REPORT

My Home Energy Report Program Evaluation

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1.1 Program Summary

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

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

1.2 Evaluation Objectives and High Level Findings

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

1.3 Evaluation Recommendations

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

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

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

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

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

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

2 Introduction and Program Description

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

2.1 Program Description

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

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

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

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

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

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

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

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

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

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

2.2 Implementation

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

2.2.1 Eligibility

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

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

2.3 Key Research Objectives

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

2.3.1 Impact Evaluation Objectives

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

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

2.3.2 Process Evaluation Objectives

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

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

2.4 Organization of This Report

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

3 Impact Evaluation

3.1 Methods

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

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

3.1.1 Data Sources and Management

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

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

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

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

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

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

3.1.2 Intention to Treat

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

3.1.3 Sampling Plan and Precision of Findings

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

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

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

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

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

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

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

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

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

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

3.1.4 Assignment Cohorts and Equivalence Testing

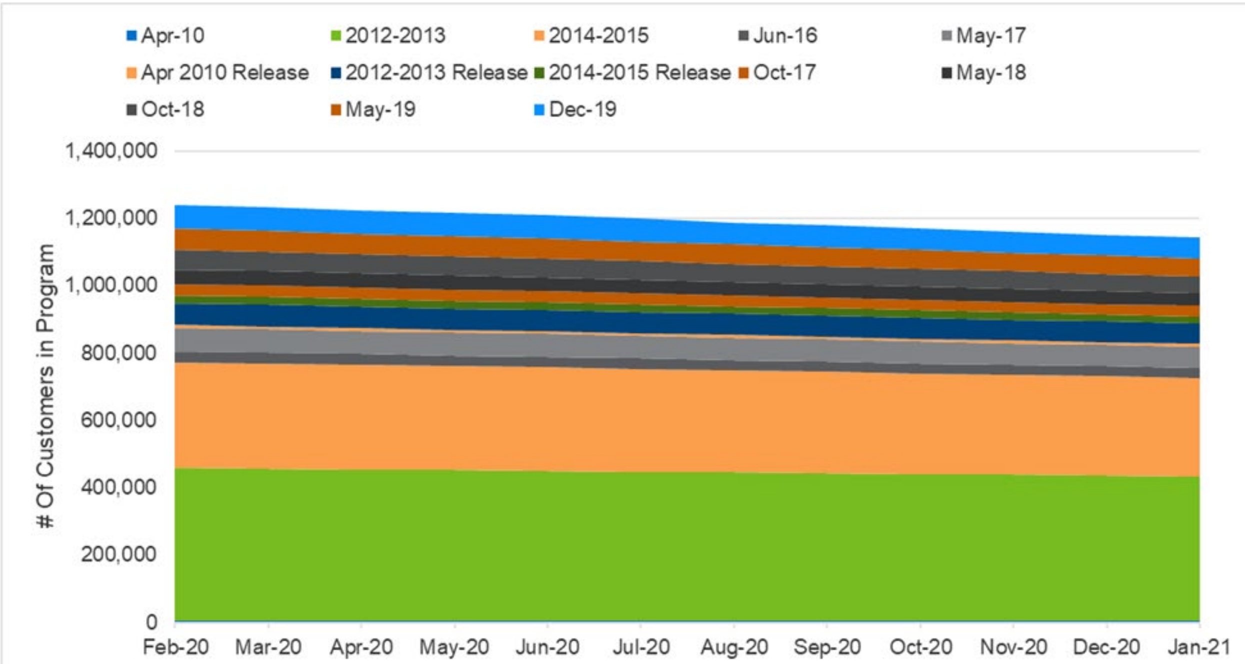
3.1.4.1 Duke Energy Carolinas Single Family

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

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

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

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



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

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

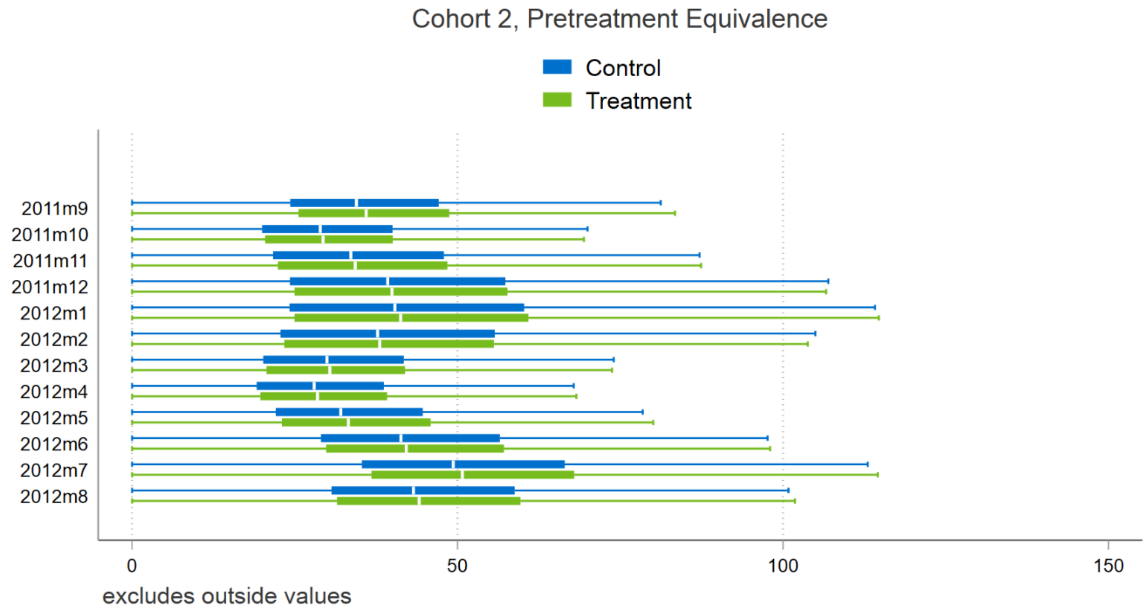
[10] Duke Energy commissioned a review of the MyHER control groups in 2015 to assess whether or not there were any control groups that were larger than necessary for the purpose of EM&V. Four relatively small releases (approximately 110,000 customers total) from the DEC jurisdiction was recommended by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

Table 3-5: DEC SF MyHER Cohort Summary Statistics

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

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

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



3.1.4.2 Duke Energy Carolinas Multi-family

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

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

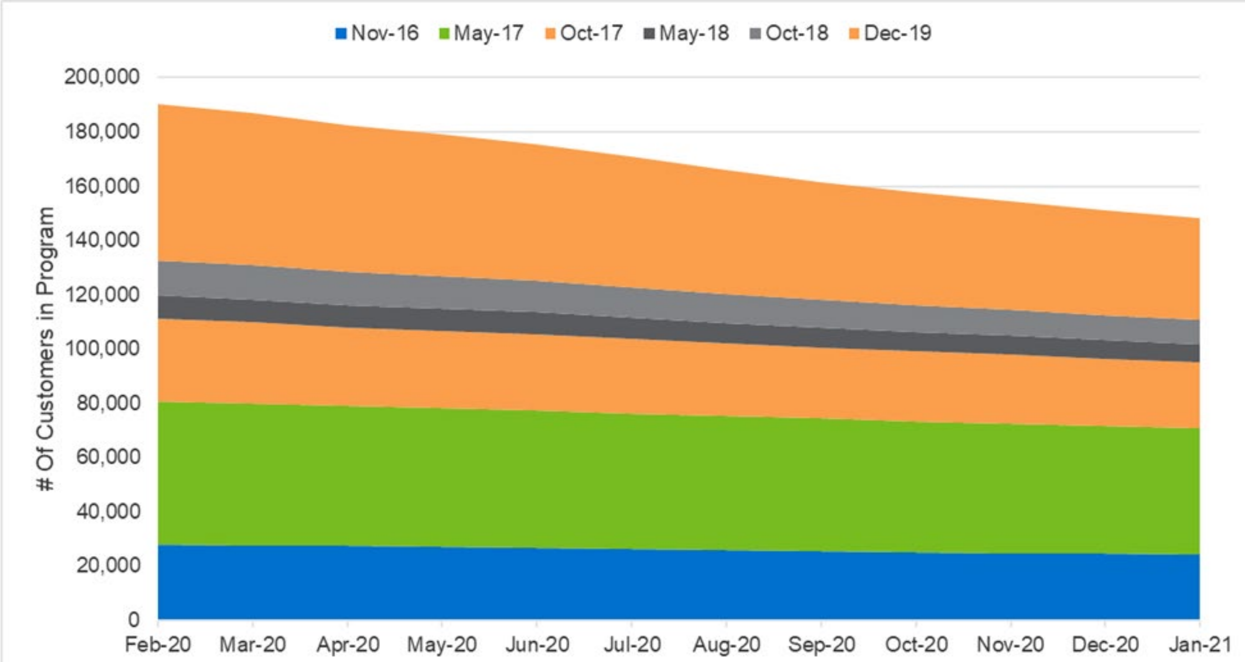


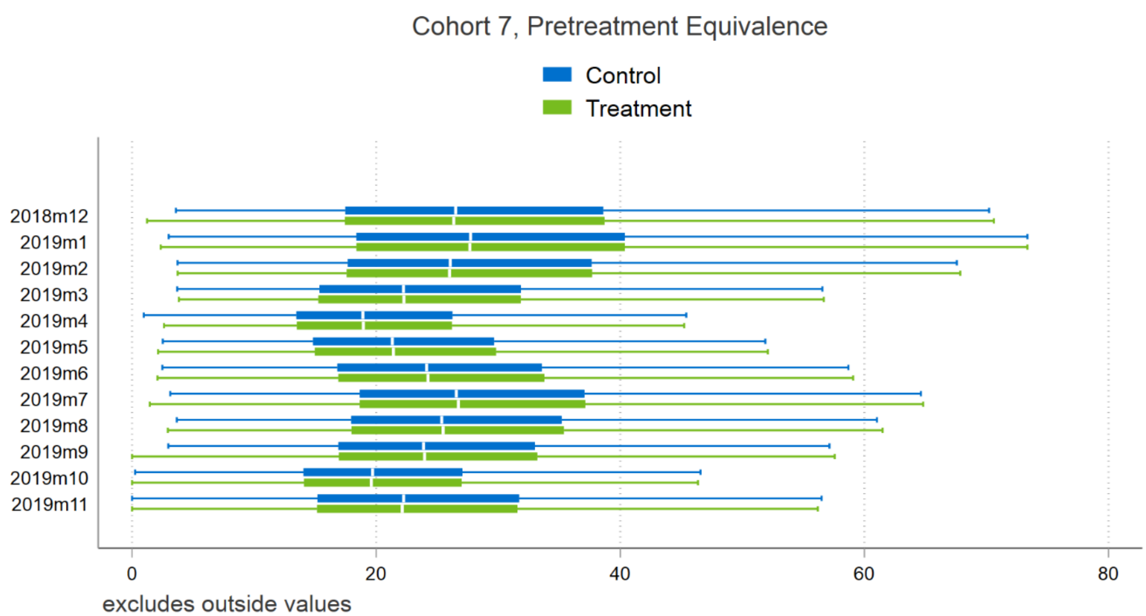
Table 3-6 presents summary information for each of the six cohorts included in Nexant's DEC MF analysis. On an annual basis, the pre-assignment usage is relatively balanced between groups for each of these cohorts, where the largest difference occurs in the first cohort ("November 2016").

Table 3-6: DEC MF Cohort Summary Statistics

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

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

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



3.1.4.3 Duke Energy Progress Single Family

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

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

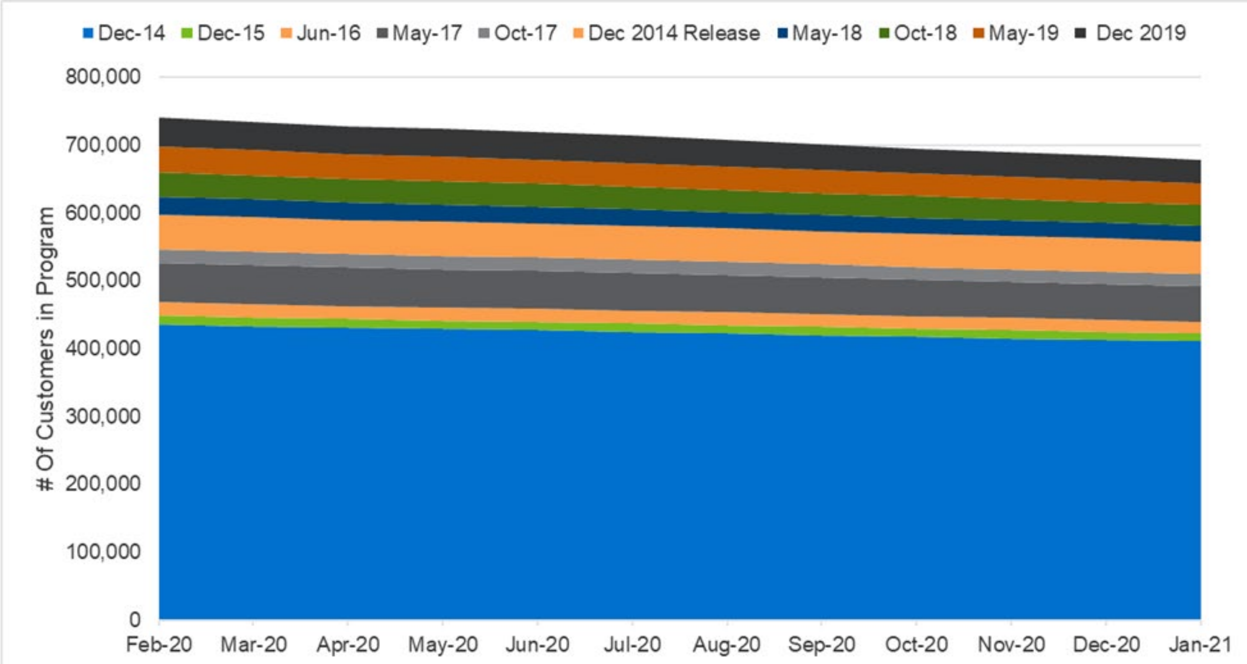


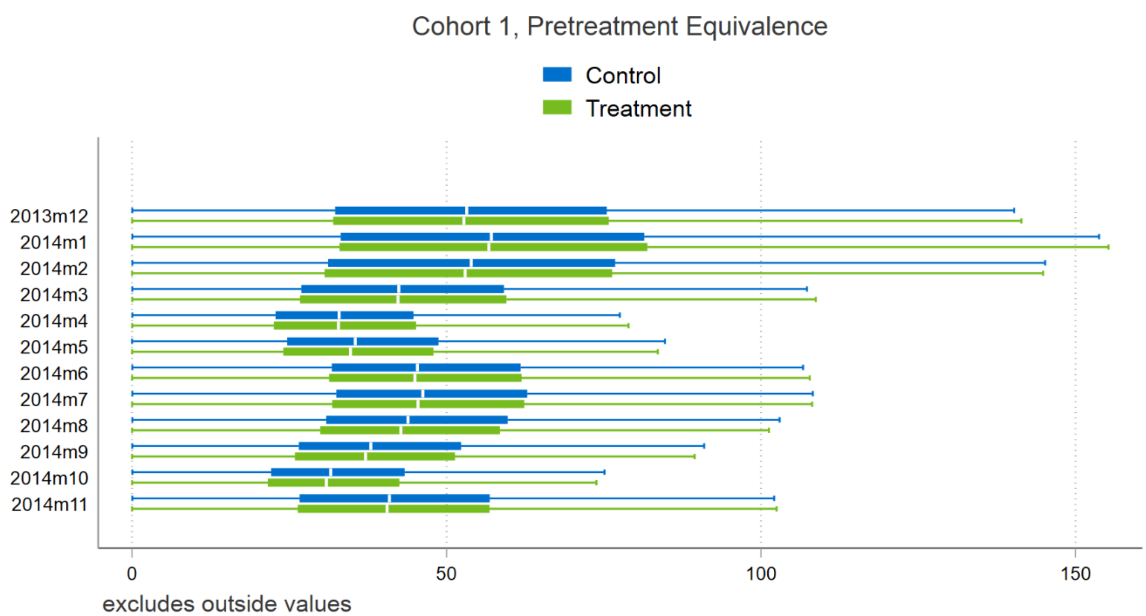
Table 3-7: presents summary information for each of the ten cohorts included in Nexant's analysis, comparing the average annual kWh usage of each cohort's treatment and control group for the 12 months prior to the beginning of assignment. Here as in DEC, on an annual basis, the pre-assignment usage is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

Table 3-7: DEP SF MyHER Cohort Statistics

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

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

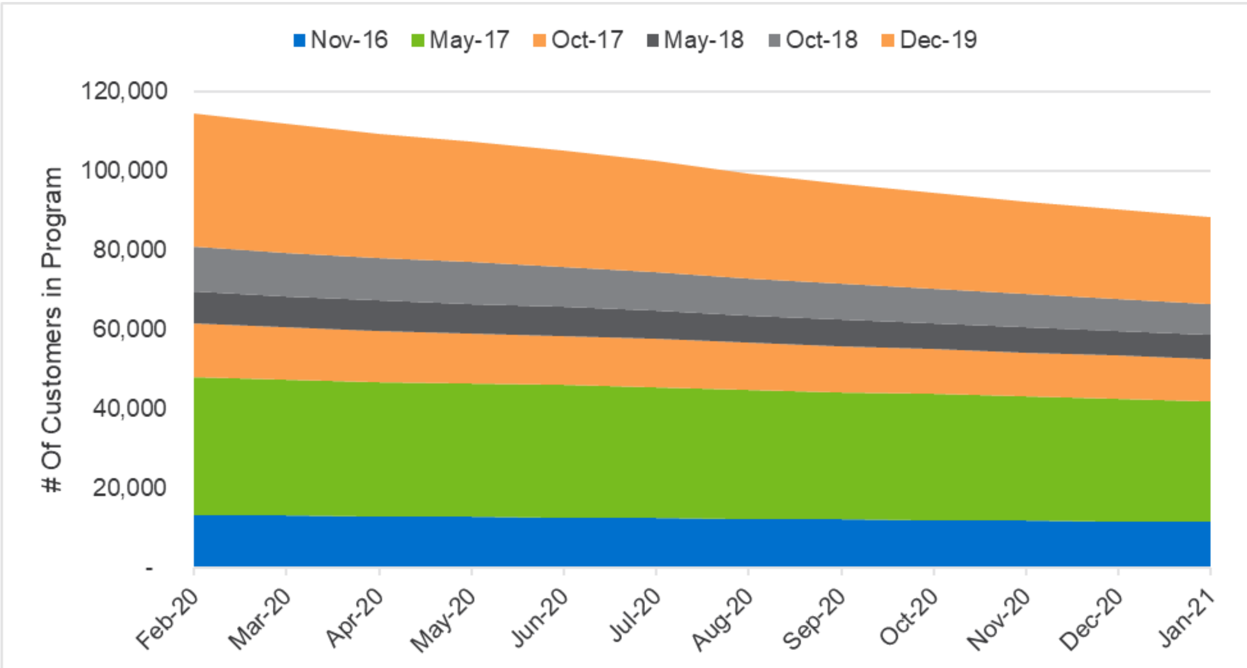
Figure 3-6: DEP SF Difference in Average Pre-treatment Billed Consumption (kWh)



3.1.4.4 Duke Energy Progress Multi-family

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

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



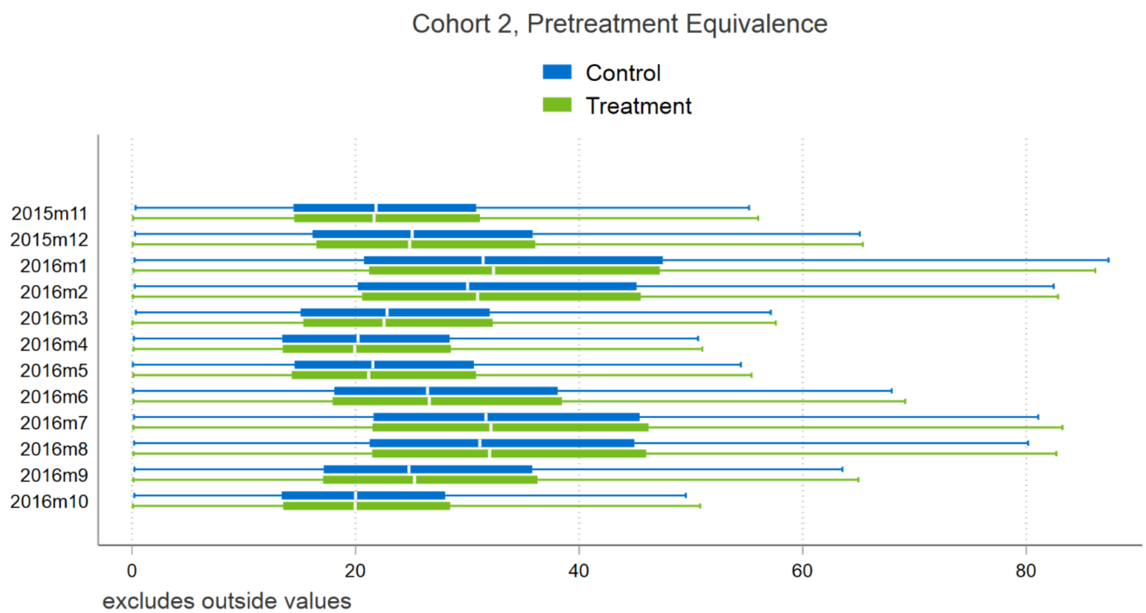
Summary statistics for DEP MF customers are presented in Table 3-8:. Cohort 2 (“May 2017”) is the largest cohort and had the biggest difference in pre-treatment usage of about 170 kWh. Cohort 4 and Cohort 5 are much smaller than the previous cohorts, but they also had the smallest difference in pre-treatment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

Table 3-8: DEP MF MyHER Cohort Summary Statistics

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

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

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



3.1.5 Regression Analysis

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

Equation 3-1: Fixed Effects Model Specification

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

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

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

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

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

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

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

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

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

3.1.6 Dual Participation Analysis

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

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

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

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

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

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

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

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

The MyHER dual participation analysis included the following steps:

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

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

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

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

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

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

Table 3-14: DEC SF Promotional Messaging by Month

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

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

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

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

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

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

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

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

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

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

3.2 Duke Energy Carolinas Impact Findings

3.2.1 Per-home kWh and Percent Impacts

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

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

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

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

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

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

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

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

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

3.2.2 Aggregate Impacts

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

Table 3-21: DEC SF MyHER Aggregate Impacts

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

Table 3-22: DEC MF MyHER Aggregate Impacts

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

3.2.3 Precision of Findings

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

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

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

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

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

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

3.2.4 Impact Estimates by Cohort

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

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

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

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

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

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

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

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

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

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

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

3.2.5 Seasonal Trends

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

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

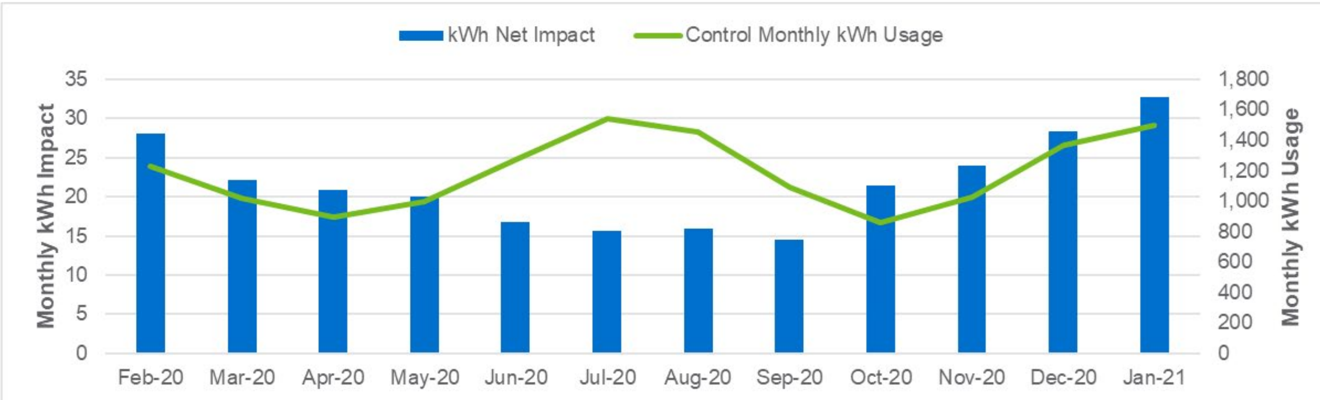
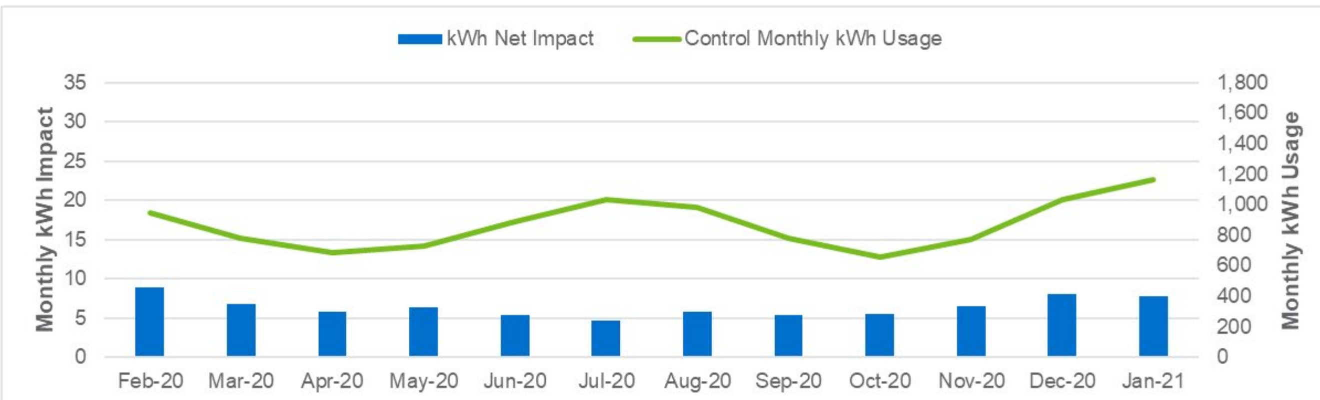


Figure 3-10: DEC MF Average kWh Savings by Month



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

3.2.6 Uplift in Other Duke Energy Programs

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

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

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

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

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

Table 3-30: DEC SF Uplift Percentage by Cohort

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

Table 3-31: DEC MF Uplift Percentage by Cohort

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

3.2.7 Peak Demand Impacts

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

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

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

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

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

3.2.8 Duration of Exposure

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

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

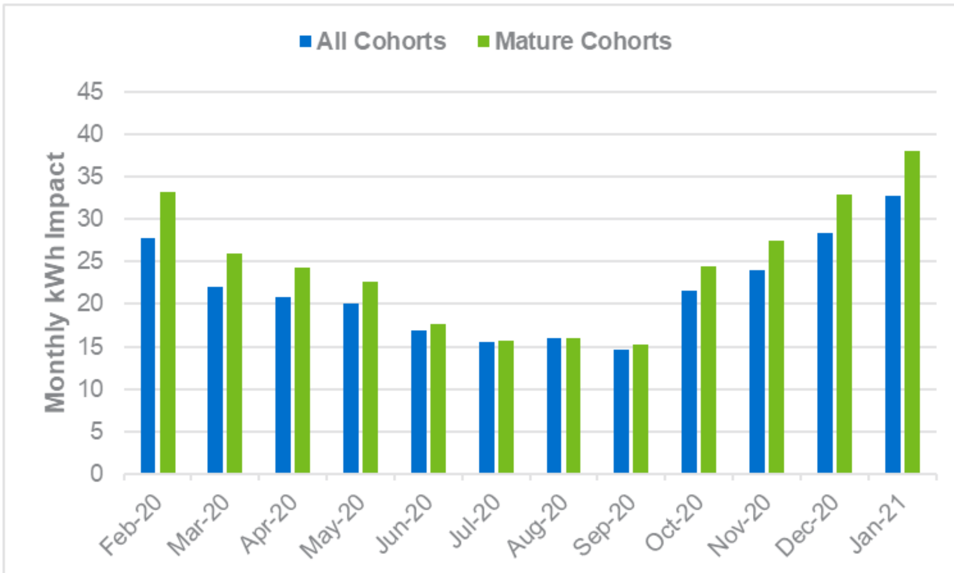
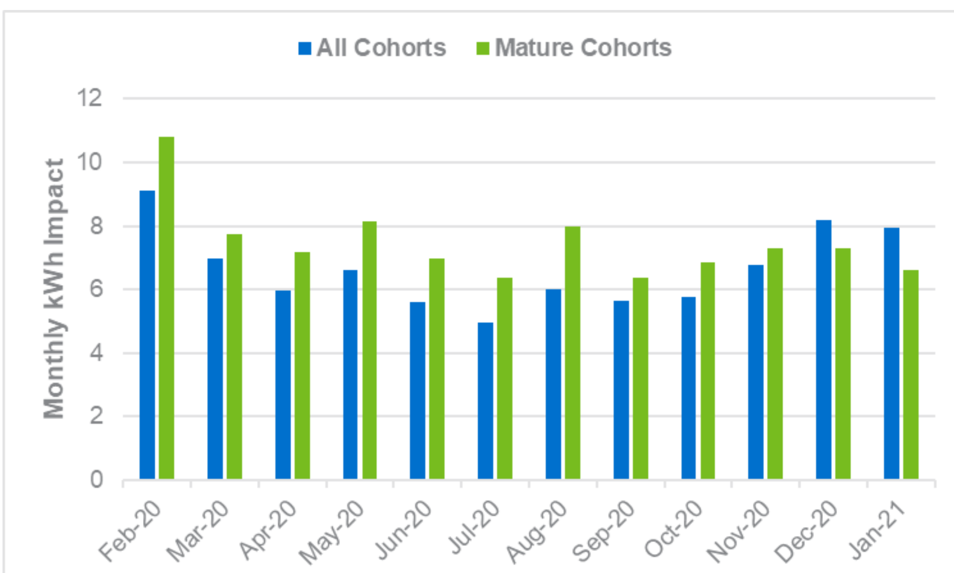


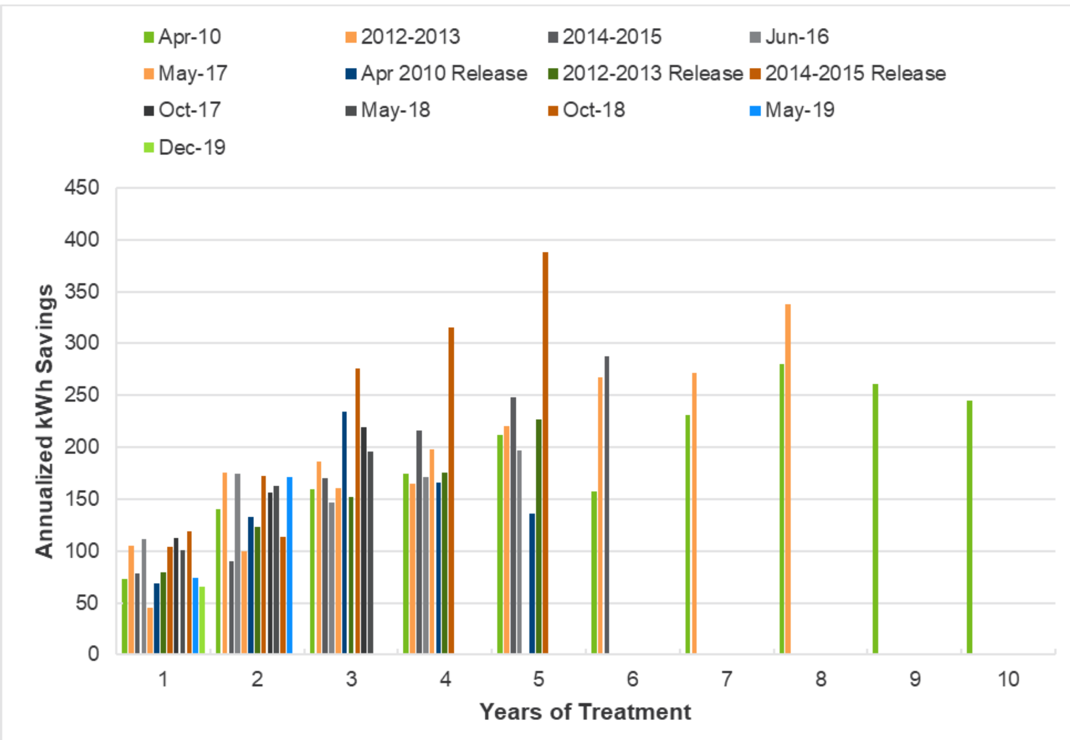
Figure 3-12: DEC MF Comparison of Average Customer Savings to the Savings of the Older Program Participants



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

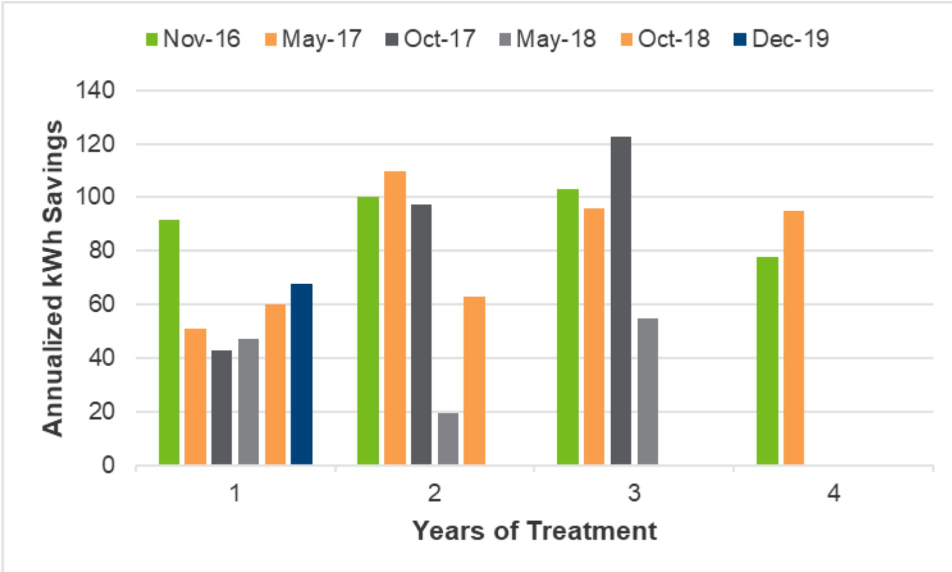
Figure 3-13 displays the annual savings by the number of years a cohort has been in the program for DEC SF MyHER participants. A general upward trend of savings occurs with longer exposure to treatment, however some exceptions are visible. The oldest cohort, which has been in treatment since 2010, shows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

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



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

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



3.3 Duke Energy Progress Impact Findings

3.3.1 Per-home kWh and Percent Impacts

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

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

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

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

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

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

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

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

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

3.3.2 Aggregate Impacts

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

Table 3-36: DEP SF MyHER Aggregate Impacts

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

Table 3-37: DEP MF MyHER Aggregate Impacts

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

3.3.3 Precision of Findings

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

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

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

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

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

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

3.3.4 Impact Estimates by Cohort

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

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

Month	Dec-14	Dec-15	Jun-16	May-17	Oct-17	Dec 2014 Release	May-18	Oct-18	May-19	Dec 2019
Feb-20	34.2	3.4	12.3	14.1	-20.6	24.0	17.7	2.8	4.2	12.8
Mar-20	26.5	3.9	21.9	9.9	2.1	18.5	19.7	5.5	8.1	10.2
Apr-20	18.0	2.3	25.9	3.9	22.3	13.9	25.9	11.1	-2.0	9.2
May-20	19.6	6.0	26.1	3.0	34.1	12.1	26.3	10.7	-1.5	7.6
Jun-20	22.8	7.8	23.8	8.2	37.8	11.5	27.4	10.5	3.5	9.8
Jul-20	24.6	7.6	21.0	8.9	37.5	11.2	27.5	13.5	4.3	8.2
Aug-20	26.5	4.3	20.1	13.9	36.2	11.3	23.1	8.6	7.3	9.5
Sep-20	21.9	1.6	18.0	15.6	31.7	11.3	24.5	11.2	3.9	4.7
Oct-20	17.2	-0.1	20.1	7.6	24.2	12.1	21.5	14.8	5.0	1.9
Nov-20	25.4	9.6	21.7	3.3	5.3	18.7	23.8	9.9	5.3	4.5
Dec-20	36.5	18.1	9.0	0.0	-15.5	24.1	24.0	7.3	10.3	5.9
Jan-21	39.8	14.4	11.0	6.6	-22.1	28.1	23.3	6.6	15.1	9.9
Total	**312.8**	**79.1**	**230.7**	**94.9**	**173.0**	**196.8**	**284.7**	**112.4**	**63.5**	**94.1**

Table 3-41: DEP MF Unadjusted Monthly kWh Impact Estimates by Cohort

Month	Nov-16	May-17	Oct-17	May-18	Oct-18	Dec-19
Feb-20	8.9	7.5	3.7	-4.1	7.3	0.6
Mar-20	14.9	6.1	7.1	5.0	5.8	2.3
Apr-20	15.5	2.0	5.7	4.6	5.3	0.4
May-20	8.0	0.4	6.4	9.6	1.1	0.7
Jun-20	0.0	3.1	6.9	11.5	-7.0	-0.2
Jul-20	-0.8	9.4	-0.4	14.5	-9.8	-2.1
Aug-20	5.0	11.1	1.0	15.0	-5.0	-0.8
Sep-20	8.2	7.4	6.2	12.4	-2.4	0.4
Oct-20	14.1	6.8	10.3	5.1	1.7	0.2
Nov-20	10.6	8.4	4.2	0.8	4.0	0.4
Dec-20	5.5	15.0	-2.0	-6.8	12.6	-1.4
Jan-21	1.6	13.6	2.1	-3.1	14.4	2.6
Total	**91.5**	**90.9**	**51.2**	**64.4**	**27.9**	**2.9**

Table 3-42 and Table 3-43 show the margin of error at the 90% confidence level for each cohort's annual impact estimate for DEP SF and MF, respectively. The combined margin of error for the entire program is lower than the error for any single cohort because the combined program impact estimate is based on a larger pool of customers. Individual cohort margins of error are high for the small cohorts due to the sizes of these groups relative to the underlying variation in consumption among the treatment and control groups constituting each cohort. This is especially relevant when looking at the DEP MF cohorts, which have the smallest customer counts in the MyHER program.

Table 3-42: DEP SF 90% Confidence Intervals Associated with Cohort Savings Estimates

Cohort	Margin of Error at 90% Confidence Level	Lower Bound (kWh)	Point Estimate (kWh)	Upper Bound (kWh)
Dec-14	60.6	252.2	312.8	373.4
Dec-15	216.5	-137.4	79.1	295.6
Jun-16	160.8	69.9	230.7	391.5
May-17	195.0	-100.0	94.9	289.9
Oct-17	168.4	4.6	173.0	341.4
Dec 2014 Release	82.3	114.5	196.8	279.2
May-18	185.6	99.1	284.7	470.3
Oct-18	171.0	-58.6	112.4	283.5
May-19	196.1	-132.6	63.5	259.6
Dec 2019	144.7	-50.7	94.1	238.8

Table 3-43: DEP MF 90% Confidence Intervals Associated with Cohort Savings Estimates

Cohort	Margin of Error at 90% Confidence Level	Lower Bound (kWh)	Point Estimate (kWh)	Upper Bound (kWh)
Nov-16	236.5	-145.0	91.5	328.1
May-17	155.0	-64.1	90.9	245.9
Oct-17	141.9	-90.7	51.2	193.0
May-18	153.5	-89.2	64.4	217.9
Oct-18	136.3	-108.4	27.9	164.2
Dec-19	80.2	-77.4	2.9	83.1

3.3.5 Seasonal Trends

There is a clear seasonal pattern to the DEP SF and MF MyHER savings profiles. SF and MF customers both consistently experience the greatest reductions in winter and the smallest, sometimes negative, reductions in summer. The blue bars in Figure 3-15 and Figure 3-16 show the average estimated monthly treatment effect for the program in each bill month from February 2020 to January 2021. The green series in Figure 3-15 and Figure 3-16 show the average control customer's load during the same time period. Annual electricity consumption for SF and MF customers is bimodal, with peaks in both summer and winter, and the results for DEP SF customers are also bimodal, unlike the DEC SF customers. DEP MF customers follow a different trend, with their highest impacts in the fall and winter months.

Figure 3-15: DEP SF Average kWh Savings by Month

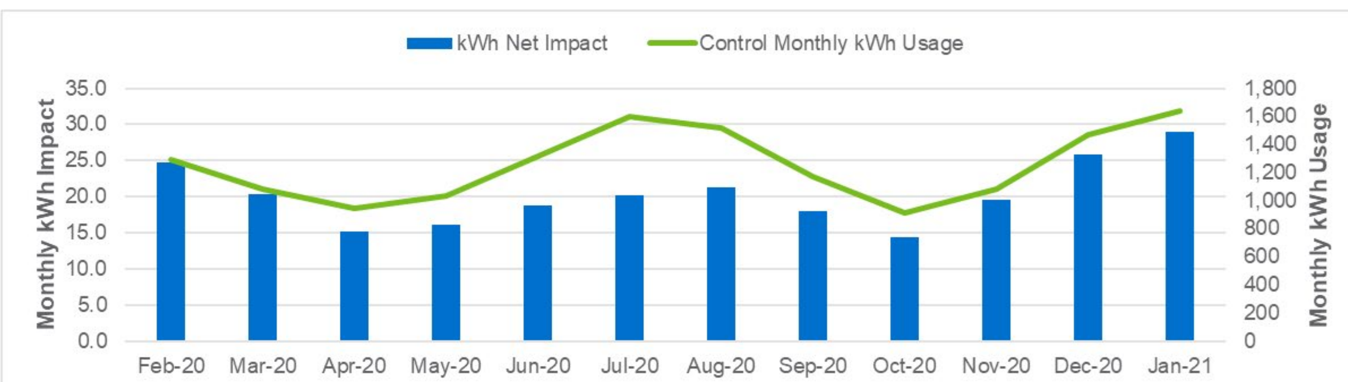
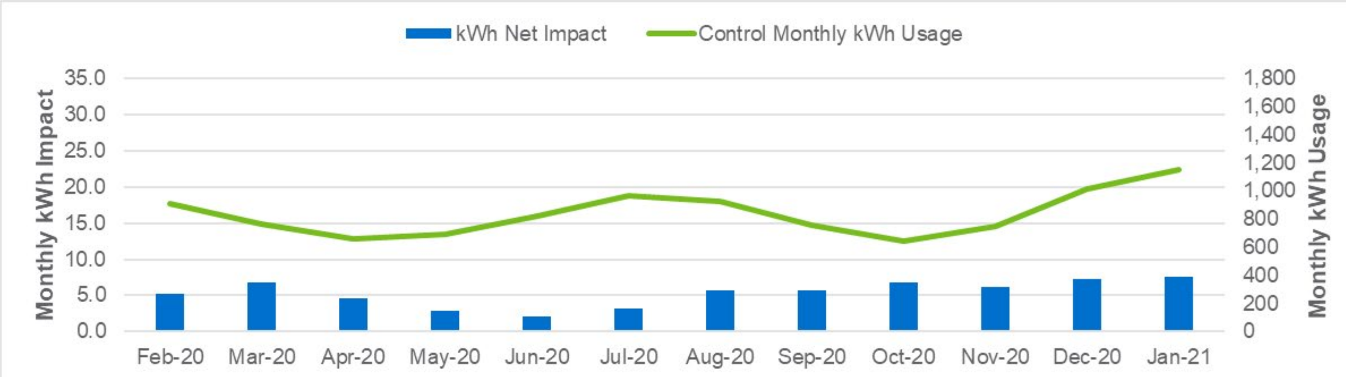


Figure 3-16: DEP MF Average kWh Savings by Month



Based on the observed savings trends among DEP MF and SF customers, MyHER is generally realizing the greatest impacts in the winter months, but DEP MyHER participants do relatively better in the summer months than the DEC MyHER participants.

3.3.6 Uplift in Other Duke Energy Programs

Section 3.1.6 outlined the methodology Nexant used to calculate the annual kWh savings attributable to increased participation in other Duke Energy programs. Table 3-44 presents the downward adjustment per home that was applied to impacts in order to avoid double-counting savings from February 2020 to January 2021. For DEP SF, the uplift was determined to be 3.19 kWh per home, or 2.31 GWh in aggregate. For DEP MF, the uplift was determined to be 1.00 kWh per home, or 0.07 GWh in aggregate.

Table 3-44: Monthly Adjustment for Overlapping Participation in Other EE Programs

Month	DEP SF Incremental kWh from Other EE Programs	DEP MF Incremental kWh from Other EE Programs
Feb-20	0.17	0.04
Mar-20	0.17	0.04
Apr-20	0.18	0.08
May-20	0.19	0.11
Jun-20	0.33	0.13
Jul-20	0.25	0.10
Aug-20	0.25	0.13
Sep-20	0.27	0.05
Oct-20	0.29	0.06
Nov-20	0.32	0.10
Dec-20	0.38	0.06
Jan-21	0.38	0.09
12-month Total	**3.19**	**1.00**

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

Table 3-45 and Table 3-46 show the average daily energy savings attributable to tracked energy efficiency measures as of January 2021 by cohort and calculates an uplift percentage. In all but two SF and one MF cohort the treatment group showed a higher propensity to adopt measures through Duke Energy programs than the control group.

Table 3-45: DEP SF Uplift Percentage by Cohort

Cohort	Monthly Net kWh Savings from EE (Treatment Group)	Monthly Net kWh Savings from EE (Control Group)	Uplift Percentage
Dec 2014	7.7	7.5	3.0%
Dec 2015	7.6	7.2	4.7%
Jun 2016	7.8	7.7	0.4%
May 2017	7.6	7.0	8.2%
Oct 2017	8.0	8.2	-2.5%
Dec 2014 Release	7.9	7.5	4.9%
May 2018	8.5	6.7	27.4%
Oct 2018	9.1	8.9	2.0%
May 2019	8.1	8.2	-1.1%
Dec 2019	6.8	6.6	2.4%

Table 3-46: DEP MF Uplift Percentage by Cohort

Cohort	Monthly Net kWh Savings from EE (Treatment Group)	Monthly Net kWh Savings from EE (Control Group)	Uplift Percentage
Nov-16	6.2	5.8	9%
May-17	4.5	4.5	0%
Oct-17	7.7	7.4	5%
May-18	7.9	6.6	21%
Oct-18	8.9	8.9	0%
Dec-19	7.4	8.0	-8%

3.3.7 Peak Demand Impacts

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

With regards to summer impacts: for single-family, Nexant applied the proportion of annual residential load in this hour to our annual MyHER impact savings estimate of 243.2 kWh; the result is an estimated MyHER residential peak demand savings of 0.047 kW. For multi-family, Nexant applied the proportion of annual residential load in this hour to our annual MyHER impact savings estimate of 64.1 kWh; the result is an estimated MyHER residential peak demand savings of 0.012 kW.

In the winter peak period, Nexant used the same method but applied the results to the proportion of annual usage during the January peak of hour ending 8:00 AM. For single family, Nexant estimated savings of 0.043 kW and for multi-family, Nexant estimated savings of 0.011 kW per customer during the winter peak hour.

Table 3-47: DEP MyHER Summer and Winter Demand Impacts

Season	Segment	Participant Count	Per Home kW Savings	Aggregate MW
Summer	Single Family	721,741	0.0468	33.77
	Multi-family	69,653	0.0123	0.86
Winter	Single Family	721,741	0.0432	31.19
	Multi-family	69,653	0.0114	0.79

3.3.8 Duration of Exposure

Home energy report evaluations in North America consistently find a trend of increasing savings with length of treatment. For DEP SF, Cohorts 1-6 have been exposed to treatment for longer than three years and provide 87% of aggregate savings, while comprising 79% of the population. For DEP MF, Cohorts 2-4[12] have been in the program for longer than three years and provide 68% of aggregate savings while comprising 68% of the population. A comparison of monthly impacts between the average customer and customers in the oldest cohorts are presented in Figure 3-17 and Figure 3-18.

[12] Cohort 1 is a catchall cohort for MF customers who were assigned before Nov 2016 and did not fit a reasonable definition of a cohort.

Figure 3-17: DEP SF Comparison of Average Customer Savings to the Savings of the Older Program Participants

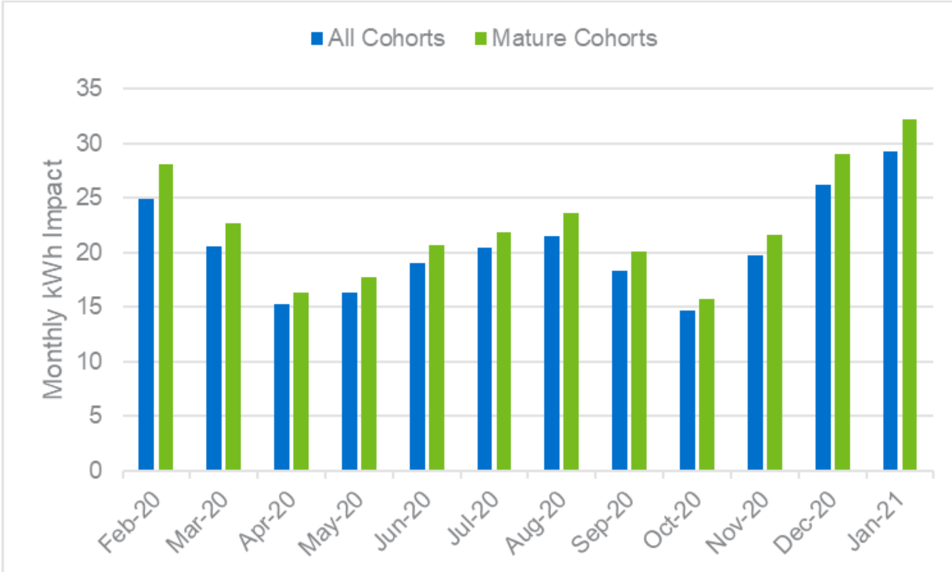


Figure 3-18: DEP MF Comparison of Average Customer Savings to the Savings of the Older Program Participants

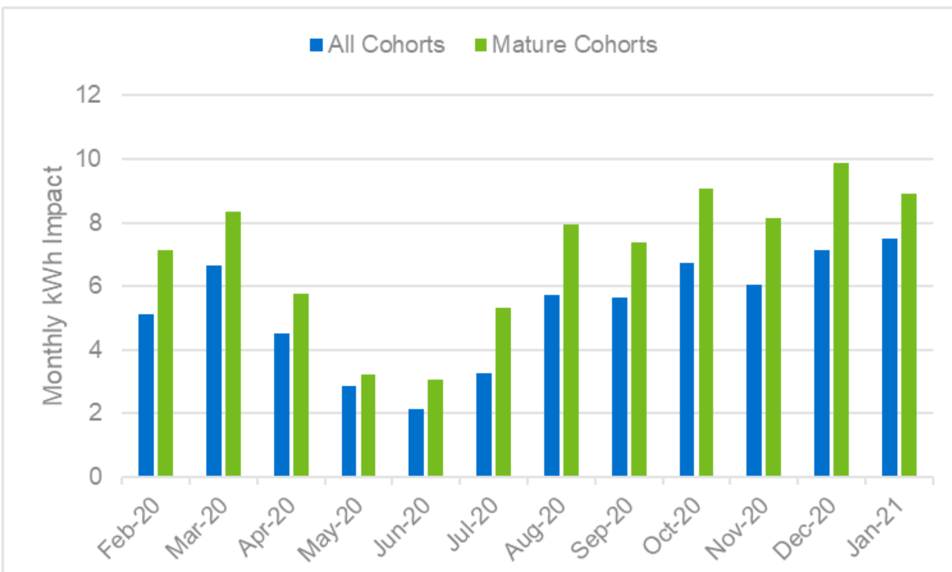


Figure 3-19 displays the annual savings for each year of treatment among the DEP SF MyHER cohorts. Like DEC SF, there is a general increase in savings across the first few years of the program, followed by a leveling out in some of the later years. This trend holds for some of the older cohorts who see continued increases in impacts before leveling out in year four or five. The same information for DEP MF customers is displayed in Figure 3-20, where the oldest cohorts see a large increase in savings between year three and year four. The other cohorts do not show a clear trend but are still in their infancy, results for MF customers will be revisited in future reports on the DEP MyHER program.

Figure 3-19: DEP SF Annual Savings by Duration of Exposure

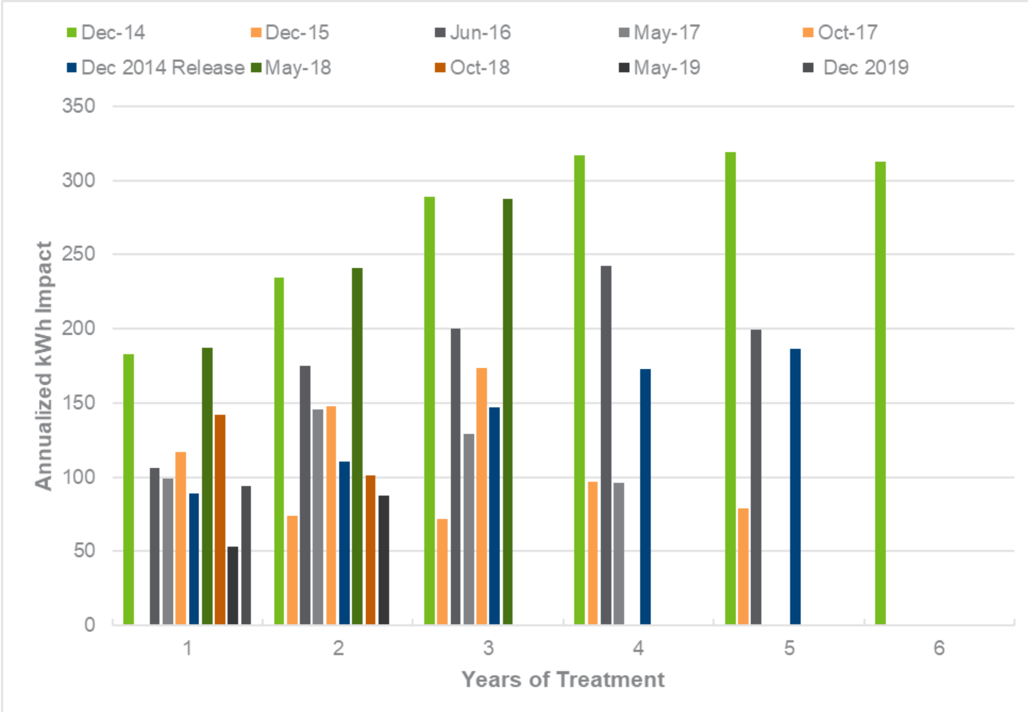
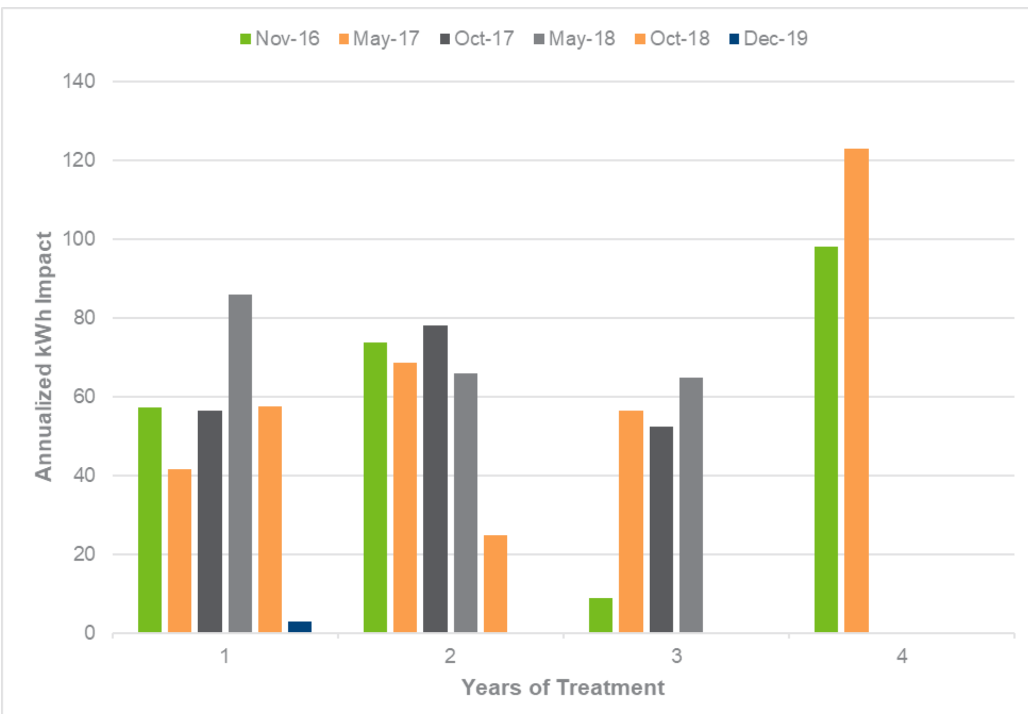


Figure 3-20: DEP MF Annual Savings by Duration of Exposure



3.1 DEC MyHER Interactive Portal

Nexant also evaluated the incremental energy savings generated by Duke Energy's online enhancement to the standard MyHER report, which has been available to Duke Energy MyHER treatment customers since 2015. The portal offers additional means for customers to customize or update Duke Energy's data on their premises, demographics, and other characteristics that affect consumption and MyHER's classification of each customer.

The portal provides additional custom tips based on updated data provided by the customer. MyHER Interactive also sends weekly email challenges that seek to engage customers in active energy management, additional efficiency upgrades, and conservation behaviors. Nexant evaluated the impacts of the MyHER Interactive Portal using a matched comparison group because MyHER Interactive is not deployed as a randomized controlled trial (RCT).

3.1.1 Estimation Procedures for MyHER Interactive

A matched comparison group is an accepted approach for establishing a counterfactual baseline when there is no random assignment to treatment and control. The goal of matching estimators is to estimate impacts by matching treatment customers to similar customers that did not participate in the program. The key assumption to matched comparison approaches is that MyHER Interactive participants closely resemble non-participants, except for the fact that one of these two groups participated in the program while the other did not. When a strong comparison group is established, evaluators can reliably conclude that any differences observed after enrollment are due to program's stimulus. In using a matched comparison group to estimate energy savings due to exposure to MyHER Interactive, the same statistical modeling approach is used to estimate energy savings impacts as was used for estimating energy savings for the program overall (i.e., with linear fixed effects regression (LFER) estimation).

Duke Energy provided Nexant with MyHER participant enrollment information for the Interactive portal. A total of 126,485 DEC SF and 15,202 DEC MF MyHER treatment customers signed up to use the portal. For DEC SF, 12.7% of Interactive users signed into the portal more than once, and 6.1% signed in more than twice between February 2020 and January 2021. For DEC MF, 14.7% of Interactive users signed into the portal more than once, and 6.6% signed in more than twice between February 2020 and January 2021. The average DEC SF interactive user logged in 0.8 times and the average DEC MF interactive user logged in to interactive 0.9 times – about 64% of registered users recorded no sessions logged in. Excluding customers that never logged in, single family Interactive users logged in on average 2.4 times, and multi-family users logged in on average 2 times.

In order for the LFER regression model to generate monthly energy savings attributable to Interactive, the customer data that the regression model uses to make the estimates must use a year of pre-treatment data. For DEC SF, 92,250 of the Interactive users (73%) had sufficient data available for the LFER analysis before their enrollment in MyHER. In the DEC MF segment, 13,690 Interactive users (90%) had sufficient data to be included in the LFER analysis. Figure 3-21 and Figure 3-22: DEC MF MyHER Interactive Portal Enrollment plot the total number of customers enrolled in MyHER Interactive as well as the subset in the analysis for each month of the 12-month period February 2020 to January 2021 for DEC SF and MF, respectively.[13]

Figure 3-21: DEC SF MyHER Interactive Portal Enrollment

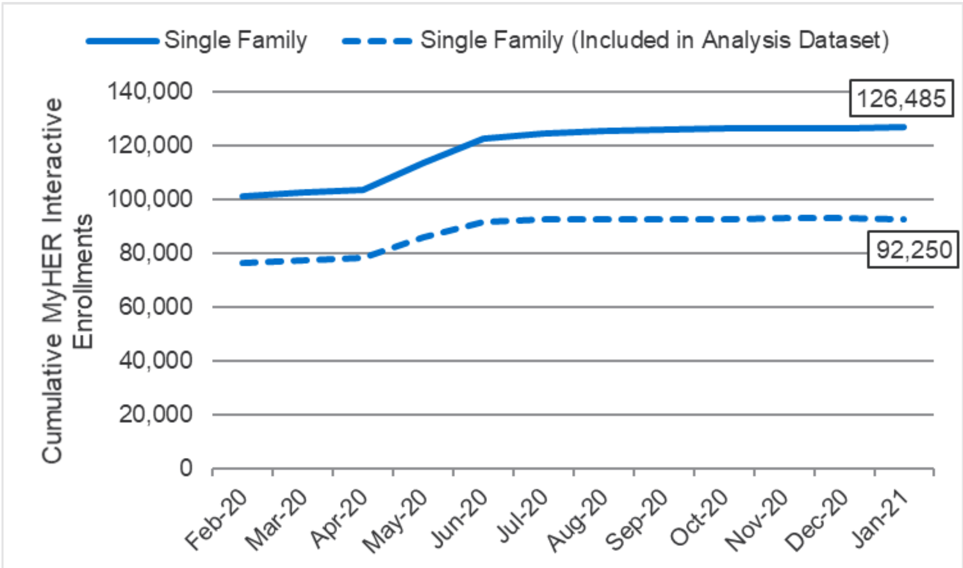
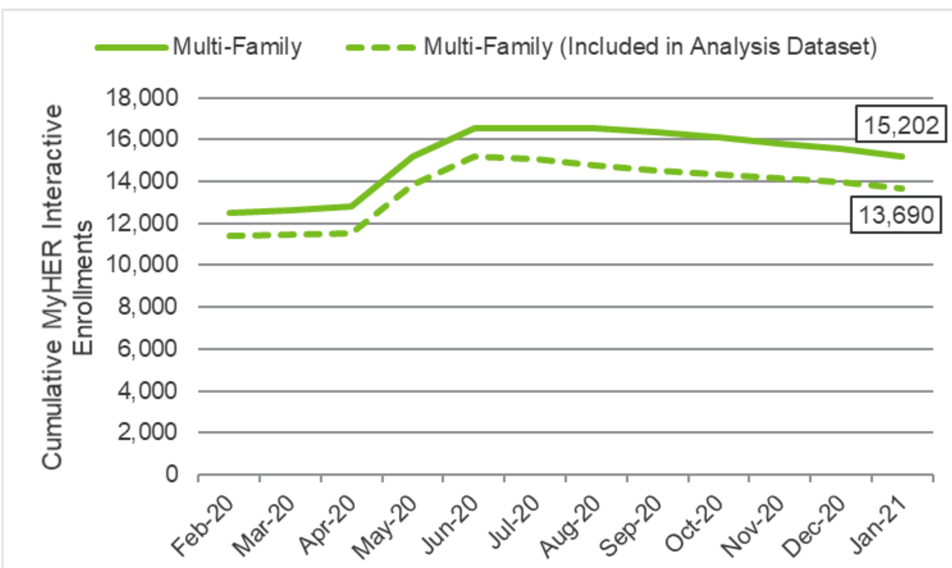


Figure 3-22: DEC MF MyHER Interactive Portal Enrollment

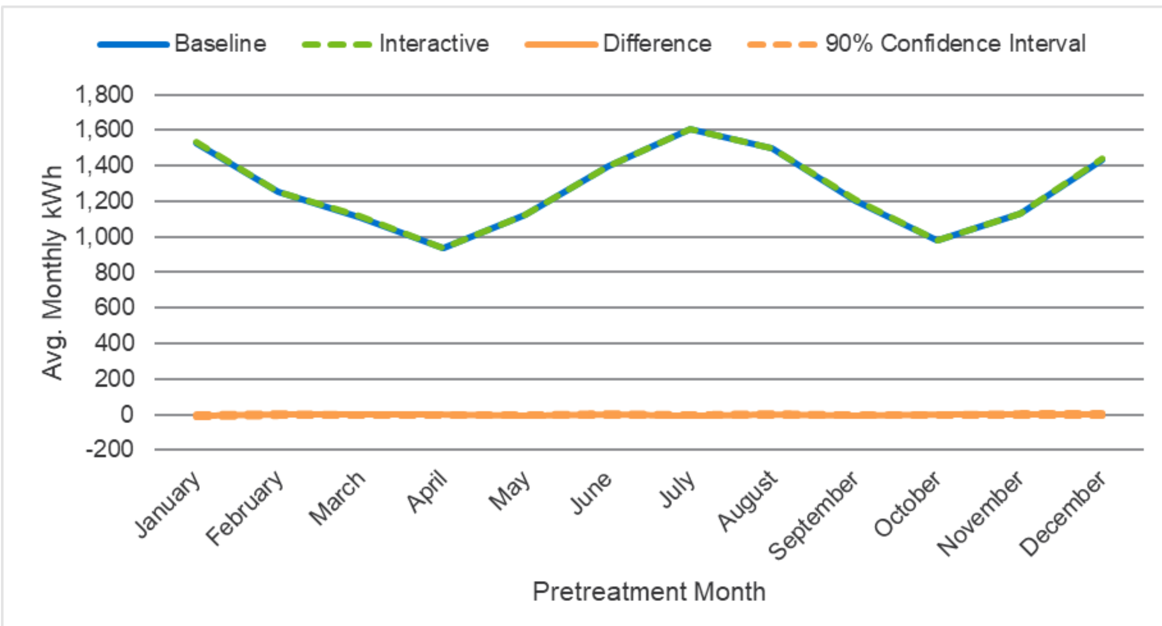


13 A total of 26,443 interactive customers were excluded from analysis due to incomplete pretreatment data (missing 12 full months) ; the totals in Figure 3-21 and Figure 3-22: DEC MF MyHER Interactive Portal Enrollment

additionally exclude Interactive users who enrolled after the evaluation period ended, a total of 1,658 customers.

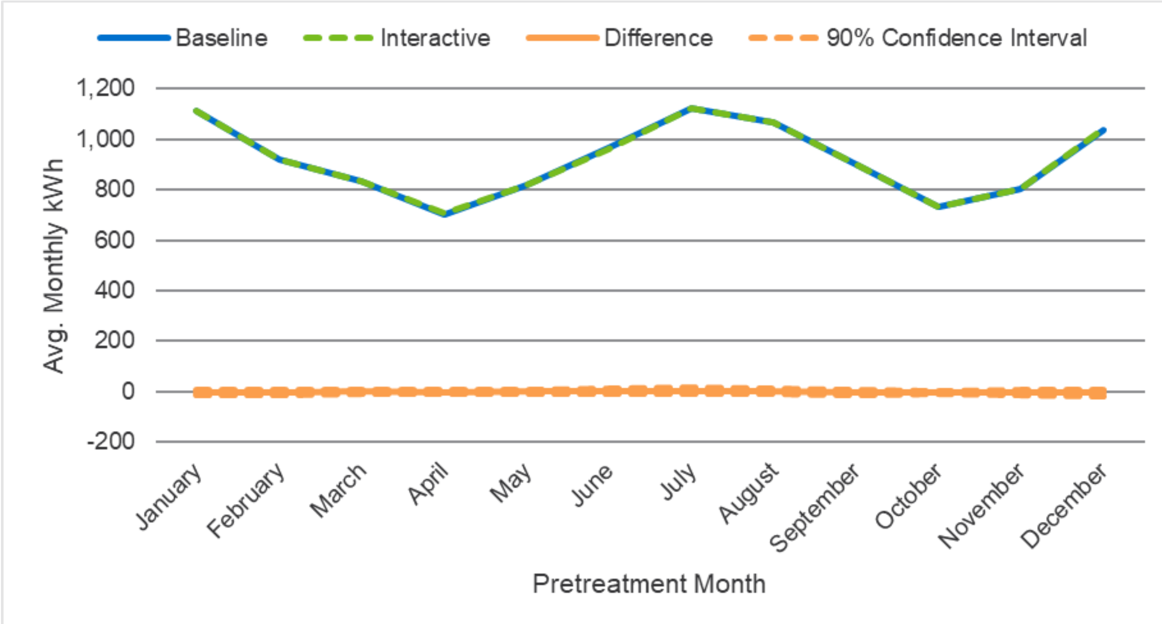
For DEC SF, the Interactive customers used in the estimation analysis were matched on pre-interactive usage based on their cohort and segment. Figure 3-23 presents the pre-treatment consumption for MyHER Interactive customers and a matched comparison group comprised of MyHER customers that have not enrolled in Interactive for the DEC and had complete pretreatment data. The matching approach generates two groups with nearly identical consumption patterns over the time period prior to customers' enrollment in MyHER Interactive. On average, the difference in monthly usage between the matched control group and the DEC SF Interactive treatment group is -0.2%. The fixed effects model specification Nexant applies controls for these pre-treatment differences, as discussed earlier in Section 3.1.5.

Figure 3-23: DEC SF MyHER Interactive Portal Customers and Matched Comparison Group Pretreatment Enrollment Periods



For DEC MF, the Interactive customers used in the estimation analysis were also matched on their pretreatment usage depending on their treatment cohort. Note that as in the primary MyHER impact analysis, customers in DEC MF Cohort 1 were removed from the analysis due to their being no consistent pre-treatment period across that group. Figure 3-24 presents the pre-treatment consumption for MyHER Interactive customers and a matched comparison group comprised of MyHER that were not enrolled in Interactive and share the same treatment cohort. The matching approach generates two groups with nearly identical consumption patterns over the time period prior to customers' enrollment in MyHER Interactive. On average, the difference in monthly usage between the matched control group and the DEP Interactive treatment group is -0.1% The fixed effects model specification Nexant applies controls for these pre-treatment differences, as discussed earlier in Section 3.1.5.

Figure 3-24: DEC MF MyHER Interactive Portal Customers and Matched Comparison Group –Pre-Interactive Enrollment Periods



3.1.2 Results and Precision

For DEC SF, the average monthly impact across the 12-month period February 2020 to January 2021 was 0.9 kWh or 10.5 kWh annually per customer, representing the uplift in savings that MyHER Interactive produces over and above the savings produced by the paper MyHER, although this impact is not statistically significant at the 90% level of confidence. In aggregate, the DEC SF MyHER Interactive Portal would equal 0.92 GWh of annual savings, incremental to the MyHER reports, however, the treatment effect is not distinguishable from zero. These high-level findings are summarized in Table 3-48.

Table 3-48: 90% Confidence Intervals Associated with DEC SF MyHER Interactive Annual Impact Estimates

Parameter	Lower Bound (90%)	Point Estimate	Upper Bound (90%)
Evaluation Period Savings per Home (kWh)	-94.6	10.5	115.5
Percent Reduction	-0.64%	0.07%	0.79%
Aggregate Impact (GWh)	-8.33	0.92	10.18

On a month-to-month basis, energy impacts were statistically significant and positive during the months of February, March, and April and range from 0.7% to 1.1% or from 6 to 13 kWh on an absolute basis. There were also statistically significant increases in electric usage of about 0.5% during the summer from August to October.

Figure 3-25 illustrates the estimated impact and 90% confidence band (the orange lines and orange dashed lines) by month. Also shown as blue bars are counts of Interactive user sessions. During earlier years of the Interactive deployment, there was a correlation between statistically significant impacts and times of high Interactive usage, but there is currently no evidence of that relationship.

Figure 3-25: DEC SF MyHER Interactive Portal Energy Impacts

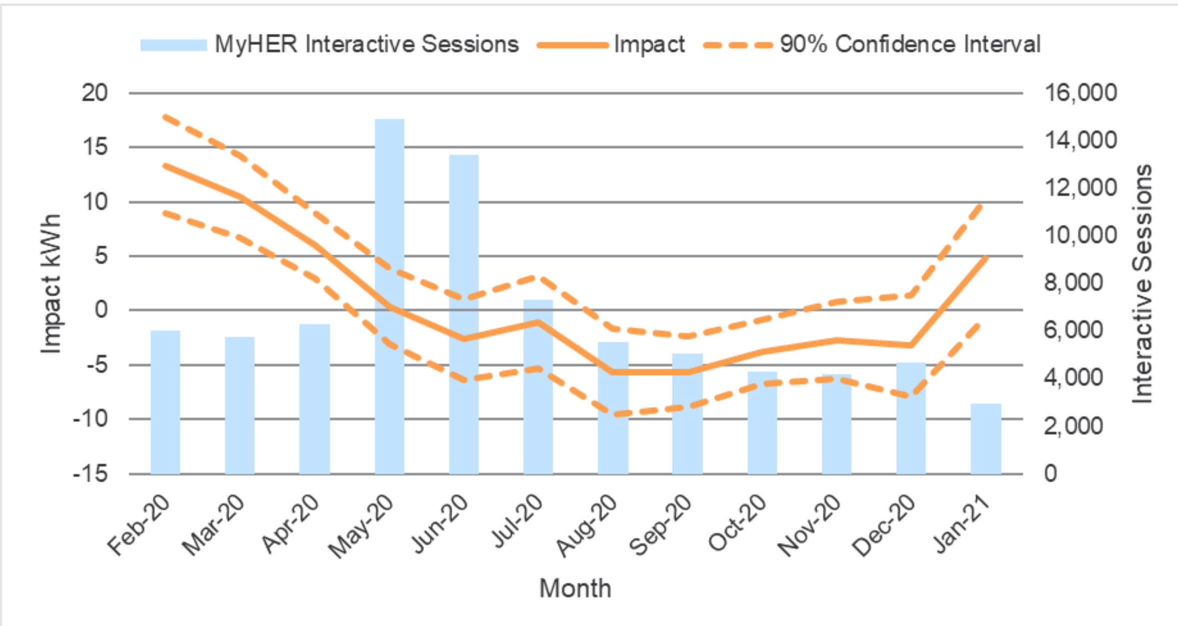


Table 3-49: provides impact model results for DEC SF, along with the margin of error for estimated impacts. The column at the right side of the table shows asterisks for those months where the energy savings are statistically significant at the 90% level of confidence.

Table 3-49: DEC SF MyHER Interactive Monthly Energy Savings

Month	Number of Participants Analyzed	MyHER Interactive Signups	Monthly kWh			90% Conf. Interval		% Impact	
			Non-Participants	Participants	Impact				
Feb-20	76,284	5,998	1,194.0	1,180.6	13.4	8.9	17.8	1.1%	*
Mar-20	77,206	5,731	1,061.9	1,051.4	10.5	6.7	14.2	1.0%	*
Apr-20	78,147	6,264	911.5	905.5	6.0	2.9	9.0	0.7%	*
May-20	86,041	14,897	1,044.2	1,043.8	0.4	-3.0	3.9	0.04%	
Jun-20	91,610	13,405	1,298.9	1,301.5	-2.6	-6.4	1.1	-0.2%	
Jul-20	92,261	7,308	1,621.5	1,622.5	-1.0	-5.3	3.2	-0.1%	
Aug-20	92,531	5,550	1,525.0	1,530.6	-5.6	-9.6	-1.7	-0.4%	*
Sep-20	92,685	5,061	1,109.4	1,115.0	-5.6	-8.9	-2.4	-0.5%	*
Oct-20	92,685	4,283	898.6	902.4	-3.8	-6.8	-0.8	-0.4%	*
Nov-20	92,728	4,193	1,027.1	1,029.8	-2.7	-6.3	0.9	-0.3%	
Dec-20	92,864	4,672	1,419.7	1,422.9	-3.2	-7.9	1.5	-0.2%	
Jan-21	92,250	2,955	1,553.7	1,548.8	4.8	-0.6	10.3	0.3%	
Average	**88,108**	**6,693**	**1,222.1**	**1,221.3**	**0.9**	**-7.9**	**9.6**	**0.1%**	

For DEC MF (Table 3-50), the average monthly impact across the 12-month period February 2020 to January 2021 was 1.2 kWh, or 14.6 kWh annually, representing the uplift in savings that MyHER Interactive produces over and above the savings produced by the paper MyHER, but this estimate is not statistically significant at the 90% level of confidence. The aggregate annual impact for DEC MF interactive customers is estimated to be 0.20 GWh, which is also not statistically significant at the 90% confidence level.

Table 3-50: 90% Confidence Intervals Associated with DEC MF MyHER Interactive Annual Impact Estimates

Parameter	Lower Bound (90%)	Point Estimate	Upper Bound (90%)
Evaluation Period Savings per Home (kWh)	-123.9	14.6	153.0
Percent Reduction	-1.11%	0.13%	1.38%
Aggregate Impact (GWh)	-1.69	0.20	2.09

On a month-to-month basis, energy impacts were statistically significant only during January, February, and December, with impacts ranging from 8.8 kWh to 12.1 kWh

Figure 3-26 illustrates the estimated impact and 90% confidence band (the orange lines and orange dashed lines) by month. Also shown as blue bars are counts of Interactive sessions.

Figure 3-26: DEC MF MyHER Interactive Portal Energy Impacts

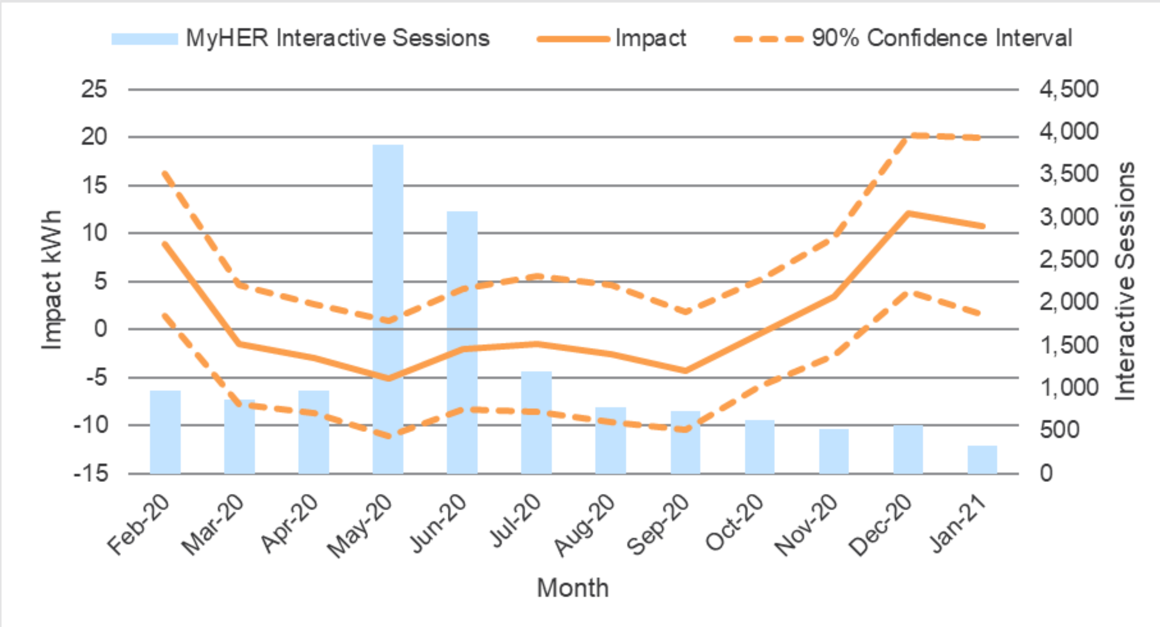


Table 3-51 provides impact model results for DEC MF, along with the margin of error for estimated impacts. The column at the right side of the table shows asterisks for those months where the energy savings are statistically significant at the 90% level of confidence.

Table 3-51: DEC MF MyHER Interactive Monthly Energy Savings

Month	Number of Participants Analyzed	MyHER Interactive Signups	Monthly kWh			90% Conf. Interval		% Impact	
			Non-Participants	Participants	Impact				
Feb-20	11,426	971	933.5	924.6	8.8	1.4	16.3	0.9%	*
Mar-20	11,483	865	829.3	830.9	-1.6	-7.8	4.7	-0.2%	
Apr-20	11,510	969	716.1	719.1	-3.0	-8.7	2.7	-0.4%	
May-20	13,841	3,853	795.9	801.0	-5.1	-11.1	0.8	-0.6%	
Jun-20	15,184	3,070	943.3	945.4	-2.1	-8.3	4.2	-0.2%	
Jul-20	15,050	1,187	1,139.3	1,140.8	-1.5	-8.6	5.6	-0.1%	
Aug-20	14,775	776	1,092.2	1,094.8	-2.5	-9.7	4.6	-0.2%	
Sep-20	14,517	727	831.8	836.1	-4.3	-10.5	1.8	-0.5%	
Oct-20	14,322	620	713.9	714.3	-0.4	-5.9	5.2	-0.1%	
Nov-20	14,153	523	804.4	801.0	3.4	-2.7	9.5	0.4%	
Dec-20	13,950	571	1,103.2	1,091.1	12.1	4.0	20.3	1.1%	*
Jan-21	13,690	331	1,225.0	1,214.3	10.7	1.5	20.0	0.9%	*
Average	**13,658**	**1,205**	**927.3**	**926.1**	**1.2**	**-10.3**	**12.8**	**0.1%**	

Nexant concludes that the DEC SF MyHER Interactive portal succeeded in generating additional statistically significant savings during some of the winter months in the time frame from February 2020 to January 2021 while observing some significant increases in usage during the summer months. The DEC MF MyHER Interactive portal only achieved additional statistically significant savings for three winter months during the evaluation period.

3.2 DEP MyHER Interactive Portal

Nexant also evaluated the incremental energy savings generated by Duke Energy's enhancement to the standard MyHER report, which has been available to MyHER treatment customers since 2015. The portal offers additional means for customers to customize or update Duke Energy's data on their premises, demographics, and other characteristics that affect consumption and MyHER's classification of each customer.

The portal additionally provides custom tips based on updated data provided by the customer. MyHER Interactive also sends weekly email challenges that seek to engage customers in active energy management, additional efficiency upgrades, and conservation behaviors. Nexant evaluated the impacts of the MyHER Interactive Portal using a matched comparison group because MyHER Interactive is not deployed as a randomized controlled trial (RCT).

3.2.1 Estimation Procedures for MyHER Interactive

A matched comparison group is a standard approach for establishing a counterfactual baseline when there is no random assignment to treatment and control. The goal of matching estimators is to estimate impacts by matching treatment customers to similar customers that did not participate in the program. The key assumption to matched comparison approaches is that MyHER Interactive participants closely resemble non-participants, except for the fact that one of these two groups participated in the program while the other did not. When a strong comparison group is established, evaluators can reliably conclude that any differences observed after enrollment are due to program's stimulus. In using a matched comparison group to estimate energy savings due to exposure to MyHER Interactive, the same statistical modeling approach is used to estimate energy savings impacts as was used for estimating energy savings for the program overall (i.e., with linear fixed effects regression (LFER) estimation).

Duke Energy provided Nexant with MyHER participant enrollment information for the Interactive portal. At the end of the evaluation period, 69,473 DEP SF and 4,896 DEP MF treatment customers were signed up to use the portal. For DEP SF, 13.3% of Interactive users signed into the portal more than once, and 6.5% signed in more than twice between February 2020 and January 2021. For DEP MF, 15.0% of Interactive users signed into the portal more than once, and 6.8% signed in more than twice between February 2020 and January 2021. The average DEP SF interactive user logged in 0.8 times and the average DEP MF interactive user logged in to interactive 0.94 times – about 65% of registered users recorded no sessions logged in. Excluding customers that never logged in, single family Interactive users logged in on average 2.5 times, and multi-family users logged in on average 2.2 times.

In order for the LFER regression model to generate monthly energy savings attributable to Interactive, the customer data that the regression model uses to make the estimates must use a year of pre-treatment data. For DEP SF, 60,519 of the Interactive users (87%) had sufficient data available for the LFER analysis before their enrollment in MyHER. In the DEP MF segment, 4,705 Interactive users (96%) had sufficient data to be included in the LFER analysis. Figure 3-27 and Figure 3-28 plot the total number of customers enrolled in MyHER Interactive as well as the subset in the analysis for each month of the 12-month period February 2020 to January 2021 for DEP SF and MF, respectively.[14]

Figure 3-27: DEP SF MyHER Interactive Portal Enrollment

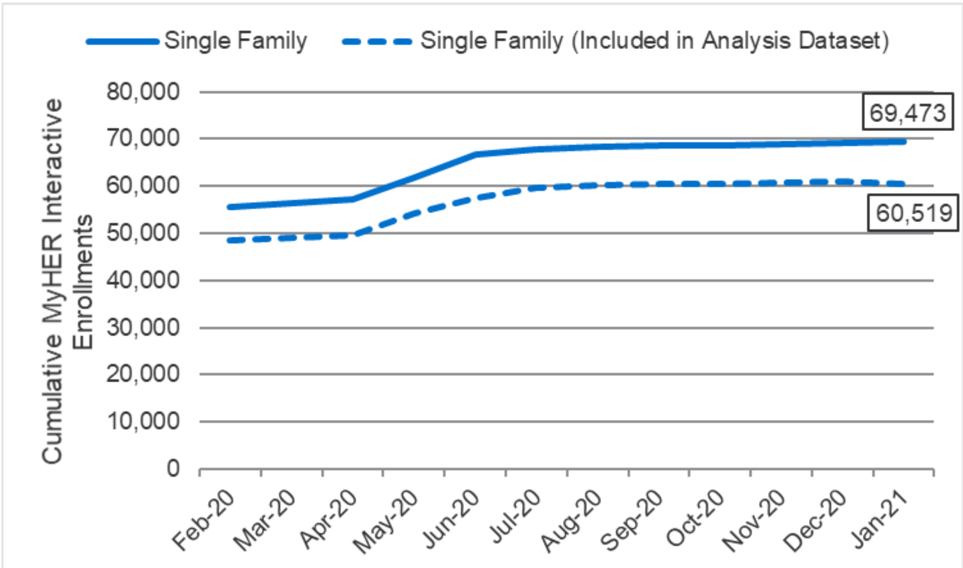
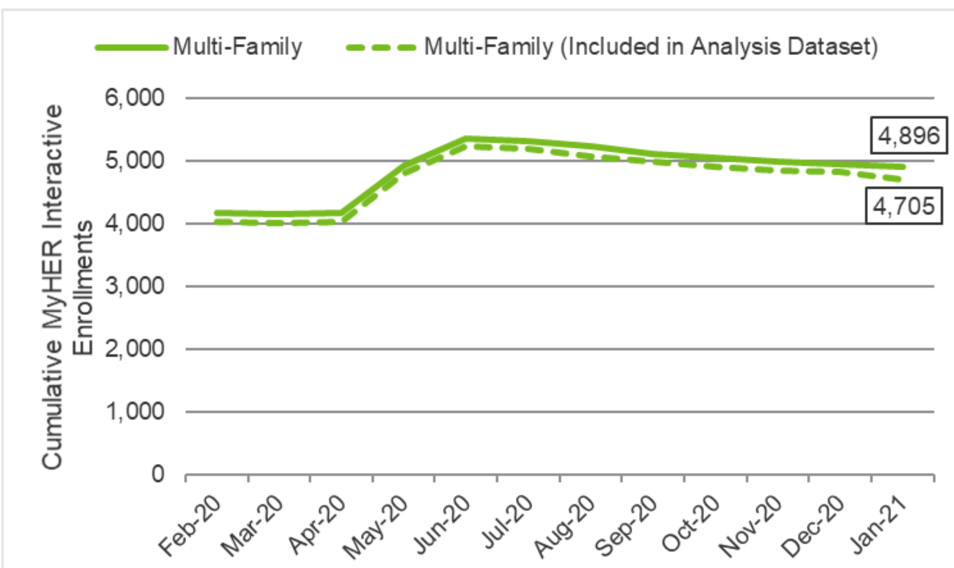


Figure 3-28: DEP MF MyHER Interactive Portal Enrollment

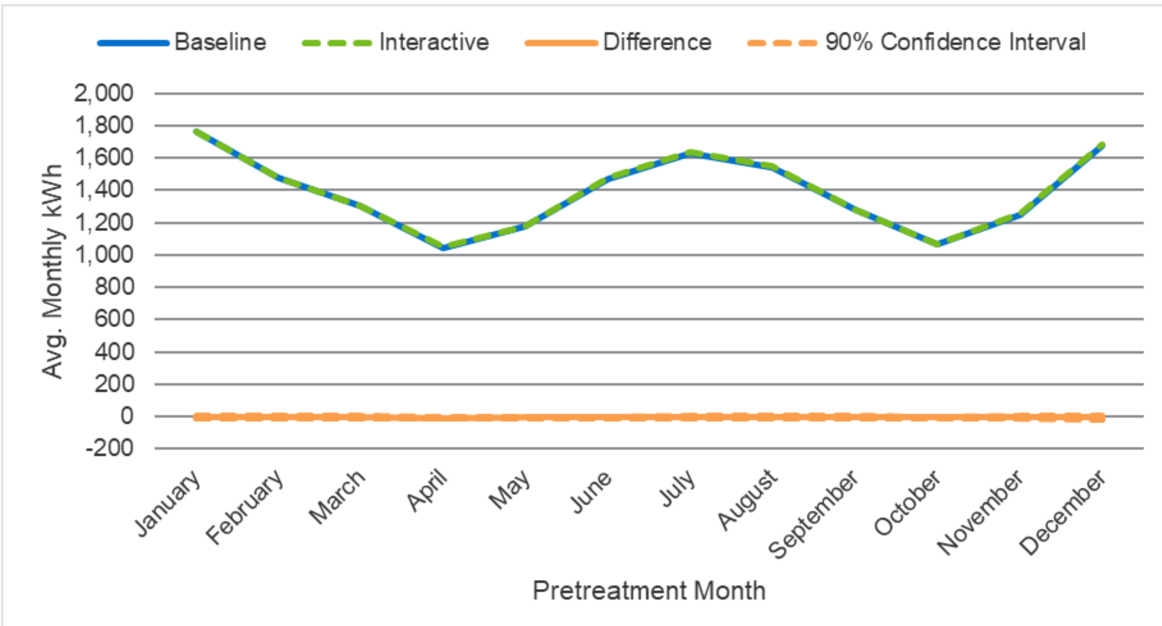


For DEP SF, the Interactive customers used in the estimation analysis were matched on pre-treatment usage based on their cohort and segment. Figure 3-29 presents the pre-treatment

[14] A total of 7,534 interactive customers were excluded from analysis due to incomplete pretreatment data; the totals in Figure 3-27 and Figure 3-28 additionally exclude Interactive users who enrolled after the evaluation period ended, a total of 1,107 customers.

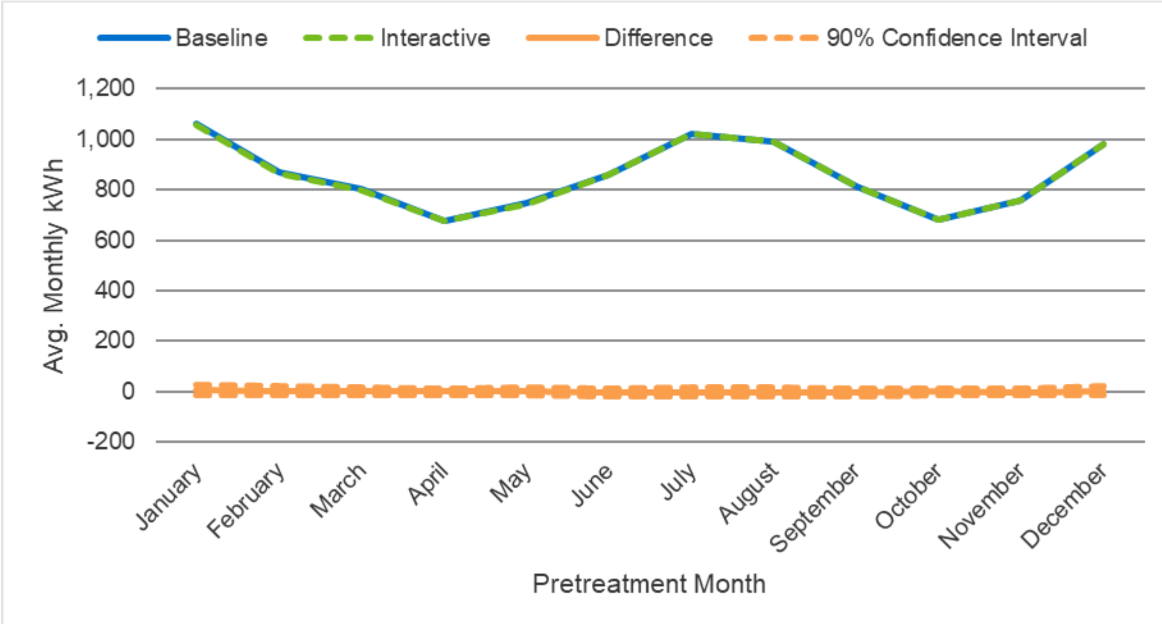
consumption for MyHER Interactive customers and a matched comparison group comprised of MyHER customers that have not enrolled in Interactive and had usage data through January 2021. The matching approach generates two groups with nearly identical consumption patterns over the time period prior to customers' enrollment in MyHER Interactive. On average, the difference in monthly usage between the matched control group and the DEP SF Interactive treatment group is -0.4%. The fixed effects model specification Nexant applies controls for these pre-treatment differences, as discussed earlier in Section 3.1.5.

Figure 3-29: DEP SF MyHER Interactive Portal Customers and Matched Comparison Group - Pre-Interactive Enrollment Periods



For DEP MF, the Interactive customers used in the estimation analysis were also matched on their pre-treatment usage depending on their treatment cohort. Note that customers in DEP MF Cohort 1 were removed from the analysis due to their being no consistent pre-treatment period across the group. Figure 3-30 presents the pre-treatment consumption for MyHER Interactive customers and a matched comparison group comprised of MyHER that were not enrolled in interactive and share the same treatment cohort. The matching approach generates two groups with nearly identical consumption patterns over the time period prior to customers' enrollment in MyHER Interactive. On average, the difference in monthly usage between the matched control group and the DEP Interactive treatment group is 0.1% The fixed effects model specification Nexant applies controls for these pre-treatment differences, as discussed earlier in Section 3.1.5.

Figure 3-30: DEP MF MyHER Interactive Portal Customers and Matched Comparison Group - Pre-Interactive Enrollment Periods



3.2.2 Results and Precision

For DEP SF, the average monthly impact across the 12-month period February 2020 to January 2021 was -5.4 kWh or -64.9 kWh annually per customer, representing the uplift in savings that MyHER Interactive produces over and above the savings produced by the paper MyHER, although this impact is not statistically significant at the 90% level of confidence. In aggregate, the DEP SF MyHER Interactive Portal resulted in -3.61 GWh of annual savings, incremental to the MyHER reports, but these savings are not differentiable from zero. These high-level findings are summarized in Table 3-52.

Table 3-52: 90% Confidence Intervals Associated with DEP MyHER Interactive Impact Estimates

Parameter	Lower Bound (90%)	Point Estimate	Upper Bound (90%)
Evaluation Period Savings per Home (kWh)	-191.8	-64.9	62.0
Percent Reduction	-1.24%	-0.42%	0.40%
Aggregate Impact (GWh)	-10.67	-3.61	3.45

On a month-to-month basis, there were statistically significant impacts in the months of February and March, ranging from 0.6% to 1.1%, with absolute impacts ranging from 7 to 13 kWh. There were statistically significant increases in electricity from May to November ranging from -0.5% to -1.5%, or -6 to -15 kWh.

Figure 3-31 illustrates the estimated impact and 90% confidence band (the orange lines and orange dashed lines) by month. Also shown as blue bars are counts of Interactive user sessions. During earlier years of the Interactive deployment, there was a correlation between statistically significant impacts and times of high Interactive usage, but there is currently no evidence of that relationship.

Figure 3-31: DEP SF MyHER Interactive Portal Energy Impacts

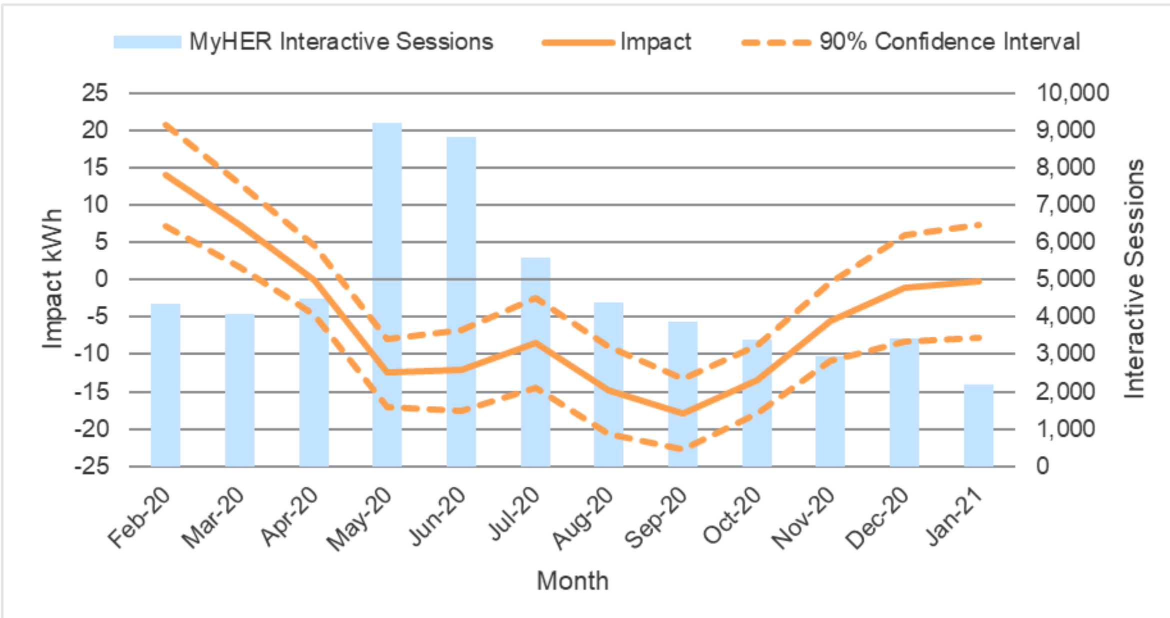


Table 3-53 provides impact model results for DEP SF, along with the margin of error for estimated impacts. The column at the right side of the table shows asterisks for those months where the energy savings are statistically significant at the 90% level of confidence.

Table 3-53: DEP SF MyHER Interactive Monthly Energy Savings

Month	Number of Participants Analyzed	MyHER Interactive Signups	Daily kWh			90% Conf. Interval		% Impact	
			Non-Participants	Participants	Impact				
Feb-20	48,512	4,364	1,247.0	1,233.1	13.9	7.2	20.7	1.1%	*
Mar-20	49,055	4,070	1,126.0	1,118.8	7.3	1.7	12.8	0.6%	*
Apr-20	49,646	4,482	961.3	961.3	0.0	-4.6	4.6	0.0%	
May-20	54,164	9,181	1,077.3	1,089.8	-12.4	-17.0	-7.9	-1.2%	*
Jun-20	57,457	8,830	1,336.4	1,348.5	-12.1	-17.6	-6.7	-0.9%	*
Jul-20	58,137	5,597	1,674.9	1,683.3	-8.5	-14.5	-2.5	-0.5%	*
Aug-20	58,343	4,381	1,588.9	1,603.6	-14.8	-20.6	-9.0	-0.9%	*
Sep-20	58,462	3,864	1,178.5	1,196.5	-18.0	-22.7	-13.3	-1.5%	*
Oct-20	58,421	3,400	956.6	970.1	-13.4	-18.0	-8.9	-1.4%	*
Nov-20	58,461	2,960	1,087.5	1,093.1	-5.6	-10.9	-0.4	-0.5%	*
Dec-20	58,748	3,418	1,517.0	1,518.1	-1.1	-8.3	6.0	-0.1%	
Jan-21	58,258	2,184	1,683.1	1,683.2	-0.2	-7.7	7.4	0.0%	
Average	**55,639**	**4,728**	**1,286.2**	**1,291.6**	**-5.4**	**-16.0**	**5.2**	**-0.4%**	

For DEP MF, the average monthly impact across the 12-month period February 2020 to January 2021 was -8.0 kWh, or -95.7 kWh annually representing the uplift in savings that MyHER Interactive produces over and above the savings produced by the paper MyHER, but this estimate is not statistically significant at the 90% level of confidence. The aggregate impact for DEP MF interactive customers was estimated to be -0.45 GWh, which was also not statistically significant at the 90% confidence level.

Table 3-54: 90% Confidence Intervals Associated with DEP MF MyHER Interactive Impact Estimates

Parameter	Lower Bound (90%)	Point Estimate	Upper Bound (90%)
Evaluation Period Savings per Home (kWh)	-276.8	-95.7	85.3
Percent Reduction	-2.75%	-0.95%	0.85%
Aggregate Impact (GWh)	-1.30	-0.45	0.40

On a month-to-month basis, there were statistically significant increases in electricity usage by Interactive customers in the months of May, June, and October, with impacts in usage ranging from -22 kWh to -31 kWh.

Figure 3-32 illustrates the estimated impact and 90% confidence band (the orange lines and orange dashed lines) by month. Also shown as blue bars are counts of Interactive user sessions.

Figure 3-32: DEP MF MyHER Interactive Portal Energy Impacts

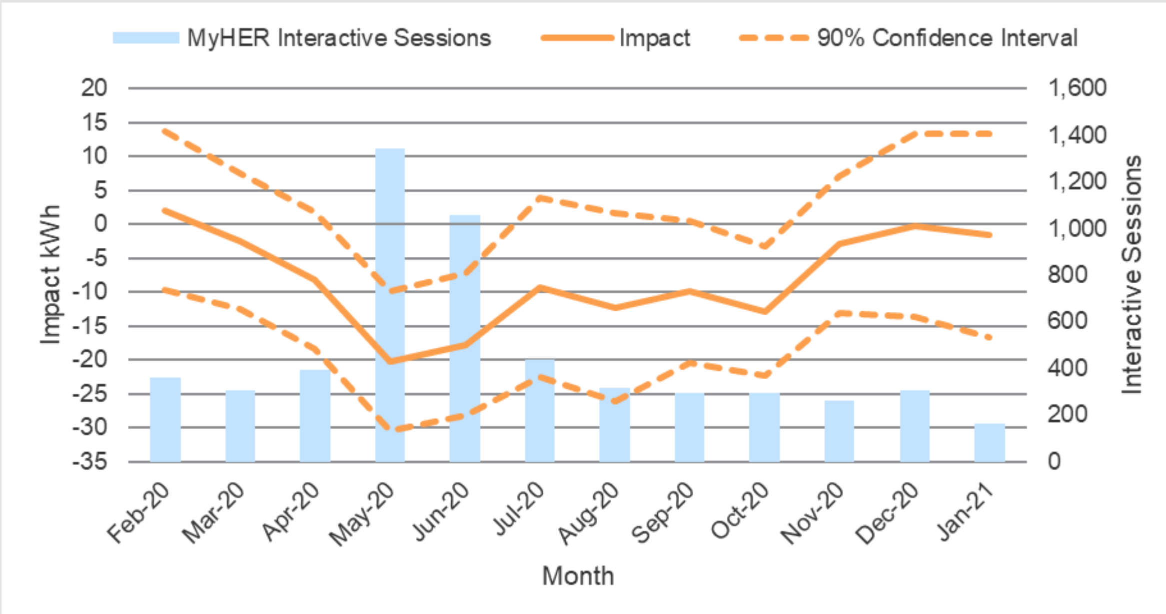


Table 3-55 provides impact model results for DEP MF, along with the margin of error for estimated impacts. The column at the right side of the table shows asterisks for those months where the energy savings are statistically significant at the 90% level of confidence.

Table 3-55: DEP MF MyHER Interactive Monthly Energy Savings

Month	Number of Participants Analyzed	MyHER Interactive Signups	Daily kWh			90% Conf. Interval		% Impact	
			Non-Participants	Participants	Impact				
Feb-20	4,018	358	846.5	844.5	2.1	-9.7	13.8	0.2%	
Mar-20	4,007	305	762.4	765.0	-2.5	-12.5	7.4	-0.3%	
Apr-20	4,022	393	650.0	658.2	-8.2	-18.3	1.9	-1.3%	
May-20	4,796	1,346	704.4	724.6	-20.2	-30.5	-9.9	-2.9%	*
Jun-20	5,226	1,056	823.9	841.7	-17.8	-28.2	-7.3	-2.2%	*
Jul-20	5,178	437	1,001.6	1,010.8	-9.3	-22.6	4.0	-0.9%	
Aug-20	5,064	319	961.5	973.8	-12.3	-26.1	1.6	-1.3%	
Sep-20	4,976	295	758.6	768.6	-10.0	-20.5	0.5	-1.3%	
Oct-20	4,905	295	661.7	674.5	-12.8	-22.4	-3.2	-1.9%	*
Nov-20	4,843	262	746.2	749.2	-3.0	-13.1	7.1	-0.4%	
Dec-20	4,824	303	1,018.2	1,018.4	-0.2	-13.7	13.4	0.0%	
Jan-21	4,705	163	1,140.1	1,141.7	-1.6	-16.6	13.3	-0.1%	
Average	**4,714**	**461**	**839.6**	**847.6**	**-8.0**	**-23.1**	**7.1**	**-1.0%**	

Nexant concludes that the DEP SF MyHER Interactive portal did succeed in generating additional statistically significant savings during some of the winter months in the time frame from February 2020 to January 2021 while observing some significant increases in usage during the summer months. The DEP MF MyHER Interactive portal did not achieve any statistically significant savings and had significant increases in usage during three of the months in the time period.

4 Process Evaluation

This section presents the results of process evaluation activities including in-depth interviews with Duke Energy staff and surveys of control and treatment households.

4.1 Methods

Process evaluations support continuous program improvement by identifying opportunities to improve the effectiveness and efficiency of program operations and services. Process evaluations also identify successful program components that should be enhanced or replicated. Process evaluation activities for MyHER sought to document program operational processes and to understand the experience of those receiving MyHER mailings. The customer survey given to MyHER recipients focused on investigating the recall and influence of MyHER messages among recipients, the extent to which MyHER affects customer engagement and satisfaction with Duke Energy, their use of MyHER Interactive, and subsequent actions taken by participants to reduce household energy consumption. A survey of control group households provided a point of comparison for estimating the effect of MyHER on behavior and attitudes of treatment households.

4.1.1 Data Collection and Sampling Plan

The process evaluation included two primary data collection activities: in-depth interviews with program management staff and surveys of a random sample of both single family and multi-family households selected to receive MyHER reports as well as surveys of a random sample of control group households (both multi-family and single family).

Nexant deployed the household surveys using a mixed-mode survey measurement protocol, the activities associated with which are summarized in Table 4-1 and Table 4-2. In this protocol, customers were contacted by letter on Duke Energy stationery (to assure recipients of the legitimacy of the survey) asking them to go online and complete the survey. The letter contained a two-dollar bill as a cost-effective measure to maximize the survey completion rates. The letter also included a personalized URL for the online survey that points the recipient to a unique location on the internet at which they were able to complete the survey. Customers for whom email addresses were available also received an email inviting them to take the survey online, which also included the same personalized URL that appeared in the letter leading to the survey website where they could complete it. After two weeks, customers who did not respond to the web survey received another mailing, this time containing a paper copy of the survey and a return postage-paid envelope for them to complete the survey by mail. Survey recipients also had the option of calling a toll-free telephone number to complete it by telephone.

Two different instruments were used in the survey deployment. A primary instrument was used to survey random samples of treatment and control customers, selected from both the single family and multi-family program populations. An additional random sample of treatment customers (selected from both the single family and multi-family program populations) received a different instrument with a battery of questions that only pertains to treatment customers (such as satisfaction with MyHER report features, recall of MyHER receipt, etc.). This treatment-only survey instrument was developed in order to prevent the primary instrument from getting too lengthy.

Table 4-1 shows that 305 DEC single family treatment customers (137 treatment only, and 168 primary treatment) and 171 DEC single family control customers completed the survey, totaling 476 responses for this group. In addition, 154 DEC multi-family treatment (87 treatment only, and 67 primary treatment) and 88 DEC multi-family control customers completed the survey, for a total of 242. In total, 718 DEC customers completed the survey.

Table 4-1: Summary of Process Evaluation Activities - DEC

Population	Approach	Population	Sample		Confidence/Precision	
			Expected	Actual	Expected	Actual
Program management and implementation	In-depth interviews	10	Up to 3	2	Not Applicable	Not Applicable
Treatment group households; Treatment only instrument	Mixed-mode; mail, web, and phone	≈ 1.1 M	68	137	90/10	90/7.0
Treatment group households; Primary instrument	Mixed-mode; mail, web, and phone		68	168	90/10	90/6.3
Control group households; Primary instrument	Mixed-mode; mail, web, and phone	≈ 160,000	68	171	90/10	90/6.3
Total Single Family Survey Responses				**476**		
Treatment group households; Treatment only instrument	Mixed-mode; mail, web, and phone	≈ 65,000	68	87	90/10	90/8.8
Treatment group households; Primary instrument	Mixed-mode; mail, web, and phone		68	67	90/10	90/10.0
Control group households; Primary instrument	Mixed-mode; mail, web, and phone	≈ 20,000	68	88	90/10	90/8.8
Total Multi-family Survey Responses				**242**		
Total Responses				**718**		

Table 4-2 shows that 327 DEP single family treatment customers (169 treatment only, and 158 primary treatment) and 181 DEP single family control customers completed the survey, totaling

508 responses for this group. In addition, 185 DEP multi-family treatment (86 treatment only, and 99 primary treatment) and 88 DEP multi-family control customers completed the survey, for a total of 273. In total, 781 DEP customers completed the survey.

Table 4-2: Summary of Process Evaluation Activities - DEP

Population	Approach	Population	Sample		Confidence/Precision	
			Expected	Actual	Expected	Actual
Program management and implementation	In-depth interviews	10	Up to 3	2	Not Applicable	Not Applicable
Treatment group households; Treatment only instrument	Mixed-mode; mail, web, and phone	≈ 725,000	68	169	90/10	90/6.3
Treatment group households; Primary instrument	Mixed-mode; mail, web, and phone		68	158	90/10	90/6.5
Control group households; Primary instrument	Mixed-mode; mail, web, and phone	≈ 155,000	68	181	90/10	90/6.1
Total Single Family Survey Responses				**508**		
Treatment group households; Treatment only instrument	Mixed-mode; mail, web, and phone	≈ 80,000	68	86	90/10	90/8.9
Treatment group households; Primary instrument	Mixed-mode; mail, web, and phone		68	99	90/10	90/8.3
Control group households; Primary instrument	Mixed-mode; mail, web, and phone	≈ 35,000	68	88	90/10	90/8.8
Total Multi-family Survey Responses				**273**		
Total Responses				**781**		

Nexant's survey instruments included demographic questions to support comparisons of the treatment and control respondents as well as to support overall comparisons to the jurisdiction's territory. We present summaries of the responses to the demographic questions in Section 4.2, after the summaries of the responses to the survey questions on customer attitudes, energy usage behaviors, energy-savings actions and purchases/investments, and experience with the MyHER program.

4.1.1.1 Interviews

Nexant conducted interviews with key contacts at Duke Energy, but not with Uplight since their engagement with Duke Energy as the MyHER implementer was concluding. The interviews built upon information obtained during previous evaluations of the Duke Energy MyHER program in multiple jurisdictions. The central objectives of the interviews were to understand program operations and the main activities required to develop and distribute the MyHER reports to DEC and DEP customers, as well as to understand any developments in program delivery.

4.1.1.2 Household Surveys

Both treatment and control groups of single family and multi-family customers were surveyed. Treatment households were surveyed as two groups that received different surveys: The first group's survey included questions about the respondents' experience of the reports themselves as well as questions to assess engagement and understanding of household energy use, awareness of Duke Energy efficiency program offers, and satisfaction with the services Duke Energy provides to help households manage their energy use. The second treatment group and control group surveys were identical, and excluded questions about the information and utility of the MyHER reports, but included identical questions on the other aspects to facilitate comparison with each other, as well as to the first treatment group sample.

Nexant analyzed the survey results to identify differences between treatment and control group households on the following:

- Levels of awareness of and interest in household energy use;
- The level of behavioral action or equipment-based upgrades;
- Satisfaction with Duke Energy communications, service, and efficiency options;
- Barriers to energy saving behaviors and purchases; and
- Inclination to seek information on managing household energy use from Duke Energy.

This survey approach is consistent with the RCT design of the program and supports both the impact and process evaluation activities by providing additional insight into potential program effects.

Survey Disposition - DEC

We mailed 908 letters to randomly selected residential customers in the treatment group and 908 letters to the randomly selected residential customers in the control group for the primary survey. We also mailed 908 letters to the treatment customers for the treatment-only survey. Of the total 2,724 customers each of these groups, 1,206 letters were mailed to multi-family customers, and 1,518 were mailed to single family customers.

The survey was completed by a total of 476 single family households and 242 multi-family households, representing an overall single family response rate of 31% and a multi-family response rate of 20%.

Among all completed surveys, 305 were completed by treatment households and 171 were completed by control households in the single family segment. About half (59% of the treatment group and 57% of the control group) of the surveys completed by single family customers were completed online. For multi-family customer surveys, 154 were completed by treatment households and 88 were completed by control households. Seventy-one percent of the treatment group and 69% of the control group of the surveys were completed online. Table 4-3 summarizes the treatment and control group survey dispositions in DEC.

Table 4-3: Survey Disposition - DEC

Mode	Treatment		Control	
Single Family	Count	Percent	Count	Percent
Completes by Mode				
Web-based Survey	179	59%	98	57%
Mail/Paper Survey	116	38%	69	40%
Inbound Phone Survey	10	3%	4	2%
Total Single Family Completes	**305**	**100%**	**171**	**100%**
Mode	**Treatment**		**Control**	
Multi-family	Count	Percent	Count	Percent
Completes by Mode				
Web-based Survey	110	71%	61	69%
Mail/Paper Survey	41	27%	25	28%
Inbound Phone Survey	3	2%	2	2%
Total Multi-family Completes	**154**	**100%**	**88**	**100%**
TOTAL	**459**		**259**	

Survey Disposition - DEP

We mailed 906 letters to randomly selected residential customers in the treatment group and 906 letters to the randomly selected residential customers in the control group for the primary survey. We also mailed 906 letters to the treatment customers for the treatment-only survey. Of the total 2,718 customers in each of these groups, 1,203 letters were mailed to multi-family customers, and 1,515 were mailed to single family customers.

The survey was completed by a total of 508 single family households and 273 multi-family households, representing an overall single family response rate of 34% and a multi-family response rate of 23%.

Among all completed surveys, 327 were completed by treatment households and 181 were completed by control households in the single family segment. More than half (60% of the treatment group and 61% of the control group) of the surveys completed by single family customers were completed online. For multi-family customer surveys, 185 were completed by treatment households and 88 were completed by control households. Sixty-six percent of the treatment group and 64% of the control group of the surveys were completed online. Table 4-4 summarizes the treatment and control group survey dispositions in DEP.

Table 4-4: Survey Disposition - DEP

Mode	Treatment		Control	
Single Family	Count	Percent	Count	Percent
Completes by Mode				
Web-based Survey	197	60%	110	61%
Mail/Paper Survey	124	38%	70	39%
Inbound Phone Survey	6	2%	1	1%
Total Single Family Completes	**327**	**100%**	**181**	**100%**
Mode	**Treatment**		**Control**	
Multi-family	Count	Percent	Count	Percent
Completes by Mode				
Web-based Survey	123	66%	56	64%
Mail/Paper Survey	57	31%	25	28%
Inbound Phone Survey	5	3%	7	8%
Total Multi-family Completes	**185**	**100%**	**88**	**100%**
TOTAL	**512**		**269**	

4.2 Findings

This section presents the findings from in-depth interviews with Duke Energy program staff and the results of the customer surveys.

4.2.1 Program Processes and Operations

As in other Duke Energy jurisdictions, MyHER at DEC and DEP is managed primarily through a core team of three Duke Energy staff members: a Program Manager in charge of the day-to-day operations of the MyHER program, a Marketing Manager that is responsible for report content, and a Data Analyst that is responsible for the substantial data tracking and cleaning tasks required to support the contracted implementation team, as well as internal program reporting to Duke Energy management.

At Uplight, Duke Energy's program implementer under contract during this evaluation period, MyHER is supported by dedicated program team members as well as shared support including a Home Energy Report Product Manager, Operations Manager (who oversees Operations Analysts and Quality Assurance Engineers), an Engineering Manager and software engineers, and an Account Manager responsible for ensuring that the Duke Energy MyHER products meet expectations for quality, timing, and customer satisfaction. Uplight staff track the number of reports sent, the quality of the reports, and the timing of when reports are mailed. Uplight's primary key performance indicators (KPIs) include in-home dates for each batch of reports sent, the percentage of eligible treatment customers actually treated, as well as report appearance and data accuracy. Customers that are eligible to receive a MyHER report are those who: have been billed for electric service in 11 of past 13 months and are billed for at least 150 kWh of monthly electricity consumption. Customers that meet these eligibility criteria are randomly assigned treatment and control status in twice-annual treatment assignment batches.

MyHER is Duke Energy's flagship behavioral energy efficiency program. Its primary goals are to achieve energy savings, increase customer satisfaction with Duke Energy, and cross-promote enrollment into Duke Energy's demand response and energy efficiency programs. Duke Energy program staff described continuous coordination with Uplight to ensure that the data behind the MyHER comparisons are accurate, the tips provided to specific households are appropriate, and that MyHERs are delivered as soon as possible after billing data is received, within the relatively short timeframe that exists between bills.

In addition to home energy reports, the MyHER program at Duke Energy also produces content for the MyHER Interactive portal, introduced to the program in 2015. The portal offers additional means for customers to customize or update Duke Energy's data on their premises, demographics, and other characteristics that affect consumption and the classification of each customer. The portal also provides additional custom tips based on updated data provided by the customer. MyHER Interactive sends email challenges to portal users that seek to engage customers in active energy management, additional efficiency upgrades, and conservation behavior.

Customers enrolled in MyHER that have also installed the Duke Energy mobile application (app) on their mobile devices (e.g., tablets and mobile phones) can also view the information found on their MyHERs in the app.[15] MyHER content is available via a link found on the app's home screen. MyHER's home comparison charts, comparison group information, and usage disaggregation are all available through the Duke Energy app.

Program operations for the management and production of the content on all of these channels are conducted with a customer-focused orientation where the commitment to producing a high-quality product is ongoing and consistently pursued by Uplight and Duke Energy staff each month of the year.

4.2.1.1 MyHER Production

During the time period under study by this evaluation, MyHERs were mailed out to DEC and DEP single family customers on paper through the U.S. Postal service eight times a year, and 12 times a year by email to customers that have provided Duke Energy with their email address. DEC and DEP multi-family customers receive six reports a year by mail, and those who have provided their email address receive four reports a year by mail and 12 reports per year by email. During the eight Single Family U.S. Mail treatment months, paper reports are generated

[15] The Duke Energy app is available to every DEC and DEP residential customer (not just customers that receive MyHERs) that provides customers with a mobile-optimized web interface that they can use to manage their Duke Energy account, pay their bills, track billed electric usage, report outages, and view special offers.

twice per week, a cadence that is designed to facilitate meeting one of Uplight's key performance indicators: Once the batch of MyHERs is approved by Duke Energy, that it arrives at the print house within twelve days, and to the customer soon after, so as to make the information presentment as useful and timely as possible.

Additionally, any customer that has provided Duke Energy with their email address also receives their report by email, and in fact, MyHER reports are generated and emailed to those customers monthly, 12 times a year, while they continue to receive paper reports less often, as described in the above paragraph.[16] In the case of the Single Family segment, starting in late 2019, Duke Energy began sending only six paper reports a year to new enrollees, so as to make the program more cost-effective while maintaining energy savings and demand impacts.

The production process for any given treatment month begins as soon as meter reads for the first billing cycle are processed by Duke Energy's meter data management system. After processing, Uplight's HOMERS (Home Energy Reporting Service) system downloads billing data nightly, five times a week (Tuesday through Saturday) and readies the data for quality control (QC). This is an improvement on Uplight's legacy (pre-HOMERS) system which required QC to be run only when batches were being readied for report production. The ability to run multiple iterations of QC protocols allows Uplight to detect, analyze, and act on any emergent issues on a daily basis.

In addition to this functionality, HOMERS is designed as a platform that unites the data management and report production processes, and provides Duke Energy with the ability to review report data and proofs in real time.

Duke Energy program management interviewees have reported that HOMERS' launch fulfilled expectations regarding the production of reports for multiple billing cycles at once, improving the production process most notably by eliminating what were referred to as "Batch 1" problems. This class of QC exceptions stemmed from the relatively large number of reports produced for the first cycle of the month using Uplight's legacy system. With HOMERS, data transfers to Duke Energy now contain much smaller and consistent batch sizes— "Batch 1" sizes have roughly been cut in half, and batches throughout the month are relatively consistent, though dependent on the availability of billing data from Duke Energy, which tends to be the most voluminous at the beginning of the month.

Upon nightly delivery to Uplight, each account's data is passed through an overnight QC process, and a report is generated under a "rendered" status. Rendered reports are then submitted to a more complex QC framework, where data is validated and text sizing and spacing checks are carried out. Once this is complete, HOMERS produces a report detailing the results of the QC process, and this is reviewed by Uplight operations analysts and engineers each morning to assess the need for further QC reviews. These reviews include further data validation, including usage disaggregation, as well as visual checks that assure charts, text, and

[16] Duke Energy will cease delivery of paper MyHER reports, and only send email reports, if the customer requests them to do so.

general report presentment is correct. The reports with no flagged concerns are assigned a "QC pass" status, and those with which errors are found at any stage of the review process are assigned a "QC fail" status and reviewed by Uplight staff to assess whether or not the error can be addressed in the current cycle to allow for a quality HER to be produced.

Twice a week, Uplight gathers reports in "QC pass" status, and a flat file containing all the data from these reports is sent to Duke Energy for an independent quality control check by their Senior Data Analyst. These data checks have been increasingly carried out on an automated basis, though manual checks on these data are still part of the protocol. While under review, reports are changed to "QC pending" status. In addition to this data, drafts of every report are available (in HTML and PDF formats) for download and subject to visual QC checks by Duke Energy.

Approved reports are then assigned back to "QC pass" status, Uplight sends the PDFs to the print house, and the print house generates a final proof for Duke Energy approval. Finally, after the proof is approved, the print house prints and mails all the reports, Uplight emails eHERs on the specified day, and then commences the process of reporting the printing, mailing, and emailing to Duke Energy.

This production chain moves quickly: once Uplight generates a batch of reports, the time elapsed until transfer to the print house is generally three to four hours when all processes are completed according to plan. This timeframe has become the norm, but when quality control problems emerge, that elapsed time can increase significantly. Considering that the print house has one week to complete the mailing, and Standard Rate postage can take another week to deliver, making the mid-cycle in-home delivery goal requires dedicated effort to achieve.

Prior MyHER process evaluations in this and other Duke Energy jurisdictions where MyHER is also implemented have found that this fast-moving process has seen improvements over time through the adoption of various changes: recently, these have been best characterized by the adoption of HOMERS, getting free-form text (FFT) content designed, approved and ready to incorporate into reports ahead of time, and an increased attention to continuously improving QC processes at Uplight. These changes have delivered reductions in both report in-home times, as well as the number of problems found during report batch quality control checks, though Uplight has the most difficulty with accommodating last-minute requests from Duke Energy.

4.2.1.2 Quality Control

As summarized above, embedded in the early days of the MyHER production cycle is a quality control process that ensures that the reports contain accurate information and are of high quality. Duke Energy analyzes a dataset containing all of the information presented in the reports for each production cycle. This data is checked for essentially anything that could be erroneous, ranging from verifying that all the customers receiving reports are eligible to receive them, that no control customers are getting reports, that the reported electricity usage is correct, that no customers who have opted-out are getting reports, and that no one has received more than one report a month. Duke Energy also checks for unexpected cluster assignment changes, presentment of messaging and tips, and overall print quality.

In the past, these checks have proven to be crucial as they occasionally revealed significant production problems, which were subsequently reviewed in Uplight's governance sessions with Duke Energy. This visibility has typically resulted in issue resolution on a going-forward basis.

Duke Energy program staff report that the incidence of significant production problems was dramatically reduced since Uplight implemented quality control automation. Uplight's automated quality control process is described as follows, recalling that customer data is transferred to Uplight daily:

- Uplight pulls Duke Energy billing data into an Amazon Redshift database and prepares the data for presentment in the HERs. The HERs are then generated and rendered;
- A series of SQL queries against the data presented in the HERS then runs. This process delivers output into the Amazon Simple Storage Solutions (S3) environment that reports on the results of the checks and indicates any reports with errors. Reports with errors are then postfiltered;
- Reports that pass the SQL checks are then visually checked by Uplight staff to be sure nothing noticeable or significant has slipped through to final report presentment; and
- An approved file is then sent to Duke Energy, along with about 100 samples of both paper and electronic HERs.

Prior evaluations of MyHER revealed that some program processes could benefit from improved quality control performance. Duke Energy program management interviewees reported that while the implementation of HOMERS and the continued refinement and automation of QC protocols have reduced errors significantly, errors on reports do occasionally pass through to them.

Continuous improvements to quality control in these areas can reduce the risk associated with running a program with processes that too often fail quality control checks. Such issues present timing risks (reports may not be sent out on time), customer service risk (reports may be sent out with problems if problems someday are missed), and risk to the overall success of the program (if the QC process is overburdened with detecting too many problems, it can become an over-leveraged component of program operations). As such, outcomes of both Uplight and Duke Energy's QC processes are monitored to detect emergent opportunities or needs to tune report production operations.

Continuous program improvement has also been facilitated by Duke Energy and Uplight collaborative activities. Duke Energy and Uplight staff join for weekly status meetings, monthly operations meetings, and quarterly governance meetings. These meetings provide a venue for shared brainstorming and roadmapping activities and the ongoing maintenance of a product request list for Uplight. Uplight's internal HER Improvement Team serves to ensure progress is made on the product request list. This team meets quarterly to reassess the feasibility of each of the list's items and reprioritize these items, as needed, based on the priorities Duke Energy has expressed in collaborative meetings.

4.2.1.3 MyHER Components

MyHER reports include several key elements that are customized for each customer each month: bar charts, tips, trend charts, and messages. Duke Energy and Uplight implemented a general refresh of the MyHER report template in 2017, designed to improve readability and to keep the presentation fresh in the eyes of recipients. Graphics were updated and images were added to some modules (described below) that were previously text-only. A new module (also described below) was added that presents usage disaggregated by end use type. Overall, recipient response to this redesign was positive, though program staff did initially note some difficulty recipients had with interpreting the disaggregated end use presentation.

The front page includes two bar chart graphics. The first chart is a vertical bar chart (stylized in the shape of homes) comparing the subject home to the average and most efficient homes for an assigned cluster or "neighborhood" of similar homes. Previously, in Duke Energy jurisdictions with the earliest MyHER program implementations, these graphs were labeled with dollars, but this occasionally caused confusion among recipients if the dollar amount didn't exactly match their recall of a recent bill. In March 2013, Duke Energy shifted to using kWh as the unit of measurement for the bar charts; Duke Energy conducted customer focus groups in an effort to understand the level of confusion this shift might cause and found that customers reported not paying attention to unit of measurement: they were simply absorbing the shape and directionality of the bar charts (Figure 4-1).

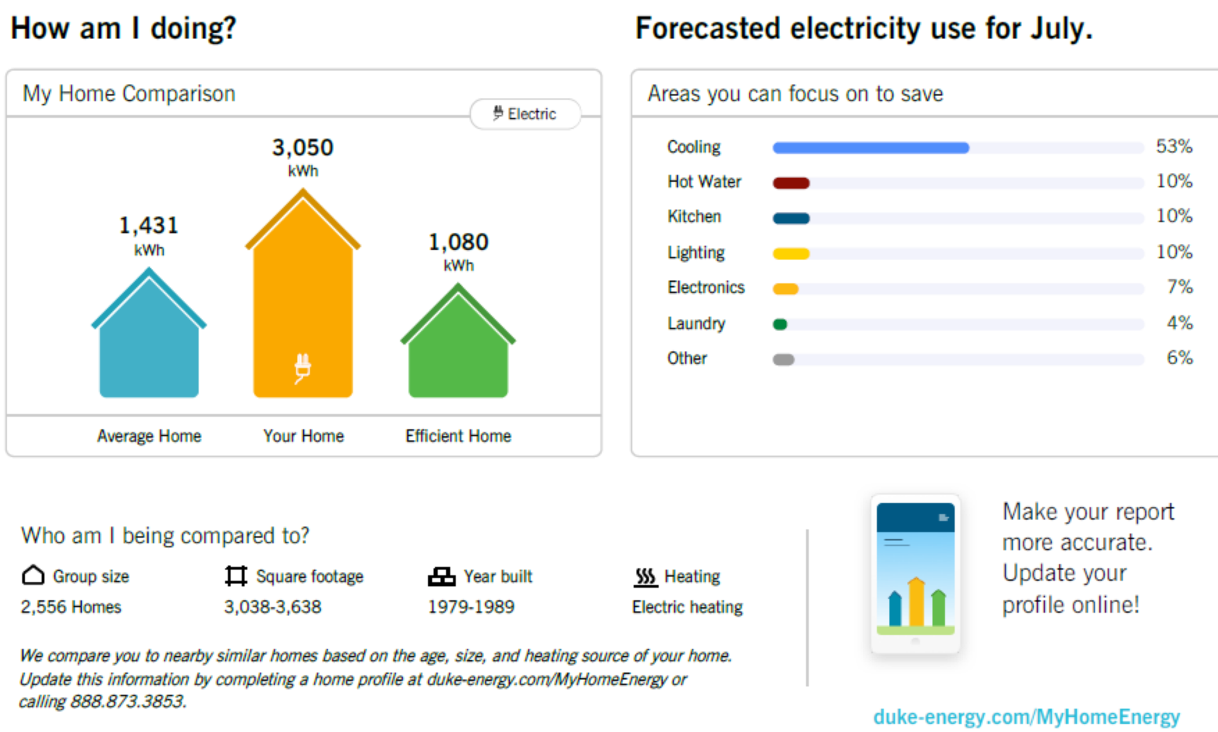
An infographic beneath the bar charts provides the size of the group of comparison homes, the assumed heating type, the approximate square footage, and the approximate age of the similar homes to which the customer's home is being compared. According to MyHER staff, a common reason for customer phone calls relating to MyHERs is simply the customer's desire to correct assumed information about a given home. For example, the MyHER could indicate that Duke Energy believes that a home has electric heat when it does not, or has assigned a home to the wrong size category. Any corrections provided in this manner are considered highly reliable and are not changed based on subsequent uploads of third party data.

To the right of the vertical bar chart is a horizontal bar chart that illustrates Uplight's forecast for the customer's home's electricity usage in the next month, disaggregated by end use type. This chart is intended to provide actionable insights to each customer as to where they might direct their energy savings efforts to make the greatest impact in their energy usage in the month ahead. Uplight staff continues to fine-tune the disaggregation in these forecasts, as a response to customer concerns about the accuracy of this component of the report.

In 2019, Uplight employed EV (electric vehicle) detection models using AMI data in order to ascertain which customers had these vehicles, and thus improve the disaggregation prediction for those customers. Similarly, an email campaign was conducted for customers who reported that they have pools, but had not specified how it was heated. These customers were encouraged to report pool heating type on the MyHER Interactive portal.

Generally, Duke Energy and Uplight continue to encourage customers to visit the Interactive portal where they can further customize or correct information about their homes that impact the accuracy of the disaggregated usage forecasts.

Figure 4-1: MyHER Electricity Usage Comparison and Forecasted Energy Use Bar Charts

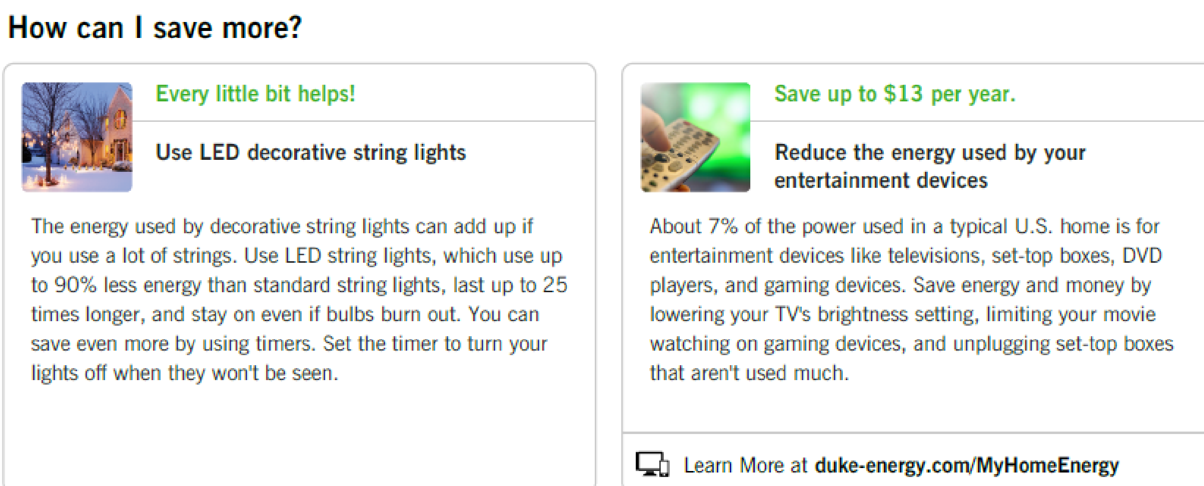


In addition to the comparison graph, each MyHER includes a set of customized action tips under the heading "How can I save more?". These tips are designed to provide information relevant to homes with similar characteristics, as presented in the box accompanying the comparison graph. These tips often are presented with monetary values (appropriately scaled to each customer receiving the tip) that estimate the bill savings that the customer might expect to realize by implementing the action tip.

The Duke Energy MyHER program has a large library of action tips, numbering between 80 and 90. Half of them were initially developed internally at Duke Energy, and Uplight's "Ask the Expert" technical writer continued to add to them over time. The large library has enabled the program to avoid any repeats to customers over long periods of time (up to three years). Tip freshness is also managed with display rules that ensure that a diversity of tip types (both in the value of the tip and the area of the household they apply to) is shown, and this management sometimes results in the removal of tips that staff no longer deem relevant. Duke Energy validates the monetary values estimated by Uplight for each tip action for reasonableness. In addition, tips that would lead to annual customer savings of less than $5 will omit their savings figure, as it is possible that such a low amount may actually dissuade customers from participating in the action.

Duke Energy and Uplight identified an opportunity for improving action tips and developed additional targeting algorithms for tip display. Some tips are now “smart” in that they are linked to Uplight’s building model that disaggregates energy use in the home, as seen in Figure 4-2, and will calculate potential savings based on the home’s characteristics. However, not all of the actions and tips are amenable to being used in this fashion, as there is significant variability in their applicability: some tips are only applicable to a few segments, while others have broader customer applicability and have lower capacity to be used as a targeted action. In 2019, the size of the tips library increased by about 50%, with about half of the newest tips enhanced as smart tips.

Figure 4-2: MyHER Tips on Saving Money and Energy



The back page of the MyHER reports includes a trend chart that displays how the recipient’s home compares to average and efficient homes with respect to energy usage over a year (Figure 4-3). This trend chart can help customers identify certain months where their usage increased relative to the efficient or average home—helping them focus on the equipment and activities most likely to affect their usage. For example, if a home tracks the average home until mid-winter and then spikes well above, that could indicate the heating equipment should be checked.

Figure 4-3: MyHER 13-month Trend Chart

The back page of the MyHER report also reserves space for Duke Energy to include seasonal and programmatic messaging, referred to by program staff as free-form text (FFT), that reflects Duke Energy-specific communication objectives (Figure 4-4). Ensuring that FFT messages are relevant and do not conflict with the actions or tips provided on the front page requires ongoing coordination and monitoring. Broad targeting efforts taking advantage of seasonal relevance, program eligibility, and the presence of end uses such as pools, are used to cross-promote Duke Energy programs. Customer participation databases are cross-checked each month to ensure that customers only receive information about programs they have not already participated in; if a customer is found to have participated in the program being promoted in a given month, that customer will receive an alternate, typically more generic, message. Occasionally the action text on the front page will be disabled to accommodate priority FFT messaging.

FFT messages are developed by the MyHER team in cooperation with Duke Energy's marketing and communications group. Duke Energy staff strive to develop messages that are clever, relevant, and upbeat—some recognize events on the calendar (such as Earth Day) while others provide specific program promotional information or promote general home upgrades (even for measures outside of current programs) or behavioral suggestions. These promotions have led to significant program participation, especially for those programs that offer free energy savings products (LED programs) or low-cost enrollment (GoGreen program).

Figure 4-4: MyHER Free-form Text Modules

Take action. Reduce your use.

We're all connected.

Duke Energy provides **heating assistance** to our neighbors in need through the **Share the Warmth** program. Your **donation** can help improve the lives of seniors and families who struggle to pay their heating bills, and the **Duke Energy Foundation matches all contributions up to $500,000**. You may donate online or by mail. **If you need help, visit our website for information.**

Visit **duke-energy.com/ShareTheWarmth** to learn more or donate.

Only Heat the Rooms You Use

Some heating systems let you **choose which rooms to heat. Electric baseboard heat, mini-split heat pumps, and zoned heating systems** are just some heating types that let you **heat specific rooms or floors**. If you have this option, there is no need to heat the rooms you don't use. **Keep unused rooms set to 62 degrees Fahrenheit until you need them.**

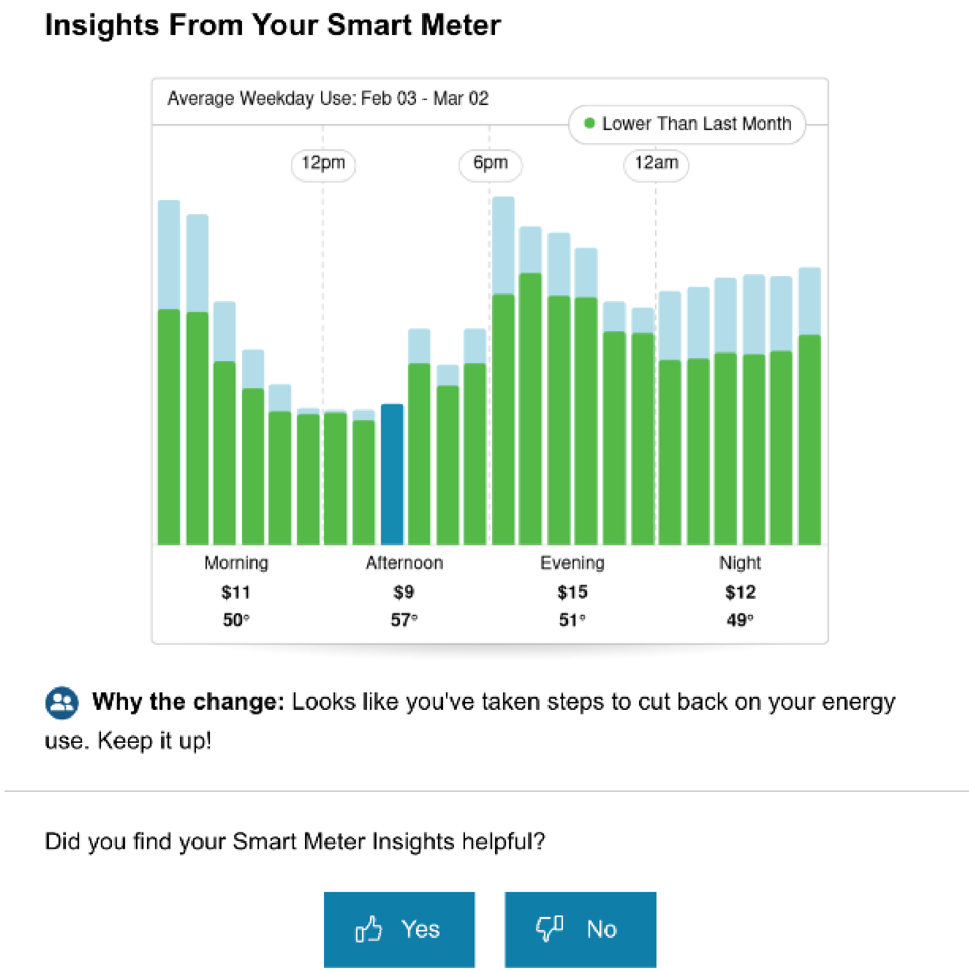
For more energy-saving ideas, visit **duke-energy.com/SavingsTips**

Establishing an FFT calendar early in each year and attempting to avoid last-minute changes to the messages each month has been challenging to implement. In the past, last-minute FFT changes were common due to changes during the course of the year to Duke Energy program promotions and incentive levels. In addition to developing the messages included in each MyHER, the program team must also ensure that the messages conform to expectations established to protect the customer experience. This feature of MyHER has historically been relatively resource-intensive with a lengthy revision-review-approval process with numerous stakeholders accompanying most changes to FFT messages. However, in 2019 this process was prioritized and planning strategies were implemented to prepare FFT messaging weeks, and often months, in advance to prevent the likelihood of disruption in the report production process due to last minute changes.

In addition, as part of Uplight's Program Manager (formerly Uplight 360) tool, an FFT-specific tool, called Content Manager was launched in 2019. Content Manager allows Duke Energy to directly produce FFT content and design the customer groups the messages are intended for.

Uplight also piloted an AMI usage chart for customers that receive eHERs (Figure 4-5). This chart displays hourly usage data, breaks it into segments, and shows the customer how much money they spend on electricity usage for the average weekday in each time period compared to the prior month.

Figure 4-5: Hourly Customer AMI Usage Chart



Finally, the back page of the reports also provides contact information for the MyHER program at Duke Energy. Customers occasionally contact Duke Energy with questions or concerns about MyHERs and, rarely, to opt-out. Duke Energy's efforts to maintain a high-quality MyHER customer experience is reflected by the high value that is placed on program participant satisfaction and as such, it is closely monitored. The rigorous quality control efforts described earlier have kept quality-related issues from ever reaching customers. Duke Energy reports to Nexant that, generally, 1% of MyHER customers contact Duke Energy annually. Nexant finds that 0.24% of MyHER participants opted-out of the program during the period January 2020 to December 2020.

4.2.1.4 MyHER Interactive

Enrollment in MyHER Interactive is still relatively low. The most reliably successful enrollment generators are email campaigns, sweepstakes, and cross-promotion with the High Bill Alerts program. Envelope messaging has also been used but is less successful. Email campaigns are a very successful enrollment generator because they can use personalized uniform resource locator (PURLs) to enable clicking through to the Interactive portal where the customers' account number is auto-populated. Program staff revamped the content and graphics of the email campaign in 2018.

In addition, Uplight and Duke Energy prioritized increasing MyHER Interactive enrollments in 2019, with relative success. An awareness campaign that included two sweepstakes was conducted that resulted in an increase in Interactive enrollment from about 100,000 to almost 250,000 across all Duke Energy jurisdictions.

Few quality control or process issues pertaining to Interactive were reported in our interviews. However, it should be noted that there is currently no mechanism by which Duke Energy can use or check the quality of data presented on Interactive in a systematic or bulk fashion. All checks on Interactive content are made on an individual customer basis. The bulk of quality control for Interactive is carried out by Uplight.

4.2.2 Customer Surveys - DEC

The customer surveys included questions focused specifically on the experience of and satisfaction with the information provided in MyHERs and awareness of MyHER Interactive—these questions were asked only of households in the treatment group.

Both treatment and control households answered the remaining questions, which focused on assessing:

- Awareness of Duke Energy efficiency program offers;
- Satisfaction with the Duke Energy, and services Duke Energy provides to help households manage their energy use;
- Levels of awareness of and interest in household energy use; motivations and perceived importance;
- Reported behavioral or equipment-based upgrades; and
- Barriers that prevent customers from undertaking energy savings actions.

4.2.2.1 Comparing Treatment and Control Responses - DEC

This section presents the results of responses to survey questions asked of both treatment and control households of single family and multi-family households in DEC and compares the response patterns of each. In addition, comparative analyses between single family and multi-family customers are included where pertinent. Statistically significant differences between treatment and control households, and between single family and multi-family households, are noted when they occur.

Duke Energy Customer Satisfaction

Both single family and multi-family treatment and control groups' overall satisfaction with Duke Energy are high. For single family, 82% of treatment customers and 78% of control customers are satisfied or very satisfied with Duke Energy as their electric supplier (rated 8 or higher on a 0-10 point scale). The difference is not statistically significant at the 90% level of confidence. For multi-family, 94% of treatment customers and 78% of control customers are satisfied or very satisfied with Duke Energy as their electric supplier (rated 8 or higher on a 0-10 point scale). This difference is statistically significant at the 90% level of confidence.

Respondents were asked if they “strongly disagree”, “disagree”, “neither agree nor disagree”, “agree”, or “strongly agree” that Duke Energy provides excellent customer service, respects its customers, and provides service at a reasonable cost. Single family control households are more likely to “agree” or “strongly agree” on these three aspects than treatment customers. None of these differences are statistically significant at the 90% level of confidence (Figure 4-6). Multi-family households reported similar levels of agreement with these statements (Figure 4-7).

Figure 4-6: Satisfaction with Various Aspects of Customer Service – Single Family Top-2 Box Scores (1-5 Scale)

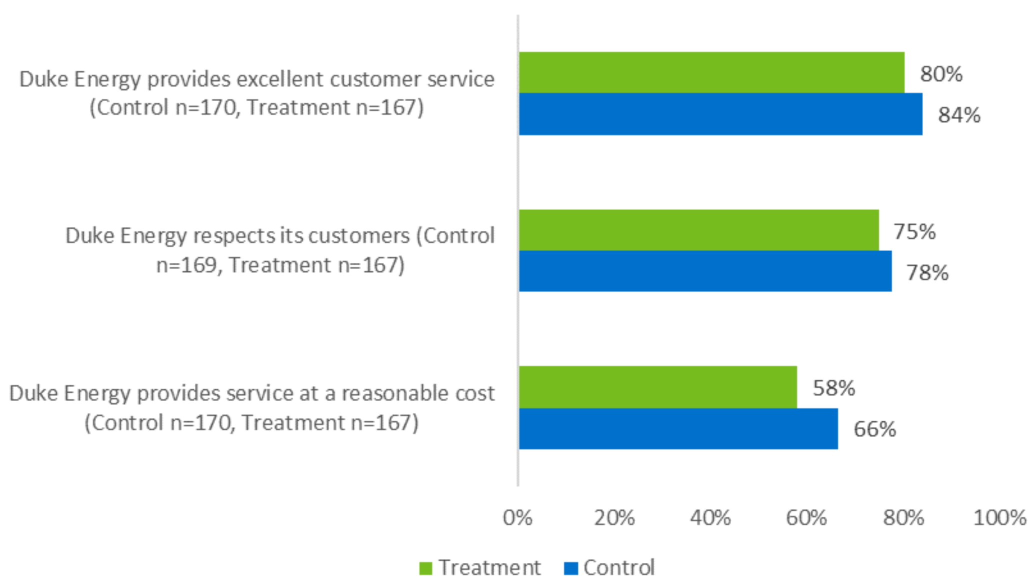
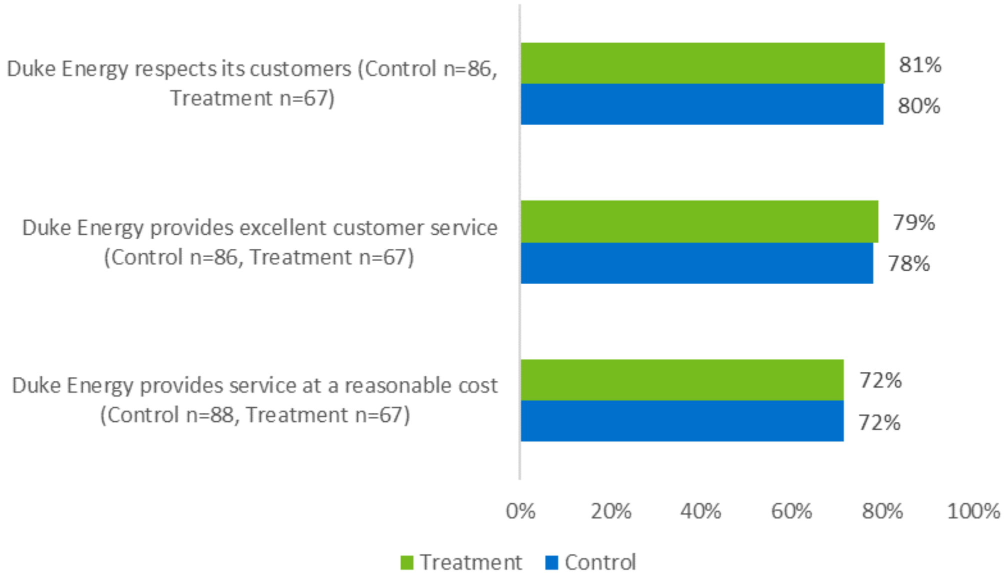


Figure 4-7: Satisfaction with Various Aspects of Customer Service – Multi-family Top-2 Box Scores (1-5 Scale)



Using a five point scale, “very dissatisfied”, “dissatisfied”, “neither dissatisfied nor satisfied”, “somewhat satisfied”, and “very satisfied”, single family treatment customers are more likely to report that they are either “somewhat satisfied” or “very satisfied” with the information available about Duke Energy’s energy efficiency programs, Duke Energy’s commitment to promoting energy efficiency and the wise use of electricity, and the information Duke Energy provides to help customers save on energy bills than control customers (Figure 4-8). However, as above, none of these differences are statistically significant at the 90% level of confidence. A new question on customer’s overall satisfaction with Duke Energy’s response to COVID-19, to help its customers dealing with financial hardship, was asked to both single family treatment and control groups. The two groups report similar levels of satisfaction. Similar patterns between single and multi-family (Figure 4-9) respondents as well as between treatment and control customers are seen for these measures of customer satisfaction. One difference to note is that significantly more multi-family respondents are satisfied with Duke Energy’s response to COVID-19 to assist customers than are single family respondents (82% and 73% for treatment and control multifamily customers and 62% and 63% for treatment and control single-family customers).

Figure 4-8: Satisfaction with Energy Efficiency Offerings and Information – Single Family Top-2 Box Scores (1-5 Scale)

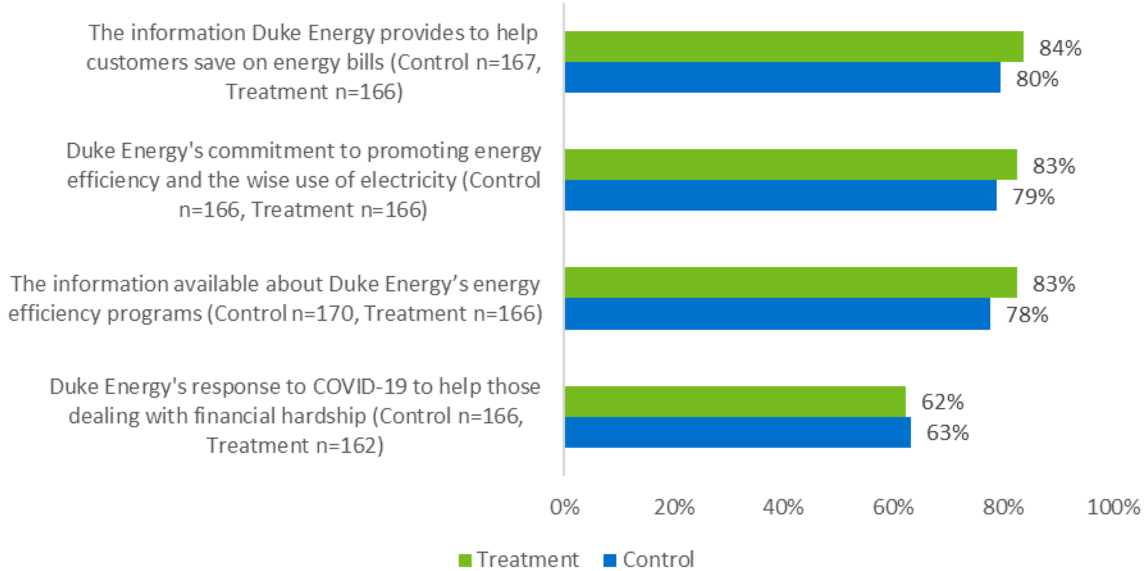
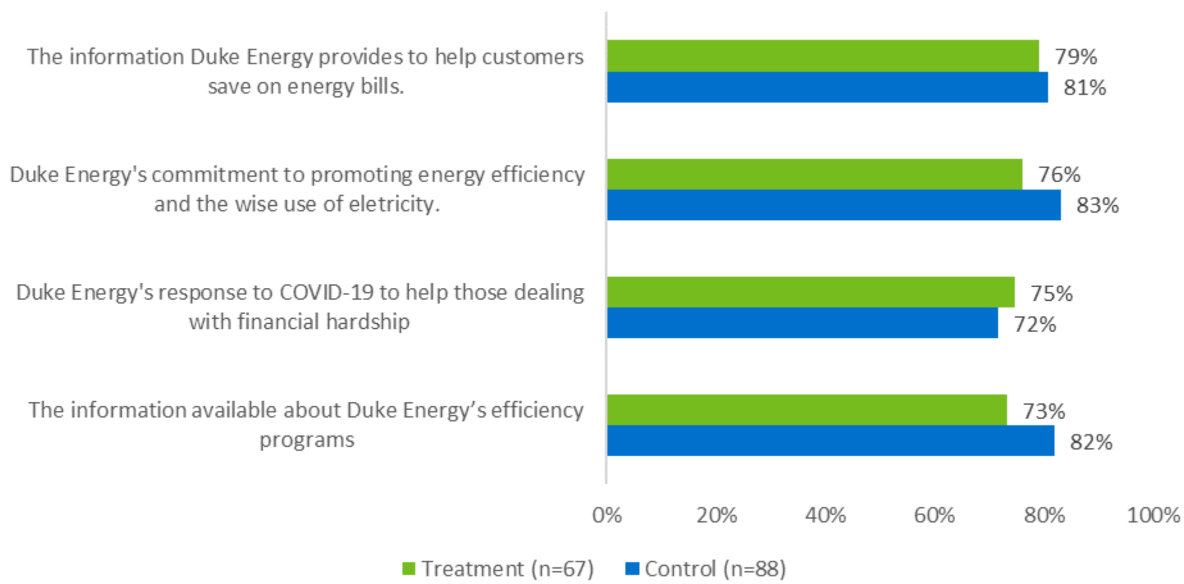


Figure 4-9: Satisfaction with Energy Efficiency Offerings and Information – Multi-family Top-2 Box Scores (1-5 Scale)



Engagement with Duke Energy's Website

Both treatment and control groups answered several questions about their use of the Duke Energy website, a proxy for overall engagement with information provided by the utility on energy efficiency and household energy use, and the results showed a significant difference on using online accounts to pay bills between multi-family treatment and control groups. Table 4-5 shows that 30% of single family treatment group and 33% of control group, and 21% of multi-family treatment group and 20% of control group reported they had never logged in to their Duke Energy accounts. Among those that had logged in, the most reported purpose was to pay their bill for both single family and multi-family respondents.

Table 4-5: Use of Duke Energy Online Account

Online Account Activity	Single Family		Multi-family	
	Treatment Group (n=168)	Control Group (n=171)	Treatment Group (n=67)	Control Group (n=88)
Never logged in	30%	33%	21%	20%
Pay my bill	40%	39%	51%*	66%*
Look for energy efficiency opportunities or ideas	14%	13%	19%	19%

*statistically significant, p=0.057

As shown in Figure 4-10, single family treatment and control group households report similarly that they accessed the Duke Energy website to search for information about rebate programs, energy efficient products, or ways to make their home more energy efficient. Multi-Family control group households are more likely to report that they accessed the Duke Energy website to search for information about rebate programs, energy efficient products, or ways to make their home more energy efficient than treatment group households (Figure 4-11). Relatively small percentages of both groups in single and multi-family report regular usage of the website for purposes other than bill payment.

Figure 4-10: Assessing Duke Energy Website for Other Information – Single Family

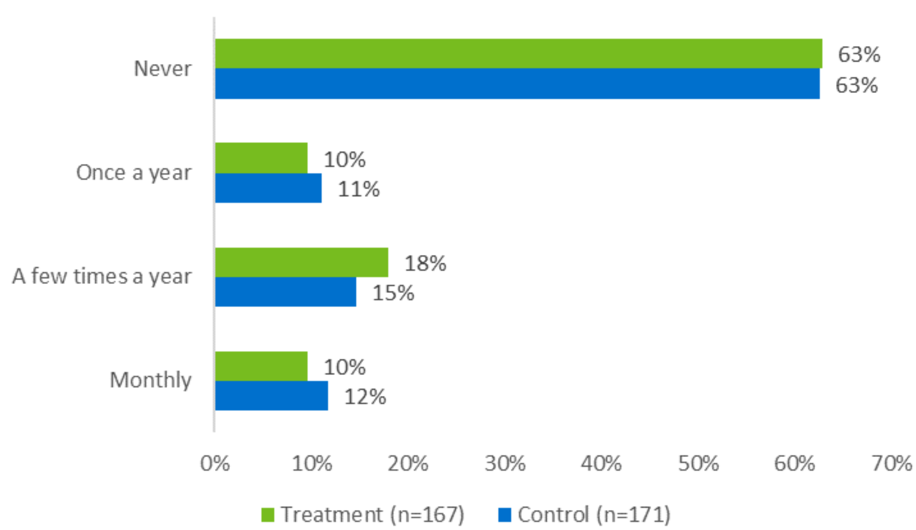
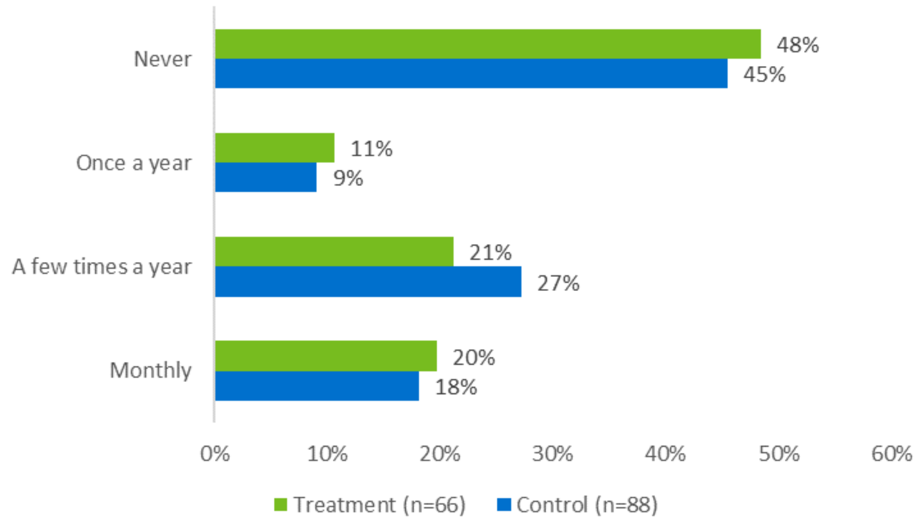


Figure 4-11: Assessing Duke Energy Website for Other Information – Multi-family



Forty-one percent of single family control group customers and 35% of treatment group customers reported they would be likely to check the Duke Energy website for information before purchasing major household equipment, while 46% of multi-family control group customers and 38% of treatment group customers reported so. The portion of respondents rating their likelihood a "7" or higher on an 11-point scale of likelihood is plotted in Figure 4-12 and Figure 4-13.

Figure 4-12: Portion Likely to Check Duke Energy Website prior to Purchasing Major Home Equipment – Single Family Split Top-4 Box Scores (0-10 Scale)

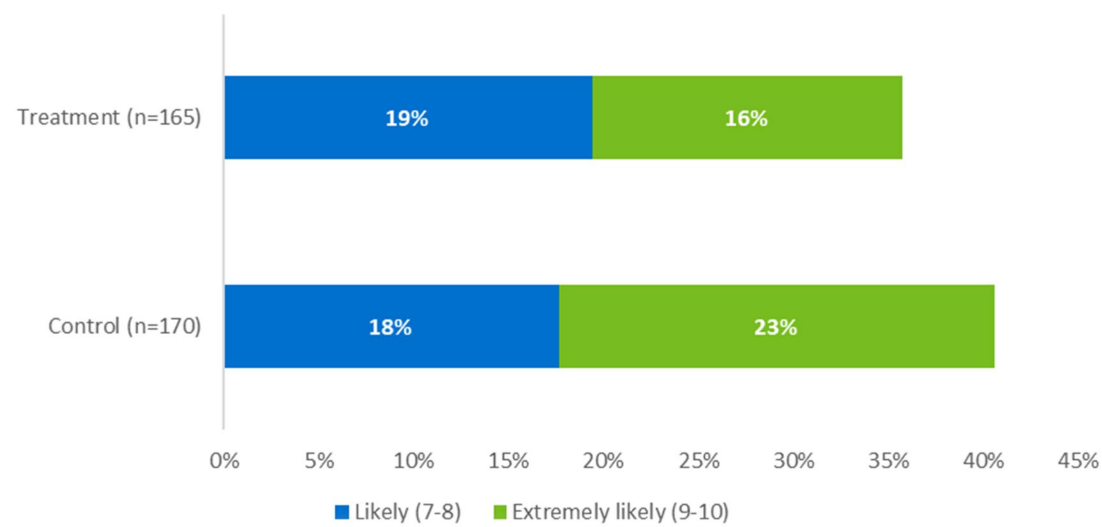
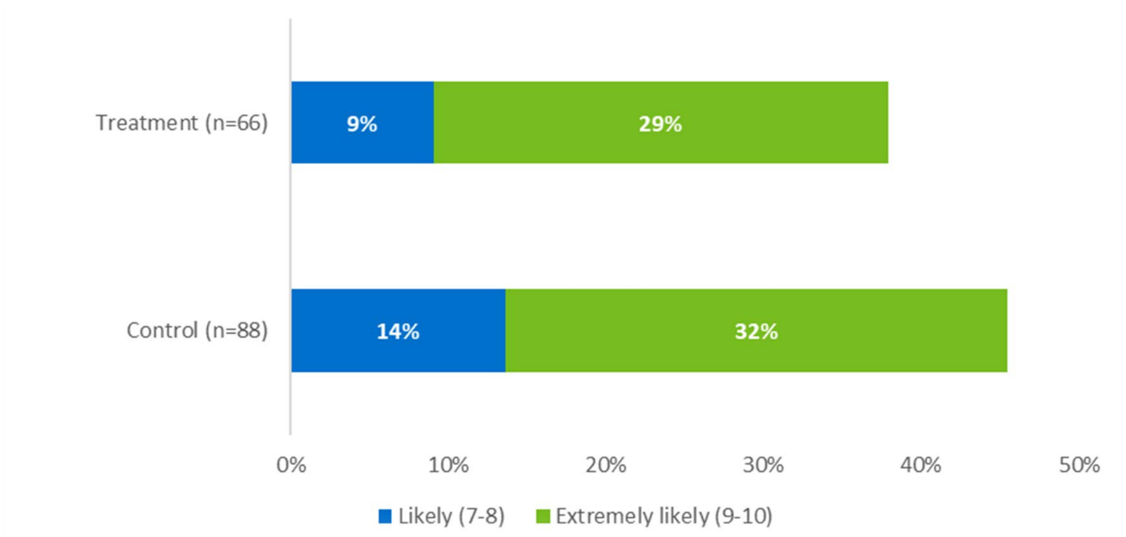


Figure 4-13: Portion Likely to Check Duke Energy Website prior to Purchasing Major Home Equipment – Multi-family Split Top-4 Box Scores (0-10 Scale)

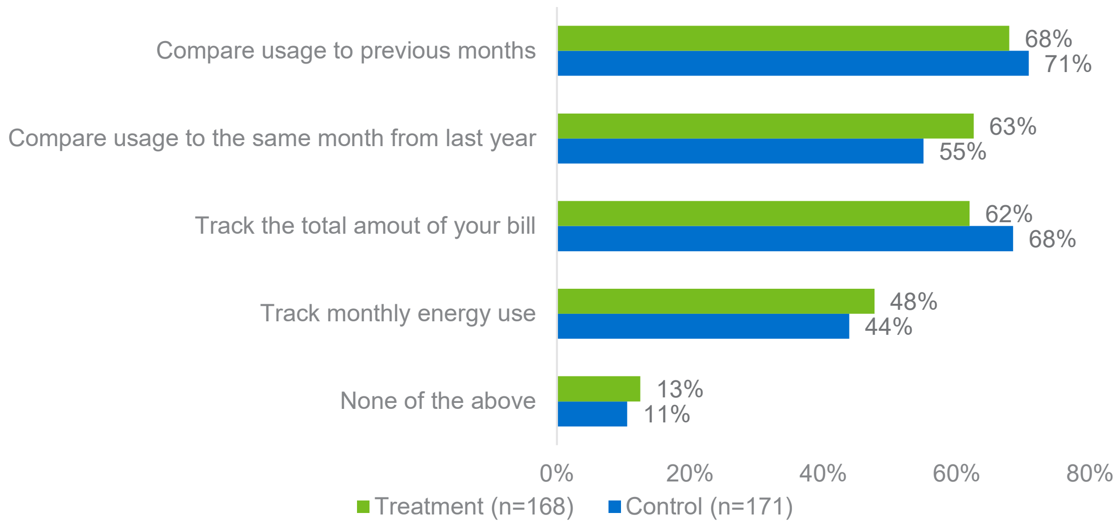


Customers' Reported Levels of Monitoring Energy Use and Energy Saving Behaviors

Single family treatment and control customers report tracking information (bills and usage) related to their household's energy usage in the following ways (Figure 4-14):

- Sixty-two percent of the treatment customers and 68% of the control customers reported tracking the total amount of the bill. The difference is not statistically significant at the 90% level of confidence.
- About two-thirds of respondents compared usage to previous months. The difference between treatment and control groups is not statistically significant.
- More than half of respondents compared usage to the same month from last year. The difference in responses here between treatment and control groups is not statistically significant at the 90% level of confidence.

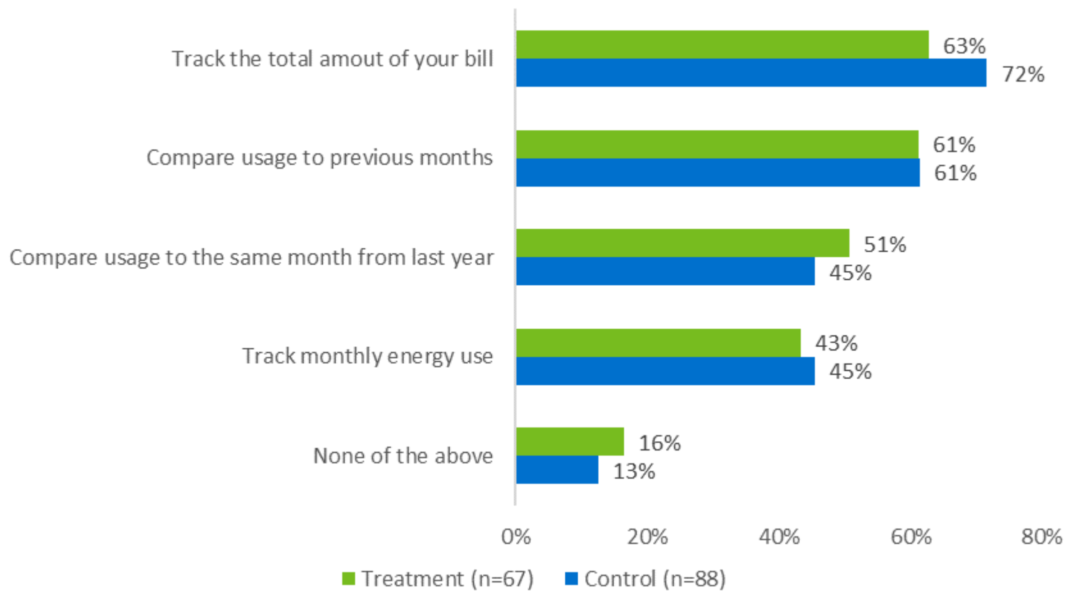
Figure 4-14: "Which of the Following Do You Do with Regard to Your Household's Energy Use?" – Single Family



Multi-family treatment and control customers report tracking information (bills and usage) related to their household's energy usage in the following ways (Figure 4-15):

- Sixty-three percent of the treatment customers and 72% of the control customers reported tracking the total amount of the bill. The difference is not statistically significant at the 90% level of confidence.
- Sixty-one percent of treatment and control respondents, respectively, compared usage to previous months.
- Fifty-one percent of treatment respondents and 45% of control respondents compared usage to the same month from last year. The difference in responses here between treatment and control groups is not statistically significant at the 90% level of confidence.

Figure 4-15: "Which of the Following Do You Do with Regard to Your Household's Energy Use?" – Multi-family



An area of significant interest in this evaluation is the identification of energy-saving behaviors that MyHERs move treatment customers to undertake. These behaviors, if they result in energy savings attributed to the reports, would be over and above what the treatment households would have done without having read or seen their MyHERs. The customer survey included a battery of questions inquiring as to whether the respondent's household has undertaken energy-savings actions. The responses to these questions are compared between the treatment and control respondents, and any statistically significant uplift in the reported behaviors undertaken can be concluded to be due to the MyHERs and may also be inferred as a driver of energy savings attributed to the program. A screening question is used to ensure that respondents answering the questions about specific behaviors only see those questions if they state that they have undertaken any energy savings actions or made energy efficiency improvements at all in the past year.[17]

For both single family and multi-family treatment and control groups, respectively, respondents reported similar levels of taking actions to save energy, as shown in Figure 4-16 and Figure 4-17. Across the nine specific behaviors and actions described by the survey, none show that treatment respondents are significantly more likely to take action to save energy than control respondents. The most cited behavior for both single family and multi-family respondents is turning off lights in unused indoor or outdoor areas, with 93-95% of single family respondents reporting taking that action and 99-100% of multi-family respondents reporting that they take the action. The least-cited action is turning down the water heater temperature – where 30-43% of

[17] Single family treatment and control customers report similar likelihood of having undertaken any behaviors to reduce household energy use or having made energy efficiency improvements to their home (66% to 67%). This is also true for treatment and control multi-family respondents (64% to 59%).

single family respondents reporting that they did that and 34-45% of the multi-family respondents reporting the same.

There are two energy-savings behaviors for which significantly more single-family control customers are reporting undertaking than treatment customers, both of which are related to conserving on water heating. The MyHER reports do not usually touch on water heating end-uses and it may be that MyHER treatment customers are taking actions that displace their interest or efforts to conserve water heating energy use.

While none of these behaviors show an uplift that can be ascribed to MyHER, that does not mean that energy savings are not coming from these behaviors. What these findings mean is that there is no evidence that MyHER has introduced new behaviors to treatment customers that they were not doing at all previously. It's quite possible that MyHER energy savings, at least in part, come from customers turning off lights in unused areas of the home – because they are doing that more than they would otherwise. The current survey instrument used by this evaluation cannot detect that change. Surveys or interviews can be designed to collect information on those more subtle differences in energy savings behaviors in the home, however they would be considerably more complicated and more expensive to field. Fewer customers would be willing to complete such a survey and non-response bias would be of greater concern. Non-response bias could be potentially overcome with completion incentives, but that would also increase the evaluation budget. Duke Energy is aware of the limitations of the customer research agenda and accepts the current resolution of the tradeoff between depth of findings, reliability of findings, and evaluation cost.

Figure 4-16: Reported Energy Savings Behaviors – Single Family

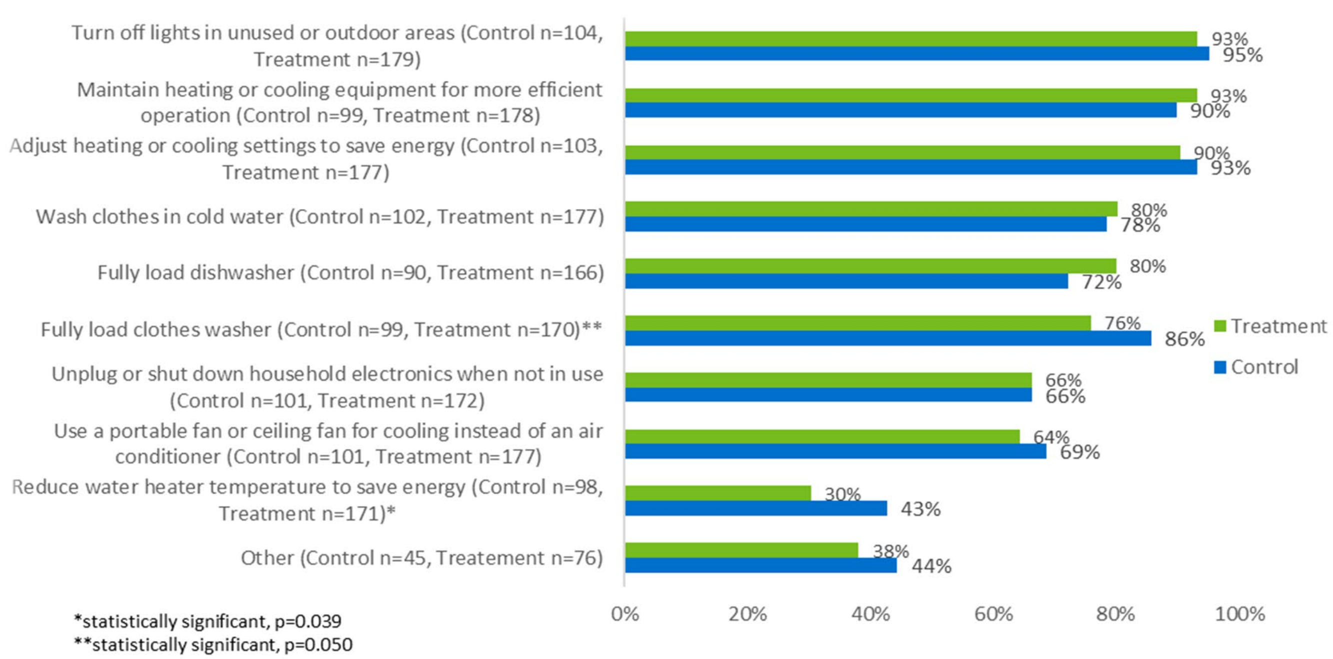
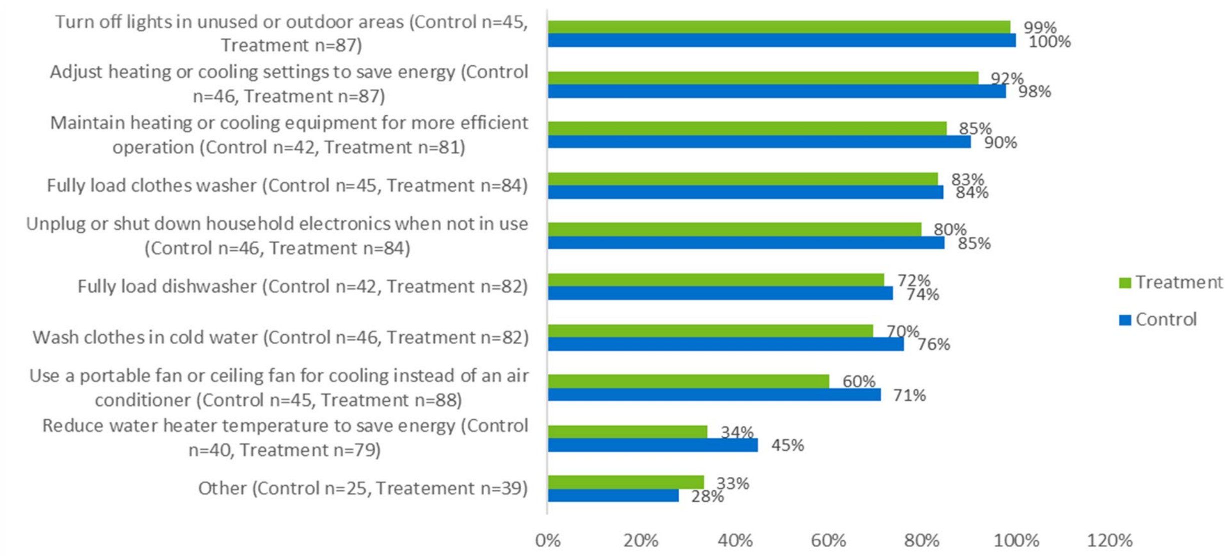


Figure 4-17: Reported Energy Savings Behaviors – Multi-family



Nexant compared the reported behaviors of single family treatment customers to those of multi-family treatment customers. Here we do see measurable differences between behaviors taken by single family customers and multi-family customers. Not surprisingly, single family treatment customers are significantly more likely to report that they "Maintain heating or cooling equipment for more efficient operation" and "Wash clothes in cold water" than multi-family treatment customers, as shown in Figure 4-18. These differences are likely due to the fact that maintenance in multi-family housing is often completed by property management companies. Additionally, the saturation of air conditioning is lower in multi-family housing units as compared to single family. Multi-family treatment customers are significantly more likely to "Turn off lights in unused or outdoor areas" and "Unplug or shut down household electronics when not in use" than single family treatment customers.

Forty-eight single family respondents (treatment and control customers in total) reported other energy savings actions. Nexant categorized these actions and the results are shown in Figure 4-19. The two most reported actions, mentioned by 15 respondents, respectively, pertain to lighting, such as switching to LED bulbs, and upgrading insulation and home sealing.

Figure 4-18: Reported Energy Savings Behaviors Single Family Treatment vs. Multi-family Treatment

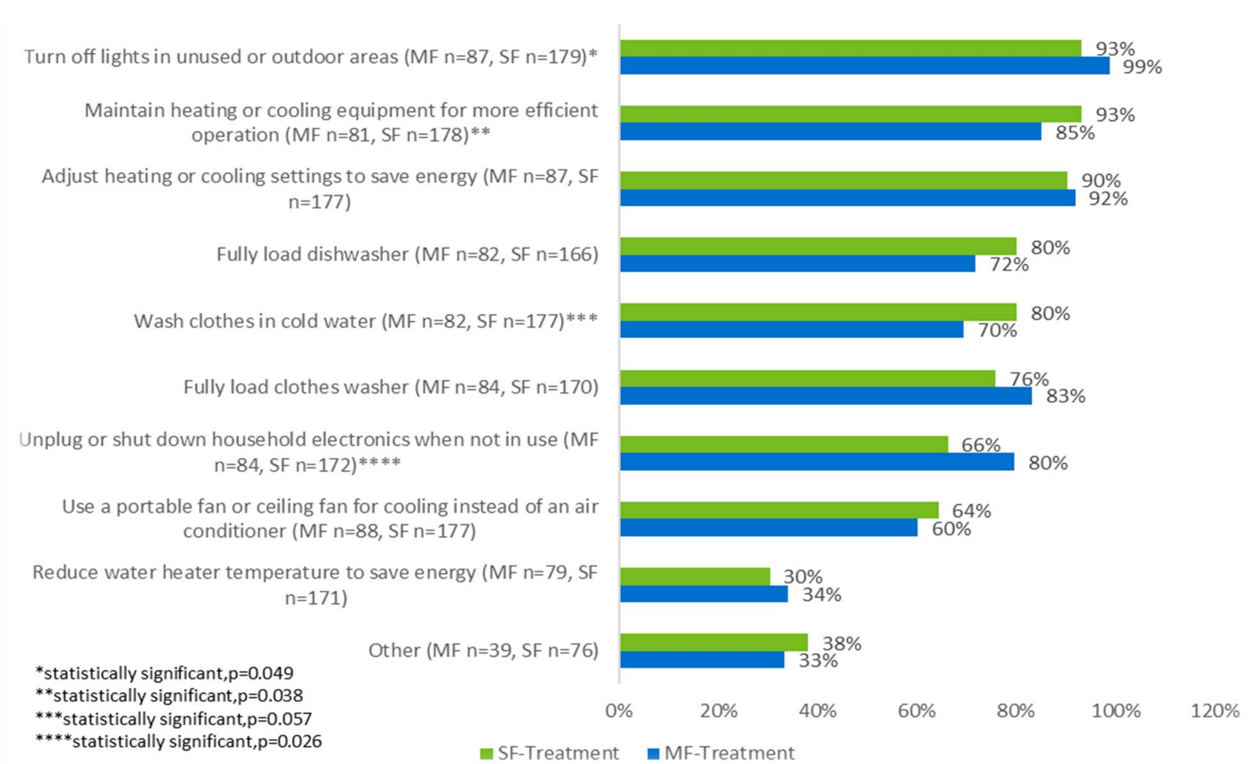
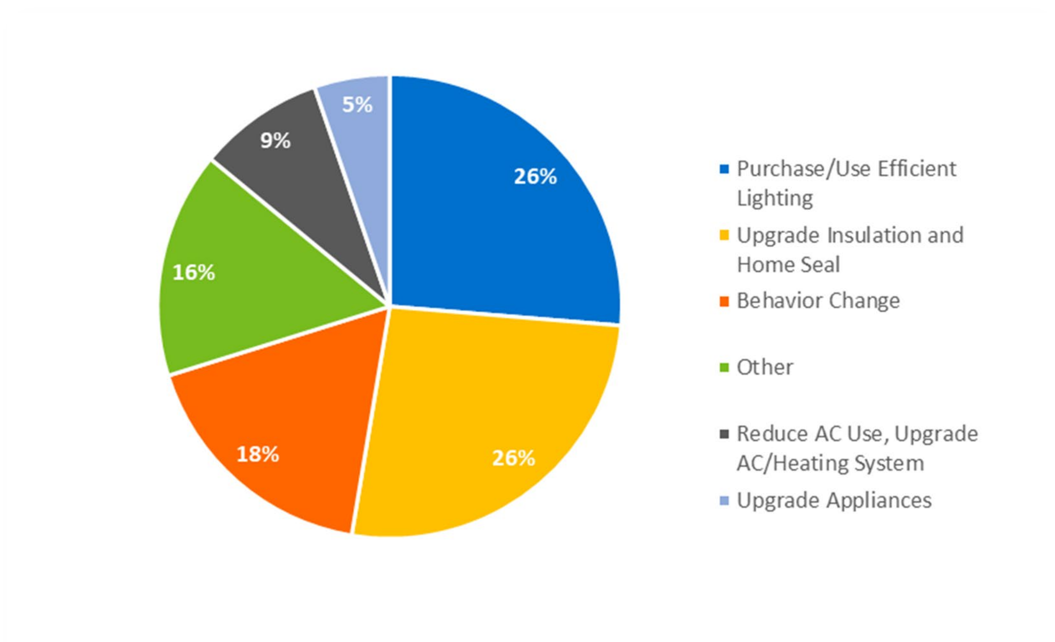
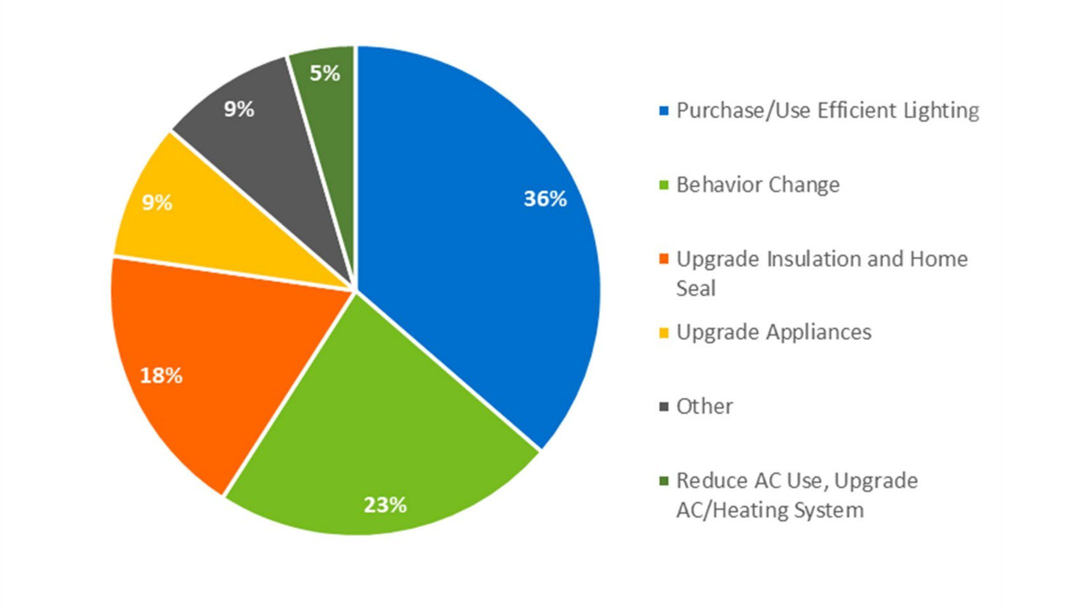


Figure 4-19: Distribution of "Other" Energy Savings Behaviors – Single Family (treatment and control n=48)



Twenty multi-family respondents (treatment and control customers in total) reported other energy savings actions. Nexant categorized these actions and the results are shown in Figure 4-20. The most reported action, mentioned by eight respondents, pertains to lighting, such as switching to LED bulbs.

Figure 4-20: Distribution of "Other" Energy Savings Behaviors – Multi-family (treatment and control n=20)



Both single family and multi-family customers were further asked a question about COVID-19's effects on their household's ability to take energy savings actions. Sixteen percent of single family control customers and 10% of treatment customers reported that the likelihood of COVID-19 pandemic increasing their ability to take energy savings actions a "7" or higher on an 11-point scale of likelihood, while 23% of multi-family control customers and 22% of treatment customers reported so. None of these differences in responses between treatment and control customers are statistically significant.

Reported Energy Efficiency Improvements

With respect to improvements and investments that customers might make after reading or seeing their MyHER reports, we have a similar finding to that of the behavior-related actions discussed above. Respondents were provided with a list of energy efficiency improvements and were asked if they had done each in the past year. In all cases, treatment group is not significantly more likely to report energy efficiency upgrades than control group – across both single family and multi-family respondents. Single family control group respondents are significantly more likely to report replacing windows or doors with more energy-efficient types than treatment group respondents. Significantly more multi-family control group respondents reported caulking or weatherstripping (windows or doors) and installing energy-efficient water heater than treatment group respondents (Table 4-6). On the one hand, this may be considered an unsavory result since the initial hypothesis is that MyHERs are likely to motivate customers to make upgrades like caulking and weatherstripping, or replacing windows and doors. However, this result may also indicate MyHER's success at educating customers about the power of inexpensive purchases and simple behavior changes in managing their electricity bills. Without that education from MyHERs, the control customers may have been more receptive to advertising for new water heaters, or caulking and weatherstripping. This is an interesting possibility and subtle enough that further insights would likely require focus groups, telephone interviews, or a follow up survey.

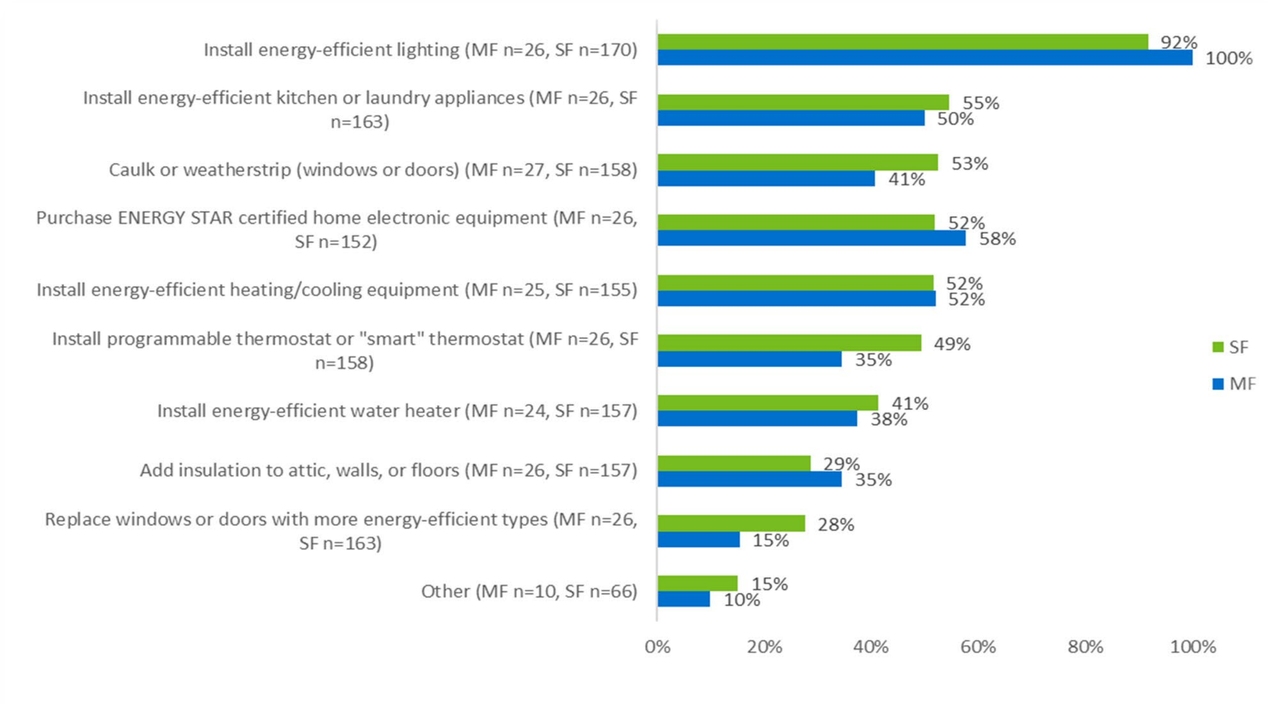
Table 4-6: Customers Indicating They Had Made Each Energy Efficiency Upgrade

Upgrade	Single Family		Multi-family	
	Treatment	Control	Treatment	Control
Install energy-efficient lighting	92% (n=179)	89% (n=104)	88% (n=80)	91% (n=44)
Install energy-efficient kitchen or laundry appliances	53% (n=171)	60% (n=97)	44% (n=75)	52% (n=42)
Purchase ENERGY STAR certified home electronic equipment	51% (n=160)	56% (n=91)	44% (n=73)	49% (n=39)
Caulk or weatherstrip (windows or doors)	51% (n=166)	50% (n=102)	38% (n=72)**	55% (n=42)**
Install energy-efficient heating/cooling equipment	51% (n=164)	51% (n=97)	37% (n=67)	48% (n=40)
Install programmable thermostat or "smart" thermostat	49% (n=166)	47% (n=100)	29% (n=79)	21% (n=43)
Install energy-efficient water heater	42% (n=166)	44% (n=95)	25% (n=68)***	45% (n=40)***
Replace windows or doors with more energy-efficient types	28% (n=172)*	42% (n=103)*	12% (n=74)	24% (n=42)
Add insulation to attic, walls, or floors	28% (n=166)	34% (n=100)	20% (n=70)	30% (n=40)

*statistically significant p=0.018
**statistically significant p=0.073
***statistically significant p=0.032

As discussed above with behavioral actions, single family treatment respondents were significantly more likely to report they had undertaken upgrades than multi-family treatment respondents on installing energy-efficient heating/cooling equipment, installing energy-efficient water heaters, replacing windows or doors with more energy-efficient types, caulking or weatherstripping (windows or doors), and installing programmable thermostat or "smart" thermostat in the survey. To control for the fact that the likelihood of renters would make these upgrades is very low, we considered the multi-family treatment responses in comparison to single family treatment responses with renters removed. When renters were removed from the analysis, five of these upgrades still emerged as higher for single family treatment respondents, as seen in Figure 4-21. None of the differences are statistically significant.

Figure 4-21: Customers Indicating They Had Made Each Energy Efficiency Upgrade Treatment Homeowners Only – Single Family vs. Multi-family



To examine broader patterns within participant responses to the behavior and upgrade questions, these questions were combined into behavior vs. upgrade categories and were also combined into end-use categories. First, as shown in Table 4-7, treatment respondents and control respondents reported very similar levels of engagement in energy efficiency behaviors and improvements generally, and also undertook a similar average number of energy efficiency behaviors across the two household types.

Table 4-7: Percent of Households That Have Undertaken Energy Efficiency Actions

Behaviors/Improvements	Single Family		Multi-family	
	Treatment	Control	Treatment	Control
Energy Efficiency Behaviors	100% (n=183)	100% (n=106)	100% (n=88)	100% (n=47)
Average Number of Behaviors	6.6	6.7	6.6	7.0
Energy Efficiency Improvements	97% (n=181)	96% (n=105)	92% (n=84)	96% (n=46)
Average Number of Improvements	4.2	4.5	3	3.8

Additionally, Table 4-8 shows the proportion of respondents that had undertaken at least one behavior or upgrade in each end use category. For those categories that have multiple behaviors or upgrades within it, these are broken out on their own for analysis. In the category “Water Heating Behaviors/Upgrades”, for example, four behaviors relevant to water heating are combined in a subcategory “Water Heating Behaviors” are broken out. Upgrades are not broken out here in that way because there is only one upgrade (“Install energy-efficient water heater”) associated with the parent category, and the proportion of respondents undertaking this upgrade is presented in Table 4-6, above. Similarly, for "Lighting Behaviors/Upgrades", there was only one upgrade and behavior, so these are not broken out. Lastly, there was only one behavior associated with the "Electronics and Appliances Behaviors/Upgrades" category ("Unplug or shut down household electronics when not in use"), so it was omitted as well. Multi-family control group members were significantly more likely to have undertaken sealing and insulation upgrades than treatment group members.

Table 4-8: Percent of Households That Had Undertaken Energy Efficiency Behaviors or Upgrades, by End Use Category

Behaviors/Improvements	Single-family		Multi-family	
	Treatment Group	Control Group	Treatment Group	Control Group
Water Heating Behaviors/Upgrades (5)	96% (n=182)	98% (n=106)	95% (n=87)	98% (n=47)
Water Heating Behaviors (4)	96% (n=182)	99% (n=105)	94% (n=87)	98% (n=47)
Space Heating Behaviors/Upgrades (5)	99% (n=183)	97% (n=106)	99% (n=88)	100% (n=47)
Space Heating Behaviors (3)	99% (n=183)	98% (n=105)	99% (n=88)	100% (n=47)
Space Heating Upgrades (2)	66% (n=173)	66% (n=103)	46% (n=81)	49% (n=43)
Lighting Behaviors/Upgrades (2)	98% (n=183)	99% (n=106)	99% (n=87)	100% (n=47)
Electronics and Appliances Behaviors/Upgrades (3)	87% (n=182)	85% (n=106)	86% (n=87)	93% (n=46)
Electronics and Appliances Upgrades (2)	65% (n=173)	69% (n=100)	55% (n=80)	63% (n=43)
Sealing and Insulation Upgrades (3)	65% (n=174)	66% (n=103)	43% (n=75)	59%* (n=44)

*statistically significant, p=0.084

Both single family and multi-family customers were further asked a question about COVID-19's effects on their households' ability to make energy efficiency improvements. Twelve percent of single family control customers and 9% of treatment customers reported that the likelihood of COVID-19 pandemic increasing their ability to make energy efficiency improvements a "7" or higher on a 0-10 point scale of likelihood, while 21% of multi-family control customers and 24% of treatment customers reported so. None of these differences in responses between treatment and control customers are statistically significant.

Customer Motivation and Awareness

Single family control and treatment groups report similar levels of motivation for saving energy. Eighty-five percent of control customers indicated that knowing they are using energy wisely is "important" or "extremely important" (rated 7 or higher on a 0-10 point scale), compared to 81% of treatment customers. This difference is not statistically significant (Figure 4-22). The same is true for multi-family. Eighty-one percent of control customers indicated that knowing they are using energy wisely is "important" or "extremely important", compared to 82% of treatment customers. This difference is not statistically significant (Figure 4-23).

Figure 4-22: "How Important Is It for You to Know if Your Household is Using Energy Wisely?"– Single Family Split Top-4 Box Scores (0-10 Scale)

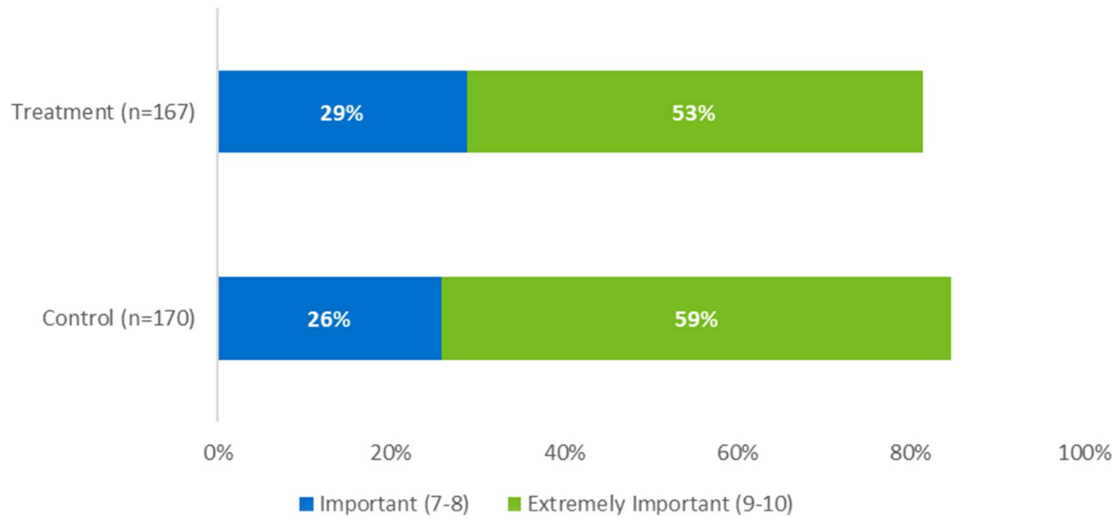
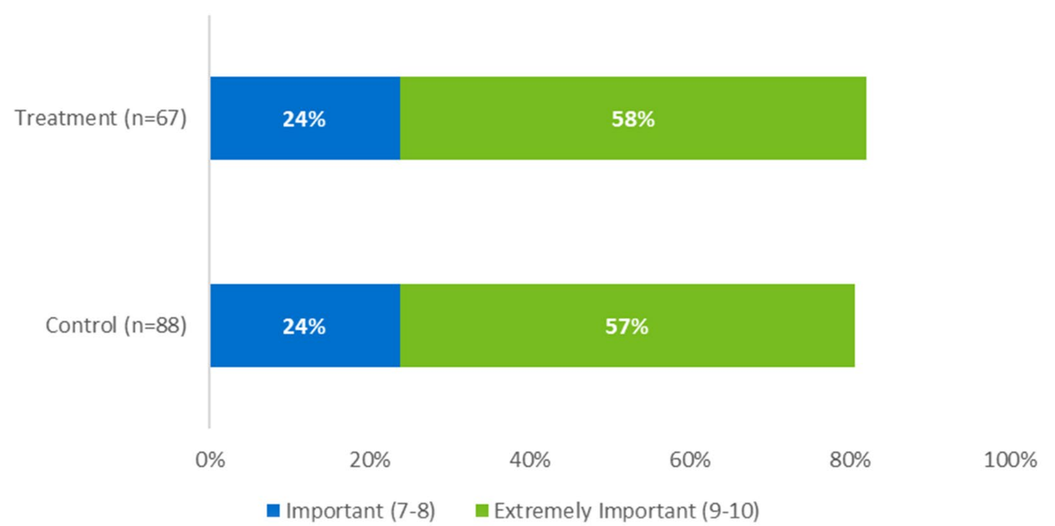
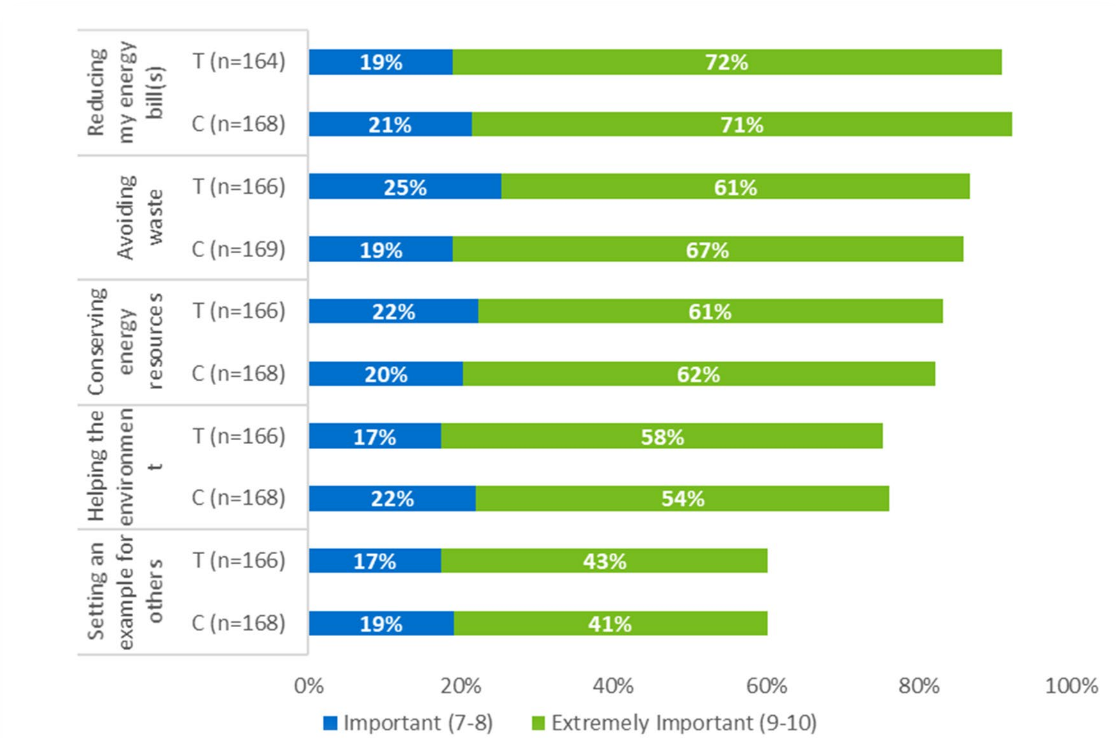


Figure 4-23: "How Important Is It for You to Know if Your Household is Using Energy Wisely?" – Multi-family Split Top-4 Box Scores (0-10 Scale)



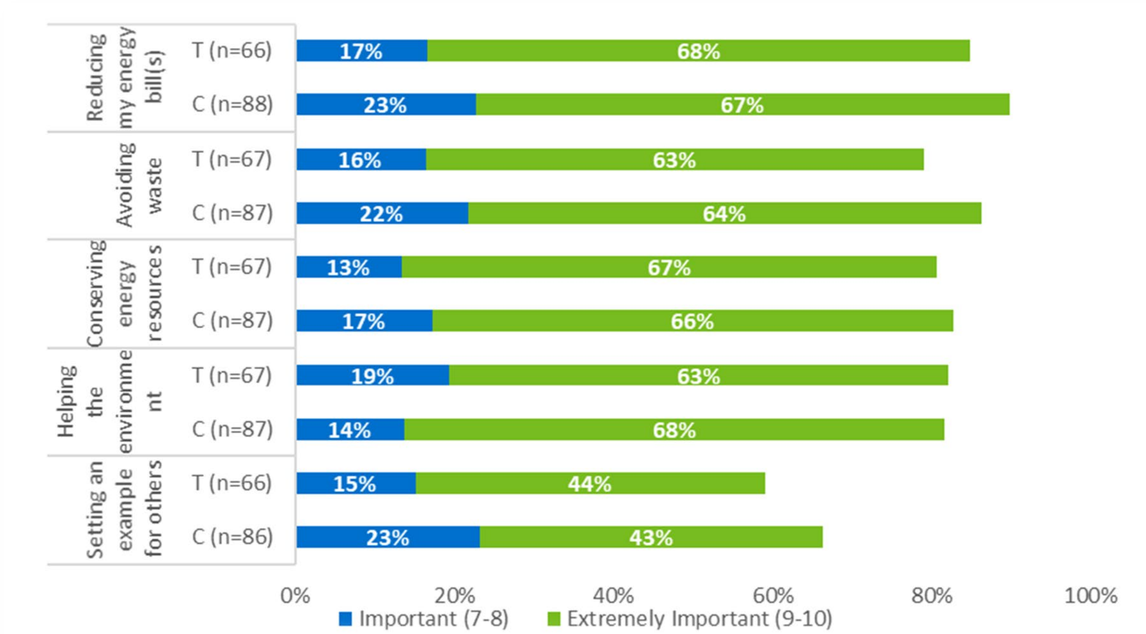
Customers were asked to rate, on a scale of 0 to 10, the importance of various reasons why they might try to reduce their home's energy use. The strongest motivation for both treatment and control groups is saving money on their energy bills. For single family, 91% of treatment respondents and 92% of control respondents reported that saving money on their energy bills was "important" or "extremely important" (rated 7 or higher on a 0-10 point scale). Eighty-six percent of treatment respondents and 86% of control respondents indicated that "avoiding waste" was "important" or "extremely important" to them. Eighty-three percent of treatment customers and 82% of control customers reported that "conserving energy resources" was "important" or "extremely important". Seventy-five percent of treatment customers and 76% of control customers reported that "helping the environment" was "important" or "extremely important". None of the differences between treatment and control groups are statistically significant. Figure 4-24 contains the frequency of responses to this question, shown as a percentage for both treatment and control groups.

Figure 4-24: "Please Indicate How Important Each Statement Is to You" – Single Family Split Top-4 Box Scores (0-10 Scale)



For multi-family, 85% of treatment respondents and 90% of control respondents reported that saving money on their energy bills was "important" or "extremely important" (rated 7 or higher on a 0-10 point scale). Seventy-nine percent of treatment customers and 86% of control customers reported that "avoiding waste" was "important" or "extremely important". Eighty percent of treatment respondents and 83% of control respondents indicated that "conserving energy resources" was "important" or "extremely important" to them. Eighty-two percent of treatment customers and control customers, respectively, reported that "helping the environment" was "important" or "extremely important". None of the differences are statistically significant at the 90% level of confidence. Figure 4-25 contains the frequency of responses to this question, shown as a percentage for both treatment and control groups.

Figure 4-25: "Please Indicate How Important Each Statement Is to You" – Multi-family Split Top-4 Box Scores (0-10 Scale)



As indicated by Figure 4-26 and Figure 4-27, among single family treatment customers, 71% of treatment group customers rated their knowledge regarding ways to save energy in the home at least seven on a 0-10 point scale (indicating they were "knowledgeable" or "extremely knowledgeable"), while 61% of control group customers rated themselves this way. The difference between treatment and control customers is statistically significant at the 90% level of confidence. Among multi-family customers, 62% of treatment respondents and 63% of control respondents rated themselves seven or higher on this scale. The difference is not statistically significant at the 90% level of confidence.

Figure 4-26: "How Would You Rate Your Knowledge of the Different Ways You Can Save Energy in Your Home?" – Single Family Split Top-4 Box Scores (0-10 Scale)

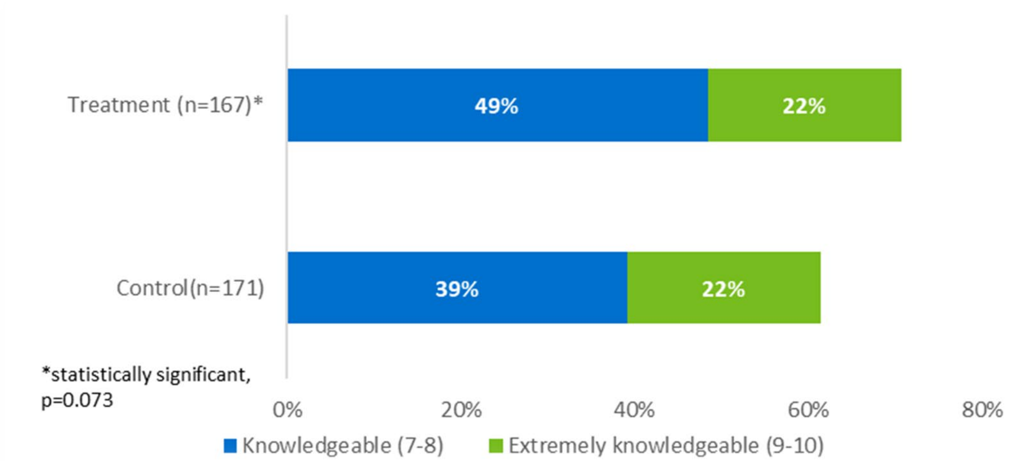
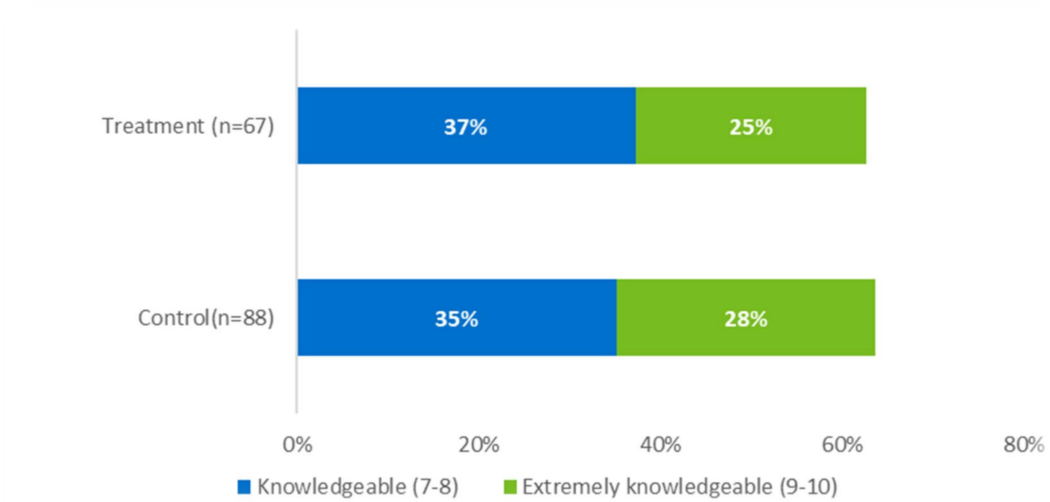


Figure 4-27: "How Would You Rate Your Knowledge of the Different Ways You Can Save Energy in Your Home?"– Multi-family Split Top-4 Box Scores (0-10 Scale)



Respondents that took the treatment-only survey were asked how useful each MyHER feature was to their homes. A similar question was asked of primary survey respondents, but rephrased to ask them how useful they might expect that information to be. Table 4-9 presents the comparison results between the actual usefulness of each item rated by treatment customers (treatment only survey) and the hypothetical usefulness rated by control customers in the primary survey for both sets of respondents who answered "7" or above on a scale from 0-10.

This table shows that among single family customers, control customers were significantly more likely to think that "Tips to help you save money and energy" and "Information about services and offers from Duke Energy" might be useful, than treatment customers actually thought they were. Among multi-family customers, control customers were significantly more likely to think that "information about services and offers from Duke Energy" might be useful, than treatment customers actually thought it was. These findings suggest that there may be an opportunity to improve the presentment of this information in MyHERs, about Duke Energy's services and offerings.

Table 4-9: Actual Usefulness versus Hypothetical Usefulness of HER Features Top-4 Box Scores (0-10 Scale)

HER Feature	Single Family		Multi-family	
	Control	Treatment Only	Control	Treatment Only
Graphs that display your home's energy use over time	67% (n=160)*	80% (n=114)*	67% (n=86)	71% (n=66)
Energy use associated with specific household items and areas	67% (n=160)	57% (n=115)	58% (n=86)****	73% (n=66)****
Tips to help you save money and energy	75% (n=165)**	54% (n=115)**	73% (n=86)	66% (n=65)
Customized suggestions for your home	56% (n=162)	53% (n=113)	56% (n=85)	57% (n=65)
Information about services and offers from Duke Energy	65% (n=164)***	50% (n=114)***	68% (n=87)*****	48% (n=66)*****
Comparison to similar homes	52% (n=160)	44% (n=115)	58% (n=85)	51% (n=65)

*statistically significant, p=0.018
**statistically significant, p=0.000
***statistically significant, p=0.015
****statistically significant, p=0.063
*****statistically significant, p=0.010

Barriers to Customers Undertaking Energy Savings Actions

When asked the reasons why customers might not be able to save as much ~~as~~ energy as they would like, statistically different response patterns between treatment and control customers were found, as shown in Figure 4-28 and Figure 4-29. On a scale of 0-10, where 0 represents "not at all important" and 10 is "extremely important", forty percent of single family control respondents reported "I do not have enough information to make a decision or understand the impacts of making energy-efficient changes or improvements" as a barrier and 30% of treatment respondents did so as well (rated this importance as 7 or higher). The difference is statistically significant at the 90% level of confidence. For multi-family, 25% of treatment respondents and 35% of control respondents reported "Getting everyone in the house to cooperate is too hard" as a barrier. The difference is statistically significant at the 90% level of confidence. When single family and multi-family treatment group responses ~~to these questions~~ were compared, roughly half of multi-family respondents and single family respondents reported "Initial cost of energy efficient equipment is too high" as a barrier. The difference between single family and multi-family respondents is statistically significant at 90% level of confidence.

Figure 4-28: Barriers to Customers Undertaking Energy Savings Actions – Single Family Top-4 Box Scores (0-10 Scale)

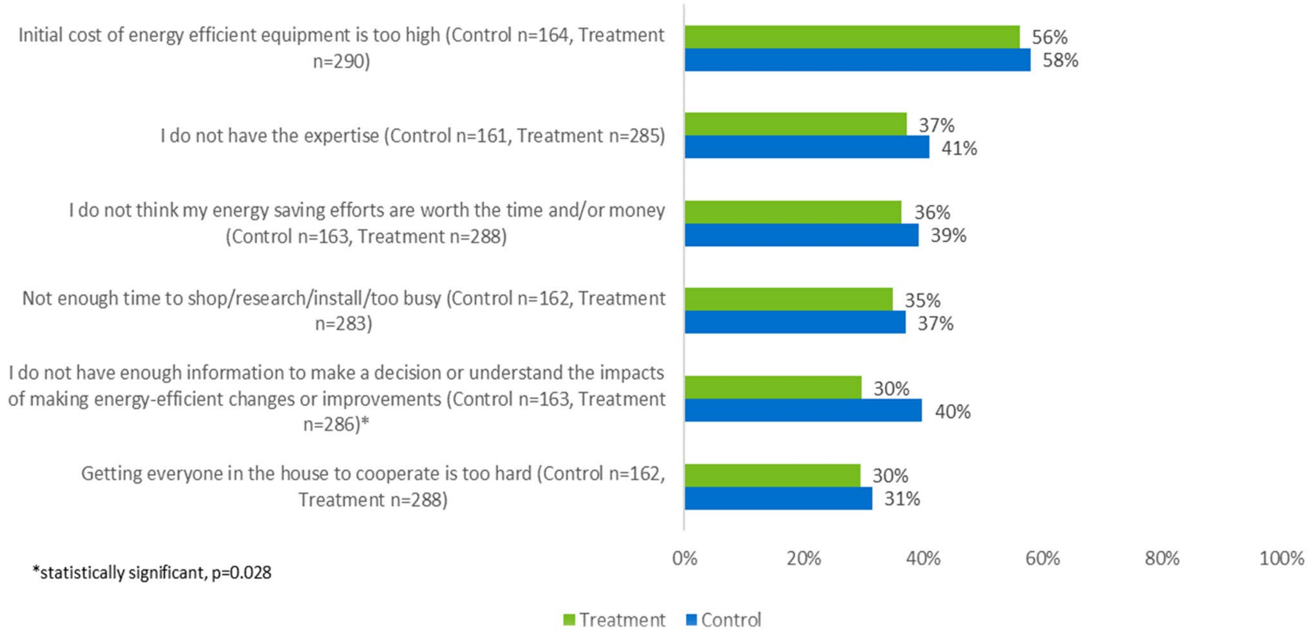
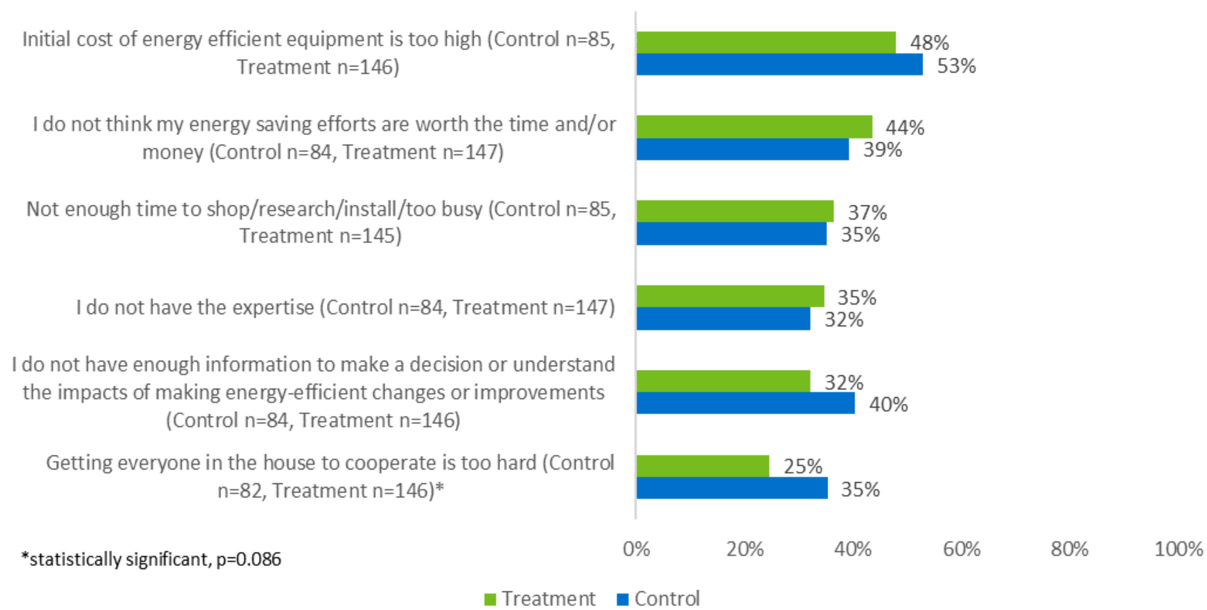


Figure 4-29: Barriers to Customers Undertaking Energy Savings Actions – Multi-family Top-4 Box Scores (0-10 Scale)



Suggestions about Duke Energy Improving Service Offerings

The survey provided an open-ended question to elicit suggestions about Duke Energy

improving its service offerings to help customers reduce energy use. Only 25% (179 of 718, treatment and control customers in total) offered suggestions, including 26 who offered only appreciative comments. Among those offering suggestions for improvement, the most common request, mentioned in 62 of the remaining 168 responses with suggestions, reflected a desire for more energy savings programs, more energy savings information, and more incentives:

- "*More options for low-cost LED bulbs. Rebates/coupons for energy efficient appliances/HVAC, fans*"
- "*Send LED light bulbs"*
- *"Offer suggestions on how to save on energy consumption"*
- *"Offer E.E. light bulbs more often. Reduce rates for low income households."*
- "*Give more energy efficient items."*

Other comments centered on other suggestions, such as reducing prices/providing senior discounts and better communication. Nexant categorized these suggestions on the general basis of their content; the results are presented in Table 4-10.

Table 4-10: Responses to Solicitation for Suggestions to Duke Energy for Improving Service Offerings

Suggestion	Single Family			Multi-family		
	Count	Percent of Respondents Mentioning (n=120)	Percent of Total Mentions (n=130)	Count	Percent of Respondents Mentioning (n=59)	Percent of Total Mentions (n=65)
Increase program offerings, incentives, or information	40	33%	31%	22	37%	34%
Appreciate current offers	20	17%	15%	7	12%	11%
Voiced frustration with Duke Energy	18	15%	14%	2	3%	3%
Reduce Price/provide senior discounts	16	13%	12%	11	19%	17%
Provide more detailed info in MyHER	15	13%	12%	8	14%	12%
Better Communication/More Emails/More mails/In-person communication	11	9%	8%	2	3%	3%
Miscellaneous	8	7%	6%	11	19%	17%
Reduce Power Outages	1	1%	1%	1	2%	2%
Improve website/app	1	1%	1%	1	2%	2%

4.2.2.2 Treatment Households: Experience and Satisfaction with MyHER

A very large majority of the single family treatment only household respondents, 95%, (124 of 131), and the multi-family treatment only household respondents, 95%, (77 of 81) recalled receiving at least one of the MyHER reports.

The survey asked those that could recall receiving at least one MyHER report if they could recall how many individual reports they had received "in the past 12 months" (Figure 4-30 and

Figure 4-31). Given Duke Energy's protocols for report delivery, respondents who receive paper HERs would receive eight reports (single family respondents) and up to six reports (multi-family respondents) in this time period, and those who receive eHERs would have received 12. Fifty percent (59 of 118) of single family customers responded that they received 12 home energy reports in the past 12 months. Twenty-nine percent (20 of 70) of multi-family customers responded that they received 12 home energy reports in the past 12 months. The scattered distribution of responses related to recall is consistent with the difficulty of recalling an exact number of reports, however the question is valuable for grounding respondents in the experience of receiving a MyHER before asking them more specific questions about the document. We note the response pattern for single family respondents is significantly different than that of multi-family respondents.

Figure 4-30: Reported Number of MyHERs Received "In the past 12 months" (n=118) Single Family

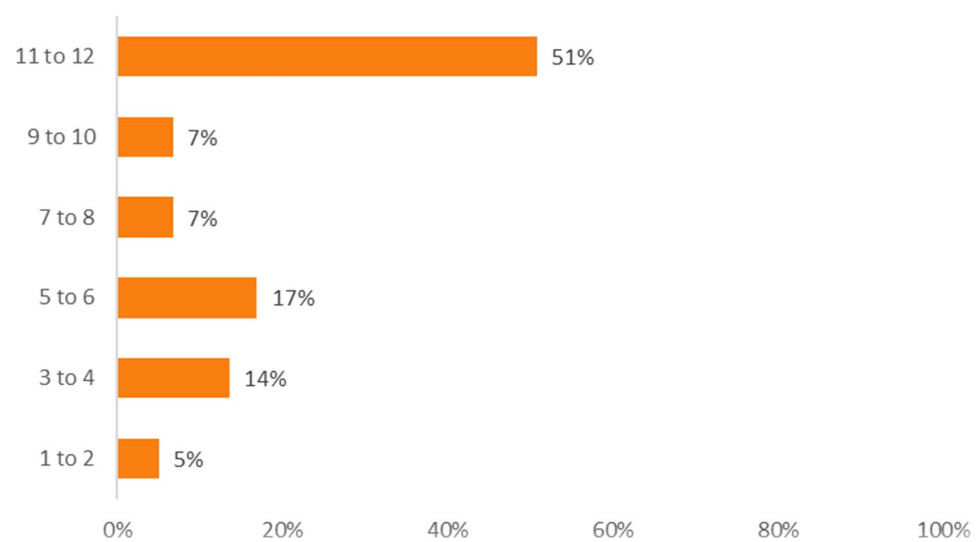
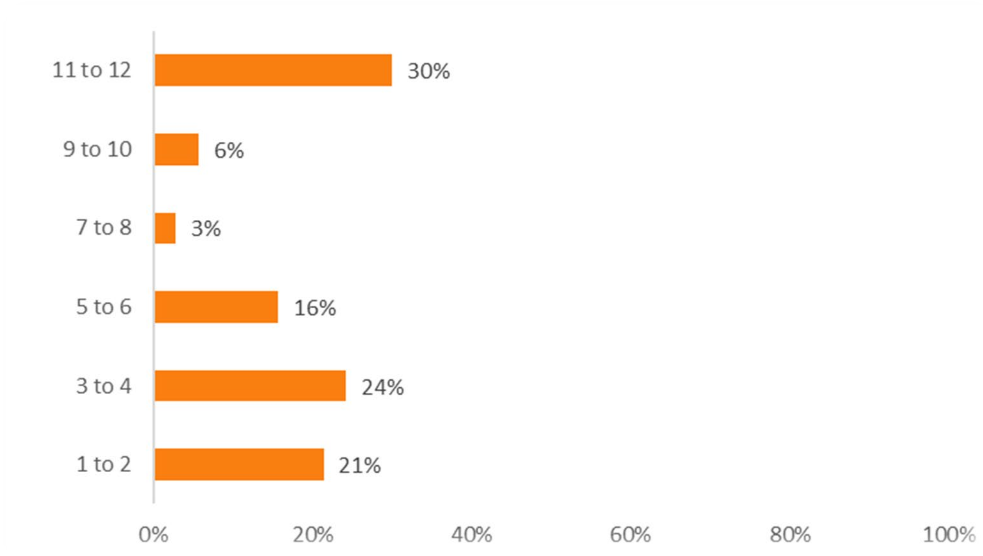


Figure 4-31: Reported Number of MyHERs Received "In the past 12 months" (n=70) Multi-family



Survey respondents indicated high interest in the MyHER reports. As shown in Figure 4-32 and Figure 4-33, when asked how often they read the reports, 98% of single family respondents indicated they "always" or "sometimes" read the reports, and 94% of multi-family respondents indicated they "always" or "sometimes" read them.

Figure 4-32: How Often Customers Report Reading the MyHER (n=117) – Single Family

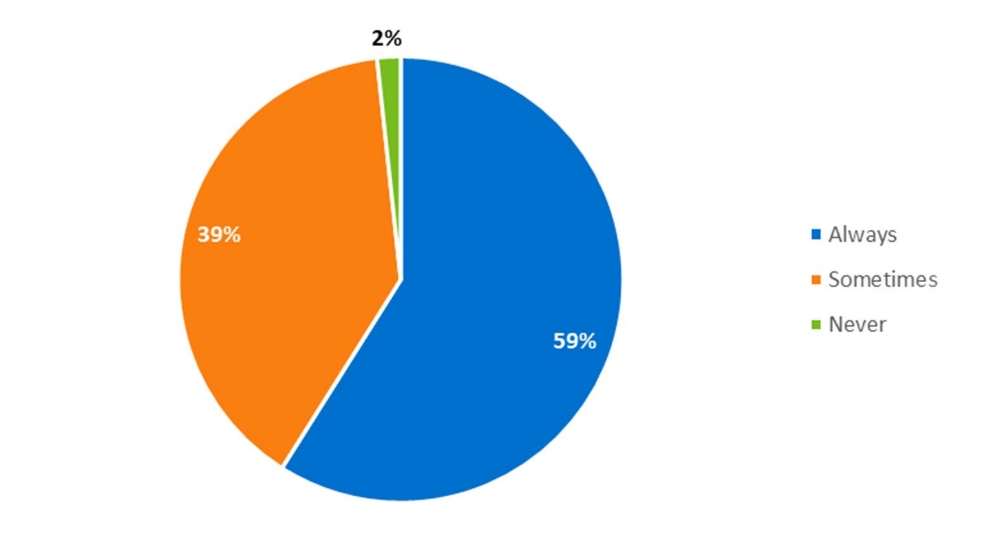
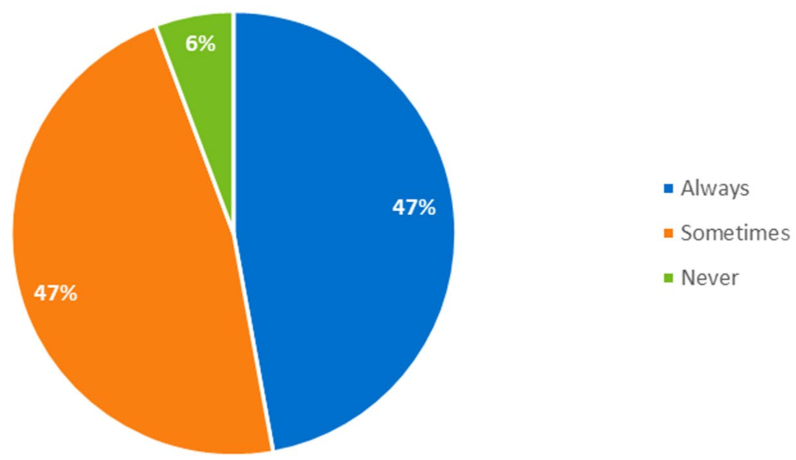


Figure 4-33: How Often Customers Report Reading the MyHER (n=70) – Multi-family



Fifty-nine percent (77 of 113) of single family respondents that provided a rating reported being "somewhat" or "very" satisfied with the information contained in the reports (Figure 4-34). Seventy-two percent (46 of 64) of multi-family respondents that provided a rating reported being "somewhat" or "very" satisfied with the information contained in the reports (Figure 4-35). The survey asked a further question to the respondents of why they said so: 8 of the satisfied single family respondents and 4 of the satisfied multi-family respondents provided reasons. Among customers who gave the highest satisfaction ratings, the most common comments on the MyHERs described the reports as "helpful."

Figure 4-34: Satisfaction with the Information in MyHER Reports (n=113) – Single Family

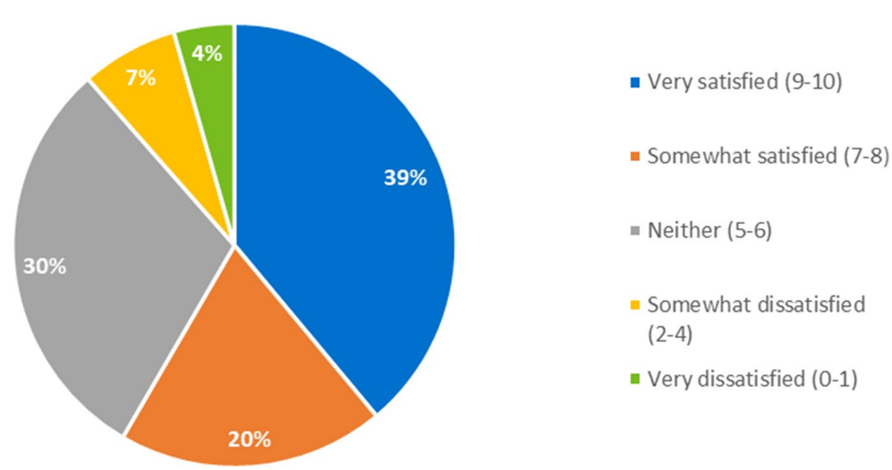
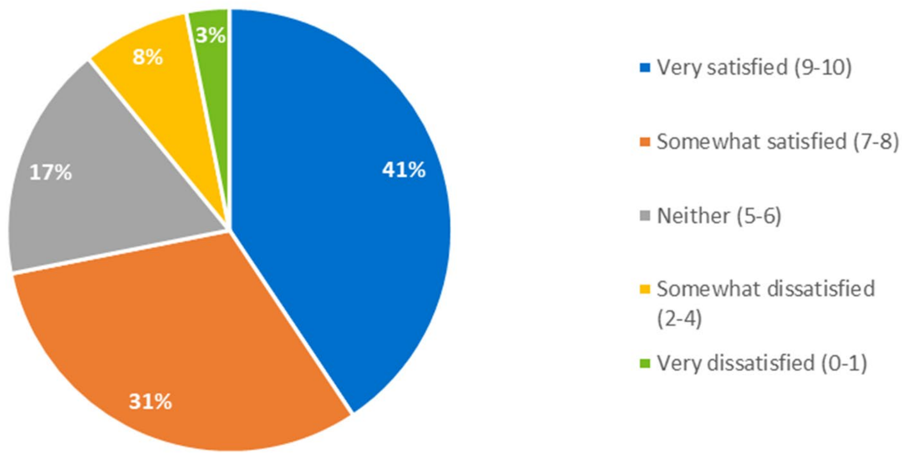


Figure 4-35: Satisfaction with the Information in MyHER Reports (n=64) – Multi-family

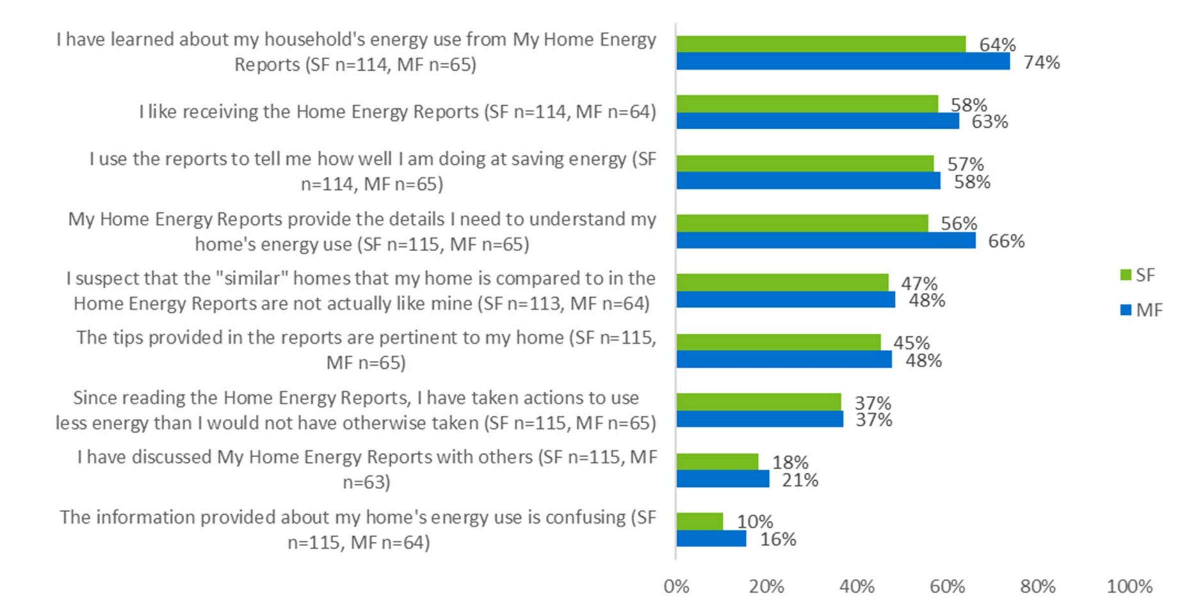


When asked to rate their agreement with a series of statements about MyHERs on a scale of 0 to 10, recipients largely agreed that the reports helped them understand their home's energy use, with 64% of single family respondents and 74% of multi-family respondents rating their agreement a seven or higher on a 0-10 point scale.

Fifty-eight percent of single family respondents and 63% of multi-family respondents agreed that they like receiving the home energy reports; this difference is not statistically significant at the 90% level of confidence.

More than half (56% of single family respondents and 66% of multi-family respondents) agreed that the reports provided the details they needed to understand their home's energy usage. The difference here between single family and multi-family respondents is not statistically significant. Respondents provided weaker agreement to statements about the pertinence of the tips provided to their homes and whether they have taken actions to use less energy than they would not have since reading MyHERs. A relatively small percentage (10% of single family respondents and 16% of multi-family respondents) agreed with the statement that the information provided is confusing; the difference is not statistically significant at the 90% level of confidence (Figure 4-36).

Figure 4-36: Level of Agreement with Statements about MyHER Top-4 Box Scores (0-10 Scale)



The survey provided an open-ended question (to customers that reported reading at least one report in the past year) to elicit suggestions for improvements to the MyHER reports. About 41% (47 of 115) of single family respondents and 26% (17 of 66) of multi-family respondents offered suggestions, including 7 single family respondents and 5 multi-family respondents who offered comments to express gratitude and appreciation of the reports only. Among those providing a response to the question, the most common response, mentioned by 17 of the 40 single family respondents with suggestions and 6 of the 12 multi-family respondents with suggestions, reflected a desire for more specific information or details about their home and specific actions they should take. Some of these requests reflected interest in understanding at a more granular level how their home uses energy and how to reduce energy consumption information:

- "*Specific Instructions on how to reduce energy consumption in the highest used category would be most useful*"
- *"Provide better more realistic tips about how I can decrease my bill"*
- "*Give improvement suggestions on each report that we could implement and save energy*"

Other comments centered on unique circumstances, such as providing relevant information for people who live in an apartment (three multi-family respondents mentioned these circumstances):

- "*I live in an apartment and I was doing all of the suggestions before I received the report. I would like suggestions on things I can control in my apartment*"

- *"I live in an apartment and some of the suggestions don't apply to me…"*

Nexant categorized these suggestions on the general basis of their content; the results are presented in Table 4-11.

Table 4-11: Suggestions for HER Improvement (Multiple Responses Allowed)

Suggestion/Comment	Single Family			Multi-family		
	Count	Percent of Respondents Mentioning (n=47)	Percent of Total Mentions (n=51)	Count	Percent of Respondents Mentioning (n=17)	Percent of Total Mentions (n=20)
Provide more specific information or details	17	36%	33%	6	35%	30%
Don't believe comparison/accuracy	12	26%	24%	1	6%	5%
Appreciate the Home Energy Report	7	15%	14%	5	29%	25%
Format/Frequency	7	15%	14%	2	12%	10%
Unique circumstances	3	6%	6%	4	24%	20%
Other	1	2%	2%	0	0%	0%
Don't see value/dislike	2	4%	4%	2	12%	10%
Expressed frustration	2	4%	4%	0	0%	0%

Treatment households were also asked questions that focused on their awareness and use of MyHER Interactive, revealing low awareness of the online Interactive platform:

- Only 31% (35 of 112) of single family treatment customers and 52% (34 of 65) of multi-family treatment customers are aware of MyHER Interactive. The difference between single family and multi-family respondents is statistically significant at the 90% level of confidence;
- Among aware customers, 91% of single family respondents and multi-family respondents, respectively, reported that they had not signed up to use MyHER Interactive; and
- When these respondents were asked why they haven't signed up to use MyHER Interactive, among the respondents who gave the answers, 29% of single family respondents and 27% of multi-family respondents reported that they were not interested in it, 21% of single family respondents and 14% of the multi-family respondents said they were too busy, 14% of single family respondents and 27% of multi-family respondents reported that they did not know about it, and 18% of multi-family respondents reported that they did not use computer.

Evidence of MyHER Effects

As noted above, while formal statistical testing found some differences among treatment and control group households for individual questions, Nexant sought to understand if the overall pattern of survey responses differed among treatment and control households. To do this, we categorized each survey question by topic area and then counted any survey item in which the treatment households provided a more positive response than the control households.

Nexant's approach consists of the following logical elements:

- Assume the number of positive responses between treatment and control customers will be equal if MyHER lacks influence;
- Count the total number of topics and questions asked of both groups – there are seven topic areas and 51 questions;
- Note any item for which the treatment group outperformed the control group:
    - Single family: The treatment group outperformed the control group in 26 questions, or 51% of the total questions;
    - Multi-family: The treatment group outperformed the control group in 14 questions, or 27% of the total questions; and
- Calculate the probability that the difference in response patterns is due to chance, rather than an underlying difference in populations – 61% in the case of single family. Since this probability is much greater than 10%, we cannot reject the null hypothesis that the number of positive responses should be equal for treatment and control customers at the 90% level of confidence.

In comparing the response patterns between the treatment and control groups, if the MyHER program did not influence customers, one would expect the treatment group to "score higher" on roughly half of the questions. In other words, if the MyHER is not influencing treatment group customers, there is a 50/50 chance that they will "outperform" the control group as many times as not. What we see in the survey data overall is the proportion of questions indicating a positive MyHER effect very near 50% in the case of single family program participants. In fact, the proportion of questions where treatment customers showed a positive MyHER effect was a little higher than 50%, however not statistically different from 50% at the 90% level of confidence.

The survey data reveal that there are specific areas where MyHER has relatively stronger and weaker positive effects. These areas of strong and weak performance are different for single family and multi-family participants, as shown in Table 4-12 and Table 4-13. In the case of single family customers, receiving the MyHER is associated with lower customer motivation, engagement and awareness of energy efficiency, lower customer-reported energy savings behaviors, and lower satisfaction with Duke Energy. These results may indicate that opportunities exist for Duke Energy to leverage the reports and website as a vehicle for delivering different or new information and opportunities to MyHER recipients that would increase their satisfaction with Duke Energy overall. On the other hand, single family MyHER recipients had a more positive view in these surveys on Duke Energy's energy efficiency offerings and customer engagement with Duke Energy website, and they reported experiencing fewer barriers to take energy savings actions.

Unlike single family customers, in the case of multi-family customers, MyHER recipients reported higher satisfaction with Duke Energy than non-recipients. Multi-family MyHER recipients reported a similar level of experiencing barriers to take energy savings actions relative to non-recipients. Multi-family MyHER survey responses also indicated lower satisfaction on Duke Energy's energy efficiency offerings and lower customer engagement with Duke Energy website.

When considering all possible areas of enhancement that the MyHERs can have on customer attitudes and actions related to satisfaction and energy savings behaviors, we observe areas of relative strength and weakness that differ between single family and multi-family customers. This result further illustrates that the messaging and approach taken in the reports delivered to multi-family customers may differ from that used in the single family reports.

Table 4-12: Survey Response Pattern Index – Single Family

Question Category	Count of Ques. where T better than C	Number of Ques. in Topic Area	Portion of Ques. where T better than C
Duke Energy's Public Stance on Energy Efficiency	3	4	75%
Customer Engagement with Duke Energy Website	3	5	60%
Customer's Reported Energy-saving Behaviors	3	11	27%
Customer's Reported Energy Efficiency Improvements Made	5	10	50%
Customer Motivation, Engagement and Awareness of Energy Efficiency	5	11	45%
Barriers of Customer Not Undertaking Energy Savings Actions	6	6	100%
Customer Satisfaction with Duke Energy	1	4	25%
Total	**26**	**51**	**51%**

Table 4-13: Survey Response Pattern Index – Multi-family

Question Category	Count of Ques. where T better than C	Number of Ques. in Topic Area	Portion of Ques. where T better than C
Duke Energy's Public Stance on Energy Efficiency	1	4	25%
Customer Engagement with Duke Energy Website	1	5	20%
Customer's Reported Energy-saving Behaviors	2	11	18%
Customer's Reported Energy Efficiency Improvements Made	2	10	20%
Customer Motivation, Engagement and Awareness of Energy Efficiency	2	11	18%
Barriers of Customer Not Undertaking Energy Savings Actions	3	6	50%
Customer Satisfaction with Duke Energy	3	4	75%
Total	**14**	**51**	**27%**

Respondent Demographics

Nearly all single family respondents—93% of treatment group customers and 90% of control group customers—own their residence. Among multi-family respondents, 69% of treatment group customers and 68% of control group customers rent their residence. More than half of households surveyed have two or fewer residents for both single family and multi-family. For single family households, about 15% of treatment households and 17% of control households have four or more residents. For multi-family households, about 18% of treatment households and 14% of control households have four or more residents. There are no statistically significant differences in the distribution of ownership or age of homes assigned to the treatment and control groups for both single family and multi-family (Figure 4-37 and Figure 4-38).

Figure 4-37: "In What Year Was Your Home Built?" – Single Family

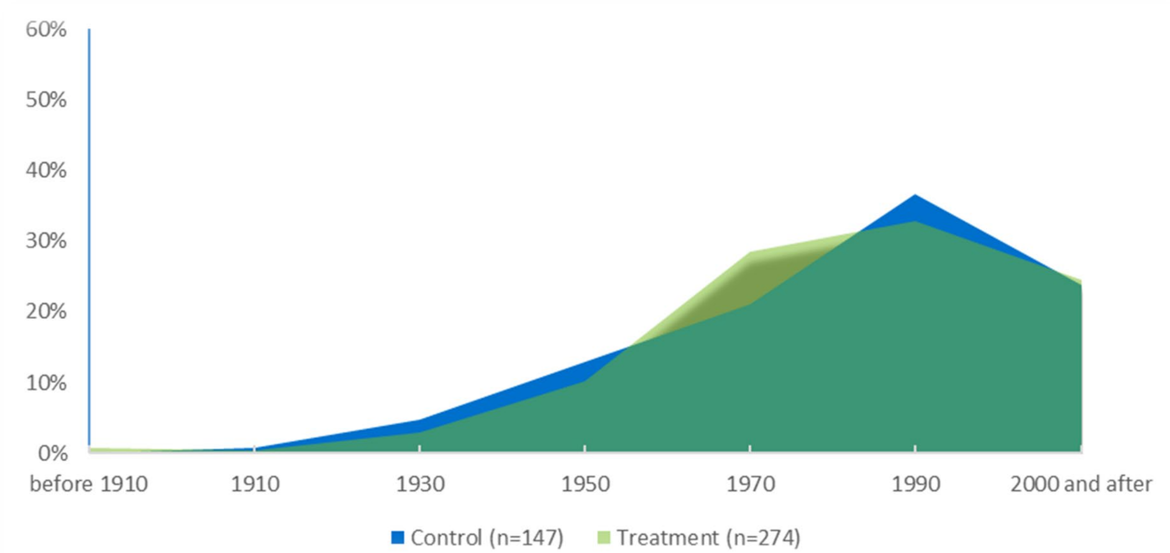


Figure 4-38: "In What Year Was Your Home Built?" – Multi-family

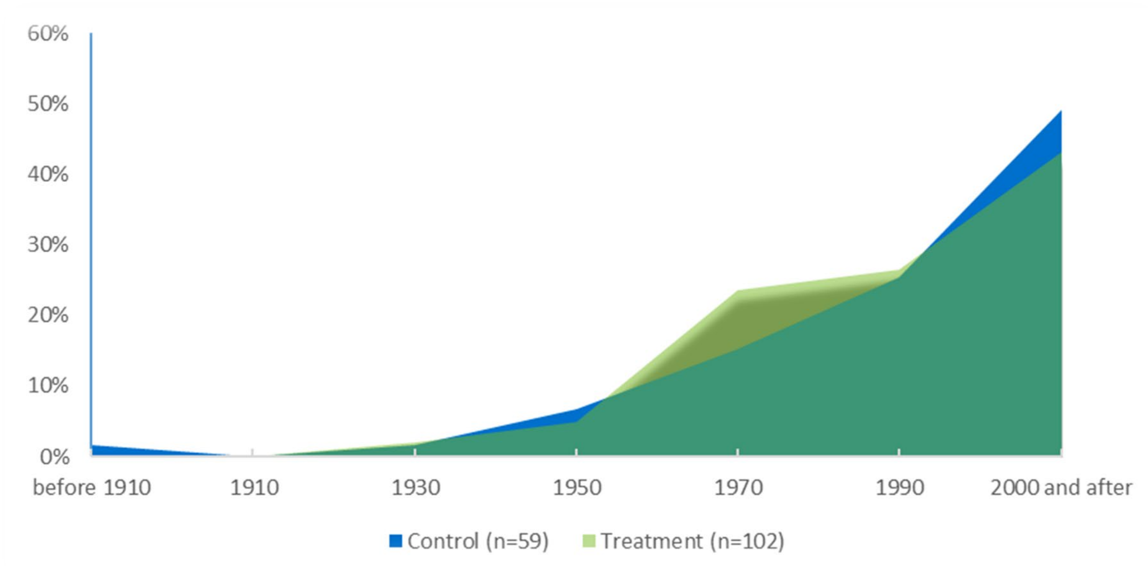


Figure 4-39 shows distribution of home square footage is similar between control and treatment group customers among single family households. The average square footage above ground is 2,055 for control households and 2,087 for treatment households, and the difference is not statistically significant. Figure 4-40 shows distribution of home square footage of control and treatment group customers among multi-family households. The average square footage above ground is 1,776 for control households and 1,419 for treatment households, and this difference is statistically significant at the 90% level of confidence. However, when the outliers in the 5,000-9,999 square feet bin are excluded, the differences in mean square footages are no longer statistically significant.

Figure 4-39: How many square feet is above ground living space? – Single Family

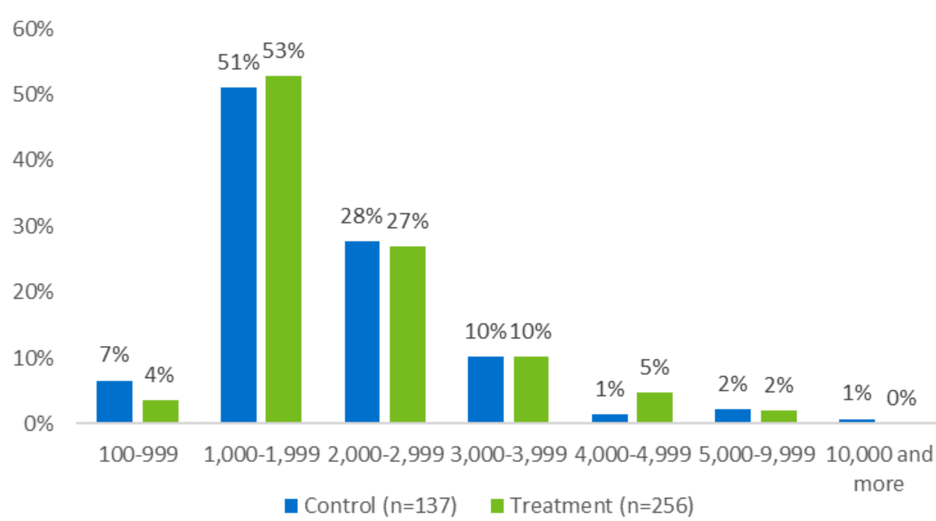
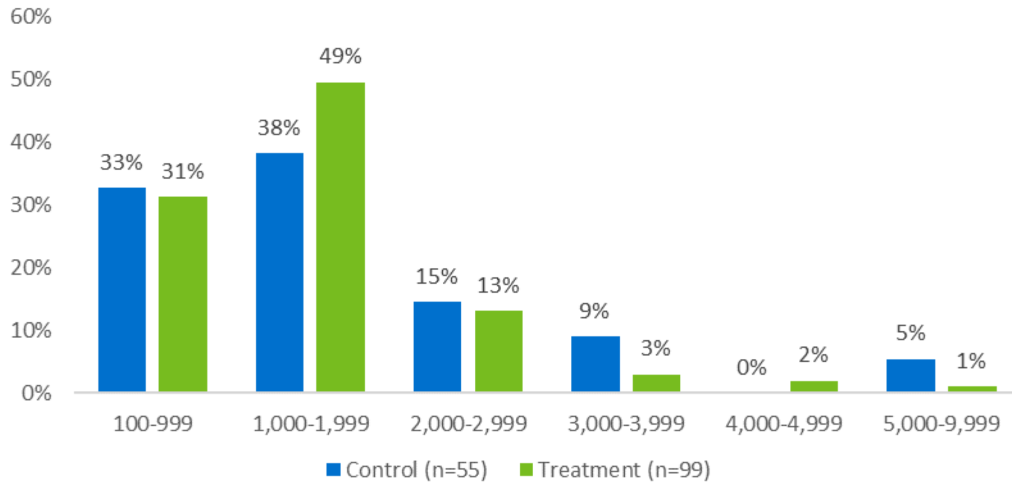


Figure 4-40: How many square feet is above ground living space? – Multi-family



The average age for single family respondents is 63 for control customers and 64 for treatment customers. For multi-family respondents it is 52 for control customers and 51 for treatment customers. The lowest age category (Younger than 25) is often underrepresented in survey studies, given that many members of that population are difficult to draw to participate in surveys. This common underrepresentation is true in this survey study, as well (see Table 4-14).

Table 4-14: Respondent Age Relative to RECS or American Housing Survey

Age	Single Family			Multi-family		
	Control Group (n=156)	Treatment Group (n=274)	EIA RECS Data_South Atlantic Census Division[18]	Control Group (n=83)	Treatment Group (n=140)	American Housing Survey[19]
Younger than 25	1%	0%	6%	0%	0%	10%
25-34	3%	3%	14%	19%	18%	30%
35-44	12%	9%	15%	25%	25%	23%
45-54	11%	12%	20%	5%	17%	19%
55-64	26%	21%	20%	23%	16%	9%
65 and over	47%	54%	26%	28%	24%	9%

Figure 4-41 shows the primary heating fuel type used in single family control and treatment households. More than half of treatment (53%) and control (53%) customers use electricity in

[18] 2015 Residential Energy Consumption Survey (RECS). https://www.eia.gov/consumption/residential/data/2015/hc/php/hc9.8.php

[19] American Housing Survey, 2011 Charlotte - Household Demographics - All Occupied Units, Charlotte-Gastonia-Rock Hill, NC-SC MSA (1993 OMB definition), Tenure Filter: Renter, https://www.census.gov/programs-surveys/ahs/data/interactive/ahstablecreator.html?s_areas=16740&s_year=2011&s_tablename=TABLE8A&s_bygroup1=1&s_bygroup2=1&s_filtergroup1=3&s_filtergroup2=1

their households for heating. Forty percent of treatment customers and 38% of control customers use natural gas for heating. The difference is not statistically significant.

Figure 4-41: Primary Heating Fuel in Households – Single Family

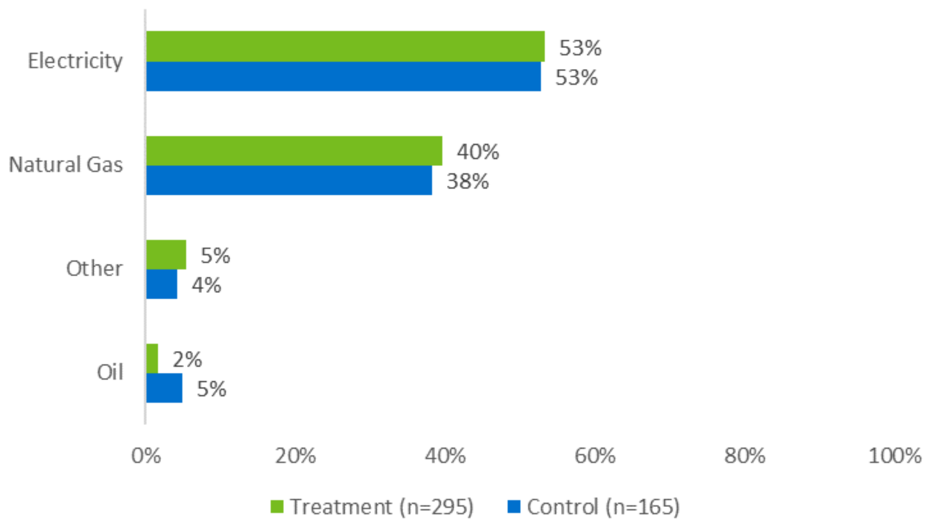


Figure 4-42 shows the primary heating fuel type used in multi-family control and treatment households. More than half of treatment (80%) and control (78%) customers use electricity in their households for heating. Sixteen percent of treatment customers and 19% of control customers use natural gas for heating. These differences are not statistically significant.

Figure 4-42: Primary Heating Fuel in Households – Multi-family

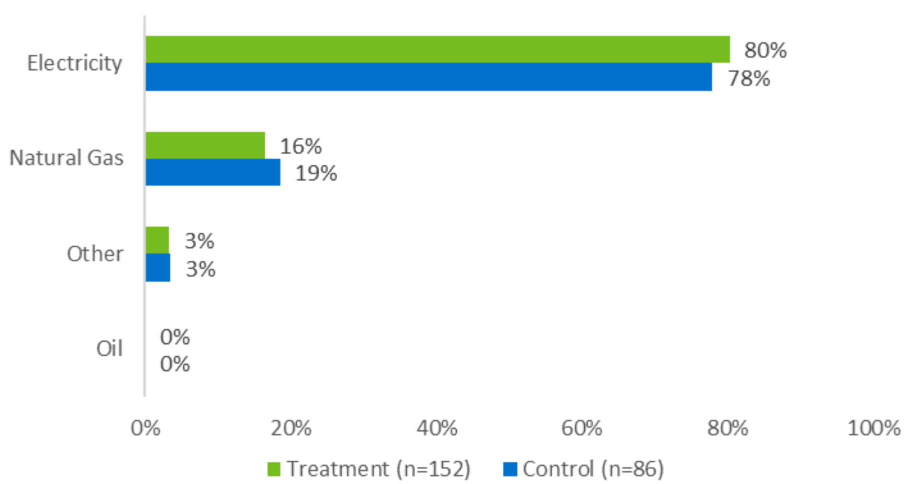


Table 4-15 shows the distribution of total annual household income in single family and multi-family households. Fifteen percent of single family treatment customers and 24% of control customers reported their household income between $50,000 and $ 75,000 in 2020. For the multi-family households, 15% of treatment and 16% of control customers reported their 2020 household income in this income bracket.

Table 4-15: 2020 Total Annual Household Income

2020 Annual Income	Single Family		Multi-family	
	Control (n=144)	Treatment (n=247)	Control (n=81)	Treatment (n=138)
Under $15,000	10%	7%	15%	17%
$15,000 to under $25,000	9%	11%	11%	12%
$25,000 to under $35,000	6%	7%	7%	12%
$35,000 to under $50,000	17%	16%	26%	21%
$50,000 to under $75,000	24%	15%	16%	15%
$75,000 to under $100,000	9%	14%	10%	10%
$100,000 to under $150,000	18%	15%	10%	6%
$150,000 to under $200,000	4%	9%	2%	1%
$200,000 or more	3%	7%	2%	7%

4.2.3 Customer Surveys – DEP

As was the case for DEC, the DEP customer surveys included questions focused specifically on the experience of and satisfaction with the information provided in MyHERs and awareness of MyHER Interactive—these questions were asked only of households in the treatment group.

Both treatment and control households answered the remaining questions, which focused on assessing:

- Awareness of Duke Energy efficiency program offers;
- Satisfaction with the Duke Energy, and services Duke Energy provides to help households manage their energy use;
- Levels of awareness of and interest in household energy use; motivations and perceived importance;
- Reported behavioral or equipment-based upgrades; and
- Barriers that prevent customers from undertaking energy savings actions.

4.2.3.1 Comparing Treatment and Control Responses - DEP

This section presents the results of responses to survey questions asked of both treatment and control households of single family and multi-family households in DEP, and compares the response patterns of each, respectively. In addition, comparative analyses between single family and multi-family customers are included where pertinent. Statistically significant differences between treatment and control households, and between single family and multi-family households, are noted when they occur.

Duke Energy Customer Satisfaction

Both single family and multi-family treatment and control groups' overall satisfaction with Duke Energy are high. For single family, 81% of treatment customers and 78% of control customers are satisfied or very satisfied with Duke Energy as their electric supplier (rated 8 or higher on a 0-10 point scale). The difference is not statistically significant at the 90% level of confidence. For multi-family, 79% of treatment customers and 89% of control customers are satisfied or very satisfied with Duke Energy as their electric supplier (rated 8 or higher on a 0-10 point scale). This difference is statistically significant at the 90% level of confidence.

Respondents were asked if they “strongly disagree”, “disagree”, “neither agree nor disagree”, “agree”, or “strongly agree” that Duke Energy provides excellent customer service, respects its customers, and provides service at a reasonable cost. Single family treatment households are more likely to “agree” or “strongly agree” that Duke Energy respects its customers and Duke Energy provides service at a reasonable cost than control households, but none of the differences are statistically significant at the 90% level of confidence (Figure 4-43). Multi-family treatment households are more likely to report that Duke Energy respects its customers, than control households. The difference is not statistically significant (Figure 4-44).

Figure 4-43: Satisfaction with Various Aspects of Customer Service – Single Family Top-2 Box Scores (1-5 Scale)

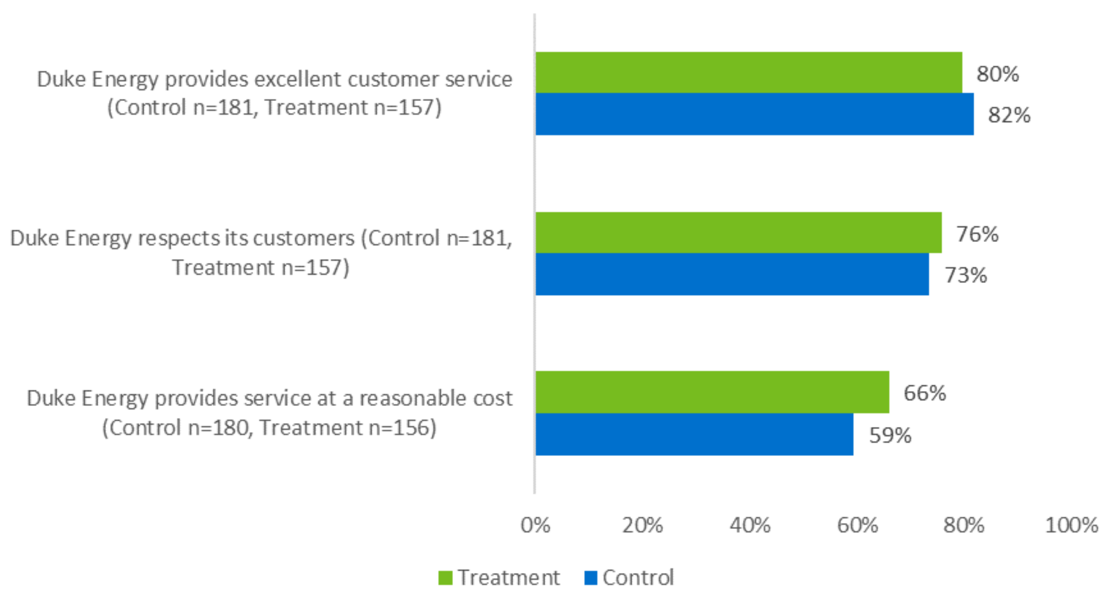
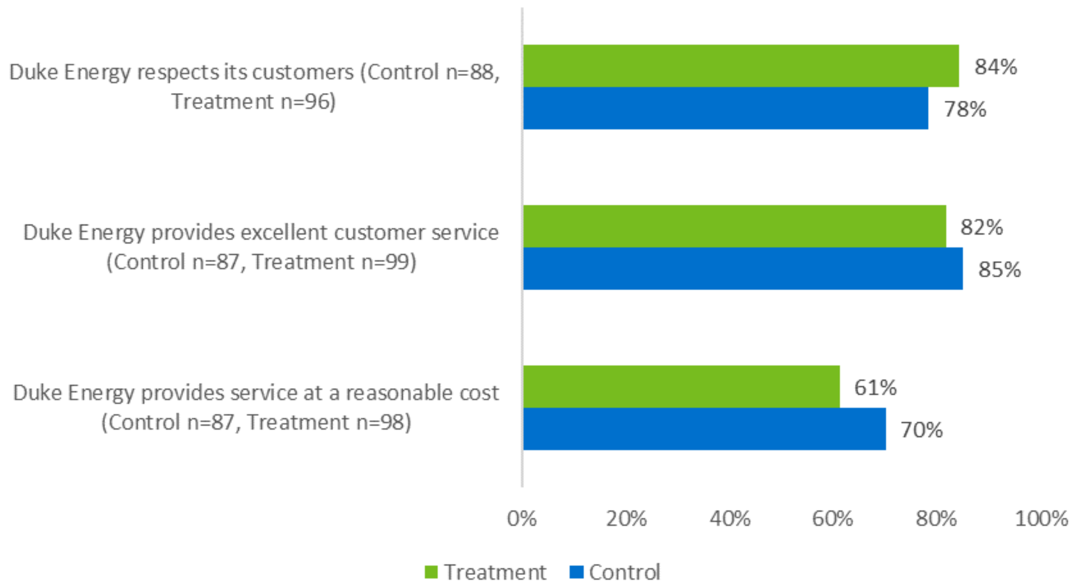


Figure 4-44: Satisfaction with Various Aspects of Customer Service – Multi-family Top-2 Box Scores (1-5 Scale)



Using a five point scale, “very dissatisfied”, “dissatisfied”, “neither dissatisfied nor satisfied”, “somewhat satisfied”, and “very satisfied”, single family treatment customers are more likely to report that they are either “somewhat satisfied” or “very satisfied” with Duke Energy’s commitment to promoting energy efficiency and the wise use of electricity, and the information available about Duke Energy’s energy efficiency programs than control customers (Figure 4-45). These differences are not statistically significant at the 90% level of confidence. MyHER has not measurably changed single family customer satisfaction with Duke Energy’s promotion of energy efficiency at DEP. Multi-family control customers are significantly more likely to report higher level of satisfaction with the Information Duke Energy provides to help customers save on energy bills than treatment customers (Figure 4-46). Like single-family, MyHER has not measurably changed multi-family customer satisfaction with Duke Energy’s promotion of EE.

Figure 4-45: Satisfaction with Energy Efficiency Offerings and Information – Single Family Top-2 Box Scores (1-5 Scale)

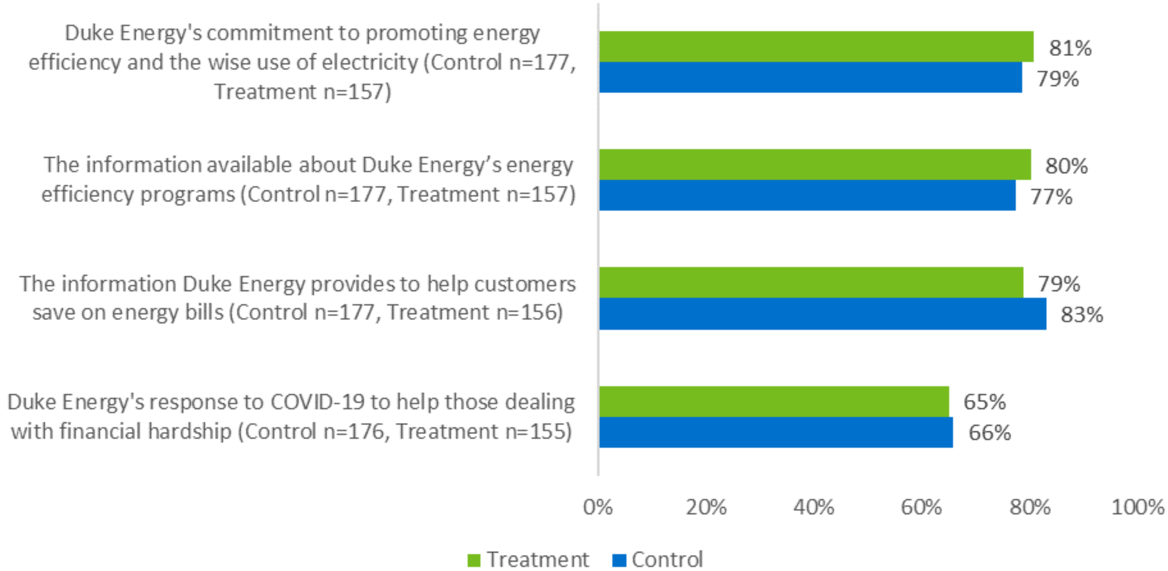
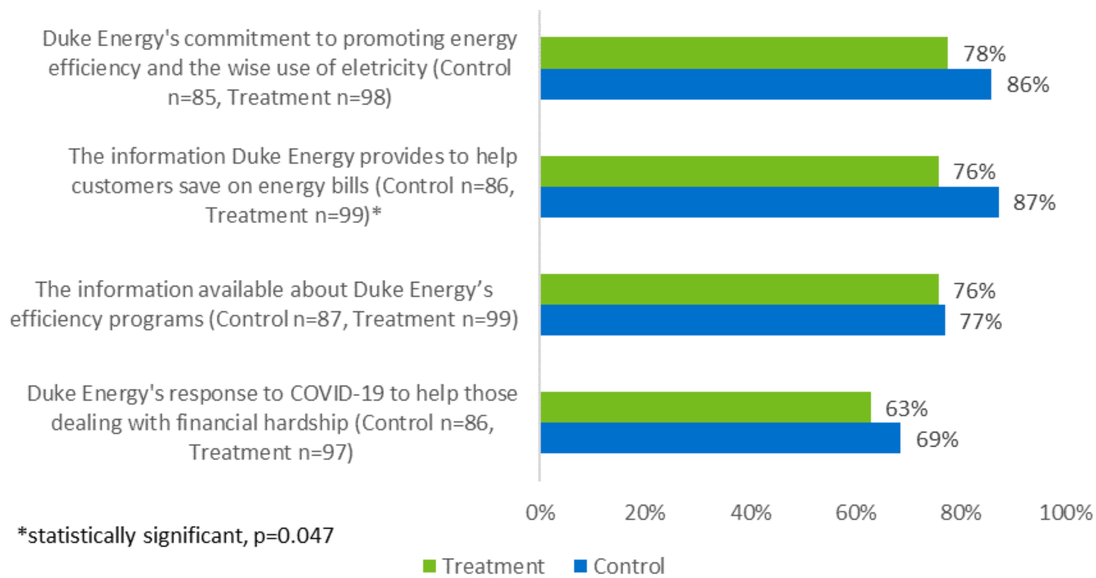


Figure 4-46: Satisfaction with Energy Efficiency Offerings and Information – Multi-family Top-2 Box Scores (1-5 Scale)



Engagement with Duke Energy's Website

Both treatment and control groups answered several questions about their use of the Duke Energy website, a proxy for overall engagement with information provided by the utility on energy efficiency and household energy use, and the results showed a similar level of using online accounts between treatment and control customers for both single and multi-family groups. Table 4-16 shows that 30% of single family treatment group and 37% of the control group, and 25% of multi-family treatment group and 25% of control group, reported they had never logged in to their Duke Energy accounts. Among those that had logged in, the most reported purpose was to pay their bill for both single family and multi-family respondents.

Table 4-16: Use of Duke Energy Online Account

Online Account Activity	Single Family		Multi-family	
	Treatment Group (n=158)	Control Group (n=181)	Treatment Group (n=99)	Control Group (n=88)
Never logged in	30%	37%	25%	25%
Pay my bill	37%	33%	56%	50%
Look for energy efficiency opportunities or ideas	15%	10%	24%	15%

As shown in Figure 4-47, single family treatment and control group households report similar levels of accessing the Duke Energy website to search for information about rebate programs, energy efficient products, or ways to make their home more energy efficient. This is also the case for multi-family control and treatment group households (Figure 4-48). Relatively small percentages of both groups in single and multi-family reported regular usage of the website for purposes other than bill payment.

Figure 4-47: Assessing Duke Energy Website for Other Information – Single Family

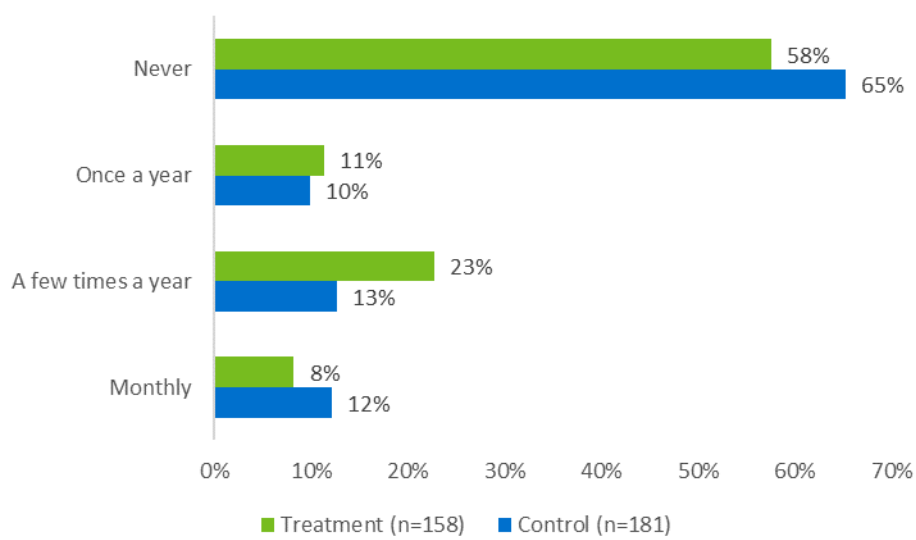
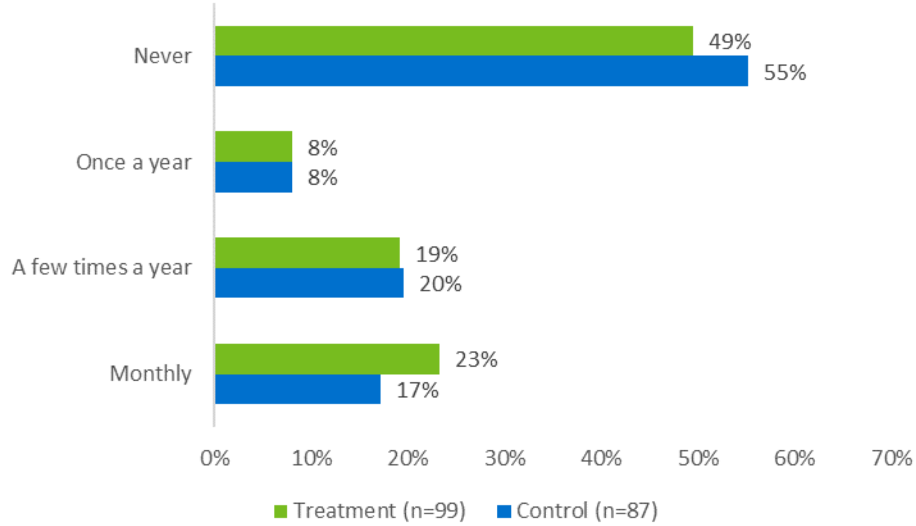


Figure 4-48: Assessing Duke Energy Website for Other Information – Multi-family



Thirty-five percent of single family control group customers and 33% of treatment group customers reported they would be likely to check the Duke Energy website for information before purchasing major household equipment, while 52% of multi-family control group customers and 51% of treatment group customers reported so. The portion of respondents rating their likelihood a “7” or higher on an 11-point scale of likelihood is plotted in Figure 4-49 and Figure 4-50.

Figure 4-49: Portion Likely to Check Duke Energy Website prior to Purchasing Major Home Equipment – Single Family – Split Top-4 Box Scores (0-10 Scale)

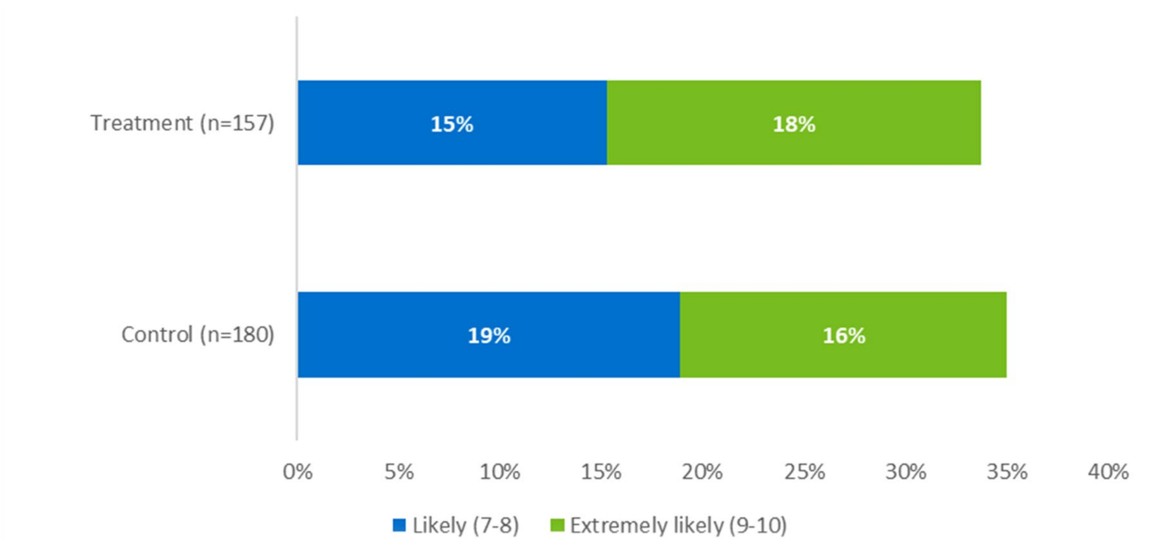
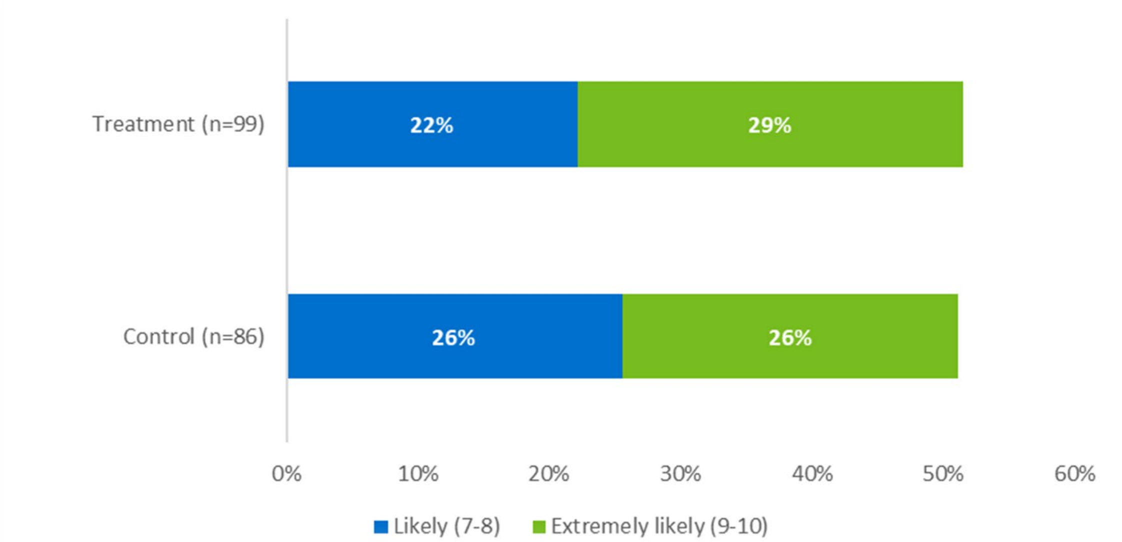


Figure 4-50: Portion Likely to Check Duke Energy Website prior to Purchasing Major Home Equipment – Multi-family – Split Top-4 Box Scores (0-10 Scale)

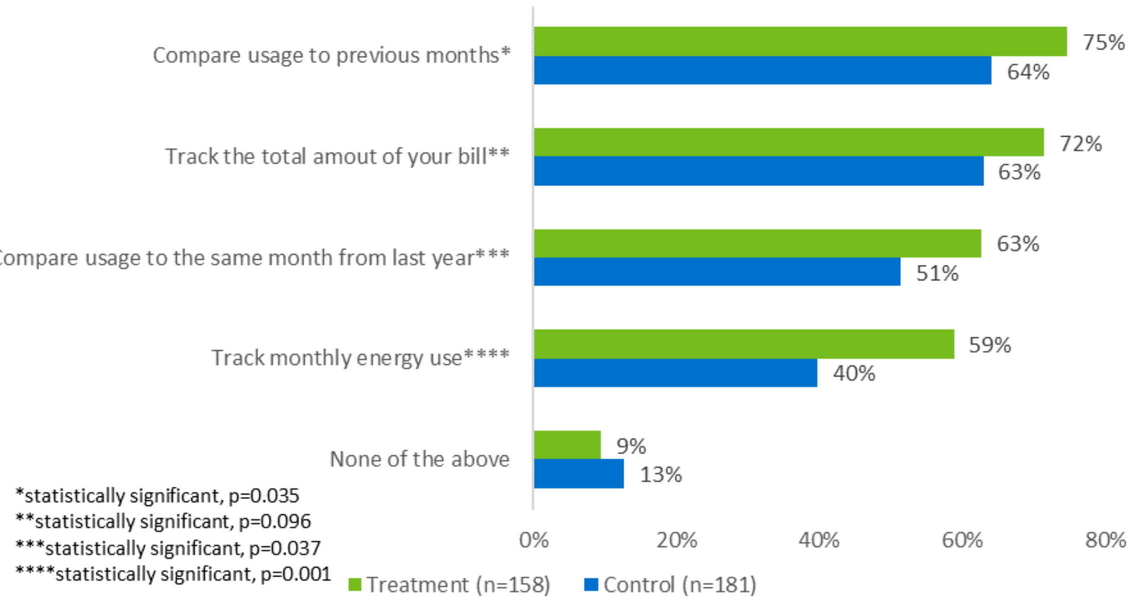


Customers' Reported Levels of Monitoring Energy Use and Energy Saving Behaviors

Single family treatment and control customers track information (bills and usage) related to their household's energy usage in the following ways (Figure 4-51):

- Seventy-five percent of the treatment customers and 64% of the control customers reported comparing usage to previous months. The difference is statistically significant at the 90% level of confidence.
- Seventy-two percent of the treatment respondents and 63% of the control respondents tracked the total amount of the bill. The difference between the treatment and control groups is statistically significant at the 90% level of confidence.
- More than half of respondents compare usage to the same month from last year, and the difference in responses here between treatment and control groups is statistically significant at the 90% level of confidence.
- Fifty-nine percent of treatment customers and 40% of control customers tracked their monthly energy use. The difference between treatment and control groups is statistically significant at the 90% level of confidence.

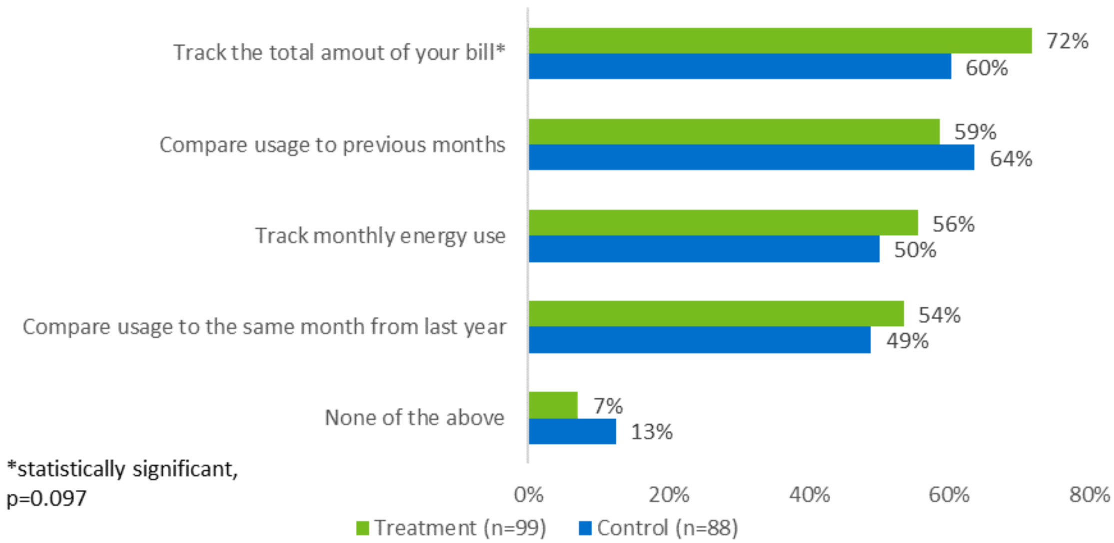
Figure 4-51: "Which of the Following Do You Do with Regard to Your Household's Energy Use?" – Single Family



Multi-family treatment and control customers track information (bills and usage) related to their household's energy usage in the following ways (Figure 4-52):

- Seventy-two percent of the treatment customers and 60% of the control customers reported tracking the total amount of the bill. The difference is statistically significant at the 90% level of confidence.
- More than half of respondents tracked monthly energy use. The difference in responses between the treatment and control groups is not statistically significant.
- Fifty-four percent of treatment respondents and 49% of control respondents compare usage to the same month from last year, and the difference in responses here between treatment and control groups is not statistically significant at the 90% level of confidence.

Figure 4-52: "Which of the Following Do You Do with Regard to Your Household's Energy Use?" – Multi-family



An area of significant interest in this evaluation is the identification of energy-saving behaviors that MyHERs move treatment customers to undertake. These behaviors, if they result in energy savings attributed to the reports, would be over and above what the treatment households would have done without having read or seen their MyHERs. The customer survey included a battery of questions inquiring as to whether the respondent's household has undertaken energy-savings actions. The responses to these questions are compared between the treatment and control respondents, and any statistically significant uplift in the reported behaviors undertaken can be concluded to be due to the MyHERs and may also be inferred as a driver of energy savings attributed to the program. A screening question is used to ensure that respondents answering the questions about specific behaviors only see those questions if they state that they have undertaken any energy savings actions or made energy efficiency improvements at all in the past year.[20]

For both single family and multi-family treatment and control groups, respectively, respondents reported similar levels of taking actions to save energy, as shown in Figure 4-53 and Figure 4-54. Across the nine specific behaviors and actions described by the survey, none show that treatment respondents are significantly more likely to take action to save energy than control respondents. The most cited behavior for single family is turning off lights in unused indoor or outdoor areas, with 95-98% of single family respondents reporting taking that action; the most two commonly cited behaviors for multi-family are turning off lights in unused indoor or outdoor areas and adjusting heating or cooling settings to save energy, with 95-98% of multi-family respondents reporting that they take that action, respectively. The least cited action for both

[20] Single family treatment and control customers report similar likelihood of having undertaken any behaviors to reduce household energy use or having made energy efficiency improvements to their home (65% to 66%). This is also true for treatment and control multi-family respondents (66% to 56%).

single and multi-family is turning down the water heater temperature, with 32-43% of single family respondents reporting that they did that and 33-38% of the multi-family respondents reporting the same.

There are two energy-savings behaviors for which significantly more single-family control customers are reporting undertaking than treatment customers, one of which is related to conserving on water heating. This is a similar finding in the DEC evaluation. The MyHER reports do not usually touch on water heating end-uses and it may be that MyHER treatment customers are taking actions that displace their interest or efforts to conserve water heating energy use.

While none of these behaviors show an uplift that can be ascribed to MyHER, that does not mean that energy savings are not coming from these behaviors. What these findings mean is that there is no evidence that MyHER has introduced new behaviors to treatment customers that they were not doing at all previously. It’s quite possible that MyHER energy savings, at least in part, come from customers turning off lights in unused areas of the home – because they’re doing that more than they would otherwise. The current survey instrument used by this evaluation cannot detect that change. Surveys or interviews can be designed to collect information on those more subtle differences in energy savings behaviors in the home, however they would be considerably more complicated and more expensive to field. Fewer customers would be willing to complete such a survey and non-response bias would be of greater concern. Non-response bias could be potentially overcome with completion incentives, but that would also increase the evaluation budget. Duke Energy is aware of the limitations of the customer research agenda and accepts the current resolution of the tradeoff between depth of findings, reliability of findings, and evaluation cost.

Figure 4-53: Reported Energy Savings Behaviors – Single Family

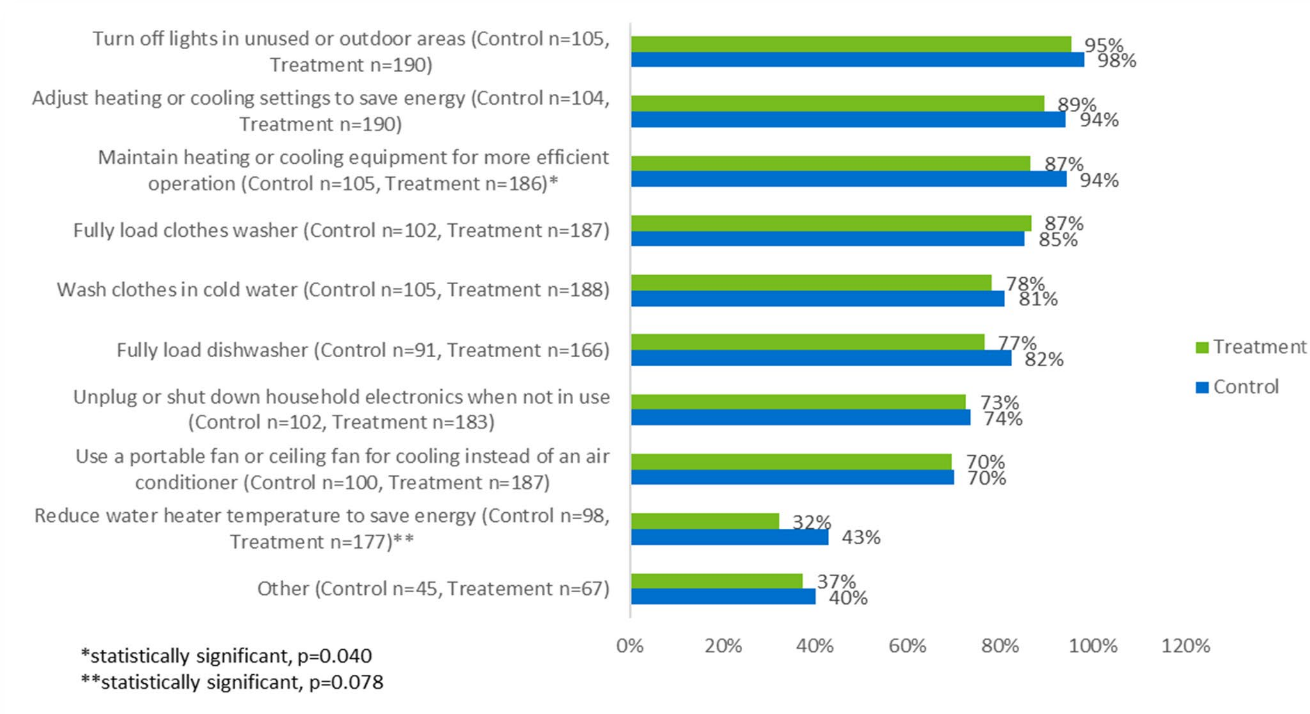
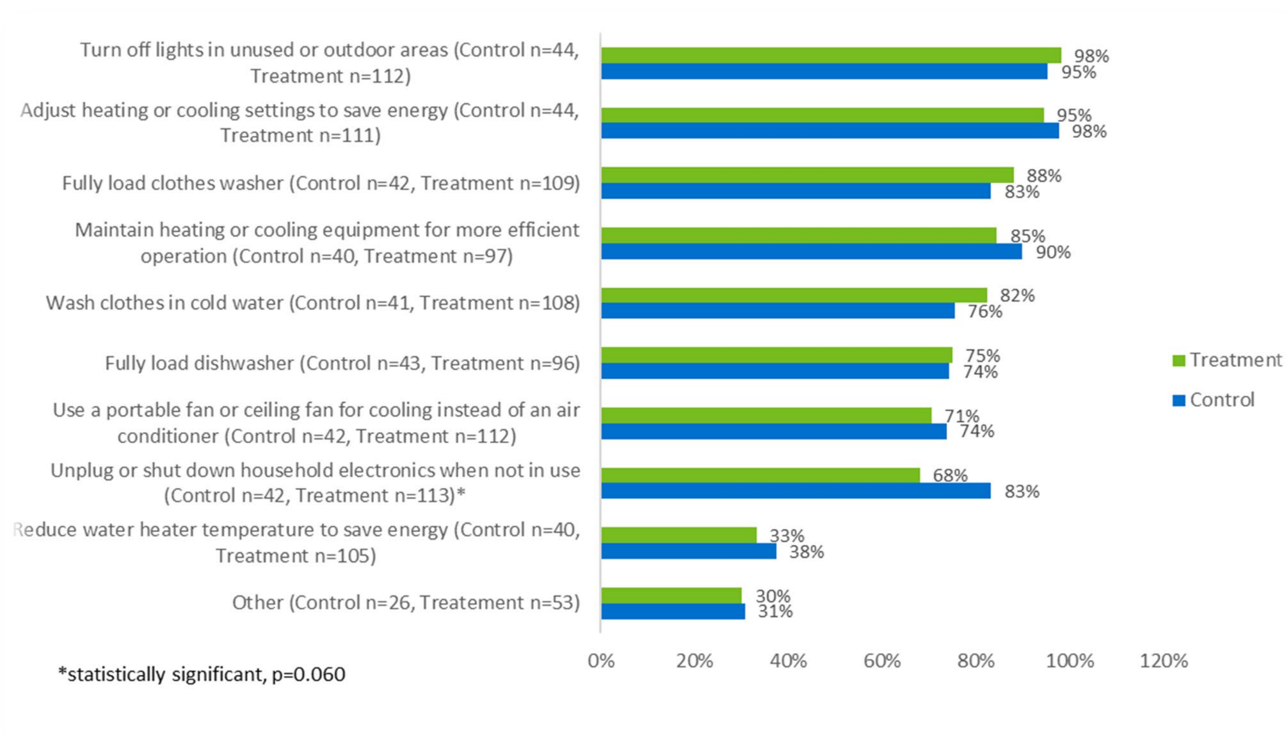


Figure 4-54: Reported Energy Savings Behaviors – Multi-family

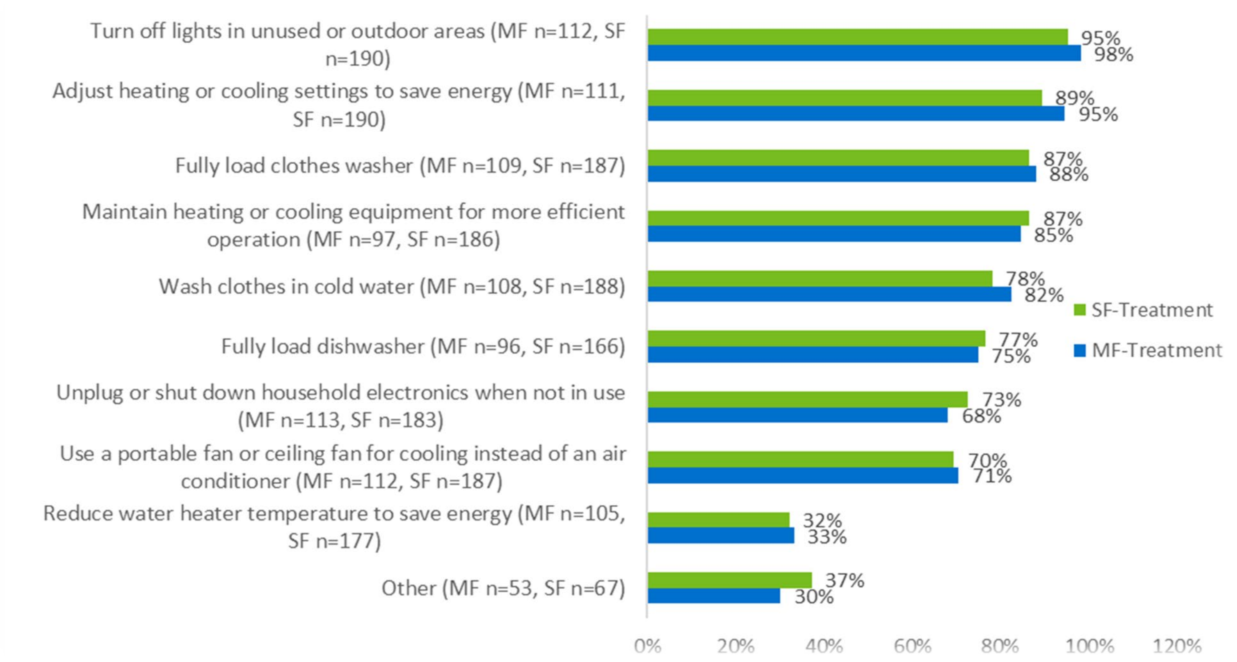


Nexant compared the reported behaviors of single family treatment customers to those of multi-family treatment customers. Here we do see differences between behaviors taken by single family customers and multi-family customers, however the differences on responses between single family treatment customers and multi-family treatment customers are not statistically significant. It is useful to consider the differences directionally:

- Single family treatment customers are more likely to report that they “Maintain heating or cooling equipment for more efficient operation”, “Fully load dishwasher”, and “Unplug or shut down household electronics when not in use” than multi-family treatment customers, as shown in Figure 4-55. Some of these differences are likely due to the fact that maintenance in multi-family housing is often completed by property management companies, or are less likely to have dishwashers.

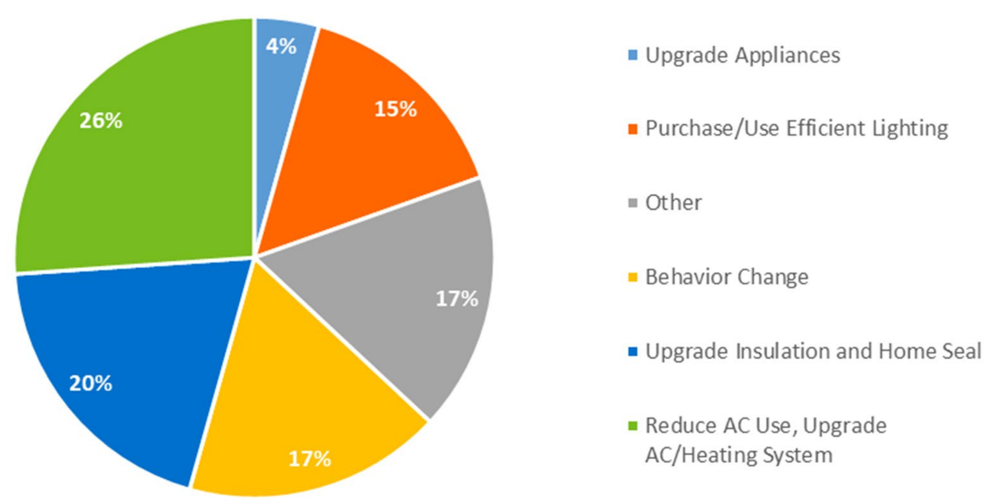
- Multi-family treatment customers are more likely to “Turn off lights in unused or outdoor areas”, “Use a portable fan or ceiling fan for cooling instead of an air conditioner”, “Reduce water heater temperature to save energy”, ”Wash clothes in cold water”, “Fully load clothes washer”, and “Adjust heating or cooling setting to save energy” than single family treatment customers.

Figure 4-55: Reported Energy Savings Behaviors Single Family Treatment vs. Multi-family Treatment



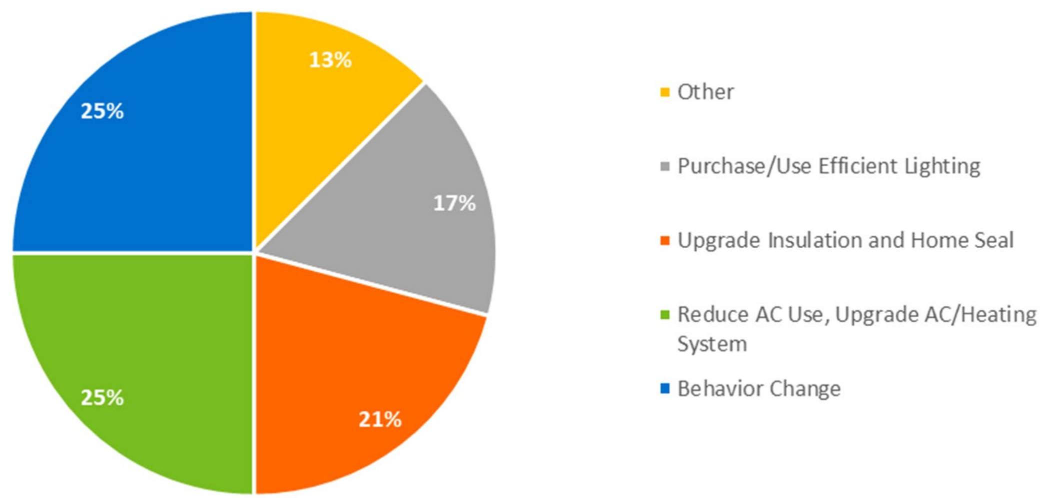
Forty-three single family respondents (treatment and control customers in total) reported “other” energy savings actions and wrote in their action(s). Nexant categorized these actions and the results are shown in Figure 4-56. The most reported action, mentioned by 12 respondents, pertains to air conditioning/heating system, such as replacing the HVAC system.

Figure 4-56: Distribution of Other Energy Savings Behaviors – Single Family (Treatment and Control n=43)



Twenty-four multi-family respondents (treatment and control customers in total) also reported "other" energy savings actions. Nexant categorized these actions and the results are shown in Figure 4-57. The most two commonly reported actions, pertain to the air conditioning/heating system (mentioned by 6 respondents, such as reducing operation of air conditioner), and behavior changes (mentioned by 6 respondents, such as washing clothes at night).

Figure 4-57: Distribution of Other Energy Savings Behaviors – Multi-family (Treatment and Control n=24)



Both single family and multi-family customers were further asked a question about COVID-19's effects on their households' ability to take energy savings actions. Sixteen percent of single family control customers and 20% of treatment customers reported that the likelihood of COVID-19 pandemic increasing their ability to take energy savings actions a "7" or higher on an 11-point scale of likelihood, while 25% of multi-family control customers and 21% of treatment customers reported so. None of these differences in responses between treatment and control customers are statistically significant.

Reported Energy Efficiency Improvements

With respect to improvements and investments that customers might make after reading or seeing their MyHER reports, we have a similar finding to that of the behavior-related actions discussed above. Respondents were provided with a list of energy efficiency improvements and were asked if they had done each in the past year. In all but one case, there are no statistically significant differences between the incidence of reporting energy efficiency upgrades between the treatment and control groups – across both single family and multi-family respondents. The one exception is that in multi-family group, significantly more control group respondents reported replacing windows or doors with more energy-efficient types than treatment group respondents (Table 4-17). As noted in the DEC reporting section above, this type of result may be indicative of MyHER's success at educating customers about the power of inexpensive purchases and behavior changes in managing their electricity bills. Without that education from MyHERs, the control customers may have been more receptive to advertising for new windows or doors.

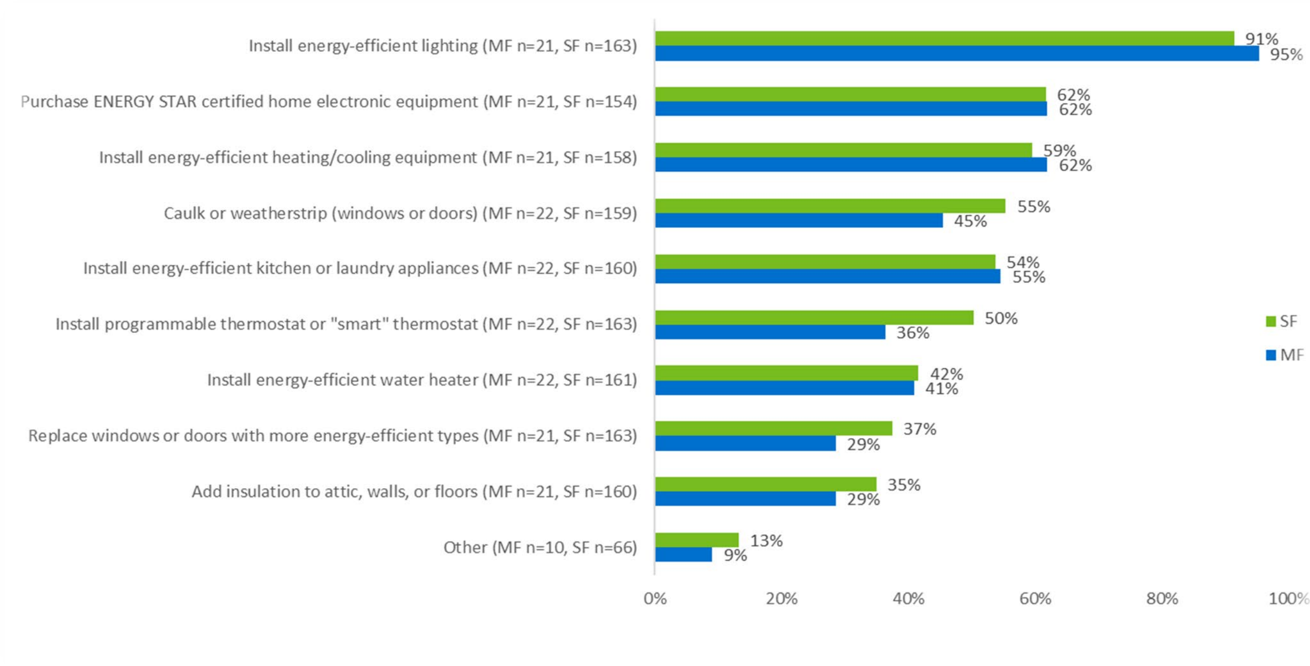
Table 4-17: Customers Indicating They Had Made Each Energy Efficiency Upgrade

Upgrade	Single Family		Multi-family	
	Treatment	Control	Treatment	Control
Install energy-efficient lighting	90% (n=184)	89% (n=106)	86% (n=103)	83% (n=40)
Install energy-efficient kitchen or laundry appliances	53% (n=182)	58% (n=97)	32% (n=102)	42% (n=36)
Purchase ENERGY STAR certified home electronic equipment	58% (n=173)	56% (n=89)	33% (n=96)	47% (n=36)
Caulk or weatherstrip (windows or doors)	53% (n=181)	54% (n=100)	38% (n=97)	39% (n=36)
Install energy-efficient heating/cooling equipment	54% (n=178)	46% (n=96)	30% (n=93)	31% (n=35)
Install programmable thermostat or "smart" thermostat	47% (n=182)	45% (n=98)	32% (n=100)	35% (n=37)
Install energy-efficient water heater	38% (n=180)	41% (n=99)	27% (n=95)	37% (n=38)
Replace windows or doors with more energy-efficient types	37% (n=183)	44% (n=100)	14% (n=97)*	29% (n=35)*
Add insulation to attic, walls, or floors	34% (n=180)	34% (n=99)	17% (n=89)	9% (n=33)

*statistically significant p=0.063

As discussed above with behavioral actions, while the differences are not significantly different at the 90% level of confidence, single family treatment respondents were more likely to report they had undertaken upgrades or made investments than multi-family treatment respondents on installing energy-efficient kitchen or laundry appliances, purchasing ENERGY STAR certified home electronic equipment, caulking or weatherstripping (windows or doors), installing energy-efficient heating/cooling equipment, installing programmable thermostat or “smart” thermostat, installing energy-efficient water heater, replacing windows or doors with more energy-efficient types, and adding insulation to attic, walks, or floors in the survey. To control for the fact that the likelihood of renters would make these upgrades is very low, we considered the multi-family treatment responses in comparison to single family treatment responses with renters removed. When renters were removed from the analysis, five of these upgrades still emerged as higher for single family treatment respondents, as seen in Figure 4-58.

Figure 4-58: Customers Indicating They Had Made Each Energy Efficiency Upgrade Treatment Homeowners Only – Single Family vs. Multi-family



To examine broader patterns within participant responses to the behavior and upgrade questions, these questions were combined into behavior vs. upgrade categories and were also combined into end-use categories. First, as shown in Table 4-18, treatment respondents and control respondents reported very similar levels of engaging in energy efficiency behaviors and improvements generally. Single family control group respondents reported significantly higher average number of energy efficiency behaviors then single family treatment group customers. This result may indicate that the MyHER treatment is encouraging customers to focus their energy saving behaviors, that are more effective, at reducing energy consumption.

Table 4-18: Percent of Households That Have Undertaken Energy Efficiency Actions

Behaviors/Improvements	Single-family		Multi-family	
	Treatment	Control	Treatment	Control
Energy Efficiency Behaviors	100% (n=195)	100% (n=106)	100% (n=113)	100% (n=44)
Average Number of Behaviors	6.6*	7.1*	6.7	7.0
Energy Efficiency Improvements	97% (n=192)	96% (n=106)	92% (n=110)	95% (n=41)
Average Number of Improvements	4.4	4.4	2.9	3.2

*statistically significant, p=0.012

Additionally, Table 4-19 shows the proportion of respondents that had undertaken at least one behavior or upgrade in each end use category. For those categories that have multiple behaviors or upgrades within it, these are broken out on their own for analysis. In the category "Water Heating Behaviors/Upgrades", for example, four behaviors relevant to water heating are combined in a subcategory "Water Heating Behaviors" are broken out. Upgrades are not broken out here in that way because there is only one upgrade ("Install energy-efficient water heater") associated with the parent category, and the proportion of respondents undertaking this upgrade is presented in Table 4-17 above. Similarly, for "Lighting Behaviors/Upgrades", there was only one upgrade and behavior, so these are not broken out. Lastly, there was only one behavior associated with the "Electronics and Appliances Behaviors/Upgrades" category ("Unplug or shut down household electronics when not in use"), so it was omitted as well. Multi-family control group members were significantly more likely to have undertaken electronics and appliances behaviors/upgrades than treatment group members.

Table 4-19: Percent of Households That Had Undertaken Energy Efficiency Behaviors or Upgrades, by End Use Category

Behaviors/Improvements	Single-family		Multi-family	
	Treatment Group	Control Group	Treatment Group	Control Group
Water Heating Behaviors/Upgrades (5)	98% (n=195)	100% (n=106)	98% (n=112)	95% (n=44)
Water Heating Behaviors (4)	99% (n=193)	100% (n=106)	98% (n=112)	95% (n=44)
Space Heating Behaviors/Upgrades (5)	97% (n=194)	99% (n=106)	99% (n=113)	100% (n=44)
Space Heating Behaviors (3)	98% (n=192)	99% (n=106)	99% (n=113)	100% (n=44)
Space Heating Upgrades (2)	63% (n=186)	64% (n=100)	46% (n=103)	49% (n=39)
Lighting Behaviors/Upgrades (2)	97% (n=194)	99% (n=106)	98% (n=113)	98% (n=44)
Electronics and Appliances Behaviors/Upgrades (3)	88% (n=191)	90% (n=105)	81% (n=113)*	91% (n=43)*
Electronics and Appliances Upgrades (2)	69% (n=186)	69% (n=99)	41% (n=104)	54% (n=37)
Sealing and Insulation Upgrades (3)	66% (n=189)	71% (n=103)	44% (n=106)	47% (n=38)

*statistically significant, p=0.073

Both single family and multi-family customers were further asked a question about COVID-19's effects on their households' ability to make energy efficiency improvements. Thirteen percent of single family control customers and 17% of treatment customers reported that the likelihood of COVID-19 pandemic increasing their ability to make energy efficiency improvements a "7" or higher on a 0-10 point scale of likelihood, while 16% of multi-family control customers and 9% of treatment customers reported so. None of these differences in responses between treatment and control customers are statistically significant.

Customer Motivation and Awareness

Single family control and treatment groups reported similar levels of motivation for saving energy. Seventy-six percent of control customers indicated that knowing they are using energy wisely is "important" or "extremely important" (rated 7 or higher on a 0-10 point scale), compared to 79% of treatment customers. This difference is not statistically significant (Figure 4-59). The same is true for multi-family. Eighty-four percent of control customers indicated that knowing they are using energy wisely is "important" or "extremely important", compared to 83% of treatment customers. This difference is not statistically significant (Figure 4-60).

Figure 4-59: "How Important Is It for You to Know if Your Household is Using Energy Wisely?"– Single Family Split Top-4 Box Scores (0-10 Scale)

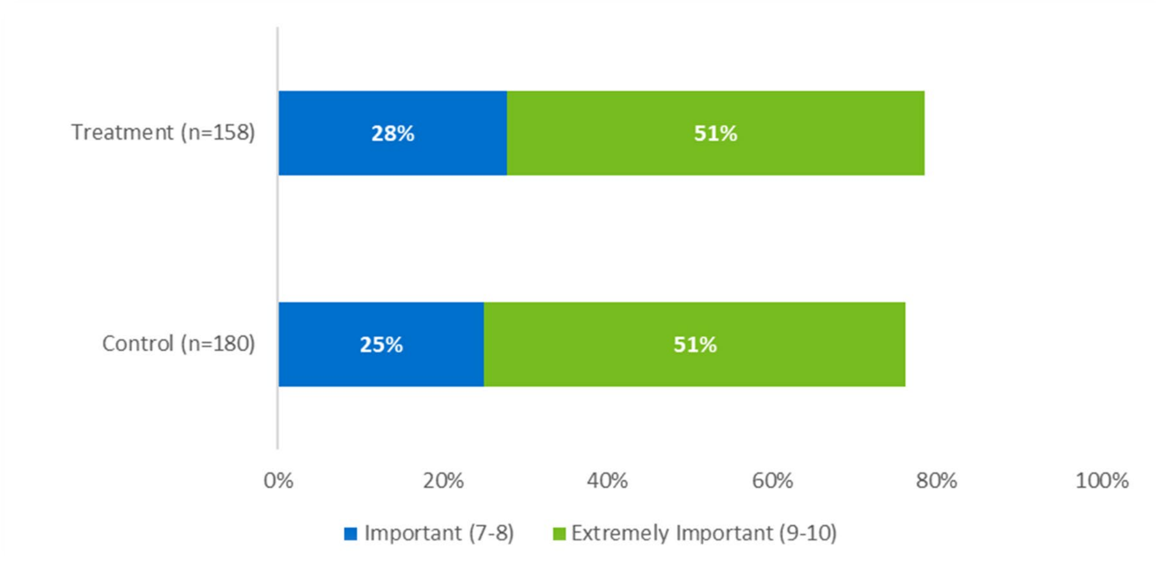
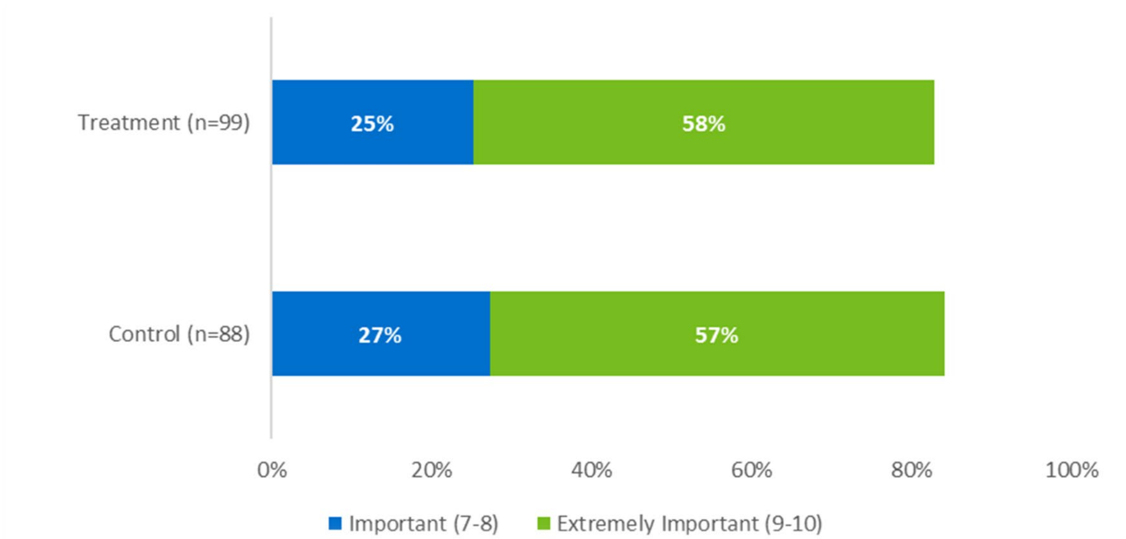
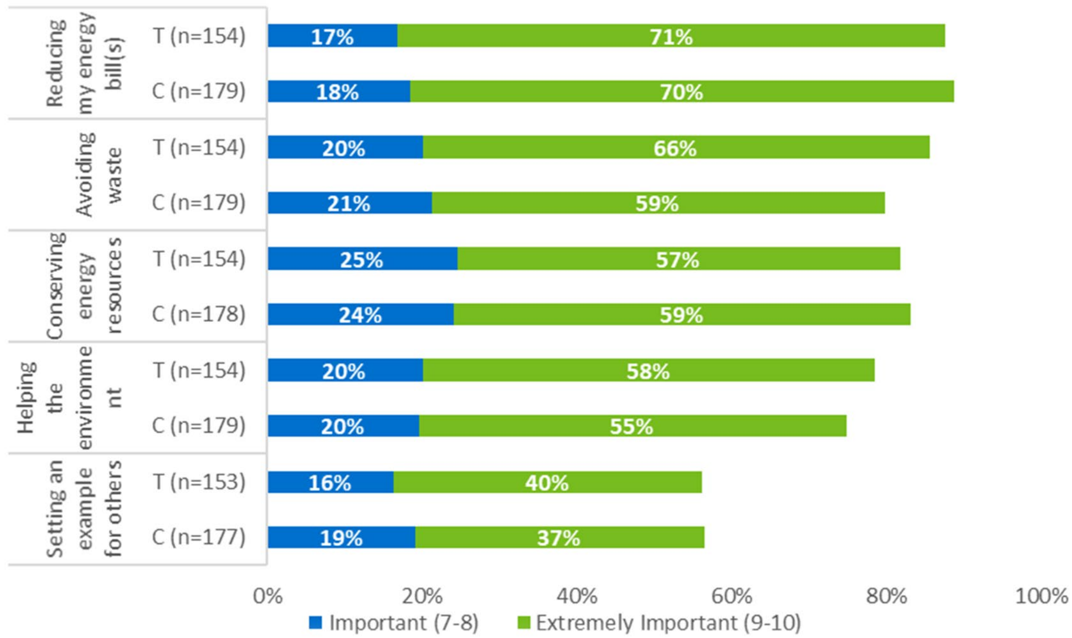


Figure 4-60: "How Important Is It for You to Know if Your Household is Using Energy Wisely?" – Multi-family Split Top-4 Box Scores (0-10 Scale)



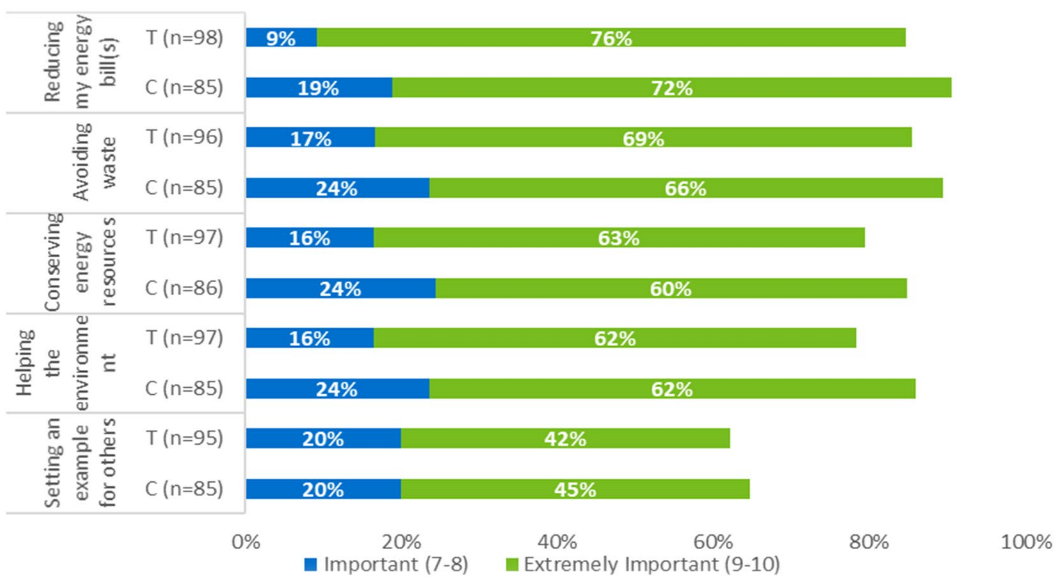
Customers were asked to rate, on a scale of 0 to 10, the importance of various reasons why they might try to reduce their home's energy use. The strongest motivation for both treatment and control groups is saving money on their energy bills. For single family, 88% of treatment respondents and 88% of control respondents reported that saving money on their energy bills was "important" or "extremely important" (rated 7 or higher on a 0-10 point scale). Eighty-six percent of treatment respondents and 80% of control respondents indicated that "avoiding waste" was "important" or "extremely important" to them. Eighty-two percent of treatment customers and 83% of control customers reported that "conserving energy resources" was "important" or "extremely important". Seventy-eight percent of treatment customers and 75% of control customers reported that “helping the environment” was “important” or “extremely important”. None of the differences between treatment and control groups are statistically significant. Figure 4-61 contains the frequency of responses to this question, shown as a percentage for both treatment and control groups.

Figure 4-61: “Please Indicate How Important Each Statement Is to You” – Single Family Split Top-4 Box Scores (0-10 Scale)



For multi-family, 85% of treatment respondents and 91% of control respondents reported that saving money on their energy bills was “important” or “extremely important” (rated 7 or higher on a 0-10 point scale). Eighty-six percent of treatment customers and 90% of control customers reported that “avoiding waste” was “important” or “extremely important”. Seventy-eight percent of treatment respondents and 86% of control respondents indicated that “helping the environment” was “important” or “extremely important” to them. Seventy-nine percent of treatment customers and 84% of control customers reported that “conserving energy resources” was “important” or “extremely important”. None of the differences are statistically significant at the 90% level of confidence. Figure 4-62 contains the frequency of responses to this question, shown as a percentage for both treatment and control groups.

Figure 4-62: "Please Indicate How Important Each Statement Is to You" – Multi-family Split Top-4 Box Scores (0-10 Scale)



As indicated by Figure 4-63 and Figure 4-64, among single family treatment customers, 70% of treatment group customers rated their knowledge regarding ways to save energy in the home at least seven on a 0-10 point scale (indicating they were "knowledgeable" or "extremely knowledgeable"), while 61% of control group customers rated themselves this way. The difference between treatment and control customers is statistically significant at the 90% level of confidence. Among multi-family customers, 63% of treatment respondents and 78% of control respondents rated themselves seven or higher on this scale. The difference is statistically significant at the 90% level of confidence.

Figure 4-63: "How Would You Rate Your Knowledge of the Different Ways You Can Save Energy in Your Home?" – Single Family Split Top-4 Box Scores (0-10 Scale)

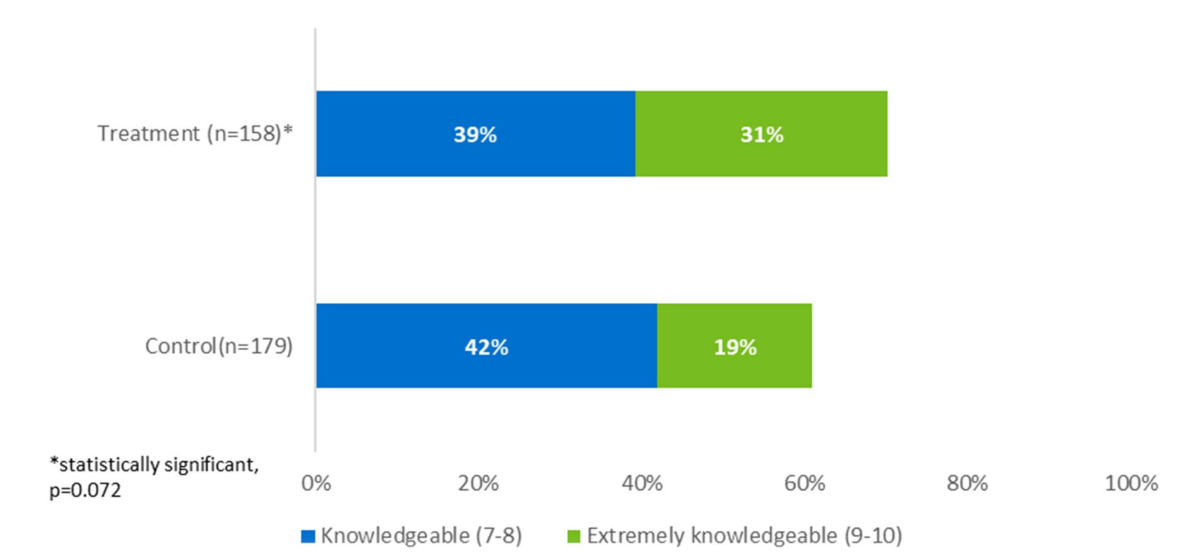
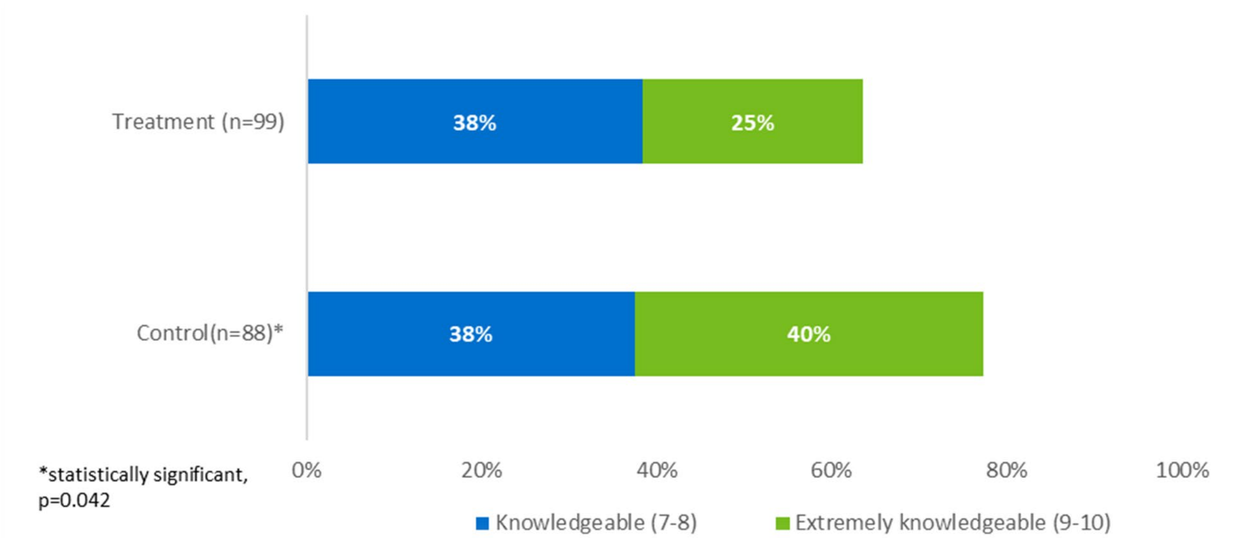


Figure 4-64: "How Would You Rate Your Knowledge of the Different Ways You Can Save Energy in Your Home?"– Multi-family Split Top-4 Box Scores (0-10 Scale)



Respondents that took the treatment-only survey were asked how useful each MyHER feature was to their homes. A similar question was asked of primary survey respondents, but rephrased to ask them how useful they might expect that information to be. Table 4-20 presents the comparison results between the actual usefulness of each item rated by treatment customers (treatment only survey) and the hypothetical usefulness rated by control customers in the primary survey for both sets of respondents who answered "7" or above on a scale from 0-10. This table shows that among single family customers, control customers were significantly more likely to think that "Tips to help you save money and energy" and "Comparison to similar homes" might be useful than treatment customers actually thought they were. These findings suggest that there is an opportunity to improve the presentment of this information to better meet customers' expectations.

Table 4-20: Actual Usefulness versus Hypothetical Usefulness of HER Features Top-4 Box Scores (0-10 Scale)

HER Feature	Single-family		Multi-family	
	Control	Treatment Only	Control	Treatment Only
Graphs that display your home's energy use over time	64% (n=174)	67% (n=135)	73% (n=83)	76% (n=59)
Energy use associated with specific household items and areas	55% (n=171)	50% (n=132)	69% (n=84)	68% (n=59)
Tips to help you save money and energy	59% (n=176)*	47% (n=133)*	73% (n=83)	68% (n=59)
Customized suggestions for your home	52% (n=174)	45% (n=132)	54% (n=81)	61% (n=59)
Information about services and offers from Duke Energy	51% (n=173)	44% (n=135)	60% (n=84)	58% (n=59)
Comparison to similar homes	51% (n=173)**	38% (n=134)**	57% (n=82)	53% (n=59)

*statistically significant, p=0.038
**statistically significant, p=0.020

Barriers to Customers Undertaking Energy Savings Actions

When asked the reasons why customers might not be able to save as much as energy as they would like, statistically different response patterns between single family control and treatment customers were found, as shown in Figure 4-65. On a scale of 0-10, where 0 represents "not at all important" and 10 is "extremely important", 41% of single family control respondents reported "I do not think my energy saving efforts are worth the time and/or money" as a barrier and 33% of treatment respondents did so as well (rated this importance as 7 or higher). The difference is statistically significant at the 90% level of confidence. For multi-family (Figure 4-66), 47% of treatment respondents and 50% of control respondents reported "Initial cost of energy efficient equipment is too high". The difference is not statistically significant at the 90% level of confidence.

When single family and multi-family responses to these questions were compared, 36% of single family respondents and 44% of multi-family respondents reported "I do not think my energy saving efforts are worth the time and/or money" as a barrier. The difference between single family and multi-family respondents is statistically significant at 90% level of confidence.

Figure 4-65: Barriers to Customers Undertaking Energy Savings Actions – Single Family Top-4 Box Scores (0-10 Scale)

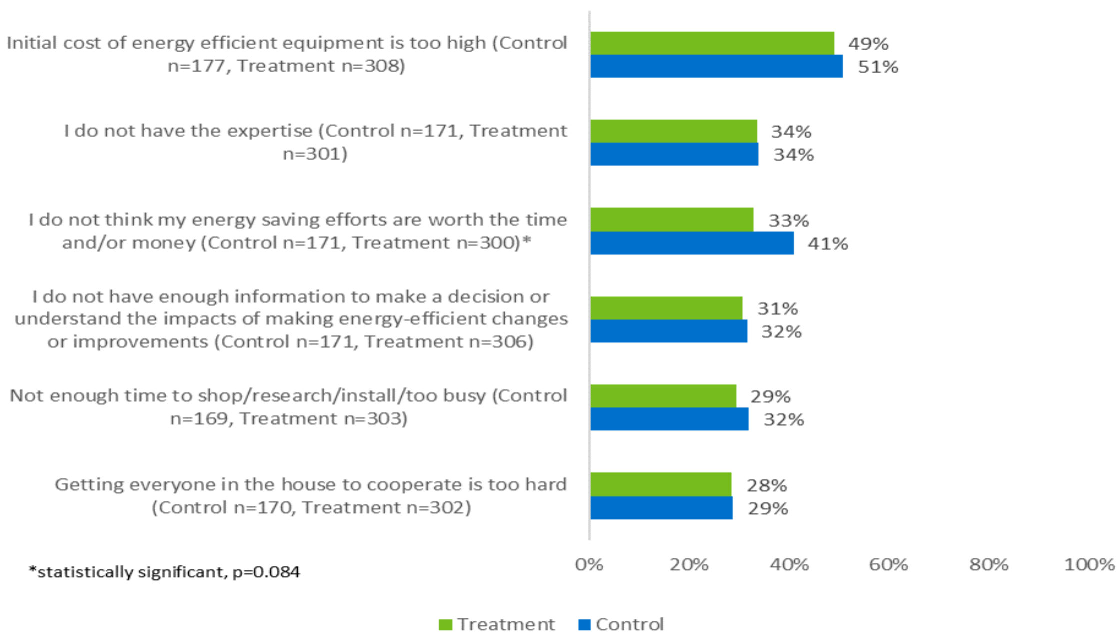
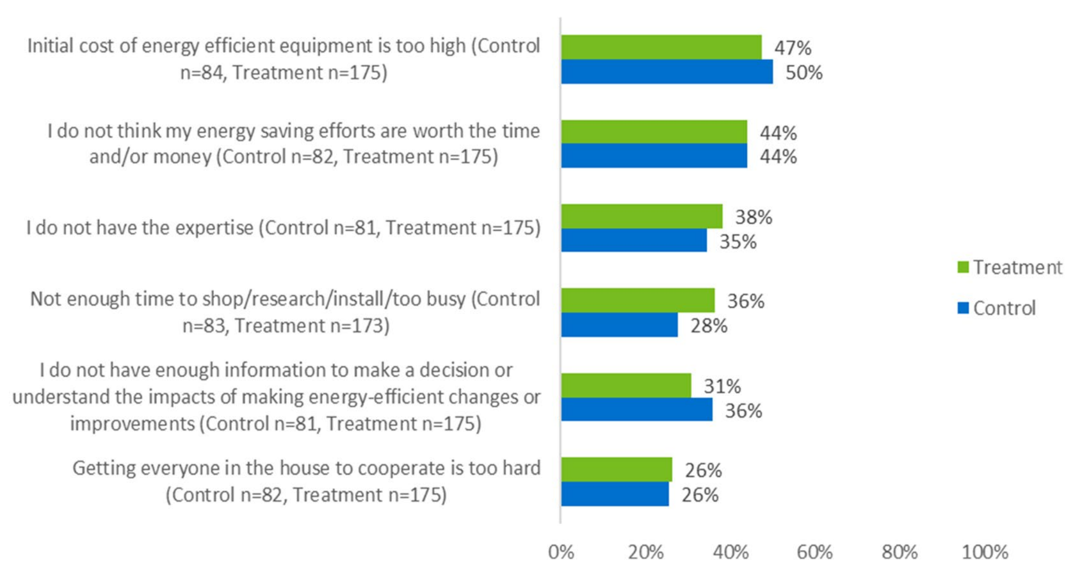


Figure 4-66: Barriers to Customers Undertaking Energy Savings Actions – Multi-family Top-4 Box Scores (0-10 Scale)



Suggestions about Duke Energy Improving Service Offerings

The survey provided an open-ended question to elicit suggestions about Duke Energy improving its service offerings to help customers reduce energy use. Only 19% (148 of 781, treatment and control customers in total) offered suggestions, including 26 who offered only appreciative comments. Among those offering suggestions for improvement, the most common request, mentioned in 38 of the remaining 127 responses with suggestions, reflected a desire for more energy savings programs, more energy savings information, and more incentives:

- "*Give me more information on how to save energy…*"
- "*Incentives for customers who do try to save energy and keep their energy bills lower.*"
- *"Provide free replacement light bulbs."*
- *"More rebate incentives."*
- "*More energy saving ideas for apartments.*"

Other comments centered on other suggestions, such as reducing prices/providing senior and disability discounts, and better communication. Nexant categorized these suggestions on the general basis of their content; the results are presented in Table 4-21.

Table 4-21: Responses to Solicitation for Suggestions to Duke Energy for Improving Service Offerings

Suggestion	Single Family			Multi-family		
	Count	Percent of Respondents Mentioning (n=104)	Percent of Total Mentions (n=107)	Count	Percent of Respondents Mentioning (n=44)	Percent of Total Mentions (n=46)
Increase program offerings, incentives, or information	24	23%	22%	14	32%	30%
Reduce price/provide senior and disability discounts	24	23%	22%	9	20%	20%
Appreciate current offers	18	17%	17%	9	20%	20%
Miscellaneous	12	12%	11%	8	18%	17%
Voiced frustration with Duke Energy	11	11%	10%	5	11%	11%
Better communication/more emails/more mails/in-person communication	9	9%	8%	1	2%	2%
Provide more detailed info in MyHER	6	6%	6%	0	0%	0%
Reduce power outages	3	3%	3%	0	0%	0%

4.2.3.2 Treatment Households: Experience and Satisfaction with MyHER

A very large majority of the single family treatment only household respondents, 95%, (158 of 166), and the multi-family treatment only household respondents, 85%, (69 of 81) recalled receiving at least one of the MyHER reports.

The survey asked those that could recall receiving at least one MyHER report if they could recall how many individual reports they had received “in the past 12 months” (respondents who receive paper HERs would receive eight reports (single family respondents) and up to six reports (multi-family respondents) in this time period, and those who receive eHERs would have received 12. Forty-five percent (65 of 146) of single family customers responded that they received 12 home energy reports in the past 12 months. Twenty percent (12 of 60) of multi-family customers responded that they received 12 home energy reports in the past 12 months. The scattered distribution of responses related to recall is consistent with the difficulty of recalling an exact number of reports, however the question is valuable for grounding respondents in the experience of receiving a MyHER before asking them more specific questions about the document. We note the response pattern for single family respondents is significantly different than that of multi-family respondents.

Figure 4-67 and Figure 4-68). Given Duke Energy’s protocols for report delivery, respondents who receive paper HERs would receive eight reports (single family respondents) and up to six reports (multi-family respondents) in this time period, and those who receive eHERs would have received 12. Forty-five percent (65 of 146) of single family customers responded that they received 12 home energy reports in the past 12 months. Twenty percent (12 of 60) of multi-family customers responded that they received 12 home energy reports in the past 12 months. The scattered distribution of responses related to recall is consistent with the difficulty of recalling an exact number of reports, however the question is valuable for grounding respondents in the experience of receiving a MyHER before asking them more specific questions about the document. We note the response pattern for single family respondents is significantly different than that of multi-family respondents.

Figure 4-67: Reported Number of MyHERs Received "In the past 12 months" (n=146) – Single Family

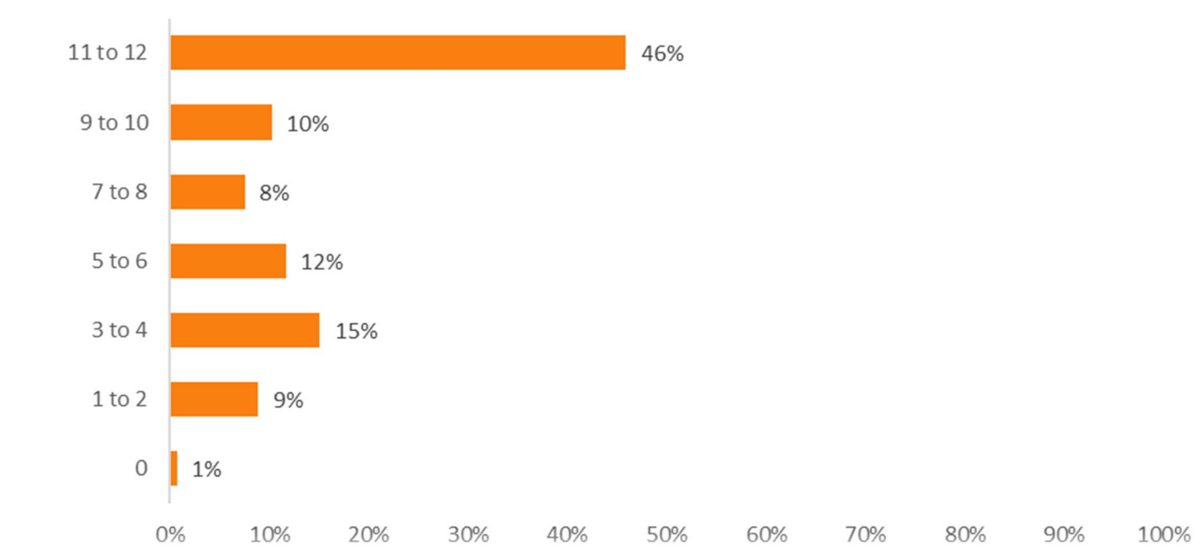
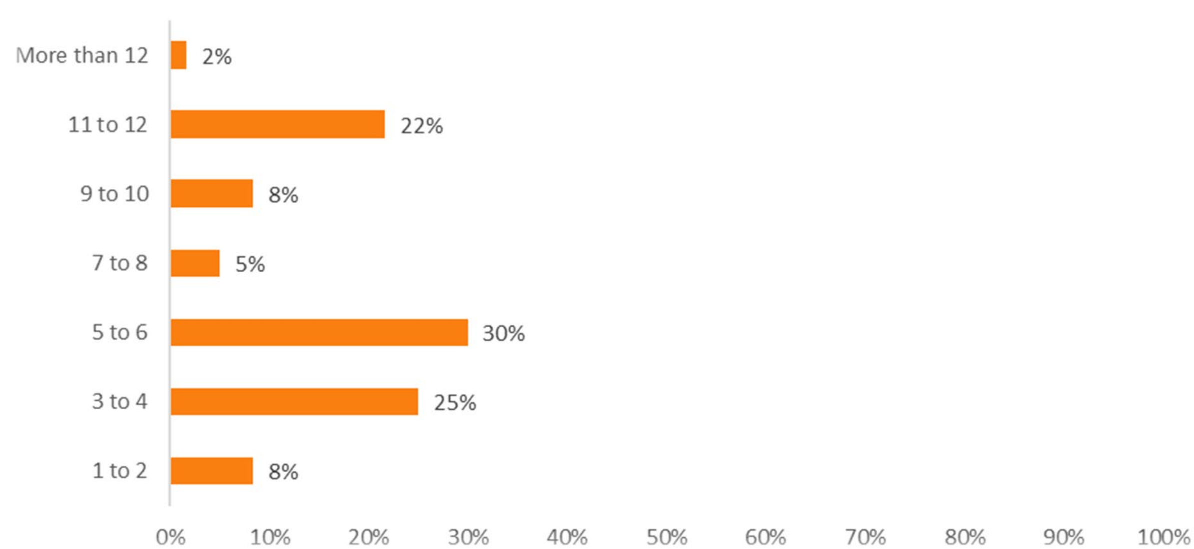


Figure 4-68: Reported Number of MyHERs Received "In the past 12 months" (n=60) – Multi-family



Survey respondents indicated high interest in the MyHER reports. As shown in Figure 4-69 and Figure 4-70, when asked how often they read the reports, 95% of single family respondents indicated they "always" or "sometimes" read the reports, and 98% of multi-family respondents indicated they "always" or "sometimes" read them.

Figure 4-69: How Often Customers Report Reading the MyHER (n=144) – Single Family

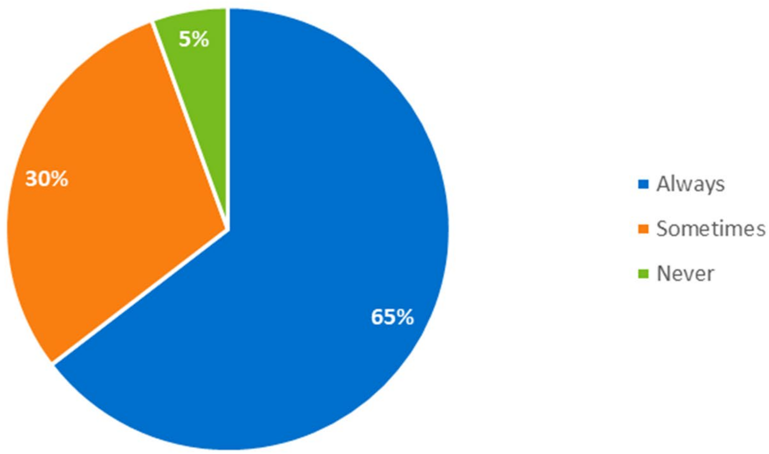
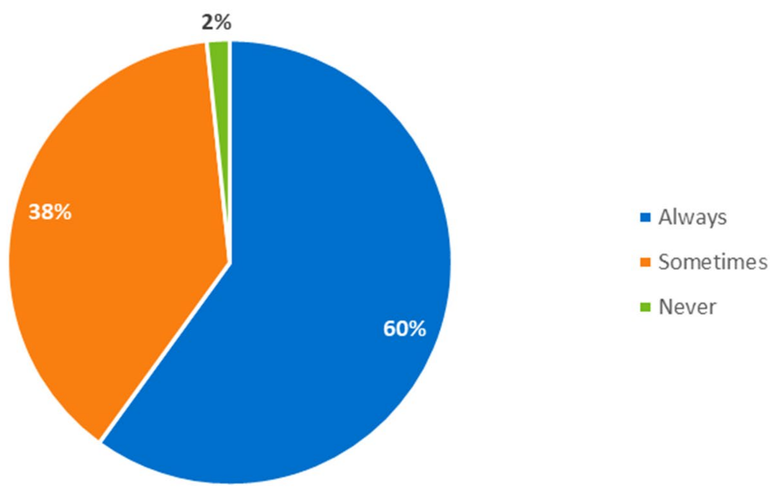


Figure 4-70: How Often Customers Report Reading the MyHER (n=60) – Multi-family



Sixty-three percent (85 of 134) of single family respondents that provided a rating reported being “somewhat” or “very” satisfied with the information contained in the reports (Figure 4-71). Seventy-three percent (43 of 59) of multi-family respondents that provided a rating reported being “somewhat” or “very” satisfied with the information contained in the reports (Figure 4-72). The survey asked a further question to the respondents of why they said so: 10 of the satisfied single family respondents and 6 of the satisfied multi-family respondents provided reasons. Among customers who gave the highest satisfaction ratings, the most common comments on the MyHERs described the reports as “helpful.”

Figure 4-71: Satisfaction with the Information in MyHER Reports (n=134) – Single Family

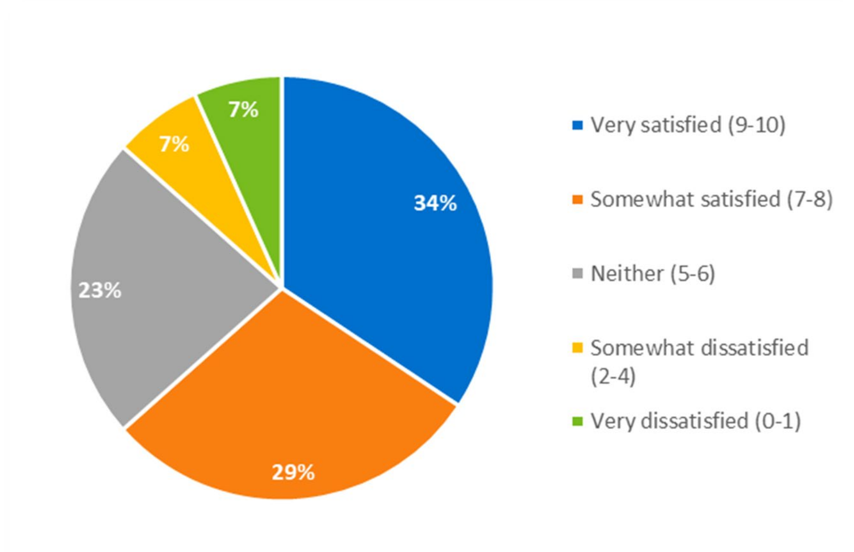
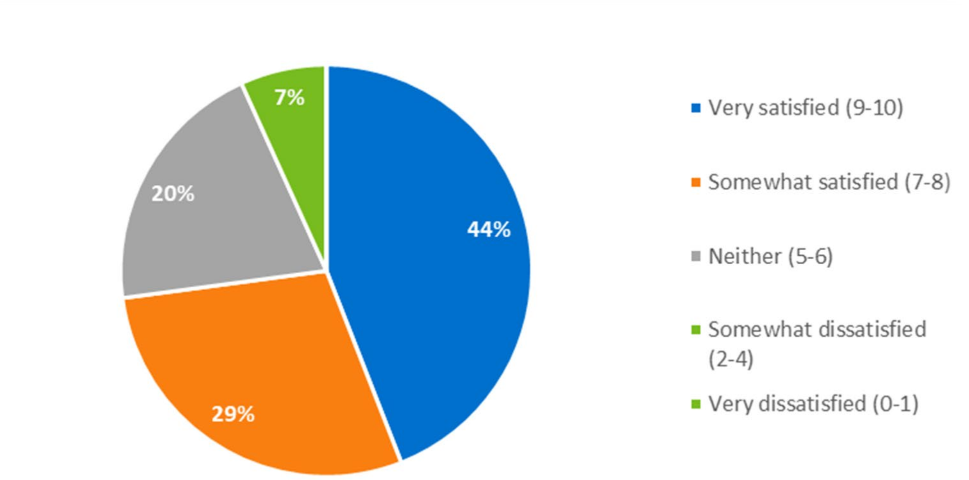


Figure 4-72: Satisfaction with the Information in MyHER Reports (n=59) – Multi-family

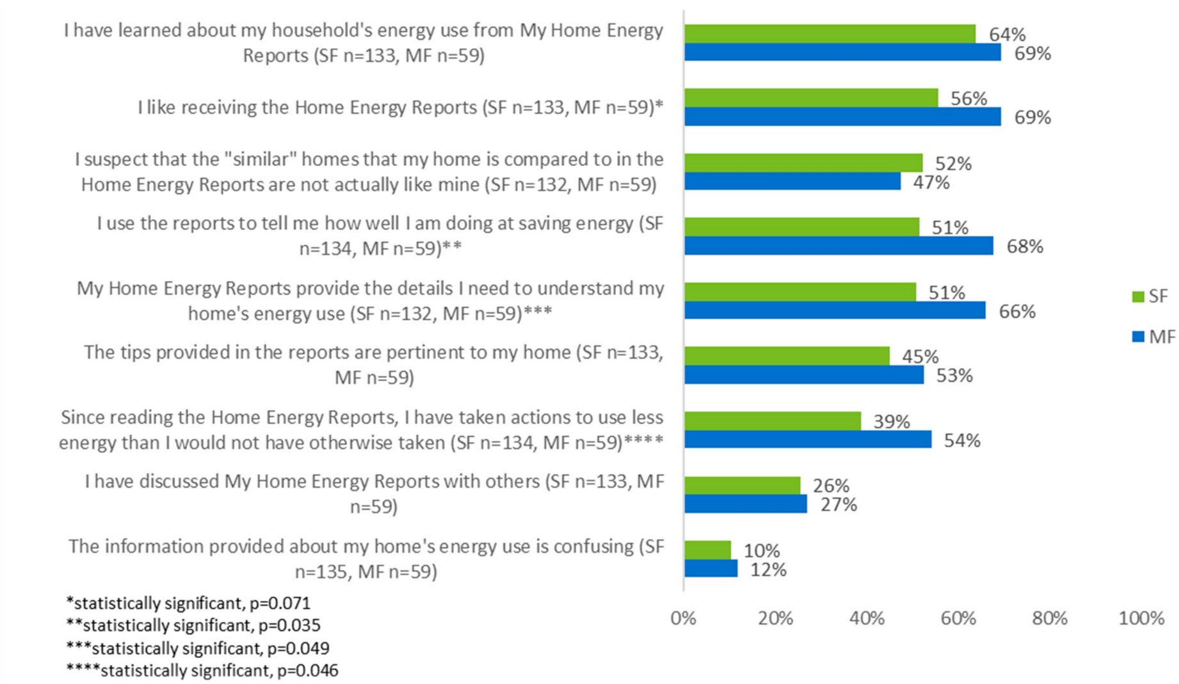


When asked to rate their agreement with a series of statements about MyHERs on a scale of 0 to 10, recipients largely agreed that the reports helped them understand their home's energy use, with 64% of single family respondents and 69% of multi-family respondents rating their agreement a seven or higher on a 0-10 point scale. The difference of responses between single family customers and multi-family customers is not statistically significant.

Fifty-six percent of single family respondents and 69% of multi-family respondents agreed that they like receiving the home energy reports; this difference is statistically significant at the 90% level of confidence.

More than half (51% of single family respondents and 68% of multi-family respondents) agreed that the reports provided the information of how well they were doing at saving energy. Fifty-one percent of single family respondents and 66% of multi-family respondents agreed that the reports provided the detailed information they needed to understand home energy use. These differences between single family and multi-family respondents are statistically significant. Respondents provided weaker agreement to statements about whether they have taken actions to use less energy than they would not have since reading MyHERs (39% of single family respondents and 54% of multi-family respondents). The difference is statistically significant at the 90% level of confidence. A relatively small percentage (10% of single family respondents and 12% of multi-family respondents) agreed with the statement that the information provided is confusing. The difference is not statistically significant at the 90% level of confidence (Figure 4-73).

Figure 4-73: Level of Agreement with Statements about MyHER Top-4 Box Scores (0-10 Scale)



The survey provided an open-ended question (to customers that reported reading at least one report in the past year) to elicit suggestions for improvements to the MyHER reports. About 32% (44 of 136) of single family respondents and 39% (23 of 59) of multi-family respondents offered suggestions, including 10 single family respondents and 4 multi-family respondents who offered comments to express gratitude and appreciation of the reports only. Among those providing a response to the question, the most common response mentioned by 15 of the 34 single family respondents with suggestions reflected a desire for more specific information or details about their home and specific actions they should take. Some of these requests reflected interest in understanding at a more granular level how their home uses energy and how to reduce energy consumption information:

- "*More suggestions on utilizing Solar Power and credible sources of obtaining solar.*"
- "*Could the report explain how Duke Energy knows how much electricity is used in laundry, cooling, heating, etc.…*"
- *"Show influence on cost per square foot…"*

The most common response mentioned by 14 of the 19 multi-family respondents with suggestions questioned the comparison/accuracy of the report, such as:

- "*Make sure all factors are current with the household.*"
- "*Well, what's strange to me is there are categories for laundry (washer and dryer) usage and a few others I can't recall that don't even apply to us. We don't HAVE a washer or dryer so that's confusing to me."*

Nexant categorized these suggestions on the general basis of their content; the results are presented in Table 4-22.

Table 4-22: Suggestions for MyHER Improvement (Multiple Responses Allowed)

Suggestion/Comment	Single Family			Multi-family		
	Count	Percent of Respondents Mentioning (n=44)	Percent of Total Mentions (n=46)	Count	Percent of Respondents Mentioning (n=23)	Percent of Total Mentions (n=25)
Provide more specific information or details	15	34%	33%	3	13%	12%
Don't believe comparison/accuracy	11	25%	24%	14	61%	56%
Appreciate the Home Energy Report	10	23%	22%	4	17%	16%
Change production (mail, paper, format)	4	9%	9%	1	4%	4%
Don't see value/dislike	4	9%	9%	0	0%	0%
Unique circumstances	2	5%	4%	3	13%	12%

Treatment households were also asked questions that focused on their awareness and use of MyHER Interactive, revealing low awareness of the online Interactive platform:

- Only 38% (51 of 133) of single family treatment customers and 38% (22 of 58) of multi-family treatment customers are aware of MyHER Interactive;
- Among aware customers, 94% of single family respondents and 82% of multi-family respondents reported that they had not signed up to use MyHER Interactive. The difference is not statistically significant at the 90% level of confidence; and
- When these respondents were asked why they haven't signed up to use MyHER Interactive, among the respondents who gave the answers, 32% of single family

respondents and 18% of multi-family respondents reported that they were not interested in it, 19% of single family respondents and 9% of the multi-family respondents said they were too busy, and 10% of single family respondents and 36% of multi-family respondents reported that they did not know about it. Ten percent of single family respondents and 9% of multi-family respondents reported they did not have a computer, and 10% of single family respondents said they did not use computer.

Evidence of MyHER Effects

As noted above, while formal statistical testing found some differences among treatment and control group households for individual questions, Nexant sought to understand if the overall pattern of survey responses differed among treatment and control households. To do this, we categorized each survey question by topic area and then counted any survey item in which the treatment households provided a more positive response than the control households.

Nexant's approach consists of the following logical elements:

- Assume the number of positive responses between treatment and control customers will be equal if MyHER lacks influence;
- Count the total number of topics and questions asked of both groups – there are seven topic areas and 51 questions;
- Note any item for which the treatment group outperformed the control group:
  - Single family: The treatment group outperformed the control group in 29 questions, or 57% of the total questions;
  - Multi-family: The treatment group outperformed the control group in 20 questions, or 39% of the total questions; and
- Calculate the probability that the difference in response patterns is due to chance, rather than an underlying difference in populations – 87% in the case of single family. Since this probability is much greater than 10%, we cannot reject the null hypothesis that the number of positive responses should be equal for treatment and control customers at the 90% level of confidence.

In comparing the response patterns between the treatment and control groups, if the MyHER program did not influence customers, one would expect the treatment group to "score higher" on roughly half of the questions. In other words, if the MyHER is not influencing treatment group customers, there is a 50/50 chance that they will "outperform" the control group as many times as not. What we see in the survey data overall is the proportion of questions indicating a positive MyHER effect near 50% in the case of single family program participants. In fact, the proportion of questions where treatment customers showed a positive MyHER effect was a little higher than 50%, however not statistically different from 50% at the 90% level of confidence.

The survey data reveal that there are specific areas where MyHER has a relatively stronger and poorer positive effect. These areas of strong and weak performance are different for single family and multi-family participants, as shown in Table 4-23 and Table 4-24. In the case of single family customers, receiving the MyHER is associated with lower customer reported energy savings behaviors. This result may indicate that opportunities exist for Duke Energy to leverage the reports and website as a vehicle for delivering different or new information and opportunities to MyHER recipients that would increase their overall energy efficiency behaviors taken. On the other hand, single family MyHER recipients had a more positive view in these surveys on customer engagement with Duke Energy website, customer motivation, engagement and awareness of energy efficiency, customer satisfaction with Duke Energy, and they reported experiencing fewer barriers to take energy savings actions.

Same as the single family customers, multi-family customers MyHER recipients reported

experiencing fewer barriers to taking energy savings actions than non-recipients and higher customer engagement with Duke Energy website. Unlike single family customers, multi-family MyHER survey responses also indicated lower satisfaction on Duke Energy's energy efficiency offerings and customer motivation, engagement and awareness of energy efficiency, and lower level of customer satisfaction with Duke Energy.

When considering all possible areas of enhancement that the MyHERs can have on customer attitudes and actions related to satisfaction and energy savings behaviors, we observe areas of relative strength and weakness that differ between single family and multi-family customers. This result further illustrates that the messaging and approach taken in the reports delivered to multi-family customers may differ from that used in the single family reports in order to optimize the desired effects of increasing satisfaction and energy savings actions across both customer groups.

Table 4-23: Survey Response Pattern Index – Single Family

Question Category	Count of Ques. where T better than C	Number of Ques. in Topic Area	Portion of Ques. where T better than C
Duke Energy's Public Stance on Energy Efficiency	2	4	50%
Customer Engagement with Duke Energy Website	4	5	80%
Customer's Reported Energy-saving Behaviors	1	11	9%
Customer's Reported Energy Efficiency Improvements Made	5	10	50%
Customer Motivation, Engagement and Awareness of Energy Efficiency	8	11	73%
Barriers of Customer Not Undertaking Energy Savings Actions	6	6	100%
Customer Satisfaction with Duke Energy	3	4	75%
Total	**29**	**51**	**57%**

Table 4-24: Survey Response Pattern Index – Multi-family

Question Category	Count of Ques. where T better than C	Number of Ques. in Topic Area	Portion of Ques. where T better than C
Duke Energy's Public Stance on Energy Efficiency	0	4	0%
Customer Engagement with Duke Energy Website	4	5	80%
Customer's Reported Energy-saving Behaviors	5	11	45%
Customer's Reported Energy Efficiency Improvements Made	3	10	30%
Customer Motivation, Engagement and Awareness of Energy Efficiency	3	11	27%
Barriers of Customer Not Undertaking Energy Savings Actions	4	6	67%
Customer Satisfaction with Duke Energy	1	4	25%
Total	**20**	**51**	**39%**

Respondent Demographics

Nearly all single family respondents—88% of treatment group customers and 90% of control group customers—own their residence. Among multi-family respondents, 81% of treatment group customers and 76% of control group customers rent their residence. More than half of households surveyed have two or fewer residents for both single family and multi-family. For single family households, about 13% of treatment households and 14% of control households have four or more residents. For multi-family households, about 7% of treatment households and 14% of control households have four or more residents. There are no statistically significant differences in the distribution of ownership or age of homes assigned to the treatment and control groups for both single family and multi-family (Figure 4-74 and Figure 4-75).

Figure 4-74: "In What Year Was Your Home Built?" – Single Family

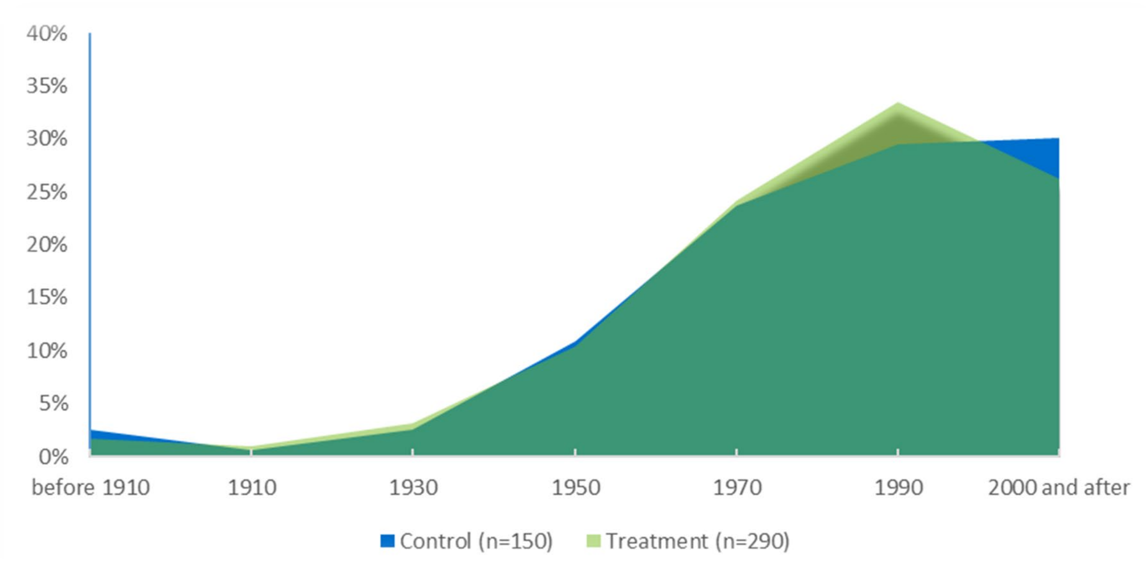


Figure 4-75: "In What Year Was Your Home Built?" – Multi-family

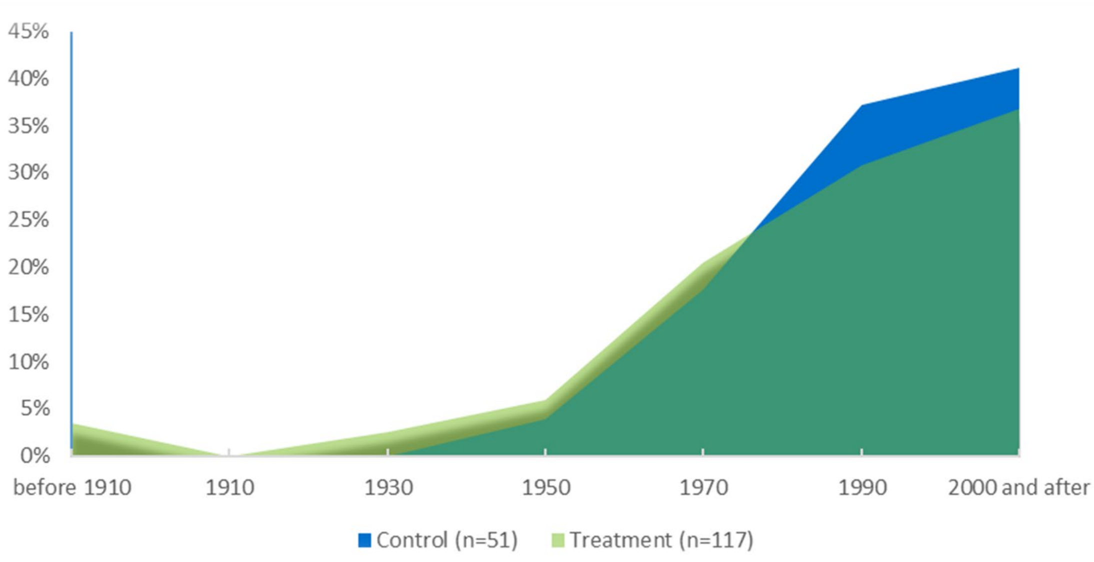


Figure 4-76 shows distribution of home square footage is similar between control and treatment group customers among single family households. The average square footage above ground is 2,152 for control households and 2,103 for treatment households, and the difference is not statistically significant. Figure 4-77 shows distribution of home square footage of control and treatment group customers among multi-family households. The average square footage above ground is 1,342 for control households and 1,323 for treatment households, and the difference is not statistically significant at the 90% level of confidence.

Figure 4-76: How many square feet is above ground living space? – Single Family

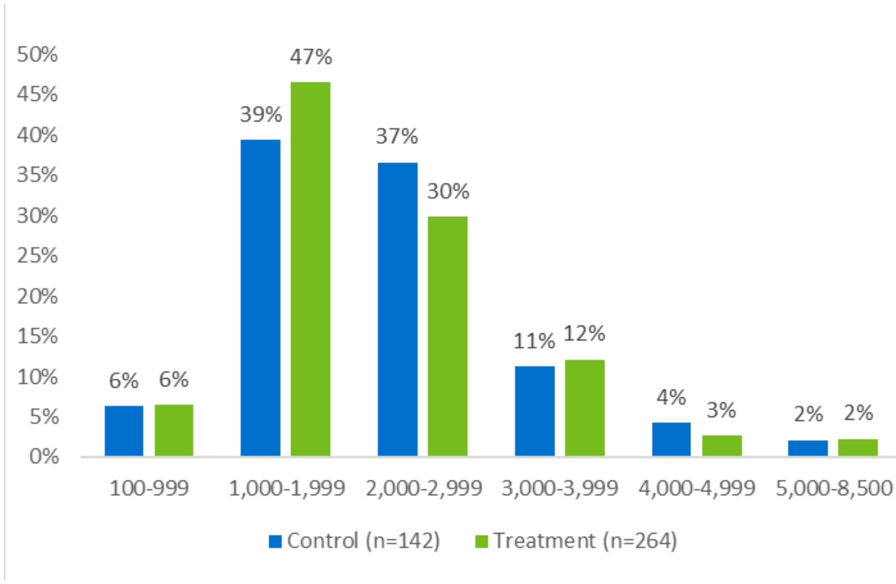
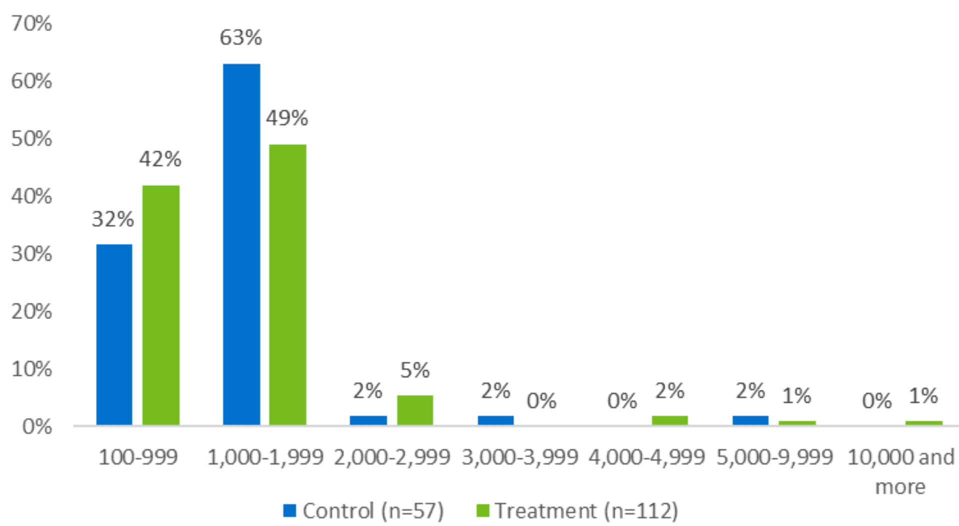


Figure 4-77: How many square feet is above ground living space? – Multi-family



The average age for single family respondents is 63 for control customers and 64 for treatment customers. For multi-family respondents it is 55 for control customers and 53 for treatment customers. The lowest age category (Younger than 25) is often underrepresented in survey studies, given that many members of that population would not participate in surveys. This common underrepresentation is true in this survey study, as well (see Table 4-25).

Table 4-25: Respondent Age Relative to RECS or American Housing Survey

Age	Single Family			Multi-family		
	Control Group (n=156)	Treatment Group (n=302)	EIA RECS Data South Atlantic Census Division[21]	Control Group (n=82)	Treatment Group (n=173)	American Housing Survey[22]
Younger than 25	0%	0%	6%	0%	1%	10%
25-34	5%	3%	14%	15%	23%	30%
35-44	7%	7%	15%	17%	14%	23%
45-54	15%	15%	20%	15%	13%	19%
55-64	23%	23%	20%	18%	14%	9%
65 and over	50%	52%	26%	35%	35%	9%

Figure 4-78 shows the primary heating fuel type used in single family control and treatment households. More than half of treatment (69%) and control (64%) customers use electricity in their households for heating. Twenty-two percent of treatment customers and 27% of control customers use natural gas for heating. These differences are not statistically significant.

Figure 4-78: Primary Heating Fuel in Households – Single Family

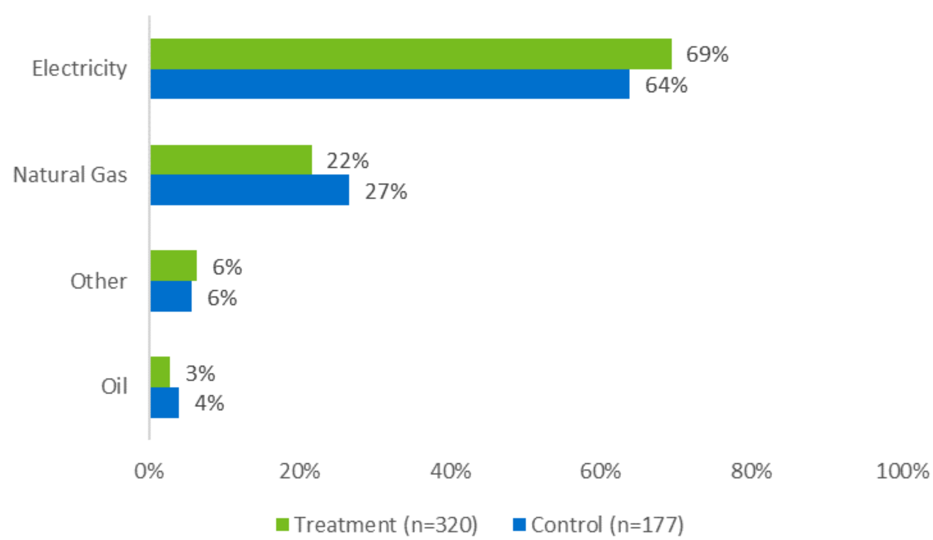


Figure 4-79 shows the primary heating fuel type used in multi-family control and treatment households. More than half of treatment (89%) and control (87%) customers use electricity in

[21] 2015 Residential Energy Consumption Survey (RECS). https://www.eia.gov/consumption/residential/data/2015/hc/php/hc9.8.php

[22] American Housing Survey, 2011 Charlotte - Household Demographics - All Occupied Units, Charlotte-Gastonia-Rock Hill, NC-SC MSA (1993 OMB definition) Tenure Filter: Renter, https://www.census.gov/programs-surveys/ahs/data/interactive/ahstablecreator.html?s_areas=16740&s_year=2011&s_tablename=TABLE8A&s_bygroup1=1&s_bygroup2=1&s_filtergroup1=3&s_filtergroup2=1"

their households for heating. The difference is not statistically significant. Ten percent of treatment customers and control customers, respectively, use natural gas for heating.

Figure 4-79: Primary Heating Fuel in Households – Multi-family

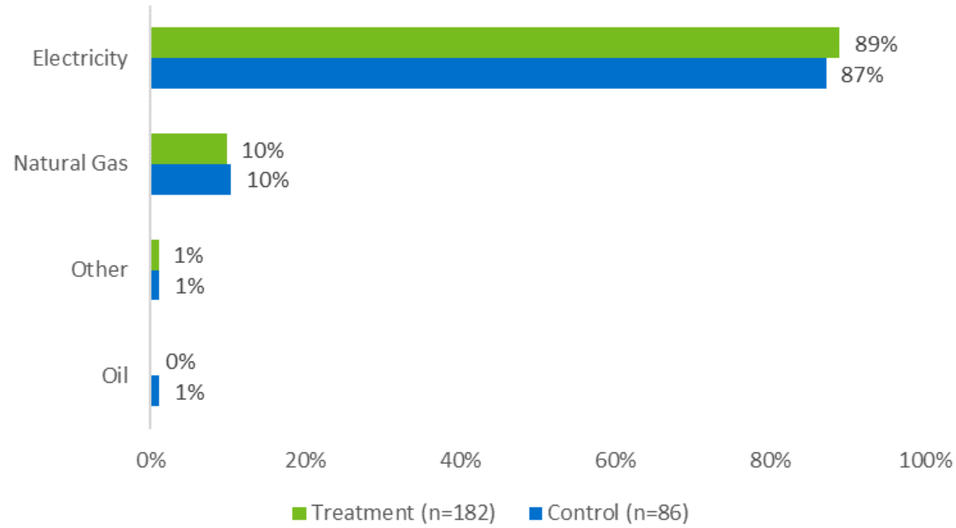


Table 4-26 shows the distribution of total annual household income in single family and multi-family households. Seventeen percent of single family treatment and control customers, respectively, reported their household income between $50,000 and $75,000 in 2020. For the multi-family households, 16% of treatment customers and 18% of control customers reported their household income in this bracket in 2020.

Table 4-26: 2020 Total Annual Household Income

2020 Annual Income	Single Family		Multi-family	
	Control (n=146)	Treatment (n=270)	Control (n=77)	Treatment (n=167)
Under $15,000	14%	13%	16%	20%
$15,000 to under $25,000	11%	10%	14%	14%
$25,000 to under $35,000	8%	10%	16%	9%
$35,000 to under $50,000	10%	12%	19%	19%
$50,000 to under $75,000	17%	17%	18%	16%
$75,000 to under $100,000	14%	10%	5%	11%
$100,000 to under $150,000	11%	16%	6%	4%
$150,000 to under $200,000	9%	6%	1%	5%
$200,000 or more	7%	5%	4%	2%

4.3 Summary of Process Evaluation Findings

In-depth interviews with Duke Energy MyHER program staff reveal that the DEC and DEP MyHER program has benefited throughout the life of the Uplight program implementation from a number of enhancements to the program and improvements in process and program management, and continues to operate effectively. A reduced number of six (from eight) paper reports are now sent to new enrollees that also receive eHERs in an effort to optimize treatment effects and program cost-effectiveness. In addition, efforts to increase enrollment for the MyHER Interactive online portal continues. In 2020, enrollment increased by nearly 30,000 customers in DEC and about 15,000 customers in DEP. The MyHER user experience is expected to be further enhanced in the future as the rollout of AMI meters recently completed in DEC and DEP and the strategic leveraging of this data continues to evolve in terms of report modeling and data presentation.

From the back office perspective, Uplight, Duke Energy's MyHER program provider, implemented a primary process improvement. Uplight launched HOMERS (Home Energy Reporting Service), which is a report management software platform that provides structure for Uplight's MyHER data management, quality control, and report production processes, while offering Duke Energy interactive management tools as well. Importantly, this shift to HOMERS has helped decrease QC errors at Uplight, and resulted in smaller and more predictable report batch sizes when reports are transferred to Duke Energy twice a week for QC purposes. In addition, the migration has reduced the amount of time reports take to get to customers. Not only did this reduction help Uplight meet their 12 day delivery SLA, customers get the report earlier in the month while their patterns of energy use from the previous month are fresher in their minds which should motivate behavioral change more effectively.

Additionally, Uplight has continued to make progress on updating the "action tips" section of the report to "smart actions", by increasing the number of these tips that are linked to the comparison housing model. In 2019, Uplight added 23 of these tips to the existing library of tips and overall have increased the size of this library by 50%. These "tips" were the latest feature to be added to the MyHER portion of the Duke Energy app, joining the home comparison chart, cohort information, and usage disaggregation.

Duke Energy and Uplight continued to collaborate for success through joint weekly status meetings, monthly operations meetings, and quarterly governance meetings for the duration of the implementation contract. Working together, monthly key performance indicators (KPIs) such as in-home dates and percentage of treated customers treated are monitored. These meetings provide the venue for brainstorming and roadmapping activities as well as monitoring Duke Energy's MyHER product request list. Uplight used an internal HER Improvement team to address the items on the list. Since the prior evaluation, Uplight has improved their performance in product quality, which is rigorously monitored by Duke Energy staff.

In general, the strong emphasis on the development of procedures and strategies to prevent problems in the MyHER production process that began in earnest in 2018 at both Uplight and

Duke Energy helped streamline the transition to the HOMERS platform that otherwise may have resulted in a more problematic and error-prone report production process and a less successful program overall.

Survey Findings – Single-family - DEC

Surveys of the single family treatment and control customers show that, among treatment group households:

- 95% recalled receiving at least one MyHER and 98% of those indicated that they “always” or “sometimes” read the reports.
- 58% reported being “very” or “somewhat” satisfied with the information provided by MyHERs.
- MyHER recipients are more likely to be satisfied with the three aspects of customer service provided by Duke Energy than non-recipients, but difference is not statistically significant.
- MyHER single family recipients are not more likely to undertake energy-saving behaviors or upgrades than non-recipients, however it is possible they do the same energy-savings behaviors with greater frequency or intensity of effort.
- Only 31% of MyHER recipients are aware of MyHER Interactive, and only 9% of the aware recipients reported that they had signed up to use it. When asked why they haven’t signed up to use MyHER Interactive, 29% of respondents reported that they were not interested in it, 21% reported that they were too busy, and 14% then stated that they did not know about it.
- More than half, 64%, of respondents strongly agree with the statement “I have learned about my household’s energy use from My Home Energy Reports”. Very few (10%) strongly agree with the idea that the energy usage information presented by the reports is confusing.
- The most useful feature of the reports, as rated by treatment customer respondents, is the graphs that illustrate the home’s energy usage over time.
- More than half (59%) of the respondents had no feedback or suggestions to improve the program. Those that made suggestions most frequently requested more specific or detailed information in their MyHERs or questioned the accuracy of the neighborhood comparisons.

Survey Findings – Multi-family – DEC

Surveys of the multi-family treatment and control customers show that, among treatment group households:

- 95% recalled receiving at least one MyHER and 94% of those indicated that they “always” or “sometimes” read the reports.
- 72% reported being “very” or “somewhat” satisfied with the information provided by MyHERs.
- MyHER recipients are more likely to be satisfied with Duke Energy’s response to COVID-19 to help those dealing with financial hardship than non-recipients, but the difference is not statistically significant.

- MyHER multi-family recipients are not more likely to undertake energy-saving behaviors or upgrades than non-recipients, but as mentioned above, it is possible they undertake the behaviors with greater frequency or intensity.
- Only 52% of MyHER recipients are aware of MyHER Interactive, and only 9% of the aware recipients reported that they had signed up to use it. When those who hadn't signed up for MyHER Interactive were asked why, 27% reported that they were not interested in it, 27% of respondents then reported that they did not know about it, 18% of respondents reported that they were having technological issues or did not use computers, and another 14% reported that they were too busy.
- More than half of multi-family MyHER recipients, 74%, agree with the statement: “I have learned about my household's energy use from My Home Energy Reports”. A minority but notable proportion of respondents, 16%, strongly agree with the idea that the energy usage information presented by the reports is confusing.
- The most useful feature of the reports, as rated by treatment customer respondents, is the energy use associated with specific household items and areas.
- A majority (74%) of respondents had no feedback or suggestions to improve the program. Those that made suggestions most frequently reflected a desire for more specific information or details about their home and specific actions they should take.

Survey Findings – Single-family and Multi-family Comparison – DEC

- Both SF and MF treatment customers have about the same level of satisfaction (as measured by top-2 of 10 box scores) – MyHER did not result in a measurable uplift in satisfaction with Duke Energy during this evaluation period.
- More MF customers report being satisfied with MyHER than SF (72% vs. 58%).
- More multi-family MyHER recipients (66%) than single family MyHER recipients (56%) reported that My Home Energy Report provided the details they needed to understand their energy use, but the difference is not statistically significant.
- Multi-family customers are significantly more likely to agree that Duke Energy provides service at a reasonable cost than single family customers (72% vs. 62%).
- Multi-family treatment customers are more likely to report “Energy use associated with specific household items or areas is useful than single family treatment customers. The difference is statistically significant at the 90% level of confidence.
- Single family treatment customers were significantly more likely to have undertaken five EE upgrades than multi-family treatment customers, and this difference appears to be driven by homeownership - Single family homeowners from this group were also more likely to undertake five energy efficient upgrades than multi-family homeowners, but the differences are not statistically significant in that case.
- There is a significant differential between satisfaction among treatment customers and interest in control customers in “information about services and offers from Duke Energy”, indicating that the MyHERs could look to improve satisfaction or acceptance of this report feature. This finding holds for both SF and MF customers.

Survey Findings – Single-family – DEP

Surveys of the single family treatment and control customers show that, among treatment group households:

- 95% recalled receiving at least one MyHER and 94% of those indicated that they “always” or “sometimes” read the reports.
- 63% reported being “very” or “somewhat” satisfied with the information provided by MyHERs.
- MyHER recipients are more likely to be satisfied with Duke Energy’s commitment to promoting energy efficiency and the wise use of electricity, and the information available about Duke Energy’s efficiency programs than non-recipients, but these differences are not statistically significant.
- MyHER single family recipients are not more likely to undertake energy-saving behaviors than non-recipients, but may undertake these actions more often.
- Only 38% of MyHER recipients are aware of MyHER Interactive, and only 6% of the aware recipients reported that they had signed up to use it. When asked why they haven’t signed up to use MyHER Interactive, 32% of respondents reported that they were not interested in it, 19% reported that they were having technological issues or they did not use computers, 19% reported that they were too busy, and 10% then stated that they did not know about it.
- More than half, 64%, of respondents strongly agree with the statement “I have learned about my household’s energy use from My Home Energy Reports”. Few (10%) strongly agree with the idea that the energy usage information presented by the reports is confusing.
- The most useful features of the reports, as rated by treatment customer respondents, are the graphs that illustrate the home’s energy usage over time.
- Most (68%) respondents had no feedback or suggestions to improve the program. Those that made suggestions most frequently requested more specific or detailed information in their MyHERs, and questioned the accuracy of the comparison.

Survey Findings – Multi-family – DEP

Surveys of the multi-family treatment and control customers show that, among treatment group households:

- 85% recalled receiving at least one MyHER and 98% of those indicated that they “always” or “sometimes” read the reports.
- 73% reported being “very” or “somewhat” satisfied with the information provided by MyHERs.
- MyHER recipients are not more likely to be satisfied with various aspects of Duke Energy customer service than non-recipients.
- MyHER multi-family recipients are not more likely to undertake energy-saving behaviors than non-recipients, but they could be undertaking those same behaviors with greater consistency or intensity.
- Only 38% of MyHER recipients are aware of MyHER Interactive, and only 18% of the aware recipients reported that they had signed up to use it. When those who hadn't signed up for MyHER Interactive were asked why, 36% reported that they actually did

not know about it, 18% reported that they were not interested in it, and 9% reported that they were too busy.

- More than half of multi-family MyHER recipients, 69%, agree with the statement: "I like receiving the Home Energy Reports". A minority (12%) strongly agree with the idea that the energy usage information presented by the reports is confusing.
- The most useful features of the reports, as rated by treatment customer respondents, are the graphs that illustrate the home's energy usage over time.
- More than half (61%) of respondents had no feedback or suggestions to improve the program. Those that made suggestions most frequently questioned the accuracy of the comparison homes.

Survey Findings – Single-family and Multi-family Comparison – DEP

- As in DEC, both SF and MF DEP treatment customers have about the same level of satisfaction (as measured by top-2 of 10 box scores) – MyHER did not result in a measurable uplift in satisfaction with Duke Energy during this evaluation period.
- Significantly more multi-family MyHER recipients (69%) than single family MyHER recipients (56%) like receiving the Home Energy Reports.
- Significantly more multi-family MyHER recipients (68%) than single family MyHER recipients (51%) report using the MyHERs to tell them how well they are doing at saving energy.
- Significantly more multi-family MyHER recipients (66%) than single family MyHER recipients (51%) report "My Home Energy Reports provide the details I need to understand my home's energy use".
- Significantly more multi-family MyHER recipients (54%) than single family MyHER recipients (39%) report "Since reading the Home Energy Reports, I have taken actions to use less energy than I would not have otherwise taken".
- Multi-family customers are more likely to agree that Duke Energy provides excellent customer service than single family customers (83% vs. 81%). The difference is not statistically significant.
- Single family treatment customers were significantly more likely to have undertaken almost all EE upgrades than multi-family treatment customers. Homeownership is an important factor - single family homeowners from this group were more likely to undertake five energy efficient upgrades than multi-family homeowners, but the differences are not statistically significant.
- There is a significant differential between satisfaction among treatment customers and interest in control customers in "comparisons to similar homes" and "tips to help you save money and energy", indicating that the MyHERs could look to improve satisfaction or acceptance of these report features. This finding holds for SF customers only.

5 Conclusions and Recommendations

Nexant finds that the MyHER program is an effective channel for increasing customer engagement with energy efficiency and demand side management. The RCT program design facilitates reliable estimates of program energy savings. Further, the energy savings generated by the program are corroborated by survey findings of respondent awareness of, engagement in, and focus on the importance of saving energy. As an additional benefit, Nexant finds that MyHER is a useful tool for increasing uptake in other Duke Energy efficiency programs. The MyHER program is at full deployment among Duke Energy Carolinas and Progress single-family home customers, and now multi-family home customers as well, and Nexant recommends that Duke Energy continue to focus on program processes and operations to further increase the efficiency of program delivery.

Duke Energy also launched the MyHER Interactive portal in March 2015. The portal offers additional means for customers to customize or update Duke Energy's data on their premises, demographics, and other characteristics that affect consumption and the classification of each customer. The portal also provides additional custom tips based on updated data provided by the customer. MyHER Interactive sends email challenges to portal users that seek to engage customer in active energy management, additional efficiency upgrades, and conservation behavior. Nexant evaluated the impacts of the MyHER Interactive portal using a matched comparison group because the MyHER Interactive portal was not deployed as a randomized controlled trial (RCT).

5.1 Impact Findings

Nexant estimates that the MyHER program saved a total of 313.5 GWh at Duke Energy Carolinas among single family program participants and 13.5 GWh among multi-family program participants. At Duke Energy Progress, single family participants saved 175.2 GWh due to the MyHER reports and multi-family participants saved 4.4 GWh. The confidence and relative precision of the estimates is 90% confidence and 8.7% and 30.4%, respectively, for DEC single family and multi-family. At DEP, the relative precisions are 9.9% and 51.3%, respectively, at the same level of confidence. These impact estimates account for the fact that MyHER increases uptake of other Duke Energy programs; 4.4 and 2.9 kWh has been subtracted from the average single family and multi-family DEC household program impact to account for the MyHER uplift in other programs. At DEP, 3.2 kWh and 1.0 kWh, respectively, were subtracted from the after single family and multi-family DEP household program impact for the same reason. Without such corrections, those savings would be double counted by Duke Energy.

Nexant does not find statistically significant (at the 90% level of confidence) incremental impacts that can be attributed to some MyHER treatment customers enrollment in Interactive for either DEC or DEP during this evaluation period.

5.2 Process Findings

MyHER is one of Duke Energy's most important residential DSM programs in terms of delivered energy savings in the Carolinas jurisdictions. Program operations are data-intensive – managing and processing the large volumes of data required to generate the monthly reports and support the program delivery schedule is the primary focus of program activities. Duke Energy and its implementation contractor, Uplight, have successfully managed this process and have provided DEC and DEP customers valuable information for managing home energy consumption.

The DEC and DEP MyHER program has benefited from a number of process and product management improvements. Careful change management and a stable operations team at Uplight have been key enablers of maintaining a production process that consistently meets MyHER quality control standards.

DEC MyHER single family participants have been found, in this evaluation's customer surveys, to display higher levels of satisfaction with how Duke Energy provides excellent customer service than multi-family participants, while multi-family participants find the energy use associated with specific household items and areas significantly more useful than control customers think they might be. Overall, 58% of DEC single family and 72% of DEC multi-family recipients are very or somewhat satisfied with the information in the HERs. In addition, single family respondents were significantly more likely to report initial cost of energy efficient equipment is too high as a barrier to energy-saving actions than multi-family.

DEP MyHER single family participants have been found, in this evaluation's customer surveys, to display higher levels of satisfaction with how Duke Energy respects its customers and provides service at a reasonable cost than control customers, while multi-family participants find the graphs that display home energy use and customized suggestions for their homes more useful than control customers think they might be. Overall, 63% of DEP single family and 73% of DEP multi-family recipients are very or somewhat satisfied with the information in the HERs. In addition, multi-family respondents were significantly more likely to report "I do not think my energy saving efforts are worth the time and/or money" as a barrier to energy-saving actions than single family

5.3 Program Recommendations

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

- **Continue the commitment to simultaneous control and treatment assignment.** New assignments to treatment and control groups must be simultaneous and Duke Energy should always add all newly assigned treatment and control groups to their respective status in a single billing month, to the extent that is technically feasible.
- **Continue the practice of making assignments of new single family accounts to MyHER treatment and control groups at most twice a year.** The numbers of Duke Energy customers becoming eligible for the program each year do not facilitate more

frequent assignments. This is due to the fact that sufficient numbers of customers must be set aside for the control group each time a group of customers is assigned to treatment in order for the evaluator to be able to measure the energy savings delivered by the new cohort.

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

- **Target Interactive customers' summertime usage as an opportunity to increase annual Interactive savings.** Currently, Interactive customers are showing statistically significant uplifts in savings, over and above the savings attributable to the report. However, on an annual basis, those savings are eroded by significant increases in energy use in the summertime. MyHER should leverage opportunities to remind Interactive users not to backslide with energy savings behaviors in the summer.

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Guidehouse
Outwit Complexity

EM&V Report for Duke Energy Progress Commercial, Industrial, and Governmental Demand Response Automation Program

2020-2021

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DUKE ENERGY®

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Executive Summary

The Commercial, Industrial, and Governmental (CIG) Demand Response Automation (DRA) program is offered to qualifying customers in the Duke Energy Progress (DEP) service territory. DRA offers participating companies a financial incentive to reduce their electricity consumption when called upon by DEP. This report covers Guidehouse's evaluation, measurement, and verification (EM&V) activities for the evaluation period covering November 1,2020 through October 31, 2021.

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

The key impact research objects specified are:

- Validate the demand reduction calculated by DEP's method of baseline estimation as described in the *Demand Response Automation Rider DRA-9* (North Carolina) and *DRA-10* (South Carolina) filed by DEP.[1]
- Produce a set of verified program impacts per meter, by sector, and for the program as a whole, using the most accurate baseline method, as determined by Guidehouse via the testing regime in the 2018 evaluation.[2]

The key process evaluation objectives specified are:

- Interview program staff and Account Executive to assess program challenges and opportunities.
- Perform online surveys with program participants to evaluate customer experience and satisfaction.

Program Summary

The DRA program offers participating companies a financial incentive to reduce their electricity consumption for no more than 8 hours at a time on select system peak days in either the summer or winter months. DEP called one summer event during the 2020-2021 evaluation period, which occurred on July 30, 2021.

[1] Duke Energy Progress, *Demand Response Automation Rider DRA-9* (North Carolina), https://www.duke-energy.com/_/media/pdfs/rates/gp2ncriderdradep.pdf?la=en.
Duke Energy Progress, *Demand Response Automation Rider DRA-10* (South Carolina), https://www.duke-energy.com/_/media/pdfs/for-your-home/rates/electric-sc/gp1scriderdra.pdf?la=en.

[2] In previous years, Guidehouse used the regression specification and approach determined as part of the 2010 and 2011 evaluations to deliver the most accurate estimate of impacts. One of the recommendations of the 2017 evaluation report was to, in light of the length of time since the initial testing, repeat and update this testing procedure. Therefore, Guidehouse used the most accurate estimate of impacts for the 2018 baseline testing analysis.

During the evaluation period, 24 customers were registered as participants in DEP's DRA program, representing 66 unique sites and 90 meters.[3] Of the 90 meters registered as participants in the 2021 summer event:

- 43 meters were at commercial sites
- 6 meters were at governmental sites
- 41 meters were at industrial sites (15 of the 41 meters belonged to a single processing industry company)

For brevity, the very large industrial participant (with 15 meters) is referred to as VLIP in this report.

Key Findings

DEP called one summer DRA event during the 2020-2021 evaluation period, which occurred on July 30, 2021. Of the 90 customer meters enrolled, 78 meters indicated a response to the event curtailment request.[4] This section of the Executive Summary outlines the key findings of the impact and process components of this evaluation.

Key Impact Findings

The key impact evaluation findings are as follows:

- **The evaluation team successfully replicated the DEP settlement baseline and reported impacts for every meter that indicated a response to the curtailment request.** Guidehouse's replicated settlement baselines did not differ materially[5] from those reported by DEP.
- **Verified impacts were in line with DEP reported impacts.** The average verified realization rate for summer demand response (DR) impacts for 2020-2021 was 99%, with approximately 32.7 MW of DR contributed by the program. This realization rate is slightly higher than the average reported across prior years (2010 through 2018) of 96%.
- **Total program summer impacts in 2020-2021 increased compared with summer 2018 impacts.** The program's verified summer impacts increased from 20.0 MW in 2018 to 32.7 MW in 2020-2021. This increase is likely due to an increase in total program enrollment (90 enrolled meters in 2020-2021 versus 73 enrolled meters in 2018).

Key Process Findings

Key findings from the process evaluation can be broken down into five categories:

[3] Each individual meter is considered a standalone participant in the program.

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

[5] "Materially" in this context is defined as the difference in the DEP settlement baseline calculated by DEP and Guidehouse being less than or equal to 0.05 kW.

- **Program Marketing and Awareness.** Financial interests are the greatest motivating factors for customer participation. However, customers with on-site generators reported that generator equipment concerns are their greatest barriers to participation, either in the form of DRA program policies conflicting with future U.S Environment Protection Agency (EPA) emissions regulations or the cost of adding catalyst controls to generators to comply with future EPA emissions regulation.

- **Event Experience.** All respondents noted that their businesses were not disrupted during the summer event and they were well prepared for the event. Respondents also noted that the number of events during the summer season was either lower than or met their expectations.

- **Energy Manager Tool[6] Usage.** Most survey respondents reported that they never use the Energy Manager Tool, and only one respondent mentioned that insights provided by the tool affected their business' decision-making.

- **Program Rule and Incentive Development.** Some respondents may be able to allocate more load to the program if aggregation were allowed.[7]

- **Customer Satisfaction.** Customers continue to be satisfied with DEP Account Executive service related to the DRA program and Duke Energy overall.

Recommendations

Guidehouse recommends a variety of discrete actions, for EM&V as well as program administrators, for improving the results of the program in future years. These recommendations include:

Baseline Estimation

- **Continue to use the regression-derived baselines determined through the 2018 baseline testing for the estimation of verified system load impacts.** These methods, based on the season and event notification type, were shown (in the 2018 report)[8] to be the most accurate baseline estimation methods for participants as a whole.

Participant Recruitment

- **Duke Energy should continue to recruit large new participants with predictable loads (including customers on the nonresidential Real-Time Pricing [RTP][9] rate).** Four meters contributed approximately 40% of the verified DR during summer 2021. In particular, the one DRA participant subject to the RTP service rate contributed more than 7.5 MW of verified impacts alone. DEP should continue to concentrate on recruiting similar large-load customers with predictable usage patterns to expand the program capability. In particular,

[6] The Energy Manager Tool allows for participants to track their energy usage and event performance.

[7] Currently, the program does not allow for participants to aggregate their load across meters.

[8] Navigant Consulting, on behalf of Duke Energy Progress, *2018 EM&V Report for the Duke Energy Progress Commercial, Industrial, and Governmental Demand Response Automation Program,* May 2019.

[9] Duke Energy Progress, *Large General Service (Real Time Pricing) Schedule LGS-RTP-71,* which provides rate information for nonresidential RTP customers, https://desitecoreprod-cd.azureedge.net/_/media/pdfs/for-your-home/rates/electric-nc/g11ncschedulelgsrtpdep.pdf?la=en&rev=9ec72a47ed424e1a81ad6f0d4e0969a2.

customers with loads correlated with system demand (i.e., temperature-sensitive loads) will tend to offer the most DR capability at times of system peak.

Participant and Account Executive Feedback

- **Consider enhancing future evaluations by undertaking in-depth interviews with program participants.** In 2020-2021, the participant survey response was less than 13%. A low response rate provides difficulty in generalizing the results to the program population. For future EM&V process analyses, rather than sending web-based surveys to all program participants, Guidehouse recommends conducting in-depth phone interviews for the highest contributing program participants. This allows for the response rate to greatly increase and provide more detailed insights when assessing program challenges and opportunities.

1. Program Description

This section presents an overview of the program and its participants.

1.1 Program Description

The Commercial, Industrial, and Governmental (CIG) Demand Response Automation (DRA) program is offered to qualifying customers in the Duke Energy Progress (DEP) service territory. DRA offers participating companies a financial incentive to reduce their electricity consumption when called upon by DEP.

DRA offers participating companies a financial incentive to reduce their electricity consumption for no more than 8 hours at a time on a few peak days each year. To be eligible, customers must be able to commit at least 50 kW or greater of curtailable load during summer peak periods; in addition, Rider DRA[10] specifies that a minimum of one summer event will be called, and the maximum number of curtailment events that could be called is 10.[11] Typical event duration is 6-8 hours. Participants receive notification of events at least 30 minutes prior to the event.

1.2 Program Activity Overview

For the summer event called in 2021, all participants received day-ahead notice in advance of the event. A summary of the event is listed in Table 1.

The notification period determines whether a same-day adjustment can be applied when estimating verified impacts. Same-day adjustments generally improve the accuracy of verification baselines, but they cannot be applied when notification is day-ahead.

Table 1. DEP DRA 2020-2021 Event Details

Season	Event Date	Start Time	End Time	Event Duration (Hours)	Advance Notification Window (Hours)	Day-of Notification
Summer	2021-07-30	13:00	19:00	6	23.13	No

Source: DEP DRA Event Details

1.3 Reported Program Participation and Savings

In 2020-2021, 24 customers were registered as participants in DEP's DRA program, representing 66 unique sites and 90 meters.[12] Of the 90 meters that were registered as participants for the event in 2020-2021, 43 were at commercial sites, 6 at governmental sites, and 41 at industrial sites. Of the 41 meters at industrial sites,15 belonged to a single company.

[10] Duke Energy Progress, *Demand Response Automation Rider DRA-9* (North Carolina), https://www.duke-energy.com/_/media/pdfs/rates/gp2ncriderdradep.pdf?la=en.

Duke Energy Progress, *Demand Response Automation Rider DRA-10* (South Carolina), https://www.duke-energy.com/_/media/pdfs/for-your-home/rates/electric-sc/gp1scriderdra.pdf?la=en.

[11] In January 2020, the North Carolina and South Carolina riders were revised in an attempt to remove barriers to growth of the DRA program by lowering the summer contract minimum from 75 kW to 50 kW and reducing the annual minimum summer events from three to one.

[12] Each individual meter is considered a standalone participant in the program.

For brevity, the very large industrial participant (with 15 meters) is referred to as the VLIP in this report. Table 2 summarizes participation in 2020-2021, including the number of customers, meters, and sites by customer type and the total demand reduction reported by DEP during the one summer event.

Table 2. Summary of Customer Meter Counts—Summer Contracts

Sector	Customer Type*	Number of Customers	Number of Sites	Number of Meters	Total Reported Summer Reduction per Meter (kW)
Commercial	Data Centers and Telecom	1	1	1	0
Commercial	Hospitals and Healthcare	1	1	1	1,558
Commercial	Manufacturing	1	1	2	1,004
Commercial	Retail and Distribution	6	39	39	7,533
Governmental	Education	1	1	1	18
Governmental	Federal and Military	1	1	1	7,415
Governmental	State and Local Government	3	4	4	5,209
Industrial	Manufacturing	6	7	14	6,142
Industrial	Process Industry	3	10	24	2,167
Industrial	Retail and Distribution	1	1	3	1,988
	Total Program	**24**	**66**	**90**	**33,033**

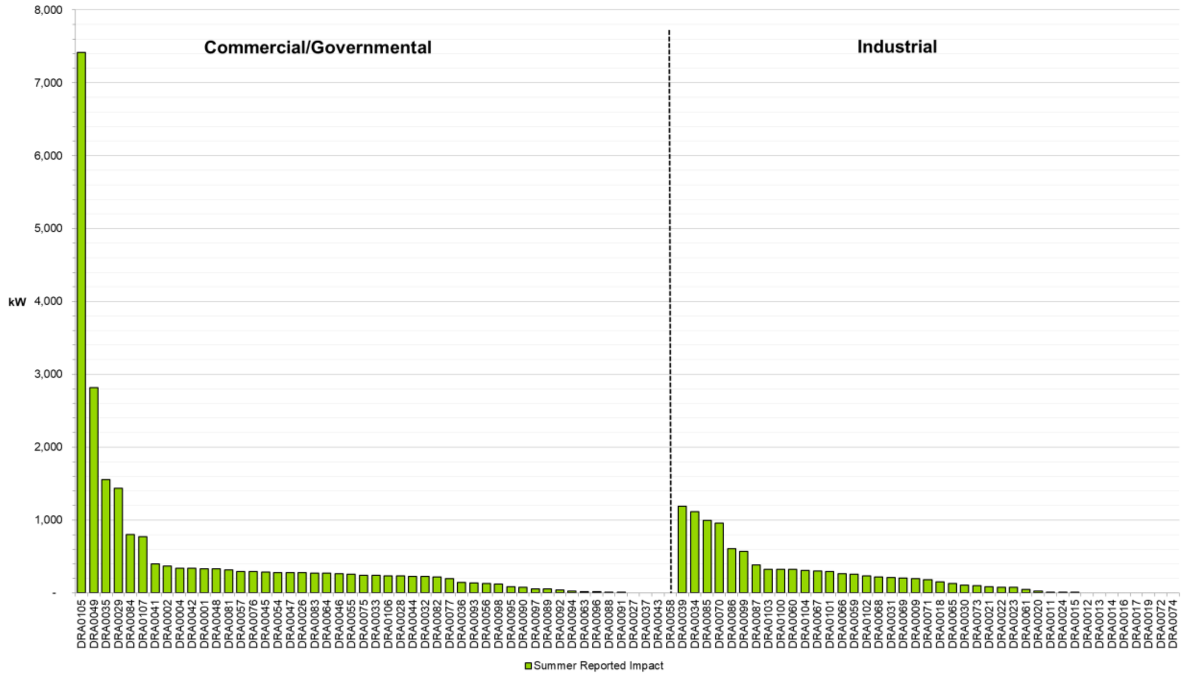
** Customer type was defined by the North American Industry Classification System codes provided to Guidehouse by DEP.*
Source: DEP DRA Program Database

The total reported impacts shown above are the total of the impacts for participating meters where DEP reported a non-zero impact (referred to as participation in this report). DEP reported a total impact of approximately 33.0 MW for the summer event in 2021.

The 2020-2021 total reported[13] event curtailments at individual meters for the summer event are shown in Figure 1. Curtailments per meter ranged from negligible to over 7,400 kW during the summer event. In this chart, meters are segregated by sector: commercial/governmental and industrial. Note that the participant with the highest reported summer impact, who is also subject to the non-residential RTP service rate, contributed approximately 22% of the program total.

[13] Note that per the convention of this report, reported impacts refer to the settlement impacts estimated using the DEP baseline algorithm.

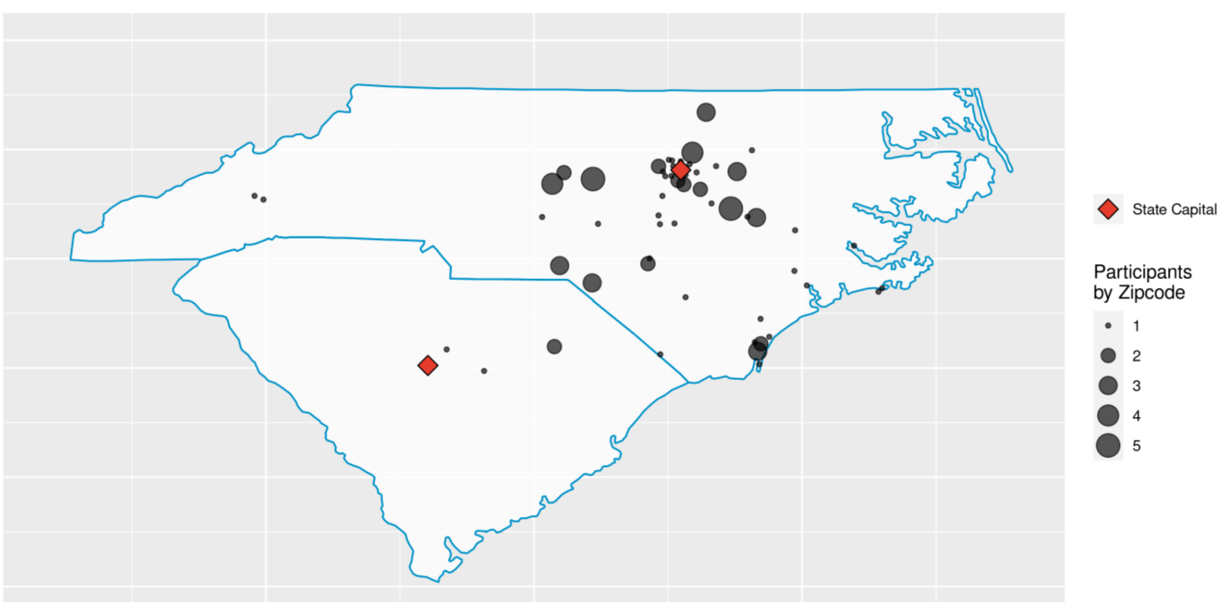
Figure 1. Total Reported Load Reductions (kW) by Meter – Summer



Source: DEP DRA Program Database

The map in Figure 2 illustrates the locations of all meters that responded to the curtailment request for the 2021 summer event.

Figure 2. Locations of Participating Meters



Source: DEP DRA Program Database

2. Evaluation Methods

This section describes the methods and data used by the evaluation team to conduct the 2020-2021 impact evaluation of the CIG DRA program. The first subsection of this chapter describes the overall evaluation objectives. The second and third sections describe the methods used for the impact and process evaluations.

2.1 Evaluation Objectives

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

The key impact research objectives specified are:

- Validate the demand reduction calculated by DEP's method of baseline estimation as described in the *Demand Response Automation Rider DRA-9* (North Carolina) and *Demand Response Automation Rider DRA-10* (South Carolina) filed by DEP.[14]
- Produce a set of verified program impacts per meter, by sector, and for the program as a whole, using the most accurate baseline method, as determined by Guidehouse via the testing regime conducted in the 2018 evaluation.[15]

The key process evaluation objectives specified are:

- Interview program staff and Account Executives to assess program challenges and opportunities.
- Perform online surveys with program participants to evaluate customer experience and satisfaction.

Eligibility. To qualify for the program, DEP commercial and industrial customers must be able to curtail 50 kW or greater during summer peak periods. Importantly, all industrial customers and any commercial customers that use more than 1 million kWh per year must also elect to forego the opportunity to opt out of the rider that funds DEP's demand-side management (DSM) programs while participating in DRA.

Incentives. The program provides three types of participant incentives:

- **A one-time participation incentive of $50 per demonstrated kW.** This incentive is intended to enhance customer acquisition and to support customer investment related to

[14] Duke Energy Progress, *Demand Response Automation Rider DRA-9* (North Carolina), https://www.duke-energy.com/_/media/pdfs/rates/gp2ncriderdradep.pdf?la=en, and Duke Energy Progress, *Demand Response Automation Rider DRA-10* (South Carolina), https://www.duke-energy.com/_/media/pdfs/for-your-home/rates/electric-sc/gp1scriderdra.pdf?la=en.

[15] In previous years, Guidehouse used the regression specification and approach determined as part of the 2010 and 2011 evaluations to deliver the most accurate estimate of impacts. One of the recommendations of the 2017 evaluation report was to, in light of the length of time since the initial testing, repeat and update this testing procedure. Verified impacts for 2021 are estimated using the approach determined by the 2018 testing to be most accurate for the program overall.

program participation, including the purchase and installation of switchgear upgrades or emission controls for backup generators.

- **A monthly availability credit of $4.25 per summer contracted kW.** This incentive is intended to provide steady payment streams and ensure readiness.
- **An event performance credit of $6 per curtailed kW.** This incentive is intended to increase resource reliability by emphasizing event compliance.

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

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

2.2 Impact Evaluation Methods

Estimating impacts of demand response (DR) events involves first estimating a counterfactual baseline of what a customer's load would have been during the hours of the curtailment event had the event not been called. Actual measured loads are then subtracted from this baseline to estimate load reductions.[16] The baseline estimation methods used by DEP and by the evaluation team are discussed below.

The evaluation team used the following data in its analysis:

- Quarter-hourly interval data for 89 DRA program participating meters from May 1, 2021, through October 31, 2021, representing total demand for each site
- Hourly interval data for 1 DRA program participating meter[17] from May 1, 2021, through October 31, 2021, representing total curtailable demand through the DRA program for the participant that is also an RTP customer
- Hourly observations of temperature data from National Oceanic and Atmospheric Administration (NOAA) weather stations
- Event logs supplied by DEP indicating the date, the start and end time of the event, and the time at which participants were notified of the imminent event

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

1. **Replicate DEP-reported impacts**, which estimated baselines using the three qualifying non-excluded days immediately prior to an event.

[16] When regression techniques are applied, this subtraction often takes place implicitly within the model, through the inclusion of a battery of dummy variables that are hour-of-sample-specific.

[17] One DRA program participant was also on an RTP rate schedule, and their data was provided in a separate file.

2. **Verify program impacts** using the best baseline for each season identified as part of the testing conducted for the 2018 evaluation[18]. Day-of load adjustments were not applied for the summer event given that participants received day-ahead notification.

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

In the case of DR programs such as DRA, there is no reason to expect that a customer would curtail loads during the event periods (the timing of which would be unknown to the customer absent participation in the program) without being enrolled in the program. Furthermore, because demand reductions are estimated relative to a baseline that captures expected participant behavior absent an event, the analysis inherently accounts for free ridership[19] and participant spillover; that is, absent the DRA program, none of the observed demand reductions would have taken place. Based on the above considerations, the evaluation team considers the NTG ratio for the impact analysis of the DRA program to be 1.0.

2.2.1 Replicating the DEP Savings Calculations

DEP estimated load reductions using a baseline calculation method developed internally and described in the *Demand Response Automation Rider DRA-9* (North Carolina) and *Demand Response Automation Rider DRA-10* (South Carolina) filed by DEP. The evaluation team replicated DEP's algorithm to confirm the results reported by DEP.

The DEP algorithm[20] generates a baseline for calculating program impacts on event days based on the three non-excluded days (holidays, weekends, and curtailment days) and qualifying days immediately prior to an event day. A day is deemed as qualifying if average demand during curtailment event hours on that day is at least 50% of the average of the three non-excluded days. If one of the first three non-excluded days prior to the event is deemed to be non-qualifying, that day is excluded, and the next prior non-excluded day is used. If there are not three qualifying days out of the 10 non-excluded days prior to the event, the algorithm reverts to using the three most immediate non-excluded days prior to the event.

The average demand over the three selected days during the hours corresponding to those in which the event was called is the baseline used to calculate impacts and participant incentive payments. The reported impact is calculated as the difference between the average baseline

[18] In previous years, Guidehouse used the regression specification and approach determined as part of the 2010 and 2011 evaluations to deliver the most accurate estimate of impacts. One of the recommendations of the 2017 evaluation report was to, in light of the length of time since the initial testing, repeat and update this testing procedure. Verified impacts for 2020-2021 are estimated using the approach determined by the 2018 testing to be most accurate for the program overall.

[19] For example, RTP response on non-DRA event days is implicitly captured in the verified baseline.

[20] The details of the DEP algorithm are described in more detail in Appendix A of the 2010 report: Navigant Consulting, on behalf of Progress Energy, *2010 EM&V Report for the Progress Energy Carolinas Commercial, Industrial, and Governmental Demand Response Automation (DRA) Program*, December 2011.

over the event period and the average actual demand over that period, excluding the first 15 minutes of the event.[21]

One DRA program participant was also subject to Duke Energy's RTP rate schedule (schedule LGS-RTP-71). Duke Energy calculates the settlement baseline for this customer by applying the approved settlement 3-of-10 baseline approach to either observed site demand or the RTP rate-schedule determined Customer Baseline Load (CBL),[22] whichever is less in any given interval. Note that this RTP CBL is not the same as the DRA program CBL.

The demand values used to estimate the DRA settlement CBL cannot be larger than the RTP rate schedule's CBL values in the given interval. Guidehouse, in calculating the DRA settlement CBL, replicated this logic, actual demand for this participant fell below the RTP CBL in 11% of the total observations included in DEP's settlement baseline.

The evaluation team, in estimating (using the regression analysis) this RTP customer's verified impact at the meter, used total site demand (i.e., did not make use of the RTP CBL). As Table 5 (page 16) shows, the two approaches deliver a very similar result for DRA0105: the DEP settlement algorithm estimates an impact of 7,415 kW, and the regression-based approach estimates an impact of 7,348 kW, a difference of less than 1%.

2.2.2 Verified Program Impacts

The evaluation team estimated verified impacts using the approach that most accurately predicted test day demand in each season, subject to the notification period, based on the testing conducted as part of the 2018 evaluation. For the summer event in 2020-2021, Guidehouse used the best model without a day-of load adjustment[23] given that participants received a day-ahead notification. The team calculated the verified impacts as the difference between actual average demand[24] over the timespan of the event (excluding the first 15 minutes)[25] and the estimated average baseline demand.[26] Equation 1 shows the model specification used to estimate the verified program impacts.

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

[22] Total curtailable demand is explained in Duke Energy Progress, *Large General Service (Real Time Pricing) Schedule LGS-RTP-71*, Customer Baseline (CBL) section, https://desitecoreprod-cd.azureedge.net/_/media/pdfs/for-your-home/rates/electric-nc/g11ncschedulelgsrtpdep.pdf?la=en&rev=9ec72a47ed424e1a81ad6f0d4e0969a2.

[23] The details of the alternative baseline testing to generate the best model to calculate the verified program impacts are described in Section 3.2 of the 2018 report.

Navigant Consulting, on behalf of Duke Energy Progress, *2018 EM&V Report for the Duke Energy Progress Commercial, Industrial, and Governmental Demand Response Automation Program,* May 2019.

[24] For the verified program impacts, Guidehouse estimated baselines using unmodified total load for a given site. This differs from the approach used to replicate the settlement baseline reported impacts as described above.

[25] This exclusion is applied to ensure that the period evaluated for impacts is consistent for verified and reported impacts (the settlement algorithm used for reported impacts excludes the first 15 minutes of the event from the impact calculation).

[26] Note that this subtraction is implicit in the model specification above. More specifically, the results of this subtraction are captured by the estimated values of the γ_d parameters.

Equation 1. Verified Impacts Model Specification

$$y_t = \sum_{i=1}^{96} \beta_{1,t} qhour_{t,i} + \sum_{i=}^{96} \beta_{2,i} qhour_{t,i} [CDQH_t \ / \ HDQH_t] + \sum_{d=1}^{D} \gamma_d C_{t,d} + EMA6dqh_t + EMA24dqh_t + hbu_t + errors$$

Where:

y_t = The average demand (kW) observed at the given meter in the quarter-hour of sample *t*.

$qhour_{t,i}$ = A set of 96 dummy variables, one for each quarter-hour of the day. The given dummy takes a value of 1 when the quarter-hour of the observation is the i-th quarter-hour of that day. For example, if quarter-hour *t* is between midnight and 12:15 a.m., $qhour_{t,i=1}$ is equal to 1 and 0 otherwise, or if quarter-hour *t* is between 1:00 p.m. and 1:15 p.m. then $qhour_{t,i=53}$ is equal to 1 and 0 otherwise.

$CDQH_t \ / \ HDQH_t$ = The cooling degree quarter-hours (for summer) or heating degree quarter-hours (for winter) in quarter-hour of sample *t*.

$C_{t,d}$ = A set of *D* dummy variables

$EMA6dqh_t$ = An exponential moving average of $CDQH_t$ (summer) or $HDQH_t$ (winter) observed in the 6-hour period leading up to, and including, hour *t*. This variable is represented as ema6hr_dqh65 in Equation 1.

$EMA24dqh_t$ = Identical to $EMA6dqh_t$, except for 24, instead of 6 hours.

hbu_t = Heat index buildup observed in quarter-hour of sample *t*. This is a 72-hour geometrically decaying average of the NOAA-defined heat index.[27] It is calculated in the following manner:

$$cbu_t = \sum_{h=1}^{72} 0.96^h \cdot heatindex_{t-h} \Big/ 1{,}000 \, .$$

Note in this case that the *t* subscript denotes hourly intervals. NOAA's heat index is calculated in the following manner:

[27] National Oceanic and Atmospheric Administration, National Weather Service – Weather Prediction Center, *The Heat Index Equation*, accessed February 2018, http://www.wpc.ncep.noaa.gov/html/heatindex_equation.shtml.

$$heatindex_t = -42.379 + 2.049 \cdot drybulb_t + 10.1433 \cdot hum_t - 0.2248 \cdot drybulb_t \cdot hum_t - 0.0068 \cdot drybulb_t^2 - 0.0548 \cdot hum_t^2 + 0.0012 \cdot drybulb_t^2 \cdot hum_t + 0.0009 \cdot drybulb_t \cdot hum_t^2 - 0.000002 \cdot drybulb_t^2 \cdot hum_t^2$$

Where $drybulb_t$ is the dry bulb temperature (in °F), hum_t is relative humidity (in percent) observed at quarter-hour *t,* and ws_t is the wind speed in miles per hour observed at quarter-hour *t.* Note that although some of NOAA's coefficients have been rounded for concision above, the complete unrounded values were used in the analysis.

2.3 Process Evaluation Methods

Guidehouse performed a series of interviews to assess the functionality of the program, program marketing, and participant satisfaction. Guidehouse sent out web-based surveys to the population of Account Executives and program participants to get their insights on the program. Table 3 summarizes the survey response rate of participants and Account Executives.[28] Guidehouse also deployed a telephone survey to all program participants to increase the response rate but did not get any responses. The participant and Account Executive results are based solely on the web-based surveys. Guidehouse also conducted a program staff in-depth interview to gain insight into the functioning of the program and to draw conclusions about how the program offering could be improved to increase the value that it provides to DEP.

Table 3. Survey Response Rate for Process Evaluation

Type	Total Population	Surveys Completed	Email Sent	Email Bounced	Partial Completes
Account Executives	13	5	7	0	1
Participants	24	3	23	1	3

Source: Guidehouse Analysis

The survey instruments for the Account Executive and participant surveys as well as the interview guide used by Guidehouse staff to guide the in-depth program staff interview are found in Appendix A, Appendix A, and Appendix B, respectively, of this document.

[28] The Account Executive recruit customers in targeted industries partner with customers to calculate load reduction opportunities, considering both incentives, customer direct costs, and the likely cost of the DSM/EE rider.

3. Program Impacts

This section describes the findings from the evaluation team's analysis of load reduction impacts for the DRA program for 2020-2021.

The remainder of this section is divided into two subsections:

- **Section 3.1: Replicated DEP-Reported Settlement Impacts:** Replication of the DEP settlement algorithm
- **Section 3.2: Verified Program Impacts:** Impacts estimated using the regression baseline method described above

3.1 Replicated DEP-Reported Settlement Impacts

- **The evaluation team successfully replicated the DEP settlement baseline and reported impacts for meters that responded to the curtailment request during this event.** Guidehouse's replicated settlement baselines did not differ materially[29] from those reported by DEP.

3.2 Verified Program Impacts

The evaluation produced two key findings:

- **Verified impacts were in line with reported impacts.** During the one summer event, the evaluation team verified that meters that responded to the curtailment request achieved a total of 32.7 MW of demand reduction, approximately 99% of that reported and 105% of that contracted. The verified versus reported realization rate is similar to the average across prior years (2010 through 2018) of 96%. The verified versus contracted realization rate is higher than the historical average (2010 through 2018) of 100% but slightly lower than the highest rate achieved in 2018 of 106%.
- **Total program impacts for the summer season increased in 2020-2021 compared with 2018 and were the highest impacts over the life of the program.** In large part, this is due to one participating meter, which curtailed nearly 7.5 MW of verified impacts in 2020-2021.

All verified impacts discussed below are based on the best performing models by season and notification type determined as part of the 2018 alternative baseline testing analysis.[30] Given that customers received a day-ahead notification for the summer event, Guidehouse used the best performing summer model without a day-of adjustment.

[29] "Materially" in this context is defined as the difference in the DEP settlement baseline calculated by DEP and Guidehouse being less than or equal to 0.05 kW.

[30] The details of the alternative baseline testing to generate the best model to calculate the verified program impacts are described in Section 3.2 of the 2018 report: Navigant Consulting, on behalf of Duke Energy Progress, *2018 EM&V Report for the Duke Energy Progress Commercial, Industrial, and Governmental Demand Response Automation Program,* May 2019.

DEP called one summer event in during the 2020-2021 evaluation period, involving 78 unique customer meters that responded to the curtailment request. Verified load reductions and verification rates for the summer event are shown in Table 4. The EM&V analysis estimated a verified load reduction[31] of approximately 32.7 MW for the summer event, or approximately 420 kW per meter.[32] These reductions are in line with the 33.0 MW reduction reported by DEP in its DRA program database (Table 4).[33]

Table 4. Verified Load Reductions and EM&V Verification Rate—Summer

Load Reduction Category	Total Reduction (kW) 7/30/2021
Reported (Duke Energy Database)	33,033
Contracted (Duke Energy Database)	31,186
Verified	
Com/Gov't	23,446
VLIP	281
Other Ind.	8,994
Verified – Total	**32,721**
Verified Realization Rate (Verified Reductions/Reported Reductions)	**99%**

Sources: DEP DRA Program Database and Guidehouse Analysis; Values subject to rounding

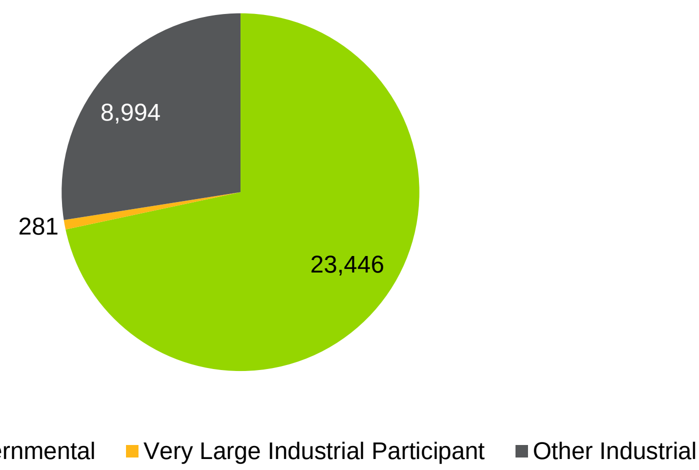
For summer 2021, the EM&V team verified the 49 commercial/governmental meters realized total of 23,446 kW of load reductions, accounting for approximately 72% of the total kW reduction. The 15 industrial meters belonging to the VLIP realized a total of 281 kW of load reductions, accounting for approximately 0.9% of the total kW reduction. The balance of load reductions—8,994 kW or 27% of the total—was made up by meters located at industrial sites not belonging to the VLIP. This distribution is shown in Figure 3.

[31] Note that the total load reduction of this event only includes non-zero load reductions achieved. For example, if two meters contributed 100 kW each and a third meter did not achieve any DR (i.e., actuals were above baseline), the total verified impact for this event would be reported as 200 kW.

[32] Total impacts per meter is calculated as the total of the event across participating meters. This value will not correspond to the total impacts (32.7 MW) divided by the total number of meters that participated in the event (78) because not all meters participated in the event.

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

Figure 3. Share of Total Verified kW Reduction—Summer



Sources: DEP DRA Program Database and Guidehouse Analysis

DEP had reported summer program impacts to be approximately 106% of the aggregate contracted load reductions, or 33.0 MW reported versus 31.2 MW contracted. The EM&V analysis verified 99% of these reported reductions (or 105% of the contracted reductions).

The contracted, DEP-reported, and verified load curtailment for each participant meter during the summer 2021 event is shown in Table 5. This table includes a count of the number of events for which each meter contributed non-zero DR impacts. The contracted, reported, and verified impacts are shown in Table 5 only if the given participant was contracted to provide DR at the time of the event and if that participant participated in the summer event.

Table 5. Total Contracted, Reported, and Verified Loads by Meter—Summer

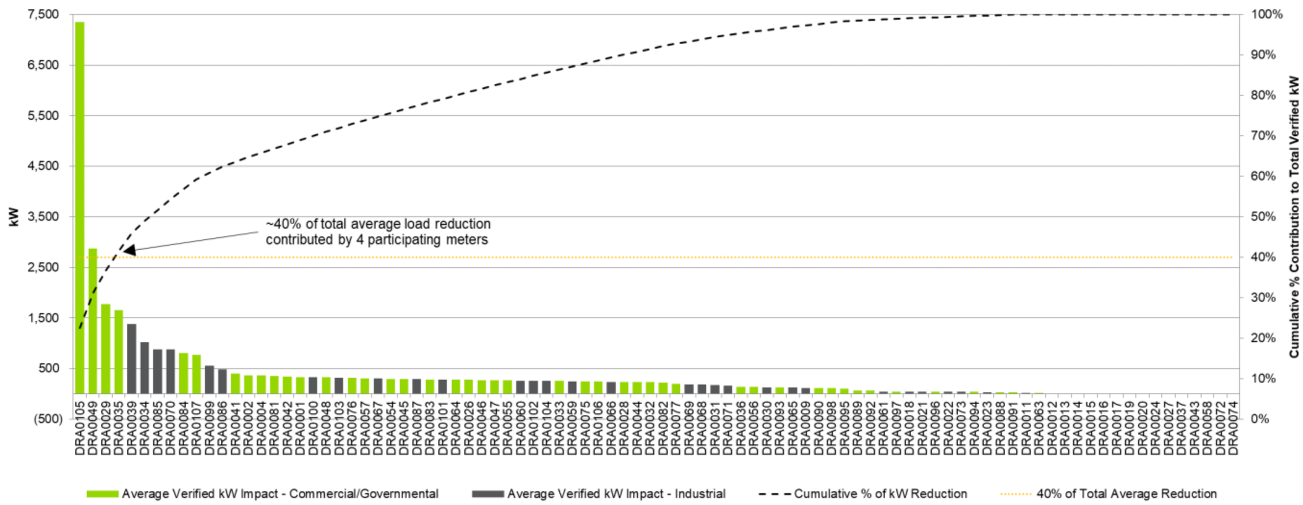
Commercial/Governmental					Industrial					
Participant Site	Contracted kW	DEP Reported kW	Verified kW	# Events Participated	Participant Site	Contracted kW	DEP Reported kW	Verified kW	# Events Participated	VLIP
DRA0001	320	334	333	1	DRA0009	450	200	117	1	1
DRA0002	383	366	368	1	DRA0011	75	10	13	1	1
DRA0004	490	341	359	1	DRA0012				0	1
DRA0026	209	276	278	1	DRA0013				0	1
DRA0027				0	DRA0014				0	1
DRA0028	183	233	235	1	DRA0015	150	3	0	1	1
DRA0029	1,250	1,437	1,772	1	DRA0016				0	1
DRA0032	200	228	232	1	DRA0017				0	1
DRA0033	204	245	250	1	DRA0018	180	154	43	1	1
DRA0035	1,350	1,558	1,649	1	DRA0019				0	1
DRA0036	75	145	141	1	DRA0020	75	23	0	1	1
DRA0037				0	DRA0021	200	88	38	1	1
DRA0041	415	398	402	1	DRA0022	75	79	37	1	1

Commercial/Governmental					Industrial					
Participant Site	Contracted kW	DEP Reported kW	Verified kW	# Events Participated	Participant Site	Contracted kW	DEP Reported kW	Verified kW	# Events Participated	VLIP
DRA0042	249	336	341	1	DRA0023	75	75	33	1	1
DRA0043				0	DRA0024	300	7	0	1	1
DRA0044	163	229	233	1	DRA0030	75	106	129	1	0
DRA0045	209	283	291	1	DRA0031	130	212	172	1	0
DRA0046	207	263	271	1	DRA0034	800	1,114	1,017	1	0
DRA0047	177	276	269	1	DRA0039	1,050	1,193	1,374	1	0
DRA0048	295	329	330	1	DRA0059	209	253	249	1	0
DRA0049	2,500	2,821	2,876	1	DRA0060	413	323	255	1	0
DRA0054	275	283	292	1	DRA0061	75	51	46	1	0
DRA0055	275	260	267	1	DRA0065	140	132	126	1	0
DRA0056	135	133	141	1	DRA0066	200	261	236	1	0
DRA0057	198	297	305	1	DRA0067	200	299	301	1	0
DRA0058				0	DRA0068	140	220	180	1	0
DRA0063	250	18	6	1	DRA0069	150	205	184	1	0
DRA0064	209	271	279	1	DRA0070	761	958	876	1	0
DRA0075	250	245	247	1	DRA0071	180	183	164	1	0
DRA0076	310	293	319	1	DRA0072				0	0
DRA0077	185	195	196	1	DRA0073	105	101	37	1	0
DRA0081	285	314	347	1	DRA0074				0	0
DRA0082	215	219	221	1	DRA0085	960	999	879	1	0
DRA0083	275	274	282	1	DRA0086	550	605	488	1	0
DRA0084	900	805	806	1	DRA0087	315	384	287	1	0
DRA0088	70	7	32	1	DRA0099	540	572	557	1	0
DRA0089	50	51	61	1	DRA0100	270	324	332	1	0
DRA0090	50	76	115	1	DRA0101	340	291	280	1	0
DRA0091	50	6	24	1	DRA0102	230	235	253	1	0
DRA0092	50	40	59	1	DRA0103	370	327	321	1	0
DRA0093	112	138	128	1	DRA0104	205	309	253	1	0
DRA0094	50	24	36	1						
DRA0095	62	81	103	1						
DRA0096	50	17	38	1						
DRA0097	50	54	45	1						
DRA0098	87	120	109	1						
DRA0105	6,976	7,415	7,348	1						
DRA0106	200	235	239	1						
DRA0107	700	769	769	1						

Sources: DEP DRA Program Database and Guidehouse Analysis

Verification rates at the portfolio level are driven by findings for individual meters. Four of the 78 meters that responded to the curtailment request in 2020-2021[34] account for a little over 40% of all summer reductions and thus drive overall summer findings. Figure 4 ranks the meters by the verified kW reduction in descending order, illustrating the decrease in load reductions between the largest and smallest contributors in the program.

Figure 4. Cumulative Percentage of Total Verified kW Reduction - Summer



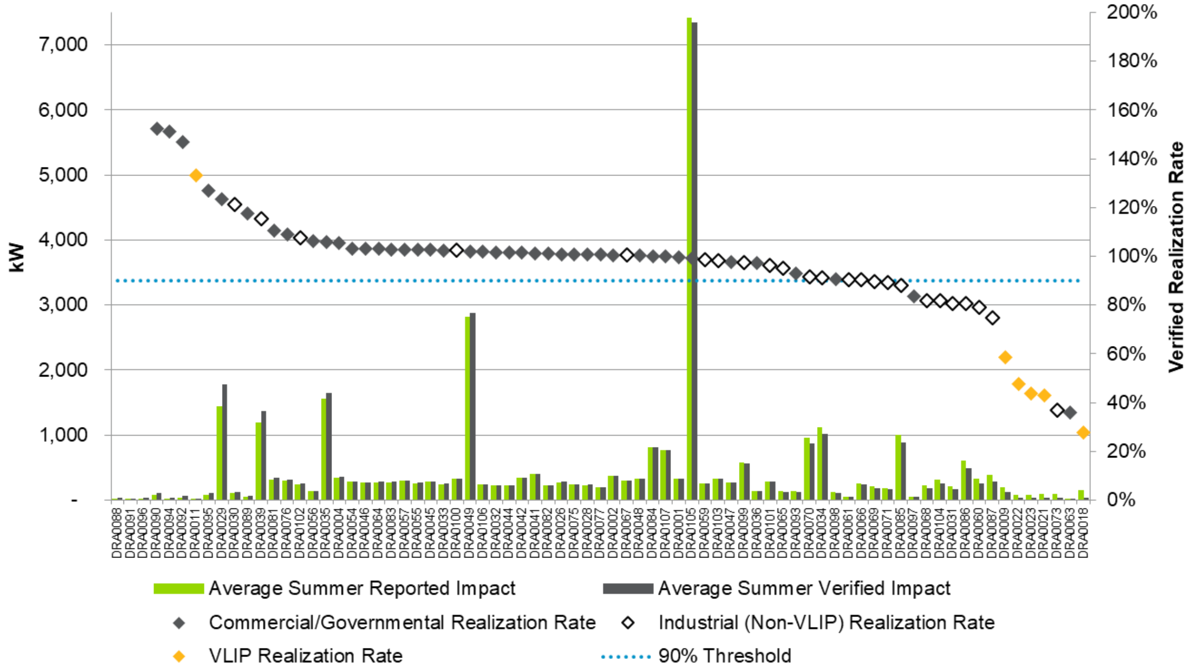
Sources: DEP DRA Program Database and Guidehouse Analysis

These results can be re-examined by plotting the reported and verified demand reductions and verified realization rate sorted in decreasing order by verified realization rate (see Figure 5). In this figure, the gray diamonds represent commercial/governmental realization rates, the yellow diamonds represent the VLIP's realization rates, and the white diamonds represent the non-VLIP industrial realization rates.

As seen in Figure 5, the verified summer realization rate for all but two of the commercial and governmental meter sites is at or above 90%. In contrast, the average verified summer realization rate for all except for one of the VLIP meters is below 90%.

[34] The four meters that are driving overall results include four commercial/governmental sites.

Figure 5. Reported and Verified DR Impact and Verification Realization Rate—Summer

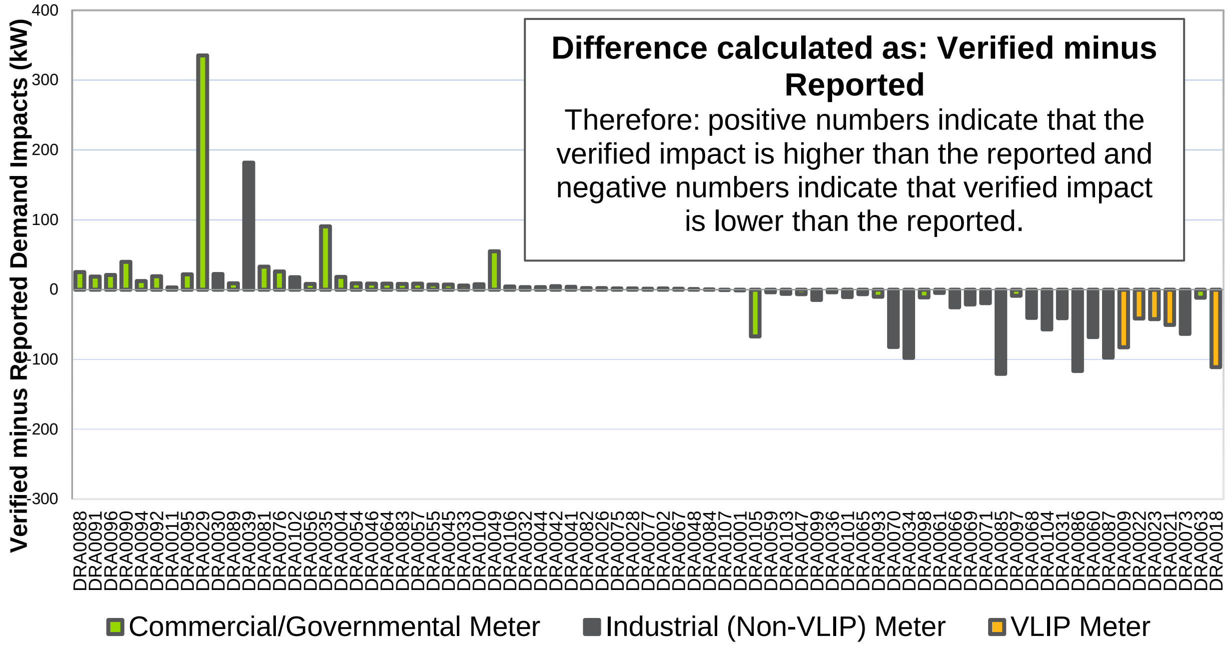


Sources: DEP DRA Program Database and Guidehouse Analysis

Recall that the verified realization rate is the verified impact (regression-estimated) divided by the reported impact (DEP algorithm calculated). The regression approach estimates a baseline using average seasonal relationships, whereas the DEP settlement approach relies entirely on the three most recent non-excluded qualifying days to calculate a baseline.

To better understand the results implied by the realization rates presented above, it is important to also observe the magnitude of the difference (in kW instead of as a percentage) between the DEP-reported impacts and the verified impacts. For this reason, the evaluation team presents the total difference (for the summer event) between the verified summer impact and the reported summer impact for each meter in Figure 6. For example, the evaluation team found that DEP's reported impacts for meter DRA0029 were 335 kW less than those verified by Guidehouse, and DEP's reported impacts for meter DRA0085 were 161 kW higher than those verified by Guidehouse. To aid understanding, meters have been sorted in this figure by realization rate in the same manner as in Figure 5.

Figure 6. Differences in Impact Estimates: Regression vs. DEP Settlement Method—Summer



Sources: DEP DRA Program Database and Guidehouse Analysis

4. Program Process Findings

Key findings from the process evaluation can be broken into five categories:

- **Program Marketing and Awareness.** Financial interests are the greatest motivating factors for customer participation. However, customers with on-site generators reported that generator equipment concerns are their greatest barriers to participation, either in the form of DRA program policies conflicting with future U.S Environment Protection Agency (EPA) emissions regulations and the cost of adding catalyst controls to generators to comply with future EPA emissions regulation.

- **Event Experience.** All respondents noted that their business was not disrupted during the summer event and they were well prepared for the event. Respondents also noted that the number of events during the summer season was either lower than or met their expectations.

- **Energy Manager Tool Usage.** Most survey respondents reported that they never use the Energy Manager Tool, and only one respondent mentioned that insights provided by the tool affected their business's decision-making.

- **Program Rule and Incentive Development.** Some respondents may be able to allocate more load to the program if aggregation were allowed.[35]

- **Customer Satisfaction.** Customers continue to be satisfied with DEP Account Executive service related to the DRA program and to Duke Energy overall.

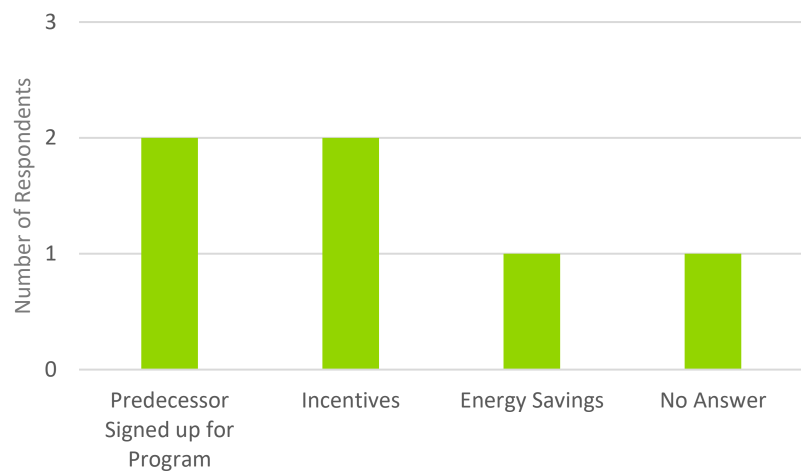
Each of these areas and key findings is expanded on further in the subsections that follow. The interviews that provided the data below were conducted in the fall of 2021.

4.1 Program Marketing and Awareness

As seen in Figure 7, financial interests are the greatest motivating factors for customer participation, either in the form of reduced costs or additional incentives. Some customers also mentioned that their predecessor signed up their business for the program.

[35] Currently, the program does not allow for participants to aggregate their load across meters.

Figure 7. Participant Reasons for Participating in the Program



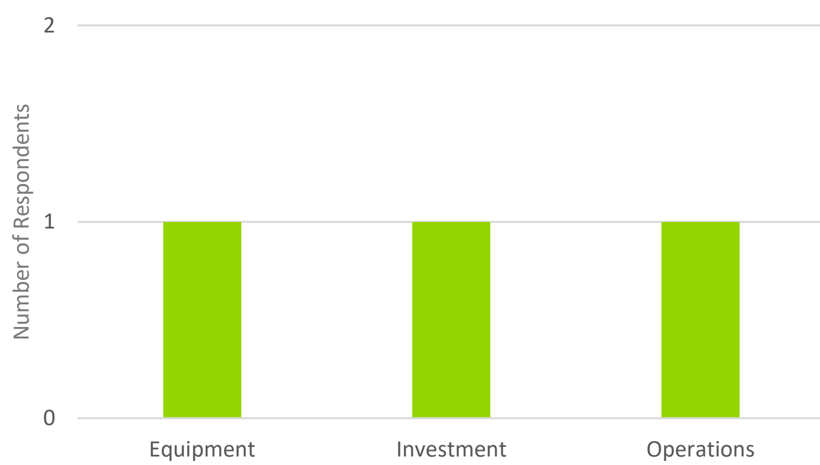
Source: Guidehouse Analysis

Other responses include:

- Ability to help Duke Energy conserve energy during times of system need
- Helps bottom line and valuing the positive impact on the business' budget

Generator equipment concerns are the greatest barrier to customer participation, either in the form of DRA program policies conflicting with future U.S Environment Protection Agency (EPA) emissions regulations or the cost of adding catalyst controls to generators to comply with future EPA emissions regulations.

Figure 8. Barriers to Program Participation



Source: Guidehouse Analysis

4.2 Event Experience

All respondents intend to continue participating in the program next year. In addition, the respondents noted that their business was not disrupted during the event and they were well prepared for the event. All respondents were satisfied with the timing of the event notifications.

None of the respondents said that they could potentially add more load to the program. Some said that aggregation would help them increase participation with smaller sites. Those that could not add more load said they were either participating to their full potential or it was not cost-effective to increase participation based on incentives and operational costs. 75% of participant survey respondents use backup generation to curtail load.

4.3 Energy Manager Tool

Most survey respondents do not use the Energy Manager Tool regularly to track energy usage and event performance. Only one respondent said that insights provided by the tool affected the business' decision-making.

4.4 Program Incentives and Rules

Some respondents may be able to allocate more load to the program if aggregation was allowed.

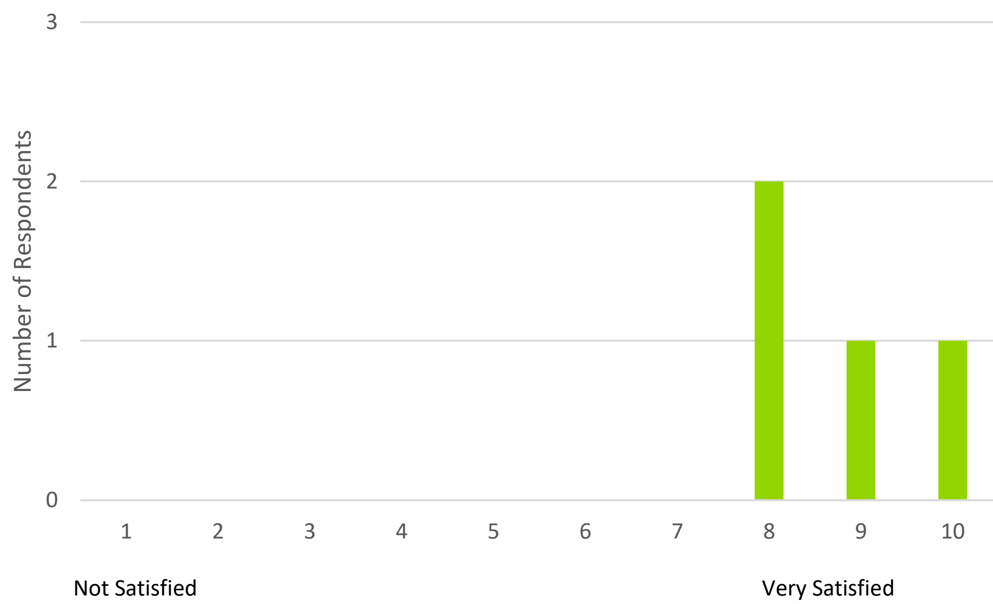
Numerous respondents expressed concern about the EPA's generator emissions rules and how the DRA program interacts with EPA requirements. Current and future participants may be affected by future EPA regulations if participants use generation to enable curtailment during DRA events and have older generators that do not meet these future regulations.

4.5 Customer Satisfaction

Customers are satisfied with DEP Account Executive service related to the DRA program and the program overall, but aggregation was suggested as an improvement to increase participation from smaller facilities.

One-quarter of respondents gave the program a satisfaction score of 10 (out of 10). The other half were split between 8 and 9 out of 10, as seen in Figure 9.

Figure 9. Participation Satisfaction Scores



Source: Guidehouse Analysis

5. Conclusions

This section describes the key findings from the 2020-2021 impact evaluation of the CIG DRA program. The first subsection describes the findings from the impact evaluation. The second subsection describes the key findings from the process evaluation.

5.1 Key Impact Findings

The key impact evaluation conclusions are as follows:

- **The evaluation team successfully replicated the DEP settlement baseline and reported impacts for every meter that indicated a response to the curtailment request.** Guidehouse's replicated settlement baselines did not differ materially[36] from those reported by DEP.
- **Verified impacts were in line with DEP reported impacts.** The average verified realization rate for summer demand response (DR) impacts for 2020-2021 was 99%, with approximately 32.7 MW of DR contributed by the program. This realization rate is slightly higher than the average reported across prior years (2010 through 2018) of 96%.
- **Total program summer impacts in 2020-2021 increased compared with summer 2018 impacts.** In the 2020-2021 event, the program's verified summer impacts increased from 20.0 MW in 2018 to 32.7 MW in 2020-2021. This increase is likely to do with an increase in total program enrollment (90 meters in 2020-2021 versus 73 in 2018).

5.2 Key Process Findings

Key findings from the process evaluation can be broken down into five categories:

- **Program Marketing and Awareness.** Financial interests are the greatest motivating factors for customer participation. However, customers with on-site generators reported that generator equipment concerns are their greatest barriers to participation, either in the form of DRA program policies conflicting with future U.S Environment Protection Agency (EPA) emissions regulations and the cost of adding catalyst controls to generators to comply with future EPA emissions regulation.
- **Event Experience.** All respondents noted that their business was not disrupted during the summer event and they were well prepared for the event. Respondents also noted that the number of events during the summer season was either lower than or met their expectations.
- **Energy Manager Tool[37] Usage.** Most survey respondents reported that they never use the Energy Manager Tool, and only one respondent mentioned that insights provided by the tool affected their business' decision-making.

[36] "Materially" in this context is defined as the difference in the DEP settlement baseline calculated by DEP and Guidehouse being less than or equal to 0.05 kW.

[37] The Energy Manager Tool allows for participants to track their energy usage and event performance.

- **Program Rule and Incentive Development.** Some respondents may be able to allocate more load to the program if aggregation were allowed.[38]

- **Customer Satisfaction.** Customers continue to be satisfied with DEP Account Executive service related to the DRA program and Duke Energy overall.

[38] Currently, the program does not allow for participants to aggregate their load across meters.

6. Recommendations

Guidehouse recommends a variety of discrete actions, for EM&V as well as program administrators, for improving the results of the program in future years. These recommendations include:

Baseline Estimation

- **Continue to use the regression-derived baselines determined through the 2018 baseline testing for the estimation of verified system load impacts.** These methods, based on the season and event notification type, were shown (in the 2018 report)[39] to be the most accurate baseline estimation methods for participants as a whole.

Participant Recruitment

- **Continue to recruit large new participants with predictable loads (including customers on the nonresidential Real-Time Pricing [RTP][40] rate).** Four meters contributed approximately 40% of the verified DR during summer 2021. In particular, the one DRA participant subject to the RTP service rate contributed more than 7.5 MW of verified impacts alone. DEP should continue to concentrate on recruiting similar large-load customers with predictable usage patterns to expand the program capability. In particular, customers with loads correlated with system demand (i.e., temperature-sensitive loads) will tend to offer the most DR capability at times of system peak.

Participant and Account Executive Feedback

- **Consider enhancing future evaluations by undertaking interviews with program participants.** In 2020-2021, the participant survey response was less than 13%. A low response rate provides difficulty in generalizing the results to the program population. For future EM&V process analyses, rather than sending web-based surveys to all program participants, Guidehouse recommends conducting in-depth phone interviews for the highest contributing program participants. This allows for the response rate to greatly increase and provide more detailed insights when assessing program challenges and opportunities.

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[39] Navigant Consulting, on behalf of Duke Energy Progress, *2018 EM&V Report for the Duke Energy Progress Commercial, Industrial, and Governmental Demand Response Automation Program,* May 2019.

[40] Duke Energy Progress, *Large General Service (Real Time Pricing) Schedule LGS-RTP-71,* which provides rate information for nonresidential RTP customers, https://desitecoreprod-cd.azureedge.net/_/media/pdfs/for-your-home/rates/electric-nc/g11ncschedulelgsrtpdep.pdf?la=en&rev=9ec72a47ed424e1a81ad6f0d4e0969a2.

7. Summary Form

Commercial, Industrial, and Governmental Demand Response Automation Program

Completed EMV Fact Sheet

Description of Program

DEP's CIG DRA program is a demand response (DR) program where customers are incentivized by DEP to curtail their loads during events as requested by DEP.

Participants must have the capability to curtail at least 50 kW of load when called upon by DEP. Most events last for 3-6 hours, and participants are guaranteed at least 30 minutes of notice before an event starts, but they are often notified the day before.

DEP called one summer event in 2021. The program included 24 customers, spanning 66 site locations and 90 electric meters that were enrolled in the program during the summer 2021 season.

Date:	March 18, 2022
Region:	Duke Energy Progress
Evaluation Period	November 1, 2020 through October 31, 2021
Annual MWh Savings	N/A
Net-to-Gross Ratio	1.0

Impact Evaluation

Evaluation Methods

The evaluation team estimated impacts from the DR events by replicating DEP's settlement baseline and applying the most accurate baseline approach to estimate verified impacts for each season.

Evaluation Details

- The program achieved a verified impact of 32.7 MW for the 2021 summer event. This reduction is 0.9% less than the 33.0 MW reductions reported by DEP for summer.
- The average impact was approximately 420 kW per meter for the summer event. For the summer event, impacts for participating meters were as low as 6 kW and as high as 7,348 kW.
- The evaluation team found the verified impacts to be at least 90% of DEP's reported impacts for most participants in the summer event.
- The net-to-gross ratio is estimated to be 1.0 for this program. This is because the regression approach estimates the baseline using all non-event summer days, and it is highly unlikely that any participants would curtail their load in the absence of the program during the same time that events are being called by DEP (because only participants are notified of events).

Process Evaluation

Evaluation Methods

The evaluation team administered web-based participant and account executive surveys as well as a program staff in-depth interview to assess program marketing, awareness, customer experiences, and satisfaction.

Evaluation Details

- Financial interests are the greatest motivating factors for customer participation, while generator equipment concerns are the greatest barrier to participation reported by the customers interviewed for this evaluation.
- All respondents noted that their business was not disrupted during the summer event and they were well prepared for the event.
- Customers continue to be satisfied with DEP account executive service related to the DRA program and the program overall.

Appendix A. Account Executive Survey Instrument

Duke Energy Progress (DEP), Commercial, Industrial, and Governmental (CIG) Demand Response Automation (DRA)

Account Manager Survey Instrument

For Year 2021

[Note to Reviewer] The Interview Guide is a tool to guide process evaluation interviews with Duke Energy account executives who oversee accounts for customers enrolled in the DRA program. The purpose of this interview guide is to drive the discussion with account executives regarding the strengths and opportunities for improvement of Duke Energy's DRA program. This interview will be conducted via email using the Qualtrics survey platform, or by telephone if needed.

Table 6. Account Executive Survey Overview

Research Objective	Interview Question Numbers
What are the strengths of the program, and what are areas for improvement?	10, 11, 12
What are the barriers to program participation? How can these barriers be addressed?	4, 7, 11, 12, 15b, 16
In what ways can the program potentially increase kW impacts?	8, 13, 15, 16
What actions can be taken, if any, to increase the efficiency of program implementation?	11, 12, 17, 18
Are there opportunities for improvement of the program?	4, 7, 8, 11, 12, 16, 17
Understand customers desire to continue with or leave the program	7, 8, 11, 13

Introductory Email

Dear [FIRSTNAME] [LASTNAME]:

Duke Energy and Guidehouse are working together to evaluate the CIG DRA program.

In the next few days, you will be receiving an email invitation to participate in an online survey. The primary goal of this survey is to collect your feedback about customer experience and satisfaction with the CIG DRA program in the Duke Energy Progress jurisdiction. Although we are also performing surveys with participating customers, we appreciate the perspective of account executives like yourself.

We appreciate your support of Duke Energy's DRA program and are grateful for your participation in this research. All information gathered is confidential and will only be used to inform our process evaluation.

Should you have further questions about the evaluation process, please reach out to Julie Smith (contact information below). We look forward to working with you.

Sincerely,
Julie Smith
Duke Energy, Measurement and Verification Operations
julie.smith@duke-energy.com

[INTRO] Thank you for your time today. The primary goal of this survey is to collect your feedback about customer experience and satisfaction with the DRA program in the Duke Energy Progress jurisdiction. Although we are also performing surveys with participating customers, we appreciate the perspective of account executives like yourself.

Screener

S1. Our records indicate that you are an account manager for customers who participate in the DRA program in Duke Energy Progress (DEP). Is this true?

1. Yes
2. No

[IF S1 = 2, TERMINATE]
Thank you for your time, unfortunately this survey is only open to account executives.

Roles and Responsibilities

R1. Which statement best describes how you engage with your accounts regarding the DRA program? Select all that apply.

1. I regularly provide my accounts with information about the DRA program.
2. I assist my accounts with enrollment and/or event notification for the DRA program.
3. I rarely communicate with my accounts regarding the DRA program.
4. I direct my accounts to the DRA program team or other sources of program support.

97. Other **[TEXT ENTRY]**
98. Don't know **[EXCLUSIVE]**

R2. How do you typically interact with your accounts involved in the program? Select all that apply.

1. Email
2. Regular meetings
3. Phone calls when necessary

97. Other **[TEXT ENTRY]**
98. Don't know **[EXCLUSIVE]**

R3. How many total customers do you work with, and are you focused on a specific geography or specific customer types?

Program Goals, Objectives, and Structure

P1. How are your customers providing load curtailments? Is it through backup generation, industrial/process curtailment, or curtailment of lighting, HVAC, and other building/facility equipment? [TEXT ENTRY]
P2. Are customers using the DRA program to monitor their demand reduction? Do you monitor your customers' real-time system reduction in load? [TEXT ENTRY]
P3. If your customers need more information about the program or contract options, how do you provide them with more information? Select all that apply.

1. Send them the program brochure
2. Direct them to the website
3. Direct them to the program management team
4. Schedule a call with them
5. Discuss over email

97. Other **[TEXT ENTRY]**
98. Don't know **[EXCLUSIVE]**

P4. Are you involved in notifying your customer accounts of a curtailment event?

1. Yes

2. No
98. Don't know

[IF P4 = 1]
P4a. Can you describe your involvement in notifying your customer accounts of a curtailment event?

[TEXT ENTRY]

P5. On a scale of 1 to 10, with 1 being extremely easy and 10 being extremely difficult, how would you rate the ease with which customers are able to curtail their load?

1. Extremely easy = 1
2. **[INSERT OPTIONS 2 THROUGH 9]**
10. Extremely difficult = 10
98. Don't know

[IF P5 > 5]
P5a. Why do you think it is difficult for customers to curtail their load?

[TEXT ENTRY]

P6. Are your customers meeting their contracted demand reductions?

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

[IF P6 = 2]
P6a. Why do you think customers are not meeting their contracted demand reductions?

[TEXT ENTRY]

P7. What aspects of the program do you perceive as barriers for your accounts? Select all that apply.

1. Incentives aren't sufficient
2. There are too many curtailment events
3. Event notification time is not sufficient
4. The program is complex
97. Other **[TEXT ENTRY]**
98. Don't know **[EXCLUSIVE]**

P7a. Do most of your participating customers choose to renew participation (or plan to renew) when their contracts expire? Why/why not? [OPEN ENDED]

P8. How frequently do you interact with the DRA program manager?

1. Monthly
2. 3 to 6 times per year
3. 1 to 2 times per year
4. Never

97. Other: **[TEXT ENTRY]**
98. Don't know

P9. What do you think the program strengths are?

1. Strengths: **[TEXT ENTRY]**
98. Don't know

P10. Are there any aspects of the program you would like to change?

1. Changes: **[TEXT ENTRY]**
98. Don't know

P11. What actions can be taken to increase the efficiency of program implementation?

1. Actions: **[TEXT ENTRY]**
98. Don't know

P12. Do you have any suggestions for improving the customer experience when they interact with Duke Energy or participate in the DRA program?

1. Suggestions: **[TEXT ENTRY]**
98. Don't know

P13. Is there any other information or communications that customers need during their program participation that they aren't currently getting?

Customer Intake, Communication, and Marketing

C1. On average, how long does it take from the time you first engage a potential participant to when they sign up for the program?

C2. When you visit a customer for reasons unrelated to the DRA program, do you generally include a discussion of the DRA program?

C3. Do you think the DRA program customer intake process is efficient and effective? How could this process be improved?

C4. How do you promote this program to your customers? Select all that apply.

1. Share the program brochure
2. Direct customers to the website
3. Direct customers to the program management team
4. Explain possible savings associated (monetary credits or energy savings)
97. Other: **[TEXT ENTRY]**
98. Don't know

C5. What are the most common reasons customers participate? Select all that apply.

1. Settlement payments/economics
2. Desire to help Duke Energy manage grid conditions
3. To achieve corporate sustainability goals
97. Other: **[TEXT ENTRY]**
98. Don't know

C6. What are common characteristics of customers who participate? Select all that apply.

1. Businesses with operational flexibility (do not need processes running at all times)
2. Businesses with the ability to transfer load to onsite generation or alternative fuels
3. Businesses that have an energy management system or building automation system that controls significant portions of their energy demand
4. Businesses that use events as an opportunity to test backup generators

97. Other: **[TEXT ENTRY]**
98. Don't know

C7. How satisfied do you think your customers are with **the notification methods used**?

1. Extremely dissatisfied = 1
2. **[INSERT 2 THROUGH 9]**

10. Extremely satisfied = 10
98. Don't know

[IF C7 != 98]
C7a. Why did you provide a rating of **[PIPE IN VALUE FROM C7]**?

[TEXT ENTRY]

C8. How satisfied do you think your customers are with **the duration of events**?

1. Extremely dissatisfied = 1
2. **[INSERT 2 THROUGH 9]**

10. Extremely satisfied = 10
98. Don't know

[IF C8 != 98]
C8a. Why did you provide a rating of **[PIPE IN VALUE FROM C8]**?

[TEXT ENTRY]

C9. How satisfied do you think your customers are with **the frequency of events**?

1. Extremely dissatisfied = 1
2. **[INSERT 2 THROUGH 9]**

10. Extremely satisfied = 10
98. Don't know

[IF C9 != 98]
C9a. Why did you provide a rating of **[PIPE IN VALUE FROM C9]**?

[TEXT ENTRY]

C10. How satisfied do you think your customers are with **the incentives provided**?

1. Extremely dissatisfied = 1
2. **[INSERT 2 THROUGH 9]**

10. Extremely satisfied = 10
98. Don't know

[IF C10 != 98]

C10a. Why did you provide a rating of **[PIPE IN VALUE FROM C10]**?

[TEXT ENTRY]

C11. How satisfied do you think your customers are with **the settlement process**?

1. Extremely dissatisfied = 1
2. **[INSERT 2 THROUGH 9]**
10. Extremely satisfied = 10
98. Don't know

[IF C11 != 98]
C11a. Why did you provide a rating of **[PIPE IN VALUE FROM C11]**?

[TEXT ENTRY]

C12. In your opinion, are DRA program costs being managed properly and efficiently by Duke Energy Progress? Are program incentives and budget appropriate to entice participants and meet goals? [OPEN ENDED]

C13. How do you handle complaints about the program? Are complaints managed efficiently and effectively by Duke Energy Progress? [OPEN ENDED]

C14. In your opinion, what prevents more customers from joining the program?

1. Barriers: **[TEXT ENTRY]**
98. Don't know

C15. Are there any changes you would recommend to make the program more widely accessible?

1. Recommendations: **[TEXT ENTRY]**
98. Don't know

C16. Do you consider DRA program marketing a significant part of your core job responsibilities? [OPEN ENDED]

C17. Do you feel like you have sufficient time to effectively market the DRA program? What would need to change for you to have more time to market the DRA program? [OPEN ENDED]

C18. What, if any, changes need to be made to the marketing materials to make them more effective? [OPEN ENDED]

C19. What is the best way to reach the customers who may not have a customer account executive assigned but would qualify for the program? [OPEN ENDED]

Interview Wrap-Up

W1. Is there anything else important about Duke Energy's DRA program that has not yet been covered?

1. Additional info: **[TEXT ENTRY]**

2. Nothing at this time

W2. If we require additional information, would it be ok to contact you via phone or email?

1. Phone
2. Email
3. No thank you **[EXCLUSIVE]**

Thank you very much for your time.

Appendix B. Participant Survey Instrument

Duke Energy Progress (DEP), Commercial, Industrial, and Governmental (CIG) Demand Response Automation (DRA)

Account Manager Survey Instrument

For Year 2021

Guidehouse will conduct and analyze online surveys from a sample of participants to assess customer experience and satisfaction with the CIG DRA program. The key process research objectives addressed through this survey will include assessing overall participant program satisfaction, and opinions on various parts of the program including recruitment, events, communication, and compensation. The surveys will include questions to collect feedback about the frequency and duration of events, ability to meet contract commitments, and effects on business operations. Guidehouse will coordinate with Duke Energy to notify participants in advance about the survey in order to increase potential response rates.

Table 7. Participant Survey Overview

Section	Description
Statement of purpose	The purpose of this survey is to identify: • Feedback on participant experience with various elements of the DRA program • Participant satisfaction with the DRA program • Participant satisfaction with Duke Energy • Opportunities for program improvement • Motivations and potential barriers to participation
Qualified respondent	Industrial, governmental and commercial participants in the DEP DRA program
Target number of completes	5-10 completes, dependent upon response rate
Estimated survey length	10-15 minutes
Survey timeline	September 2021-October 2021

Introductory Mailed Letter

Dear [FIRSTNAME] [LASTNAME]:

Duke Energy has selected Guidehouse to evaluate the Demand Response Automation (DRA) program and to collect feedback regarding the experience of participating businesses like yours.

In the next few days, you will receive an email invitation to participate in an online survey. Your feedback will help Duke Energy understand how the DRA program has affected your business and will identify opportunities to improve the program. All information gathered is confidential and will only be used to inform the evaluation activity. Responses will be provided to Duke Energy in aggregate.

We appreciate your support of Duke Energy’s DRA program and are grateful for your participation in this research!

Should you have further questions about the evaluation process, please contact me at the number below. We look forward to working with you.

Sincerely,

Julie Smith
Duke Energy, Measurement and Verification Operations
julie.smith@duke-energy.com
513-287-3620

Email Invitation

Subject: Please Share Your Thoughts about Duke Energy's DRA Program!

Dear [FIRSTNAME] [LASTNAME],

We would appreciate feedback regarding your participation in Duke Energy's Demand Response Automation (DRA) program and invite you to complete a brief survey. Your participation is very important to the program. By completing this 10-15 minute survey, you will help Duke Energy understand your experience with the DRA program and assist in making the program better.

To complete this survey, please click on the button below.

Take the Survey

Or copy and paste the URL below into your internet browser: [survey link].

If you cannot complete the survey in its entirety or you accidentally exit the survey mid-course, you can resume the survey where you left off by clicking on the above link from this email or hitting the back button. All responses will be kept anonymous and only be reported to Duke Energy in aggregate with other responses.

Thank you for taking the time to complete the survey!

Sincerely,

Julie Smith
Duke Energy, Measurement and Verification Operations
julie.smith@duke-energy.com
513-287-3620

Reminder Email

Subject: Duke Energy's DRA program would like your feedback

Dear [FIRSTNAME] [LASTNAME],

Duke Energy is working to help businesses like yours save money and energy. Recently, we sent you an invitation to take a survey regarding your company's experience with the Demand Response Automation (DRA) program. We are collecting customer feedback and would like to hear from you.

Please take about 10-15 minutes today to complete the survey.

Your input is very important to us and will be kept strictly confidential. We will use your feedback to help improve Duke Energy's DRA program.

Take the Survey

Or copy and paste the URL below into your internet browser: [survey link]

If you cannot complete the survey in its entirety or you accidentally exit the survey mid-course, you can resume the survey where you left off by clicking on the above link from this email or hitting the back button.

Thank you for taking the time to complete the survey!

Julie Smith
Duke Energy, Measurement and Verification Operations
julie.smith@duke-energy.com
513-287-3620

Survey Body

Introduction

Thank you for your interest in Duke Energy's Demand Response Automation (DRA) program. The DRA program provides incentives for businesses like yours to reduce energy use during times of system need. We are conducting a survey to understand your experience and satisfaction with the program.

If you cannot complete the survey in its entirety or you accidentally exit the survey mid-course, you can resume the survey where you left off by clicking the link from your invitation email or hitting the back button.

Screening Questions

S1 Are you the person most familiar with your business's participation in Duke Energy's DRA program?

Yes (1)
No (2)

[ASK IF S1=2]
S2 Please provide the contact information for the person most familiar with BUSINESS/ORGANIZATION NAME's participation in the DRA program.
Contact information [OPEN-ENDED] (1) **[TERM]**
Don't know/prefer not to respond (98) [**TERM]**

S3 Which selection best describes your position within the business?
Business Owner (1)
Office/Site Manager (2)
Receptionist/Administrative Assistant/Clerical (3)
Facilities/Energy Manager (4)
Other (please describe): **[OPEN-ENDED]** (97)

S4 How did you originally hear about the DRA program?
Email (1)
Mailing (2)
Bill insert (3)
Duke Energy account representative (4)
Word of mouth (5)
Other (please describe): (97)
I'm not sure (98) **[EXCLUSIVE]**

Program Participation

PP1 What motivated you to sign up for the DRA program? (select all that apply)
The incentive/bill credit associated with participation (1)
I wanted my business to conserve energy (2)
I wanted my business to save on energy costs (3)
I wanted to help Duke Energy conserve energy during times of peak system needs (4)
I wanted to increase the bottom line (profit)
Other (Please specify) (97)
I'm not sure (98) **[EXCLUSIVE]**

PP2 On a 0 to 10 scale, with 0 being highly unsatisfied and 10 being highly satisfied, how satisfied are you with: **[SCALE 0-10]**

a. Duke Energy overall
b. DRA program overall
c. Process of signing up for DRA program
d. Requirement that each participating building is capable of contracting a minimum of 50 kW in curtailable demand
e. Method used to calculate the baseline demand
f. Installation and use of the program-compatible interval meter
g. The program incentive structure (one-time participation incentive of $50/kW, monthly credits of $4.25/kW for contracted amount of curtailable demand and performance credits of $6/kW for demand reduced during each curtailment)
h. Expected participation in a minimum of one summer curtailment event

i. Loss of monthly credits if demand reduction falls below 90% of contracted curtailable demand
j. 5-year commitment periods with 2-year extensions
k. Communication with the account executive

[If PP2a-g<6; OPEN-ENDED]
PP2a Why did you rate your satisfaction with Duke Energy a(n) **{PIPE IN PP2a}**?
PP2b Why did you rate your satisfaction with the DRA program a(n) **{PIPE IN PP2b}**?
PP2c Why did you rate your satisfaction with the process of signing up for DRA a(n) **{PIPE IN PP2c}**?
PP2d Why did you rate your satisfaction with the curtailment demand requirements a(n) **{PIPE IN PP2d}**?
PP2e Why did you rate your satisfaction with the method used to calculate the baseline demand a(n) **{PIPE IN PP2e}**?
PP2f Why did you rate your satisfaction with the installation and use of the program-compatible interval meter a(n) **{PIPE IN PP2f}**?
PP2g Why did you rate your satisfaction with the program incentive structure provided a(n) **{PIPE IN PP2g}**?
PP2h Why did you rate your satisfaction with the expected participation in a minimum of one summer curtailment event a(n) **{PIPE IN PP2gh**?
PP2i Why did you rate your satisfaction with loss of monthly credits if demand reduction falls below 90% of contracted curtailable demand a(n) **{PIPE IN PP2gi**?
PP2j Why did you rate your satisfaction with 5-year commitment periods with 2-year extensions provided a(n) **{PIPE IN PP2gj**?
PP2k Why did you rate your satisfaction with the communication with the account executive a(n) **{PIPE IN PP2gk**?

PP3 On a scale of 0 to 10, with 0 being "do not understand at all," 10 being "understand completely," and 5 being neutral, how well do you understand the three-part incentive structure of this program? **[SCALE 0-10]**

[If PP3<6]
PP3a Why did you rate your understanding of incentives a(n) **{PIPE IN PP3}**? **[OPEN-ENDED]**

PP4 Would you suggest any changes to the incentive structure? **[OPEN-ENDED]**

Program Interactions and Impacts

The next set of questions will collect feedback about your experience with your business's level of curtailment in 2021.

PII1 Which item best describes how you were notified of load curtailment events? Please select all that apply.

I received an email or text message (1)
I received an automated telephone call (2)
My Duke Energy account executive emailed/called me (3)
Other, please specify: **[OPEN-ENDED]** (97)
I'm not sure (98) **[EXCLUSIVE]**

PII2 Which item best describes your opinion of the amount of time allowed for load curtailment notifications?

The notification time was sufficient for my business to prepare for the curtailment event (1)
The notification time was not sufficient for my business to prepare for the curtailment event (2)

Other, please specify: **[OPEN-ENDED]** (97)
I'm not sure (98) **[EXCLUSIVE]**

PII2 a Does your organization participate in winter DRA events?

Yes (1)
No (2)
Other, please specify: **[OPEN-ENDED]** (97)
I'm not sure (98) **[EXCLUSIVE]**

[IF PII2a=2]
PII2 b Why not? **[OPEN-ENDED]**

PII3 Which item best describes your business's experience during load curtailment events?

My business was well prepared for the curtailment events (1)
The curtailment events were disruptive to business operations (2)
The curtailment events caused a decrease in comfort at my business due to changes in temperature or equipment operations (3)
The curtailment events caused no disruption to operations or comfort (4)
Other, please specify: **[OPEN-ENDED]** (97)
I'm not sure (98) **[EXCLUSIVE]**

PII4 Which item best describes your opinion of the typical frequency of load curtailment events?

The number of curtailment events meet my expectations (1)
There are fewer curtailment events than I expected (2)
There are too many curtailment events (3)
Other, please specify: **[OPEN-ENDED]** (97)
I'm not sure (98) **[EXCLUSIVE]**

PII5 Which item best describes your opinion of the duration of typical load curtailment events?

The event duration is about what I expected (1)
The events are too short to justify changing my business operations (2)
The events are too long and create challenges for my business (3)
Other, please specify: **[OPEN-ENDED]** (97)
I'm not sure (98) **[EXCLUSIVE]**

PII6 Does your business have plans to adjust its level of curtailment (i.e., summer or winter contracted demands) in the future?

Yes (1)
No (2)
My business is already committed to curtailing the maximum load possible (3)
Other, please specify: **[OPEN-ENDED]** (97)
I'm not sure (98) **[EXCLUSIVE]**

[IF PII6 =1]
PII6a Have you discussed adjusting your business' level of curtailment with your Duke Energy Account Executive?

Yes (1)
No (2)
Other, please specify: **[OPEN-ENDED]** (97)
I'm not sure (98) **[EXCLUSIVE]**

PII7 On a 0-to-10 scale, with 0 being "extremely difficult" and 10 being "easy," how easy did you find it to meet your business's contracted demand reductions? **[SCALE 0-10]**

[If PII7<6]
PII7a Why did you rate the ease of meeting BUSINESS/ORGANIZATION NAME's contracted demand reductions a(n) **{PIPE IN PII7}**? **[OPEN-ENDED]**

PII8 Does your company plan on continuing in the program next year?

Yes (1)
No (2)
Other (please describe): (97)
I'm not sure (98) **[EXCLUSIVE]**

[IF PII8 = 2 or 98]
PII8a Please describe why you would consider leaving the program? **[OPEN-ENDED]**

PII9 What aspects of the program encourage customers to continue in the program? Please select all that apply.

Incentives/bill credits (1)
Reduced energy costs (2)
Ease of participation (3)
Ability to help Duke Energy reduce peak demand during times of system need (4)
Helps my bottom line and we value the positive impact on our budget
We do it for other reasons
Other, please specify: **[OPEN-ENDED]** (97)
I'm not sure (98) **[EXCLUSIVE]**

PII10 What aspects of the program are challenging? Please select all that apply.

Incentive doesn't offset the cost of lost production (1)
Risk of not meeting a business deadline (2)
Impacts on client/customer comfort (3)
Meeting 50 kW minimum (4)
Number of events (5)
Duration of events (6)
Upfront capital investments required to participate (7)
Concerns with using the equipment needed to participate in the program (8)
Other, please specify: **[OPEN-ENDED]** (97)
I'm not sure (98) **[EXCLUSIVE]**

PII11 What do you think the program strengths are? Please select all that apply.

It provides valuable incentives that help reduce energy costs (1)
It's easy to participate (2)
It helps Duke Energy provide consistent, reliable electricity to customers (3)
It helps Duke Energy avoid building additional electricity-generating capacity (4)
Other, please specify: **[OPEN-ENDED]** (97)
I'm not sure (98) **[EXCLUSIVE]**

PII12 What do you think prevents other businesses from participating in the program? Please select all that apply.

Inability to reduce their load due to operating conditions (1)
Lack of knowledge about the program (2)
Too many curtailment events (3)
The incentive is too low (4)
No reason not to participate (5)
Other, please specify: **[OPEN-ENDED]** (97)
I'm not sure (98) **[EXCLUSIVE]**

PII13 How can Duke Energy reduce these barriers and change the program to make participation easier? **[OPEN-ENDED]**

Customer Communication and Marketing

CCM0 Did you feel you were fully informed about the program by your account executive?? **[OPEN-ENDED]**

CCM1 If you have questions regarding the DRA program, who do you contact and are your questions resolved by the contact? **[OPEN-ENDED]**

CCM2 Did you receive an onsite visit from your account executive?? Was this meeting reasonable/necessary to finalize your DRA commitment? **[OPEN-ENDED]**

CCM3 How were your communications and experiences with the personnel who installed the equipment needed to participate in the program?

CCM 4 Are there any improvements you would recommend with regards to how you receive information about the DRA program and upcoming curtailment events? **[OPEN-ENDED]**

Wrap-Up

W1 Are there any other aspects of the program you would like to change or feedback you consider important for Duke Energy regarding the DRA program? **[OPEN-ENDED]**

Closing

CLOSE Thank you very much for taking the time to complete this survey. Duke Energy greatly appreciates your ongoing participation and engagement.

Appendix C. Program Staff In-Depth Interview Guide

Duke Energy Progress (DEP), Commercial, Industrial, and Governmental (CIG) Demand Response Automation (DRA)

Program Manager Interview Guide

For Year 2021

Interview Goals

The goal of interviewing Duke Energy program staff is to better understand the program, including goals, barriers, and future considerations. This continually improved understanding will allow a more thorough and useful evaluation of the program in question.

Interview Guide

Roles and Responsibilities

Objective: Understand staff structure and identify key staff.

1. Outline program staffing with roles and responsibilities in 2021. Projected for 2022? *[Probe for an understanding of each person's role.]*

Program Goals, Objectives, and Structure

Objective: Understand the program goals, detailed objectives, and operational structure. Identify any changes to the program in the current evaluation period and considered changes for future years.

2. How close did the program come to meeting its goals for 2021? *[Probe for impact from COVID-19.]*

3. What are the overall program goals for 2022?
[Probe for details about specific demand savings, seasonal peak, reliability of resources, number of resources.]

4. What is the count of participants by type (commercial, industrial, governmental) and what is the percentage demand reduction for summer and winter by each group? *[Probe on heating fuel, opportunities for winter curtailment, participation rate, efforts to increase participation.]*

5. Are there any specific actions you are hoping to encourage, beyond responding to events, with the program? *[Probe on channeling to other EE programs.]*

6. What external factors outside your control affect the program or the program's expected results?

7. What do you see as barriers to participation and then to responding to called events? *[Probe for impacts of technology to decline, notice, production interruptions, heating fuel issues, business ability to aggregate among smaller facilities.]*

8. How could the program address these barriers? *[Probe for .]*

9. How is the program marketed? Was marketing collateral developed to address barriers? How do customers respond to options?

10. How are participants using the Energy Manager Tool?

11. What are the future plans for the program?
[Probe for details about specific components of the program, changes to implementation, or goals.]

Data Tracking

Objective: Understand data QA/QC procedures (both on the utility side and the implementer side).

12. I'm unfamiliar with the data. Any questions here?
[Probe for .]

Other

Miscellaneous and wrap-up questions.

13. What questions are most important to answer through our evaluation?

14. Is there anything you would like to add?

Thank you very much for taking the time to talk with me. Your contribution is a very important part of the process.

Guidehouse
Outwit Complexity

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

Prepared for:

DUKE ENERGY.

Duke Energy Progress, Duke Energy Carolinas

FINAL

April 20, 2022

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Table of Contents

List of Tables, Figures and Equations

1. Evaluation Summary

1.1 Program Summary

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

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

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

1.2 Evaluation Objectives and Methods

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

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

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

1.3 Evaluation Parameters and Sample Period

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

Table 1-1. Evaluated Parameters

Evalauted Parameter	Description	Details
Efficiency Characteristics	Inputs and assumptions used to estimate energy and demand savings	1. LED Wattage 2. Baseline Lamp Wattage 3. Aerator flow rates 4. Showerhead flow rates
In-Service Rates	The percentage of program measures in use as compared to reported	1. LED, aerator, and showerhead quantities 2. Pipe wrap length
Satisfaction	Customer satisfaction	1. Satisfaction with program 2. Satisfaction with measures 3. Satisfaction with contractor
Free Ridership	Fraction of reported savings that would have occurred, even in the absence of the program	1. Property manager interviews
Spillover	Additional, non-reported savings that occurred as a result of participation in the program	1. Property manager interviews 2. Tenant phone surveys

Source: Guidehouse

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

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

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

Source: Guidehouse

1.4 Program Level Findings

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

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

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

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

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

Source: Guidehouse analysis, values subject to rounding.

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

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

Source: Guidehouse analysis, values subject to rounding.

Table 1-5. Program Evaluated Net Energy Impacts

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

Source: Guidehouse analysis, values subject to rounding.

Table 1-6. Program Evaluated Net Peak Demand Impacts

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

Source: Guidehouse analysis, values subject to rounding.

1.5 Evaluation Considerations and Recommendations

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

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

2. Program Description

2.1 Design

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

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

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

2.2 Implementation

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

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

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

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

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

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

3. Evaluation Research Objectives and Methods

3.1 Research Objectives

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

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

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

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

3.2 Evaluation Methods

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

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

3.2.1 Overview of Impact Methodology

3.2.1.1 Detailed Review of Ex Ante Deemed Savings

Guidehouse reviewed the ex-ante savings and supporting documentation used to estimate ex ante program impacts. For all measures, Duke Energy indicated that the deemed energy and demand impacts for this program are equivalent to the verified impacts from the most recent EM&V report, which was completed by Guidehouse (then Navigant) in 2020.[1] The deemed ex ante savings for LED measures are shown in Table 3-1 below.

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

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

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

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

Equation 1. Energy Savings Algorithms for LED Measures

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

Equation 2. Summer Coincident Demand Savings Algorithm for LED Measures

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

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

Equation 3. Winter Coincident Demand Savings Algorithm for LED Measures

$$Winter\ kW\ Savings^{2} = \left(\frac{Watts_{BASE} - Watts_{EFF}}{1000}\right) * ISR * \left(1 - \left((WHFd - 1) * \%\ Electric\ Heat\right)\right) * CF_{Winter}$$

Where the parameters are defined as:

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

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

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

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

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

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

* Duke Energy Multifamily EMV Report DEC-DEP 16Apr2020

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

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

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

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

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

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

Equation 4. Energy Savings Algorithms for Aerator Measures

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

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

Equation 5. Energy Savings Algorithms for Showerhead Measure

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

Equation 6. Demand Savings Algorithms for Aerator and Showerhead Measures

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

Equation 7. Energy Savings Algorithms for Pipe Wrap Measure

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

Equation 8. Demand Savings Algorithms for Pipe Wrap Measure

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

Where the parameters are defined as:

ISR – In-Service rate
GPM_{BASE} – Gallons per minute of baseline faucet aerator or showerhead
GPM_{LOW} – Gallons per minute of low-flow faucet aerator or showerhead
$Throttle_{BASE}$ – Baseline throttling factor
$Throttle_{LOW}$ – Low-flow throttling factor
$Time_{FAUCET}$ – Average daily length faucet use per capita for faucet of interest in minutes
\# People – Average number of people per household
Days/Year – Days faucet or showerhead used per year
DR – Percentage of water flowing down drain
8.3 – Specific weight of water in pounds per gallon multiplied by the specific heat of water ($1.0 \frac{Btu}{lb°F}$)
$Temp_{FT}$ – Temperature of water used by faucet
$Temp_{IN}$ – Temperature of water entering house
DHW Recovery efficiency – Recovery efficiency of electric hot water heater
3412 – Constant to convert Btu to kWh
Hours – Average number of hours per year spent using faucet or showerhead
CF – Coincidence factor
$Time_{SHOWER}$ – Average daily shower length in minutes
$Showers_{PERSON}$ – Average showers per person per day
Showerheads per Home – Average number of showerheads in the home
$Temp_{SH}$ – Temperature of water used by showerhead
R_{EXIST} – Pipe heat loss coefficient (R-value) of existing uninsulated piping

R_{NEW} – Pipe heat loss coefficient (R-value) of existing pipe plus installed insulation
L – Feet of pipe from water heating source covered by pipe wrap
C – Circumference of pipe in feet
ΔT – Average temperature difference between water in pipe and ambient air temperature
8760 – Hours per year
η_{DHW} – Recovery efficiency of electric hot water heater

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

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

Parameter	Bath Aerator – 0.5 GPM	Bath Aerator – 1.0 GPM	Kitchen Aerator	Showerhead	Source
ISR	0.96	0.96	0.83	0.92	Guidehouse field verification and phone surveys
GPM_{BASE}	2.12	2.12	2.17	2.76	Data provided by Duke Energy from Franklin Energy sample
GPM_{LOW}	0.84	0.50	0.73	1.50	Guidehouse field verification[a]
$Throttle_{BASE}$	0.83	0.83	0.83	NA	2018 Mid-Atlantic TRM
$Throttle_{LOW}$[a]	0.95	0.95	0.95	NA	2018 Mid-Atlantic TRM
# People	2.07	2.07	2.07	2.07	EIA RECs Study 2015
Days/Year	365	365	365	365	2018 Mid-Atlantic TRM
DR	0.70	0.70	0.50	NA	2018 Mid-Atlantic TRM
$Temp_{FT}$[b] / $Temp_{SH}$	96.03	96.03	96.99	105.00	Guidehouse field verification 2018 Mid-Atlantic TRM
$Temp_{IN}$	66.34	66.34	66.34	66.34	Building America Benchmark[4]
$Time_{FAUCET}$ / $Time_{SHOWER}$	1.60	1.60	4.50	7.80	2018 Mid-Atlantic TRM

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

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

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

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

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

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

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

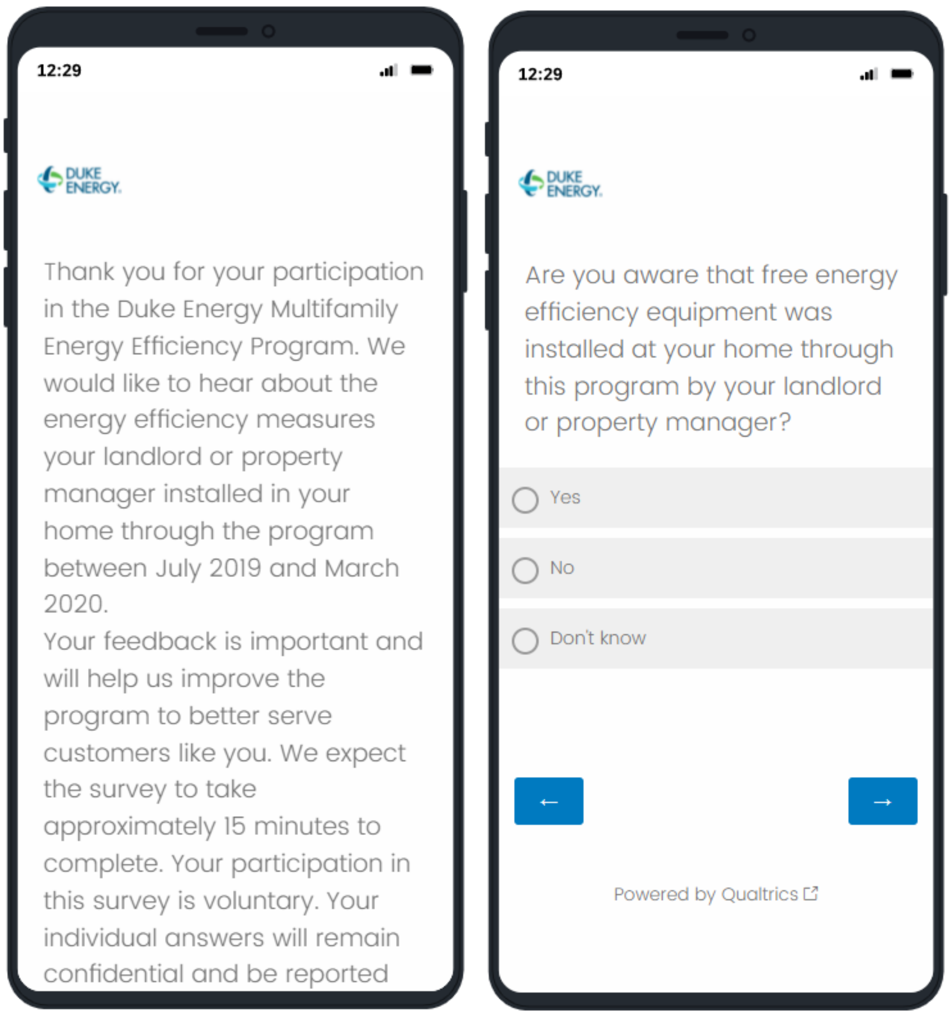
Parameter	Pipe Wrap	Source
ISR	0.91	Guidehouse field verification and phone surveys
R_{EXIST}	1.00	2018 Mid-Atlantic TRM
R_{NEW}	4.12	Guidehouse field verification
L	1	Savings are calculated per linear foot
C	0.16	Assumed as average of 0.5” and 0.75” diameter pipe
ΔT	65	2018 Mid-Atlantic TRM
η_{DHW}	0.98	2018 Mid-Atlantic TRM

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

3.2.1.2 Virtual Verification

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

Figure 1. Virtual Verification Platform



Source: Guidehouse

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

Table 3-6. Virtual Verification – Sampling Summary

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

Source: Guidehouse analysis

Table 3-7 shows the target number of program measures in the virtual verification sample order to achieve a 90/10 confidence and precision target at the program level. Guidehouse developed these targets based on prior experience evaluating this program. The target completes indicate the minimum number of measures that Guidehouse planned to assess via the virtual verification impact surveys. A total of 138[5] tenants completed the virtual verification surveys, which represented 1,978 program measures. Guidehouse reviewed tenant responses and removed some data from the analysis if respondents did not provide sufficient information. This resulted in a total of 1,011 measures in the final sample used for analysis. Table 3-7 also shows the distribution of the target and achieved representation for each measure.

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

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

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

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

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

Source: Guidehouse analysis

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

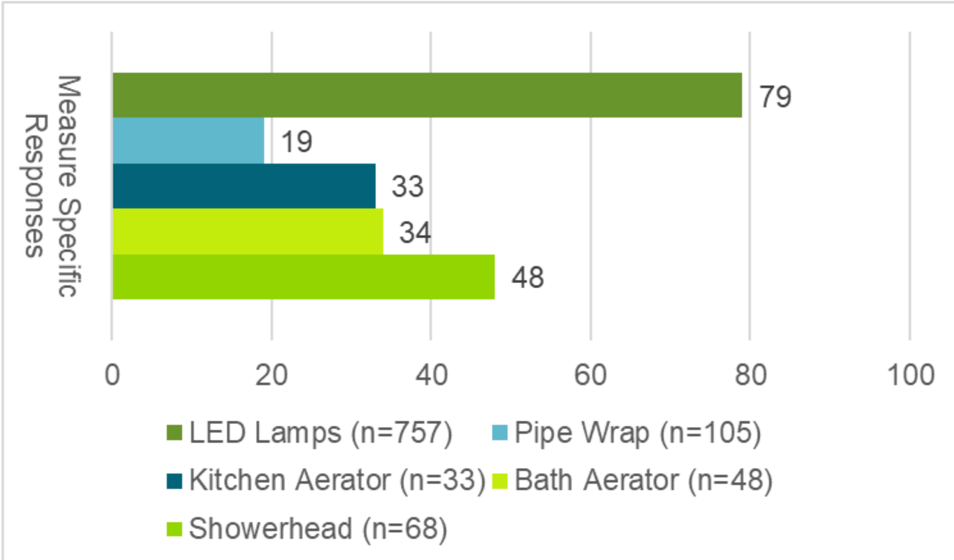
Table 3-8. Virtual Verification Survey – Completes Achieved by Jurisdiction

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

Source: Guidehouse analysis

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

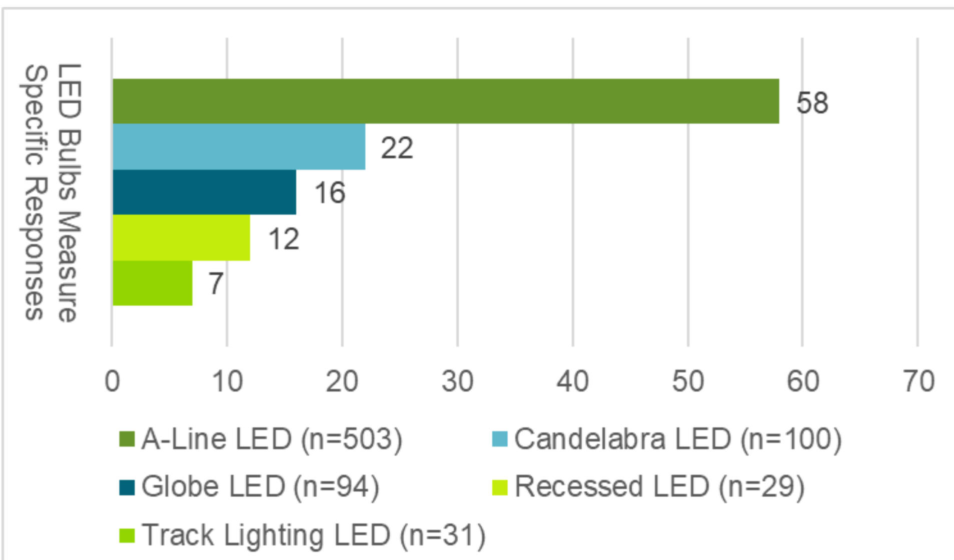
Figure 2. Virtual Verification – Survey Completes by Measure



Respondents were able to answer questions for multiple measures

Source: Guidehouse analysis

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



Respondents were able to answer questions for multiple measures

Source: Guidehouse analysis

3.2.2 Overview of Net-to-Gross Methodology

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

3.2.2.1 Definitions of Free Ridership, Spillover and NTG Ratio

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

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

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

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

Equation 9. Net-to-Gross Algorithm

$$NTG = 1 - Free\ Ridership + Spillover$$

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

3.2.2.2 Estimating Free Ridership

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

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

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

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

- **Likelihood:** To estimate the likelihood that they would have incorporated measures "of the same high level of efficiency," if not for the assistance of the program. In cases where respondents indicated that they might have incorporated some but not all of the measures, they were asked to estimate the share of measures that would have been incorporated anyway at high efficiency. This flexibility in how respondents could conceptualize and convey their views on free ridership allowed respondents to give their most informed response, thus improving the accuracy of the free ridership estimates.

- **Prior planning:** To further estimate the probability that a participant would have implemented the measures without the program. Participants were asked the extent to which they had considered installing the energy efficient measure prior to participating in the program. The general approach holds that if customers were not definitively planning to install all of the efficiency measures prior to participation then the program can reasonably be credited with at least a portion of the energy savings resulting from the high-efficiency measures. Strong free ridership is reflected by those participants who indicated they had already allocated funds for the purchase and selected the equipment and an installer.

- **Program importance:** To clarify the role that program components (e.g., information, incentives) played in decision-making and to provide supporting information on free ridership. Responses to these questions were analyzed for each respondent, not just in aggregate, and were used to identify whether the direct responses on free ridership were consistent with how each respondent rated the influence of the program.

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

[7] Scores were calculated by the following formulas:

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

savings and divided by 10 to convert the scores into a free ridership percentage. Next, a timing multiplier was applied to the average of the three scores to reflect the fact that respondents indicating that their energy efficiency actions would not have occurred until far into the future may be overestimating their level of free ridership. Participants were asked when they would have installed the equipment without the program. Respondents who indicated that they would not have installed the equipment for at least two years were not considered free riders and received a timing multiplier of 0.[8] If they would have installed at the same time as they did, they received a timing multiplier of 1; within one year, a multiplier of 0.67; and between one and two years, a multiplier of 0.33.

3.2.2.3 Estimating Spillover

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

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

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

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

3.2.2.4 Combining Results Across Respondents

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

- Individual respondents, by evaluating the responses to the relevant questions and applying the rules-based approach discussed above.

- Program Importance: This score was calculated by taking the response to the following question "Please rate your agreement with the following statement: My decision to install energy efficiency equipment at my property was largely motivated by Duke Energy's program" on a scale of 0-10 and subtracting from 10 (i.e., the higher the program importance, the lower the influence on free ridership).

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

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

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

3.2.2.5 Review of Data Collection Efforts for Attribution Analysis

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

Table 3-9. Property Manager Sample Representation

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

Source: Guidehouse analysis, values subject to rounding

3.2.3 Overview of Process Methology

3.2.3.1 Tenant Surveys

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

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

Jurisdiction	Survey Completes
DEP	72
DEC	77
Total	149

Source: Guidehouse analysis

3.2.3.2 Property Manager Surveys

Guidehouse completed surveys with property managers for 26 of the 294 participating properties. The completed surveys represented almost 50,000 measures or 8 percent of the program reported energy savings. The survey included a number of questions to assess participation experience and satisfaction, satisfaction with new equipment, as well as questions to assess free ridership and spillover. Also included in the survey were questions to assess the impacts of COVID-19 on different aspects of property management activities including energy use.

3.2.3.3 Interviews with Duke Energy Program Manager and Franklin Energy

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

3.2.3.4 Documentation Review

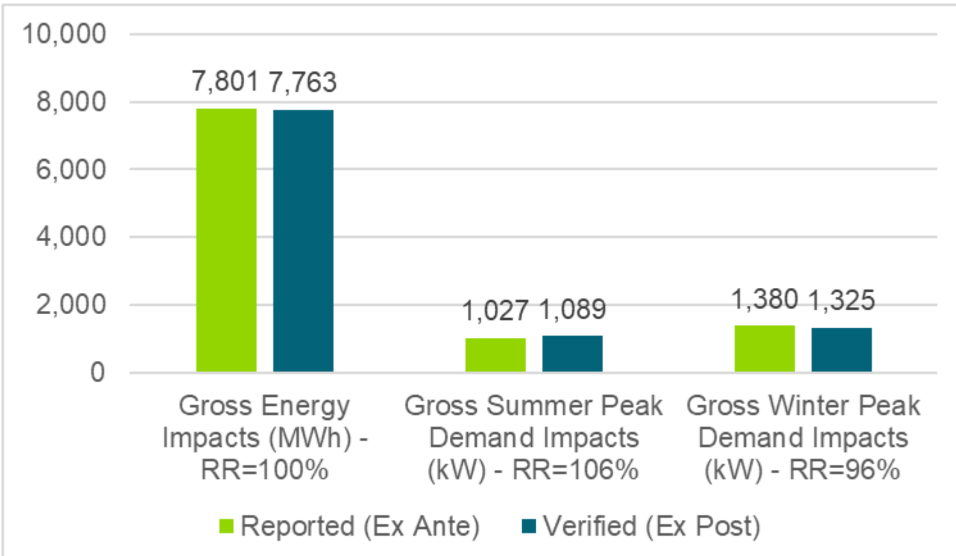
Guidehouse requested program documentation and tracking data to conduct a review of current processes. The program tracking data was sufficient to identify the measure characteristics and quantities of installed measures for each tenant at the participating properties.

4. Impact Evaluation

4.1 Impact Results

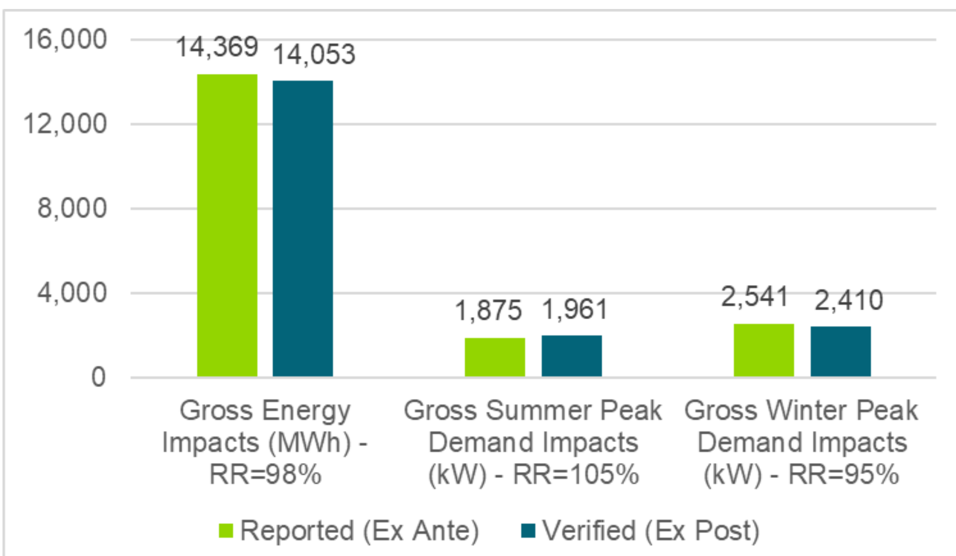
Figure 4 shows the program level results for gross energy and demand savings for DEP and Figure 5 shows the corresponding results for DEC.

Figure 4. Reported and Verified Program-Level Impacts – DEP



Source: Guidehouse analysis

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



Source: Guidehouse analysis

Table 4-1 shows a comparison of gross and net impact findings. The evaluation team calculated the gross impact results in Table 4-1 by multiplying the measure quantities found in the tracking database by the verified energy and demand savings estimated during the EM&V process for each measure. The net impacts were found by multiplying the gross impacts by the NTG ratio of 0.96. The NTG methodology and results are discussed in detail in Section 3.2.2 and Section 5 of this report respectively.

Table 4-1. Summary of Program Impacts

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

Source: Guidehouse analysis, values subject to rounding.

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

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

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

Measure	Measure Count from Tracking Data	Total Ex Ante Savings from Tracking Data (MWh)	Share of Total Savings from Tracking Data	Total Verified Ex Post Gross Savings (MWh)	Realization Rate
Total	**196,636**	**7,801**	**100%**	**7,763**	**100%**

Source: Guidehouse analysis, values subject to rounding.

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

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

Source: Guidehouse analysis, values subject to rounding.

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

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

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

Source: Guidehouse analysis, values subject to rounding.

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

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

Source: Guidehouse analysis, values subject to rounding.

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

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

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

Source: Guidehouse analysis, values subject to rounding.

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

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

Source: Guidehouse analysis, values subject to rounding.

4.2 Impact Evaluation Findings

4.2.1 LED Measures

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

Equation 10. Updated Energy Savings Algorithms for LED Measures

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

Where,

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

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

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

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

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

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

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

Source: Guidehouse analysis, values subject to rounding

4.2.1.1 In-Service Rate

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

Table 4-9. LED Measures – ISR

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

Source: Guidehouse analysis

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

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

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

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

Source: Guidehouse analysis

4.2.1.2 Baseline and Efficient Lamp Wattage

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

Table 4-11. LED Measures – Baseline Lamp Wattage

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

Source: Guidehouse analysis

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

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

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

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

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

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

Source: Guidehouse analysis

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

Table 4-13. LED Measures – Efficient Lamp Wattage

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

Source: Guidehouse analysis

4.2.1.3 Lighting Hours of Use and Coincidence Factors

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

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

4.2.1.4 Waste Heat Factors

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

Table 4-14. LED Measures – Waste Heat Factors

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

Source: Guidehouse analysis

4.2.2 Water Flow Regulation Measures

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

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

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

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

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

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

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

Source: Guidehouse analysis, values subject to rounding

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

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

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

Source: Guidehouse analysis, values subject to rounding

4.2.2.1 In-Service Rate

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

Table 4-17. Water Flow Regulation Measures – ISR

Measure	Completes Achieved	Tracking Data Quantity	Verified Quantity	In-Service Rate (ISR)
Bath Aerator	34	48	46	96%
Kitchen Aerator	33	33	28	85%
Showerhead	48	68	66	97%

Source: Guidehouse analysis

4.2.2.2 Baseline and Efficient Flow Rate (GPM)

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

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

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

Source: Guidehouse analysis

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

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

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

Source: Guidehouse analysis

4.2.2.3 Average Number of People per Household (# People)

Guidehouse updated the average number of people per household parameter using the EIA RECs study 2015[12] for the South Atlantic census region.

4.2.2.4 Average Number of Showerheads per Home

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

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

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

Source: Guidehouse analysis

4.2.2.5 Hours and Coincidence Factors

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

Equation 11. Updated Hours Algorithms for Showerhead Measure

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

4.2.3 Pipe Wrap Measure

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

[12] https://www.eia.gov/consumption/residential/data/2015/hc/php/hc9.8.php

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

Parameter	Source	Pipe Wrap
ISR	Virtual verification survey	99.9%
R_{EXIST}	Mid-Atlantic TRM v9*	1.00
R_{NEW}	Specification sheet	4.35
L	Savings are calculated per linear foot	1.00
C	Assumed as average of 0.5" and 0.75" diameter pipe	0.16
ΔT	Mid-Atlantic TRM v9	65.00
η_{DHW}	Mid-Atlantic TRM v9	0.98
Gross Energy Savings per Linear Foot (kWh)		**21.43**
Gross Summer Coincident Demand Savings per Linear Foot (kW)		**0.0024**
Gross Winter Coincident Demand Savings per Linear Foot (kW)		**0.0024**

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

Source: Guidehouse analysis, values subject to rounding

4.2.3.1 In-Service Rate

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

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

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

Source: Guidehouse analysis

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

[13] https://www.energy.gov/energysaver/do-it-yourself-savings-project-insulate-hot-water-pipes

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

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

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

Source: Guidehouse analysis

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

Table 4-24. Pipe Wrap Measure – Effective ISR

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

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

**Calculated as (Effective Installed Quantity/Total Installed Quantity).

Source: Guidehouse analysis

4.2.3.2 R-value of Installed Insulation

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

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

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

*Assumed as average of 0.5” and 0.75” diameter pipe

Source: Guidehouse analysis

5. Net-To-Gross Analysis

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

Table 5-1. NTG Results

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

Source: Guidehouse analysis, values subject to rounding

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

5.1.1 Free Ridership Results

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

Below are summaries by scoring component.

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

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

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

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

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

5.1.2 Spillover Results

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

Table 5-2. Property Manager Spillover Measures

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

Source: Guidehouse analysis

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

Table 5-3. Tenant Spillover Measures

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

Source: Guidehouse analysis

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

6. Process Evaluation

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

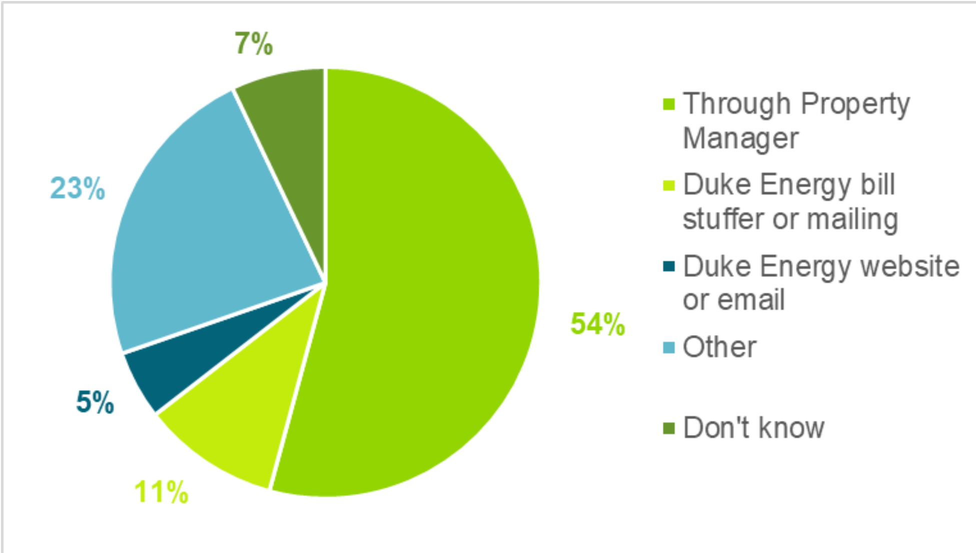
6.1 Key Findings

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

6.2 Tenant Surveys

Customer outreach is a key driver to program participation. Guidehouse recognizes the importance of marketing and outreach with regards to continued participation and satisfaction, so several questions in the tenant survey and property manager interviews were included to address these factors. Figure 6 shows how tenants learned about the program. Tenant participants were asked to indicate all the sources through which they learned about the program, and about 54 percent indicated they heard about the program through property managers as would be expected given the program model. Tenants also indicated they learned about the program though Duke Energy bill stuffer or mailing and Duke Energy's website.

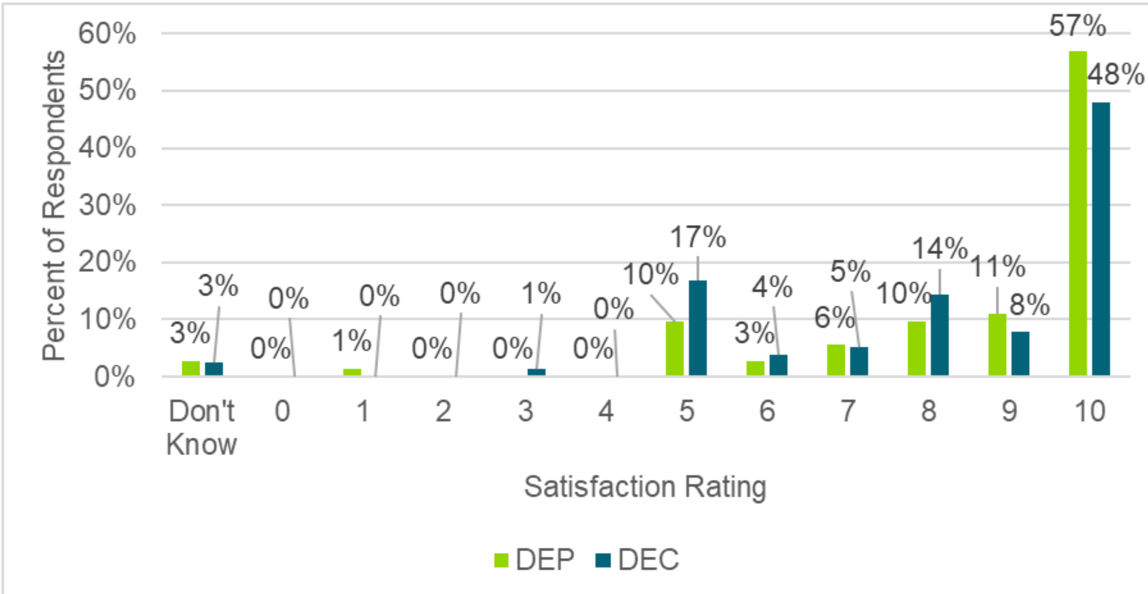
Figure 6. How Tenants Heard About the Program (n=149)



Source: Guidehouse analysis

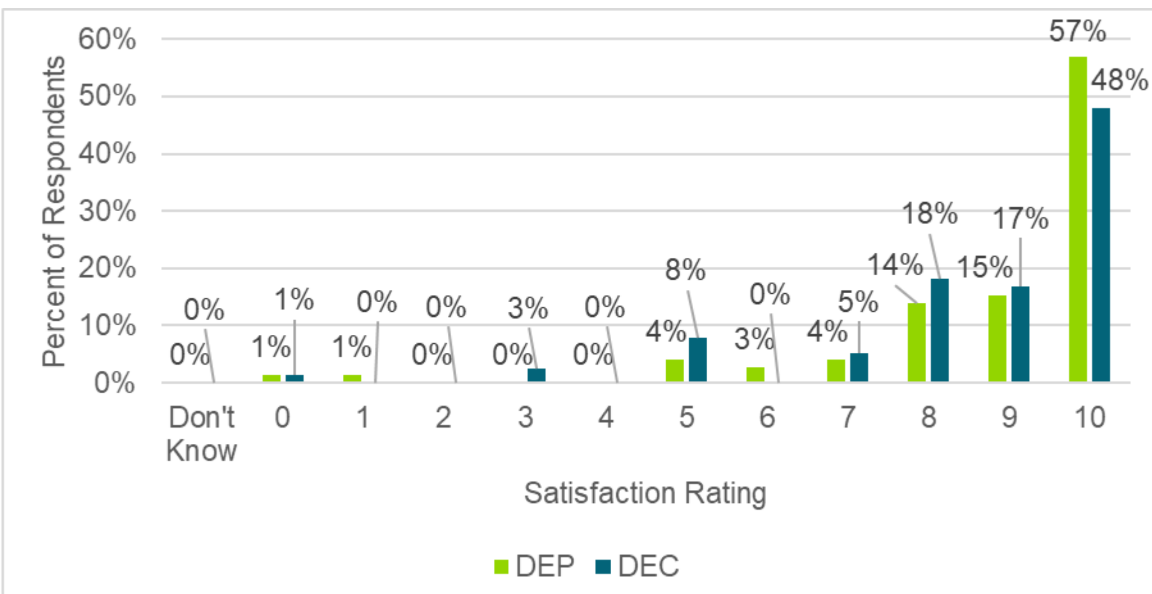
Survey results showed tenant satisfaction with the program is high. On a scale of 0 to 10, where 0 indicates "Not at all satisfied" and 10 indicates "Extremely satisfied," about three-fourths of the tenants rated satisfaction with the program as an 8-10 as shown in Figure 7. The average overall tenant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

Figure 7. Tenant Satisfaction with Duke Energy Multifamily Energy Efficiency Program (n=149)



Source: Guidehouse analysis

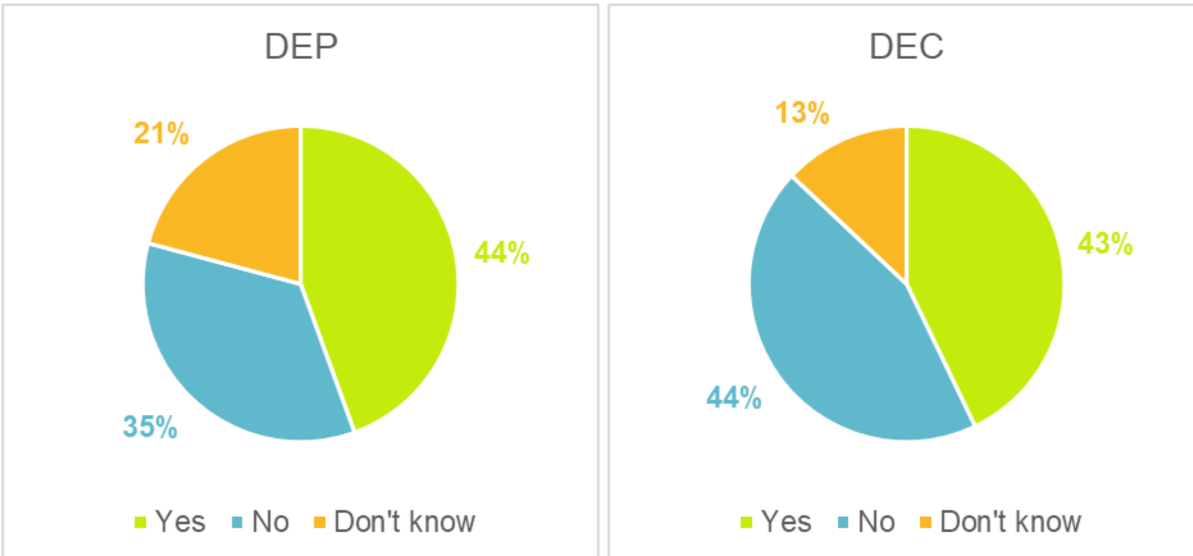
Figure 8. Tenant Satisfaction with Duke Energy (n=149)



Source: Guidehouse analysis

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

Figure 9. Tenants Who Noticed a Decrease in Their Energy Bill After Installing Program Measures

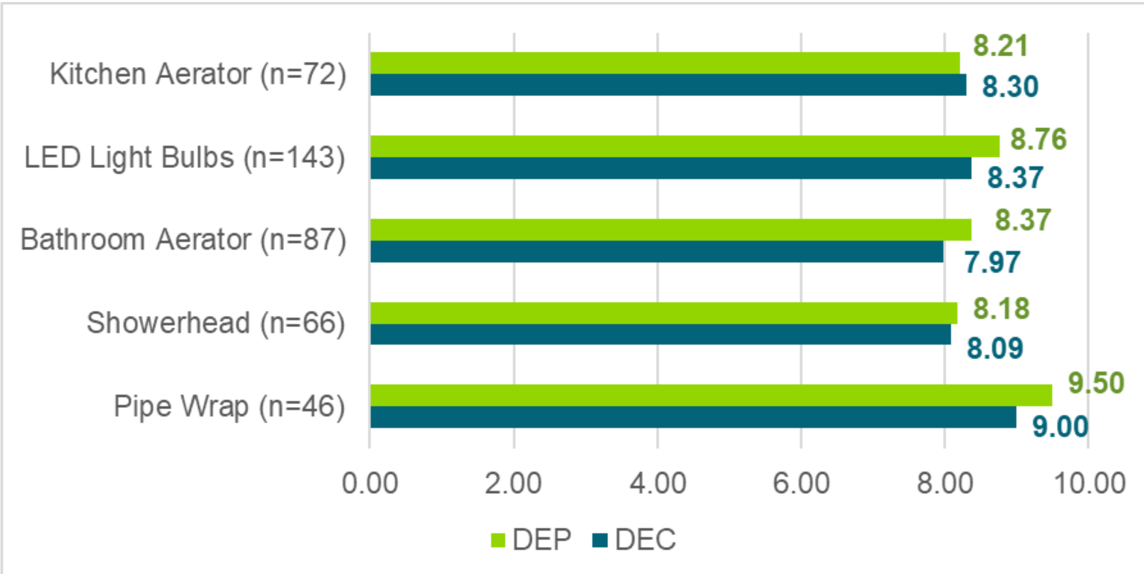


DEP – n = 72, DEC – n = 77

Source: Guidehouse analysis

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

Figure 10. Tenant Satisfaction with Program Measures



Source: Guidehouse analysis

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

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

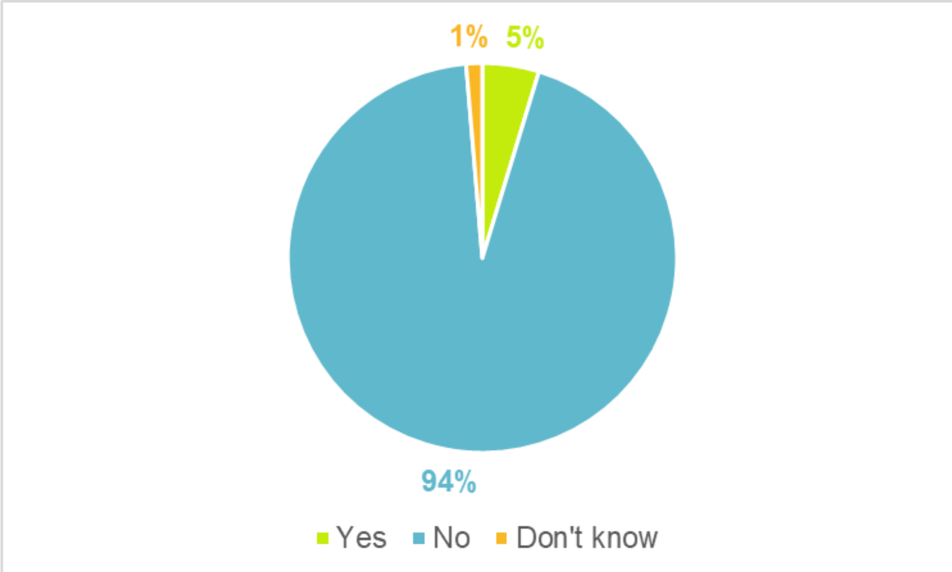
Table 6-1. Removed Measures – Tenant Survey

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

Source: Guidehouse analysis

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

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



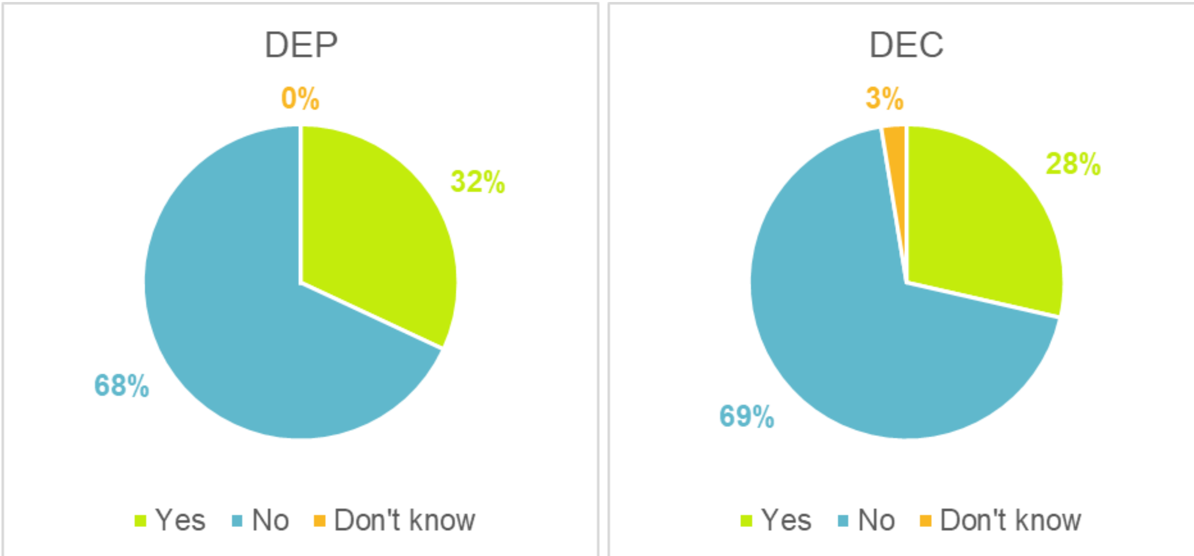
Source: Guidehouse analysis

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

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

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

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



DEP – n = 72, DEC – n = 77

Source: Guidehouse analysis

6.2.1 Participant Suggestions

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

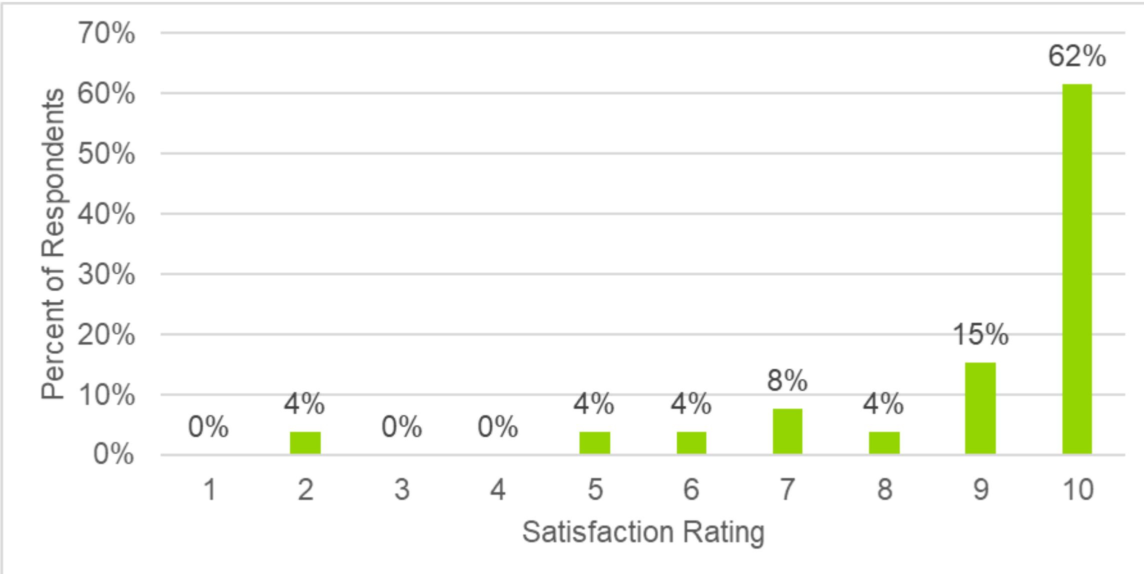
- Nine respondents recommended offering better quality equipment, specifically aerators and showerheads with stronger water pressure and longer lasting LED lamps.
- Two respondents recommended offering HVAC related measures through the program to reduce energy consumption during the cooling season. One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

6.3 Property Manager Interviews

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

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

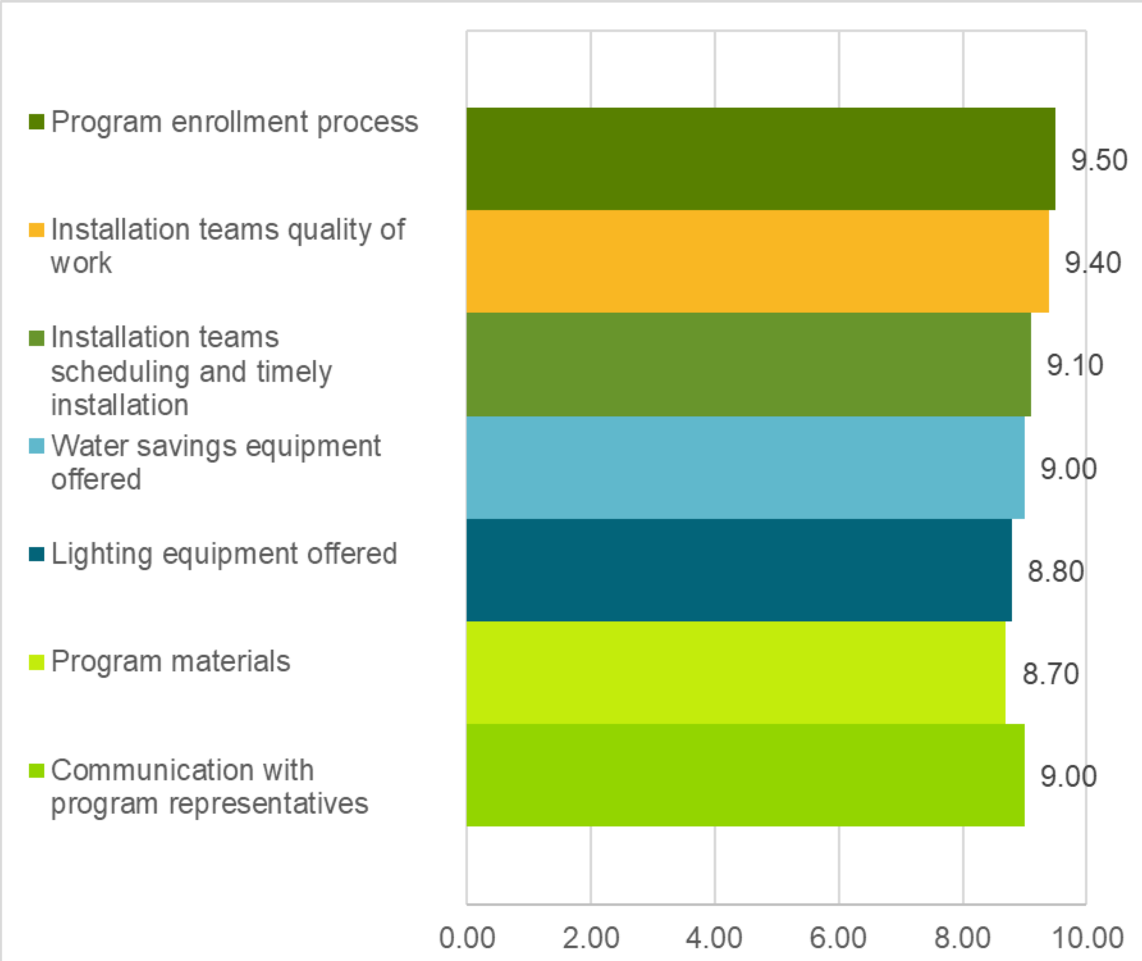
Figure 13. Property Manager Satisfaction with Overall Program Experience (n=26)



Source: Guidehouse analysis

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

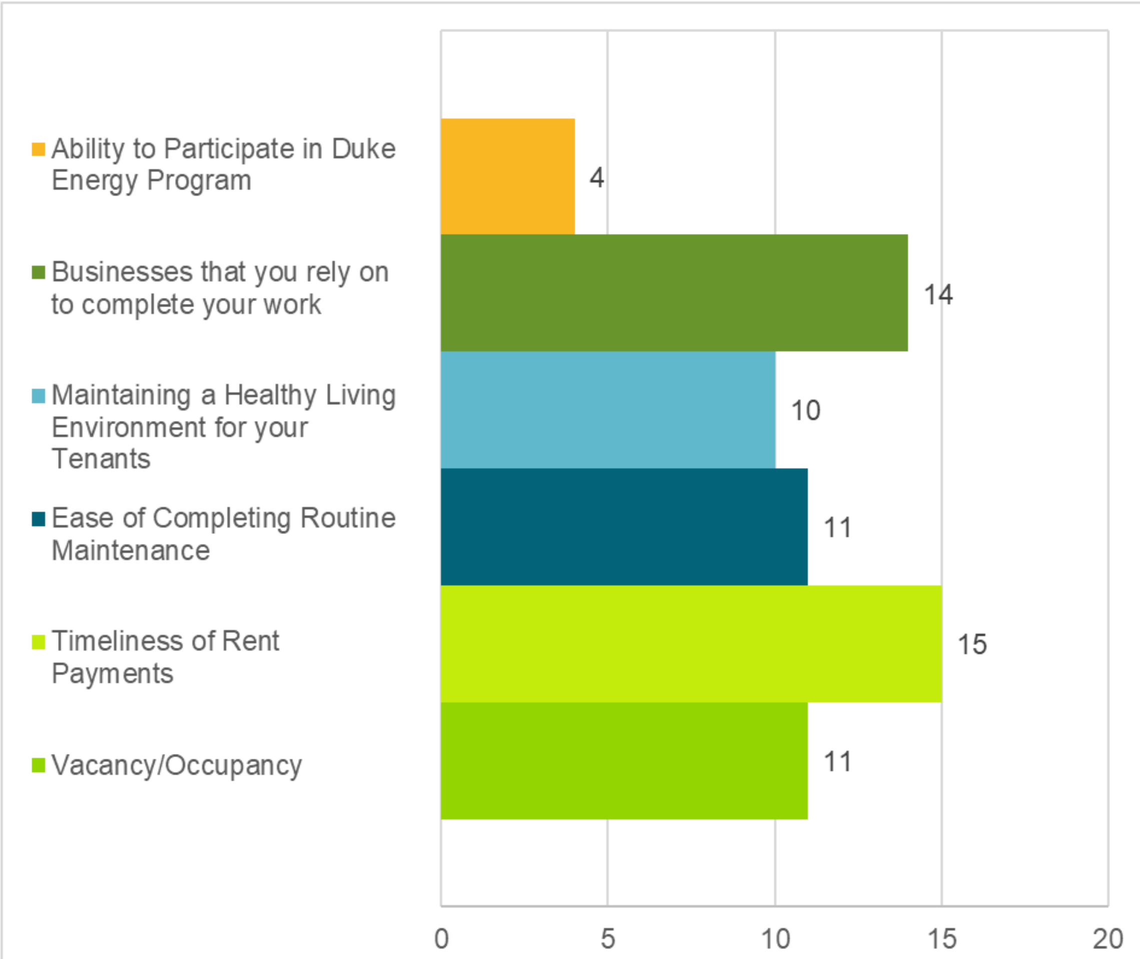
Figure 14. Property Manager Satisfaction with Program Aspects (n=26)



Source: Guidehouse analysis

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

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



Source: Guidehouse analysis

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

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

6.4.1 Interview with Duke Energy's Program Manager

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

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

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

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

6.4.2 Interview with Franklin Energy Implementation Staff

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

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

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

7. Conclusions and Recommendations

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

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

8. Summary Form

Multifamily Energy Efficiency Program

Completed EMV Fact Sheet

Description of program

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

The program consists of lighting and water measures.

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

Evaluation Methods

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

Impact Evaluation Details

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

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

9. Measure Level Inputs for Duke Energy Analytics

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

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

Table 9-1. Gross Measure Level Impacts

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

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

Source: Guidehouse analysis, values subject to rounding

Appendix A. Tenant Survey Guide

DUKE ENERGY MULTIFAMILY ENERGY EFFICIENCY PROGRAM
TENANT SURVEY

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

Company: ______________________________ Telephone: ____________________________
Name: _________________________________ Cell phone: ____________________________
Title: _________________________________ Fax: _________________________________
City: ____________________________ State: __________________ Zip: __________________
Interview date: ___________ Time: __________

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

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

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

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

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

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

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

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

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

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

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

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

S3. Is there anyone available who might know? (IF NOT AVAILABLE, SCHEDULE A CALL BACK).

1. Yes **[REPEAT S1 WITH NEW RESPONDENT TO CONFIRM MEASURES INSTALLED.]**
2. No
99. Refused

[IF S3 = 2 OR 99, THANK AND TERMINATE]
[FOR TERMINATIONS]: I thank you for your time and have a nice day.

===

NTG Survey: Res
Notes for Client:

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

===

PARTICIPATION and SATISFACTION

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

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

(DO NOT READ LIST. RECORD ALL MENTIONS.)

1. Through property manager
2. Duke Energy website

3. Participation in other Duke Energy Programs
4. I haven't heard of the program
5. Other (Please Specify)
98. Don't know
99. Refused

PS2. On a scale of 0 to 10, with 0 being "Not at all satisfied", and 10 being "Extremely satisfied", how satisfied are you with your **[INSERT MEASURE(S)]? [REPEAT FOR EACH MEASURE INSTALLED BY PARTICIPANT.]**

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

[IF PS2 < 5, ASK PS3]

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

____**[OPEN-END]**

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

PS4. Have you noticed any savings on your electric bill since the installation of your new **[INSERT MEASURE(S)]**?

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

PS5. Using a scale from 0 to 10, with 0 being "Not at all satisfied" and 10 being "Extremely satisfied", how satisfied are you with the Duke Energy Multifamily Energy Efficiency Program?

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

[IF PS5 = 0-10, ASK PS5A]

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

____**[OPEN-END]**

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

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

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

[IF PS6 = 1, ASK PS6A.]
PS6a. What are those suggestions? (RECORD VERBATIM. PROBE FOR CLARIFICATION.)
____**[OPEN-END]**

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

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

[IF PS7 < 5, ASK PS7A.]
PS7a. Why did you rate your satisfaction with Duke Energy a [INSERT ANSWER FROM PS10]? (RECORD VERBATIM.)
____**[OPEN-END]**

MEASURES

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

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

[IF M1 = 2 OR 98, SKIP TO IS1. OTHERWISE CONTINUE.]
M2. As I read the following measures, please tell me which ones you removed. Did you remove…(READ LIST. RECORD ALL MENTIONS)? **[INSERT MEASURE(S)] ONLY INCLUDE MEASURE INSTALLED IN THE UNIT.**
1. Bathroom faucet aerators
2. Kitchen faucet aerators
3. Low flow showerhead
4. Water heater pipe wrap
5. LED A-lamps
6. LED Globe lamps
7. LED Candelabras
8. LED Recessed lamps
9. LED Track Lighting lamps

10. (DO NOT READ) None were removed

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

M3. Please tell me the quantity of items you removed for each of the following. How many (READ LIST) did you remove? (INTERVIEWER: RECORD-QUANTITY FOR EACH MEASURE. USE "98" FOR DON'T KNOW AND "99" FOR REFUSED.) **[INSERT MEASURE(S)] ONLY INCLUDE MEASURE INSTALLED IN THE UNIT.**

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

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

M3_1a. You indicated that you removed bathroom faucet aerators. Why did you remove those items?
(RECORD VERBATIM.)
____**[OPEN-END]**

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

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

M3_2a. You indicated that you removed kitchen faucet aerators. Why did you remove those items?
(RECORD VERBATIM.)
____**[OPEN-END]**

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

M3_3a. You indicated that you removed low flow showerheads. Why did you remove those items?
(RECORD VERBATIM.)
____**[OPEN-END]**

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

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

M3_4a. You indicated that you removed water heater pipe wrap. Why did you remove those items?
(RECORD VERBATIM.)
____[OPEN-END]

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

M3_5a. You indicated that you removed LED light bulbs. Why did you remove those items?
(RECORD VERBATIM.)
____[OPEN-END]

M3_5b. From which rooms did you remove LEDs? (DO NOT READ LIST. RECORD ALL MENTIONS.)

1. Bathroom(s)
2. Bedroom(s)
3. Kitchen/Pantry
4. Living room/Family room/Den/Playroom
5. Home office
6. Laundry room
7. Exterior room (garage/patio/outdoor area)
8. Dining room
9. Hall
10. Other (Please Specify)

M4. How many LED light bulbs were installed in your home through the program? (USE "98" FOR DON'T KNOW AND "99" FOR REFUSED.)
1. _____[ENTER A NUMBER 1 TO 999]

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

M5_ 1. Regular Incandescent Bulbs (NOTE: Traditional light bulbs that look like an upside down pear. These are no longer being produced.)
M5_2. Halogen (NOTE: Usually found in outside or recessed lighting.)
M5_3. LEDs (NOTE: LEDs last longer than CFLs.)
M5_4. Compact Fluorescent Bulbs or CFLs (NOTE: These look like a spiral or "twisty.")
M5_5. Other (Please Specify)
98. Don't know

M6. What is the quantity of light bulbs you have in the other lights in your home? (RECORD QUANTITY FOR ALL
MENTIONS IN M4.)

M6_1. Regular Incandescent Bulbs ____________
M6_2. Halogen ____________
M6_3. LEDs ____________
M6_4. Compact Fluorescent Bulbs or CFLs ____________
M6_5. Other (Please Specify) ____________
98. Don't know

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

SPILLOVER (INSIDE SPILLOVER)

IS1. As a result of your experience with the program, did you purchase additional energy efficiency equipment for your home or adopt any energy efficient behavior for which you did not receive a rebate/discount from any other Duke Energy program? (FOR BELOMY: AS AN EXAMPLE, THIS COULD MEAN BUYING ADDITIONAL LED LAMPS OR TURNING OFF LIGHTS.)

1. Yes **[CONTINUE]**
2. No

98. Don't know
99. Refused

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

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

	Measure Description	Quantity
IS2a.	1.________________________________	2.______
IS2b.	3.________________________________	4.______
IS2c.	5.________________________________	6.______
IS2d.	7.________________________________	8.______
IS2e.	9.________________________________	10.______

IS3. Please briefly describe how the program has influenced your decisions to incorporate additional energy efficient items in your home that were not part of a program rebate. (RECORD VERBATIM.)
____**[OPEN-END]**

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

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

DEMOGRAPHICS AND ADDITIONAL FEEDBACK

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

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

1. Yes
2. No
98. Don’t know
99. Refused

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

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

____**[OPEN-END]**

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

____**[OPEN-END]**

DA2. How many bedrooms does your home have?

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

DA3. How many people live in your home?

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

COVID-19

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

1. Yes
2. No

3. Don’t know

[IF C1=1 ASK C2]
C2. Please describe how you are using energy in your home differently as a result of COVID-19
[RECORD VERBATIM]
____**[OPEN-END]**

[IF C1=1 ASK C3]
C3. Thinking of how COVID-19 has changed your home energy use, are there any tools or resources that Duke Energy could provide to help you?
[RECORD VERBATIM]
____**[OPEN-END]**

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

Appendix B. Property Manager Survey Guide

DUKE ENERGY MULTIFAMILY ENERGY EFFICIENCY PROGRAM
PROPERTY MANAGER SURVEY

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

Company: ____________________________ Telephone: __________________________
Name: ______________________________ Cell phone: __________________________
Title: _______________________________ Fax: _______________________________
City: ___________________________ State: _________________ Zip: ________________
Interview date: __________ Time: _________

Screening

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

[If S1 = 2 or 98, 99, TERMINATE. Otherwise, Continue]
[*FOR TERMINATIONS]*: This survey is for people who participated in Duke Energy's Multifamily Energy Efficiency Program during 2019 or 2020. Since you did not, these are all the questions I have at this time, and I thank you for your time.

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

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

S2a. I understand that the decision to install the **lighting and/or water equipment** may have been driven by someone other than yourself. However, if you had some involvement in the decision process to participate in the program, your input will be helpful. Are you somewhat familiar with the program participation and installation process?

1. Yes
2. No

98. Don't know
99. Refused

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

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

1. Yes [Gather correct contact information before terminating]
2. No [Terminate]

98. Don't know [Terminate]
99. Refused [Reassure participant prior to Terminating]

[If S2b = 1, Gather correct contact information before ending. If S2 = 2, 98 or 99, Terminate]
[*FOR ENDING*]: Thank you for providing us with this information and thank you for your time.
[*FOR TERMINATIONS]*: This survey is for people who participated in Duke Energy's Multifamily Energy Efficiency Program during 2019 or 2020. Since you did not, these are all the questions I have at this time, and I thank you for your time.

Survey Introduction

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

Participation and Satisfaction

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

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

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

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

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

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

____

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

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

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

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

____

PS10b. Can you tell me about any feedback that you have received from your tenants about their experience with the water equipment? [Probe to understand any improvements to aesthetics in the space, reduced energy bills, etc.] (RECORD VERBATIM)

PS11. When speaking to prospective tenants, do you highlight the energy efficient features of your units?

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

PS12. Are there other energy efficiency options you think the program should include? Some examples might be outdoor lighting solutions, heating and cooling solutions, programmable or smart thermostats (i.e. nests), electric vehicle charging stations, etc.? (RECORD VERBATIM)

Awareness Questions

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

A1. What was the primary 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, had you considered installing 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, had you considered installing 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 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. (USE "98" FOR DON'T KNOW. USE "99" FOR REFUSED.)

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

Own

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

____

Likelihood

L1. Given everything you've just told me, what is the likelihood that you would have installed the same energy efficient **lighting and/or water equipment** without the Duke Energy program and its financial and technical assistance? Would you say you … [READ LIST]?

1. Definitely would NOT have installed the same **lighting and/or water equipment without the Duke Energy program**
2. MAY HAVE installed the same **lighting and/or water equipment**, even without the Duke Energy program
3. Definitely WOULD have installed the same **lighting and/or water equipment,** even without the Duke Energy program

98. (DO NOT READ) Don't know
99. Refused

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

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

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

L2. Thinking about the quantity of lighting and/or water equipment you installed through the program, what is the likelihood that you would have installed the same quantity of the same measures without the program's financial and technical assistance? Would you say you … [READ LIST]

1. Definitely would NOT have installed the same quantity of the same **lighting and/or water equipment** without the Duke Energy program
2. MAY HAVE installed the same quantity of the same energy efficient **lighting and/or water equipment**, even without the Duke Energy program
3. Definitely WOULD have installed the same quantity of the same energy efficient **lighting and/or water equipment**, even without the Duke Energy program

98. (DO NOT READ) Don't know
99. Refused

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

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

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

L3. **[If L2 = 3, proceed to L3A. Otherwise, continue]**
Is there a chance you would have had at least some of the work done without the program?

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

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

L3a. Could you estimate the percentage of the work that you might have had done without the program? By percentage, I mean about what portion of the total energy efficient equipment would you have installed without the program _________%

L3b. On a scale of 0 to 10 where 0 is "DEFINITELY WOULD NOT have installed" and 10 is "DEFINITELY WOULD have installed", what is the likelihood you might have installed [INSERT L3A ANSWER] percent of the **lighting and/or water equipment** without the Duke Energy program? (USE "98" FOR DON'T KNOW. USE "99" FOR REFUSED.)

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

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

____

L4. Without the program, about when would you have installed the **lighting and/or water equipment**?
Would it have been… (READ LIST)?
1. At the same time as you did
2. Within 1 year of the time you did
3. Between 1 and 2 years within the time you did
4. Between 2 and 4 years within the time you did
5. Sometime after 4 years within the time you did
6. Would have never installed without the program

Spillover

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

IS1. Did your <u>experience with the program</u> 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 <u>not</u> receive a program rebate. [INTERVIEWER: RECORD MEASURE DESCRIPTION AND QUANTITY FOR EACH. AFTER EACH QUANTITY, ASK: Any others?]

Measure Description	Quantity
1.________________________________	________
2.________________________________	________
3.________________________________	________
4.________________________________	________
5.________________________________	________
6.________________________________	________

IS1b. Please briefly <u>describe how</u> the program influenced your decisions to incorporate <u>additional</u> 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 <u>experience with the program</u> in any way influence you to incorporate additional energy efficiency equipment where you did not receive a program rebate at any other properties managed by your company?

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

[IF IS2 = 2, SKIP TO P1]

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

____

Property Characteristics

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

P1. How many housing units does your property have?

1. Record Verbatim
98. Don't know
99. Refused

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

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

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

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

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

P4. Do you manage more than one property?

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

[IF P4 = 2, SKIP TO C1]

P4a. How many properties do you manage?

(RECORD NUMBER.)

____________________**[NUMBER]**

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

1. Individual Properties
2. Owner or Property Management Company
98. Don't know

COVID-19

The next few questions are about COVID-19 impacts.

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

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

For each yes, follow up and record verbatim.

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

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

[ASK IF C2=1]
C3. How are you using energy at your multifamily property differently as a result of COVID-19?
(RECORD VERBATIM)

[ASK IF C2=1]
C4. Thinking of how COVID-19 has changed your energy use at your multifamily property, what kind of energy efficiency tools or resources could Duke Energy provide to help you?
(RECORD VERBATIM)

Impact

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

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

1. Yes
2. No
98. Don't know
99. Other (Record verbatim)

IM2. Our records show that the following measures were installed at your property:
[Read list of measures with quantity > 0]

- LED Lamps
- Bathroom faucet aerator

- Kitchen faucet aerator
- Showerhead
- Water heater pipe wrap

Is this information correct?

1. Yes
2. No
98. Don't know
99. Other (Record verbatim)

IM3. I will now read out the total quantity of units installed for each measure that your property received. Could you please confirm if the quantity seems accurate based on your recollection of the program?

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

1. Yes
2. No
98. Don't know
99. Other (Record verbatim)

[Collect response for each measure installed]

Closing

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

____

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