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EM&V Report for the Duke Energy Multifamily Energy Efficiency Program

Prepared for:



Duke Energy Progress, Duke Energy Carolinas

FINAL

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Prepared by:

Sagar Phalke Guidehouse Inc

guidehouse.com

Submitted to:

Duke Energy 411 Fayetteville St Raleigh, NC 27601-1849

Submitted by:

Guidehouse Inc. 101 N. Tryon Street, 27th Floor Charlotte, NC 28280

Contact:

Chip Wood, Partner 704.347.7621 <u>Chip.wood@guidehouse.com</u> Jeff Erickson, Director 608.616.4962 jeff.erickson@guidehouse.com Charles Ampong, Associate Director 608.446.3172 charles.ampong@guidehouse.com

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1. Evaluation Summary

1.1 Program Summary

The Multifamily Energy Efficiency Program is a direct install program offering efficient lighting and water products free of charge to Duke Energy customers in the multifamily sector. The program is delivered through coordination between Duke Energy (or Franklin Energy, the program implementation contractor) and property managers or owners at qualifying multifamily sites. The program consists of the following lighting and water measures.

- Lighting Measures: Light-emitting diode (LED) bulbs installed in permanent fixtures, including A-lines, candelabra, globe, track and recessed lights.
- Water Measures: Low flow bathroom and kitchen faucet aerators, water-saving showerheads, and water heater pipe wrap (pipe wrap) are installed to reduce electric energy used for water heating.

All direct installations are overseen by Franklin Energy. Third party quality control inspections are completed on twenty percent of properties in any given month. The quantities of units that are inspected at each property are dependent upon the property size. Overall, at year end, at least 5 percent of all completed units must be inspected.

1.2 Evaluation Objectives and Methods

Guidehouse's evaluation included an independent assessment of program impacts and performance for participation that occurred in both the Duke Energy Progress (DEP) and Duke Energy Carolinas (DEC) jurisdictions between July 1, 2019 through June 30, 2021. For this Evaluation, Measurement, and Verification (EM&V) effort, Guidehouse used an engineering-based approach to calculate program impacts, similar to previous evaluation cycles with some differences pertaining to data collection activities. The sampling procedure was updated to reflect the current mix of program measures, facility characteristics like jurisdiction and year of participation, and data collection activities. In order to manage risk associated with COVID-19, Guidehouse replaced the previous onsite field study with virtual verification to collect information necessary for impact calculations. The evaluation approach and objectives can be described as follows:

- **Impact evaluation:** To quantify the net and gross energy and coincident demand savings associated with program activity at both the measure level and program level
- Process evaluation: To assess program delivery and customer satisfaction
- Net-to-Gross evaluation: To assess the net-to-gross ratio

By performing both impact and process components of the EM&V effort, Guidehouse provides Duke Energy with verified energy and demand impacts, as well as a set of recommendations that are intended to aid Duke Energy with improving or maintaining the satisfaction with program delivery while meeting energy and demand reduction targets in a cost-effective manner.

1.3 Evaluation Parameters and Sample Period

To accomplish the evaluation objectives, Guidehouse performed an engineering review of measure savings algorithms, virtual verification to assess installed quantities and characteristics, as well as surveys with tenants and property managers to assess satisfaction, decision-making processes and the net-to-gross ratio. The evaluated parameters are summarized in Table 1-1. For virtual verification the target sampling confidence and precision was 90 percent \pm 10 percent and the achieved was 90 percent \pm 3.0 percent.

Table 1-1. Evaluated Parameters

Evalauted Parameter	Description	Details
Efficiency Characteristics	Inputs and assumptions used to estimate energy and demand savings	 LED Wattage Baseline Lamp Wattage Aerator flow rates Showerhead flow rates
In-Service Rates	The percentage of program measures in use as compared to reported	 LED, aerator, and showerhead quantities Pipe wrap length
Satisfaction	Customer satisfaction	 Satisfaction with program Satisfaction with measures Satisfaction with contractor
Free Ridership	Fraction of reported savings that would have occurred, even in the absence of the program	1. Property manager interviews
Spillover	Additional, non-reported savings that occurred as a result of participation in the program	 Property manager interviews Tenant phone surveys

Source: Guidehouse

This evaluation covers participation from July 1, 2019 through June 30, 2021 for both water and lighting measures. The program suspended operations in March 2020 in response to the COVID-19 pandemic and hence the program tracking data does not include participation beyond this date. Thus, the evaluation effectively covers participation from July 1, 2019 through March 16, 2020. Table 1-2 shows the start and end dates of Guidehouse's EM&V data collection activities for this evaluation.

Table 1-2. EM&V Activity Period Start and End Dates

Activity	Start Date	End Date
Virtual Verification	9/28/2021	11/10/2021
Tenant Phone Surveys	8/12/2021	9/8/2021
Property Manager Interviews	8/16/2021	9/24/2021

Source: Guidehouse

1.4 Program Level Findings

Guidehouse found that Duke Energy is successfully delivering the Multifamily Energy Efficiency Program to customers, participant satisfaction is generally favorable, and the reported measure installations are relatively accurate.

For the evaluation period covered by this report, there were a total of 12,181 housing units at 114 participating properties in the DEP jurisdiction and 24,720 housing units at 180 participating properties in the DEC jurisdiction. The program-level evaluation findings are presented in Table 1-3 through Table 1-6. For the DEP jurisdiction, Guidehouse found the realization rate for gross energy savings to be 100 percent. For the DEC jurisdiction, Guidehouse found the realization rate for gross energy savings to be 98 percent, meaning that total verified gross energy savings were found to be slightly lower than claimed in the tracking database provided by Duke Energy.

Guidehouse found the net-to-gross (NTG) ratio to be 0.96, meaning that for every 100 kWh of reported energy savings, 96 kWh can be attributed directly to the program. Guidehouse calculated the net energy and demand impacts by multiplying the gross energy and demand impacts by the NTG ratio. These findings will be discussed in greater detail throughout this report.

Table 1-3. Program Claimed and Evaluated Gross Energy Impacts

	Claimed	Evaluated	Realization Rate
DEP Gross Energy Impacts (MWh)	7,801	7,763	100%
DEC Gross Energy Impacts (MWh)	14,369	14,053	98%

Source: Guidehouse analysis, values subject to rounding.

Table 1-4. Program Claimed and Evaluated Gross Peak Demand Impacts

	Claimed	Evaluated	Realization Rate
DEP Gross Summer Peak Demand Impacts (MW)	1,027	1,089	106%
DEP Gross Winter Peak Demand Impacts (MW)	1,380	1,325	96%
DEC Gross Summer Peak Demand Impacts (MW)	1,875	1,961	105%
DEC Gross Winter Peak Demand Impacts (MW)	2,541	2,410	95%

Source: Guidehouse analysis, values subject to rounding.

Table 1-5. Program Evaluated Net Energy Impacts

	Evaluated
DEP Gross Energy Impacts (MWh)	7,454
DEC Gross Energy Impacts (MWh)	13,494

Source: Guidehouse analysis, values subject to rounding.

	Evaluated
DEP Gross Summer Peak Demand Impacts (MW)	1,046
DEP Gross Winter Peak Demand Impacts (MW)	1,272
DEC Gross Summer Peak Demand Impacts (MW)	1,883
DEC Gross Winter Peak Demand Impacts (MW)	2,314

Source: Guidehouse analysis, values subject to rounding.

1.5 Evaluation Considerations and Recommendations

Guidehouse developed several recommendations during the EM&V effort. These recommendations are intended to assist Duke Energy with enhancing the program delivery and customer experience, as well as to possibly increase program impacts. Further explanation for each recommendation can be found later in this report.

- 1. Guidehouse recommends that Duke Energy should adopt the per unit ex post energy and demand impacts from this evaluation and use them going forward.
- 2. Duke Energy should consider educating participating tenants and property managers about the Duke Energy Online Store as an option to purchase additional or replacement equipment. This could involve distribution of additional marketing material to tenants during participation in this program.
- 3. Duke Energy should track additional existing energy efficiency opportunities (not offered through this program) at participating properties and consider channeling them through other applicable programs that offer those measures by sharing relevant leads internally.
- 4. Guidehouse recommends that Franklin Energy track the actual equipment type (bathroom aerator, kitchen aerator, or showerhead) for the water measures removed during installation along with the GPM value of the removed equipment already captured and provide that as part of the removed measures data going forward.

2. Program Description

2.1 Design

The Multifamily Energy Efficiency Program is designed to provide energy efficiency to a sector that is often underserved or difficult to reach via traditional, incentive-based energy efficiency programs. This market can be difficult to penetrate because multifamily housing units are often tenant-occupied rather than owner-occupied, meaning that the benefits of performing energy efficiency upgrades may be realized by the tenant whereas the incremental costs are absorbed by the property owner.

Duke Energy's Multifamily Energy Efficiency Program in both the DEP and DEC jurisdictions provides energy efficient equipment at no cost to multifamily housing property owners. The program is delivered through coordination with property managers/owners. Tenants are provided with notice and informational materials to inform them of the program and potential for reduction in their energy bills. The program consists of lighting and water measures.

- Lighting Measures: Light-emitting diode (LED) bulbs installed in permanent fixtures, including A-lines, candelabra, globe, track and recessed lights.
- Water Measures: Low flow bathroom and kitchen faucet aerators, water-saving showerheads, and water heater pipe wrap installed to reduce energy used for electric water heating.

2.2 Implementation

Franklin Energy is the implementation contractor for the program and coordinates recruiting and measure installation. Recruiting methods include primary outreach by energy advisors to identify properties, property managers, or property management companies likely to participate.

When the energy advisors have identified properties with an interest in the program, Franklin Energy then sends an outreach team to coordinate with property managers and explain the program delivery and benefits. This is considered an Energy Assessment. This is the time for energy advisors to determine the type of measures along with associated quantities that can be installed.

Once a property has been fully assessed and a service agreement has been signed, the project is handed over to a different group at Franklin Energy to schedule the installations. The installation crew performs the work as scheduled, while displaying Duke Energy branded clothing, badges, and vehicle decals as directed. The installation crews record the quantities and locations of installed measures for each housing unit via a tablet device, which are entered into a tracking database.

When energy efficient program measures are installed, Franklin Energy removes the existing or baseline equipment and generally disposes of it onsite. If the property management previously requested to keep the existing equipment, Franklin Energy will package it up and leave it behind with property management or maintenance personnel. Franklin Energy records the baseline characteristics (e.g. lamp type, wattage, aerator flow rates) for a sample of measures removed and makes that information available to Duke Energy and Guidehouse for evaluation purposes.

Franklin Energy uses internal and external quality control (QC) procedures to ensure consistent measure installation. On the internal side, a Franklin Energy supervisor may accompany installation crews to ensure quality work. On the external side, a third-party inspector, High Performance Building Solutions, conducts inspections on a least five percent of total participating housing units each year. The QC inspections are required to happen within 22 business days of installation. If a property is selected for a QC inspection, at least 20 percent of the units at the property are targeted for inspection.

During each month of QC inspections, Franklin Energy is provided with a discrepancy report that indicates when measures were missing, installed incorrectly, or if there were missed opportunities. Franklin Energy attempts to address the discrepancies, and subsequently updates the tracking data to reflect the QC findings. Franklin Energy then presents the tracking data to Duke Energy, and subsequently to Guidehouse for EM&V.

3. Evaluation Research Objectives and Methods

3.1 Research Objectives

As outlined in the Statement of Work, the key research objectives were to conduct impact and process evaluations, as well as a net-to-gross (NTG) analysis. Evaluation objectives include the following:

1. Impact evaluation:

- a. Verify deemed savings estimates through review of measure assumptions and calculations.
- b. Perform virtual verification of measure installations and collect data for use in an engineering analysis.
- c. Estimate the gross and net energy and peak demand savings (both summer and winter) by measure via engineering analysis.

2. Net-to-Gross Analysis:

a. Assess the Net-to-Gross ratio by addressing free-ridership via property manager interviews and spillover via property manager and tenant surveys.

3. Process evaluation:

- a. Conduct phone interviews with program management and implementation contractor(s) to collect data for use in process analysis.
- b. Administer property manager phone or online surveys to collect data for use in process analysis. Evaluate the strengths and weaknesses of current program processes and customer perceptions, with special consideration for effects of the COVID-19 pandemic.
- c. Administer tenant survey via phone to a sample of tenants in participating multifamily units to understand tenant program satisfaction, spillover, and COVID-19 impacts.

3.2 Evaluation Methods

Guidehouse's methodology for evaluating the gross and net energy and demand impacts of the program included the following components:

- 1. Detailed review of deemed savings estimates including engineering algorithms, key input parameters, and supporting assumptions
- 2. Virtual verification to assess measure characteristics and in-service rates (ISRs)
- 3. Net-to-gross (NTG) analysis (discussed in Section 5).

3.2.1 Overview of Impact Methodology

3.2.1.1 Detailed Review of Ex Ante Deemed Savings

Guidehouse reviewed the ex-ante savings and supporting documentation used to estimate ex ante program impacts. For all measures, Duke Energy indicated that the deemed energy and demand impacts for this program are equivalent to the verified impacts from the most recent EM&V report, which was completed by Guidehouse (then Navigant) in 2020.¹ The deemed ex ante savings for LED measures are shown in Table 3-1 below.

Measure	Annual Gross Energy Savings (kWh per lamp)	Summer Coincident Demand Savings (kWm per lamp)	Winter Coincident Demand Savings (kW per lamp)
A-Line LED	27.65	0.0046	0.0034
Globe LED	32.87	0.0042	0.0045
Candelabra LED	13.98	0.0029	0.0010
Track LED	24.08	0.0034	0.0024
Recessed LED	45.01	0.0080	0.0030

Table 3-1. Deemed Ex Ante Savings for LED Measures

Source: EM&V Report for the Duke Energy Multifamily Energy Efficiency Program, April 16, 2020 – Table 31

The deemed ex ante savings for the LED measures are calculated using the following algorithms from the 2018 Mid-Atlantic Technical Resource Manual (TRM) Version 8 for energy and summer coincident demand savings. Guidehouse modified the summer demand savings algorithm to develop a winter demand savings algorithm since the Mid-Atlantic TRM does not provide one.

Equation 1. Energy Savings Algorithms for LED Measures

$$kWh \ Savings = \left(\frac{Watts_{BASE} - Watts_{EE}}{1000}\right) * ISR * Hours * \left(WHFe_{Heat} + (WHFe_{Cool} - 1)\right)$$

Equation 2. Summer Coincident Demand Savings Algorithm for LED Measures

 $Summer \ kW \ Savings = \left(\frac{Watts_{BASE} - Watts_{EFF}}{1000}\right) * ISR * WHFd * CF_{Summer}$

¹ EM&V Report for the Duke Energy Multifamily Energy Efficiency Program, April 16, 2020.

Equation 3. Winter Coincident Demand Savings Algorithm for LED Measures

Winter kW Savings²

$$= \left(\frac{Watts_{BASE} - Watts_{EFF}}{1000}\right) * ISR * \left(1 - \left((WHFd - 1) * \% Electric Heat\right)\right) \\ * CF_{Winter}$$

Where the parameters are defined as:

Watts_{BASE} – Wattage of baseline lamp removed
Watts_{EE} – Wattage of efficient lamp installed
ISR – In-Service rate
Hours – Average hours of use per year
WHFe_{Heat} – Waste heat factor for energy to account for electric heating savings from reducing waste heat from efficient lighting
WHFe_{Cool} – Waste heat factor for energy to account for cooling savings from reduced waste heat from efficient lighting
WHFd – Waste heat factor for demand to account for cooling savings from efficient lighting
CF_{Summer} – Summer coincidence factor
% Electric Heat – Percentage of homes with electric heating
CF_{Winter} – Winter coincidence factor

The parameters used in the calculation of deemed ex ante savings for the A-line, globe, candelabra, track and recessed LED measures are shown in Table 3-2.

Table 3-2. Impact Parameters Used in the Deemed Ex Ante Savings from Prior Evaluation - LED Measures

Parameters	A-Line LED	Globe LED	Candelabra LED	Track LED	Recessed LED	Source
Watts _{BASE}	60.57	41.09	35.00	40.23	65.00	Duke Energy
Watts _{EE}	9.00	6.00	5.00	6.80	8.10	Guidehouse field verification
ISR	0.95	0.97	0.94	0.91	0.90	Guidehouse field verification
Hours	572	983	502	806	893	Guidehouse metering study*
WHFe _{Heat}	0.899	0.899	0.899	0.899	0.899	2018 Mid-Atlantic TRM
WHFe _{Cool}	1.087	1.087	1.087	1.087	1.087	2018 Mid-Atlantic TRM

² To calculate winter coincident demand savings, Guidehouse assumed that the WHFd subtracted from savings by the same proportion that it added to savings in the summer equation.

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Parameters	A-Line LED	Globe LED	Candelabra LED	Track LED	Recessed LED	Source
WHFd	1.19	1.19	1.19	1.19	1.19	2018 Mid-Atlantic TRM
CF _{Summer}	0.08	0.10	0.09	0.09	0.13	Guidehouse metering study*
% Electric Heat	55%	55%	55%	55%	55%	EIA RECs Study ³
CF _{Winter}	0.08	0.15	0.04	0.09	0.07	Guidehouse metering study*

* Duke Energy Multifamily EMV Report DEC-DEP 16Apr2020

Source: EM&V Report for the Duke Energy Multifamily Energy Efficiency Program, April 16, 2020 – Table 23, Table 24 and Footnote 7

Similar to the LED measures, the source for the deemed ex ante savings for water measures is the prior evaluation report, and they are shown in Table 3-3.

Table 3-3. Deemed Ex Ante Savings for Water Measures

Measure	Unit Basis	Annual Gross Energy Savings (kWh)	Summer Coincident Demand Savings (kW)	Winter Coincident Demand Savings (kW)
Bathroom Aerator – 0.5 GPM	Per aerator	75.11	0.0099	0.0087
Bathroom Aerator – 1.0 GPM	Per aerator	55.09	0.0073	0.0064
Kitchen Aerator	Per aerator	114.61	0.0151	0.0133
Showerhead	Per showerhead	281.09	0.0232	0.0906
Pipe Wrap	Per linear foot	19.20	0.0022	0.0022

Source: EM&V Report for the Duke Energy Multifamily Energy Efficiency Program, April 16, 2020 - Table 31

The deemed ex ante savings for the water measures are calculated using the following algorithms from the 2018 Mid-Atlantic TRM.

Equation 4. Energy Savings Algorithms for Aerator Measures

$$\begin{aligned} kWh \, Savings &= ISR \\ &* \left((GPM_{BASE} * Throttle_{BASE} - GPM_{LOW} * Throttle_{LOW}) * Time_{FAUCET} * \#People + \\ &* \frac{Days}{Year} * DR \right) * \left(\frac{8.3 * (Temp_{FT} - Temp_{IN})}{DHW \, Recovery \, Efficiency * 3412} \right) \end{aligned}$$

³ US Energy Information Administration (EIA) Residential Energy Consumption Survey (found at https://www.eia.gov/consumption/residential/data/2015/)

Equation 5. Energy Savings Algorithms for Showerhead Measure

$$kWh \ Savings = ISR \\ * \left((GPM_{BASE} - GPM_{LOW}) * Time_{SHOWER} * \# People * \frac{Days}{Year} \\ * \frac{Showers_{PERSON}}{Showerheads \ per \ Home} \right) * * \left(\frac{8.3 * (Temp_{SH} - Temp_{IN})}{DHW \ Recovery \ Efficiency * 3412} \right)$$

Equation 6. Demand Savings Algorithms for Aerator and Showerhead Measures

 $kW Savings = \frac{kWh Savings}{Hours} * CF$

Equation 7. Energy Savings Algorithms for Pipe Wrap Measure

 $kWh \, Savings = ISR * \left(\frac{1}{R_{EXIST}} - \frac{1}{R_{NEW}}\right) * \frac{L * C * \Delta T * 8760}{\eta_{DHW} * 3412}$

Equation 8. Demand Savings Algorithms for Pipe Wrap Measure

 $kW Savings = \frac{kWh Savings}{8760}$

Where the parameters are defined as:

ISR – In-Service rate

GPM_{BASE} – Gallons per minute of baseline faucet aerator or showerhead

GPM_{LOW} – Gallons per minute of low-flow faucet aerator or showerhead

ThrottleBASE - Baseline throttling factor

Throttle_{LOW} – Low-flow throttling factor

Time_{FAUCET} – Average daily length faucet use per capita for faucet of interest in minutes # People – Average number of people per household

Days/Year – Days faucet or showerhead used per year

DR – Percentage of water flowing down drain

8.3 – Specific weight of water in pounds per gallon multiplied by the specific heat of water $(1.0 \frac{Btu}{lb^{\circ}F})$

Temp_{FT} – Temperature of water used by faucet

Temp_{IN} – Temperature of water entering house

DHW Recovery efficiency – Recovery efficiency of electric hot water heater 3412 – Constant to convert Btu to kWh

Hours – Average number of hours per year spent using faucet or showerhead CF – Coincidence factor

Time_{SHOWER} – Average daily shower length in minutes

Showers_{PERSON} – Average showers per person per day

Showerheads per Home – Average number of showerheads in the home Temp_{SH} – Temperature of water used by showerhead

REXIST – Pipe heat loss coefficient (R-value) of existing uninsulated piping

 R_{NEW} – Pipe heat loss coefficient (R-value) of existing pipe plus installed insulation L – Feet of pipe from water heating source covered by pipe wrap

C – Circumference of pipe in feet

 ΔT – Average temperature difference between water in pipe and ambient air temperature

8760 – Hours per year

 $\eta_{\text{DHW}}-\text{Recovery}$ efficiency of electric hot water heater

The impact parameters used in the calculation of deemed ex ante savings for the bathroom faucet aerator, kitchen faucet aerator and low flow showerhead measures are shown in Table 3-4, while the parameters for the water heater pipe wrap measure are shown in Table 3-5.

Table 3-4. Impact Parameters Used in the Deemed Ex Ante Savings from Prior Evaluation – Aerator and Showerhead Measures

Parameter	Bath Aerator – 0.5 GPM	Bath Aerator – 1.0 GPM	Kitchen Aerator	Showerhead	Source
ISR	0.96	0.96	0.83	0.92	Guidehouse field verification and phone surveys
GPM _{BASE}	2.12	2.12	2.17	2.76	Data provided by Duke Energy from Franklin Energy sample
GPM _{LOW}	0.84	0.50	0.73	1.50	Guidehouse field verification ^a
Throttle _{BASE}	0.83	0.83	0.83	NA	2018 Mid-Atlantic TRM
Throttle _{LOW} ^a	0.95	0.95	0.95	NA	2018 Mid-Atlantic TRM
# People	2.07	2.07	2.07	2.07	EIA RECs Study 2015
Days/Year	365	365	365	365	2018 Mid-Atlantic TRM
DR	0.70	0.70	0.50	NA	2018 Mid-Atlantic TRM
Temp _{FT} b/ Temp _{SH}	96.03	96.03	96.99	105.00	Guidehouse field verification 2018 Mid-Atlantic TRM
Temp _{IN}	66.34	66.34	66.34	66.34	Building America Benchmark⁴
Time _{FAUCET} / Time _{SHOWER}	1.60	1.60	4.50	7.80	2018 Mid-Atlantic TRM

⁴ https://www.energy.gov/eere/buildings/downloads/building-america-analysis-existing-homes

Parameter	Bath Aerator – 0.5 GPM	Bath Aerator – 1.0 GPM	Kitchen Aerator	Showerhead	Source
Showers _{PERSON}	NA	NA	NA	0.60	2018 Mid-Atlantic TRM
Faucet / Showerhead per Home	1.53	1.53	1.00	1.39	Guidehouse field verification
DHW Recovery Efficiency	0.98	0.98	0.98	0.98	2018 Mid-Atlantic TRM
Summer CF	0.003	0.003	0.007	0.005	2018 Mid-Atlantic TRM & Guidehouse calculation using data from Building America Benchmark
Witner CF	0.002	0.002	0.007	0.019	2018 Mid-Atlantic TRM & Guidehouse calculation using data from Building America Benchmark
Hours ^c	20.11	20.11	56.56	58.82	2018 Mid-Atlantic TRM & Guidehouse calculation

a. Guidehouse measured flow rates during onsite field verification. For faucet aerators, Guidehouse used the measured flow rates to calculate impacts instead of multiplying the nameplate flowrate by the throttling factor since primary data was available.

b. For faucet aerators, Guidehouse assumed that customers use water at a temperature equal to the average of the hot and cold water temperatures measures during field verification

c. The demand savings for these measures in Table 3-3 are consistent with the hours values provided in this table. The hours values provided in the previous report appear to be typos.

Source: EM&V Report for the Duke Energy Multifamily Energy Efficiency Program, April 16, 2020 - Table 26

Table 3-5. Impact Parameters Used in the Deemed Ex Ante Savings from Prior Evaluation – Pipe Wrap Measure

Parameter	Pipe Wrap	Source
ISR	0.91	Guidehouse field verification and phone surveys
REXIST	1.00	2018 Mid-Atlantic TRM
R _{NEW}	4.12	Guidehouse field verification
L	1	Savings are calculated per linear foot
С	0.16	Assumed as average of 0.5" and 0.75" diameter pipe
ΔΤ	65	2018 Mid-Atlantic TRM
η _{DHW}	0.98	2018 Mid-Atlantic TRM

Source: EM&V Report for the Duke Energy Multifamily Energy Efficiency Program, April 16, 2020 - Section 4.3.3

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3.2.1.2 Virtual Verification

Guidehouse used the Qualtrics platform to create a virtual verification survey interface used by tenants to collect key project information and verify the installed equipment. The tenants also had the option to provide photo documentation of the installed equipment as part of the survey. Participants were also provided pictures of the measures to help them identify the sampled measures. Figure 1 shows an example of the Qualtrics virtual verification platform.



12:29 .il =	12:29 all =
ENERGY.	DUKE ENERGY.
Thank you for your participation in the Duke Energy Multifamily Energy Efficiency Program. We would like to hear about the energy efficiency measures your landlord or property	Are you aware that free energy efficiency equipment was installed at your home through this program by your landlord or property manager?
manager installed in your	⊖ Yes
between July 2019 and March	O No
2020. Your feedback is important and	O Don't know
will help us improve the program to better serve customers like you. We expect the survey to take approximately 15 minutes to complete. Your participation in	← →
this survey is voluntary. Your individual answers will remain confidential and be reported	Powered by Qualtrics I ⁴

Source: Guidehouse

One important consideration for the multifamily housing sector is that tenant turnover can be high, so individual customers may not have lived in the unit when program measures were installed and may not be aware that previous tenants participated in the program. In order to avoid this, Guidehouse used only a subset of program participants who were indicated in the program tracking database as "Active" at the same apartment unit in which the program measures were installed. Subsequently, Guidehouse only contacted "Active" tenants with a valid email address, and screening questions were used to further determine respondent awareness of the program. Table 3-6 shows number of total and active housing units along with the number

of housing units selected as part of the impact sample for tenant virtual verification surveys based on email address availability. The remaining "Active" housing units were reserved for the tenant process evaluation survey discussed later in this report.

Duke Energy Operating Area	Number of Properties	Total Number of Housing Units	Total Number of Housing Units with Active Tenants	Impact Sample Housing Units		
DEP	114	12,183	5,950	2,965		
DEC	180	24,720	10,704	5,335		

Table 3-6. Virtual Verification – Sampling Summary

Source: Guidehouse analysis

Table 3-7 shows the target number of program measures in the virtual verification sample order to achieve a 90/10 confidence and precision target at the program level. Guidehouse developed these targets based on prior experience evaluating this program. The target completes indicate the minimum number of measures that Guidehouse planned to assess via the virtual verification impact surveys. A total of 138⁵ tenants completed the virtual verification surveys, which represented 1,978 program measures. Guidehouse reviewed tenant responses and removed some data from the analysis if respondents did not provide sufficient information. This resulted in a total of 1,011 measures in the final sample used for analysis. Table 3-7 also shows the distribution of the target and achieved representation for each measure.

Table 3-7. Virtual Verification – Target Completes and Completes Achieved

Measure	Unit Basis	Total Count Tracking Data	Target Measures in Sample	Total Achieved Measures in Sample	Measures from Usable Responses*
A-Line LED	Lamp	249,905	24	955	503
Globe LED	Lamp	64,260	16	155	94
Candelabra LED	Lamp	61,156	16	233	100
Track LED	Lamp	22,263	16	78	31
Recessed LED	Lamp	15,570	16	44	29
Bath Aerator	Aerator	30,027	12	100	48
Kitchen Aerator	Aerator	11,179	12	49	33
Showerhead	Showerhead	22,958	20	89	68
Pipe Wrap	Linear Feet	86,264	12	275	105

⁵ Some responses were removed based on consistency checks when respondents provided insufficient information for Guidehouse to analyze.

	8
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Measures Total **Total Count** Target from Achieved Measure **Unit Basis** Tracking Measures Measures Usable in Sample Data in Sample **Responses*** Total 563,582 144 1,978 1,011

*Guidehouse removed some responses and measures from analysis if respondent information did not pass consistency checks.

Source: Guidehouse analysis

The distribution of the survey completes by jurisdiction and the corresponding quantity represented by them is shown in Table 3-8.

Table 3-8. Virtual Verification Survey – Completes Achieved by Jurisdiction

		DE	P	DE	EC
Measure	Unit Basis	Survey Completes	Quantity of Measures	Survey Completes	Quantity of Measures
A-Line LED	Lamp	44	340	68	615
Globe LED	Lamp	12	63	17	92
Candelabra LED	Lamp	25	111	27	122
Track LED	Lamp	10	51	6	27
Recessed LED	Lamp	10	28	13	16
Bath Aerator	Aerator	27	37	43	63
Kitchen Aerator	Aerator	22	22	27	27
Showerhead	Showerhead	23	29	42	60
Pipe Wrap	Linear Feet	25	129	27	146
Total		55	810	83	1,168

Source: Guidehouse analysis

Figure 2 shows the distribution of completed virtual verification assessments by program measure. The magnitude of each bar indicates the number of completed virtual verification surveys for each measure, and the values in parenthesis indicate the number of measures represented by the completed surveys. Respondents were able to answer questions about each measure type they received, so the total exceeds 138. Figure 3 shows the same information with a breakdown by the various LED lamp types.

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Figure 2. Virtual Verification – Survey Completes by Measure

Respondents were able to answer questions for multiple measures *Source: Guidehouse analysis*

Figure 3. Virtual Verification – LED Bulbs Survey Completes by Lamp Type



Respondents were able to answer questions for multiple measures Source: Guidehouse analysis

3.2.2 Overview of Net-to-Gross Methodology

As indicated in the evaluation plan, Guidehouse used a survey-based, self-report methodology to estimate free ridership and spillover for the program. A self-report approach is outlined in the Universal Methods Protocol (UMP) as an acceptable NTG methodology. Guidehouse primarily targeted property managers for the NTG surveys because they are the decision makers for participation in the program.⁶ Guidehouse also incorporated supplemental data gathered during tenant phone surveys into the analysis.

3.2.2.1 Definitions of Free Ridership, Spillover and NTG Ratio

The methodology for assessing the energy savings attributable to a program is based on a NTG ratio. The NTG ratio has two main components: free ridership and spillover.

Free ridership is the share of the gross savings that is due to actions participants would have taken anyway (i.e., actions that were not induced by the program). This is meant to account for naturally occurring adoption of energy efficiency measures. The Multifamily Energy Efficiency Program and most other Duke Energy programs cover a wide range of energy efficiency measures and are designed to advance the overall energy efficiency market. However, it is likely that, for various reasons, some participants would have wanted to install some high-efficiency measures even if they had not participated in the program or been influenced by the program in any way.

Spillover captures program savings that go beyond the measures installed through the program. The term spillover is often used because it reflects savings that extend beyond the bounds of the program records. Spillover adds to a program's measured savings by incorporating indirect (i.e., non-incentivized) savings and effects that the program has had on the market above and beyond the directly incentivized or directly induced program measures.

The overall NTG ratio accounts for both the net savings at participating projects and spillover savings that result from the program but are not included in the program's accounting of energy savings. When the NTG ratio is multiplied by the estimated gross program savings, the result is an estimate of energy savings that are attributable to the program (i.e., savings that would not have occurred without the program). The NTG formula is shown in Equation 9.

Equation 9. Net-to-Gross Algorithm

NTG = 1 - Free Ridership + Spillover

The underlying concept inherent in the application of the NTG formula is that only savings caused by the program should be included in the final net program savings estimate but that this estimate should include all savings caused by the program.

3.2.2.2 Estimating Free Ridership

Data to assess free ridership was gathered through the self-report method using a series of survey questions asked to the property managers at participating properties. The survey

⁶ Guidehouse recognizes that some property managers may have been instructed to participate by higher-level decision makers at the corporate level. Although we do not think this was the case very often, we do think that the local property managers were still privy to the decision-making process.

assessed free ridership using both direct questions, which aimed to obtain respondent estimates of the appropriate free ridership rate that should be applied to them, and supporting or influencing questions, which could be used to verify whether the direct responses were consistent with participants' views of the program's influence.

Each respondent to the survey provided perspectives on the measures that they had installed through the program. The core set of questions addressed the following three categories:

- Likelihood: To estimate the likelihood that they would have incorporated measures "of the same high level of efficiency," if not for the assistance of the program. In cases where respondents indicated that they might have incorporated some but not all of the measures, they were asked to estimate the share of measures that would have been incorporated anyway at high efficiency. This flexibility in how respondents could conceptualize and convey their views on free ridership allowed respondents to give their most informed response, thus improving the accuracy of the free ridership estimates.
- **Prior planning:** To further estimate the probability that a participant would have implemented the measures without the program. Participants were asked the extent to which they had considered installing the energy efficient measure prior to participating in the program. The general approach holds that if customers were not definitively planning to install all of the efficiency measures prior to participation then the program can reasonably be credited with at least a portion of the energy savings resulting from the high-efficiency measures. Strong free ridership is reflected by those participants who indicated they had already allocated funds for the purchase and selected the equipment and an installer.
- **Program importance:** To clarify the role that program components (e.g., information, incentives) played in decision-making and to provide supporting information on free ridership. Responses to these questions were analyzed for each respondent, not just in aggregate, and were used to identify whether the direct responses on free ridership were consistent with how each respondent rated the influence of the program.

Free ridership scores were calculated for each of the three categories.⁷ Guidehouse then calculated a weighted average from each respondent based on their share of sample energy

⁷ Scores were calculated by the following formulas:

- Likelihood: The overall likelihood score is calculated by multiplying the scores for the likelihood that the participant would have installed the same energy efficient equipment and the likelihood that the participant would have installed the same quantity of the same measures without the program's financial and technical assistance. The likelihood score is 0 for those that "definitely would NOT have installed the same energy efficient measure" and 1 for those that "definitely WOULD have installed the same energy efficient measure." For those that "MAY HAVE installed the same energy efficient measure," the likelihood score is their answer to the following question: "On a scale of 0 to 10, where 0 is DEFINITELY WOULD NOT have installed and 10 is DEFINITELY WOULD have installed, what is the likelihood that you would have installed the same equipment without the program?"
- <u>Prior Planning:</u> If participants stated they had considered installing energy efficient equipment prior to program participation, then the prior planning score is their answer to the following question: "On a scale of 0 to 10, where 0 means you 'had not yet started to plan for equipment or installation' and 10 means you 'had identified and selected specific equipment and the contractor to install it,' please tell me how far along you were in your plans to install the equipment before participating in the program." The overall prior planning score was then calculated as a weighted average of their response to this question for both the lighting and water equipment.

savings and divided by 10 to convert the scores into a free ridership percentage. Next, a timing multiplier was applied to the average of the three scores to reflect the fact that respondents indicating that their energy efficiency actions would not have occurred until far into the future may be overestimating their level of free ridership. Participants were asked when they would have installed the equipment without the program. Respondents who indicated that they would not have installed the equipment for at least two years were not considered free riders and received a timing multiplier of 0.⁸ If they would have installed at the same time as they did, they received a timing multiplier of 1; within one year, a multiplier of 0.67; and between one and two years, a multiplier of 0.33.

3.2.2.3 Estimating Spillover

The basic method for assessing participant spillover was an approach that asked a set of questions to determine the following:

- Whether spillover exists at all. These were yes-or-no questions that asked, for example, whether the respondent incorporated energy efficiency measures or designs that were not recorded in program records and did not receive any rebates from Duke Energy.
- The savings that could be attributed to the influence of the program. Participants were asked to list the extra measures they installed, and the evaluation team assigned a savings value. See below for the method of assigning savings.
- **Program attribution**. Estimates were derived from a question asking the program importance on a 0 to 10 scale. Participants were also asked how the program influenced their decisions to incorporate additional energy efficiency measures.

If respondents said no, they did not install additional measures, they were assigned a 0 score for spillover. If they said yes, then Guidehouse estimated the energy spillover savings on a case-by-case basis.

It is important to note that although free ridership questions were only asked of property managers, Guidehouse surveyed both property managers and tenants for spillover.⁹

3.2.2.4 Combining Results Across Respondents

The evaluation team determined free ridership estimates for each of the following:

- Individual respondents, by evaluating the responses to the relevant questions and applying the rules-based approach discussed above.
- <u>Program Importance</u>: This score was calculated by taking the response to the following question "Please rate your agreement with the following statement: My decision to install energy efficiency equipment at my property was largely motivated by Duke Energy's program" on a scale of 0-10 and subtracting from 10 (i.e., the higher the program importance, the lower the influence on free ridership).

⁸ Guidehouse believes a two-year horizon is appropriate for assessing free ridership as it likely reduces certain types of bias and it becomes difficult for respondents to predict behavior beyond that horizon.

⁹ The reason for not assessing free ridership at the tenant level is because tenants generally participated in the program via their property managers rather than personal choice. It is possible that tenants would have installed the same measures themselves, but Guidehouse does not believe they should be considered free riders to the program because the timing of those installations would have been difficult to evaluate and tenants would still have the ability to install LEDs in non-retrofitted fixtures. If a tenant already had equivalent measures in place, it is unlikely that the implementer would have replaced them with program measures.

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- The program as a whole, by taking a weighted average of the individual results based on each respondent's share of reported energy savings.

3.2.2.5 Review of Data Collection Efforts for Attribution Analysis

Surveys were conducted with decision makers to provide the information to estimate free ridership, and thus, NTG ratios. Guidehouse completed surveys with 26 property managers. This sample represents about 8 percent of the total reported energy savings, as shown in Table 3-9.

Measure Category	Program Total Reported Energy Savings (MWh)	Sample Total Energy Savings (MWh)	% Share of Program
LED Bulbs	11,113	953	9%
Bathroom Aerator	1,667	148	9%
Kitchen Aerator	1,281	101	8%
Showerhead	6,453	448	7%
Pipe Wrap	1,656	163	10%
Total	22,170	1,813	8%

Table 3-9. Property Manager Sample Representation

Source: Guidehouse analysis, values subject to rounding

3.2.3 Overview of Process Methology

3.2.3.1 Tenant Surveys

Guidehouse conducted phone surveys with 149 residential tenants to assess program satisfaction. The distribution of the phone survey completes by jurisdiction are outlined in Table 3-10. The surveys contained several questions to assess satisfaction with program participation, satisfaction with new equipment, questions to assess measures removed by the tenant after participation and tenant spillover. Also included in the survey were questions to assess the impacts of COVID-19 on energy consumption at tenant units.

Table 3-10. Survey Completes by Jurisdiction – Tenant Survey

Jurisdiction	Survey Completes
DEP	72
DEC	77
Total	149

Source: Guidehouse analysis

3.2.3.2 Property Manager Surveys

Guidehouse completed surveys with property managers for 26 of the 294 participating properties. The completed surveys represented almost 50,000 measures or 8 percent of the program reported energy savings. The survey included a number of questions to assess

participation experience and satisfaction, satisfaction with new equipment, as well as questions to assess free ridership and spillover. Also included in the survey were questions to assess the impacts of COVID-19 on different aspects of property management activities including energy use.

3.2.3.3 Interviews with Duke Energy Program Manager and Franklin Energy

Guidehouse interviewed Duke Energy's Program Manager and the Franklin Energy implementation staff to discuss program goals and any relevant changes to delivery or offerings since the previous evaluation.

3.2.3.4 Documentation Review

Guidehouse requested program documentation and tracking data to conduct a review of current processes. The program tracking data was sufficient to identify the measure characteristics and quantities of installed measures for each tenant at the participating properties.

4.1 Impact Results

Figure 4 shows the program level results for gross energy and demand savings for DEP and Figure 5 shows the corresponding results for DEC.





Source: Guidehouse analysis



Figure 5. Reported and Verified Program-Level Impacts – DEC

Table 4-1 shows a comparison of gross and net impact findings. The evaluation team calculated the gross impact results in Table 4-1 by multiplying the measure quantities found in the tracking

Source: Guidehouse analysis

database by the verified energy and demand savings estimated during the EM&V process for each measure. The net impacts were found by multiplying the gross impacts by the NTG ratio of 0.96. The NTG methodology and results are discussed in detail in Section 3.2.2 and Section 5 of this report respectively.

	Energy (MWh)	Summer Coincident Demand (kW)	Winter Coincident Demand (kW)
DEP Verified Gross Impacts	7,763	1,089	1,325
DEP Verified Net Impacts	7,454	1,046	1,272
DEC Verified Gross Impacts	14,053	1,961	2,410
DEC Verified Net Impacts	13,494	1,883	2,314

Table 4-1. Summary of Program Impacts

Source: Guidehouse analysis, values subject to rounding.

A summary of each measure's contribution to program energy savings and realization rate between reported and verified savings is shown in Table 4-2 for DEP and Table 4-3 for DEC. By dividing the total verified savings by the total reported savings in the tracking data, Guidehouse calculated a gross realization rate of 100 percent and 98 percent for energy savings at the program level for the DEP and DEC jurisdictions respectively. This realization rate includes adjustments to the estimated savings for each measure discussed in the remainder of this report.

Table 4-2. Distribution of Program Gross Energy Savings by Measure (DEP)

Measure	Measure Count from Tracking Data	Total Ex Ante Savings from Tracking Data (MWh)	Share of Total Savings from Tracking Data	Total Verified Ex Post Gross Savings (MWh)	Realization Rate
A-Line LED	96,516	2,668	34%	2,588	97%
Showerhead	8,119	2,282	29%	2,018	88%
Bathroom Aerator - 1.0 GPM	11,594	639	8%	717	112%
Pipe Wrap	31,162	598	8%	668	112%
Kitchen Aerator	4,658	534	7%	660	124%
Globe LED	12,070	397	5%	326	82%
Candelabra LED	19,791	277	4%	317	115%
Track LED	7,949	191	2%	311	162%
Recessed LED	4,777	215	3%	158	74%

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	OFFICIAL C	Realization Rate	Total Verified Ex Post Gross Savings	Share of Total Savings from Tracking Data	Total Ex Ante Savings from Tracking
Data (MWh) 7 801 100% 7 801 100%		100%	(MWh)	100%	ta (MWh)

Source: Guidehouse analysis, values subject to rounding.

Measure

Total

Measure **Count from**

Tracking Data

196,636

Table 4-3. Distribution of Program Gross Energy Savings by Measure (DEC)

Measure	Measure Count from Tracking Data	Total Ex Ante Savings from Tracking Data (MWh)	Share of Total Savings from Tracking Data	Total Verified Ex Post Gross Savings (MWh)	Realization Rate
A-Line LED	153,389	4,241	30%	4,113	97%
Showerhead	14,839	4,171	29%	3,689	88%
Globe LED	52,190	1,715	12%	1,411	82%
Pipe Wrap	55,102	1,058	7%	1,181	112%
Bathroom Aerator - 1.0 GPM	17,818	982	7%	1,101	112%
Kitchen Aerator	6,521	747	5%	924	124%
Candelabra LED	41,365	578	4%	663	115%
Track LED	14,314	345	2%	560	162%
Recessed LED	10,793	486	3%	358	74%
Bathroom Aerator - 0.5 GPM	615	46	0%	54	117%
Total	366,946	14,369	100%	14,053	98%

Source: Guidehouse analysis, values subject to rounding.

The results for gross summer coincident demand by measure for DEP and DEC are shown in Table 4-4 and Table 4-5, respectively.

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Total Ex Ante Total Verified Share of Total Savings from Ex Post Realization Measure Savings from **Tracking Data** Gross Rate **Tracking Data** Savings (kW) (kW) A-Line LED 443 43% 106% 469 Showerhead 188 18% 167 88% Bathroom Aerator - 1.0 84 8% 95 112% GPM Pipe Wrap 7% 68 76 112% 70 **Kitchen Aerator** 7% 87 124% Globe LED 50 5% 45 90% Candelabra LED 58 72 125% 6% Track LED 27 3% 178% 47 Recessed LED 38 4% 81% 31 Total 1,027 100% 1,089 106%

Table 4-4. Distribution of Summer Coincident Demand Savings by Measure (DEP)

Source: Guidehouse analysis, values subject to rounding.

Table 4-5. Distribution of Summer Coincident Demand Savings by Measure (DEC)

Measure	Total Ex Ante Savings from Tracking Data (kW)	Share of Total Savings from Tracking Data	Total Verified Ex Post Gross Savings (kW)	Realization Rate
A-Line LED	703	38%	746	106%
Showerhead	344	18%	304	88%
Globe LED	218	12%	196	90%
Pipe Wrap	121	6%	135	112%
Bathroom Aerator - 1.0 GPM	130	7%	145	112%
Kitchen Aerator	99	5%	122	124%
Candelabra LED	120	6%	151	125%
Track LED	48	3%	85	178%
Recessed LED	86	5%	69	81%
Bathroom Aerator - 0.5 GPM	6	0%	7	117%
Total	1,875	100%	1,961	105%

Source: Guidehouse analysis, values subject to rounding.

The results for gross winter coincident demand by measure for DEP and DEC are shown in Table 4-6 and Table 4-7, respectively.

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Measure	Total Ex Ante Savings from Tracking Data (kW)	Share of Total Savings from Tracking Data	Total Verified Ex Post Gross Savings (kW)	Realization Rate
A-Line LED	332	24%	327	98%
Showerhead	735	53%	650	88%
Bathroom Aerator - 1.0 GPM	74	5%	83	112%
Pipe Wrap	68	5%	76	112%
Kitchen Aerator	62	5%	77	124%
Globe LED	54	4%	45	83%
Candelabra LED	21	2%	24	116%
Track LED	19	1%	31	165%
Recessed LED	14	1%	11	75%
Total	1,380	100%	1,325	96%

Table 4-6. Distribution of Winter Coincident Demand Savings by Measure (DEP)

Source: Guidehouse analysis, values subject to rounding.

Table 4-7. Distribution of Winter Coincident Demand Savings by Measure (DEC)

Measure	Total Ex Ante Savings from Tracking Data (kW)	Share of Total Savings from Tracking Data	Total Verified Ex Post Gross Savings (kW)	Realization Rate
A-Line LED	528	21%	520	98%
Showerhead	1,344	53%	1,188	88%
Globe LED	233	9%	195	83%
Pipe Wrap	121	5%	135	112%
Bathroom Aerator - 1.0 GPM	114	4%	128	112%
Kitchen Aerator	87	3%	108	124%
Candelabra LED	43	2%	50	116%
Track LED	34	1%	56	165%
Recessed LED	32	1%	24	75%
Bathroom Aerator - 0.5 GPM	5	0%	6	117%
Total	2,541	100%	2,410	95%

Source: Guidehouse analysis, values subject to rounding.

4.2 Impact Evaluation Findings

4.2.1 LED Measures

Guidehouse updated certain impact parameters for the LED measures based on review of the information available and data collected for this evaluation period. Guidehouse used these updated impact parameters as shown in Table 4-8 with the updated energy savings algorithm (Equation 10) from the Mid-Atlantic TRM v10 as shown below and Equation 2 and Equation 3 from Section 3.2.1.1 to determine the verified energy, summer coincident and winter coincident demand impacts respectively.

Equation 10. Updated Energy Savings Algorithms for LED Measures

$$kWh \ Savings = \left(\frac{Watts_{BASE} - Watts_{EE}}{1000}\right) * ISR * Hours * WHF_e$$

Where,

WHFe – Waste heat factor for energy to account for cooling and electric heating savings from reduced waste heat from efficient lighting

Table 4-8. Impact Parameters Used for Calculating Verified Impacts – LED Measures

Parameter	Source	A-Line LED	Globe LED	Candelabra LED	Track LED	Recessed LED
Watts _{BASE} ^a	Duke Energy data for removed equipment	59.89	40.99	40.09	59.88	60.17
Watts _{EE}	Duke Energy tracking data and specification sheets	9.00	6.00	5.00	7.00	8.49
ISR	Virtual verification survey	0.972	0.830	0.960	0.968	0.759
Hours	Guidehouse metering study from previous evaluation ^b	572	983	502	806	893
WHFe℃	Mid-Atlantic TRM v10	0.948	0.948	0.948	0.948	0.948
WHFd℃	Mid-Atlantic TRM v10	1.251	1.251	1.251	1.251	1.251
CF_{Summer}	Guidehouse metering study from previous evaluation ^b	0.08	0.10	0.09	0.09	0.13

Parameter	Source	A-Line LED	Globe LED	Candelabra LED	Track LED	Recessed LED
% Electric Heat	EIA RECs Study 2015 ¹⁰	50%	50%	50%	50%	50%
CF_{Winter}	Guidehouse metering study from previous evaluation ^b	0.08	0.15	0.04	0.09	0.07
Gross Energ (kWh)	gy Savings per Lamp	26.82	27.04	16.02	39.10	33.18
Gross Sum Demand Sa	mer Coincident vings per Lamp (kW)	0.0049	0.0038	0.0036	0.0059	0.0064
Gross Winte Savings per	er Coincident Demand ^r Lamp (kW)	0.0034	0.0037	0.0012	0.0039	0.0022

a. The removed equipment data was collected by Franklin Energy for a sample of program participants and was provided to Guidehouse as part of the tracking data file by Duke Energy.

b. Duke Energy Multifamily EMV Report DEC-DEP 16Apr2020

c. Guidehouse calculated the average value using waste heat factors for all utilities (BGE, Pepco, Delmarva, PE, and SMECO) from the Mid-Atlantic TRM v10.

Source: Guidehouse analysis, values subject to rounding

4.2.1.1 In-Service Rate

There were a total of 757 reported program LEDs in the tracking database corresponding to the 79 virtual verification survey completes for the LED measure. Guidehouse found 715 of the program LEDs to be still installed and functioning based on the review of tenant responses. Guidehouse used these quantities to determine the in-service rate for the LED measures on a lamp-type basis as shown in Table 4-9.

Table 4-9. LED Measures – ISR

Measure	Completes Achieved	Tracking Data Quantity	Verified Quantity	In-Service Rate (ISR)
A-Line LED	58	503	489	97%
Globe LED	16	94	78	83%
Candelabra LED	22	100	96	96%
Track LED	7	31	30	97%
Recessed LED	12	29	22	76%
Total	79	757	715	94%

Source: Guidehouse analysis

¹⁰ EIA Residential Energy Consumption Survey (found at https://www.eia.gov/consumption/residential/data/2015/hc/php/hc6.1.php) for Apartment (5 or more unit building) housing unit type.

The completed virtual surveys were reasonably representative of the population-wide distribution of lamp types as shown in Table 4-10. Thus, Guidehouse used the virtual verification survey responses to calculate ISR values on a lamp-type basis for all LED measures. Guidehouse performed a sensitivity analysis to calculate total ex post impacts using a single ISR for all LEDs, and the difference in total impacts was negligible.

Table 4-10. LED Measures – Tracking Data vs Virtual Verification Measure Type Distribution

Measure	Tracking Data Quantity	% Share	Virtual Verification Quantity	% Share
A-Line LED	249,905	60%	503	66%
Globe LED	64,260	16%	94	12%
Candelabra LED	61,156	15%	100	13%
Track LED	22,263	5%	31	4%
Recessed LED	15,570	4%	29	4%

Source: Guidehouse analysis

4.2.1.2 Baseline and Efficient Lamp Wattage

Duke Energy provided Guidehouse with wattage data from lamps removed during the retrofit process. This data was collected by Franklin Energy from a sample of participant sites, and included information for 9,073 removed lamps at 100 of the 294 participating properties. Guidehouse used this data to determine the baseline lamp wattage corresponding to each LED lamp type in the impact calculations as shown in Table 4-11.

Table 4-11. LED Measures – Baseline Lamp Wattage

Measure	Sum of Baseline 40W Lamps Removed	Sum of Baseline 50W Lamps Removed	Sum of Baseline 60W Lamps Removed	Sum of Baseline 75W Lamps Removed	Sum of Baseline 100W Lamps Removed	Weighted Baseline Wattage
A-Line	59	10	6,060	7	13	59.89
Globe	984	0	51	0	0	40.99
Candelabra	979	3	3	0	0	40.09
Track	4	0	666	0	0	59.88
Recessed	0	0	233	0	1	60.17

Source: Guidehouse analysis

The Energy Independence and Security Act (EISA) of 2007 established that, as of January 1, 2014, 60W and 40W incandescent bulbs could no longer be manufactured or imported. The new, EISA compliant wattage for these bulbs are 43W and 29W respectively. However, Guidehouse's experience has shown that there was considerable lag between the EISA compliance schedule and actual market activity, and potential back stocking of incandescent lamps by multifamily maintenance staff. Because Duke Energy's Multifamily Energy Efficiency

Program is a retrofit program (rather than replace on burnout), it is important to consider the actual characteristics of the lamps removed because they likely had remaining useful life.

Due to the EISA standards and changing market for lighting, the baseline wattage for energy efficiency lighting programs will continue to decrease. If Duke Energy continues to collect information about the wattage of lamps removed during the retrofit process, Guidehouse believes it is reasonable to use those values in future evaluations as necessary as this is a direct install program.

Among the installed LED measures, the track and recessed LED measures can be further characterized based on the specific LED lamp type (BR30, PAR20, PAR30 SN, etc.) as shown in Table 4-12.

Measure	Lamp Type	Watts EE	Quantity Installed
A-Line LED	LED A-Line	9.00	249,905
Globe LED	LED Globe	6.00	64,260
Candelabra LED	LED Candelabra	5.00	61,156
Track LED	LED MR16 – GU10	7.00	14,827
Track LED	LED MR16 – GU5.3	7.00	350
Track LED	LED PAR20	7.00	7,086
Recessed LED	LED BR30	8.00	13,039
Recessed LED	LED PAR30 SN	11.00	2,531

Table 4-12. LED Measures – Installed Quantity Lamp Type Distribution

Source: Guidehouse analysis

Duke Energy provided specification sheets for each of these LED lamp types and Guidehouse used the specification sheet wattage value along with the tracking data installed quantity to calculate a weighted average efficient wattage value at the measure level as shown in Table 4-13.

Table 4-13. LED Measures – Efficient Lamp Wattage

Measure	Watts EE
A-Line LED	9.00
Globe LED	6.00
Candelabra LED	5.00
Track LED	7.00
Recessed LED	8.49

Source: Guidehouse analysis

4.2.1.3 Lighting Hours of Use and Coincidence Factors

The evaluation team used the measure type specific annual operating hours and summer and winter coincidence factors from the 2018-2019 lighting logger study conducted as part of the
previous evaluation for these jurisdictions to calculate the ex post verified savings for LED measures.

Guidehouse also used the tenant responses to the lighting hours of use questions in the virtual verification survey to get a preliminary understanding of the impact of COVID-19 on the lighting use pattern in tenant homes. The tenant responses indicate that the COVID-19 pandemic may have resulted in an increase in the lighting hours of use. However, Guidehouse concluded that the lighting hours of use may normalize post COVID-19 and hence does not recommend any adjustment to the lighting hours of use for the current evaluation. Guidehouse believes a lighting logger study as part of the next evaluation for this jurisdiction would be able to capture the more permanent long-term impats of the pandemic on the lighting use pattern in multifamily tenant homes.

4.2.1.4 Waste Heat Factors

Guidehouse used the Mid-Atlantic TRM v10 to gather estimates for the waste heat factors. Guidehouse calculated the waste heat factors for the current evaluation as the average of the WHFe and WHFd from the Mid-Atlantic TRM v10 for all utilities as shown in Table 4-14.

Utility	WHFe	WHFd
BGE	0.959	1.241
Рерсо	0.947	1.264
Delmarva Power	0.915	1.245
PE	0.956	1.266
SMECO	0.963	1.241
Average	0.948	1.251

Table 4-14. LED Measures – Waste Heat Factors

Source: Guidehouse analysis

4.2.2 Water Flow Regulation Measures

Guidehouse updated certain impact parameters for the aerator measures based on review of the information available and data collected for this evaluation period. Guidehouse used these updated impact parameters as shown in Table 4-15 with Equation 4 and Equation 6 from Section 3.2.1.1 to determine the verified energy and demand impacts respectively.

Table 4-15. Impact Parameters Used for Calculating Verified Impacts – Aerator Measures

Parameter	Source	Bath Aerator – 0.5 GPM	Bath Aerator – 1.0 GPM	Kitchen Aerator
ISR	Virtual verification survey	0.958	0.958	0.848
GPM _{BASE} ^a	Duke Energy data for removed equipment	2.05	2.05	2.17

Parameter	Source	Bath Aerator – 0.5 GPM	Bath Aerator – 1.0 GPM	Kitchen Aerator
GPM _{LOW} ^b	Guidehouse field verification from previous evaluation and Duke Energy tracking data and specification sheets	0.50	0.84	0.73
Throttle _{BASE}	Mid-Atlantic TRM v10	0.83	0.83	0.83
Throttle _{LOW}	Mid-Atlantic TRM v10	0.95	0.95	0.95
# People	EIA RECs Study 2015	2.48	2.48	2.48
Days/Year	Mid-Atlantic TRM v10	365	365	365
DR	Mid-Atlantic TRM v10	0.70	0.70	0.50
Temp _{FT}	Guidehouse field verification from previous evaluation	96.03	96.03	96.99
Temp _{IN}	Building America Benchmark ¹¹	66.34	66.34	66.34
Time _{FAUCET}	Mid-Atlantic TRM v10	1.60	1.60	4.50
DHW Recovery Efficiency	Mid-Atlantic TRM v10	0.98	0.98	0.98
Summer CF	Mid-Atlantic TRM v10 and Guidehouse calculation using data from Building America Benchmark	0.0032	0.0032	0.0090
Witner CF	Mid-Atlantic TRM v10 and Guidehouse calculation using data from Building America Benchmark	0.0028	0.0028	0.0079
Hours	Mid-Atlantic TRM v10 and Guidehouse calculation	24.14	24.14	67.89
Gross Energy Sav	rings per Aerator (kWh)	87.65	61.81	141.66
Gross Summer Co Aerator (kW)	pincident Demand Savings per	0.0116	0.0082	0.0187
Gross Winter Coir Aerator (kW)	ncident Demand Savings per	0.0102	0.0072	0.0165

a. The removed equipment data was collected by Franklin Energy for a sample of program participants and was provided to Guidehouse as part of the tracking data file by Duke Energy.

¹¹ https://www.energy.gov/eere/buildings/downloads/building-america-analysis-existing-homes

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- b. For Bath Aerator 1.0 GPM and Kitchen Aerator measures, Guidehouse used the measured flow rates to calculate impacts instead of multiplying the nameplate flowrate by the throttling factor since primary data was available from the previous evaluation.

Source: Guidehouse analysis, values subject to rounding

Guidehouse also updated certain impact parameters for the showerhead measure based on review of the information available and data collected for this evaluation period. Guidehouse used these updated impact parameters as shown in Table 4-16 with Equation 5 and Equation 6 from Section 3.2.1.1 to determine the verified energy and demand impacts respectively.

Table 4-16. Impact Parameters Used for Calculating Verified Impacts – Showerhead Measure

Parameter	Source	Showerhead
ISR	Virtual verification survey	0.971
GPM _{BASE}	Duke Energy data for removed equipment	2.40
GPM _{LOW}	Duke Energy tracking data and specification sheets	1.50
# People	EIA RECs Study 2015	2.48
Days/Year	Mid-Atlantic TRM v10	365
Temp _{SH}	Mid-Atlantic TRM v10	105.00
Temp _{IN}	Building America Benchmark	66.34
Time _{shower}	Mid-Atlantic TRM v10	7.80
ShowersPERSON	Mid-Atlantic TRM v10	0.60
Showerhead per Home	Duke Energy tracking data	1.44
DHW Recovery Efficiency	Mid-Atlantic TRM v10	0.98
Summer CF	Mid-Atlantic TRM v10 and Guidehouse calculation using data from Building America Benchmark	0.004
Witner CF	Mid-Atlantic TRM v10 and Guidehouse calculation using data from Building America Benchmark	0.016
Hours	Mid-Atlantic TRM v10 and Guidehouse calculation	49.17
Gross Energy Savings per Showerhead (kWh)		248.57
Gross Summer Coincident Demand Savings per Showerhead (kW)		0.0205
Gross Winter Coincident Demand Savings per Showerhead (kW)		0.0801

Source: Guidehouse analysis, values subject to rounding

4.2.2.1 In-Service Rate

Guidehouse used the reported program quantities in the tracking database and the quantities indicated to be still installed and functioning by the tenants based on the review of tenant responses to the virtual verification survey to determine measure specific in-service rates for this evaluation period as shown in Table 4-17.

Table 4-17. Water How Regulation measures – lor					
Measure	Completes Achieved	Tracking Data Quantity	Verified Quantity	In-Service Rate (ISR)	
Bath Aerator	34	48	46	96%	
Kitchen Aerator	33	33	28	85%	
Showerhead	48	68	66	97%	

Table 4-17. Water Flow Regulation Measures – ISR

Source: Guidehouse analysis

4.2.2.2 Baseline and Efficient Flow Rate (GPM)

Duke Energy provided Guidehouse with flow rate data from aerators and showerheads removed during the retrofit process. This data was collected by Franklin Energy from a sample of participant sites (data was collected at 53 out of the 205 participating properties with water flow regulation measures). Guidehouse used this data along with the tracking data installed quantity to determine the baseline flow rate corresponding to each measure in the impact calculations as shown in Table 4-18.

Table 4-18. Water Flow Regulation Measures – Baseline Flow Rate

Measure	Sum of Removed Measure – Water 2.0 GPM	Sum of Removed Measure – Water 2.2 GPM	Sum of Removed Measure – Water 2.5 GPM	Sum of Removed Measure – Water 3.0 GPM	Weighted Baseline GPM
Bath Aerator	295	91	0	0	2.05
Kitchen Aerator	15	98	0	0	2.17
Showerhead	1	90	160	6	2.40

Source: Guidehouse analysis

For the 0.5 GPM bathroom faucet aerator, in the absence of measured flow rate for the GPM_{LOW} parameter, Guidehouse used the rated flow rate of the installed unit and the low-flow throttling factor from the Mid-Atlantic TRM v10 to determine the effective flow rate of the low-flow faucet aerator as shown in Table 4-19. The 0.5 GPM bathroom faucet aerator was not part of the tracking data for the evaluation period covered by the previous evaluation and hence no measured flow rate from onsite field verification is available for this measure.

Table 4-19. Water Flow Regulation Measures – Efficient Aerator Flow Rate

Measure	Rated Flow Rate	Low-Flow	Effective Flow
	(GPM)	Throttling Factor	Rate (GPM)
Bath Aerator – 0.5 GPM	0.5	0.95	0.48

Source: Guidehouse analysis

4.2.2.3 Average Number of People per Household (# People)

Guidehouse updated the average number of people per household parameter using the EIA RECs study 2015¹² for the South Atlantic census region.

4.2.2.4 Average Number of Showerheads per Home

Guidehouse updated the average number of showerheads per home parameter for the showerhead measure using tracking data as shown in Table 4-20. This assumes that Franklin Energy attempted to replace every showerhead in the housing unit during installation.

Table 4-20. Water Flow Regulation Measures – Showerhead per Home

Measure	Quantity Installed	Number of Housing Units	Showerheads per Home
Showerhead	22,958	15,987	1.44

Source: Guidehouse analysis

4.2.2.5 Hours and Coincidence Factors

Guidehouse updated the average number of hours per year spent using each showerhead for the showerhead measure, and the corresponding summer and winter coincidence factor algorithms, to account for the average number of showerheads in the home as per the Mid-Atlantic TRM v10.

Equation 11. Updated Hours Algorithms for Showerhead Measure

 $Hours = \left(\frac{Time_{SHOWER} * \# People * Showers_{PERSON}}{Showerheads \ per \ Home * 60}\right) * \frac{Days}{Year}$

4.2.3 Pipe Wrap Measure

Guidehouse updated the in-service rate and R-value of the insulation for the pipe wrap measure based on review of the information available and data collected for this evaluation period. Guidehouse used these updated impact parameters as shown in Table 4-21 with Equation 7 and Equation 8 from Section 3.2.1.1 to determine the verified energy and demand impacts respectively.

Parameter	Source	Pipe Wrap
ISR	Virtual verification survey	99.9%
R _{EXIST}	Mid-Atlantic TRM v9*	1.00
R _{NEW}	Specification sheet	4.35
L	Savings are calculated per linear foot	1.00
С	Assumed as average of 0.5" and 0.75" diameter pipe	0.16
ΔΤ	Mid-Atlantic TRM v9	65.00
η _{DHW}	Mid-Atlantic TRM v9	0.98
Gross Energ	y Savings per Linear Foot (kWh)	21.43
Gross Sumn	ner Coincident Demand Savings per Linear Foot (kW)	0.0024
Gross Winte	r Coincident Demand Savings per Linear Foot (kW)	0.0024

Table 4-21. Impact Parameters Used for Calculating Verified Impacts – Pipe Wrap Measure

* The DHW Pipe Insulation measure is no longer included in the Mid-Atlantic TRM v10. Guidehouse used the energy and demand savings algorithms and deemed input parameters from the Mid-Atlantic TRM v9 to calculate savings for this measure.

Source: Guidehouse analysis, values subject to rounding

4.2.3.1 In-Service Rate

Guidehouse used the reported program quantities in the tracking database and the quantities indicated to be still installed and functioning by the tenants based on the review of tenant responses to the virtual verification survey to determine pipe wrap in-service rate for this evaluation period as shown in Table 4-22.

Table 4-22. Pipe Wrap Measure – Virtual Verification ISR

Measure	Completes	Tracking Data	Verified	Virtual
	Achieved	Quantity	Quantity	Verification – ISR
Pipe Wrap	19	105	105	100%

Source: Guidehouse analysis

Also, based on the tracking data review, Guidehouse found that some of the water heater pipe wrap was installed on the cold water inlet pipe to the water heater. Industry standards are to install pipe wrap on all hot water pipes, and only the first three feet of the cold water pipe because savings are minimal from insulating cold water pipes.¹³ Therefore, when calculating the ISR, Guidehouse did not count savings from pipe wrap of greater than three feet installed on cold water pipes as shown in Table 4-23.

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Table 4-23. Pipe Wrap Measure – Cold Water Pipe Wrap Length

Cold Water Pipe Wrap Length – Tracking Data	Number of Tenants	Total Cold Water Pipe Wrap Installed in Feet	Cold Water Pipe Wrap Length Allowed*	Total Allowed Cold Water Pipe Wrap Length in Feet
1 Feet	340	340	1 Feet	340
2 Feet	1,093	2,186	2 Feet	2,186
3 Feet	2,497	7,491	3 Feet	7,491
4 Feet	47	188	3 Feet	141
5 Feet	7	35	3 Feet	21
6 Feet	4	24	3 Feet	12
Total		10,264		10,191

*Determined as the minimum of the installed cold water pipe wrap length or 3 feet. Source: Guidehouse analysis

Source. Guidenouse analysis

Guidehouse then used the virtual verification ISR and the additional cold water pipe wrap length (10,264 - 10,191 = 73 Feet) to calculate the effective ISR for this measure as shown in Table 4-24

Table 4-24. Pipe Wrap Measure – Effective ISR

Measure	Virtual Verification – ISR	Total Installed Quantity	Additional Cold Water Pipe Wrap Length	Effective Installed Quantity*	Effective ISR**
Pipe Wrap	100.0%	86,264 Feet	73 Feet	86,191 Feet	99.9%

*Calculated as ((Total Installed Quantity * Virtual Verification ISR) – Additional Cold Water Pipe Wrap Length). **Calculated as (Effective Installed Quantity/Total Installed Quantity).

Source: Guidehouse analysis

4.2.3.2 R-value of Installed Insulation

Guidehouse updated the R-value of the installed insulation using specification sheet provided by Franklin Energy for this measure as shown in Table 4-25.

Table 4-25. Pipe Wrap Measure – R-Value of Installed Insulation

Model #	Dimensions	R-Value
PI010	1/2" Wall for 1/2" Pipe	3.54
PI011	1/2" Wall for 3/4" Pipe	3.15
R-Value of Installed Ins	ulation*	3.35

*Assumed as average of 0.5" and 0.75" diameter pipe *Source: Guidehouse analysis*

5. Net-To-Gross Analysis

Guidehouse conducted an NTG analysis to estimate the share of program savings that can be attributed to participation in or influence from the program. Table 5-1 shows the results of Guidehouse's NTG analysis. Guidehouse anticipated low free ridership and spillover given that the program is structured to offer energy efficient equipment at no cost to multifamily housing units, which are typically not owner-occupied. The results shown here are in line with expectations and very similar to our previous evaluations of this program. Guidehouse chose to present a program-level NTG ratio rather than measure level due to the difficulty in estimating spillover by measure. Guidehouse believes it is more appropriate to present the NTG ratio in aggregate.

Table 5-1. NTG Results

Parameter	Value
Estimated Free Ridership	5.85%
Estimated Spillover	1.88%
Estimated NTG	0.9602

Source: Guidehouse analysis, values subject to rounding

5.1 Results of Free Ridership, Spillover and Net-to-Gross

5.1.1 Free Ridership Results

As described in Section 3.2.2.2, surveyed participants responded to a series of questions intended to elicit explicit estimates of free ridership, as well as ratings of program influence. Guidehouse estimated free ridership to be 5.9 percent.

Below are summaries by scoring component.

Prior Planning: Nine out of 24 property managers who installed energy efficient lighting equipment at their property through the program indicated they had prior plans to install the energy efficient lighting equipment. Five out of 18 property managers who installed energy efficient water equipment at their property indicated they had prior plans to install the energy efficient water equipment. However, only three (two for both lighting and water equipment and 1 for just the lighting equipment) of the nine property managers indicated their plans were well developed (greater than or equal to 8 on a scale of 0 to 10).

Program Importance: Respondents stated that the program was very important in having the measures installed. The average response for how important the Duke Energy program was in influencing respondent decision to retrofit the properties was 9.2 on a scale of 0 to 10.

Likelihood: Respondents were asked in the absence of the program, if they would have had at least some of the work done (in terms of both quantity of measures and the efficiency of measures installed). Five respondents stated they "definitely would not have" installed the same quantity of measures in the absence of the program, and seven said they "may have". Respondents who said they may have installed some measures without the program indicated they would have only installed, on average, thirty-one percent of the measures they did install. Five respondent stated that they "definitely would not have" installed the same energy efficient equipment in the absence of the program, nine said they "may have" and indicated the likelihood of them installing the same energy efficient equipment to be 5 on a scale of 0 to 10. The respondents who answered "don't know" to the likelihood questions were assumed to have a likelihood of 5 on a scale of 0 to 10 for installing the same energy efficient equipment and the same quantity of measures.

Timing: Four of the 12 property managers who indicated they likely would have completed some of the energy efficiency upgrades in the absence of the program, indicated they would have done so at the same time or within a year of the program. Five indicated they likely would have completed some of the upgrades between 1-2 years after the program in the absence of it. The rest of the property managers indicated they likely would have completed some of the upgrades of they likely would have completed some of the upgrades between 1-2 years after the program in the absence of it.

In summary, respondents indicated that the program was very important in their decisions to have the energy efficient measures installed. A few property managers indicated that they did have some prior plans to install the measures, and the free ridership estimates account for those responses.

5.1.2 Spillover Results

Four of the 26 surveyed property managers indicated that the program influenced them to install additional, non-incentivized energy efficiency measures at the property as shown in Table 5-2.

Respondent	Spillover Measure	Quantity Installed
PM 1	LED bulbs for overhead light fixtures	100
PM 1	Auto Faucet	3
PM 2	Energy efficient lights for the front doors and patios	464
PM 3	LED lights in the stairways and front doors	165
PM 4	LED overhead bulbs in the community area	30

Table 5-2. Property Manager Spillover Measures

Source: Guidehouse analysis

In addition to the property managers reporting spillover, seven tenants reported installing a small number of LEDs and one tenant reported installing a small number of LEDs and a smart thermostat as a result of program participation. As seen in Table 5-3, four of the seven tenants qualified for spillover.

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Table 5-3. Tenant Spillover Measures

Respondent	Spillover Measure	Quantity Installed
Tenant 1	LED Light Bulbs	8
Tenant 1	Smart Thermostat	1
Tenant 2	LED Light Bulbs	20
Tenant 3	LED Light Bulbs	3
Tenant 4	LED Light Bulbs	10

Source: Guidehouse analysis

Guidehouse estimated spillover from the equipment reported by property managers and tenants by applying simple engineering equations along with the self-reported measure quantities and characteristics. Guidehouse calculated the total spillover to be 1.9 percent.

6. Process Evaluation

Guidehouse conducted a process evaluation of the Multifamily Energy Efficiency Program to assess program delivery and customer satisfaction. The process findings summarized in this section are based on the results of customer surveys with 149 program participants and detailed surveys with 26 property managers. The property manager and tenant surveys were also used to inform the NTG analysis as discussed previously.

6.1 Key Findings

- Some of the key challenges inherent to delivering energy efficiency programs to nonowner-occupied multifamily housing facilities include lack of financial capital for upfront costs, multiple decision makers, limited resources to manage retrofits, time and complexity associated with distrupting tenants. The program appears to be effectively addressing these challenges.
- 54 percent of the tenants indicated that they heard about the program through their property manager as would be expected given the program model.
- 44 percent of the tenants reported that they noticed savings on their energy bills since the installation of the measures.
- Most tenants were satisfied with the program. On a scale of 0 to 10, where 0 indicates "not satisfied at all" and 10 indicates "extremely satisfied":
 - About 74 percent of participants indicated 8-10 for satisfaction with the overall program.
 - About 85 percent of participants indicated 8-10 for satisfaction with Duke Energy.
- 30 percent of the tenants indicated that COVID-19 has impacted how they use energy at their home.
- Tenant satisfaction was higher for the lighting equipment than for the water equipment offered as part of the program.
- 14 out of 26 property managers indicated they chose to participate in the program to save money for their tenants on their utility bills. Other reasons to participate in the program included to reduce maintenance costs, and to get more efficient equipment or the latest technology.
- Most property managers were highly satisfied with the program and the installation team's scheduling, quality of work and timely installation.

6.2 Tenant Surveys

Customer outreach is a key driver to program participation. Guidehouse recognizes the importance of marketing and outreach with regards to continued participation and satisfaction, so several questions in the tenant survey and property manager interviews were included to address these factors. Figure 6 shows how tenants learned about the program. Tenant participants were asked to indicate all the sources through which they learned about the program, and about 54 percent indicated they heard about the program through property

managers as would be expected given the program model. Tenants also indicated they learned

about the program though Duke Energy bill stuffer or mailing and Duke Energy's website.

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Figure 6. How Tenants Heard About the Program (n=149)

Survey results showed tenant satisfaction with the program is high. On a scale of 0 to 10, where 0 indicates "Not at all satisfied" and 10 indicates "Extremely satisfied," about three-fourths of the tenants rated satisfaction with the program as an 8-10 as shown in Figure 7. The average overall tenant satisfaction rating with the program was 8.6 out of 10. Tenants who ranked their overall satisfaction low did so largely because they did not notice any monetary savings. Survey results also show a high tenant satisfaction with Duke Energy as shown in Figure 8 with an average overall tenant satisfaction rating with Duke Energy of 8.7 out of 10.

Source: Guidehouse analysis





Source: Guidehouse analysis



Figure 8. Tenant Satisfaction with Duke Energy (n=149)

Source: Guidehouse analysis

As shown in Figure 9, 44 percent of DEP tenants and 43 percent of DEC tenants noticed a decrease in their energy bills after the new measures were installed, 21 percent DEP and 13 percent DEC tenants are unsure if they are saving energy, while 35 percent of DEP and 44 percent of DEC tenants did not notice a decrease in their utility bills. This represents an opportunity for Duke Energy to communicate energy savings to tenants and help provide them

with guidance and tips to save energy and water after the new measures have been installed in their home.





DEP - n = 72, DEC - n = 77Source: Guidehouse analysis

While a majority of tenants were satisfied with the new measures, some were not. Guidehouse asked the participants to rate their satisfaction for each measure installed at their home. Pipe wrap had the highest average satisfaction rating, while showerhead and bathroom aerator measures had relatively lower average satisfaction ratings, as shown in Figure 10.



Figure 10. Tenant Satisfaction with Program Measures

Source: Guidehouse analysis

For tenants who received the aerators and showerheads, low satisfaction ratings were tied to the low flow rates of the devices.

Nineteen percent of tenants reported they removed some of their program measures. Twentyeight respondents reported removing equipment and a summary of the measures removed as indicated by the tenants is shown in Table 6-1. Seventeen respondents reported removing LED bulbs largely due to lamp burn out. Eight out of the 11 respondents removed the aerator and showerhead measures due to low water pressure.

Measure	Total Respondents
LED Bulbs	17
Bathroom Aerator	3
Kitchen Aerator	5
Showerhead	3
Total	28

Table 6-1. Removed Measures – Tenant Survey

Source: Guidehouse analysis

As a result of the tenant's participation in the program, some tenants (5 percent) purchased additional energy efficiency equipment that they did not receive a rebate for, as shown in Figure 11. Of the seven tenants who reported purchasing additional energy efficient equipment, four tenants qualified for spillover. All four spillover qualified tenants indicated they purchased additional LEDs, while one spillover qualified tenant also indicated that they purchased a smart thermostat.



Figure 11. Tenants Who Purchased Additional Energy Efficiency Equipment (n=149)

Source: Guidehouse analysis

When asked how important their participation was in their decision to install additional energy efficiency measures, the mean rating was 8.8 out of 10, indicating that the program influenced customers. As discussed previously, Guidehouse incorporated these responses into the spillover calculations used in the NTG analysis.

Tenants reported that 77 percent of the light bulbs installed in their home are LED light bulbs. Most tenants indicated regular incandescent and compact fluorescent bulbs (CFLs) as the most common light bulbs installed in the other lights (non-LED) in their home.

Thirty-two percent of the DEP tenants and 28 percent of the DEC tenants indicated that emergence of COVID-19 has changed how they use energy in their home as shown in Figure 12. Tenants who answered in the affirmative indicated they use more energy due to them being home more since COVID-19.



Figure 12. Tenants Who Indicated a Change in Their Energy Use Due to COVID-19

DEP - n = 72, DEC - n = 77Source: Guidehouse analysis

6.2.1 Participant Suggestions

Guidehouse included a question in the tenant satisfaction survey that allowed respondents to offer suggestions for improving the program. Suggestions were offered by 23 percent of respondents, and some of the suggestions are as follows:

- Nine respondents recommended offering better quality equipment, specifically aerators and showerheads with stronger water pressure and longer lasting LED lamps.
- Two respondents recommended offering HVAC related measures through the program to reduce energy consumption during the cooling season. One respondent recommended offering assessment of the existing appliances at the units and making energy efficient appliance recommendations if they need to be replaced.
- Three respondents recommended offering a few options (color, wattage, brightness) on the LED bulbs installed through the program.
- One respondent recommended including additional information in the online account or energy bill for program participants to compare energy usage and track savings.

6.3 Property Manager Interviews

Guidehouse completed surveys with property managers for 26 of the 294 participating properties. This section presents details of the survey responses. Overall, property managers indicated that their experience with the program was very favorable. Some key findings from the property manager interviews are listed below:

• On a scale of 0 to 10, where 10 indicates "extremely satisfied" and 0 indicates "not at all satisfied", the average rating from property managers for overall program experience was 8.9, with 81 percent of the property managers rating their satisfaction as an 8-10 as shown in Figure 13.



Figure 13. Property Manager Satisfaction with Overall Program Experience (n=26)

Source: Guidehouse analysis

- On a scale of 0 to 10, where 10 indicates "extremely satisfied" and 0 indicates "not at all satisfied", the average rating from property managers for tenant satisfaction with the new lighting equipment was 8.7. Three property managers indicated that the tenant feedback about their experience with the new LED lights was that the bulbs were starting to go out and did not last as long as expected. Three property managers also reported that some of the tenants had indicated issues with the brightness of the lamps. Seven other property managers indicated that most of the tenants were satisfied with the new LED bulbs and that they reduced energy bills.
- On a scale of 0 to 10, where 10 indicates "extremely satisfied" and 0 indicates "not at all satisfied", the average rating from property managers for tenant satisfaction with the new water equipment was also 8.7. Three property manager indicated that the tenant feedback about their experience with the new water equipment was that the aerators and showerheads produced low water flow. One other property manager reported that some tenants indicated the kitchen aerator nozzle clogged easily.
- Property managers expressed high satisfaction with the program enrollment process, the installation team's quality of work and their scheduling and installation as shown in Figure 14.



Source: Guidehouse analysis

- Four property managers indicated that their experience with the program influenced them to incorporate additional energy efficient equipment at their property. All four property managers indicated that they installed LED bulbs in the common areas of their property and one property manager indicated that they also installed auto faucets.
- The property manager responses to impacts of COVID-19 on various property management aspects are shown in Figure 15. Two property managers indicated that the emergence of COVID-19 has changed how the tenants use energy at the property and that people are now using more energy as they are home more. Nine property managers indicated no change, while 14 other property managers answered, "don't know".



Figure 15. Property Managers That Answered in the Affirmative to the Following COVID-19 Impacts (n=26)

Source: Guidehouse analysis

- Four property managers indicated that COVID-19 has affected their ability to participate in Duke Energy Programs as "people [tenants] fear opening the door" and "techs would not have access to resident's apartments without PPE".
- Seven property managers indicated they manage more than one property. For six of these properties, the decision to participate in the program was driven by the owner or the property management company. This indicates an opportunity for Duke Energy to encourage participation for sister properties managed by the same property management company if they haven't already participated in the program.
- Twelve property managers recommended offering outdoor lighting measures through the program, seven property managers also recommended offering smart thermostats, while three property managers recommended considering offering electric vehicle charging stations through the program.

6.4 Interviews with Duke Energy Program Manager and Franklin Energy Implementation Staff

6.4.1 Interview with Duke Energy's Program Manager

Duke Energy indicated that program participation for 2020 and 2021 was affected by COVID-19 as the program suspended operations in March 2020 in response to the COVID-19 pandemic and did not resume prior to the end of the current evaluation period (June 30, 2021). However, the annual program goals for the current evaluation period were not adjusted and goal attainment was affected by COVID-19 shutdowns.

Duke Energy also noted that new measures like smart thermostats and ultra-low flow showerheads (1.25 GPM) are now offered through the program (post resumption after the COVID-19 shutdown). After program resumption, because of the restrictions that may be in place at the participating properties due to COVID-19, Duke Energy has made updates to the program implementation process to prioritize a culture of safety at all levels of program operation and to combat the increased risk at multifamily properties due to high number of units. These changes include a requirement for the installation team to wear PPE, gloves, masks and maintain social distancing even when working in teams. Prior to the installation site visit, property managers are now contacted about any active COVID-19 cases at the property, and installation proceeds only if the property manager reports no cases. Tenants are now asked if they are experiencing any symptoms and depending on their answer, the team may not install measures in certain units at the property. If any COVID-19 cases are reported at the property, the direction is to stop all activity and reschedule the installation site visit after 30 days. However, Duke Energy understands that the COVID-19 requirements and the situation is continuously evolving and expects to adjust their processes as needed.

Duke Energy identified the lack of resources (staffing) at the participating properties as a barrier to program participation and timely installation of measures. The installation team is highly reliant on the property managent team (property manager or maintenance staff) to escort them around the property during installation and often have to delay installation depending on the availability of the staff at the property. Duke Energy is currently considering working with the property managers to identify third-party resources to provide this service during installation to address this issue. Duke Energy also identified market saturation and lack of information on the existing and newly built multifamily properties as potential barriers to program participation.

Duke Energy is satisfied with Franklin Energy's management of the program. However, they would like Franklin Energy to track lost opportunities or opportunities at the property not currently addressed by the program measure mix as a data point. This information could be utilized to identify potential measure offerings through the program.

6.4.2 Interview with Franklin Energy Implementation Staff

Guidehouse also interviewed program implementation staff from Franklin Energy. The primary implementation steps for this program include outreach conducted by the Energy Advisor, assessment to identify and quantify opportunity, scheduling, installation of the measures based on assessment (additional measures may be installed if applicable), quality control and assessment conducted within three-weeks of installation. Since program resumption after COVID-19 shutdown, the quality assessment is now conducted virtually by calling the tenants and confirming installations.

Staff from Franklin Energy indicated that the program fell short of the annual energy savings (kWh) goal for both the DEP and DEC jurisdictions for 2019 (the only year within the evaluation period unaffected by COVID-19) due to challenges like weather concerns, which resulted in having to pull technicians out of the field, and the inability to ramp up the program as quickly in the DEP jurisdiction among others. Franklin Energy is the primary party responsible for program marketing. Marketing has typically been carried out by the Energy Advisor through cold calls and visiting the properties. However, Franklin Energy is considering reviving a few marketing initiatives like the mail campaign, outbound call campaign (dedicated persion to call property and introduce the program) and the email campaign, to promote the program and encourage participation.

Franklin Energy identified lack of resources (staffing) at the participating properties, COVID-19 and the ability to safely implement the program as the barriers to program participation. Franklin Energy also indicated that there have been no changes to eligibility for this program, but that new measures are now offered through the program including low flow water measures and smart thermostats. While all other program measures are offered at no cost to the customer, smart thermostats require a \$100 co-pay. The co-pay will be charged to the property since smart thermostats are intended to be a permanent fixture and improvement to the property.

7. Conclusions and Recommendations

Guidehouse's findings suggest that Duke Energy's Multifamily Energy Efficiency Program is being delivered and tracked effectively in both the DEP and DEC jurisdictions. Customer satisfaction is generally high, and the program measure installations appear to be tracked appropriately. Guidehouse presents the following list of recommendations to help improve program delivery and impacts:

- 1. Guidehouse recommends that Duke Energy adopt the per-unit energy and demand impacts from this evaluation and use them going forward. The engineering analysis and data collection described in this report provide support for updating the estimated impacts for each program measure.
- 2. Duke Energy should consider investigating the possibility of providing property managers and tenants information about the Duke Energy Online Store as a way to order additional or replacement equipment.
- 3. Duke Energy should track additional existing energy efficiency opportunities (not offered through this program) at participating properties and consider channeling them through other applicable programs that offer those measures by sharing relevant leads internally.
- 4. Guidehouse recommends that Franklin Energy track the actual equipment type (bathroom aerator, kitchen aerator, or showerhead) for the water measures removed during installation along with the GPM value of the removed equipment already captured and provide that as part of the removed measures data going forward.

8. Summary Form

Multifamily Energy Efficiency Program

Completed EMV Fact Sheet

Description of program

Duke Energy's Multifamily Energy Efficiency Program provides energy efficient equipment to multifamily housing properties at no cost to the property managers or tenant end-users. The program is delivered through coordination with property managers and owners. Tenants are provided with notice and informational materials to inform them of the program and potential for reduction in their energy bills. Typically, measures are installed directly by the implementation contractor rather than tenants or onsite maintenance staff.

The program consists of lighting and water measures.

- Lighting measures: Light Emitting Diode (LED) bulbs installed in permanent fixtures
- Water measures: Bathroom and kitchen faucet aerators, water-saving showerheads, water heater pipe wrap

Evaluation Methods

The evaluation team used engineering analysis and a virtual impact assessment as the primary basis for estimating program impacts. Additionally, telephone surveys were conducted with tenants and multifamily housing units to assess customer satisfaction and spillover. Detailed interviews were conducted with property managers to assess their decision-making process, and ultimately to estimate a net-to-gross ratio.

Impact Evaluation Details

- Virtual verifications surveys were completed for 138 housing units. Tenant responses to the survey covering over 1,000 program measures were used to assess measure quantities and characteristics to be compared with the program tracking database.
- In-Service rates (ISRs) varied by equipment type. The evaluation team found ISRs ranging from 76 percent for Recessed LED lamps to 100 percent for pipe wrap.
- Participants achieved an average of 637 kWh of energy savings per year in DEP, and 568 kWh in DEC. Differences were driven by the mix and quantity of measures installed between the jurisdictions.

Date:	April 20, 2022
Region:	Duke Energy Progress Duke Energy Carolinas
Evaluation Period	7/1/19 – 6/30/21
Annual kWh Savings	DEP 7,763,174 DEC 14,053,099
Per Participant kWh Savings	DEP 637 DEC 568
Net-to-Gross Ratio	0.9602

9. Measure Level Inputs for Duke Energy Analytics

Guidehouse used the findings from virtual verification and review of Duke Energy's deemed savings to estimate an updated set of deemed savings for Duke Energy to use for tracking program activity.

Table 9-1 provides the measure-level inputs that can be used by Duke Energy Analytics for estimates of future program savings.

Measure	Unit Basis	Annual Per Unit Energy Savings (kWh)	Annual Per Unit Summer Coincident Demand Savings (kW)	Annual Per Unit Winter Coincident Demand Savings (kW)
A-Line LED	Per lamp	26.82	0.0049	0.0034
Globe LED	Per lamp	27.04	0.0038	0.0037
Candelabra LED	Per lamp	16.02	0.0036	0.0012
Track LED	Per lamp	39.10	0.0059	0.0039
Recessed LED	Per lamp	33.18	0.0064	0.0022
Bathroom Aerator – 0.5 GPM	Per aerator	87.65	0.0116	0.0102
Bathroom Aerator – 1.0 GPM	Per aerator	61.81	0.0082	0.0072
Kitchen Aerator – 1.0 GPM	Per aerator	141.66	0.0187	0.0165
Showerhead – 1.5 GPM	Per showerhead	248.57	0.0205	0.0801
Showerhead – 1.25 GPM*	Per showerhead	317.26	0.0262	0.1022
Pipe Wrap	Per linear foot	21.43	0.0024	0.0024

Table 9-1. Gross Measure Level Impacts

* Duke Energy did not offer showerheads at the 1.25 GPM flow rate for this evaluation period. The values in this table are presented for planning purposes only. The savings for these measures are calculated assuming the same input parameters as Showerhead – 1.5 GPM measure except GPM Low.

Source: Guidehouse analysis, values subject to rounding

Appendix A. Tenant Survey Guide

DUKE ENERGY MULTIFAMILY ENERGY EFFICIENCY PROGRAM TENANT SURVEY

This survey guide will be administered to residents who have received energy efficient equipment through Duke Energy's Multifamily Energy Efficiency Program in DEP and DEC (the Carolinas) between 07/01/2019 and 06/30/2021. The goal of the tenant satisfaction survey is to collect feedback about customer experience and satisfaction with program equipment. The recruiting calls for tenant surveys will be made between 10:00am-8:30pm ET on weekdays, and 10:00am-5:00pm ET on Saturdays. No calls are to be made on Sundays.

Company:			Telephone:		
Name:			Cell phone:		
Title:			Fax:		
City:		State:		Zip:	
Interview date:	Time:			•	

[PROGRAMMER: INSERTS FOR "MEASURE(S)": (add MEASURE_NAME # to sample) IF LED_LIGHT_BULBS_1 ≥ 1, [INSERT MEASURE(S)] = "LED LIGHT BULBS" IF BATHROOM_FAUCET_AERATORS_2 ≥ 1, [INSERT MEASURE(S)] = "BATHROOM FAUCET AERATORS" IF KITCHEN_FAUCET_AERATORS_3 ≥ 1, [INSERT MEASURE(S)] = "KITCHEN FAUCET AERATORS" IF WATER_HEATER_PIPE_WRAP_4 ≥ 1, [INSERT MEASURE(S)] = "WATER HEATER PIPE WRAP" IF LOW_FLOW_SHOWERHEADS_5 ≥ 1, [INSERT MEASURE(S)] = "LOW FLOW SHOWERHEAD"

INTRO [IF COMPLEX_NAME = 2 USE THIS INTRO.] (individual - add "2" to sample) Hello, my name is (YOUR NAME) calling from Bellomy Research. I'm calling on behalf of DUKE ENERGY about the energy saving equipment that your landlord or property manager installed in your home as a part of a Duke Energy efficiency program. These may have included light bulbs, faucet aerators, pipe wrap or showerheads. Is this the [INSERT CONTACT_NAME FROM SAMPLE] residence? (IF NOT AVAILABLE, SCHEDULE A CALLBACK.)

INTRO 2 [IF COMPLEX_NAME = 1 USE THIS INTRO.] (complex – add "1" to sample) Hello, my name is (YOUR NAME) calling from Bellomy Research. I'm calling on behalf of DUKE ENERGY about the energy saving equipment that your landlord or property manager installed in your home as a part of a Duke Energy efficiency program. These may have included light bulbs, aerators, pipe wrap or showerheads. Do you reside at a property managed by [INSERT CONTACT_NAME FROM SAMPLE]? (IF NOT AVAILABLE, SCHEDULE A CALLBACK.)

S1. Safety is always first at Duke Energy. Are you able to safely take this call right now?

- 1. Yes [CONTINUE]
- 2. No [THANK AND TERMINATE]
- 98. Don't know [SCHEDULE A CALLBACK]
- 99. Refused [THANK AND TERMINATE]

[FOR TERMINATIONS]: I thank you for your time.

[IF RESPONDENT ASKS HOW LONG, SAY: "APPROXIMATELY 10-12 MINUTES."]

OFFICIAL COPY

S2. I am calling for your opinion on your experience with the Multifamily Energy Efficiency Program from Duke Energy. We will keep all of your responses confidential. For quality purposes, this call may be monitored and recorded. I just need to ask a few screening questions before we get started. Our records show that your household received new energy efficient lighting and/or water-saving equipment in 2019 or 2020. Your landlord or property manager organized your participation in this program, and a work crew or maintenance staff would have installed [INSERT MEASURE(S)] in your home.

Do you recall these [INSERT MEASURE(S)] being installed in your home?

- 1. Yes, respondent recalls the program [CONTINUE TO PS1.]
- 2. No [THANK AND TERMINATE]
- 98. Don't know [ASK S3]
- 99. Refused [ASK S3]

[FOR TERMINATIONS]: I have been asked to conduct interviews with people who are familiar with the energy efficient equipment installed as part of this Duke Energy Multifamily Energy Efficiency Program. Since you do not recall this process, these are all the questions I have at this time. Thank you for your time and have a nice day.

[IF S2 = 98 OR 99, CONTINUE to S3. OTHERWISE SKIP TO PS1.]

- S3. Is there anyone available who might know? (IF NOT AVAILABLE, SCHEDULE A CALL BACK).
 - 1. Yes [REPEAT S1 WITH NEW RESPONDENT TO CONFIRM MEASURES INSTALLED.]
 - 2. No
 - 99. Refused

[IF S3 = 2 OR 99, THANK AND TERMINATE]

[FOR TERMINATIONS]: I thank you for your time and have a nice day.

===========

NTG Survey: Res

Notes for Client:

- Scoring and multipliers are for FR (not NTGR).
- Text in brackets {} serve as a placeholder and will be concluded with the survey firm

PARTICIPATION and SATISFACTION

The following survey pertains to the energy efficiency improvements you had completed in your home: **[INSERT MEASURE(S)]** This survey contains questions relating to your overall satisfaction with the Multifamily Energy Efficiency Program as well as questions about your experience with the energy efficient equipment that were installed.

PS1. How did you first hear about Duke Energy's Multifamily Energy Efficiency Program?

(DO NOT READ LIST. RECORD ALL MENTIONS.)

- 1. Through property manager
- 2. Duke Energy website

- 3. Participation in other Duke Energy Programs
- 4. I haven't heard of the program
- 5. Other (Please Specify)
- 98. Don't know
- 99. Refused
- PS2. On a scale of 0 to 10, with 0 being "Not at all satisfied", and 10 being "Extremely satisfied", how satisfied are you with your [INSERT MEASURE(S)]? [REPEAT FOR EACH MEASURE INSTALLED BY PARTICIPANT.]

Not at all satisfied										Extremely satisfied	Dk	Ref
0	1	2	3	4	5	6	7	8	9	10	98	99

[IF PS2 < 5, ASK PS3]

PS3. Why did you rate your satisfaction with your equipment a [INSERT ANSWER FROM PS2]? (RECORD VERBATIM.)

[LOOP PS2/PS3 WILL BE ASKED MULTIPLE TIMES, BASED ON NUMBER OF MEASURES INSTALLED AT PS2.]

[OPEN-END]

- PS4. Have you noticed any savings on your electric bill since the installation of your new [INSERT MEASURE(S)]?
 - 1. Yes
 - 2. No
 - 98. Don't know
 - 99. Refused
- PS5. Using a scale from 0 to 10, with 0 being "Not at all satisfied" and 10 being "Extremely satisfied", how satisfied are you with the Duke Energy Multifamily Energy Efficiency Program?

Not at all satisfied										Extremely satisfied	Dk	Ref
0	1	2	3	4	5	6	7	8	9	10	98	99

[IF PS5 = 0-10, ASK PS5A]

PS5a. Why did you rate your satisfaction with the program a [INSERT ANSWER FROM PS8]? (RECORD VERBATIM.)

[OPEN-END]

PS6. Do you have any suggestions to improve the Multifamily Energy Efficiency Program? These could be suggestions regarding the:

- a. Current equipment offered through the program
- b. Additional equipment you would like to see offered as part of the program
- c. Possible improvements to implementation based on your experience
- d. Other

1. Yes

- 2. No
- 98. Don't know
- 99. Refused

[IF PS6 = 1, ASK PS6A.]

PS6a. What are those suggestions? (RECORD VERBATIM. PROBE FOR CLARIFICATION.)

[OPEN-END]

PS7. How would you rate your overall satisfaction with Duke Energy on a scale of 0 to 10, with 0 meaning "Not at all satisfied" and 10 meaning "Extremely satisfied"?

Not at all satisfied										Extremely satisfied	Dk	Ref
0	1	2	3	4	5	6	7	8	9	10	98	99

[IF PS7 < 5, ASK PS7A.]

PS7a. Why did you rate your satisfaction with Duke Energy a [INSERT ANSWER FROM PS10]? (RECORD VERBATIM.)

[OPEN-END]

MEASURES

Now I'd like to ask you a few questions about your experience with the energy efficient equipment installed through the Duke Energy Multifamily Energy Efficiency Program.

- M1. Have you removed any of the **[INSERT MEASURE(S)]** that were installed in your home through this Duke Energy program?
 - 1. Yes
 - 2. No
 - 98. Don't know

[IF M1 = 2 OR 98, SKIP TO IS1. OTHERWISE CONTINUE.]

M2. As I read the following measures, please tell me which ones you removed. Did you remove...(READ LIST. RECORD ALL MENTIONS)? [INSERT MEASURE(S)]

INSTALLED IN THE UNIT.

ONLY INCLUDE MEASURE

- 1. Bathroom faucet aerators
- 2. Kitchen faucet aerators
- 3. Low flow showerhead
- 4. Water heater pipe wrap
- 5. LED A-lamps
- 6. LED Globe lamps
- 7. LED Candelabras
- 8. LED Recessed lamps
- 9. LED Track Lighting lamps

10. (DO NOT READ) None were removed

M3.

[IF M2 = 10, SKIP TO IS1. OTHERWISE CONTINUE.]

Please tell me the quantity of items you removed for each of the following. How many (READ LIST) did you remove? (INTERVIEWER: RECORD-QUANTITY FOR EACH MEASURE. USE "98" FOR DON'T KNOW AND "99" FOR REFUSED.) [INSERT MEASURE(S)] ONLY INCLUDE MEASURE INSTALLED IN THE UNIT.

Measure Description	Quantity Removed
M3_1. Bathroom faucet aerators	
M3_2. Kitchen faucet aerators	
M3_3. Low flow showerheads	
M3_4. Water heater pipe wrap (in feet)	
M3_5. LED A-lamps	
M3_6. LED Globe lamps	
M3_7. LED Candelabras	
M3_8. LED Recessed lamps	
M3_9. LED Track Lighting lamps	

[IF M3_1 > "0", CONTINUE. OTHERWISE, SKIP TO IS1.]

M3_1a. You indicated that you removed bathroom faucet aerators. Why did you remove those items?

(RECORD VERBATIM.)

[OPEN-END]

- M3_1b. Did you remove an aerator from the master bathroom or another type of bathroom? (RECORD ONE ANSWER ONLY.)
 - 1. Master bathroom
 - 2. Another type of bathroom

[IF M3_2 > "0", CONTINUE. OTHERWISE, SKIP TO IS1.]

M3_2a. You indicated that you removed kitchen faucet aerators. Why did you remove those items?

(RECORD VERBATIM.)

[OPEN-END]

[IF M3_3 > "0", CONTINUE. OTHERWISE, SKIP TO IS1.]

M3_3a. You indicated that you removed low flow showerheads. Why did you remove those items?

(RECORD VERBATIM.)

[OPEN-END]

- M3_3b. Did you remove a showerhead from the master bathroom or another type of bathroom? (RECORD ONE ANSWER ONLY.)
 - 1. Master bathroom
 - 2. Another type of bathroom

[IF M3_4 > "0", CONTINUE. OTHERWISE, SKIP TO IS1.]

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M3_4a. You indicated that you removed water heater pipe wrap. Why did you remove those items?

(RECORD VERBATIM.)

[OPEN-END]

[IF M3_5, M3_6, M3_7, M3_8, OR M3_9 > "0", CONTINUE. OTHERWISE, SKIP TO IS1.]

M3_5a. You indicated that you removed LED light bulbs. Why did you remove those items? (RECORD VERBATIM.)

[OPEN-END]

- M3_5b. From which rooms did you remove LEDs? (DO NOT READ LIST. RECORD ALL MENTIONS.)
 - 1. Bathroom(s)
 - 2. Bedroom(s)
 - 3. Kitchen/Pantry
 - 4. Living room/Family room/Den/Playroom
 - 5. Home office
 - 6. Laundry room
 - 7. Exterior room (garage/patio/outdoor area)
 - 8. Dining room
 - 9. Hall
 - 10. Other (Please Specify)

M4. How many LED light bulbs were installed in your home through the program? (USE "98" FOR DON'T KNOW AND "99" FOR REFUSED.)

1. _____[ENTER A NUMBER 1 TO 999]

M5. What types of light bulbs do you have in the other lights in your home? (RECORD ALL MENTIONS.)

M5_ 1. Regular Incandescent Bulbs (NOTE: Traditional light bulbs that look like an upside down pear. These are no longer being produced.)

M5_2. Halogen (NOTE: Usually found in outside or recessed lighting.)

M5_3. LEDs (NOTE: LEDs last longer than CFLs.)

M5_4. Compact Fluorescent Bulbs or CFLs (NOTE: These look like a spiral or "twisty.")

M5_5. Other (Please Specify)

98. Don't know

M6. What is the quantity of light bulbs you have in the other lights in your home? (RECORD QUANTITY FOR ALL

MENTIONS IN M4.)

M6_1. Regular Incandescent Bulbs _____

M6_2. Halogen _____

M6_3. LEDs _____

M6_4. Compact Fluorescent Bulbs or CFLs _____

- M6_5. Other (Please Specify) _____
- 98. Don't know

M7. What percent of the light bulbs installed in your home are LED light bulbs? (USE "98" FOR DON'T KNOW AND "99" FOR REFUSED.) 1. _____[ENTER A NUMBER 0% TO 100%]

SPILLOVER (INSIDE SPILLOVER)

- IS1. As a result of your experience with the program, did you purchase additional energy efficiency equipment for your home or adopt any energy efficient behavior for which you did not receive a rebate/discount from any other Duke Energy program? (FOR BELOMY: AS AN EXAMPLE, THIS COULD MEAN BUYING ADDITIONAL LED LAMPS OR TURNING OFF LIGHTS.)
 - 1. Yes [CONTINUE]
 - 2. No
 - 98. Don't know
 - 99. Refused

[IF IS1 = 2 OR 98, SKIP TO DA1.]

Measure Description

IS2. Please tell me the types of additional energy efficient items and the quantity you had installed

where you did \underline{not} receive a program rebate. (INTERVIEWER: RECORD MEASURE DESCRIPTION

AND QUANTITY FOR EACH. AFTER EACH QUANTITY, ASK: Any others?) (USE "98" FOR DON'T

KNOW AND "99" FOR REFUSED.) (ONLY THE FIRST LINE IS REQUIRED. ENTER AS MANY

MEASURES AS THE RESPONDENT HAD INSTALLED AND LEAVE THE REST BLANK.)

	<u>Quantity</u>	
IS2a.	1	2
IS2b.	3	4
IS2c.	5	6
IS2d.	7	8
IS2e.	9	10

IS3. Please briefly <u>describe how</u> the program has influenced your decisions to incorporate <u>additional</u> energy efficient items in your home that were not part of a program rebate. (RECORD VERBATIM.)

[OPEN-END]

IS4. On a scale of 0 to 10, where 0 is "Not at all important" and 10 is "Extremely important," how important was your participation in the program in your decision to install additional energy efficiency measures?

Not at all										Extremely	Dk	Ref
important										important		
0	1	2	3	4	5	6	7	8	9	10	98	99

DEMOGRAPHICS AND ADDITIONAL FEEDBACK

Thank you for your time and patience; there are only a few more questions.

DA1. Do you consider Duke Energy a trusted resource for energy efficiency information?

- 1. Yes
- 2. No
- 98. Don't know
- 99. Refused

[IF DA1 = 1 "YES", ASK DA1a. IF DA1 = 2 "NO", ASK DA1b]

DA1a. Why do you consider Duke Energy a trusted resource?

[OPEN-END]

DA1b. Why do you not consider Duke Energy a trusted resource?

[OPEN-END]

DA2. How many bedrooms does your home have?

- 1. 1
- 2. 2
- 3. 3
- 4. More than 3
- 98. Don't know
- 99. Refused

DA3. How many people live in your home?

- 1. 1
- 2. 2
- 3. 3
- 4. More than 3
- 98. Don't know
- 99. Refused

COVID-19

C1. Has the emergence of COVID-19 changed how you use energy in your home?

- 1. Yes
- 2. No

3. Don't know

[IF C1=1 ASK C2]

C2. Please describe how you are using energy in your home differently as a result of COVID-19 [RECORD VERBATIM]

[OPEN-END]

[IF C1=1 ASK C3]

C3. Thinking of how COVID-19 has changed your home energy use, are there any tools or resources that Duke Energy could provide to help you? [RECORD VERBATIM]

[OPEN-END]

CLOSING: This completes the survey. Your responses are very important to Duke Energy and will help as we design future energy efficiency programs. We appreciate your participation and thank you for your time. Have a good day.

Appendix B. Property Manager Survey Guide

DUKE ENERGY MULTIFAMILY ENERGY EFFICIENCY PROGRAM PROPERTY MANAGER SURVEY

This survey guide will be administered to property managers who participated in Duke Energy's Multifamily Energy Efficiency Program in DEP and DEC (the Carolinas) between 07/01/2019 and 06/30/2021. The goal of property manager surveys is to collect feedback about program experience, satisfaction, and to inform the net-to-gross analysis. Surveys will be conducted via phone, between 10:00am-8:30pm ET on weekdays, and 10:00am-5:00pm ET on Saturdays. No calls are to be made on Sundays. The Guidehouse interviewer will introduce himself/herself and inform the customer about the purpose of the interview.

Company:			Telephone:		
Name:			Cell phone:		
Title:			Fax:		
City:		State:		Zip:	
Interview date:	Time:			·	

Screening

- S1. According to our records, your property participated in Duke Energy's Multifamily Energy Efficiency Program during 2019 or 2020 and received free installation of energy efficient **lighting and/or water equipment**. Is that correct?
 - 1. Yes
 - 2. No
 - 98. Don't know
 - 99. Refused

[If S1 = 2 or 98, 99, TERMINATE. Otherwise, Continue]

[FOR TERMINATIONS]: This survey is for people who participated in Duke Energy's Multifamily Energy Efficiency Program during 2019 or 2020. Since you did not, these are all the questions I have at this time, and I thank you for your time.

- S2. Are you the primary person who was involved in making the decision to participate in Duke Energy's program and receive the installation for the energy efficient lighting and/or water efficiency equipment at the property you manage?
 - 1. Yes
 - 2. No
 - 98. Don't know
 - 99. Refused

[If S2 = 1, Move to PS1. If S2 = 99, Terminate. Otherwise, Continue]

[FOR TERMINATIONS]: This survey is for people who participated in Duke Energy's Multifamily Energy Efficiency Program during 2019 or 2020. Since you did not, these are all the questions I have at this time, and I thank you for your time.

- *S2a.* I understand that the decision to install the **lighting and/or water equipment** may have been driven by someone other than yourself. However, if you had some involvement in the decision process to participate in the program, your input will be helpful. Are you somewhat familiar with the program participation and installation process?
 - 1. Yes
 - 2. No
 - 98. Don't know
 - 99. Refused

[If S2a = 1, proceed to PS1. If S2 = 2 or 98, proceed to S2b. If S2a= 99, Terminate] [*FOR TERMINATIONS]:* This survey is for people who participated in Duke Energy's Multifamily Energy Efficiency Program during 2019 or 2020. Since you did not, these are all the questions I have at this time, and I thank you for your time.

S2b. Please provide me with the contact information of the person who was involved in the decision making:

- 1. Yes [Gather correct contact information before terminating]
- 2. No [Terminate]
- 98. Don't know [Terminate]
- 99. Refused [Reassure participant prior to Terminating]

[If S2b = 1, Gather correct contact information before ending. If S2 = 2, 98 or 99, Terminate]

[FOR ENDING]: Thank you for providing us with this information and thank you for your time.

[FOR TERMINATIONS]: This survey is for people who participated in Duke Energy's Multifamily Energy Efficiency Program during 2019 or 2020. Since you did not, these are all the questions I have at this time, and I thank you for your time.

Survey Introduction

My questions are about the energy efficient **lighting and/or water equipment** installed at **[Insert Property]** through the Duke Energy Multifamily Energy Efficiency Program in 2019 or 2020. The lighting equipment refers to LED retrofits in tenant housing units, and the water equipment refers to low flow showerheads, faucet aerators, and water heater pipe wrap. I will ask about your satisfaction with the program as well as questions relating to your decision to participate in the program. Finally, I am also interested in hearing about any decisions to pursue efficiency projects at other properties your company manages.
Participation and Satisfaction

The first set of questions relate to your satisfaction with the program. Using a scale from 0 to 10, with 0 being "not at all satisfied" and 10 being "extremely satisfied", how would you rate your satisfaction with the following aspects of Duke Energy's Multifamily Energy Efficiency program? *(INTERVIEWER: USE "98" FOR DON'T KNOW. USE "99" FOR REFUSED.)*

Questions	Ra	ating	js a	nd	ехр	lana	atio	าร					
PS1. Overall experience with the program	0	1	2	3	4	5	6	7	8	9	10	98 Don't Know	99 Refused
PS1a. Why did you rate your overall experience with the program a [INSERT ANSWER FROM PS1]? (RECORD VERBATIM)													
PS2. Communication with program representatives	0	1	2	3	4	5	6	7	8	9	10	98 Don't Know	99 Refused
[If PS2 < 5, ASK] PS2a. Why did you rate the communication with program representatives a [INSERT ANSWER FROM PS2]? (RECORD VERBATIM)													
PS3. Program materials to help you communicate with tenants about the program	0	1	2	3	4	5	6	7	8	9	10	98 Don't Know	99 Refused
[If PS3 < 5, ASK] PS3a. Why did you rate the program materials a [INSERT ANSWER FROM PS3]? (RECORD VERBATIM)													
PS4. The lighting equipment offered in the program	0	1	2	3	4	5	6	7	8	9	10	98 Don't Know	99 Refused
[If PS4 < 5, ASK] PS4a. Why did you rate the lighting equipment offered in the program a [INSERT ANSWER FROM PS4]? (RECORD VERBATIM)													
PS5. The water-saving equipment offered in the program	0	1	2	3	4	5	6	7	8	9	10	98 Don't Know	99 Refused
[If PS5 < 5, ASK] PS5a. Why did you rate the water-saving equipment offered in the program a [INSERT ANSWER FROM PS5]? (RECORD VERBATIM)													

PS6. Installation team's	0	1	2	3	4	5	6	7	8	9	10	98	99
scheduling and timely												Don't	Refused
installation in tenant-units												Know	
[If PS6 < 5, ASK] PS6a. Why													
did you rate the installation													
team's scheduling and timely													
installation a [INSERT ANSWER													
FROM PS6]? (RECORD													
VERBATIM)													
PS7. Installation team's quality	0	1	2	3	4	5	6	7	8	9	10	98	99
of work												Don't	Refused
												Know	
[If PS7 < 5, ASK] PS7a. Why													
did you rate the installation													
team's quality of work a													
[INSERT ANSWER FROM													
PS7]? (RECORD VERBATIM)													
PS8. Program enrollment	0	1	2	3	4	5	6	7	8	9	10	98	99
process												Don't	Refused
												Know	
[If PS8 < 5, ASK] PS8a. Why													
did you rate the program													
enrollment process a [INSERT													
ANSWER FROM PS8]?													
(RECORD VERBATIM)													

PS9. [If property received lighting equipment ask PS9, otherwise skip to PS10] On a scale of 0 to 10, with 0 being "not at all satisfied", and 10 being "extremely satisfied", how satisfied would you say *your tenants* are with the new lighting equipment? (USE "98" FOR DON'T KNOW. USE "99" FOR REFUSED.)

Not at all										Extremely	Don't	Refused
Important										Important	Know	
0	1	2	3	4	5	6	7	8	9	10	98	99

PS9a. Why did you rate your tenants' satisfaction with the new lighting equipment a [INSERT ANSWER FROM PS9]? (*RECORD VERBATIM*)

PS9b. Can you tell me about any feedback that you have received from your tenants about their experience with the LED lights? [Probe to understand any improvements to aesthetics in the space, reduced energy bills, etc.) (RECORD VERBATIM)

PS10. **[If property only received lighting equipment skip to PS11]** On a scale of 0 to 10, with 0 being "not at all satisfied", and 10 being "extremely satisfied", how satisfied would you say your tenants are with the new **water equipment**? (USE "98" FOR DON'T KNOW. USE "99" FOR REFUSED.)

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Not at all										Extremely	Don't	Refused
Important										Important	Know	
0	1	2	3	4	5	6	7	8	9	10	98	99

PS10a. Why did your rate your tenants' satisfaction with the new water equipment a [INSERT ANSWER FROM PS10]? (*RECORD VERBATIM*)

- PS10b. Can you tell me about any feedback that you have received from your tenants about their experience with the water equipment? [Probe to understand any improvements to aesthetics in the space, reduced energy bills, etc.] (RECORD VERBATIM)
- PS11. When speaking to prospective tenants, do you highlight the energy efficient features of your units?
 - 1. Yes
 - 2. No
 - 98. Don't know
 - 99. Refused
- PS12. Are there other energy efficiency options you think the program should include? Some examples might be outdoor lighting solutions, heating and cooling solutions, programmable or smart thermostats (i.e. nests), electric vehicle charging stations, etc.? (RECORD VERBATIM)

Awareness Questions

The next set of questions relate to your decision to participate in the program.

- A1. What was the <u>primary</u> reason for your decision to participate in the program? [DO NOT READ LIST. RECORD ONLY ONE MENTION.]
 - 1. To save money on utility bills; save money on electric bills
 - 2. Because the equipment was free to me
 - 3. To replace old equipment
 - 4. To replace broken equipment
 - 5. To get more efficient equipment or the latest technology
 - 6. To reduce maintenance costs
 - 7. Because the program was sponsored by Duke Energy
 - 8. Previous experience with other Duke Energy programs
 - 9. To help protect the environment
 - 10. To save energy
 - 11. To improve tenant satisfaction
 - 12. To attract new tenants
 - 13. Part of a broader remodeling or renovation
 - 14. Recommended by contractors/trade allies
 - 15. Recommended by family, friend, or neighbor
 - 16. Existing equipment was due for its regularly-scheduled checkup
 - 17. Duke Energy Advertising

- 18. Advertising other than Duke Energy
- 19. No other reasons
- 20. Other [SPECIFY] _____
- 98. Don't know
- 99. Refused
- A2. Are there any other reasons you decided to install **lighting and/or water equipment**? [DO NOT READ LIST. RECORD ALL MENTIONS]
 - 1. To save money on utility bills; save money on electric bills
 - 2. Because the equipment was free to me
 - 3. To replace old equipment
 - 4. To replace broken equipment
 - 5. To get more efficient equipment or the latest technology
 - 6. To reduce maintenance costs
 - 7. Because the program was sponsored by Duke
 - 8. Previous experience with other Duke programs
 - 9. To help protect the environment
 - 10. To save energy
 - 11. To improve tenant satisfaction
 - 12. To attract new tenants
 - 13. Part of a broader remodeling or renovation
 - 14. Recommended by contractors/trade allies
 - 15. Recommended by family, friend, or neighbor
 - 16. Existing equipment was due for its regularly-scheduled checkup
 - 17. Duke Advertising
 - 18. Advertising other than Duke.
 - 19. Federal tax credit
 - 20. No other reasons
 - 21. Other [SPECIFY]
 - 98. Don't know
 - 99. Refused

A3. On a scale of 0 to 10 where 0 means "strongly disagree" and 10 means "strongly agree," please rate your agreement with the following statements:

A3a. I consider Duke Energy to be a resource for energy efficiency information.

- 1. Record response 0-10
- 98. Don't know
- 99. Refused
- A3b. My decision to install energy efficient equipment at my property was largely motivated by Duke Energy's program.
 - 1. Record response 0-10
 - 98. Don't know
 - 99. Refused

Prior Plans

[Ask if property received lighting equipment]

PP1. Prior to participating in the Duke Energy program, <u>had you considered installing</u> the energy efficient **lighting equipment** at the property?

- 1. Yes
- 2. No
- 98. Don't know
- 99. Refused

[Ask if property received water equipment]

PP2. Prior to participating in the Duke Energy program, <u>had you considered installing</u> the energy efficient **water equipment** at the property?

- 1. Yes
- 2. No
- 98. Don't know
- 99. Refused

[If PP1 OR PP2 = 1 or 98, ASK PP2A. Otherwise ASK L3]

PP2a. Please describe any plans you had to install the **lighting and/or water equipment** prior to participating in the Duke Energy program.

[Record PM Response verbatim]: _____

PP3. Thinking about before you decided to participate in the Duke Energy Multifamily Energy Efficiency program. On a scale of 0 to 10, where 0 means you "had not yet started to plan for equipment or installation" and 10 means you "had identified and selected specific equipment <u>and</u> the contractor to install it", please tell me how far along you were in your plans to install the equipment before participating in the program. (USE "98" FOR DON'T KNOW. USE "99" FOR REFUSED.)

Had not										Identified	Don't	Refused
Yet										and	know	
planned										selected		
for										specific		
Equipment										equipment		
and										and the		
Installation										contractor		
										to install it		
0	1	2	3	4	5	6	7	8	9	10	98	99

Own

O1. Please tell me in your own words how the program influenced your decision to install the **lighting and/or water equipment**. (RECORD VERATIM)

Likelihood

- L1. Given everything you've just told me, what is the likelihood that you would have installed the same energy efficient lighting and/or water equipment without the Duke Energy program and its financial and technical assistance? Would you say you ... [READ LIST]?
 - 1. Definitely would NOT have installed the same **lighting and/or water** equipment without the Duke Energy program
 - 2. MAY HAVE installed the same **lighting and/or water equipment**, even without the Duke Energy program
 - 3. Definitely WOULD have installed the same **lighting and/or water** equipment, even without the Duke Energy program
 - 98. (DO NOT READ) Don't know
 - 99. Refused

[If L1 = 2, ASK L1A. Otherwise ASK L2]

L1a. You indicated you may have installed the same energy efficient **[INSERT MEASURES DENOTED ABOVE]**, even without the Duke Energy program. On a scale of 0 to 10 where 0 is "DEFINITELY WOULD NOT have installed" and 10 is "DEFINITELY WOULD have installed", can you tell me the likelihood that you would have installed the same equipment without the program?

Definitely Would										Definitely Would	Don't Know	Refused
Not												
0	1	2	3	4	5	6	7	8	9	10	98	99

- L2. Thinking about the quantity of lighting and/or water equipment you installed through the program, what is the likelihood that you would have installed <u>the same quantity of the same measures</u> without the program's financial and technical assistance? Would you say you ... [READ LIST]
 - 1. Definitely would NOT have installed the same quantity of the same **lighting and/or water equipment** without the Duke Energy program
 - 2. MAY HAVE installed the same quantity of the same energy efficient lighting and/or water equipment, even without the Duke Energy program
 - 3. Definitely WOULD have installed the same quantity of the same energy efficient **lighting and/or water equipment**, even without the Duke Energy program
 - 98. (DO NOT READ) Don't know
 - 99. Refused

[If L2 = 2, ASK L2A. Otherwise ASK L3]

L2a. You indicated you may have installed the same <u>quantity of the same lighting and/or</u> water equipment even without the Duke Energy program. Using a scale of 0 to 10 where 0 is "DEFINITELY WOULD NOT have installed" and 10 is "DEFINITELY WOULD have installed", can you tell me the likelihood that you would have installed <u>the same quantity</u> of the same measures without the program?

Definitely Would Not										Definitely Would	Don't Know	Refused
0	1	2	3	4	5	6	7	8	9	10	98	99

L3. [If L2 = 3, proceed to L3A. Otherwise, continue]

Is there a chance you would have had <u>at least some</u> of the work done without the program?

- 1. Yes
- 2. No
- 98. Don't know

[If L3 = 2, ASK IS1. Otherwise, continue]

- L3a. Could you estimate the percentage of the work that you might have had done without the program? By percentage, I mean about what portion of the total energy efficient equipment would you have installed without the program _____%
- L3b. On a scale of 0 to 10 where 0 is "DEFINITELY WOULD NOT have installed" and 10 is "DEFINITELY WOULD have installed", what is the likelihood you might have installed [INSERT L3A ANSWER] percent of the **lighting and/or water equipment** without the Duke Energy program? (USE "98" FOR DON'T KNOW. USE "99" FOR REFUSED.)

Not at all										Extremely	Don't	Refused
Important										Important	Know	
0	1	2	3	4	5	6	7	8	9	10	98	99

L3c. You mentioned you might have done some work without the program, please describe what you might have had done. (RECORD VERBATIM)

L4. Without the program, about when would you have installed the **lighting and/or water** equipment?

Would it have been... (READ LIST)?

- 1. At the same time as you did
- 2. Within 1 year of the time you did
- 3. Between 1 and 2 years within the time you did
- 4. Between 2 and 4 years within the time you did
- 5. Sometime after 4 years within the time you did
- 6. Would have never installed without the program

Spillover

Thank you for your time and patience, we are almost done and the next few questions pertain to how the program may have influenced you to perform other energy efficiency activities are your property.

- IS1. Did your experience with the program in any way influence you to incorporate additional energy efficiency equipment where you did not receive a program rebate at your property?
 - 1. Yes
 - 2. No
 - 98. Don't know
 - 99. Refused

[IF IS1 = 2, SKIP TO IS2]

IS1a. Please tell me the types of additional energy efficient equipment and the quantity you had installed where you did not receive a program rebate. [INTERVIEWER: RECORD MEASURE DESCRIPTION AND QUANTITY FOR EACH. AFTER EACH QUANTITY, ASK: Any others?]

Ν

Measure Description	<u>Quantity</u>
1.	
2.	
3	
Δ	
5	
0	
0	

- IS1b. Please briefly describe how the program influenced your decisions to incorporate additional energy efficiency equipment at your property that were not part of a program rebate. (RECORD VERBATIM)
- IS1c. On a scale of 0 to 10, where 0 is "not at all important" and 10 is "extremely important," how important was your participation in the program in your decision to install the additional energy efficiency equipment? (USE "98" FOR DON'T KNOW. USE "99" FOR REFUSED.)

Not at all Important										Extremely Important	Don't Know	Refused
0	1	2	3	4	5	6	7	8	9	10	98	99

- IS2. Aside from the primary property that participated in the program, did your experience with the program in any way influence you to incorporate additional energy efficiency equipment where you did not receive a program rebate at any other properties managed by your company?
 - 1. Yes
 - 2. No
 - 98. Don't know

[IF IS2 = 2, SKIP TO P1]

IS2a. Please briefly <u>describe how</u> the program influenced your decisions to incorporate <u>additional</u> energy efficiency equipment at another property that were not part of a program rebate. (RECORD VERBATIM)

Property Characteristics

The next few questions are about the size and occupancy characteristics of your property.

- P1. How many housing units does your property have?
 - 1. Record Verbatim
 - 98. Don't know
 - 99. Refused

P2. Can you tell me the approximate percentage of housing units at your facility that have the following number of bedrooms?

- 1. One-bedroom (record percentage of units):
- 2. Two-bedrooms (record percentage of units):
- 3. Three-bedrooms (record percentage of units):
- 4. More than three bedrooms (record percentage of units):
- 98. Don't know
- 99. Refused

P3. Can you tell me the average number of occupants that live in a typical unit at your property?

(RECORD VERBATIM AND PROBE FURTHER IF THEY HAVE OCCUPANCY BY NUMBER OF BEDROOMS)

- 1. One-bedroom (enter average number of occupants)
- 2. Two-bedrooms (enter average number of occupants)
- 3. Three-bedrooms (enter average number of occupants)
- 4. More than three bedrooms (enter average number of occupants)
- 98. Don't know
- 99. Refused

P4. Do you manage more than one property?

- 1. Yes [Continue]
- 2. No [Skip to IS3]
- 99. Don't know

[IF P4 = 2, SKIP TO C1]

P4a. How many properties do you manage? (RECORD NUMBER.) [NUMBER]

P4b. Was the decision to participate in this program driven by the individual properties or by the property management company?

1. Individual Properties

- 2. Owner or Property Management Company
- 98. Don't know

COVID-19

The next few questions are about COVID-19 impacts.

C1. Over the past year, have you experienced any changes to any of the following due to COVID 19? (Yes/No for each)

- a. Vacancy/occupancy
- b. Timeliness of rent payments
- c. Ease of completing routine maintenance
- d. Maintaining a healthy living environment for your tenants (e.g., increased air filtration needs, cleaning)
- e. Businesses that you rely on to complete your work (e.g., contractors, suppliers)
- f. Ability to participate in Duke Energy programs

For each yes, follow up and record verbatim.

C2. Has the emergence of COVID-19 changed how the tenants use energy at your multifamily property?

- 1. Yes
- 2. No

98. Don't know

[ASK IF C2=1]

C3. How are you using energy at your multifamily property differently as a result of COVID-19?

(RECORD VERBATIM)

[ASK IF C2=1]

C4. Thinking of how COVID-19 has changed your energy use at your multifamily property, what kind of energy efficiency tools or resources could Duke Energy provide to help you? (RECORD VERBATIM)

Impact

The final few questions are about quantities of measures installed at your property.

IM1. Our records indicate that about **[Units per Property]** housing units at your property received energy efficient measures through the program. Does that sound right?

- 1. Yes
- 2. No
- 98. Don't know
- 99. Other (Record verbatim)
- IM2. Our records show that the following measures were installed at your property: [Read list of measures with quantity > 0]
 - o LED Lamps
 - Bathroom faucet aerator

- Kitchen faucet aerator
- o Showerhead
- Water heater pipe wrap

Is this information correct?

1. Yes

- 2. No
- 98. Don't know
- 99. Other (Record verbatim)
- IM3. I will now read out the total quantity of units installed for each measure that your property received. Could you please confirm if the quantity seems accurate based on your recollection of the program?

[Read list of measures with quantity > 0] LED Lamps – [Total Quantity of LED Lamps] lamps Bathroom faucet aerator – [Total Quantity of Bath Aerator] aerators Kitchen faucet aerator – [Total Quantity of Kitchen Aerators] aerators Showerhead – [Total Quantity of Showerheads] showerheads Water heater pipe wrap – [Total Quantity of Pipe Wrap] feet Is this information correct?

Yes
No
Don't know
Other (Record verbatim)

[Collect response for each measure installed]

Closing

CL1. Is there anything you would suggest to improve Duke Energy's Multifamily Energy Efficiency Program?

(RECORD VERBATIM)

This completes the survey. Your responses are very important to DUKE ENERGY and will help as we design future energy efficiency programs. We appreciate your participation and thank you for your time. Have a good day.