,153	$ 7,687,891
11	Residential Energy Assessments			$ 1,417,924	$ 1,863,486	$ 1,851,965
12	Save Energy and Water Kit			$ 674,538	$ 888,869	$ 825,279
13	Business Energy Report		$ 74,374	$ 69,516	$ 20,330	$ -
14	Energy Efficiency for Business		$ 6,226,453	$ 14,159,310	$ 21,749,807	$ 13,690,077
15	Energy Efficient Lighting		$ 1,775,958	$ 1,889,694	$ 1,324,943	$ 1,063,434
16	Non-Res SmartSaver Performance				$ 147,160	$ 201,559
17	Small Business Energy Saver		$ 9,780,196	$ 9,336,274	$ 8,770,755	$ 8,858,213
18	EnergyWise		$ 12,212,851	$ 13,633,666	$ 13,125,314	$ 14,619,512
19	EnergyWise for Business		$ 65,456	$ 1,112,815	$ 1,390,549	$ 2,108,030
20	CIG DR		$ 1,899,146	$ 1,615,703	$ 1,523,514	$ 1,692,473
21	**Total Energy Efficiency & Demand Side Program C**	Sum(Lines 1-19)	**$ 71,330,960**	**$ 85,558,746**	**$ 92,232,546**	**$ 86,641,573**
				$ -		
22	NC Allocation Factor for EE programs	Miller Exhibit 5 Pg.1 thr	85.29%	85.44%	85.51%	85.56%
23	NC Allocation Factor for DSM programs	Miller Exhibit 5 Pg.1 thr	86.05%	86.17%	86.16%	86.53%

			NC Allocated - 12 Months Ended 12/31/2015 (1)	NC Allocated - 12 Months Ended 12/31/2016 (1)	NC Allocated - 12 Months Ended 12/31/2017 (1)	NC Allocated - 12 Months Ended 12/31/2018 (1)
24	Appliance Recycling Program	Line 1 * Line 21	$ 1,040,934.99	$ (117,058.57)	$ 4,776.58	$ -
25	Residential Service – Smart $aver	Line 2 * Line 21	$ 4,518,861.95	$ 5,137,557.41	$ 5,952,627.50	$ 6,133,715.68
26	Residential Lighting Program	Line 3 * Line 21	$ 12,466,102.61	$ 13,287,540.35	$ 9,324,062.29	$ 7,488,339.94
27	Neighborhood Energy Saver Program	Line 4 * Line 21	$ 1,352,751.03	$ 1,753,653.63	$ 1,523,082.68	$ 1,579,230.00
28	Residential New Construction	Line 5 * Line 21	$ 6,351,766.01	$ 8,036,009.10	$ 9,980,291.02	$ 11,285,434.67
29	Residential Energy Efficient Benchmarking	Line 6 * Line 21	$ -	$ -	$ -	$ -
30	Residential Home Advantage	Line 7 * Line 21	$ -	$ -	$ -	$ -
31	Energy Education Program for Schools	Line 8 * Line 21	$ 600,176.12	$ 707,000.01	$ 714,841.32	$ 579,088.78
32	Multi-Family	Line 9 * Line 21	$ 2,230,968.51	$ 1,747,403.44	$ 2,150,031.73	$ 2,061,796.67
33	My Home Energy Report	Line 10 * Line 21	$ 4,954,445.77	$ 5,032,402.60	$ 5,774,505.65	$ 6,577,826.06
34	Residential Energy Assessments	Line 11 * Line 21	$ -	$ 1,211,452.08	$ 1,593,434.59	$ 1,584,557.04
35	Save Energy and Water Kit	Line 12 * Line 21	$ -	$ 576,314.67	$ 760,056.35	$ 706,115.88
36	Business Energy Report	Line 13 * Line 21	$ 63,433.37	$ 59,393.23	$ 17,383.70	$ -
37	Energy Efficiency for Business	Line 14 * Line 21	$ 5,310,541.74	$ 12,097,490.87	$ 18,597,886.97	$ 11,713,348.28
38	Energy Efficient Lighting	Line 15 * Line 21	$ 1,514,714.78	$ 1,614,524.95	$ 1,132,935.88	$ 909,883.35
39	Non-Res SmartSaver Performance	Line 16 * Line 21	$ -	$ -	$ 125,834.21	$ 172,455.95
40	Small Business Energy Saver	Line 17 * Line 21	$ 8,341,529.15	$ 7,976,765.21	$ 7,499,722.72	$ 7,579,163.64
41	EnergyWise	Line 18 * Line 22	$ 10,508,750.77	$ 11,747,962.62	$ 11,308,498.16	$ 12,650,326.09
42	EnergyWise for Business	Line 19 * Line 22	$ 56,323.08	$ 958,898.92	$ 1,198,068.36	$ 1,824,087.26
43	CIG DR	Line 20 * Line 22	$ 1,634,152	$ 1,392,232	$ 1,312,628	$ 1,464,504
44	**Total Energy Efficiency & Demand Side Program C**	Sum (Lines 21-39)	**$ 60,945,452**	**$ 73,219,542**	**$ 78,970,668**	**$ 74,309,873**

(1) NC Allocations are based on annual weighted average, which are employed in the allocation of Utility Cost Test (UCT) results for PPI determination. This differs from the allocation used in Miller

Evans Exhibit 4
Duke Energy Progress, LLC
January - December 2018 Actuals
January 2019 - December 2020 Estimates
Docket Number E-2, Sub 1206
North Carolina Found Revenues

	Actual/Reported KWH			Estimated KWH	
	2016	2017	2018	2019	2020
Economic Development	40,751,172	217,748,650	43,971,258	-	-
Lighting					
Residential	21,158	18,164	15,302	15,302	15,302
Non Residential (Regulated)	328,140	304,084	111,625	111,625	111,625
MV to LED Credit - Residential (Regulated)	(460,649)	(456,768)	(2,478)	(3,371)	(3,371)
MV to LED Credit - Non-Residential (Regulated)	(105,415)	(105,982)	(919)	(1,250)	(1,250)
Total KWH	40,534,406	217,508,148	44,094,788	122,305	122,305
Total KWH Included	(216,766)	(240,502)	123,530	122,305	122,305
Total KWH Included (net of Free Riders 15%)	(184,251)	(204,427)	105,001	103,959	103,959
Annualized Found Revenue - Non Residential	$ 113,553	$ 106,296	$ 55,439	$ 57,950	$ 55,252
Annualized Found Revenue - Residential	$ (279,063)	$ (297,693)	$ 8,353	$ 7,960	$ 7,769

	2016	2017	2018	2019	2020
Vintage 2016 - Non Res	$ 68,561	$ 113,553	$ 69,282	$ 22,835	$ -
Vintage 2017 - Non Res		$ 72,644	$ 106,296	$ 106,296	$ 33,652
Vintage 2018 - Non Res			$ 31,247	$ 55,439	$ 55,439
Vintage 2019 - Non Res				$ 31,390	$ 57,950
Vintage 2020 - Non Res					$ 29,928
Net Negative Found Revenues to Zero*	-	-	-	-	-
Subtotal - Non Res	**$ 68,561**	**$ 186,197**	**$ 206,825**	**$ 215,959**	**$ 176,969**
Vintage 2016 - Res	$ (150,940)	$ (279,063)	$ (76,592)	$ (20,406)	$ (20,406)
Vintage 2017 - Res		$ (160,772)	$ (199,235)	$ (173,325)	$ (173,325)
Vintage 2018 - Res			$ 4,903	$ 8,353	$ 8,353
Vintage 2019 - Res				$ 4,312	$ 4,312
Vintage 2020 - Res					$ -
Net Negative Found Revenues to Zero*	150,940	439,836	270,925	181,067	181,067
Subtotal - Residential	$ -	$ -	$ -	$ -	$ -
Total Found Revenues	**$ 68,561**	**$ 186,197**	**$ 206,825**	**$ 215,959**	**$ 176,969**

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

Evans Exhibit 5

Duke Energy Progress
System Event Based Demand Response January 1, 2018 - December 31, 2018
Docket Number E-2, Sub 1206

Date	State	Program Name	Event Trigger	Customers Notified /Switches Dispatched	MW Reduction
1/1/2018	NC and SC	DSDR	Capacity Needs	-NA-	426
1/2/2018	NC and SC	DEP DRA	Capacity Needs	14 Customers / 41 Sites	7.5
1/2/2018	NC	DEP EnergyWise Home	Capacity Needs	10,760/14,909	13.6
1/2/2018	NC and SC	DSDR	Capacity Needs	-NA-	714
1/2/2018	NC and SC	DSDR	Capacity Needs	-NA-	402
1/3/2018	NC and SC	DSDR	Capacity Needs	-NA-	1,446
1/3/2018	NC and SC	DSDR	Capacity Needs	-NA-	594
1/4/2018	NC and SC	DSDR	Capacity Needs	-NA-	487
1/4/2018	NC and SC	DSDR	Capacity Needs	-NA-	585
1/5/2018	NC	DEP EnergyWise Home	Capacity Needs	10,763/14,918	12.3
1/5/2018	NC and SC	DSDR	Capacity Needs	-NA-	867
1/5/2018	NC and SC	DSDR	Capacity Needs	-NA-	519
1/6/2018	NC and SC	DSDR	Capacity Needs	-NA-	989
1/7/2018	NC and SC	DEP DRA	Capacity Needs	14 Customers / 42 Sites	8.7
1/7/2018	NC	DEP EnergyWise Home	Capacity Needs	10,749/14,900	15
1/7/2018	NC and SC	DSDR	Capacity Needs	-NA-	1,177
1/8/2018	NC	DEP EnergyWise Home	Capacity Needs	10,749/14,900	5.6
1/8/2018	NC and SC	DSDR	Capacity Needs	-NA-	1,055
1/14/2018	NC and SC	DSDR	Capacity Needs	-NA-	617
1/15/2018	NC and SC	DEP DRA	Capacity Needs	14 Customers / 42 Sites	8.1
1/15/2018	NC	DEP EnergyWise Home	Capacity Needs	10,738/14,883	8.2
1/15/2018	NC and SC	DSDR	Capacity Needs	-NA-	633
1/16/2018	NC and SC	DSDR	Capacity Needs	-NA-	413
1/17/2018	NC and SC	DSDR	Capacity Needs	-NA-	1,005
1/18/2018	NC and SC	DEP DRA	Capacity Needs	14 Customers / 42 Sites	7.1
1/18/2018	NC	DEP EnergyWise Home	Capacity Needs	10,738/14,883	8.2
1/18/2018	NC and SC	DSDR	Capacity Needs	-NA-	899
3/9/2018	NC and SC	DSDR	Capacity Needs	-NA-	564
3/13/2018	NC and SC	DSDR	Capacity Needs	-NA-	526
3/15/2018	NC and SC	DSDR	Capacity Needs	-NA-	253
3/22/2018	NC and SC	DSDR	Capacity Needs	-NA-	189
6/18/2018	NC and SC	DSDR	Capacity Needs	-NA-	968
6/19/2018	NC and SC	DEP DRA	Tariff - Minimum Event	22 Customers / 71 Sites	22.2
6/19/2018	NC and SC	DSDR	Capacity Needs	-NA-	747
6/20/2018	NC and SC	DSDR	Capacity Needs	-NA-	1,019
8/8/2018	NC and SC	DEP DRA	Tariff - Minimum Event	22 Customers / 70 Sites	21.7
8/28/2018	NC and SC	DEP DRA	Tariff - Minimum Event	22 Customers / 70 Sites	20.7
8/28/2018	NC & SC	EnergyWise Business	Economic	3179	4
8/30/2018	NC & SC	DEP EnergyWise Home	Test	174,282/223,248	278
11/28/2018	NC	DEP EnergyWise Home	Capacity Needs	11,752/16,351	11.8
11/29/2018	NC	DEP EnergyWise Home	Capacity Needs	11,752/16,351	11
11/29/2018	NC and SC	DSDR	Capacity Needs	-NA-	516

Income-Qualified Programs

A. Description

Neighborhood Energy Savers

The purpose of Duke Energy Progress's ("DEP") Neighborhood Energy Saver program (the "Program") is to reduce energy usage through the direct installation of energy efficiency measures within the households of income-qualified residential customers. The Program utilizes Honeywell Building Solutions, which was awarded the contract through a competitive bid process, to (1) to identify appropriate energy conservation measures through an on-site energy assessment of the residence, (2) to install a comprehensive package of energy conservation measures at no cost to the customer, and (3) to provide one-on-one energy education. Program measures address end-uses in lighting, refrigeration, air infiltration and HVAC applications.

Program participants receive a free energy assessment of their homes followed by a recommendation of energy efficiency measures to be installed at no cost to the resident. A team of energy technicians install applicable measures and provide one-on-one energy education about each measure, emphasizing the benefit of each and recommending behavior changes to reduce and control energy usage. The goal is to serve a minimum of 4,500 households each year.

Pay for Performance

The Pay for Performance Pilot Program will provide payments, based on kilowatt-hour ("kWh") savings, to local non-profit organizations that provide weatherization and other energy saving upgrades to residential low-income households. These payments are intended to assist these organizations in expanding the number of customers they serve through their programs. The Program is also intended to leverage funding from other third-party sources.

The Company is proposing that this Pilot remain in place for thirty-six months and begin in Buncombe County, North Carolina.

Audience

Neighborhood Energy Savers

The Program is designed for individually-metered residential homeowners and tenants within DEP. Implementation of the program is done in neighborhoods designated by DEP. Income-eligible neighborhoods must have at least 50% of households with income equal to or less than 200% of the poverty level set by the U.S. Department of Energy. Participants are only able to participate in the Program once.

Pay for Performance

The Pay for Performance Pilot Program is designed for non-profit agencies providing weatherization and energy efficiency measures to low-income, individually-metered residential homeowners and tenants with incomes equal to or less than 200% of the poverty level living within DEP service territory.

B & C. Impacts, Participants and Expenses

2018 YTD Results	Annual Forecast	Actual at 12/31/2018	Variation
Savings (MWH)	2,033	2,279	246
Savings (MW)	0.31	0.35	0.04
Participants		5,047	
2018 Program Expenses		$1,845,739	

D. Qualitative Analysis

Highlights

Neighborhood Energy Savers

During 2018 the Program offered free walk-through energy assessments to 5 qualifying neighborhoods: Florence, SC; Asheville, NC; Jacksonville, NC; Lake City, SC and Sumter, SC. The program moved to and is currently working in Spring Lake, NC in January 2019. Neighborhood events included support from community groups and speakers such as elected officials, community leaders and community action agency representatives.

The program has been very successful and widely accepted by the eligible Duke Energy Progress customers. Nearly 70 percent of the eligible customers in the neighborhoods where the program has been offered have participated.

Pay for Performance

This program will launch January 1, 2019.

Issues

Neighborhood Energy Savers

The program continues to operate with minimal issues. The implementers are constantly striving to install the best quality measures and to use techniques that will motivate better customer behavior responses and participation.

Pay for Performance

None at this time since program has not officially launched.

Potential Changes

Neighborhood Energy Savers

None at this time.

Pay for Performance

None at this time.

E. Marketing Strategy

Neighborhood Energy Savers

Current methods of marketing the program have been very successful in driving participation. The Company will continue the following marketing strategies in 2018:

Direct mail (letters and postcards to qualifying customers)
Secure local support from community leaders and organizations
Community outreach events
Publicized kickoff events
Door-to-door canvassing

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

F. Evaluation, Measurement and Verification

The process and impact evaluation report for the Neighborhood Energy Saver portion of the Program is scheduled for completion in the third quarter of 2019 upon the program's transition to LEDs. This will be a combined evaluation with DEC. No EM&V for Pay for Performance is planned at this time.

Energy Efficiency Education Program

A. Description

The Energy Efficiency Education Program ("Program") is an energy efficiency program available to students in grades K-12 enrolled in public and private schools who reside in households served by Duke Energy Progress in North and South Carolina. 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 that educates students about energy, resources, the relationship between energy and resources, ways energy is wasted and ways they can 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 materials for their classrooms and assignments for students to take home. The workbooks, assignments, and activities meet state curriculum requirements.

School principals are the main point of contact for scheduling their school's performance. Once the principal confirms the performance date and time, all materials are scheduled for delivery two weeks prior to the performance. Materials include school posters, teacher guides, and classroom and family activity books.

Students are encouraged to compete a request form with their family (found in their classroom and family activity book, as well as online), 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.

Audience

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

B &C. Impacts, Participants and Expenses

2018 YTD Results	Annual Forecast	Actual at 12/31/2018	Variation
Savings (MWH)	1,997	2,563	566
Savings (MW)	0.20	0.77	.57
Participants		9,013	
2018 Program Expenses		$676,815	

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.

For the 2018-2019 school year, elementary students enjoy watching *Showdown at Resource Ranch* performed by two professional actors who lead the students through an action-packed Wild West adventure, all while teaching about energy conservation and resources. In this 25-minute play, Sheriff Carrie Gooper is on the case of a natural resource crisis throughout Dodge Ball City – but that's not all she has to deal with … she's also been challenged to a showdown by none other than notorious bandit, Billy the Kit! With the help of the students, will the sheriff be able to face Billy and find out what in tarnation is going on with the city's resources?

The Resource Force is performed by two professional actors who lead the students through a series of comical improvisational shenanigans, all while teaching about energy conservation and resources.
In this 40-minute show, the middle school students in grades 6-9 will assist the actors in constructing the show in front of them, as it happens, with their very own suggestions – so each show is unique to the audience that creates it! The show is a series of improvised comedy sketches between characters in all sorts of hilarious situations. Before each scene, actors interact with the audience and get ideas to use during the sketch, such as their favorite bands or a household pet. The ideas are incorporated into the show and may change the course of a scene.

What's Your Goal? is performed by two professional actors who lead the students through a series of interactive comedy sketches, all while teaching about the importance of energy efficiency.

In this 45-minute show, the high school students in grades 9-12 will assist with the improvisation process via audience participation and suggestions. Volunteers will be brought up on stage for games like "Carbon Footrace," puzzles, general improv shenanigans and energy-oriented trivia – so each performance is unique to the group of students that help create it!

The objective of the program is to encourage high school science classrooms, environmental clubs and Green Teams to champion energy conservation in their schools and communities. *What's Your Goal?* also offers the opportunity for the students (and staff) to save energy at home by providing Energy Kits that contain items to conserve electricity and water.

From January through December 2018, a total of 192 schools hosted 308 performances in the Company's DEP service territory, reaching approximately 71,906 students and spurring the distribution of 9,013 kits.

Once an eligible customer submits a completed energy efficiency, the Energy Efficiency Starter Kit is shipped for delivery within two to four weeks. To ensure customer satisfaction with the Energy Efficiency Starter Kit and the installation of items, customers receive an email reminder monthly after the kit delivery to encourage families to return their Business Reply Card (BRC) verifying installation of measures. Qualified households that submit their energy efficiency survey and return the BRC are automatically entered into the household contest drawing, sponsored by NTC.

Additionally, school and classroom contests encourage sign-ups, and NTC awards checks to schools whose students, along with their families, completed home energy surveys and received energy efficiency kits. In the fall and spring of each year, a drawing is held selecting one school and one household contest winner. Principals, teachers and students may view their school's progress and compare the number of sign-ups to other schools via the website, www.trackmysignups.org.

E. Marketing Strategy

The Company works through the vendor to market to schools. 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.

In Q1 2019, the Program plans to release a gamification application that will further drive participation in the program and provide an additional channel of on-going engagement with the students.

F. Evaluation, Measurement and Verification

The next evaluation work is combined Duke Energy Carolinas and Duke Energy Progress process and impact evaluation. Evaluation activities began third quarter of 2018, with a final report delivery date of First Quarter 2019.

The evaluator will verify impacts through engineering estimates. Participant surveys were also utilized to refine in-service rates, provide inputs into other algorithm variables, and help establish free ridership and spillover.

The process evaluation will help uncover participants' program awareness, identify opportunities to improve program operations, and measure participants' satisfaction with measures provided through the kit.

A. Description

The Save Energy and Water Kit Program ("SEWK") launched in November 2015. The Program is designed to increase the energy efficiency of residential customers by offering customers energy efficient water fixtures and insulating pipe tape 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. Customers owning and living in a single-family home with an electric water heater who have not received similar measures through another Company-offered energy efficiency program are eligible for the program. Kits are available in two sizes for homes with one or more full bathrooms and contain varying quantities of shower heads, bathroom aerators, kitchen aerator and insulating pipe tape. Program participants are eligible for one kit shipped free of charge to their home.

Customers are pre-screened based on the eligibility requirements. Marketing channels include both a direct mail business reply card (BRC) and direct email. Customers receiving the BRC may choose to return the BRC, navigate to a redemption website listed on the card, or call a toll-free number to take advantage of the offer. 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 the methods above, Energy Federation Inc. (EFI), 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 watch videos to aid in installing the kit measures.

Audience

The Program is available 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

2018 YTD Results	Annual Forecast	Actual at 12/31/2018	Variation
Savings (MWH)	21,484	15,252	-6,232
Savings (MW)	1.72	5.06	3.34
Participants		276,327	
2018 Program Expenses		$825,279	

D. Qualitative Analysis

Highlights

In 2018, the Program distributed over 276,000 water measures in over 28,000 kits to Duke Energy Progress customers in the Carolinas. These kits delivered approximately 68,878 bath aerators, 28,043 kitchen aerators, 39,191 showerheads, and 140,215 feet of pipe insulation. In 1Q 2018, Duke Energy expanded redemption channels to include online store for customers who prefer to enroll in the program online. Online redemptions were 17% of all redemptions.

Issues

The program was successfully launched without any issues regarding ordering, fulfillment or support of the program. EM&V data shows a higher percentage of gas water heater customers participated in the program in 2016 than expected. In 2017, the electric water heater propensity model was updated in order to reduce participation by customers with gas water heaters.

Potential Changes

In early 2019, the Program will add other energy efficient water saving products to the online ordering platform to allow customers to upgrade the products offered through the program and pay the difference during checkout.

E. Marketing Strategy

The overall strategy of the program is to reach residential customers who have not adopted low flow water devices. In 2Q 2018 the Company updated water kit materials to better educate customers on the benefits of low flow water devices. The updates also included streamlining the instruction manual to address installation barriers for consumers who have not participated in the program.

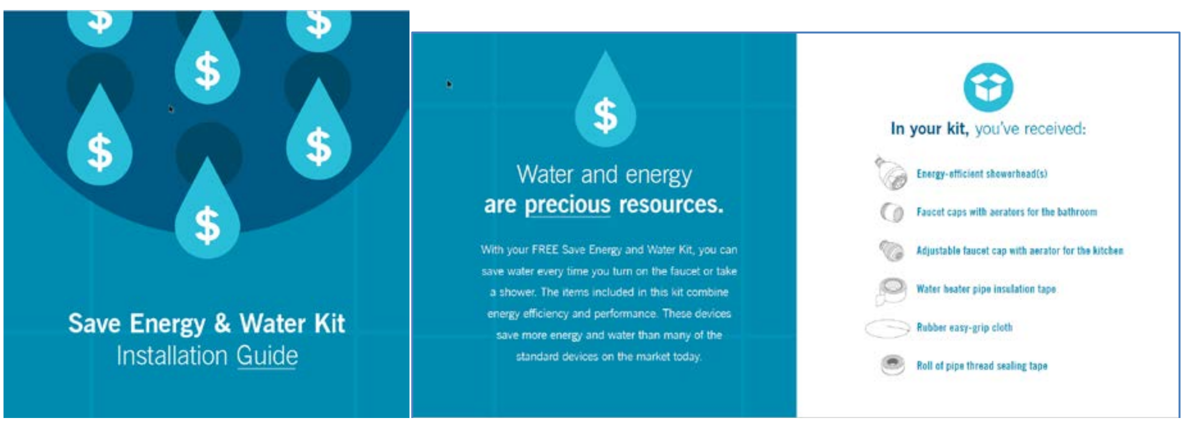
Both direct mail marketing in the form of BRCs and direct email are the current marketing channels being utilized by this program in the Carolinas. With the addition of online ordering and email as a marketing channel, the paper and cost associated with traditional mail solicitations has been reduced. Examples of the updated kit materials, direct mail, and direct email are included in the Appendix.

F. Evaluation, Measurement and Verification

No evaluation activities were conducted in 2018 for this program. Evaluation planning is expected to commence in 2019, with a final evaluation report tentatively scheduled for 2nd Quarter 2020.

G. Appendix

Save Energy and Water Kit Program Installation Guide



Showerhead Installation

Newer, top-of-the-line showerheads can help you save up to **2 gallons of water per minute** while maintaining water pressure and your comfort. For each energy-efficient showerhead installed, you save up to 52% on the energy used to heat water for showers.

What you'll need:

- **A. Energy-efficient showerhead(s)**
- **B. Rubber easy-grip cloth**
- **C. Pipe thread sealing tape**
- **D. Pliers**
- **E. Rag (not included)**

SHOWERHEAD

1. **Remove your existing showerhead.** Wrap the rubber easy-grip cloth around the base of your showerhead and turn counterclockwise (left) to loosen. Use pliers if necessary.
2. **Apply pipe thread sealing tape.** Once showerhead is removed, wipe pipe threads with the rag to remove excess moisture and residue. Wrap two layers of pipe thread sealing tape across the threads to cover them.
3. **Install your new energy-efficient showerhead.** Twist your new showerhead onto the threaded area of the shower arm in a clockwise direction (right).
4. **Test your showerhead.** When you turn the water on, look closely at the connection between the shower arm and the base of the showerhead collar to see if water is leaking. If so, tighten with pliers.
5. **Adjust the water flow mode.** Your new low-flow showerhead is equipped with two modes: massage and pulsating. Turn the outer ring all the way to the right for massage mode. Turn it all the way to the left for full-spray mode.

Faucet Aerator Installation

Mixing air with water reduces the amount of water needed. The aerator also maintains constant and satisfactory water pressure. Energy-efficient faucet aerators can **cut energy costs up to 46% annually** compared to non-energy-efficient aerators.

What you'll need:

- **A. Faucet caps with aerators***
- **B. Rubber easy-grip cloth**
- **C. Pliers (optional)**

* If the aerator provided in this kit does not fit your faucet, call 866.807.1544 to request a free adapter.

FAUCET AERATORS

1. **Remove your existing faucet cap.** Using the rubber easy-grip cloth, unscrew the existing faucet cap. If the faucet arm has threads on the inside (female), use male rubber washer. If it has threads on the outside (male), use female rubber washer.
2. **Install your new faucet cap with aerator.** Align the threads on the inside of the faucet arm with the exterior threads of the new cap. Turn the faucet cap in a clockwise (right) direction and tighten fully with the rubber easy-grip cloth.
3. **Test your new aerator(s).** While the water is flowing, look closely for any leaks at the threads. If you notice a leak or spray, tighten with the rubber easy-grip cloth.

TIP: Install your new tri-flow faucet cap in your kitchen

Use the dial to adjust the flow of water at three different rates. Try using the lowest setting for hand washing, the middle setting for washing dishes and the highest setting for filling pots or the sink.

Water Heater Pipe Wrap Insulation Tape Installation

Wrapping your water heater pipes is a simple way to manage water temperature in your home and **could save you nearly 17 percent on the energy used to heat water.**

What you'll need:

- **A. Insulation tape (one roll = 15 feet of tape)**
- **B. Scissors (not included)**

PIPE WRAP INSULATION TAPE

1. **Locate the hot water pipe for your water heater.** The hot water pipe extends out of the top or side of your water heater.

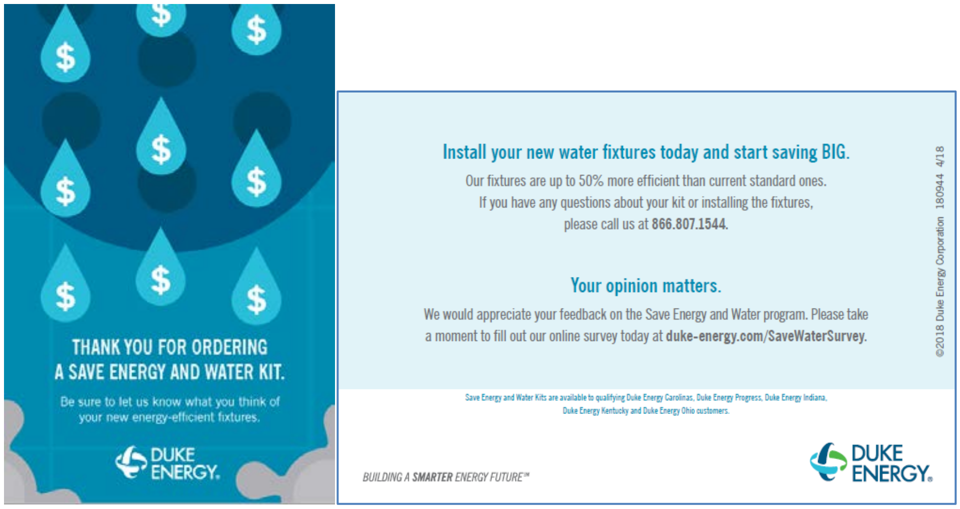
   CAUTION: The hot water pipe will be very warm to the touch. Note the length of that pipe where it leads out of the electric water heater and up into the subfloor or walls of your home.
2. **Make sure the pipe is both clean and dry.**
3. **Wrap your pipe with the tape.** Carefully wrap the tape fully around the exposed length of the pipe, making sure that the edges of the tape meet each time you wrap it around the pipe for maximum insulation and energy savings.

Need help installing your energy-efficient equipment?

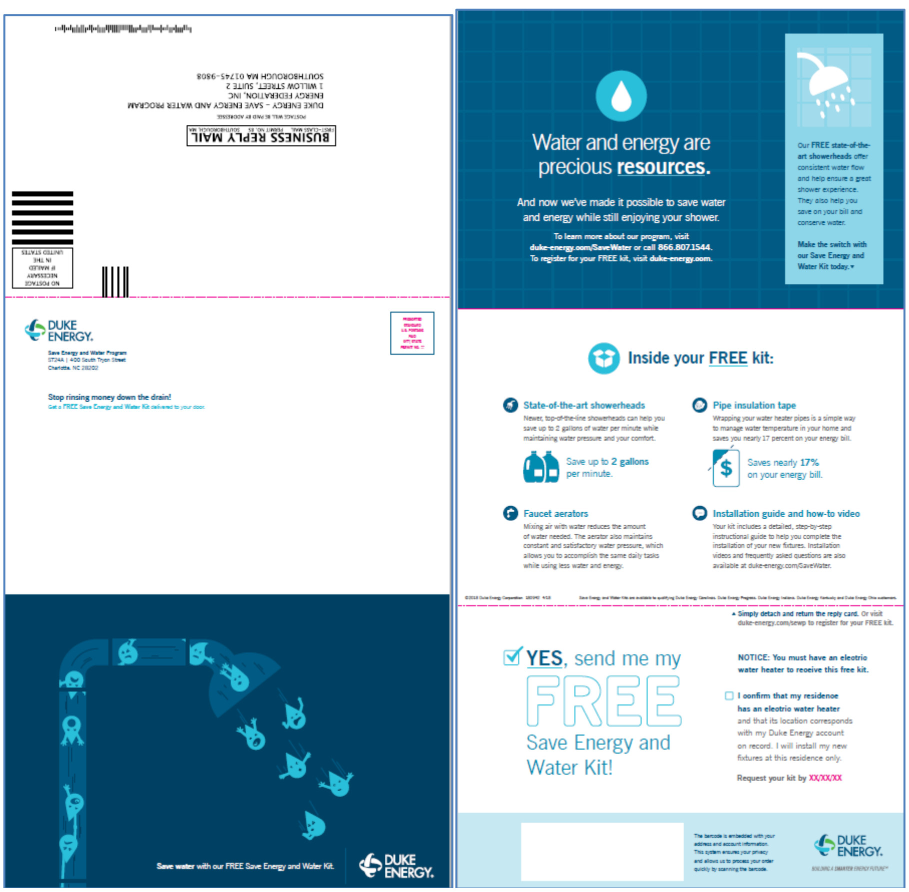
View our installation videos at **duke-energy.com/SaveWater** or call customer service at **866.807.1544** for assistance.

Save Energy and Water Kits are available to qualifying Duke Energy Carolinas, Duke Energy Progress, Duke Energy Indiana, Duke Energy Kentucky and Duke Energy Ohio customers.

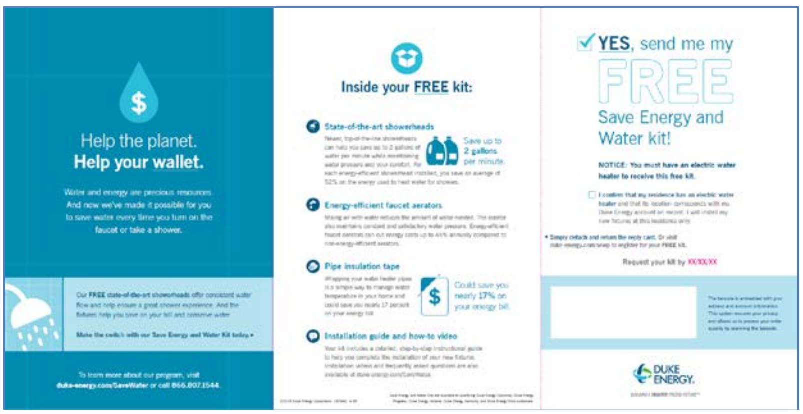
Save Energy and Water Kit Program Thank You Survey Card



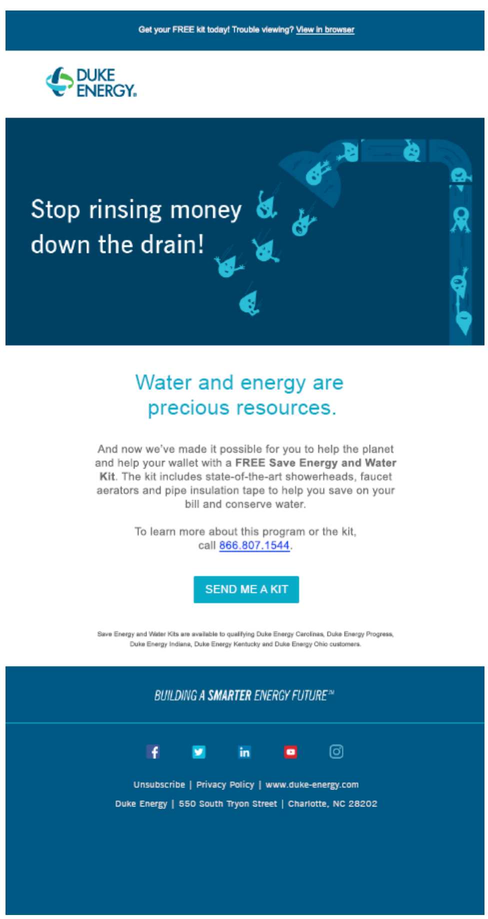
Save Energy and Water Kit Program Direct Mail



Save Energy and Water Kit Program Direct Mail



Save Energy and Water Kit Program Direct Email



A. Description

The Energy Efficient Lighting Program partners with lighting manufacturers and retailers across North and South Carolina to provide marked-down prices at the register to DEP customers purchasing energy efficient lighting products. Participation continues to be high, and the success of this Program can be attributed to high customer interest in energy efficiency, increased knowledge of the benefits associated with energy efficient lighting, and effective promotion of the Program.

As the Program moves into its ninth year, the Energy Efficient Lighting Program continues to incentivize customers to adopt a wide range of energy efficient lighting products, including LEDs and fixtures. Customer education is imperative to ensure customers are purchasing the right bulb for the application, to obtain high satisfaction with lighting products and to encourage subsequent purchases.

Audience

The Program is available to existing residential and non-residential customers. Customers simply shop for their lighting needs at a wide variety of retail locations. Incentives are provided at the point of purchase.

B & C. Impacts, Participants and Expenses

2018 YTD Results	Annual Forecast	Actual at 12/31/2018	Variation
Savings (MWH)	29,251	32,403	3,152
Savings (MW)	4.92	5.98	1.06
Participants		2,147,254	
2018 Program Expenses		$9,815,496	

D. Qualitative Analysis

Highlights

In 2018, the Program incentivized a total of 2,147,254 measures, including 1,812,060 LEDs and; 335,194 fixtures. The DEP Energy Efficiency Program had 17 lighting retail channels actively participating in 2018. While the top five retail channels account for 71% of the Program sales, all retail channels allow access to the Program for a diverse and geographically wide population of DEP customers. The Program is designed to reach 90% of customers within 30 miles of a participating retail location.
The Program continues to operate efficiently with 80% of overall Program costs going directly to customers in the form of incentives. Additionally, a total of 94% of the Program costs are spent on implementation and administration of the Program, including incentives and management fees. Therefore, only 6% is spent on marketing, labor and other costs.

Issues

No issues at this time.

Potential Changes

The Program will continue to evaluate the market and adjust products and incentive levels as necessary, focusing on specialty applications and strategically targeting underserved customers through select channels and events.

E. Marketing Strategy

The Company will continue the Program marketing efforts in 2018 through the following:

- Point of Purchase materials at the participating retailer locations
- Duke Energy Progress and Program website
- General Awareness Campaigns
- Bill Inserts
- Email
- Online Advertising

Advertised events at key retailers including:

- Direct mail
- Email
- In Store materials (fliers, bag stuffers, posters, banners, etc.)
- Community outreach events (national night out, cultural events, etc.)

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. Additionally, marketing efforts related to in-store events are designed to motivate customer participation.

F. Evaluation, Measurement and Verification

For the Retail Lighting evaluation, the combined DEC/DEP process and impact report was completed in the second quarter of 2018. Both evaluations consisted of engineering estimates of the measures in retail channels to determine gross impacts. Net impacts were determined via sales data modeling.

EnergyWise Home Program

A. Description

EnergyWise Home ("Program") allows Duke Energy Progress, LLC ("Company") to install load control switches at the customer's premise to remotely control the following residential appliances:

- Central air conditioning or electric heat pumps
- Auxiliary strip heat on central electric heat pumps (Western Region only)
- Electric water heaters (Western Region only)

For each of the appliance options above, Program participants receive an initial one-time bill credit of $25 following the successful installation and testing of load control device(s) and an annual bill credit of $25 in exchange for allowing the Company to control the listed appliances.

Audience

The Program is available to all of the Company's residential customers residing in owner-occupied or leased, single-family, or multi-family residences.

B & C. Impacts, Participants and Expenses

2018 YTD Results	Annual Forecast	Actual at 12/31/2018	Variation
Savings (MWH)	N/A	N/A	N/A
Savings (MW)	386.11	391.03	4.92
Participants		197,740	
2018 Program Expenses		$14,619,512	

1 MW Savings at the meter include Summer MW for AC participants and Winter MW for Heat Strip and Water Heater Participants

D. Qualitative Analysis

Highlights

After receiving regulatory approval from both the North Carolina Utilities Commission and the South Carolina Public Service Commission late in 2008, the Company officially launched the Program in April of 2009. Comverge, which specializes in integrated demand response solutions, was awarded the contract for the load management system software and switch technology, and GoodCents was awarded the contract for enrollment, field implementation, and call center support.

The program has met or exceeded its customer acquisition and impact goals every year since its inception. The program has achieved approximately 14% market penetration in nine years with over 182,000 participants and full shed load impacts of 376 MW summer and 14.5 MW winter at the meter.

Potential Changes

On December 21, 2017 the company filed a modification to the current Load Control Rider LC-SUM to allow customer-owned smart thermostats to function as load control devices. This was approved by the NCUC on February 7, 2018 and the SCPSC on March 14, 2018. This Bring Your Own Thermostat (BYOT) Measure will be available to residential customers who agree to allow Duke Energy to temporarily control their eligible thermostats via the internet. We are currently working toward program launch.

E. Marketing Strategy

The Company continues to deploy Program marketing efforts through various channels that include but are not limited to the following:

- Door-to-door canvassing
- Outbound calling
- Duke Energy Progress website
- Email
- Direct mail (letters and postcards to qualifying customers)

Additional detailed program information is located at https://www.duke-energy.com/home/products/energywise-home

F. Evaluation, Measurement and Verification

During the Collaborative Meeting in November 2018, the Company presented the findings from the EM&V for the Winter program. Loggers were installed at a sample of participants' homes and a series of EM&V events were conducted during the winter months.

- The current DR capability of DEP's EnergyWise program in the winter is approximately 13 MW.
- The estimated average program impact of the six population events deployed in the winter of 2017/2018 was approximately 11 MW.
- The estimated impact per set of heat strips (that responded in some way to DEP's curtailment signal) controlled during the population events was 2.77 kW, and the estimated impact per responsive water heater during the same events was 0.41 kW.

A. Description

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

The Program provides a free in-home assessment performed by an energy specialist certified by the Building Performance Institute ("BPI"). The BPI-certified energy specialist completes a 60- to 90-minute walk through of a customer's home and analyzes energy usage to identify energy savings opportunities. The energy specialist discusses behavioral and equipment modifications that use less energy. The customer also receives a customized report identifying actions the customer can take to increase their home's efficiency. The following are examples of recommendations that might be included in the report:

Turn off vampire load equipment when not in use.
Use energy efficient lighting.
Use a programmable thermostat to manage heating and cooling usage.
Replace old equipment.
Add insulation and seal 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 efficient lighting, a shower head, faucet aerators, outlet/switch gaskets, weather stripping and a booklet of energy saving tips.

Audience

Residential customers that own a single-family residence with central air, electric heat or an electric water heater and that have at least four months of billing history are eligible to participate in the Program.

B & C. Impacts, Participants and Expenses

2018 YTD Results	Annual Forecast	Actual at 12/31/2018	Variation
Savings (MWH)	2,720	7,752	5,032
Savings (MW)	0.45	0.94	0.48
Participants		37,923	
2018 Program Expenses		$1,851,965	

D. Qualitative Analysis Highlights

The program conducted 6,707 assessments and installed 31,216 additional LEDs in 2018. The program continues to focus on maximizing measures installed as well as cross promoting other Duke Energy programs and offerings.

Issues

The program continues to coordinate closely with the vendor to monitor incoming demand, to balance marketing and to ensure adequate appointment slots are available.

Potential Changes

- Continuing to optimize the online scheduling tool to enhance the customer experience
- Upgrading free measures to include pipewrap and additional bathroom aerators where relevant.
- Evaluation of upgradeable measures in field such as hand-held showerheads, smart thermostats, specialty bulbs, blower door option.
- Evaluating the incentive offerings to maximize savings and impacts as well as customer acceptance
- Including for townhomes/condos for audit eligibility
- Implementing post audit follow up with reminders of recommendations/referrals

Currently, Program implementers are evaluating the need for a plan to obtain customer feedback proactively and identify improvement or EM&V opportunities.

E. Marketing Strategy

The Program continued to use a multichannel marketing approach including targeted mailings to pre-qualified residential customers, bill inserts, online promotions and online video. Examples of online messages, bill inserts and direct mail promotions are available in the appendix. For those who elect to receive offers electronically, email marketing is used to supplement direct mail. In between larger initiatives, such as bill inserts, the program utilizes direct mail which can easily be modified based on demand. Core messaging is simple and focuses on key benefits (a free energy assessment from Duke Energy can help save energy and money while also increasing comfort) and 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

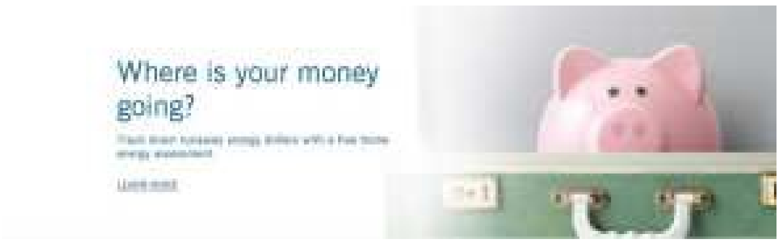
The program completed an impact and process evaluation in October 2018, with the summary findings presented at the Fourth Quarter 2018 DEC/DEP Collaborative.

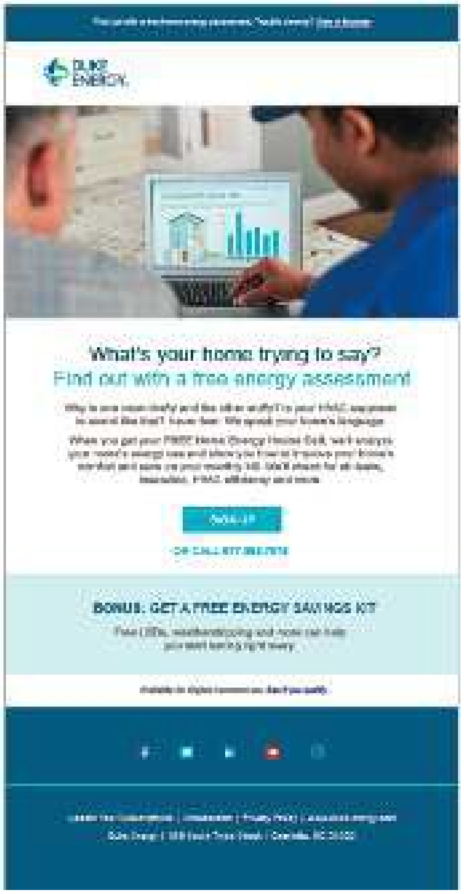
A billing analysis was the primary methodology to determine energy and demand savings. The billing analysis compared the consumption of program participants to future program participants. Engineering estimates for the HEHC kit measures were also conducted to provide insight into the behavioral impacts achieved through the program and to provide impacts for the Additional Bulbs provided to program participants. Participants surveys were used to determine in-service rates and determine free ridership at the measure level.

The process evaluation consisted of participant surveys; results were used to identify barriers to participation and improve program processes.

G. Appendix

Online Banners:




DUKE ENERGY.
What's your home trying to say?
Find out with a free energy assessment
BONUS: GET A FREE ENERGY SAVINGS KIT


What's your home trying to say? Find out with a free energy assessment.


DUKE ENERGY.
Where is your money going?
FIND OUT FOR FREE
Here's what you'll get:


Where is your money going?
Here's what you'll get:


Where's your money going?
Find out with a free home energy assessment


HOME ENERGY ASSESSMENT

Direct Mail:


Home Energy House Call
FREE
FREE
We make house calls.
We make house calls.


Home Energy House Call
Solutions for a more energy-efficient home


Sign up today and discover ways to save
Take the first step toward energy efficiency.


Home Energy House Call
DUKE ENERGY.


Where is your money going?
Find out with a FREE home energy assessment
DUKE ENERGY.


Home Energy House Call
Sign up and get:
A free home energy assessment
Sign up today!


DUKE ENERGY.
Where is your money going?

Bill Inserts:

Pandora

My Home Energy Report

A. Description

My Home Energy Report ("MyHER") helps Duke Energy Progress ("DEP") customers put their energy use in perspective with simple and easily understood graphics that compare customers' energy use with homes of similar size, age and heating source. The reports motivate customers to change their behaviors and reduce their consumption by presenting them with timely tips and program offers.

My Home Energy Report Interactive links customers to a portal where they can complete a home profile, set savings goals and track their progress, get answers to their personal energy questions from an energy expert, and share their energy saving tips with other customers. Customers can also see how much electricity they might use in the coming months based on their usage history.

Audience

Program participants are identified through demographic information and must reside in an individually-metered, single-family residence served on a residential rate schedule and must have at least 13 months of electric usage with the Company. These customers receive up to 8 paper reports per year. Electronic versions of the report are distributed 12 times a year for customers who have enrolled in My Home Energy Report Interactive and/or who have a registered email address with the Company.

Customers who live in an individually-metered, multi-family dwelling served on a residential rate schedule and who have at least 13 months of electric usage with the Company may also participate. Multi-family customers who have registered their email address with the Company receive 4 printed reports and 12 electronic reports throughout the year. Multi-family customers without a registered email address with the Company receive 6 printed reports throughout the year with a strong call to action to provide their email address to receive more energy efficiency tips and information through additional reports delivered.

B & C. Impacts, Participants and Expenses

2018 YTD Results	Annual Forecast	Actual at 12/31/2018	Variation
Savings (MWH)	132,895	122,685	-10,210
Savings (MW)	36.11	20.78	-15.34
Participants		827,741	
2018 Program Expenses		$7,687,891	

D. Qualitative Analysis

As of December 31, 2018, over 737,000 DEP single-family customers and 90,000 multifamily customers were receiving the MyHER, and over 29,000 DEP single-family customers and over 1,700 multifamily customers were enrolled in the MyHER Interactive portal.

E. Marketing Strategy

Since the MyHER paper report is an opt-out program, customers who meet the eligibility requirements automatically receive the report. Less than 0.04% of single-family customers and .03% of multi-family chose to opt out. The MyHER Interactive portal is an opt-in portal. Marketing for the portal includes email campaigns and messages in the paper report and on its envelope.

Between March and April 2018, the Company offered a sample group of roughly 200,000 MyHER DEP customers the opportunity to purchase an *ecobee* Smart thermostat at a $50 discount. 70 thermostats were purchased by DEP customers. In July, those DEP customers who did not take advantage of the *ecobee* offer will be presented with a discounted offer on a Nest thermostat which resulted in an additional 18 Nest thermostats purchased.

F. Evaluation, Measurement and Verification

The next process and impact evaluation report, combined with DEP, is scheduled for completion in the second quarter of 2019. As is typical with MyHER evaluations, the impact evaluation will consist of a billing analysis to determine the consumption differences between the treatment group and the control group.

Residential Smart $aver Energy Efficiency Program

A. Description

The purpose of this Program is to offer customers a variety of energy conservation measures that increase energy efficiency in existing residential dwellings. The Program utilizes a network of participating contractors to do the following: (1) to encourage the installation of high efficiency central air conditioning (AC) and heat pump systems with an optional add on measure such as Smart Thermostats, (2) to encourage attic insulation and sealing, (3) to encourage the installation of heat pump water heaters, and (4) to encourage high efficiency variable speed pool pumps.

Incentives are only applicable to measures installed by a contractor approved by Company

Duke Energy contracts with a third-party vendor for application processing, incentive payment disbursement, and customer/contractor support.

Audience

The Program is available to customers whose premise is at least one year old, who are served on a residential rate, and who meet the service delivery qualifications.

B & C. Impacts, Participants and Expenses

2018 YTD Results	Annual Forecast	Actual at 12/31/2018	Variation
Savings (MWH)	3,134	7,229	4,095
Savings (MW)	1.14	1.80	0.66
Participants		24,562	
2018 Program Expenses		$7,168,833	

D. Qualitative Analysis

Highlights

The Program's tiered incentive structure continues to receive a positive reaction from customers as well as Trade Allies. Reporting continues to show that the increased incentive amounts for higher SEER equipment has encouraged customers to have higher efficiency equipment installed properly and managed well.

The Referral Channel, which provides free, trusted referrals to customers who are trying to find reliable qualified contractors, has successfully generated roughly 21,000 customer referrals through 2018 exceeding the total number of referrals generated in all of 2017. Customers whose referral generates a sale for the Trade Ally were asked to rate their experience with the Referral Channel. The Referral Channel has improved their star rating from a 4.68 to 4.88 out of 5 stars during 2018. The program also continued to see a reduction in the incremental cost to the customer across all measures which was noted in the previous filing which was approved on February 25,2019. Additionally, the program staff is working on potential modifications to further improve cost effectiveness of the program for 2019 and beyond.

Issues

The participation of the Trade Ally network is vital to the success of the Program. The Program continues to try and shift the market away from some of the more commonly utilized practices which rely heavily on decentralized training and varying knowledge levels; imprecise, manual field calculations. Instead, the Program encourages Trade Allies to train and certify technicians to use quality diagnostic instruments and processes. The Company has not seen significant acceptance with the diagnostic-based measures because of the need for expensive equipment, the need to obtain additional industry certifications and to alter current business practices. Historically, any additional cost associated with diagnostic readings, training or equipment purchases seem to be passed on to the customer and not absorbed thorough the companies offering as an added benefit. The program will continue to place emphasis on these best practices and continue offering additional training to the Trade Allies and modifications to program requirements when needed to build support.

E. Marketing Strategy

Promotion of the Program is primarily targeted to HVAC and home performance contractors. Trade Allies are integral to the Program's success because they interface with the customer during the decision-making event.

Program information and Trade Ally enrollment links are available on the Program's website to educate customers about the Program and encourage participation. By increasing the overall awareness of the Program and the participation of Trade Allies, more customers will consider the benefits of the Program at time of purchase.

Based on numerous customer engagement surveys and focus groups, the Program rebranded the referral channel, currently known as "Find It Duke," in March of 2018 with the intent of positioning Duke Energy as a trusted advisor for customers who are making energy related home improvements. Various customer marketing campaigns during 2018 leveraged channels such as direct mail, TV, radio, and email messaging in order to build awareness of the referral service. Other marketing efforts, such as a paid search and co-branded special offer campaigns with eligible referral contractors, manufacturers, and national retailers, also created awareness for the channel.

F. Evaluation, Measurement and Verification

Due to broader changes in the Program in 2016, and subsequent measure removals in 2017, there were no planned EM&V activities associated with the Program in 2018.

A. Description

The Multifamily Energy Efficiency program ("Program") provides energy efficient lighting and water measures to reduce energy usage in multi-family properties. The Program allows Duke Energy Progress ("Company") to target multi-family apartment complexes with an alternative delivery channel. The measures are installed in permanent fixtures by Franklin Energy, the program administrator, or by the property management staff. 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 water measures such as bath and kitchen faucet aerators, water saving showerheads, and pipe wrap. Water measures are available to customers with electric water heating. These measures assist with reducing maintenance costs while improving tenant satisfaction by lowering energy bills.

The Program offers a direct install ("DI") service by Franklin Energy. Franklin Energy installs the lighting and water measures during scheduled visits. Crews carry tablets to keep track of which measures are installed in each apartment. Alternatively, property managers have the option to complete the installations during routine maintenance visits. In these cases, the property maintenance crews track the number of measures they install and report these totals, by apartment, back to Franklin Energy. Franklin Energy then validates the information and submits the results to the Company.

After the installations are completed, Quality Assurance ("QA") inspections are conducted on 20 percent of the 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 an individually metered residential rate schedule. To receive water measures, apartments must have electric water heating.

B & C. Impacts, Participants and Expenses

2018 YTD Results	Annual Forecast	Actual at 12/31/2018	Variation
Savings (MWH)	13,579	13,292	-287
Savings (MW)	1.84	1.74	-.09
Participants		288,092	
2018 Program Expenses		$2,409,743	

D. Qualitative Analysis

Highlights

Through December 2018, the Program completed installations at 101 properties, accounting for over 16,200 units. The Program installed 288,093 measures with lighting measures representing 69 percent of the total number of installations and water measures representing 31 percent. In 2018, the Program successfully added new LED bulb options to the offering for recessed and track fixtures, which have been well received by tenants and property managers. The new recessed and track LEDs approved in April represent 15% of the LEDs installed during 2018. Also in 3Q and 4Q 2018, the Program successfully added brushed nickel bath aerators and showerheads as an option. Added in late September, brushed nickel bath aerators represented 5% of total bath aerators installed.

Added in December, brushed nickel showerheads represented 1% of all total showerheads installed. Additionally, the Program expanded the criteria to serve all units in a complex and removed the requirement for 4 conjoined units so that all units within a complex can benefit from energy savings.

Issues

There are no issues to report.

Potential Changes

Program Management continues to evaluate new energy efficient measures for addition to the program.

New technology enhancements are being implemented to increase accuracy of recording measures installed, bulb wattages removed, increase efficiencies with scheduling units, and improved tracking of new opportunities from both the direct installers and energy advisors.

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 calls and on-site visits to gauge initial interest in the program. The Program also utilizes local apartment association memberships to obtain access to contact information for local properties and to attend association trade shows and events to promote the program. The Program was an exhibitor in the May 2018 AANC Conference in Raleigh, NC and generated over 50 leads for the region and 6 DEP property contacts.

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.

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 a variety of marketing tools to create awareness of the Program among their tenants. The tools include letters to each tenant informing them of what energy efficient measures are being installed and when the installations will take 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 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. Placement of the window clings at a minimum will be at the common areas entry and each residential building on site (to the extent applicable). Using the window clings 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 began in April of 2018. The evaluation will determine the net annual energy and demand associated with the program participants between January 1, 2017, and May 1, 2018. The evaluator will use a combination of surveys, on site data collection, a lighting logger study, and engineering analysis to determine the impacts for the program. The final report is in draft stage and should be complete in 1Q 2019.

Appendix

Tenant Letter-
Updated for new LEDs and safety messages

DUKE ENERGY.

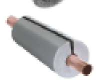
Dear Resident:

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


Straight Line, Globe and Candelabra LED Light-bulbs to replace your outdated incandescent lightbulbs


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

Trained technicians will perform the free installations in each unit 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 unit if you are not home at the time of installation. Additionally, the technicians will be in uniform with proper photo identification.

Technicians will be in your building:

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 unit. Included in these materials is a customer satisfaction survey that we would appreciate your completing.

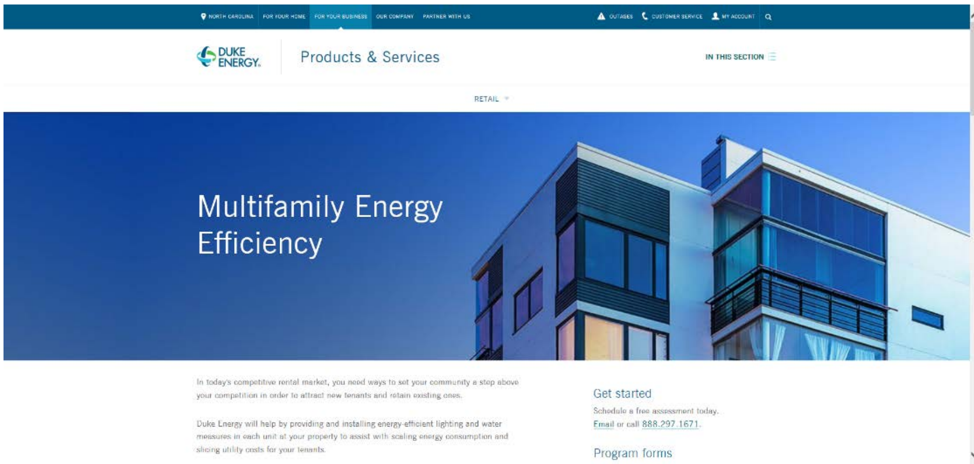
For additional information about this offering, or other offerings from Duke Energy, contact the Multifamily Energy Efficiency Program at 888.297.1671, email dukeenergymultifamilyeep@franklinenergy.com or visit duke-energy.com/multifamily.

Thank you!

Multifamily Energy Efficiency Team

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 unit

Program Web Page-



Program Brochure-

Updated for new LEDs and chrome aerators

Window Cling-

This property participated in Duke Energy's Multifamily Energy Efficiency program and now has energy-efficient products that benefit you.

DUKE ENERGY.

Tenant Leave Behind-

Updated for new LEDs, chrome aerators and Survey modifications

Multifamily Energy Efficiency Program

DUKE ENERGY.

Based on an assessment of your unit, these products were selected to offset your monthly energy usage:

Electric

Straight Line, Globe, Candelabra, Recessed and Track LED Lightbulbs
LEDs last longer and use up to 90 percent less energy than incandescent bulbs.

Water
(Water-saving products are only installed in properties that use electricity to heat water.)

Faucet aerators*
Faucet aerators installed in the kitchen and bathroom use up to 55 percent less water than standard faucet aerators.
Allows for adjustable flow

Showerhead*
An energy-efficient 1.5-gpm showerhead will use less water than a regular showerhead, which means you can also use less energy to heat the water.
Adjustable flow

Pipe wrap*
Hot water pipe wrap reduces water and energy use by preventing heat loss while hot water travels through the pipes.

*Provided only to properties that use electricity to heat water.

For more information, contact the Multifamily Energy Efficiency Program at 888.297.1671 or dukeenergymultifamilyeep@franklinenergy.com. Or, visit duke-energy.com/multifamily.

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

Property name:
Name:
Address: Unit No.: City: State: ZIP:
Email:
I was at home while the technicians installed the products. ❑ Yes ❑ No
What effect has your participation in the Multifamily Energy Efficiency Program had on your overall satisfaction with Duke Energy? ❑ Positive effect ❑ Negative effect ❑ No effect ❑ Don't know

ON A SCALE OF 1 TO 10, PLEASE RATE YOUR OVERALL SATISFACTION OR LEVEL OF AGREEMENT: 1=NOT SATISFIED/DISAGREE 10=VERY SATISFIED/AGREE	Not satisfied										Very satisfied
Overall, I was satisfied with the Duke Energy Multifamily Energy Efficiency Program.	0	1	2	3	4	5	6	7	8	9	10
The Technicians treated me with courtesy and my property with respect.	0	1	2	3	4	5	6	7	8	9	10
My questions were answered about the products installed.	0	1	2	3	4	5	6	7	8	9	10
Satisfaction with Light-Emitting Diode (LED bulb).	0	1	2	3	4	5	6	7	8	9	10
Satisfaction with Kitchen faucet aerators.	0	1	2	3	4	5	6	7	8	9	10
Satisfaction with Bathroom faucet aerators.	0	1	2	3	4	5	6	7	8	9	10
Satisfaction with Shower head.	0	1	2	3	4	5	6	7	8	9	10
Satisfaction with Pipe wrap.	0	1	2	3	4	5	6	7	8	9	10

Comments:

Thank you for participating in this program. We'd like to know how we did installing your new energy-saving products. Please complete the survey at left and mail it to us. The survey is also available online at **duke-energy.com/multifamilysurvey**.

A. Description

The purpose of this Program is to incent new construction that falls within the 2012 North Carolina Residential Building Code to meet or exceed the 2012 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 of the dwelling's total annual energy costs. Additionally, the Program incents the installation of high-efficiency heating ventilating and air conditioning ("HVAC") and heat pump water heating ("HPWH") equipment in new residential construction.

Audience

The Program is available to builders and developers installing high-efficiency HVAC and HPWH 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 2012 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 2012 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

2018 YTD Results	Annual Forecast	Actual at 12/31/2018	Variation
Savings (MWH)	16,048	14,263	-1,784
Savings (MW)	6.95	5.44	-1.51
Participants		11,275,657	
2018 Program Expenses		$13,189,949	

D. Qualitative Analysis

Highlights

The Program's move to a whole-house incentive structure that pays incentives to builders for HERO- compliant homes based solely on annual kWh savings continues to drive builders toward increasing savings. The Program requested approval from RESNET to offer 34 courses online for rater CEU□s. The Program has provided on-site instruction to over 400 builders and trade allies.

Currently there are 580 builders and 28 approved raters registered in the Program. For 2018 the Program invoiced homes for 326 builders from 23 raters. The top 10 builders in the Program contribute 40% of the savings. ICF is responsible for the operational oversight of Home Energy Raters and builders or developers participating in the Program.

Ekotrope, an energy modeling software that is a cloud-based HERS rating software, was evaluated and approved in May as an approved software for the Program.

Whole-House Requirement	Eligibility	Incentive
HERO	Meet 2012 NCECC HERO standards	$750
HERO plus HERS Score	Meet HERO standards and submit confirmed annual kWh savings from the Energy Summary Report.	$0.90/kWh
	Equipment Description	**Incentive**
Tier 1	AC or heat pump with SEER (Seasonal Energy Efficiency Ratio) of 14 or greater but less than 15. The HVAC system must meet the Quality Installation Standard of 90%. High Efficiency Heat Pumps: The unit(s) shall be a minimum SEER of 14 with ECM. High Efficiency Central AC: The unit(s) shall be a minimum SEER of 14 with ECM.	$250 per unit
QI	Quality Installation Standard (Optional for Tier 2).	$75 per unit
Tier 2	AC or heat pump with SEER of 15 or greater.	$300 per unit
Heat Pump Water Heater	ENERGY STAR® qualified HPWH(s) with minimum Energy Factor of 2.0.	$350 per unit

Issues

Air sealing in townhomes and multifamily projects continues to be a sticking point for many builders. While the North Carolina building code has specific requirements for fire-rated assemblies, there are different approaches being used to meet these requirements, and the acceptance and interpretations of these assemblies differs among code officials by jurisdiction. To assist builders, Program staff will work with various resources to identify code compliant separation wall assemblies and accepted air sealing methods. This information will provide builders and raters recommendations that will not only meet the code but also increase compliance with program standards. Program is partnering with NCBPA to perform technical research in support of the Program's interests in identifying townhome and multifamily assembly air sealing practices that meet or exceed minimum code and program requirements. BASF will provide technical support and research and development resources on an as-needed basis. Suppliers including Dow, Knauf Insulation and others will participate on an as-needed basis.

Potential Changes

The Program is considering modifying the incentives and eliminating non-cost-effective measures and measures that are no longer applicable. Those changes may include the following:

- Eliminate the existing tier structure for HVAC incentives;
- Remove incentives for HVAC equipment with a SEER of less than 15;
- Remove Quality Installation and Heat Pump Water Heater measures, as they are typically included when building to HERO standards and rarely implemented on a stand-alone basis.

E. Marketing Strategy

The Company drove awareness in 2018 through various marketing channels that include but are not limited to the following:

- Duke Energy Progress website
- Community outreach events/HBA Parade of Homes
- 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

Process and impact evaluation activities began in second quarter of 2017 and a final report delivered in the second quarter of 2018. Summary results were presented at the 4th Quarter 2018 DEC/DEP Collaborative.

The impact evaluation verified energy savings, demand savings, and savings from market effects attributable to the RNC program. The impact evaluation consisted of an analysis of participants' bills calibrated to building models. Net program savings will be determined through interviews with participant builders, non-participant builders and HERS raters.

The process evaluation focused on the new program processes and associated customer satisfaction as well as assessing their effectiveness and their impact on the broader RNC market.

G. Appendix

Small Business Energy Saver

A. Description

The purpose of the Duke Energy Progress ("Company") Small Business Energy Saver program ("Program") is to reduce energy usage through the direct installation of energy efficient measures within qualifying non-residential customer facilities. All aspects of the Program are administered by a single Company-authorized vendor. Program measures address major end-uses in lighting, refrigeration, and HVAC applications.

Program participants receive a free, no-obligation energy assessment of their facility followed by a recommendation of energy efficiency measures that could be installed in their facility along with the projected energy savings, costs of all materials and installation, and the amount of the up-front incentive the Company. The customer makes the final determination of which measures will be installed after receiving the results of the energy assessment. The vendor schedules the installation of the energy efficiency measure at a convenient time for the customer, and electrical subcontractors perform the installation.

The Program is designed as a pay-for-performance offering, meaning that the vendor administering the Program is only compensated for energy savings achieved through the installation of energy efficiency measures.

Audience

The Program is available to non-residential customers that are not opted-out of the Company's EE/DSM rider and have an average annual demand of 180 kW or less per active account.

B & C. Impacts, Participants and Expenses

2018 YTD Results	Annual Forecast	Actual at 12/31/2018	Variation
Savings (MWH)	53,576	40,298	-13,277
Savings (MW)	9.94	6.67	-3.27
Participants		38,604,480	
2018 Program Expenses		$8,858,213	

D. Qualitative Analysis

Highlights

Lime Energy is the Company-authorized vendor administering the Program in both DEC and DEP service areas.

In 2018, the Program continued to be popular with the Company's small and midsize business customers, with over 1,200 Small Business Energy Saver projects completed though year end in DEP's North and South Carolina territories.

The Company has administered a customer satisfaction survey to Program participants since 2014. Customers continue to respond very positively to the Program, with 87% of all survey participants in 2018 rating their overall satisfaction with the Program experience at an 8 or above (out of a 10 scale). Also, the majority of Program participants continue to respond that the Program has improved their perceptions of Duke Energy, with 86% of responders indicating that the Program has had a positive effect on their overall satisfaction with the Company.

Issues

While LED lighting measures are expected to remain the primary driver of kWh savings in the Program for the foreseeable future, the Company has been actively working with our vendor Lime Energy to implement initiatives focused on increasing refrigeration and HVAC measure adoption.

Potential Changes

Moving into 2019, the Company implemented a modification to the Program incentive design to offer higher, tiered incentives for deep energy retrofit projects with multiple measure technologies, actively incentivizing customers to undertake efficiency upgrades beyond lighting. Ultimately, the Company would like for the Program to encourage customers to take on more comprehensive energy efficiency upgrades to maximize energy savings.

As the Program matures, the Company will continue to evaluate opportunities to add incentivized measures suitable for the small business market to the approved Program which fit the direct install program model.

E. Marketing Strategy

The Program is marketed primarily using the following channels:

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

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

F. Evaluation, Measurement and Verification

Evaluation activities began in the third quarter of 2017 and completed in the third quarter of 2018. Summary findings were presented at the 4th Quarter DEC/DEP Collaborative.

New process evaluation activities included a customer journey mapping exercise to assess the qualitative experience of the customer, and revealed key information such as loyalty, satisfaction, and frustrations with the program. These customer journey findings were used to refine the subsequent participant survey.

The impact evaluation included site visits to conduct field metering and verification. Other impact methodology included engineering estimates. Participant surveys determined free ridership and spillover as well as participant satisfaction with the program measures and the program overall.

Non-Residential Smart $aver Program

A. Description

The Non-Residential Smart $aver Program ("Program") provides incentives to Duke Energy Progress, LLC's ("DEP" or the "Company") commercial and industrial customers to install high efficiency equipment in applications involving new construction and retrofits and to replace failed equipment.

Commercial and industrial customers can have significant energy consumption but may lack knowledge and understanding of the benefits of high efficiency alternatives. The Program provides financial incentives to reduce the cost differential between standard and high efficiency equipment so that customers see a quicker return on their investments into high efficiency equipment and so that the money they save on utility bills can be reinvested in their businesses. Incentives are determined based on the Company's modeling of cost effectiveness over the life of the measure. 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 provides incentives through prescriptive measures, custom measures and assessment/ technical assistance.

Prescriptive Measures:
Customers receive incentive payments after they install certain high efficiency equipment from the list of pre-defined measures, including lighting; heating, ventilating and air conditioning equipment; and refrigeration measures and equipment. A list of eligible equipment and measures and specific incentive amounts are available at the Program website: https://www.duke-energy.com/business/products/smartsaver.

Custom Measures:
The Smart $aver Custom Program is designed for customers with electrical energy-saving projects involving more complicated or alternative technologies or 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.

Unlike the Non-Residential Smart $aver Prescriptive Program, the custom 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 in this Program are Classic Custom and Custom-to-Go, depending on the method by which energy savings are calculated. The documents required as part of the application process vary slightly as well.

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.
- Energy savings calculation support:
  - Classic Custom excel spreadsheet 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 Calculator approach (< 700,000 kWh and applicable Custom-to-Go calculator)
    - HVAC & Energy Management Systems
    - Lighting (no project size limit)
    - Process VFDs
    - Compressed Air

Non-Residential Smart $aver Program

Energy Assessments and Design Assistance:
Incentives are available to assist customers with energy studies such as energy audits, retro commissioning, and system-specific energy audits for existing buildings and with design assistance such as energy modeling for new construction. Customers may use a contracted Duke Energy vendor to perform the work or they may select their own vendor. Additionally, the Program assists customers who identify measures that may qualify for Smart $aver Incentives with their applications. Pre-approval is required.

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

Audience

This Program is designed for all of the Company's non-residential customers billed on an eligible Duke Energy Progress rate schedule.

B & C. Impacts, Participants and Expenses

2018 YTD Results	Annual Forecast	Actual at 12/31/2018	Variation
Savings (MWH)	41,403	97,014	55,611
Savings (MW)	4.46	16.67	12.21
Participants		1,110,170	
2018 Program Expenses		$13,690,077	

D. Qualitative Analysis

Highlights

The prescriptive, custom, and assessment/technical assistance programs continue to generate substantial savings and customer satisfaction by leveraging internal staff focused on providing solutions to participants. Prescriptive measures foster high-volume participation for common retrofit projects, while custom programs seek ways to provide in-depth technical expertise required to bring in larger and more unique projects.

In 2018 the number of TAs grew, there are now 2,936 energy-efficiency equipment vendors, contractors, engineers, architects and energy services providers in the Carolinas who are registered as a trade ally (TA with the Smart $aver® Non-residential Programs (Prescriptive and Custom, DEC and DEP). The Smart $aver® outreach team builds and maintains relationships with TAs in and around Duke Energy's service territory. Existing relationships continue to be cultivated while recruiting new TAs remains a focus. Duke Energy's efforts to engage TAs include the following activities:

- TA Search tool located on the Smart $aver® website
- Inspections of a sample of all projects to ensure quality control
- TA co-marketing including information about the Smart $aver Program in the TA□s marketing efforts
- Online application portal training and support
- Midstream channel support
- TA year-end awards
- TA quarterly newsletter
- Technology- and segment-specific marketing collateral
- TA discussion group (20 trade allies that give input on the Program)
- TA training
- Sponsorship of TA events
- Online collateral toolkit for access to marketing materials

Non-Residential Smart $aver Program

The TA outreach team educates TAs on the Program rules and the Smart $aver Program expectations for TA conduct. The Company engages the TAs in promoting the Program as well as targeting TAs more effectively based on market opportunities.

An online application portal launched in 2016 and allows applicants to apply for incentives and track project progress throughout the submission process. The Company continues to consider ways to expand participation through new channels that offer instant incentives thus reducing the price of energy efficient products at the time of purchase and reducing or eliminating the need for a separate incentive application. In 2016, the Program launched an online energy savings store and a midstream marketing channel.

The Program has developed multiple approaches to reaching a broad and diverse audience of business customers through incentive payment applications, paper and online options, and instant incentives offered through the midstream marketing channel and the online energy savings store.
The 2018 results include:

- Customers showed high interest in energy efficiency and had significant funds to invest when combined with the rebates which offset a portion of the cost. The program activity in 2018 exceeded target by 134%.
- More customers were drawn to the easy-to-use midstream marketing channel, which contributed 54% of the 2018 prescriptive impacts.
- More applicants are using the online application, an easier way to apply
- Outreach continued to support TAs working with the Program
- Targeted marketing reached out to customers and TAs
- A dedicated team of customer service representatives answered customer questions via phone and email
- Large account managers and business energy advisors developed personal relationships with large and medium businesses and were able to identify and support new EE projects

Customers have several options to participate in the Prescriptive measures offered by the Program. The following chart summarizes 2018 participating customers by Program channel:

Prescriptive Program Option	Participating Customers*	% 2018 Repeat Customer
Paper and Online Application Form	690	63%
Midstream Marketing Channel	1,019	60%
Online Energy Savings Store	136	43%

*May include multiple facilities/sites for one customer.

During 2018, 1,156 applications, consisting of2,751 measures, were paid for Duke Energy Progress prescriptive measures. New application activity declined during the second half of 2018. During 2018, 61% of applications were submitted via the new online application portal. The average payment paid per application was $4,018. Duke Energy utilizes an internal database that allows the Program to self-administer applications and track data.

Many TAs 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 approach rather than paying the full cost of equipment upfront and receiving an incentive check from Duke Energy later.

The Program launched an optional new process for customers to pre-verify equipment eligibility for prescriptive incentives, which is designed to give customers certainty that their selected equipment qualifies for an incentive prior to purchase and will overcome another barrier that can delay investment in EE projects. In 2018, 821 applications for pre-qualification were approved for customer projects in NC and SC, many of which are already completed and paid.

The Duke Energy Business Savings Store on the Duke Energy website uses EFI, a the third-party that fulfills orders directly for the customers. The site gives customers the opportunity to take advantage of a limited number of prescriptive measure incentives by purchasing products from the on-line store at a purchase price reduced by the amount of the incentive. The discounts in the store are consistent with current incentive levels.

The midstream marketing channel provides instant prescriptive incentives to eligible customers at a participating distributor's point of sale. Approved midstream distributors validate eligible customers and the lighting, HVAC, food service and IT products they selected to purchase through an online portal and use that information to show customers the reduced price of high efficiency equipment. Upon purchase, the distributor reduces the customer's invoice for the eligible equipment by the amount of the 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.

Since 2016, DEP has partnered with Energy Solutions to provide an online portal for distributors to manage paperless validation and the online application, two features expected to drive growth significantly. In 2018, approximately 54% of the impact from prescriptive measure were from participation through the midstream marketing channel. Duke Energy currently has 238 distributors signed up for the midstream channel.

Smart $aver Custom participants continue to identify energy efficiency offers eligible under this Program. 150 new pre-approval applications were received in 2018. Smart $aver Custom Incentives Program uses a flat rate incentive. A flat rate incentive is available for both energy and demand savings.

The Program launched a fast track option in 2017 which gives customers the ability to pay to speed up the processing time for their applications to seven business days. This fee is passed through to the vendor for its cost to expedite the application.

In March of 2018 Lighting and HVAC tools were migrated from the Custom To Go platform to the new Smart Saver Tool web platform with plans to migrate the remaining tools later in 2018. Currently, for the lighting tool only, the customer is able to submit one file for both Prescriptive and Custom creating a single review look externally and reducing some of the burden off of the customer. To date we have received eight combined lighting applications for DEP.

Issues

Feedback from participating customers and TAs is positive overall and provides some insight into program participation. Less than 5% of surveyed customers report dissatisfaction with the Program. Reasons for being dissatisfied include unhappiness with the 90-day time limit to submit an application, communication issues, and changes in the qualified products list that the Program references for eligibility. Less than 10% of surveyed TAs report dissatisfaction with the Program, with the most frequent reasons offered being that applications are too complex or incentive payments too slow. In response, the Program continues to work to improve communications, streamline application forms and processing, and promote channels that have simpler application processes and faster incentive payments. Some TAs cited competition with the vendor implementing Small Business Energy Saver, which is not intended in either programs' designs. Duke Energy also continues to reach out to customers who have not yet participated in the Smart $aver® Program to gather feedback as well.

Recently, the combination of the Program's incentives and the low cost of LED equipment has been very attractive for customers, and many have taken advantage of the opportunity to invest in LED upgrades. While significant opportunity for high efficiency lighting upgrades still exists, the excitement around LEDs has taken customers' attention away from EE opportunities outside of lighting. The Program has continued to promote non-lighting EE and encourage customers to go beyond lighting for efficiency. The Company continues to work with outside consultants and internal resources to develop strategies for leveraging equipment supply/value chains and for increasing awareness of non-lighting measures going forward.

The Smart $aver Custom Program application process is considered burdensome by some customers due to the individual and technically intensive review all projects applying for custom incentives requires. Each year, the Program works to reduce the length of the application process, and the current process takes 17 days for all states/jurisdictions as a result.

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

The custom program is subject to large fluctuations in performance due to the fact that a significant number of large projects can drive the majority of annual impacts.

Custom program performance remains limited by customers who are opted out of the EE Rider. Those customers are not eligible to participate, and any projects they may have completed are considered lost opportunities. The custom program is actively working with internal resources (large account managers and business energy advisors) to evaluate whether 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

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 so that it can provide incentives for a broader suite of energy efficient products. This work is ongoing, and a limited number of new measures and measure updates are expected to be made under the flexibility guidelines. For changes in existing measures, such as removing a measure or reducing the incentive amount, a 90-day grace period is extended to applications that were in process prior to the change.

Duke Energy is looking for new and innovative ways to reach out to customer segments that have had a lower rate of prescriptive incentive applications and considering options for partnering with other Duke Energy EE programs to cover gaps in the market. Additionally, the Program is planning to add limited quantities of new low-cost measures at no out-of-pocket costs to customers in 2019.

E. Marketing Strategy

The Company continued marketing the Program in 2018 through various marketing channels such as the following:

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

A table listing the marketing campaigns during the first half of 2018, with some samples of marketing graphics, are included as an appendix. These marketing efforts are designed to create awareness of the Program, to educate customers on energy saving opportunities, and to emphasize the convenience of Program participation.

Non-residential customers learn about programs via targeted marketing material and communications. TAs, who sell equipment and services to all sizes of nonresidential customers, pass along information about incentives also. Company account managers target large businesses or assigned accounts directly while the Company's business energy advisors reach out to unassigned small to medium business customers. The business energy advisors follow up on customer leads to assist with questions and to steer customers who are not already working with a TA to the referral tool. In addition, the business energy advisors contact customers with annual electrical costs between $60,000 and $250,000 to promote the Smart $aver Program.

Large Business Account Managers and Local Government and Community Relations, who identify potential opportunities as well as distribute program collateral and informational material to customers and TAs, comprise the internal marketing team. 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 projects for customers currently underserved in the small and medium business market. This channel utilizes the vendor Weidt Group to help find those opportunities, complete savings calculations as well as submit applications for the customer. As of January 20, 2019, 98 projects have enrolled in the DEP - NCEEDA offering, representing 10.6 million square feet of new construction along with 89 Smart $aver Custom project applications representing 26.5 million kilowatt hours of energy savings.

F. Evaluation, Measurement and Verification

Non-Residential Smart $aver Prescriptive Program

A final combined DEC and DEP impact and process report was received for the Non Residential Smart $aver Prescriptive program at the end the first quarter of 2018. The report covered projects completed between March 2016 and February 2017. The process report revealed that the participants overall satisfaction with their program experience was an average of 8.8 on a 10 point scale with 10 meaning extremely satisfied and 0 meaning extremely dissatisfied.

The impact report results indicated that the verified gross energy savings were 112% of deemed reported energy savings, and the gross summer peak demand reduction was 103 percent. The net-to-gross (NTG) ratio was estimated at .86.

Non-Residential Smart $aver Custom Program

An impact and process combined DEC/DEP evaluation was completed in the fourth quarter of 2018 and presented at the 4th Quarter DEC/DEP Collaborative. Methodologies to verify savings included desk reviews, onsite verification and billing analyses. Participant surveys helped establish net-to-gross.

Process evaluation activities included participant surveys and trade ally interviews. Key objectives for the process evaluation were to determine opportunities to improve program operations as well as gauge customer satisfaction with the program overall.

Appendix: Marketing schedule and examples

Month	Channel	Audience	Incentives Highlighted
January	Email	All Business Customers	Program Changes Teaser
February	Email	Commercial Real Estate	Good Better Best (All Measure Categories)
February	Email, Direct Mail	All Business Customers	Program Changes Announcement
March	Email	Manufacturing Customers	Good Better Best (All Measure Categories)
March	Email, Direct Mail	Commercial Real Estate, Lodging, Restaurants	Commercial Cooking Equipment
March	Email	Previous Program Participants	Smart $aver Tools
April	Email	Lodging Customers	Good Better Best (All Measure Categories)
April	Email, Direct Mail	All Small Business Customers	Commercial Refrigerator, Clothes Washer and Clothes Dryer
May	Email	Education Customers	Good Better Best (All Measure Categories)
May	Email	All Assigned Customers	Custom Tools
June	Email, Direct Mail	All Business Customers	Online Application Portal
August	Email	All Business Customers	Website Refresh
September	Email	All Business Customers	Rapid Payback (HVAC)
October	Email	All Business Customers	Rapid Payback (Operations & Maintenance)
October	Email	All Business Customers	Rapid Payback (Food Service)
October	Email	All Business Customers	Rapid Payback (Lighting)
November	Email	All Business Customers	Exterior Lighting

January Program Changes Teaser – Email

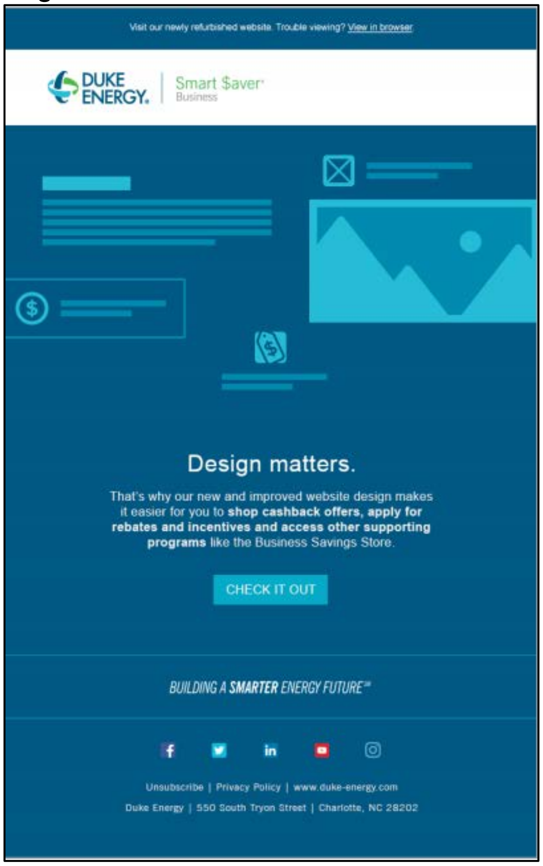
March Good Better Best (Manufacturing) Campaign – Email
Landing Page - https://www.duke-energy.com/customer-landing-pages/good-better-best-mfg

April Small Business Week Campaign – Email and Direct Mail (DM below)

May Custom Awareness – Email

Non-Residential Smart $aver Program

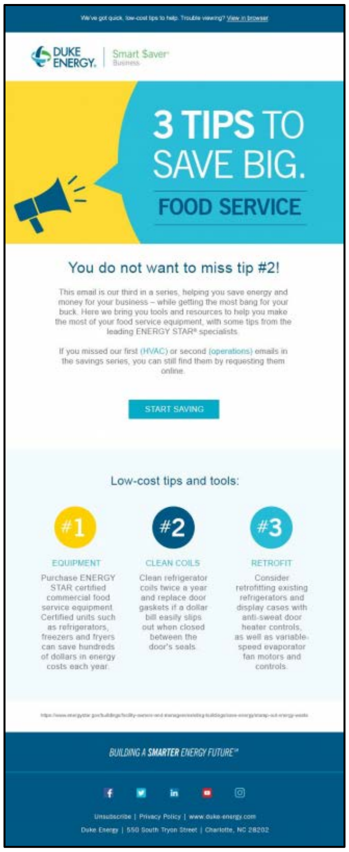
August Website Refresh – Email



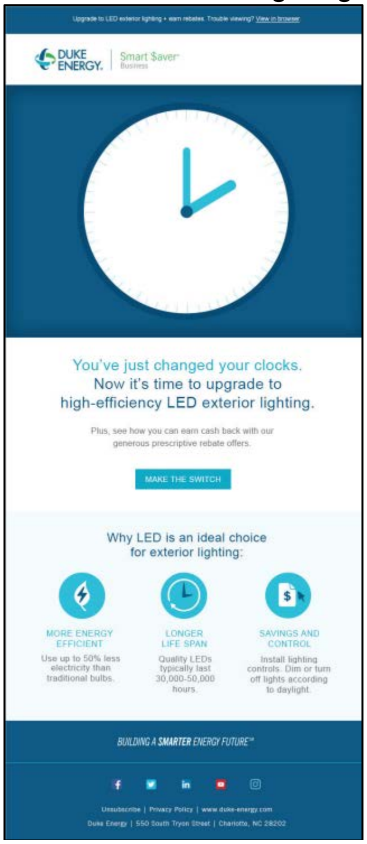
September Rapid Payback Campaign (HVAC) – Email

Non-Residential Smart $aver Program

October Rapid Payback Campaign (Food Service) – Email



November Exterior Lighting – Email



Non-Residential Smart $aver® Performance Incentive

A. Description

Duke Energy Progress, LLC's (the "Company") Non-Residential SmartSaver® Performance Incentives (the "Program") offers financial assistance to qualifying commercial, industrial and institutional customers to enhance their ability to adopt and install cost-effective electrical energy efficiency projects.

The Program encourages the installation of new high efficiency equipment in new and existing nonresidential establishments as well as 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 projects 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 measures incentivized are stated in the agreement with the customer. The Program coordinates closely with the existing custom program team and shares resources for administrative review and payment processing. The Program requires pre-approval prior to project initiation. Only projects that demonstrate that they clearly reduce electrical consumption and/or demand are eligible for incentives.

The intent of the Program is to broaden participation in non-residential efficiency programs by being able to provide incentives for projects that previously were deemed too unpredictable to calculate an acceptably accurate savings amount, and therefore ineligible for incentives. This Program provides a platform to understand new technologies better.

The key difference between the Performance Incentive Program and the custom program is that the performance incentive customers get paid based on actual measure performance. A plan is developed to verify actual performance of the project upon completion and is the basis for the performance portion of the incentive.

The incentive is typically paid out on the following schedule, though the quantity & timing of payment installments may vary:

- Incentive #1: For the portion of savings that are expected to be achieved with a high degree of confidence, an initial incentive is paid once the installation is complete.
- Incentive #2: After actual performance is measured and verified, the performance-based part of the incentive is paid. The amount of the payout is tied directly to the savings achieved by the measures.

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

Audience

All of the Company's non-residential electric accounts billed on qualifying rate schedules are eligible, except accounts that are opted out of the rider.

B & C. Impacts, Participants and Expenses

2018 YTD Results	Annual Forecast	Actual at 12/31/2018	Variation
Savings (MWH)	1,729	1,519	-210
Savings (MW)	0.20	0.13	-0.07
Participants		37	
2018 Program Expenses		$201,559	

D. Qualitative Analysis

Non-Residential Smart $aver® Performance Incentive

Highlights

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

In DEP, the Program is beginning to see a significant increase in program interest and participation. Currently there are:

- 14 enrolled projects
- 106 individual project sites
- 5.2 million kWh of potential savings (realization of kWhr impacts over multiple years: 2018-2020)

The program is subject to large fluctuations in performance due to long project lead times, long monitoring and verification times, and the timeliness and size of the projects. With a compelling value proposition and with internal resources and trade allies getting comfortable with this unique program offering, participation is expected to continue to be strong.

Issues

Program management is monitoring the following areas of interest that could affect participation:

- The preferred method for measuring and verifying a project's performance is accomplished by gathering, monitoring and analyzing customer billing history. However, if energy savings are not significant, an effective evaluation with billing information may not be possible. If this is the case, sub-metering is required at the customer's expense, and the time and expense may be a hurdle to participation.

- 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. The extended timeframe could make opting-in more difficult to justify.

Potential Changes

The Company will continuously consider functional enhancements to enhance participation, processing speed, and program efficiency.

E. Marketing Strategy

The 2018 marketing strategy for the Smart $aver Performance Incentive Program aligned closely with the Custom Program. The goal is to educate non-residential customers about the technologies incentivized through both programs, as well as the benefits of installing energy-efficient equipment. These efforts utilize a multi-channel approach, which includes the following:

- Email
- Direct Mail (letters to qualifying customers)
- Duke Energy Progress website
- Webinars
- Small Business Group outreach events
- Paid advertising/mass media
- Industry Associations

- o Large Account Managers
- o Business Energy Advisors
- o Trade Ally Outreach

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

Non-residential customers are informed of programs via targeted marketing material and communications. Information about incentives is also distributed to trade allies, who in turn sell equipment and services to all sizes of non-residential customers. Large business or assigned accounts are targeted primarily through assigned 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 to answer 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 Non-Residential Smart $aver Program.

The internal marketing channel is comprised of assigned Large Business Account Managers, Business Energy Advisors, and Local Government and Community Relations who all identify potential opportunities as well as distribute program collateral and 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

Since the Program was launched in January 2017, no evaluation activities occurred in 2018. Future evaluation timing will depend upon sufficient participation.

A. Description

The Duke Energy Progress, LLC□s (‘Company’) EnergyWise Business (‘Program’) is an energy efficiency and demand response program for non-residential customers that allows the Company to reduce the operation of participants□ AC units to mitigate system capacity constraints and improve reliability of the power grid. The Program provides customers with options for how they would like to participate. In exchange for participation, the Company provides participants with an annual incentive applied directly to their bill.

Program participants can choose between a Wi-Fi thermostat or a load control switch which is professionally installed for free for each air conditioning or heat pump unit at the premise. In addition to choosing the equipment, the participants can also choose at what cycling level they would like to participate□ 30%, 50%, or 75%. During a conservation period, the Company sends a signal to the thermostat or switch to reduce the amount of time the unit is running 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 the 50% level, or $135 for the 75% level. Additionally, participants with a heat pump unit with electric resistance emergency/back up heat that choose the thermostat can also participate in a winter option which 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 have access to a portal that allows them to control their units from anywhere with internet access. They can set schedules, adjust temperature set points, and receive energy conservation tips and communications from the Company. In addition to the portal access, participants also receive notifications of upcoming conservation periods. These 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 without penalty. They can activate an override before or during the conservation period.

Audience

The Program is available to existing non-residential customers that are not opted-out of the DSM Rider, 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 LGS-RTP and SI, Riders NM, DRA, 57, 68 IPS, LLC or NFS. Also, customers must have an average minimum usage of 1,000 kWh during those same calendar months.

B & C. Impacts, Participants and Expenses

2018 YTD Results	Annual Forecast	Actual at 12/31/2018	Variation
Savings (MWH)	2,158	38.2	-2,120
Savings (MW)	10.54	2.66	-7.88
Participants (EE & DR)		5,426	
2018 Program Expenses		$2,108,030	

D. Qualitative Analysis

Highlights

During 2018, the Program continued to experienced growth. The Program enrolled almost 2,500 accounts and completed installation on over 1200 accounts adding over 2,200 installed devices. The total number of installed devices at the endo of 2018 is 4,250. The door to door marketing (canvassing) efforts have continued to be the most productive marketing efforts producing enrollments, installations and positive customer interactions. During 2018 canvassing was expended to Florence, SC and Wilmington NC. The Program is now canvassing in Raleigh, the greater Raleigh region, Asheville areas, Wilmington and Florence SC. Through the canvassing efforts we touched over 10,000 customers during 2018.

Issues

One factor impacting the Programs overall performance in the high number of customer selecting to enroll in the 30% cycling option. 80% of our customers are participating on this option. The assumption when the program was filed projected 50% of the customers would select this option. Also, over the second half of the year the program experienced an increase in the number of customers that failed to reschedule their installation appointment. To help try and recapture some of these customers we are implementing a reoccurring monthly email targeting these customers. Finally, if was found during our M&V that the technicians were not doing a consistent job in promoting the Winter option to customers with heat pumps. We have addressed this with our technicians and we have also implemented a reoccurring email to those customers that have the heat pumps and selected the thermostat.

Potential Changes

To address this, the Program is going to work with the canvassers to improve their pitches to promote the higher cycling options. We will follow those changes with compensation modifications to support the promotion of the higher cycling options. Also, the program is evaluating the possibility of adding additional thermostat options to offer customers during the install. The new thermostat will reduce the number of installs that are turned down due to the current version not having features used by the customer.

E. Marketing Strategy

In 2018, the Program has continued to use a dedicated canvassing vendor for door-to-door marketing in Raleigh, the greater Raleigh region, and Asheville. Additionally, the Program continues to see enrollments as a result of cross promotion efforts with the Small Business Energy Saver program and the Duke Energy Business Energy Advisors.

F. Evaluation, Measurement and Verification

During the Collaborative Meeting in November 2018, the Company presented the findings from the second evaluation of the Program. The program called five summer Conservation Period demand response events in 2017. Results of the process evaluation showed participants rated the following highly:

- the time required to install their device (mean of 9.4,
- the training received during installation (mean of 9.3),
- and the representative that installed their device (mean of 9.2).

DEP participants reported lower satisfaction with participation in Conservation Periods (mean of 7.2) and with their use of the program's online portal (mean of 8.2).

Per Participant Weighted Average Summer Coincident Savings (kW) were determined to be .79 and Per Participant Average Annual kWh impacts were determined to be 18.

A. Description

Demand Response Automation ("Program") allows Duke Energy Progress, LLC ("Company") to install data acquisition and optional load control devices to remotely monitor and control the following electrical equipment:

HVAC	Variable speed motors
Lighting	Non-critical, interruptible operations
Standby generation	

Program participants agree to reduce their total metered demand by the seasonal contracted kilowatt (kW) amount during the time specified in the event notification. Participants may reduce their demand using any method, including the use of other power sources. In return, these businesses receive valuable incentives as follows:

1. A one-time participation incentive of $50/kW for demonstrated demand reduction during initial summer event(s) on the program,
2. Monthly credits of $3.25/kW for the contracted amount of curtailable demand, and
3. Performance credits of $6/kW for demand reduced during each curtailment event.

Audience

The Program is available to commercial, industrial and governmental customers with a service base that is capable of contracting for a minimum of 75 kW in curtailable demand. Some exclusions apply based on rate schedules and participation in other riders.

B & C. Impacts, Participants and Expenses

2018 YTD Results	Annual Forecast	Actual at 12/31/2018	Variation
Savings (MWH)	N/A	N/A	N/A
Savings (MW)	33.63	22.59	-11.04
Participants		69	
2018 Program Expenses		$1,692,473	

D. Qualitative Analysis

Highlights

Recruitment of new participants continues to be a challenge. Final EPA regulations prevent many originally targeted customers with older standby generators from participating in the program, while the rider minimum of three annual curtailment events remains a deterrent to many industrial customers. Larger customers interested in demand response programs also have an alternative through Rider LLC that does not have the DSM/EE Opt-In requirement.

The Company dispatched the program seven times in 2018, with four curtailments in January due to high system peak loads during polar vortex events and three curtailments during the summer to meet rider minimums.

Potential Changes

No further changes to the program are anticipated.

E. Marketing Strategy

The Company continues to market the Program directly through Large Account Management and has expanded efforts to reach eligible unassigned customers through various channels that include but are not limited to the following:

Direct mail (letters and postcards to qualifying customers)
Duke Energy Progress website
Email
Video
Trade event presence
Promotion by the new Medium Business Energy Advisors team
Additional detailed program information is located at www.duke-energy.com/dra.

F. Evaluation, Measurement and Verification

The 2017 EM&V of this program was presented in the Collaborative meeting in November 2018. The evaluation for the program had the following objectives: to replicate the DEP settlement algorithm, to validate the settlement impacts reported by DEP, to estimate verified impacts using a regression-based approach with day-of load adjustment, to estimate average kW event load shed per meter, by sector, and for the program. The 2017 analysis found the following:

- DEP called three events in 2017. The program included 20 customers, spanning 45 site locations and 69 electric meters.
- The program achieved a verified average of 19.3 MW per event.
- The average impact per meter was about 300 kW, with impacts as low as about 33 kW and as high as over 2,800 kW for individual meters.

Evans Exhibit 7

Duke Energy Progress
Estimate - January 1, 2020 - December 31, 2020
Docket Number E-2, Sub 1206
Projected Program/Portfolio Cost Effectiveness - Vintage 2020

Program	UCT	TRC	RIM	PCT
Residential Programs				
· Energy Education Program for Schools	1.35	1.38	0.51	10.30
· Energy Efficient Appliances & Devices	14.59	15.40	0.88	34.77
· Energy Efficient Lighting	2.01	2.70	0.71	6.42
· EnergyWise Home	5.27	15.93	5.27	
· Multi-Family EE Products & Services	2.65	2.65	0.54	24.31
· My Home Energy Report	1.01	1.01	0.43	
· Neighborhood Energy Saver	0.49	0.49	0.31	2.23
· Residential Energy Assessments	2.15	2.19	0.56	49.13
· Residential New Construction	1.55	4.93	1.30	6.84
· Residential Smart $aver	1.60	0.97	0.69	1.66
Residential Total	**2.56**	**3.68**	**1.11**	**7.90**
Non-Residential Programs				
· Non-Residential Smart $aver	3.36	1.68	0.87	3.32
· Non-Residential Smart $aver Performance Incentive	4.05	0.99	1.09	1.54
· Small Business Energy Saver	2.51	1.55	0.86	2.85
· EnergyWise ® for Business	0.27	0.46	0.27	
· Commercial Industrial Governmental Demand Response	1.84	28.03	1.84	
Non-Residential Total	**2.59**	**1.77**	**0.92**	**3.21**
Overall Portfolio total	**2.57**	**2.51**	**1.02**	**4.52**

Exhibit 8

Duke Energy Progress
Changes to DSM/EE Cost Recovery Vintage 2018 True Up January 1, 2018 - December 31, 2018
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

Program Name	Filed in Docket E-2, Sub 1145 kWh	Filed in Docket E-2, Sub 1145 kW	Filed in Docket E-2, Sub 1206 kWh	Filed in Docket E-2, Sub 1206 kW	Overall Variance kWh	Overall Variance kW	E-2 Sub 1145 System Participation	E-2 Sub 1206 System Participation	Delta Participation	Variance due to Change in Impacts and Measure Mix kWh	Variance due to Change in Impacts and Measure Mix kW	Variance due to Change in Participation kWh	Variance due to Change in Participation kW	Sum of Variances kWh	Sum of Variances kW
Appliance Recycling Program	2,298,513	304	-	-	(2,298,513)	(304)	3,847	-	(3,847)	-	-	(2,298,513)	(304)	(2,298,513)	(304)
Energy Education Program for Schools	1,997,287	198	2,563,019	766	565,732	568	8,798	9,013	215	516,924	563	48,808	5	565,732	568
Energy Efficient Lighting	23,122,871	3,334	25,642,842	4,227	2,519,971	893	1,666,217	1,915,182	248,964	(935,023)	394	3,454,993	498	2,519,971	893
Home Energy Improvement	3,133,816	1,141	7,228,648	1,805	4,094,831	664	9,260	24,562	15,302	(1,083,749)	(1,222)	5,178,580	1,885	4,094,831	664
Multi-Family	13,578,543	1,837	13,291,652	1,744	(286,891)	(93)	264,177	288,092	23,915	(1,516,133)	(259)	1,229,243	166	(286,891)	(93)
Neighborhood Energy Saver	2,033,179	310	2,278,804	347	245,625	37	4,503	5,047	544	-	-	245,625	37	245,625	37
Residential Energy Assessments	2,719,898	455	7,751,895	935	5,031,997	480	22,036	37,923	15,887	3,071,069	152	1,960,928	328	5,031,997	480
Residential New Construction	16,047,598	6,950	14,263,235	5,440	(1,784,363)	(1,510)	11,341,393	11,275,657	(65,736)	(1,691,350)	(1,470)	(93,014)	(40)	(1,784,363)	(1,510)
Save Energy and Water Kit	21,484,411	1,720	15,252,311	5,058	(6,232,100)	3,337	432,591	276,327	(156,264)	1,528,672	3,959	(7,760,772)	(621)	(6,232,100)	3,337
Residential Home Advantage	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
My Home Energy Report (1)	132,895,213	36,113	122,685,145	20,776	(10,210,068)	(15,337)	673,400	827,741	154,341	(40,669,279)	(23,614)	30,459,210	8,277	(10,210,068)	(15,337)
EnergyWise ® Home	-	29,079	-	29,483	-	404	14,985	15,602	617	-	(793)	-	1,196	-	404
Residential Programs Total	219,311,328	81,441	210,957,549	70,580	(8,353,779)	(10,861)	14,441,207	14,675,145	233,939	(40,778,869)	(22,289)	32,425,090	11,428	(8,353,779)	(10,861)

Non-Residential Programs

Program Name	Filed in Docket E-2, Sub 1145 kWh	Filed in Docket E-2, Sub 1145 kW	Filed in Docket E-2, Sub 1206 kWh	Filed in Docket E-2, Sub 1206 kW	Overall Variance kWh	Overall Variance kW	E-2 Sub 1145 System Participation	E-2 Sub 1206 System Participation	Delta Participation	Variance due to Change in Impacts and Measure Mix kWh	Variance due to Change in Impacts and Measure Mix kW	Variance due to Change in Participation kWh	Variance due to Change in Participation kW	Sum of Variances kWh	Sum of Variances kW
Energy Efficient Lighting	6,127,641	1,587	6,759,940	1,752	632,299	165	202,457	232,072	29,616	(264,062)	(67)	896,361	232	632,299	165
Non-Residential Smart $aver Performance (Custom)	11,484,274	1,311	11,901,442	1,883	417,167	572	8,760	11,338	2,578	(2,962,565)	186	3,379,733	386	417,167	572
Non-Residential Smart $aver Performance (Prescriptive)	29,918,863	3,145	85,112,310	14,782	55,193,448	11,637	2,927,380	1,098,832	(1,828,548)	73,881,856	13,602	(18,688,409)	(1,965)	55,193,448	11,637
Non-Residential Smart $aver Performance Incentive	1,729,413	197	1,519,117	129	(210,295)	(69)	1,662,148	37	(1,662,111)	1,519,079	129	(1,729,374)	(197)	(210,295)	(69)
Small Business Energy Saver	53,575,693	9,940	40,298,466	6,667	(13,277,227)	(3,273)	44,500,000	38,604,480	(5,895,520)	(6,179,326)	(1,956)	(7,097,900)	(1,317)	(13,277,227)	(3,273)
EnergyWise ® for Business	2,157,913	10,542	38,158	2,661	(2,119,756)	(7,882)	2,838	5,426	2,588	(4,087,449)	(17,495)	1,967,693	9,613	(2,119,756)	(7,882)
Commercial Industrial Governmental Demand Response	-	7,357	-	1,629	-	(5,728)	7,000	1,550	(5,450)	-	-	-	(5,728)	-	(5,728)
Non-Residential Programs Total	104,993,797	34,080	145,629,433	29,503	40,635,636	(4,577)	49,310,582	39,953,735	(9,356,847)	61,907,532	(5,601)	(21,271,897)	1,024	40,635,636	(4,577)

Distribution System Demand Response

Program Name	Filed in Docket E-2, Sub 1145 kWh	Filed in Docket E-2, Sub 1145 kW	Filed in Docket E-2, Sub 1206 kWh	Filed in Docket E-2, Sub 1206 kW	Overall Variance kWh	Overall Variance kW	E-2 Sub 1145 System Participation	E-2 Sub 1206 System Participation	Delta Participation	Variance due to Change in Impacts and Measure Mix kWh	Variance due to Change in Impacts and Measure Mix kW	Variance due to Change in Participation kWh	Variance due to Change in Participation kW	Sum of Variances kWh	Sum of Variances kW
DSDR	49,637,083	310,515	44,989,144	275,885	(4,647,939)	(34,630)	-	-	-	N/A	N/A	-	-	N/A	N/A
Total Residential and Non-Residential Programs	373,942,208	426,037	401,576,126	375,968	27,633,919	(50,069)	63,751,789	54,628,880	(9,122,909)	21,128,663	(27,890)	11,153,194	12,452	32,281,857	(15,438)

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

Program Name As Filed	Docket	Report Reference	Effective Date
CIG-DR	E-2, Sub 953	2017 EM&V Report for the Duke Energy Progress Commercial, Industrial, and Governmental Demand Response Automation (DRA) Program	5/1/2018
Residential New Construction	E-2, Sub 1021	EM&V Report for the Residential New Construction Program Years: 2015-2016	1/1/2016
EnergyWise	E-2, Sub 927	EM&V Report for the EnergyWise Home Program Winter 2017/2018	8/6/2018
Small Business Energy Saver	E-2, Sub 1022	EM&V Report for the Small Business Energy Saver Program Duke Energy Progress and Duke Energy Carolinas	7/1/2017
Residential Energy Assessment	E-2, Sub 1094	Duke Energy Progress Residential Energy Assessments Program Evaluation Report - Final	4/1/2016
EnergyWise for Business	E-2, Sub 1086	Duke Energy Carolinas and Progress EnergyWise Business Evaluation Report - Final	1/1/2018
Non-Residential Smart $aver	E-2, Sub 938	Smart $aver® Non-Residential Custom Program Years 2016-2017 Evaluation Report	12/1/2018
EnergyWise	E-2, Sub 927	EM&V Report for the EnergyWise Home Demand Response Program Summer PY2018	11/30/2018
Energy Efficiency in Education	E-2, Sub 1060	Energy Efficiency Education in Schools Program Year 2017 – 2018 Evaluation Report	8/1/2018

DE Progress DSM Opt Out at December 31, 2018

North Carolina (excludes outdoor lighting)

Customer Name	DSM
1922 SKIBO CROSS CREEK LLC	1
3141 PROPERTIES LLC	1
333 VENTURES LLC	2
3700 GLENWOOD LLC	1
4208 SIX FORKS ROAD LLC	2
5400 RALEIGH CRABTREE KKC	1
81ST REGIONAL SUPPT COMMAND	1
A STUCKI COMPANY	1
ABB MOTORS AND MECHANICAL INC	1
ADVANCED PLASTIC EXTRUSION LLC	2
AG PROVISION LLC	3
AIR SYSTEM COMPONENTS INC	1
AJINOMOTO USA INC	3
ALAMAC AMERICAN KNITS LLC	2
ALBANY ROAD-WYCLIFF LLC	2
ALCAMI CAROLINAS CORPORATION	5
ALL TRUSS LLC	1
ALLEN HARIM FOODS LLC	1
ALPLA INC	1
AMCOR FLEXIBLES INC	1
AMCOR RIGID PLASTICS USA LLC	1
AMERICAN AIRLINES GROUP INC	1
AMERICAN GROWLER INC	2
AMERICAN SKIN COMPANY INC	1
AMERICAN TEL & TEL CO	1
AMERICHEM INC	3
AMISUB OF NORTH CAROLINA INC	1
ANGUS BARN LTD	6
ANSON COUNTY WATER DEPT	1
ANSON COUNTY WTR SYSTEM	1
ANSON MACHINE WORKS	4
APAC TENNESSEE INC	3
APEX OIL CO INC/TERMINALS DIVI	5
APEX TOOL GROUP LLC	2
ARAUCO PANELS USA LLC	4
ARCADIA FARMS LLC	2
ARCHER DANIELS MIDLAND CO	1
ARCLIN USA INC	6
ARDAGH GLASS INC	3
ARDEN CORPORATION	3
ASHEBORO CITY OF	3
ASHEBORO ELASTICS CORP	2
ASHEVILLE BUNCOMBE TECH	22

ASHEVILLE CITY OF	8
ASHEVILLE WASTE PAPER CO INC	5
ASTON PARK HEALTH CARE CENTER	1
AT & T MOBILITY	3
AT HOME STORES LLC	2
ATEX TECHNOLOGIES INC	2
ATLANTIC CORP OF WILM INC	7
ATLANTIC VENEER CORP	3
ATLAS PRECISION INC	1
AUSTIN QUALITY FOODS INC	2
AUX KITCHEN LLC	1
B V HEDRICK GRAVEL & SAND CO	9
BAILEY FARMS INC	1
BALCRANK CORPORATION	1
BALLY REFRIGERATED BOXES INC	2
BARNES FARMING CORPORATION	8
BARNHARDT MFG CO	1
BARTLETT MILLING CO	2
BB&T	3
BEAR CREEK ARSENAL, INC	5
BELK INC	7
BELLSOUTH TELECOMMUNICATIONS	13
BELT CONCEPTS OF AMERICA	1
BI-LO LLC	1
BILTMORE BAPTIST CHURCH	1
BILTMORE FARMS HOTEL GRP LLC	3
BILTMORE FOREST CNTRY CLUB INC	5
BJ'S WHOLESALE CLUB INC	8
BLACK MTN CENTER	6
BLUE RIDGE METALS CORP	3
BLUE RIDGE PAPER PRODUCTS INC	29
BOISE CASCADE WOOD PRDCTS LLC	7
BOLIVIA LUMBER CO LLC	2
BONSAL AMERICAN INC	1
BORG WARNER TURBO SYSTEMS INC	2
BORGWARNER THERMAL SYSTEMS INC	1
BP SOLUTIONS GROUP INC	2
BRAIFORM ENTERPRISES INC	1
BRIDGESTONE BANDAG LLC	7
BRIER CREEK OFF #6 LLC	1
BRIER CREEK OFFICE # 1 LLC	1
BRIER CREEK OFFICE # 2 LLC	1
BRIER CREEK OFFICE # 5 LLC	1
BRIER CREEK OFFICE #4 LLC	1

BRM PARTNERS II LLC	1
BRM PARTNERS LLC	1
BROMLEY PLASTICS CORPORATION	1
BROOKS HOWELL RETIREMENT HOME	3
BROOKWOOD FARMS INC	5
BRUNSWICK CO	1
BRUNSWICK CO UTILITIES	1
BRUNSWICK COUNTY SCHOOLS	18
BSH HOME APPLIANCES	5
BUNCOMBE CO BD OF EDUCATION	2
BUNCOMBE COUNTY	2
BURCAM CAPITAL II LLC	1
BURLINGTON INDUSTRIES LLC	2
BUSINESS TELECOM LLC	2
CAMP DAVIS INDUSTRIAL PARK INC	6
CAMPBELL SOUP SUPPLY CO LLC	5
CAMPBELL UNIVERSITY INC	66
CAN AM SOUTH LLC	2
CANTON SAWMILL LLC	7
CAPE FEAR ACADEMY	2
CAPE FEAR COMMUNITY COLLEGE	30
CAPE FEAR COUNTRY CLUB	7
CAPE FEAR PUBLIC UTILITY AUTH	5
CAPEL INC	6
CAPITAL FUNDS INC	2
CAPITOL BROADCASTING CO	13
CARDINAL METALWORKS INC	2
CARLIE C OPERATION CENTER INC	7
CAROLINA APPAREL GROUP INC	1
CAROLINA BAY OF WILMINGTON LLC	5
CAROLINA BEACH TOWN OF	2
CAROLINA COUNTRY CLUB	3
CAROLINA CRATE & PALLET INC	3
CAROLINA DAIRY LLC	2
CAROLINA EGG CO INC	1
CAROLINA ELECTRONIC ASSEMBLERS	1
CAROLINA EYE ASSOCIATES PA	1
CAROLINA ICE INC	4
CAROLINA INNOVATIVE FOOD INGRE	3
CAROLINA PRESERVE BY DEL WEBB	4
CAROLINA TECHNICAL PLASTICS	3
CARQUEST OF SRONCE	2
CARTERET CO BD OF ED	5
CARTERET COMMUNITY COLLEGE	18

CARTERET COUNTY FINANCE	1
CARTERET GENERAL HOSPITAL	0
CARY TOWN OF	19
CARY VENTURE LTD PRTNRSHIP	14
CASCADES HOLDING US INC	5
CASE FARMS	8
CATALENT PHARMA SOLUTIONS LLC	16
CATERPILLAR INC	11
CECIL BUDD TIRE COMPANY LLC	3
CERTAINTEED CORPORATION	4
CERTAINTEED GYPSUM NC INC	3
CERTAINTEED INC	1
CFVH - BLADEN HEALTHCARE	11
CHARTER COMMUNICATIONS INC	1
CHATHAM CO	1
CHATHAM CO BOARD OF EDUCATION	21
CHATHAM HOSPITAL INC	3
CITRIX SYSTEMS INC	0
CITY OF HENDERSON	2
CITY OF RALEIGH PARKS REC DEPT	9
CLIFFORD W ESTES CO INC	3
CLINTON CITY BD OF ED	8
CLINTON CITY OF	3
CLOVERLEAF COLD STORAGE CO	1
CMC CORPORATION	3
CMS FOOD SOLUTIONS INC	1
COAST LAMP MANUFACTORY	2
COASTAL CAR COMM COLL RES BLD	1
COASTAL CAROLINA COMM COLLEGE	13
COASTAL FEDERAL CREDIT UNION	1
COATINGS AND ADHESIVES CORP	7
COBB VANTRESS INC	1
COKER FEED MILL INC	1
COLONIAL CARTON CO	1
COLUMBUS COUNTY SCHOOLS	11
COLUMBUS REG HEALTHCARE SYSTEM	3
COMFORT TECH INC	1
COMPUTER DESIGN INC	1
CONESTOGA WOOD SPECIALTIES	2
CONSOLIDATED METCO INC	2
CONVEYOR TECHNOLOGIES OF SANFO	4
COOPER INDUSTRIES INC	2
COOPER-STANDARD AUTOMOTIVE INC	2
CORE-MARK DISTRIBUTORS INC	2

CORNELIA NIXON DAVIS INC	5
CORNELIA NIXON DAVIS NURSING	1
CORNING INC	3
CORTEK	4
COSTCO	4
COTTLE STRAWBERRY NURSERY INC	8
COTY US LLC	6
COUNCIL TOOL CO INC	4
COUNTRY CLUB OF LANDFALL	17
COUNTY OF WAYNE	1
COURTYARD BY MARRIOTT	2
COVIA HOLDINGS CORPORATION	6
CPI USA NORTH CAROLINA LLC	1
CRAVEN CO BD OF ED	13
CRAVEN CO JUSTICE CENTER	2
CRAWFORD KNITTING INC	1
CROP PRODUCTION SERVICES INC	1
CROSS CANVAS COMPANY INC	3
CRUMPLER PLASTIC PIPE INC	8
CSX TRANSPORTATION	2
CTC FURNITURE DISTRIBUTORS INC	1
CUMBERLAND CO BD ED	5
DAK AMERICAS LLC	3
DALIAH PLASTICS CORP	4
DAY INTERNATIONAL INC	2
DCI INC	1
DEERFIELD EPISCOPAL RETIREMENT	18
DENNISON, WYNDHAM V	1
DEPT OF HEALTH & HUMAN RESOURC	34
DESCO INDUSTRIES INC	4
DEVIL DOG MFG CO INC	2
DEWEY DEVELOPMENT INC	1
DIXIE PIPELINE COMPANY	4
DRPFC I LLC	5
DUKE UNIV HEALTH SYSTEM INC	26
DUKE UNIVERSITY MARINE LAB	1
DUNN CITY OF	2
DUPLIN CO BD OF ED	7
DUPLIN GENERAL HOSP	3
DUPONT SPECIALTY PRODUCTS	10
DYNAPAR CORP	3
E CAROLINA METAL TREATING INC	2
EAGLE SPORTSWEAR LLC	4
EARTH FARE INC	4

EATON CORPORATION	8
EDWARDS BROTHERS INC	2
EDWARDS WOOD PRODUCTS INC	6
ELAND INDUSTRIES INC	1
ELASTIC THERAPY INC	1
ELECTRO SWITCH CORPORATION	1
ELEMENTIS CHROMIUM INC	4
ELKAY SOUTHERN PLANT 2	1
ELKINS SAWMILL INC	3
EMC CORPORATION	4
EMERGEORTHO PA	2
EMERSON AUTOMATION SOLUTIONS	3
ENERGIZER BATTERY MANUFACTURIN	3
ENTERCO LLC	1
ENVIVA PELLETS SAMPSON LLC	1
ENVIVA PORT OF WILMINGTON, LLC	4
EOS ACQUISITION I LLC	1
ERICO INC	1
EVERGREEN PACKAGING INC	4
EXTREME NETWORKS INC	1
FAYETTEVILLE TECH COMM COLL	2
FCC (NC) LLC	1
FENNER DRIVES	1
FIRST BAPTIST CH OF ASHE INC	1
FIRST CITIZENS BANK	1
FIRST CITIZENS BANK & TRUST CO	5
FIRSTHEALTH OF THE CAROLINAS	43
FLETCHER BUSINESS PARK LLC	1
FLETCHER HOSPITALITY, LLC	1
FLOCO FOODS INC	2
FLOWSERVE US INC	1
FLYING J INC	1
FOOD LION LLC	167
FORTRON INDUSTRIES LLC	1
FOUNTAIN POWER BOATS INC	5
FOUR SEASONS MNGMT SVCS INC	6
FRANK THEATRES PARKSIDE COMMON	1
FRANKLIN BAKING COMPANY LLC	7
FRANKLIN COUNTY SCHOOLS	5
FRATERNITY/SORORITY LIFE	4
FRESH BUY INC	2
FRESH FOODS LLC	5
FUJIFILM DIOSYNTH BIOTEC USA	1
FUQUAY-VARINA TOWN OF	1

GALE FORCE SPORTS & ENTERTAIN	13
GALLOWAY RIDGE INC	17
GENERAL ELECTRIC CO	2
GENERAL INDUSTRIES INC	5
GENERAL PARTS DIST LLC	1
GENERAL SHALE BRICK INC	8
GENERAL TIMBER INC	4
GEORGIA PACIFIC WOOD PROD LLC	1
GEORGIA-PACIFIC CORP	2
GH CRESCENT GREEN INC	1
GIBRALTAR PACKAGING GROUP INC	4
GILDAN YARNS LLC	1
GIVENS ESTATES INC	12
GIVENS HIGHLAND FARMS LLC	11
GKN DRIVELINE N AMERICA INC	4
GLAXOSMITHKLINE	9
GLEN RAVEN MILLS INC	1
GLENWOOD ASSET MANAGEMENT LLC	1
GLENWOOD HOSPITALITY ASSOC LLC	1
GLENWOOD PLACE VENTURES LLC	1
GLOBAL PACKAGING INC	1
GODWIN MFG CO INC	14
GOLDSBORO CITY OF	2
GOLDSBORO HOUSING AUTHORITY	3
GOLDSBORO MILLING CO	13
GRANITE FALLS SWIM/ATHL CLUB	2
GREATER ASHEVILLE REG AIRPORT	1
GREDE II LLC	3
GREENE COUNTY MANAGER	1
GRIFOLS THERAPEUTICS LLC	4
H & H FURNITURE MFG INC	3
HALIFAX MEDIA HOLDINGS LLC	4
HANESBRANDS INC	2
HANSON AGGREGATES SE LLC	33
HANSON BRICK EAST LLC	1
HAPPY JACK INC	1
HARDEN ROAD ASSOCIATES	1
HARGER LIGHTNING & GROUNDING	1
HARNETT CO BD OF ED	24
HARNETT CO PUBLIC UTIL	9
HARNETT CO SHERIFF OFFICE	1
HARNETT HEALTH SYSTEM INC	19
HARRIS PRINTING CO INC	3
HARRIS TEETER INC	30

HASTY PLYWOOD CO	3
HAVELOCK CITY OF	1
HAYWOOD COUNTY LOCAL GOV	1
HAYWOOD REGIONAL MEDICAL CNTR	6
HCL AMERICA INC	1
HEATMASTERS LLC	3
HERAEUS QUARTZTECH AMERICA LLC	1
HEXION INC	2
HIGHWOODS JOINT VENTURE	1
HIGHWOODS REALTY LP	26
HJH ASSOCIATES	1
HOG SLAT INC	9
HOLLY SPRINGS TOWN OF	1
HOME CARE PRODUCTS LLC	1
HOME DEPOT USA INC	9
HOPE COMMUNITY CHURH OF NC INC	2
HORNWOOD INC	3
HOUSE OF RAEFORD FARMS INC	14
HOUSING AUTH CITY OF RALEIGH	2
HUGHES FURNITURE INDUSTRIE INC	1
HULSING HOTELS INC	13
HUVEPHARMA INC	1
HYDRO TUBE ENTERPRISES INC	1
IAC TROY LLC	1
IMMEDION LLC	
INGERSOLL-RAND	1
INGLES MARKETS INC	84
INN ON BILTMORE ESTATE INC	1
INNOVATIVE LAMINATIONS CO	1
INTERNATIONAL BROADCAST BUREAU	1
INTERNATIONAL PAPER COMPANY	6
INVISTA S A R L	1
J & D WOOD INC	3
J A MCNEILL & SONS	1
J C HOWARD FARMS LLC	8
J P TAYLOR COMPANY LLC	4
J&J SNACK FOODS HANDHELDS CORP	2
JACKSONVILLE CITY OF	4
JACOB HOLM IND AMERICA INC	1
JOHN DEERE TURF CARE INC	3
JOHNSTON CO BOARD OF EDUCATION	77
JOHNSTON CO PUBLIC UTILITIES	2
JOHNSTON MEM HOSPITAL AUTH	1
JORDAN LUMBER & SUPPLY INC	14

JOVC FOOD CORP INC	1
KAYSER-ROTH HOSIERY INC	4
KENNAMETAL INC	2
KESSLER ASHEVILLE LLC	1
K-FLEX USA LLC	9
KILELEE, KATHRYN	1
KING CHARLES INDUSTRIES LLC	1
KINGS HOLDINGS 4,LLC	1
KINGSLAND REALTY LLC	1
KLAUSSNER FURN IND INC	24
KOOPMAN DAIRIES INC	4
KORDSA INC	2
KROGER COMPANY	3
KRYOCAL, LLC	3
LAKE JUNALUSKA ASSEMBLY INC	51
LANCER INC	4
LAZAR INDUSTRIES LLC	4
LCNRC OF COLUMBUS CO LLC	2
LEAR CORPORATION	3
LEE BRICK & TILE COMPANY	7
LEE COUNTY COURT HOUSE	2
LEE IRON & METAL CO	3
LENOVO INTERNATIONAL	1
LEWIS SAUSAGE CO INC	1
LIBERTY COMMONS WARREN CO LLC	1
LIBERTY HEALTHCARE SERVICES	3
LIFEWAY CHRISTIAN RESOURCES OF	41
LINAMAR NORTH CAROLINA INC	4
LINPRINT CO	1
LIVE OAK BANKING COMPANY	2
LOCAL GOVERNMENT FED CREDIT UN	1
LORD CORPORATION	2
LOUISBURG COLLEGE INC	12
LOUISE WELLS CAMERON ART MUSEU	4
LOUISIANA PACIFIC CORP	4
LOW & BONAR INC	1
LOWER CAPE FEAR WATER & SEWER	0
LOWES COMPANIES INC	34
LOWES FOODS LLC	25
LUMBERTON CELLULOSE LLC	4
M ADLER'S SON, INC	1
MAGNETI MARELLI USA INC	4
MANHATTEN AMERICAN	1
MANUFACTURING METHODS, LLC	1

MARS PETCARE US, INC	7
MARTIN MARIETTA MATERIALS INC	59
MAS US HOLDINGS INC	3
MAY FURNITURE INC	3
MCDOWELL LUMBER CO INC	11
MCGILL ENVIRONMENTAL SYS OF NC	1
MCLAMBS ABATTOIR AND MEATS INC	1
MCMURRAY FABRICS INC	7
MEASUREMENTS GROUP INC	4
MEDICAL ACTION INDUSTRIES INC	1
MEDICAL SPECIALTIES INC	1
MEMORIAL MISSION HOSPITAL INC	1
MEREDITH COLLEGE	6
MERITOR HEAVY VEHICLE SYS LLC	2
MERTEK SOLUTIONS INC	1
METAL-CAD & STEEL FRAMING	1
METCHEM, LLC	1
METROPOLITAN SEWAGE DISTRICT	5
MHG ASHEVILLE AL LP	1
MICROSPACE COMM CORP	1
MILKCO INC	4
MINE SAFETY APPL CO INC	1
MISSION HEALTH SYSTEM INC	16
MISSION ST JOSEPH HEALTH SYS	1
MISSION ST JOSEPH HOSPITAL	1
MITCHELL CO BD OF ED	2
MMIC-TL INC PARTNERS LLC	1
MOEN INC	4
MONTGOMERY COUNTY OF	2
MOORE COUNTY	1
MOORE COUNTY SCHOOLS	18
MOORE'S INLET LIMITED PRTNRSHP	1
MOUNTAIRE FARMS INC	21
MT OLIVE PICKLE CO	16
MULE CITY SPEC FEED INC	2
MURPHY BROWN LLC	1
N C TELEVISION INC	1
N RALEIGH CHRISTIAN ACADEMY	2
N RALEIGH MEDICAL REALTY LLC	1
NASH BRICK CO INC	2
NASH COMMUNITY COLLEGE	8
NASH COUNTY	1
NASH COUNTY MANAGERS OFFICE	1
NASH ROCKY MOUNT BD OF ED	23

NATIONAL SPINNING CO INC	5
NATIONAL WIPER ALLIANCE INC	1
NATURAL BLEND VEG DEHYDR LLC	1
NATURES EARTH PELLETS INC LLC	3
NATURES WAY FARMS INC	1
NC AQUARIUM	3
NC DEPT OF AGRICULTURE	3
NC DEPT OF PUBLIC SAFETY	48
NC FARM BUREAU FEDERATION	1
NC RENEWABLE PWR LUMBERTON LLC	5
NC STATE FAIRGROUNDS	5
NC STATE PORTS AUTH	13
NC STATE PORTS AUTHORITY	26
NC STATE UNIVERSITY	143
NC STATE VETERANS HOME	2
NC WILDLIFE COMMISSION	1
NESBITT ASHEVILLE VENTURE LLC	2
NEW BELGIUM BREWING CO INC	1
NEW HANOVER CO BD OF ED	45
NEW HANOVER REGIONAL MED CTR	32
NG PURVIS FARMS INC	3
NHC PROPERTY MANAGEMENT	3
NOBLE OIL SERVICES	4
NOMACO INC	3
NOMACORC LLC	3
NORCRAFT COMPANIES LP	2
NORTH CAROLINA MFG CO INC	1
NORTH HILLS TOWER II LLC	3
NORTH STATE TECH SOLUTIONS	
NOVIPAX LLC	4
NOVO NORDISK PHARMACUTICAL INC	4
NOVOZYMES NORTH AMERICA INC	6
NYPRO ASHEVILLE INC	2
OFFICE OF INFOR TECH SVCS	4
OHM HOTELS RTP, LLC	1
OLDCASTLE LAWN & GARDEN INC	5
OLIVER RUBBER COMPANY	2
OMNI GROVE PARK LLC	21
ONSLOW CO BD OF COMM	2
ONSLOW CO BD OF EDUC	23
ONSLOW MEMORIAL HOSPITAL AUTH	2
ONSLOW WATER AND SEWER AUTH	5
ORACLE AMERICA, INC	1
OWENS & MINOR	1

OXFORD CITY OF	1
P G & C INC	2
PACTIV LLC	1
PAK A SAK FOOD STORES	1
PALLET EXPRESS, INC	5
PALZIV NORTH AMERICA INC	1
PAPA JOHNS USA INC	1
PARADIGM ANALYTICAL	1
PARK COMMUNICATIONS LLC	2
PARK N SHOP FOOD MART INC	6
PARKDALE AMERICA LLC	2
PARRISH & RONE INC	1
PCS PHOSPHATE CO INC	2
PEAK 10 INC	3
PENDER CO BD OF ED	17
PENDER MEMORIAL HOSPITAL INC	7
PENICK VILLAGE INC	13
PENTAIR WATER POOL AND SPA INC	10
PEPSI BOTTLING VENTURES LLC	6
PERDUE FARMS INC	23
PERSON CO BD OF ED	2
PETROLEUM TANK CO	2
PFIZER INC	11
PH HS LLC	1
PHOENIX LTD PARTNERSHIP	1
PIEDMONT NATURAL GAS	1
PIEDMONT NATURAL GAS CO	1
PILGRIMS PRIDE CORPORATION	11
PILKINGTON	1
PINEHURST LLC	84
PINEHURST MEDICAL CLINIC	1
PIONEER HI BRED INC	4
PLASTEK IND INC (PA) NC	3
PLASTICARD PRODUCTS INC	1
POLYMER GROUP INC	3
POLYZEN INC	1
PORT CITY COMMUNITY CHURCH	3
PR II WADE PARK LLC	3
PRAXAIR INC	2
PRC NC LLC	2
PRECISION HYDRAULIC CYL INC	4
PRECISIONAIRE INC	3
PREMIERE FIBERS INC	4
PRESTAGE AGENERGY OF NC LLC	2

PRESTAGE FARMS INC	35
PRESTIGE FABRICATORS INC	3
PRESTON TAYLOR FOOD INC	1
PRINTLOGIC LLC	2
PRO PALLET SOUTH INC	1
PROTO LABS INC	1
PSNC ENERGY	1
PUBLIC SCHOOLS OF ROBESON CO	1
PUBLIX NORTH CAROLINA LP	3
QUAIL HAVEN OF PINEHURST LLC	1
QUALCOMM INC	1
QUALITY CHEMICAL LABORATRS LLC	2
QUALITY TEXTILE SERVICES INC	1
RAEFORD CITY OF	1
RAILROAD FRICTION PRODUCT CORP	4
RALEIGH CITY OF	6
RALEIGH FITNESS & WELLNESS	1
RALEIGH HOTEL OPERATOR INC	1
RALEIGH PRECISION PRODUCTS INC	0
RANDOLPH COUNTY	9
RAVEN ANTENNA SYSTEMS INC	1
RC CREATIONS, LLC	2
RD AMERICA LLC	1
RDU AIRPORT AUTHORITY	6
RED HAT INC	1
RED WOLF COMPANY, LLC	1
REDDY ICE CORP	2
REGAL CINEMAS	3
REGAL ENTERAINMENT GROUP	4
REICH LLC	2
RESINART EAST INC	1
REVLON CONSUMER PRODUCTS CORP	3
REX HEALTH CARE INC	14
REX MOB PARTNERS LLC	1
RHEINFELDEN AMERICAS LLC	1
RICHMOND COUNTY	1
RICHMOND COUNTY BOARD OF COMM	2
RICHMOND COUNTY SCHOOLS	2
RICHMOND SPECIALTY YARNS LLC	2
RIDGECREST CONFERENCE CENTER	1
ROBESON COUNTY DSS	1
ROCKINGHAM CITY OF	9
RODECO CO	2
ROYAL TEXTILE MILLS INC	1

RUBY'S PROPERTIES II LLC	1
S AND J HOLDINGS LLC	1
S B SMITH & SON INC	4
S T & F PRECISION INC	1
S T WOOTEN CORPORATION	17
SAAB BARRACUDA LLC	6
SAINT JOSEPH OF THE PINES INC	21
SAMPSON REGIONAL MEDICAL CTR	3
SANDERSON FARMS INC	7
SANDHILLS COMM COLLEGE	12
SANFORD CITY OF	4
SANFORD LEE CO BD OF ED	40
SANFORD MILLING CO INC	2
SAPONA MFG CO INC	2
SAS INSTITUTE INC	26
SCHINDLER ELEVATOR CORP	2
SCOTLAND CONTAINER INC	2
SCOTLAND MANUFACTURING	1
SEPARATION TECHNOLOGIES LLC	2
SEQIRUS INC	1
SIBELCO NORTH AMERICA INCORPOR	45
SIGMA PHI EPSILON	1
SILAR LABORATORIES, INC.	1
SILER CITY TOWN OF	2
SILVER LINE PLASTICS CORP	11
SINCLAIR BROADCAST GROUP INC	1
SIX FORKS OFFICE, LLC	3
SKYLAND BEER DIST	3
SMITHFIELD FRESH MEATS	6
SMOKY MOUNTAIN MACHINING INC	3
SNEEDEN, NORMAN E	2
SNUG HARBOR MANAGEMENT LLC	1
SONOCO PRODUCTS CO	1
SOUTH RIVER EMC COMM ASST CORP	1
SOUTHCO INC OF NC	1
SOUTHEASTERN REGIONAL MED CTR	4
SOUTHERN BAG CORP	1
SOUTHERN CONCRETE MATERIAL INC	14
SOUTHERN FABRICATORS INC	4
SOUTHERN PINES TOWN OF	2
SOUTHERN PRODUCE DIST INC DIP	3
SOUTHERN PRODUCTS & SILICA CO	6
SOUTHERN STATES CHEMICAL INC	3
SPANSET INC	1

SPECGX LLC	13
SPIRIT AEROSYSTEMS INC	2
SPORTS FACTORY LLC	2
SPX FLOW TECHNOLOGY SYSTEMS	1
ST ANDREWS PRESBYTERIAN COLL	1
ST. DAVIDS SCHOOL	7
STAN JOHNSON & ASSOCIATES LLC	2
STANADYNE INC	2
STARPET INC	6
STATIC CONTROL COMP INC	11
STEEL & PIPE CORP	2
STEVEN ROBERTS ORIGINAL	2
STI POLYMER INC	1
SUMITOMO ELECTRIC LIGHTWAVE CO	1
SUN LIFE ASSURANCE CO OF CANAD	1
SUNBRIDGE REGENCY NC LLC	2
SUNRISE SENIOR LIVING	1
SUPERIOR MODULAR PRODUCT INC	1
SUPERIOR PLASTICS EXTRUSION	1
SUPERTEX, INC	4
SURGERY CENTER OF PINEHURST	1
SURGICAL CARE AFFILIATES	1
SURTRONICS	2
SVT VENTURES LP	4
SYRACUSE PLASTIC OF NC INC	1
TALBERT BUILDING SUPPLY INC	1
TARGET STORES	18
TCDC PARTNERSHIP, LLC	2
TE CONNECTIVITY CORPORATION	2
THE ATRIUM AT BLUE RIDGE, LLC	1
THE BILTMORE COMPANY	3
THE CHEESECAKE FACTORY	1
THE CHEMOURS COMPANY FC, LLC	8
THE COUNTRY CLUB OF NC INC	1
THE CYPRESS OF RALEIGH	7
THE HARRELSON BUILDING INC	1
THE NEWS REPORTER CO INC	1
THE QUARTZ CORP USA	17
THE UMSTEAD	1
THEO DAVIS SONS INC	1
THERMAL METAL TREATING INC	1
THERMOFISHER SCI ASHEVILLE LLC	1
TIERPOINT LLC	3
TIME WARNER CABLE SE LLC	4

TIPPER TIE INC	3
TOP TOBACCO CO	3
TOWN SQUARE WEST LLC	7
TRAM LUMBER LLC	3
TRAMWAY VENEERS INC	1
TRANS CAROLINA PRODUCTS LLC	1
TREEHOUSE FOODS INC	6
TRIANGLE AQUATIC CENTER	1
TRIANGLE BRICK CO	6
TRIANGLE TOWN CENTER, LLC	22
TRINITY MANUFACTURING INC	6
TROTTERS SEWING COMPANY INC	1
TROY LUMBER CO	16
TROY POLYMER INC	1
TUCSON CARY, LLC	1
TURN BULL LUMBER COMPANY	1
TYCO ELECTRONICS	1
TYSON FOODS INC	3
U S REIF 4700 FALLS NC LLC	1
UCHIYAMA MANUF AMERICA LLC	3
UNC AT ASHEVILLE	8
UNC INSTITUTE OF MARINE SCI	3
UNC PUBLIC TV OF NC	1
UNCW	18
UNILEVER MANUFACTURING US INC	6
UNILIN NORTH AMERICA LLC	4
UNILIN US MDF	3
UNISON ENGINE COMPONENTS INC	4
UNITED STATES COLD STORAGE INC	6
UNITED STATES GYPSUM CO	1
UNIVERSAL HEALTHCARE N RAL INC	1
UNIVERSAL LEAF NORTH AMERICA	3
UNIVERSITY OF NC AT PEMBROKE	16
UNIVERSITY RESEARCH UNIT	1
US ARMY	1
US ARMY FORT BRAGG	3
US DEPT OF AIR FORCE	1
US FLUE CURED TOBACCO GROWERS	1
US MARINE CORP	1
US MARINE CORPS	1
US POST OFFICE	2
US VETERANS ADMIN HOSPITAL	3
USCG FINANCE CENTER	7
USS NC BATTLESHIP COMM	2

UWHARRIE FRAME MFG LLC	2
UWHARRIE LUMBER CO	3
VALLEY PROTEINS INC	15
VANDERBILT MINERALS LLC	4
VANGUARD CULINARY GROUP LTD	1
VENEER TECHNOLOGIES INC	7
VERTEX RAILCAR CORPORATION	2
VICTAULIC CO OF AMERICA	2
VILLARI BROS FOODS LLC	1
VONDREHLE CORP	6
VULCAN CONST MATERIALS LP	18
W N WILDER CO INC	1
WADESBORO IGA INC	1
WAKE CO HOSP SYSTEM INC	4
WAKE COUNTY BOARD OF EDUCATION	190
WAKE COUNTY GENERAL SERVICES	15
WAKE STONE CORP	17
WAKEMED	6
WAKEMED FACILITIES SVC	2
WAKEMED PROPERTY SERVICES	15
WAL MART PDC #6091	4
WALMART STORES INC	76
WALNUT CREEK AMPHITHEATER	5
WARP TECHNOLOGIES INC	1
WARREN CO BD OF ED	5
WAYNE BAILEY INC	2
WAYNE CO PUBLIC SCHOOLS	1
WAYNE COMMUNITY COLLEGE	1
WAYNE COUNTY	4
WAYNE MEMORIAL HOSPITAL INC	9
WAYNESVILLE TOWN OF	1
WELLS FARGO BANK NA	2
WEST CRAVEN HIGH SCHOOL	3
WEST CRAVEN MIDDLE SCHOOL	1
WEST FRASER INC	5
WESTERN NC HEALTHCARE INNO III	1
WESTERN NC HEALTHCARE INNO LLC	1
WEYERHAEUSER NR COMPANY	5
WHITEVILLE FABRICS LLC	4
WILLIAM BARNET & SON INC	5
WILLIAMS PROPERTY GROUP INC	1
WILMINGTON CITY OF	1
WILMINGTON HOTEL ASSOC CORP	2
WILMINGTON INTL AIRPORT	8

WILMINGTON MACHINERY INC	1
WILSONART INTERNATIONAL	4
WNC PALLET & FOREST PRDCTS INC	0
WRDC LLC	1
WRIGHT FOODS INC	2
WRIGHT MACHINE & TOOL CO INC	1
XELLIA PHARMACEUTICALS USA LLC	1
YALE INDUSTRIAL PRODUCTS INC	1
YAMCO LLC	1
YMCA OF WESTERN NORTH CAROLINA	2
Grand Total	**4,354**

Customer Name	EE
1922 SKIBO CROSS CREEK LLC	1
3141 PROPERTIES LLC	1
333 VENTURES LLC	2
3700 GLENWOOD LLC	1
4208 SIX FORKS ROAD LLC	2
5400 RALEIGH CRABTREE KKC	1
81ST REGIONAL SUPPT COMMAND	1
A STUCKI COMPANY	1
ABB MOTORS AND MECHANICAL INC	1
ADVANCED PLASTIC EXTRUSION LLC	2
AG PROVISION LLC	3
AIR SYSTEM COMPONENTS INC	1
AJINOMOTO USA INC	3
ALAMAC AMERICAN KNITS LLC	2
ALBANY ROAD-WYCLIFF LLC	2
ALCAMI CAROLINAS CORPORATION	4
ALL TRUSS LLC	1
ALLEN HARIM FOODS LLC	1
ALPLA INC	1
AMCOR FLEXIBLES INC	1
AMCOR RIGID PLASTICS USA LLC	1
AMERICAN AIRLINES GROUP INC	1
AMERICAN GROWLER INC	2
AMERICAN SKIN COMPANY INC	1
AMERICAN TEL & TEL CO	1
AMERICHEM INC	3
AMISUB OF NORTH CAROLINA INC	1
ANGUS BARN LTD	6
ANSON COUNTY WATER DEPT	1
ANSON COUNTY WTR SYSTEM	1
ANSON MACHINE WORKS	4
APAC TENNESSEE INC	3
APEX OIL CO INC/TERMINALS DIVI	5
APEX TOOL GROUP LLC	2
ARAUCO PANELS USA LLC	4
ARCADIA FARMS LLC	2
ARCHER DANIELS MIDLAND CO	1
ARCLIN USA INC	6
ARDAGH GLASS INC	3
ARDEN CORPORATION	3
ASHEBORO CITY OF	3
ASHEBORO ELASTICS CORP	2

ASHEVILLE BUNCOMBE TECH	22
ASHEVILLE CITY OF	7
ASHEVILLE WASTE PAPER CO INC	5
ASTON PARK HEALTH CARE CENTER	1
AT & T MOBILITY	3
AT HOME STORES LLC	2
ATEX TECHNOLOGIES INC	2
ATLANTIC CORP OF WILM INC	7
ATLANTIC VENEER CORP	3
ATLAS PRECISION INC	1
AUSTIN QUALITY FOODS INC	2
AUX KITCHEN LLC	1
B V HEDRICK GRAVEL & SAND CO	9
BAILEY FARMS INC	1
BALCRANK CORPORATION	1
BALLY REFRIGERATED BOXES INC	2
BARNES FARMING CORPORATION	8
BARNHARDT MFG CO	1
BARTLETT MILLING CO	2
BB&T	3
BEAR CREEK ARSENAL, INC	5
BELK INC	6
BELLSOUTH TELECOMMUNICATIONS	12
BELT CONCEPTS OF AMERICA	1
BI-LO LLC	1
BILTMORE BAPTIST CHURCH	1
BILTMORE FARMS HOTEL GRP LLC	3
BILTMORE FOREST CNTRY CLUB INC	5
BJ'S WHOLESALE CLUB INC	8
BLACK MTN CENTER	6
BLUE RIDGE METALS CORP	3
BLUE RIDGE PAPER PRODUCTS INC	29
BOISE CASCADE WOOD PRDCTS LLC	7
BOLIVIA LUMBER CO LLC	2
BONSAL AMERICAN INC	1
BORG WARNER TURBO SYSTEMS INC	2
BORGWARNER THERMAL SYSTEMS INC	1
BP SOLUTIONS GROUP INC	2
BRAIFORM ENTERPRISES INC	1
BRIDGESTONE BANDAG LLC	7
BRIER CREEK OFF #6 LLC	1
BRIER CREEK OFFICE # 1 LLC	1
BRIER CREEK OFFICE # 2 LLC	1

BRIER CREEK OFFICE # 5 LLC	1
BRIER CREEK OFFICE #4 LLC	1
BRM PARTNERS II LLC	1
BRM PARTNERS LLC	1
BROMLEY PLASTICS CORPORATION	1
BROOKS HOWELL RETIREMENT HOME	3
BROOKWOOD FARMS INC	5
BRUNSWICK CO	1
BRUNSWICK CO UTILITIES	1
BRUNSWICK COUNTY SCHOOLS	18
BSH HOME APPLIANCES	5
BUNCOMBE CO BD OF EDUCATION	0
BUNCOMBE COUNTY	0
BURCAM CAPITAL II LLC	1
BURLINGTON INDUSTRIES LLC	2
BUSINESS TELECOM LLC	2
CAMP DAVIS INDUSTRIAL PARK INC	6
CAMPBELL SOUP SUPPLY CO LLC	5
CAMPBELL UNIVERSITY INC	65
CAN AM SOUTH LLC	2
CANTON SAWMILL LLC	7
CAPE FEAR ACADEMY	2
CAPE FEAR COMMUNITY COLLEGE	30
CAPE FEAR COUNTRY CLUB	7
CAPE FEAR PUBLIC UTILITY AUTH	5
CAPEL INC	6
CAPITAL FUNDS INC	2
CAPITOL BROADCASTING CO	13
CARDINAL METALWORKS INC	2
CARLIE C OPERATION CENTER INC	11
CAROLINA APPAREL GROUP INC	1
CAROLINA BAY OF WILMINGTON LLC	5
CAROLINA BEACH TOWN OF	2
CAROLINA COUNTRY CLUB	3
CAROLINA CRATE & PALLET INC	3
CAROLINA DAIRY LLC	2
CAROLINA EGG CO INC	1
CAROLINA ELECTRONIC ASSEMBLERS	1
CAROLINA EYE ASSOCIATES PA	1
CAROLINA ICE INC	4
CAROLINA INNOVATIVE FOOD INGRE	3
CAROLINA PRESERVE BY DEL WEBB	4
CAROLINA TECHNICAL PLASTICS	3

CARQUEST OF SRONCE	2
CARTERET CO BD OF ED	5
CARTERET COMMUNITY COLLEGE	18
CARTERET COUNTY FINANCE	1
CARTERET GENERAL HOSPITAL	3
CARY TOWN OF	19
CARY VENTURE LTD PRTNRSHIP	14
CASCADES HOLDING US INC	5
CASE FARMS	8
CATALENT PHARMA SOLUTIONS LLC	16
CATERPILLAR INC	11
CECIL BUDD TIRE COMPANY LLC	3
CERTAINTEED CORPORATION	4
CERTAINTEED GYPSUM NC INC	3
CERTAINTEED INC	1
CFVH - BLADEN HEALTHCARE	11
CHARTER COMMUNICATIONS INC	1
CHATHAM CO	1
CHATHAM CO BOARD OF EDUCATION	21
CHATHAM HOSPITAL INC	3
CITRIX SYSTEMS INC	3
CITY OF HENDERSON	2
CITY OF RALEIGH PARKS REC DEPT	9
CLIFFORD W ESTES CO INC	3
CLINTON CITY BD OF ED	8
CLINTON CITY OF	3
CLOVERLEAF COLD STORAGE CO	1
CMC CORPORATION	3
CMS FOOD SOLUTIONS INC	1
COAST LAMP MANUFACTORY	2
COASTAL CAR COMM COLL RES BLD	1
COASTAL CAROLINA COMM COLLEGE	13
COASTAL FEDERAL CREDIT UNION	1
COATINGS AND ADHESIVES CORP	7
COBB VANTRESS INC	1
COKER FEED MILL INC	1
COLONIAL CARTON CO	1
COLUMBUS COUNTY SCHOOLS	11
COLUMBUS REG HEALTHCARE SYSTEM	3
COMFORT TECH INC	1
COMPUTER DESIGN INC	1
CONESTOGA WOOD SPECIALTIES	2
CONSOLIDATED METCO INC	2

CONVEYOR TECHNOLOGIES OF SANFO	4
COOPER INDUSTRIES INC	2
COOPER-STANDARD AUTOMOTIVE INC	2
CORE-MARK DISTRIBUTORS INC	2
CORNELIA NIXON DAVIS INC	5
CORNELIA NIXON DAVIS NURSING	1
CORNING INC	3
CORTEK	4
COSTCO	4
COTTLE STRAWBERRY NURSERY INC	8
COTY US LLC	6
COUNCIL TOOL CO INC	4
COUNTRY CLUB OF LANDFALL	17
COUNTY OF WAYNE	1
COURTYARD BY MARRIOTT	2
COVIA HOLDINGS CORPORATION	6
CPI USA NORTH CAROLINA LLC	1
CRAVEN CO BD OF ED	11
CRAVEN CO JUSTICE CENTER	2
CRAWFORD KNITTING INC	1
CROP PRODUCTION SERVICES INC	1
CROSS CANVAS COMPANY INC	3
CRUMPLER PLASTIC PIPE INC	8
CSX TRANSPORTATION	2
CTC FURNITURE DISTRIBUTORS INC	1
CUMBERLAND CO BD ED	5
DAK AMERICAS LLC	3
DALIAH PLASTICS CORP	4
DAY INTERNATIONAL INC	2
DCI INC	1
DEERFIELD EPISCOPAL RETIREMENT	18
DENNISON, WYNDHAM V	1
DEPT OF HEALTH & HUMAN RESOURC	34
DESCO INDUSTRIES INC	4
DEVIL DOG MFG CO INC	1
DEWEY DEVELOPMENT INC	1
DIXIE PIPELINE COMPANY	4
DRPFC I LLC	5
DUKE UNIV HEALTH SYSTEM INC	26
DUKE UNIVERSITY MARINE LAB	1
DUNN CITY OF	2
DUPLIN CO BD OF ED	7
DUPLIN GENERAL HOSP	3

DUPONT SPECIALTY PRODUCTS	10
DYNAPAR CORP	3
E CAROLINA METAL TREATING INC	2
EAGLE SPORTSWEAR LLC	3
EARTH FARE INC	3
EATON CORPORATION	8
EDWARDS BROTHERS INC	2
EDWARDS WOOD PRODUCTS INC	6
ELAND INDUSTRIES INC	1
ELASTIC THERAPY INC	3
ELECTRO SWITCH CORPORATION	1
ELEMENTIS CHROMIUM INC	4
ELKAY SOUTHERN PLANT 2	1
ELKINS SAWMILL INC	3
EMC CORPORATION	4
EMERGEORTHO PA	2
EMERSON AUTOMATION SOLUTIONS	3
ENERGIZER BATTERY MANUFACTURIN	3
ENTERCO LLC	1
ENVIVA PELLETS SAMPSON LLC	1
ENVIVA PORT OF WILMINGTON, LLC	4
EOS ACQUISITION I LLC	1
ERICO INC	1
EVERGREEN PACKAGING INC	4
EXTREME NETWORKS INC	1
FAYETTEVILLE TECH COMM COLL	2
FCC (NC) LLC	1
FENNER DRIVES	1
FIRST BAPTIST CH OF ASHE INC	1
FIRST CITIZENS BANK	1
FIRST CITIZENS BANK & TRUST CO	5
FIRSTHEALTH OF THE CAROLINAS	43
FLETCHER BUSINESS PARK LLC	0
FLETCHER HOSPITALITY, LLC	0
FLOCO FOODS INC	2
FLOWSERVE US INC	1
FLYING J INC	1
FOOD LION LLC	179
FORTRON INDUSTRIES LLC	1
FOUNTAIN POWER BOATS INC	5
FOUR SEASONS MNGMT SVCS INC	6
FRANK THEATRES PARKSIDE COMMON	1
FRANKLIN BAKING COMPANY LLC	7

FRANKLIN COUNTY SCHOOLS	5
FRATERNITY/SORORITY LIFE	4
FRESH BUY INC	2
FRESH FOODS LLC	3
FUJIFILM DIOSYNTH BIOTEC USA	1
FUQUAY-VARINA TOWN OF	1
GALE FORCE SPORTS & ENTERTAIN	13
GALLOWAY RIDGE INC	17
GENERAL ELECTRIC CO	2
GENERAL INDUSTRIES INC	4
GENERAL PARTS DIST LLC	1
GENERAL SHALE BRICK INC	8
GENERAL TIMBER INC	4
GEORGIA PACIFIC WOOD PROD LLC	1
GEORGIA-PACIFIC CORP	2
GH CRESCENT GREEN INC	1
GIBRALTAR PACKAGING GROUP INC	4
GILDAN YARNS LLC	1
GIVENS ESTATES INC	12
GIVENS HIGHLAND FARMS LLC	11
GKN DRIVELINE N AMERICA INC	4
GLAXOSMITHKLINE	9
GLEN RAVEN MILLS INC	1
GLENWOOD ASSET MANAGEMENT LLC	1
GLENWOOD HOSPITALITY ASSOC LLC	1
GLENWOOD PLACE VENTURES LLC	1
GLOBAL PACKAGING INC	1
GODWIN MFG CO INC	14
GOLDSBORO CITY OF	2
GOLDSBORO HOUSING AUTHORITY	3
GOLDSBORO MILLING CO	13
GRANITE FALLS SWIM/ATHL CLUB	2
GREATER ASHEVILLE REG AIRPORT	1
GREDE II LLC	3
GREENE COUNTY MANAGER	1
GRIFOLS THERAPEUTICS LLC	4
H & H FURNITURE MFG INC	2
HALIFAX MEDIA HOLDINGS LLC	4
HANESBRANDS INC	2
HANSON AGGREGATES SE LLC	33
HANSON BRICK EAST LLC	1
HAPPY JACK INC	1
HARDEN ROAD ASSOCIATES	1

HARGER LIGHTNING & GROUNDING	1
HARNETT CO BD OF ED	22
HARNETT CO PUBLIC UTIL	9
HARNETT CO SHERIFF OFFICE	1
HARNETT HEALTH SYSTEM INC	19
HARRIS PRINTING CO INC	3
HARRIS TEETER INC	23
HASTY PLYWOOD CO	3
HAVELOCK CITY OF	1
HAYWOOD COUNTY LOCAL GOV	1
HAYWOOD REGIONAL MEDICAL CNTR	5
HCL AMERICA INC	1
HEATMASTERS LLC	3
HERAEUS QUARTZTECH AMERICA LLC	1
HEXION INC	2
HIGHWOODS JOINT VENTURE	1
HIGHWOODS REALTY LP	26
HJH ASSOCIATES	1
HOG SLAT INC	9
HOLLY SPRINGS TOWN OF	1
HOME CARE PRODUCTS LLC	1
HOME DEPOT USA INC	9
HOPE COMMUNITY CHURH OF NC INC	2
HORNWOOD INC	3
HOUSE OF RAEFORD FARMS INC	14
HOUSING AUTH CITY OF RALEIGH	2
HUGHES FURNITURE INDUSTRIE INC	1
HULSING HOTELS INC	12
HUVEPHARMA INC	1
HYDRO TUBE ENTERPRISES INC	1
IAC TROY LLC	1
IMMEDION LLC	3
INGERSOLL-RAND	1
INGLES MARKETS INC	84
INN ON BILTMORE ESTATE INC	1
INNOVATIVE LAMINATIONS CO	1
INTERNATIONAL BROADCAST BUREAU	1
INTERNATIONAL PAPER COMPANY	6
INVISTA S A R L	1
J & D WOOD INC	3
J A MCNEILL & SONS	1
J C HOWARD FARMS LLC	8
J P TAYLOR COMPANY LLC	4

J&J SNACK FOODS HANDHELDS CORP	2
JACKSONVILLE CITY OF	4
JACOB HOLM IND AMERICA INC	1
JOHN DEERE TURF CARE INC	3
JOHNSTON CO BOARD OF EDUCATION	76
JOHNSTON CO PUBLIC UTILITIES	2
JOHNSTON MEM HOSPITAL AUTH	1
JORDAN LUMBER & SUPPLY INC	14
JOVC FOOD CORP INC	0
KAYSER-ROTH HOSIERY INC	4
KENNAMETAL INC	2
KESSLER ASHEVILLE LLC	1
K-FLEX USA LLC	9
KILELEE, KATHRYN	1
KING CHARLES INDUSTRIES LLC	1
KINGS HOLDINGS 4,LLC	1
KINGSLAND REALTY LLC	1
KLAUSSNER FURN IND INC	21
KOOPMAN DAIRIES INC	4
KORDSA INC	2
KROGER COMPANY	3
KRYOCAL, LLC	3
LAKE JUNALUSKA ASSEMBLY INC	51
LANCER INC	4
LAZAR INDUSTRIES LLC	4
LCNRC OF COLUMBUS CO LLC	2
LEAR CORPORATION	3
LEE BRICK & TILE COMPANY	7
LEE COUNTY COURT HOUSE	1
LEE IRON & METAL CO	5
LENOVO INTERNATIONAL	1
LEWIS SAUSAGE CO INC	1
LIBERTY COMMONS WARREN CO LLC	1
LIBERTY HEALTHCARE SERVICES	3
LIFEWAY CHRISTIAN RESOURCES OF	41
LINAMAR NORTH CAROLINA INC	4
LINPRINT CO	1
LIVE OAK BANKING COMPANY	0
LOCAL GOVERNMENT FED CREDIT UN	1
LORD CORPORATION	2
LOUISBURG COLLEGE INC	12
LOUISE WELLS CAMERON ART MUSEU	4
LOUISIANA PACIFIC CORP	4

LOW & BONAR INC	1
LOWER CAPE FEAR WATER & SEWER	1
LOWES COMPANIES INC	25
LOWES FOODS LLC	25
LUMBERTON CELLULOSE LLC	4
M ADLER'S SON, INC	1
MAGNETI MARELLI USA INC	4
MANHATTEN AMERICAN	1
MANUFACTURING METHODS, LLC	1
MARS PETCARE US, INC	7
MARTIN MARIETTA MATERIALS INC	59
MAS US HOLDINGS INC	3
MAY FURNITURE INC	3
MCDOWELL LUMBER CO INC	11
MCGILL ENVIRONMENTAL SYS OF NC	1
MCLAMBS ABATTOIR AND MEATS INC	1
MCMURRAY FABRICS INC	7
MEASUREMENTS GROUP INC	4
MEDICAL ACTION INDUSTRIES INC	1
MEDICAL SPECIALTIES INC	1
MEMORIAL MISSION HOSPITAL INC	1
MEREDITH COLLEGE	6
MERITOR HEAVY VEHICLE SYS LLC	2
MERTEK SOLUTIONS INC	1
METAL-CAD & STEEL FRAMING	1
METCHEM, LLC	1
METROPOLITAN SEWAGE DISTRICT	5
MHG ASHEVILLE AL LP	1
MICROSPACE COMM CORP	1
MILKCO INC	0
MINE SAFETY APPL CO INC	1
MISSION HEALTH SYSTEM INC	16
MISSION ST JOSEPH HEALTH SYS	1
MISSION ST JOSEPH HOSPITAL	1
MITCHELL CO BD OF ED	2
MMIC-TL INC PARTNERS LLC	1
MOEN INC	4
MONTGOMERY COUNTY OF	2
MOORE COUNTY	1
MOORE COUNTY SCHOOLS	18
MOORE'S INLET LIMITED PRTNRSHP	1
MOUNTAIRE FARMS INC	21
MT OLIVE PICKLE CO	16

MULE CITY SPEC FEED INC	2
MURPHY BROWN LLC	1
N C TELEVISION INC	1
N RALEIGH CHRISTIAN ACADEMY	0
N RALEIGH MEDICAL REALTY LLC	1
NASH BRICK CO INC	2
NASH COMMUNITY COLLEGE	8
NASH COUNTY	1
NASH COUNTY MANAGERS OFFICE	1
NASH ROCKY MOUNT BD OF ED	23
NATIONAL SPINNING CO INC	5
NATIONAL WIPER ALLIANCE INC	1
NATURAL BLEND VEG DEHYDR LLC	1
NATURES EARTH PELLETS INC LLC	3
NATURES WAY FARMS INC	1
NC AQUARIUM	0
NC DEPT OF AGRICULTURE	3
NC DEPT OF PUBLIC SAFETY	45
NC FARM BUREAU FEDERATION	1
NC RENEWABLE PWR LUMBERTON LLC	5
NC STATE FAIRGROUNDS	5
NC STATE PORTS AUTH	12
NC STATE PORTS AUTHORITY	23
NC STATE UNIVERSITY	143
NC STATE VETERANS HOME	2
NC WILDLIFE COMMISSION	1
NESBITT ASHEVILLE VENTURE LLC	2
NEW BELGIUM BREWING CO INC	1
NEW HANOVER CO BD OF ED	36
NEW HANOVER REGIONAL MED CTR	32
NG PURVIS FARMS INC	3
NHC PROPERTY MANAGEMENT	1
NOBLE OIL SERVICES	4
NOMACO INC	3
NOMACORC LLC	3
NORCRAFT COMPANIES LP	2
NORTH CAROLINA MFG CO INC	1
NORTH HILLS TOWER II LLC	3
NORTH STATE TECH SOLUTIONS	1
NOVIPAX LLC	4
NOVO NORDISK PHARMACUTICAL INC	4
NOVOZYMES NORTH AMERICA INC	6
NYPRO ASHEVILLE INC	2

OFFICE OF INFOR TECH SVCS	4
OHM HOTELS RTP, LLC	0
OLDCASTLE LAWN & GARDEN INC	5
OLIVER RUBBER COMPANY	2
OMNI GROVE PARK LLC	21
ONSLOW CO BD OF COMM	2
ONSLOW CO BD OF EDUC	23
ONSLOW MEMORIAL HOSPITAL AUTH	2
ONSLOW WATER AND SEWER AUTH	5
ORACLE AMERICA, INC	1
OWENS & MINOR	1
OXFORD CITY OF	0
P G & C INC	1
PACTIV LLC	1
PAK A SAK FOOD STORES	1
PALLET EXPRESS, INC	4
PALZIV NORTH AMERICA INC	1
PAPA JOHNS USA INC	0
PARADIGM ANALYTICAL	1
PARK COMMUNICATIONS LLC	2
PARK N SHOP FOOD MART INC	6
PARKDALE AMERICA LLC	2
PARRISH & RONE INC	1
PCS PHOSPHATE CO INC	2
PEAK 10 INC	3
PENDER CO BD OF ED	17
PENDER MEMORIAL HOSPITAL INC	7
PENICK VILLAGE INC	13
PENTAIR WATER POOL AND SPA INC	10
PEPSI BOTTLING VENTURES LLC	6
PERDUE FARMS INC	23
PERSON CO BD OF ED	2
PETROLEUM TANK CO	2
PFIZER INC	11
PH HS LLC	1
PHOENIX LTD PARTNERSHIP	1
PIEDMONT NATURAL GAS	1
PIEDMONT NATURAL GAS CO	1
PILGRIMS PRIDE CORPORATION	11
PILKINGTON	1
PINEHURST LLC	84
PINEHURST MEDICAL CLINIC	1
PIONEER HI BRED INC	4

PLASTEK IND INC (PA) NC	3
PLASTICARD PRODUCTS INC	1
POLYMER GROUP INC	3
POLYZEN INC	1
PORT CITY COMMUNITY CHURCH	3
PR II WADE PARK LLC	3
PRAXAIR INC	2
PRC NC LLC	2
PRECISION HYDRAULIC CYL INC	4
PRECISIONAIRE INC	3
PREMIERE FIBERS INC	4
PRESTAGE AGENERGY OF NC LLC	2
PRESTAGE FARMS INC	35
PRESTIGE FABRICATORS INC	2
PRESTON TAYLOR FOOD INC	1
PRINTLOGIC LLC	2
PRO PALLET SOUTH INC	1
PROTO LABS INC	0
PSNC ENERGY	1
PUBLIC SCHOOLS OF ROBESON CO	1
PUBLIX NORTH CAROLINA LP	2
QUAIL HAVEN OF PINEHURST LLC	1
QUALCOMM INC	1
QUALITY CHEMICAL LABORATRS LLC	2
QUALITY TEXTILE SERVICES INC	1
RAEFORD CITY OF	1
RAILROAD FRICTION PRODUCT CORP	4
RALEIGH CITY OF	6
RALEIGH FITNESS & WELLNESS	1
RALEIGH HOTEL OPERATOR INC	1
RALEIGH PRECISION PRODUCTS INC	0
RANDOLPH COUNTY	9
RAVEN ANTENNA SYSTEMS INC	1
RC CREATIONS, LLC	2
RD AMERICA LLC	1
RDU AIRPORT AUTHORITY	6
RED HAT INC	1
RED WOLF COMPANY, LLC	1
REDDY ICE CORP	2
REGAL CINEMAS	2
REGAL ENTERAINMENT GROUP	4
REICH LLC	2
RESINART EAST INC	1

REVLON CONSUMER PRODUCTS CORP	3
REX HEALTH CARE INC	14
REX MOB PARTNERS LLC	1
RHEINFELDEN AMERICAS LLC	1
RICHMOND COUNTY	1
RICHMOND COUNTY BOARD OF COMM	2
RICHMOND COUNTY SCHOOLS	2
RICHMOND SPECIALTY YARNS LLC	2
RIDGECREST CONFERENCE CENTER	1
ROBESON COUNTY DSS	1
ROCKINGHAM CITY OF	9
RODECO CO	2
ROYAL TEXTILE MILLS INC	1
RUBY'S PROPERTIES II LLC	1
S AND J HOLDINGS LLC	1
S B SMITH & SON INC	4
S T & F PRECISION INC	1
S T WOOTEN CORPORATION	17
SAAB BARRACUDA LLC	6
SAINT JOSEPH OF THE PINES INC	21
SAMPSON REGIONAL MEDICAL CTR	3
SANDERSON FARMS INC	7
SANDHILLS COMM COLLEGE	0
SANFORD CITY OF	4
SANFORD LEE CO BD OF ED	20
SANFORD MILLING CO INC	2
SAPONA MFG CO INC	2
SAS INSTITUTE INC	25
SCHINDLER ELEVATOR CORP	2
SCOTLAND CONTAINER INC	2
SCOTLAND MANUFACTURING	1
SEPARATION TECHNOLOGIES LLC	2
SEQIRUS INC	1
SIBELCO NORTH AMERICA INCORPOR	45
SIGMA PHI EPSILON	1
SILAR LABORATORIES, INC.	1
SILER CITY TOWN OF	2
SILVER LINE PLASTICS CORP	11
SINCLAIR BROADCAST GROUP INC	1
SIX FORKS OFFICE, LLC	3
SKYLAND BEER DIST	3
SMITHFIELD FRESH MEATS	6
SMOKY MOUNTAIN MACHINING INC	3

SNEEDEN, NORMAN E	2
SNUG HARBOR MANAGEMENT LLC	1
SONOCO PRODUCTS CO	1
SOUTH RIVER EMC COMM ASST CORP	1
SOUTHCO INC OF NC	1
SOUTHEASTERN REGIONAL MED CTR	4
SOUTHERN BAG CORP	1
SOUTHERN CONCRETE MATERIAL INC	14
SOUTHERN FABRICATORS INC	4
SOUTHERN PINES TOWN OF	2
SOUTHERN PRODUCE DIST INC DIP	3
SOUTHERN PRODUCTS & SILICA CO	6
SOUTHERN STATES CHEMICAL INC	3
SPANSET INC	1
SPECGX LLC	13
SPIRIT AEROSYSTEMS INC	2
SPORTS FACTORY LLC	2
SPX FLOW TECHNOLOGY SYSTEMS	1
ST ANDREWS PRESBYTERIAN COLL	1
ST. DAVIDS SCHOOL	6
STAN JOHNSON & ASSOCIATES LLC	2
STANADYNE INC	2
STARPET INC	6
STATIC CONTROL COMP INC	11
STEEL & PIPE CORP	1
STEVEN ROBERTS ORIGINAL	2
STI POLYMER INC	1
SUMITOMO ELECTRIC LIGHTWAVE CO	1
SUN LIFE ASSURANCE CO OF CANAD	1
SUNBRIDGE REGENCY NC LLC	2
SUNRISE SENIOR LIVING	1
SUPERIOR MODULAR PRODUCT INC	1
SUPERIOR PLASTICS EXTRUSION	1
SUPERTEX, INC	4
SURGERY CENTER OF PINEHURST	1
SURGICAL CARE AFFILIATES	1
SURTRONICS	2
SVT VENTURES LP	4
SYRACUSE PLASTIC OF NC INC	1
TALBERT BUILDING SUPPLY INC	0
TARGET STORES	8
TCDC PARTNERSHIP, LLC	2
TE CONNECTIVITY CORPORATION	2

THE ATRIUM AT BLUE RIDGE, LLC	1
THE BILTMORE COMPANY	3
THE CHEESECAKE FACTORY	1
THE CHEMOURS COMPANY FC, LLC	8
THE COUNTRY CLUB OF NC INC	1
THE CYPRESS OF RALEIGH	7
THE HARRELSON BUILDING INC	0
THE NEWS REPORTER CO INC	1
THE QUARTZ CORP USA	17
THE UMSTEAD	1
THEO DAVIS SONS INC	1
THERMAL METAL TREATING INC	1
THERMOFISHER SCI ASHEVILLE LLC	0
TIERPOINT LLC	3
TIME WARNER CABLE SE LLC	4
TIPPER TIE INC	2
TOP TOBACCO CO	3
TOWN SQUARE WEST LLC	7
TRAM LUMBER LLC	3
TRAMWAY VENEERS INC	1
TRANS CAROLINA PRODUCTS LLC	1
TREEHOUSE FOODS INC	6
TRIANGLE AQUATIC CENTER	1
TRIANGLE BRICK CO	6
TRIANGLE TOWN CENTER, LLC	19
TRINITY MANUFACTURING INC	6
TROTTERS SEWING COMPANY INC	1
TROY LUMBER CO	16
TROY POLYMER INC	1
TUCSON CARY, LLC	1
TURN BULL LUMBER COMPANY	1
TYCO ELECTRONICS	1
TYSON FOODS INC	3
U S REIF 4700 FALLS NC LLC	1
UCHIYAMA MANUF AMERICA LLC	3
UNC AT ASHEVILLE	8
UNC INSTITUTE OF MARINE SCI	3
UNC PUBLIC TV OF NC	1
UNCW	18
UNILEVER MANUFACTURING US INC	6
UNILIN NORTH AMERICA LLC	4
UNILIN US MDF	3
UNISON ENGINE COMPONENTS INC	4

UNITED STATES COLD STORAGE INC	6
UNITED STATES GYPSUM CO	1
UNIVERSAL HEALTHCARE N RAL INC	1
UNIVERSAL LEAF NORTH AMERICA	3
UNIVERSITY OF NC AT PEMBROKE	16
UNIVERSITY RESEARCH UNIT	1
US ARMY	1
US ARMY FORT BRAGG	3
US DEPT OF AIR FORCE	1
US FLUE CURED TOBACCO GROWERS	1
US MARINE CORP	1
US MARINE CORPS	1
US POST OFFICE	2
US VETERANS ADMIN HOSPITAL	3
USCG FINANCE CENTER	7
USS NC BATTLESHIP COMM	2
UWHARRIE FRAME MFG LLC	2
UWHARRIE LUMBER CO	3
VALLEY PROTEINS INC	15
VANDERBILT MINERALS LLC	4
VANGUARD CULINARY GROUP LTD	1
VENEER TECHNOLOGIES INC	7
VERTEX RAILCAR CORPORATION	2
VICTAULIC CO OF AMERICA	2
VILLARI BROS FOODS LLC	1
VONDREHLE CORP	6
VULCAN CONST MATERIALS LP	26
W N WILDER CO INC	1
WADESBORO IGA INC	1
WAKE CO HOSP SYSTEM INC	4
WAKE COUNTY BOARD OF EDUCATION	190
WAKE COUNTY GENERAL SERVICES	15
WAKE STONE CORP	17
WAKEMED	6
WAKEMED FACILITIES SVC	2
WAKEMED PROPERTY SERVICES	15
WAL MART PDC #6091	4
WALMART STORES INC	76
WALNUT CREEK AMPHITHEATER	5
WARP TECHNOLOGIES INC	1
WARREN CO BD OF ED	6
WAYNE BAILEY INC	3
WAYNE CO PUBLIC SCHOOLS	1

WAYNE COMMUNITY COLLEGE	1
WAYNE COUNTY	6
WAYNE MEMORIAL HOSPITAL INC	13
WAYNESVILLE TOWN OF	1
WELLS FARGO BANK NA	2
WEST CRAVEN HIGH SCHOOL	5
WEST CRAVEN MIDDLE SCHOOL	0
WEST FRASER INC	6
WESTERN NC HEALTHCARE INNO III	1
WESTERN NC HEALTHCARE INNO LLC	1
WEYERHAEUSER NR COMPANY	8
WHITEVILLE FABRICS LLC	4
WILLIAM BARNET & SON INC	7
WILLIAMS PROPERTY GROUP INC	1
WILMINGTON CITY OF	1
WILMINGTON HOTEL ASSOC CORP	2
WILMINGTON INTL AIRPORT	13
WILMINGTON MACHINERY INC	1
WILSONART INTERNATIONAL	5
WNC PALLET & FOREST PRDCTS INC	0
WRDC LLC	1
WRIGHT FOODS INC	2
WRIGHT MACHINE & TOOL CO INC	1
XELLIA PHARMACEUTICALS USA LLC	1
YALE INDUSTRIAL PRODUCTS INC	1
YAMCO LLC	1
YMCA OF WESTERN NORTH CAROLINA	1
Grand Total	**4,277**

DE Progress
Industrial and Commercial Accounts Opted In 2018

Customer Name	DSM	EE
Carlie C Operation Center	1	
NCDPS (Nash Correctional)	1	
Carteret General Hospital		3
Food Lion Llc		2
Fresh Foods Llc		1
Klaussner Furn Ind Inc		5
Nc Dept Of Public Safety		1
New Hanover Co Bd Of Ed		6
Prestige Fabricators Inc		1
Target Stores		1
West Craven Middle School		1
Whole Foods Market Group Inc		1
Grand Total	**2**	**22**

EM&V Activities

Planned Evaluation, Measurement and Verification (EM&V) Activities through the rate period (Dec. 31, 2020)

Evaluation is a term adopted by Duke Energy Progress (DEP), and refers generally to the systematic process of gathering information on program activities, quantifying energy and demand impacts, and reporting overall effectiveness of program efforts. Within evaluation, the activity of measurement and verification (M&V) refers to the collection and analysis of data at a participating facility/project. Together this is referred to as “EM&V.”

Refer to the accompanying Evans Exhibit 11 chart for a schedule of process and impact evaluation analysis and reports that are currently scheduled.

Energy Efficiency Portfolio Evaluation

DEP has contracted with independent, third-party evaluation consultants to provide the appropriate EM&V support, including the development and implementation of an evaluation plan designed to measure the energy and demand impacts of the residential and non-residential energy efficiency programs.

Typical EM&V activities:

- Develop evaluation action plan
- Process evaluation interviews
- Collect program data
- Verify measure installation and performance through surveys and/or on-site visits
- Program database review
- Impact data analysis
- Reporting

The process evaluation provides unbiased information on past program performance, current implementation strategies and opportunities for future program improvements. Typically, the data collection for process evaluation consists of surveys with program management, implementation vendor(s), program partner(s), and participants; and, in some cases, non-participants. A statistically representative sample of participants will be selected for the analysis.

The impact evaluation provides energy and demand savings resulting from the program. Impact analysis may involve engineering analysis (formulas/algorithms), billing analysis, statistically adjusted engineering methods, and/or building simulation models, depending on the program and the nature of the impacts. Data collection may involve surveys and/or site visits. A statistically representative sample of participants is selected for the analysis. Duke Energy Progress intends to follow industry-accepted methodologies for all measurement and verification activities, consistent with International Performance Measurement Verification Protocol (IPMVP) Options A, C or D depending on the measure.

The field of evaluation is constantly learning from ongoing data collection and analysis, and best practices for evaluation, measurement and verification continually evolve. As updated best practices are identified in the industry, DEP will consider these and revise evaluation plans as appropriate to provide accurate and cost-effective evaluation.

Demand Response Program Evaluation

DEP has contracted with independent, third-party evaluation consultants to provide an independent review of the evaluation plan designed to measure the demand impacts of the residential and non-residential demand response programs and the final results of that evaluation.

Typical EM&V activities:

- Collect program data
- Process evaluation interviews
- Verify operability and performance through on-site visits
- Collect interval data
- Program database review
- Benchmarking research
- Dispatch optimization modeling
- Impact data analysis
- Reporting

The process evaluation provides unbiased information on past program performance, current implementation strategies and opportunities for future improvements. Typically, the data collection for process evaluation consists of surveys with program management, implementation vendor(s), program partner(s), and participants; and, in some cases, non-participants. A statistically representative sample of participants will be selected for the analysis.

The impact evaluation provides demand savings resulting from the program. Impact analysis for EnergyWise involves a simulation model to calculate the duty cycle reduction, and then an overall load reduction. Impact analysis for CIG-DR involves statistical modeling of an M&V baseline load shape for a customer, then modeling the event period baseline load shape and comparing to the actual load curve of the customer during the event period.

The field of evaluation is constantly learning from ongoing data collection and analysis, and best practices for evaluation, measurement and verification continually evolve. As updated best practices are identified in the industry, DEP will consider these and revise evaluation plans as appropriate to provide accurate and cost-effective evaluation.

DEP DSM/EE Programs - Anticipated EM&V Schedule
As of June 4, 2019

DEP DSM/EE Programs - Anticipated EM&V Schedule

Program Name	NC Docket	SC Docket	Short name	2019 2nd Quarter	2019 3rd Quarter	2019 4th Quarter	2020 1st Quarter	2020 2nd Quarter	2020 3rd Quarter	2020 4th Quarter	Notes
Commercial Demand Response	Docket No. E-2, Sub 953	Docket 2010-41-E	CIG DR	REP (2018)				REP (2018)			
Distribution System Demand Response	Docket No. E-2, Sub 926	Docket 2009-190-E	DSDR								
Nonresidential Smart $aver EE Products & Assessment (Prescriptive)	Docket No. E-2, Sub 938	Docket 2009-190-E	EEB		PROC/IMP	PROC/IMP	REP				Smart $aver Prescritpvie DEC combined with DEP
Nonresidential Smart $aver EE Products & Assessment (Custom)	Docket No. E-2, Sub 938	Docket 2009-190-E	EEB					PROC/IMP	PROC/IMP		EEB Custom projects combined with DEC Smart $aver Custom eval report
EnergyWise	Docket No. E-2, Sub 927	Docket 2009-190-E	EW		REP (W2018/2019)		REP (S2019)				
EnergyWise for Business	Docket No. E-2, Sub 1086	Docket 2015-163-E	EWB								Next evaluation TBD
Energy Efficiency Education	Docket No. E-2, Sub 1060	Docket 2014-420-E	K12						PROC/IMP		
Residential Energy Assessment	Docket No. E-2, Sub 1094	Docket 2016-82-E	REA					PROC/IMP	REP		Combined DEC/DEP evaluation in 2020/2021
Lighting (Retail)	Docket No. E-2, Sub 950	Docket 2010-41-E	LP								No further EM&V work planned
Multi-Family Energy Efficiency	Docket No. E-2, Sub 1059	Docket 2014-419-E	MF			PROC/IMP	REP				Will be combined DEC/DEP evaluation; evaluation schedule extended
My Home Energy Report	Docket No. E-2, Sub 989	Docket 2011-180-E	MyHER	REP						PROC/IMP	Report in 2019 will be combined DEC/DEP evaluation
Neighborhood Energy Saver	Docket No. E-2, Sub 952	Docket 2009-190-E	NES	IMP	REP						2018 delayed to 2019 due to complete switchover to LEDs; evaluation to be combined with DEC evaluation
Residential New Construction	Docket No. E-2, Sub 1021	Docket 2015-237-E	RNC								Next evaluation tbd
Residential Save Energy & Water Kit	Docket No. E-2 Sub 1085	Docket 2015-322-E	SEW			PROC/IMP	REP				To be combined with DEC evaluation; timing pushed back due to program changes
Small Business Energy Saver	Docket No. E-2, Sub 1022	Docket 2015-163-E	SBES					PROC/IMP	REP		

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

NOTE: THESE DATES ARE SUBJECT TO CHANGE

NAVIGANT

2017 EM&V Report for the Duke Energy Progress Commercial, Industrial, and Governmental Demand Response Automation (DRA) Program

Prepared for:

Duke Energy Progress

Prepared by:

Navigant Consulting, Inc.

DUKE ENERGY®

May 1, 2018

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TABLE OF CONTENTS

Attached as separate documents:
Appendix A: Event Day Load Profile and Baseline Plots (.pdf document)
Appendix B: Analysis Data Tables & Graphics (.xlsx document)

EXECUTIVE SUMMARY

The Commercial, Industrial, and Governmental Demand Response Automation (DRA) program is part of the portfolio of demand-side management and energy efficiency (DSM/EE) programs initiated by Duke Energy Progress (DEP) in 2009. DRA offers participating companies and agencies a financial incentive to reduce their electricity consumption when called upon by DEP. This report covers evaluation, measurement, and verification (EM&V) activities for Program Year 2017 (PY2017).

This EM&V report is intended to verify program impacts as per the requirements established by the North Carolina Utilities Commission and the Public Service Commission of South Carolina. Major objectives of the evaluation were as follows:

- Verify the demand reduction calculated by DEP's method of baseline estimation as described in the *Demand Response Automation Rider DRA-7 (North Carolina) and DRA-8 (South Carolina)* filed by DEP [1]
- Produce a set of verified program impacts by customer and for the program as a whole using the most accurate baseline method identified in PY2010 and PY2011. Specifically, per Navigant's SOW and the approved evaluation plan, Navigant was required to:
    - Estimate verified impacts using a regression-based approach with a day-of load adjustment (as appropriate[2]);
    - Estimate average kW event load shed per meter, by sector, and for the program as a whole; and,
    - Provide a detailed baseline approach and explanation of the kW impact calculations.

Program Summary

The DRA program offers participating companies and agencies a financial incentive to reduce their electricity consumption for up to 8 hours at a time on only a few system peak days in either the summer or winter months. As in PY2016, no winter events were called in PY2017. Under the program, DEP's technology vendor (Comverge) installs two-way communications equipment to remotely monitor and record interval loads at 15-minute intervals. Customer load curtailments are commonly provided through the use of onsite generation or from shutting down manufacturing processes. Curtailments might also include modifications in the use of heating, ventilation, and air conditioning (HVAC) systems, lighting, and other building loads.

In PY2017, 20 customers were registered as participants in DEP's DRA program, representing 45 unique sites and 69 meters. Of the 69 meters that were registered as participants in PY2017, 31 are at commercial sites and three are at governmental sites. Thirty-five meters are at industrial sites, 16 of which belong to a single manufacturing company. For brevity, the very large industrial participant (with 16 meters) is referred to in this report as the "VLIP."

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[1] North Carolina Rider, DRA-7: https://www.duke-energy.com/_/media/pdfs/rates/gp2ncriderdradep.pdf?la=en
South Carolina Rider, DRA-8: https://www.duke-energy.com/_/media/pdfs/for-your-home/rates/electric-sc/gp1scriderdra.pdf?la=en

[2] Day-of load adjustments are not appropriate when event notification is not provided on the same day as the event.

An overview of the participating customers and average reported DR impacts for summer events is presented in Table 1.

Table 1. Summary of Participating Companies and Agencies

Sector	Customer Type	Number of Customers	Number of Sites	Number of Meters	Avg. Reported Reduction per Meter (kW)
Commercial	Warehouse/ Distribution	1	1	1	614
Industrial	Manufacturing	8	15	35	271
Governmental	Government Institution	1	1	1	2,766
Governmental	Water Treatment	2	2	2	640
Commercial	Grocery	4	22	24	246
Commercial	Office	3	3	3	271
Commercial	Hospital/Medical	1	1	3	363
	Total Program	**20**	**45**	**69**	**N/A**[3]

Source: DEP DRA program database

Evaluation Methods

The PY2017 evaluation consisted of an impact evaluation only. The methods used for the evaluation are summarized below.

1. **Replication of DEP-Reported Impacts**

   The evaluation team used interval data for all participant meters and event schedule data to calculate a baseline for each event and each participant meter. These baselines were all calculated using the algorithm Duke Energy uses to report program impacts and calculate participant incentives for settlement purposes.

2. **Verification of Program Impacts**

   Navigant estimated verified impacts by comparing a regression-estimated baseline to actual event day demands. The team estimated baselines using individual customer regressions. This approach is the result of a set of tests conducted as part of the PY2011 and PY2012 evaluation to determine the most accurate approach for estimating impacts.

Key Findings

Three DRA events were called during the summer of PY2017, involving 69 unique customer meters.

This section outlines the key findings of this impact evaluation.

[3] An average by meter is not provided here to avoid undue confusion in comparison with aggregated impacts. Average impacts per participating meter across multiple events ignore "impacts" of events in which the meter did not participate, reporting an average per meter value here could appear to inflate program-level impacts inappropriately.

Key Impact Findings

The key impact evaluation findings are:

- **Verified impacts were slightly less than reported impacts.** The realization rate for the summer DR impacts for PY2017 was 96%, with an average of approximately 19.3 MW of DR contributed by the program.
- **Participation[4] remains inconsistent between events.** The average total event impacts for the summer of PY2017 were highest for the second two events (20 and 20.8 MW), but substantially lower for the first event (17 MW). Only 55 meters participated in the first event.
- **Total program impact increased in PY2017 compared to PY2016, but is still lower than PY2015 result.** The average event impact increased from about 17.6 MW in PY2016 to about 19.3 MW in PY2017. The average impact across all three PY2015 events was approximately 20.1 MW. Duke Energy staff indicate that changes in US Environmental Protection Agency (EPA) regulations regarding onsite generators were a major contributor to the decline in impacts since 2015 and that changes in these regulations resulted in the loss to the program (after 2015) of participants, accounting for 5 MW of contracted DR.

The EM&V analysis found average load reductions of approximately 19.3 MW per summer event, or about 300 kW per meter, on average[5], or 96% of the figure reported[6] by Duke Energy in its DRA program database (Table 2). On average, the relative precision associated with the baselines used to develop estimated impacts, during event periods, was +/- 1.2% at the 90% confidence level.

Table 2. Verified Load Reductions and EM&V Verification Rate – Summer

Load Reduction Category	Event kW			Avg. Total Reduction Over Summer Events
	2017-07-13	2017-07-21	2017-08-18	
Reported (Duke Energy Database)	17,974	20,088	22,262	20,108
Verified	16,992	20,020	20,767	19,260
Relative Precision (Verified Impacts +/-)	2.2%	2.0%	2.1%	1.2%
Verified Realization Rate (Verified Reductions/Reported Reductions	95%	100%	93%	96%

Sources: DEP DRA program database and Navigant analysis

The evaluation team found that, as in previous years' evaluations, the VLIP's demand was highly variable across many of its meters in the summer of 2017. On many non-holiday weekdays, demand for a given meter was close to zero and on others in the range of hundreds of kilowatts. These volatile patterns of

[4] Event-specific participation refers to enrolled participants delivering more than 0 kW of DR for a given event. An enrolled customer meter has participated in only two of three events if that meter has contributed more than 0 kW on only two of the three events.

[5] Average impact per meter is calculated as the average across events of the average across participating meters by event. This value will not correspond to the total number of meters that participated at some point in the summer (69) divided by the average impact across events (19.2 MW), since not all meters participated in all events.

[6] Reported impacts are those impacts calculated by DEP using the DRA baseline algorithm.

use cause the estimated baselines and impacts for each of the individual meters to be less reliable than for other meters with a more consistent pattern of demand.

Navigant successfully replicated the DEP settlement baseline and reported impacts for every meter/event pair.

As in previous program year evaluations, a set of plots of event day load profiles—by meter—is included in Appendix A (separate document). These plots provide the average hourly demand, the load-adjusted regression baseline, and a non-load-adjusted regression baseline for each event and for each participating meter. These plots also highlight the evaluated event period. The evaluation team has found this set of plots to be extremely useful for its analysis and would recommend examining them after (or while) reading the report below.

1. PROGRAM DESCRIPTION AND RESEARCH OBJECTIVES

The Commercial, Industrial, and Governmental (CIG) Demand Response Automation (DRA) program is part of the portfolio of demand-side management and energy efficiency (DSM/EE) programs initiated by Duke Energy Progress (DEP) in 2009. DRA offers participating companies and agencies a financial incentive to reduce their electricity consumption for up to 8 hours at a time on a few peak days. DEP's program literature specifies that a minimum of three summer events will be called, and the maximum number of curtailment events is 10. Typical event duration is 6-8 hours.

This report covers evaluation, measurement, and verification (EM&V) activities for the seventh year of the DRA program, Program Year 2017 (PY2017). EM&V is a term adopted by DEP and refers generally to the assessment and quantification of the energy and peak demand impacts of an EE or DR program. For DR, estimating reductions in peak demand is the primary objective, as energy impacts are generally negligible.

1.1 Objectives of the Evaluation

This EM&V report is intended to verify program impacts as per the requirements established by the North Carolina Utilities Commission and the Public Service Commission of South Carolina. Major objectives of the evaluation were as follows:

- Verify the demand reduction calculated by DEP's method of baseline estimation as described in the *Demand Response Automation Rider DRA-7 (North Carolina) and DRA-8 (South Carolina)* filed by DEP [7]
- Produce a set of verified program impacts by customer and for the program as a whole using the most accurate baseline method identified in PY2010 and PY2011. Specifically, per Navigant's SOW and the approved evaluation plan, Navigant was required to:
    - Estimate verified impacts using a regression-based approach with a day-of load adjustment (as appropriate[8]);
    - Estimate average kW event load shed per meter, by sector, and for the program as a whole; and,
    - Provide a detailed baseline approach and explanation of the kW impact calculations.

1.2 Program Overview

The DRA program was developed in response to DEP's determination that a curtailable load program would be a valuable resource for the company and an additional service offering for customers that would complement DEP's existing load curtailment riders. The program seeks to increase DEP's DR resources by improving customer receptiveness to curtailment programs through increased awareness of load

[7] North Carolina Rider, DRA-7: https://www.duke-energy.com/_/media/pdfs/rates/gp2ncriderdradep.pdf?la=en
South Carolina Rider, DRA-8: https://www.duke-energy.com/_/media/pdfs/for-your-home/rates/electric-sc/gp1scriderdra.pdf?la=en

[8] Day-of load adjustments are not appropriate when event notification is not provided on the same day as the event.

reduction potential and restructuring of the incentives and non-compliance charges used for current DR programs.

The DRA program offers participating companies and agencies a financial incentive to reduce their electricity consumption for up to 8 hours at a time on only a few system peak days annually. Under the program, DEP's technology vendor (Comverge) installs two-way communications equipment to remotely monitor and record interval loads at 15-minute intervals. Participants are guaranteed at least 30 minutes of advanced notice before a curtailment event, but often are given several hours of notice for summer events and day-ahead notice for winter events. For the summer of PY2017, all participants received notice day-ahead of all events.

Eligibility. To qualify for the program, DEP commercial and industrial customers must be able to curtail 75 kW. Importantly, all industrial customers and any commercial customers that use more than 1 million kWh per year must also elect to forego the opportunity to opt out of the rider that funds DEP's DSM/EE programs. By opting in, customers become eligible for DSM/EE incentives and commit to pay the rider for a period of 3 years.[9]

Incentives. The program provides three types of participant incentives:

- **A one-time participation incentive of $50 per demonstrated kW.** Intended to enhance customer acquisition and to support customer investment related to program participation, including purchase and installation of automated controls
- **A monthly availability credit of $3.25 per contracted kW.** Intended to provide steady payment streams and ensure readiness
- **An event performance credit of $6 per curtailed kW.** Intended to increase resource reliability through an emphasis on event compliance

This three-part incentive structure was selected to benefit customers for responding to more events and to ensure that DEP pays for performance but limits its costs when few events are called. As a pay-for-play program, it ensures that customers will receive more incentives when the need for peak reduction is high.

Performance and Compliance. DEP provides customers with information about complying with program requirements based on curtailment levels during pre-defined seasonal peak periods. Participants are also provided information about the method for estimating baseline to determine curtailment impacts.

- Summer peak period: defined as 1 p.m. – 9 p.m. on weekdays in June through September
- Winter peak period: defined as 5 a.m. – 10 a.m., and 5 p.m. – 11 p.m. on weekdays in December through February

1.3 Reported Program Participation and Savings

In PY2017, 20 customers were registered as participants in DEP's DRA program, representing 45 unique sites and 69 meters. Of the 69 meters, 31 are at commercial sites and three are at governmental sites.

[9] Prior to January 1, 2016, the required commitment was 10 years.

Thirty-five meters are at industrial sites, 16 of which belong to a single manufacturing company. For brevity, the very large industrial participant (with 16 meters) is referred to in this report as the VLIP.

An overview of the participating customers is presented in Table 3, including number of meters and sites by customer type and the average demand reduction reported by DEP over the three summer events by customer type.

Table 3. Summary of Participating Customers

Sector	Customer Type	Number of Customers	Number of Sites	Number of Meters	Avg. Reported Reduction per Meter (kW)[10]
Commercial	Warehouse/ Distribution	1	1	1	614
Industrial	Manufacturing	8	15	35	271
Governmental	Government Institution	1	1	1	2,766
Governmental	Water Treatment	2	2	2	640
Commercial	Grocery	4	22	24	246
Commercial	Office	3	3	3	271
Commercial	Hospital/Medical	1	1	3	363
	Total Program	**20**	**45**	**69**	**N/A[11]**

Source: DEP DRA program database

The average reported impacts shown above are the average only of the impacts for event/participant pairs where DEP reported a non-zero impact (sometimes referred to as “participation” in this report). DEP reported a total impact of approximately 20.1 MW on average, per event.

PY2017 average reported[12] event curtailments at individual meters ranged from the trivial to nearly 2,800 kW, as shown in Figure 1. In this chart, meters are segregated by sector: commercial/governmental and industrial.

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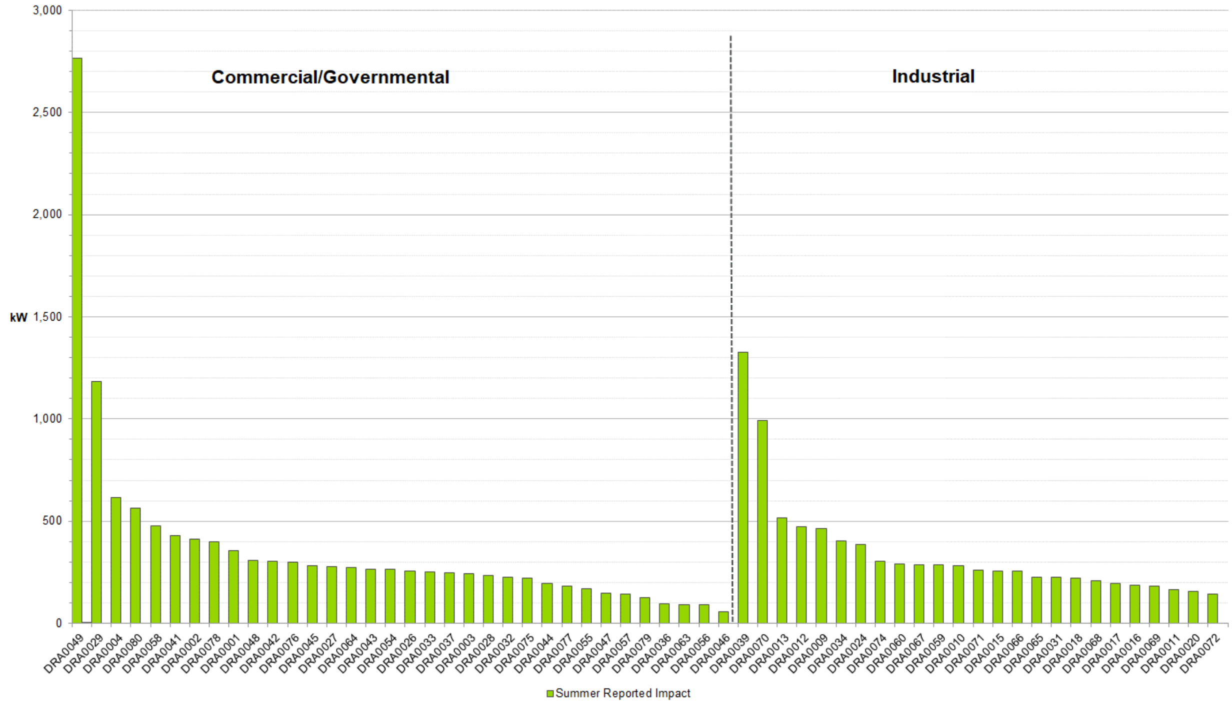
[10] Average reported demand by customer type is calculated as the average by customer type of the average individual meter impacts across events in which participants achieved some DR. Because these values are based only on compliant reported DR achievement, a total calculated based on the values in this table will overstate the total reported average DR achieved across the three events. This value is reported in Table 2 and Table 4.

[11] An average by meter is not provided here to avoid undue confusion in comparison with aggregated impacts. Average impacts per participating meter across multiple events ignore “impacts” of events in which the meter did not participate, reporting an average per meter value here could appear to inflate program-level impacts inappropriately.

[12] Note that as per the convention of this report, reported impacts refer to the settlement impacts estimated using the DEP baseline algorithm and not the regression-estimated verified impacts.

Figure 1. Reported Load Reductions (kW) by Meter



Source: DEP DRA program database

2. EVALUATION METHODS

This section describes the methods and data used by the evaluation team to conduct the PY2017 impact evaluation of the CIG DRA program.

Estimating impacts of DR events is generally a matter of first estimating a counter-factual baseline of what a customer's load would have been during the hours of the curtailment event had the event not been called. Actual measured loads are then subtracted from this baseline to estimate load reductions. The baseline estimation methods used by DEP and by the evaluation team are discussed below. The regression approach applied by Navigant implicitly applies this arithmetic through the use of indicator or "dummy" variables included on the right-hand-side of the regression equation.

The evaluation team used the following data in its analysis:

- Quarter-hourly interval data for 69 DRA program participating meters between May 1, and October 31, 2017
- Hourly observations of temperature data from National Oceanic and Atmospheric Administration (NOAA) weather stations
- Event logs supplied by DEP indicating the date, and start and end time of each event, as well as the time at which participants were notified of an imminent event.

Using this data, the evaluation team conducted three principal sets of analyses:

1. **Replication of the savings calculations provided by DEP**, which estimated baselines using the three qualifying non-excluded days immediately prior to an event.
2. **Estimation of the impact of events for all meters** using a regression-derived baseline. Unlike in some previous program years, day-of-load adjustments could not be applied to the baselines. Day-of-load adjustments are possible when participants are notified on the date of the event. Notification was provided day-ahead for all three events in 2017.

Evaluations of DSM/EE programs commonly estimate a net-to-gross (NTG) ratio based on the evaluated percentage of demand reductions that may be ascribed either to free ridership (which reduces the NTG ratio) or program spillover (which increases the NTG ratio). Free ridership is typically defined as the percentage of demand reductions that would have occurred anyway, absent the presence of the program. Participant spillover is typically defined as incremental demand reductions undertaken by a program's participants though not directly incented or promoted by the program administrator.

In the case of DR programs such as DRA, there is no reason to expect that a customer would curtail loads during the event periods (the timing of which would be unknown to the customer absent participation in the program) without being enrolled in the program. Furthermore, because demand reductions are estimated relative to an estimated baseline that captures expected participant behavior absent an event, the analysis inherently accounts for free ridership and participant spillover; that is, absent the DRA program, none of the observed demand reductions would have taken place. Based on the above considerations, the evaluation team considers the NTG ratio for the impact analysis of the DRA program to be 1.0.

2.1 Replication of the DEP Savings Calculations

DEP estimated load reductions using a baseline calculation method developed internally by DEP and described in *Demand Response Automation Rider DRA-7 (North Carolina) and DRA-8 (South Carolina)* filed by DEP. The evaluation team replicated DEP's algorithm to confirm the results reported by DEP.

The DEP algorithm[13] generates a baseline for calculating program impacts on event days based on the three non-excluded (holidays, weekends, and curtailment days) and qualifying days immediately prior to an event day. A day is deemed as qualifying if average demand during curtailment event hours on that day is at least 50% of the average of the three non-excluded days. If one of the first three non-excluded days prior to the event is deemed to be non-qualifying, the next prior non-excluded day is used. If there are not three qualifying days out of the 10 non-excluded days prior to the event, the algorithm reverts to using the three most immediate non-excluded days prior to the event.

The average demand over the three selected days during the hours corresponding to those in which the event was called is the baseline used to calculate impacts and participant incentive payments. The reported impact is calculated as the difference between the average baseline over the event period and the average actual demand over that period, excluding the first 15 minutes of the event.[14]

2.2 Estimation of Regression-Based Baseline for Calculating Verified Impacts

The evaluation team estimated verified impacts as the difference between actual average demand over the time span of the event (excluding the first 15 minutes) and the regression-estimated average baseline demand.

To estimate the baseline, the team estimated the following regression for each meter in the summer, including only non-holiday and non-event weekdays:

Equation 1. Individual Meter Regression Specification

$$y_t = \sum_{i=0}^{96} \beta_{1,i} Quarterhour_{i,t} + \sum_{i=0}^{96} \beta_{2,i} Quarterhour_{i,t} CDH_t + \sum_{c=1}^{69} \gamma_c C_{i,t} + errors_t$$

Where:

y_t	=	The average demand (kW) observed at the given meter in the quarter hour of sample *t*.
$Quarterhour_{i,t}$	=	96 dummy variables, each one equal to 1 if quarter hour *t* is *i*-th quarter hour of the day (for example, if quarter hour t is between midnight and 12:15 a.m., $Quarterhour_0$ is equal to 1 and 0 otherwise or if quarter hour t is between 1:00 p.m. and 1:15 p.m. then $Quarterhour_{52}$ is equal to 1 and 0 otherwise).
CDH_t	=	The cooling degree hours in quarter hour of sample *t*.

[13] The details of the DEP algorithm are described in more detail in Appendix A of the PY2010 report.

[14] Note, however, that the baseline is calculated using all event quarter-hours.

$C_{i,t}$ = A set of 69 dummy variables, intended to control for program impacts in every event quarter hour of the evaluation period (three events, six hours each, less the first quarter hour of each). Each variable takes a value of 1 when the *t*-th hour of the sample is also the *c*-th event quarter hour for which impacts are being evaluated.[15]

Navigant applied the estimated coefficients from the regression above. The estimated impact in each quarter hour is delivered by the relevant parameters $\sum_{c=1}^{69} \gamma_c$.

[15] Using a set of dummy variables in this manner is analytically equivalent to simply excluding the event quarter-hours, estimating the model and subtracting the actual from the baseline. The key difference is that it makes estimating impact uncertainty (through the standard errors) much more convenient.

3. PROGRAM IMPACTS

This chapter describes the findings from the evaluation team's analysis of load reduction impacts for the DRA program for PY2017.

DEP called three events during the summer of 2017, involving 69 unique customer meters. The EM&V analysis found average load reductions[16] of approximately 19.3 MW per summer event—approximately 300 kW per meter[17], or slightly less than the 20.1 MW figure reported[18] by DEP in its DRA program database (Table 4).[19]

Table 4: Verified Load Reductions and EM&V Verification Rate

Load Reduction Category	Event kW			Avg. Total Reduction Over Summer Events
	2017-07-13	2017-07-21	2017-08-18	
Reported (Duke Energy Database)	17,974	20,088	22,262	20,108
Verified	16,992	20,020	20,767	19,260
Relative Precision (Verified Impacts +/-)	2.2%	2.0%	2.1%	1.2%
Verified Realization Rate (Verified Reductions/Reported Reductions	95%	100%	93%	96%

Sources: DEP DRA program database and Navigant analysis

Other significant findings of the impact evaluation, by topic areas, are as follows:

Approved Baseline Methodology

- **Finding 1:** Navigant successfully replicated the DEP settlement baseline and reported impacts for every meter/event pair.

Verified Impacts

- **Finding 2:** Using the regression-derived baseline, the evaluation team verified that participants as a whole achieved an average of 19.3 MW of demand reduction during summer events, approximately 96% of that reported and 100% of that contracted.

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[16] Note that the average load reduction per event is the average of only non-zero load reductions achieved. For example, if two meters contributed 100 kW each and a third meter did not achieve any DR (i.e., actuals were above baseline) the average verified impact for this event would be reported as 100 kW.

[17] Average impact per meter is calculated as the average across events of the average across participating meters by event. This value will not correspond to the total number of meters that participated at some point in the summer (69) divided by the average impact across events (19.2 MW), since not all meters participated in all events.

[18] Reported impacts are those impacts calculated by DEP using the DRA baseline algorithm.

[19] As noted previously, reported impacts are those impacts calculated by DEP using the DRA baseline algorithm. Verified impacts are based on a regression baseline. Both sets of impacts are net values, implicitly assuming an NTG ratio of 1.0. See Section 2 for further discussion.

- **Finding 3:** Total program impacts increased in PY2017 compared to PY2016, but were still somewhat lower than in PY2015. DEP staff indicate that changes in US Environmental Protection Agency (EPA) regulations regarding onsite generators is a major contributor to this reduction in DR impacts from PY2015.

The remainder of this chapter is divided into two sections:

- **Section 3.1 – Replication of DEP-Reported Impacts.** Replication of the DEP settlement algorithm.
- **Section 3.2 – Verified Impacts .** Impacts estimated using the regression baseline method described above.

3.1 Replication of DEP-Reported Impacts

As noted above, part of the task assigned to the evaluation team was to replicate the DEP algorithm to confirm the validity of the results reported by DEP.

Navigant successfully replicated the DEP settlement baseline and reported impacts for every meter/event.

3.2 Verified Impacts

All verified impacts discussed below are based on the regression model without a symmetric day-of load adjustment. The evaluation team found that baselines with day-of-load adjustments delivered the most accurate estimated impacts, on average, in the PY2010 and PY2011 evaluations; however, these are not possible when participants are notified the day prior to an event date.

DEP called three events during the summer of 2017, involving 69 unique customer meters. The EM&V analysis found average load reductions of 19.3 MW per event—approximately 300 kW per meter, or approximately 96% of the 20.1 MW figure reported by DEP in its DRA program database (Table 5).[20]

[20] As noted previously, reported impacts are those impacts calculated by DEP using the DRA baseline algorithm. Verified impacts are net values, implicitly assuming an NTG ratio of 1.0. See Section 2 for further discussion.

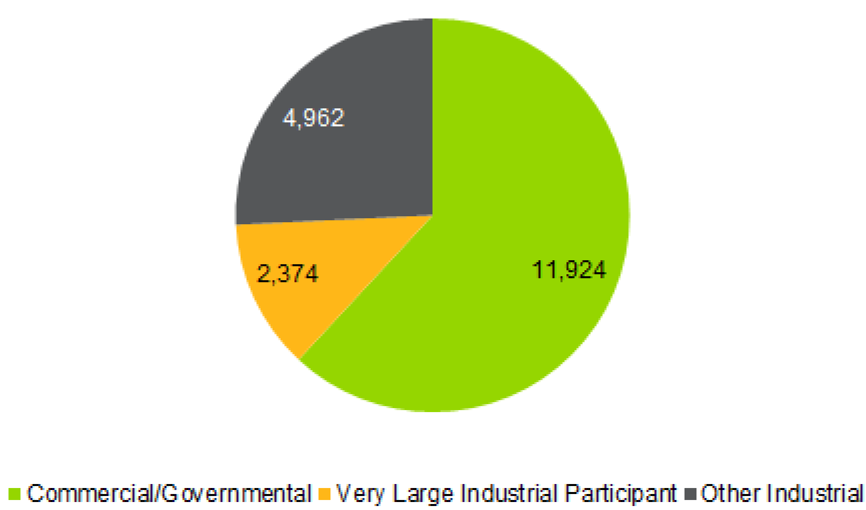
Table 5. Verified Load Reductions and EM&V Verification Rate (By Customer Type)

Load Reduction Category	Event kW			Avg. Total Reduction Over Summer Events
	2017-07-13	2017-07-21	2017-08-18	
Reported (Duke Energy Database)	17,974	20,088	22,262	20,108
Verified				
Com/Gov't	11,857	11,512	12,402	11,924
VLIP	833	3,312	2,977	2,374
Other Ind.	4,302	5,196	5,388	4,962
Verified – Total	**16,992**	**20,020**	**20,767**	**19,260**
Verified Realization Rate (Verified Reductions/Reported Reductions	**95%**	**100%**	**93%**	**96%**

Sources: DEP DRA program database and Navigant analysis

For summer 2017, the EM&V team verified that the 34 commercial/governmental meters realized an average total of 11,924 kW of load reductions, accounting for approximately 62% of the total kW reduction; the 16 industrial meters belonging to the VLIP realized an average total of 2,374 kW of load reductions, which accounts for approximately 12% of the total kW reduction. The balance of load reductions—4,962 kW or 25% of the total—were made up by meters located at industrial sites not belonging to the VLIP. This distribution is shown in Figure 2.

Figure 2. Share of Total Verified kW Reduction: Commercial/Governmental vs. Industrial



Sources: DEP DRA program database and Navigant analysis

The following discussion provides a summary of load impact findings based on a linear-regression baseline method identified by the evaluation team as the most accurate for predicting customers' loads (see PY2011 and PY2012 evaluation reports for more detail). The team estimated load reductions for individual participants for each event. Average verified program savings were then calculated as the average across each of the three summer events across all 69 participants' meters.

DEP had reported summer program impacts to be approximately 104% of the aggregate contracted load reductions, or 20.1 MW. The EM&V analysis verified 96% of these reported reductions (or 100% of the contracted reductions). The average contracted, DEP-reported, and verified load curtailment for each participant meter is shown in Table 6.

This table includes a count of the number of events for which each meter contributed non-zero DR impacts. The average contracted, reported, and verified impacts shown in Table 6 are the averages only of events for which the given participant was contracted and in which that participant participated. This means that the sum of the average impacts in this table will not match the average of the total impacts reported in Table 5, which are the average of the total impacts across all participants for each event.

Table 6. Average Contracted, Reported, and Verified Loads by Meter

Commercial/Governmental					Industrial				
Participant Site	Contracted kW	DEP Reported kW	Verified kW	# Events Participated	Participant Site	Contracted kW	DEP Reported kW	Verified kW	# Events Participated
DRA0001	362	357	359	3	DRA0009	450	462	424	2
DRA0002	383	413	442	2	DRA0010	75	282	217	2
DRA0003	150	243	246	3	DRA0011	75	164	118	2
DRA0004	490	614	632	3	DRA0012	300	475	292	2
DRA0026	209	257	270	3	DRA0013	75	517	368	3
DRA0027	220	277	291	3	DRA0014	75	98	77	3
DRA0028	183	234	241	3	DRA0015	150	257	145	2
DRA0029	900	1181	1571	3	DRA0016	200	188	153	3
DRA0032	200	228	226	3	DRA0017	200	196	148	3
DRA0033	204	253	254	3	DRA0018	180	220	173	3
DRA0036	75	98	85	3	DRA0019	100	107	95	3
DRA0037	203	249	258	3	DRA0020	75	155	149	2
DRA0041	415	429	445	3	DRA0021	200	32	173	3
DRA0042	249	303	315	3	DRA0022	75	74	41	1
DRA0043	240	265	271	3	DRA0023	75	0	52	1
DRA0044	163	197	205	3	DRA0024	300	386	391	2
DRA0045	209	284	285	3	DRA0030	75	104	123	3
DRA0046	207	56	62	1	DRA0031	225	224	225	3
DRA0047	177	146	149	3	DRA0034	920	405	250	3
DRA0048	328	307	318	3	DRA0039	1,050	1328	1270	3
DRA0049	2500	2766	2828	3	DRA0051	135	130	91	3
DRA0054	275	263	281	3	DRA0052	75	57	57	3
DRA0055	275	171	184	3	DRA0059	209	285	260	2
DRA0056	143	89	95	3	DRA0060	413	292	268	3
DRA0057	198	143	146	2	DRA0061	75	44	33	3
DRA0058	500	477	505	3	DRA0065	130	228	232	3
DRA0063	250	92	95	3	DRA0066	200	255	253	3
DRA0064	209	273	276	3	DRA0067	190	288	304	3
DRA0075	258	221	232	3	DRA0068	140	207	218	3
DRA0076	303	298	307	3	DRA0069	150	184	180	3
DRA0077	185	180	179	3	DRA0070	761	993	731	3
DRA0078	500	398	96	1	DRA0071	180	262	202	3
DRA0079	700	125	0	1	DRA0072	125	144	104	3
DRA0080	500	565	224	1	DRA0073	105	132	82	3
					DRA0074	225	302	165	3

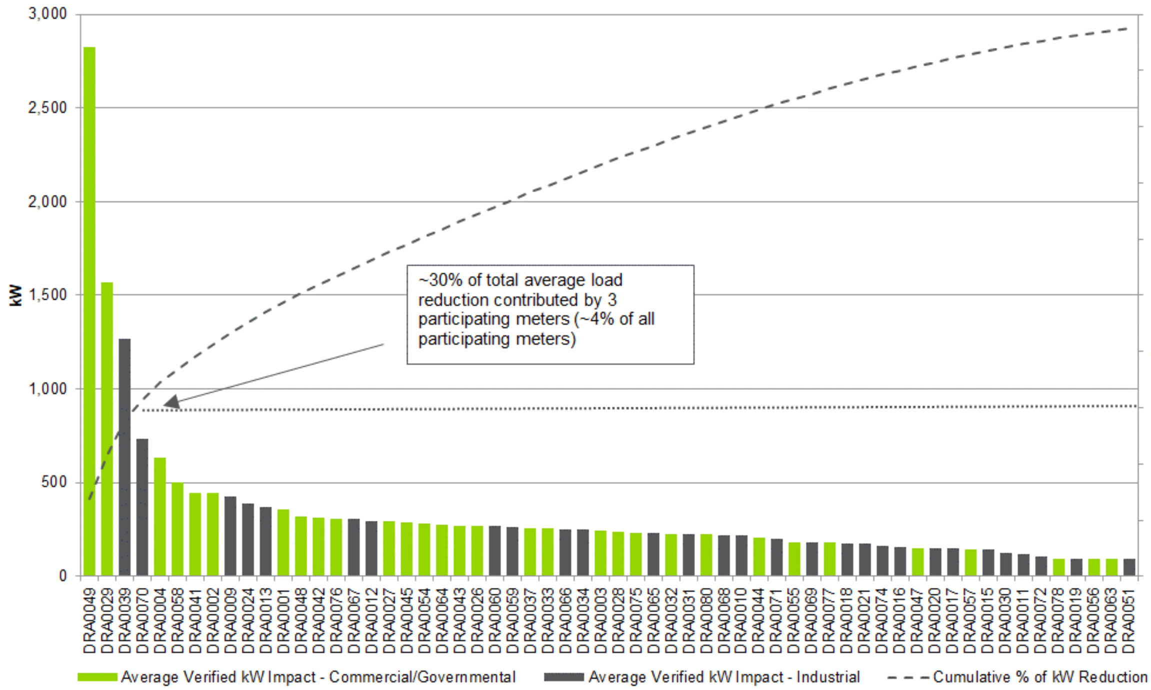
Sources: DEP DRA program database and Navigant analysis

Verification rates at the portfolio level are driven by findings for individual meters. Three of the 69 participating meters in 2017[21] account for a little less than one-third of all summer reductions and thus drive overall summer findings. Figure 3 ranks the meters by the amount of verified kW reduction in

[21] The three meters that are driving overall results include two governmental sites and one industrial (manufacturing) site.

descending order, illustrating the decrease in load reductions between the largest and smallest contributors in the program.

Figure 3. Cumulative Percentage of Total Verified kW Reduction

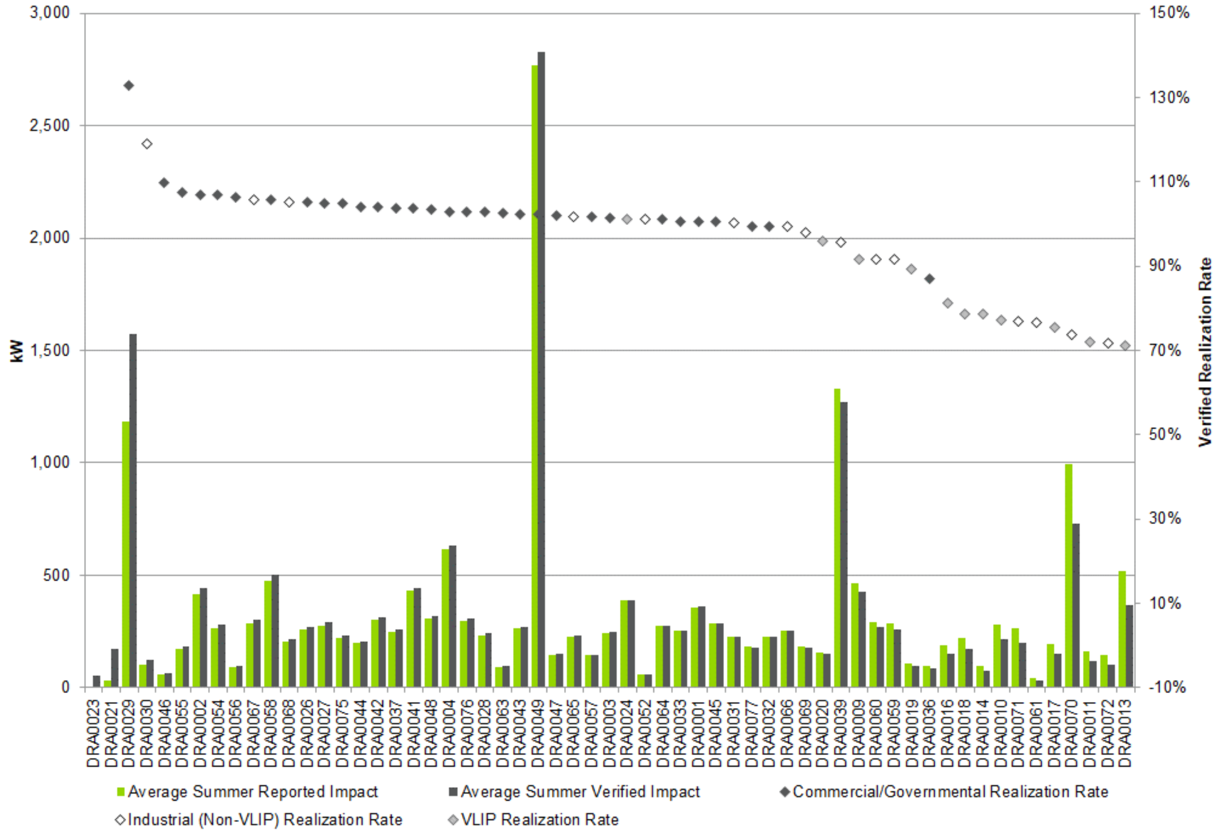


Sources: DEP DRA program database and Navigant analysis

These results can be re-examined by plotting the reported and verified demand reductions and verified realization rate (average verified kW across three events divided by average reported kW across three events) once they have been sorted by verified realization rate (see Figure 4). In this figure, the black diamonds represent commercial/governmental realization rates, the gray diamonds represent the VLIP's realization rates, and the white diamonds represent the non-VLIP industrial realization rates.

As may be seen in Figure 4, the average verified summer realization rate for all but five of the commercial and governmental meter sites is at or above 90%. In contrast, the average verified summer realization rate of three-quarters of the VLIP meters is below 90%.

Figure 4. Reported and Verified DR and Verified Realization Rate

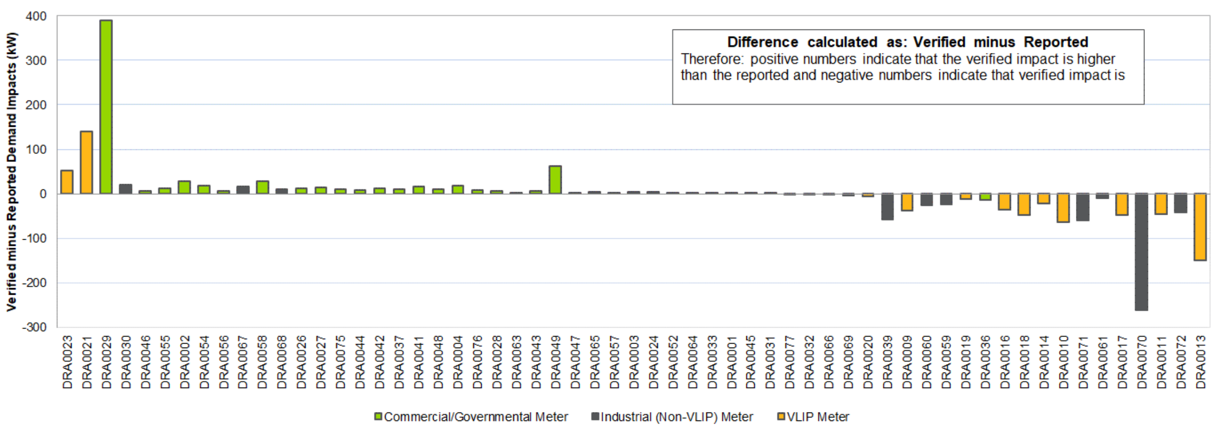


Sources: DEP DRA program database and Navigant analysis

Recall that the verified realization rate is the (regression-estimated) verified impact divided by the (DEP algorithm calculated) reported impact. The regression approach estimates a baseline using average seasonal relationships whereas the DEP approach relies entirely on the three most recent non-excluded qualifying days to calculate a baseline.

To better understand the results implied by the realization rates presented above, it is important to also observe the magnitude of the difference (in kW instead of as a percentage) between the DEP-reported impacts and the verified impacts. For this reason, the evaluation team presents the average difference (across the seasonal events) between the verified summer impact and the reported summer impact for each meter in Figure 5. For example, the evaluation team found that Duke Energy's reported impacts for meter DRA 0029 were nearly 400 kW less than those verified by Navigant, and that the Duke Energy's reported impacts for meter DRA0070 were 250 kW higher than those verified by Navigant. To aid understanding, these have been sorted in this figure by realization rate in the same manner as in Figure 4.

Figure 5. Differences in Impact Estimates: Regression vs. DEP Settlement Method



Sources: DEP DRA program database and Navigant analysis

4. SUMMARY FORM

Commercial, Industrial, and Governmental Demand Response Automation Program

Completed EMV Fact Sheet

Description of program

DEP's CIG DRA program is a demand response program where customers are incentivized by DEP to curtail their loads during "events" as requested by DEP.

Participants must have the capability to curtail at least 75 kW of load when called upon by DEP. Most events last for 3-6 hours, and participants are guaranteed at least 30 minutes of notice before an event starts, but are often notified the day before.

DEP called three events in 2017. The program included 20 customers, spanning 45 site locations and 69 electric meters.

Evaluation Methods

The evaluation team estimated impacts from the demand response events by replicating DEP's settlement baseline and applying a regression-based approach.

Impact Evaluation Details

- The program achieved a verified average of 19.3 MW per event, which is about 4% less than DEP's reported value of 20.1 MW.
- The average impact per meter was about 300 kW, with impacts as low as about 33 kW and as high as over 2,800 kW for individual meters.
- The evaluation team found the verified impacts to be between 90% and 110% of DEP's reported impacts for the majority of participants.
- The Net to Gross ratio is estimated to be 1.0 for this program. This is because the regression approach accounts for the counterfactual baseline and it is highly unlikely that any participants would curtail their load in the absence of the program during the same time that events are being called by Duke Energy (since only participants are notified of events).

Date:	March 21, 2018
Region:	Duke Energy Progress
Evaluation Period	January 1, 2017 through December 31, 2017
Annual MWh Savings	N/A
Net-to-Gross Ratio	1.0

5. CONCLUSIONS & RECOMMENDATIONS

This section of the evaluation report presents the evaluation team's principal findings, conclusions, and recommendations.

The key impact evaluation findings are:

- **Verified impacts were slightly less than reported impacts.** The realization rate for the summer DR impacts for PY2017 was 96%, with an average of approximately 19.3 MW of DR contributed by the program.
- **Participation[22] was inconsistent between events.** The average total event impacts for the summer of PY2017 were highest for the second and third events (20.0 and 20.8 MW, respectively), but substantially lower for the first event (17.0 MW).
- **Total program impact increased in PY2017 compared to PY2016, but has yet to recover to PY2015 levels.** The average event impact increased from 17.6 MW in PY2016 to 19.3 MW in PY2017, but is still lower than the 20.1 MW achieved in 2015. DEP staff indicate that changes in US EPA regulations regarding onsite generators are a major contributor to this.

Navigant has one recommendation for the PY2018 evaluation, regarding a possible re-examination of the evaluation approach. In PY2010 and PY2011, Navigant tested a large number of potential baseline estimation techniques and tested these "out-of-sample" to select the approach that was, on average, the most accurate for all participants. Since that time, the group of enrolled participants has changed materially, with some participants leaving the program and others joining. Likewise, there appears to be a trend to shifting away from day-of notification to day-prior notification. This is doubtless very helpful for engaging customer response, but does materially impact the accuracy of the impact estimation: recall that the most accurate approach tested in the previous evaluation cycles was one which made use of a symmetric day-of adjustment, an adjustment that cannot be reasonably applied when notification is day-prior.

Navigant would therefore recommend that DEP consider allowing Navigant, for the PY2018 evaluation, to re-test a large set of potential regression model specifications, as it did in 2010 and 2011..

[22] Event-specific participation refers to enrolled participants delivering more than 0 kW of DR for a given event. An enrolled customer meter has participated in only two of three events if that meter has contributed more than 0 kW on only two of the three events.

NAVIGANT

EM&V Report for the Residential New Construction Program

Program Years: 2015 – 2016

Prepared for:

Duke Energy Progress

DUKE ENERGY®

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1. EVALUATION SUMMARY

The Duke Energy Progress (DEP) Residential New Construction (RNC) program[1] offers incentives to both single family and multi-family builders involved in new construction projects for the installation of energy efficient equipment or the development of high efficiency homes. The RNC program is designed to encourage energy efficiency during the planning and construction process, when energy efficiency upgrades have lower incremental costs. Participating builders can elect to follow either the whole-house or equipment paths to receive program incentives.

The RNC program allows DEP to be actively engaged in the efficiency considerations of the new construction market within its service territory. DEP closely coordinates with builders to maintain a productive relationship and a pathway for newly constructed homes to exceed the energy efficiency standards set by established building codes.

In 2016, DEP implemented considerable changes to the program design, incentive structure, and implementation contractor for the RNC program. This is the first Evaluation, Measurement, and Verification (EM&V) cycle to assess the program after those changes.

1.1 Evaluation Objectives

DEP selected Navigant to perform EM&V for the RNC program. The primary purpose of the EM&V assessment is to estimate the gross and net annual energy and demand impacts associated with participation for the 2016 Program Year (PY2016). Projects defined as being completed in the PY2016 encompass whole building projects that were submitted to the program between July 1, 2016 and December 31, 2016 and equipment only building projects that were submitted between January 1, 2016 and December 31, 2016.[2] This EM&V effort also includes a process evaluation to assess the program delivery structure, barriers to participation, and strengths or shortcomings of the program.

Navigant performed a comprehensive assessment of the RNC program to accomplish these objectives. The evaluation activities included:

- Interviews with DEP program staff, and ICF implementation staff
- Interviews with participant and nonparticipant builders
- Interviews with Home Energy Rating System (HERS) Raters
- Detailed review and analysis of program tracking data and program materials
- Onsite field verification at 40 program homes
- Calibrated energy simulation modeling based on participant billing data
- Market research

[1] http://www.duke-energyrncinfo.com/

[2] The 2016 program year was defined separately for Whole Building and Equipment Only projects, as the RNC program underwent a transition at the beginning of 2016 that redefined incentives for Whole Building projects, but did not affect the equipment only incentives.

1.2 Program Level Findings

The evaluation team found DEP's RNC program to be highly effective at reaching the new construction housing market and achieving energy and demand savings that exceed established building codes. The program is well-managed and properly structured to engage with builders and achieve program objectives.

Navigant found that participating builders and HERS Raters generally speak favorably about the RNC program. A small number of builders indicate dissatisfaction directly related to the program redesign, either because they are receiving a smaller incentive than they had in the past, or because of the clarified focus on electric savings which penalizes them for installing gas appliances.[3] That said, the most significant complaint about the RNC program, from both builders and HERS Raters, is that it is only offered in DEP territory. Across the board, builders would like to see the geography of the program offering extended, so that they can use the incentive to encourage greater uptake of energy efficient practices from all the homebuyers they work with.

The evaluation team found that the new program implementation contractor is effectively bringing this program to the market, and adequately tracking participation and program activity. The evaluation team does recommend that DEP and the implementation contractor consider exploring the possibility of using a different software platform to estimate ex ante impacts.

1.2.1 Gross Impact Findings

Navigant found the overall, program-level verified gross energy impacts to be about 6% less than the amount reported in the tracking data from DEP. Verified summer demand impacts were about 2% less than the reported tracking data from DEP, and verified winter demand impacts were about 4% greater than the tracking data. The calculation of gross impact findings is discussed in detail in Section 4 of this report. Table 1 presents the program-level gross savings results.

Table 1. PY2016 Reported & Verified Gross Program-Level Impacts

	PY2016 Energy Savings (MWh)	PY2016 Summer Demand Savings (MW)	PY2016 Winter Demand Savings (MW)
Reported Gross Program Savings (A)	3,743	1.59	1.51
Verified Gross Program Savings (B)	3,503	1.56	1.57
Gross Realization Rate (B/A)	94%	98%	104%

Source: Navigant analysis, totals subject to rounding

[3] The focus of the RNC program was always electric savings, but under the previous program design builders were incentivized for their HERS score through a tiered incentive structure. This incentive structure masked the electric focus and gave builders the impression that the program incentivized all energy efficiency – so the program adjustment was a surprise to some.

1.2.2 Net Impact Findings

The evaluation team found a net-to-gross (NTG) ratio of 1.051, meaning that the RNC impacts extend beyond the reach of program measures. The NTG analysis is discussed in extensive detail in Section 5 of this report, and the NTG ratio includes adjustments made for free ridership, spillover, and market effects. Table 2 shows program-level net energy and demand impacts.

Table 2. Verified Net Energy and Demand Impacts

	PY 2016 Energy Savings (MWh)	PY 2016 Summer Demand Savings (MW)	PY 2016 Winter Demand Savings (MW)
Verified Gross Program Savings (A)	3,503	1.56	1.57
Net-to-Gross Ratio (B)	1.051	1.051	1.051
Verified Net Program Savings (AxB)	3,681	1.64	1.65

Source: Navigant analysis, totals subject to rounding

1.3 Evaluation Parameters and Sample Period

To accomplish the evaluation objectives, Navigant completed an engineering review, calibrated building energy modeling, and field verification to assess installed quantities and characteristics. The whole house calibrated modeling process served as the basis for the gross savings calculations for all measures. This modeling process achieved a relative precision of 5.6% at a 90% confidence level, as illustrated in Table 3.

Table 3: Whole House Simulation Model Sample Statistics

Strata	2016 Strata Population Size (N)	Average Savings (kWh)	Coefficient of Variation	Single Family Electric Sample Size (N)	Relative Precision (90% CI)
2016 HERO + HERS Homes	1,049	2,891*	0.7	427	5.6%

** Average savings includes gas-heated homes*
Source: Navigant analysis

The RNC program underwent a significant program redesign at the beginning of 2016, therefore most efforts focused on activities completed during 2016. For the impact evaluation, PY2016 is defined as whole building projects that were submitted to the program between July 1, 2016 and December 31, 2016 and equipment only building projects that were submitted between January 1, 2016 and December 31, 2016. The process evaluation included participants from both the 2015 and 2016 program years, but preference was given to program participants who had participated in the RNC program since the redesign. Table 4 displays the start and end dates of Navigant's sample period for evaluation activities.

Table 4. Sample Period Dates

Activity	Evaluation Period Start Date	Evaluation Period End Date
Program staff and implementer interviews	Throughout	
Participant builder interviews	May 29, 2017	July 7, 2017
Nonparticipant builder interviews	July 10, 2017	August 11, 2017
HERS Rater interviews	July 10, 2017	August 17, 2017
Field verification of equipment-only measures	June 1, 2017	July 28, 2017

Source: Summary of Navigant analysis

1.4 Evaluation Recommendations

Navigant developed a series of recommendations during the EM&V effort. These recommendations are intended to assist Duke Energy with enhancing the program delivery, customer experience, support future EM&V activities, and possibly increase program impacts. Further explanation for each recommendation can be found later in this report.

- Navigant recommends that Duke Energy adopt the per-unit energy and demand impacts for the deemed measures (equipment only and HERO) from this evaluation and use them going forward.
- Duke Energy should consider increasing the deemed measure life for HVAC equipment from 15 years to 18 years.
- Navigant recommends Duke Energy adjust the User Defined Reference Home (UDRH) heating system thermostat setpoint to 70°F.
- Duke Energy should consider expanding the RNC program offering to territories beyond the DEP territory.
- Navigant recommends that Duke Energy consider whether software modeling platforms other than REM/Rate could be used to confirm program requirements.
- Duke Energy should consider whether there is an opportunity to partner with a gas utility to provide value to gas savings, or consider program education around the goal of the program being electric savings.

2. PROGRAM DESCRIPTION

The DEP RNC program offers incentives to both single family and multi-family builders for the installation of energy efficient equipment in new construction projects or the construction of high efficiency homes.

2.1 Design

The RNC program is designed to encourage energy efficiency during the planning and construction process, when energy efficiency upgrades have lower incremental costs. Participating builders can elect to follow either the whole-house or equipment paths to receive program incentives. The RNC program incentives were redesigned at the end of the PY2015 program year. The incentives presented below reflect the current program incentives, those that have been applied starting in PY2016.

2.1.1 Whole-House Incentives

Participating builders can receive up to $9,000 per dwelling unit (classified by Premise number) for building more efficiently, or above energy code specifications. Projects receive a minimum incentive of $750 for meeting the requirements of the 2012 North Carolina Energy Conservation Code's High Efficiency Residential Option (HERO) or the equivalent in South Carolina. If building project teams elect to exceed the efficiency requirements of the HERO code, project specific incentives are calculated per kWh saved as estimated through Home Energy Rating System (HERS) modeling as illustrated in Table 5.

Table 5. Whole House Measures and Eligibility Requirements

	Whole-House Eligibility Requirement	Incentive
HERO	Meet 2012 NCECC HERO standards.[4]	$750
HERO plus HERS Score	Meet HERO standards and submit confirmed annual kWh savings from the Energy Summary Report.	$0.90/kWh

Source: Duke Energy Progress, Residential New Construction Program Materials

In addition to the whole-house incentives outlined in Table 5, the whole-house incentive program offers the following benefits:

1. An optional three-year Heating and Cooling Energy Usage Limited Guarantee that participating builders can offer to home buyers.
2. Onsite subcontractor training.
3. Marketing support, including advertising and promotional campaigns, signage, and collateral.

2.1.2 Equipment Incentives

Participating builders that choose the equipment upgrade path can receive up to $725 for installing high-efficiency HVAC equipment, as described in Table 6.

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[4] Homes must be a minimum of 699 heated square feet when meeting HERO standard but not submitting a HERS score.

Table 6. Equipment Measures and Eligibility Requirements

	Equipment Incentive Description	Incentive
Tier 1	AC or heat pump with SEER (Seasonal Energy Efficiency Ratio) of 14 or greater but less than 15. The HVAC system must meet the Quality Installation Standard of 90%. High Efficiency Heat Pumps: The unit(s) shall be a minimum SEER of 14 with ECM. High Efficiency Central AC: The unit(s) shall be a minimum SEER of 14 with ECM.	$250
Tier 2	AC or heat pump with SEER of 15 or greater.	$300
	Quality Installation Standard (Option for Tier 2).	$75
HPWH Installation	ENERGY STAR qualified HPWH(s) with minimum Energy Factor of 2.0.	$350/unit

Source: Duke Energy Progress, Residential New Construction Program Materials

2.2 Implementation

The RNC program is currently implemented by ICF International. Prior to 2016, the RNC program was implemented by MASCO. DEP provides ICF with goals and directions for the program and collaborates around how those goals will be met. ICF manages all day-to-day interactions with builders and HERS Raters including, assisting builders and raters with administrative and technical issues, i.e. modeling issues; providing information about projects that are in the incentive process; and QC's raters' work in the field to ensure program compliance.

Recruiting new builders into the RNC program is primarily the responsibility of the ICF team, but this is done in close collaboration with the DEP RNC program team. The process of recruiting a new builder usually starts with an in-person meeting to walk them through the details of the program. ICF then reviews a full set of plans for a builder's typical home and shows them the adjustments that would be needed to get to program standards, and what they would be able to achieve in terms of rebates.

Once a builder has been recruited to participate in the RNC program, most of the work to ensure compliance with program requirements results from the work between the builder and HERS Rater. The HERS Rater completes the HERS score for each individual home and submits through the program for the builder to receive the incentive. For equipment or HERO only whole-house projects, the builder may manage the submittal process themselves. ICF completes in-field QA/QC throughout the building process to ensure that quality standards are met and to educate builders in the field. QA/QC findings are provided back to builders to support this education process.

RNC program rebates are processed twice per month. ICF pulls final documentation for projects that have final, confirmed REM/Rate files including blower door testing and sends invoices to DEP. Tracking data supporting all completed projects is provided to DEP and subsequently to Navigant for EM&V.

3. KEY RESEARCH OBJECTIVES

The key research objectives of the RNC evaluation included conducting impact, process, and NTG research. The primary purpose of the EM&V assessment was to estimate the gross and net annual energy and demand impacts associated with participation for the 2016 Program Year. Projects defined as being completed in the 2016 Program Year encompass whole building projects that were submitted to the program between July 1, 2016 and December 31, 2016 and equipment only building projects that were submitted between January 1, 2016 and December 31, 2016.[5]

The detailed key research objectives included the following:

- Calculate verified net and gross energy and demand savings for all incentives offered after the 2016 incentive redesign (i.e. after July 1, 2016) and explain any differences between the verified kWh and kW savings and the reported values.
- Quantify RNC program attributable net savings through interviews with participant builders, nonparticipant builders, and HERS Raters, with consideration of the market effects quantification completed for the PY2013-14 evaluation.
- Evaluate the strengths and weaknesses of current program processes, including any barriers that might prevent participation.
- Review closeout of previous program design and transition to new program design.
- Provide updated deemed savings estimates by measure.
- Recommend improvements to program rules and processes that support greater savings, enhanced cost-effectiveness, and improved customer satisfaction.

[5] The 2016 program year was defined separately for Whole Building and Equipment Only projects, as the RNC program underwent a transition at the beginning of 2016 that redefined incentives for Whole Building projects.

4. IMPACT EVALUATION

Navigant estimates program-level gross realization rates of 94%, 98%, and 104% for energy, summer peak demand, and winter peak demand, respectively. These results are presented in Table 7. The differences between reported and verified impacts are largely a result of energy simulation model calibration. Unlike the REM/Rate models used to calculate reported savings, the BEopt models used by the evaluation team for savings verification were calibrated to ensure that resulting energy consumption matches actual participant billing data.[6] More details are provided throughout this report.

Table 7. PY 2016 Reported & Verified Program-Level Impacts

	PY 2016 Energy Savings (MWh)	PY 2016 Summer Demand Savings (MW)	PY 2016 Winter Demand Savings (MW)
Reported Gross Program Savings (A)	3,743	1.59	1.51
Verified Gross Program Savings (B)	3,503	1.56	1.57
Gross Realization Rate (B/A)	94%	98%	104%

Source: Navigant analysis, totals subject to rounding

4.1 Summary of Reported Program Savings

Table 8 outlines the reported measure level savings for each of the RNC program measures. As indicated, the HERO and equipment only measures rely on deemed savings estimates, while the HERO+HERS measure is a custom measure, where energy savings are derived from the HERS building model report and a savings factor is applied to determine summer and winter demand savings.

Table 8. Summary of 2016 Reported Savings, by Measure

Measure Category	Measure	Reported Energy Savings (kWh)	Reported Summer Demand Savings (kW)	Reported Winter Demand Savings (kW)
Whole House	HERO	1,195	0.48	0.64
	HERO + HERS	Varies	0.000435423 per kWh	0.00038392 per kWh
Equipment Only	Heat Pump (SEER ≥ 15)	510	0.17	0.23
	Central AC (SEER ≥ 15)	293	0.429	0.0
	Heat Pump Water Heater (EF ≥ 2.0)	2,164	0.29	0.43

[6] BEopt is an advanced energy simulation modeling software package developed by the National Renewable Energy Laboratory. https://beopt.nrel.gov/

Quality Install Standard	379	0.12	0.09

Source: RNC program staff

The 2016 program year was somewhat unique for the RNC program as program changes affecting the whole house measures went into effect partway through the year. As the purpose of this evaluation was to determine the impact and effectiveness of the program after the change, it was important to only review those projects that were completed under the new incentive system. Therefore, the evaluation captured only those projects that had been submitted to the program after July 1, 2016. Equipment measures were included starting on January 1, 2016, as there were no changes to the equipment-only measures. The total number of measures and associated savings evaluated through the 2016 RNC program evaluation are presented in Table 9.[7]

Table 9. Summary of 2016 Reported RNC Program Savings

Measure	Number of Projects	Reported Energy Savings (kWh)	Reported Summer Demand Savings (kW)	Reported Winter Demand Savings (kW)	Rebate Amount
Whole House	**1,358**	**3,402,834**	**1,469**	**1,363**	**$2,949,078**
HERO	309	369,255	148	198	$231,750
HERO+HERS	1,049	3,033,579	1,321	1,165	$2,717,328
Equipment Only	**681**	**339,715**	**125**	**149**	**$207,900**
Heat Pump (SEER ≥ 15)	646	329,460	110	149	$196,800
Central AC (SEER ≥ 15)	35	10,255	15	0	$11,100
TOTAL	**2,039**	**3,742,549**	**1,594**	**1,512**	**$3,156,978**

Source: Navigant analysis of 2016 RNC tracking data

4.2 Impact Evaluation Methodology

This section presents the impact evaluation methodology for the RNC Program. DEP's program tracking database provided savings values for energy and peak demand (reported gross savings) based on program participation data and deemed or calculated savings estimates for each measure. The evaluation team verified the accuracy of the reported savings values for each measure category through deemed savings review, onsite field verification, and calibrated energy simulation modeling.

[7] The program tracking data indicated that there was zero participation for the heat pump water heater and quality installation measures during the period covered by this evaluation.

4.2.1 Deemed Savings Review

The evaluation team performed a detailed, engineering review of the deemed savings assumptions and algorithms for the prescriptive equipment measures offered through the RNC program. The program offers prescriptive incentives for heat pump water heaters (HPWHs), high-efficiency air source heat pumps (ASHPs) and high-efficiency central air conditioners (CACs), and quality installation. The incentives for ASHPs and CACs are further segmented into two incentive tiers based on SEER value. Table 10 presents the deemed savings values reviewed for this evaluation.

Table 10: Deemed Savings Review

Measure	Unit Basis for Tracking	Source	Annual Gross Energy Savings (kWh)	Summer Coincident Demand Impacts (kW)	Winter Coincident Demand Impacts (kW)
HERO[8]	Per home	2013 & 2014 EM&V Report for RNC program, by Navigant	1,195	0.48	0.64
Heat Pump (SEER $\geq$ 15)	Per home	HEIP Program Savings: high efficiency HVAC with ECM	510	0.17	0.23
Central AC (SEER $\geq$ 15)	Per home	HEIP Program Savings: high efficiency HVAC with ECM	293	0.43	0.00
Quality Installation	Per home	HEIP Program Savings	379	0.12	0.09
Heat Pump Water Heater (EF $\geq$ 2.0)	Per home	2013 & 2014 EM&V Report for RNC program, by Navigant	2,164	0.29	0.43

Source: Navigant review of RNC program data

For the equipment only portion of the program, the evaluation team's review was focused on the ASHP and CAC measures. The reported savings for the HERO and heat pump water heater measures referenced values from the most recent RNC evaluation completed by Navigant. Furthermore, the program tracking data showed zero participation for heat pump water heaters and the quality installation measure during the period covered by this evaluation so the evaluation team did not make any adjustments to deemed savings for these measures.

The reported savings for the 2016 ASHP and CAC measures reference values from the Home Energy Improvement Program (HEIP), which offers rebates for energy efficiency measures in existing homes.

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[8] HERO references the High Efficiency Residential Option, which is a voluntary, stretch code detailed in Appendix 4 of the 2012 North Carolina Energy Conservation Code. The HERO code was launched on January 1, 2012 and is comprised of measures that achieve 15-20 percent greater energy savings than minimum state code requirements.

The evaluation team reviewed the HEIP savings assumptions[9] for the DEP territory to better through understand the underlying references for the RNC Equipment claimed savings. No *ex ante* calculations were available for review, as the HEIP savings were developed using an energy model and only outputs were referenced in the provided workbook.

The program also uses a deemed savings value for the HERO homes. This value (1,195 kWh) was developed using calibrated simulation modeling through the most recent RNC evaluation (PY2013-14). The evaluation team confirmed that the 2016 reported HERO savings referenced the correct values from the 2013 & 2014 EM&V Report. The evaluation team also verified the deemed savings values in 2016 using calibrated simulation modeling as described in Section 4.2.3.

4.2.2 Onsite Field Verification

Navigant conducted 40 site visits to verify the installation of prescriptive HVAC measures reported in the measure tracking database. The field-work sample was stratified by builder volume, focusing on the top five, who represented 90% of prescriptive HVAC measure participation. Navigant compared the results of the field data collection activity with the reported installations to check for both quantitative and qualitative differences.

4.2.3 Energy Model Development and Calibration

Reported participant savings were calculated for each HERO+HERS project using REM/Rate modeling software. The baseline home characteristics were defined by prescriptive code specifications in the 2012 North Carolina Energy Conservation Code. Similar to the EM&V methodology used for the 2013-2014 RNC program evaluation, the evaluation team used calibrated simulation modeling to assess the degree to which un-calibrated REM/Rate models for program homes accurately reflect actual participant consumption and weather patterns. This model calibration process was only used to development of a realization rate for electric heated homes. The development of a realization rate for gas homes, for which only partial consumption data was available, is discussed in the next section.

For electric homes, the evaluation team used BEopt hourly building simulation software for calibrated simulation: modelling a sample of electric program participant homes based on average home specifications extracted from the REM/Rate files used for program verification. DEP provided Navigant with monthly electricity consumption data for PY2016 program participants. Model results were weather-normalized using 2016 historical weather data. The baseline home was modeled in BEopt using the same prescriptive code specifications used in the reported savings models.

The verified gross energy and demand savings were calculated as the difference between the program baseline and simulation results. Peak demand savings were extracted directly from the BEopt hourly simulation results during DEP's peak period.[10] Appendix A provides more detail about the model development and calibration process.

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[9] The HEIP savings assumptions were used for Navigant's PY2013 EM&V report for the HEIP Program. See *2013 EM&V Report for the Home Energy Improvement Program, Prepared for Duke Energy Progress, July 6, 2015.*

[10] The winter peak period was defined as weekdays during the month of January for the hour ending 8. The summer peak period was defined as weekdays during the month of July for the hour ending 17.

4.2.4 Calculating Realization Rates

Realization rates are calculated as the ratio of verified savings to reported savings. For whole house measures, the realization rate calculated for the sample of single family electric homes was applied to the remainder of electrically heated projects when calculating a program-level realization rate. While conducting further analysis around the discrepancy between reported and verified savings, the evaluation team compared the estimated annual consumption from REM/Rate models to the actual annual consumption from the participant billing data, for the sample of electrically heated homes. This analysis found that the REM/Rate files over-estimated total annual consumption by 15%. Since the BEopt models were calibrated to this same billing data, the REM/Rate models overestimate the BEopt models by that same 15% when the BEopt models were run with actual weather data from the same period as the billing data. However, when the BEopt models were run using TMY weather data, the results were very similar, suggesting that the actual weather conditions for the sampled period were not all that different from average weather conditions.

The evaluation team repeated this comparison of REM/Rate estimates and billing data for the gas-heated homes. In this case, the REM/Rate models were found to underestimate electric consumption by 5% compared to billing data (effectively a 105% realization rate). Rather than applying the realization rate from electrically-heated homes to the gas-heated homes to develop the program-level realization rate, the evaluation team applied the 105% realization rate found from this analysis to the gas homes in the population. This approach is justified because the difference between the REM/Rate estimates and the billing data for electrically-heated homes is approximately equal to the difference between the REM/Rate estimates and the BEOpt estimates for electrically-heated homes. It is reasonable to assume that the same is true for gas-heated homes.

4.3 Impact Evaluation Findings

This section presents the verified gross savings results for the RNC program, including data collected during field verification and developed through energy model calibration.

4.3.1 Whole House Measures

Table 11 shows the results of the modeling procedures discussed in Section 4.1, which were used to develop the verified gross energy savings for each whole house measure. Unit realization rates were calculated from the modeling results for an average single family home with electric heat representing each whole house measure. The resulting realization rates were then applied to all the electric-heated homes. A realization rate for gas heated homes was developed through a comparison of the REM/Rate model estimates and the billing data, as described in Section 4.2.4. The gas-home realization rate was applied to all gas-heated homes and the resulting saving were rolled-up to a program level total. This process resulted in a 137% realization rate for the HERO measure, an 94% realization rate for the HERO+HERS measure, and an 95% realization rate for the whole home measures in total.

Table 11: Whole House Measure Gross Energy Savings and Realization Rates

Incentive Level	Count	Unit Energy Savings		Program Total Energy Savings		
		Reported (kWh)	Verified (kWh)	Reported (MWh)	Verified (MWh)	RR%
HERO	309	1,195	1,639	369	507	137%

HERO + HERS	1,049	2,891	2,707	3,034	2,730	94%
Whole Home Total	**1,358**	**-**	**-**	**3,403**	**3,237**	**95%**

Source: Navigant analysis, totals subject to rounding

Table 12 shows the whole house model results for summer peak demand savings. Navigant's evaluation found an overall realization rate of 88% for whole house summer demand savings.

Table 12: Whole House Measure Gross Summer Demand Savings and Realization Rates

Incentive Level	Count	Unit Summer Demand Savings		Program Total Summer Demand Savings		
		Reported (kW)	Verified (kW)	Reported (MW)	Verified (MW)	RR%
HERO	309	0.48	0.98	0.15	0.30	203%
HERO + HERS	1,049	1.26	1.05	1.32	1.00	83%
Whole Home Total	**1,358**	**-**	**-**	**1.47**	**1.30**	**88%**

Source: Navigant analysis, totals subject to rounding

Table 13 shows the whole house model results for winter peak demand savings. Navigant's evaluation found an overall realization rate of 103% for whole house winter demand savings.

Table 13: Whole House Measure Gross Winter Demand Savings and Realization Rates

Incentive Level	Count	Unit Winter Demand Savings		Program Total Winter Demand Savings		
		Reported (kW)	Verified (kW)	Reported (MW)	Verified (MW)	RR%
HERO	309	0.64	0.97	0.20	0.30	151%
HERO + HERS	1,049	1.11	1.10	1.16	1.11	99%
Whole Home Total	**1,358**	-	-	**1.36**	**1.41**	**103%**

Source: Navigant analysis, totals subject to rounding

The difference between the reported and verified savings is attributed primarily to the difference between calibrated and uncalibrated simulation models for the HERO+HERS measure. The REM/Rate models used for reported savings cannot be calibrated to actual billing consumption and weather data, due to limitations of the REM/Rate software. However, the BEopt models used for savings verification were calibrated to ensure that resulting energy consumption matches billing data to within five percent. To illustrate this effect, the evaluation team compared the annual energy consumption estimates from PY2016 REM/Rate project files to the actual billing consumption for a sample of 250 projects. This analysis found that on average REM/Rate models overestimated annual energy consumption by 16 percent, compared to actual billing records.

Navigant also conducted a review of other evaluation studies that compared REM/Rate results to other modeling software. Appendix B presents a summary of the findings from each study. Nearly all studies found discrepancies between REM/Rate and other models. More than half of these studies attributed those discrepancies to REM/Rate's overestimation of energy consumption (especially heating consumption).

This evaluation found higher realization rates for HERO homes. Both the reported and verified savings estimates were calculated using the same calibrated simulation methodology. However, the program home and baseline home characteristics were updated since the previous evaluation, based on market forces and program design changes. The result was an increase in average energy savings for PY 2016 homes.

4.3.2 Prescriptive Equipment Measures

Navigant conducted an onsite field verification of prescriptive HVAC measures reported in the measure tracking database for PY2016. Navigant completed 40 site visits and found an installation rate of 100%, as shown in Table 14. The field-work sample was stratified by the top five program builders, who represented 90% of prescriptive HVAC measure participation. Differences between the sample target and actual completed site visits are due to scheduling issues.

Table 14: Onsite Sample Targets

Builder	Projects	Sample Target	Completed Site Visits	Verified Installation Rate
1	221	11	13	100%
2	110	8	8	100%
3	109	8	8	100%
4	71	6	11	100%
5	64	6	0	N/A
Total	**575**	**39**	**40**	**100%**

Source: Navigant analysis

Verified gross energy savings, summer demand savings, and winter demand savings for the prescriptive equipment measures are presented in Table 15,
Table **16**, and Table 17, respectively. These results were developed following the modeling procedures discussed in Section 4.2.3. The evaluation team modified the calibrated simulation models developed for the Whole House measures to match the specifications for equipment measures. In other words, the prescriptive heat pump and air conditioner were modeled with a 15 SEER unit in BEopt, per program specifications. A baseline model was then created with a 14 SEER unit and savings were calculated as the difference in consumption between the two models. Unit-level realization rates were calculated from the modeling results. These values were then applied to the 2016 program total reported energy savings to calculate the total verified savings. This resulted in an overall prescriptive measure gross energy savings realization rate of 78%, 205% for summer demand, and 108% for winter demand savings.

Table 15: Prescriptive Measure Gross Energy Savings and Realization Rates

Incentive Level	Count	Unit Energy Savings		Program Total Energy Savings		
		Reported (kWh)	Verified (kWh)	Reported (MWh)	Verified (MWh)	RR%

Heat Pump (SEER 15)	646	510	401	329	259	79%
Central AC (SEER 15)	35	293	207	10	7	71%
Prescriptive Total	681	-	-	**340**	**267**	**78%**

Source: Navigant analysis, totals subject to rounding

Table 16: Prescriptive Measure Gross Summer Demand Savings and Realization Rates

Incentive Level	Count	Unit Summer Demand Savings		Program Total Summer Demand Savings		RR%
		Reported (kW)	Verified (kW)	Reported (MW)	Verified (MW)	
Heat Pump (SEER 15)	646	0.17	0.38	0.11	0.25	226%
Central AC (SEER 15)	35	0.43	0.24	0.02	0.01	57%
Prescriptive Total	681	**-**	**-**	**0.13**	**0.26**	**205%**

Source: Navigant analysis, totals subject to rounding

Table 17: Prescriptive Measure Gross Winter Demand Savings and Realization Rates

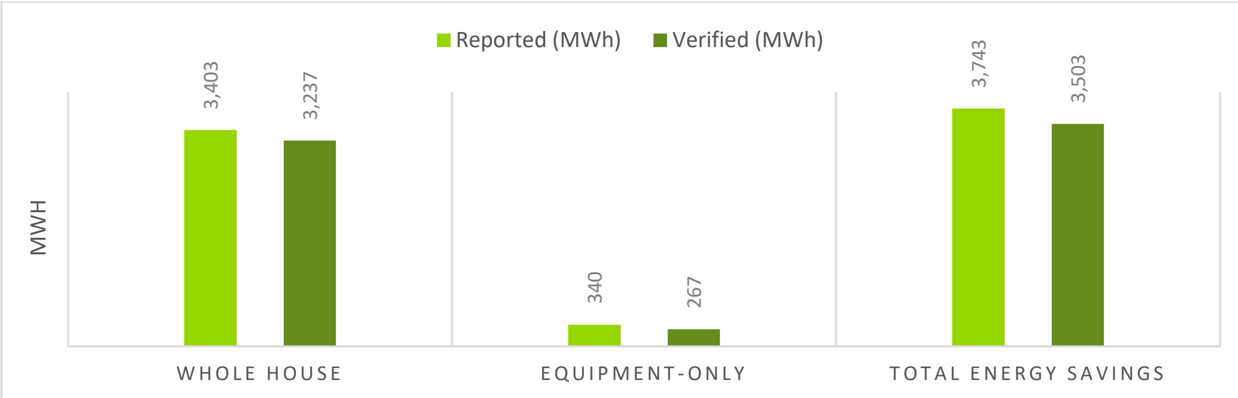
Incentive Level	Count	Unit Winter Demand Savings		Program Total Winter Demand Savings		RR%
		Ex-Ante (kW)	Ex-Post (kW)	Ex-Ante (MW)	Ex-Post (MW)	
Heat Pump (SEER 15)	646	0.23	0.25	0.15	0.16	108%
Central AC (SEER 15)	35	0.00	0.00	-	-	-
Prescriptive Total	681	-	-	**0.15**	**0.16**	**108%**

Source: Navigant analysis, totals subject to rounding

4.3.3 Summary of Impact Evaluation Findings

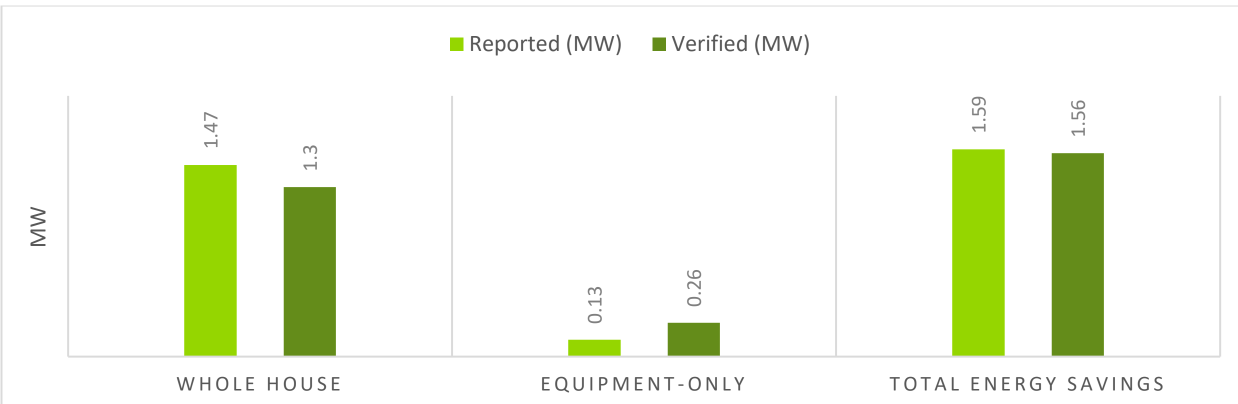
Figure 1 through Figure 3 show the total gross RNC program energy and demand savings, for both the whole house and prescriptive measures. The program's total verified gross energy savings for PY2016 were 3,503 MWh, summer peak demand savings were 1.56 MW and winter peak demand savings were 1.57 MW.

Figure 1. Reported & Verified Gross Energy Savings



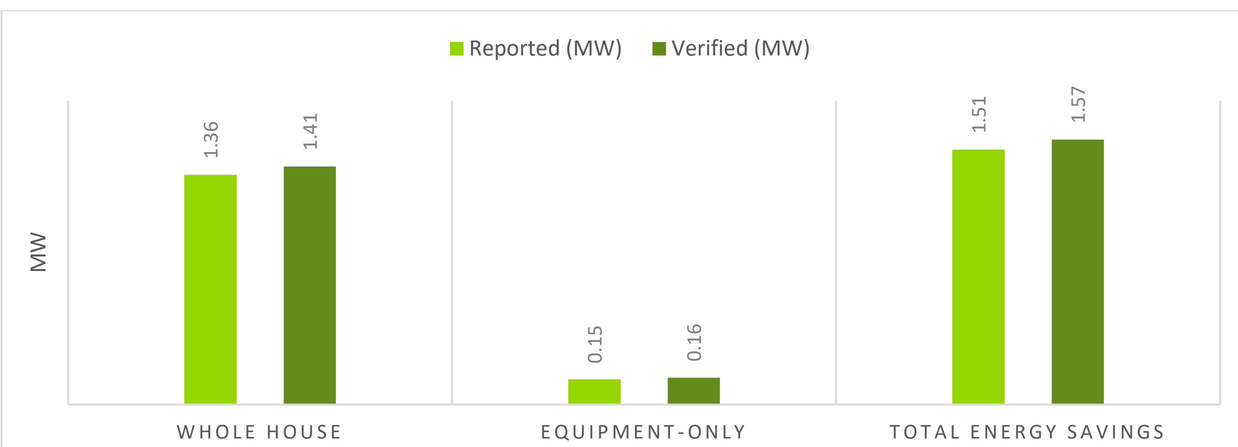
Source: Navigant Analysis

Figure 2. Reported & Verified Summer Demand Savings



Source: Navigant Analysis

Figure 3. Reported & Verified Winter Demand Savings



Source: Navigant Analysis

5. NET-TO-GROSS ANALYSIS

Navigant conducted a NTG analysis to estimate the share of program savings that can be attributed to participation in or influence from the program. Table 18 shows the results of Navigant's NTG analysis.

Table 18. Summary of NTG Findings

NTG Category	Ratio
Estimated Free Ridership Ratio	0.054
Estimated Spillover Ratio	0.000
Estimated Market Effects Ratio	0.105
Estimated NTG Ratio	1.051

Source: Navigant analysis

5.1 Net-to-Gross Methodology

As indicated in the evaluation plan, the goal of the NTG work was to quantify free ridership, spillover, market effects for the RNC program. Together these three inputs would result in an updated NTG ratio for the program. Navigant used a survey-based, self-report method to estimate free ridership and spillover for this evaluation. A self-report approach is outlined in the Uniform Methods Protocol,[11] and Navigant has previously used this method to estimate a NTG ratio for several other Duke Energy programs. Navigant engaged with HERS Raters, participant builders, and nonparticipant builders for the NTG surveys. Specific involvement of each of these market actor groups is identified in the following specific methodology sections. To estimate market effects for the RNC program, Navigant updated the evaluation methodology developed through the PY2013-2014 evaluation. The previous methodology was developed using a Delphi Panel, which is outlined in the Uniform Methods Protocol as a standard method for determining market effects.[12]

The outcome of the net savings assessment for the RNC program were defined by Equations 1-3, all referenced from the Uniform Methods Protocol.[13]

Equation 1. Net Savings Including Free Ridership, Spillover, and Market Effects

Net Savings = Gross Savings - FR + SO + ME (not already captured by SO)

Where: Net Savings includes free ridership, spillover, and market effects savings
FR = free ridership savings
SO = spillover savings
ME = market effects savings not already captured by SO

[11] National Renewable Energy Laboratory, *Chapter 23: Estimating Net Savings: Common Practices*, 2014. https://energy.gov/sites/prod/files/2015/02/f19/UMPChapter23-estimating-net-savings_0.pdf.

[12] Ibid.

[13] Ibid.

Equation 2. Net-to-Gross Ratio

NTG Ratio = 1 - FR ratio + SO ratio + ME ratio

Where: NTG Ratio = Net-to-Gross ratio
The denominator in each ratio is the gross savings

Equation 3. Net Savings Calculation Using the Net-to-Gross Ratio

Net Savings = NTG Ratio x Gross Savings

The determination of net savings for new construction programs is often difficult due to the complexity and subjectivity in quantifying and attributing changes in baseline practices. It can be difficult to identify why a program participating builder made the choice to build an energy efficient home and what they would have done in the absence of the program influence. To add to the complexity of this evaluation, the evaluation team determined two program participant subsets: custom and production builders. Whether builders were self-defined as custom or production was a significant predictor of how builders would answer questions around program attribution. As a result, the evaluation team developed net savings estimates separately for the two groups before rolling the results up to a program level finding.

To ground this conversation, custom and production builders must be clearly defined. For this evaluation, a custom home was defined as a home built from a unique set of plans – these are most often developed with an architect, but in some cases may be developed as part of a design/build process. Conversely, a production home was defined as a home where the plan comes from a library, in some cases these are semi-custom in that the homeowner specifies equipment and portions of the plan, but even if the home is semi-custom the home is still considered to be built by production methods if the plan comes from a library.

Table 19 summarizes the results from the program participating builder interviews as they relate to understanding the RNC program's effects on these builders. It is important to note that none of the three questions outlined within this table were asked directly, instead these responses represent a composite of responses from multiple open-ended questions. Using multiple questions to compile a result was seen by the evaluation team as more accurate, because it limited the ability for a builder to say that they absolutely build energy efficient homes and would have done so without the RNC program, which always brings up questions in terms of the legitimacy of the self-reported answers. In some cases, the builder's statement clearly placed them in one category, and is identified by an "X". However, in other cases, the placement in a specific category is inferred by the builder's responses, and is identified by an "/."

Table 19. Program Participating Builder Interview Summary

			Would have built energy efficient homes without the RNC program		*Would have followed other green building program without the RNC program*		*Standard building practices have been affected by program participation*		
Builder	***Custom***	***Production***	***Yes***	***No***	***Yes***	***No***	***Definitely***	***Some***	***No***
1	-	100%		X		X	X		
2	-	100%		X		X	X		
3	-	100%	/		/			/	
4	-	100%		/	/			X	
5	-	100%		X	/		X		
6	5%	95%		X	/		X		
7	5%	95%	X		X			/	
8	20%	80%		X		X	X		
9	50%	50%		X		X	X		
10	50%	50%	X		X			/	
11	60%	40%	X		X			X	
12	70%	30%	X		X			/	
13	75%	25%	X			X		/	
14	75%	25%	X		/			X	
15	90%	10%	X		X				X
16	100%	-	/			X		X	
17	100%	-	X		/			X	
18	100%	-	X		X			/	

KEY: X = Clear Response
/ = Inferred Response

Source: Navigant analysis

Table 19 indicates a clear difference in baseline and energy efficient practices as well as RNC program influence for custom and production builders. Builders that define more than half of their building as production[14] would not have built energy efficient homes without the influence of the RNC program, and their standard building practices have significantly changed because of their program participation. The evaluation team also heard from these production builders that their decision to build efficient homes was a financial one. They didn't necessarily use energy efficiency as a selling point or a differentiator, but they were willing to make the changes because they could produce a better house by leveraging the program incentive.

Because of the vast differences in the participant motivations around program participation and the resulting program effects on building practices, the evaluation team determined that it was appropriate to consider RNC program net savings separately for production and custom builders.

[14] For simplification, production builders will be defined as those builders who define more than half of their building as production and custom builders will be defined as those who define more than half of their building as custom.

In contrast to the production builders, most of the custom builders indicated that they would leverage other energy efficiency programs like ENERGY STAR to build energy efficient homes in absence of the RNC program. These custom builders indicated that they had made changes to their building practices because of their participation in the RNC program, like a greater focus on air sealing or the inclusion of a heat pump water heater, but they were in most cases already building above-code buildings. This finding was echoed by the HERS Raters who work with these builders. Custom builders use energy efficient practices as a differentiator in the marketplace; the incentive is nice, but they would continue to build energy efficient homes because the financials penciled out before the RNC incentive.

Because of the vast differences in the participant motivations around program participation and the resulting program effects on building practices, the evaluation team determined that it was appropriate to consider RNC program net savings separately for production and custom builders, which will be seen in the specific methodologies used to calculate free ridership and spillover. The separate results are combined to a full program result using a weighted average that relies on the proportion of production and custom homes within the RNC program for the 2016 Program Year.

5.1.1 Free Ridership

Free ridership is a measure of “program savings attributable to free riders (program participants who would have implemented a program measure or practice in the absence of the program).”[15] Free riders can be further segmented into total free riders, partial free riders, and deferred free riders. An example of an RNC program free rider is a participant who would have built to another above-code standard, such as ENERGY STAR, even if DEP did not offer a program incentive.

The evaluation team used inputs from the builder and HERS Rater interviews to calculate free ridership for the RNC program. Additionally, because the differences identified between custom and production builders were expected to significantly impact the calculation of RNC program free ridership, the evaluation team considered free ridership separately across within these two program actor groups. The results for each group were combined through a weighted average accounting for the percent of homes completed in the 2016 RNC program that could be defined as production and custom, as illustrated in Equation 4. The free ridership results for the RNC program, as calculated using the methodology described in this section, are presented in Section 5.2.1.

Equation 4. RNC Program Free Ridership

Total FR = (Custom FR x 2016 % Custom Homes) + (Production FR x 2016 % Production Homes)

Where: Custom FR = Percent of custom homes meeting RNC requirements without intervention
Production FR = Percent of production homes meeting RNC requirements without intervention
2016 % Custom Homes = Percent of 2016 RNC homes built using custom practices
2016 % Production Homes = Percent of 2016 RNC homes built using production practices

[15] National Renewable Energy Laboratory, *Chapter 23: Estimating Net Savings: Common Practices*, 2014. https://energy.gov/sites/prod/files/2015/02/f19/UMPChapter23-estimating-net-savings_0.pdf.

5.1.1.1 Calculation of Custom and Production Free Ridership

The evaluation team used results from the HERS Rater interviews to understand the percent free ridership for the custom and production builder categories.[16] The evaluation team asked HERS Raters to quantify the percentage of home plans that would achieve program-qualifying levels of efficiency upon initial review (i.e. before intervention by the rater). A senior member of the evaluation team teased out the answers to this question, to identify differences for custom and production builders and whether the builder would be able to achieve the proposed level of efficiency.

The HERS Rater answers to the question of what percent of homes would meet program qualifying levels without intervention, were rolled up using a weighted average based on the number of homes each HERS Rater reviewed in 2016. Therefore, answers from HERS Raters who reviewed hundreds of homes will carry more value than those from HERS Raters who only reviewed a few homes, which should result in a more accurate result for the RNC program. This exercise resulted in a separate free ridership ratio for custom and production builders, as illustrated in Figure 4.

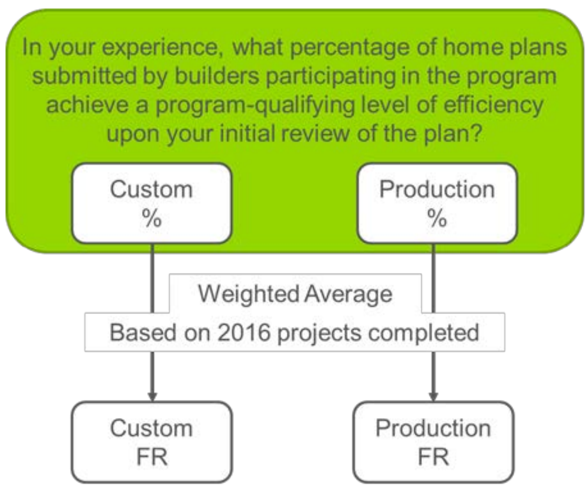


Figure 4. Free Ridership Calculation

Source: Navigant analysis

The evaluation team reviewed the results of the HERS Rater determination of free ridership against results from the participant builder interviews. While no quantitative process was developed for this comparison, the evaluation team did not identify a qualitative difference between the free ridership understanding for the HERS Raters and the participant builders. Answers from two specific questions in the program participating builder interview were considered in this corroboration process.

1. What are the most significant factors that have caused you to make the decision to build energy efficient homes? Using the scale of 1 to 5, where 1 is “not at all influential” and 5 means “very influential,” tell us how influential the following were on your decision to build energy efficient homes?

[16] The HERS Rater interviews were considered a better source of information for determining free ridership than the participant builder interviews, because of the concern of builders overestimating the energy efficient practices that they would employee without program intervention.

a. The Duke Energy RNC Program

b. Another energy efficient building standard, i.e. ESTAR or LEED

c. Corporate decisions/purchasing

d. Homebuyer preference

e. Other market influences [specify]

2. Using a scale of 1 to 5, where 1 is "not at all influential" and 5 means "very influential," tell us how influential the following elements were on your decision to build homes to the RNC program standards:

   a. Program incentive

   b. Program information/training from Duke Energy/ICF program staff

   c. Program marketing materials

   d. Program information provided by your HERS Rater

5.1.1.2 Calculation of Custom and Production Home Percentage

The evaluation team used results from the participant builder interviews to understand the percent of program homes that could be defined as production and custom. During the participant builder interviews, the evaluation team asked builders to describe what percent of the homes they build could be defined as production or custom, using the definitions identified in Section 5.1 Net-to-Gross Methodology. These answers were rolled up, using a weighted average based on the number of homes that each builder submitted to the program in 2016 within each of the predefined builder size categories: small, medium, and large as defined in Table 20.[17] A program level ratio production and custom homes was developed through a weighted average based on the total number of homes within each of the size categories. The entire process of developing the program level custom and production percentages is illustrated in Figure 5.

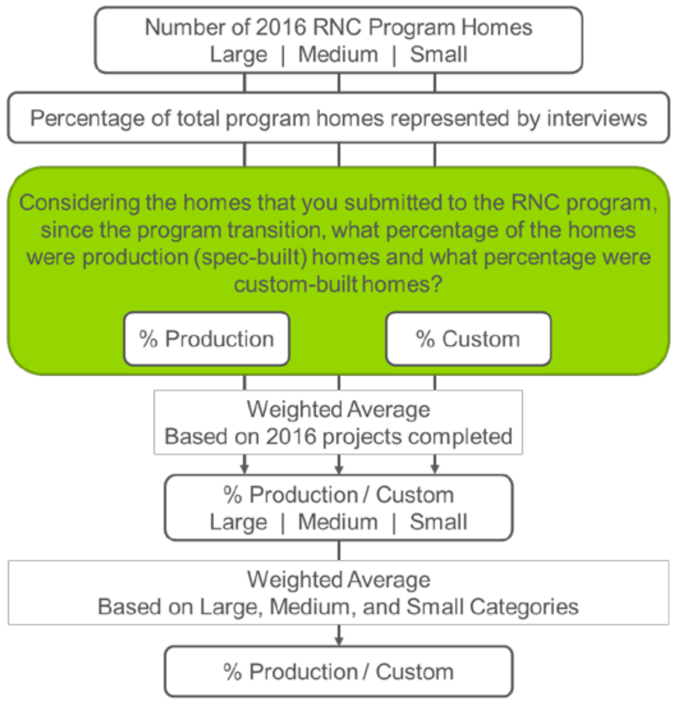
Table 20. Builder Size Definitions

Builder Strata	Strata Definition [Projects Completed in the RNC Program during PY2016]	Builders in Strata
Large	> 50	7
Medium	10-50	21
Small	< 10	285

Source: Navigant analysis

[17] Because different proportional quotas were set for completed interviews in each of the size categories, the builder responses cannot be considered representative across the entire program, but only representative within each category.

Figure 5. Program Level Production Calculation of Custom and Percentages



Source: Navigant analysis

5.1.2 Spillover

Spillover describes "additional reductions in energy consumption or demand that are due to program influences beyond those directly associated with program participation."[18] Because these savings are beyond standard program participation, they may not be tracked by or credited to the program. Spillover can include participant spillover, where program participants install energy efficient practices outside the program due to program influence, or nonparticipant spillover, where nonparticipants implement energy efficient practices not through the program, but resulting from the program's influence—i.e., through exposure to the program.

An example of participant spillover within the RNC program is a builder that uses insulation practices learned through the program in a home that is not incentivized through the program. An example of nonparticipant spillover is a nonparticipant builder installing an above-code HVAC system after walking through an RNC program home. The evaluation team considered both participant and nonparticipant spillover within the 2016 RNC program evaluation.

5.1.2.1 Participant Spillover

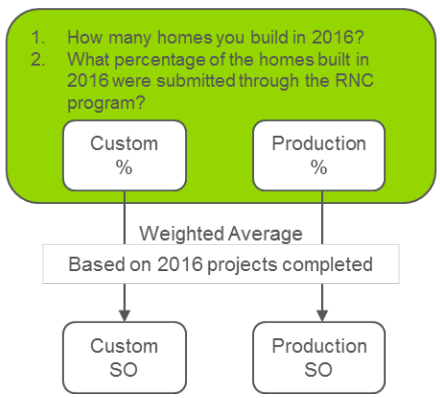
Because the majority of RNC program participation is through comprehensive, whole house rebates, which rewards participants for all electric savings, there is very little opportunity for participant spillover

[18] National Renewable Energy Laboratory, *Chapter 23: Estimating Net Savings: Common Practices*, 2014. https://energy.gov/sites/prod/files/2015/02/f19/UMPChapter23-estimating-net-savings_0.pdf.

within program participating homes. The evaluation team identified the largest opportunity for participant spillover as program participating builders using practices learned in the program to build homes within DEP territory that don't get submitted to the program and incentivized with program dollars. The hypothesis was that builders may decide to not submit either an individual home or neighborhood to the program because of timing or financial reasons, but would still use some of the energy efficiency practices developed through the program.

The evaluation team attempted to identify and quantify participant spillover by asking questions during the participant builder interviews to understand how many homes are built within the DEP territory, but not submitted to the RNC program, as illustrated in Figure 5. If builders identified homes that fit in this category, the evaluation team would assess the construction practices used within these homes and how these align with building practices used by the builder for program participation.

Figure 6. Spillover Calculation



Source: Navigant analysis

The evaluation team expected the spillover ratio to be different for custom and production homes, resulting in separate results, like the free ridership calculation. The evaluation team would then use the same custom and production percentages developed for the free ridership calculation (described in Section 5.1.1.2) to roll-up the results to the program. The results of the participant builder interviews in relation to spillover are discussed in Section 5.2.2.1.

5.1.2.2 Nonparticipant Spillover

The evaluation team completed interviews with nonparticipant builders to look for nonparticipant spillover. These interviews included a series of questions about familiarity with the DEP RNC program, to understand if these builders had any connection to the program, such that program induced spillover could be a possibility. The interviews also included a detailed review of building practices to understand if the nonparticipant builders were building to minimum code prescriptive levels or above. If the builders indicated that they were both aware of the RNC program and were building above prescriptive code minimums in any capacity, the evaluation team asked questions about why, i.e. what were the influences driving decisions above code.

If the RNC program was identified as an influence in the decision to build above code, the evaluation team would quantify the potential savings from the identified above code building measures. The resulting savings would be combined in a weighted average based on the number of homes built by each of the non-participating builders. The evaluation team would then scale the number resulting from the interviews to the entire market of non-participating homes built within DEP Progress territory using the results of the 2016 census, which collects data on the number of new homes by county.[19] The results of the nonparticipant builder interviews in relation to spillover are discussed in Section 5.2.2.2.

5.1.3 Market Effects

Market effects savings are separate from spillover savings in that they reflect "significant program-induced changes in the structure or functioning of energy efficiency markets."[20] So, market effects savings are savings induced by the program that are beyond standard program savings and that are different from spillover savings because they are representative of a change in the structure of the market reflecting an increase in the adoption of energy efficient products, services, or practices. An example of market effects for the RNC program is a nonparticipant builder being induced to build a more energy efficient home than they otherwise would because homebuyers in the North Carolina market only buy energy efficient homes because of program intervention in the market.

The PY2013-2014 evaluation attributed significant market effects savings to the RNC program, resulting from the findings of a Delphi Panel, which was convened to determine market effects. The evaluation team determined the market effects ratio for PY2013 to be 1.72 and 0.30 for PY2014. The significant difference in the market effects ratios between the two years is a result of a significant difference in program participation and savings between the two years, given that 2013 was a program transition year with very low participation. The conclusion of the PY2013-2014 evaluation was that market effects would continue to exist for the DEP RNC program, but they would degrade over time, as more time passed since there was significant RNC program investment in educational activities.[21] After review of the current program activities, the evaluation team determined that the conclusion from the PY2013-2014 was still relevant; market effects savings resulting from past program activities should continue to be quantified, but current program activities would not contribute to additional market effects savings.

The PY2013-2014 evaluation identified separate market effects factors for participant and nonparticipant homes. This resulted from the realization that energy efficient builders were self-selecting into the RNC program following the PY2013 program redesign, which meant that the quantification framework had to account for a separate baseline for participant and nonparticipant builders, as indicated in Figure 7.

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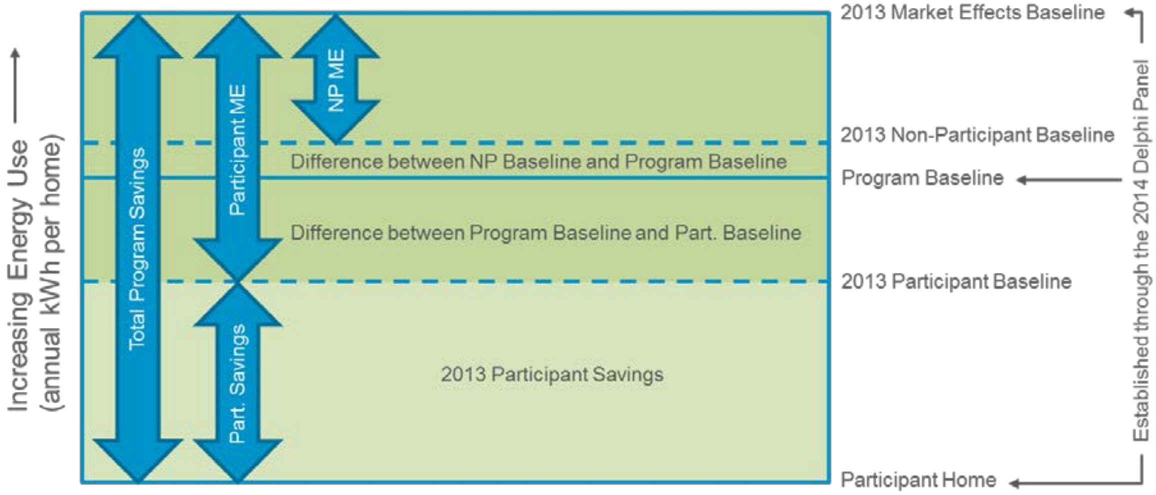
[19] Census data on the number of new homes built was used in the previous evaluation to identify the number of hon-participating homes built within DEP territory. While the census data does not match directly with the Duke Energy Progress boundaries, it does provide the best estimate of home construction activity that the evaluation team could develop.

[20] National Renewable Energy Laboratory, *Chapter 23: Estimating Net Savings: Common Practices*, 2014. https://energy.gov/sites/prod/files/2015/02/f19/UMPChapter23-estimating-net-savings_0.pdf.

[21] The market effects quantification framework developed through the PY2013-2014 evaluation would continue to be relevant until the adoption of a new residential energy code in DEP territory. When a new residential energy code is adopted, the quantification framework would need to be adjusted to account for an updated baseline.

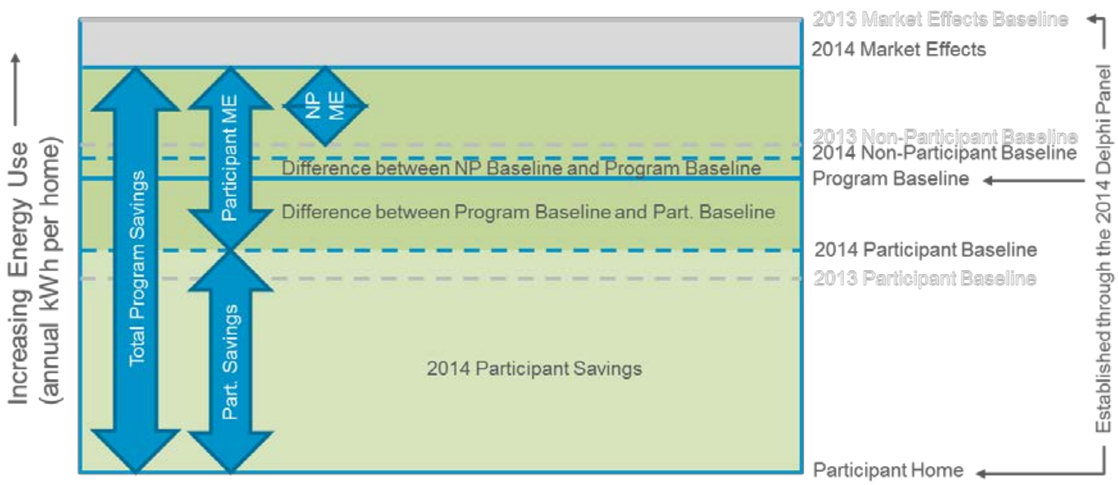
Figure 7. PY2013 Market Effects Model (From PY2013-2014 Evaluation)



Source: Navigant analysis

The PY2013-14 evaluation also indicated that the variation in the participant and nonparticipant baseline would reduce over time, as the program matured and a wider range of builders participated. This was seen in the PY2014 participant mix, which saw the participant and nonparticipant builder baselines migrating towards an average, what was named the *Program Baseline*, as indicated in Figure 8. The market effects evaluated for PY2014 were smaller than the market effects in PY2013, because more time had passed since the program activities that had induced market effects resulting in the market effects baseline moving closer to the program baseline (Figure 8).

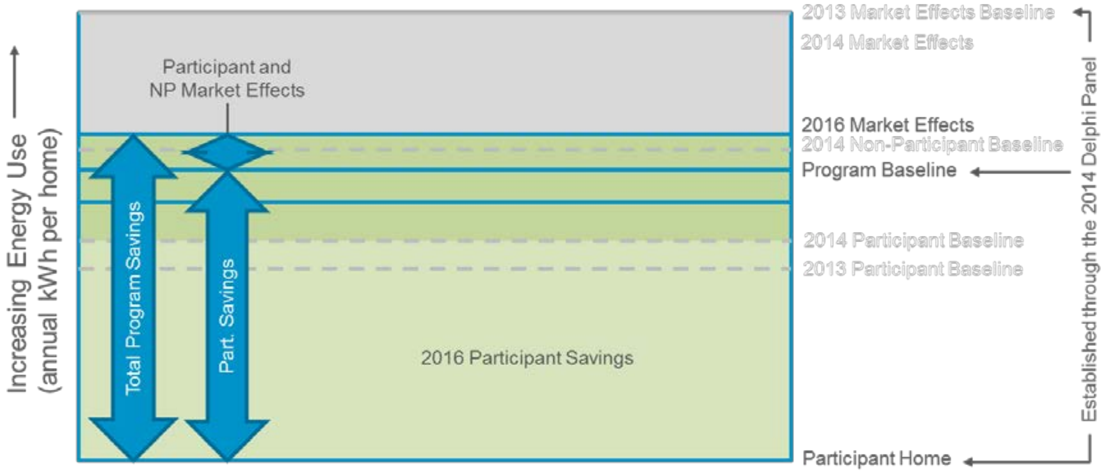
Figure 8. PY2014 Market Effects Model (From PY2013-2014 Evaluation)



Source: Navigant analysis

The PY2016 market effects calculation was expected to explore two opportunities: (1) do any current program activities result in the need to quantify additional market effects savings and (2) what are the remaining residual market effects from past program activities using the PY2013-2014 market effects model. The evaluation team planned to explore the opportunity for additional market effects savings first through the interviews with the program managers and implementers, where the team would determine if any current program activities should be explored through the builder and HERS Rater interviews to quantify additional market effects. To quantify residual market effects from past program activities, required the evaluation team to adjust the PY2014 market effects model to reflect the PY2016 program activities. The model was expected to be adjusted in two ways: (1) the market effects baseline was adjusted closer to the program baseline to account for the additional passage of time and (2) the individual nonparticipant and participant baselines disappeared into a single program baseline, as illustrated in Figure 9. The details of these adjustments are discussed in the Market Effects Results Section (5.2.3).

Figure 9. PY2016 Market Effects Model



Source: Navigant analysis

The evaluation team did not recommend updating the Delphi panel, used to develop the primary market effects model in the PY2016 evaluation, because the overall North Carolina residential building market had not changed significantly. Instead, the evaluation team recommended using the prior model as it existed and pulling from it a market effects ratio that could be applied to the specific participant population who participated in the RNC program in PY2016. The market effects results for the PY2016 RNC program are presented in Section 5.2.3.

5.1.4 Net-to-Gross Ratio

The NTG portion of the 2016 RNC program evaluation will result in program level estimates for free ridership, spillover, and market effects savings. The free ridership and spillover calculations will identify impacts resulting from PY2016 activities, while the market effects calculation will identify residual impacts from prior program activities that are realized in PY2016. The individual savings estimates will together be rolled into a calculation of the NTG ratio. In the end, equation 2 (presented above) will be adjusted to account for the specifics of the 2016 RNC program net savings as follows:

Equation 2a. Net-to-Gross Ratio for the 2016 RNC Program

NTG Ratio = 1 – FR ratio + SO ratio + ME ratio

Where: FR ratio = Custom FR x % Custom + Production FR x % Production
SO ratio = Custom SO x % Custom + Production SO x % Production
ME ratio = [(Prog. Baseline – ME Baseline) * Total Homes Constructed in DEP Territory

5.2 Net-to-Gross Findings

As identified in Table 21, Navigant completed interviews with 18 participant builders, nine HERS Raters, and nine nonparticipant builders to inform the calculation of RNC program net savings.

Table 21. Participant / Nonparticipant Builder and HERS Rater Interviews

Market Actor Category	Targeted Interviews	Completed Interviews
Participant Builders	**15-20**	**18**
Large (>50)*	6-8	5
Medium (10-50)	6-8	7
Small (<10)	4-6	6
HERS Raters	**6-8**	**9**
Nonparticipant Builders	**8-10**	**9**

**Values in parenthesis indicate the number of participating homes built by each builder*
Source: Navigant analysis

5.2.1 Free Ridership

The evaluation team determined the free ridership ratio for the RNC program overall to be 0.054. Through this section, we describe the findings from participant builder and HERS Rater interviews that lead to that overall result for the program.

The interviews completed with participant builders and HERS Raters indicated some degree of free ridership in the RNC program. As expected the interview results pointed to significantly different free ridership results for custom and production builders. As illustrated in Table 19 and discussed previously, custom builders were identified as already meeting many of the program requirements, already building above-code prior to their participation, and would have continued to make these choices in the absence of RNC program intervention. On the other hand, production builders indicated that RNC program participation has shaped their company policies around energy efficiency and they would most likely revert to code minimum building policies if they weren't participating in the program. These findings were identified through the HERS Rater interviews and corroborated through the participant builder interviews.

The evaluation team identified free ridership at 17% for custom builders and 1% for production builders. The program-level result was calculated through a weighted average, based on number of homes evaluated in the 2016 program, of the HERS Raters answers to the question: what percent of builders were already meeting program requirements prior to program intervention? These separate free ridership results for custom and production builders were combined to a program level result by weighting by the number of custom and production homes incentivized through the RNC program in PY2016, using the methodology described in Section 5.1.1.2, and illustrated in Table 22.

The evaluation team made one adjustment to the planned methodology after reviewing the results of the participant builder interviews. One large builder (Builder 3) indicated that 40% of the homes they built were custom homes. Through interviews with other builders and the program team, the evaluation team identified that this finding was not representative of other builders in the large strata and it would not be appropriate to apply the findings for this one builder across the rest of the large strata. Instead, the evaluation team made the decision to isolate the findings for this one large builder, as described in Table 22.

Table 22. Calculation of Custom and Production Home Percentage

Builder	Size	Custom	Production	2016 Total Program Homes	% of Total Homes Represented in Interviews	% Production	% Custom
1	Large	-	100%	456	25%	100%	0%
2	Large	-	100%				
3	Large	40%	60%	66	100%	40%	60%
4	Medium	-	100%	466	36%	68%	32%
5	Medium	-	100%				
6	Medium	-	100%				
7	Medium	5%	95%				
8	Medium	70%	30%				
9	Medium	75%	25%				
10	Medium	100%	-				
11	Small	5%	95%	370	9%	57%	43%
12	Small	20%	80%				
13	Small	50%	50%				
14	Small	50%	50%				
15	Small	75%	25%				
16	Small	90%	10%				
17	Small	100%	-				
18	Small	100%	-				
TOTAL				1,358	28%	74%	26%

Source: Navigant analysis, totals subject to rounding.

The overall free ridership result for the RNC program was calculated to be 0.054, through Calculation 4, identified in Section 5.1.1, and as follows:

Total FR = (Custom FR x 2016 % Custom Homes) + (Production FR x 2016 % Production Homes)
Total FR = (0.171 x 0.26) + (0.013 x 0.74) = 0.054

5.2.2 Spillover

Through interviews with participant builders, HERS Raters, and nonparticipant builders, the evaluation team found no substantive evidence for spillover from the RNC program, resulting in an overall spillover ratio of 0.00. Through this section we describe the specific findings leading to that result.

5.2.2.1 Participant Spillover

Identification of participant spillover was based on the results of the participant builder and HERS Rater interviews. Like free ridership, the avenues for spillover are different for production and custom builders, so the evaluation team considered these groups separately.

Every production builders interviewed by the evaluation team indicated that all the homes they build within the DEP territory are submitted to the RNC program, meaning that there is no opportunity for spillover within this participant group. Custom builders indicated that not every home that they build within the DEP territory meets RNC program standards, and for these builders and their clients it is really a home-by-home decision. The evaluation team found no clear indication that RNC program practices are being applied to non-program homes. In fact, HERS Raters reported that custom builders and subcontractors know which homes will be submitted to the program and improve their building practices in these homes knowing that they will be subject to additional testing.[22]

5.2.2.2 Nonparticipant Spillover

The evaluation team was not able to identify evidence for nonparticipant builder spillover, as summarized in the interview results presented in Table 23. Though some of the interviewed nonparticipant builders were aware of the DEP RNC program, there are no indications that the program has had any direct influence on their building practices. In addition, a significant number of builders that are not aware of the DEP RNC program are typically building above code homes and using the services of a HERS Rater.

Table 23. Nonparticipant Builder Interview Summary

Builder	Homes per Year	Familiar with RNC Program	Other Green Standards/Work with HERS Rater
1	1-2	No	• Have built to LEED standards, does not certify • Not aware of/does not use NC HERO code • No HERS Raters, don't like billing practices or attitudes
2	2	No	• Client driven efficiency decisions, do build above code • Issues with Duke Energy, no interest in program
3	Varies	Yes	• Standard practice is to use ENERGY STAR, because they receive credit through HUD • Above code decisions for durability not efficiency • Work with a HERS Rater
4	5-10	Yes	• Efficiency decisions are client by client, not many clients looking for above code homes
5	50-60	Yes	• Have built through ENERGY STAR and LEED when requested by clients • HERS Rater on some homes, client request
6	5	No	• Built a few homes to HERO code • All homes are certified by a HERS Rater
7	3-5	No	• Have built some homes to ENERGY STAR • All homes are certified by a HERS Rater

[22] It is possible that participant spillover may exist for custom builders, but it is likely very small and almost impossible to quantify without inspections of non-program homes. The evaluation team was not able to collect enough evidence through the participant builder interviews to clearly recommend a claim of spillover for the production builder category.

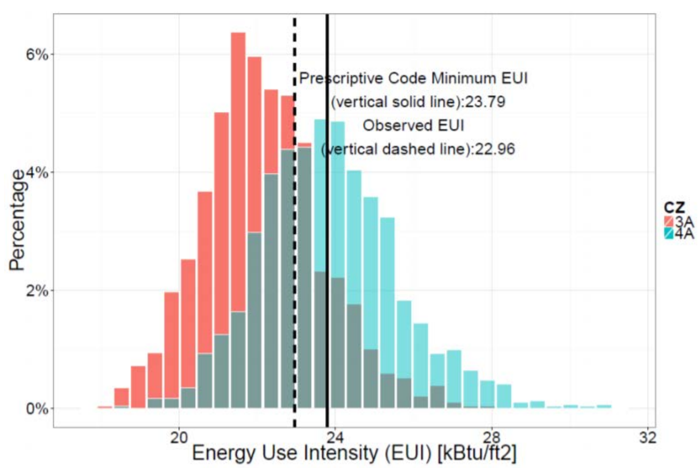
Table 24. Nonparticipant Builder Interview Summary (continued)

Builder	Homes per Year	Familiar with RNC Program	Other Green Standards/Work with HERS Rater
8	6-8	Yes	• Built a few homes to HERO code • May have previously participated in DEP RNC program • HERS Rater on some homes, client request
9	500-600	Yes	• Have built some homes to ENERGY STAR • Efficiency decision made by price point, higher price homes receive more efficiency measures • Compete with very efficient builders, in other parts of the country efficiency is a bigger selling point

Source: Navigant analysis of Nonparticipant Builder Interviews

The finding of no nonparticipant builder spillover is additionally supported by the recently completed North Carolina Residential Energy Field Code Study.[23] The study found that on average, homes in North Carolina are 3.5% more energy efficient than would be expected based solely on prescriptive code requirements (Figure 10).

Figure 10. Statewide EUI Analysis for North Carolina



Source: North Carolina Residential Energy Code Field Study, August 2017.

This finding in and of itself does not necessarily lead to a finding that nonparticipant spillover is non-existent for the RNC program. However, when combined with the results of the overall code study that found that the average energy consumption for new single family homes in five of the six states analyzed was less than what would be expected in comparison to the prescriptive code requirements, it makes a strong statement for the lack of nonparticipant spillover.[24] This result was consistent even across states

[23] Bartlett, R., M Halverson, V Mendon, et al. *North Carolina Residential Energy Code Field Study: Baseline Report.* August 2017. Pacific Northwest National Laboratory (PNNL-26752). https://www.energycodes.gov/sites/default/files/documents/North_Carolina_Residential_Field_Study.pdf

[24] U.S. DOE. *Building Energy Codes Program Single Family Residential Energy Code Field Study.* December 2015. https://www.energycodes.gov/sites/default/files/documents/Field_Study_120715_Final.pdf

without, of with less active, residential new construction incentive programs. Based on this finding, it would be hard to argue for the presence of nonparticipant spillover connected to the DEP RNC program.

5.2.3 Market Effects

The evaluation team determined the market effects ratio for the RNC program to be 0.105. Through this section we describe the findings from interviews with the program managers, implementers, builders, and HERS Raters that lead to this overall program result.

To quantify market effects, the evaluation team first interviewed program managers and implementers to determine if new sources of market effects needed to be considered in the quantification approach, beyond those resulting from past program activities identified through the prior market effects model. The identification of significant market effects savings through the PY2013-2014 evaluation was a result of a strong legacy of engaging and teaching the local building community within the RNC program. Through the interviews with DEP program managers and the implementer, the evaluation team determined that current training activities are limited to one-on-one builder mentoring, to support builders meeting specific program requirements. Broader, building science trainings are available to builders and Home Energy Rating System (HERS) raters on the program website, but these are voluntary and not as significant as the program trainings previously offered by Advanced Energy.

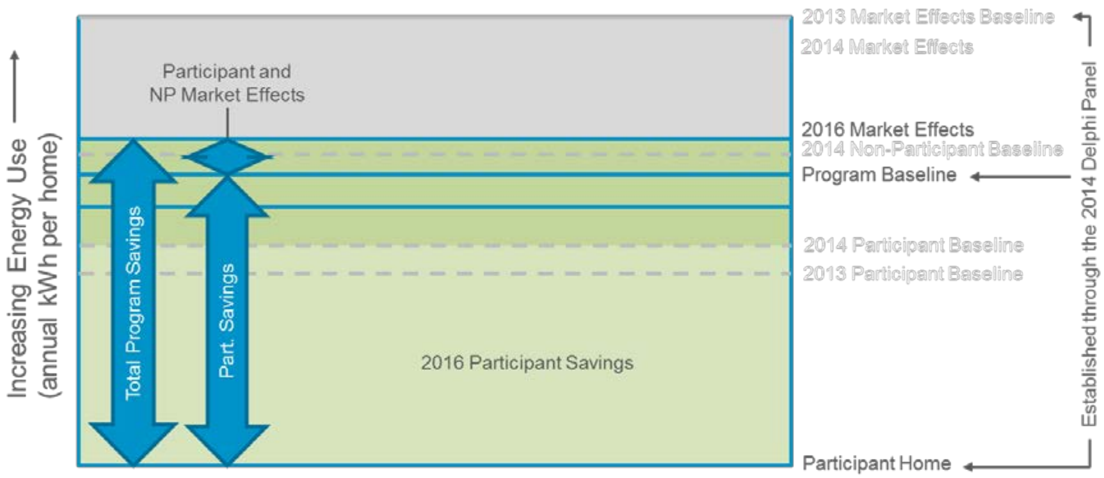
> The current RNC program is more heavily focused on encouraging a higher level of program participation, both in the number of builders as well as the depth of participation by each builder, than on developing an overall market that supports greater uptake of energy efficient practices.

The evaluation team identified that the RNC program is currently more focused on encouraging a higher level of program participation—both in the number of builders as well as the depth of participation by each builder—than on developing an overall market that supports greater uptake of energy efficient practices. Additionally, the program incentive structure has changed such that builders are rewarded for each incremental change in kilowatt-hour savings, with all energy efficiency increases being captured and rewarded equally. Thus, little participant builder behavior in relation to program homes is expected to occur outside of what is captured through program savings. As a result, the evaluation team did not expect to find evidence to support new sources of market effects savings, and instead focused on quantifying residual market effects savings from past program activities.

The Market Effects Methodology Section (5.1.3) describes the process of updating the market effects model developed through the PY2013-2014 evaluation to reflect the PY2016 program activities and NC residential new construction market. Because the PY2013-2014 market effects model was developed based on a different set of program homes, and there was no reason for the PY2016 evaluation to update the costly Delphi panel, the evaluation team used the PY2013-2014 model to extract a market effects savings ratio that could be applied to the PY2016 gross savings to determine market effects savings.

The evaluation team determined that the 2016 participant builder population no longer reflected the self-selection that had caused the program baseline to be split into a participant and nonparticipant builder population. With a single program baseline, participant and nonparticipant market effects converged to a single value (Figure 11).

Figure 11. PY2016 Market Effects Model



Source: Navigant analysis

Additionally, the nonparticipant builder interviews conducted as part of this evaluation and summarized in Table 23 illustrate that the market effects baseline has moved towards higher efficiency since the previous evaluation, as the evaluation team had expected. Likely, the new baseline sits somewhere between the 2014 market effects baseline and the 2014 nonparticipant baseline, but the evaluation team opted for a conservative approach, using the 2014 nonparticipant baseline as the new baseline for calculating market effects. These baseline definitions were applied to the 2014 program savings using the 2014 market effects model, resulting in a market effects ratio of 0.105, which the evaluation team applied to the 2016 program savings.

5.2.4 Net-to-Gross Results

The NTG ratio, combining free ridership, spillover, and market effects, was calculated as written in Equation 5:

Equation 5. NTG Ratio

NTG Ratio = 1 - FR ratio + SO ratio + ME ratio[25] = 1 – 0.054 +0.000 + 0.105 = 1.051

This suggests that for every 1 kWh reduced from program measures, about 1.043 kWh of savings can be directly attributed to the program.

Applying the NTG ratio to the PY2016 verified gross savings values results in verified net energy savings of 3,469 MWh, verified net summer peak demand savings of 1.44 MW and verified net winter peak demand savings of 1.69 MW as shown in Table 25.

[25] National Renewable Energy Laboratory, *Chapter 23: Estimating Net Savings: Common Practices*, 2014. https://energy.gov/sites/prod/files/2015/02/f19/UMPChapter23-estimating-net-savings_0.pdf.

Table 25. Impact Evaluation Results (Net)

	Reported Savings	*Verified Net Savings*	Net Realization Rate
Energy Savings (MWh)	3,743	3,681	98%
Summer Peak Demand Savings (MW)	1.59	1.64	103%
Winter Peak Demand Savings (MW)	1.51	1.65	109%

Source: Navigant analysis

6. PROCESS EVALUATION

Navigant completed a process evaluation of the RNC program to assess the success of current program activities and explore opportunities available to address program participation gaps, identified in the PY2013-14 evaluation cycle. In addition, the process evaluation supported the NTG methodology, presented in section 5.1. The process findings are based on detailed interviews with program and market actors, a roundtable discussion with RNC program and ICF staff, and a high-level review of program documentation including the website. In total, 18 interviews were completed with participant builders, nine with HERS Raters, and nine with nonparticipant builders, as indicated in Table 26

Table 26. Participant / Nonparticipant Builder and HERS Rater Interviews

Market Actor Category	Targeted Interviews	Completed Interviews
Participant Builders	**15-20**	**18**
Large (>50)	6-8	5
Medium (10-50)	6-8	7
Small (<10)	4-6	6
HERS Raters	**6-8**	**9**
Nonparticipant Builders	**8-10**	**9**

Source: Navigant analysis

6.1 Process Evaluation Results

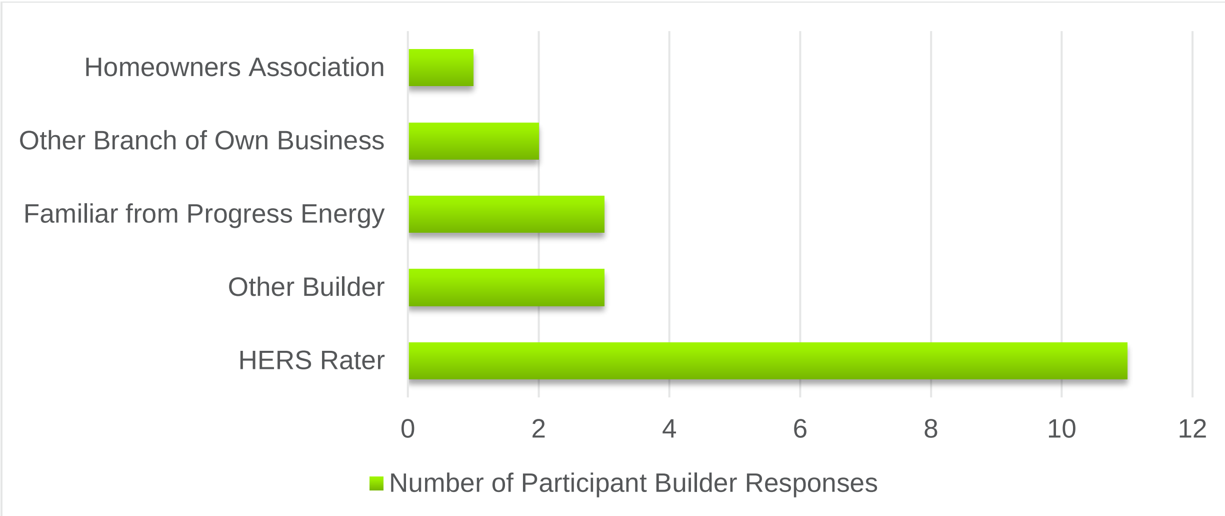
Through Navigant's process evaluation, the RNC program was generally determined to be a strong program that was well liked by builders and HERS Raters. In fact, the most significant complaint about the RNC program, from both builders and HERS Raters, is that it is only offered in DEP territory. Across the board, builders would like to see the geography of the program offering extended, so that the program incentive is available for all homes that they build. Additional detailed findings resulting from the process evaluation are discussed throughout this chapter.

6.1.1 Builder & HERS Rater Relationship

The RNC program is designed such that once builders are active participants in the program, HERS Raters serve as the main connection between RNC program staff and participating builders. Participating builders work with HERS Raters to file the necessary program documentation and HERS Raters often work with RNC program and implementer staff to deal with modeling or documentation issues. In addition, most HERS Raters identify RNC program participation as a significant piece of their building model, because the financial incentives for builders drive their interest in the HERS Rater's services.

The interviews completed with program participating builders indicated that HERS Raters serve as a critical program recruitment avenue. In fact, 11 out of the 18 builders interviewed indicated that they first learned about the RNC program through a HERS Rater, or a HERS Rater in association with another source (Figure 12).

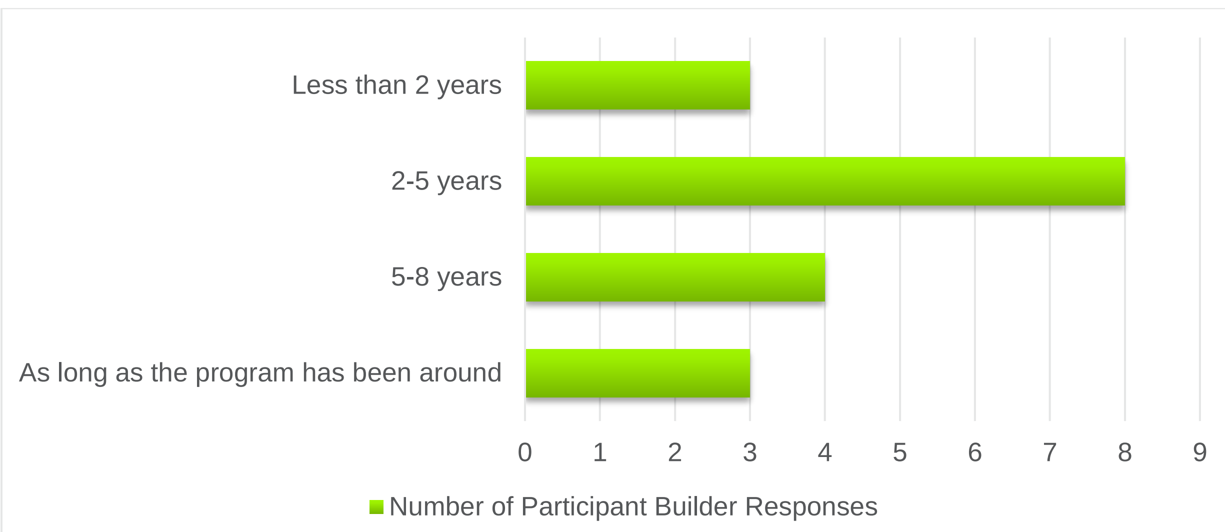
Figure 12. How Participant Builders Reported First Hearing about the RNC Program



Source: Navigant analysis of participant builder interview responses (Total number of responses adds up to more than 18, because 2 builders provided multiple responses.)

While most builders learned about the RNC program through their HERS Rater, most of the builders that were interviewed as part of the process evaluation had been participating in the RNC program for many years. So, for most builders, significant time had passed since they first learned about the RNC program, as indicated in Figure 13.

Figure 13. How Long Builders Have Received Incentives through the DEP RNC Program



Source: Navigant analysis of participant builder interview responses

For most builders, the relationship with their HERS Rater is the most successful aspect of the RNC program, beyond the incentive. Through the interviews, participant builders volunteered the following about the relationship with their HERS Rater.

- HERS Rater has been a consultant for eight years (have not used anyone else). They rely on their HERS Rater to determine where their money is best spent.

- Rater tells them when a problem may exist and pinpoints the exact measure requirements to get to compliance.
- Rater is a "good go-between." Has been very helpful in talking to and educating his tradesman.
- Likes the HERS Rater's suggestions on how to make energy-related improvements that make whole building packages work better.

6.1.2 Program Implementer & Tracking Software

At the start of PY2016, ICF International serves as the program implementer for the RNC program. The change in implementer was both recognized and appreciated by program participants. Of the builders and HERS Raters who were interviewed who had worked with the previous implementer, multiple participants indicated high-levels of satisfaction with ICF's services. The general sentiment is summarized by one of the interviewed HERS Raters as follows, "ICF has done a phenomenal job. Seems like a tighter ship, more professional. I have appreciated the way they have tackled complicated issues – I don't feel like the resource was there before."

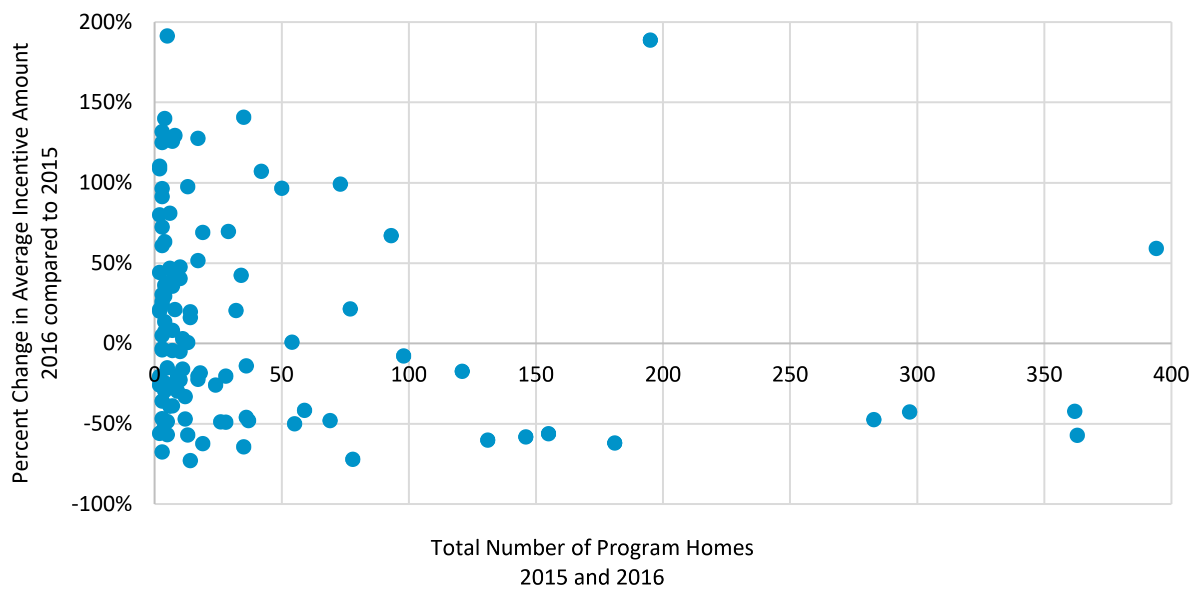
The change in program implementer also resulted in a change in the program tracking software, by which HERS Raters upload projects for review and incentives are tracked. When this tracking software change was discussed it was well received by all. The only potential complaint mentioned by a couple of the HERS Raters was that the RNC program continues to require REM/Rate as the base modeling system for claiming savings. A few of the HERS Raters have switched their standard software to Ekotrope and are having to build a second model in REM/Rate to submit homes to the RNC program.

6.1.3 Program Satisfaction - Builders

The overall sentiment from the process interviews was that program satisfaction was a bit mixed for PY2016. Some program participants reported high program satisfaction, even providing compliments, such as the following, "It's a user friendly, simple program that benefits the builder, homeowner and the environment. A win/win. I find it hard to believe that a huge corporate like Duke Progress could keep it simple, and that's a compliment." On the other hand, some program participants indicated very low program satisfaction. What stands out to the evaluation team is that at least for this year, program satisfaction seemed to be quite contingent on whether builders were receiving a smaller or larger incentive under the new program design. For example, when one builder was asked how satisfied they were with the RNC program they responded, "In the current form it's a 6 out of 10, previously I would have said 8 or 9." And another builder responded, "not nearly as satisfied as before the incentive change," in response to the same question.

To better understand the relationship between reported program satisfaction and program incentive levels, Navigant performed an analysis of the incentive levels between the incentives offered under the previous program design and those offered in PY2016. On average, builders received a 15% smaller incentive under the new program design as compared to the incentives received under the previous program design. However, for individual builders, the difference between the incentives received under the two program designs varied more significantly, with some builders receiving incentives that were almost 200% greater and as much as 75% smaller when compared to the incentives received prior to 2016 (Figure 14).

Figure 14. Percent Change in Incentives (2015 to 2016), by Builder



Source: Navigant Analysis

In general, the Navigant team found that builders who were receiving higher incentives under the new program structure were much more likely to indicate satisfaction with the RNC program than the builders who were receiving smaller incentives under the new program structure. For most builders, the Navigant evaluation team expects that the volatile program satisfaction will even out as time extends from the program transition, but for a few builders, specifically larger production builders, the incentive change may affect long-term program participation if they cannot determine how to make the new financials work across their business plan.

Through the process interviews, the Navigant evaluation team found one other trend around program satisfaction. A few of the program builders indicated confusion about the program structure, indicating that it was counter-intuitive that the program rewarded electric savings over gas/all fuel savings. This subset of builders indicated that it was easier to get higher rebates for their entry-level homes, because these homeowners are willing to accept electric appliances over gas appliances. In fact, the builders indicated that to receive higher incentives, they needed to push their homes to use a higher percentage of electricity, which seemed counter-intuitive from a holistic environmental perspective.

6.2 Program Gap Research

As part of the PY2016 process evaluation, the Navigant team explored three potential program gaps that were identified in the PY2013 & PY2014 RNC Evaluation report. Though the previous report indicated that the RNC program performed adequately in terms of the program focus: single family, new homes built by production builders, the report indicated that, “The program falls short in supporting energy efficiency improvements in very small or low-income homes; multi-family buildings; and high dollar value homes.” All builders who participated in the process interviews were asked whether they built homes in each of the three categories of interest, and if so, were asked a few questions about the specific challenges facing these market categories.

6.2.1 Affordable Homes

Affordable/small homes have always been a challenge for residential new construction programs. The margin for builders on affordable homes is smaller, meaning that the builder must turn over many homes to make the numbers work – which means they are focused primarily on what will make homes sell the fastest. Additionally, at this price point, builders don't have the option to pass along any energy efficiency costs to the homeowner.

The process interviews indicated two potential solutions to serve greater numbers of affordable/small homes within the RNC program. First, the program could consider a higher incentive for smaller, affordable homes. Second, builders indicated that providing a homeowner incentive, such as a percentage off their energy bill could encourage participation, but this may not be possible for Duke Energy to implement in line with regulatory requirements.[26]

6.2.2 High Dollar Value Homes

The high dollar value segment is one of particular interests for many of programs, because these homes are often larger and influencing energy efficient decisions in this market segment results in more kWh savings per home, even if on a percentage basis, the savings are similar to other segments. Builders indicate that in this market, client choice becomes a bigger issue, as these clients often know what they want and help to specify products within the home; homebuyers in this market segment want gas appliances. In addition, because homes in this segment are larger, efficiency measures become proportionally more expensive.

Two opportunities were presented in the process interviews to close the gap in the high dollar value home category. First, Duke Energy may want to partner with a gas utility e.g. Piedmont to offer incentives for comprehensive energy efficiency, because the electric only focus may be significantly more limiting to this group. Second, homeowner education around the financial benefits of energy efficiency is likely not as compelling. In this market, the three-year heating and cooling guarantee is not going to drive as much interest as appliances that meet more of the *want to haves*.

6.2.3 Multi-family Buildings

Within the RNC program, multi-family buildings[27] have historically participated in the equipment-only track at a high percentage. In general, multi-family projects have encountered challenges participating in the whole building track of the RNC program. Builders interviewed in the process interviews indicated two reasons why multi-family buildings have been underrepresented in the whole building track:

1. Builders, even large builders, rarely specialize in both single family and multi-family buildings. This means that multi-family builders are often outside the recruiting paths for the RNC program

[26] It should be noted that the Duke Energy RNC program does encourage builders participating in the RNC program to offer homebuyers a three-year Heating and Cooling Energy Usage Limited Guarantee. This program covers only the energy used to heat and cool the home and provides homeowners a guarantee that their heating/cooling energy usage will not exceed the expected value over the three-year period. However, not all builders in the RNC program take advantage of this offer.

[27] Within the RNC program multi-family refers to any attached dwelling unit, which could include townhouses, condos, or traditional apartments. Note that not all condos are necessarily attached dwelling units and could be considered single family homes. To qualify for the RNC program, multi-family buildings must be three or fewer stories to qualify for the Whole-House incentives; multi-family buildings over three stories only qualify for the Equipment incentives.

and in general are often less aware of whole building efficiency programs, making it harder for them to get on board with the whole building track.

2. Builders have issues with the foundation insulation requirement for multi-family projects, because multi-family projects are commonly built on slab foundations. This issue is also seen for single family builders in more coastal regions of the DEP territory, where slab foundations are also common. The use of slab foundations require builders to locate foundation insulation at the slab edge which raises questions around potential termite damage.

Through the process interviews, two opportunities were identified to encourage greater program participation for multi-family builders. First, the program could consider targeted marketing for multi-family builders, because the primary builders in this category don't often overlap with the single family builders that are targeted by the program. Second, the program could consider whether the program technical requirements, that were designed more directly for single family homes are all applicable to the multi-family home segment.

6.2.4 Conclusion

In general, participating builders and HERS Raters are happy with the RNC program including the changes in the structure and the implementer. There are some discontented builders, specifically those who have received smaller incentives because of the program transition, but in most cases builders are happy enough with the RNC program that their biggest complaint is that the program is only offered within DEP territory. Specific recommendations resulting from the process evaluation are presented in Section 8.

7. CONCLUSIONS AND RECOMMENDATIONS

Navigant's evaluation suggests that Duke Energy's RNC program effectively drives a more energy efficient residential new construction market within DEP territory. In fact, the greatest complaint from program participants is that the program offering is limited to DEP territory, which limits the homes that can take advantage of the program. Navigant presents the following conclusions and recommendations to help improve program delivery and impacts.

7.1 Key Impact Findings & Recommendations

- **Navigant recommends that Duke Energy adopt the per-unit energy and demand impacts for the deemed measures (equipment only and HERO) from this evaluation and use them going forward.** The current equipment-only deemed savings values reference HEIP deemed savings values developed from models that represent existing buildings, which are not representative of the new homes in which these measures are installed. The engineering analysis and data collection described in this report provide support for updating the estimated impacts for the RNC program deemed savings measures, including the equipment-only and HERO measures.
- **Duke Energy should consider increasing the deemed measure life for HVAC equipment from 15 years to 18 years.** The current deemed measure life for HVAC equipment through the RNC program is 15 years. The Mid Atlantic TRM v6 2016 cites a 2016 study identifying an EUL / ML of 18 years. The evaluation team believes that this measure life increase is appropriate to use for the equipment-only measures in the RNC program
- **Navigant recommends Duke Energy adjust the User Defined Reference Home (UDRH) heating system thermostat setpoint to 70°F.** The evaluation team attributes the difference between reported and verified savings primarily to the calibration of energy models used to calculate savings. Unlike the REM/Rate models used to calculate ex-ante savings, the BEopt models used for savings verification were calibrated to ensure that resulting energy consumption matches billing data to within 5%. The evaluation team conducted additional research and analysis that indicate the REM/Rate software tends to overestimate energy consumption and savings.

  To address this issue, the evaluation team recommends a minor adjustment to the UDRH specifications. The UDRH specifications define the baseline home conditions for REM/Rate's savings calculations. The UDRH currently specifies a heating system thermostat setpoint of 72°F. However, to calibrate the BEopt models to participant billing data, the evaluation team had to reduce the thermostat setpoint to 70°F. By reducing the UDRH setpoint accordingly, the REM/Rate models will produce a savings estimate much closer to billing data and calibrated model results.

7.2 Key Process Findings & Recommendations

- **Duke Energy should consider expanding the RNC program offering to territories beyond the DEP territory.** The most consistent complaint of program builders was that not all of their homes could participate in the program because the RNC program is only offered within Progress territory. Offering the program beyond the current DEP territory would encourage a greater uptake of energy efficient practices at the most cost-effective time within a home's lifecycle.

- **Navigant recommends that Duke Energy consider, if feasible, whether software modeling platforms other than REM/Rate could be used to confirm program requirements.** Some of the HERS Raters who actively participate with the RNC program indicated that they use Ekotrope for residential home modeling with their clients and that they build a separate REM/Rate model to conform to program requirements.
- **Duke Energy should consider whether there is an opportunity to partner with a gas utility to provide value to gas savings, or consider program education around the goal of the program being electric savings.** After the program change, builders indicate greater confusion around the program focus on electric savings only. While this was always the program focus, it was less clear to builders when the incentive was based on the HERS score and not just the associated electricity savings.

8. INPUTS FOR DUKE ENERGY ANALYTICS

Navigant used the findings from field verification, modeling, 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 27 provides the measure-level inputs that can be used by Duke Energy Analytics for estimates of future program savings.

Table 27. Gross Measure-Level Impacts

Measure	Average Verified Energy Savings Per-Unit (kWh)	Summer Coincident Demand Savings Per-Unit (kW)	Winter Coincident Demand Savings Per-Unit (kW)
HERO	1,639	0.98	0.97
HERO + HERS[28]	2,707	1.05	1.10
Heat Pump (SEER ≥ 15)	401	0.38	0.25
Central AC (SEER ≥ 15)	207	0.24	0.00

Source: Navigant Analysis

DSMore table template -DEP RNC -c

[28] The average savings values for the HERO + HERS measure are not meant to be used prescriptively as deemed values. The reported savings for this measure are calculated using the REM/Rate software and verified through calibrated simulation modeling. These average savings values are intended for application in program planning and cost-effectiveness purposes.

9. SUMMARY FORM

Residential New Construction Program

Completed EMV Fact Sheet

Description of program

DEP's Residential New Construction Program provides incentives to participating home builders for incorporating energy efficient practices into the construction of new homes.

Participating builders can choose from two program incentive paths.

- **Whole Home:** Incentives are awarded on a per-kWh basis for homes that submit a HERS score and exceed the efficiency standards established by the 2012 North Carolina Energy Conservation Code's High Efficiency Residential Option (HERO) or the equivalent in South Carolina. A minimum deemed incentive is available for homes that only meet HERO or equivalent.
- **Equipment Only:** Prescriptive incentives are awarded for installation of high-efficiency HVAC equipment

Date:	May 25, 2018
Region:	Duke Energy Progress
Evaluation Period	Whole Home: July 1, 2016 through December 31, 2016 Equipment Only: January 1, 2016 through December 31, 2016
Annual MWh Savings	3,503
Net-to-Gross Ratio	1.051

Evaluation Methods

The evaluation team used engineering analysis, onsite field inspections, and calibrated energy simulation modeling as the basis for estimating verified program impacts. Additionally, the evaluation team performed in-depth interviews with the following groups to assess program delivery and Net-to Gross considerations:

- DEP program staff
- Implementation contractor staff
- HERS Raters
- Participant builders
- Nonparticipant builders

Impact Evaluation Details

- **Field inspections were conducted at 40 program homes.** The evaluation team inspected program equipment at 40 participating homes to inspect the high-efficiency HVAC equipment and compare the field-verified quantities and characteristics with the program tracking database. Navigant found the equipment in the field to be exactly as reported in the tracking data.
- **Calibrated energy simulation modeling.** The evaluation team developed energy simulation models in the BEopt platform. The team used participant billing data to calibrate the energy simulation models, and the final calibrated models were used to estimate verified impacts.
- **The average annual gross energy savings achieved by each participating home depends on the measures pursued.**

  Heat pump – 401 kWh

  Central air conditioner – 207 kWh

  HERO – 1,639 kWh

  HERO + HERS – 2,707 kWh
- The Net to Gross ratio is estimated to be 1.051. Free ridership was generally offset by the program market effects. The evaluation team found zero spillover.

APPENDIX A. PY2016 BUILDING SIMULATION MODELS

For the PY2016 evaluation, Navigant developed a new set of energy simulation models to estimate energy and demand savings for RNC program homes. This appendix includes a detailed discussion of the energy simulation model development process.

Sample

The evaluation team conducted a review of program tracking data and REM/Rate file extracts for all 2016 HERO+HERS program homes to look for variances in building characteristics. This analysis was used to understand the effect of these variations on actual billing consumption and to determine the most appropriate sample of projects for use in model calibration. The most important factors effecting billing consumption were the HVAC system type and home type (single family vs multi-family). Single family electrically-heated homes were selected as the representative sample to calibrate the building simulation models as the majority of 2016 participant homes were single family all-electric homes and gas billing data was not available to calibrate gas-heated home models. Table 28 shows the relative precision (+/- 5 percent) achieved by this sample at a 90 percent level of confidence.

Table 28: Whole House Simulation Model Sample Statistics

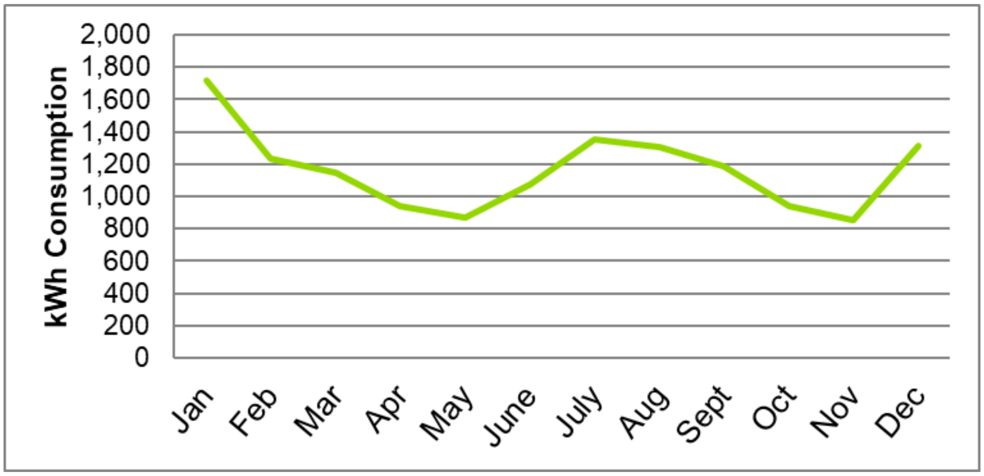
Strata	2016 Strata Population Size (N)	Average Savings (kWh)	Coefficient of Variation	Single-Family Electric Sample Size (N)	Relative Precision (90% CI)
2016 HERO + HERS Homes	1,049	2,891	0.7	427	5.6%

Source: Navigant analysis

Billing Data Analysis

Duke Energy provided electric consumption billing data for PY2016 program participants. The evaluation team cleaned and aggregated the billing data to create a load shape for the sampled single family electric homes. Figure 15 shows the aggregated participant billing data load shape used for model calibration (discussed below).

Figure 15. Single-Family Electric Load Shape



Source: Navigant analysis

Model Construction

The evaluation team constructed the energy simulation models using the Building Energy Optimization (BEopt) software package. BEopt is a residential software modeling platform developed by the National Renewable Energy Laboratory (NREL). It utilizes the industry-trusted EnergyPlus or DOE-2.2 simulation engines and contains built-in assumptions that are based on the U.S. Department of Energy's (DOE's) Building America House Simulation Protocols. The evaluation team based the model specifications on average building characteristics extracted from REM/Rate files for the sample of 427 projects, as shown in Table 29.

Table 29: Whole House Simulation Model Sample Statistics

Parameter	Average 2016 Sample Characteristics
Home Characteristics	
Conditioned Floor Area (sf)	2,700
Stories	2
Bedrooms	4
Envelope Characteristics	
Ceiling R-Value	34.1
Above Grade Wall R-Value	16.1
Slab Floor R-Value	10.0
Window Area	356.9
Window U Value	0.33
Window SHGC	0.25
Infiltration (ACH @ 50 Pascals)	2.9

Mechanical Equipment	
Air Source Heat Pump (HSPF)	8.7
Air Source Heat Pump (SEER)	14.8
Air Source Heat Pump (EER)	12.2
Duct Insulation R-Value	8.3
Duct Leakage (CFM@25Pa/100 sq. ft.)	1.8
Water Heater Energy Factor (EF)	1.54

Source: Navigant analysis of 2016 REM/Rate files

Load Disaggregation and Model Calibration

Proper calibration of energy simulation models requires that the billing data load shape be disaggregated to estimate the individual contribution from primary end uses.[29]

Once the billing load shape was disaggregated, the evaluation team conducted a rigorous calibration procedure to adjust model simulation parameters so that the modeled energy consumption output was within 5% of participants' annual electric consumption for lighting, appliance, plug, heating, and cooling loads. The calibration parameters were kept within reasonable ranges to ensure that simulation inputs were representative of realistic home and customer behaviors.

During the calibration process, the evaluation team used 2016 actual meteorological year (AMY) weather data to ensure that models were properly calibrated to the consumption that occurred as a result of the weather during the same time period. Once the models were calibrated, measure savings estimates were generated using typical meteorological year (TMY3) weather data so that the savings reflect what would be observed during a typical weather year rather than a specific weather year.[30]

Establishing Measure Baselines

To model the baseline home, the evaluation team used the baseline specifications found in the program's User-Defined Reference Home (UDRH) file. The UDRH specifies baseline conditions for use in REM/Rate models, to generate an energy savings report. Navigant used these values to ensure direct comparison with the reported savings estimates from REM/Rate files for each program home.

Measure Savings Estimates

After creating a complete set of modeling input parameters, Navigant performed a number of model simulation runs to estimate energy savings for the whole house option and the prescriptive HVAC measures. The evaluation team adjusted the efficiency parameters in order to simulate the baseline condition versus the efficient condition. The evaluation team chose criteria for the efficient categories that

[29] Navigant has developed a rigorous approach for load disaggregation, which has been used as an accepted approach for several evaluations among various utility clients, including several previous evaluations for DEP.

[30] Navigant chose to use TMY3 weather data for model savings because it provides the best estimate of the typical savings that a customer would experience. Furthermore, Duke Energy generally uses the evaluated savings from one program year as the deemed savings for the next program year, which makes TMY3 data the most appropriate choice.

were consistent with actual RNC program activity to simulate the most appropriate measure combinations.

Estimating Prescriptive HVAC Measure Savings

Using the calibrated models developed for the whole house option, Navigant performed a series of model runs to estimate energy savings for the prescriptive HVAC measures. The evaluation team adjusted the efficiency parameters to simulate the baseline condition versus the efficient condition. The evaluation team chose criteria for the efficient categories that were consistent with actual RNC program activity to simulate the most appropriate measure combinations.

APPENDIX B. REM/RATE LITERATURE REVIEW

Source	Study	Findings
ACEEE	Accuracy of Home Energy Saver Energy Calculation Methodology	A comparison across three tools (Home Energy Saver, REM/Rate, and SIMPLE) resulted in REM/Rate systematically over predicting annual energy use; approximations used in translating REM/Rate inputs to HES inputs unavoidably introduced error compared to cases where audits gathered inputs expressly for HES. NREL's BEopt is generally accurate, though is also prone to over-predicting heating energy.
Advanced Energy	Houston Home Energy Efficiency Study	Analysis found no systematic bias of REM/rate, though there was a large amount of variability in data; vintage and square footage of home were as good predictors of energy use as REM/Rate projections. REM projected average cooling loads about 3% higher than actual, but given the likely positive bias in billing data, these figures should be considered in excellent agreement.
Energy Center of Wisconsin	Energy and Housing in Wisconsin	Overall error statistics when comparing PRISM to REM/Rate indicates that REM/Rate overestimates heating energy use by a median of 20% when compared to utility billing records. For most houses, the difference is moderate, but the REM/Rate predictions of heating use are much higher for houses that are predicted by REM/Rate to have a high heating energy intensity. Plots and regression results point to a systematic difference between REM/Rate and billing data that is a function of the predicted heating energy intensity.
ACEEE	Energy Analysis Beyond Benchmarking for Multi-family Buildings: Results from Wisconsin's 30 Multi-family Buildings Study	A simple analysis of the mean difference between the REM/Rate and PRISM estimates of heating use per square foot of multi-family buildings suggest a flight positive bias to the REM/Rate estimates (vs PRISM estimates), though small study size affects ability to defend this statement. REM/Rate and PRISM are noticeably congruent and there is a lack of evidence that their estimates differ systematically in this study. Lack of ability of REM/Rate to accurately predict space heating for individual buildings greatly limits utility of tool in new construction programs geared toward apartments and condominiums. However, REM/Rate will still accurately demonstrate acceptable energy upgrades, and would not recommend measures that might be incorrect in multi-family settings. REM/Rate is a reasonable tool to use for retrofit planning in smaller apartment buildings, and the use of REM/Rate in new construction could be effective where analysis is performed at unit level, or in garden apartments and row houses.

Source	Study	Findings
NREL	Assessing and Improving the Accuracy of Energy Analysis for Residential Buildings	A general perception is that software-based energy analysis of inefficient existing homes tends to overpredict pre-retrofit energy use and retrofit energy savings. Energy Trust of Oregon performed study to evaluate programs, including SIMPLE, REM/Rate, HES, and on average REM/Rate and HES predicted energy use higher than utility bill (especially in older homes).
DOE	Review of Selected Home Energy Auditing Tools	2008 Energy Performance Score report compared REM/Rate against two versions of HES and SIMPLE, and found all tools have issues with accurate prediction of actual energy use across a broad range of house types. Conclusion from Energy Trust of Oregon study was that none of the software reviewed was extremely accurate, but SIMPLE performed the best across an entire population of houses.
DOE	Validating Savings Claims of Cold Climate Zero Energy Ready Homes	REM/RATE models aligned with BEopt baseline models on the total consumption level, but a more detailed analysis showed major discrepancies at end-use level. Only trend consistent in all three sites was REM/Rate higher prediction of LAMELs, but heating, cooling, water heating consumption alignment varied site to site. At site, heating was overpredicted by REM/Rate, but underpredicted by BEopt. Modeling methods need improvement to increase whole-building electricity consumption estimates in cold climates. To accurately model these systems in BEopt it may be appropriate to use a slightly reduced heating season performance factor input. REM/Rate currently uses data collected from the 1970s to the 1990s, thus modeling predictions are not entirely reflective of today's inverter-driven technology. Also, cold climate heating energy consumption is significantly overpredicted.
Energy Trust of Oregon	2009-2011 New Homes Billing Analysis: Comparison of Modeled vs. Actual Energy Usage	For gas heated homes, average differences between normalized and modeled gas use were less than 10% and individual differences were within 25% of modeled usages for 2/3 of homes. Average differences for electric base load usage were also less than 10%, although variability was much higher. For electric heated homes, sample sizes were too small to provide reliable results. Analysis of energy use over time showed that the energy models consistently underestimated average annual gas and electric use by a small amount. Energy models used by the program appear to be relatively accurate particularly for gas use, though they may underestimate usages. However, there are substantial deviations from modeled usage in individual homes.

APPENDIX C. PARTICIPANT BUILDER INTERVIEW GUIDE

The following document outlines the participant builder interviews that will be completed as part of the 2015/2016 Duke Energy Residential New Construction (RNC) program evaluation. The participant builder interviews will meet objectives for *Task I1 – Participant Builder Interviews to Understand Program Freeridership, P2 – Market Research to Address Program Gaps,* and *Task P3 – Participant Builder Process Interviews.*

Goals of the Participant Builder Interviews

- Measure key indicators of market progress.
- Identify areas and recommendations for program improvement.
- Identify challenges and benefits of the transition to the new program design.
- Quantify free-ridership, separate from market effects.
- Identify barriers and possible solutions to reaching categories of lower program participation, including affordable housing, multi-family development, and high value homes.

Interview Targets

Table 30 outlines the interview targets for the Duke Energy Residential New Construction participant builder interviews. Targets for individual categories are relatively loose and do require that some builders will meet the requirements of multiple categories.

Table 30. Interview Targets

Builder Program Participation		Target Markets		TOTAL INTERVIEWS
	Interviews		Interviews	
Large (>50)*	4-6	Affordable Housing	3-4	15 - 20 Interviews
Medium (10-50)	4-6	Multi-family	3-4	
Small (<10)	3-4	High Dollar Value	3-4	

**Values in parenthesis indicate the number of participating homes built by each builder*

NOTE: Priority will be placed on builders who have completed homes under the new program structure.

Incentives

The interview guide outlines a pretty substantial/long interview. In response to the fact that we expect that builders will be on the phone with us for ~45 minutes, we will be offering a $50 incentive for their participation.

Participant Builder Interview Guide

INTRODUCTION

Hi, my name is ______ and I'm calling from Navigant on behalf of Duke Energy, specifically the Residential New Construction program. We are talking to builders who participated in the Residential New Construction program to gather feedback for a program evaluation we are completing. I would like to talk with you for about 30-45 minutes, where we are hoping that you can give us insights into your experience that will help to identify improvements in the program and its support of you as a participating builder. In recognition of your time we are happy to offer a $50 incentive in the form of a Visa gift card.

BUILDER BACKGROUND

1. What is your current position?
2. How long have you been with your company in this current position?
3. How long has your company received incentives through the Duke Energy Residential New Construction, or RNC program?
4. How did you first hear about the Duke Energy RNC program?
5. What was the main reason that you got involved with the Duke Energy RNC program?
6. Do you see your company continuing to participate with the RNC program in future years?

CURRENT PROGRAM/TRANSITION

[NOTE FOR INTERVIEWER: In 2016, the Duke Energy RNC program underwent a transition, specifically related to the incentive structure. The new program was fully in effect as of June 1, 2016.]

1. [If builder participated in the Duke Energy RNC program prior to the program transition]. What changes have you seen as a result of the recent transition in the Duke Energy RNC program? The new version of the program was fully in effect as of June 1, 2016. [Allow time for open-ended response before moving into prompts.]
    a. Building practices [have you made changes to your homes as a result of the program changes?]
    b. Incentives [have you received greater or smaller incentives per home?]
    c. Implementer [have you seen differences in approaches or your interaction with the program?]
    d. Technical Assistance [have you received different levels of technical assistance?]
    e. Overall Satisfaction [has your overall satisfaction with the program changed?]

For the remainder of this interview, please focus your responses on your interaction with the Duke Energy RNC program following the program transition, since June 1, 2016.

PROGRAM REQUIREMENTS

1. What do you think of the Duke Energy RNC program's eligibility requirements for construction standards and quality assurance? Do you have any major concerns or insights? Please explain.

2. Specifically focusing on the program requirements following the program transition, do you feel that the program has clearly communicated participation requirements?
    a. [If no] How could the program better communicate participation requirements?

3. Are there any areas in which the program could improve that would make it more compelling for you and other builders to participate?

BUILDING PRACTICES

1. Considering the homes that you submitted to the Duke Energy RNC program, since the program transition, what percentage of the homes were production (spec-built) homes and what percentage were custom-built homes?
    a. [Note for interviewer, the two percentages should sum to 100%]

2. Since the program transition, what percentage of the homes that you built in Duke Energy territory were submitted to the Duke Energy RNC program?
    a. [If not 100%] Why have you not submitted 100% of your homes through the program?
    b. [If not 100%] What would it take to build 100% of your homes to program standards?

3. What measures have you employed to meet the HERO/RNC program requirements? Please also note any places where these building practices differ from your standard building practices? (check as appropriate)? [Note for interviewer: please read this list of building characteristics]
    a. R-19 wall insulation (either 2x6 framing or R-3 external sheathing)
    b. R-38 or greater attic insulation to meet performance specification
    c. Radiant barrier
    d. Window U-Factor, 0.32 upgrade
    e. Window SHGC, 0.25 upgrade
    f. Enclosed crawl space
    g. R-5/10 slab insulation
    h. ACH50 less than 4 to meet performance specification
    i. HVAC duct leakage less than 4% to meet performance specification
    j. Any procedures/measures initiated for the purpose of meeting RNC program requirements not listed above? Please list ___________________.

4. Have you submitted homes that have been rejected from the program because they did not meet program requirements?
    a. [If yes] What have you done to either resubmit or make sure that this doesn't happen for other projects?
    b. [If yes] For these projects that didn't quite meet program standards, what were the reason(s) that the homes did not meet program requirements?

HERS RATERS/TECHNICAL SUPPORT

1. Please describe your relationship with the HERS Rater(s) who you work with for the program?

2. In what areas do you find HERS Rater(s) to be most helpful? In what areas have you learned the most from them?

3. Have you been offered any training through the Duke Energy RNC program? Did you participate?
    a. [If yes] How satisfied were you with that training? Was it at the right level for you?

4. Are there areas where you would like additional technical support or training, either from HERS Raters or program staff?

FREE-RIDERSHIP

1. What were your company's policies regarding green building and energy efficiency prior to your participation in the Duke Energy RNC program?
2. How would your building practices be different if Duke Energy had never provided the RNC program incentive and training?
    a. Would you be building to different specifications or purchasing different products/materials?
    b. Would you employ different subcontractors or work with them differently onsite?
    c. Would your company consider a different green/energy efficient certification system for your homes, i.e. HERO (without incentive), ENERGY STAR, or LEED?
3. [If participant indicates that they would not have made any changes to building practices as a result of the Duke Energy program never having existed] You indicate that your building practices would have been the same, even if the Duke Energy program would not have existed. Would you have also made the changes to build more energy efficient homes at the same time, or would it have taken you longer to make that change?
4. What are the most significant factors that have caused you to make the decision to build energy efficient homes? [Leave this open ended first, then ask the following to clarify] Using the scale of 1 to 5, where 1 is "not at all influential" and 5 means "very influential," tell us how influential the following were on your decision to build energy efficient homes?
    a. The Duke Energy RNC Program
    b. Another energy efficient building standard, i.e. ESTAR or LEED
    c. Corporate decisions/purchasing
    d. Homebuyer preference
    e. Other market influences [Ask to clarify, if they indicate "other" was influential]
5. Using a scale of 1 to 5, where 1 is "not at all influential" and 5 means "very influential," tell us how influential the following elements were on your decision to build homes to the RNC program standards:
    a. Program incentive
    b. Program information/training from Duke Energy/ICF program staff
    c. Program marketing materials
    d. Program information provided by your HERS Rater

LOWER PARTICIPATION TARGETS

1. Does your company build within any of the following market segments: affordable housing, multi-family, and/or high dollar value homes? To clarify, we are looking at both program and non-program homes here, but please limit your answers to building that you are doing in North Carolina. [Note to interviewer: High dollar value homes should be homes over $500,00]

[If yes to affordable housing]

2. Does your company submit any affordable housing projects through the Duke Energy RNC program?
3. It is our understanding that there may be significant challenges with program participation for affordable housing projects. Can you elaborate on any of the specific barriers to program participation that may be experienced by builders of affordable housing?
4. How could the Duke Energy RNC program better encourage participation by the affordable housing sector?

[If yes to multi-family]

5. Does your company submit any multifamily projects through the Duke Energy RNC program?
6. It is our understanding that there may be significant challenges with program participation for multi-family housing projects. Can you elaborate on any of the specific barriers to program participation that may be experienced by builders of multi-family projects?
7. How could the Duke Energy RNC program better encourage participation by the multi-family sector?

[If yes to high dollar value homes, ~$500,000 or greater]

8. Does your company submit any high dollar value homes through the Duke Energy RNC program?
9. It is our understanding that there may be significant challenges with program participation for high dollar value homes. Can you elaborate on any of the specific barriers to program participation that may be experienced by builders of high dollar value homes?
10. How could the Duke Energy RNC program better encourage program participation for high dollar value homes?

CONCLUSION:

1. Overall, how satisfied are you with the Duke Energy RNC program?
2. In closing, do you have any last insights on how the program can improve or ideas that would make participation in the program more compelling for you and other builders?

APPENDIX D. NONPARTICIPANT BUILDER INTERVIEW GUIDE

The following document outlines the nonparticipant builder interviews that will be completed as part of the 2015/2016 Duke Energy Residential New Construction (RNC) program evaluation. The nonparticipant builder interviews will meet objectives for *Task I2 – Calculation of Net Program Savings.*

Goals of the Non-Participant Builder Interviews

- Measure key indicators of market progress.
- Quantify spillover and free-ridership.

Interview Targets

Nonparticipant builders are relatively challenging to recruit for interviews. However, their responses are significantly important to this study. As such, the evaluation team sets a target of 8-10 completed interviews. These nonparticipant builder interviews, will be focused as much as possible on builders focused on the Greater Raleigh Area, as this area comprises the majority of program activity.

Incentives

Nonparticipant builders will be offered a $50 incentive for their participation. Though the interview should be relatively short (~20 min), this incentive is offered in hopes that it supports recruiting a larger and more diverse sample.

INTRODUCTION

Hi, my name is ______ and I'm calling from Navigant on behalf of Duke Energy, specifically the Residential New Construction program. We are reaching out to builders who have not participated in the Residential New Construction program to better understand the residential construction market in North Carolina. I would like to talk with you for about 20 minutes and am hoping that your insight can help me to better understand the North Carolina residential building market as a whole. In recognition of your time we are happy to offer a $50 incentive in the form of a Visa gift card.

BUILDER BACKGROUND

1. What is your current position?
2. How long have you been with your company in this current position?
3. Annually, how many homes does your company build in North Carolina?
4. Where are these homes generally built? [i.e. Raleigh area, Ashville area, coastal, or across the state – collect as much detail as we can]

5. How would you generally describe the standard homes that you build? [i.e. production vs. custom, low-cost, general market, or high dollar value]

DEP RNC PROGRAM

1. Are you familiar with the Duke Energy Progress (DEP) Residential New Construction program, which provides incentives to builders for building homes that meet or exceed the requirements of the NC HERO code? [The North Carolina High Efficiency Residential Option (HERO) code is an additional **voluntary** criteria of the North Carolina Energy Conservation Code for increasing energy efficiency.]

    a. **[If no]** Would knowing that Duke Energy offers incentives to builders for building homes that meet or exceed the requirements of the NC HERO code, cause you to consider building above code?
    b. **[If yes]** Why have you chosen not to participate in the program?
    c. **[If yes]** Are you considering participating in the program in the future?
    d. **[If yes]** Are you familiar with the two separate paths for participation in the DEP program? [If needed, the whole house path and the equipment path]
        i. Would you be more likely to consider participating in one or the other?
    b. **[If yes]** Are there any changes that could be made to the program to make it more compelling for you or other builders to participate?

ENERGY EFFICIENCY DECISIONS

1. Do you regularly build to any specific energy efficient building standards?
    a. **[If yes]** Why? What drives your decision to build to these standards?
    b. **[If no]** Why not?
2. What portion of your homes are verified to meet the NC HERO code?

3. Do any of your equipment or building envelope systems exceed minimum energy code levels? [i.e. specifying equipment above code, including additional insulation, etc.]

BUILDING PRACTICES

Now I would like to discuss specific building practices with you. For these questions, please focus your answers on the homes that you have built in North Carolina during 2017.

Framing Practices

1. In what percentage of the homes you constructed in 2017 was the **attic/ceiling interface** framed such that all attic penetrations include a full interior air barrier aligned with insulation, and that any gaps in the air barrier are fully gasketed and/or sealed with caulk, foam, or mastic?

    [Openings in the attic ceiling interface include for example: the attic access panel, attic drop-down stair, recessed lighting fixtures, and whole house fan applications.]

2. In what percentage of the homes you constructed in 2017 were the **chases and soffits capped**, such that all openings to unconditioned spaces, including dropped ceiling soffits, shafts, and chases are sealed with a rigid air barrier and air sealed?

    [Where drop ceilings or soffits occur at exterior walls, air barriers shall be included at the wall as well as the attic floor.]

3. In what percentage of the homes you constructed in 2017 were the **thermal bypass paths eliminated** through the proper alignment of insulation and the air barrier at the garage ceiling and cantilevered floor assemblies and that all seams, gaps, and holes in the air barrier are sealed caulk or foam?

   [For a garage with conditioned space above, a continuous rigid air barrier or other supporting material separates the garage from conditioned space. For cantilevered floors, a continuous rigid air barrier or other supporting blocking separates the cantilever from the conditioned space. This air barrier can be the exterior finished material if it is airtight.]

4. In what percentage of the homes you constructed in 2017 were the **knee walls backed**, such that a continuous top and bottom plate or blocking is installed at the top and bottom or all knee walls including exposed edges of insulation at the joists and rafters?

   [Attic knee walls are backed with a rigid air barrier or other supporting material to prevent insulation from sagging. Where truss framing is used, the top and bottom of each framing bay is blocked.]

Insulation Practices

5. In what percentage of the homes you constructed in 2017 was the insulation installed in cavities framed on all six sides, in **full contact with the air barrier**, and had no gaps, voids, compressions, or misalignments with the air barrier?

   [Insulation is cut and split around any wiring, pipes, or blocking and is correctly sized for wall width and height.]

6. In what percentage of the homes you constructed in 2017 was **the insulation maintaining permanent contact with the sub-floor** above, including necessary supports (e.g. staves for blankets and netting for blown-in)?

   [Insulation has no gaps, voids, compression, or misalignment with the air barrier. Blown-in insulation has proper density with firm packing.]

7. In what percentage of the homes you constructed in 2017 were **rough openings around windows and exterior doors air sealed** using a backer rod, caulk, or low expansion foam?

   [Fibrous insulation is not used for sealing gaps, typical expansion foam is not used for sealing around windows and doors as it might interfere with the proper functioning of the window or door.]

8. In what percentage of the homes you constructed in 2017 were **all openings or penetrations** between conditioned and unconditioned spaces, such as penetrations in framing made by plumbers, electricians, or HVAC contractors are **sealed** with solid backing and caulk or foam, as needed.

9. In what percentage of the homes you constructed in 2017 were the **roof trusses constructed** so that the **full value of attic insulation** can be installed over the exterior top-plates?

   [This is typically 10” for R38 insulation.]

HVAC Practices

10. In what percentage of the homes you constructed in 2017 were the installed **heating and cooling equipment sized** based on the ACCA Manual J or 2009 ASHRAE?

11. In what percentage of the homes you constructed in 2017 were all HVAC components at all seams, gaps, and holes **sealed with mastic** before installing insulation?

[Additionally, insulation is installed without misalignments, compressions, gaps, or voids around all connections and exposed ductwork. Duct insulation is sealed in place with mastic.]

12. In what percentage of the homes you constructed in 2017 were the **room pressures balanced and air flow volumes optimized**?

    [Jump ducts, dedicated returns in each room, or under-cut doors are used to provide proper air flow for pressure balancing. Connections and routing of duct work do not have kinks or sharp bends and usually take the path of least resistance.]

General

13. Do you have an internal quality assurance process for verifying that the measures referenced above were effectively implemented? If yes, can you describe briefly?

ENERGY EFFICIENCY IN THE MARKET

1. Are you familiar with HERS Raters as home building subcontractors?
   a. **[If yes]** Ask question #2
   b. **[If no]** Move to question #3

2. Do you work with a HERS Rater?
   a. **[If yes]** What services do they provide for you?
   b. **[If no]** Is there any reason in particular why you do not?

3. Do you see any benefit in building high efficiency homes? What do you see as the advantages or disadvantages of advertising a home as energy efficient?

4. How would you describe the level of customer demand for higher efficiency new homes? [high, moderate, low]

5. From your perspective, are realtors and appraisers willing/able to add a price premium to energy efficient homes?

6. How would you describe builder competition in the North Carolina market in relation to energy efficiency? Are all builders generally building to the same level of efficiency, or is there a large range between different builders?

CONCLUSION

1. In conclusion, do you have anything else that you would like to tell us about your building practices in terms of energy efficiency or the North Carolina market as a whole?

2. Before we hang up, I need to capture your current contact information so that we can mail you the $25 Visa gift card.
   a. Name:
   b. Street Address:
   c. City/State:
   d. Zip Code:

   The gift card will be mailed once all interviews are complete and are expected to arrive within 4-6 weeks.

Thank you for your time today. Please feel free to reach out if you have any questions or additional thoughts you'd like to share.

APPENDIX E. HERS RATER INTERVIEW GUIDE

The following document outlines the HERS Rater interviews that will be completed as part of the 2015/2016 Duke Energy Residential New Construction (RNC) program evaluation. The HERS Rater interviews will meet objectives for *Task I2 – Calculation of Net Program Savings.*

Goals of the HERS Rater Interviews

- Measure key indicators of market progress.
- Quantify spillover and free-ridership.

Interview Targets

The evaluation team targets completing with 6-8 HERS Raters interviews from the population described in Table 31. These interviews will prioritize discussions with the most active HERS Raters, but will supplement as necessary with some of the smaller/less active HERS Raters.

Table 31. Characteristics of DEP RNC Program HERS Raters

Registered with DEP RNC Program	Completed Projects in PY2016	Completed >50 Projects in PY2016	Completed <50 Projects in PY2016
23	20	8	12

Incentives

HERS Raters will be offered a $50 incentive for their participation. Though the interview should be relatively short (20-30 min), this incentive is offered in hopes that it supports recruiting efforts.

HERS Rater Interview Guide

INTRODUCTION

Hi, my name is ______ and I'm calling from Navigant on behalf of Duke Energy, specifically the Residential New Construction program. We are reaching out to HERS Raters who have participated in the Residential New Construction program to better understand the residential construction market in North Carolina. I would like to talk with you for about 20-30 minutes and am hoping that your insight can help me to better understand the North Carolina residential building market as a whole. In recognition of your time we are happy to offer a $50 incentive in the form of a Visa gift card.

RATER BACKGROUND

1. What is your current position?
2. How long have you been with your company in this current position?
3. How long have you worked with the Duke Energy (DEP) Residential New Construction program [previously Home Advantage, prior to 2014]?
4. How did you first learn about the RNC program?
5. What was the main reason you got involved with the RNC program?

DEP RNC PROGRAM EXPERIENCE

1. Annually how many homes does your company rate in North Carolina?
2. How much of your current work is through the DEP RNC program? [Prompt for a percentage]
3. How many builders do you work with in the RNC program [one or multiple]?
4. At what point in the plan development process do you typically begin interacting with builders for each home? [During the initial design phase; during the design review phase, prior to design completion; after the design is finalized]
5. In your experience, what percentage of home plans submitted by builders participating in the program achieve a program-qualifying level of efficiency upon your initial review of the plan?
6. In the cases where a home plan does not achieve a qualifying level of efficiency upon your initial review, how would you characterize the extent to which plans require revisions? [Significant revisions required, moderate revisions required, minor revisions required]
    a. What are the most common reasons that a home plan does not qualify? [Thermal bypass checklist issues, window to wall ratio, insulation levels, HVAC system]
    b. How many iterations of the plan are typically needed?
7. For the builders you work with who are not currently involved in the DEP RNC program, what improvements would be necessary to meet the program requirements?
8. For these builders that are not currently involved in the DEP RNC program, are there other energy efficiency certifications that these builders are pursuing?

BUILDING PRACTICES

Now I would like to discuss specific building practices with you. For these questions, please focus your answers on your work completed on homes built within Duke Energy Progress territory during 2017. **[Specifically focus on North Carolina.]** For each of these questions about specific building practices, I would like you to provide three percentages: (1) total percentage of homes constructed in DEP territory that exhibit this building practice, (2) percentage of program homes exhibiting this building practice, and (3) percentage of non-program homes exhibiting this practice.

Framing Practices

14. In what percentage of the homes constructed in DEP territory in 2017 was the **attic/ceiling interface** framed such that all attic penetrations include a full interior air barrier aligned with insulation, and that any gaps in the air barrier are fully gasketed and/or sealed with caulk, foam, or mastic?

    [Openings in the attic ceiling interface include for example: the attic access panel, attic drop-down stair, recessed lighting fixtures, and whole house fan applications.]

15. In what percentage of the homes constructed in DEP territory in 2017 were the **chases and soffits capped**, such that all openings to unconditioned spaces, including dropped ceiling soffits, shafts, and chases are sealed with a rigid air barrier and air sealed?

    [Where drop ceilings or soffits occur at exterior walls, air barriers shall be included at the wall as well as the attic floor.]

16. In what percentage of the homes constructed in DEP territory in 2017 were the **thermal bypass paths eliminated** through the proper alignment of insulation and the air barrier at the garage ceiling and cantilevered floor assemblies and that all seams, gaps, and holes in the air barrier are sealed caulk or foam?

    [For a garage with conditioned space above, a continuous rigid air barrier or other supporting material separates the garage from conditioned space. For cantilevered floors, a continuous rigid air barrier or other supporting blocking separates the cantilever from the conditioned space. This air barrier can be the exterior finished material if it is airtight.]

17. In what percentage of the homes constructed in DEP territory in 2017 were the **knee walls backed**, such that a continuous top and bottom plate or blocking is installed at the top and bottom or all knee walls including exposed edges of insulation at the joists and rafters?

    [Attic knee walls are backed with a rigid air barrier or other supporting material to prevent insulation from sagging. Where truss framing is used, the top and bottom of each framing bay is blocked.]

Insulation Practices

18. In what percentage of the homes constructed in DEP territory in 2017 was the insulation installed in cavities framed on all six sides, in **full contact with the air barrier**, and had no gaps, voids, compressions, or misalignments with the air barrier?

    [Insulation is cut and split around any wiring, pipes, or blocking and is correctly sized for wall width and height.]

19. In what percentage of the homes constructed in DEP territory in 2017 was **the insulation maintaining permanent contact with the sub-floor** above, including necessary supports (e.g. staves for blankets and netting for blown-in)?

    [Insulation has no gaps, voids, compression, or misalignment with the air barrier. Blown-in insulation has proper density with firm packing.]

20. In what percentage of the homes constructed in DEP territory in 2017 were **rough openings around windows and exterior doors air sealed** using a backer rod, caulk, or low expansion foam?

    [Fibrous insulation is not used for sealing gaps, typical expansion foam is not used for sealing around windows and doors as it might interfere with the proper functioning of the window or door.]

21. In what percentage of the homes constructed in DEP territory in 2017 were **all openings or penetrations** between conditioned and unconditioned spaces, such as penetrations in framing made by plumbers, electricians, or HVAC contractors are **sealed** with solid backing and caulk or foam, as needed.

22. In what percentage of the homes constructed in DEP territory in 2017 were the **roof trusses constructed** so that the **full value of attic insulation** can be installed over the exterior top-plates?

    [This is typically 10" for R38 insulation.]

HVAC Practices

23. In what percentage of the homes constructed in DEP territory in 2017 were the installed **heating and cooling equipment sized** based on the ACCA Manual J or 2009 ASHRAE?

24. In what percentage of the homes constructed in DEP territory in 2017 were all HVAC components at all seams, gaps, and holes **sealed with mastic** before installing insulation?

    [Additionally, insulation is installed without misalignments, compressions, gaps, or voids around all connections and exposed ductwork. Duct insulation is sealed in place with mastic.]

25. In what percentage of the homes constructed in DEP territory in 2017 were the **room pressures balanced and air flow volumes optimized**?

    [Jump ducts, dedicated returns in each room, or under-cut doors are used to provide proper air flow for pressure balancing. Connections and routing of duct work do not have kinks or sharp bends and usually take the path of least resistance.]

ENERGY EFFICIENCY DECISIONS

1. What do you see as the benefit of building high efficiency homes? What do you see as the advantages or disadvantages of advertising a home as energy efficient?

2. From your perspective, how receptive are realtors and appraisers to attribute added value to energy efficient homes?

3. How would you describe builder competition in the North Carolina market in relation to energy efficiency? Are all builders generally building to the same level of efficiency, or is there a large range between different builders?

4. How would you describe the builders who participate in the DEP RNC program? Do program participating builders represent a general cross-section of all builders in terms of efficiency, or do they tend to be the most efficient builders?

5. How would you describe the builders who choose not to participate in the DEP RNC program? What are the most common reasons why builders choose not to participate?

CONCLUSION

3. In conclusion, do you have anything else that you would like to tell us about your building practices in terms of energy efficiency or the North Carolina market as a whole?
4. Before we hang up, I need to capture your current contact information so that we can mail you the $50 Visa gift card.
    a. Name:
    b. Street Address:
    c. City/State:
    d. Zip Code:

   The gift card will be mailed once all interviews are complete and are expected to arrive within 4-6 weeks.

   Thank you for your time today. Please feel free to reach out if you have any questions or additional thoughts you'd like to share.

APPENDIX F. ONSITE DATA COLLECTION PLAN

This document presents a summary of Navigant's plan to conduct onsite field verification as part of the evaluation efforts for the Residential New Construction Program. This field verification will occur during June and July of 2017 in Duke Energy Progress jurisdictions. The Duke Energy Call Center has been notified of these efforts and the date ranges. During field site visits, Navigant technicians will assess the quantities and efficiency characteristics of the prescriptive, equipment only program measures (HVAC and water heating) and will compare field findings to the reported measure tracking database. The field technicians have received safety training, and each is categorized into a field tier level by Navigant's Field Operations Group based on experience and training. The field work for this program does not consist of any metering or measurements of live electrical equipment.

Navigant will contact homeowners of Residential New Construction prescriptive measure participants to schedule site visits, and will request access to HVAC and water heating equipment for verification. Navigant will send postcards to customers identified for potential verification before scheduling. Field technicians will leave an informational letter behind with each homeowner describing the reason for the inspection and providing them with contact information should they have any follow-up questions.

Sampling

As identified in the evaluation plan, Navigant will visit 40 prescriptive measure sites. Based on the experience from the HVAC study during the PY2013-14 evaluation, 40 sites should be adequate to meet the precision and confidence levels necessary for this evaluation. Navigant plans to stratify the sample based on equipment incentivized, region, and home type (i.e. single family vs. multi-family) such that the sample is representative of the population of participants for these equipment only measures. We are still analyzing the tracking data to determine the example sample quota for each strata, however this final stratification will be shared with the Duke Energy team prior commencing recruitment for this study.

Data Collection

Measure Specific
Navigant will verify prescriptive HVAC and Heat Pump Water Heaters installed through the program. Verification will include equipment specifics such as equipment type, make, and model. The collected data will be compared to values in the tracking database and previous deemed savings assumptions to assess the accuracy of program reporting and evaluate other customer-initiated efficiency changes. Navigant will collect basic home characteristics such as square footage, year built and conditioned stores of homes verified.

Field Equipment
Navigant will use the following equipment for this evaluation: flashlight, camera, and field collection form loaded onto an iPad. All data collected during these sit visits will be collected through Fulcrum, an online data entry system, which allows the field tech to combine notes and pictures from each site. The data from each site visit will be uploaded to a secure server for QC and storage.

HVAC

Field technicians will record the type, make and model of the HVAC system. Prescriptive Air Source Heat Pump system information will be collected. Navigant will collect both heating and cooling equipment information if an Air Source Heat Pump is not identified onsite.

Water Heaters
Field technicians will record the type, make and model of water heating equipment. Prescriptive Heat Pump Water Heater information will be collected. Navigant will also collect water heating equipment information if a Heat Pump Water Heater is not identified onsite.

Customer Survey

In the event that the field technicians have an opportunity to speak with the resident, they will ask a brief list of questions to collect additional information about measures unrelated to the verification for the Residential New Construction program, but of interest to Duke Energy Progress.[31] Table 32 identifies the four additional measures and associated characteristics to be collected.

Table 32. Secondary Measures for Field Data Collection

	Lighting (non-hard wired)	Smart Strips	Smart Thermostats	Home Automation
Installed quantity	x	x	x	x
Installed type	x			
Installed wattage	x			
Attached equipment		x		x

Lighting
Navigant will verify non-hard wired lighting with the customer should time permit. Lighting types, quantity and installed wattages will be collected. Wattage will be collected, but only total quantities will be collected and not broken out by wattage.

Smart Strips
Smart strip use will be collected in addition to total quantity in use. Attached equipment controlled by smart strips will be collected. Attached equipment could include: TV, DVR, set-top-box, video game systems, computer, printer, scanner, modem, router, and all-in-one unit.

Smart Thermostat
In addition to smart thermostat type, Navigant will verify if programmable thermostats have been programmed properly.

Home Automation
Navigant will verify if the customer was offered home automation products by their homebuilder, or whether they are interested in installing any home automation products. Additionally, Navigant will verify automation products currently in use by the customer such as: Amazon Echo, Google Home, connected music system, lighting automation, connected locks, connected security and smart meters.

[31] A request to collect this additional data was transmitted to the Navigant team by Marc Faircloth on April 28, through email.

NAVIGANT

EM&V Report for the EnergyWise Home Program

Winter 2017/2018

Presented for:
Duke Energy Progress

Prepared by:
Navigant Consulting, Inc.

DUKE ENERGY®

August 6, 2018

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TABLE OF CONTENTS

Included as a separate .xlsx document:
Appendix D. Detailed Output Tables

EXECUTIVE SUMMARY

The EnergyWise Home (EnergyWise) demand response (DR) program offers Duke Energy Progress (DEP) residential customers the opportunity to earn credit on their electricity bill by allowing DEP to remotely control the following appliances during times of seasonal peak consumption:

- Summer: Air conditioning
- Winter: Water heater and heat pump auxiliary heating strips

This report covers evaluation, measurement, and verification (EM&V) activities conducted by Navigant for this program during the winter of 2017/2018. The total program population in this period included approximately 10,000 water heater participants and approximately 5,000 heat strip participants.

Navigant estimated impacts using logger data from a sample of 70 participating households.[1] Participating households were split randomly into two separate EM&V samples and curtailed in alternating order throughout the winter. These groupings are referred to as EM&V Group A and EM&V Group B (or Group A and Group B) throughout this report.

Each EM&V group was subject to nine DR events (18 events[2] in total across both groups) during which both heat strips and water heaters were curtailed and four additional events each (eight across both groups) during which only water heaters were curtailed. Altogether the EM&V sample was subject to 26 curtailment events over the analysis period. The overall program population was subject to six of these 26 events, all occurring in January. Both appliances were controlled for all population events.

At the program level, Navigant has estimated the DR capability delivered by heat strips to be approximately 7.2 MW and the DR capability of water heaters to be approximately 5.6 MW. These values, the average capability of an appliance that is responsive to DEP's control signal, and a series of adjustment factors that account for non-responsive devices, devices not in use, and devices not connected are summarized in Table ES-1. This table also provides the same metrics, on average, across the six events to which the entire program population was subject.

Table ES-1. Estimated Program Impacts

	Appliance Type	Impact per Appliance (kW)*	Relative Precision (+/- %)	% Non-Responsive	% Not in Use	% Not Connected	Pop. Avg. Impact per Appliance (kW)	Total Program Impact (MW)
Projected Capability (Ex Ante)	Heat Strips	**3.11**	20%	41%	13%	4%	**1.39**	**7.2**
	Water Heaters	**0.57**	21%	5%	0%	0%	**0.54**	**5.6**
Population Impact - Winter 2017/2018 (Ex Post)	Heat Strips	**2.77**	8%	32%	19%	4%	**1.30**	**6.7**
	Water Heaters	**0.41**	9%	4%	0%	0%	**0.40**	**4.1**

*Includes only partially or fully responsive appliances.
Relative precision is estimated at the 90% confidence level.

[1] Navigant deployed loggers to 78 homes as an intentional over-sample; data of sufficient quality to include in the regression analysis was recovered from 70 of these homes.

[2] Thirteen of these events were EM&V events, and six were the January general population events.

Source: Navigant analysis

The principal factors driving the differences between the projected capability and population historical impacts are summarized in Table ES-2.

Table ES-2. Differences Between Projected Capability and Historical Population Impact

Metric/Assumption	Projected Capability (Ex Ante)	Population Impact – Winter 2017/2018 (Ex Post)
Average event temperature for heat strip events (°F)	10[3]	15.8
Timing of water heater event	8:00-9:00[4]	Mixed Events started as early as 6:00 and as late as 6:30 Events ended as early as 7:30 and as late as 10:00
Non-responsive rate (all appliances)	Average across all EM&V events, grouped by temperature band	Event-specific non-responsiveness rate
Device not in use rate (heat strips only)	Average across all EM&V events, grouped by temperature band[5]	Event-specific device not in use rate

Sources: DEP program staff, Navigant analysis

Navigant conducted its analysis at the appliance level, rather than the customer level. Although the impact per customer and the impact per appliance are very close, there are, on average, slightly more than one appliances controlled per household. The table immediately below provides the average number of appliances controlled per participating customer household[6] and the average impact per customer for responsive (fully or partially) devices and for the population average as a whole (i.e., accounting for non-responsive, non-connected, and not in use devices).

Table ES-3. Per Customer Impacts

	Appliance Type	Impact per Appliance (kW)*	Avg. # of Appliances per Customer	Impact per Customer (kW)*	Pop. Avg. Impact per Customer (kW)**
Projected Capability (Ex Ante)	Heat Strips	**3.11**	1.083	3.37	1.51
	Water Heaters	**0.57**	1.021	0.58	0.55
Population Impact - Winter 2017/2018 (Ex Post)	Heat Strips	**2.77**	1.083	3.00	1.40
	Water Heaters	**0.41**	1.021	0.42	0.40

[3] Specified by DEP staff as the appropriate temperature for evaluating system peak capability.

[4] Specified by DEP staff as the appropriate period of time for evaluating system peak capability. Note that unless stated otherwise all times provided in this report are in the 24-hour format—e.g., 8:00 a.m. is represented as 8:00 and 8:00 p.m. is represented as 20:00.

[5] See Section 4.2.1 for additional details.

[6] Derived from the population program tracking database.

**Includes only partially or fully responsive appliances*
***Accounts for devices not in use or not responsive to curtailment signal.*

Source: Navigant analysis and DEP program tracking data.

Evaluation Objectives

The key objectives for the impact analysis conducted as part of this evaluation were identified in Navigant's evaluation plan; they include the following:

1. **Estimating hourly kilowatt (kW) DR impacts by device type (i.e., water heaters and auxiliary heat strips).** Navigant estimated the average kW DR impact for all EM&V events[7] and population-wide events by quarter-hour or hour. Quarter-hourly impacts for EM&V and population-wide events are provided in Appendix D, an Excel spreadsheet attached as a separate document.
2. **Estimating the program-level DR impact per population-wide event.** Based on regression-estimated relationships, observed temperatures, and the findings of the field work and switch responsiveness analysis, Navigant has estimated the average demand impact of the program for each event to which the entire program population (i.e., not just the EM&V sample) was subject.
3. **Estimating hourly kW snapback impacts.** Navigant has estimated the average kW snapback[8] impact for all EM&V events and population-wide events by quarter-hour. Quarter-hourly impacts for EM&V and population-wide events are provided in Appendix D, an Excel spreadsheet attached as a separate document.
4. **Estimating average event load shed capability.** Navigant has applied the regression-estimated parameters to a series of assumed average event temperatures to deliver a projected load shed under a variety of weather conditions. As in previous years' evaluations, this is presented graphically, showing average event temperature/event impact pairs for actual 2017/2018 events as data points and the estimated average event temperature/event impacts relationship as a line extending through the range of temperatures presented on the plot. The values underlying this plot are provided in Appendix D, an Excel spreadsheet attached as a separate document.
5. **Quantifying switch responsiveness and operability.** Navigant's analysis reports the percentage of switches found to be inoperative when inspected as part of the field metering study and the proportion of devices that appeared to be:
    - Fully responsive to the curtailment signal
    - Partially responsive to the curtailment signal (heat strips only)[9]
    - Totally unresponsive to the curtailment signal
    - Not in use at the time of the DR event (heat strips only)

[7] To improve precision, EM&V participants are subjected to substantially more curtailment events than the program population as a whole.

[8] Snapback refers to the manner in which demand from water heaters or HVAC systems tends to rise considerably above normal levels in the period immediately following a DR event as the equipment works to restore water or air temperature to its setpoint level.

[9] "Partial response" refers to the apparent curtailment of the load punctuated with short load spikes throughout the curtailment period. An explanation for this behavior is provided below.

6. **Providing a clear technical description of the analytic approach.** A detailed description of the approach Navigant used may be found in Appendix B. This is most suitable for technical reviewers or those interested in reproducing the analysis. A higher-level description of the evaluation team's approach may be found in Chapter 2 of this report.

The key objectives for the process analysis conducted as part of this evaluation were identified in Navigant's evaluation plan; these include the following:

1. **Assessing participant satisfaction with DEP and the EnergyWise programs.** Responses to general questions about program and utility satisfaction have been compared to responses recorded in prior years.
2. **Assessing the degree to which customer comfort is affected by curtailment.** Navigant deployed post-event surveys and one placebo[10] post-event survey to determine how severe participant discomfort is during winter DR events.

Evaluation Methods

For the evaluation of the winter 2017/2018, Navigant undertook both process and impact analyses.

Impacts were estimated using appliance load data collected from data loggers deployed and in place over the winter season. These data were combined with weather and event schedule data to allow the evaluation team to estimate a fixed effects regression that delivered an estimated relationship between heat strip DR impacts and outdoor temperature and water heater impacts and the time of day. A significant difference from prior winter EnergyWise evaluations is the use of a randomized control trial (RCT) style experimental design.

For the RCT design, all EM&V participants were randomly assigned to two Groups: Group A and Group B. When Group A was curtailed, Group B was not, and vice versa. This means that there are available contemporaneous observations of non-curtailed appliance demand on event days to help develop the baseline (also referred to as counterfactual) demand. This differs significantly from previous winters in which all EM&V participants were curtailed for all events, and baseline estimation was driven by the use of similar weather non-event days.

The RCT approach's principal benefit is making the analysis much less sensitive to model specification bias: the baseline estimation relies much less on the accuracy of analyst assumptions about demand-driving relationships because of the availability of a contemporaneous control group not subject to curtailment.

The process analysis is driven by data collected from a series of phone surveys fielded to a sample of EnergyWise participants immediately following DR events and a placebo event where no real event was called. Navigant's process findings were driven by an analysis of these survey responses.

Impacts

The principal EM&V findings regarding winter 2017/2018 event demand impacts are as follows:

[10] A "placebo" event (in the context of the survey analysis) refers to a survey deployed in which participants were allowed to believe that an event had recently occurred when in fact none had. This provides a valuable control for assessing participant survey responses to actual events.

- **The current DR capability of DEP's EnergyWise program in the winter is approximately 13 MW.** This is the sum of the projected program capability of 7.2 MW from heat strip curtailment when the average temperature is 10°F and 5.6 MW from water heater curtailment deployed between 8:00 and 9:00 on winter mornings.
- **The estimated average program impact of the six population events deployed in the winter of 2017/2018 was approximately 11 MW.** This is the sum of the estimated average impact of 6.7 MW from heat strips where the average event temperature was slightly less than 16°F and an estimated average impact of 4.1 MW from water heaters where events began as early as 6:00 and ended as late as 10:00 in the morning.
- **The estimated impact per set of heat strips (that responded in some way to DEP's curtailment signal) controlled during the population events was 2.77 kW, and the estimated impact per responsive water heater during the same events was 0.41 kW.** On the coldest event (January 7, 2018) the average impact per responsive, including both fully and partially responsive, set of heat strips was 3.1 kW. The reason why the average water heater population event impact was lower than the projected capability is due to the differing time-spans – population events could start as early as 6:00 and end as late as 10:00, whereas the population capability was calculated assuming an event from 8:00 to 9:00.
- **Navigant's investigation into the cause of why some heat strips were only partially responsive during curtailment events concluded that this behavior was driven by a heat pump's auto-defrost cycle.** Navigant logged heat pump compressors as well as heat strips to test the hypothesis that partial response was a result of a heat pump's defrost cycle periodically overriding the control signal. If this were the cause of the partial response, the expectation would be that the demand spikes characteristic of partial response would be coincident with a shutdown of the compressor fan to thaw the compressor coils. The evaluation team confirmed that this was the case, and that partial response (as defined here) was a result of the defrost cycle.
- **On average, of heat strips in use on the event day, approximately 40% were fully responsive to the curtailment signal and approximately 20% were partially responsive.** The percentage of devices not in use varied significantly across events and was correlated with outdoor temperature. During the four events in which the average event temperature was less than 15°F, 13% of heat strips expected to curtail were not in use, on average. In contrast, for the six events in which the average temperature was between 30°F and 40°F, 41% of heat strips were not in use, on average.

Participant Perceptions

The evaluation team conducted post-event phone surveys with 401 EnergyWise participants during this study. The surveys were conducted after three real DR events and one placebo event. For the placebo event, respondents were told that an event had been called when in fact one had not. All surveyed participants were from the general program population, as those involved in Groups A and B for the field study were removed from the survey sample.

Of the 401 survey respondents, 301 were surveyed after real DR events; the remaining 100 were surveyed after the placebo event. The surveys achieved a relative precision of ±3% at the 90% confidence level for key quantitative outcomes.

Analysis of these participant perception surveys was intended to determine the degree to which participants were aware of curtailment events, and if aware, what changes participants noticed during the event, including perceptions of comfort.

The principal EM&V findings from the analysis of participant perception were as follows:

- **Participants were generally unaware of curtailment events when they happened.** Most (>90%) survey respondents indicated that they had not been aware that an event had occurred recently.
- **The program has little impact on the comfort of its participants.** Only 23 respondents (out of 301 event participants) were aware that an event had been called during the period in question. For that subgroup, comfort levels reported during the event varied widely, ranging from a rating of a 0 to a 10 on the 0-10 comfort scale, with only two rating their comfort less than 5. Most survey respondents indicated that they were “very comfortable” during the event.
- **The program does not appear to be a key driver of supplemental heating use.** A similar portion of placebo survey respondents reported using supplemental methods for heating their homes during “event” periods as those respondents who were subject to actual events.
- **Participants were generally satisfied with the EnergyWise program.** Over half of the respondents indicated that they were very satisfied, while only 4% of all survey respondents (18 people) indicated that they were “dissatisfied” with the program. Satisfaction with the program did not differ significantly between respondents who responded to actual events versus those who responded to placebo events.
- **Fewer than half of participants were aware of the bill credits they receive as part of their program participation.** Every customer enrolled in the program receives a hardcopy brochure explaining the bill credits details (when the are received, amounts, etc.). It is important to note that many of the particpants received their bill credits outside the EM&V study calendar.

1. PROGRAM DESCRIPTION AND RESEARCH OBJECTIVES

The EnergyWise Home (EnergyWise) demand response (DR) program offers Duke Energy Progress (DEP) residential customers the opportunity to earn credit on their electricity bill by allowing DEP to remotely control the following appliances during times of seasonal peak consumption:

- Summer: Air conditioning
- Winter: Water heater and heat pump auxiliary heating strips

This report covers evaluation, measurement, and verification (EM&V) activities conducted by Navigant for this program during the winter of 2017/2018. The total program population in this period included approximately 10,000 water heater participants and approximately 5,000 heat strip participants.

Navigant estimated impacts using logger data from a sample of 70 participating households. Participating households were split randomly into two separate EM&V samples and curtailed in alternating order throughout the winter. These groupings are referred to as EM&V Group A and EM&V Group B (or Group A and Group B) throughout this report.

Each EM&V group was subject to nine DR events (18 events in total across both groups) during which both heat strips and water heaters were curtailed and four additional events each (eight across both groups) during which only water heaters were curtailed. Altogether the EM&V sample was subject to 26 curtailment events over the analysis period.

EM&V is a term adopted by DEP and refers generally to the assessment and quantification of the energy and peak demand impacts of an energy efficiency or DR program. For DR, estimating peak demand reductions is the primary objective, as energy impacts are generally negligible. EM&V also encompasses an evaluation of program processes and customer feedback, typically conducted through participant surveys.

1.1 Evaluation Objectives

This EM&V report is intended to support program improvements and to verify program impacts as per the requirements established by the North Carolina Utilities Commission and the Public Service Commission of South Carolina.

The key objectives for the impact analysis conducted as part of this evaluation were identified in Navigant's evaluation plan; these include the following:

1. **Estimating hourly kilowatt (kW) DR impacts by device type (i.e., water heaters and auxiliary heat strips).** Navigant estimated the average kW DR impact for all EM&V events[11] and population-wide events by quarter-hour or hour. Quarter-hourly impacts for EM&V and population-wide events are provided in Appendix D, an Excel spreadsheet attached as a separate document.
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[11] To improve precision, EM&V participants are subjected to substantially more curtailment events than the program population as a whole.

3. **Estimating hourly kW snapback impacts.** Navigant has estimated the average kW snapback[12] impact for all EM&V events and population-wide events by quarter-hour. Quarter-hourly impacts for EM&V and population-wide events are provided in Appendix D, an Excel spreadsheet attached as a separate document.
4. **Estimating average event load shed capability.** Navigant has applied the regression-estimated parameters to a series of assumed average event temperatures to deliver a projected load shed under a variety of weather conditions. As in previous years' evaluations, this is presented graphically, showing average event temperature/event impact pairs for actual 2017/2018 events as data points and the estimated average event temperature/event impacts relationship as a line extending through the range of temperatures presented on the plot. The values underlying this plot are provided in Appendix D, an Excel spreadsheet attached as a separate document.
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2. **Assessing the degree to which customer comfort is affected by curtailment.** Navigant deployed post-event surveys and one placebo[13] post-event survey to determine how severe participant discomfort is during winter DR events.

1.2 Program Overview

The EnergyWise program was developed in response to DEP's determination that a curtailable load program would be a valuable resource for the company and would provide an opportunity to engage directly with customers to help reduce costly seasonal peak demand. The program seeks to attract DR

[12] Snapback refers to the manner in which demand from water heaters or HVAC systems tends to rise considerably above normal levels in the period immediately following a DR event as the equipment works to restore water or air temperature to its setpoint level.

[13] A "placebo" event (in the context of the survey analysis) refers to a survey deployed in which participants were allowed to believe that an event had recently occurred when in fact none had. This provides a valuable control for assessing participant survey responses to actual events.

resources by incenting residential customers to allow DEP to remotely control water heater and heat pump auxiliary heating strips in the winter months.

The winter program offers an annual bill credit of $25 for each enrolled appliance type. Electric water heaters and heat pumps with auxiliary heat strips may be enrolled in the program, allowing DEP to control those appliances during EnergyWise DR events.

Eligibility. To be eligible to participate in the EnergyWise program, a household must meet the following criteria:

- The participant's heat pump must be a central unit with a ducted system. Wall, window, and ductless units are not eligible for participation.
- All central heat pump units in the home must be controlled by DEP as part of the EnergyWise program.
- Residential electricity service must be in the name of the participant.

Incentives. Each participant receives a one-time bill credit of $25 upon joining the program and then an additional $25 bill credit annually per appliance type controlled to encourage continued participation.

Marketing. DEP is responsible for all marketing of the EnergyWise program. Participation leads are generated through a mix of direct mailings, email, outbound calling, and canvassing door to door.

1.3 Reported Program Participation

The overall program participation for the EnergyWise program is discussed in this section. The sample sizes for the EM&V analysis may be found in Section 2.1.1.

Six population-wide DR events were called in the winter of 2017/2018 for the EnergyWise program, all in January. The total program population (subject to winter curtailment) in this period included approximately 10,000 water heater participants and approximately 5,000 heat strip participants.[14]

The date, time,[15] and length of each event are provided in Table 1-1. For each event, both heat strips and water heaters were controlled.

[14] The precise values provided to Navigant by DEP to calculate program impacts were 5,154 sets of heat strips controlled (4,777 participants) and 10,316 water heaters controlled (10,107 participants).

[15] Note that unless stated otherwise all times provided in this report are in the 24-hour format—e.g., 8:00 a.m. is represented as 8:00 and 8:00 p.m. is represented as 20:00.

Table 1-1. Overall Winter PY2017/2018 Program Participation by Event

Date	Start Time	End Time	Length of Event (Hours)	Average Event Temperature (°F)[16]
2018-01-02	6:30	9:30	3	10
2018-01-05	6:30	9:30	3	13
2018-01-07	6:00	9:00	3	9
2018-01-08	6:00	7:30	1.5	27
2018-01-15	6:00	10:00	4	22
2018-01-18	6:00	9:00	3	14

Source: DEP DR control event tracking report

[16] Average event temperature shown here is the average event temperature to which all heat strip participants included in the analysis were subject during the event.

2. EVALUATION METHODS

This chapter of the evaluation report provides a description of the approaches used to conduct both the impact and process evaluations. Additional technical details of the approach used for the impact analysis may be found in Appendix B.

2.1 Impact Evaluation

Navigant estimated demand reduction, snapback, and event-level energy impacts using a fixed effects regression analysis applied to participant interval data, weather data, and data flags indicating the intervals in which events took place. The remainder of this subsection details the data and the econometric method used in the analysis. Appendix B provides further discussion of the regression models used.

2.1.1 EM&V Participants and Events

The estimated impacts presented in this evaluation report are based on a sample of participants from the overall population that agreed to have data loggers installed so that each curtailed device's consumption could be monitored in isolation of the rest of the household's demand. This sample of participants was also subjected to more events than the overall sample to provide the evaluation team with more data points from which impacts could be estimated.

Altogether, Navigant obtained useable logger data from the following:

- 60 participating homes with controlled heat strips (out of 69 homes in which heat strip loggers were installed)
- 36 participating homes with controlled water heaters (out of 40 homes in which water heater loggers were installed)

For the 2017/2018 evaluation, Navigant randomly allocated each EM&V participant site to one of two groups: Group A and Group B. This enabled a randomized control trial (RCT) experimental design, where when one group is subject to curtailment, the other is not. This means that only event days needed to be included in the analysis. Participants were assigned randomly by winter energy usage strata to one group or the other by the evaluation team. The purpose of this approach (discussed in greater detail below) was to improve estimation accuracy.

A key concern of DR evaluations when all participants are subject to the same events is that there remain some non-event days that sufficiently resemble (in terms of temperature and other factors) the event days. This is required to allow for the estimation of a robust baseline. One problem with this approach is that often events are highly correlated with extreme weather events, meaning that baselines are often projected out of sample (i.e., baselines are predicted over temperature conditions that may not actually have been observed on non-event days).

Subjecting only half of all EM&V participants to each event ensures the existence of event-like, non-event days in the sample and provides additional information (from the non-curtailed devices) that helps estimate the counterfactual event demand (the baseline). These factors improve model accuracy by substantially reducing the likelihood of model specification bias compared to a purely within-subject approach (as used in prior years).[17]

EM&V participants were subjected to 26 events, 13 for each group. Six of these events (all in January) were also population-wide events (i.e., the program population and the selected EM&V group were both controlled). The date, time, event length, EM&V group controlled, appliances controlled, and mean event temperature (in °F) are shown in Table 2-1.

Table 2-1. Water Heater EM&V Sample Participation

Date	Start Time	End Time	Length of Event (Hours)	Average Event Temperature (°F)[18]	Appliance(s) Controlled	Population Event	Group
2017-12-07	6:30	9:00	2.5	39	WH and HS[19]	No	A
2017-12-08	6:30	9:00	2.5	35	WH and HS	No	B
2017-12-13	6:30	8:30	2	24	WH and HS	No	A
2017-12-15	6:30	8:30	2	30	WH and HS	No	B
2017-12-20	6:30	8:30	2	53	WH Only	No	B
2017-12-21	6:30	8:30	2	49	WH Only	No	A
2017-12-27	6:30	8:30	2	31	WH and HS	No	A
2017-12-28	6:30	8:30	2	23	WH and HS	No	B
2018-01-02	6:30	9:30	3	10	WH and HS	Yes	A
2018-01-05	6:30	9:30	3	13	WH and HS	Yes	B
2018-01-07	6:00	9:00	3	10	WH and HS	Yes	A
2018-01-08	6:00	7:30	1.5	28	WH and HS	Yes	B
2018-01-15	6:00	10:00	4	22	WH and HS	Yes	A
2018-01-18	6:00	9:00	3	13	WH and HS	Yes	B
2018-01-24	6:00	9:00	3	31	WH and HS	No	B
2018-01-25	6:00	9:00	3	28	WH and HS	No	A
2018-01-30	6:00	9:00	3	29	WH and HS	No	B
2018-01-31	6:00	9:00	3	22	WH and HS	No	A
2018-02-07	6:00	9:00	3	47	WH and HS	No	B
2018-02-08	6:00	9:00	3	34	WH and HS	No	A
2018-02-12	6:00	9:00	3	56	WH Only	No	B
2018-02-16	6:00	9:00	3	63	WH Only	No	A
2018-02-19	6:00	9:00	3	50	WH Only	No	A
2018-02-20	6:00	9:00	3	57	WH Only	No	B
2018-02-27	6:00	9:00	3	34	WH Only	No	B
2018-03-02	6:00	9:00	3	43	WH Only	No	A

[17] Navigant used this RCT-style evaluation approach to evaluate DEP's EnergyWise Home program for the summer of 2016.

[18] Average event temperature shown here is the average event temperature to which all heat strip participants included in the analysis were subject during the event on days in which heat strips were controlled. On event days in which heat strip participants were not curtailed, the average temperature is the average event temperature to which water heater participants included in the analysis were subject.

[19] WH = water heater, HS = heat strips

Sources: Navigant logger data, DEP event schedule data, and National Oceanic and Atmospheric Administration (NOAA) temperature data

2.1.2 Data Used for Impact Evaluation

The impact evaluation made use of three sources of data:

- **Logger data.** Five-minute interval logger data from loggers connected to each participating unit in an EM&V participant's home. These data were aggregated to quarter-hourly frequency for the analysis.
- **Event scheduling data.** The schedule of events deployed to the program population and the EM&V groups.
- **NOAA weather data.** Outdoor temperature data were drawn from 15 NOAA weather stations in the DEP service territory. Each participant's ZIP code was used to locate the eight most proximate NOAA stations to that ZIP code. Values from these stations were averaged on an hourly basis to deliver a complete and consistent series[20] of weather values. These values were then interpolated across the quarter-hourly intervals to deliver a separate quarter-hourly weather series for each participant ZIP code. The complete list of weather stations used may be found in Appendix D (attached as a separate Excel spreadsheet).

2.1.3 Data Collection

In November 2017, the evaluation team installed data loggers at a sample of homes in the service territory. Of the 121 data loggers deployed, 79 logged auxiliary heat strips and 42 logged water heaters. The data loggers were set to log at 5-minute intervals. Navigant reset the EnergyWise switch event counter and curtailment timer during the logger installation visit using the IntelliPORT device and readout the event counter and curtailment tier during the retrieval visit.

The evaluation team visited a total of 100 residences during the deployment of the data loggers. Of these:

- There were six sites at which data logger installation was not possible due to the customer not being at home, poor access, impending heat pump replacement planned, etc.
- There were fourteen sites at which the switch that controls equipment cycling was either non-functional or disconnected. Because the switch did not appear to be functional, logging was not conducted at these sites.

Navigant selected the EM&V sample size to target a relative precision of ±10% at the 90% confidence level based on the previous evaluations in PY2011 and PY2014.

2.1.4 Data Quality Control

Upon retrieval, Navigant downloaded and batch-processed the data loggers. The quality control (QC) process involved three steps: visual inspection of each logger file, visual inspection of field photographs and notes, and discarding of bad data. First, the evaluation team plotted all logger interval data for inspection. If data appeared suspect, the team reviewed the field photographs and notes to determine

[20] Weather stations often include many missing values in their weather series, particularly for values such as dewpoint and windspeed.

the cause for the bad data. In all cases where the team identified a problem with the data, it was discarded.

2.2 Method for Estimating Device Responsiveness to Curtailment Signal

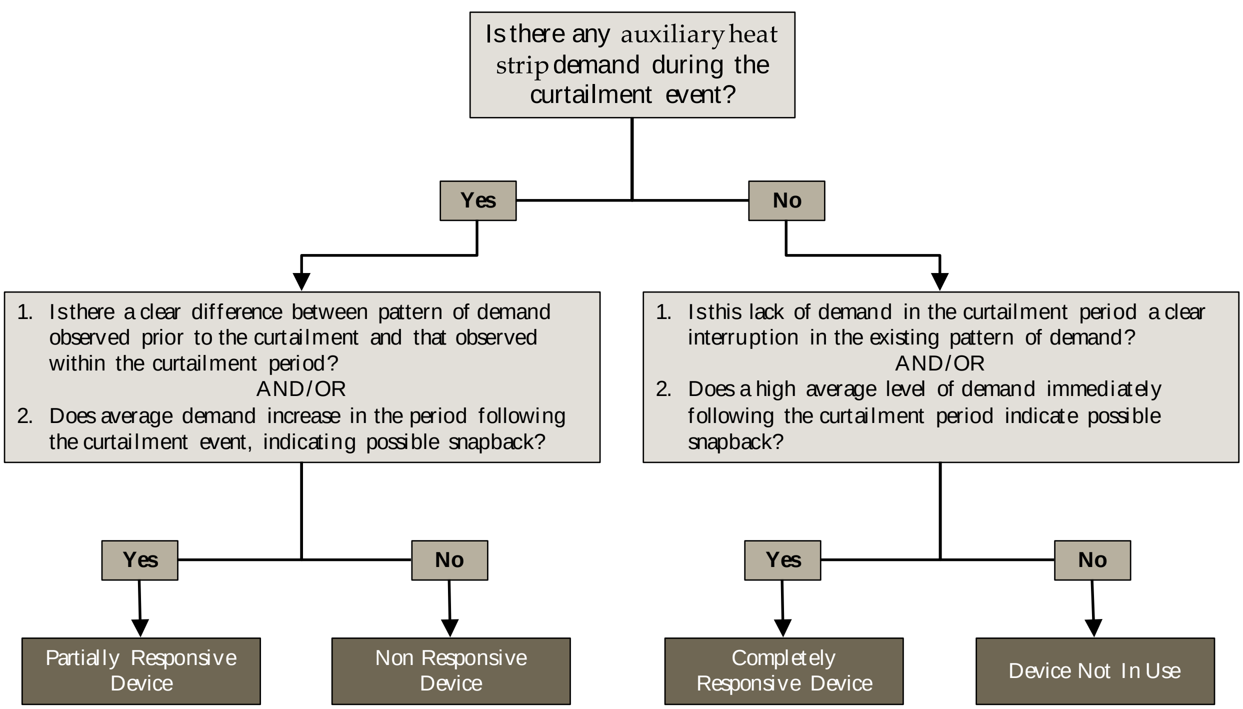
As part of its evaluation of the EnergyWise program, Navigant estimated the share of auxiliary heat strips that failed to respond to DEP's control signal. The evaluation team also estimated the share of water heaters that failed to respond to the control signal. This section provides the details of how this was carried out.

The team assigned heat strips to one of the four dispositions defined below:

1. **Responsive:** During the given event, the device was completely responsive to the signal to curtail.
2. **Partially Responsive:** During the given event, the device showed evidence of response to the curtailment signal but also showed evidence of some demand occurring during the event.
3. **Non-Responsive:** During the given event, the device showed no evidence of response to the curtailment signal.
4. **Device Not in Use (DNU):** During the given event (and across the whole day), the device showed no evidence of being in use, meaning that even if it were to be responsive, it would not deliver any DR.

Navigant assigned the heat strips to each of these categories by examining a data plot of the raw 1-minute interval logger data for each device/curtailment event pair. The team determined assignment for each pair using the decision tree shown in Figure 2-1.

Figure 2-1. Decision Tree for Responsiveness Analysis



To determine the disposition of water heaters, the evaluation team employed a simpler method: any water heater with an average event demand of more than 0.5 kW was determined to be non-responsive to the curtailment signal for the given event and was used in the control group for that event.

2.3 Method for Estimating Impacts

The evaluation team used an econometric technique known as a fixed effects regression to estimate the impacts of the devices curtailed. Fixed effects regression is a form of linear regression commonly used to estimate the impact of DR programs. The technique is applied to a set of observations of some variable of interest (in this case electricity demand) from several different individuals (i.e., program participants)—also known as longitudinal or panel data—over time.

Fixed effects regression assigns each individual appliance its own dummy variable. In this way, the evaluation team may control for each individual's time-invariant characteristics such as the size of a participant's home, its orientation, etc. The fixed effects regressions were applied to quarter-hourly data.

Heat strip impacts were estimated as a function of the 3-hour exponential moving average of heating degree quarter-hours and the relative hour of the event (e.g., the first quarter-hour of the event, the second quarter-hour of the event, etc.). Water heater impacts were estimated as a function of the time of day (e.g., the quarter-hour between 8:15 and 8:30, the quarter-hour between 8:30 and 8:45, etc.)

Impacts were only estimated for fully or partially responsive heat strips and for fully responsive water heaters.[21] Non-responsive devices were included in the regression and augmented the control group. Heat strips determined to DNU were excluded entirely from the regression. Note that this means the regression parameters deliver an estimated impact only for responsive devices and that these impacts must be adjusted to reflect the percentage of devices that were non-responsive, DNU,[22] or not connected.[23]

Formal model specifications with additional input variable detail may be found in Appendix B of this report.

2.4 Participant Perceptions Evaluation Method

In parallel with the impact evaluation activities discussed earlier in this report, Navigant also conducted a process evaluation of the program to understand the participant experience. The primary source of data for the process portion of this evaluation was a series of phone surveys that were fielded to a sample of EnergyWise participants immediately following DR events and a placebo event where no real event was called but participants were asked similar questions. Surveys were administered to a sample of participants from the broader program population, and those in the EM&V group for the impact evaluation were excluded. The survey was designed to:

- Assess participant understanding, satisfaction, and attitudes about the program

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[21] No water heaters were classified as partially responsive.

[22] Note that the proportion of devices not in use for any given day is a function of temperature. This is reflected in the proportion of devices assumed to not be in use to predict capability.

[23] As part of the field work, when technicians were deploying data loggers they confirmed whether a physical wired connection existed between the appliance being controlled and the direct load control (DLC) switch. Where no connection was present, the information was collected, but no data logger was deployed. Of heat strips, 4% were not connected. All water heaters were connected.

- Assess participant awareness and comfort during DR events

The survey was fielded by telephone directly following the first, second, and fourth program-wide DR events of the winter 2017/2018 season, as well as one placebo day—a day when the weather was cold but no DR event was called. Fielding was completed within 48 hours of the end of the event.

An evaluation team completed 401 telephone surveys. Table 2-2 provides a summary of the completed surveys by date and event status.

Table 2-2. Summary of Telephone Survey Completes

	Event: January 2, 2018	Event: January 5, 2018	Event: January 8, 2018	Placebo: January 31, 2018
Survey completes	100	100	101	100
Mean temperature[24] (°F) between 7:00 and 9:00	9	12	28	22

Source: Navigant analysis

A more comprehensive disposition of the survey attempts is shown in Table 2-3.

Table 2-3. Complete Disposition Report of Telephone Surveys

Survey Disposition	Total
Saved callback (mid-survey)	225
No answer	857
Busy	66
Disconnect/wrong #/blocked #	330
Business/government	29
Deaf/language barrier	25
Answering machine	2,505
Initial refusal (Opted Out)	45
Respondent refused	406
Callback for correct person	122
Changed number	1
Complete	**401**
Total	**5,012**

The survey achieved a relative precision ±3% at the 90% confidence level for key quantitative outcomes.

[24] Average across all EM&V participant ZIP codes.

3. IMPACT FINDINGS

The discussion of program impacts on winter demand is divided into the following sections:

1. **Historical Estimated Impacts.** This section provides the estimated impacts of heat strip and water heater curtailment during both population and EM&V events.
2. **Forecast Curtailment Capability.** This section provides the estimated DR capability of heat strips and water heaters across a variety of different temperatures (heat strips) and times of day (water heaters).
3. **Partially Responsive Heat Strips: Defrost Cycling.** The section reports on Navigant's findings with respect to the probable cause of some heat strips only partially responding to DEP's curtailment signal.
4. **Net-to-Gross.** This section outlines why the appropriate net-to-gross factor for this program should be 1.

The evaluation team's principal findings regarding winter event demand impacts are as follows:

- **The current DR capability of DEP's EnergyWise program in the winter is approximately 13 MW.** This is the sum of the projected program capability of 7.2 MW from heat strip curtailment when the average temperature is 10°F and 5.6 MW from water heater curtailment deployed between 8:00 and 9:00 on winter mornings.
- **The estimated average program impact of the six population events deployed in the winter of 2017/2018 was approximately 11 MW.** This is the sum of the estimated average impact of 6.7 MW from heat strips where the average event temperature was slightly less than 16°F and an estimated average impact of 4.1 MW from water heaters where events began as early as 6:00 and ended as late as 10:00 in the morning.
- **The estimated impact per set of heat strips (that responded in some way to DEP's curtailment signal) controlled during the population events was 2.77 kW, and the estimated impact per responsive water heater during the same events was 0.41 kW.** On the coldest event (January 7, 2018) the average impact per responsive, including both fully and partially responsive, set of heat strips was 3.1 kW. The reason why the average water heater population event impact was lower than the projected capability is due to the differing time-spans – population events could start as early as 6:00 and end as late as 10:00, whereas the population capability was calculated assuming an event from 8:00 to 9:00.
- **Navigant's investigation into the cause of why some heat strips were only partially responsive during curtailment events concluded that this behavior was driven by a heat pump's auto-defrost cycle.** Navigant logged heat pump compressors as well as heat strips to test the hypothesis that partial response was a result of a heat pump's defrost cycle periodically overriding the control signal. If this were the cause of the partial response, the expectation would be that the demand spikes characteristic of partial response would be coincident with a shutdown of the compressor fan to thaw the compressor coils. The evaluation team confirmed that this was the case, and that partial response (as defined here) was a result of the defrost cycle.
- **On average, of heat strips in use on the event day, approximately 40% were fully responsive to the curtailment signal and approximately 20% were partially responsive.** The percentage of devices not in use varied significantly across events and was correlated with outdoor temperature. During the four events in which the average event temperature was less

than 15°F, 13% of heat strips expected to curtail were not in use, on average. In contrast, for the six events in which the average temperature was between 30°F and 40°F, 41% of heat strips were not in use, on average.

The key outputs—estimated capability (sometimes referred to as ex ante impacts) and the historical actual program population impacts (also referred to as ex post)—are summarized in Table 3-1.

This table provides the average per appliance impact for appliances that were in some way responsive to DEP's curtailment signal (left-most numeric column) and the overall program average and totals (right-most columns). The difference between these two values is captured by the factors shown in the columns between those two estimated sets of impacts:

- The percentage of appliances that were **non-responsive** to the curtailment signal (determined as described above using the appliance logger data)
- The percentage of appliances that were **not in use** at the time of the event (determined as described above using the appliance logger data)
- The percentage of appliances observed by the field deployment team that were **not physically connected** to the direct load control (DLC) switch.[25]

Table 3-1. Summary of Capability and Historical Population Impacts

	Appliance Type	Impact per Appliance (kW)*	Relative Precision (+/- %)	% Non-Responsive	% Not in Use	% Not Connected	Pop. Avg. Impact per Appliance (kW)	Total Program Impact (MW)
Projected Capability (Ex Ante)	Heat Strips	**3.11**	20%	26%	13%	4%	**1.39**	**7.2**
	Water Heaters	**0.57**	21%	5%	0%	0%	**0.54**	**5.6**
Population Impact - Winter 2017/2018 (Ex Post)	Heat Strips	**2.77**	8%	32%	19%	4%	**1.30**	**6.7**
	Water Heaters	**0.41**	9%	4%	0%	0%	**0.40**	**4.1**

*Includes only partially or fully responsive appliances.
Relative precision is estimated at the 90% confidence level.
Source: Navigant analysis

The principal differences between the projected capability and population historical impacts are summarized in Table 3-2.

[25] Appliances not connected to a DLC switch were not logged.

Table 3-2. Differences Between Projected Capability and Historical Population Impact

Metric/Assumption	Projected Capability (Ex Ante)	Population Impact – Winter 2017/2018 (Ex Post)
Average event temperature for heat strip events (°F)	10[26]	15.8
Timing of water heater event	8:00-9:00[27]	Mixed Events started as early as 6:00 and as late as 6:30 Events ended as early as 7:30 and as late as 10:00
Non-responsive rate (all appliances)	Average across all EM&V events, grouped by temperature band	Event-specific non-responsiveness rate
DNU rate (heat strips only)	Average across all EM&V events, grouped by temperature band[28]	Event-specific DNU rate

Sources: DEP program staff, Navigant analysis

Navigant conducted its analysis at the appliance level, rather than the customer level. Although the impact per customer and the impact per appliance are very close, there are, on average, slightly more than one appliances controlled per household. The table immediately below provides the average number of appliances controlled per participating customer household[29] and the average impact per customer for responsive (fully or partially) devices and for the population average as a whole (i.e., accounting for non-responsive, non-connected, and not in use devices).

Table 3-3. Per Customer Impacts

	Appliance Type	Impact per Appliance (kW)*	Avg. # of Appliances per Customer	Impact per Customer (kW)*	Pop. Avg. Impact per Customer (kW)**
Projected Capability (Ex Ante)	Heat Strips	**3.11**	1.083	3.37	1.51
	Water Heaters	**0.57**	1.021	0.58	0.55
Population Impact - Winter 2017/2018 (Ex Post)	Heat Strips	**2.77**	1.083	3.00	1.40
	Water Heaters	**0.41**	1.021	0.42	0.40

**Includes only partially or fully responsive appliances*
***Accounts for devices not in use or not responsive to curtailment signal.*

Source: Navigant analysis and DEP program tracking data.

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[26] Specified by DEP staff as the appropriate temperature for evaluating system peak capability.

[27] Specified by DEP staff as the appropriate period of time for evaluating system peak capability.

[28] See Section 4.2.1for additional details.

[29] Derived from the population program tracking database.

3.1 Historical Estimated Impacts

Historical demand impacts are the impacts estimated by the evaluation team for the actual events that were called in the winter of PY2017/2018. This section is divided into three subsections:

- **Population Event Impacts.** This subsection summarizes the estimated program-level impacts of the six events called for the entire program population.
- **EM&V Event Impacts.** This subsection summarizes the average event impacts by event and EM&V group.
- **Load Profile Comparisons.** This subsection provides an illustration of EM&V participant load profiles during events, showing both actual demand and the counterfactual (i.e., the estimated baseline).

3.1.1 Population Event Impacts

This subsection (split into two parts) provides detail regarding the average event impacts for the six events to which the entire program population was subject. The first part presents the program-level impacts for curtailed heat strips and the second presents the program-level impacts for curtailed water heaters.

3.1.1.1 Heat Strip Program-Level Impacts

The full population of EnergyWise participants was subject to six events in the winter of PY2017/2018. The estimated program total (in MW) and average per appliance (in kW) event demand impact for all six heat strip curtailment events is provided in Table 3-4. This table includes the event-specific factors used to adjust the regression-estimated impacts (non-responsive rate, etc.) and the average event temperature.

Table 3-4. Heat Strip Population Event Impacts

Event Date	Avg. Event Temperature (°F)	Impact per Appliance (kW)*	Relative Precision (+/- %)	% Non-Responsive	% Not in Use	% Not Connected	Pop. Avg. Impact per Appliance (kW)	Total Program Impact (MW)
2018-01-02	10	**3.15**	20%	41%	9%	4%	**1.51**	**7.8**
2018-01-05	13	**3.05**	20%	44%	13%	4%	**1.27**	**6.6**
2018-01-07	9	**3.10**	20%	38%	19%	4%	**1.30**	**6.7**
2018-01-08	27	**2.34**	20%	6%	28%	4%	**1.47**	**7.6**
2018-01-15	22	**2.13**	22%	25%	34%	4%	**0.83**	**4.3**
2018-01-18	14	**2.85**	20%	41%	9%	4%	**1.36**	**7.0**

*Impact per responsive/partially responsive appliance.
Sources: Navigant logger data and analysis, NOAA weather data

3.1.1.2 Water Heater Program-Level Impacts

The estimated program total (in MW) and average per appliance (in kW) event demand impact for all six water heater curtailment events is provided in Table 3-5. This table includes the event-specific factors used to adjust the regression-estimated impacts (non-responsive rate, etc.) and the event start and end times.

Table 3-5. Water Heater Population Event Impacts

Event Date	Event Start Time	Event End Time	Impact per Appliance (kW)*	Relative Precision (+/- %)	% Non-Responsive	Pop. Avg. Impact per Appliance (kW)	Total Program Impact (MW)
2018-01-02	6:30	9:30	**0.50**	21%	6%	**0.46**	**4.8**
2018-01-05	6:30	9:30	**0.50**	21%	10%	**0.45**	**4.6**
2018-01-07	6:00	9:00	**0.38**	25%	6%	**0.36**	**3.7**
2018-01-08	6:00	7:30	**0.23**	32%	0%	**0.23**	**2.4**
2018-01-15	6:00	10:00	**0.47**	20%	0%	**0.47**	**4.8**
2018-01-18	6:00	9:00	**0.38**	25%	0%	**0.38**	**4.0**

*Impact per responsive appliance.
Sources: Navigant logger data and analysis

3.1.2 EM&V Event Impacts

This subsection details the average event impacts for all events (26 for water heaters, 18 for heat strips) to which the EM&V participants were subject. These estimated impacts reflect the characteristics of the entire sample included in the regression equation—e.g., the average weather affecting all EM&V participants, the average relationship across all EM&V participants between DR impacts and the time of day, etc.[30]

This subsection is divided into two parts. The first presents the impacts for curtailed heat strips during the 18 heat strip EM&V events; the second part presents the impacts for curtailed water heaters during the 26 water heater EM&V events.

3.1.2.1 Heat Strip Curtailment Impacts

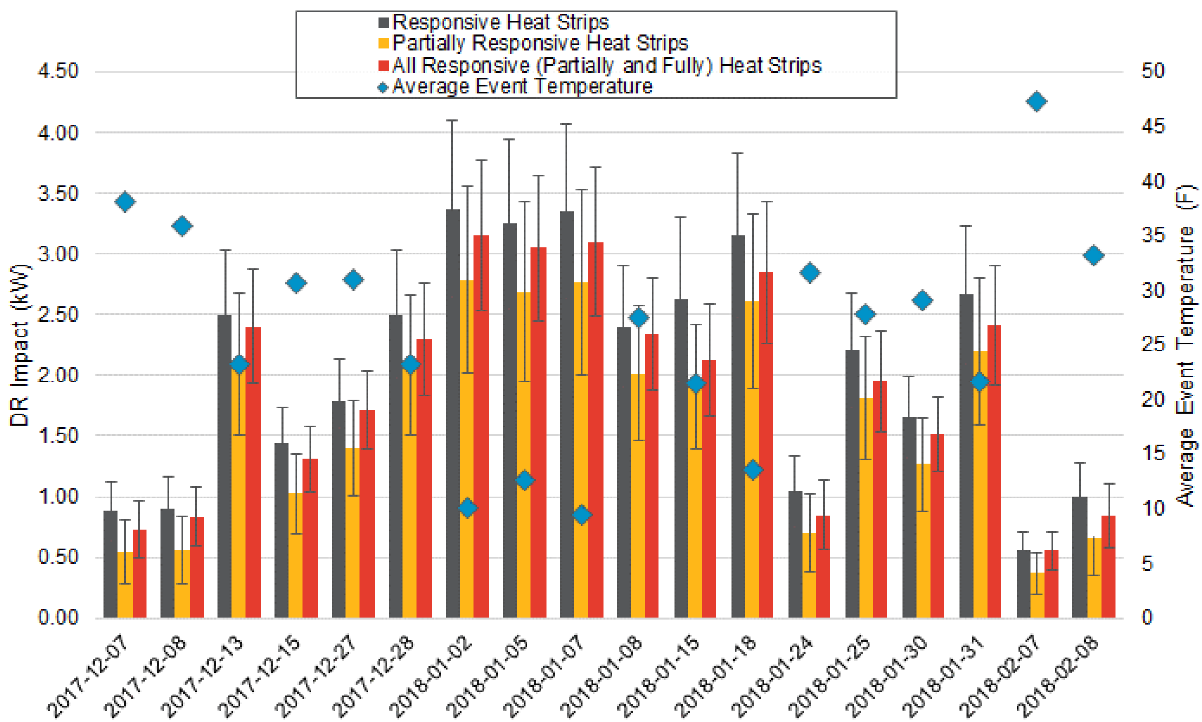
Figure 3-1 provides a graphical summary of the estimated DR impact of heat strip curtailment for all 18 heat strip curtailment events. Each vertical bar represents the average event DR impact of the following:

- Fully responsive heat strips (grey)
- Partially responsive heat strips (yellow)
- The weighted (reflecting the distribution of partially and fully responsive appliances) average impact (red)

Event average temperatures are captured by the blue diamonds, scaled to the right-hand vertical axis. The whiskers attached to the columns capture the 90% confidence interval of the estimated impacts.

[30] Put another way, the estimated impacts presented in this sub-section are the estimated impact had all EM&V participants (representative of the program population) been subject to each curtailment event as opposed to only the proportion represented by Group A or Group B. This is to ensure that EM&V event impacts are presented in a manner that is consistent with the population impacts.

Figure 3-1. Average Heat Strip Event Impacts by Disposition



Source: Navigant analysis, and NOAA data

Impacts are substantially higher at the lowest observed temperatures than they are at higher temperatures. These estimated impacts are only for those heat strips that responded to the curtailment signal and do not account for the percentage of heat strips that were non-responsive, not in use, or not connected. The average population impact per controlled set of heat strips that accounts for these effects is presented in Table 3-6.

Table 3-6. Average Heat Strip Impacts by EM&V Curtailment Event

Event Date	DR Impacts (kW)			Avg. Event Temperature (°F)	% Non-Responsive	% Not in Use	% Not Connected	Avg. Impact per Appliance (kW)
	Responsive Heat Strips	Partially Responsive Heat Strips	All Responsive (Partially and Fully) Heat Strips					
	A	B	C	D	E	F	G	H = C*(1-(E+F))*(1-G)
2017-12-07	0.88	0.54	0.73	38	13%	59%	4%	**0.20**
2017-12-08	0.91	0.56	0.83	36	22%	34%	4%	**0.35**
2017-12-13	2.50	2.09	2.40	23	13%	34%	4%	**1.22**
2017-12-15	1.45	1.03	1.31	31	38%	25%	4%	**0.47**
2017-12-27	1.78	1.40	1.71	31	9%	38%	4%	**0.87**
2017-12-28	2.50	2.09	2.29	23	31%	25%	4%	**0.96**
2018-01-02	3.37	2.79	3.15	10	41%	9%	4%	**1.51**
2018-01-05	3.25	2.68	3.05	13	44%	13%	4%	**1.27**
2018-01-07	3.35	2.77	3.10	9	38%	19%	4%	**1.30**

2018-01-08	2.40	2.02	2.34	27	6%	28%	4%	**1.47**
2018-01-15	2.63	1.91	2.13	22	25%	34%	4%	**0.83**
2018-01-18	3.16	2.61	2.85	14	41%	9%	4%	**1.36**
2018-01-24	1.05	0.70	0.85	32	31%	47%	4%	**0.18**
2018-01-25	2.21	1.81	1.95	28	19%	47%	4%	**0.64**
2018-01-30	1.66	1.27	1.51	29	31%	44%	4%	**0.36**
2018-01-31	2.66	2.20	2.41	22	31%	34%	4%	**0.79**
2018-02-07	0.56	0.37	0.56	47	3%	94%	4%	**0.02**
2018-02-08	1.00	0.66	0.85	33	28%	44%	4%	**0.23**

Source: Navigant analysis

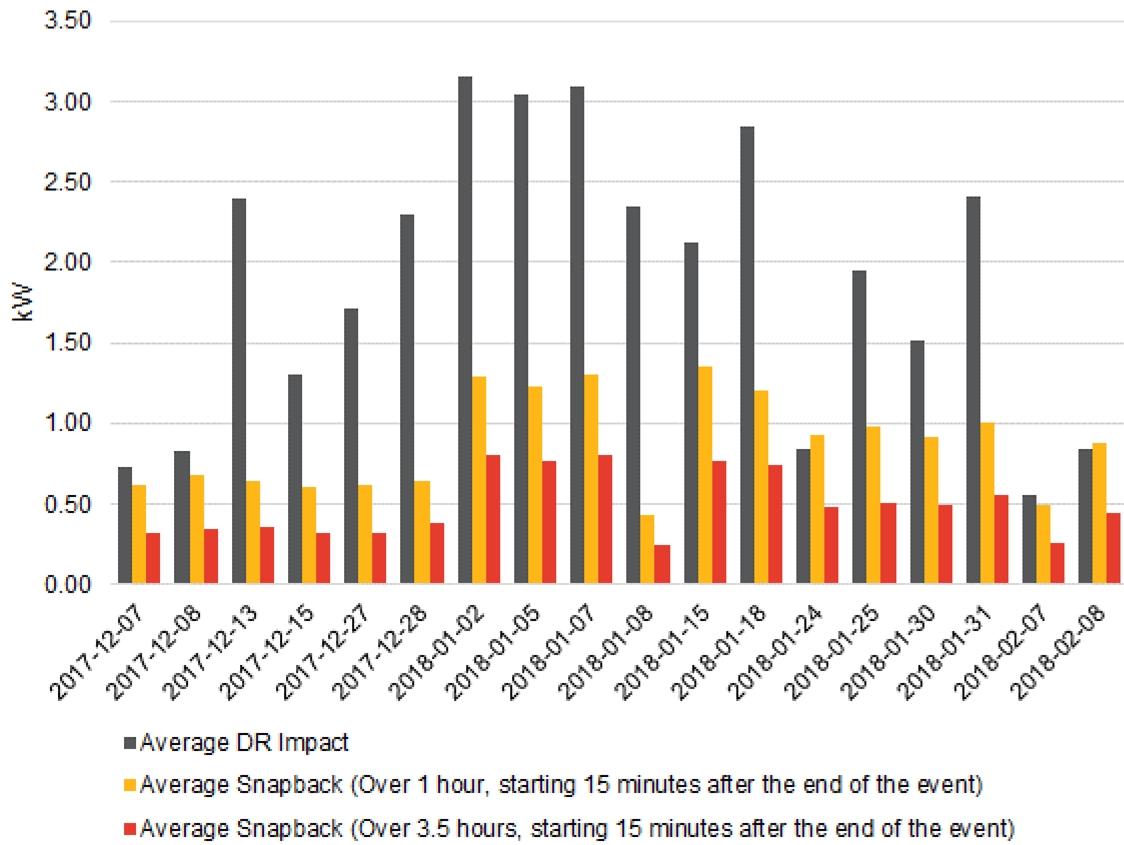
A key feature of DLC DR programs is the phenomenon known as "snapback". This refers to the period of elevated appliance demand that immediately follows a DR event. This reflects the additional load placed on the appliance to return the home to the thermostat setpoint temperature in the period following the event (in which many homes would have cooled below the setpoint due to heat strip curtailment).

Figure 3-2 shows the average DR impact of each heat strip event (for partially and fully responsive heat strips, grey column) as well as the following:

- The average snapback in the first hour beginning 15 minutes after the end of the DR event (yellow column).
- The average snapback in the 3.5 hours beginning 15 minutes after the end of the DR event (red column).

The 15-minute gap between the end of the event and the beginning of the period in which snapback is reported is to accommodate appliance ramping (some appliances may still be curtailing during this period).

Figure 3-2. Heat Strip DR and Snapback Impacts

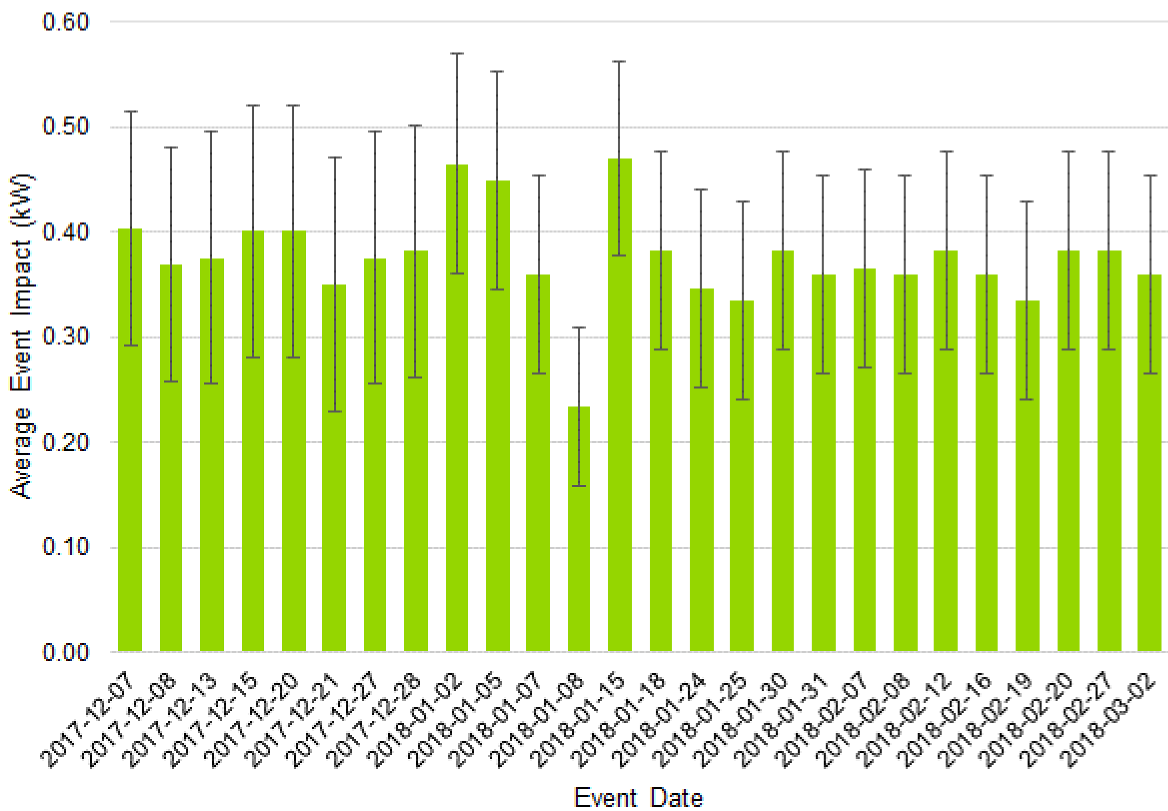


Quarter-hourly snapback and DR impacts are not presented above for reasons of concision but may be found as tables in Appendix D, the Excel spreadsheet document attached to this report.

3.1.2.2 Water Heater Curtailment Impacts

Figure 3-3 provides a graphical summary of the estimated DR impact of water heater curtailment for all 26 water heater curtailment events. Each vertical bar represents the average event DR impact of fully responsive water heaters. The whiskers attached to the columns capture the 90% confidence interval of the estimated impacts.

Figure 3-3. Average Water Heater Impacts



These estimated impacts are only for those water heaters that responded to the curtailment signal and do not account for the percentage of water heaters that were non-responsive. The average population impact per controlled water heater that accounts for these effects is presented in the right-most column of Table 3-7.

Table 3-7. Average Water Heater Impacts by EM&V Curtailment Event

Event Date	Event Start Time	Event End Time	Avg. Impact per Responsive Appliance (kW)	% Non-Responsive	Avg. Impact per Appliance (kW)
2017-12-07	6:30	9:00	0.43	6%	0.40
2017-12-08	6:30	9:00	0.43	14%	0.37
2017-12-13	6:30	8:30	0.40	6%	0.38
2017-12-15	6:30	8:30	0.40	0%	0.40
2017-12-20	6:30	8:30	0.40	0%	0.40
2017-12-21	6:30	8:30	0.40	13%	0.35
2017-12-27	6:30	8:30	0.40	6%	0.38
2017-12-28	6:30	8:30	0.40	5%	0.38
2018-01-02	6:30	9:30	0.50	6%	0.46
2018-01-05	6:30	9:30	0.50	10%	0.45
2018-01-07	6:00	9:00	0.38	6%	0.36

Event Date	Event Start Time	Event End Time	Avg. Impact per Responsive Appliance (kW)	% Non-Responsive	Avg. Impact per Appliance (kW)
2018-01-08	6:00	7:30	0.23	0%	0.23
2018-01-15	6:00	10:00	0.47	0%	0.47
2018-01-18	6:00	9:00	0.38	0%	0.38
2018-01-24	6:00	9:00	0.38	10%	0.35
2018-01-25	6:00	9:00	0.38	13%	0.34
2018-01-30	6:00	9:00	0.38	0%	0.38
2018-01-31	6:00	9:00	0.38	6%	0.36
2018-02-07	6:00	9:00	0.38	5%	0.36
2018-02-08	6:00	9:00	0.38	6%	0.36
2018-02-12	6:00	9:00	0.38	0%	0.38
2018-02-16	6:00	9:00	0.38	6%	0.36
2018-02-19	6:00	9:00	0.38	13%	0.34
2018-02-20	6:00	9:00	0.38	0%	0.38
2018-02-27	6:00	9:00	0.38	0%	0.38
2018-03-02	6:00	9:00	0.38	6%	0.36

Source: Navigant analysis

A key feature of DLC DR programs is the phenomenon known as “snapback”. This refers to the period of elevated appliance demand that immediately follows a DR event. This is especially pronounced in water heaters and is characterized by a very short spike in demand immediately following the end of the curtailment period.

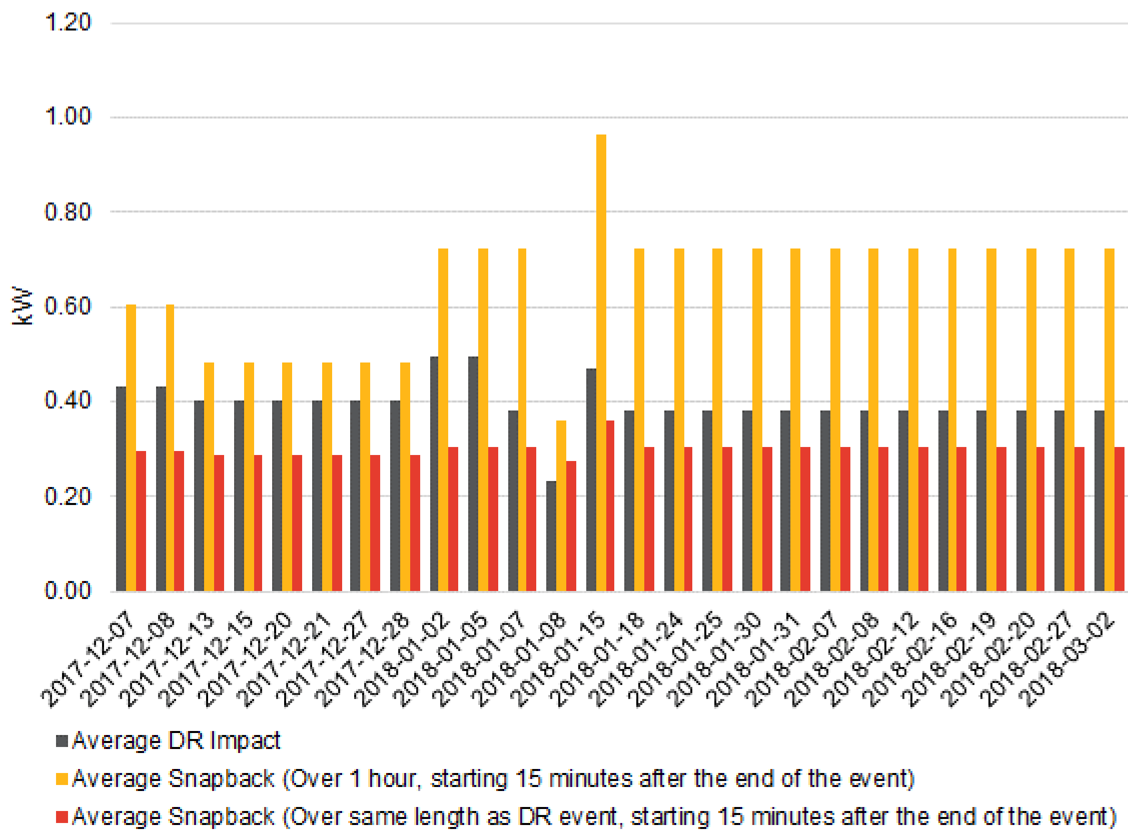
This demand spike, although quite short in length, will exceed the average DR impact. This reflects the mechanics of the heating system, which works to restore tank setpoint temperature as quickly as possible. Often doing so requires using a second heating element that is not normally required. This spike is evident in the example load profile provided below in sub-section 3.1.3 and is reflected in the average snapback impact in the period following curtailment (see Figure 3-4).

Figure 3-4 shows the average DR impact of each water heater event (grey column) as well as the following:

- The average snapback in the first hour beginning 15 minutes after the end of the DR event (yellow column).
- The average snapback covering the length of the DR event itself, beginning 15 minutes after the end of the DR event (e.g., if the event was 3 hours long, then this is the average DR impact across 3 hours) (red column).

The 15-minute gap between the end of the event and the beginning of the period in which snapback is reported is to accommodate appliance ramping (some appliances may still be curtailing during this period).

Figure 3-4. Water Heater DR and Snapback Impacts



3.1.3 Load Profile Comparisons

It is Navigant's standard practice in DR evaluations to provide one or more plots of average actual and counterfactual (i.e., model-predicted baseline) participant demand during DR events. These plots are particularly useful in providing a more intuitive understanding of the processes driving the results presented above. This subsection is divided into two parts. The first part provides the load profile comparison for heat strips, while the second provides the load profile comparison for water heaters.

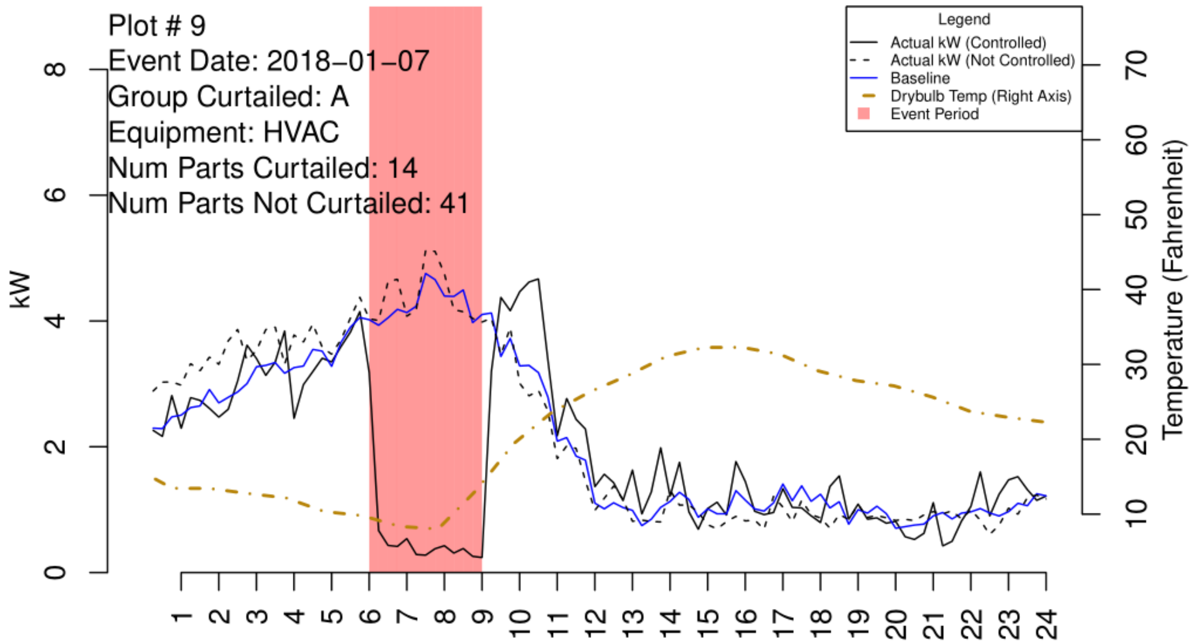
3.1.3.1 Heat Strip Load Profile Comparison

Two examples of event load profile plots for heat strips are provided below. The first, Figure 3-5, shows load profiles associated with the coldest event observed as part of this study, occurring on Sunday, January 7.

- The **solid black line** indicates average heat strip demand for those heat strips that were partially or fully responsive to DEP's signal to curtail (note the deep trough during the event period).
- The **blue line** is what the model predicted demand would have been had no event been called. This is baseline, or counterfactual, heat strip demand.
- The **dashed black line** shows the actual average heat strip load of the control group (in this case Group B heat strips and those Group A heat strips that did not respond to the signal to curtail).

- The **dash-dotted yellow line** shows the average outdoor temperature (right axis).

Figure 3-5. Heat Strip Load Shape Comparison: January 7, 2018



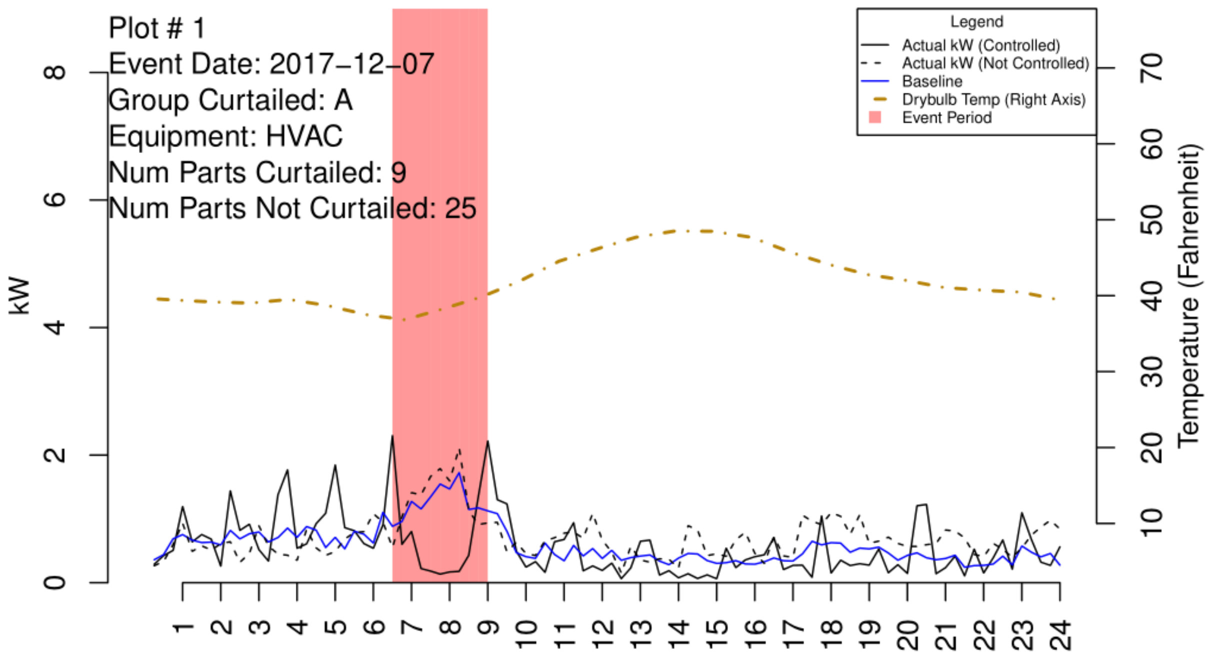
Source: Navigant logger data and analysis

Note how closely the dashed blue line tracks the solid black line prior to the curtailment period. This is a strong indication that the model is doing a good job of estimating the average heat strip baseline and thus the true average impact that the curtailment event is having across the group of EM&V participants during the DR event period.

The second example provided in Figure 3-6 is for the EM&V event that occurred on December 7, 2017. In contrast to the previous example (the coldest event), this is the second warmest of the EM&V events.[31] All of the data series represented in this plot follow the definitions of Figure 3-5. Like the plot above, the baseline closely tracks the participant actuals in the period immediately prior to the curtailment event and in the hours following the end of the snapback period.

[31] The warmest event, on February 7, 2018, is a poor example load profile to present for the purposes of assessing the average event impact graphically because the proportion of devices not in use was so high that only a single heat strip expected to curtail fell into either the responsive or partially responsive" category.

Figure 3-6. Heat Strip Load Shape Comparison: December 7, 2017

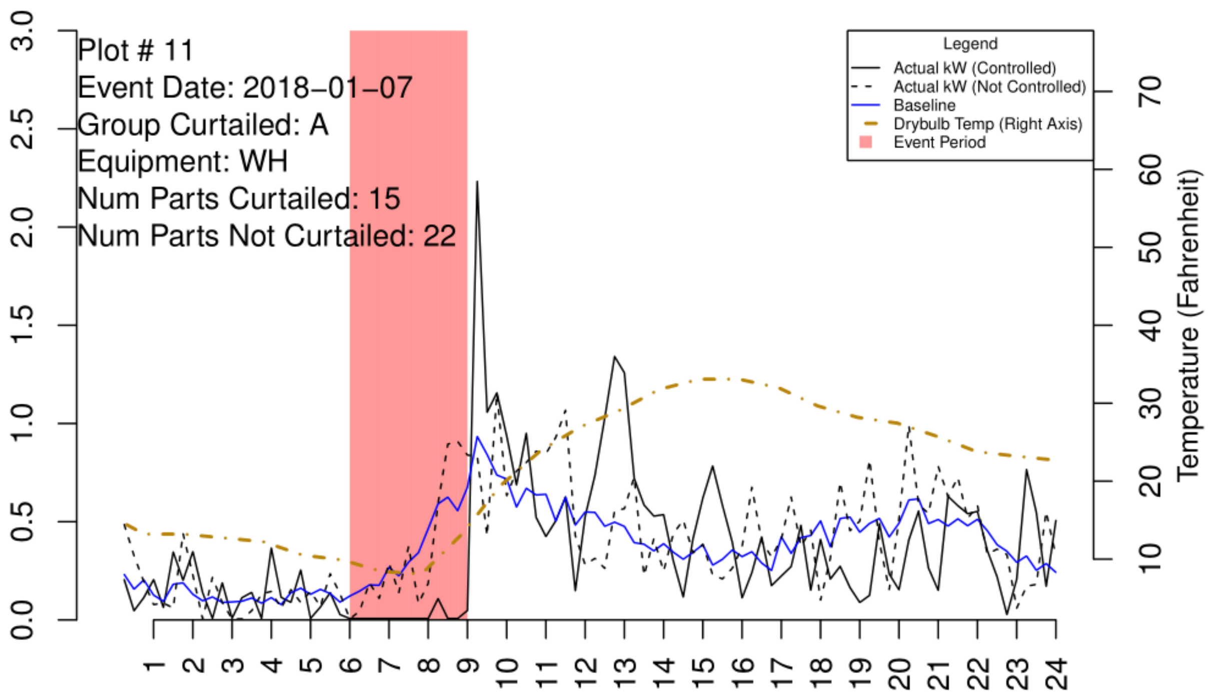


Source: Navigant logger data and analysis

3.1.3.2 Water Heater Load Profile Comparison

Figure 3-7 shows the water heater load profile on January 7, 2018 an event that lasted from 6:00 to 9:00. One key characteristic of water heater loads evident from this plot is the more volatile nature of their loads. These appliances tend to have either very high loads or very low loads; while an average demand of 0.4 kW is quite common, median loads tend to be very low, well below 0.1 kW (a function of the manner in which they operate). This characteristic may be observed in the very spiky loads shown in the plot below. Note, however, that the baseline (the blue line) traces smoothly through these loads with actuals (outside of periods affected by the event) being higher than the baseline as often as they are lower.

Figure 3-7. Water Heater Load Shape Comparison: January 7, 2018

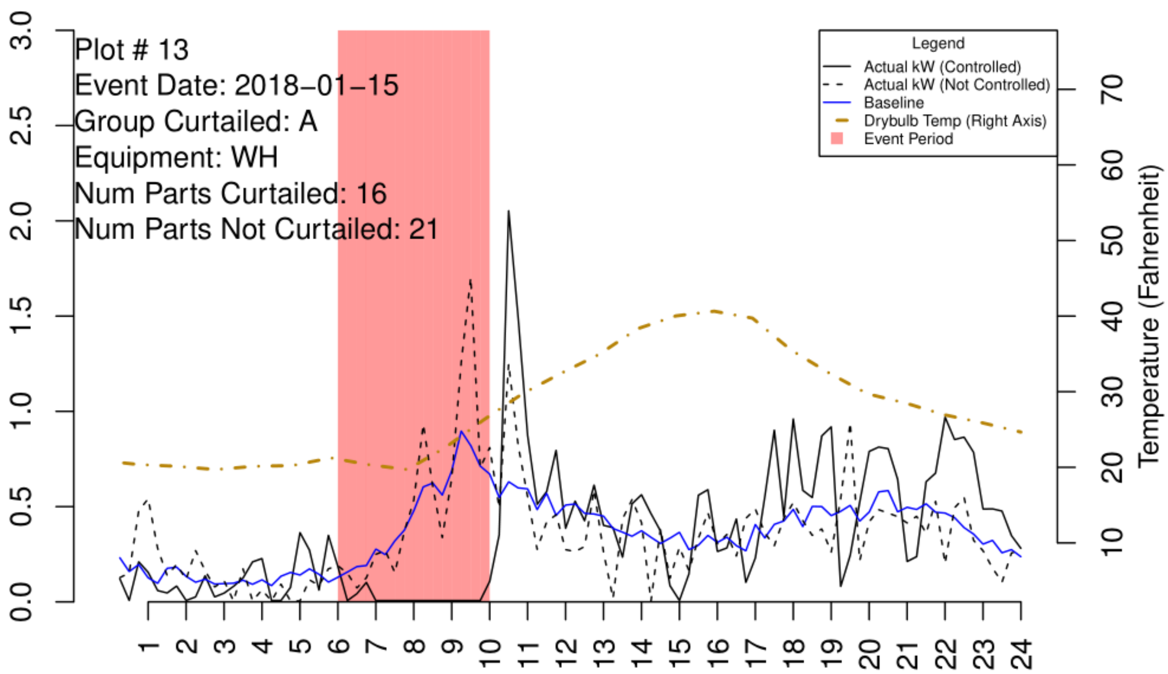


Source: Navigant analysis, and NOAA weather data

A few other key characteristics of water heater DR are evident from this comparison: the double-peaked nature of the load, morning loads peak at about the time (or shortly after) many residents would be expected to have completed their morning showers, and a sudden spike in demand immediately following the end of the event (snapback).

A second example load comparison plot, for January 15, 2018, is provided in Figure 3-8.

Figure 3-8. Water Heater Load Shape Comparison: January 15, 2018



Source: Navigant analysis, and NOAA weather data

3.2 Forecast Curtailment Capability

This section provides the estimated EnergyWise DR capability (sometimes referred to as the ex ante impacts), Navigant's projection of how much DR appliances and the program could offer at system peak conditions. This estimate of capability is based on the relationships between DR impacts and outdoor temperature (for heat strips) or time of day (water heaters).

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 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).

This section is divided into two subsections: the first details the projected DR capability of heat strips under different weather conditions, and the second details the projected DR capability of water heaters at different times of day.

3.2.1 Heat Strip DR Capability

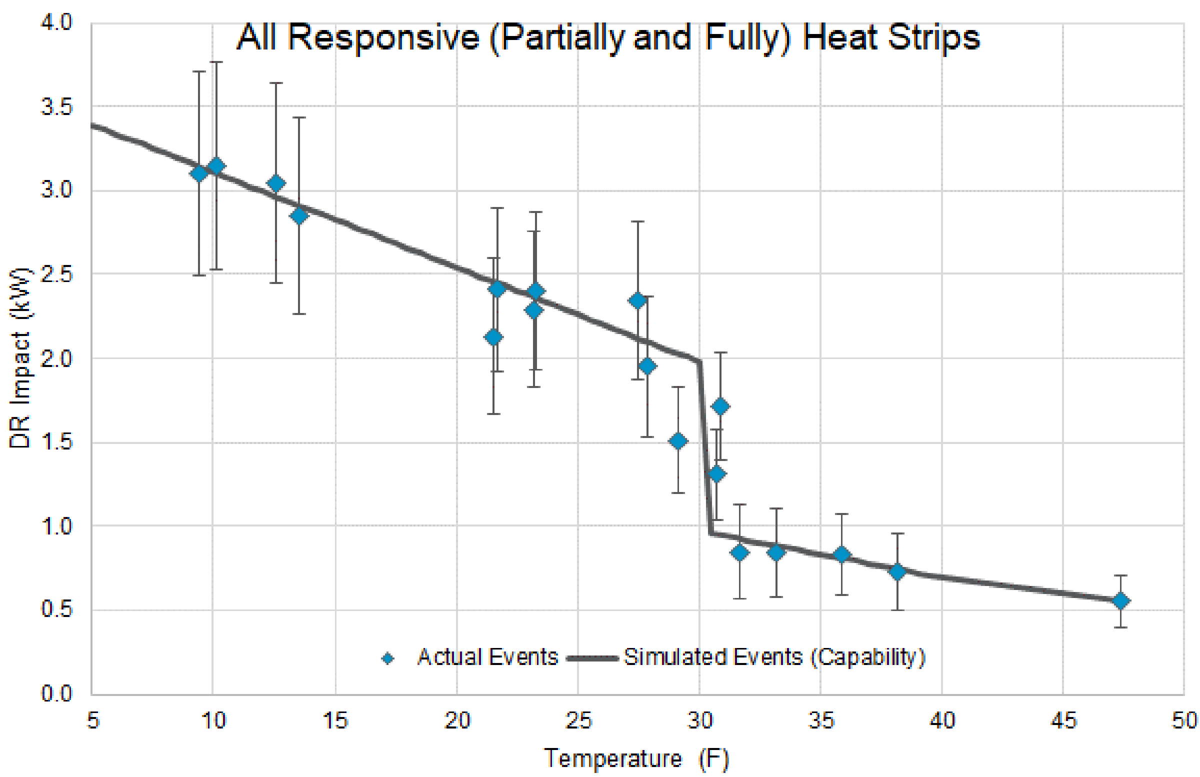
This subsection provides the projected capability of heat strips. This capability is projected by applying a series of temperature values to the estimated model parameters. Navigant's projected capability (shown in Figure 3-9) assumes that the temperature at which the capability is estimated: lasts the entire length of the event and is the same as the temperature in the 3 hours leading up to the event.

This second assumption is required due to the manner in which impacts are estimated. Because homes have thermal mass, a sudden swing in outdoor temperature does not immediately provoke a concomitant swing in heat strip load—it takes time for the building's indoor temperature to fall below the setpoint temperature because of that outdoor temperature swing. This is reflected in Navigant's estimation approach (see Appendix B for more details), where impacts are modeled as a function of a 3-hour exponential moving average of outdoor temperature. Therefore, projecting capability requires an assumption of what the temperature is in the 3 hours leading up to the event.

Figure 3-9 provides the average projected capability of all responsive devices[32] (partially and fully) from 5°F to 50°F (grey line). Actual estimated EM&V event impacts are represented on this chart as blue diamonds, with the 90% confidence interval around each estimate represented by the whiskers. The values underlying this plot may be found in Appendix D, the Excel spreadsheet that accompanies this report.

The capability of heat strips shows a significant discontinuity at 30°F. This reflects the highly nonlinear nature of heat strip demand and is captured in the model by two temperature splines (for more details, please refer to Appendix B).

Figure 3-9. Projected Average DR Capability per Responsive Heat Strip Installation



Source: Navigant analysis

As noted above, the projected capability shown in Figure 3-9 is the average capability per responsive appliance. To obtain the average population capability, values from the chart above must be adjusted by three factors:

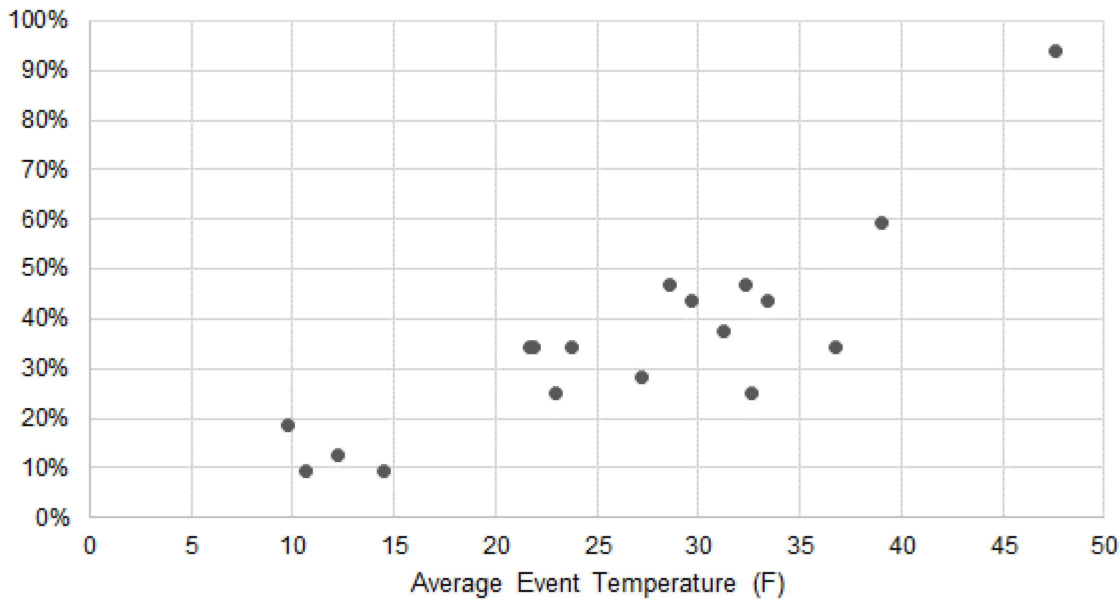
1. **Percentage of non-responsive devices.** On average, 26% of heat strips expected to curtail during the EM&V events failed to respond to DEP's signal to curtail.

[32] This represents the weighted average impact of partially and fully responsive devices based on the proportion of devices by disposition and event. Capability by disposition is provided in Appendix D, the Excel spreadsheet that accompanies this report.

2. **Percentage of devices not in use (DNU).** A material proportion of heat strips were not in use on EM&V event days. As would be expected, this proportion varies by temperature. The details of this adjustment are presented below.
3. **Percentage of devices not connected.** As part of Navigant's field work, all switch/appliance physical connections were inspected. As a result of this exercise, it was found that 4% of heat strips observed had no physical (wired) connection to the DLC switches.

Devices not in use on event days were excluded from the regression analysis to improve the precision of estimated impacts. This proportion of appliances must be accounted for in determining average population capability. The proportion of devices not in use on event days is a function of average temperature. This is shown in Figure 3-10, which plots the percentage of devices not in use for any given event against the average event temperature.

Figure 3-10. Scatterplot of Event-Specific Percentage of DNU and Average Event Temperature



Given this, Navigant developed the following four values to apply against the responsive capability estimate to obtain the population capability estimate. Each factor is the average of the proportion of heat strips not in use for the events encompassed by the range of average event temperatures shown in Table 3-8. Applying the DNU adjustment factor by temperature band necessitates a consistent treatment of the non-responsive factor as well. Although the proportion of devices in use that are non-responsive is not correlated with weather, the overall proportion of non-responsive devices *is* since it is implicitly a function of the percentage DNU, which, as demonstrated above, is correlated with outdoor temperature.

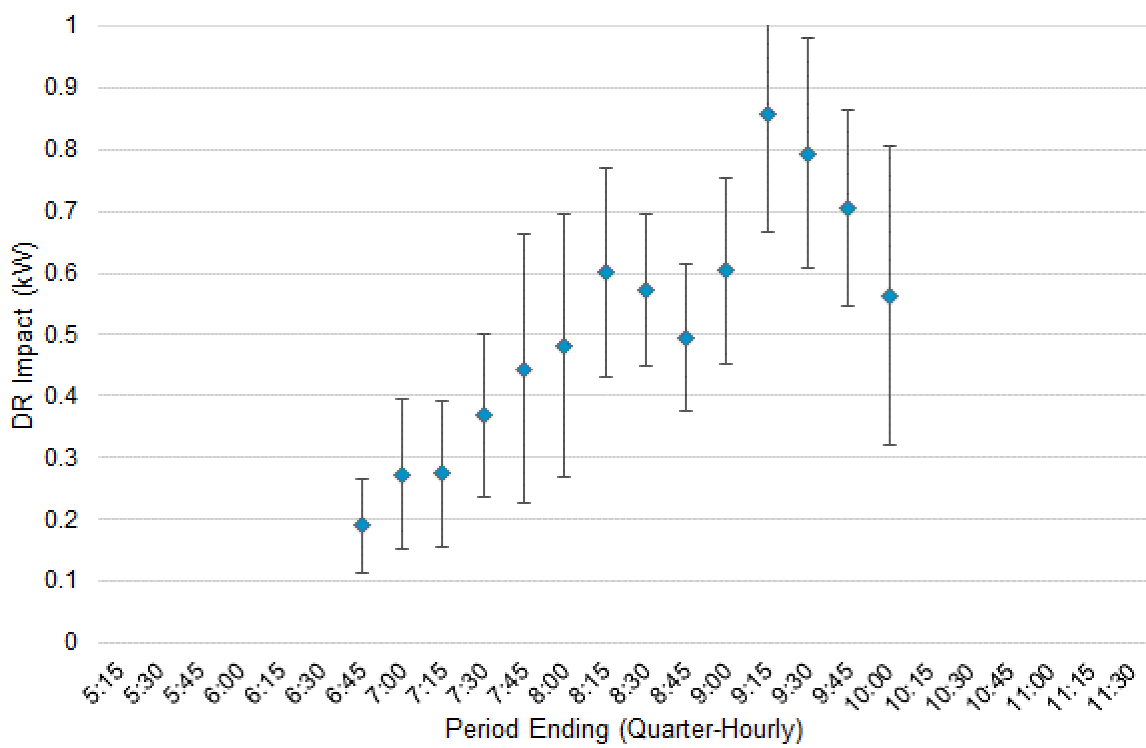
Table 3-8. DNU Adjustment Factors

Temperature Thresholds (°F)		Group	Average DNU %	Average NR %
Less Than	Equal to or Greater			
15	0	1	**13%**	**41%**
30	15	2	**35%**	**22%**
40	30	3	**41%**	**23%**
60	40	4	**94%**	**3%**

3.2.2 Water Heater DR Capability

This subsection provides the projected capability of water heaters. Unlike heat strips, water heater impacts are modeled as a function of the time of day in which curtailment occurs rather than the outdoor temperature.[33] Figure 3-11 provides the average estimated impact of responsive water heater curtailment by quarter-hour of the day. The blue diamonds represent the average estimated impact at each quarter-hour of the day and correspond to the values used to calculate the impacts of each of the EM&V events. The whiskers capture the 90% confidence interval. Note that the quite wide confidence interval for the impacts between 9:00 and 10:00 is because only a single event lasted until 10:00 and only three events lasted later than 9:00 (including the one event that lasted until 10:00).

Figure 3-11. Projected Average DR Capability per Responsive Water Heater



[33] See Appendix B for the rationale for modeling water heater capability as a function of time of day instead of outdoor temperature..

As noted above, the projected capability shown in Figure 3-11 is the average capability per responsive appliance. To obtain the average population capability, values from the figure above must be adjusted by the average non-response rate observed across the 26 water heater EM&V events, which was 5%. All water heaters inspected by Navigant field staff were found to be connected to the DLC switch.

3.3 Partially Responsive Heat Strips: Defrost Cycling

To determine the cause of "partially responsive" heat strips as described in previous EnergyWise Home winter impact evaluation reports, Navigant worked with DEP program staff and the program implementer's technical lead to design a data collection strategy to determine the cause. The hypothesis put forward by the DEP program staff was that the heat pump compressor defrost cycle was causing heat strips to turn on intermittently during a control event (i.e. override the control action). In addition to logging heat strips, EM&V field technicians logged outdoor heat pump compressors. During a defrost cycle, the heat pump compressor reversing valve engages and the compressor fan shuts off, allowing the coils to thaw. The result is a drop in total compressor power draw during the defrost cycle.

The results of this research effort were conclusive: partial response of a heat strip during a control event is most likely caused by defrost cycling and can be seen by visually inspecting the compressor and heat strip data together. The phenomenon is a normal and necessary part of heat pump system operation and is not a shortcoming of the switch control. Furthermore, the evaluation team was able to differentiate between systems that were controlled with defrost cycling and systems that were completely non-responsive to curtailment signals. Example plots are shown below for reference (Figure 3-12 and Figure 3-13). Note how in Figure 3-12 the blue line showing the heat pump load dips as the compressor fan cycles off while the heat strips (in green) momentarily cycle on to counteract the cold air that would blow while the compressor coils defrost.

Figure 3-12. Example of Defrost Cycling During a Partial Response Event

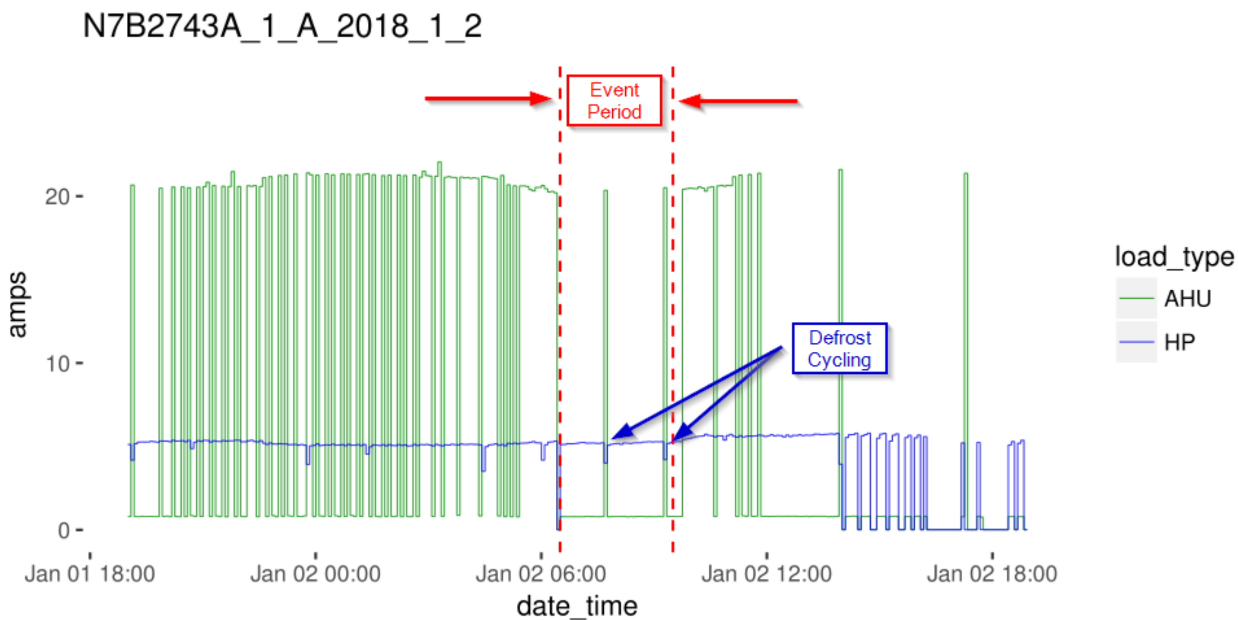
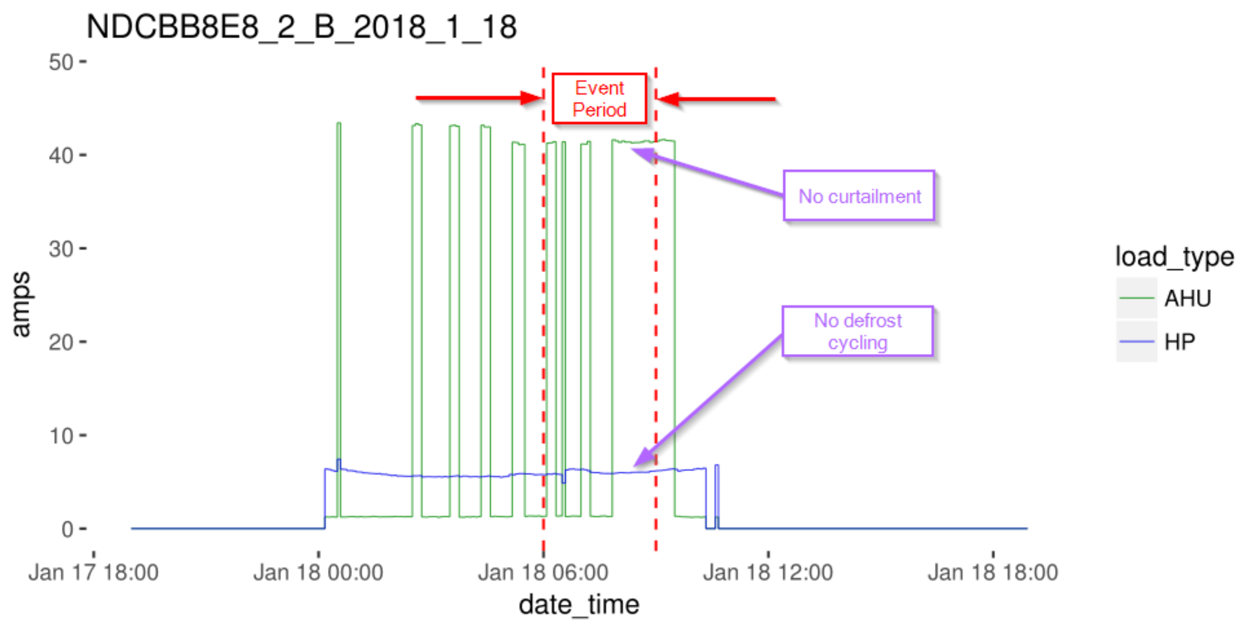


Figure 3-13. Example of a Non-Responsive Heat Strip



3.4 Net-to-Gross Ratio

Evaluations of demand-side management programs typically estimate a net-to-gross (NTG) ratio based on the evaluated percentage of demand reductions that may be ascribed either to free ridership (which increases the NTG ratio) or to program spillover (which reduces it). Free ridership is typically defined as the percentage of demand reductions that would have occurred anyway, absent the presence of the program. Spillover is typically defined as incremental demand reductions undertaken by a program's participants not directly incented or promoted by the program administrator. In this case, because demand reductions are estimated in contrast to an implied estimated baseline[34] that captures expected participant behavior absent an event, the evaluation team can confidently state that the free ridership is 0: absent the EnergyWise program, none of the observed demand reductions would 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, the evaluation team considers the EnergyWise program to have a NTG ratio of 1.

34 That is, the average level of behavior implied by the estimated parameter values of the regressions used.

4. PROCESS EVALUATION FINDINGS

A detailed presentation of the process evaluation survey findings can be found in 0, and the final version of the survey guide can be found in Appendix C.

The principal EM&V findings from the analysis of participant perception were as follows:

- **Participants were generally unaware of curtailment events when they happened.** Most (>90%) survey respondents indicated that they had not been aware that an event had occurred recently.
- **The program has little impact on the comfort of its participants.** Only 23 respondents (out of 301 event participants) were aware that an event had been called during the period in question. For that subgroup, comfort levels reported during the event varied widely, ranging from a rating of a 0 to a 10 on the 0-10 comfort scale, with only two rating their comfort less than 5. Most survey respondents indicated that they were "very comfortable" during the event.
- **The program does not appear to be a key driver of supplemental heating use.** A similar portion of placebo survey respondents reported using supplemental methods for heating their homes during "event" periods as those respondents who were subject to actual events.
- **Participants were generally satisfied with the EnergyWise program.** Over half of the respondents indicated that they were very satisfied, while only 4% of all survey respondents (18 people) indicated that they were "dissatisfied" with the program. Satisfaction with the program did not differ significantly between respondents who responded to actual events versus those who responded to placebo events.
- **Fewer than half of participants were aware of the bill credits they receive as part of their program participation.** Every customer enrolled in the program receives a hardcopy brochure explaining the bill credits details (when the are received, amounts, etc.). It is important to note that many of the particpants received their bill credits outside the EM&V study calendar.

5. SUMMARY FORM

EnergyWise Home

Winter PY2017/2018

Completed EM&V Fact Sheet

Description of Program

Duke Energy's EnergyWise Home program is a demand response (DR) program offered to residential customers in the Duke Energy Progress (DEP) territory.

EnergyWise is a direct load control (DLC) program. Participants receive an incentive to allow Duke Energy to control their air conditioners (in the summer) their heat pump auxiliary heat strips (in the winter) or their electric water heaters (winter or summer). Only participants in the Western region are curtailed in the winter.

This report evaluates the impact of the program in the summer of 2016. Two program-wide events were called in the summer of 2016. Ten events were called for a sample of 78 participants to whom data loggers had been deployed.

Date	July 20, 2018	
Region	Duke Energy Progress	
Evaluation Period	Winter 2017/2018	
DR Event Capability (kW)	**per Appliance**	**per Customer**
Heat Strips	1.39	1.51[35]
Water Heaters	0.54	0.55[36]
DR Event Capability Impact (MW)		
Heat Strips	7.2	
Water Heaters	5.6	
Net-to-Gross Ratio	1	

Evaluation Methods

Navigant estimated DR impacts for heat strip and water heater DLC through the use of two fixed effects regressions applied to logger data collected from a representative sample of 70 EnergyWise participants. EM&V appliances were divided into two sub-samples and curtailed on alternating events. This experimental design approach is superior to the previously used within-subject design because it avoids the possibility that all very cold winter days are used up for events, leaving no observed cold temperatures with which to properly estimate the implicit baseline (impacts are measured against the baseline). This design reduces the possibility of model specification bias.

Impact Evaluation Details

- **The current DR capability of DEP's EnergyWise program in the winter is approximately 13 MW.** This is the sum of the projected program capability of 7.2 MW from heat strip curtailment when the average temperature is 10°F and 5.6 MW from water heater curtailment deployed between 8:00 and 9:00 on winter mornings.
- **The estimated average program impact of the six population events deployed in the winter of 2017/2018 is approximately 11 MW.** This is the sum of the estimated average impact of 6.7 MW from heat strips where the average event temperature was slightly less than 16°F and an estimated average impact of 4.1 MW from water heaters where events began as early as 6:00 and ended as late as 10:00.
- **The estimated impact per responsive set of heat strips controlled during the population events was 2.77 kW, and the estimated impact per responsive water heater during the same events was 0.4 kW.** On the coldest event (January 7, 2018) the average impact per responsive, including both fully and partially responsive, set of heat strips was 3.1 kW.

[35] Based on 1.083 appliances per customer.

[36] Based pm 1.021 appliances per customer.

6. PROGRAM FINDINGS AND CONCLUSIONS

The following are the principal findings of the impact evaluation:

- **The current DR capability of DEP's EnergyWise program in the winter is approximately 13 MW.** This is the sum of the projected program capability of 7.2 MW from heat strip curtailment when the average temperature is 10°F and 5.6 MW from water heater curtailment deployed between 8:00 and 9:00 on winter mornings.
- **The estimated average program impact of the six population events deployed in the winter of 2017/2018 was approximately 11 MW.** This is the sum of the estimated average impact of 6.7 MW from heat strips where the average event temperature was slightly less than 16°F and an estimated average impact of 4.1 MW from water heaters where events began as early as 6:00 and ended as late as 10:00 in the morning.
- **The estimated impact per set of heat strips (that responded in some way to DEP's curtailment signal) controlled during the population events was 2.77 kW, and the estimated impact per responsive water heater during the same events was 0.41 kW.** On the coldest event (January 7, 2018) the average impact per responsive, including both fully and partially responsive, set of heat strips was 3.1 kW. The reason why the average water heater population event impact was lower than the projected capability is due to the differing time-spans – population events could start as early as 6:00 and end as late as 10:00, whereas the population capability was calculated assuming an event from 8:00 to 9:00.
- **Navigant's investigation into the cause of why some heat strips were only partially responsive during curtailment events concluded that this behavior was driven by a heat pump's auto-defrost cycle.** Navigant logged heat pump compressors as well as heat strips to test the hypothesis that partial response was a result of a heat pump's defrost cycle periodically overriding the control signal. If this were the cause of the partial response, the expectation would be that the demand spikes characteristic of partial response would be coincident with a shutdown of the compressor fan to thaw the compressor coils. The evaluation team confirmed that this was the case, and that partial response (as defined here) was a result of the defrost cycle.
- **On average, of heat strips in use on the event day, approximately 40% were fully responsive to the curtailment signal and approximately 20% were partially responsive.** The percentage of devices not in use varied significantly across events and was correlated with outdoor temperature. During the four events in which the average event temperature was less than 15°F, 13% of heat strips expected to curtail were not in use, on average. In contrast, for the six events in which the average temperature was between 30°F and 40°F, 41% of heat strips were not in use, on average.

The principal EM&V findings from the analysis of participant perception were as follows:

- **Participants were generally unaware of curtailment events when they happened.** Most (>90%) survey respondents indicated that they had not been aware that an event had occurred recently.
- **The program has little impact on the comfort of its participants.** Only 23 respondents (out of 301 event participants) were aware that an event had been called during the period in question. For that subgroup, comfort levels reported during the event varied widely, ranging from a rating

of a 0 to a 10 on the 0-10 comfort scale, with only two rating their comfort less than 5. Most survey respondents indicated that they were "very comfortable" during the event.

- **The program does not appear to be a key driver of supplemental heating use.** A similar portion of placebo survey respondents reported using supplemental methods for heating their homes during "event" periods as those respondents who were subject to actual events.
- **Participants were generally satisfied with the EnergyWise program.** Over half of the respondents indicated that they were very satisfied, while only 4% of all survey respondents (18 people) indicated that they were "dissatisfied" with the program. Satisfaction with the program did not differ significantly between respondents who responded to actual events versus those who responded to placebo events.
- **Fewer than half of participants were aware of the bill credits they receive as part of their program participation.** Every customer enrolled in the program receives a hardcopy brochure explaining the bill credits details (when the are received, amounts, etc.). It is important to note that many of the particpants received their bill credits outside the EM&V study calendar.

APPENDIX A. PARTICIPANT PERCEPTIONS ANALYSIS

This appendix presents the findings of Navigant's analysis of four phone surveys conducted in the winter of 2017/2018 of EnergyWise participants. Participants from the EM&V group who received data loggers for the impact evaluation were excluded from the survey effort.

The evaluation team conducted 401 phone surveys with EnergyWise participants during this study. The surveys were conducted after three real DR events and one placebo event. For the placebo event, respondents were told that an event had been called when in fact one had not.

Of the 401 total survey respondents, 301 were surveyed after real DR events; the remaining 100 were surveyed after the placebo event. The survey achieved a relative precision ±3% at the 90% confidence level for key quantitative outcomes.

A summary of the survey disposition by group is shown in Table A-1. For event surveys, respondents were surveyed 1-2 days following an actual curtailment event and asked questions related to their perception and comfort specifically during the event. The placebo event survey respondents were asked the same set of questions, although the event in question was a placebo because no curtailment event was called that day for the group in question.

Table A-1. Survey Status by Event

	Event: January 2, 2018	Event: January 5, 2018	Event: January 8, 2018	Placebo: January 31, 2018
Survey completes	100	100	101	100
Participant minimum temperature during survey event period	9	12	28	22

The principal EM&V findings from the analysis of participant perceptions were as follows:

- **Participants were generally unaware of curtailment events when they happened.** Most (>90%) survey respondents indicated that they had not been aware that an event had occurred recently.
- **The program has little impact on the comfort of its participants.** Only 23 respondents (out of 301 event participants) were aware that an event had been called during the period in question. For that subgroup, comfort levels reported during the event varied widely, ranging from a rating of a 0 to a 10 on the 0-10 comfort scale, with only two rating their comfort less than 5. Most survey respondents indicated that they were "very comfortable" during the event.
- **The program does not appear to be a key driver of supplemental heating use.** A similar portion of placebo survey respondents reported using supplemental methods for heating their homes during "event" periods as those respondents who were subject to actual events.
- **Participants were generally satisfied with the EnergyWise program.** Over half of the respondents indicated that they were very satisfied, while only 4% of all survey respondents (18 people) indicated that they were "dissatisfied" with the program. Satisfaction with the program

did not differ significantly between respondents who responded to actual events versus those who responded to placebo events.

- **Fewer than half of participants were aware of the bill credits they receive as part of their program participation.** Every customer enrolled in the program receives a hardcopy brochure explaining the bill credits details (when the are received, amounts, etc.). It is important to note that many of the particpants received their bill credits outside the EM&V study calendar.
-

Table A-2 provides a summary of the number of surveys completed in each category.

Table A-2. Simplified Survey Disposition Report

Survey Disposition	Total
Saved callback (mid-survey)	225
No answer	857
Busy	66
Disconnect/wrong #/blocked #	330
Business/government	29
Deaf/language barrier	25
Answering machine	2,505
Initial refusal (Opted Out)	45
Respondent refused	406
Callback for correct person	122
Changed number	1
Complete	**401**
Total	**5,012**

This section of the report is divided into four subsections, the first three of which analyze a distinct aspect of participant perspectives. These are:

1. **Awareness of Event:** To what degree were participants aware that an event had taken place?
2. **Comfort During Event:** How comfortable were participants who were aware an event had taken place?
3. **General Program Satisfaction:** How happy or unhappy are participants with the program?

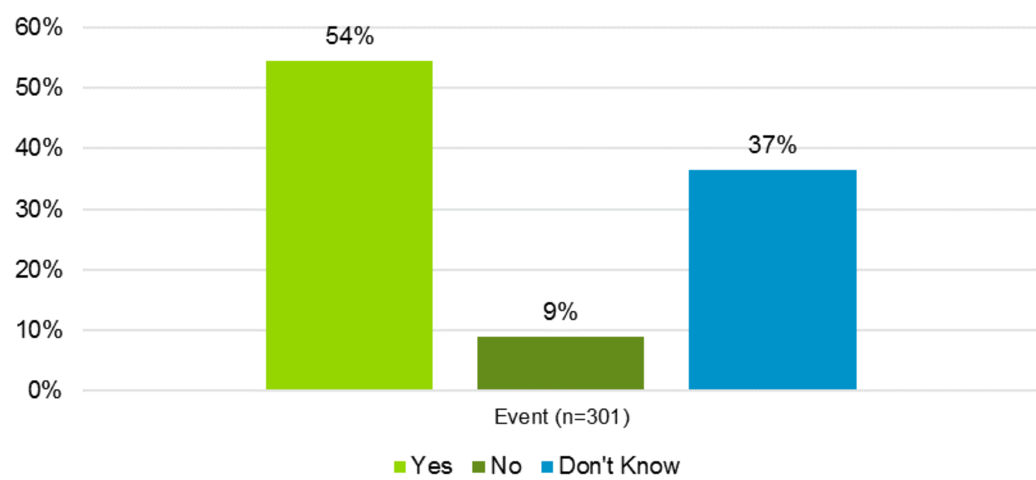
The fourth section presents participant responses to questions about typical HVAC usage, familiarity with electricity billing, and other topics covered by the survey.

A.1 Awareness of Event

The principal objective of the survey was to determine the degree to which participants took notice of and were affected by curtailment events. While the surveys included a series of more nuanced questions, one of the most important questions was whether or not the respondents took note of their device activation.

The survey assessed whether participants believed that DEP had activated their EnergyWise device, and 54% of all participants said yes, as shown in Figure A-1.

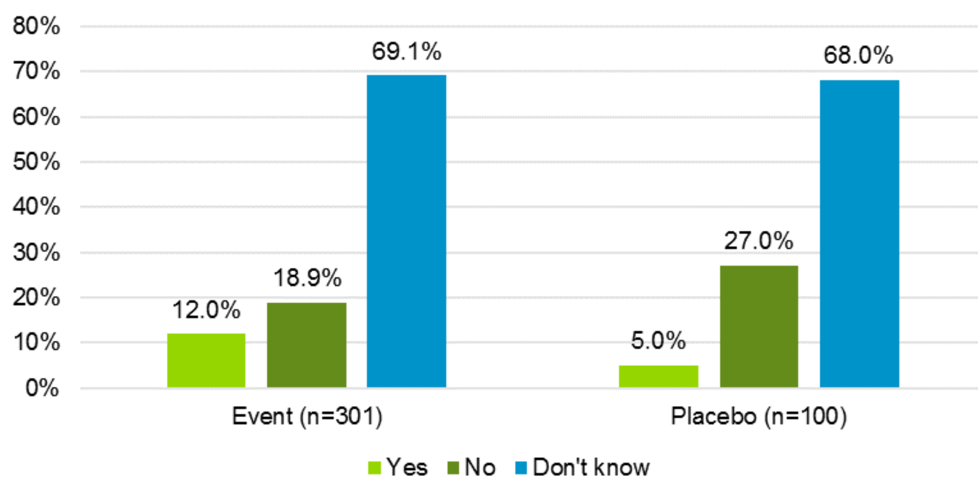
Figure A-1. Has Duke Energy Progress activated your EnergyWise device?



Source: Navigant analysis of post-event survey data, 2018

While a majority of participants believed their EnergyWise device was activated, they were unsure as to whether it had been called in the past 7 days. Figure A-2 shows that nearly 70% of participants did not know. While the results are slightly different between the event and placebo survey groups, the differences between the two are not statistically significant.

Figure A-2. Has your device been activated in the last 7 days?

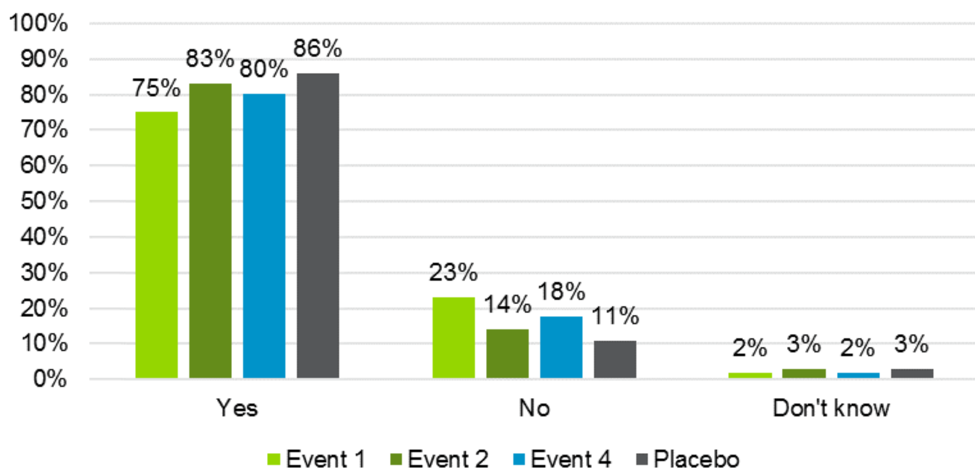


Source: Navigant analysis of post-event survey data, 2018

A.2 Comfort During Event

Awareness of a curtailment event is the most important indicator of the event's impact on customer comfort. If a participant did not notice an event, then its perceived impact on their comfort must be trivial. Event awareness is not, however, the only measure of the impact on the participant. Each respondent that was home during an event, regardless of whether they were aware of the event, was asked to characterize their level of comfort both immediately before and during the event. Prior to asking about levels of comfort, the survey screened for respondents who were home at the time of the event, as shown in Figure A-3. The majority of participants were home during the event hours, with a slightly higher percentage of participants reporting that they were not home during the first event (January 2, 2018). This is likely because January 2 is the day after a national holiday.

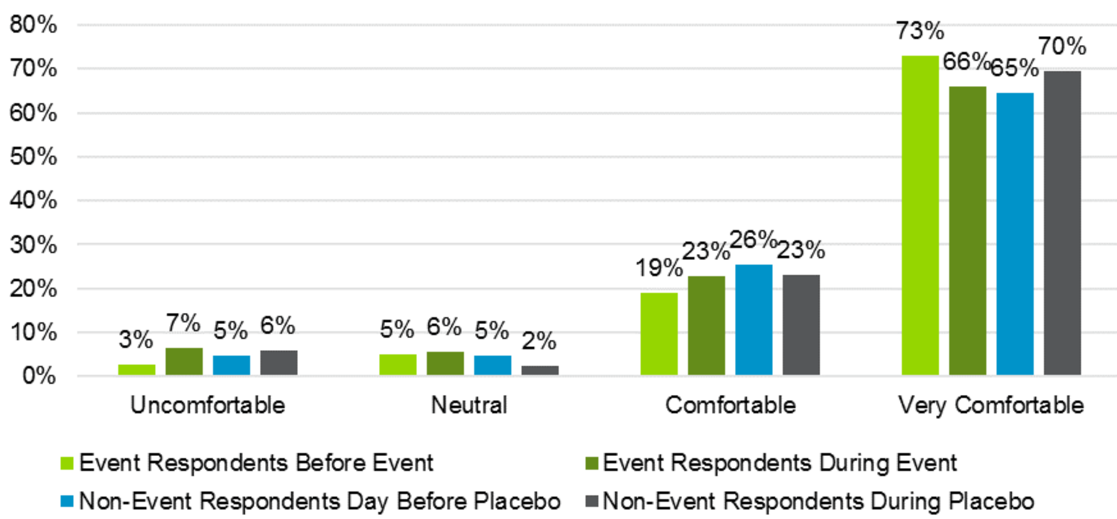
Figure A-3. Respondents Who Were Home During the Time of the Event



Source: Navigant analysis of post-event survey data, 2018

Most survey respondents reported high levels of comfort during both the actual and placebo events. Figure A-4 shows comfort levels both before and during the events for each group. The percentage of event respondents who rated themselves as very comfortable decreased during the event, going from 73% to 66%. Similarly, the percentage of event respondents who rated themselves as uncomfortable increased from 3% to 7% during the event. For the non-event respondents, the data revealed no discernible pattern in comfort level change.

Figure A-4. Change in Comfort Level During Curtailment and Placebo Events
(n_{event} = 214, $n_{placebo}$ = 82)

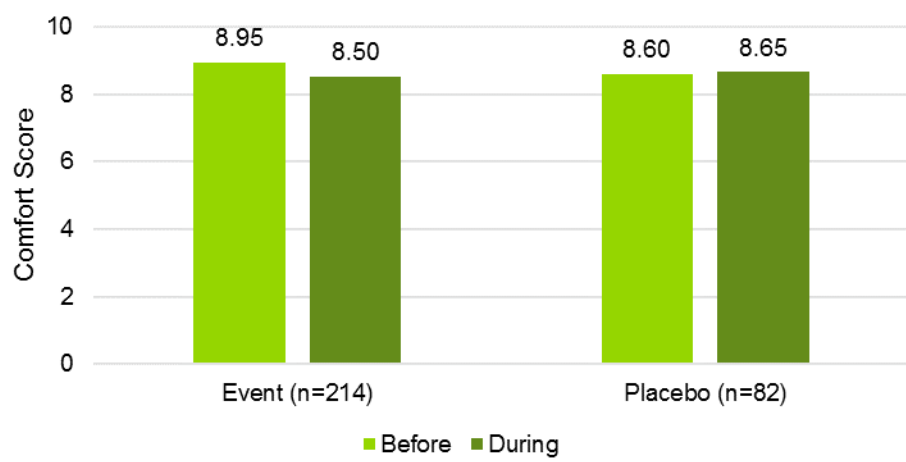


Note: Comfort levels assigned based on 0-10 rating scale: 0-4 = Uncomfortable, 5 = Neutral, 6-8 = Comfortable, 9-10 = Very Comfortable. Results exclude Don't know responses.

Source: Navigant analysis of post-event survey data, 2018

Participants who reported being home during the event period were then asked to rate their comfort with the air temperature and/or water temperature in their home before and during the event, dependent upon the types of equipment they have enrolled in the EnergyWise program. Figure A-5 shows that the comfort scores were high, with the lowest average score at 8.5 on a scale of 0-10. It is interesting to observe that the event day scores go down slightly during the event compared to before, but the difference is not statistically significant. This indicates that most participants' comfort is not being negatively affected by their participation in the EnergyWise program.

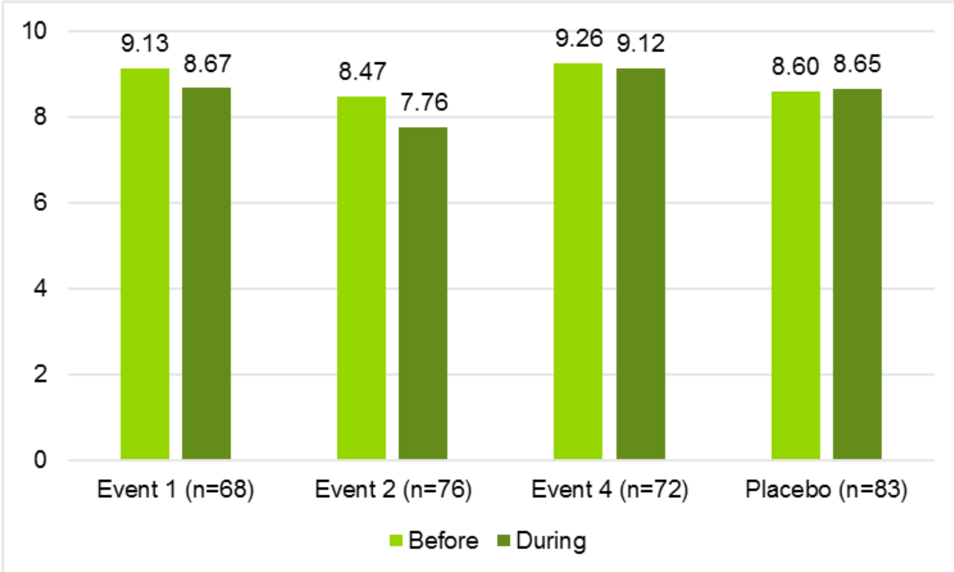
Figure A-5. Mean Comfort Score Before and During Control Event by Event Status



Source: Navigant analysis of post-event survey data, 2018

Figure A-6 shows that there is a difference between comfort scores given during the events that were surveyed, as Event 2 did have statistically lower scores. However, it is important to note that the reported comfort scores before the event started were lower than any other day surveyed.

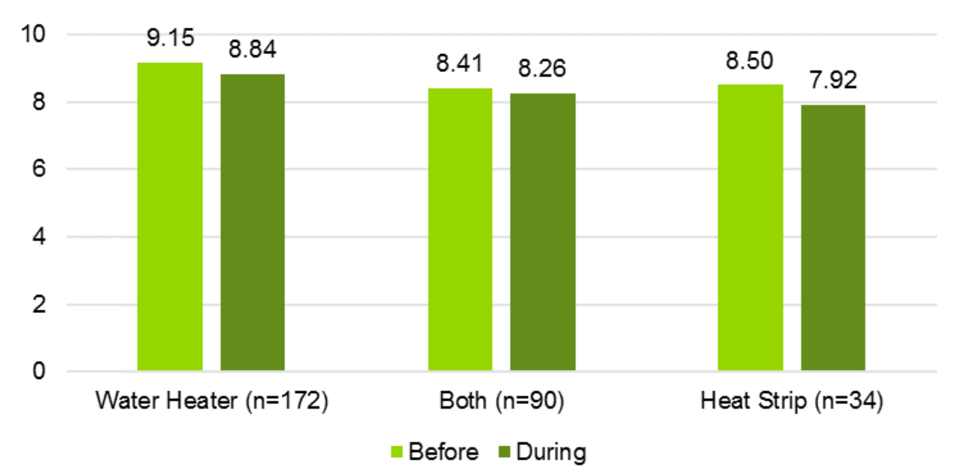
Figure A-6. Mean Comfort Score Before and During Control Event by Date



Source: Navigant analysis of post-event survey data, 2018

Figure A-7 shows the comfort scores before and during events separated by equipment type. Some participants have only a water heater or only heat strip device enrolled in the program, while others have both. Respondents were only asked about the devices they have enrolled in the program. Navigant's analysis of this data indicates that the water heater group is statistically higher than the other two equipment groups both before and during events, but the other groups are not statistically different from one another nor are the differences between before and during the event different for any given equipment type.

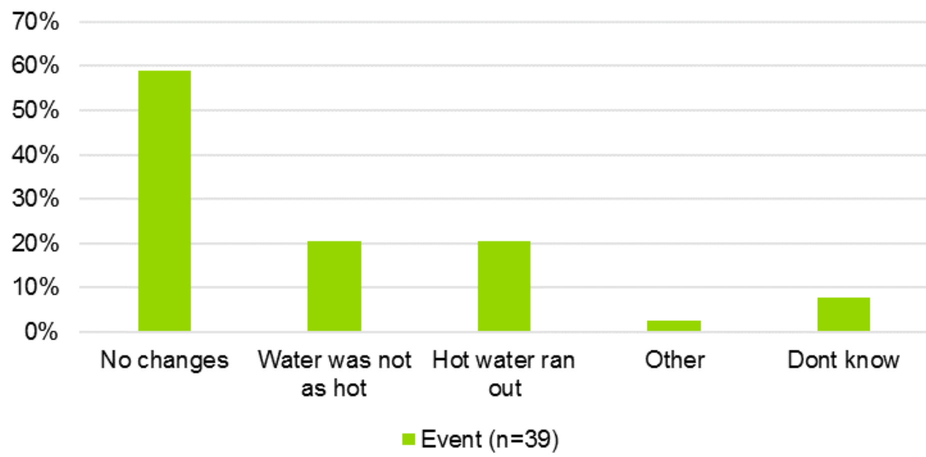
Figure A-7. Mean Comfort Score Before and During Control Event by Equipment Type



Source: Navigant analysis of post-event survey data, 2018

The participants who rated their comfort lower than 7 were asked to elaborate on their scores, and verbatim responses from the survey indicate that some of these participants observed lower air or water temperatures during the event. However, as Figure A-8 shows, most water heater participants who reported low comfort did not notice any changes in their hot water.

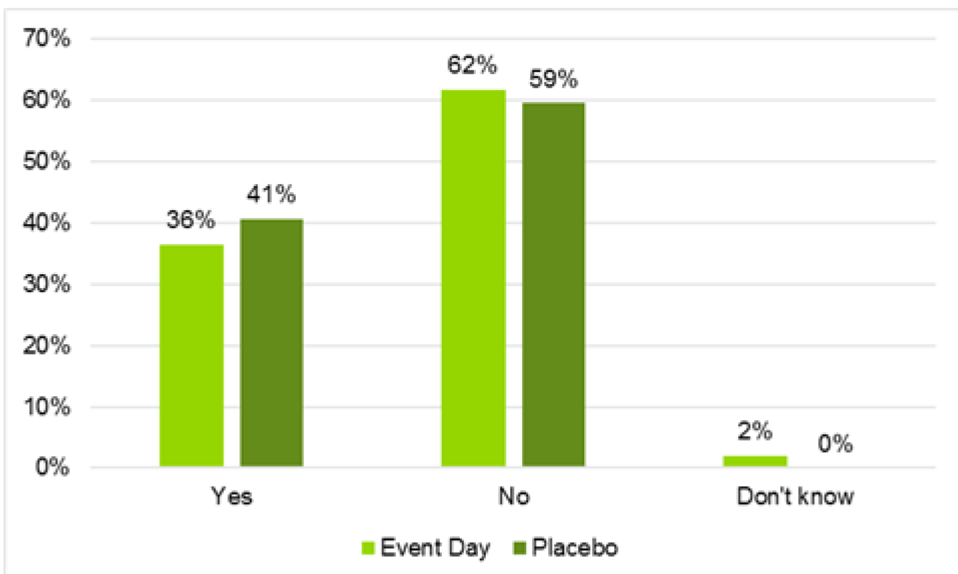
Figure A-8. Describe Changes You Noticed with Your Hot Water



Source: Navigant analysis of post-event survey data, 2018

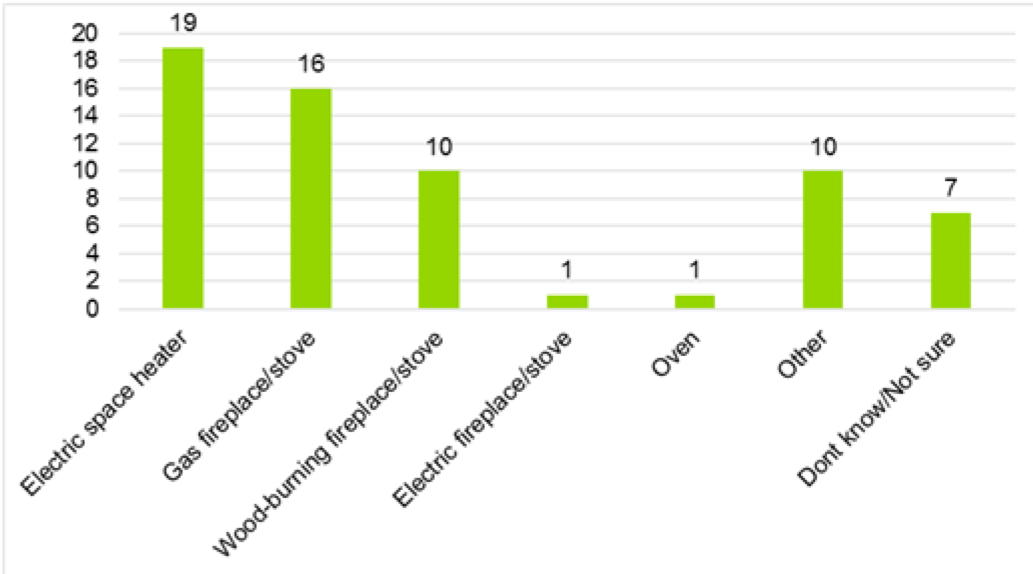
There is limited suggestion that the comfort of program participants decreased during the event, and coupled with low levels of awareness of device activation, it can be safely concluded that the program is having a minimal effect on the comfort of its participants.
Participants who have heat strips enrolled in the program were asked whether they used additional sources of heat to stay warm during the event and placebo periods. As shown in Figure A-9, Fewer than half of respondents reported using additional heat sources, and a similar portion of placebo and actual event respondents reported using alternate heat. These findings seem to indicate that actual DR events are not a key driver in customer use of alternate heating sources.

Figure A-9. Respondent Use of Additional Heat Sources During Event or Placebo Period



Of those respondents who reported using additional heat sources, Figure A-10 shows that most used an electric space heater (19), a gas fireplace or stove (16), or a wood-burning fireplace or stove (10). Ten respondents reported using other heat sources not listed in the survey, which included pellet stove, gas furnace, and propane heaters.

Figure A-10. Types of Additional Heat Sources Used

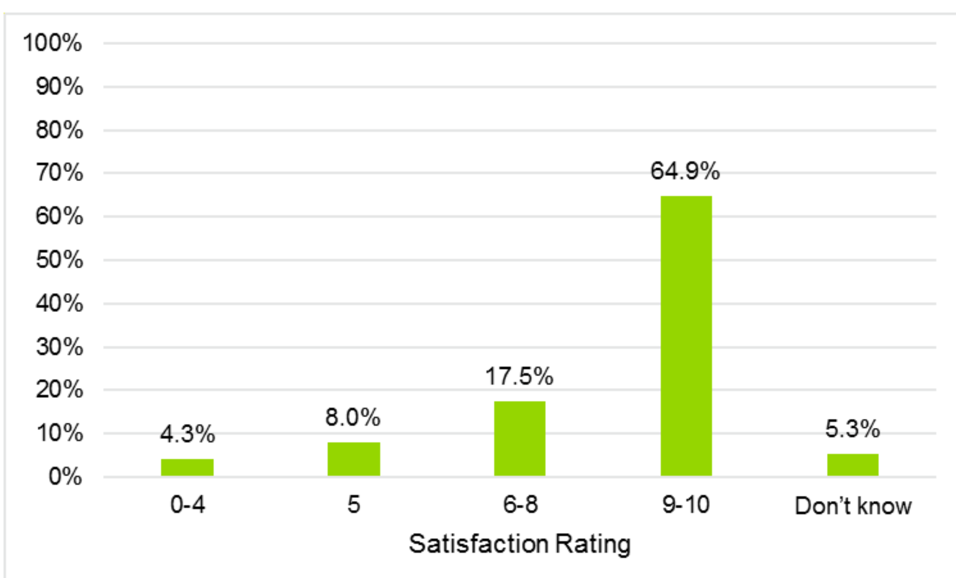


A.3 General Program Satisfaction

In addition to testing participant awareness of events and comfort during events, an important component of the post-event survey effort was to determine the general level of satisfaction participants had with the program. The evaluation team asked respondents to rate their satisfaction with the program overall on a scale from 0 to 10, where 10 is extremely satisfied.

Most survey respondents reported high levels of satisfaction with the program, with 65% of participants highly satisfied (9-10). Only 4% of survey participants rated themselves as dissatisfied with the program (4 or below). Figure A-11 shows a breakdown of these findings.

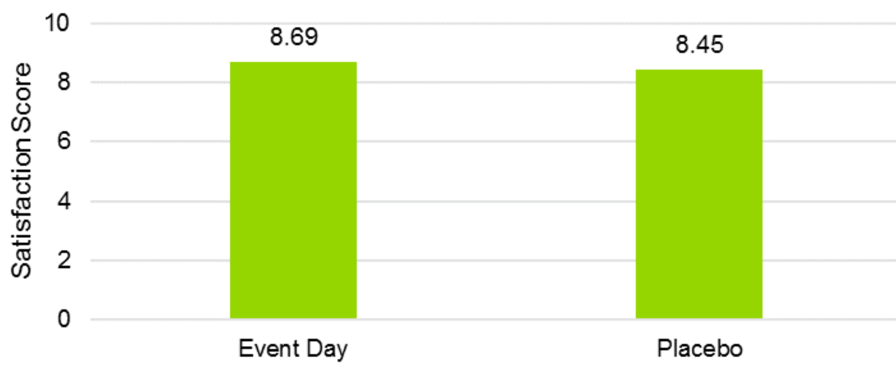
Figure A-11. Program Satisfaction of Survey Respondents (n = 399)



Source: Navigant analysis of post-event survey data, 2018

The survey also investigated satisfaction. Satisfaction was assessed using a scale of 0-10, with 1 being very unsatisfied and 10 being very satisfied. Navigant found that the average satisfaction scores were around 8.5 for participants surveyed after event days and the placebo day, indicating high satisfaction with the program. Note that while Figure A-12 shows a difference between the two groups, that difference is not statistically significant.

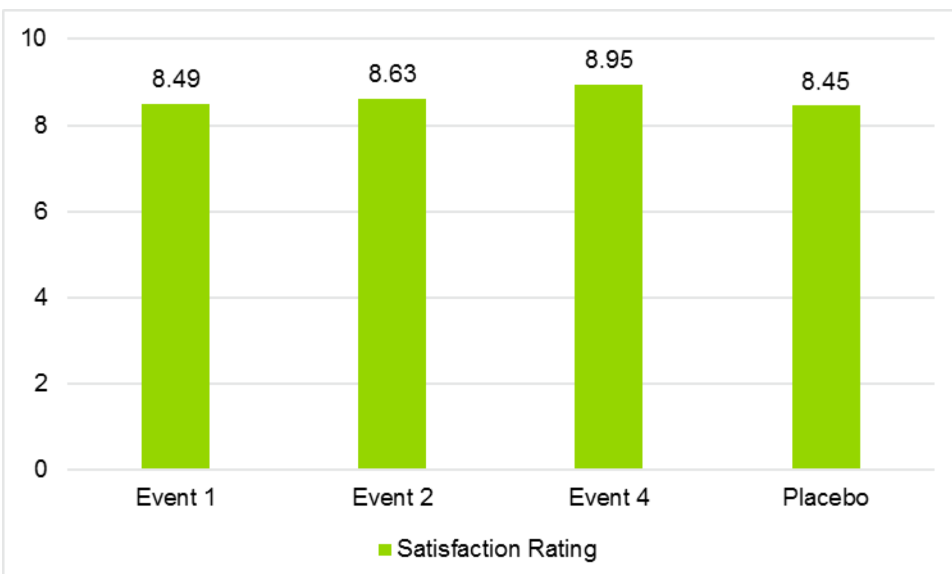
Figure A-12. Reported Satisfaction with the EnergyWise Program by Event Status



Source: Navigant analysis of post-event survey data, 2018

Similarly, the reported satisfaction did not differ significantly between event days, indicating that the frequency in events did not impact participants' overall satisfaction with the program. Figure A-13 shows these results.

Figure A-13. Reported Satisfaction with the EnergyWise Program by Event



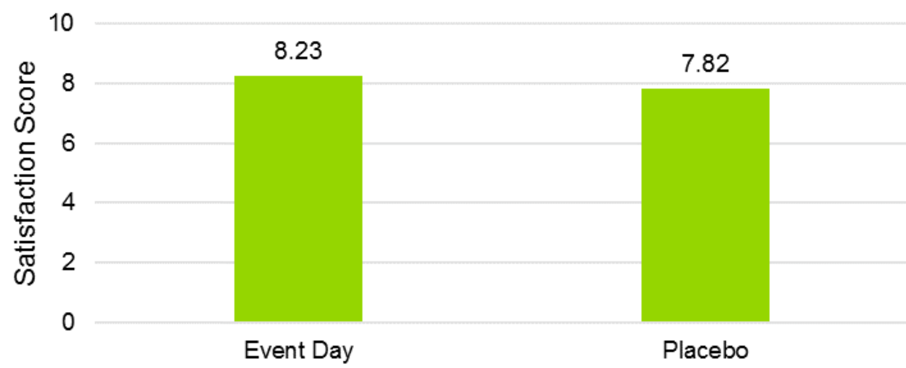
Source: Navigant analysis of post-event survey data, 2018

Building on their reported satisfaction, 83% of survey respondents indicated that they would recommend the program to a friend or colleague, characterized by a rating of 6 or higher on a likelihood scale from 0 to 10.

The evaluation team asked respondents who expressed lower satisfaction with the program (a rating of a 7 or below) to expand on their reasoning. The most common reason for dissatisfaction was a lack of notification when DEP activates their device or lack of information about the program in general. Five participants mentioned that they either ran out of hot water or their water was not hot enough.

Compared to their satisfaction with the EnergyWise program, participants rated their satisfaction with DEP as a utility slightly lower, though most participants were still satisfied, as shown in Figure A-14. As above, while there is a slight difference in the scores given after an event day versus a placebo day, the difference is not statistically significant.

Figure A-14. Satisfaction with DEP

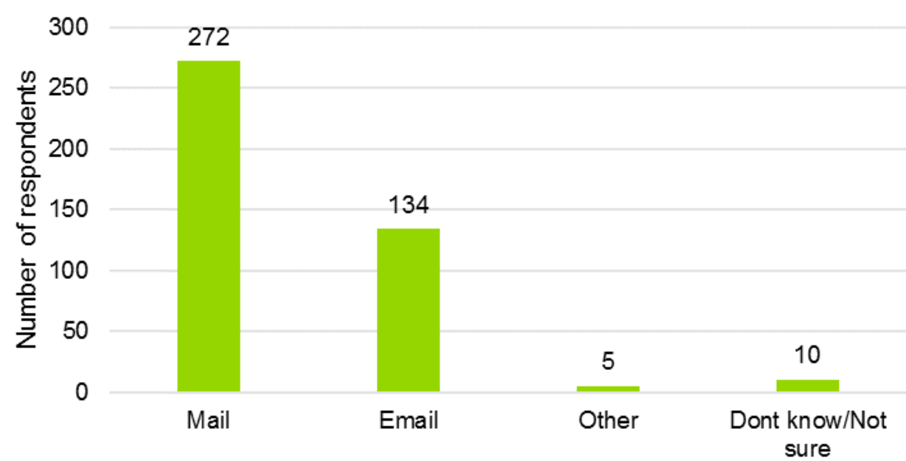


Source: Navigant analysis of post-event survey data, 2018

A.4 Other Survey Findings

This subsection contains additional results from the participant surveys. Navigant's survey asked participants to report the mode by which they receive their monthly DEP bill. Figure A-15 shows that about two-thirds of participants get their bill in the mail.

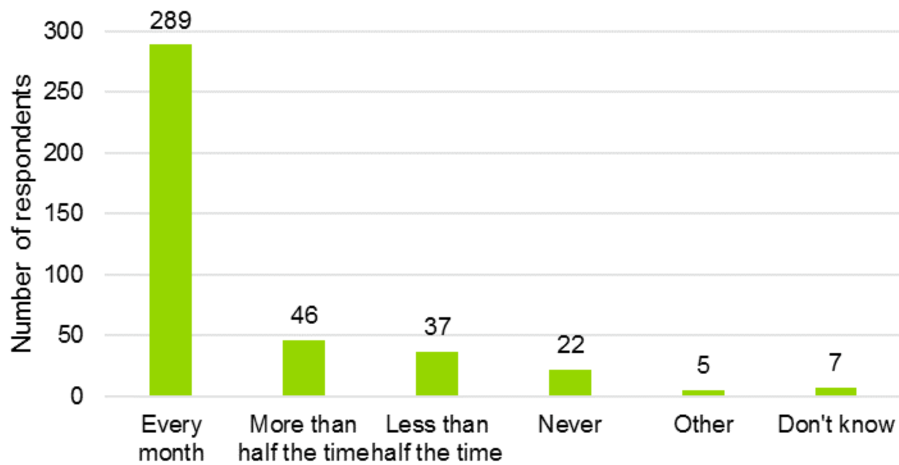
Figure A-15. Mode of DEP Bill Receipt



Source: Navigant analysis of post-event survey data, 2018

The survey then asked how frequently the participants review the details of their bill. Most participants reported reviewing the details of their bill every month, as shown in Figure A-16.

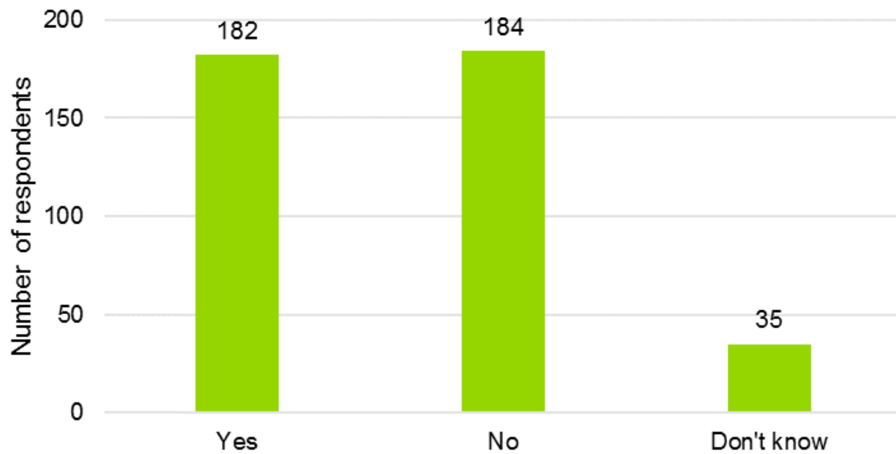
Figure A-16. Frequency of Reviewing DEP Bill



Source: Navigant analysis of post-event survey data, 2018

The survey respondents were then asked whether they have noticed the EnergyWise credit on their bill. As shown in Figure A-17, just under half of participants have noticed.

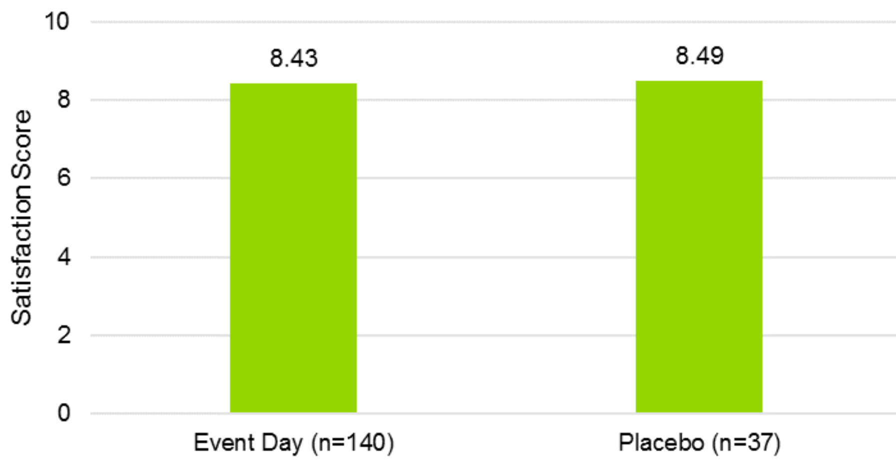
Figure A-17. Have you noticed the EnergyWise credit on your bill?



Source: Navigant analysis of post-event survey data, 2018

Finally, the survey asked participants who reported noticing the EnergyWise bill credit to rate their satisfaction with the credit amount on a scale of 1-10. The average scores above 8 (shown in Figure A-18) indicate that participants are generally satisfied with the bill credit.

Figure A-18. Satisfaction with Bill Credit Amount



Source: Navigant analysis of post-event survey data, 2018

The evaluation team also asked several questions about the participants' home heat pumps. When participants were asked at what outdoor temperature they will run their heat pumps, the majority did not know the answer. Most participants reported that they run their heat pump every day during cooling season, as opposed to only when it is below a certain temperature. Participants were also asked to report the age of their heat pump. Participants reported a relatively even distribution across ages between new and about 20 years old.

APPENDIX B. ESTIMATION DETAILS AND MODEL SPECIFICATION

This appendix provides more detail on the methods employed by the evaluation team to estimate DR impacts and the capability of heat strips and water heaters controlled during the winter of 2017/2018. It is divided into two sections. The first addresses heat strips, while the second addresses water heaters.

B.1 Heat Strips Model Specification and Details

Heat strip impacts were estimated using a single regression equation, shown in Equation B-1. Only event days were included in the estimation set. This differs from previous winter EnergyWise evaluations, which also included some non-event days in the estimation set. Limiting the estimation set to include event days only is possible due to the two-group RCT-style experimental design. Heat strips found to be not in use during event days (both those expected to curtail and those not) were excluded from the estimation set.

Equation B-1. Heat Strips Regression Model

$$\begin{aligned} y_{i,t} = &\sum_{r=1}^{R=2} \alpha_{i,r} \cdot spline_{r,t} + \sum_{r=1}^{R=2}\sum_{q=1}^{Q=96} \beta_{1,q} \cdot qh_{q,t} \cdot spline_{r,t} + \sum_{r=1}^{R=2}\sum_{q=1}^{Q=96} \beta_{2,q} \cdot qh_{q,t} \cdot cbu_{i,t} \cdot spline_{r,t} \\ &+ \sum_{r=1}^{R=2}\sum_{q=1}^{Q=96} \beta_{3,q} \cdot qh_{q,t} \cdot emaHDQH_{i,t} \cdot spline_{r,t} + \sum_{r=1}^{R=2}\sum_{d=1}^{D=16} \gamma_{d,1} \cdot relQH_{d,t} \cdot c_{i,t} \cdot emaHDQH_{i,t} \cdot spline_{r,t} \\ &+ \sum_{r=1}^{R=2}\sum_{d=1}^{D=16} \gamma_{d,1} \cdot relQH_{d,t} \cdot c_{i,t} \cdot emaHDQH_{i,t} \cdot PR_{i,t} \cdot spline_{r,t} + \sum_{r=1}^{R=2}\sum_{s=1}^{S=15} \beta_{5,s} \cdot eventHDQH_{i,t} \cdot sb_{i,t,s} \cdot spline_{r,t} \\ &+ \sum_{r=1}^{R=2}\sum_{s=1}^{S=15} \beta_{5,s} \cdot eventHDQH_{i,t} \cdot sb_{i,t,s} \cdot PR_{i,t} \cdot spline_{r,t} \cdot \varepsilon_{i,t} \end{aligned}$$

Where:

$y_{i,t}$	=	Appliance *i*'s demand during quarter-hour of sample *t*.
$spline_{r,t}$	=	A set of two dummy variables.
		One is equal to 1 when the value of $emaHDQH_t$ is less than 35 (approximately equivalent to taking a value of one when the temperature is greater than 30°F).
		The other is equal to 1 when the value of $emaHDQH_t$ is greater than or equal to 35 (approximately equivalent to taking a value of one when the temperature is less than or equal to 30°F). See below for the reasoning for the selection of this value as the spline breakpoint.
α_i	=	An individual device-level fixed effect. This is equivalent to a battery of dummy variables, one for each device. This set of dummy variables controls for all time-invariant differences in demand between devices (e.g., the size or age of the system, etc.)

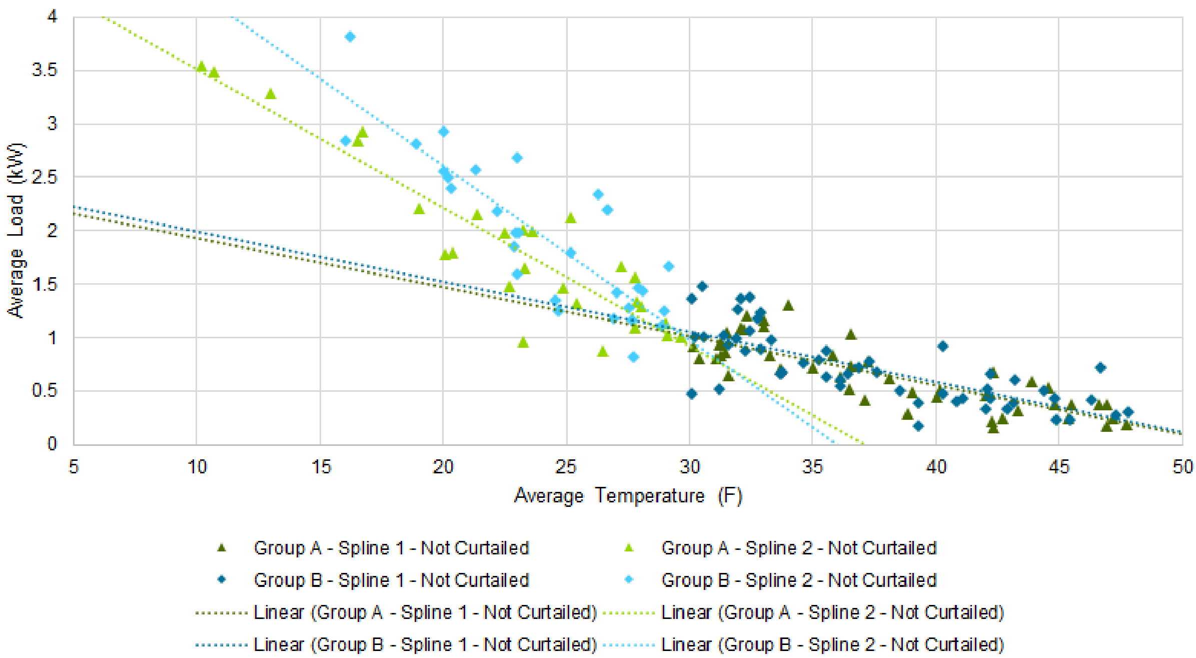
$qh_{q,t}$	=	Dummy variables (96) to capture time of day effects. Each one is equal to 1 when quarter-hour of sample *t* is the *q*-th quarter-hour of that day, and 0 otherwise.
cbu_t	=	Cold buildup observed in quarter-hour of sample *t*. This is a 72-hour geometrically decaying average of the NOAA-defined wind chill/temperature index.[37] It is calculated in the following manner: $cbu_t = \sum_{h=1}^{72} 0.96^h \cdot wchill_{t-h} \Big/ 1{,}000$. Note in this case that the *t* subscript denotes hourly intervals. As noted above, the cbu_t (normalized cold buildup) is a geometrically decaying 72-hour moving average of NOAA's wind chill/temperature index. That variable is calculated in the following manner: $wchill_t = 35.74 + 0.6215 \cdot drybulb_t - 35.75 \cdot (0.16 \cdot ws_t) + 0.4275 \cdot drybulb_t \cdot (0.16 \cdot ws_t)$ Where $drybulb_t$ is the drybulb temperature (in °F) observed at quarter-hour *t* and ws_t is the windspeed in miles per hour observed at quarter-hour *t.*
$emaHDQH_t$	=	A 3-hour exponential moving average of heating degree quarter-hours (HDQHs). That is, an exponential moving average that includes the current quarter-hour *t* and the 11 quarter-hours prior to that. The moving average calculated over HDQHs with a base of 65°F (i.e., HDQH is equal to 65 minus temperature, or 0, whichever is highest).
$relQH_{d,t}$	=	A set of 16 dummy variables, each equal to 1 when quarter-hour *t* is the *d*-th quarter-hour of the event.
$c_{i,t}$	=	A dummy variable equal to 1 when appliance *i* is both expected to curtail (i.e., is in Group A during a Group A curtailment event or is in Group B during a Group B curtailment event) and is found to be either fully or partially responsive to the curtailment signal.
$PR_{i,t}$	=	A dummy variable equal to 1 when appliance *i* has been found to be partially responsive to the event on day *t*, and 0 otherwise.
$sb_{i,t,s}$	=	A set of 15 dummy variables. Each one is equal to 1 when quarter-hour *t* is the *s*-th quarter-hour following the end of a DR event and when appliance *i* was both expected to curtail and was partially or fully responsive on event day *t*.
$eventHDQH_{i,t}$	=	The sum of HDQHs to which the home in which appliance *i* resides was exposed over the course of the event that took place on day *t*, and 0 otherwise.

[37] NOAA, National Weather Service, *Wind Chill/Temperature Index*, accessed February 2018. https://www.weather.gov/oun/safety-winter-windchill

The parameter estimates obtained from this model were used to calculate the estimated impact of each of the curtailment events and the forecast capability at a variety of temperatures.

The purpose of the splines (two dummy variables) is to explicitly account for the highly nonlinear nature of average heat strip demand. The effect of these dummies (which are interacted with every other variable in the model) is analytically equivalent to estimating two different regression equations. Using splines instead of two different equations, however, means that covariances between variables that cross both splines are available for the purposes of calculating aggregated standard errors. The selection of the spline threshold (approximately 30°F) was selected based on a visual inspection of average event period demand on non-event days. A scatter plot of average demand between 6:30 and 7:30 on non-event days, by EM&V group, is plotted in Figure B-1. The dashed lines show how the trend shifts at approximately 30°F.

Figure B-1. Average Non-Event Day Demand and Temperature



Source: Navigant analysis, NOAA data

B.2 Water Heater Model Specification and Details

Water heater impacts were estimated using a single regression equation, shown in Equation B-2. Only event days were included in the estimation set. This differs from previous winter EnergyWise evaluations, which also included some non-event days in the estimation set. Limiting the estimation set to include event days only is possible due to the two-group RCT-style experimental design.

Equation B-2. Water Heater Regression Model

$$y_{i,t} = \alpha_i + \sum_{q=1}^{Q=96} \beta_{1,q} \cdot qh_{q,t} + \sum_{q=1}^{Q=96} \beta_{3,q} \cdot qh_{q,t} \cdot ma2wkHDQH_{i,t}$$
$$+ \sum_{q=27}^{Q=40} \gamma_q \cdot c_{i,t} \cdot qh_{q,t} + \sum_{s=1}^{S=16} \beta_{4,s} \cdot numQH_{i,t} \cdot sb_{i,t,s} + \varepsilon_{i,t}$$

Where:

$ma2wkHDQH_{i,t}$	=	A 2-week moving average of the HDQHs for appliance *i*. Although an inspection of the data indicates there is no material or significant relationship between water heater demand and contemporaneous temperature, the fact that many water heaters are installed in semi-conditioned areas would suggest that longer-term temperature shifts are likely to affect demand. This variable is included principally to improve baseline precision.
$numQH_{i,t}$	=	The number of quarter-hours over which the water heater was curtailed. This is to capture that the longer that a water heater is curtailed, the more energy will need to be taken back by the snapback to restore tank setpoint.

And all other variables are as defined above.

APPENDIX C. FINAL SURVEY GUIDE USED FOR PARTICIPANT PERCEPTION PHONE SURVEYS

C.1 DEP EnergyWise Home Program Evaluation

Residential Post-Event Survey

Purpose: The EnergyWise program provides residential customers the opportunity to earn credit on their electricity bill by allowing Duke Energy Progress to remotely control air conditioners (AC) in the summer months during times of seasonal peak demand, known as DR events. Telephone surveys will be conducted with program participants following DR events and "placebo" events, where no event is actually called, but features similar conditions to DR event days. The key process research objectives addressed through this survey will include assessing overall participant program satisfaction and evaluating participant awareness and comfort levels during actual DR events as compared to "awareness" of placebo DR events.

FOR EVENT SAMPLE: Use two attempts at different times of the day within 27 hours of event notification before dropping contact from the contact list. Call times are from 10:00 a.m. to 8:00 p.m. EDT or 9-7 CST Monday through Saturday. No calls on Sunday. For example, if a control event occurs on a Monday, calling hours for that particular event would be:

Monday 6:30pm-8pm Eastern (5:30-7 Central)
Tuesday 10am-8pm Eastern (9-7 Central)

FOR NON-EVENT SAMPLE: Use two attempts at different times of the day within 27 hours of weather similar to when a real event would be called but no EnergyWise Home event being called. Call times are from 10:00 a.m. to 8:00 p.m. EDT or 9-7 CST Monday through Saturday. No calls on Sunday. For example, if a high temperature/no event day occurs on a Monday, calling hours for that particular non-event would be:

Monday 6:30pm-8pm Eastern (5:30-7 Central)
Tuesday 10am-8pm Eastern (9-7 Central)

For a Friday Event calls can be made on the Monday following if needed.

State:
( ) North Carolina
( ) South Carolina

Info
Survey ID: ________________________
Event ID: __DATE_____________________
Surveyor Name: ________________________

Basic Customer Data: (To be provided from Sample)

- Name (Adult Customer of Record and/or Spouse)
- Date Survey Completed
- Property Address
- Phone number
- Utility Account Number

Sample Variables:

1. CONTACT_NAME
2. SAMPLE_TYPE (1 = EVENT; 2 = NON-EVENT)
3. HIGHTEMP_DATE
4. EVENT_STARTTIME

5. EVENT_ENDTIME
6. BEFORE_HIGHTEMP_DATE

INSERT LABEL	Round 1/ Event 1	Round 2/ Event 2	Round 3/ Event 3 (Placebo)
HIGHTEMP_DATE	August 11, 2016	September 8, 2016	September 14, 2016
EVENT_STARTTIME	3:00 p.m.	3:00 p.m.	3:00 p.m.
EVENT_ENDTIME	6:00 p.m.	6:00 p.m.	6:00 p.m.
BEFORE_HIGHTEMP_DATE	August 10, 2016	September 7, 2016	September 13, 2016

INTRO. Hello, my name is (YOUR NAME), and I'm calling from Bellomy Research on behalf of Duke Energy Progress. May I please speak to [INSERT CONTACT NAME]? (IF NOT AVAILABLE, SAY:) May I please speak to the person who would be most familiar with your household's participation in the EnergyWise Home Program? (IF NO ONE AVAILABLE TO SPEAK WITH, TRY TO SCHEDULE A CALLBACK WITHIN THE NEXT 24 HOURS ONLY.)

According to our information, you presently participate in Duke Energy Progress's EnergyWise Home Program. This program allows Duke Energy Progress to cycle your air conditioner when there is a critical need for electricity in the region. This is a short survey that will take about 5 minutes to complete and the information you provide will be confidential and will help to improve the program.

1. Are you aware of your participation in the EnergyWise Home Program?
   1. Yes
   2. No
   98. Don't know/Not sure

[IF Q1 = 2 OR 98 CONTINUE. OTHERWISE, SKIP TO Q2.]
1a. May I please speak to the person who would be most familiar with your household's participation in the EnergyWise Home Program? (IF NOT AVAILABLE, TRY TO SCHEDULE A CALLBACK WITHIN THE NEXT 24 HOURS ONLY.)
   1. Yes, available
   99. Refused

[IF Q1A = 1, CONTINUE. OTHERWISE, THANK AND TERMINATE.]
1b. Hello, my name is (YOUR NAME), and I'm calling from Bellomy Research on behalf of Duke Energy Progress. According to our information, you presently participate in Duke Energy Progress's EnergyWise Home Program. This program allows Duke Energy Progress to cycle your air conditioner when there is a critical need for electricity in the region. This is a short survey that will take about 5 minutes to complete and the information you provide will be confidential and will help to improve the program.
   1. Yes, continue
   99. Refused

[IF 1B = 1, CONTINUE. OTHERWISE, THANK AND TERMINATE.]
2. Has Duke Energy Progress activated the EnergyWise Home device since you joined the program?
(IF THEY ASK WHAT THIS MEANS, RESPOND WITH:) "Duke Energy Progress has the ability to send a signal to activate the device to cycle your central air conditioner on and off during an event." (THEN REPEAT THE QUESTION.)
   1. Yes
   2. No
   98. Don't know/Not sure

3. How do you know when the device has been activated? (DO NOT READ LIST. RECORD ALL MENTIONS.)
   1. AC shuts down
   2. Home temperature rises
   3. The light on the meter is on
   4. Light on AC unit flashes
   5. Bill credits
   6. Lower bill
   97. Other (Please Specify)
   98. Don't know/Not sure

Has your device been activated within the last 7 days?
   1. Yes
   2. No
   98. Don't know/Not sure

5. [IF SAMPLE_TYPE = 1 "Event", DISPLAY: According to our records, your device was activated on [INSERT HIGHTEMP_DATE] starting at [INSERT EVENT_STARTTIME] and ending at [INSERT EVENT_ENDTIME]].
[IF SAMPLE_TYPE = 1 "EVENT", Q5_INSERT = "during the time of the event?"]
[IF SAMPLE_TYPE = 2 "NON-EVENT", Q5_INSERT = "at 3pm on [INSERT HIGHTEMP_DATE]?"]
At what temperature was your thermostat set to [INSERT Q5_INSERT]
   1. Less than 65 degrees
   2. 65-68 degrees
   3. 69-72 degrees
   4. 73-75 degrees
   5. 76-78 degrees
   6. 79-81 degrees
   7. 82-84 degrees
   8. 85-87 degrees
   9. 88-90 degrees
   10. 91-94 degrees
   11. 95-97 degrees
   12. 98-100 degrees
   13. Greater than 100 degrees
   14. It's programmed into the thermostat
   15. Thermostat was turned off
   16. Air conditioner was turned off
   98. Don't know/Not sure

[IF SAMPLE_TYPE = 1 "EVENT", Q6_INSERT = "when Duke Energy Progress activated your EnergyWise Home device at that time?"]
[IF SAMPLE_TYPE = 2 "NON-EVENT", Q6_INSERT = "at that time?"]
6. Were you or any members of your household home [INSERT Q6_INSERT]

   1. Yes

   2. No

   98. Don't know/Not sure

[IF Q6 = 1, CONTINUE. OTHERWISE, SKIP TO Q14.]
[IF SAMPLE_TYPE = 1 "EVENT", Q71_INSERT = "During this recent activation,"]
[IF SAMPLE_TYPE = 1 "EVENT", Q72_INSERT = "before the recent activation?"]
[IF SAMPLE_TYPE = 2 "NON-EVENT", Q71_INSERT = "During this time,"]
[IF SAMPLE_TYPE = 2 "NON-EVENT", Q72_INSERT = "on [INSERT BEFORE_HIGHTEMP_DATE]?"]

7. [INSERT Q71_INSERT] using a scale of 0 to 10, where 0 means "Very Uncomfortable" and 10 means "Very Comfortable", how would you describe your level of comfort [INSERT Q72_INSERT]

Very Uncomfortable										Very Comfortable	Don't know/Not sure
0	1	2	3	4	5	6	7	8	9	10	98

[IF SAMPLE_TYPE = 1 "EVENT", Q8_INSERT = "during the recent activation?"]
[IF SAMPLE_TYPE = 2 "NON-EVENT", Q8_INSERT = "on [INSERT HIGHTEMP_DATE]?"]

8. Using the same scale of 0 to 10, where 0 means "Very Uncomfortable" and 10 means "Very Comfortable", how would you describe your level of comfort [INSERT Q8_INSERT]

Very Uncomfortable										Very Comfortable	Don't know/Not sure
0	1	2	3	4	5	6	7	8	9	10	98

[IF Q7 OR Q8 = 98 "DK/NS", SKIP TO Q10.]
[IF Q8 ANSWER < Q7 ANSWER, CONTINUE. OTHERWISE SKIP TO Q10.]
[IF SAMPLE_TYPE = 1 "EVENT", Q9_INSERT = "EnergyWise Home Program/Control"]
[IF SAMPLE_TYPE = 2 "NON-EVENT", Q9_INSERT = "EnergyWise"]

9. What do you feel caused your decrease in comfort? (DO NOT READ LIST. RECORD ALL MENTIONS.)

1. [INSERT Q9_INSERT]
2. Rising temperature
3. Rising humidity
4. Power outage
97. Other (Please Specify)
98. Don't know/Not sure

[IF SAMPLE_TYPE = 1 "EVENT", Q10_INSERT = "When Duke Energy Progress activated your EnergyWise Home device on [INSERT HIGHTEMP_DATE],"]
[IF SAMPLE_TYPE = 2 "NON-EVENT", Q10_INSERT = "On [INSERT HIGHTEMP_DATE],"]

10. [INSERT Q10_INSERT] did you or any other members of your household adjust the settings on your thermostat?
1. Yes
2. No
98. Don't know/Not sure

[IF Q10 = 1, CONTINUE. OTHERWISE SKIP TO Q12.]
[IF SAMPLE_TYPE = 1 "EVENT", Q11_INSERT = "during the control event?"]
[IF SAMPLE_TYPE = 2 "NON-EVENT", Q11_INSERT = "on [INSERT HIGHTEMP_DATE]?"]

11. At what temperature was it originally set, and what temperature did you set it to [INSERT Q11_INSERT] (USE 998 FOR DON'T KNOW/NOT SURE.)

______ Original temperature setting (degrees F) [ENTER NUMBER FROM 0-100.]
______ Adjusted temperature setting (degrees F) [ENTER NUMBER FROM 0-100.]

[IF SAMPLE_TYPE = 1 "EVENT", Q12_INSERT = "When Duke Energy Progress activated your EnergyWise Home device on [INSERT HIGHTEMP_DATE],"]
[IF SAMPLE_TYPE = 2 "NON-EVENT", Q12_INSERT = "On [INSERT HIGHTEMP_DATE],"]

12. [INSERT Q12_INSERT] did you or any other members of your household turn on any fans to keep cool?
    1. Yes
    2. No
    98. Don't know/Not sure

13. What else did you or other members of your household do to keep cool? (DO NOT READ LIST. RECORD ALL MENTIONS.)
    1. Continued normal activities/Didn't do anything different [EXCLUSIVE]
    2. Turned on room/window air conditioners
    3. Closed blinds/shades
    4. Moved to a cooler part of the house
    5. Left the house and went somewhere cool
    6. Wore less clothing
    7. Drank more water/cool drinks
    9. Opened windows
    97. Other (Please Specify)
    98. Don't know/Not sure

14. Now I'm going to ask you some questions about your usual air conditioning use. How often do you use your central air conditioner? Would you say you use it...(READ LIST)? (STOP WHEN RESPONDENT ANSWERS.)
    1. Not at all
    2. Only on the hottest days
    3. Frequently during the cooling season
    4. Most days during the cooling season
    5. Every day during the cooling season
    8. (DO NOT READ) Don't know/Not sure

15. When you think of a typical hot and humid summer day, at what outside temperature do you tend to feel uncomfortably warm? (DO NOT READ LIST.)
    1. Less than 65 degrees
    2. 65-68 degrees
    3. 69-72 degrees
    4. 73-75 degrees
    5. 76-78 degrees
    6. 79-81 degrees
    7. 82-84 degrees
    8. 85-87 degrees
    9. 88-90 degrees
    10. 91-94 degrees
    11. 95-97 degrees
    12. 98-100 degrees
    13. Greater than 100 degrees
    98. Don't know/Not sure

16. At what <u>outside temperature</u> do you tend to turn on the air conditioner? (DO NOT READ LIST.)
    1. Less than 65 degrees
    2. 65-68 degrees
    3. 69-72 degrees
    4. 73-75 degrees
    5. 76-78 degrees
    6. 79-81 degrees

7. 82-84 degrees
8. 85-87 degrees
9. 88-90 degrees
10. 91-94 degrees
11. 95-97 degrees
12. 98-100 degrees
13. Greater than 100 degrees
14. It's programmed into the thermostat
98. Don't know/Not sure

17. How old is your air conditioner? (DO NOT READ LIST.)

1. 0 to 6 years old
2. 7 to 12 years old
3. 13 to 20 years old
4. Over 20 years old
98. Don't know/Not sure

18. Using a scale of 0 to 10, where 0 means "Very Dissatisfied" and 10 means "Very Satisfied", what is your overall satisfaction with the EnergyWise Home Program?

Very Dissatisfied										Very Satisfied	Don't know/Not sure
0	1	2	3	4	5	6	7	8	9	10	98

[IF Q18 = 0-7, CONTINUE. OTHERWISE SKIP TO Q20.]

19. Why are you less than satisfied with EnergyWise Home? (RECORD ALL MENTIONS.)

1. They activated my EnergyWise Home device more often than I would like
2. The bill credit/incentives were not large enough
3. I was uncomfortable when my EnergyWise device was activated
97. Other (Please Specify)
98. Don't know/Not sure

20. Using a scale of 0 to 10, where 0 means "Very Dissatisfied" and 10 means "Very Satisfied", what is your overall satisfaction with Duke Energy Progress?

Very Dissatisfied										Very Satisfied	Don't know/Not sure
0	1	2	3	4	5	6	7	8	9	10	98

[IF Q20 = 0-7, CONTINUE. OTHERWISE SKIP TO Q22.]

21. Why are you less than satisfied with Duke Energy Progress? (RECORD VERBATIM.)

____ CODING USE ONLY

22. Using a scale of 0 to 10, where 0 means "Extremely Unlikely" and 10 means "Extremely Likely", how likely is it that you would recommend this program to a friend or colleague?

Extremely Unlikely										Extremely Likely	Don't know/Not sure
0	1	2	3	4	5	6	7	8	9	10	98

[IF Q22 = 0-7, CONTINUE. OTHERWISE SKIP TO Q24.]

23. Why would you not recommend the program? (RECORD VERBATIM.)

____ CODING USE ONLY

24. Do you get your Duke Energy Progress bill in the mail or by email?
1. Mail
2. Email
97. Other (Please Specify)
98. Don't know/Not sure

25. How do you pay your bill? Do you…(READ LIST)? (STOP WHEN RESPONDENT ANSWERS.)
1. Mail a check
2. Log into your Duke Energy Progress account and pay online
3. Or, do you have an auto-pay set up for your account
97. (DO NOT READ) Other (Please Specify)
98. (DO NOT READ) Don't know/Not sure

26. On average, how often do you review the details of your Duke Energy Progress bill? (READ LIST.) (STOP WHEN RESPONDENT ANSWERS.)
1. Every month
2. More than half the time
3. Less than half the time
4. Never
97. (DO NOT READ) Other (Please Specify)
98. (DO NOT READ) Don't know/Not sure

27. Have you noticed EnergyWise Home credit on your bill?
1. Yes
2. No
98. Don't know/Not sure

[IF Q27 = 1, CONTINUE. OTHERWISE SKIP TO Q30.]

28. Using a scale of 0 to 10, where 0 means "Very Dissatisfied" and 10 means "Very Satisfied", what is your overall satisfaction with the credit amount?

Very Dissatisfied										Very Satisfied	Don't know/Not sure
0	1	2	3	4	5	6	7	8	9	10	98

[IF Q28 = 0-7, CONTINUE. OTHERWISE SKIP TO Q30.]

29. Why do you say you're not satisfied? (RECORD VERBATIM.)

____ CODING USE ONLY

[PROGRAMMER: ALLOW A DON'T KNOW/NOT SURE CHECK BOX.]

[IF SAMPLE_TYPE = 1 "EVENT", Q30_INSERT = "Duke Energy Progress about the EnergyWise Home Program?"]
[IF SAMPLE_TYPE = 2 "NON-EVENT", Q11_INSERT = "Duke Energy Progress?"]

30. We have reached the end of the survey. Do you have any comments that you would like for me to pass on to [INSERT Q30_INSERT] (RECORD VERBATIM.)

____ CODING USE ONLY

[PROGRAMMER: ALLOW A NO COMMENTS CHECK BOX.]

CLOSE 2. Thank you for your time and feedback today!

NAVIGANT

EM&V Report for the Small Business Energy Saver Program

Duke Energy Progress and Duke Energy Carolinas

Prepared for:

Duke Energy

DUKE ENERGY®

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1. EVALUATION SUMMARY

1.1 Program Summary

The Small Business Energy Saver (SBES) Program is part of a portfolio of energy efficiency programs operated by Duke Energy. Duke Energy selected Lime Energy to implement the SBES program again in the Duke Energy Progress (DEP) jurisdiction, as well as the Duke Energy Carolinas (DEC) jurisdiction for this evaluation cycle. The program caters specifically to small business customers (up to 180 kilowatts demand service, up from 100 kW demand service in previous years) and offers a performance-based incentive up to 80 percent of the total project cost, inclusive of both materials and installation, on high-efficiency lighting and refrigeration equipment.

The SBES Program generates energy savings and peak demand reductions by offering eligible customers a streamlined service including marketing outreach, technical expertise, and performance incentives to reduce equipment and installation costs from market rates on high-efficiency lighting, refrigeration, and HVAC equipment. The SBES Program seeks to bundle all eligible measures together and sell them as a single project to maximize the total achievable energy and demand savings, while working with customers to advise equipment selection to meet their unique needs.

1.2 Evaluation Objectives and High-Level Findings

Evaluation, Measurement, and Verification (EM&V) involves the use of a variety of analytic approaches, including on-site verification of installed measures and application of engineering models. EM&V also encompasses an evaluation of program processes and customer feedback, typically conducted through participant surveys and program staff interviews. This report details the EM&V activities that Navigant Consulting, Inc. (Navigant) performed on behalf of Duke Energy for the SBES Program covering the period between March 1, 2016 through June 30, 2017, referenced simply as PY2016.

The primary purpose of the evaluation assessment is to estimate net annual energy and peak demand impacts associated with SBES activity. Net savings are calculated as the reported “gross” savings from Duke Energy, verified and adjusted through EM&V, and netted for free ridership (i.e., savings that would have occurred even in the absence of the program) and spillover (i.e., additional savings attributable to the program but not captured in program records).

The EM&V assessment of the SBES program included impact and process evaluations.

- The impact evaluation consisted of engineering analysis and on-site field verification and metering to validate energy and demand impacts of reported measure categories, as well as a customer survey to assess net impacts.
- The process evaluation used customer surveys with 150 participants and interviews with program staff and the implementation contractor to characterize the program delivery and identify opportunities to improve the program design and processes. The customer survey data also formed the basis of the evaluation team’s estimation of free ridership and spillover, used to calculate an NTG ratio.

The evaluation team verified gross energy savings at 102 percent of deemed reported energy savings for DEP and 101 percent for DEC, and gross peak demand reductions at 77 percent for DEP and 76 percent for DEC. A net-to-gross (NTG) ratio was estimated at 0.98, yielding total verified net energy savings of

53,302 megawatt-hours (MWh) for DEP and 90,923 MWh for DEC, and net summer peak demand reductions of 9.4 megawatts (MW) for DEP and 16.6 MW for DEC (Table 1-1 through Table 1-4).

Table 1-1. Program Claimed and Evaluated Gross Energy Impacts

	Jurisdiction	Claimed	Evaluated	Realization Rate
Gross Energy Impacts (MWh)	DEP	53,490	54,390	1.02
Gross Energy Impacts (MWh)	DEC	92,079	92,779	1.01

Source: Navigant analysis and Duke Energy tracking data, totals subject to rounding.

Table 1-2. Program Claimed and Evaluated Gross Peak Demand Impacts

	Jurisdiction	Claimed	Evaluated	Realization Rate
Gross Summer Peak Demand Impacts (MW)	DEP	12.5	9.6	0.77
Gross Winter Peak Demand Impacts (MW)	DEP	12.5	8.7	0.69
Gross Summer Peak Demand Impacts (MW)	DEC	22.3	17.0	0.76
Gross Winter Peak Demand Impacts (MW)	DEC	22.3	15.5	0.69

Source: Navigant analysis and Duke Energy tracking data, totals subject to rounding.

Table 1-3. Program Net Energy Impacts

	Jurisdiction	MWh
Net Energy Impacts	DEP	53,302
Net Energy Impacts	DEC	90,923

Source: Navigant analysis, totals subject to rounding.

Table 1-4. Program Net Peak Demand Impacts

	Jurisdiction	MW
Net Summer Peak Demand Impacts	DEP	9.4
Net Winter Peak Demand Impacts	DEP	8.5
Net Summer Peak Demand Impacts	DEC	16.6
Net Winter Peak Demand Impacts	DEC	15.2

Source: Navigant analysis, totals subject to rounding.

1.3 Evaluation Parameters and Sample Period

To accomplish the evaluation objectives, Navigant performed a variety of primary and secondary research activities including:

- Engineering review of measure savings algorithms
- Field verification and metering to assess installed quantities and characteristics

- Participant surveys with customers to assess satisfaction and decision-making processes.

Table 1-5 summarizes the evaluated parameters. The targeted sampling confidence and precision for both DEP and DEC was 90 percent ± 10 percent, and the achieved was 90 percent ± 2.4 percent for energy savings, 6.8 percent for summer and 3.1 percent for winter peak demand reductions.[1]

Table 1-5. Evaluated Parameters

Evaluated Parameter	Description	Details
Efficiency Characteristics	Inputs and assumptions used to estimate energy and demand savings	1. Lighting wattage 2. Operating hours 3. Coincidence factors 4. HVAC interactive effects 5. Baseline characteristics
In-Service Rates	The percentage of program measures in use as compared to reported	1. Measure quantities found onsite
Satisfaction	Customer satisfaction with various stages of their project	1. Overall satisfaction with program 2. Satisfaction with implementation and installation contractors 3. Satisfaction with program equipment
Free Ridership	Fraction of reported savings that would have occurred in the absence of the program	
Spillover	Additional, non-reported savings that occurred as a result of participation in the program	1. Inside spillover (at same facility as program measures) 2. Outside spillover (at different facility as program measures)

Source: Navigant analysis

This evaluation covers program participation from March 2016 through June 2017. Table 1-6 shows the start and end dates of Navigant's sample period for evaluation activities.

Table 1-6. Sample Period Start and End Dates

Activity	Start Date	End Date
Field Verification and metering	September 18, 2017	November 30, 2017
Participant Phone Surveys	October 1, 2017	November 30, 2017

Source: Navigant analysis

---

[1] Navigant designed the impact sample to achieve 90/10 confidence and precision using the industry-standard coefficient of variation of 0.5 and results from previous (PY2013, PY2014, and PY2015) SBES program evaluations in the DEP and DEC jurisdictions. The sample quotas were met as planned, and the final precision was different due to natural variation in individual site level characteristics.

1.4 Recommendations

The evaluation team recommends four discrete actions for improving the SBES Program, based on insights gained through the comprehensive evaluation effort. These recommendations provide Duke Energy with a roadmap to fine-tune the SBES Program for continued success and include the following broad objectives. Table 1-7 summarizes these program recommendations.

Table 1-7. Summary of PY2016 SBES Recommendations

Increasing Program Participation and Satisfaction
1. **Continue to focus on quality, clear communication, and depth of energy efficiency retrofits.** The most common suggested improvements were post-installation equipment issues and a perceived lack of coordination between the various parties involved in delivering the SBES program. There was also a minority of customers reporting that the program was unable to provide all the energy efficiency equipment they wanted. There are opportunities for continued improvement and channeling to other Duke Energy programs or education about measures that are not offered through the SBES program.
2. **Consider effects of increased program eligibility rules**. With a 180 kW demand limit, there is likely significant overlap between the SBES program and other business programs in Duke Energy's portfolio. The largest project is almost 2 GWh, which is larger than typical large business prescriptive projects seen in other utility offerings. Larger businesses typically have additional resources that small businesses do not, and often do not require the high incentive levels that the SBES program offers. Duke Energy should consider whether the SBES incentive levels are appropriate for these very large projects, or if a different program channel would be sufficient. For example, the Smart $aver program offers LED incentives that are capped at a lower percentage of incremental costs.
Improving Accuracy of Reported Savings
3. **Track burnout lamps and fixtures during the initial audit.** It is likely that some burnouts were present and tolerated by customers, and may contribute to customers not realizing expected savings on their energy bills. Burnouts found during the initial audit are no longer included in tracking data. While not generally required in the industry, customers with many burnouts will not achieve the expected energy savings.
4. **Ensure that the IC has access to up-to-date and accurate customer billing records.** There are several (2706) instances where project deemed savings exceed annualized site data, likely due to incomplete annualized energy usage estimates. Since this is used as an overridable QC check, more accurate data could help reduce the need for such overrides.

Source: Navigant analysis

2. PROGRAM DESCRIPTION

The Small Business Energy Saver (SBES) Program is part of a portfolio of energy efficiency programs operated by Duke Energy. The program began as a pilot in early 2013 in South Carolina before expanding into the remainder of the Duke Energy Progress (DEP) jurisdiction. The program further expanded into the Duke Energy Carolinas (DEC) jurisdiction in August 2014. Since 2015, the program showed continued growth measured by participant count, claimed energy savings, and peak demand reductions.

2.1 Program Design

The SBES Program is available to qualifying commercial customers with less than 180 kilowatts (kW) demand service, up from 100 kW demand service in previous years. 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 and refrigeration equipment. These incentives increase adoption of efficient technologies beyond what would occur naturally in the market. In PY2016, the SBES Program achieved most 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 refrigeration measures at a similar level to previous years.

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 maintains 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, the IC maintains a tracking database that contains additional measure level details that are useful for EM&V activities. For PY2016 Navigant reviewed the IC database as the basis for deemed energy savings. Duke Energy ensured that the IC database savings accurately represents all claimed program savings, and further defined demand ratios that are used to derive final deemed demand impacts.

Table 2-1 provides a summary of the gross reported energy and demand savings and participation for PY2013 through PY2016. Note the growth of average savings per project, especially in PY2016 in the DEC jurisdiction, driven by an increase in maximum customer size eligible for participation in the program (up to 180 kW demand).

Table 2-1. Reported Participation and Gross Savings Summary

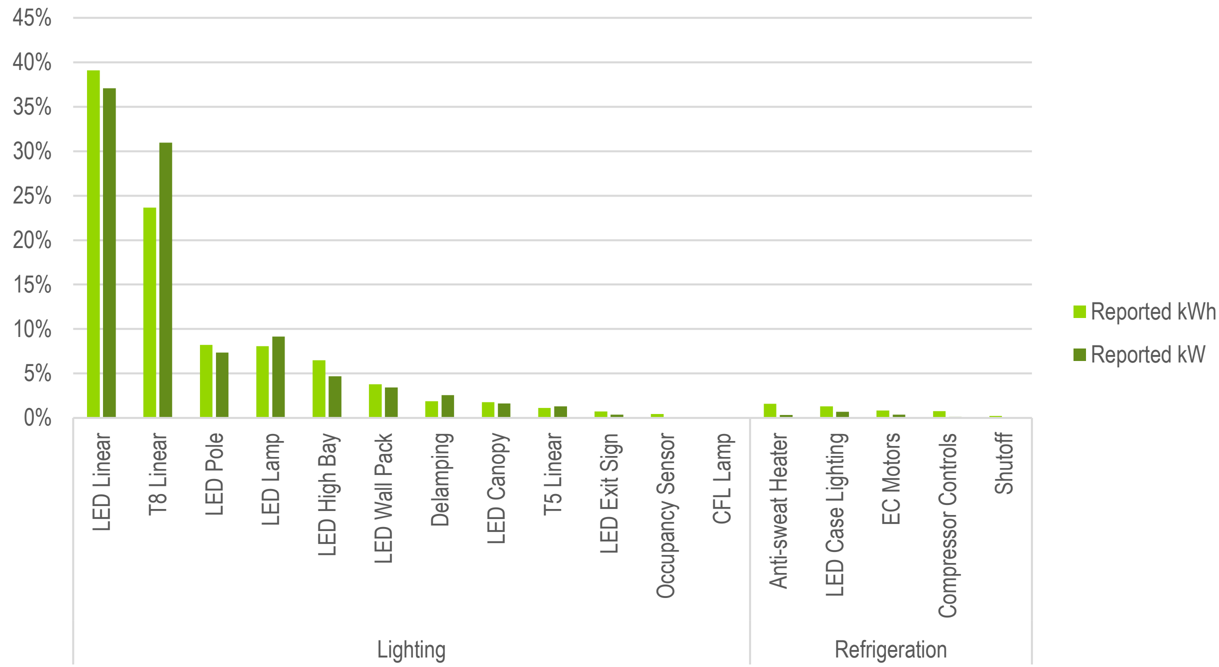
Reported Metrics	PY2013 (DEP)	PY2014 (DEP)	PY2015 (DEP)	PY2015 (DEC)	PY2016 (DEP)	PY2016 (DEC)
Participants	675	1,759	1,790	3,080	1,829	2,435
Measures Installed	42,537	108,816	132,977	234,788	121,181	210,775
Gross Annual Energy Savings (MWh)	14,242	38,665	48,772	77,269	53,490	92,079
Average Quantity of Measures per Project	63	62	74	76	66	87
Average Savings Per Project (MWh)	21.1	22	27.2	25.1	29.2	37.8

Source: SBES Tracking Database

2.2.1 Program Summary by Measure

Efficient LED linear lighting retrofits were the highest contributor to program energy savings in PY2016 across both jurisdictions, followed by T8 linear fluorescent retrofits and a variety of LED lighting measures. In addition, refrigeration measures, T5 linear retrofits and LED exit signs also contributed to savings. The SBES program has rapidly adopted LED lighting products in PY2016, although T8 lighting still contributed over 20% of energy savings. Program staff have indicated that T8 retrofits are actively being phased out of the current SBES program. Figure 2-1 shows the reported gross savings by measure category as reported by Duke Energy.

Figure 2-1. Reported Gross Energy Savings by Measure Category

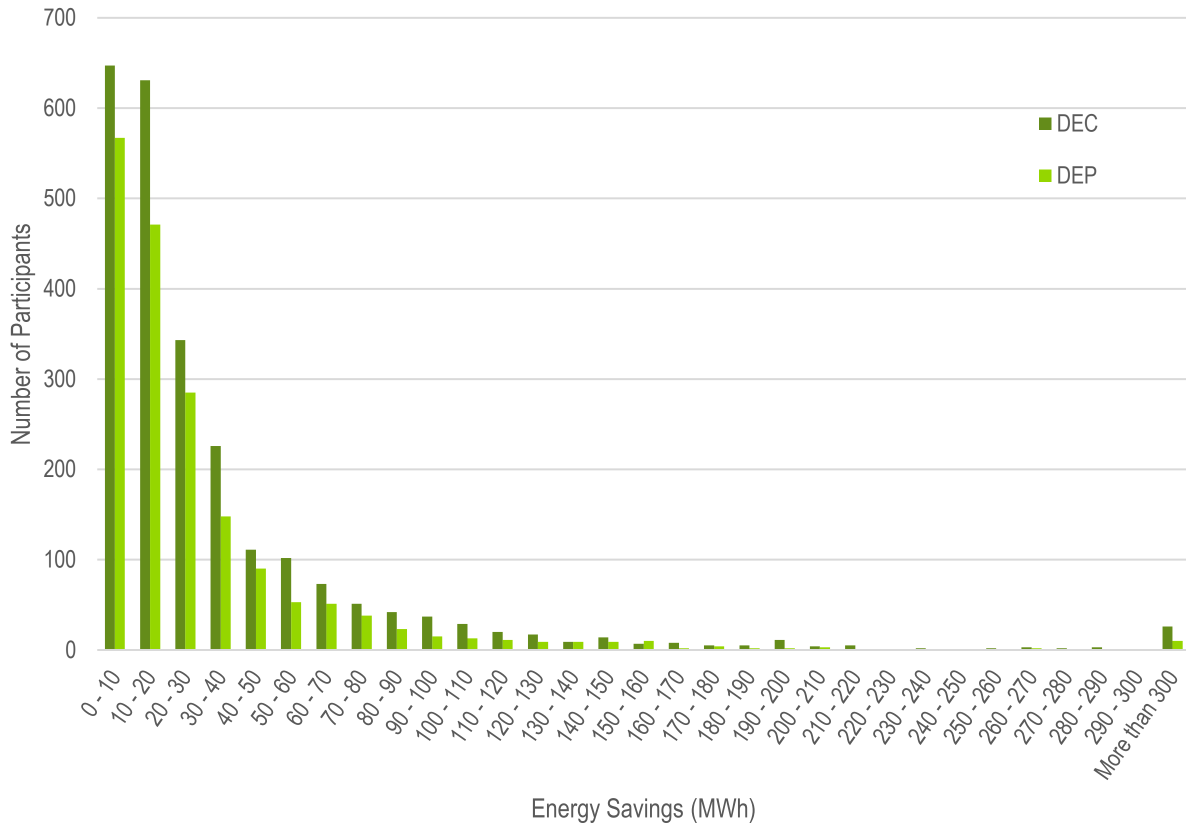


Source: SBES Tracking Database

2.2.2 Savings by Project

Because the SBES program is limited to small business customers only, the variations in project energy and peak demand savings and the quantity of measures installed exhibit less spread than typical large business program offerings. Along with the increase for participant eligibility to 180 kW, however, several very large projects are now part of the program. Figure 2-2 shows the distribution of project sizes. The largest site reported savings of over almost 2 GWh per year, which is nearly four times the value of 500 MWh found during the PY2015 evaluation when eligibility was limited to 100 kW or less.

Figure 2-2. Histogram of Reported Energy Savings per Project



Source: SBES Tracking Database

3. KEY RESEARCH OBJECTIVES

As outlined in the Statement of Work (SOW), the primary purpose of the EM&V activities is to estimate verified net annual energy and peak demand impacts associated with program activity for PY2016. Additional research objectives include the following:

3.1 Impact Evaluation

The impact evaluation focuses on quantifying the magnitude of verified energy savings and peak demand reductions. Objectives include:

- Verify deemed savings estimates through review of measure assumptions and calculations.
- Perform on-site verification of measure installations, and collect data for use in an engineering analysis.
- Estimate the amount of observed energy and peak demand savings (both summer and winter) by measure via engineering analysis.

3.2 Net-to-Gross Analysis

The net-to-gross analysis focuses on estimating the share of energy savings and peak demand reductions that can be directly attributed to the SBES program itself. Objectives include:

- Assess the Net-to-Gross ratio by addressing spillover and free-ridership in customer surveys.

3.3 Process Evaluation

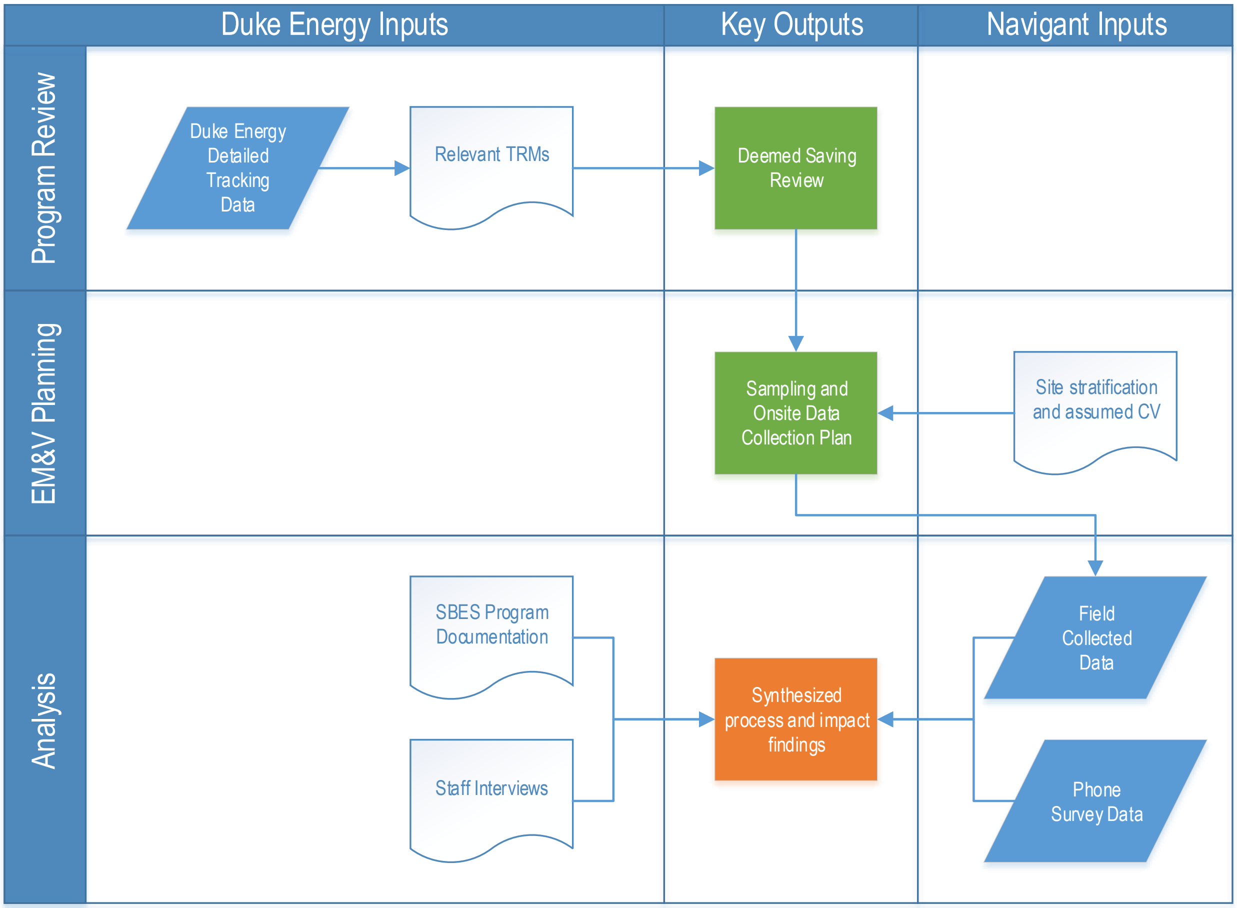
The process evaluation focuses on the program implementation and the customer experience. Objectives include:

- Identify barriers to participation in the program, and how the program can address these barriers.
- Identify program strengths and the potential for introducing additional measures.

3.4 Evaluation Overview

Figure 3-1 outlines the high-level approach used for evaluating the SBES Program, which is designed to address the research objectives outlined above. The impact, net-to-gross, and process sections provide further detail for each of the individual EM&V activities.

Figure 3-1. Evaluation Process Flow Diagram



Source: Navigant

4. IMPACT EVALUATION

The purpose of this impact evaluation is to quantify the verified energy and demand savings estimates for the SBES Program in both the DEP and DEC jurisdictions. Table 4-1 and Table 4-2 show high-level program results of Navigant's impact analysis. Ultimately, Duke Energy can use these results for planning purposes.

Table 4-1. PY2016 SBES Summary of Program Impacts for DEP

DEP	Energy Savings (MWh)	Summer Peak Demand Reductions (MW)	Winter Peak Demand Reductions (MW)
Reported Gross Savings	53,490	12.5	12.5
Realization Rate	1.02	0.77	0.69
Verified Gross Savings	54,390	9.6	8.7
NTGR	0.98	0.98	0.98
Verified Net Savings	53,302	9.4	8.5

Source: Navigant analysis, totals subject to rounding.

Table 4-2. PY2016 SBES Summary of Program Impacts for DEC

DEC	Energy Savings (MWh)	Summer Peak Demand Reductions (MW)	Winter Peak Demand Reductions (MW)
Reported Gross Savings	92,079	22.3	22.3
Realization Rate	1.01	0.76	0.69
Verified Gross Savings	92,779	17.0	15.5
NTGR	0.98	0.98	0.98
Verified Net Savings	90,923	16.6	15.2

Source: Navigant analysis, totals subject to rounding.

4.1 Impact Methodology

The methodology for assessing the gross energy savings and peak demand reductions follows IPMVP Option A (Retrofit Isolation: Key Parameter Measurement)[2]. This involved an engineering-based approach for estimating savings, supplemented by key parameter measurements. This also included using time-of-use lighting loggers to directly measure operating hours and coincidence factors for program-incented lighting measures. Note that for the refrigeration measures, verification activities were performed on-site to assess installation and operation.

The evaluation team employed the following steps to conduct the impact analysis:

[2] International Performance Measurement & Verification Protocol Concepts and Options for Determining Energy and Water Savings Volume I. http://www.nrel.gov/docs/fy02osti/31505.pdf

1. **Review Field Data and Design Sample** – First, the team analyzed the tracking data to determine the most appropriate sampling methodology. The team created four strata based on reported energy savings (small, medium, and large lighting, and refrigeration) to ensure that a variety of different businesses and measures were captured in the site visits. A subset of each strata was selected for more detailed data logger deployment (23 of 62 total sites visits were logged). The sample was designed to utilize double-ratio techniques to meet a precision target of 90/10 at the program level while attempting to minimize sample sizes.
2. **Pull Sample** – Next, the team pulled a sample from the four strata and scheduled site visits, including several backup sites if a visitation could not be arranged.
3. **Perform Participant Site Visits** – The evaluation team used an electronic data collection system in the field to ensure consistency and decrease data processing time. For all site visits, Navigant field technicians uploaded all collected site data to the online system as soon as they were completed. Navigant performed quality control verifications for all field data collection forms and online data entry. This included a thorough inspection of each site's building characteristic inputs, operating schedules, measure-level in-service rates, and descriptions. The following steps were taken at each participant site:
    a. The team first determined the in-service rate (ISR) of the equipment for each measure found. The field technicians accomplished this by visually verifying and counting all equipment included in the project documentation.
    b. The team then calculated the difference in watts between the base-case fixtures and the energy-efficient fixtures for each fixture type installed on-site. The team verified efficient fixture wattage through visual inspection, while deriving base-case fixture wattage from customer-provided data found in the documentation review, if available, or from information found by field technicians during the site visits. There is typically little to no information about the specifications of base-case equipment that has been removed from a site. If both customer data and field data were insufficient, the team utilized the tracking data and assessed the reasonableness of their assumptions.
    c. Operating hours were determined from a detailed customer interview for each unique lighting schedule in the building, and adjusted for holiday building closures. For the subset of sites that received logging, the EM&V team left time-of-use loggers in place for roughly four weeks and then returned to retrieve the logging equipment.
    d. Coincidence factors and HVAC interactive effects were taken from prior Duke Energy program (EEB) evaluation findings[3] and previous SBES reports[4] for similar building types for the verification only sites. For logged sites, the team calculated both summer and winter coincidence factors from the logger data; no further adjustments were made to HVAC interactive effects, however.
4. **Calculate Project-Level Savings** – The team calculated project-level energy and demand savings for each site in the sample based on operational characteristics found on site and engineering-based parameter estimates. The project-level savings represent the total of all the individual measure-level savings at each site.
5. **Calculate Program-Level Savings** – The team calculated verification rates for all sites and applied a ratio, representing the adjustment based on the logger data, resulting in final verified

[3] PY2013 DEP EEB EM&V Report

[4] PY2013 and PY2014 DEP SBES EM&V Report

savings for each sampled site. Next, the team calculated stratum-level realization rates, consisting of the sum of the verified savings divided by the deemed reported savings. Last, the team applied the stratum-level realization rates to the deemed reported savings for each respective strata, and arrived at final program-level realization rates. Note that for demand savings, final program-level realization rates were calculated by comparing verified demand savings to reported demand savings using the demand ratios outlined in Section 2.2.

4.2 Sample Design

After reviewing the Duke Energy and IC tracking data, the evaluation team opted to split up the population of projects into four strata based on the projects' estimated energy savings to ensure that the sample represented both small, medium and large customers, and that field verification assessed a large percentage of program savings. The strata were designed according to the following guidelines:

1. First, all projects with refrigeration measures were assigned to a single stratum.
2. The remaining projects were sorted from highest claimed savings to lowest claimed savings.
3. The team then examined the reported savings and selected criteria that would result in three strata, each containing an approximately equal share of total claimed savings:
    - Lighting Large – greater than 105,000 kWh reported savings;
    - Lighting Medium – between 35,000 kWh and 105,000 kWh reported savings;
    - Lighting Small – less than 35,000 kWh savings;
    - Refrigeration – all projects with refrigeration savings.

Note that the stratum cutoff points for PY2016 are higher than in PY2015 due to the larger average per-project savings in this evaluation. The limits in PY2014 were 25,000 kWh and 65,000 kWh.

To achieve a 10 percent relative precision at a 90 percent confidence interval, the evaluation team targeted 62 total sites, which were spread roughly equally among the three lighting strata and the refrigeration stratum. Among the 62 sites, a subsample of 23 sites were selected for additional lighting metering to more accurately measure lighting hours of use. Sample sizes were based on coefficients of variations (CV) of 0.45 for verification and 0.2 for metering, which were derived from previous work on SBES evaluations on behalf of Duke Energy in other jurisdictions. Additional detail on the sampling and analysis methodologies are included in APPENDIX A.

Navigant conducted on-site verification at 62 sites during the fall of 2017. While on-site, the team conducted customer interviews and visual verification to collect data on building operation, HVAC system details, and seasonal and holiday schedules. For the subsample of sites that received onsite metering, Navigant conducted logging on key retrofit fixtures to estimate hours of use and coincidence factors. The adjustments to savings based on logged data were extrapolated to the full 62 site sample. Key evaluation parameters came primarily from on-site data; however, where this data was lacking or was deemed unusable, customer application data was used in its place. As there are many parameter inputs to the savings calculation for each site, this approach ensures that the best available data is used for each site's savings estimate.

Table 4-3 below details the final site visit disposition.

Table 4-3. Onsite Sample Summary

Strata	Population Size	Onsite Verification Sample Size	Onsite Metering Sample Size (Subset of Verification Sample)
Lighting Large	207	15	6
Lighting Medium	744	19	6
Lighting Small	3088	21	9
Refrigeration	226	7	2
Total	**4,265**	**62**	**23**

Source: Navigant analysis

4.3 Algorithms and Parameters

Navigant used data collected from the field and the engineering review to calculate site-level energy and demand savings, using the following algorithms. Table 4-4 shows the algorithms that the evaluation team used to calculate verified savings for lighting measures. The impact evaluation effort focused on verifying the inputs for these algorithms.

Table 4-4. Verified Savings Algorithms for Lighting Measures

Measure	Energy Savings Algorithm	Coincident Peak Demand Savings Algorithm
Lighting Measures	kWh_Verified = Qty_Verified x HOU x Verified_Watts_Reduced x IF_Energy	kW_Verified = Verified x CF x Verified_Watts_Reduced x IF_Demand
Refrigeration	kWh_Verified = Unit_Savings x Qty_Verified	kW_Verified = Unit_Savings x Qty_Verified

ISR = in-service rate (not in calculation, calculated to provide context)
Fixture_Quantity_Verified = quantity of equipment verified on-site
HOU = verified operating hours
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
Verified Watts Reduced = watts of baseline equipment - watts of energy-efficient equipment.
Unit_Savings = deemed per unit savings appropriate for measure.

Source: Navigant analysis

The detailed description of each parameter and any related assumption are as follows:

4.3.1 Fixture Quantity Verified and In-Service Rate (ISR)

The Navigant evaluation team visually counted fixtures on-site to quantify the quantity and type of lighting equipment installed. The team calculated the ISR as the ratio between the findings from the on-site verification compared to the quantity reported in the program-tracking databases. On-site verifications determined the total number of installed measure-level equipment.

4.3.2 Verified Watts

The team calculated base and efficient watts at the measure level. Efficient nameplate wattages were determined using manufacturer specifications based on fixture-level data collected on-site. The project documentation contained in the IC tracking database determined base wattages. In the cases where efficient fixture data were unavailable, due to inaccessible fixtures, the wattages found in the IC database values were applied.

4.3.3 HVAC Interactive Effects

Reductions in lighting energy generally increase a building's heating requirements (load) and decrease cooling requirements. The HVAC interactive effects accounts for these secondary effects on the HVAC system energy use and acts as a multiplier in the energy savings algorithms. The team applied the HVAC interactive effects used in prior EEB and SBES program evaluations (both 2013 and 2014) for consistency, which were sourced from a 2011 Navigant study (including over 120 buildings) in Maryland that used building energy models of field-verified building characteristics (i.e., HVAC, lighting, and envelope) and actual billing data to assess the interactive effects of lighting energy reductions on HVAC system energy use. The resulting interaction factors are specific to both building type (e.g., office, warehouse) and heating/cooling systems. Future evaluations will consider updating the HVAC interactive effects specifically for the climate zones in North Carolina and South Carolina within the Duke Energy service territory based on energy simulation modelling.

4.3.4 Annual Operating Hours

Measure-level annual operating hours were determined from a detailed interview with the SBES customer. Hours used per day or week were rolled up to annual hours of use and corrected for holidays, seasonal variations in use, and any other change in operating characteristics. For logged sites, the team extrapolated the time of use logger data to develop annual hours of operation.

4.3.5 Coincidence Factor (CF)

Coincidence factors represent the portion of installed lighting that is operational during the utility peak performance hours. These were determined similarly to HVAC interactive effects by using deemed values by building type in addition to data collected on-site. For example, light-emitting diode (LED) exit signs that are on all day receive a CF on 1.0, while exterior lights on daylight sensors receive a CF of 0.0. For logged sites, the team extrapolated the time of use logger data to develop coincidence factors.

4.3.6 Unit Savings

For refrigeration measures, the engineering analysis follows a deemed savings methodology based on the NY Technical Reference Manual (TRM) unit savings. This methodology is based on measure-specific characteristics and is not dependent on the climate in New York. The assumptions and parameters used to estimate reported energy savings and peak demand reductions were therefore considered appropriate by the evaluation team. The team verified that the measures were installed and operational during on-site visits to projects that installed efficient refrigeration equipment.

4.4 Key Impact Findings

The energy realization rates by strata are shown in Table 4-5. This shows the verification realization rate, the metering realization rate, and the final realization rate by strata. The total realization rate for each strata is calculated by multiplying the verification realization rate by the metering realization rate adjustment. This method in effect extrapolates the project-specific results to the stratum-level, which implicitly assumes that these findings in aggregate are representative of other sites within their stratum. In addition, the weighted final realization rate for the program is shown, which represents the total program savings as a weighted result of each stratum. Note that strata-level realization rates are derived from both DEP and DEC projects, and are applied to each jurisdiction separately to calculate program level verified energy savings and peak demand reductions. Additional information specific to the metering realization rate adjustments is provided in Section 4.5.

During review of individual project savings, Navigant identified one project within the large stratum that contained a considerable discrepancy between the reported hours of use and the logged hours of use. Upon further investigation, this particular customer had recently opened their business and anticipated a specific operational schedule. This was not realized at the time of the evaluation, however, and the customer was operating significantly fewer hours per week. Navigant's opinion is that this discrepancy was unique to this particular project and not representative of the broader program, and therefore created a separate stratum just for this project. In effect, the low project realization rate is still included in the final program verified savings, but the results are not extrapolated to the rest of the large stratum.

Table 4-5. Energy Impacts by Strata

Strata	Verification Realization Rate (kWh)	Metering Realization Rate Adjustment (kWh)	Total Realization Rate (kWh)
Lighting Large	1.00	1.00	1.00
Lighting Medium	1.02	0.92	0.94
Lighting Small	1.10	1.02	1.12
Refrigeration	1.00	0.93	0.94
Total	**1.02**	**0.97**	**1.01**

Source: Navigant analysis, totals subject to rounding.

The summer and winter peak demand reductions are shown in Table 4-6 and Table 4-7. Contrary to the energy adjustments based on metering, there is a more substantial reduction in the realization rate due to application of measure-specific coincidence factors based on logger data for both the summer and winter periods. Navigant notes that these realization rates are calculated by comparing verified savings with the Duke Energy reported savings calculated from demand ratios rather than reported in the detailed measure database.

Table 4-6. Summer Peak Demand Impacts by Strata

Strata	Verification Realization Rate (kW)	Metering Realization Rate Adjustment (kW)	Total Realization Rate (kW)
Lighting Large	0.83	0.98	0.81
Lighting Medium	0.91	0.64	0.59
Lighting Small	1.12	0.80	0.90
Refrigeration	0.69	1.02	0.71
Total	**0.87**	**0.86**	**0.76**

Source: Navigant analysis, totals subject to rounding.

Table 4-7. Winter Peak Demand Impacts by Strata

Strata	Verification Realization Rate (Winter kW)	Metering Realization Rate Adjustment (Winter kW)	Total Realization Rate (Winter kW)
Lighting Large	0.90	0.95	0.85
Lighting Medium	0.90	0.60	0.54
Lighting Small	0.89	0.77	0.69
Refrigeration	0.94	0.98	0.93
Total	**0.90**	**0.85**	**0.69**

Source: Navigant analysis, totals subject to rounding.

Overall, the verification realization rates are slightly below 1.0 for energy savings and summer peak demand reduction. This indicates that the program is accurately reporting impacts at the aggregate program level, despite varying realization rates for each individual stratum.

4.5 Detailed Impact Findings

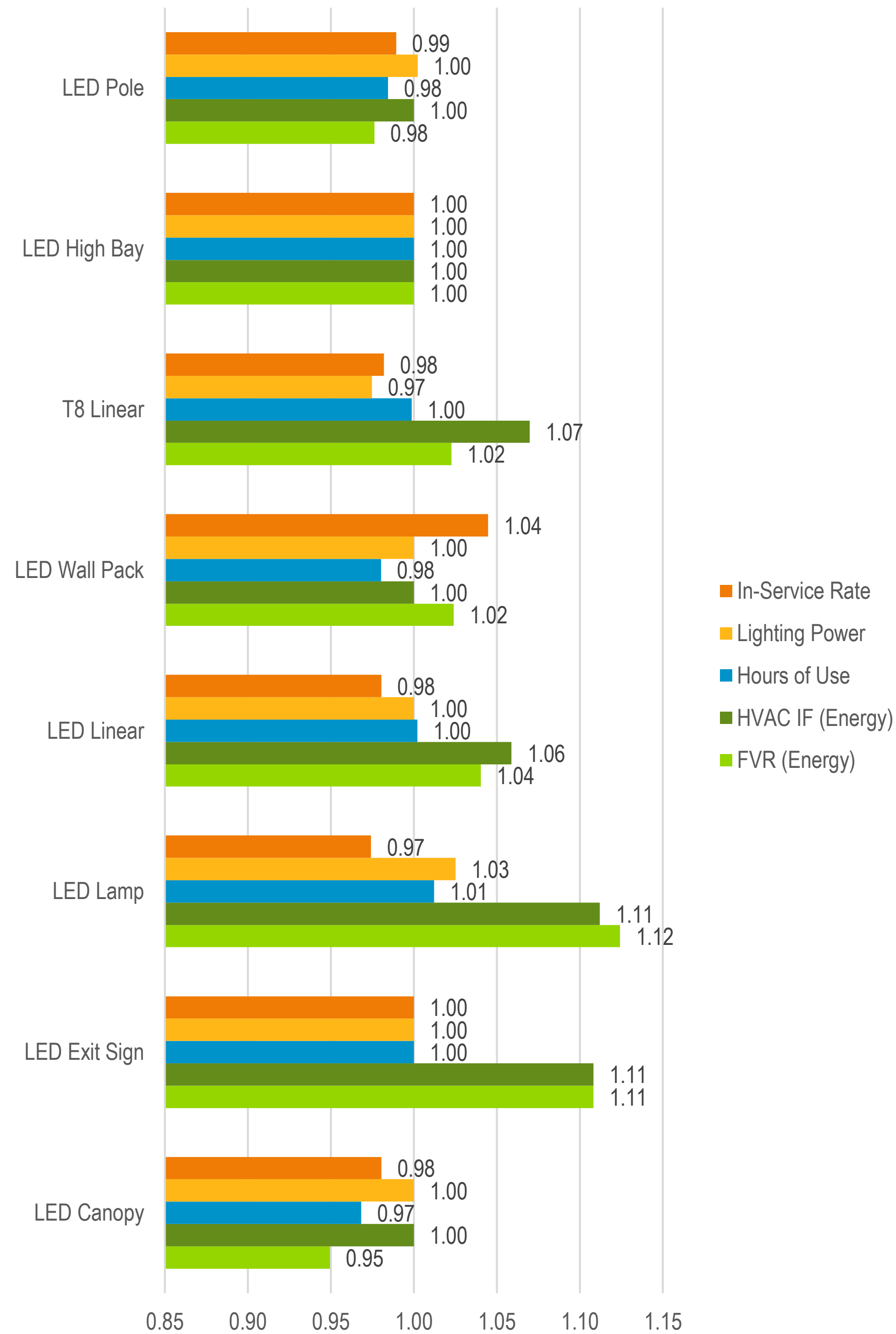
This section examines findings from the evaluation of lighting measures in order to identify the main drivers of the verified savings values. The evaluation team uses the Field Verification Rate (FVR) to describe the overall verified savings relative to the reported savings for each measure. FVRs reflect differences between the quantity of equipment installed on-site and the quantity reported in the tracking database, as well as differences between operating characteristics verified in the field and assumed operating characteristics in the program deemed savings estimates. The team calculates the field verification rate as the verified savings divided by the reported savings by measure, which is driven by a combination of the in-service rate, the hours of use adjustment rate, the lighting power adjustment rate, the HVAC interactive effect adjustment rate, and the coincidence factor, described as follows:

1. **In-Service Rate**[5] **(ISR)** is the ratio of the verified (i.e., installed) quantity to the reported quantity.
2. **Hours of Use (HOU) Adjustment Rate** reflects discrepancies between reported and verified operating hours.
3. **Lighting Power Adjustment Rate** is a ratio of the verified wattage difference between the efficient and baseline equipment to the reported wattage difference between the efficient and baseline equipment.
4. **HVAC Interactive Effect (IE) Adjustment Rate** is a multiplier that reflects HVAC interactive effects due to space heating and cooling loads caused by a reduction in heat output from efficient lighting. Note that the IC did not deem HVAC IE for any measures so this adjustment is equal to the average HVAC IE itself. There are separate adjustments for energy savings and peak demand reduction.
5. **Coincidence Factor** represents the portion of installed lighting that is on during the peak utility hours. This affects only summer and winter peak demand reductions, not energy savings.

Figure 4-1 below shows the relative effect of each of the aforementioned adjustment rates on the measure-level FVR for energy savings, which the following subsections describe in further detail. Note that FVR cannot be used to derive program level realization rates. This is because the contributions of each parameter update are described relative to their reported value, while the program analysis was structured to stratify savings by participant energy savings per site rather than by individual measures.

[5] In-Service Rate is an industry-standard term that describes verified quantities of installed equipment relative to reported quantities.

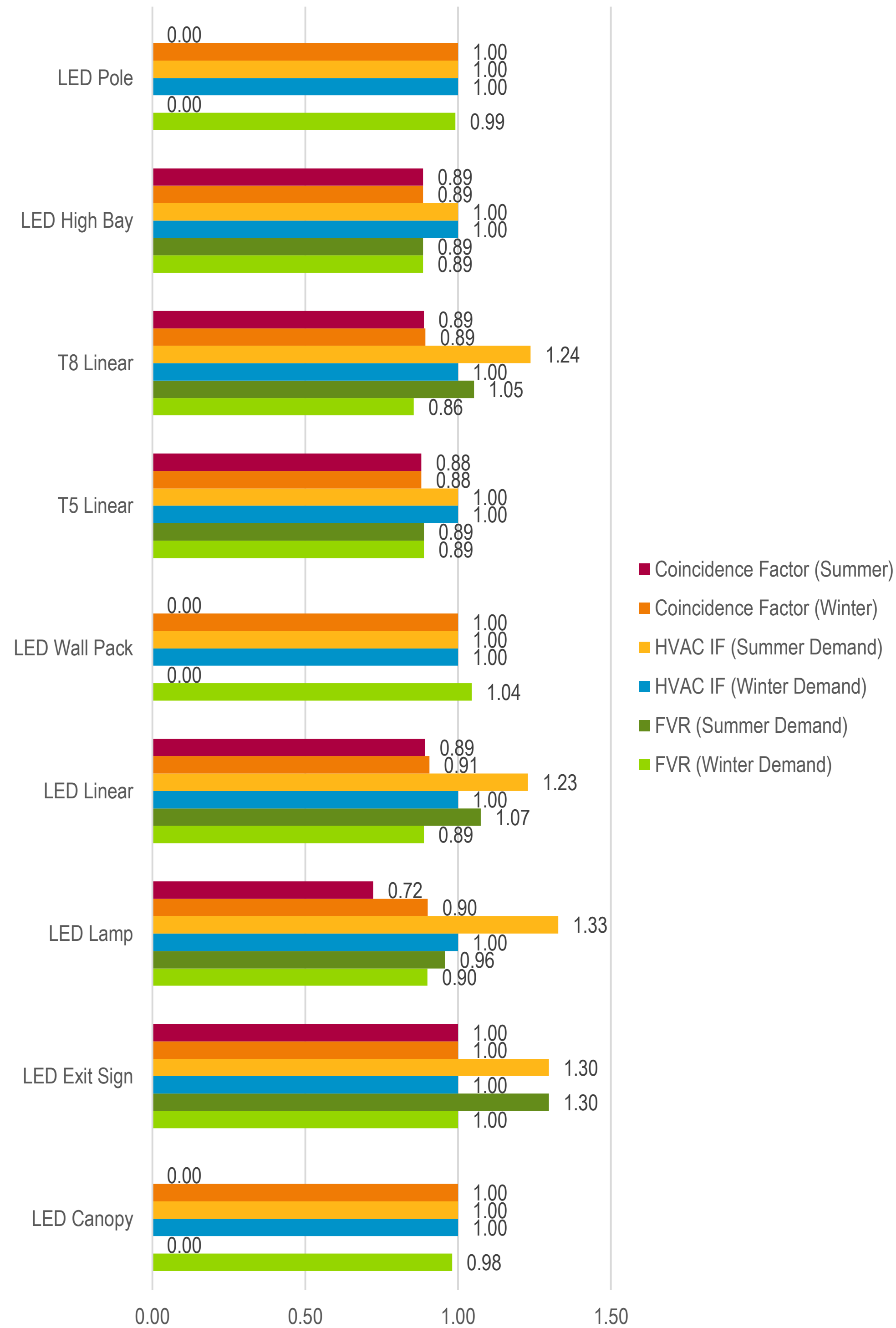
Figure 4-1. Gross Energy Savings Field Verification Rates



Source: Navigant analysis

Figure 4-2 below shows the relative effect of each of the aforementioned adjustment rates on the measure-level FVR for summer peak demand reductions, which the following subsections describe in further detail.

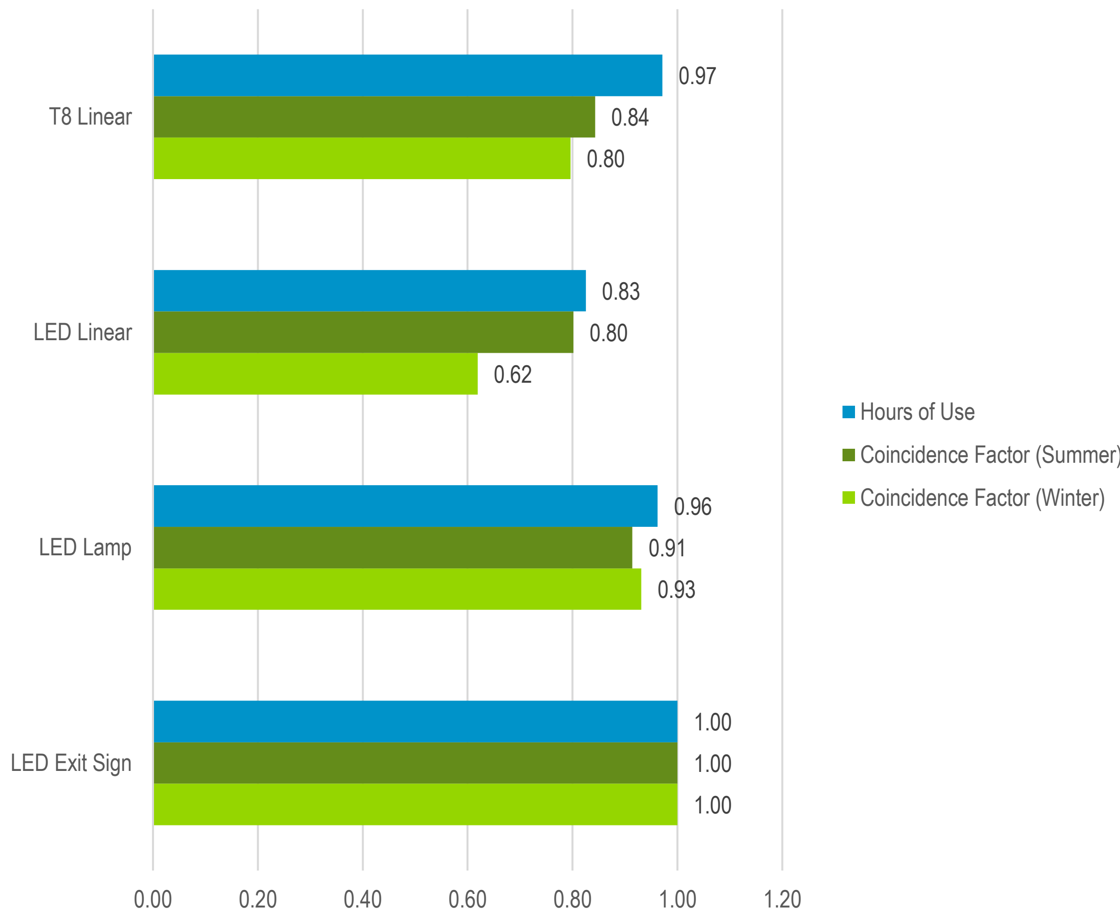
Figure 4-2. Gross Peak Demand Reductions Field Verification Rates



Source: Navigant analysis

The final adjustment to develop site-specific verified gross savings is the ratio of metered HOU and CF compared to estimated (or deemed) HOU and CF used for verification. The results of these adjustments, analogous to FVR, are shown in Figure 4-3 below. The metered data results in a downward adjustment for both HOU and CF, but this effect is more pronounced for CF due to the high rigor of the HOU estimates compared to the CF estimates in the tracking data.

Figure 4-3. HOU and CF Adjustments from Metered Data



Source: Navigant analysis

The remainder of this section discusses in more detail the parameters that are part of the energy and peak demand savings algorithms: ISR, HOU, lighting power, HVAC interactive effects and coincidence factors.

4.5.1 In-Service Rates

One of the primary functions of evaluation, particularly for lighting measures, is to verify the quantity of the installed equipment relative to the reported quantity. The resulting ratio is the ISR. As shown in Figure 4-1 above, the ISR for each measure varies from 0.97 for LED screw-in lamps and 1.04 for LED wall packs.

4.5.2 Hours-of-Use Adjustments

The EM&V team performed customer interviews and installed data loggers to make adjustments to hours of use to estimate final verified impacts. Measure-level annual operating hours were determined from confirmation of operation hours with the SBES participant, similar to the approach taken by the IC. For all sample sites, the EM&V team performed interviews with customers using a similar approach as the IC. This relies on the customer to self-report hours used on a daily or weekly basis, and were rolled up to an annual hours of use basis which is also corrected for holidays, seasonal variations in use, and any other change in operating characteristics. The purpose of validating the self-reported hours of use is to confirm whether the estimates provided by the customer during implementation is what actually makes it into the tracking database. The EM&V also installed data loggers at a nested sample of sites to measure the accuracy of the self-reported hours. For logged sites, the team extrapolated the time of use logger data to develop annual hours of operation.

During the on-site participant interviews, the EM&V team found that the hours of use that site technicians reported was close to the HOU reported in the tracking database, with adjustment values ranging from 0.97 for LED canopy fixtures and 1.01 for LED lamps. Overall, these findings suggest that the tracking data is accurately reflecting what customers estimate their operating hours to be. However, it is well-known that estimating operation hours for lighting is difficult, and many evaluations have found that customers tend to overestimate operation hours for lighting. Therefore, the EM&V team used results from the data loggers to adjust impacts.

Additional adjustments based on logger data range from 0.83 for LED linear retrofits and 0.97 for T8 linear retrofits (excluding LED exit signs), as shown in Figure 4-3. This demonstrates that although the IC team notes that overall the IC is reasonably characterizing hours of use based on both customer interviews, and logger data, but the data loggers show that customers tended to overestimate hours of use for both LED and T8 linear lighting measures.

4.5.3 Lighting Power

The evaluation team based the lighting power parameter on the best estimates available for actual power draw of the baseline and efficient equipment. The baseline equipment is assumed to be as-found lighting installed and in use at the time of the audit; however, because the baseline equipment was no longer present at the participant sites, the team could not verify the baseline power draw and defaulted to the IC-provided value.

The evaluation team verified the efficient equipment wattage from manufacturer specification sheets to provide a more accurate lighting power figure than the deemed values that the IC used. Overall lighting power level differences were very minor across the measure categories, between 0.97 for T8 fixtures and 1.03 for LED lamps. Note that the evaluation team found slightly lower than reported lighting power values for T8 lamp and ballast configurations, which resulted in a slight increase in energy savings.

The evaluation team would like to note that newer linear LED systems can be configured in a variety of ways, including with or without an electronic ballast. The manufacturer specifications for these systems typically do not account for every installation scenario with different ballast brands, models, and configurations possible. The team did not perform power measurements as part of this evaluation, but encourages the IC team to ensure that the power consumption of these systems is accurately characterized as their contribution to total program savings grows and T8 retrofits are phased out.

4.5.4 HVAC Interactive Effects

The evaluation team applied HVAC interactive effects for both energy, summer and winter peak demand. The deemed values are based on the building type and the heating and cooling system types as verified in the field for the sample sites. However, the IC did not apply HVAC IE for any of the lighting measures claimed in PY2016, as in previous evaluations. This adjustment is between 1.00 and 1.11 for energy and 1.00 and 1.33 for summer peak demand. Deemed values are described in Section 9 below for energy and summer peak demand; winter peak demand interactive effects were assumed to be 1.0 for all measures.

4.5.5 Coincidence Factors

Similar to the HVAC interactive effects, the team applied coincidence factors consistent with the deemed values used in the previous Duke Energy program evaluations. This factor takes into account that not all lights are on for the duration of the peak demand period. Coincidence factors range from 0 and 1.0, based on building type, and are detailed in Section 9. The metered data further validates the deemed coincidence factors. Note that although the detailed IC database does not include a coincidence factor, the demand ratios provided by Duke Energy and used as the final reported deemed savings implicitly include these assumptions.

LED exit signs that are on all day receive a CF on 1.0, while exterior lights receive a CF of 0 (summer) and 1.0 (winter). For logged sites, the team extrapolated the time of use logger data to develop coincidence factors. As shown in Figure 4-3, the CF adjustments based on metered data range from 0.80 to 1.0 for summer, and 0.62 to 1.0 for winter. The overall effect on demand savings from metering was a decrease in both summer and winter savings compared to the coincidence factors applied in the verification phase. The overall effect of applying coincidence factors is a decrease from reported savings, and is the primary driver of the demand realization rates.

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, field verification, and metering 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 Navigant's NTG analysis. Navigant anticipated low free ridership and spillover based on previous findings from the SBES evaluations. The estimated NTG ratio shown for PY2016 is lower than the findings from the 2015 evaluation, but consistent with 2013.

Table 5-1. Net-to-Gross Results

	PY2013 (DEP)	PY2014 (DEP)	PY2015 (DEP & DEC)	PY2016 (DEP & DEC)
Estimated Free Ridership	0.04	0.04	0.06	0.06
Estimated Spillover	0.02	0.07	0.09	0.04
Estimated NTG	0.98	1.03	1.03	0.98

Source: Navigant analysis, totals subject to rounding.

The results are consistent with the program theory and delivery model, whereby the Implementation Contractor (IC) actively recruits participants and presents a suite of energy efficiency measures to potential customers. Customers are not eligible to retroactively claim incentives under this program, which reduces the potential for free ridership significantly.

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. Also called “market effects,” 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.

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

$$NTG = 1 - \text{Free Ridership} + \text{Spillover}$$

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

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[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).

measures to be less than, similar to, or more than the energy savings from the SBES program equipment.

- **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 had 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
  - For spillover: by taking the sum of the individual spillover results for each measure category and weighting each category by the population
- 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 savings
  - For spillover: measure category results were summed and then weighted by the sum of the reported savings for the sample (which were also weighted by the population)

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

The EM&V team conducted 150 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. Attribution Survey Completes by Project Type

Measure Category	DEP Surverys	DEC Surveys	Total Surveys
Lighting	50	86	136
Refrigeration	5	9	14
Total	**55**	**95**	**150**

Source: Navigant analysis

5.3.2 Free-Ridership Results

The evaluation team 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. The evaluation team estimates free-ridership for the SBES Program at 6 percent of program-reported savings.

5.3.3 Spillover Results

The SBES Program influenced approximately 7 percent of participants to install additional energy efficiency measures on-site (down from 15 percent in PY2015) and influenced 7 percent of participants (down from 12 percent in PY2015) to install additional measures at other locations. Spillover values are consistent with those found in previous evaluations, such as PY2014, however. Based on the survey findings, the evaluation team estimates the overall program spillover to be 4 percent of program-reported savings. Participants reported a variety of spillover measures installed, including AC units, additional lighting, and appliances.

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

$$NTG = 1 - \textit{free ridership} + \textit{spillover}$$

Using the overall free ridership value of 6 percent and the overall spillover value of 4 percent, the NTG ratio is 1 – 0.06 + 0.04 = 0.98. The estimated NTG ratio of 0.98 implies that for every 100 megawatt-hours (MWh) of realized savings recorded in SBES records, 98 MWh is attributable to the program.

Table 5-3. SBES Free Ridership, Spillover, and NTG Ratio

	Free Ridership	Spillover	NTG Ratio
SBES Program Total	0.06	0.04	0.98

Source: Navigant analysis

6. PROCESS EVALUATION

The purpose of the process evaluation is to understand, document and provide feedback on the program implementation components and customer experience for the Small Business Energy Saver (SBES) Program in the DEP and DEC jurisdictions.

The feedback received indicates that **the SBES Program is a successful, mature program for PY2016, but could benefit from continuous improvements** as in previous years. Customer satisfaction with the implementer and contractor are very high, but there are instances where the installation contractor was responsible for a negative customer experience.

6.1 Process Methodology

The evaluation team conducted customer journey mapping and customer participant surveys as part of the process evaluation. In addition, the team gathered information from interactions with participants during the site verification visits and maintained regular communication with Duke Energy program staff, which included a review of program processes to provide the evaluation team with an understanding of the program's operations, nuances and qualitative and quantitative questions on customer satisfaction, participation, marketing, and outreach.

The process findings summarized in this document are based on the results of:

- Customer journey mapping with 13 program participants;
- Participant surveys with 150 program participants;
- Onsite visits at 62 program participant sites;
- Discussions with the Duke Energy Program Manager;
- A review of the program documentation.

6.2 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. 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. In PY2016 the program increased the eligibility limit from 100 kW to 180 kW demand, resulting in an increase of average project size.
- **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, 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, taking into account existing equipment, proposed equipment, and operational characteristics unique to each customer.

6.3 Customer Journey Mapping

The Customer Journey Mapping analysis aimed to gather qualitative data about customer experiences with the SBES Program to understand customer sentiments and perspectives on program performance and establish a deeper understanding of customer satisfaction throughout the program process. Key aspects of journey mapping involved the development of a process map and the identification of the journey mapping lenses. In conversations with program staff, Navigant explored staff perceptions concerning the use of a variety of potential journey mapping lenses. Journey mapping lenses included a set of overarching questions and potential customer satisfaction concerns as the core focus of this research effort and were included in participant interviews. To conduct the customer journey analysis, Navigant completed seven steps, working closely with Duke Energy staff:

1. Program document review and conversations with program staff
2. Development of a process map and identification of journey mapping lenses
3. Development of a sampling plan, recruitment strategy and interview guide
4. Fielding of interviews
5. Analysis of interview notes
6. Development of Journey Map and other findings

In total, Navigant interviewed 13 Duke Energy Carolinas and Duke Energy Progress SBES Program customers across various building types and measures. The final participant sample included a diverse mix of office, retail, and restaurant owners or managers, who participated in upgrading their lighting or lighting and refrigeration equipment through the SBES Program. All interviewees installed lighting measures and two installed refrigeration measures in addition to the lighting measure. Most participants conducted business in North Carolina (11) as compared to South Carolina (2); however, participants were evenly split between Duke Energy Carolinas (8) and Duke Energy Progress (5). **Table 6-1** shows specific customer characteristic information.

Table 6-1. SBES Interviewee Characteristics

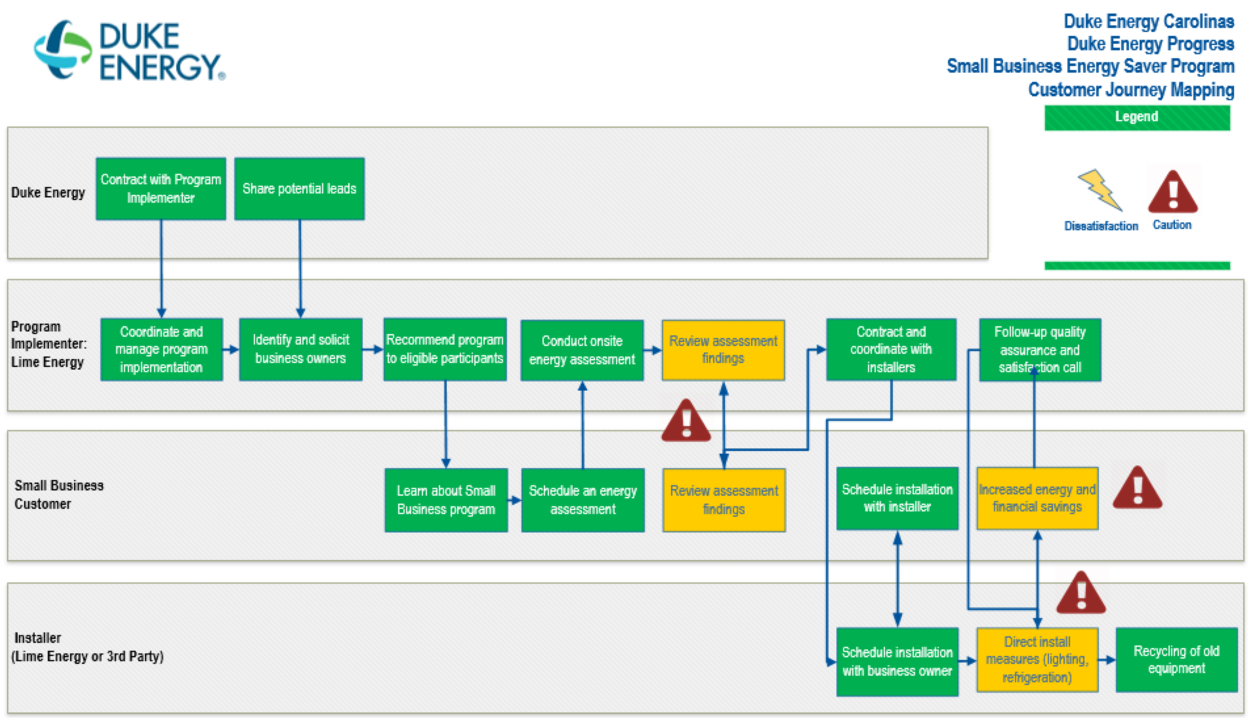
Building Type	Business Type	Lighting	Refrigeration	Lighting KWh*	Utility	Location
Office	Real Estate Office	X	--	Low	DEC	NC
Office	Textile Mill	X	--	Low	DEC	NC
Office	Printing Store	X	--	Low	DEP	NC
Office	Warehouse	X	--	Medium	DEP	NC
Office	Law Office	X	--	Low	DEC	NC
Retail	Materials Distributor	X	--	High	DEC	NC
Retail	Gas Station	X	--	Low	DEP	NC
Retail	Grocery Store	X	--	High	DEC	NC
Retail	Retail Store	X	--	Low	DEP	SC
Restaurant	Multi-Sector**	X	X	High	DEC	NC
Restaurant	Restaurant & Catering	X	--	Low	DEC	NC
Restaurant	Restaurant	X	X	Low	DEC	SC
Restaurant	Diner	X	--	Low	DEP	NC

**Low = <10,000 KWh; Medium = 10,000-30,000 KWh; High = >30,000 KWh*
***Includes convenience stores, restaurants, and car dealerships*
Source: Navigant analysis

6.4 Customer Journey Map Findings

Navigant developed a process map detailing the journey of the customer's experience through the SBES program (see Figure 6-1). Findings depicted in the process map below indicate isolated instances of dissatisfaction with the measure installation and recycling of old equipment processes. Potential customer dissatisfaction and areas of concerns are seen in the presentment onsite energy assessment findings and savings outcomes.

Figure 6-1. DEP and DEC SBES Process Map



Source: Navigant analysis

More specifically, participant interviews offered insight into the overall customer satisfaction with the SBES program and certain steps in the program participation process. Navigant examined the six process customer journey phases within the SBES program: 1) the Initial Contact; 2) the Energy Assessment; 3) the Installation Process; 4) Equipment Performance; 5) Energy Savings Expectations & Perceptions; and 6) Quality Assurance & Satisfaction. The list below outlines the key findings for each of these customer journey phases.

1. **Initial Contact** – Respondents felt highly satisfied with their initial contact and introduction into the program overall. Interviewees cited knowledgeable and professional sales representatives and Duke Energy's reputation as trustworthy as major reasons for their participation in the program and high satisfaction in this phase. Many felt particularly excited about the opportunity to save money and energy.
2. **Energy Assessment** – Similar to the Initial Contact phase, respondents reported high satisfaction with the Energy Assessment process overall. Many thought the assessments were simple and easy to understand. Participants were also pleased to hear about the number of lighting alternatives and customizations available through the program. Despite the high satisfaction overall, some interviewees felt that the representatives did not present the assessment clearly, indicating inconsistencies in presentation.
3. **Installation Process** – Similar to the previous two phases, participants expressed high satisfaction ratings for the Installation Process. In general, respondents were relieved that installers worked around employees and customers, minimizing disruption to the business. Many felt the process went more smoothly and quickly than expected. While respondents generally

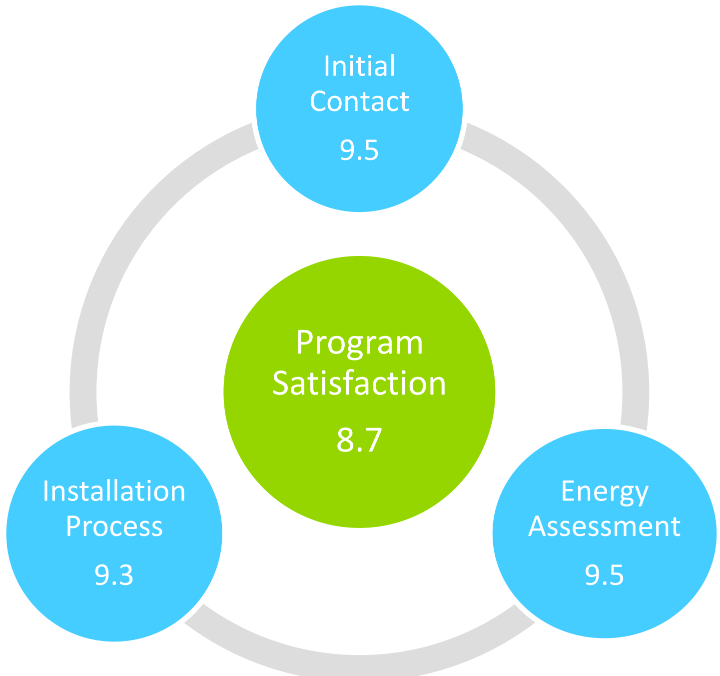
praised installers, a couple felt displeased that crews changed their product order (sometimes necessary due to facility conditions) and communicated poorly about installation timing.

4. **Equipment Performance** – In general, equipment worked as expected and most respondents felt pleased with the enhanced lighting quality, ambiance, and lifespan of the new bulbs. Some even expressed doing additional lighting replacements. However, there were isolated issues in equipment performance, including concerns about equipment quality, performance, and lifespan.
5. **Energy Savings Expectations & Perceptions** – The perceived achievement of energy savings received mixed responses: the majority felt satisfied or unconcerned about bill savings while some felt dissatisfied with savings, especially as compared to the initial energy assessment.
6. **Quality Assurance & Satisfaction** – Customers felt positive about post-program quality assurance and satisfaction. Respondents were particularly pleased that customer representatives remained engaged throughout the program process and followed-up post-installation.

Although respondents provided positive feedback overall, the findings indicate isolated problems throughout the process. This fact indicates inconsistencies in the program participation process, mostly as a result of poor performances from program subcontractors in the energy assessment and installation phases.

In general, interviewees reported high satisfaction ratings with the SBES program despite program inconsistencies. Out of a 1-10 rating scale, customer program satisfaction averaged 8.9, although scores ranged from as high as “10” to as low as “2.” Overall customer satisfaction with the initial contact and energy assessment was a 9.5. Interviewee satisfaction of equipment installation was 9.3. In general, most customers felt that the program process went smoothly and enhanced their business. Figure 6-2 below shows the average satisfaction ratings from interviewees by program component through the installation process.

Figure 6-2. Overall Program Satisfaction



Source: Navigant analysis

6.5 Participant Survey Sampling Plan

The participant survey targeted a random sample of all PY2016 program participants broken out by measure family. The two measure families are lighting and refrigeration. Navigant weighed customer responses by their stratum savings for net-to-gross findings as described in the preceding section.

The survey effort targeted 150 participants and successfully completed surveys with 150 customers, of which 135 were participants that only installed lighting measures and 15 were participants that installed some refrigeration measures. The survey targets were designed to achieve 90/10 confidence and precision, with significant oversampling due to the relatively inexpensive per-survey cost.

6.6 Participant Survey Findings

The following sections detail the process findings from the customer surveys, organized by topic. The feedback received indicates that the SBES Program continues to be a successful program in PY2016 and is a mature program in the Duke Energy portfolio.

The following sections detail the process findings and addresses the following topics:

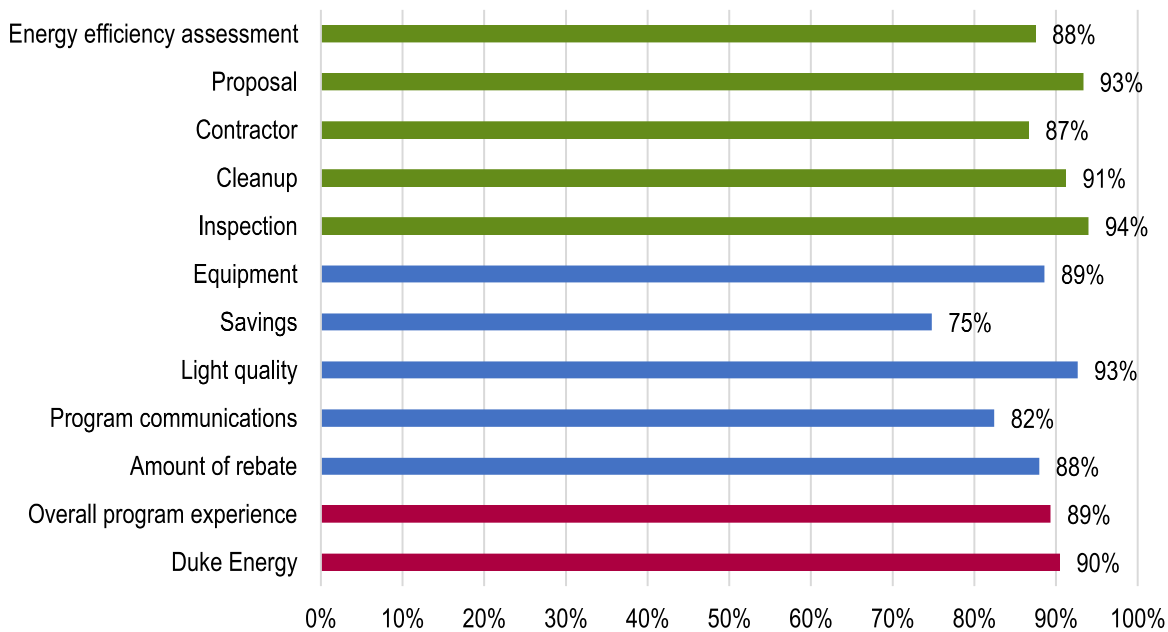
1. Customer Satisfaction;
2. Program Challenges;
3. Marketing and outreach; and
4. Suggested improvements.

6.6.1 Customer Satisfaction

Participants report high levels of satisfaction with the program overall: 89% of participants rated their satisfaction with the program at an 8 or higher, on a scale from 0 to 10. Satisfaction with Duke Energy was high at 90%. Satisfaction with the equipment installed is *most* strongly correlated with overall program satisfaction. Satisfaction with the rebate amount is *least* correlated with overall program satisfaction.

Participants are most satisfied with the inspection they received, the light quality, and the energy efficiency proposal. Participants are less satisfied with energy savings, program communications, and their installation contractor. Detailed top box (8 or higher out of 10) satisfaction scores are shown below in Figure 6-2.

Figure 6-3. Detailed Satisfaction Scores (n=150)



Source: Navigant analysis

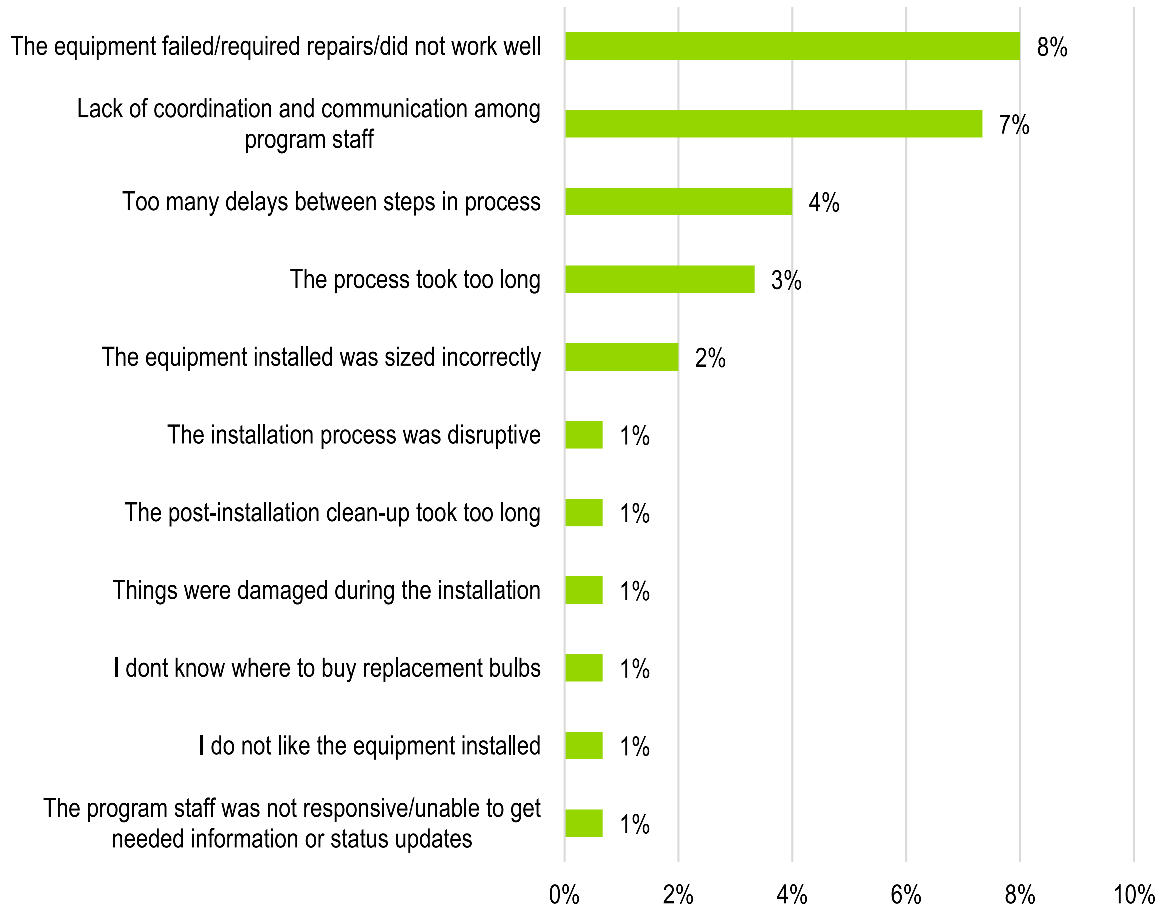
6.6.2 Program Challenges

Despite the high overall satisfaction scores, some customers had minor complaints or identified drawbacks of the program. Figure 6-4 below shows the responses when customers were asked program challenges or drawbacks. The most common challenges were:

- Issues with the equipment after installation
- Perceived lack of coordination and communication between program implementation staff
- Impatience with delays or the length of the process

Looking at total responses to this question, 75% of all customers did not mention *any* of the complaints shown.

Figure 6-4. Detailed Program Challenges (n=38)

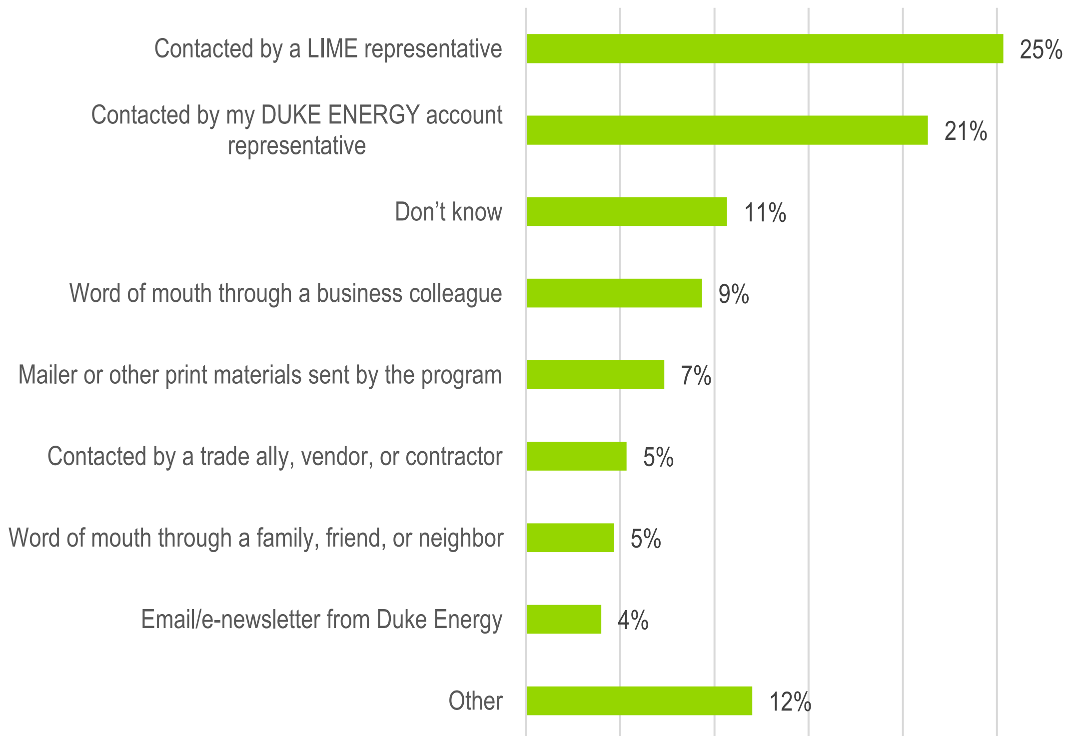


Source: Navigant analysis

6.6.3 Marketing and Outreach

Duke Energy markets the program to eligible customers primarily through direct contact that both Lime Energy and Duke Energy initiate. Participants were asked to indicate all the sources through which they learned about the program. One quarter of the participants indicated that they learned about the program directly from the IC staff (either through direct contact or outreach materials), and almost an additional quarter indicated they had learned about the program through Duke Energy themselves. Figure 6-5 shows the range of ways in which customers found out about the program. Compared to PY2015, less customers reported that they learned about the program through Duke Energy directly (25 percent in PY2016 compared to 38 percent in PY2015), indicating that the IC is generating a larger share of program participation.

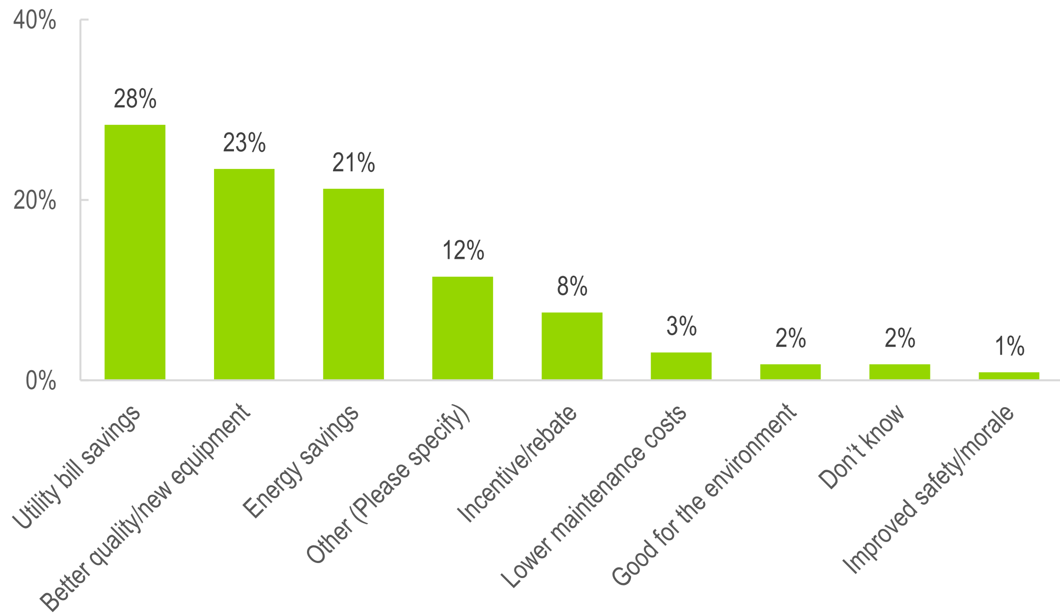
Figure 6-5. How Program Participants First Learned About the SBES Program (n = 150)



Source: Navigant analysis

When asked about the main benefits of participating in the program, over one quarter of respondents cited utility bill savings, compared to over 50 percent of survey respondents in PY2015 that cited energy savings as a reason they decided to participate in the program (see Figure 6-6 below). There was an increase in the percentage that reported better quality equipment as a primary driver (23% in PY2016 compared to 14% in PY2015). This indicates that the program marketing and sales communications have likely shifted towards bill savings and quality equipment. Coordinated efforts to market all of the benefits of program participation are key to enhancing participation across the variety of small business customer that Duke Energy serves.

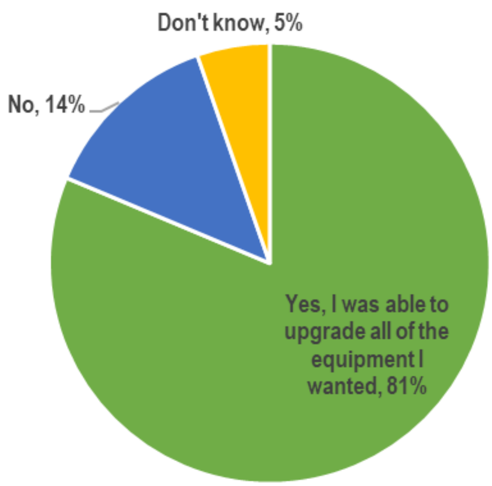
Figure 6-6. Primary Reasons for Deciding to Participate in the Program (n = 150)



Source: Navigant analysis

Another important survey finding was that 81 percent of participants stated that equipment offered through the program allowed them to upgrade all of the lighting equipment they wanted at the time of the project, rather than piecing together the upgrades in multiple phases (see Figure 6-7 below). This is a decrease from 89 percent in PY2015, which indicates that there may be opportunity to increase the depth of energy efficiency measures available to participants.

Figure 6-7. Participants Who Stated that Equipment Offered Through the Program Allowed Them to Upgrade All of the Equipment They Wanted at the Time (n = 150)



Source: Navigant analysis

6.6.4 Suggested Improvements

Some customers reported difficulties they faced and provided suggested improvements in the survey's open-ended questions. The list below summarizes a few key points.

Summary of Improvements Mentioned by Customers

- Better communication/improved program information
- Greater program publicity
- More equipment offered through the program.

7. SUMMARY FORM

SBES Program

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 and refrigeration measures.

- **Lighting measures:** LED lamps and fixtures, T8 fluorescent fixtures, occupancy sensors.
- **Refrigeration measures:** LED case lighting, EC motor upgrades, compressor and fan motor controls.

Date	September 10, 2018
Region(s)	Duke Energy Progress; Duke Energy Carolinas
Evaluation Period	DEP 3/1/16 – 6/30/17 DEC 3/1/16 – 6/30/17
Annual kWh Savings (net)	DEP 53,302,070 kWh DEC 90,923,371 kWh
Per Participant kWh Savings	DEP 29,143 DEC 37,340
Coincident kW Impact	DEP 9,207 DEC 16,308
Net-to-Gross Ratio	0.98
Process Evaluation	Annual
Previous Evaluation(s)	2013, 2014, 2015

Evaluation Methodology

The evaluation team used engineering analysis, onsite field inspections, and time-of-use metering as the primary basis for estimating program impacts. Additionally, telephone surveys were conducted with participants to assess customer satisfaction and determine a net-to-gross ratio. Interviews were conducted with program and implementation team staff to understand program operational changes and enhancements.

Impact Evaluation Details

- **Onsite visits were conducted at 62 participant sites, while 23 of those sites were logged.** The evaluation team inspected program equipment to assess measure quantities and characteristics to compare with the program tracking database, and installed lighting loggers to verify hours of use and coincidence factors.
- **In-Service rates (ISRs) varied by equipment type.** The evaluation team found ISRs ranging from 0.97 for LED screw-in lamps to 1.04 for exterior LED wall packs.
- **Participants achieved an average of 29,143 kWh of energy savings per year in DEP, and 37,340 kWh in DEC.** The program is accurately characterizing energy and demand impacts.

8. CONCLUSIONS AND RECOMMENDATIONS

The evaluation team performed extensive on-site work, telephone surveys, and analysis to determine gross and net verified savings. Overall conclusions and recommendations appear in the following sections.

8.1 Conclusions

Overall, the SBES Program is a well performing, mature program in the DEP and DEC jurisdictions. The key to continued success is working through quality control issues as they arise and ensuring that the program continues to offer leading energy efficiency equipment.

- **Participants continue to be overwhelmingly satisfied with the SBES Program and Duke Energy**, including overall service, pricing, installation, and efficient equipment quality. Participants were excited about the opportunity to save money and energy, and expressed limited, minor pain points with the program.
- **Duke Energy has successfully increased the eligibility limit** in PY2016. The program had no apparent issues adapting to larger projects, and there are no meaningful differences in the EM&V team's findings between different project sizes. The higher eligibility limit also increased the average project size, and the ability of the program to generate substantial energy savings.
- The **installation of high–efficiency lighting equipment continues to be the key selling point**. The SBES Program continued to expand the LED lighting offerings. LED measures have grown considerably as a share of total program savings, while refrigeration has remained stable from PY2015 at under 10 percent.
- The **energy savings realization rate is 1.02 for DEP and 1.01 for DEC,** and is driven by several EM&V adjustments. The key adjustments the EM&V team made were the hours of use based on metering and HVAC interactive effects. The **peak demand realization rate is lower at 0.77 for DEP and 0.76 for DEC** and is driven by HVAC interactive effects and coincidence factors.
- The evaluation effort estimated **free ridership for the SBES Program at 6 percent and spillover at 4 percent**, which drives an **NTG ratio of 0.98**. This indicates that the SBES Program is successfully reaching customers that would have not completed energy efficiency upgrades in the absence of the program. Spillover has decreased from PY2015, while free-ridership has remained the same.

8.2 Recommendations

The evaluation team recommends four actions for improving the SBES Program, based on insights gained through the comprehensive evaluation effort for PY2016. These recommendations provide Duke Energy with a roadmap to fine-tune the SBES Program for continued success and include the following broad objectives:

Increasing Program Participation and Satisfaction

1. **Continue to focus on quality, clear communication, and depth of energy efficiency retrofits.** The most common suggested improvements were post-installation equipment issues and a perceived lack of coordination between the various parties involves in delivering the SBES program. There was also a minority of customers reporting that the program was unable to

provide all the energy efficiency equipment they wanted. There are opportunities for continued improvement and channeling to other Duke Energy programs or education about measures that are not offered through the SBES program.

2. **Consider effects of increased program eligibility rules**. With a 180 kW demand limit, there is likely significant overlap between the SBES program and other business programs in Duke Energy's portfolio. The largest project is almost 2 GWh, which is larger than typical large business prescriptive projects seen in other utility offerings. Larger businesses typically have additional resources that small businesses do not, and often do not require the high incentive levels that the SBES program offers. Duke Energy should consider whether the SBES incentive levels are appropriate for these very large projects, or if a different program channel would be sufficient. For example, the Smart $aver program offers LED incentives that are capped at a lower percentage of incremental costs.

Improving Accuracy of Reported Savings

3. **Track burnout lamps and fixtures during the initial audit.** It is likely that some burnouts were present and tolerated by customers, and may contribute to customers not realizing expected savings on their energy bills. Burnouts found during the initial audit are no longer included in tracking data. While not generally required in the industry, customers with many burnouts will not achieve the expected energy savings.
4. **Ensure that the IC has access to up-to-date and accurate customer billing records.** There are several (2706) instances where project deemed savings exceed annualized site data, likely due to incomplete annualized energy usage estimates. Since this is used as an overridable QC check, more accurate data could help reduce the need for such overrides.

9. 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 only.

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 9-1 and Table 9-2. Note that for the PY2016 SBES evaluation the EM&V team applied the summer coincidence factors for both summer and winter peak demand reductions, with additional adjustments based on logger data for each of the corresponding peak periods, as in previous years.

Table 9-1. HVAC Interactive Effects[7]

Building Type	Cooling Type	Heating Type	Energy HVAC Interactive Effect	Demand HVAC Interactive Effect
Grocery	Electric	Electric Resistance	1	1.43
Grocery	Electric	Electric HP	1.08	1.43
Grocery	Electric	Not Electric	1.22	1.42
Grocery	No Cooling	Electric Resistance	0.77	1
Grocery	No Cooling	Electric HP	0.86	1
Grocery	No Cooling	Not Electric	1	1
Grocery	DK	DK	1.14	1.36
Lodging	Electric	Electric Resistance	1.11	1.18
Lodging	Electric	Electric HP	1.11	1.18
Lodging	Electric	Not Electric	1.11	1.18
Lodging	No Cooling	Electric Resistance	1.11	1.18
Lodging	No Cooling	Electric HP	1.11	1.18
Lodging	No Cooling	Not Electric	1.11	1.18
Lodging	DK	DK	1.14	1.36
Manufacturing	Electric	Electric Resistance	1.1	1.29
Manufacturing	Electric	Electric HP	1.1	1.29
Manufacturing	Electric	Not Electric	1.1	1.29
Manufacturing	No Cooling	Electric Resistance	1.1	1.29
Manufacturing	No Cooling	Electric HP	1.1	1.29
Manufacturing	No Cooling	Not Electric	1.1	1.29
Manufacturing	DK	DK	1.14	1.36
Medical	Electric	Electric Resistance	1.05	1.44

[7] PY2013 DEP EEB EM&V Report

Medical	Electric	Electric HP	1.12	1.44
Medical	Electric	Not Electric	1.22	1.43
Medical	No Cooling	Electric Resistance	0.83	1
Medical	No Cooling	Electric HP	0.89	1
Medical	No Cooling	Not Electric	1	1
Medical	DK	DK	1.14	1.36
Office	Electric	Electric Resistance	1.05	1.44
Office	Electric	Electric HP	1.12	1.44
Office	Electric	Not Electric	1.22	1.43
Office	No Cooling	Electric Resistance	0.83	1
Office	No Cooling	Electric HP	0.89	1
Office	No Cooling	Not Electric	1	1
Office	DK	DK	1.14	1.36
Other	Electric	Electric Resistance	1.05	1.44
Other	Electric	Electric HP	1.12	1.44
Other	Electric	Not Electric	1.22	1.43
Other	No Cooling	Electric Resistance	0.83	1
Other	No Cooling	Electric HP	0.89	1
Other	No Cooling	Not Electric	1	1
Other	DK	DK	1.14	1.36
Restaurant	Electric	Electric Resistance	1	1.43
Restaurant	Electric	Electric HP	1.08	1.43
Restaurant	Electric	Not Electric	1.22	1.42
Restaurant	No Cooling	Electric Resistance	0.77	1
Restaurant	No Cooling	Electric HP	0.86	1
Restaurant	No Cooling	Not Electric	1	1
Restaurant	DK	DK	1.14	1.36
Retail	Electric	Electric Resistance	1	1.43
Retail	Electric	Electric HP	1.08	1.43
Retail	Electric	Not Electric	1.22	1.42
Retail	No Cooling	Electric Resistance	0.77	1
Retail	No Cooling	Electric HP	0.86	1
Retail	No Cooling	Not Electric	1	1
Retail	DK	DK	1.14	1.36
School	Electric	Electric Resistance	1.05	1.44
School	Electric	Electric HP	1.12	1.44

School	Electric	Not Electric	1.22	1.43
School	No Cooling	Electric Resistance	0.83	1
School	No Cooling	Electric HP	0.89	1
School	No Cooling	Not Electric	1	1
School	DK	DK	1.14	1.36
Warehouse	Electric	Electric Resistance	1.1	1.29
Warehouse	Electric	Electric HP	1.1	1.29
Warehouse	Electric	Not Electric	1.1	1.29
Warehouse	No Cooling	Electric Resistance	1.1	1.29
Warehouse	No Cooling	Electric HP	1.1	1.29
Warehouse	No Cooling	Not Electric	1	1
Warehouse	DK	DK	1.14	1.36

Table 9-2. Coincidence Factors[8]

Building Type	Summer Coincidence Factor
OFFICE	0.81
SCHOOL	0.42
COLLEGE/UNIVERSITY	0.68
RETAIL/SERVICE	0.88
RESTAURANT	0.68
HOTEL/MOTEL	0.67
MEDICAL	0.74
GROCERY	0.81
WAREHOUSE	0.84
LIGHT INDUSTRY	0.99
HEAVY INDUSTRY	0.99
AVERAGE/MISC	0.77
AGRICULTURAL	0.50

The Duke Energy DSMore table is embedded below for reference.

DSMore table
template - DEC DEP

[8] PY2013 Savings Basis and Changes, December 10, 2013. EEB Program Documentation.

APPENDIX A. STATISTICS DETAIL

This appendix is intended to provide additional context around Navigant's sampling approach and impact findings for the PY2016 SBES evaluation for the DEP and DEC jurisdictions. Overall, Navigant believes that the evaluation results represents the program impacts in accordance with the evaluation approach and sample design. This is evidenced by the calculated statistical confidence and precision values, which were in line with expectations.

A.1 Sampling Approach

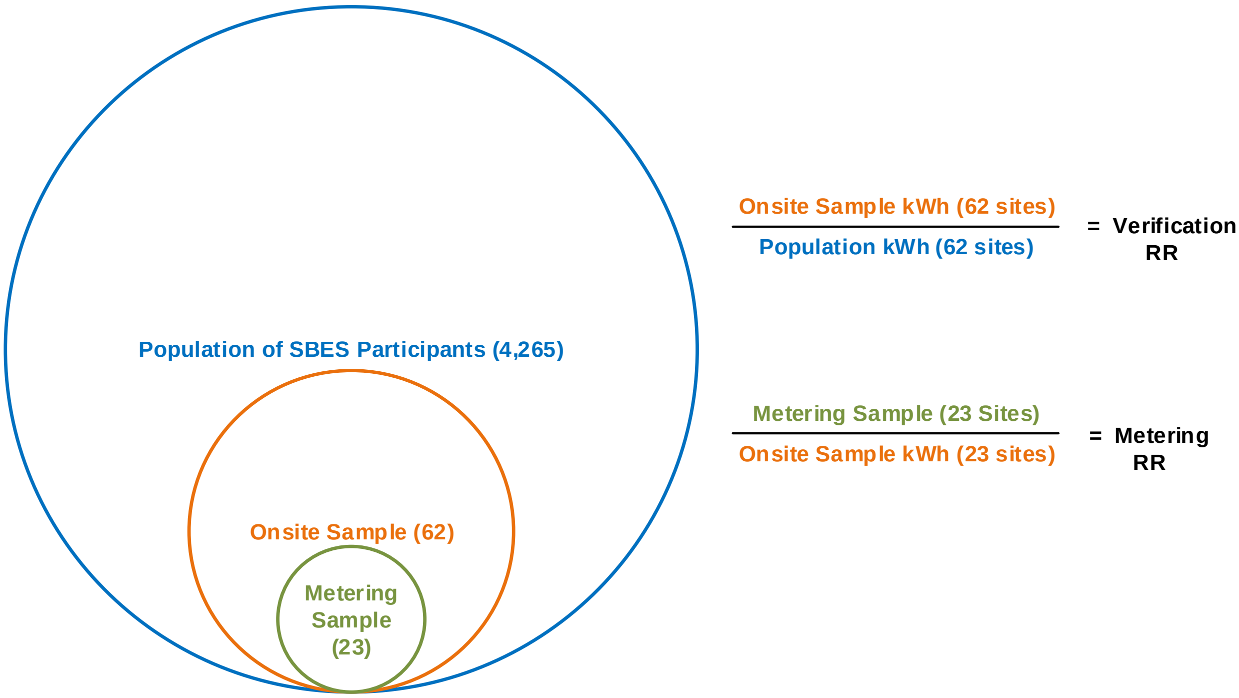
Navigant's methodology includes a double-ratio (nested) sampling approach. This approach is designed to efficiently utilize resources for primary data collection while minimizing sampling error. For the SBES program, Navigant chose a relatively large sample of sites to perform onsite verification activities, and a relatively smaller subsample of these sites for more detailed data collection with data loggers. The underlying assumption is that the larger verification sample represents the larger *population*, while the smaller metering sample represents the larger verification *sample*. This allows Navigant to perform high-rigor evaluation at lower cost for a given assumed sampling error.

For this evaluation, Navigant targeted 90/10 sampling and relative precision for the entire program. Sample sizes are ultimately driven by assumptions related to the variability of Navigant's verified savings compared to the Duke Energy deemed savings values. This is represented by the coefficient of variation, or CV. Less variation results in a lower CV value, which in turn results in lower sample sizes.

Based on previous evaluation work with the SBES program, Navigant designed a sample with 62 sites selected for verification, with a subsample of 23 of these sites for additional metering. Figure 9-1 illustrates the sample design and analysis plan.

Navigant will also note that the population split into four separate strata – large, medium, and small lighting, and one strata for refrigeration. The underlying assumption is that similar projects will tend to exhibit similar variations, so by grouping like projects (e.g. all refrigeration projects) we can further reduce sampling error and draw more meaningful conclusions from our onsite data collections efforts.

Figure 9-1. Illustration of Nested Sampling Concept



A.2 Analysis Approach

After performing the site visits, the next step is to analyze the measure-level data to develop project-level verification and metering estimates for each site. Because there are three sets of savings estimates, two ratios (hence double-ratio) are required to compare results.

1. The first ratio compares the onsite verification findings to the population for 62 sites. The onsite verification findings include all of Navigant's adjustments performed onsite, such as any adjustments due to in-service rate, HVAC interactive effects, wattage, or customer-reported hours of operation.
2. The second ratio compares the metering findings to the onsite findings for 23 sites. The only adjustment made here is due to hours of use adjustments (or for demand savings, the coincidence factor).

With these ratios, final program-level savings and realization rates are calculated. First, for each stratum, a total realization rate is calculated by multiplying the verification and metering realization rates together (ratios 1 and 2 outlined above). The total realization rate is then multiplied by the stratum deemed savings resulting in the verified savings. The verified savings for each of the four strata are then added together resulting in total program verified savings.

The last step of the analysis includes a statistical analysis to assess whether or not the precision targets were met. In some cases, if there is larger than expected variation between the claimed savings and the verified savings, it is possible that the precision target of 10% is not met. It is also possible that the "true" savings value will be outside of the confidence interval calculated from the statistics. This occurs on average 10% of the time at the 90% confidence level.

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Duke Energy Progress

Residential Energy Assessments Program Evaluation Report – Final

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1. Evaluation Summary

1.1 Program Summary

The Duke Energy Progress (DEP) Residential Energy Assessments (REA) program is a home assessment program that provides customers with a customized energy report that includes recommendations to help lower energy bills. Customers also receive an Energy Efficiency Starter Kit that contains two LEDs, a low-flow shower head, two faucet aerators (one kitchen faucet aerator and one bathroom faucet aerator), weather stripping, and outlet seals, which the energy specialist (or auditor) who performs the assessment can install free of charge. Up to six additional LEDs may also be installed based on the auditor's assessment findings. Auditors also encourage behavioral changes related to energy use and recommend higher-cost energy-saving investments to customers, such as a new HVAC system or energy-efficient appliances.

The REA program targets owner-occupied, single-family residences and relies primarily on direct mail marketing. Our evaluation includes 6,754 customers[1] who participated in the program between April 2016 and March 2017.

1.2 Evaluation Objectives

This evaluation included a gross impact evaluation, a net-to-gross (NTG) analysis, and a process evaluation. The overall objectives of the REA program evaluation were to:

- Estimate energy savings using monthly billing data
- Verify the accuracy of deemed per-unit savings estimates and develop in-service rates (ISRs)
- Estimate energy, summer demand, and winter demand savings at the measure level using engineering analysis
- Assess the likelihood that participants would have installed program measures had the energy efficiency kit not been provided (i.e., free-ridership [FR])
- Document spillover (SO) associated with program participation
- Identify the most successful components of the program's implementation
- Identify the barriers to participation and provide recommendations to address these barriers

To achieve these research objectives, Opinion Dynamics completed several data collection and analytic activities, including an interview with the program manager, a review of program materials, a participant telephone survey, an analysis of the survey results, an analysis of program-tracking data, a billing analysis, a deemed savings review, and an engineering analysis. Through the primary data collection efforts, the evaluation team developed estimates of measure-level ISRs and measure- and program-level net-to-gross ratios (NTGRs).

[1] Participant count is based on the *vendor_update_ts* date variable in the program-tracking data. This represents the date at which the customer was input into the database and is not the date of the assessment.

1.3 High-Level Findings

Table 1-1 presents the participant- and program-level net savings from the billing analysis for the evaluation period, which ran from April 1, 2016 through March 31, 2017. These results include the savings from the measures included in the distributed energy efficiency kits, as well as from additional LEDs provided to program participants. The results also include savings from behavioral changes that participants made based on the recommendations received during the assessment, as well as participant SO attributable to the program.

Table 1-1. Net Impact Results from Billing Analysis

Net Participant Savings			Net Program Savings		
Energy (kWh)	Summer Coincident Demand (kW)	Winter Coincident Demand (kW)	Energy (MWh)	Summer Coincident Demand (MW)	Winter Coincident Demand (MW)
1,095	0.132	0.1051	7,396	0.8912	0.7098

Using information collected during the participant survey, we estimated ISRs ranging from 41% for weather stripping to 85% for LEDs. Table 1-2 presents the ISR estimates and relative precision values for the measures included in the energy efficiency kits. We designed our sample to achieve a relative precision of 10% with 90% confidence; however, for most measures, we were unable to achieve this target due to low installation rates (IRs) among the surveyed participants.

Table 1-2. ISR Results and Relative Precision

	Kit Average	By Measure				
		LEDs	Faucet Aerators	Low-Flow Shower Head	Outlet Seals	Weather Stripping
Sample size (n)	149	132	133	149	92	103
Estimated ISR	61%	85%	54%	60%	51%	41%
Relative precision (at 90% confidence)	6.5%	5.3%	11.2%	10.9%	16.5%	18.5%

Table 1-3 presents per-participant gross impact results, based on an engineering review of the measures included in the energy efficiency kit. Note that the results incorporate ISRs. The table presents estimated gross savings for the kit only and for the kit plus additional LEDs, based on the average number provided per participant for the evaluation period.[2]

[2] Participants were eligible to receive up to six additional LEDs per home. Note that we did find instances in the program-tracking data where more than six were provided.

Table 1-3. Gross Impact Results per Home from Engineering Review

Measure		April 2016–March 2017			
		Energy Savings (kWh)	Summer Peak Demand (kW)	Winter Peak Demand (kW)	Percent of Total kWh Savings
Energy Efficiency Kit	LEDs (two 9W bulbs)	58.8	0.0087	0.0042	13%
	Low-flow shower head (1)	120.1	0.0051	0.0102	26%
	Bathroom faucet aerator (1)	12.6	0.0012	0.0024	3%
	Kitchen faucet aerator (1)	83.1	0.0041	0.0082	18%
	Outlet seals (package of 6)	4.1	0.0006	0.0019	7%
	Weather stripping (roll of 17 feet)	33.5	0.0140	0.0066	1%
Total kit only		**312.3**	**0.0336**	**0.0335**	**68%**
Additional LEDs (average of 4.4 bulbs)		146.0	0.0216	0.0105	32%
Total per-home estimate		**458.2**	**0.0552**	**0.0440**	**100%**

The gross impact results from the engineering analysis per household are far lower than those that we found using billing analysis. It is common to see a lower estimate from an engineering analysis, as it does not incorporate behavioral changes that customers make as a result of their interaction with the program.

Based on responses to the participant survey, measure-level NTGRs (defined as 1 – FR + SO) were calculated for customers who installed the measure (see Table 1-4). FR survey questions asked about each measure included in the Energy Efficiency Starter Kit, while SO questions asked about measures installed outside of the program for which no incentives were received but which were influenced by participation in the REA program. The evaluation team estimated FR at the measure level and SO at the program level.

Table 1-4. Net-to-Gross Results

Component	FR	SO	NTGR
Energy Efficiency Starter Kit*	23.7%	9.2%	85.5%
LEDs**	53.4%		55.8%
Faucet Aerators***	13.6%		95.6%
Low-Flow Shower Head	15.3%		93.9%
Outlet Seals	13.9%		95.3%
Weather stripping	32.1%		77.1%

*FR for the Energy Efficiency Kit is the weighted average of the measure-level FR values.
**FR for LEDs applies to LEDs in the kit as well as additional ones supplied.
*** FR questions for faucet aerators did not differentiate between kitchen and bathroom aerators.

For planning purposes, Duke Energy requires separate per-participant savings values for the energy efficiency kit and the additional bulbs distributed to participants. To provide these estimates, the evaluation team subtracted the engineering-derived net savings of the average number of additional bulbs distributed (4.4 LED bulbs) from the per-participant billing analysis savings. Taking this step ensures that savings from the additional bulbs are not double-counted, as these savings are already included in the billing analysis estimate (see Table 1-5).

Table 1-5. DSMore Inputs

Development of DSMore Inputs	kWh	Summer Peak Savings (kW)	Winter Peak Savings (kW)
Net energy efficiency kit savings per participant (excluding additional LEDs)	1,013.5	0.1199	0.0992
Net savings per additional LED bulb: Engineering analysis	18.5	0.0027	0.0013

1.4 Evaluation Recommendations

We have developed a series of recommendations based on the results of our evaluation:

- **Program energy savings would likely improve if auditors installed all possible measures from the kit. If auditors are unable to install all measures, they should document the barriers they face so that these can be assessed for ways to overcome them.** If the program could improve measure installation, it is likely that measure ISRs and program savings would improve, particularly because we found high persistence rates (PRs) for all measures. We understand that there may be safety concerns related to the installation of outlet seals, which may lead auditors to leave these measures uninstalled, but our understanding is that Duke Energy has an expectation that all measures will be installed during home assessments. It should be noted that in subsequent conversations, the evaluation team learned from Duke Energy that in the spring of 2017, after the close of this evaluation period, additional training of implementation staff occurred to address this issue and to instruct installers to document why measures were not installed.

  Specifically, to address faucet aerators that do not fit, we recommend providing adaptors to participants to increase the installation rate of this measure.

- **Provide education on the benefits of early light bulb replacement.** Participants report "not needing them" as the most common reason for not installing the LEDs provided in the kit, suggesting that participants are waiting for their current bulbs to burn out. While more emphasis on installing all measures during the audit (see recommendation above) will help with ISRs, providing additional education on the savings potential of LEDs might lead to additional spillover savings by encouraging participants to more quickly replace inefficient bulbs in the future as well.

- **Channeling efforts by auditors that direct participants of the REA program to other Duke Energy programs could be improved.** While our data preparation for the billing analysis showed that a majority of REA participants have participated in other Duke Energy programs prior to participation, our survey findings showed that only a small portion of customers recalled hearing about other Duke Energy programs through the REA program. If Duke Energy is interested in using the REA program to channel customers to their other offerings, program staff may want to direct auditors to leave behind applicable materials to market its other programs. Additionally, we recommend that auditors familiarize themselves with Duke Energy's other programs and make recommendations to program participants based on the programs that are most suitable.

  According to Duke Energy, the program refreshed the technology and audit report in March 2017 to provide a more user-friendly report to the customer, outlining audit recommendations as well as cross-program recommendations. Additionally, the implementer now has the ability to report back to Duke Energy all recommendations, including cross-promotional referrals. Finally, in addition to including FindItDuke referrals in the audit report, advisors can now generate (where relevant) and email referrals to the customer during the assessment.

- **Ensure that auditors provide all applicable recommendations to customers during assessment visits.** Based on a review of the program-tracking data, several potential audit recommendations were never provided to DEP participants. Recommendations that auditors provided to REA participants in other jurisdictions, but not to DEP participants, included replace or install a heat pump, seal air leaks in duct systems, and turn down water heater temperature. In addition, most recommendations that were given were only provided to about 50% of participants. While it is expected that some recommendations do not apply to all participants, the incidence of recommendations not received appears to be too high to be the result of applicability alone.

  The energy savings from the program could be improved if auditors provided customers with more recommendations on which they could act, since they may not be knowledgeable about the amount of energy that they could save by making changes, such as replacing furnace filters and adjusting thermostat settings. As noted above, Duke Energy has provided additional training to implementation staff to address providing recommendations to program participants that can help them save energy in their homes.

- **Consider adding "premium" audit services for a fee at the time of the audit or soon thereafter.** Based on interest from the program team, we asked surveyed participants about their desire for "premium" audit services, for a fee, that could be offered in addition to the standard assessment. Customers expressed interest in these additional premium audit services, particularly for blower door tests and thermal imaging. When scheduling an audit, customers could be given this option so that the auditor could come prepared to conduct the free audit, install measures from the energy efficiency kit, and provide additional fee-based audit services.

2. Program Description

The DEP REA program is a home assessment program that provides customers with a customized energy report with recommendations to help lower energy bills. The program targets residents of owner-occupied, single-family households who have been in their homes for at least four months and uses direct mailing as its main source of marketing and outreach.

2.1 Program Design

The REA program has two main components. The first is the home energy assessment, branded to customers as the "Home Energy House Call." During the assessment, energy specialists (auditors) enter participants' homes to inspect and assess energy using equipment in the home, including their heating and cooling equipment and the state of duct and home insulation. Auditors also look for places where customers could either make an improvement to equipment (e.g., replacing an outdated heat pump, removing older secondary appliances) or adjust the way that they use current equipment (e.g., adjusting the settings for their furnace fan, using window shades in the summer). These recommendations are meant to steer customers toward home improvements that will help them save more energy.

The second component is a free kit of low-cost, energy-efficient measures. The Energy Efficiency Starter Kit consists of two 9W LEDs, two faucet aerators, a low-flow shower head, outlet seals (a package of four outlet and two switch seals), and a 17-foot roll of closed cell foam weather stripping. Customers can also receive up to six additional LEDs, regardless of bulbs received from other Duke Energy programs.

In its program-tracking databases, DEP tracks the date that customers sign up for the program, the recommendations made by the auditor during the assessment, and the number of additional light bulbs given to the customer.

2.2 Program Implementation

During the evaluation period, DEP contracted with Franklin Energy to implement the REA program. The program was implemented using a multichannel marketing approach, including bill inserts and direct mail letters, as well as a paid search on Google. The successful launch of the program led to a backlog of participants, causing DEP to scale back its marketing during the evaluation period. It is worth noting that this evaluation is the first of the DEP REA program.

2.3 Program Performance

The program period under evaluation is April 1, 2016 through March 31, 2017. Over this period, the program served 6,754 unique participants. The program saved participants, on average, 1,095 kWh per household per year. Coincident demand savings per household were 0.132 kW in summer and 0.105 kW in winter.

3. Key Research Objectives

This evaluation included a gross impact evaluation, a NTG analysis, and a process evaluation. The overall objectives of the REA program evaluation were to:

- Estimate energy savings using monthly billing data
- Verify the accuracy of deemed per-unit savings estimates and develop ISRs
- Estimate energy, summer demand, and winter demand savings at the measure level using engineering analysis
- Assess the likelihood that participants would have installed program measures had the energy efficiency kit not been provided (i.e., FR)
- Document SO associated with program participation
- Identify the most successful components of the program's implementation
- Identify the barriers to participation and provide recommendations to address these barriers

4. Overview of Evaluation Activities

4.1 Program Staff Interview

Opinion Dynamics conducted an in-depth interview with the current REA program manager in October 2017. The purpose of the interview was to gauge the current environment of, and expectations for, the REA program, including the program's goals, successes, and challenges over the evaluation period. During the interview, we discussed the multichannel approach to marketing the program, as well as the receptiveness of DEP customers to participating in this offering.

4.2 Program Materials Review

Opinion Dynamics reviewed program materials, including implementation plans, marketing and outreach materials, training materials, and the program-tracking database. We found the program materials relating to the assessment, recommendations, and marketing to be complete and of high quality.

4.3 Participant Survey

Opinion Dynamics implemented a computer-assisted telephone interviewing (CATI) survey in February 2018. The survey gathered data to verify participation in the program; develop measure-level estimates of installation, persistence; and ISRs; estimate the program NTGR; and support our process evaluation.

The survey sample design and sample size were based on customers who participated between April 2016 and March 2017. Of the 6,754 participants in the database, we drew a random sample of 2,001 valid telephone numbers. We used this sample to complete 150 participant telephone surveys.

The average length of the interviews was approximately 27 minutes; the response rate was 23%.

4.4 Billing Analysis

Opinion Dynamics conducted a billing analysis to determine the net savings attributable to the REA program in 2016 and 2017. We used a linear fixed effects regression (LFER) model to estimate the overall net ex post program savings. The fixed effect in our model is the customer, which allows us to control for all household factors that do not vary over time. The billing analysis used customers who participated from April 2016 through March 2017 as the treatment group and those who participated from April 2017 through December 2017 as the comparison group. A summary of the billing analysis approach is provided in Section 5.1.1; a detailed description of the billing analysis methodology is presented in Appendix F.

4.5 Deemed Savings Review and Engineering Analysis

Opinion Dynamics conducted a review of Duke Energy's deemed savings values and assumptions for each of the measures included in the Energy Efficiency Starter Kit. The deemed savings review had two main objectives:

1. Develop updated measure-level savings algorithms and input assumptions that are consistent with standard industry practice and comparable with applicable technical reference manuals (TRMs)

2. Develop a ratio between energy and demand savings that can be applied to the billing analysis energy savings to determine net demand savings.

To conduct our deemed savings review, we reviewed the Indiana TRM (IN TRM V2.2)[3] and other secondary resources and developed per-unit savings estimates for each kit measure. For each of the reviewed measures, we identified recommendations and suggested approaches for quantifying savings for this evaluation.

Our evaluation also relied on telephone survey data to confirm measure installation and persistence, which were combined with engineering estimates for each measure to develop per-unit gross energy and demand savings by measure type. Program-level energy savings are estimated through a billing analysis. Appendix E provides more detail on the methods used in the deemed savings review and engineering analysis.

[3] Indiana Technical Reference Manual Version 2.2. July 28, 2015. We reviewed several TRMs, including regional TRMs (e.g., Mid-Atlantic) as part of our engineering review. Many of these TRMs reference consistent methodologies for savings calculations and we ultimately followed the Indiana TRM methods to remain consistent with other Duke evaluations but made DEP-specific updates as applicable based on weather and survey data.

5. Impact Evaluation

5.1 Methodology

5.1.1 Billing Analysis

Opinion Dynamics conducted a billing analysis to determine the net savings of the REA program. Our billing analysis used participants from April 2016 through March 2017 as the treatment group and participants from April 2017 through December 2017 as the comparison group. This type of comparison group is referred to as a "future participant comparison group," since comparison group participants participated in the future, relative to the evaluation period. A comparison group allows us to establish a counterfactual, i.e., the baseline energy that participants in the treatment group would have used in the absence of the program. In addition, because the comparison group represents energy use in absence of the program, results from the billing analysis are net results, and application of a NTGR to billing analysis results is unnecessary.

Our method requires pre- and post-installation electricity usage data for the treatment group. To be included in the treatment group, we need both pre- and post-installation usage data for at least nine months before and after participation. For the control group, the model includes only electricity usage data from before their participation.

Table 5-1 summarizes information about the treatment and comparison groups included in the analyses.

Table 5-1. Accounts Included in Final Billing Analysis Model

Metric	Treatment Group	Comparison Group
Months of participation	April 2016–March 2017	April 2017–December 2017
# customers included in the analysis	2,198	1,488
Usage data included	9+ Months of Pre- and Post-Participation Data	9+ Months of Pre-Participation Data

The number of customers included in the analysis is approximately 33% of those who participated during the evaluation period, and 38% of those who participated between April and December of 2017. The main reason customers were dropped from the analysis was due to participation in other Duke Energy programs (approximately 52% in the treatment group and 54% in the comparison group). The evaluation team recognizes that this is a large number of customers to exclude from the analysis but took this necessary step to limit the risk of the effects of other programs being confounded with the treatment effect of the REA program. It should be noted that while these customers were not included in the billing analysis model, average modeled savings are still applied to them, i.e., the program receives credit for their savings.

The billing analysis employed a LFER model, which accounts for time-invariant factors, such as square footage, appliance stock, habitual behaviors, household size, and other factors that do not vary over time. The model accounts for differences in weather and pre-program energy use between participants. We also added dummy variables for each calendar month, i.e., binomial terms with "1" signifying that the bill occurred in that month of year and "0" otherwise. The monthly variables help control for seasonal trends in energy use and allow for a more accurate estimate of baseline usage absent the program. The model includes interaction terms between weather and the post-participation period for the treatment group, to account for differences in weather patterns across years. A more detailed discussion of the billing analysis methodology, including data-cleaning steps, the comparison group assessment, and the final model, is provided in Appendix F.

5.1.2 Engineering Analysis

As part of our impact evaluation, Opinion Dynamics conducted an engineering analysis for each measure included in the REA program Energy Efficiency Starter Kit. The purposes of the engineering estimates were to:

1. Provide a ratio of kW coincident demand to kWh energy savings, which is then applied to the billing analysis energy savings to estimate demand savings
2. Provide insight into the individual measure contributions to the overall kit savings

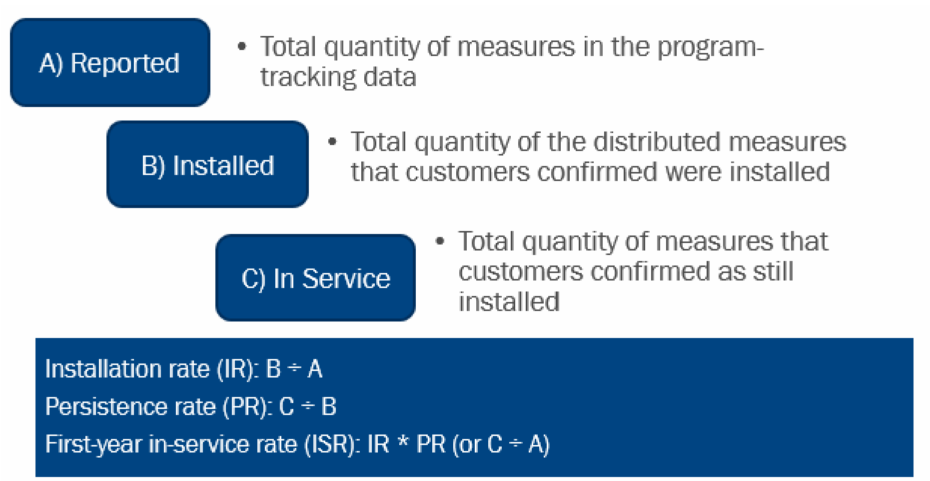
We used the IN TRM V2.2 and other references and assumptions to conduct our engineering analysis. The engineering analysis takes into consideration the measure ISRs to ensure only savings for installed measures are counted. Additional details and information on the engineering analysis are provided in Appendix E.

It should be noted that the billing analysis determines actual energy (kWh) impacts for the program; the engineering analysis only supplements the billing analysis for the two reasons mentioned above.

Installation Verification and Persistence

As part of the participant survey, we verified measure installation and persistence to obtain measure-level ISRs. Our engineering estimates use these values in calculations for annual per-customer savings (Figure 5-1). Specifically, we asked sampled participants to confirm the quantity of installed kit measures and, when necessary, to provide the corrected quantity. We then divided the number of measures verified by the respondent by the quantity that they received in the kit. This verified IR is the first component of the total ISR. Where applicable, we also asked participants to confirm whether program measures remained installed in their homes to create a PR. We then created a measure-specific total ISR by multiplying the two components.

Figure 5-1. Installation Rate Components



5.2 Results

5.2.1 Billing Analysis Results

This section provides billing analysis results and savings estimates for the DEP REA program evaluation period. Appendix F contains a detailed methodology for data cleaning and analysis, as well as complete results of the models. Table 5-2 shows the results of the billing model for REA program participants. The variable "Post" represents the unadjusted treatment effect, i.e., the change in average daily consumption (ADC) attributable to participation in the REA.

Table 5-2. Results of Billing Analysis Models

Variable	Coefficient
Post (REA program participation)	5.966773*
Cooling Degree-Days (CDD)[4]	0.141938*
Heating Degree-Days (HDD)	0.041427*
Post-participation period CDD	−0.035910*
Post-participation period HDD	−0.020669*
Additional bulbs received	−0.193460*
Constant	34.271583*
R-squared	0.699741
Additional Terms	**Included**
Monthly effects included	YES
Post-participation period interacted with months included	YES

*p<0.01.

Due to post-participation period interaction terms in the model, it is necessary to recalculate the coefficient of the treatment effect (Post) by combining the average value with the coefficient for each interaction term. The coefficient seen in the regression represents the reduction of daily consumption during the post-participation period, separate of any effect of the included interaction terms. Making these adjustments (detailed in Appendix F), Opinion Dynamics found that REA program participants included in the model realized 3.0 kWh of daily energy savings, on average.

Table 5-3 shows the per-home and program-level savings for the program. Overall, customers who participated in the REA program saved 1,095 kWh per year. During the evaluation period, the program realized 7,396 MWh of energy savings.

[4] 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 five CDD. On the other hand, if the weather has been cool, and the mean temperature is, say, 55 degrees, then there have been 10 HDD (65 minus 55). http://www.srh.noaa.gov/ffc/?n=degdays.

Table 5-3. Annual Savings from Billing Analysis

Annual Savings	
April 2016–March 2017 participants	6,754
Per-home daily savings (kWh)	3.0
Per-home annual savings (kWh)	1,095
Program savings (MWh)	**7,396**

5.2.2 Engineering Analysis Results

This section provides the results of the engineering analysis, including ex post deemed savings values, survey-based ISRs, and application of measure quantities to determine per-participant gross energy and demand savings. Table 5-4 shows the net of ISR ex post deemed savings values presented from the deemed savings review completed by the evaluation team (see Appendix E).

Table 5-4. Ex Post Deemed Savings for Energy Efficiency Starter Kit Measures

Measure	Ex Post Deemed Savings per Unit (kWh)	Ex Post Deemed Savings per Kit (kWh)*
LED	34.5	68.9
Low-flow shower head	198.8	198.8
Bathroom faucet aerator	22.8	22.8
Kitchen faucet aerator	149.9	149.9
Outlet seals	1.3	8.0
Weather stripping	4.8	82.2
Energy Efficiency Kit	N/A	530.6

*Energy efficiency kit contains two LEDs, six outlet seals and 17 feet of stripping; the per unit value for weather stripping is for 1 foot.

Table 5-5 provides the IR, PR, and ISR by measure. Except for LEDs, the evaluation found relatively low ISRs for measures included in the kit. Findings from the participant survey confirm that auditors often do not install kit measures during the assessments.

Table 5-5. Measure-Level ISRs

Measure	IR	PR	ISR
LEDs	88.4%	96.3%	85.2%
Low-flow shower head	67.1	90.0%	60.4%
Bathroom faucet aerator	58.2%	95.3%	55.4%
Kitchen faucet aerator			
Outlet seals	51.2%	100.0%	51.2%
Weather stripping	40.8%	100.0%	40.8%
Additional LEDs*	100.0%	96.3%	96.3%

*The IR of additional LEDs is assumed to be 100%. The PR is based on survey responses about LEDs provided in the kit.

To calculate per-participant engineering gross impacts, we multiplied the deemed savings values by measure-level ISRs and the average distributed quantity of each measure included in the kit. Table 5-6 shows the resulting estimated energy and demand savings for each measure included in the kit. In addition to the kit measures, the program reported distributing 29,707 additional LEDs to customers through the assessments, an average of 4.4 per household. The estimated energy savings for these additional LEDs is also included in Table 5-6. The lighting portion of the kit and the additional LEDs accounted for approximately 42% of the energy savings for each household. These estimates of energy savings include the ISRs presented in Table 5-5 above.

Table 5-6. Engineering Analysis Gross Impact Results

Measure		April 2016–March 2017			
		Energy Savings (kWh)	Summer Peak Demand (kW)	Winter Peak Demand (kW)	Percent of Total kWh Savings
Energy Efficiency Kit	LEDs (two 9W bulbs)	58.8	0.0087	0.0042	13%
	Low-flow shower head (1)	120.1	0.0051	0.0102	26%
	Bathroom faucet aerator (1)	12.6	0.0012	0.0024	3%
	Kitchen faucet aerator (1)	83.1	0.0041	0.0082	18%
	Outlet seals (package of 6)	4.1	0.0006	0.0019	7%
	Weather stripping (roll of 17 feet)	33.5	0.0140	0.0066	1%
Total kit only		**312.3**	**0.0336**	**0.0335**	**68%**
Additional LEDs (average of 4.4 bulbs)		146.0	0.0216	0.0105	32%
Total per-home estimate		**458.2**	**0.0552**	**0.0440**	**100%**

Using the estimated savings from Table 5-6, we can calculate an overall kW per kWh savings ratio from the engineering analysis. Table 5-7 displays two different ratios: one for the kit only and one for the kit plus additional LEDs.

Table 5-7. Engineering Demand-to-Energy Ratios

	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)
Kit only	312.3	0.034	0.034	0.0001077	0.0001074
Kit + additional LEDs	458.2	0.055	0.044	0.0001205	0.0000960

5.2.3 Comparison between Billing Analysis and Engineering Results

We estimated that the program realized per-participant energy savings of 1,095 kWh during the evaluation period. Savings from our engineering analysis (458 kWh per participant) are smaller in comparison to the billing analysis results. Differences in the estimated savings from these analyses are expected, due to differences in methodology and the fact that the engineering analysis addresses only a subset of program savings (i.e., the Energy Efficiency Starter Kit and the additional LEDs that can be included). In contrast, the billing analysis provides a comprehensive estimate of program impacts. In addition to the components addressed by the engineering analysis, the billing analysis includes reduced energy consumption associated with improvements made due to assessment recommendations and behavioral changes. In addition, the billing analysis captures other unobserved factors that might have resulted in additional energy savings among participants.

6. Net-to-Gross Analysis

6.1 Methodology

Our participant survey included a NTG module to determine both program and measure-level NTGRs. A 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, a NTGR represents the share of tracked savings that are attributable to the program. A NTGR consists of FR and participant SO components.

6.1.1 Free-Ridership

Free-riders are program participants who would have paid for an assessment or installed energy efficiency products on their own, without the program. FR scores represent the percentage of savings that would have been achieved in the absence of the program. We categorized participants who reported that they would not have installed a measure without the program as 0% free-riders and participants who would have installed the measure without the program as 100% free-riders. Partial scores were assigned to customers who had plans to install the measure, but the program had at least some influence over that decision, particularly in terms of timing (i.e., the program accelerated the installation) or quantity (i.e., the program led to the installation of additional measures). We asked questions for each program measure, to enable us to develop measure-level FR estimates. The survey questions measured the following areas of program influence:

- Influence on installation: We asked participants about the likelihood that they would have installed each kit measure if they had not received it with the assessment.
- Influence on timing: We asked participants when they would have installed the measure on their own, whether that would have been around the same time, within six months, within a year, or longer.
- Influence on quantity: We asked participants whether they would have purchased the same quantity, more, or fewer on their own.

As part of the FR survey module, we included follow-up questions to check participant responses for consistency. We checked survey data for item non-response, and calculated the FR rate per the algorithms presented in Appendix C.

6.1.2 Spillover

SO represents energy savings from additional actions (expressed as a percentage of total program savings) that were the result of program participation, but that did not receive program financial support. While SO can result from a variety of measures, it is not possible to ask about all possible SO measures on a survey due to the need to limit its length. Thus, Opinion Dynamics chose to focus on actions that participants would reasonably take following their program participation and would do so without additional program support.

The participant survey included a series of questions to assess overall SO among program participants. To qualify for program-induced SO, we asked two main questions:

- Did the participant make any additional improvements (or change his or her behavior) to reduce household energy consumption since participation in the program for which he or she received no rebate or incentive?

- *If the respondent indicates making additional improvements (or changing behaviors):* How would the participant rate (on a scale from 0 to 10, with 0 indicating no influence and 10 indicating complete influence) how much influence the experience with the program had on the decision to make these improvements?

We asked participants to rate the degree to which the program influenced their action and to provide a rationale for their rating. We attributed SO for all respondents who gave a program influence score of 7 or higher. These respondents were asked a series of follow-up questions to assess the efficiency of measures.

To estimate the SO rate, we estimated savings for each SO measure using engineering algorithms and assumptions. We determined the program-level SO rate by dividing the sum of measure-level SO savings by the evaluated gross savings achieved by the sample of participants who received SO questions (Equation 6-1).

Equation 6-1. Spillover Rate

$$Spillover\ Rate = \frac{Spillover\ Savings}{Evaluated\ Gross\ Savings\ in\ the\ Respondent\ Sample}$$

6.1.3 Net-to-Gross Ratios

To calculate measure-level NTGRs, we combined the FR and SO rates using Equation 6-2:

Equation 6-2. Net-to-Gross Ratio

$$NTGR_{measure} = 1 - FR_{measure} + SO_{program}$$

6.2 Net-to-Gross Results

This section presents our estimates of FR and participant SO, and the resulting NTGRs. Both FR and SO components of the NTGR were derived from self-reported information from telephone interviews with program participants. The final NTGR is the percentage of gross program savings that can be attributed to the program. Table 6-1 shows FR estimates at the measure level and the SO estimate at the program level. Appendix A of this report contains the participant survey instrument, which includes the questions used in our algorithms. Appendix C provides an overview of the FR algorithm. We estimate program FR to equal 24% and program SO to equal 9%. The resulting NTGR for the REA program for the evaluation period is 86%. When applied to engineering gross estimates, the estimated SO rate of 9% represents an average of about 42 kWh per household.

Table 6-1. Measure-Level NTGRs

Component	FR	SO	NTGR
Energy Efficiency Starter Kit*	23.7%	9.2%	85.5%
LEDs**	53.4%		55.8%
Faucet aerators***	13.6%		95.6%
Low-flow shower head	15.3%		93.9%
Outlet seals	13.9%		95.3%
Weather stripping	32.1%		77.1%

*FR for the Energy Efficiency Kit is the weighted average of the measure-level FR values.
** FR and NTGR for LEDs applies to LEDs in the kit as well as additional ones supplied.
***FR questions for faucet aerators did not differentiate between kitchen and bathroom aerators.

6.2.1 Measure-Level Free-Ridership

Based on responses to measure-level FR questions in our participant survey, we calculated FR scores for customers who installed the measure. Table 6-2 shows the FR estimate for each measure, the resulting NTGR (excluding SO) as well as the relative precision, which was calculated around 1 - FR.

Table 6-2. Net-to-Gross Results and Relative Precision

	LEDs	Faucet Aerators	Low-Flow Shower Head	Outlet Seals	Weather Stripping
Sample size (n=)	102	106	114	73	65
FR estimate	46.6%	86.4%	84.7%	86.1%	67.9%
1 - FR	53.4%	13.6%	15.3%	13.9%	32.1%
Relative precision around 1 – FR (at 90% confidence)	11.4%	4.5%	4.5%	6.0%	9.9%

6.2.2 Spillover Savings

From our participant survey, we collected information on participants who were influenced by the program and installed additional energy-savings measures in their homes and for which they received no incentive or rebate. In all, 27 unique participants qualified for SO out of the survey sample of 150. The total breakdown of SO savings from these participants is shown in Table 6-3. We estimated a SO rate of 9% by taking the total measure-level SO estimates from survey respondents in Table 6-3 (i.e., 6,313 kWh) and dividing it by the total engineering savings from survey respondents (68,730 kWh).[5]

Table 6-3. Engineering Spillover Summary

Measure Type	Quantity of Measure Type	Total Energy Savings (kWh)	Total Coincident Demand Savings (kW)	Source of Savings
LEDs	80	2,756	0.61	Deemed Savings
Shower head (electric water heating)	5	994	0.13	Deemed Savings
Dishwasher	4	527	0.18	Indiana TRM v2.2
Aerator (electric water heating)	6	518	0.09	Deemed Savings
Clothes washer	6	463	0.06	IL TRM V6
Refrigerator	8	402	0.06	IL TRM V6
Smart thermostat	1	247	0.18	Indiana TRM
Windows	18	162	0.24	Indiana TRM v2.2
Freezer	3	113	0.02	Indiana TRM v2.2
Clothes dryer	1	93	0.01	IL TRM V3 v6.0
Attic insulation	1	25	0.02	IL TRM V3 v6.0
Attic tent*	1	14	0.01	NY TRM
Total	**134**	**6,313**	**1.601**	

*Attic tents cover the opening into the attic with an air sealing and insulating barrier. They are sometimes referred to as attach hatch covers.

[5] Total engineering savings of participants is calculated by multiplying the average engineering savings per home (i.e., 458.2 kWh) by the total number of survey participants (i.e., 150). Note that numbers are rounded.

7. Process Evaluation

7.1 Researchable Questions

Based on discussions with Duke Energy program and evaluation, measurement, and verification (EM&V) staff, the evaluation team developed the following process-related research questions:

- What are the most successful components of the program? What improvements can be made to the program's design and implementation?
- Are customers satisfied with the participation process and program measures?
- Do participants find the assessment recommendations useful and actionable?
- Are eligible customers channeled into other Duke Energy programs?
- What kind of behavioral changes do participants make following the assessment?

7.2 Methodology

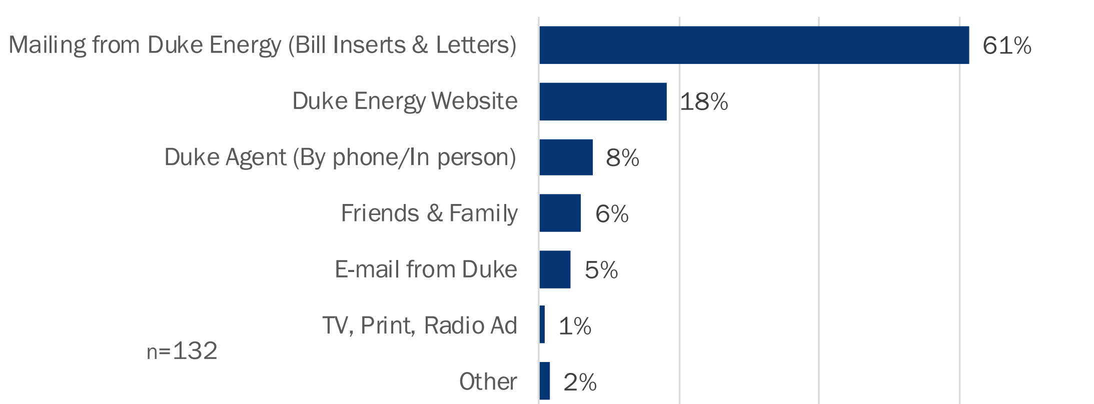
Our process evaluation relied primarily on our interview with program staff, our review of program materials and program-tracking data, and our analysis of the participant survey results. The full survey document is included in Appendix A.

7.3 Key Findings

7.3.1 Marketing and Channeling

Duke Energy has relied heavily on a direct mail marketing strategy to generate interest in the REA program. As shown in Figure 7-1, the majority of respondents (61%) reported first hearing about the program via a direct mailing from Duke Energy (e.g., a bill insert or a letter). Given the length of time between the customer learning about the program and taking the survey, we do not distinguish between the types of mailed items. Customers may simply remember receiving "something" in the mail.

Figure 7-1. Sources of Program Awareness



While REA auditors are instructed to inform program participants about other suitable Duke Energy programs for which they might be eligible, only about a quarter of REA participants (23%) recalled learning about other programs during their assessment. Of these participants, the largest share reported hearing about the Residential Smart $aver program (37%), followed by the Home Energy Report (34%) and Power Manager (31%) programs (see Table 7-1). To ensure auditors mention applicable programs, the REA program manager has noted that the implementation team has received additional training in this area around the Spring of 2017.

Table 7-1. Channeling to Other Duke Energy Programs

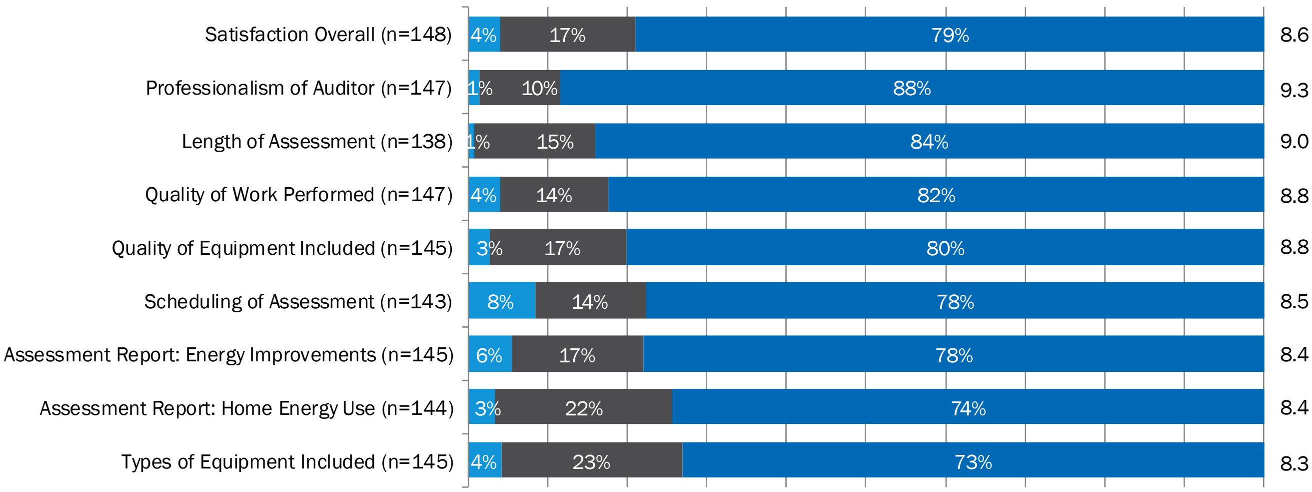
Which programs did you recall hearing about? (multiple responses accepted) (n=35)	
Smart $aver	37%
Home Energy Report	34%
Power Manager	31%
Solar	9%
Other	17%
Don't know	23%

7.3.2 Satisfaction

Overall, program satisfaction was high across various aspects of the program. Seventy-nine percent of participants said that they were "satisfied" with the program overall. One-third of participants said that they have noticed savings on their Duke Energy bill since participating in the program. However, fewer than half of the participants who said that they were satisfied with the program also noticed savings on their bill. This suggests that satisfaction with the program is not directly tied to noticeable energy savings.

The areas of highest satisfaction relate to the quality and speed of the auditor's work. Professionalism of the auditor was rated a 9.3 out of 10, the length of the assessment was rated 9.0, and the quality of work performed received an average rating of 8.8 (see Figure 7-2). Factors that were rated slightly lower were related to the equipment, the recommendations in the assessments and the scheduling process. Overall, however, all these aspects had a mean satisfaction rating above 8 out of 10 and low levels of dissatisfaction (a rating of 4 or less).

Figure 7-2. Program Satisfaction



7.3.3 Program Value

Understanding customers' motivations for participating can help in developing effective program marketing strategies. Opinion Dynamics asked participants for their reason(s) they participated in the program (Table 7-2). A majority (65%) mentioned saving money on energy bills as a reason for their participation; reducing energy consumption was also cited frequently (40% of participants). Only a small share of participants (9%) cited "it was free" as a reason for participation.

Table 7-2. Reasons for Participating

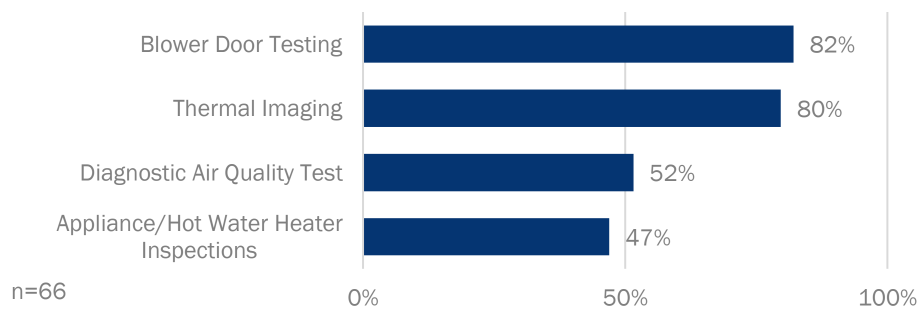
Why did you choose to participate? (n=150) multiple responses accepted	
Save money on energy/electric/gas bill	65%
Reduce energy consumption	40%
Learn more about home energy use and the program	16%
Make your home more comfortable	13%
It was free	9%
Other	5%
Don't know	2%

Note: Because multiple responses are accepted, total will not sum to 100%.

To assess participants' perception of the value of the REA offerings, the survey asked how much money they would be willing to pay for the energy assessment and for the kit. Participants reported valuing the program components much lower than their actual value. Customers who would be willing to pay for both components of the program (35% of participants) value the assessment and kit at $95.50, which is just over half the stated value ($180) on Duke Energy's website. The average willingness-to-pay for an assessment was $67, based on respondents who would have paid more than $0. Respondents were willing to pay less for the Energy Efficiency Starter Kit, valuing it at nearly $29. The majority of participants found the LEDs most valuable among the kit items (64%); fewer participants found shower heads (28%) and faucet aerators (24%) to be the most valuable measures.

In addition, respondents were asked if they would be willing to pay for additional premium services as part of the energy assessment, including blower door testing, thermal imaging, air quality tests, and appliance inspections. Among the 44% who said that they would be willing to pay for additional audit services, blower door tests were most popular, as seen in Figure 7-3.

Figure 7-3. Additional Assessment Components



7.3.4 Experience with Measures and Program Improvement Suggestions

Respondents who installed some or all of the measures in the energy efficiency kit were asked whether they, the auditor, or both installed each measure. The majority of the installations of LEDs and water measures were performed by the auditor or both, whereas the outlet seals and weather stripping were predominately installed by the customers. The evaluation team believes that the lower installation rates by the auditors contributes to the lower installation rates of outlet seals and weather stripping overall (see Table 7-3). It should be noted that DEP program staff reported that auditors have been given instruction to perform these installations and the proportion of auditor installations has grown since the end of the evaluation period.

Table 7-3. Measure Installations

Measure	IR	Auditor Installed	Customer Installed	Both Installed
LEDs (n=129)	88%	52%	32%	15%
Faucet aerators (n=98)	58%	76%	22%	2%
Shower head (n=100)	67%	64%	34%	N/A
Outlet seals (n=49)	51%	18%	71%	6%
Weather stripping (n=49)	41%	16%	78%	2%

Additionally, respondents who did not install all of the measures in the energy efficiency kit were asked to provide reasons for not installing them. Common reasons varied across the measure types. For LEDs, the majority reported that they were waiting for their current bulbs to burn out to install their new ones (59%), suggesting that they may benefit from additional education about the energy savings benefits of replacing existing bulbs with LEDs. For faucet aerators, the most common response was that the measure did not fit (21%) or that the respondent did not see a need (21%), while for shower heads, the customers did not like the measure (24%) or already had an efficient shower head (24%). Most respondents who had not installed all their weather stripping reported that they did not see a need (30%), whereas for outlet seals respondents noted that they had not had the time to install them yet (30%). See Table 7-4 below for full details of the responses by measure.

Table 7-4. Common Reasons for Not Installing Measures

Common reasons for not installing	LEDs (n=17)	Faucet Aerators (n=75)	Shower Head (n=50)	Outlet Seals (n=50)	Weather stripping (n=71)
Haven't needed the equipment yet	59%	0%	0%	0%	1%
Did not see a need	0%	21%	2%	12%	30%
Haven't had time	0%	0%	2%	30%	10%
Already have the measure	0%	19%	24%	10%	17%
Did not like the measure	6%	0%	24%	0%	0%
Did not fit	18%	21%	12%	0%	3%
Did not receive enough / Only received one*	0%	20%	10%	10%	10%
Unable to install / Needed assistance	0%	4%	4%	18%	13%
Not enough water pressure	N/A	5%	16%	N/A	N/A
Don't know	18%	9%	6%	20%	11%

Note: The n values represent the number of respondents who said that they had installed only some or none of the measure.
*This response was given by participants who, for example, had more showers, outlet seals, and faucet aerators than could be accommodated by the measures in the kit. In the case of weather stripping, there was not enough to weather strip around all windows and doors in the home.

When asked about additional measures that would be of interest, the majority of participants reported that the kit equipment was sufficient (64%) or that they did not know what other equipment they would have liked in the kit (13%). The list of additional measures that participants reported that they would have liked to receive in addition to those in the kit are listed in Table 7-5.

Participants were also asked to rate their interest in a "Home Energy Score," which uses a 1–10 scale to rate the efficiency of one's home energy usage; 71% said that they were at least somewhat interested in receiving their score.

Table 7-5. Additional Measures

What equipment would you have liked to receive? (n=150)	
More weather stripping/outlet seals	5%
Insulation	4%
Variety of outlet seals	3%
More LED bulbs	2%
Other types of LEDs	1%
Other	8%
Nothing else	64%
Don't know	13%

Consistent with the high satisfaction levels, the majority of respondents (57%) did not have any recommendations to improve the program. Of the 43% who did provide suggestions for improvement, the most common were to include additional measures in the energy efficiency kit, to increase communication and follow-up regarding their assessment, and to increase the quantity of the current measures – all mentioned by less than 10% of respondents (see Table 7-6).

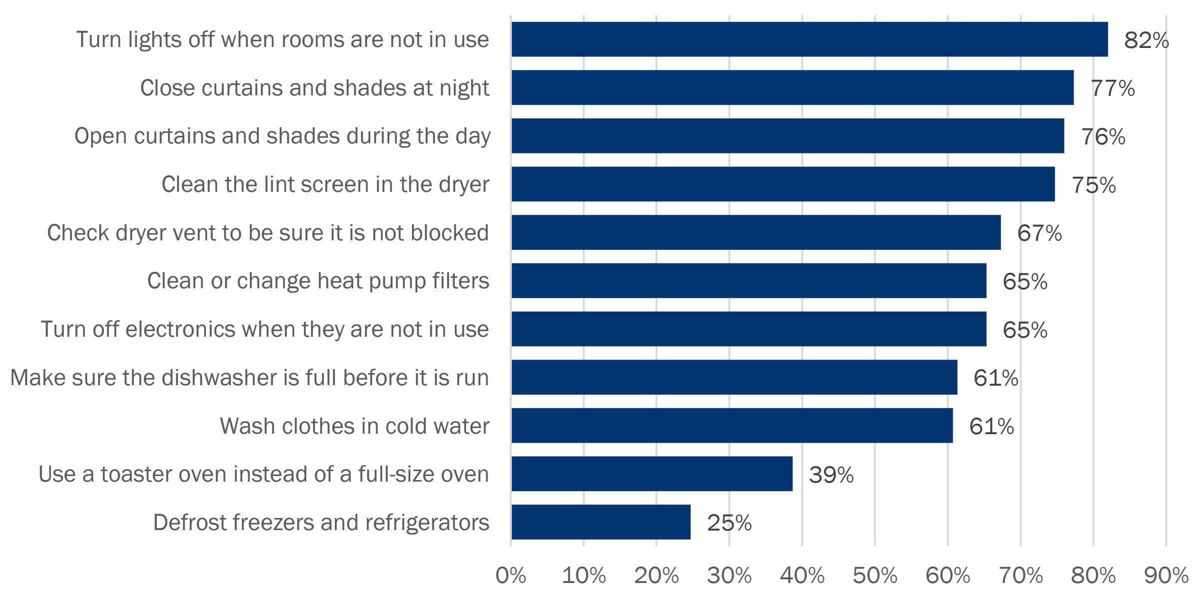
Table 7-6. Suggested Program Improvements

What, if anything, could be done to improve the program? (n=150)	
Add additional measures	9%
Have a pre- or post-audit/follow-up/communicate	7%
Increase current measures	6%
Have auditor install all measures/thorough assessment	5%
Scheduling/timing issues	5%
Offer rebates for repairs	3%
Increase program awareness	2%
Other	6%
Nothing	57%

7.3.5 Education

As part of the Energy Efficiency Starter Kit, customers received a "Department of Energy, Energy Savers Booklet." This educational material outlines how energy is used, and wasted, in the home. The booklet provides insights about the effects that insulation, lighting, appliances, and other items can have on energy use in the home. Most respondents remember receiving the booklet (82%), and 80% of those participants reported taking the time to read it. Included in the booklet is a list of energy-saving tips. All participants were asked about any behavioral changes that they have made since participating and, overall, customers reported high uptake (see Figure 7-4). The only exceptions are two recommendations related to kitchen appliances.

Figure 7-4. Behavioral Changes



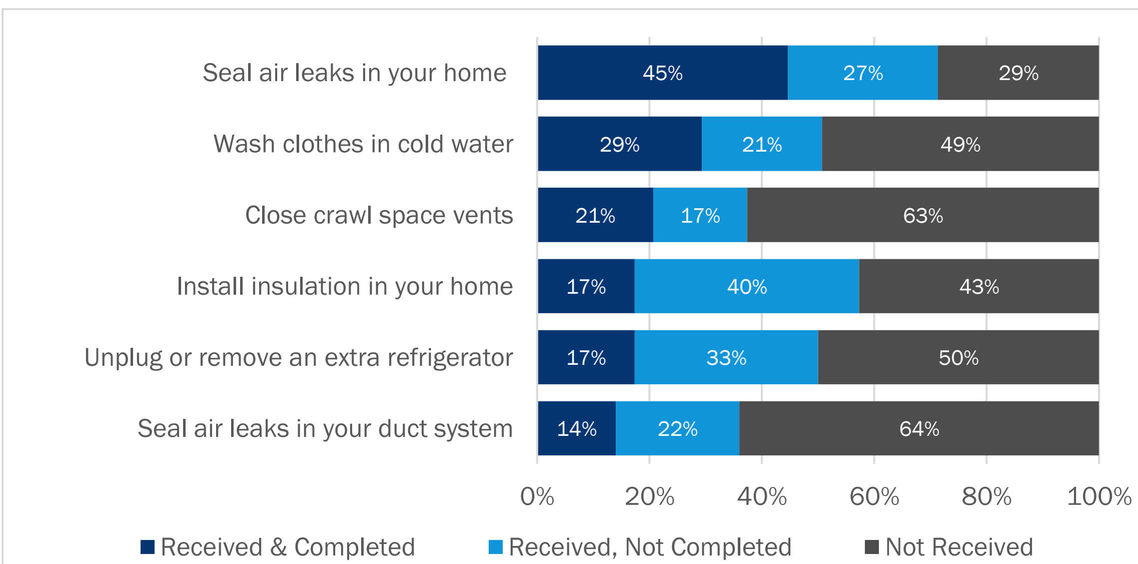
7.3.6 Assessment Recommendations

The program-tracking data includes information about specific recommendations on energy efficiency actions provided to DEP REA program participants during the assessment. The telephone survey then asked participants to confirm that they had received the tracked recommendations, which ones they had completed, and whether they planned to implement any of those recommendations not yet completed. Note that to reduced survey response burden similar recommendations were grouped into categories for the survey. For example, “seal leaky fireplace”, “seal leaky windows”, and “seal leaky doors” were all grouped into the category “seal air leaks” in the survey instrument.

Based on the program tracking database, only six categories of recommendations available for auditors to suggest to participants were actually given during the evaluation cycle (shown in Figure 7-5). While there were additional recommendations that auditors had provided through the REA program in other jurisdictions, such as replace or install a heat pump, seal air leaks in duct systems, and turn down water heater temperature, it is not clear why these were not suggested to participants in DEP’s jurisdiction. One possible explanation is that they did not think that they were applicable. According to Duke Energy, the program implementer has since received additional training to ensure that all appropriate audit recommendations are provided. In addition, the program refreshed its audit reports in March 2017 to make sure to cover applicable audit recommendations.

The proportion of participants who received and acted on the given recommendations is shown by the dark blue bars in Figure 7-5. The lighter blue bars represent recommendations that were received but not carried out by participants. The grey bars show recommendations not received. Figure 7-5 shows that, on average, recommendations that were given were suggested, on average, just over 50% of the time (the sum of the dark and light blue bars). Among respondents who had not completed any of their recommendations, the majority said that they were currently planning to complete some or all of the remaining recommendations (54%), while the rest either had no plans to complete them (42%) or said that they did not know (4%).

Figure 7-5. Received and Completed Recommendations



8. Conclusions and Recommendations

The following discussion presents our findings and accompanying recommendations. Note that each finding does not have a recommendation.

Finding: Overall, Opinion Dynamics found that the DEP REA program performed well. Participants were highly satisfied with the program and net savings were in line with results from most prior evaluations of this program in other Duke Energy jurisdictions. We found that most participants first heard about the program through Duke Energy mailings, which is consistent with Duke's marketing efforts.

Finding: Like the REA program that operates in other Duke Energy jurisdictions, not all measures from the Energy Efficiency Starter Kit were installed by auditors. Almost half of the kit measures were not installed by the auditor during the home assessment (weighted average of 52% were installed). However, measures that save more energy, such as LEDs, faucet aerators, and low-flow showerheads were installed more frequently than outlet seals and weather stripping. Of the 50% who did not have their faucet aerators installed, about 20% said it was because they did not fit, and of the 11% of customers who did not have their free LEDs installed, about 60% said they were waiting for their old bulbs to burn out first.

> **Recommendation: Program energy savings would likely improve if auditors installed all possible measures from the kit. If auditors are unable to install all measures, they should document the barriers they face so that these can be assessed for ways to overcome them.** If the program could improve measure installation, it is likely that measure ISRs and program savings would improve, particularly because we found high PRs for all measures. We understand that there may be safety concerns related to the installation of outlet seals, which may lead auditors to leave these measures uninstalled, but our understanding is that Duke Energy has an expectation that all measures will be installed during home assessments. It should be noted that in subsequent conversations, the evaluation team learned from Duke Energy that in the spring of 2017, after the close of this evaluation period, additional training of implementation staff occurred to address this issue and to instruct installers to document why measures were not installed.
>
> Specifically, to address faucet aerators that do not fit, we recommend providing adaptors to participants to increase the installation rate of this measure.
>
> **Recommendation: Provide education on the benefits of early light bulb replacement.** Participants report "not needing them" as the most common reason for not installing the LEDs provided in the kit, suggesting that participants are waiting for their current bulbs to burn out. While more emphasis on installing all measures during the audit (see recommendation above) will help with ISRs, providing additional education on the savings potential of LEDs might lead to additional spillover savings by encouraging participants to more quickly replace inefficient bulbs in the future as well.

Finding: While our data preparation for the billing analysis showed that a majority of REA participants have participated in other Duke Energy programs, our survey findings show showed that only a small portion of customers recalled hearing about other Duke Energy programs through the REA program.

> **Recommendation: Channeling efforts by auditors that direct participants of the REA program to other Duke Energy programs could be improved.** While our data preparation for the billing analysis showed that a majority of REA participants have participated in other Duke Energy programs prior to participation, our survey findings showed that only a small portion of customers recalled hearing about other Duke Energy programs through the REA program. If Duke Energy is interested in using the REA program to channel customers to their other offerings, program staff may want to direct auditors to

leave behind applicable materials to market its other programs. Additionally, we recommend that auditors familiarize themselves with Duke Energy's other programs and make recommendations to program participants based on the programs that are most suitable.

According to Duke Energy, the program refreshed the technology and audit report in March 2017 to provide a more user-friendly report to the customer, outlining audit recommendations as well as cross-program recommendations. Additionally, the implementer now has the ability to report back to Duke Energy all recommendations, including cross-promotional referrals. Finally, in addition to including FindItDuke referrals in the audit report, advisors can now generate (where relevant) and email referrals to the customer during the assessment.

Finding: Based on a review of the program-tracking data, several audit recommendations were not provided to participants. Of the subset that were given to customers, these were provided about half the time. During assessment visits, auditors are expected to provide participants with all applicable recommendations to improve energy efficiency in their homes. It is unclear if recommendations were not provided because they were not applicable or for some other reason. According to Duke Energy, the program implementer has since received additional training to ensure that all appropriate audit recommendations are provided. In addition, the program refreshed its audit reports in March 2017 to make sure to cover applicable audit recommendations.

Recommendation: The energy savings from the program could be improved if auditors provided customers with more recommendations on which they could act. They may not be knowledgeable about the amount of energy that they could save by making changes, such as replacing furnace filters and adjusting thermostat settings. As noted above, Duke Energy has provided additional training to implementation staff to address providing recommendations to program participants that can help them save energy in their homes.

Finding: Based on interest from the program team, we asked customers about their desire for "premium" audit services that could be offered in addition to the standard assessment for some price. **We found that customers do have some interest in having the option to pay for certain additional premium audit services, particularly for blower door tests and thermal imaging.**

Recommendation: Consider adding premium audit services, particularly those in which customers have shown an interest. We recommend that DEP consider inquiring with customers about the premium audit services they would consider paying for out of pocket, perhaps through a survey effort with past program participants. It would also be worthwhile to ask customers how much they would be willing to pay for these services to understand how they are valued by program participants.

9. DSMore Inputs

For planning purposes, Duke Energy requires separate per-participant savings values for the energy efficiency kit and the additional bulbs distributed to participants. To provide these estimates, the evaluation team took the following steps:

1. We estimated **net savings per additional LED** by multiplying gross savings per additional LED by the LED NTG ratio of 55.8 %.
2. We estimated **net savings of the kit exclusive of additional LEDs** by subtracting net savings for the average number of additional LEDs (4.4 bulbs) from per household savings based on the billing analysis.

Developing these separate inputs ensures that savings from the additional bulbs are not double-counted for planning purposes, as their savings are already included in the billing analysis estimate.

Table 9-1 presents the development of the DSMore inputs.

Table 9-1. Development of DSMore Inputs

Data for Development of DSMore Inputs	Energy Savings (kWh)*	Summer Coincident Demand (kW)	Winter Coincident Demand (kW)
Gross savings per additional LED bulb: Engineering analysis	33.19	0.00491	0.00238
LED NTG ratio = 55.8%			
Net savings per LED additional bulb: Engineering analysis	18.52	0.0027	0.0013
Program savings per participant: Billing analysis	1095	0.1313	0.1060
Net Savings for additional LED Bulbs	81.4881	0.0121	0.0058
Net kit savings per participant (excluding additional LEDs)	1013.51	0.1199	0.0992

The DSMore Inputs are included in a separately provided Microsoft Excel file.

10. Summary Form

Residential Energy Assessments

Completed EM&V Fact Sheet

The REA program provides, free of cost, a home energy assessment, which includes a kit of low-cost energy efficiency measures. A report of recommended upgrades and behavioral changes is given to the customer at the end of the assessment.

Date	October 12, 2018
Region(s)	Duke Energy Progress
Evaluation Period	April 2016–March 2017
Annual kWh Savings	7,395,630 kWh
Annual kWh Savings (per participant)	1,095 kWh
Coincident kW Impact	0.132 kW (Summer), 0.105 kW (Winter)
Measure Life	Not Evaluated
Net-to-Gross Ratio	85.5%
Process Evaluation	Yes
Previous Evaluation(s)	N/A

Evaluation Methodology

The evaluation team verified measure-level deemed savings estimates using an engineering analysis of savings assumptions and calculations. The evaluation team also leveraged a participant survey to verify installation and ISRs for each measure and to estimate a NTGR. The evaluation team conducted a billing analysis to estimate energy savings and used a combination of billing analysis and engineering analysis results to estimate coincident demand savings.

Impact Evaluation Details

- Residential customers in DEP service territory who have owned their single-family home for at least four months are eligible for the program. Homes must have an electric water heater, electric heat, or central air conditioning.
- The evaluation team based assumptions and inputs, for deemed savings and gross impacts on the IN TRM V2.2. The engineering analysis applied deemed savings values to measures distributed and in service (e.g., via an Energy Efficiency Starter Kit and additional LEDs).
- Results from the billing analysis reflect savings associated with measures installed, assessment recommendations, SO, and potential behavioral changes from energy efficiency knowledge gained through participation in the REA program.

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