# EM&V Report for the EnergyWise Home Demand Response Program

Winter 2020/2021

Prepared for:

**Duke Energy Progress**

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## Included as Separate Documents

### Appendix G: EM&V Sample Event-Day Load Profiles – Water Heaters

Filename: "*Appendix G – Water Heater EMV Sample Plots 2021-08-25.pdf*"

Description: Includes plots of average EM&V participant profiles and baselines on the 22 water heater EM&V event days, as well averaged across event day-types (coldest days, warmest days, middle temperature days).

### Appendix H: EM&V Sample Event-Day Load Profiles – Auxiliary Heat Strips

Filename: "*Appendix H – Aux Heat Strips EMV Sample Plots 2021-08-25.pdf*"

Description: Includes plots of average EM&V participant profiles and baselines on the 17 heat strip EM&V event days, as well averaged across event day-types (coldest days, warmest days, middle temperature days).

### Appendix I: Output Summary

Filename: "*DEP EnergyWise Winter 2020_2021 Appendix I - Output Summary 2020-10-04.xlsx*"

Description: Includes all modeling outputs and graphics referred to in the report below.

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# Evaluation Summary

The EnergyWise Home (EnergyWise) demand response (DR) program offers Duke Energy Progress (DEP) residential customers the opportunity to earn credits on their electricity bill by allowing DEP to remotely cycle and curtail air conditioners (A/C) during times of peak seasonal load in the summer months (available system wide) and space- and water-heating equipment in winter months (Western region customers only).

This report covers the evaluation, measurement, and verification (EM&V) activities for the winter of 2020/2021. For this evaluation, Guidehouse evaluated program impacts using whole-home quarter-hourly interval data provided by DEP's Advanced Metering Infrastructure (AMI). This is the first winter evaluation for which AMI data have been used and the first DEP EnergyWise evaluation in any season in which *only* AMI data have been used.[1] In addition to estimating average program impacts, for this evaluation cycle Guidehouse conducted a process evaluation, analyzing participant responses to survey data regarding their satisfaction with the program and with Duke energy, and their perceived comfort during demand response events. Guidehouse also conducted an interview with members of the EnergyWise program team to collect feedback about operational activities and goals.

At the start of the winter 2020/2021 DR season, the program had 13,009 participants eligible for winter curtailment in DEP's Western region, representing approximately 11,498 controlled water heaters and 6,737 sets of heat pump auxiliary heat strips. DEP called 22 water heater and 17 heat strip EM&V events that applied only to a sample of 863 participants, known as the "EM&V sample". There were no program-wide winter DR events in the winter of 2020/2021.

Table ES - 1, below presents a summary of average impacts: ex ante and ex post impacts. Ex ante impacts represent the projected program capability at design conditions: 10 degrees Fahrenheit (heat strips) and between 7:30am and 8:30am Eastern prevailing time (water heaters). Ex post impacts represent the average estimated impact (per participant and per appliance) across all hours of all EM&V events deployed during the winter of 2020/2021. Note that for the ex ante capability rows of the table below, the "Total Program Impact (MW)" is the program capability, obtained as the product of the impact per appliance estimated for the EM&V sample times the total program population. No program impact is provided for the ex post estimates as no program-wide events were called in the winter of 2020/2021.

[1] The summer 2019 evaluation estimated impacts using both AMI and logger data, comparing both sets of results side-by-side. In that evaluation the impacts estimated using the whole-house AMI data were found to not be statistically significantly different from those estimated using the appliance-specific logger data.

**Table ES - 1. Summary of Impacts**

| | Appliance Type | Cycling Strategy | Impact per EM&V participant (kW) | Relative Precision +/-% (90% Confidence) | Impact per Appliance (kW) | Total Program Impact (MW) |
|---|---|---|---|---|---|---|
| Projected Capability (Ex Ante) | Heat Strips | 100% | 0.43 | 32% | 0.41 | 2.8 |
| | Water Heaters | 100% | 0.26 | 17% | 0.25 | 2.9 |
| Average Impact – Winter 2020/2021 (Ex Post) | Heat Strips | 100% | 0.21 | 9% | 0.20 | N/A |
| | Water Heaters | 100% | 0.22 | 16% | 0.21 | N/A |

*Source: Guidehouse analysis*

These estimated capability values are lower (in the case of the auxiliary heat strips considerably lower) than the ex ante program capability projected as part of the winter 2017/2018 evaluation. Unfortunately, a confluence of potential causal factors makes it impossible to conclusively demonstrate in this report the primary factor driving this result.

Guidehouse believes that the number of offline paging towers during the DR season is most likely to be the primary cause of the reduced water heater impacts. In the case of heat strips, field verification evidence from a small sample of participants suggests that in addition to paging issues, switch condition was also a major driving factor. Duke Energy field verification of heat strip switches noted that a very high proportion appeared to have been disabled by the customer or else improperly installed.

The evidence for the conclusion that paging issues were a major contributor to reduced impacts is compelling, but not conclusive and, in an effort to ensure transparency, Guidehouse has spelled out all the various hypotheses developed by the evaluation and DEP program teams to explain this result. Each hypothesis is presented along with the evidence for (or against) it, and Guidehouse's interim conclusion on the basis of this evidence. These hypotheses and conclusions are summarized further below in this Executive Summary and described in greater detail in section 3.3.3 of this report.

## *Evaluation Objectives*

The key objectives of the impact analysis include:

1. **Estimating demand response impacts (kW).** Guidehouse has estimated the average impact of curtailment by equipment type, per participant, for every quarter-hour of each event to which EM&V participants are subject.
2. **Estimating the program-level DR capability per population-wide event.** No program-wide DR events were called in the winter of 2020/2021, so there are no program-wide ex post impacts to estimate.

3. **Estimating hourly kW snapback impacts.** Guidehouse has estimated the average kW snapback[2] impact for all EM&V events.
4. **Estimating average event load shed capability (ex ante impacts).** Guidehouse has applied the regression-estimated impact parameters to a range of event temperatures to deliver a projected load shed under a variety of weather conditions. As in previous years' evaluations, this is presented graphically in the body of the report. The values underlying this plot will are also included in Appendix I, the spreadsheet that accompanies this report.
5. **Providing a clear technical description of the analytic approach.** Although not an output of the analysis itself, Section 2.1 and Appendix A provide a clear explanation of the approach such that the results may be reasonably reproduced by a qualified third party provided with the same data.

The key objectives of the process analysis include:

1. **Assessing participants' satisfaction with Duke Energy and the EnergyWise program.** Guidehouse administered online surveys to a sample of participants and has reported on the results below.
2. **Assess the degree to which customer comfort is impacted by curtailment.** Guidehouse deployed post-event surveys and one "placebo[3]" post-event survey to evaluate participant comfort during winter DR events and has reported on the results below.
3. **Evaluate program delivery and achievements relative to Duke Energy's goals.** Guidehouse performed a phone interview with the EnergyWise program team to collect feedback about operational activities and goals and has provided a summary of the most salient information and insights gained as part of this process in the report below.

In addition to the objectives above, when it became apparent that estimated impacts for the winter 2020/2021 evaluation period were substantially lower than those estimated in prior years, Guidehouse adopted an additional impact evaluation objective. This objective was to develop a suite of hypotheses that might explain the lower-than-expected estimated impacts and to test these hypotheses with as much rigor as possible, given the evaluation timelines and data availability. The ultimate objective was to identify the most likely driver of this unexpected result in as transparent and reproducible a manner as possible.

## *Impact Evaluation Methods*

Guidehouse's impact evaluation approach includes three components:

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[2] Snapback refers to the manner in which demand from water heaters or HVAC systems tends to rise considerably above normal levels in the period immediately following a DR event as the equipment works to restore water or air temperature to its set-point level. Snapback impacts are not included in the body of the report, but may be found as tables and figures in Appendix I, the spreadsheet appendix that accompanies this report.

[3] A survey deployed on a given date may be a placebo to some respondents, but not to others. For example, if an EM&V participant responds to the survey after an EM&V only event, it is a "real" survey for that participant, but a placebo survey for a participant not included in the EM&V group.

- Sample Selection and Experimental Design
- EM&V Regression Estimation
- Comparison of Winter 2020/2021 with Winter 2017/2018 Impacts

## Sample Selection and Experimental Design

The estimated impacts presented in this evaluation report are based on a sample of participants from the overall population that were randomly chosen.[4] DEP did not call a population-wide event during the season so this sample of participants was subjected to EM&V events to provide Guidehouse with data points from which impacts could be estimated.

Based on lessons learned in previous evaluations, auxiliary strip heat customers were over-sampled to target improved confidence and precision of the regression. As in all previous evaluations since 2016, Guidehouse worked with DEP to carefully select EM&V events to maximize the value of information they provided for the estimation of program capability and used a robust experimental design to ensure estimates of impacts are unbiased. In this case the experimental design requires that for any given EM&V event only half of the EM&V sample are curtailed, ensuring a contemporaneous control group for all events.

## EM&V Regression Estimation

As in previous years, impacts were estimated through the use of panel data fixed-effects regression.

## Comparison of Winter 2020/2021 with Winter 2017/2018 Impacts

The most significant finding of the winter 2020/2021 evaluation of the EnergyWise Home program is the degree to which estimated impacts are much lower than in prior years.

Table ES - 2, below, provides the average estimated ex post impact of water heater impacts from prior years. These events started as early as 6am and ended as late as 10am, though the vast majority took place no earlier than 6:30 or no later than 9:00.

**Table ES - 2. Comparison of Average Ex Post Water Heater Impacts from Prior Evaluations**

| Evaluation Year | Estimated Average Impact Per Water Heater (kW) |
|---|---|
| 2011/2012 | 0.42 |
| 2014/2015 | 0.40 |
| 2017/2018 | 0.41 |
| *2020/2021* | *0.21*[5] |

*Source: Guidehouse analysis*

[4] The randomized sample of customers received a postcard with details on the study and instructions on how to opt out. Approximately 2% of contacted customers chose to opt out of the study.

[5] See Table ES - 1 above (in the Executive Summary) or Table 3-1 below.

Water heaters are subject to very few factors that could confound estimation: patterns of use tend to be highly consistent day-to-day (and year to year), there exist no auxiliary technologies with any kind of material penetration (i.e., the water heater is typically the home's only source of domestic hot water), and appliance efficiencies (driven by stand-by losses) have barely changed over the last decade.

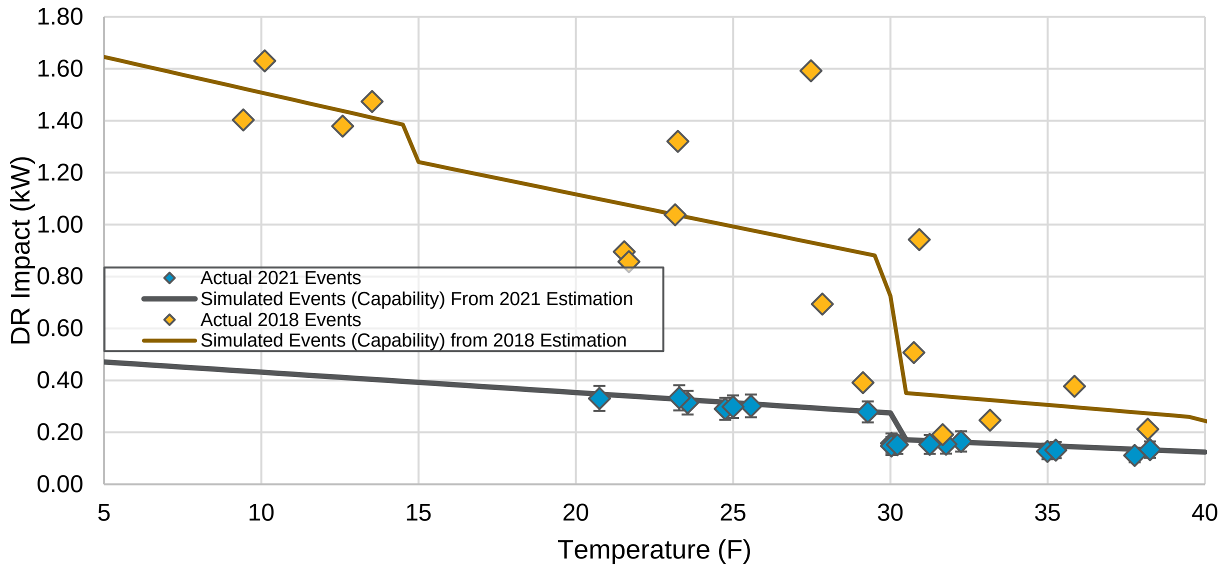
Heat strip impacts, unlike water heaters, have been much more variable in prior evaluations. This is due to fluctuation in responsiveness and impact, both of which change with respect to temperature. When temperatures are sufficiently warm, heat strips will not be in use, so responsiveness and impacts will be very low. Impacts increase as temperature decreases; however, when temperatures are very cold, partial responsiveness increases due to the appliance's emergency defrost capability overriding curtailment (see Section 3.3 of the 2017/2018 evaluation report[6]). For reference, during the two of the coldest events of the 2017/2018 (January 2 and 5, 2018) over 40% of switches were not responsive to Duke Energy's curtailment signal and delivered no DR (see Table 3-4 of the 2017/2018 report).

A comparison of heat strip capability can be seen Figure ES - 1 below. This plot shows the average event impact (kW) and temperature (Fahrenheit) pairs from the 2017/2018 and 2020/2021 evaluation per appliance. The line indicates the estimated capability per appliance at a range of different temperatures. Note the observable change in relationship between temperature and impact between evaluations. A table of values that includes all the data points shown in this plot may be found in Appendix I, the spreadsheet appendix that accompanies this report. The 2017/2018 values on this chart reflect the responsiveness rates estimated in that evaluation[7], ensuring the comparison across the two years is "apples-to-apples".

[6] Navigant (n/k/a Guidehouse) Presented for Duke Energy Progress, *EM&V Report for EnergyWise Home Program – Winter 2017/2018,* August 2018 – see pdf page 295/447:
https://starw1.ncuc.net/NCUC/ViewFile.aspx?Id=bf5a0379-5789-4457-99bc-8e71ac76e96f

[7] The capability chart presented in the 2017/2018 report showed the capability only of fully or partially responsive switches, the capability of which was then de-rated to reflect non-responsive rates for the reporting of program impacts. To ensure an appropriate comparison across the years, the 2017/2018 capabilities have been de-rated to reflect the non-responsive rates estimated as part of that evaluation.

**Figure ES - 1: Comparison of Heat Strip Capability – Winter 2017/2018 and Winter 2020/2021**




*Source: Guidehouse analysis*

The significantly reduced impacts estimated here are not just natural year-over-year fluctuations, but the result of some step-change in the program operating conditions. This is a matter of great concern to Guidehouse and to Duke Energy, particularly as it has been, to this point, impossible to conclusively identify the cause. The key driver of this uncertainty is the coincidence of a number of significant exogenous changes, any one of which could a contributing (or the primary) cause of these reduced impacts. The most significant of these changes are: the effect of the COVID-19 pandemic on participant behavior, the significantly reduced signal strength in Duke Energy's paging network due to outages (some directly attributable to COVID public health restrictions[8]), the length of time since the last full empirical evaluation, and the shift from evaluation using appliance-specific logger data to whole-home AMI data.[9]

At present, Guidehouse has concluded that *the most likely principal driver of reduced impacts for water heaters in the 2020/2021 winter is the set of paging tower failures* for which remediation, due to questions of public health and security of access, was outside of Duke Energy's control and could not be applied until after the end of the DR season. Additionally, field verification conducted by Duke Energy has confirmed that in addition to the paging network issues, it appears as though a very high proportion of heat strip switches were disabled by participants or never installed properly. More detailed discussion and additional supporting figures can be found in Section 3.3, and the outputs of Duke Energy's field verification may be found in Appendix F

Given the above, Guidehouse recommends that Duke Energy consider (following the remediation of paging tower problems) conducting another full econometric evaluation of the

[8] The paging site located at the Mission St. Joseph Hospital in Asheville was not operational for the 2020/2021 DR season, but no remedial action was possible due to public health measures restricting access to the hospital.

[9] More specifically, under certain circumstances the use of secondary electric room heaters could "take back" some of the DR impacts, an effect that would be apparent only in whole-home AMI data, and not appliance-specific logger data.

program again in winter 2021/2022 rather than waiting until winter 2022/2023 to do so, as originally planned.

Should Duke Energy consider moving forward in time the next winter evaluation, Guidehouse would also recommend that Duke Energy consider deploying data loggers to a sub-sample of the larger EM&V sample to enable a robust comparison of the estimated impacts delivered by the two approaches, as was done for the summer 2019 evaluation.

## *Process Evaluation Methods*

The process analysis is driven by data collected from a series of online fielded to a sample of EnergyWise participants immediately following DR events and a placebo event where no real event was called. Guidehouse's process findings were driven by an analysis of these survey responses.

The evaluation team conducted post-event phone surveys with 257 EnergyWise participants during this study. The surveys were conducted after three real DR events and one placebo event. For the placebo event, respondents were told that an event had been called when in fact one had not.

Of the 257 total survey respondents, 57 were surveyed after actual DR events; the remaining 200 were surveyed after the placebo event.

Analysis of these participant perception surveys was intended to determine the degree to which participants were aware of curtailment events, and if aware, what changes participants noticed during the event, including perceptions of comfort.

## *Findings and Conclusions*

The principal EM&V impact findings and conclusions regarding the winter event demand impacts for 2020/2021 are as follows:

- **Estimated impacts are much lower than in prior years, likely because of an increase in individual device non-responsiveness.** Estimated water heater impacts are on average only slightly more than half of what they were in the prior three most recent full econometric evaluations, and heat strip impacts are less than a quarter of what was estimated in the 2017/2018 impact evaluation. This difference in impact reductions across the two appliance types could be explained by a proportionate increase in device non-responsiveness; the 2017/2018 evaluation found that, on average, 5% of water heaters failed to respond to the DR curtailment signal and 26% of heat strips failed to respond.

- **The estimated average impact of the Winter 2020/2021 EM&V water heater events was 0.22 kW per participant, or 0.21 kW per appliance.** This is the average of the estimated impacts across 22 100% cycling events taking place between 6:30 and 8:30 in the morning.

- **The estimated average impact of the six coldest Winter 2020/2021 EM&V heat strip events was 0.31 kW per participant, or 0.30 kW per appliance.** The average temperature across these events was 24 degrees Fahrenheit and the lowest observed temperature was 21 degrees Fahrenheit. This is, to date, the warmest minimum temperature event evaluated for this program since Guidehouse first began evaluating the program in the winter of 2011/2012.

- **The current DR capability of DEP's EnergyWise program in the winter is approximately 5.7 MW**. This is the sum of the projected capability of 2.8 MW from heat strip curtailment when the average temperature is 10 degrees Fahrenheit (0.41 kW per appliance) and 2.9 MW from water heater curtailment deployed between 7:30 and 8:30 in the morning (0.21 kW per appliance). These capability values are, as noted above, considerably lower than in prior evaluation years, and may be due to transitory effects outside of Duke Energy's control. If it can be demonstrated (e.g., via testing in the winter of 2021/2022) that remedial action has been successful at restoring prior capabilities, Duke Energy should base its planning on the capabilities projected as part of the 2017/2018 evaluation or on (if available) updated capability estimates.
- **Guidehouse believes that the most significant single driver of reduced program impacts and capability for water heaters was the poor health of the Duke paging network during the 2020/2021 DR season.** During three-quarters of the DR events dispatched in the DR season of 2020/2021 60% or less of the Western region paging towers were online. This was a result both of COVID public health restrictions (preventing maintenance of the tower located in a hospital) and due to damage to the satellite receiver. The paging provider did not service the site because two-way monitoring of the site was off-line and no operational alerts could be communicated. A secondary contributing factor may have been a shift in participant behavior due to COVID; a comparison of pre-COVID and winter 2021 water heater only participant load profiles reveals differences that are consistent with a shift to later showering, which could materially reduce water heater DR capability.
- **Field verifications conducted by Duke Energy indicate that the proportion of heat strip switches that are disconnected (unable to curtail) has also increased quite substantially in the four years since the 2017 field work.** None of the 46 switches examined by the field verification staff was found to be without problem. The vast majority of issues uncovered were that the customer had disabled the switch (48% of cases) or that it had been incorrectly installed (33% of cases). The reduced program capability due to the high proportion of non-functioning devices is compounded by the paging network issues above, which would mean that curtailment would be erratic even when the switch was fully functional. In addition, Guidehouse has identified the possibility that heat strip DR impacts may have been affected by participant use of secondary (room-specific) space heating. Under certain circumstances (detailed in the report) erosion, or "take-back", of auxiliary heat strip impacts as a result of participants' use of secondary (room) space heaters is possible, though Guidehouse believes it is improbable that such circumstances would be observed sufficiently often to significantly affect DR impacts.

The principal EM&V findings from the analysis of participant perception were as follows:

- **Participants were generally unaware of curtailment events when they happened.** Most (91%) survey respondents indicated that they had not been aware that an event had occurred recently.
- **The program has little impact on the comfort of its participants.** Only 6 respondents (out of 57 event participants) were aware that an event had been called during the period in question. Most survey respondents indicated that they were "very comfortable" or "neutral" during the event.
- **The program does not appear to be a key driver of supplemental heating use.** A similar portion of placebo survey respondents reported using supplemental methods for

heating their homes during “event” periods as those respondents who were subject to actual events.

- **Participants were generally satisfied with the EnergyWise program.** Over half of the respondents indicated that they were very satisfied, while only 5% of all survey respondents (10 people) indicated that they were “dissatisfied” with the program. Satisfaction with the program did not differ significantly between respondents who responded to actual events versus those who responded to placebo events.
- **Fewer than half of participants were aware of the bill credits they receive as part of their program participation.** Every customer enrolled in the program receives a hardcopy brochure explaining the bill credits details (when they are received, amounts, etc.), however less than half (45%) of participants reported they noticed the credits on their bill.

# 1.0 Introduction

The EnergyWise program provides residential customers the opportunity to earn credits on their electricity bill by allowing DEP to remotely cycle air conditioning (in the summer) and curtail water heater and heat pump auxiliary heating strips (in the winter, Western region customers only) during times of seasonal peak load. This report covers the evaluation, measurement, and verification (EM&V) activities for the winter of 2020/2021. At the start of the winter 2020/2021 DR season, the program had over 13,000 participants eligible for winter curtailment in DEP's Western region, representing approximately 11,498 controlled water heaters, and 6,737 sets of heat pump auxiliary heat strips.

EM&V refers generally to the assessment and quantification of the energy and peak demand impacts of an energy efficiency or DR program. For DR, estimating reductions in peak demand is the primary objective, as energy impacts are generally negligible. EM&V can also encompass an evaluation of program processes and customer feedback typically conducted through participant surveys. The winter 2020/2021 EM&V cycle included a process evaluation that examined both customer comfort and attitudes (via surveys) as well as collecting program staff insight (via an interview).

Guidehouse estimated impacts using quarter-hourly AMI data from a sample of 864 participating households (the EM&V sample). Participating households were split randomly into two separate samples and only one group was curtailed for each of the 22 water heater EM&V and 17 auxiliary heat strip curtailment events called by DEP throughout the winter. These groupings are referred to as Group A and Group B throughout this report. In the winter of 2020/2021, the overall EnergyWise program population was not subject to any DR events.

## *1.1 Objectives of the Evaluation*

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

The key objectives for the impact analysis conducted as part of this evaluation were identified in Guidehouse's evaluation plan; these include the following:

1. **Estimating demand response impacts (kW).** Guidehouse has estimated the average impact of curtailment by equipment type, per participant, for every quarter-hour of each event to which EM&V participants are subject.
2. **Estimating the program-level DR impacts per population-wide event.** No program-wide DR events were called in the winter of 2020/2021, so there are no program-wide ex post impacts to estimate.
3. **Estimating hourly kW snapback impacts.** Guidehouse has estimated the average kW snapback[10] impact for all EM&V events.

[10] Snapback refers to the manner in which demand from water heaters or HVAC systems tends to rise considerably above normal levels in the period immediately following a DR event as the equipment works to restore water or air temperature to its set-point level. Snapback impacts are not included in the body of the report, but may be found as tables and figures in Appendix I, the spreadsheet appendix that accompanies this report.

4. **Estimating average event load shed capability (ex ante impacts).** Guidehouse has applied the regression-estimated impact parameters to a range of event temperatures to deliver a projected load shed under a variety of weather conditions. As in previous years' evaluations, this is presented graphically in the body of the report. The values underlying this plot will are also included in Appendix I, the spreadsheet that accompanies this report.
5. **Providing a clear technical description of the analytic approach.** Although not an output of the analysis itself, Section 2.1 and Appendix A provide a clear explanation of the approach such that the results may be reasonably reproduced by a qualified third party provided with the same data.

The key objectives of the process analysis include:

1. **Assessing participants' satisfaction with Duke Energy and the EnergyWise program.** Guidehouse administered online surveys to a sample of participants and has reported on the results below.
2. **Assess the degree to which customer comfort is impacted by curtailment.** Guidehouse deployed post-event surveys and one "placebo[11]" post-event surveys to evaluate participant comfort during winter DR events and has reported on the results below.
3. **Evaluate program delivery and achievements relative to Duke Energy's goals.** Guidehouse performed a phone interview with the EnergyWise program team to collect feedback about operational activities and goals and has provided a summary of the most salient information and insights gained as part of this process in the report below.

In addition to the objectives above, when it became apparent that estimated impacts for the winter 2020/2021 evaluation period were substantially lower than those estimated in prior years, Guidehouse adopted an additional impact evaluation objective. This objective was to develop a suite of hypotheses that might explain the lower-than-expected estimated impacts and to test these hypotheses with as much rigor as possible, given the evaluation timelines and data availability. The ultimate objective was to identify the most likely driver of this unexpected result in as transparent and reproducible a manner as possible.

## *1.2 Program Overview*

The EnergyWise program was developed in response to DEP's determination that a curtailable load program would be a valuable resource for the company and that it would provide an opportunity to engage directly with customers to help reduce costly seasonal peak demand. The program seeks to attract DR by incenting residential customers to allow DEP to remotely control water heater and heat pump auxiliary heating strips in the winter months.

[11] A survey deployed on a given date may be a placebo to some respondents, but not to others. For example, if an EM&V participant responds to the survey after an EM&V only event, it is a "real" survey for that participant, but a placebo survey for a participant not included in the EM&V group.

The program offers an annual bill credit of $25 (per appliance type controlled) to customers that choose to allow DEP to cycle their central air conditioners (summer only), electric auxiliary heat strips, and/or water heaters (winter only).

**Eligibility.** To be eligible for participation in the winter component of the EnergyWise program, a household must meet the following criteria:

- **Auxiliary Heat Strip Participants:**
    - The participant's home must use a centrally ducted heat pump with resistive strip heat for space heating. Wall, window, and ductless units are not eligible for participation.
    - All central heat pump units in the home must be controlled by DEP as part of the EnergyWise program.
- **Water Heaters Participants:**
    - The participant's home must use an electric storage water heater for domestic hot water service.
- **All Participants:**
    - Residential electricity service must be in the name of the participant.

**Incentives.** Each participant receives a $25 yearly bill credit upon joining the summer program, and then an additional $25 bill credit every 12 months they remain on the program.

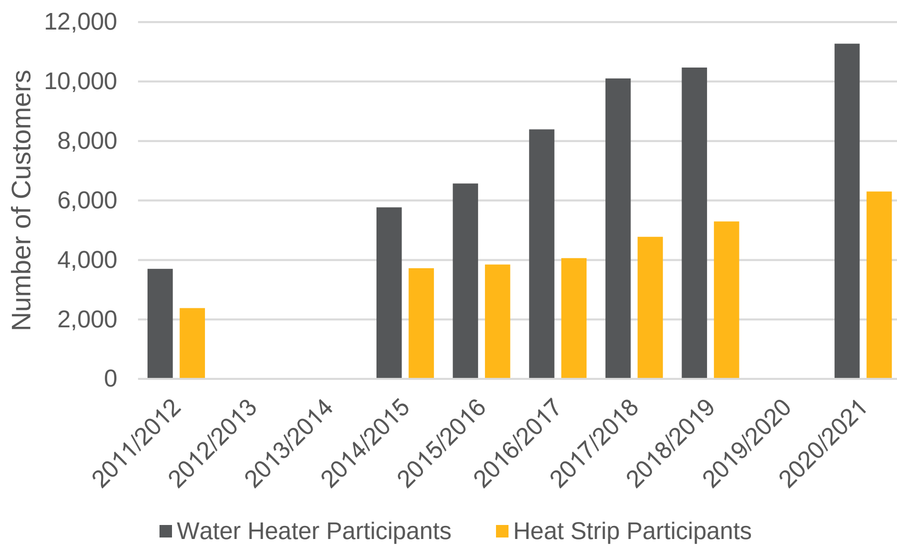
**Marketing.** DEP is responsible for all marketing of the EnergyWise program. Participant enrollments are generated through a mix of direct mail, bill inserts, email, outbound calling, and door-to-door canvassing.

## *1.3 Reported Program Participation*

This section reports the overall program participation for the winter EnergyWise program in the winter of 2020/2021. In total, at the beginning of the DR season, approximately 11,276 water heater participants and 6,300 heat strip customers were enrolled in the program and eligible for curtailment.

Since the winter of 2011/2012, program growth has been tapering off with a compound annual growth rate of approximately 13% for water heater participants and 11% for heat strip participants (see Figure 1-1).

**Figure 1-1. Historical EnergyWise Winter Participation[12]**




*Source: DEP*

Altogether the 11,276 water heater participants that were enrolled at the start of the winter 2020/2021 DR season have a total of 11,498 water heaters enrolled, or approximately 1.02 per participant. The 6,300 heat strip participants that were enrolled at the start of the winter 2020/2021 DR season have a total of 6,737 auxiliary heat strips enrolled or approximately 1.07 per participant. These ratios have not changed meaningfully over time; the average number of water heaters per water heater participant from the winter of 2015/2016 through the winter of 2017/2018 was 1.02. The average number of heat strips per heat strip in the same period was 1.08.[13]

## *1.4 Prior Year Evaluations*

Guidehouse (formerly Navigant)'s full econometric evaluations[14] of the EnergyWise Home program for prior years are available online and can provide valuable context for the current evaluation. The locations of these evaluations are provided below.

- Winter 2011/2012

  https://starw1.ncuc.net/NCUC/ViewFile.aspx?Id=c238437c-be5b-46f9-815c-71a0a5d9a52b

- Winter 2014/2015 (pdf page 67/266)

[12] The winters of 2012/2013, 2013/2014, and 2019/2020 were not evaluated so participant numbers are not available. For the winter of 2018/2019 only device counts (rather than participant numbers) were reported. Participant numbers in this year were estimated by applying the average number of devices per participants to the appliance counts reported in that year.

[13] Evaluations reported both number of participants and device count by appliance type only in these three years.

[14] Historically evaluations have alternated between full econometric evaluations, in which impacts are estimated by applying regression analysis to demand data collected from participants, and smaller scale evaluations that have applied the regression parameters estimated in the most recent prior evaluation to the event conditions observed in the given year.

https://starw1.ncuc.net/NCUC/ViewFile.aspx?Id=e8e0cdea-897f-4608-9cd9-924791146 14a

- Winter 2017/2018 (pdf page 295/447)

  https://starw1.ncuc.net/NCUC/ViewFile.aspx?Id=bf5a0379-5789-4457-99bc-8e71ac76e96f

# 2.0 Evaluation Methods

This chapter of the evaluation report provides a description of the approaches used to conduct the impact evaluation. Additional technical details of the approach used may be found in Appendix A.

Guidehouse estimated demand reduction and snapback impacts using a fixed effects regression analysis applied to quarter-hourly participant interval data drawn from DEP's AMI system, weather data, and data flags indicating the intervals in which events took place. The remainder of this chapter details the data and the econometric method used in the analysis.

## *2.1 Impact Evaluation Methods*

This chapter is divided into three sections:

- **EM&V Sample Participants, Events.** This section describes the sample of participants exposed to the EM&V events, and the timing and temperatures associated with those events.
- **Method for Estimating Capability and Impacts.** This section describes the empirical approach used by Guidehouse to estimate the relationship between event periods and event impacts required to deliver ex-ante (capability) and ex-post (historical) impacts.

### 2.1.1 EM&V Sample Participants, Events, and Data

The estimated impacts presented in this evaluation report are based on the AMI data from a sample of participants drawn from the overall population. This sample of participants was subjected to more events than would be observed by the overall population in a typical year in order to provide Guidehouse with more data points from which impacts could be estimated.

Consistent with previous years, Guidehouse developed a random sample of participants with three combinations of switches:

- Water heater switch only;
- Auxiliary heat strip switch only, and;
- Both water heater and auxiliary heat strip switches.

Based on the lessons learned in previous winter studies, the sample included a higher percentage of heat strips and fewer water heaters compared to the program population. Guidehouse selected 880 participants to be included in the EM&V sample, of whom 17 opted out, leaving a starting sample size of 863 participants. This is a larger sample than in previous years, which typically had sample sizes of approximately 80 – 100 participants. The expanded sample size is possible for this year due to the migration from the logger-based approach to an AMI-based approach, which substantially reduces the data collection cost per sample participant.

Table 2-1 specifies the sample size for each equipment type.

**Table 2-1 – EM&V AMI Sample Size**

| Category | Sample Size | Removed Due to Vendor Acquisition Data Issues | Removed or Unavailable AMI[15] Data | Customers with <90% Complete AMI Data | Included in Final Analysis |
|---|---|---|---|---|---|
| **Participants with Both Heat Strips and Water Heaters** | 207 | 2 | 25 | 0 | **180** |
| **Participants with Heat Strips Only** | 355 | 0 | 33 | 0 | **322** |
| **Participants with Water Heater Only** | 301 | 0 | 27 | 2 | **272** |
| **Total Participants** | **863** | **2** | **85** | **2** | **774** |

*Source: Guidehouse analysis of program tracking data*

During the recruitment phase, Guidehouse selected a sample of participants and mailed them postcards indicating that they had been selected to participate in a study, but that no action was needed on the participant's part. Participants were given the opportunity to opt out. Approximately 2% of participants chose to opt out of the study.

Guidehouse randomly allocated each EM&V participant site to one of two groups: Group A or Group B. This enabled a randomized control trial (RCT) experimental design. Under this design, when one group is subject to curtailment (for a given event), the other is not, with the group curtailed changing from event to event. This means that only event days need to be included in the analysis – the group of participants not curtailed on the given event day acting as the control group and the group curtailed acting as the treatment group.

Guidehouse randomly assigned participants to one group or the other using a random ordered pairing based on winter energy[16] usage. The purpose of this approach (discussed in greater detail below) was to minimize the likelihood that the random allocation to groups could result in one group having substantially higher (or lower) consumption patterns than the other.

A key concern of DR evaluations when all participants are subject to the same events is that there remain some non-event days that sufficiently resemble (in terms of temperature and other factors) the event days. This is required to allow for the estimation of a robust baseline. One problem with this approach is that often events are highly correlated with extreme weather

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[15] The database query executed by Duke Energy data management staff was designed to extract all AMI data for currently enrolled EnergyWise Home participants with available AMI data. Guidehouse worked with Duke Energy staff to spot check 8 of the EM&V participants for whom the query did not return AMI data. In every case, the customer had no interval data (because the AMI meter had been replaced by a non-AMI meter, or the AMI meter was not certified – possibly due to insufficient mesh network coverage) or the customer had withdrawn from the program between when they had been included in the EM&V group and when the query had been executed.

[16] After arranging the participants in order of increasing winter energy consumption total, the participants were grouped in pairs. For each pair, the participant with the larger consumption total was randomly assigned to the A or B group, with the lower consumption participant assigned to the opposite group. This was to prevent biasing the A or B group to always have slightly higher consumption. The definition of winter energy usage for this analysis is the sum of January and February 2020 kWh consumption.

events, meaning that baselines are often projected out of sample (i.e., baselines are predicted over temperature conditions that may not actually have been observed on non-event days).

Subjecting only half of all EM&V participants to each event ensures the existence of event-like, non-event days in the sample and provides additional information (from the non-curtailed devices) that helps estimate the counterfactual event demand (the baseline). These factors improve model accuracy by substantially reducing the likelihood of model specification bias compared to a purely within-subject[17] approach.

EM&V water heater participants were subjected to 22 water heater DR events, 11 for Group A, 11 for Group B. EM&V heat strip participants were subjected to 17 heat strip DR events, 8 for Group A, 9 for Group B. The date, EM&V group controlled, appliances controlled, and mean event temperature (in °F) are shown in Table 2-3 for water heater participants and Table 2-2 for heat strip participants. All events began at 6:30 AM and ended at 8:30 AM (prevailing time). A consistent event period was applied to all events to maximize the precision of estimated impacts, and the period itself was selected in consultation with Duke Energy staff as the period of most interest for projected program capability. All appliances were cycled at 100% (completely shut off) during the event period.

**Table 2-2: Water Heater EM&V Sample Participation**

| Date | Number of Participants | Number of Water Heaters | Temperature (F) | EM&V Group |
|---|---|---|---|---|
| 2021-01-12 | 235 | 240 | 37 | A |
| 2021-01-13 | 219 | 222 | 38 | B |
| 2021-01-20 | 235 | 240 | 39 | A |
| 2021-01-21 | 219 | 222 | 38 | B |
| 2021-01-25 | 235 | 240 | 48 | A |
| 2021-01-26 | 219 | 222 | 56 | B |
| 2021-02-01 | 219 | 222 | 32 | B |
| 2021-02-05 | 235 | 240 | 39 | A |
| 2021-02-10 | 219 | 222 | 47 | B |
| 2021-02-11 | 235 | 240 | 48 | A |
| 2021-02-24 | 235 | 240 | 49 | A |
| 2021-02-26 | 219 | 222 | 43 | B |
| 2021-03-03 | 219 | 222 | 47 | B |
| 2021-03-04 | 235 | 240 | 50 | A |
| 2021-03-10 | 235 | 240 | 51 | A |
| 2021-03-11 | 219 | 222 | 57 | B |
| 2021-03-16 | 235 | 240 | 43 | A |
| 2021-03-19 | 192 | 195 | 46 | B |
| 2021-03-22 | 235 | 240 | 53 | A |

[17] A “within-subject” approach models customer demand on non-event days to predict the event-day baseline used to estimate impacts. When non-linearities in the temperature/demand relationships exist, this can result in baselines that are too low.

| Date | Number of Participants | Number of Water Heaters | Temperature (F) | EM&V Group |
|---|---|---|---|---|
| 2021-03-23 | 219 | 222 | 52 | B |
| 2021-03-29 | 219 | 222 | 49 | B |
| 2021-03-30 | 235 | 240 | 54 | A |

*Sources: DEP AMI data, DEP event schedule data, and National Oceanic and Atmospheric Administration (NOAA) temperature data*

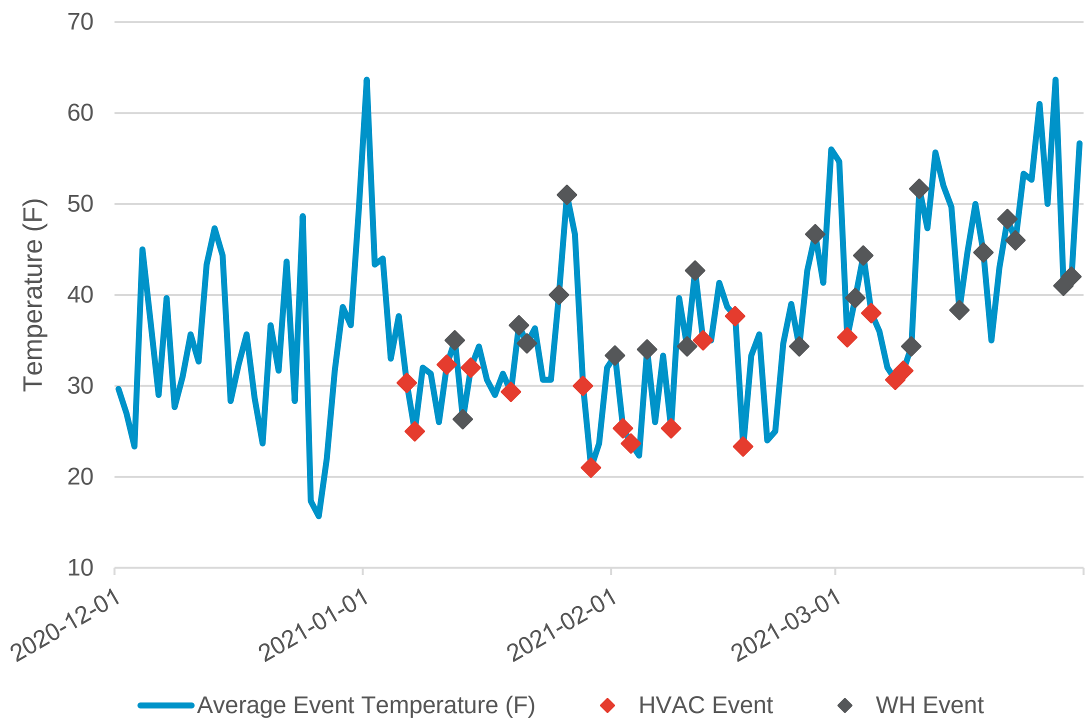
**Table 2-3. Heat Strip EM&V Sample Participation**

| Date | Number of Participants | Number of Heat Strips | Temperature (F) | EM&V Group |
|---|---|---|---|---|
| 2021-01-06 | 250 | 265 | 35 | A |
| 2021-01-07 | 253 | 263 | 33 | B |
| 2021-01-11 | 250 | 265 | 34 | A |
| 2021-01-14 | 253 | 263 | 40 | B |
| 2021-01-19 | 253 | 263 | 39 | B |
| 2021-01-28 | 253 | 263 | 30 | B |
| 2021-01-29 | 250 | 265 | 30 | A |
| 2021-02-02 | 253 | 263 | 28 | B |
| 2021-02-03 | 250 | 265 | 29 | A |
| 2021-02-08 | 253 | 263 | 36 | B |
| 2021-02-12 | 250 | 265 | 36 | A |
| 2021-02-16 | 250 | 265 | 31 | A |
| 2021-02-17 | 253 | 263 | 31 | B |
| 2021-03-02 | 253 | 263 | 39 | B |
| 2021-03-05 | 250 | 265 | 43 | A |
| 2021-03-08 | 250 | 265 | 46 | A |
| 2021-03-09 | 253 | 263 | 47 | B |

*Sources: DEP AMI data, DEP event schedule data, and National Oceanic and Atmospheric Administration (NOAA) temperature data*

Figure 2-1 illustrates the timing of the EM&V events across the winter. The daily average temperature between 6:30 AM and 8:30 AM (prevailing time) – the average temperature during the event window – is shown as the blue line. Water heater EM&V events are indicated by grey diamonds and heat strip events by red triangles. As noted previously, there were no population-wide DR events in the winter of 2020/2021.

**Figure 2-1. Timing and Temperature of EnergyWise DR Events**




*Sources: DEP event schedule data and National Oceanic and Atmospheric Administration (NOAA) temperature data.*

The impact evaluation made use of four sources of data:

- **AMI data.** Quarter-hourly interval AMI data from EM&V participants' AMI meters.
- **Event scheduling data.** The schedule of events deployed to the EM&V groups.
- **Weather data.** Hourly weather data downloaded for three weather stations from the National Oceanic and Atmospheric Administration (NOAA). Weather data collected included dry bulb temperature, relative humidity, and wind speed. The three weather stations used can be seen below in Table 2-4. Each participant was mapped to the closest station to their ZIP code.

**Table 2-4: Weather Stations used based on proximity**

| Weather Station Name | USAF | WBAN |
|---|---|---|
| ASHEVILLE REGIONAL AIRPORT | 723150 | 03812 |
| MORGANTON-LENOIR AIRPORT | 723148 | 63859 |
| BOONE | 722198 | 63819 |

*Source: Guidehouse analysis and National Oceanic and Atmospheric Administration (NOAA) weather station data.*

### 2.1.2 Method for Estimating Capability and Impacts

Guidehouse used an econometric technique known as a fixed effects regression to estimate the impacts of the devices curtailed. Fixed effects regression is a form of linear regression commonly used to estimate the impact of DR programs. The technique is applied to a set of observations of some variable of interest (in this case electricity demand) from several different individuals (i.e., program participants)—also known as longitudinal or panel data—over time.

Fixed effects regression assigns each individual participant[18] its own dummy variable. In this way, Guidehouse may control for each individual's time-invariant characteristics such as the size of a participant's home, its orientation, etc.

Heat strip impacts were estimated as a function of the 3-hour exponential moving average of heating degree quarter-hours and the relative hour of the event (e.g., the first quarter-hour of the event, the second quarter-hour of the event, etc.). Water heater impacts were estimated as a function of the relative quarter hour of each event (e.g., the quarter-hour between 6:30 and 6:45 is the first relative hour, the quarter-hour between 6:45 and 7:00 is the second, etc.). Since all event times and lengths were identical, interacting the treatment effect with the relative quarter hour of each event is analytically equivalent to interacting it with the absolute quarter hour of the day (i.e., the first relative quarter hour is also always the quarter hour between 6:30 and 6:45, etc.).

In prior years, impacts were estimated only for partially responsive or fully responsive heat strips and fully responsive water heaters. These impacts (in previous evaluations) were then "de-rated" on the basis of the rate of non-response for each event (or on average across a range of events, for the purposes of estimating ex ante capability impacts). Despite Duke Energy's DR network not being capable of two-way communication, this segmentation of individual device responsiveness was possible because logger data was appliance-specific, and device responsiveness could be confirmed simply through a visual inspection of individual appliance event period high frequency demand plots.

For this evaluation (winter 2020/2021) this granular segmentation was not possible. Firstly, this is because the AMI data used for impact evaluation includes the electricity used for all end-uses in the home, there can be much less certainty if (for example) the lack of a distinct drop in demand during the event is due to appliance non-response or simply some other household load obscuring the demand reduction. Secondly, this is due to the much larger number of participants, (over 800, compared to approximately 100 in prior years) which makes the comprehensive inspection of individual participant event demand profiles infeasible.

As a point of reference, it should be noted that in the 2017/2018 evaluation (the most recent winter evaluation which employed field data collection) an average of 41% of auxiliary heat strips failed to respond to the signal to curtail during the four coldest events (i.e., when average event temperatures were less than 15 degrees Fahrenheit). A further 13% of heat strips were only partially responsive (due, it was identified in that evaluation, to servicing the heat pump coil defrost needs). An average of 5% of water heaters failed to respond to the curtailment signal in that year.

As a result of the much lower-than expected estimated impacts, Guidehouse did attempt to identify individual water heater responsiveness for this evaluation through the application of individual baselines. This was purely for diagnostic purposes and has no impact on estimated

[18] In prior years, where appliance-specific logger data were available, these dummy variables – the "fixed effects" that give the approach its name were assigned to individual appliances not participants.

impacts reported this year. The details of how this diagnostic analysis was developed and applied, and the outcomes of that analysis are reported in Appendix B.[19]

Formal model specifications with additional input variable detail may be found in Appendix A of this report.

All estimates of uncertainty presented in this report are derived from standard errors that have been clustered at the individual participant level.

## *2.2 Process Evaluation Methods*

The evaluation team conducted 257 online surveys with EnergyWise participants during this study. The surveys were conducted after three real DR events and one placebo event. For the placebo event, respondents were told that an event had been called when in fact one had not. Of the 257 total survey respondents, 57 were surveyed after real DR events; the remaining 200 were surveyed after the placebo event.

A summary of the survey disposition by group is shown inTable 2-5. For event surveys, respondents were surveyed the same day following an actual curtailment event and asked questions related to their perception and comfort specifically during the event. The placebo event survey respondents were asked the same set of questions, although the event in question was a placebo because no curtailment event was called that day for the group in question.

**Table 2-5. Survey Status by Event**

| | Event: January 21, 2021 | Event: February 18, 2021 | Event: March 2, 2021 | Placebo: February 3, 2021 |
|---|---|---|---|---|
| Survey completes | 10 | 13 | 34 | 200 |

### 2.2.1 Program Staff Interview

On May 20, 2021, the lead impact evaluator from the Guidehouse evaluation team met with the EnergyWise Home Program manager to discuss their views regarding the program goals and the most significant challenges to meeting these goals. The outcome of the interview and Guidehouse's analysis of the items discussed is addressed in Section 4.2, below.

[19] Guidehouse only attempted to identify individual customer event responsiveness for water-heater-only participants. Water heater DR is characterized by a very high (but short-lived) snapback impact. This occurs as the storage water heater elements operate at peak capacity to restore storage tank temperature. This distinctive load feature – as well as the historic reliability of water heaters – means that although estimates of responsiveness derived from whole-home AMI data may be highly uncertain (see Appendix B for details) they may still be very useful for diagnostic purposes. Heat strip impacts, on the other hand, have proven historically highly variable in responsiveness (see Table 3-4), as well as (naturally) temperature making an examination of individual participant responsiveness for this appliance much less useful as a diagnostic tool.

# 3.0 Impact Findings

The discussion of program impacts on winter demand is divided into the following sections:

1. **Historical (Ex-Post) Impacts.** This section provides the estimated impacts of water heater and auxiliary heat strip curtailment during the EM&V events.
2. **Forecast Curtailment Capability.** This section provides the estimated DR capability of water heater curtailment across different hours of the morning and auxiliary heat strip curtailment across a variety of different temperatures.
3. **Comparison of Winter 2020/2021 with Winter 2017/2018 Impacts.** This section compares the estimated impacts from this evaluation with those of the most recently conducted full econometric evaluation (winter 2017/2018), defines a set of possible hypotheses for the much lower-than-expected impacts, and assigns a qualitative likelihood to each of these hypotheses.
4. **Net-to-Gross.** This section outlines why the appropriate net-to-gross factor for this program should be 1.

All impacts reported in this chapter should be considered “at the meter” and should be scaled up by the appropriate loss factor when, for example, determining avoided cost benefits for cost-effectiveness testing.

The evaluation calculated the ex-ante estimate of program capability at design conditions, which are 10 degrees Fahrenheit (heat strips) between 7am and 8am Eastern prevailing time (water heaters). These capabilities are shown in Table 3-1.

**Table 3-1. Program-Wide Ex-Ante Impacts (Program Capability)**

| | Appliance Type | Cycling Strategy | Impact per EM&V participant (kW) | Relative Precision +/-% (90% Confidence) | Impact per Appliance (kW) | Total Program Impact (MW |
|---|---|---|---|---|---|---|
| Projected Capability (Ex Ante) | Heat Strips | 100% | 0.43 | 32% | 0.41 | 2.8 |
| | Water Heaters | 100% | 0.26 | 17% | 0.25 | 2.9 |
| Average Impact - Winter 2020/2021 (Ex Post) | Heat Strips | 100% | 0.21 | 9% | 0.20 | N/A |
| | Water Heaters | 100% | 0.22 | 16% | 0.21 | N/A |

*Source: Guidehouse analysis*

The principal EM&V findings and conclusions regarding the winter event demand impacts for 2020/2021 are as follows:

- **Estimated impacts are much lower than in prior years, likely because of an increase in individual device non-responsiveness.** Estimated water heater impacts are on average only slightly more than half of what they were in the prior three most recent full econometric evaluations, and heat strip impacts are less than a quarter of what was estimated in the 2017/2018 impact evaluation. This difference in impact reductions across the two appliance types could be explained by a proportionate increase in device non-responsiveness; the 2017/2018 evaluation found that, on average, 5% of water heaters failed to respond to the DR curtailment signal and 26% of heat strips failed to respond.

- **The estimated average impact of the Winter 2020/2021 EM&V water heater events was 0.22 kW per participant, or 0.21 kW per appliance.** This is the average of the estimated impacts across 22 100% cycling events taking place between 6:30 and 8:30 in the morning.
- **The estimated average impact of the six coldest Winter 2020/2021 EM&V heat strip events was 0.31 kW per participant, or 0.30 kW per appliance.** The average temperature across these events was 24 degrees Fahrenheit and the lowest observed temperature was 21 degrees Fahrenheit. This is, to date, the warmest minimum temperature event evaluated for this program since Guidehouse first began evaluating the program in the winter of 2011/2012.
- **The current DR capability of DEP's EnergyWise program in the winter is approximately 5.7 MW**. This is the sum of the projected capability of 2.8 MW from heat strip curtailment when the average temperature is 10 degrees Fahrenheit (0.41 kW per appliance) and 2.9 MW from water heater curtailment deployed between 7:30 and 8:30 in the morning (0.21 kW per appliance). These capability values are, as noted above, considerably lower than in prior evaluation years, and may be due to transitory effects outside of Duke Energy's control. If it can be demonstrated (e.g., via testing in the winter of 2021/2022) that remedial action has been successful at restoring prior capabilities, Duke Energy should base its planning on the capabilities projected as part of the 2017/2018 evaluation or on (if available) updated capability estimates.
- **Guidehouse believes that the most significant single driver of reduced program impacts and capability for water heaters was the poor health of the Duke paging network during the 2020/2021 DR season.** During three-quarters of the DR events dispatched in the DR season of 2020/2021 60% or less of the Western region paging towers were online. This was a result both of COVID public health restrictions (preventing maintenance of the tower located in a hospital) and due to damage to the satellite receiver. The paging provider did not service the site because two-way monitoring of the site was off-line and no operational alerts could be communicated. A secondary contributing factor may have been a shift in participant behavior due to COVID; a comparison of pre-COVID and winter 2021 water heater only participant load profiles reveals differences that are consistent with a shift to later showering, which could materially reduce water heater DR capability.
- **Field verifications conducted by Duke Energy indicate that the proportion of heat strip switches that are disconnected (unable to curtail) has also increased quite substantially in the four years since the 2017 field work.** None of the 46 switches examined by the field verification staff was found to be without problem. The vast majority of issues uncovered were that the customer had disabled the switch (48% of cases) or that it had been incorrectly installed (33% of cases). The reduced program capability due to the high proportion of non-functioning devices is compounded by the paging network issues above, which would mean that curtailment would be erratic even when the switch was fully functional. In addition, Guidehouse has identified the possibility that heat strip DR impacts may have been affected by participant use of secondary (room-specific) space heating. Under certain circumstances (detailed in the report) erosion, or "take-back", of auxiliary heat strip impacts as a result of participants' use of secondary (room) space heaters is possible, though Guidehouse believes it is improbable that such circumstances would be observed sufficiently often to significantly affect DR impacts.

## 3.1 Historical (Ex-Post) Impacts

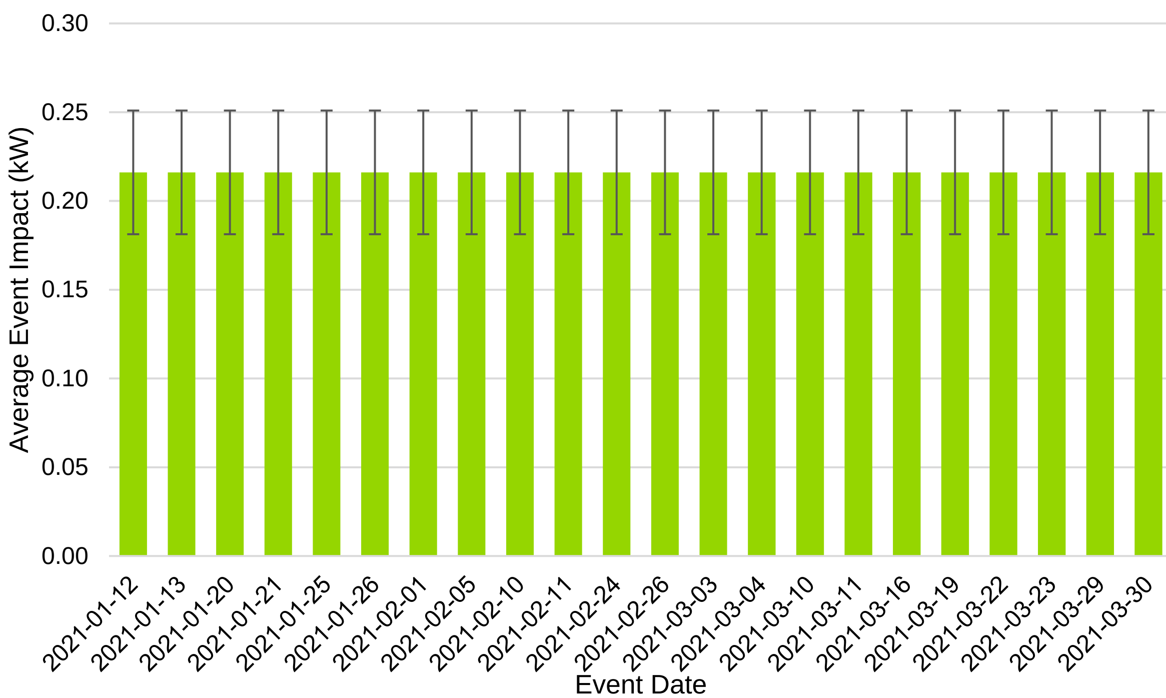
The ex-post impacts are the estimated impacts for the actual EM&V events that were called in the winter of 2020/2021. This section is divided into two sub-sections.

1. **EM&V Event Impacts.** This sub-section summarizes the estimated impacts of the 22 water heater events and 17 auxiliary heat strip events called for the EM&V sample.
2. **Load Profile Comparisons.** This subsection provides an illustration of EM&V participant load profiles during events, showing both actual demand and the counterfactual (i.e., the estimated baseline).

### 3.1.1 EM&V Event Impacts

Figure 3-1 provides a graphical summary of the estimated DR impact of water heater curtailment for all 22 of the events in the winter of 2020/2021. Each vertical bar represents the average estimated event impact. The 90% confidence interval is identified by the whiskers. Note that since impacts are estimated as a function only of the relative hour of the event (required in order to project an ex-ante capability by time of day), and all events are the same length (and cover the same hours) the individual event ex post estimated impacts are all identical.

**Figure 3-1. Average Water Heater Event Impacts**




*Source: Guidehouse analysis*

The results shown above in Figure 3-1 are also summarized in a tabular fashion in Table 3-3. Unlike in prior evaluations of the EnergyWise Home winter program all impacts presented above (and below) are inclusive of both responsive *and* non-responsive devices. As noted in Section 2.1.2, the shift from the use of individual appliance data to whole-home AMI data, as well as the substantially larger number of participants included in the EM&V sample has meant that for this evaluation cycle, Guidehouse has not been able to segment devices into “responsive” or “non-responsive” groupings. There is more discussion on the lower impacts in Section 3.3.

The values included in Table 3-3, as well as the graphic above may be found in the spreadsheet Appendix I, attached as a separate document.

**Table 3-2. Average Water Heater EM&V Event Impacts**

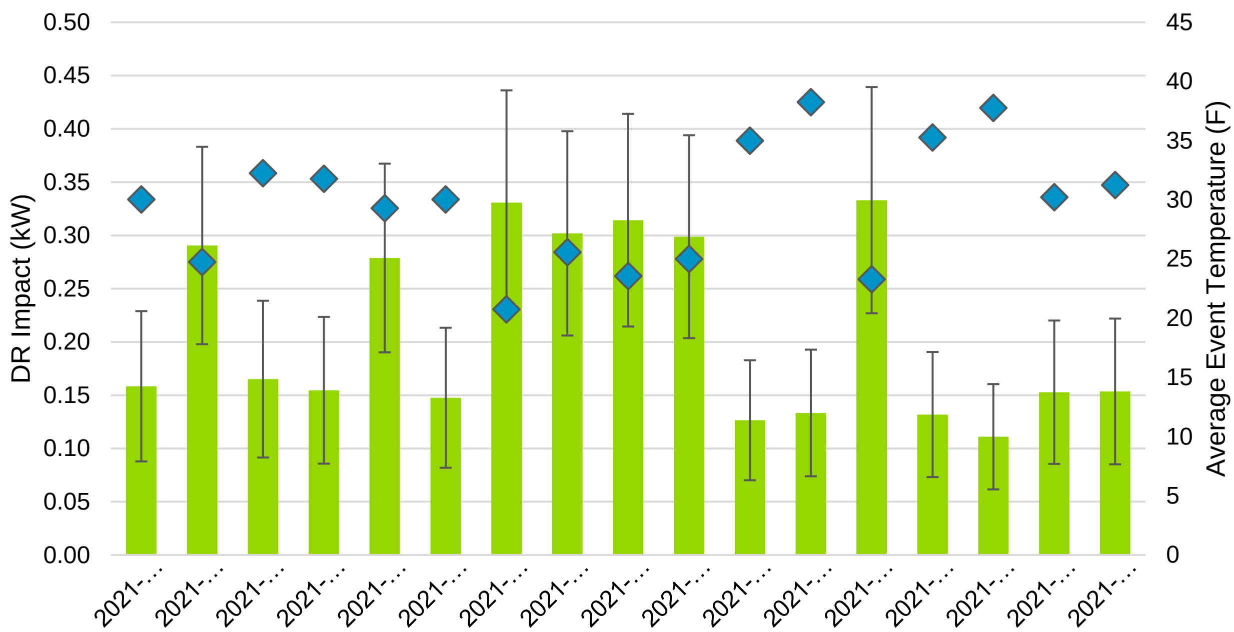
| Event Date | Avg. Event Temperature (F) | Avg. Impact per Participant (kW) | Relative Precision +/- % (90% Confidence) |
|---|---|---|---|
| 2021-01-12 | 37 | 0.22 | 16% |
| 2021-01-13 | 38 | 0.22 | 16% |
| 2021-01-20 | 39 | 0.22 | 16% |
| 2021-01-21 | 38 | 0.22 | 16% |
| 2021-01-25 | 48 | 0.22 | 16% |
| 2021-01-26 | 56 | 0.22 | 16% |
| 2021-02-01 | 32 | 0.22 | 16% |
| 2021-02-05 | 39 | 0.22 | 16% |
| 2021-02-10 | 47 | 0.22 | 16% |
| 2021-02-11 | 48 | 0.22 | 16% |
| 2021-02-24 | 49 | 0.22 | 16% |
| 2021-02-26 | 43 | 0.22 | 16% |
| 2021-03-03 | 47 | 0.22 | 16% |
| 2021-03-04 | 50 | 0.22 | 16% |
| 2021-03-10 | 51 | 0.22 | 16% |
| 2021-03-11 | 57 | 0.22 | 16% |
| 2021-03-16 | 43 | 0.22 | 16% |
| 2021-03-19 | 46 | 0.22 | 16% |
| 2021-03-22 | 53 | 0.22 | 16% |
| 2021-03-23 | 52 | 0.22 | 16% |
| 2021-03-29 | 49 | 0.22 | 16% |
| 2021-03-30 | 54 | 0.22 | 16% |

*Source: Guidehouse analysis and National Oceanic and Atmospheric Administration (NOAA) temperature data.*

Figure 3-2 provides a graphical summary of the estimated DR impact of heat strip curtailment for all 17 of the events in the winter of 2020/2021. Each vertical bar represents the average estimated event impact. The 90% confidence interval is identified by the whiskers, and the blue triangles (to be read off the right axis) identify the average event dry bulb temperature.

**Figure 3-2. Average Heat Strip Event Impacts**




*Source: Guidehouse analysis and National Oceanic and Atmospheric Administration (NOAA) temperature data.*

The distribution of the magnitude of impacts across events shown in Figure 3-2 appears bimodal: where the average event temperature is above 30 degrees Fahrenheit average impacts cluster around 0.15 kW per participant, whereas when average event temperatures are below 30 degrees Fahrenheit average impacts cluster around 0.3 kW per participant. This is a result of the fact that auxiliary heat strip demand is non-linear in temperature. As noted in the 2017/2018 report (and illustrated in Figure B-1 of that document), heat strip specific demands (i.e., from logger data) on non-event days, when plotted against average temperatures during the morning period in which winter events are typically called, display a distinct "kink" upwards at 30 degrees. This reflects the increasing need of the appliances to use the heat provided by the auxiliary heat strips to supply thermal loads at lower temperatures.

In estimating impacts, Guidehouse has controlled for this effect through the use of splines[20] in its regression modeling. This effect is more intuitively visible in the ex ante capability plots found in Section 3.2, below.

The results shown above in Figure 3-1 are also summarized in a tabular fashion in Table 3-3, below.

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[20] Temperature "splines" are an econometric technique for modeling discrete structural breaks in relationships. In this case they are applied to temperatures to capture the non-linear relationship between auxiliary heat strip demand and temperature. Guidehouse has used two splines, implicitly assuming a linear relationship between temperature demand below 30 degrees Fahrenheit that is different from a linear relationship between temperature and demand above 30 degrees (i.e., a steeper slope at lower temperatures).

**Table 3-3. Average Heat Strip EM&V Event Impacts**

| Event Date | Avg. Event Temperature (F) | Avg. Impact per Participant (kW) | Relative Precision +/-% (90% Confidence) |
|---|---|---|---|
| 2021-01-06 | 30 | 0.16 | 45% |
| 2021-01-07 | 25 | 0.29 | 32% |
| 2021-01-11 | 32 | 0.17 | 45% |
| 2021-01-14 | 32 | 0.15 | 45% |
| 2021-01-19 | 29 | 0.28 | 32% |
| 2021-01-28 | 30 | 0.15 | 45% |
| 2021-01-29 | 21 | 0.33 | 32% |
| 2021-02-02 | 26 | 0.30 | 32% |
| 2021-02-03 | 24 | 0.31 | 32% |
| 2021-02-08 | 25 | 0.30 | 32% |
| 2021-02-12 | 35 | 0.13 | 45% |
| 2021-02-16 | 38 | 0.13 | 45% |
| 2021-02-17 | 23 | 0.33 | 32% |
| 2021-03-02 | 35 | 0.13 | 45% |
| 2021-03-05 | 38 | 0.11 | 45% |
| 2021-03-08 | 30 | 0.15 | 44% |
| 2021-03-09 | 31 | 0.15 | 45% |

*Source: Guidehouse analysis and National Oceanic and Atmospheric Administration (NOAA) temperature data.*

## 3.1.2 Load Profile Comparisons

It is Guidehouse's standard practice in DR evaluations to provide one or more plots of average actual and counterfactual (i.e., model-predicted baseline) participant demand during DR events. These plots are particularly useful in providing a more intuitive understanding of the processes driving the results presented above. This subsection is divided into two parts. The first part provides the load profile comparison for heat strips, while the second provides the load profile comparison for water heaters.

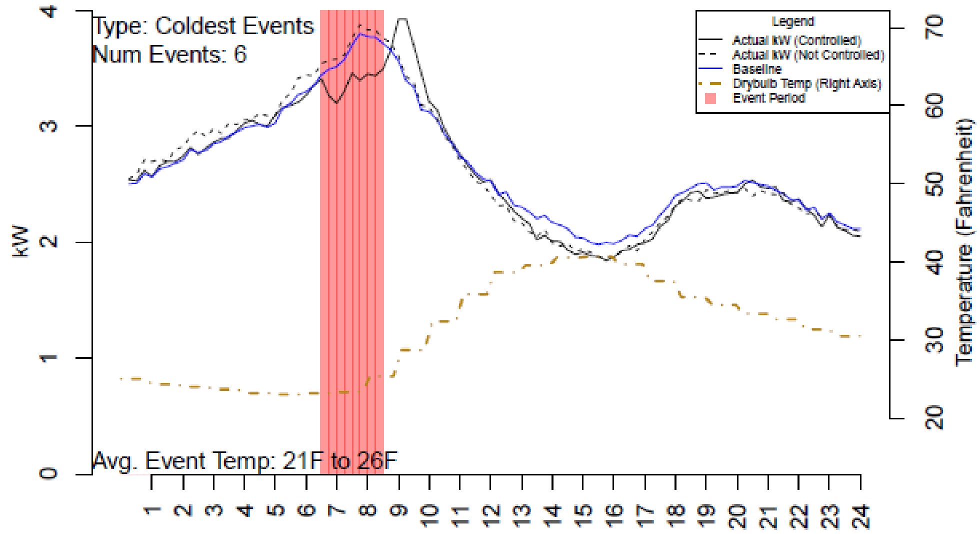
### 3.1.2.1 Heat Strip Load Profile Comparison

Three examples of event load profile plots for days on which heat strips were curtailed are provided below. The first, Figure 3-3, shows the average load profile associated with the six coldest events observed as part of this study, occurring on January 7$^{th}$ and 29$^{th}$, February 2$^{nd}$, 3$^{rd}$, 8$^{th}$, and 17$^{th}$. The coldest average event temperature observed across these six events was 21 degrees Fahrenheit (January 29$^{th}$ event), the mildest average event temperature observed across these six events was 26 degrees, and the average temperature across these events was 24 degrees.

- The **solid black line** indicates average participant demand for those participants whose heat strips were curtailed (note the trough during the event period).
- The **blue line** is what the model predicts demand would have been had no event been called. This is baseline, or counterfactual, heat strip participant demand.

- The **dashed black line** shows the actual average heat strip load of the control group.[21]
- The **dash-dotted yellow line** shows the average outdoor temperature (right axis).

**Figure 3-3. Heat Strip Load Shape Comparison: Six Coldest Days**




*Source: Guidehouse analysis, DEP AMI data and National Oceanic and Atmospheric Administration (NOAA) temperature data.*

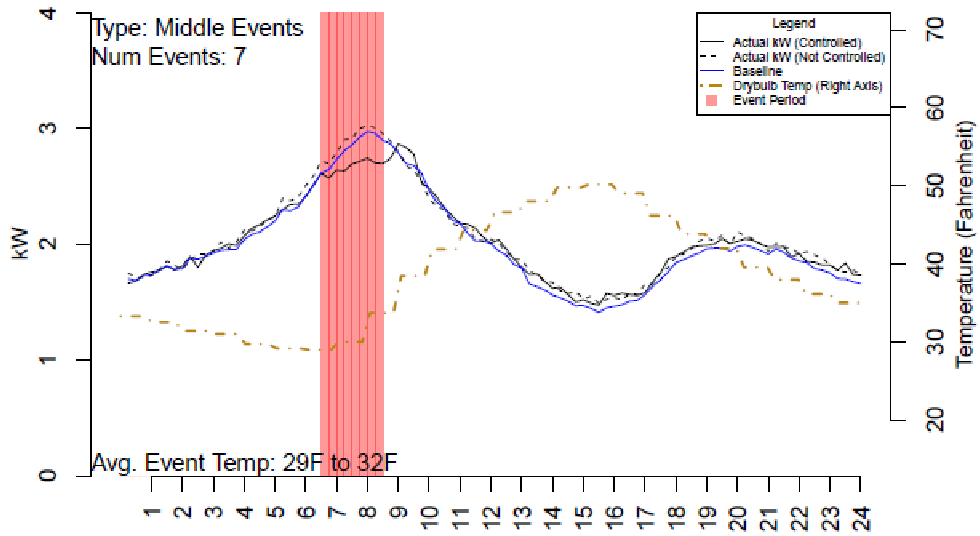
Note how closely the dashed blue line tracks the solid black line prior to the curtailment period. This is a strong indication that the model is doing a good job of estimating the average baseline of the curtailed heat strip participants and thus the true average impact that the curtailment event is having across the group of EM&V participants during the DR event period.

The second example, Figure 3-4, shows the average load profile associated with the seven “middle” temperature events observed as part of this study, occurring on January 6th, 11th, 14th, 19th, 28th, and March 8th and 9th. The coldest average event temperature observed across these events was 29 degrees Fahrenheit, the mildest average event temperature observed across these events was 32 degrees, and the average temperature across these events was 31 degrees.

[21] Note that because these profiles are averages across multiple event days (and that Group A and Group B alternated acting as control groups) both the solid black line and the dashed black line are averages of the loads of participants in both Group A and B.

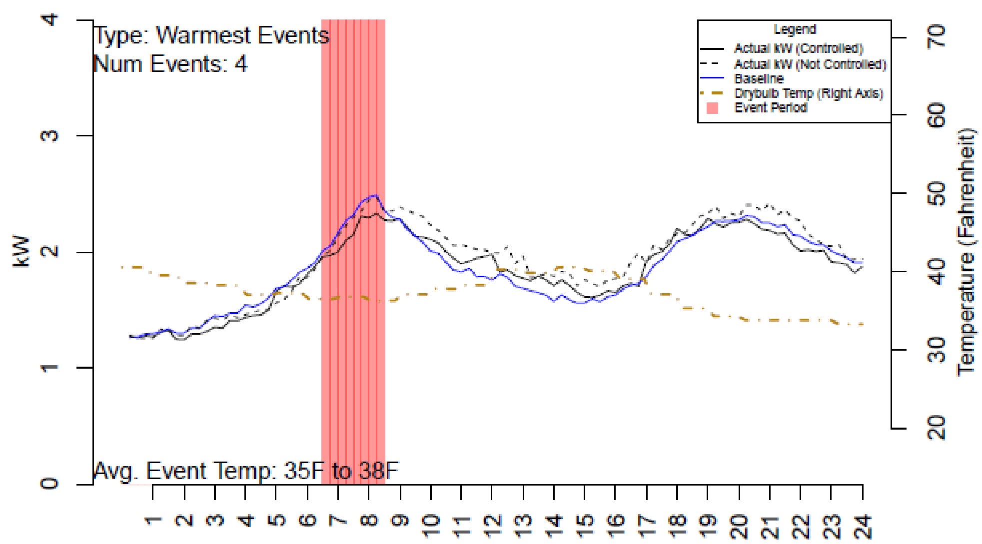
**Figure 3-4. Heat Strip Load Shape Comparison: Seven Middle Temperature Days**




*Source: Guidehouse analysis, DEP AMI data and National Oceanic and Atmospheric Administration (NOAA) temperature data.*

The third example, Figure 3-5, shows the average load profile associated with the four warmest temperature events observed as part of this study, occurring on February 12th and 16th, and March 2nd and 5th. The coldest average event temperature observed across these events was 35 degrees Fahrenheit, the mildest average event temperature observed across these four events was 38 degrees, and the average temperature across these events was 35 degrees.

**Figure 3-5. Heat Strip Load Shape Comparison: Four Warmest Days**




*Source: Guidehouse analysis, DEP AMI data and National Oceanic and Atmospheric Administration (NOAA) temperature data.*

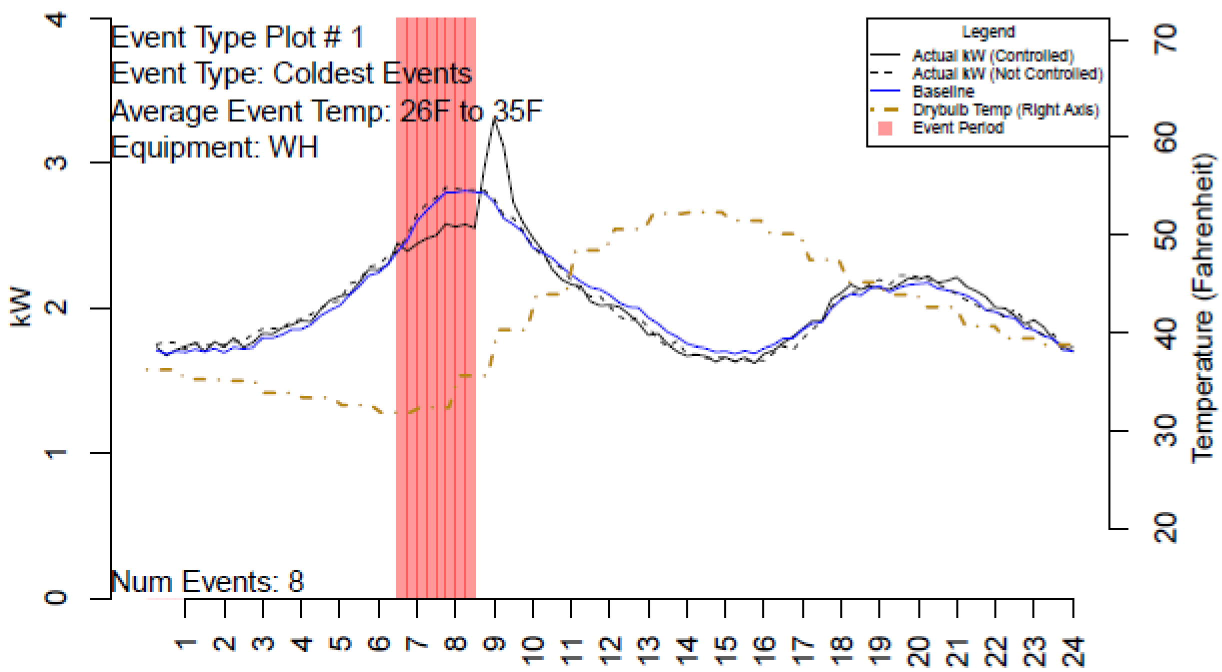
The three load profiles above, as well as a separate load profile for each individual event day, may all be found in Appendix H, under a separate cover.

#### 3.1.2.2 Water Heater Load Profile Comparison

As for heat strips, Guidehouse has grouped the load profiles of water heater events together on the basis of the average event period temperature into “Coldest”, “Middle”, and “Warmest” event day profiles. Although previous evaluations of this program[22] have demonstrated water heater loads (and thus DR impacts) are insensitive to day-to-day swings in temperature, the whole home demands *are* sensitive to such swings, making it reasonable to differentiate profiles in this way. This also ensures consistency of presentation with the heat strip load profiles.

Since water heater DR impacts do not materially fluctuate with daily changes in temperature, Guidehouse has included only a single example load profile below, showing, in Figure 3-6 shows the average profiles on the eight coldest water heater event days. Since water heater events were never called on the same days as heat strip event days (to avoid any additional confounding effects from participants equipped with both water heater and heat strip switches), the coldest days for water heater events are not the same as the coldest days for heat strip events.

**Figure 3-6. Water Heater Load Shape Comparison: Eight Coldest Days**




*Source: Guidehouse analysis, DEP AMI data and National Oceanic and Atmospheric Administration (NOAA) temperature data.*

The averaged load profiles for the nine middle temperature event days and the five warmest event days, as well as the load profiles for each event individually may be found in Appendix G, under a separate cover.

## *3.2 Forecast Curtailment Capability*

This section provides the estimated EnergyWise DR capability, or ex-ante impacts. These estimates are Guidehouse’s projection of how much DR the program could offer under a range

[22] Most recently in the 2017/2018 evaluation, in the spreadsheet Appendix D, tab “Fig B-2 WH kW Temp Scatter”

of different possible temperatures at different cycling levels. This estimate of capability is based on the regression-estimated relationships between DR impacts and outdoor temperature from which the ex-post impacts were also developed.

*As mentioned earlier, and discussed in much greater detail below, the projected capability estimated this year is much lower than in prior years. Guidehouse has done considerable exploratory analysis to identify the potential reasons that may be driving this reduction in capability. Although there is no one conclusive answer, the balance of probabilities – based on Guidehouse's analysis in Section 3.3 – suggests that this much-reduced capability is the result of transitory factors that may be remedied prior to the start of the next winter DR series, principally the poor health of Duke Energy's paging system in the winter of 2020/2021..*

*If this is in fact the case, the capability values reported here should only be used until such time as it can be demonstrated that remedial action has been taken. If, going forward, the estimated impacts from low-temperature test events deliver impacts that are more in line with expectations on the basis of prior year evaluations, Guidehouse would recommend using those prior estimated values for capability planning.*

It is this forecast of capability that should provide the truest estimate of a given DR program's value as a system resource because it provides DEP staff with an understanding of how much of a demand reduction the program may be counted on to deliver in future system peak conditions. This is also why it is the forecast DR capability that should be used to calculate the benefits for any cost-benefit ratio test (e.g., total resource cost test, or TRC).

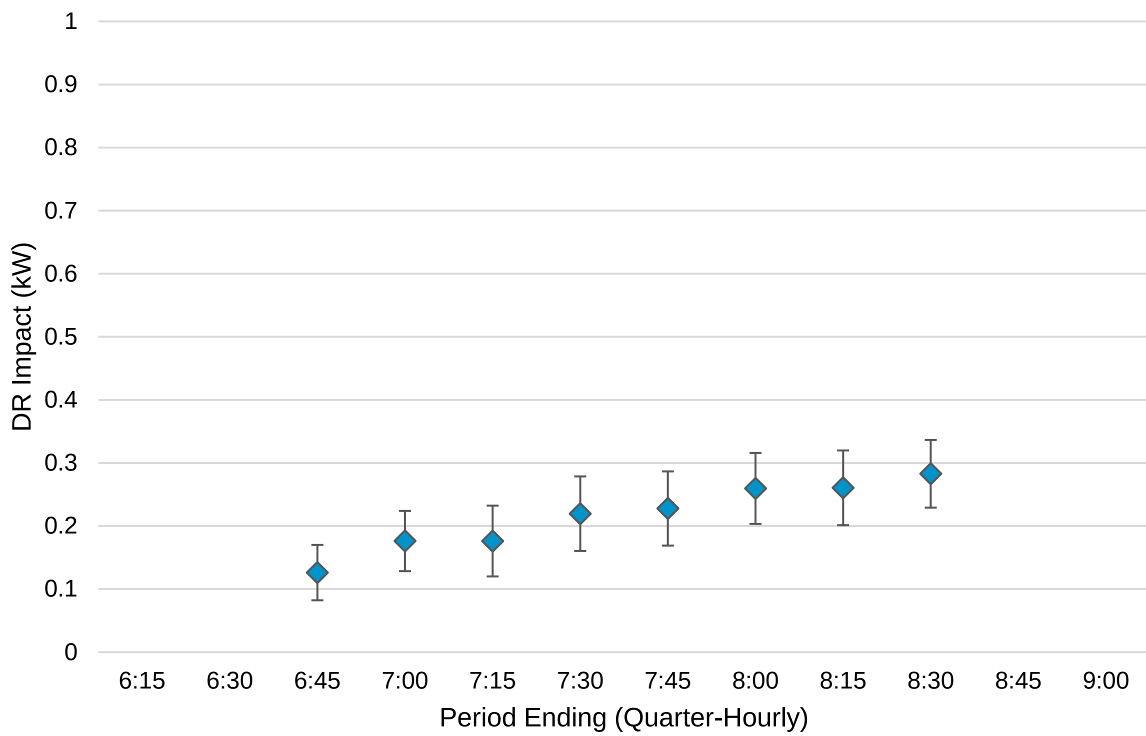
This section is divided into two subsections: the first details the projected DR capability of water heaters at different times of day, and the second details the projected DR capability of heat strips under different weather conditions.

### 3.2.1 Water Heater DR Capability

This subsection provides the projected capability of water heaters. Water heater impacts are modeled as a function of the time of day in which curtailment occurs. Figure 3-7 provides the average estimated impact per water heater participant in each of the quarter-hours of the day included in EM&V events deployed for the 2020/2021 winter revaluation.

The blue diamonds represent the average estimated impact at each quarter-hour of the day and correspond to the values used to calculate the impacts of each of the EM&V events. The whiskers capture the 90% confidence interval.

**Figure 3-7. Projected Average DR Capability per Water Heater Participant**




*Source: Guidehouse analysis*

The capability shown above is not directly comparable to that provided in the 2017/2018 evaluation report. In that report, the plotted capability (in Figure 3-11 of the 2017/2018 report) is shown on a per appliance basis (not per participant basis, as it is here), and is shown (in the 2017/2018 report) only for fully responsive water heaters. In the plot above, the capability is shown for all water heaters.

Guidehouse has, however, applied all the appropriate conversions to allow for a one-for-one graphical comparison of the 2020/2021 and 2017/2018 ex ante water heater capability in Section 3.3 below.

### 3.2.2 Heat Strip DR Capability

This subsection provides the projected capability of heat strips. This capability is projected by applying a series of temperature values to the estimated model parameters. Guidehouse's projected capability (shown in Figure 3-8) assumes that the temperature at which the capability is estimated lasts the entire length of the event and is the same as the temperature in the 3 hours leading up to the event.

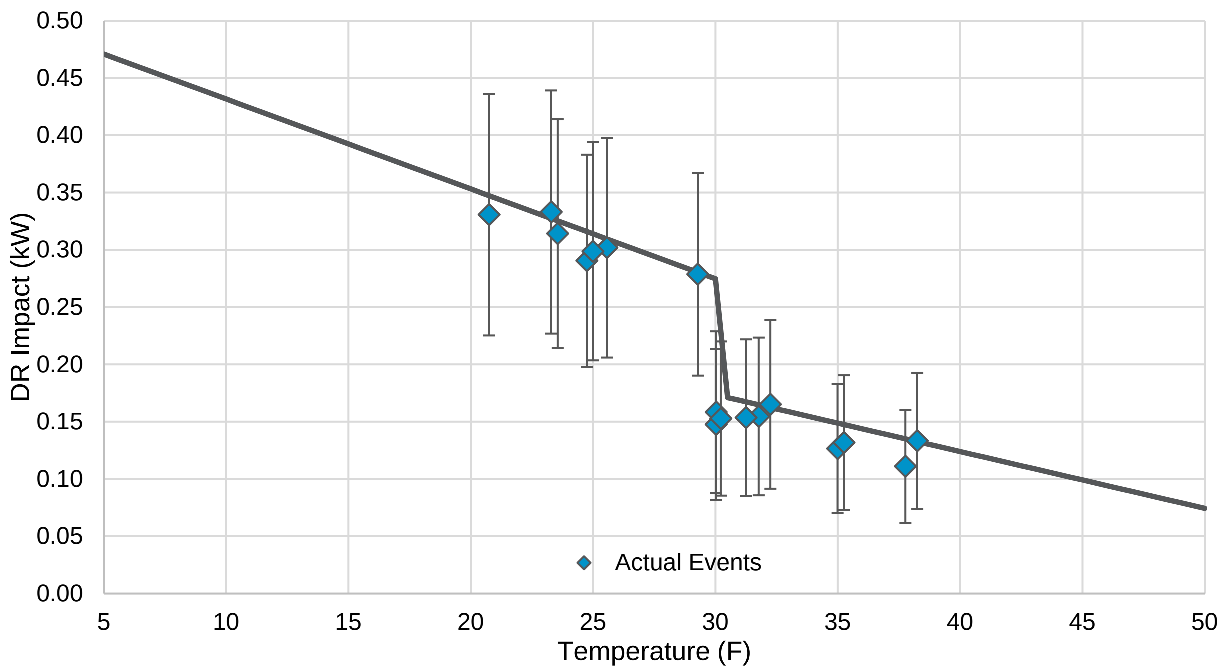
This second assumption is required due to the manner in which impacts are estimated. Because homes have thermal mass, a sudden swing in outdoor temperature does not immediately provoke a concomitant swing in heat strip load—it takes time for the building's indoor temperature to fall below the setpoint temperature because of that outdoor temperature swing. This is reflected in Guidehouse's estimation approach (see Section 2.1.2 for more details), where impacts are modeled as a function of a 3-hour exponential moving average of outdoor temperature. Therefore, projecting capability requires an assumption of what the temperature is in the 3 hours leading up to the event.

Figure 3-8 provides the average projected capability of all participants with curtailable heat strips from 5°F to 50°F (grey line). Actual estimated EM&V event impacts are represented on this chart as blue diamonds, with the 90% confidence interval around each estimate represented by the whiskers. The values underlying this plot may be found in Appendix I, the Excel spreadsheet that accompanies this report.

The capability of heat strips shows a significant discontinuity at 30°F. This reflects the highly nonlinear nature of heat strip demand and is captured in the model by two temperature splines (for more details, please refer to Section 2.1.2). This hinge-point for the splines – i.e., the threshold above which the relationship between temperature and demand impacts becomes much steeper – is set at 30 degrees on the basis of an analysis of appliance-specific loads on very cold non-event days conducted as part of the 2017/2018 evaluation.[23]

**Figure 3-8. Projected Average DR Capability per Heat Strip Participant[24]**




*Source: Guidehouse analysis*

Caution should be applied in considering projected capability that is some distance outside the range of observed temperatures. Guidehouse, in estimating the ex ante DR capability in the figure above has projected impacts implied by the regression-estimated parameters for temperatures as low as 5 degrees Fahrenheit. This is far below the lowest event temperature actually observed in the winter of 2020/2021 (21 degrees on January 29). Typically, Guidehouse would project capability only out to 5 degrees beyond the lowest (and highest) observed event temperatures because of potential dangers of predicting so far out of the observed sample. In this case, however, Guidehouse has extended its estimates of ex ante impacts to as low as 5

[23] See Appendix B of the 2017/2018 report, specifically, Figure B-1.

[24] Note that the average 3-hour exponential moving average of temperature is higher than the average event temperature shown on the graph, which is why the actual events trend slightly below the projected average line.

degrees (and as high as 50 degrees) to be consistent with the temperature range used for reporting ex ante impacts in the previous evaluation, that of winter 2017/2018.

The capability shown above is not directly comparable to that provided in the 2017/2018 evaluation report. In that report, the plotted capability (in Figure 3-9 of the 2017/2018 report) is shown on a per appliance basis (not per participant basis, as it is here), and is shown (in the 2017/2018 report) only for partially or fully responsive heat strips. In the plot above, the capability is shown for all heat strips.

Guidehouse has, however, applied all the appropriate conversions to allow for a one-for-one graphical comparison of the 2020/2021 and 2017/2018 ex ante heat strip capability in Section 3.3 below.

## *3.3 Comparison of Winter 2020/2021 with Winter 2017/2018 Impacts*

The most significant finding of the winter 2020/2021 evaluation of the EnergyWise Home program is the degree to which estimated impacts are much lower than in prior years.

This section begins by providing a clear comparison of 2017/2018 and 2020/2021 estimated impact results to demonstrate the degree to which the program capability has been eroded. Following this comparison, Guidehouse identifies a comprehensive array of hypotheses for possible causes of this result, provides a summary of the evidence supporting (or undermining) each hypothesis, and finally draws a (sometimes uncertain) conclusion regarding the likelihood of the hypothesis. This section ends with a summary of Guidehouse's analysis, which concludes that the most significant contributing factor to the lower than expected DR impacts for the winter of 2020/2021 was the poor health of Duke Energy's paging system.

### 3.3.1 Comparison of Water Heater Results

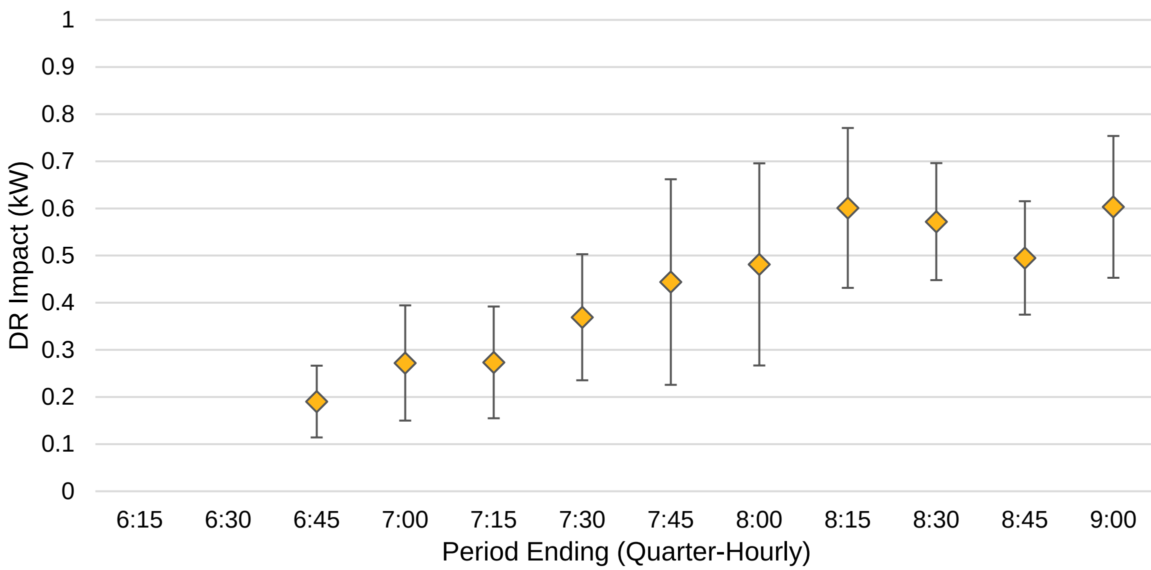
In previous evaluations, impacts were assessed at the device level. This was possible due to the use of appliance-specific data-loggers, the deployment of which was, in the absence of AMI, was the only way that the data required to evaluate DR impacts could be collected. Though this approach to data collection is very costly, one distinct advantage it offers is the ability to assess the responsiveness of appliances to the Duke Energy curtailment signal.

The Duke Energy DR paging system is capable of one-way communication only, so it is possible to assess individual appliance responsiveness only via direct observation. Identifying individual appliance responsiveness via an examination of load data is highly uncertain (i.e., many false positives and negatives) when conducted using whole-home (i.e., AMI) data. In contrast, examinations of appliance-specific loads from logger data (available in prior evaluations but not this one) is a reasonably robust approach for identifying device responsiveness.

In previous evaluations devices found to be non-responsive were removed from the estimation sample to improve the estimated precision of results. Observed non-responsive rates were then applied to the impacts estimated only from responsive devices when extrapolating these results to the entire program, either for the purposes of estimating the impact of actual program-wide events or (more importantly) for estimating the program's capability under pre-specified design conditions.

Guidehouse believes that it will be helpful to the understanding of the reader to see this adjustment for the rate of non-responsive devices illustrated graphically. Figure 3-9, below, shows the water heater DR capability by quarter-hour of the day for an individual water heater that is responsive to the Duke Energy curtailment signal. This figure (albeit with different colors) was presented in Section 3.2.2 of the 2017/2018 evaluation report.

**Figure 3-9: Winter 2017/2018 Water Heater Responsive Appliance Capability**

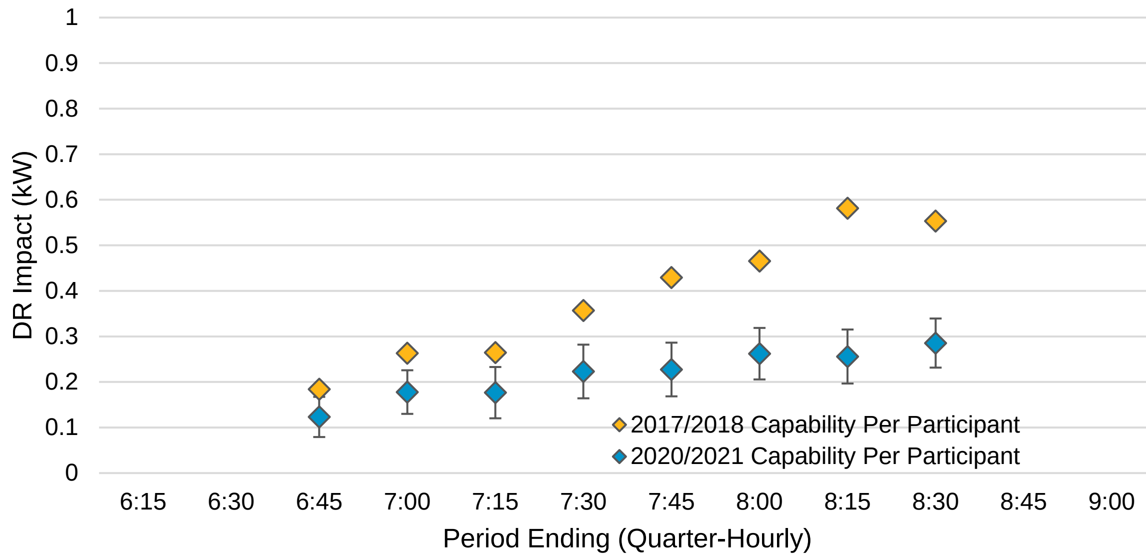



*Source: Guidehouse analysis*

As part of the 2017/2018 evaluation it was found that on average 5% of water heaters failed to respond to the Duke Energy curtailment signal. This non-responsiveness varied between 0% (all appliances responded) and 14% (the event on December 8, 2017). Additionally, some participants had more than one water heater controlled by the program. In the winter of 2017/2018 there were approximately 1.02 water heaters controlled per participant.

Figure 3-10 applies these non-responsiveness adjustments to the capability estimates above such that the 2017/2018 capability estimates can be compared with those estimated in this evaluation from the AMI data (i.e., per participant impacts inclusive of all non-response). As may be seen, program capability has fallen significantly.

**Figure 3-10: Comparison of Water Heater Capability – Winter 2017/2018 and Winter 2020/2021**




*Source: Guidehouse analysis*

This change in program capability is a significant departure from prior years. Historically, water heater impacts have been extremely stable, as would be expected from the curtailment of an end-use with highly consistent patterns of use (daily showering behavior, principally) provided by a mature technology that has exhibited only modest average efficiency changes over the previous ten years (the electric storage water heater).

Figure 3-11, below, provides the average estimated ex post impact of water heater impacts from prior years. These events started as early as 6am and ended as late as 10am, though the vast majority took place no earlier than 6:30 or no later than 9:00.

**Figure 3-11: Comparison of Average Ex Post Water Heater Impacts from Prior Evaluations**

| Evaluation Year | Estimated Average Impact Per Water Heater (kW) |
|---|---|
| 2011/2012 | 0.42 |
| 2014/2015 | 0.40 |
| 2017/2018 | 0.41 |
| *2020/2021* | *0.21* |

*Source: Guidehouse analysis*

The pattern above is vital for contextualizing all the changes in estimated impacts for both heat strips *and* water heaters compared to prior years. Unlike heat strips, water heaters are subject to very few factors that could confound estimation: patterns of use tend to be highly consistent day-to-day (and year to year), there exist no auxiliary technologies with any kind of material penetration (i.e., the water heater is typically the home's only source of domestic hot water), and appliance efficiencies (driven by stand-by losses) have barely changed over the last decade.

The significantly reduced impacts estimated here are not just natural year-over-year fluctuations, but the result of some step-change in the program operating conditions.

### 3.3.2 Comparison of Heat Strip Results

The section above emphasized the historic stability of water heater DR capability. This is important context, and as a bell-weather for changes in overall program effects because the much larger number of potential confounding effects for auxiliary heat strips make inter-year comparisons of heat strip impacts more complicated.

Where water heater impacts are very consistent over time due to having very low rates of non-responsiveness and being insensitive to changes in the weather, heat strip impacts have been much more variable. The rates of device non-responsiveness – identified in each evaluation on the basis of visual inspections of high-frequency logger data – fluctuate significantly from year to year and within years. These rates are summarized in Table 3-4, below.

**Table 3-4: Comparison of Heat Strip Non-Responsiveness Rates**

| Evaluation Year | % Non-Responsive | | | # of Heat Strips | # of Events |
|---|---|---|---|---|---|
| | Average | Max | Min | | |
| 2011/2012 | 41% | 45% | 33% | 38 | 5 |
| 2014/2015 | 16% | 21% | 9% | 67 | 10 |
| 2017/2018 | 26% | 44% | 3% | 64 | 18 |
| *2020/2021* | *Unknown* | | | *528* | *17* |

*Source: Guidehouse analysis*

It is important to note that part of the fluctuation in responsiveness is due to temperatures: where temperatures are sufficiently high that heat strips aren't required (referred to as the proportion of "Devices Not In Use", or DNU in prior reports), non-responsiveness will tend to be lower simply because responsiveness cannot be observed where there is no load to begin with. So, for example, in the winter of 2017/2018, the event on which the non-responsiveness was only 3% was a very mild day and 94% of heat strips were not even in use. In 2017/2018 the average non-responsiveness rate on the four coldest events was 41%.

In addition to total device non-responsiveness, heat strips were often observed to be only *partially* responsive to the curtailment signal. Partial response is characterized by the sharp, distinctive, drop in demand at the start of the DR event as would be expected in fully responsive devices, followed by semi-regular spikes in heat strip demand over the course of the event. Work conducted as part of the 2017/2018 impact evaluation determined that this partial response is a result of the appliance's emergency defrost capability overriding curtailment (see Section 3.3 of the 2017/2018 evaluation report).[25]

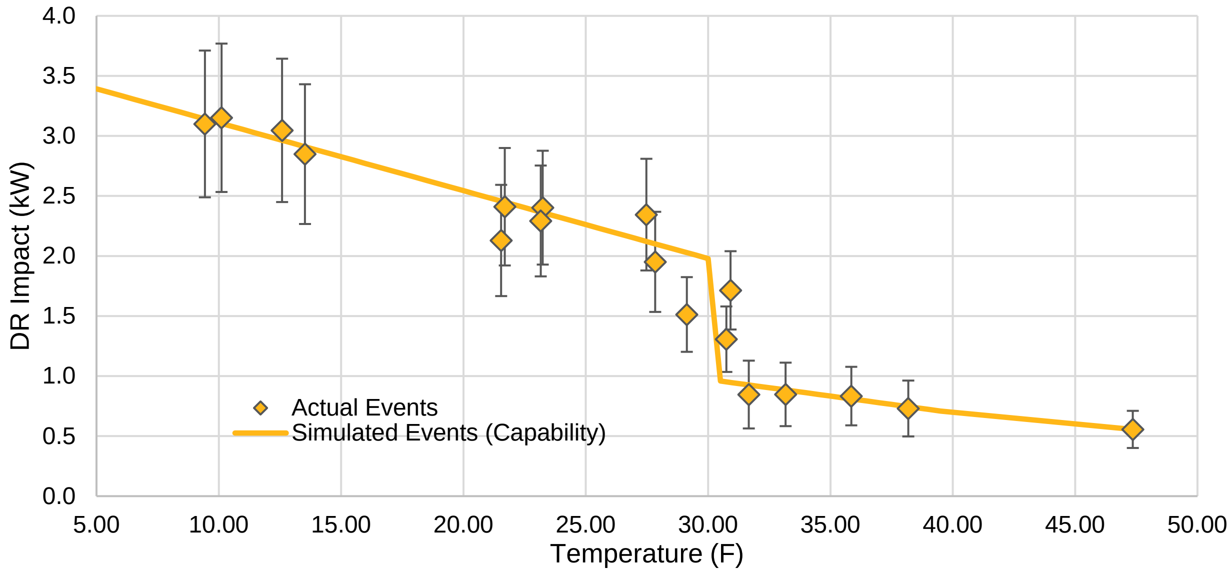
As with water heaters, Guidehouse has, in prior years, estimated the impacts of fully and partially responsive heat strips separately from those that are non-responsive or not in use. This reduces statistical noise, increasing the precision of the estimate (i.e., narrowing the confidence

[25] Navigant (n/k/a Guidehouse) Presented for Duke Energy Progress, *EM&V Report for EnergyWise Home Program – Winter 2017/2018,* August 2018 – see pdf page 295/447: https://starw1.ncuc.net/NCUC/ViewFile.aspx?Id=bf5a0379-5789-4457-99bc-8e71ac76e96f

interval). This also allows for scenario analysis (i.e., how much could program capability be improved by reducing the non-responsiveness rate). These impacts are then adjusted to reflect non-responsiveness, devices not in use, etc. when being extrapolated out to the program population for program-wide ex post event impacts or ex ante projected capability.

Figure 3-12, below, plots average event impact (kW) and temperature (Fahrenheit) pairs from the 2017/2018 evaluation for all fully or partially responsive heat strips – these are per appliance impacts. The line indicates the estimated capability per partially or fully responsive appliance at a range of different temperatures.

**Figure 3-12: Winter 2017/2018 Heat Strip Fully and Partially Responsive Appliance Capability**




*Source: Guidehouse analysis*

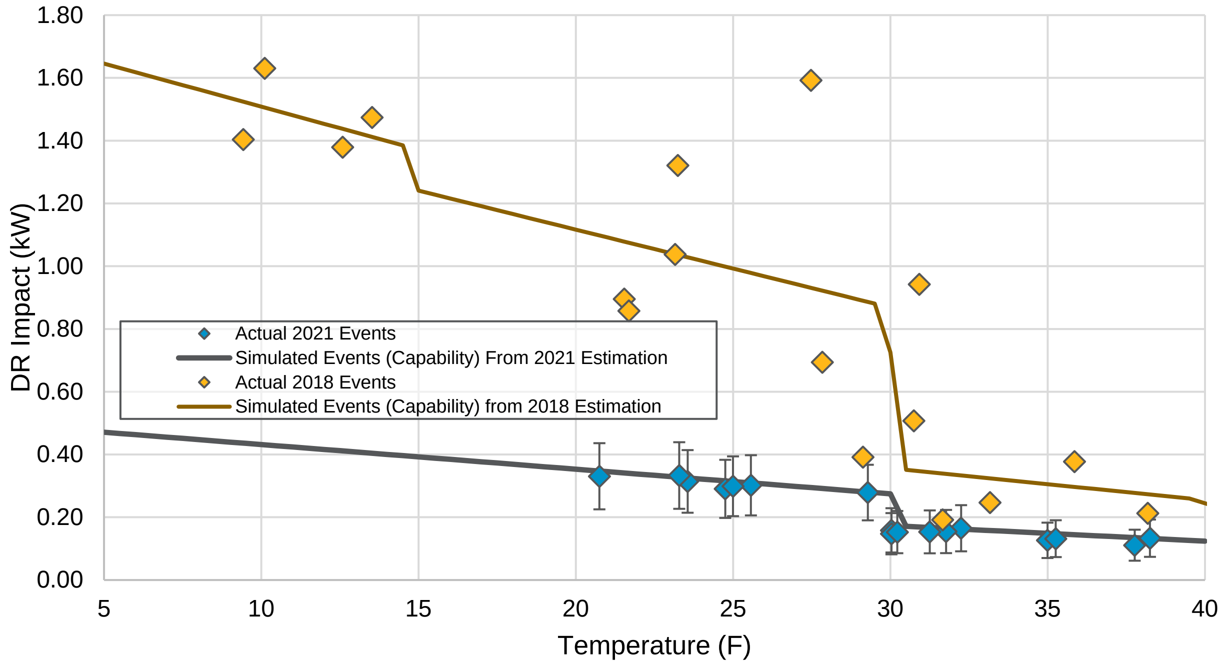
To “translate” the capability and impacts above to make them comparable to those estimated this year, Guidehouse applied the non-responsiveness rate, the device-not-in-use rate, and the average connection rate.[26] This delivers a population average impact per appliance. This is then scaled up slightly to reflect the fact that on average each participant has approximately 1.08 sets of heat strips controlled by Duke Energy. Even after applying these adjustments, it’s clear that the estimated impacts for the winter 2020/2021 are – as they are for water heaters – far lower than in prior years.

This comparison is shown in Figure 3-13 below.

[26] In previous years, the “connection rate” is a factor applied to appliance impacts to account for the number of disconnected switches observed by field staff during the deployment of loggers. This is different from the non-responsive or partially responsive rate, which apply only to connected appliances.

**Figure 3-13: Comparison of Heat Strip Capability – Winter 2017/2018 and Winter 2020/2021**




*Source: Guidehouse analysis*

### 3.3.3 Potential Causes of Reduced Impacts

The substantially reduced impacts estimated for 2020/2021 compared to previous years is a matter of great concern to Guidehouse and to Duke Energy. Guidehouse carefully reviewed the data for this DR season as well as from prior evaluations and is reasonably confident that the most likely major contributor to reduced impacts was the weakening of the DR paging system as a result of a higher than usual number of offline paging towers. Uncertainty as to the cause of lower impacts remains, however, with insufficient evidence available to conclusively identify that cause or causes.

The key driver of this uncertainty is the coincidence of a number of significant exogenous changes to the program – and the evaluation - any one of which could be a contributing cause of these reduced impacts. The most significant of these changes are: the effect of the COVID-19 pandemic on participant behavior, and the significantly reduced paging signal strength in Duke Energy's service area due to outages (some directly attributable to COVID public health restrictions). The shift from evaluation using appliance-specific logger data to whole-home AMI data is major contributor to the uncertainty here, due to the difficulty in accurately disaggregating appliance loads from overall household demand in the AMI data (in contrast to logger data, which is appliance-specific).

The table immediately below provides a summary of the hypotheses considered by Guidehouse, the evidence for or against them, and Guidehouse's conclusion regarding the likelihood of that hypothesis.

| # | Hypothesis | Context | Evidence | Conclusion |
|---|---|---|---|---|
| 1 | Accidental inclusion of non-EM&V participants or mixing | Inclusion of participants not subject to EM&V events (but assuming they were) would reduce impacts, as would | Comprehensive comparison of analysis sample with direct output of groupings | Hypothesis rejected. |

| # | Hypothesis | Context | Evidence | Conclusion |
|---|---|---|---|---|
| | up Group A and B mapping. | mixing up Group A and B participants. | from Intellisource provided by Duke Energy Staff. | |
| 2 | Logger measurement error. | If logger reads were inaccurately inflated, transition to AMI data would result in much lower impacts. | Highly consistent water heater results across all prior studies, despite shifting groups of deployment staff and hardware.<br><br>Side-by-side comparison of A/C logger and AMI-estimated impacts in summer 2019 evaluation found the estimated difference between AMI and logger-derived impacts to not be statistically significant. | Hypothesis rejected. |
| 3 | Whole-home consumption captures secondary effects that "take back" DR not captured in prior logger studies. | If some secondary appliance serves the same end-use as the controlled load, it is possible that load from secondary appliance could increase during events (in response to reduced output from controlled equipment), offsetting DR impacts. | *Water Heaters:* for most homes storage water heaters are the only source of domestic hot water for showering (key driver of water heater impacts).<br><br>*Heat Strips:* incremental secondary space heater (e.g., baseboard) loads in response to heat strip curtailment would reduce whole home DR impacts but leave appliance-specific (data logger-connected) loads unaffected. Take-back from thermostatically controlled secondary heaters is possible only if set-point is higher than minimum indoor temperature during event *and* room in which heating is located is also served by controlled heat pump. Take-back from manually controlled secondary heaters is possible only if participant notices heat pump curtailment and responds by turning on the secondary heater. A more detailed discussion of these scenarios is presented in Appendix D. | *Water Heaters:* Sufficiently improbable that hypothesis may be rejected.<br><br>*Heat Strips:* If a contributor to reduced impacts, unlikely to be the most significant one, given reduced water heater impacts.<br>Guidehouse believes that the sequence of events required to result in DR take-back from secondary space heaters is sufficiently particular that it is improbable that such take-back is a significant contributor to the reduced estimated impacts. Robustly testing this effect would require a side-by-side logger data/AMI data analysis of a winter DR season similar to that performed as part of the summer 2019 DR evaluation. |
| 4 | COVID-related behavior change | Guidehouse has noted in some other evaluations that public health restrictions in response to COVID led to a "stretching" of the morning peak, suggesting a shifting of early morning pre-work behavior to later in the day. Participants choosing to shower later in the day (i.e., outside of the DR event period) would lower DR impacts compared to in previous years. | Guidehouse has, in Appendix C, compared the normalized load profile of water heater only participants on non-event days in the 2021 DR season with a normalized load profile for the same participants drawn from January and December of 2020. This comparison shows a difference between the load profiles that is consistent with the hypothesis of shifted showering behavior. | The evidence reviewed is such that this hypothesis cannot be rejected. The observed difference in load profiles shown in Appendix C is highly suggestive of the hypothesized change in behavior. It is unclear, however, how much of the magnitude in reduced water heater DR capability can be attributed to this apparent change in participant behavior. |
| 5 | Problems with paging signal simulcast reduces switch responsiveness | Paging towers' signals overlap each other to act like a mesh network. If paging signals are not in sync (i.e., not cast simultaneously), switches may not detect the signal and so not curtail. | Duke Energy's paging vendor has investigated the issue and indicated that safeguards exist such that simulcast problems should be impossible.<br><br>Duke Energy program staff have also conducted their own independent tests to rule out this possibility. | Hypothesis rejected. |
| 6 | Problematic switch activations and deactivations | Duke Energy has recently completed a data reconciliation process with one its implementation vendors. As part of this process a number of customer records were identified where switch activations and deactivations were potentially erroneous. A non-activated customer switch would not curtail when signaled to do so. | Duke Energy identified approximately 30 EM&V participants flagged as part of the reconciliation effort. All flagged customers were removed from the estimation set prior to regression estimation. Estimated impacts did not materially change. | Hypothesis rejected. |

| # | Hypothesis | Context | Evidence | Conclusion |
|---|---|---|---|---|
| 7 | Several paging towers with significant reach were offline for part (or all) of the 2020/2021 winter DR season. | St. Joseph's hospital is one of the principal Asheville paging towers. This tower was offline for the majority of the 2020/2021 winter DR season and could not be restored due to hospital COVID protocols. The Bear Wallow paging tower was offline for four events, and, most significantly, the Mount Mitchell paging tower (which provides coverage for ~70% of participants) was offline for the entire season. Additional details regarding the online status of all Western region paging towers may be found in Appendix E | Duke Energy's paging network is akin to a mesh network: because each switch is within range of multiple paging towers' signal there is inbuilt redundancy – the failure of a single tower will not result in a complete loss of curtailment.<br>The loss of multiple towers, however, while not catastrophic, could lead to switches more frequently failing to receive the signal and then curtailing. Exploratory analysis of water heater participants (selected because of the historic stability and consistency of water heater response) detailed in Appendix B is strongly suggestive of a paging tower issue, as are the preliminary findings of Duke Energy program staff's field verifications, summarized in Appendix F. | Guidehouse believes, based on the evidence presented in the appendices to this report, and on evidence cited elsewhere in this table, that offline paging towers during the 2020/2021 DR season are the most significant contributor to reduced ex post impacts and ex ante capability. .<br>With the restoration of all paging towers, this hypothesis could be further tested through the deployment of EM&V events in the winter of 2021/2022. A more detailed testing protocol that Duke Energy could undertake internally is described in the text below. |
| 8 | Heat strip switch functionality has declined substantially in the four years since the fieldwork was conducted in support of the evaluation of the winter of 2017/2018. | This hypothesis was developed as a result of the results of Duke Energy's field verification of a sample of 46 heat strip participants' homes. | As detailed in Appendix F, Duke Energy staff conducting field verification of EM&V participant homes found that an extremely high proportion of switches in these homes were effectively non-functional (for a variety of reasons). For example, nearly half of switches had been disconnected by the customers themselves. | It is possible that the Duke Energy field verification simply drew an unlucky sample, and the results of its investigations are not broadly reflective of the population. Though possible, it still seems highly probable that a significantly higher proportion of heat strip switches are non-functional than was the case four years ago, in 2017. Duke Energy has begun a program-wide census of its program and anticipates inspecting (and remediating) as necessary *all* heat strip switches in the program. |

At present, Guidehouse has concluded that the most likely principal driver of reduced impacts of water heaters for the 2020/2021 winter is the set of paging tower failures for which remediation, due to questions of public health and security of access, was outside of Duke Energy's control and could not be applied until after the end of the DR season. Duke Energy's field verification has also revealed that, if its sample of results is representative of the program, an extremely high number of the switches associated with heat strips controls are non-functional.

Participant behavior changes (in the form of later showering) may also be a contributing factor (see Appendix C) to reduced impacts. Though also a possible contributor to reduced DR impacts, Guidehouse believes that scenarios that would result in significant "take-back" from secondary space heating are edge cases (see Appendix D for reasoning). Quantification of the magnitude (or lack thereof) of this effect would require an evaluation year with a side-by-side comparison of logger and AMI data, such as that completed for the of 2019, when Guidehouse conclusively demonstrated that if auxiliary cooling equipment was being used, it was sufficiently inconsequential that the AMI- and logger-based impacts were statistically equivalent.

Given the above, Guidehouse recommends that Duke Energy consider (following the remediation of paging tower problems) either:

- Conducting another full econometric evaluation of the program again in winter 2021/2022 rather than waiting until winter 2022/2023 to do so, as originally planned; or,
- Conducting a series of test events on the coldest mornings of the winter and work to demonstrate that (using participant AMI data) that the temperature/impact relationship has (or has not) reverted to that estimated in prior evaluations.

Should Duke Energy consider moving forward in time the next winter evaluation, Guidehouse would also recommend that Duke Energy consider deploying data loggers to a sub-sample of the larger EM&V sample to enable a robust comparison of the estimated impacts delivered by the two approaches, as was done for the summer 2019 evaluation.

## *3.4 Net-to-Gross*

Evaluations of demand-side management programs typically estimate a net-to-gross (NTG) ratio based on the evaluated percentage of demand reductions that may be ascribed either to free ridership (which decreases the NTG ratio) or to program spillover (which increases it). Free ridership is typically defined as the percentage of demand reductions that would have occurred anyway, absent the presence of the program. Spillover is typically defined as incremental demand reductions undertaken by nonparticipants or extra reductions taken by participants that were not directly incented by the program administrator but caused by the program. In the analysis in this report, because demand reductions are estimated in contrast to an implied estimated baseline[27] that captures expected behavior absent an event, Guidehouse can confidently state that the free ridership is 0: absent the EnergyWise program, none of the observed demand reductions would have taken place. It is possible that there may have been some spillover resulting from the program (from participants becoming more aware of their sites' consumption profiles, for example). However, it is likely impossible to estimate such an effect in a sufficiently robust manner and the assessment of such impacts is beyond the scope of this report.

Since spillover cannot be robustly estimated and because free ridership must, by program design, be considered 0, Guidehouse considers the EnergyWise program to have a NTG ratio of 1.

[27] That is, the average level of behavior implied by the estimated parameter values of the regressions used.

# 4.0 Process Evaluation Findings

This chapter of the evaluation report provides the results of the process evaluation: the summarized survey responses of the program participants as well as feedback provided to the Guidehouse evaluation team by program staff.

## *4.1 Participant Process Findings*

The principal EM&V findings from the analysis of participant perceptions were as follows:

- **Participants were generally unaware of curtailment events when they happened.** Most (91%) survey respondents indicated that they had not been aware that an event had occurred recently.
- **The program has little impact on the comfort of its participants.** Only 6 respondents (out of 57 event participants) were aware that an event had been called during the period in question. Most survey respondents indicated that they were "very comfortable" or "neutral" during the event.
- **The program does not appear to be a key driver of supplemental heating use.** A similar portion of placebo survey respondents reported using supplemental methods for heating their homes during "event" periods as those respondents who were subject to actual events.
- **Participants were generally satisfied with the EnergyWise program.** Over half of the respondents indicated that they were very satisfied, while only 5% of all survey respondents (10 people) indicated that they were "dissatisfied" with the program. Satisfaction with the program did not differ significantly between respondents who responded to actual events versus those who responded to placebo events.
- **Fewer than half of participants were aware of the bill credits they receive as part of their program participation.** Every customer enrolled in the program receives a hardcopy brochure explaining the bill credits details (when the are received, amounts, etc.), however less than half (45%) of participants reported they noticed the credits on their bill.

This section of the report is divided into four subsections, the first three of which analyze a distinct aspect of participant perspectives. These are:

1. **Awareness of Event:** To what degree were participants aware that an event had taken place?
2. **Comfort During Event:** How comfortable were participants who were aware an event had taken place?
3. **General Program Satisfaction:** How happy or unhappy are participants with the program?

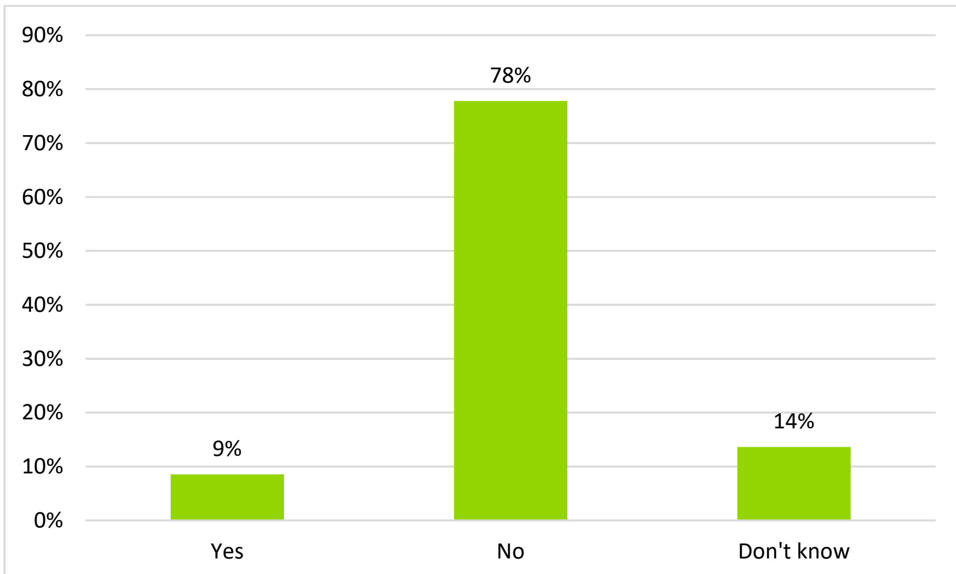
The fourth section presents participant responses to questions about typical HVAC usage, familiarity with electricity billing, and other topics covered by the survey.

### 4.1.1 Awareness of Event

The principal objective of the survey was to determine the degree to which participants took notice of and were affected by curtailment events. While the surveys included a series of more nuanced questions, one of the most important questions was whether or not the respondents took note of their device activation.

The survey assessed whether participants believed that DEP had activated their EnergyWise device, and only 9% of all participants said yes, as shown in Figure 4-1.

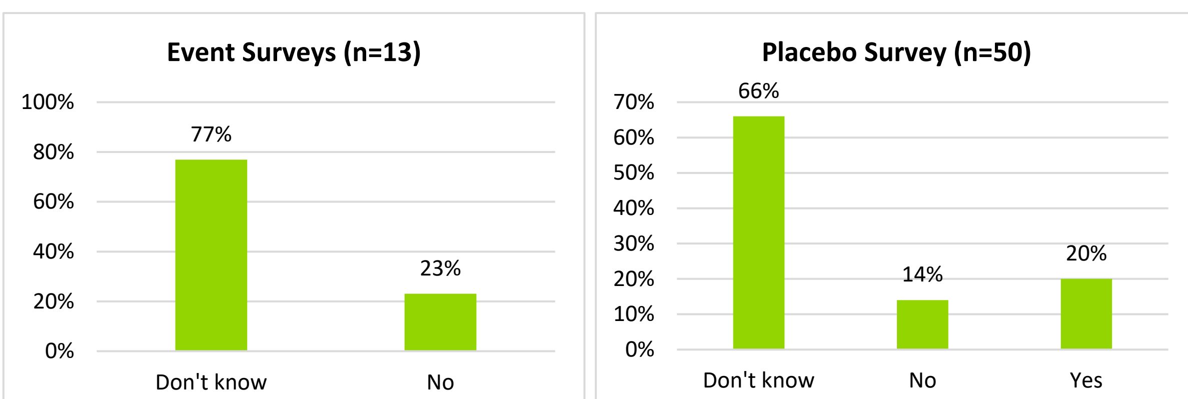
**Figure 4-1. Has Duke Energy Progress activated your EnergyWise device?**




*Source: Guidehouse analysis of post-event survey data, 2021*

While a majority of participants believed their EnergyWise device was activated, they were unsure as to whether it had been called in the past 7 days. Figure 4-2 shows that nearly 70% of participants did not know. While the results are slightly different between the event and placebo survey groups, the differences between the two are not significant.

**Figure 4-2. Has your device been activated in the last 7 days?**

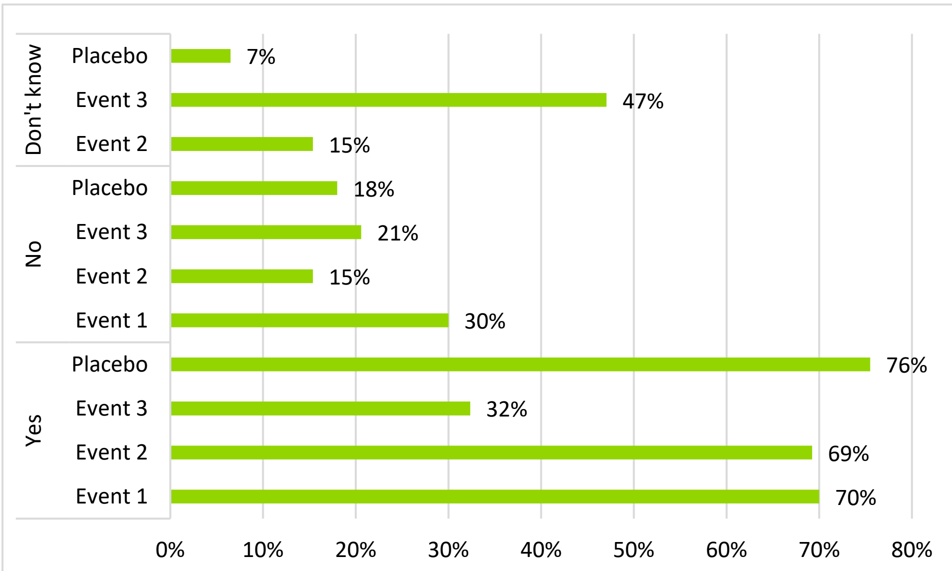



*Source: Guidehouse analysis of post-event survey data, 2021*

### 4.1.2 Comfort During Event

Awareness of a curtailment event is the most important indicator of the event's impact on customer comfort. If a participant did not notice an event, then its perceived impact on their comfort must be trivial. Event awareness is not, however, the only measure of the impact on the participant. Each respondent that was home during an event, regardless of whether they were aware of the event, was asked to characterize their level of comfort both immediately before and during the event. Prior to asking about levels of comfort, the survey screened for respondents who were home at the time of the event, as shown in Figure 4-3. The majority of participants were home during the event hours, with a slightly higher percentage of participants reporting that they were didn't know if they were home during the third event.

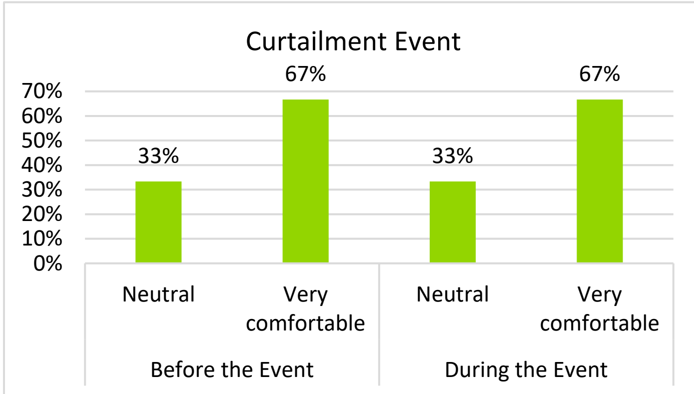
**Figure 4-3. Respondents Who Were Home During the Time of the Event**

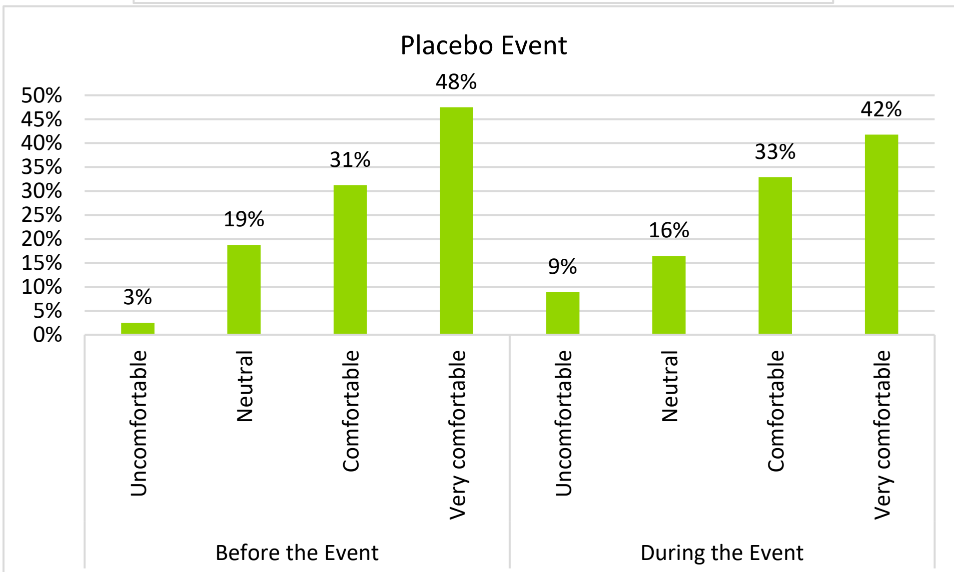



*Source: Guidehouse analysis of post-event survey data, 2021*

Most survey respondents reported high levels of comfort during both the actual and placebo events. Figure 4-4 shows comfort levels both before and during the events for each group. The percentage of event respondents who rated themselves as very comfortable and neutral remained the same before and during the event. For the non-event respondents, the percentage of respondents who rated themselves as uncomfortable increased from 3% to 9%. Similarly, the percentage of respondents who rated themselves as very comfortable decreased from 48% to 42%.

**Figure 4-4. Change in Comfort Level During Curtailment and Placebo Events**




Note: Comfort levels assigned based on 0-10 rating scale: 0-4 = Uncomfortable, 5 = Neutral, 6-8 = Comfortable, 9-10 = Very Comfortable. Results exclude Don't know responses.

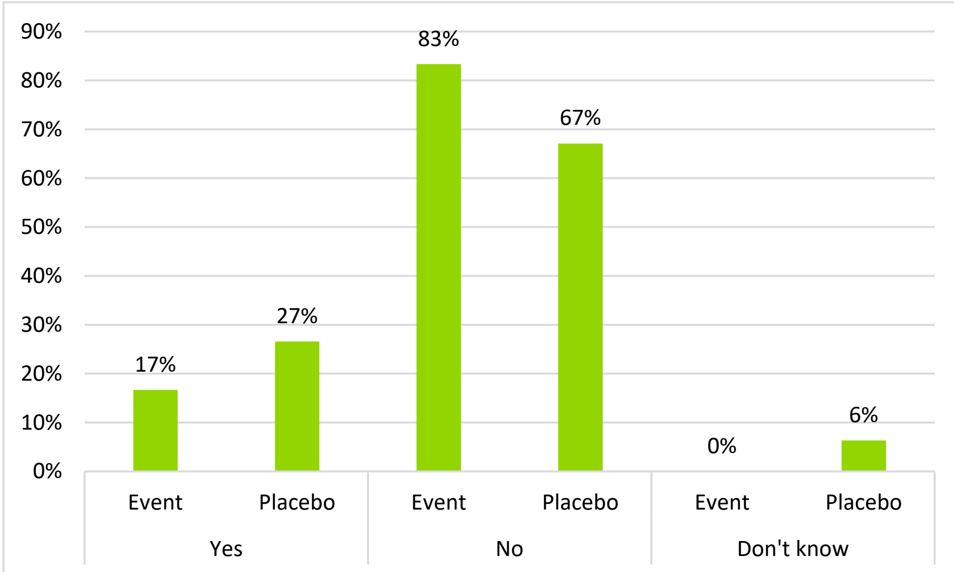
*Source: Guidehouse analysis of post-event survey data, 2021*

The participants who rated their comfort lower than 7 were asked to elaborate on their scores, and verbatim responses from the survey indicate that two of these participants observed lower air or water temperatures during the event.

There is limited suggestion that the comfort of program participants decreased during the event, and coupled with low levels of awareness of device activation, it can be safely concluded that the program is having a minimal effect on the comfort of its participants.

Participants who have heat strips enrolled in the program were asked whether they used additional sources of heat to stay warm during the event and placebo periods. As shown in Figure 4-5, Fewer than a third of respondents reported using additional heat sources, and a similar portion of placebo and actual event respondents reported using alternate heat. These findings seem to indicate that actual DR events are not a key driver in customer use of alternate heating sources.

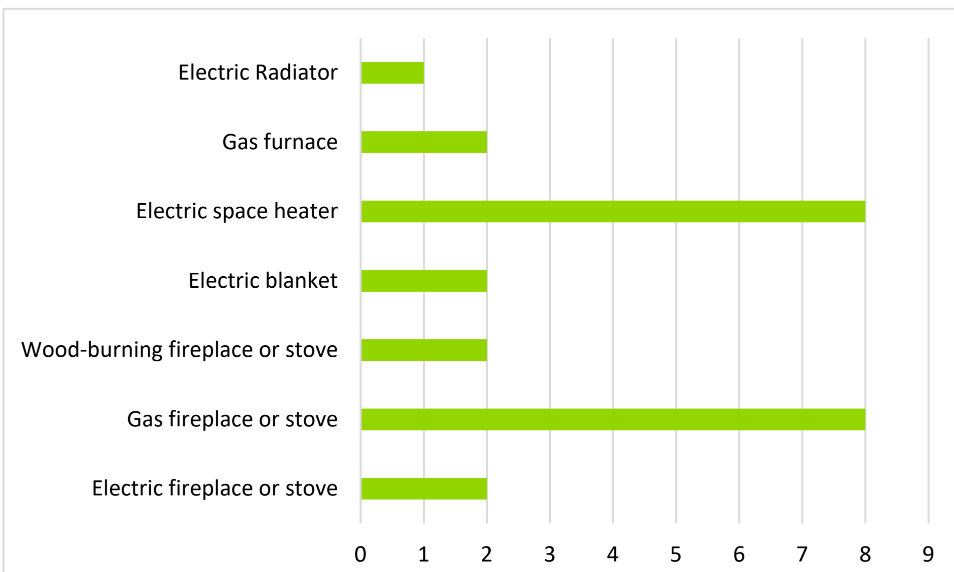
**Figure 4-5. Respondent Use of Additional Heat Sources During Event or Placebo Period**




*Source: Guidehouse analysis of post-event survey data, 2021*

Of those respondents who reported using additional heat sources (n=25), Figure 4-6 shows that most used an electric space heater (8) or a gas fireplace or stove (8).

**Figure 4-6. Types of Additional Heat Sources Used**



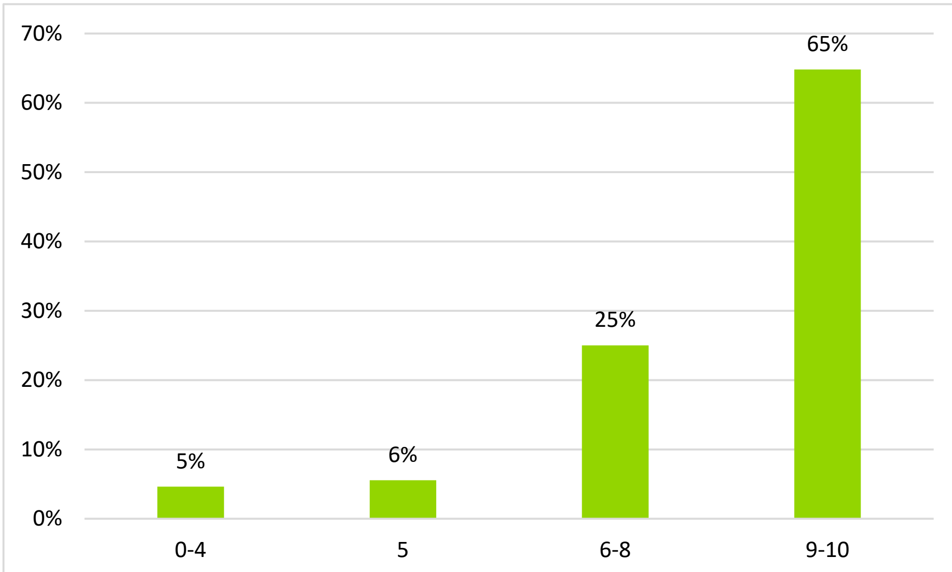

*Source: Guidehouse analysis of post-event survey data, 2021*

### 4.1.3 General Program Satisfaction

In addition to testing participant awareness of events and comfort during events, an important component of the post-event survey effort was to determine the general level of satisfaction participants had with the program. The evaluation team asked respondents to rate their satisfaction with the program overall on a scale from 0 to 10, where 10 is extremely satisfied.

Most survey respondents reported high levels of satisfaction with the program, with 65% of participants highly satisfied (9-10). Only 5% of survey participants rated themselves as dissatisfied with the program (4 or below). Figure 4-7 shows a breakdown of these findings.

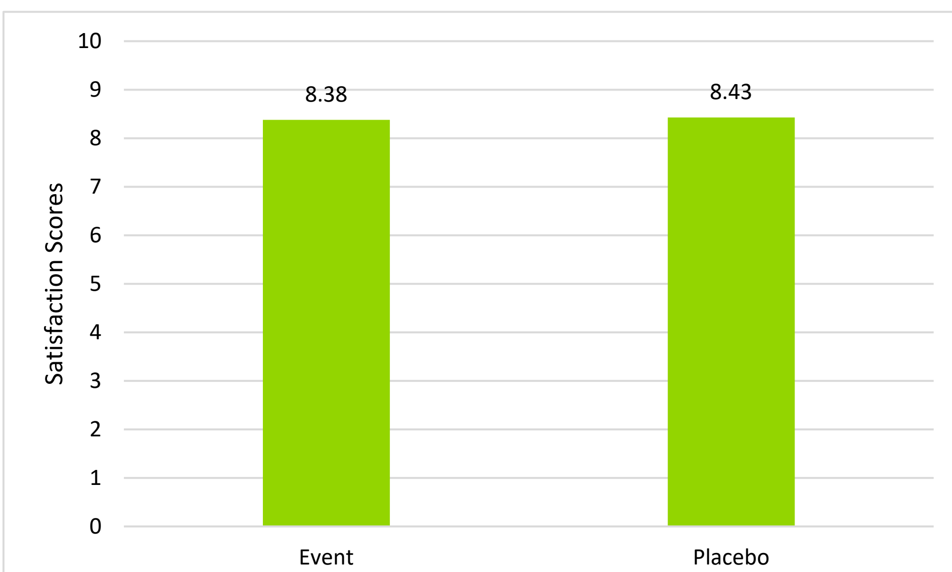
**Figure 4-7. Program Satisfaction of Survey Respondents (n = 257)**




*Source: Guidehouse analysis of post-event survey data, 2021*

Guidehouse found that the average satisfaction scores were around 8.4 for participants surveyed on event days and the placebo day, indicating high satisfaction with the program. Note that while Figure 4-8 shows a difference between the two groups, that difference is not significant.

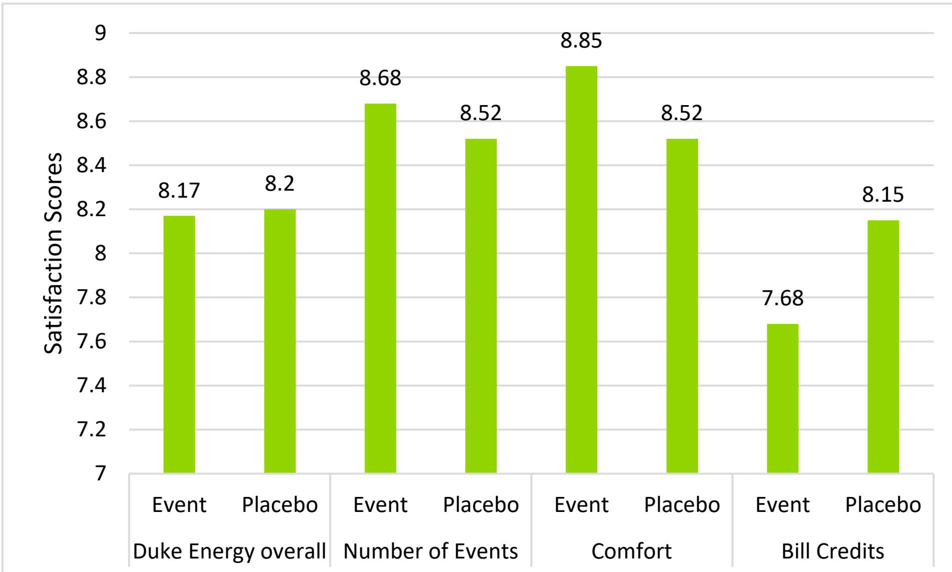
**Figure 4-8. Reported Satisfaction with the EnergyWise Program by Event Status**




*Source: Guidehouse analysis of post-event survey data, 2021*

Guidehouse also asked survey respondents to rate their satisfaction with different elements of the program. As seen in Figure 4-9, majority of the respondents are satisfied with program elements. In most cases, the scores between the event and placebo day are the same with the exception of bill credits associated with the program.

**Figure 4-9. Reported Satisfaction with Program Elements**




*Source: Guidehouse analysis of post-event survey data, 2021*

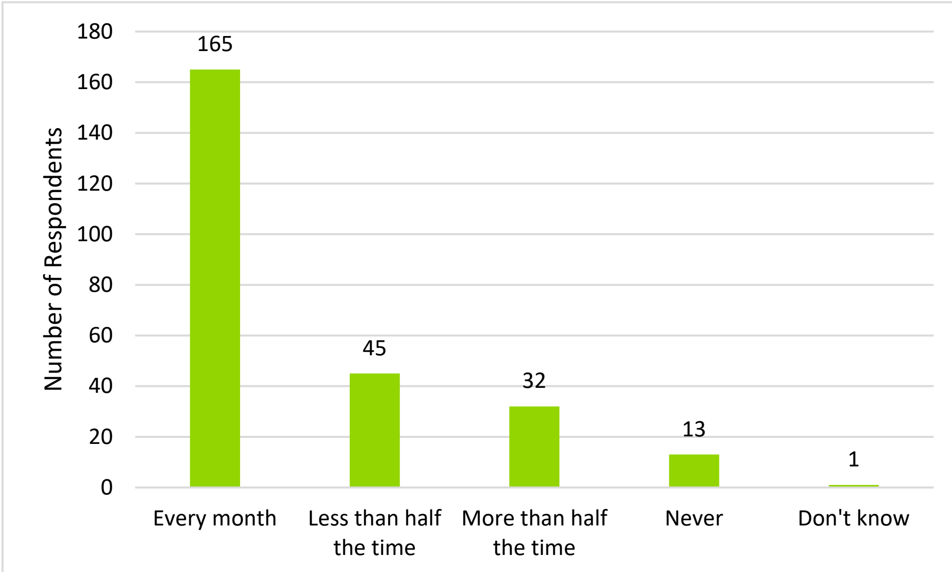
Building on their reported satisfaction, 83% of survey respondents indicated that they would recommend the program to a friend or colleague, characterized by a rating of 6 or higher on a likelihood scale from 0 to 10.

The evaluation team asked respondents who expressed lower satisfaction with the program (a rating of a 7 or below) to expand on their reasoning. The most common reason for dissatisfaction was Duke Energy's lack of promotion of more carbon neutral energy sources such as wind and solar and a lack of notification when DEP activates their device or lack of information about the program in general.

### 4.1.4 Other Survey Findings

This subsection contains additional results from the participant surveys. Guidehouse's survey asked participants to report their frequency of reviewing the DEP bill. Figure 4-10 shows that majority of the participants review their bill monthly.

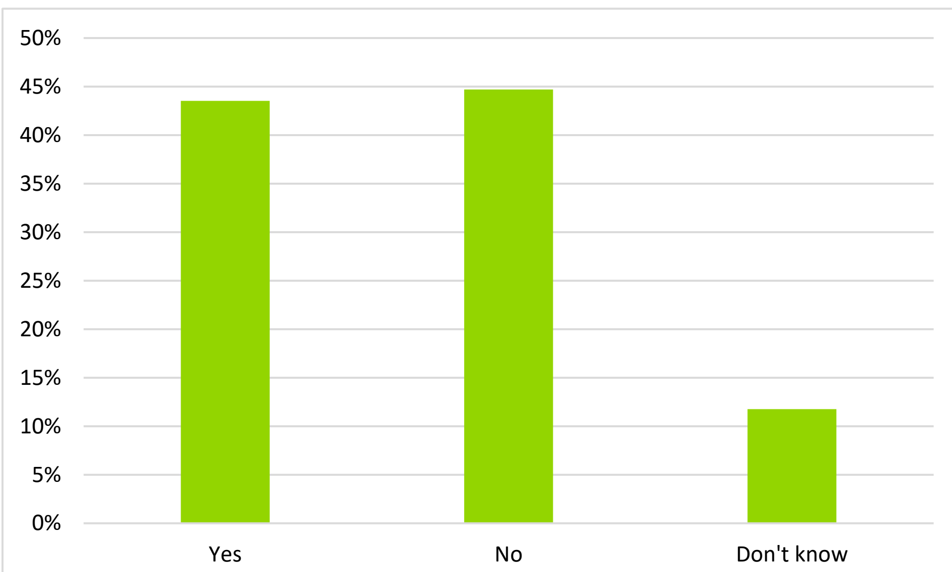
**Figure 4-10. Frequency of Reviewing DEP Bill**




*Source: Guidehouse analysis of post-event survey data, 2021*

The survey respondents were then asked whether they have noticed the EnergyWise credit on their bill. As shown in Figure 4-11, just under half of respondents had noticed that they received a credit on their bill.

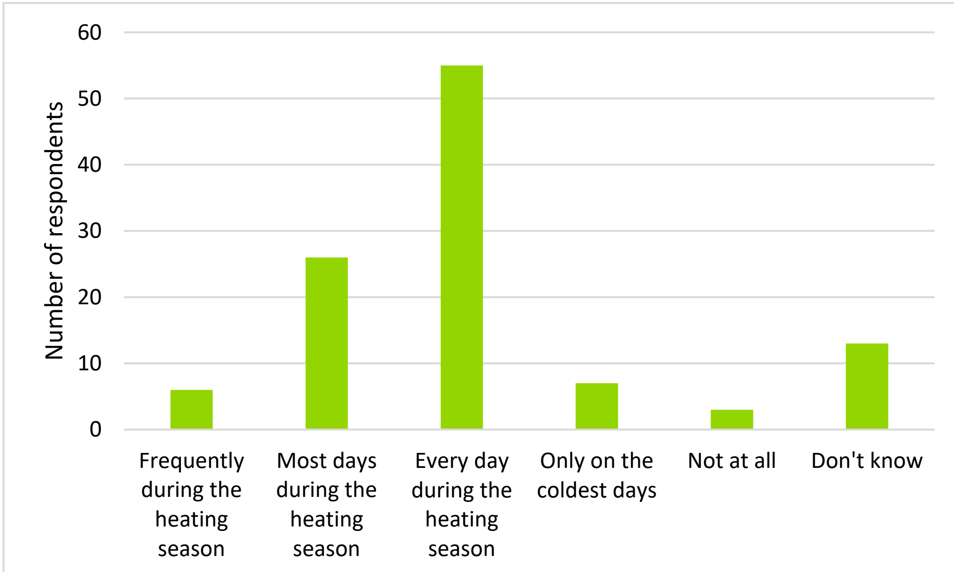
**Figure 4-11. Noticed the EnergyWise credit on the bill**




*Source: Guidehouse analysis of post-event survey data, 2021*

The evaluation team also asked several questions about the participants' home heat pumps. As shown in Figure 4-12, most participants used their heat pumps either most days or every day during the heating season. When participants were asked at what outdoor temperature, they will run their heat pumps, they reported an even distribution between 40-60 degrees. Participants were also asked to report the age of their heat pump. Participants reported an even distribution between new to 20 years.

**Figure 4-12. Frequency of using heat pumps**




*Source: Guidehouse analysis of post-event survey data, 2021*

## *4.2 Program Staff Process Findings*

As part of Guidehouse's process evaluation of DEP's EnergyWise Home program, Guidehouse staff interviewed the Duke Energy program manager (PM). The purpose of the PM interview was to capture and document as part of the evaluation (and so ensure it lives in the organization's institutional memory) any insights such staff can offer.

> *This interview took place prior to the start of Guidehouse's impact evaluation of the 2020/2021 DR season. At the time of the interview (the findings of which are detailed below) program staff were unaware of how much program capability had eroded since the previous full evaluation of the program, the 2017/2018 winter DR season.*

The most significant outcome of this interview, in the opinion of the Guidehouse interview team, was the observation that while the incorporation of a bring-your-own-thermostat (BYOT) element to the EnergyWise program is a significant opportunity, it carries with clear challenges and risks.

In terms of opportunities and benefits of the introduction of BYOT, the PM was unambiguous: BYOT has, by opening up what is more or less a new market for the program, materially increased potential program recruitment. Prior to the recent introduction of a thermostat option, in December of 2019, the EnergyWise Home program was strictly (since its introduction in April 2009) a switch-based demand response program.

The program load control switches are controlled by Duke Energy using a one-way paging network signal and are (in most cases) effectively invisible to participants – most participants are unaware of events[28] as they occur and almost none of them choose to opt out of events (the Duke Energy PM indicated that historically opt-out rates fell well below 1% of participants in each event). Over time, the PM had noted that maintaining growth in enrolment numbers has required strategic migrations across engagement channels: first via email and direct mail, then transitioning to out-bound calling as enrolment driven by the earlier channels dwindled and most recently through in-person canvassing. The PM noted that switch-based enrollment through these channels had been satisfactory and sufficient to meet the firm's Integrated Resource Plan (IRP) summer commitments and very nearly meet the winter commitments.

With the introduction of a BYOT stream for the program, the PM noted that enrollment had increased substantially, to the point that the program is – for the summer months – now effectively of meeting the summer 2030 IRP capacity commitment. The challenge here lies in balancing the program's summer and winter needs cost-effectively.

Though the program must acquire more winter capacity in order to meet the requirements of the IRP, it can only do so (via the BYOT route) at the cost of increasing its over-capacity in the summer months. The PM identified that unlike the tariff rider related to the load control switches (which unbundles the seasons, allowing enrollment of exclusively winter capacity) the thermostat tariff rider bundles the seasons: every BYOT winter participant is also, perforce, a summer participant.

An additional point identified by the PM with respect to BYOT participants was that event opt-out is much simpler, and the PM indicated that his understanding was that opt-out rates as high as 25% are not uncommon in other, similar, BYOT DR programs. Though the PM did not say this, Guidehouse understands as well (from its evaluations of other DR programs) that when thermostats are controlled for DR programs, that control is more obvious to participants (and hence more likely to be overridden via opt-out).

As Duke Energy confronts this potential seasonal differential dilemma going forward, it may wish to consider ways that the strong customer relationship it evidently has with smart thermostat owners can be leveraged to reduce its program costs without jeopardizing its ability to meet its IRP commitments. For example, offering to some of its participants (that have no winter capacity to offer) migration from EnergyWise Home to a voluntary technology-enabled TOU rate could help reduce customer bills on a more consistent basis *and* reduce Duke Energy's system costs. Modest daily direct load control during a regularly scheduled summer peak period (the acceptance of which might be incented by a cost-reflective TOU tariff) could provide a more consistent source of bill relief to some customers than the annual EnergyWise Home payments, as well as better value to Duke Energy.

Another possible avenue Duke Energy may wish to consider (for the purposes of growing its winter, but not its summer capacity) is attempting to increase still further the number of EnergyWise Home participants that allow Duke Energy to control their water heater. Water heaters are historically the most reliable and consistent source of residential demand response, and, as water heaters cannot be dispatched via thermostat, are not subject to the same constraints as the BYOT element of this program. Water heater control is, in addition, even

[28] The PY2011/2012 summer and winter evaluations found that 95% of winter event survey respondents were unaware that a curtailment event had taken place (when asked within a few days of one), and that more participants exposed to a "placebo" event claimed to be aware of the event than participants *actually* exposed to an event. A similar pattern of awareness of summer events was identified in PY2013 (11% of survey respondents exposed to placebo events indicated awareness of them, whereas 13% of survey respondents exposed to actual events indicated awareness of them).

more invisible to participants than switch-based HVAC control suggesting that a material amount of capacity remains to be acquired.

# 5.0 Findings, Conclusions, and Recommendations

The principal EM&V findings and conclusions regarding the winter event demand impacts for 2020/2021 are as follows:

- **Estimated impacts are much lower than in prior years, likely because of an increase in individual device non-responsiveness.** Estimated water heater impacts are on average only slightly more than half of what they were in the prior three most recent full econometric evaluations, and heat strip impacts are less than a quarter of what was estimated in the 2017/2018 impact evaluation. This difference in impact reductions across the two appliance types could be explained by a proportionate increase in device non-responsiveness; the 2017/2018 evaluation found that, on average, 5% of water heaters failed to respond to the DR curtailment signal and 26% of heat strips failed to respond.

- **The estimated average impact of the Winter 2020/2021 EM&V water heater events was 0.22 kW per participant, or 0.21 kW per appliance.** This is the average of the estimated impacts across 22 100% cycling events taking place between 6:30 and 8:30 in the morning.

- **The estimated average impact of the six coldest Winter 2020/2021 EM&V heat strip events was 0.31 kW per participant, or 0.30 kW per appliance.** The average temperature across these events was 24 degrees Fahrenheit and the lowest observed temperature was 21 degrees Fahrenheit. This is, to date, the warmest minimum temperature event evaluated for this program since Guidehouse first began evaluating the program in the winter of 2011/2012.

- **The current DR capability of DEP's EnergyWise program in the winter is approximately 5.7 MW**. This is the sum of the projected capability of 2.8 MW from heat strip curtailment when the average temperature is 10 degrees Fahrenheit (0.41 kW per appliance) and 2.9 MW from water heater curtailment deployed between 7:30 and 8:30 in the morning (0.21 kW per appliance). These capability values are, as noted above, considerably lower than in prior evaluation years, and may be due to transitory effects outside of Duke Energy's control. If it can be demonstrated (e.g., via testing in the winter of 2021/2022) that remedial action has been successful at restoring prior capabilities, Duke Energy should base its planning on the capabilities projected as part of the 2017/2018 evaluation or on (if available) updated capability estimates.

- **Guidehouse believes that the most significant single driver of reduced program impacts and capability for water heaters was the poor health of the Duke paging network during the 2020/2021 DR season.** During three-quarters of the DR events dispatched in the DR season of 2020/2021 60% or less of the Western region paging towers were online. This was a result both of COVID public health restrictions (preventing maintenance of the tower located in a hospital) and due to damage to the satellite receiver. The paging provider did not service the site because two-way monitoring of the site was off-line and no operational alerts could be communicated. A secondary contributing factor may have been a shift in participant behavior due to COVID; a comparison of pre-COVID and winter 2021 water heater only participant load profiles reveals differences that are consistent with a shift to later showering, which could materially reduce water heater DR capability.

- **Field verifications conducted by Duke Energy indicate that the proportion of heat strip switches that are disconnected (unable to curtail) has also increased quite substantially in the four years since the 2017 field work.** None of the 46 switches examined by the field verification staff was found to be without problem. The vast majority of issues uncovered were that the customer had disabled the switch (48% of cases) or that it had been incorrectly installed (33% of cases). The reduced program capability due to the high proportion of non-functioning devices is compounded by the paging network issues above, which would mean that curtailment would be erratic even when the switch was fully functional. In addition, Guidehouse has identified the possibility that heat strip DR impacts may have been affected by participant use of secondary (room-specific) space heating. Under certain circumstances (detailed in the report) erosion, or “take-back”, of auxiliary heat strip impacts as a result of participants’ use of secondary (room) space heaters is possible, though Guidehouse believes it is improbable that such circumstances would be observed sufficiently often to significantly affect DR impacts.

The principal EM&V findings from the analysis of participant perceptions were as follows:

- **Participants were generally unaware of curtailment events when they happened.** Most (91%) survey respondents indicated that they had not been aware that an event had occurred recently.
- **The program has little impact on the comfort of its participants.** Only 6 respondents (out of 57 event participants) were aware that an event had been called during the period in question. Most survey respondents indicated that they were “very comfortable” or “neutral” during the event.
- **The program does not appear to be a key driver of supplemental heating use.** A similar portion of placebo survey respondents reported using supplemental methods for heating their homes during “event” periods as those respondents who were subject to actual events.
- **Participants were generally satisfied with the EnergyWise program.** Over half of the respondents indicated that they were very satisfied, while only 5% of all survey respondents (10 people) indicated that they were “dissatisfied” with the program. Satisfaction with the program did not differ significantly between respondents who responded to actual events versus those who responded to placebo events.
- **Fewer than half of participants were aware of the bill credits they receive as part of their program participation.** Every customer enrolled in the program receives a hardcopy brochure explaining the bill credits details (when the are received, amounts, etc.), however less than half (45%) of participants reported they noticed the credits on their bill.

# 6.0 Summary Form

## *EnergyWise Home*
### *Winter 2020/2021*
Completed EMV Fact Sheet

### Description of Program

Duke Energy's EnergyWise program is a DR program offered to residential customers in the DEP territory.

EnergyWise is a direct load control program. Participants receive an incentive to allow DEP to control their air conditioners (in the summer), their heat pump auxiliary heat strips (in the winter), or their electric water heaters (winter or summer). Only participants in the Western region are curtailed in the winter.

This report evaluates the capability of the program as of the winter of 2020/2021. In winter 2021, no events were called for the entire program population, but 22 water heater, and 17 heat strip events were called for the EM&V sample used to evaluate capability. Ex ante impacts reported below are the projected program capability between 7am and 8am when the average event temperature is approximately 10 degrees Fahrenheit.

| | |
|---|---|
| Date: | 2021-07-28 |
| Region: | DEP |
| Evaluation Period | Winter 2020/2021 |
| **DR Ex Ante Impact (Capability) per Device (kW)** | |
| Water Heater | 0.25 |
| Auxiliar Heat Strips | 0.41 |
| **DR Ex Ante Program Impact Capability (MW)** | |
| Water Heater | 2.9 |
| Auxiliar Heat Strips | 2.8 |
| Net-to-Gross Ratio | 1 |

### Evaluation Methods

Guidehouse estimated DR impacts for water heaters and heat strips by applying regression analysis to an EM&V sample of program participants selected to be representative of the overall population. DEP did not call any population-wide events during the season so this sample of participants was subjected to EM&V events to provide Guidehouse with data points from which impacts could be estimated.

Guidehouse applied a randomized control style experimental design, randomly allocating sample participants to one of two groups, with each group acting as a treatment or control group for different events. This ensures a robust contemporaneous control group and unbiased estimate of impacts. Impacts were estimated with panel data regression analysis.

### Impact Evaluation Details

- **The estimated average impact of the EM&V participant sample water heater events was 0.22 kW per participant, or 0.21 kW per appliance.** This is the average of the estimated impacts across 22 100% cycling events taking place between 6:30 and 8:30 in the morning.
- **The estimated average impact of the six coldest EM&V heat strip events was 0.31 kW per participant, or 0.30 kW per appliance.** The average temperature across these events was 24 degrees Fahrenheit and the lowest observed temperature was 21 degrees Fahrenheit. This is to date the warmest minimum temperature event evaluated for this program since Guidehouse first began evaluating the program for summer 2011/2012.
- **Estimated impacts are much lower in prior years, potentially because of an increase in individual device non-responsiveness.** Estimated water heater impacts are on average only slightly more than half of what they were in the prior three most recent full econometric evaluations, and heat strip impacts are less than a quarter of what they were. This difference in impact reductions across the two appliance types could be explained by a proportionate increase in device non-responsiveness, which was (across all events) 5% for water heaters in 2017/2018, but 26% for heat strips..
- **The current DR capability of DEP's EnergyWise program in the winter is approximately 5.7 MW**. This is the sum of the projected capability of 2.8 MW from heat strip curtailment when the average temperature is 10 degrees Fahrenheit and 2.9 MW from water heater curtailment deployed between 7:30 and 8:30 in the morning.
- **Guidehouse believes that the most significant driver of reduced program impacts and capability for water heaters was the poor health of the Duke paging network during the 2020/2021 DR season.** During three quarters of the DR events dispatched in the DR season of 2020/2021 60% or less of the Western region paging towers were fully online. A secondary contributing factor may have been a shift in participant behavior (later showering times) due to COVID.
- **Field verifications conducted by Duke Energy indicate that the proportion of heat strip switches that are disconnected (unable to curtail) has also increased quite substantially in the four years since the 2017 field work**. None of the 46 switches examined by the field verification staff was found to be without problem. The vast majority of issues uncovered were that the customer had disabled the switch (48% of cases) or that it had been incorrectly installed (33% of cases). The reduced program capability due to the high proportion of non-functioning devices is compounded by the paging network issues above, which would mean that curtailment would be erratic even when the switch was fully functional.

# Appendix A. Regression Model Specification

This appendix provides more detail on the methods employed by the evaluation team to estimate DR impacts and the capability of heat strips and water heaters controlled during the winter of 2020/2021. It is divided into two sections. The first addresses water heaters, while the second addresses heat strips.

## *A.1 Water Heater Model Specification and Details*

Water heater impacts were estimated using a single regression equation, shown in Equation 1, below. Only event days were included in the estimation set. Limiting the estimation set to include event days only is possible due to the two-group RCT-style experimental design.

Note that the specification below is considerably more complex than used in prior years when logger data were available. The logger data used in previous years provide appliance-specific demand values. The regression specification therefore needs only capture the expected baseline behavior of the water heater. For this evaluation, whole home AMI data are used. This means that additional variables need to be included to control for the effects of (for example) weather on whole-home demand, even though intra-daily weather has no real impact (per prior years' analysis) on water heater demand.

**Equation 1: Water Heater Regression Equation**

$$y_{i,t} = \sum_{q=1}^{Q=96} \alpha_i \cdot qh_{q,t} + \sum_{r=1}^{R=2} \sum_{q=1}^{Q=96} \beta_{1,q} \cdot qh_{q,t} \cdot cbu_{i,t} \cdot spline_{r,t} + \sum_{r=1}^{R=2} \sum_{q=1}^{Q=96} \beta_{2,q} \cdot qh_{q,t} \cdot emaHDQH_{i,t} \cdot spline_{r,t} + \sum_{r=1}^{R=2} \sum_{d=1}^{D=8} \gamma_{d,1} \cdot relQH_{d,t} \cdot c_{i,t} + \sum_{r=1}^{R=2} \sum_{s=1}^{S=15} \beta_{3,s} \cdot sb_{i,t,s} \cdot numQH_{i,t} + \varepsilon_{i,t}$$

Where:

$y_{i,t}$ = Water heater participant *i*'s demand during quarter-hour of sample *t*.

$spline_{r,t}$ = A set of two dummy variables.

One is equal to 1 when the value of $emaHDQH_t$ is less than 35 (approximately equivalent to taking a value of one when the temperature is greater than 30°F).

The other is equal to 1 when the value of $emaHDQH_t$ is greater than or equal to 35 (approximately equivalent to taking a value of one when the temperature is less than or equal to 30°F). This hinge point temperature was selected on the basis of analysis included in Appendix A of the 2017/2018 EnergyWise Home evaluation that found that the relationship between heat strip demand and temperature changed materially on either side of this hinge point.[29]

$\alpha_i$ = An individual participant-level fixed effect. This is equivalent to a battery of dummy variables, one for each participant. This set of dummy variables controls for all time-invariant differences in demand between participants (e.g., the size of the home, etc.)

$qh_{q,t}$ = Dummy variables (96) to capture time of day effects. Each one is equal to 1 when quarter-hour of sample *t* is the *q*-th quarter-hour of that day, and 0 otherwise.

$cbu_t$ = Cold buildup observed in quarter-hour of sample *t*. This is a 72-hour geometrically decaying average of the NOAA-defined wind chill/temperature index.[30] It is calculated in the following manner:

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

Note in this case that the *t* subscript denotes hourly intervals. As noted above, the $cbu_t$ (normalized cold buildup) is a geometrically decaying 72-hour moving average of NOAA's wind chill/temperature index. That variable is calculated in the following manner:

$$wchill_t = 35.74 + 0.6215 \cdot drybulb_t - 35.75 \cdot (0.16 \cdot ws_t) + \\ 0.4275 \cdot drybulb_t \cdot (0.16 \cdot ws_t)$$

Where $drybulb_t$ is the drybulb temperature (in °F) observed at quarter-hour *t* and $ws_t$ is the windspeed in miles per hour observed at quarter-hour *t.*

$emaHDQH_t$ = A 3-hour exponential moving average of heating degree quarter-hours (HDQHs). That is, an exponential moving average that includes the current quarter-hour *t* and the 11 quarter-hours prior to that. The moving average calculated over HDQHs with a base of 65°F (i.e., HDQH is equal to 65 minus temperature, or 0, whichever is highest).

$relQH_{d,t}$ = A set of 8 dummy variables, each equal to 1 when quarter-hour *t* is the *d*-th quarter-hour of the event. Note that although this differs somewhat from the approach used in prior years – in which the treatment or

---

[29] The inclusion of this term is predicated on the fact that at least some water heater participants also use heat pumps (with auxiliary heat strips) for space-heating and that the improved precision the inclusion of these terms offers outweighs the reduction in precision imposed by the loss of degrees of freedom associated with including additional independent variables.

[30] NOAA, National Weather Service, *Wind Chill/Temperature Index*, accessed August 2019. https://www.weather.gov/oun/safety-winter-windchill

curtailment dummy was interacted with the absolute as opposed to the relative quarter hour of the day – the practical effect is the same as all events start at the same time of day and last the same number of hours. For example, relative quarter hour 1 is always the period between 6:30 and 6:45 AM.

$c_{i,t}$ = A dummy variable equal to 1 when participant *i* is expected to curtail (i.e., is in Group A during a Group A curtailment event or is in Group B during a Group B curtailment event).

$sb_{i,t,s}$ = A set of 15 dummy variables. Each one is equal to 1 when quarter-hour *t* is the *s*-th quarter-hour following the end of a DR event and when participant *i* was expected to be curtailed on event day *t*.

$numQH_{i,t}$ = The number of quarter hours that the DR event to which participant *i* was subject, that took place on day *t* lasted, and 0 otherwise.

## A.2 Heat Strip Model Specification

Heat strip impacts were estimated using a single regression equation, shown in Equation 2, below. Only event days were included in the estimation set. Limiting the estimation set to include event days only is possible due to the two-group RCT-style experimental design.

**Equation 2: Heat Strip Regression Equation**

$$
\begin{aligned}
y_{i,t} = & \sum_{r=1}^{R=2} \alpha_{i,r} \cdot spline_{r,t} + \sum_{r=1}^{R=2} \sum_{q=1}^{Q=96} \beta_{1,q} \cdot qh_{q,t} \cdot spline_{r,t} + \sum_{r=1}^{R=2} \sum_{q=1}^{Q=96} \beta_{2,q} \cdot qh_{q,t} \cdot cbu_{i,t} \cdot spline_{r,t} \\
& + \sum_{r=1}^{R=2} \sum_{q=1}^{Q=96} \beta_{3,q} \cdot qh_{q,t} \cdot emaHDQH_{i,t} \cdot spline_{r,t} + \sum_{r=1}^{R=2} \sum_{d=1}^{D=16} \gamma_{d,1} \cdot relQH_{d,t} \cdot c_{i,t} \cdot emaHDQH_{i,t} \cdot spline_{r,t} \\
& + \sum_{r=1}^{R=2} \sum_{s=1}^{S=15} \beta_{5,s} \cdot eventHDQH_{i,t} \cdot sb_{i,t,s} \cdot spline_{r,t} + \varepsilon_{i,t}
\end{aligned}
$$

Where:

$eventHDQH_{i,t}$ = The sum of HDQHs to which participant *i* was exposed over the course of the event that took place on day *t*, and 0 otherwise.

And all other variables are as defined above.

# Appendix B. Water Heater Diagnostic Analysis

Early in Guidehouse's exploratory data analysis of the AMI data provided by Duke Energy it became apparent that curtailment in the winter was delivering much less DR than it had in prior winter seasons evaluated by the Guidehouse (formerly Navigant) team.

Guidehouse began by undertaking some very standard quality control procedures. These confirmed that all participants were accurately mapped to the correct A and B groups (via direct comparison with addressing in Duke's Intellisource system), and further that A and B events were mapped to the correct dates. Guidehouse and Duke Energy satisfied themselves that the apparently significantly reduced impacts were not the result of any data management problems.

Following this confirmation, the Guidehouse team worked to identify which participants had successfully curtailed in response to the Duke Energy paging signal and which had not. The motivation for this exercise was to identify whether there existed any patterns that might suggest the underlying cause of the lower estimated impacts than in previous evaluation years.

None of these outputs below were applied to the regression analysis used to estimate the ex post and ex ante impacts; the exercise described below is purely diagnostic – an attempt to better understand why the estimated impacts were so much lower than in prior years.

This appendix is divided into five sections:

1. **Identifying Non-Responsive Participants.** Describes how (and why) Guidehouse developed an approach to identify the which water heater only participants appeared to successively respond to Duke Energy's DR signal and curtail on individual events.
2. **Assessing the Quality of the Baseline.** Outlines the approach Guidehouse used to identify the uncertainty associated with this individual-specific approach. This is essential in understanding how strong a conclusion may be drawn from the evidence these diagnostic findings provide.
3. **Temporal Distribution of Non-Response.** Describes patterns of successful curtailment rates across events.
4. **Cross-Sectional Distribution of Non-Response.** Describes patterns of successful curtailment across individuals: i.e., is it more a case of some participants being unresponsive to many events, or many participants being unresponsive to some events?
5. **Geographic Distribution of Non-Response.** Plots EM&V participant locations on a map, by frequency of successful curtailment, identifying an apparent geographic trend in curtailment success.

## *B.1 Identifying Non-Responsive Participants*

To better assess the scale and scope of the problem, Guidehouse developed a very simple customer baseline to apply to water heater participants to attempt to identify (on an individual customer and event basis) when curtailment had been successful and when it had not.

**This diagnostic analysis in no way impacts the core regression analysis described in the body of the report, or its estimated results. It is presented here to provide transparency and additional context only.**

For the group of participants for whom only water heaters were controlled, an individual customer baseline was compared to each participant's observed demand during, and immediately after each event. A participant was categorized as having successfully curtailed when two conditions were met:

- The average demand during the event period was less than the estimated baseline demand.
- The average demand in the 30-minute period beginning 15 minutes after the event was at least 25% higher than the baseline.

These conditions were selected to attempt to take advantage of the very distinctive spike in demand typically observed after successful water heater curtailment. A fifteen-minute gap between the end of the event period and the beginning of the snapback period was included to account for ramping (in prior years Guidehouse has found that on average ramping results in some – very small – demand response persisting in the fifteen-minute interval following the end of the event).

Guidehouse supplemented this with visual inspections of a sample of individual participant event-day load profiles, overriding the category allocation made by the baseline algorithm when the analyst reviewing the profiles deemed it prudent to do so. Approximately 5% of the individual participant/event profiles were so inspected.

Only participants with controlled water heaters (but no controlled heat strips) were included in this analysis, in an attempt to minimize any additional variation in demand due to the effects of space-heating.[31] Note that Guidehouse was not, with this exploratory analysis, attempting to conduct a comprehensive cataloguing of device response. Rather, Guidehouse sought to take advantage of those participants and devices with the most stable demands and the most (historically) reliable and stable demand response in an attempt to identify whether there existed any observable patterns in apparent device non-responsiveness that could provide clues as to the ultimate cause of the much lower than typical estimated impacts.

Guidehouse envisaged using the outputs of this analysis for three purposes:

1. Providing a list of device responsiveness to Duke Energy to allow program staff to conduct on-site verification of participants that appeared to successfully curtail the least often.
2. Identify whether non-responsiveness appeared to be more a case of a smaller number of participants frequently (or always) failing to curtail, or a larger number of participants occasionally failing to curtail. This could provide evidence for the source of the reduced demand response.
3. Identify whether there existed any clear geographic patterns in non-curtailment.

## *B.2 Assessing the Quality of the Baseline*

Evaluations of residential demand response programs and pilots nearly always use some form of panel-data regression analysis to evaluate impacts. That is, impacts are estimated on average across all participants (or groups of participants) and not for individual participants. There is a good reason for this convention: individual customer AMI usage data is notoriously “noisy”. Whole home demand data is an agglomeration of many different end-uses, not all of

[31] Doubtless some of the customers subject to water heater control only also used electric heat, but it seems reasonable to assume that fewer of these customers use electric heat than those water heater-controlled customers that *also* have heat strips that are controlled.

which have consistent patterns of use: this means that trying to identify DR effects on an individual participant basis is *highly* imprecise.

Guidehouse, before proceeding too far with its diagnostic analysis, wished to better understand to what degree its (relatively crude) diagnostic customer baseline delivered false positives and false negatives. To this end, the baseline algorithm was applied both to participants expected to curtail for a given event (e.g., a participant in Group A at a date on which Group A was subject to a water heater DR event) but also to participants that were *not* expected to curtail for a given event (e.g., a participant in Group A at a date on which *Group B* was subject to a water heater event).

Firstly, Guidehouse divided all participant/event pairs to which the baseline was applied (and a judgement made regarding curtailment or non-curtailment) into four groups:

- **Expected to Curtail and Curtailed** – Responsive participants, successful curtailments.
- **Expected to Curtail and Did Not Curtail** – Non-responsive participants – either unsuccessful curtailment or no material water heater use during DR event.
- **Not Expected to Curtail and Curtailed** – *A definite false positive.* Standard load patterns mis-identified by the algorithm as curtailment.
- **Not Expected to Curtail and Did Not Curtail** – A true negative – an accurate assessment by the algorithm of non-curtailment.

There does not unfortunately exist, with the data in hand, a way to assess the proportion of false negatives: i.e., the proportion of those participants estimated to have not curtailed but that could be confirmed to have curtailed.

Table 6-1, below, summarizes the average (across all events) percentage of participants that fall into each category. The false positive diagnostic ("Not Expected to Curtail" and "Curtailed") is highlighted in red. This rate of high false positives is high. Sufficiently high that caution should be used in interpreting the results on an individual participant basis.

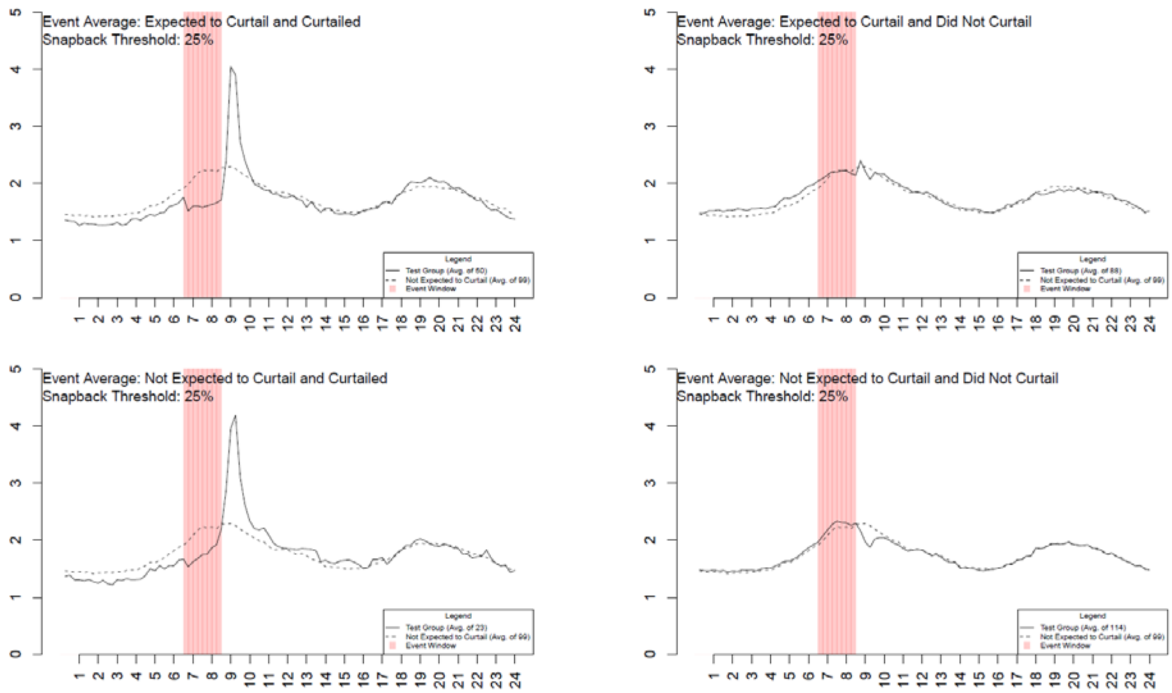
**Table 6-1: Average Percent Distribution by Category**

| | Curtailed | Did Not Curtail |
|---|---|---|
| Expected to Curtail | 36% | 64% |
| Not Expected to Curtail | 16% | 84% |

Despite this high rate of false positives, **the results of this analysis may be informative when considered in aggregate** (e.g., considering distributions as opposed to individual results), **provided all judgements are tempered with an explicit understanding of the imprecision at play.**

To further illustrate the effect of the application of this baseline approach, consider Figure 6-1 below. This shows four plots, each corresponding to the average load event load profile of each of the cells in the table above (solid black line). The average profile of participants not expected to curtail is shown in all plots as a dotted black line. So, for example, the solid black line in the top left plot represents the average load profile of participant/event pairs in which the participant was expected to curtail and (according to comparison to the baseline) did.

**Figure 6-1: Average Load Profiles by Grouping**




*Source: Guidehouse analysis*

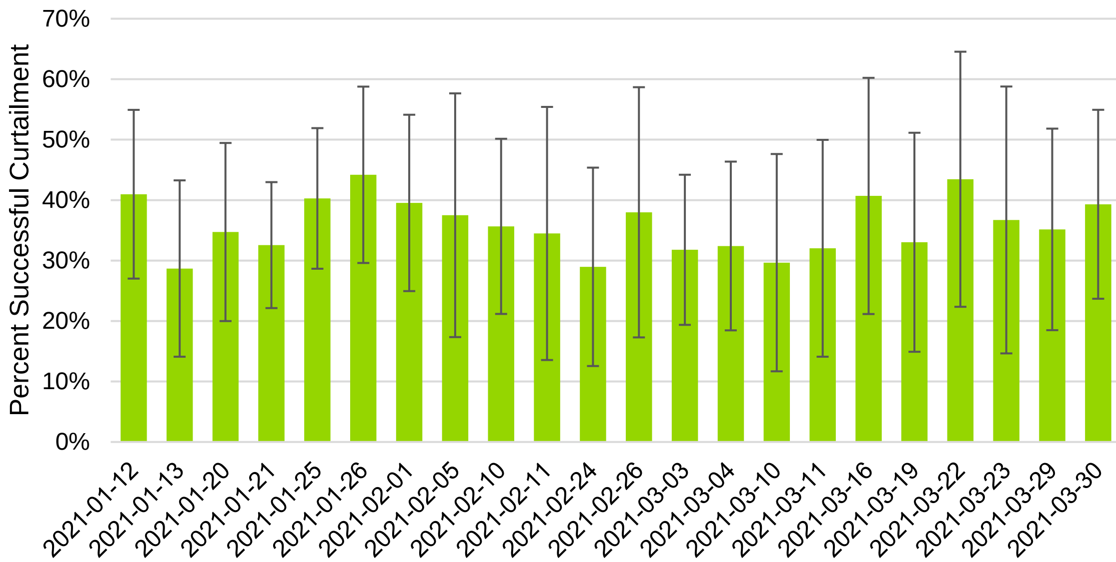
Note the shape of the profiles in the two right-hand plots: the plot in the bottom right (not expected to curtail, did not curtail) shows a distinct dip in demand in the period immediately following the event period. This is a result of the false positives (participants that just happen to have high demands during the snapback period) being classified as “curtailed” in the bottom left plot. *There is no such dip in the snapback period demand of participants expected to curtail but found not to curtail*. This is suggestive of two things: a) the false positive rate is lower than suggested by the bottom-left group, and b) the baseline algorithm approach is flagging as negatives (did not curtail) participants where curtailment occurred, but for which the impact was relatively modest. This could occur, for example, if participants were not showering during the event period, or if the participant’s overall household load was quite large (meaning water heating was a relatively smaller share of the total).

## *B.3 Temporal Distribution of Non-Response*

Figure 6-2 plots the percentage of participants determined by the baseline algorithm discussed above to have successfully curtailed in each event.

To highlight the uncertainty associated with these estimates, this plot includes error bands (whiskers). This very approximate measure of estimated uncertainty of successful curtailment is simply the false positive percentage rate delivered by the baseline algorithm for each event. So, for example, for the first event 41% of participants that were expected to curtail have (according the baseline method) curtailed. For the same event, 14% of those participants *not expected to curtail* have been (incorrectly) determined by the baseline method to have curtailed. This 14% is used for both the upper and lower whisker (i.e., implicitly assuming that the unknown false negative rate is approximately the same as the false positive rate).

**Figure 6-2: Percentage Successful Curtailment by Event**




*Source: Guidehouse analysis*

While the high level of uncertainty associated with these estimates makes it a challenge to robustly identify any patterns, when examined *in toto* the lack of a clear pattern does stand out. That is, the overall percentage of successfully curtailed participants appears to be *reasonably* consistent across the entire season: there are no really stark differences between events and nearly three quarters of events have a successful curtailment percentage that is with five percentage points of the mean of 36%.

Put another way: whatever is responsible for the low level of successful curtailment in water heaters appears to have been a factor for the entire DR season and not just part of it.

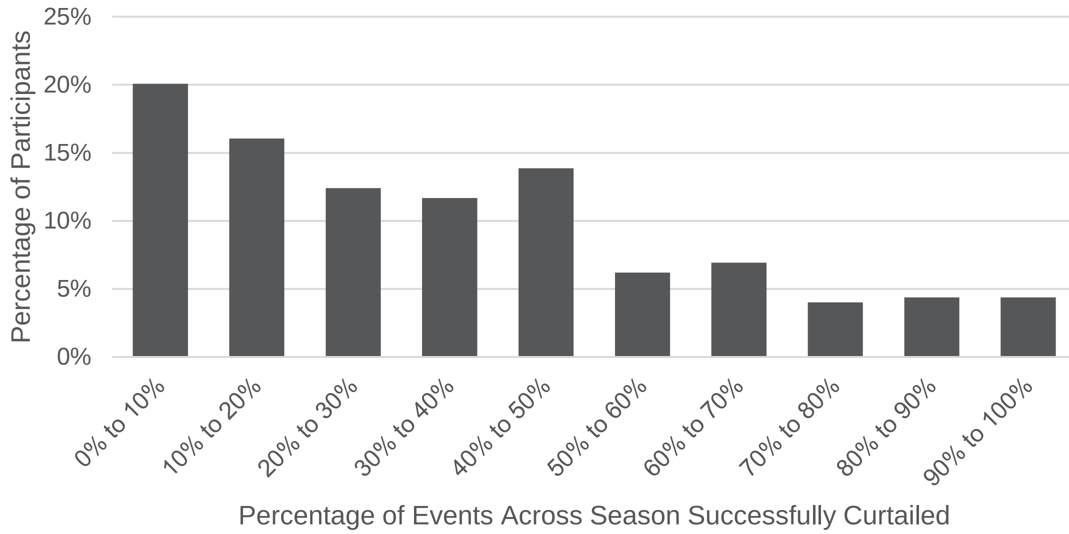
## *B.4 Cross-Sectional Distribution of Non-Response*

A key question regarding device curtailment success is: is it some participants failing to curtail all the time, or all participants failing to curtail some of the time? If the distribution is bi-modal – if individual participants appear to either successfully curtail for most events or else not curtail for most events, this suggests that the root of the problem is rooted in device functionality: switches that are nonfunctional or disconnected due to sub-par installation, participant interference or some other factor.

Where the distribution of successful curtailment is more continuous – i.e., where it is a case of all (or nearly all) participants failing to curtail some of the time –suggests a more general problem. For example a change in participant behavior (later showering) or an ongoing issue with the health of the paging network that dispatches events.

Figure 6-3, below shows the distribution of participants by the percentage of DR events for which they successfully curtailed. For example, the first column (starting from the left) indicates that approximately 20% of participants successfully curtailed for between 0% and 10% of DR events. The second column indicates that approximately 16% of participants successfully curtailed for between 10% and 20% of DR events, etc.

**Figure 6-3: Distribution of Average Percentage of Events Successfully Curtailed**




*Source: Guidehouse analysis*

Although the uncertainty associated with estimated participant responsiveness makes most conclusive judgements impossible, the figure above strongly suggests that while there is a non-trivial number of participants that appear to almost never successfully respond to events, in most cases participants are successfully responding to some – but nearly never to all – events. This suggests that either a change in customer behaviour (later showering) or issues with paging network health are driving the reduction in estimated impacts.

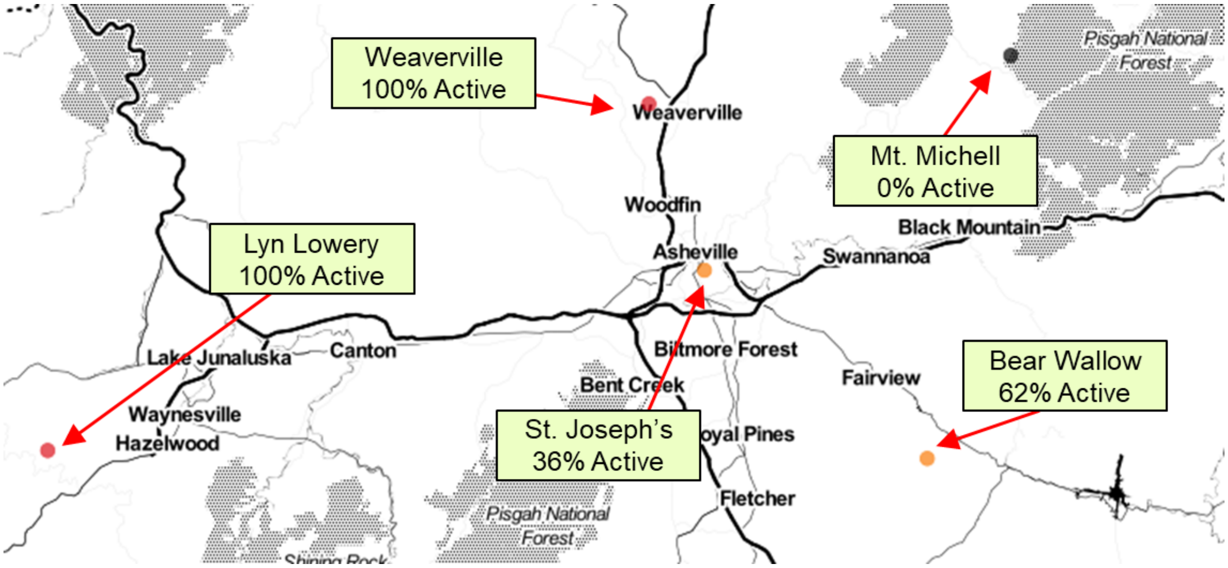
## *B.5 Geographic Distribution of Non-Response*

Finally, Guidehouse examined to what degree device responsiveness was geographically correlated. To do this Guidehouse classified each participant in one of three categories:

- “Low Response” – successfully curtailed to 0 – 29% of events.
- “Medium Response” – successfully curtailed to 30% - 59% of events
- “High Response” – successfully curtailed to 60% - 100% of events.

Figure 6-4, below, identifies the five Western region paging towers and the percentage of DR events for which these were active (for event-specific detail on active paging towers, see Appendix E). Paging towers that were online for the entire DR season (Lyn Lowery, Weaverville) are marked larger red circles, paging towers that were online for some, but not all, of the DR events are marked as larger orange circles (St Joseph’s and Bear Wallow), and the paging tower that wasn’t online at all during the DR season is marked as a larger black circle (Mount Mitchell).

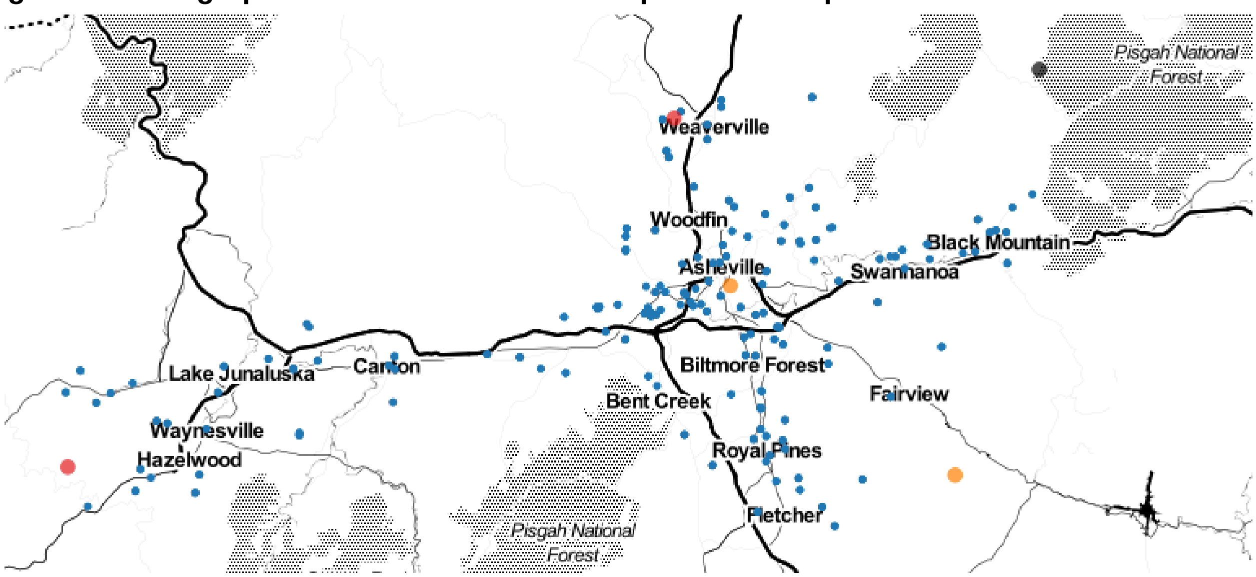
**Figure 6-4: Paging Tower Locations and % Active**




*Source: Guidehouse analysis*

Figure 6-5, below shows the geographic distribution of LOW response water heater only participants (blue dots).

**Figure 6-5: Geographic Distribution of Low Response Participants**

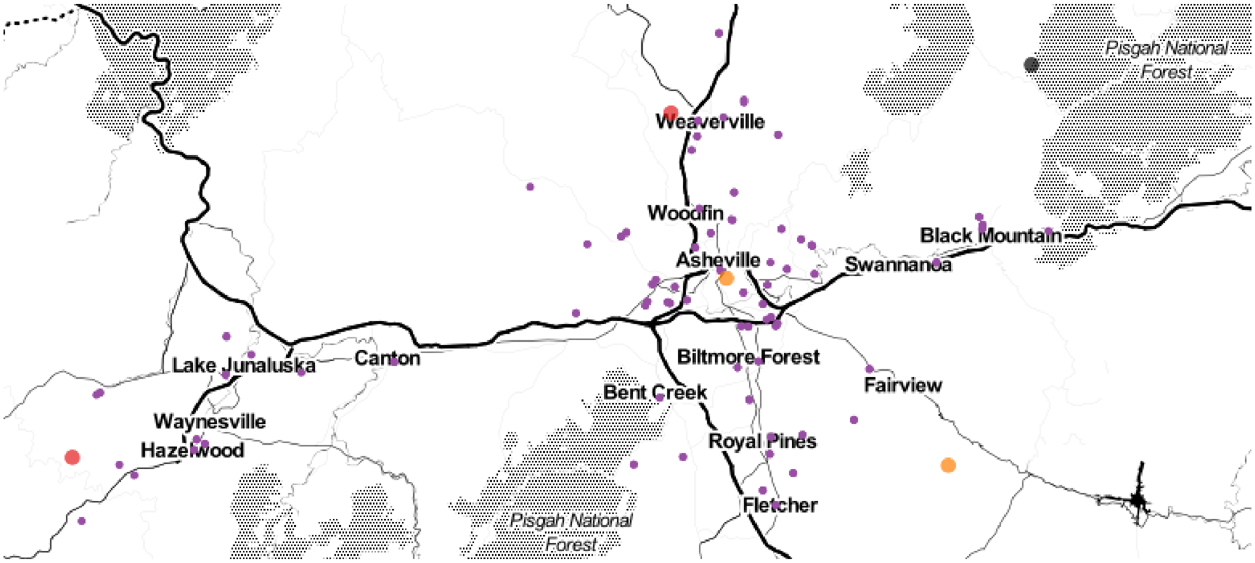



*Source: Guidehouse analysis*

Unfortunately, the geographic distribution of the LOW response participants approximately matches the population distribution and demonstrates no pattern of any apparent significance.

Figure 6-6 below shows the geographic distribution of MEDIUM response water heater only participants (small purple dots). Paging towers are marked as above.

**Figure 6-6: Geographic Distribution of Medium Response Participants**

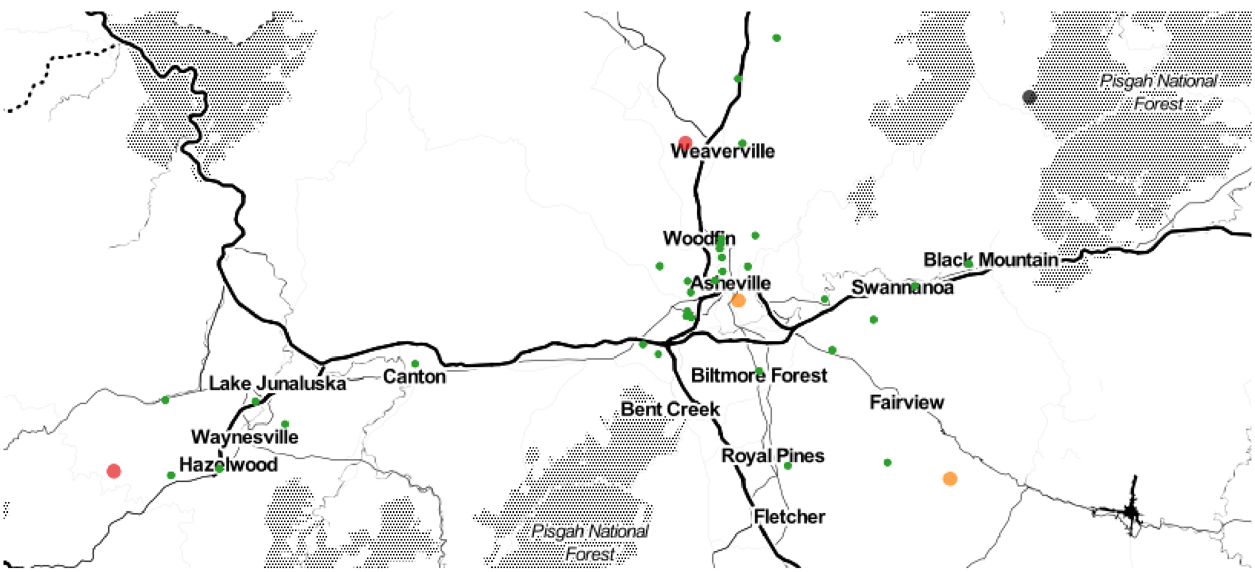



*Source: Guidehouse analysis*

The geographic distribution of the medium response participants remains relatively diffuse, though the purple dots do appear to be more clustered in the urban areas likely to have better coverage from the paging mesh network.

Figure 6-7 below shows the geographic distribution of HIGH response water heater only participants (green dots). Paging towers are marked as above.

**Figure 6-7: Geographic Distribution of High Response Participants**




*Source: Guidehouse analysis*

HIGH response participants seem to exhibit definite clustering in the urban centres, which, taken together with the tighter clustering of the MEDIUM response participants suggests a trend. Responsiveness improves in proximity to denser population areas, areas which also tend to receive better coverage from the mesh network (just as they receive better cell network coverage).

This effect would be consistent with an overall reduction in paging system strength as the result of fewer towers transmitting during DR events.

# Appendix C. Water Heater Participant Load Profile Changes

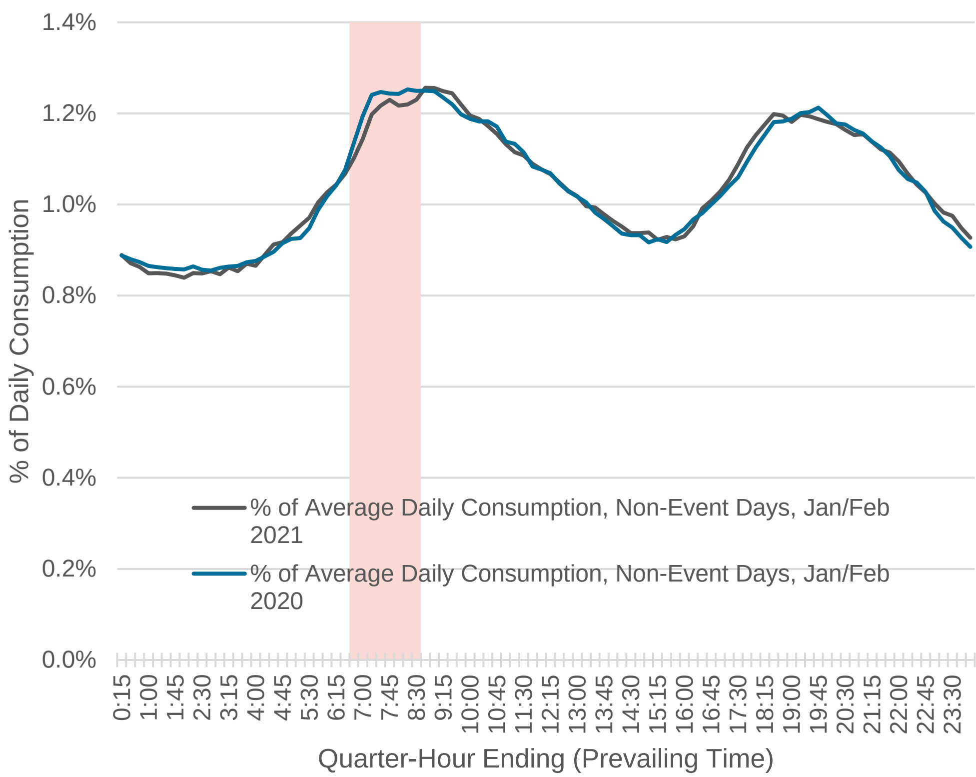
One of the possible hypotheses developed by Guidehouse to explain the lower than expected water heater impacts is related to COVID-driven behavior changes. COVID-related public health measures have in most jurisdictions resulted in layoffs, furloughs, or employees working from home. It is possible that if a material number of Duke customers faced such circumstances they might shift their standard morning behaviors in ways that could affect the EnergyWise Home program's DR capability.

If, for example, some material proportion of customers began to take morning showers later in the morning – after the DR event period – this would reduce the baseline demand and, consequently, the impact of demand response.

To assess the likelihood of this possibility, Guidehouse compared the average load profile of EM&V participants on non-event days during the DR season (January and February of 2021) with that of the same participants on non-event days during the same period in the year before (i.e., January and February 2020, before most major public health restrictions were imposed in North America).

Figure 6-8 below compares the pre-COVID (January and February 2020) average profile of the water heater only participants with the same participants' profile in January and February of 2021. The dark blue line is the pre-COVID load profile, and the dark grey line is the 2021 DR season load profile. The 2021 DR event period (6:30 to 8:30, prevailing time) is identified by the red box.

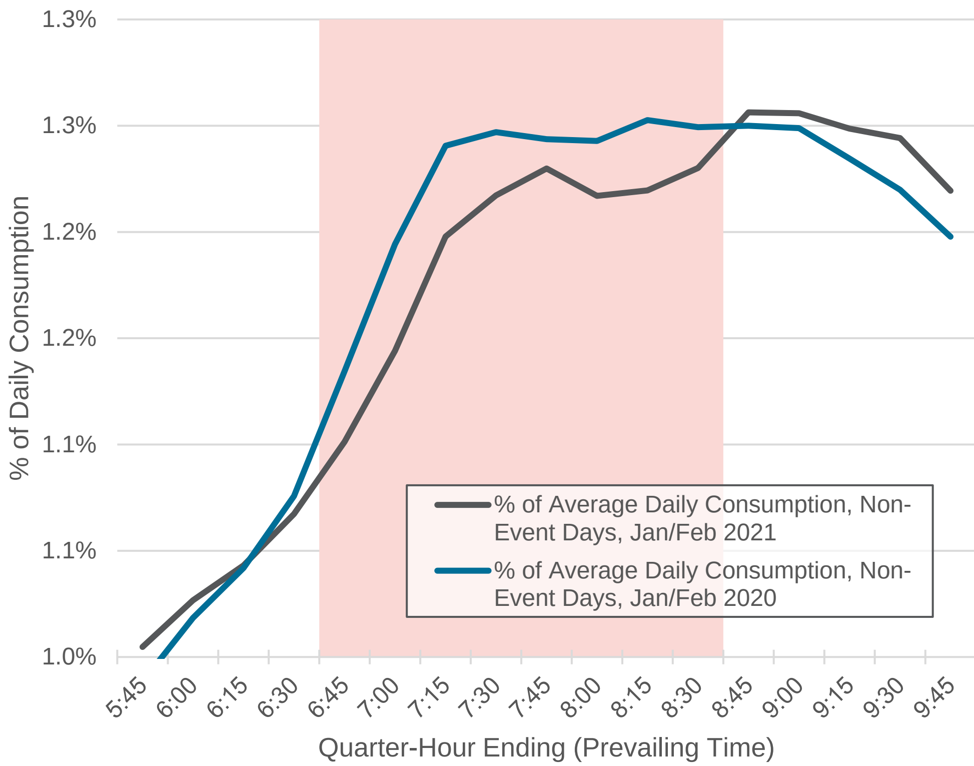
**Figure 6-8: Water Heater Only Participant Non-Event Load Profiles – Pre-COVID and 2021**




*Source: Guidehouse analysis, DEP AMI data*

The two profiles are very similar in nearly all periods, with almost trivial differences between them – *except during the DR event period*. In this period, pre-COVID normalized demand is distinctly higher than 2021 demand. A larger-scale plot (“zoomed in”) is presented in Figure 6-9, below.

**Figure 6-9: Water Heater Only Participant Non-Event Load Profiles – Detail**




*Source: Guidehouse analysis, DEP AMI data*

Guidehouse has not tested the statistical significance of this difference, and notes that these normalized profiles have been produced through the use of simple average quarter-hourly demands, normalized to average total daily consumption. The effects of weather or other effects have not explicitly been controlled for.

Despite these caveats, the difference observed between these two profiles would be consistent with the hypothesis that some meaningful number of participants have shifted their showering behavior to later in the day, reducing their baseline level of water heater demand during DR events, and therefore the DR capability they offer the program.

# Appendix D. Space Heating DR Take-Back

In previous evaluations impacts were estimated on the basis of end-use-specific loads: interval readings obtained from data loggers attached to the controlled equipment. Under certain circumstances it is possible that secondary space heating loads (e.g., electric resistance baseboard heating, standalone plug-in room heaters) could compensate for the reduced thermal output of the heat pump's auxiliary heat strips. Such "take back" would erode the DR impact of curtailment, and would be visible only if whole home (rather than appliance-specific) data were used to estimate impacts.

Guidehouse's econometric evaluation of the summer 2019 DR season explicitly addressed this concern in the summer months by deploying data loggers and conducting a very careful side-by-side comparison of the impacts estimated from whole-home AMI with the impacts estimated from appliance-specific logger data. The impacts from the two different data sources were not statistically significantly different from one another.

Patterns of consumer behavior and equipment ownership for space cooling and space heating differ, of course. Anecdotally, residential consumers in temperate regions are typically more likely to be equipped with secondary space-heating equipment than secondary space-cooling equipment.[32]

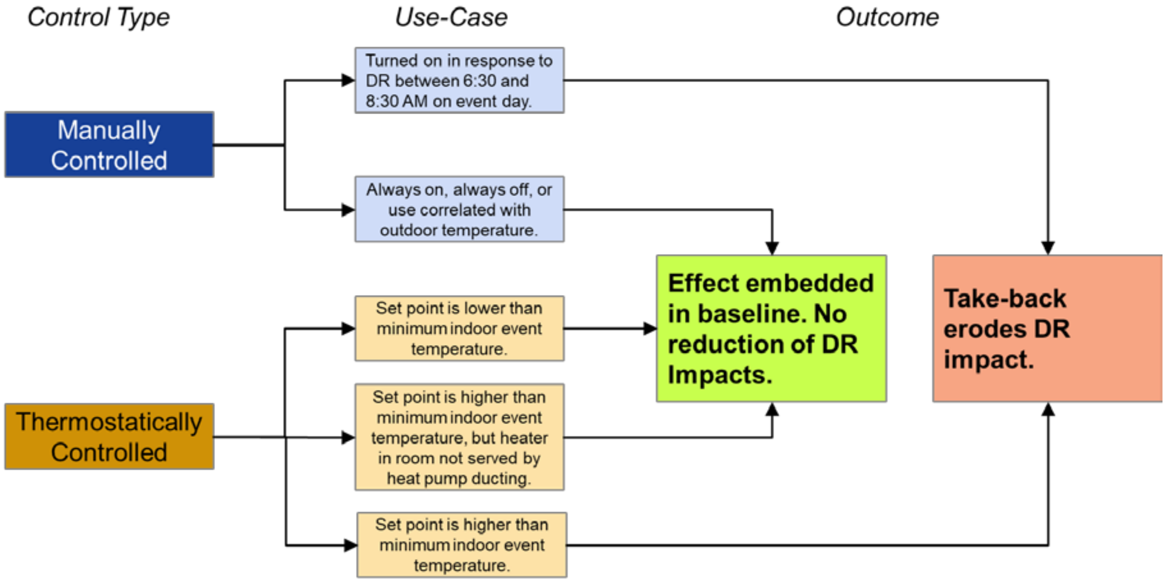
Without another side-by-side AMI/logger data study it is impossible to conclusively state to what degree secondary electric space-heating take-back could be eroding DR impacts. A careful consideration of the scenarios under which such erosion could take place, however, may be support the development of a qualitative estimate of the potential contribution to lower impacts that this take-back effect may have had in the DR season of 2020/2021.

Figure 6-10 summarizes the scenarios considered by the Guidehouse team. It identifies the two control types for secondary heating (manual, thermostatic), the different possible use-cases of those control types, and what the outcome might be on DR impacts. Based on this review of possible scenarios it is Guidehouse's conclusion that, while the possibility that secondary space heating may be eroding DR impacts somewhat cannot be dismissed, it seems improbable that it would be a major contributor to the reduced impacts estimated in this DR season.

[32] This is observation can be supported by residential end-use data in many temperate jurisdictions, though Guidehouse has not confirmed this against any residential survey data specific to Duke Energy's Western region.

**Figure 6-10: Demand Response Take-Back Scenarios**




*Source: Guidehouse analysis*

When secondary heat is manually controlled, it will erode DR impacts only if it is turned on by participants specifically in response to the DR event. Given that participants are not notified of events ahead of time and that events all occurred between 6:30 and 8:30, it seems reasonable to suppose that it would require an exceptionally fast drop in indoor temperature to motivate such an intervention.

As part of the evaluation of the winter 2011/2012 season[33] Guidehouse (then Navigant) reviewed event indoor temperature data. Guidehouse found that on average, by the end of a three-hour event, for homes with fully responsive (to curtailment) heat strips, the indoor temperature dropped by an average of less than three degrees Fahrenheit. This seems insufficiently extreme a drop to provoke widespread manual interventions.

In the case of thermostatically controlled heat, DR impacts will be affected only if the thermostat set-point is both:

- higher than the minimum indoor temperature observed during the event (as a result of curtailment), and
- if the room in which the secondary heat source is located is also heated by the ducted heat pump being controlled by the program.

Given that secondary heat sources are typically adopted for rooms *because* they are not heated directly by the ducted system, it seems improbable that such sources had any really significant impact on estimated DR impacts.

[33] See Appendix E of
Navigant Consulting, Inc. (n/k/a Guidehouse) presented to Progress Energy Carolinas, *EM&V Report for the EnergyWise Home Program – Summer 2011 and Winter 2011-12*, September 2012.

# Appendix E. Paging System Health

EnergyWise Home participants' appliances are controlled by load control switches that are triggered through paging signals sent across the Duke Energy service area. In the winter DR season of 2020/2021, Duke Energy experienced significantly more paging tower outages than would be expected. Duke Energy program staff have indicated that a reduction in the number of paging towers in operation could result in fewer participant switches successfully receiving the DR paging signal and curtailing.

There are five paging towers in the Duke Energy Western Region. One of these (located in the St. Joseph hospital) was offline for 23 DR events with no remedial action possible due to access being limited as a result of COVID-related public health restrictions. One of these (Mount Mitchell) was offline for the entire DR season due to to damage to the satellite receiver. The paging provider did not service the site because two-way monitoring of the site was off-line and no operational alerts could be communicated.. A third site was completely offline for 10 events and partially offline for another four events.

Of the 42 events (EM&V and test events for which no impacts have been estimated), there were 11 events in which only two of the five paging towers were online, 21 events in which three of the five were online, and only 10 events in which four of the five towers were online. The details of this distribution are presented below.

Table 6-2, below, was provided to Guidehouse by Duke Energy program staff and identifies the status of each tower for each event. There are four possible values:

- "Active" – the tower was online during the entire event
- "Ceased" – the tower was offline during the entire event
- "C / A" and "A / C" – the tower was partially online for the event, either starting the event "Active" and moving to "Ceased" or vice versa.

**Table 6-2: Paging Tower Status Tracker**

| Date | Lyn Lowery | Weaverville | St. Joseph's | Bear Wallow | Mt Mitchell |
|---|---|---|---|---|---|
| 2020-12-30 | Active | Active | Ceased | Active | Ceased |
| 2020-01-05 | Active | Active | Ceased | Active | Ceased |
| 2021-01-06 | Active | Active | Ceased | Active | Ceased |
| 2021-01-07 | Active | Active | Ceased | Active | Ceased |
| 2021-01-11 | Active | Active | Ceased | Active | Ceased |
| 2021-01-12 | Active | Active | Ceased | Active | Ceased |
| 2021-01-13 | Active | Active | Ceased | Active | Ceased |
| 2021-01-14 | Active | Active | Ceased | Active | Ceased |
| 2021-01-19 | Active | Active | Ceased | Active | Ceased |
| 2021-01-20 | Active | Active | Ceased | Active | Ceased |
| 2021-01-21 | Active | Active | Active | Active | Ceased |
| 2021-01-25 | Active | Active | Active | Active | Ceased |
| 2021-01-26 | Active | Active | Ceased | Active | Ceased |
| 2021-01-28 | Active | Active | Ceased | C / A | Ceased |

| Date | Lyn Lowery | Weaverville | St. Joseph's | Bear Wallow | Mt Mitchell |
|---|---|---|---|---|---|
| 2021-01-29 | Active | Active | Ceased | Active | Ceased |
| 2021-02-01 | Active | Active | Ceased | Active | Ceased |
| 2021-02-02 | Active | Active | Ceased | C / A | Ceased |
| 2021-02-03 | Active | Active | Ceased | Ceased | Ceased |
| 2021-02-05 | Active | Active | Active | Ceased | Ceased |
| 2021-02-08 | Active | Active | Ceased | Ceased | Ceased |
| 2021-02-10 | Active | Active | Ceased | Ceased | Ceased |
| 2021-02-11 | Active | Active | Ceased | Ceased | Ceased |
| 2021-02-12 | Active | Active | Active | C / A | Ceased |
| 2021-02-16 | Active | Active | Active | Ceased | Ceased |
| 2021-02-17 | Active | Active | Ceased | Ceased | Ceased |
| 2021-02-18 | Active | Active | Ceased | C / A | Ceased |
| 2021-02-24 | Active | Active | Ceased | Ceased | Ceased |
| 2021-02-26 | Active | Active | Ceased | A / C | Ceased |
| 2021-03-02 | Active | Active | Active | Ceased | Ceased |
| 2021-03-03 | Active | Active | Active | Ceased | Ceased |
| 2021-03-04 | Active | Active | Active | Active | Ceased |
| 2021-03-05 | Active | Active | Active | Active | Ceased |
| 2021-03-08 | Active | Active | Active | Active | Ceased |
| 2021-03-09 | Active | Active | Active | Active | Ceased |
| 2021-03-10 | Active | Active | Active | Active | Ceased |
| 2021-03-11 | Active | Active | Active | Active | Ceased |
| 2021-03-16 | Active | Active | Active | Active | Ceased |
| 2021-03-19 | Active | Active | Active | Active | Ceased |
| 2021-03-22 | Active | Active | Ceased | Active | Ceased |
| 2021-03-23 | Active | Active | Ceased | Active | Ceased |
| 2021-03-29 | Active | Active | Ceased | Active | Ceased |
| 2021-03-30 | Active | Active | Ceased | Ceased | Ceased |

*Source: DEP event paging performance data*

# Appendix F. Duke Energy Program Staff Field Verification

In response to Guidehouse's findings, Duke Energy staff conducted field verification activities, making targeted visits to EM&V participants to assess the quality of the switch installation and attempt to identify the driving factors behind the apparently very low rate at which successful curtailment was realized. Duke Energy staff visited participants equipped with water heaters and those equipped with heat strips.

## *F.1 Water Heater Field Verification*

Guidehouse provided Duke Energy staff with a list of water heater only participants, sorted by the number of events that Guidehouse had estimated the participant had successfully responded to (see Appendix B, for a full description of how this was derived). Duke Energy field staff prioritized the least responsive participant locations first. Duke Energy staff have provided periodic updates on their findings.

Summaries of the findings of this field verification process are presented below in Table 6-3, Table 6-4, and Table 6-5. The first of these tables presents a summary of the findings of the field verifications of the 13 water heater only participants estimated by Guidehouse to have failed to successfully curtail to any events.

**Table 6-3: Summary of Field Verifications of Water Heater Only Participants Found to Have Successfully Curtailed to No Events**

| EM&V Issue Category | # Participants | % Participants | % Excluding "No Technical Issues" |
|---|---|---|---|
| No Technical Issues Preventing Curtailment Found | 3 | 23% | N/A |
| Switch Topology Addressing - Paging Issue | 4 | 31% | 40% |
| Field Install Issue | 4 | 31% | 40% |
| Customer Disabled | 1 | 8% | 10% |
| Event Paging Issue | 0 | 0% | 0% |
| Finaled or Closed Account | 0 | 0% | 0% |
| Headend Application Issue | 1 | 8% | 10% |
| **Total Issues to Date** | **13** | | |

*Source: DEP responsiveness data*

Of the 13 participants that Guidehouse had estimated had failed to successfully curtail to a single event:

- Three were without any technical issues affecting the switch. Lack of curtailment in these cases was likely due simply to customer behavior patterns (i.e., showering outside the DR event period).

- Six were equipped with switches for which issues were identified that Duke Energy field staff would expect would result the switch completely non-functional (i.e., field install issue, customer disabled, and headend application issues).
- Four appeared to have been inhibited from normal curtailment operation as a result of issues with the paging network (switch topology addressing – paging issues).

The second of these tables, Table 6-4, presents a summary of the findings of the field verifications of 16 water heater only participants that were estimated by Guidehouse to have successfully responded to less than 25% of the events to which they were subject.

**Table 6-4: Summary of Field Verifications of Water Heater Only Participants Found to Have Successfully Curtailed to Less than 25% of Events**

| EM&V Issue Category | # Participants | % Participants | % Excluding "No Technical Issues" |
|---|---|---|---|
| No Technical Issues Preventing Curtailment Found | 2 | 13% | N/A |
| Switch Topology Addressing - Paging Issue | 2 | 13% | 14% |
| Field Install Issue | 1 | 6% | 7% |
| Customer Disabled | 2 | 13% | 14% |
| Event Paging Issue | 8 | 50% | 57% |
| Finaled or Closed Account | 1 | 6% | 7% |
| Headend Application Issue | 0 | 0% | 0% |
| **Total Issues to Date** | **16** | | |

*Source: DEP responsiveness data*

Of the 16 participants in this category visited by Duke Energy field personnel:

- Two were without any technical issues affecting the switch. Lack of curtailment in these cases was likely due simply to customer behavior patterns (i.e., showering outside the DR event period).
- Three were equipped with switches that were completely non-functional (field install issue or customer disbled).
- One had closed their account.
- Ten (71% of those switches where some issue was uncovered) had experienced paging issues, impeding successful curtailment (switch topology addressing – paging issue, and event paging issue).

The third of these tables, Table 6-5, presents a summary of the findings of the field verifications of 31 water heater only participants that were estimated by Guidehouse to have successfully responded to between 25% and 50% of the events to which they were subject.

**Table 6-5: Summary of Field Verifications of Water Heater Only Participants Found to Have Successfully Curtailed to Between 25% and 50% of Events**

| EM&V Issue Category | # Participants | % Participants | % Excluding "No Technical Issues" |
|---|---|---|---|
| No Technical Issues Preventing Curtailment Found | 13 | 42% | N/A |
| Switch Topology Addressing - Paging Issue | 4 | 13% | 22% |
| Field Install Issue | 3 | 10% | 17% |
| Customer Disabled | 3 | 10% | 17% |
| Event Paging Issue | 7 | 23% | 39% |
| Finaled or Closed Account | 0 | 0% | 0% |
| Headend Application Issue | 1 | 3% | 6% |
| **Total Issues to Date** | **31** | | |

*Source: DEP responsiveness data*

Of the 31 participants in this category visited by Duke Energy field personnel:

- 13 were without any technical issues affecting the switch. Lack of curtailment in these cases was likely due simply to customer behavior patterns (i.e., showering outside the DR event period).
- Six were equipped with switches that were completely non-functional (field install issue and customer disabled).
- Eleven (61% of those switches where some issue was uncovered) had experienced paging issues, impeding successful curtailment (switch topology addressing – paging issu, and event paging issue).

The above strongly suggests that in those cases where participants' water heaters curtailed to some, but not all, of the dispatched DR events, problems with the paging network were a significant contributing cause.

## *F.2 Heat Strip Field Verifications*

Unlike with water heaters, Guidehouse did not attempt to identify responsive and non-responsive appliances. The Guidehouse team noted that to do so in the face of all the potentially confounding issues related to heat strips (sensitivity to temperature, partial responsiveness, etc.) would result in estimates of responsiveness that would be too uncertain to be useful.

Therefore rather than providing Duke Energy with the list of EM&V participants ordered according to estimated individual participant responsiveness, Guidehouse provided Duke Energy with its list of all heat strip participants in random order. Duke Energy staff used this ordered list to schedule field verifications.

Duke Energy field staff visited 46 sites as part of this exercise, and found that in nearly all (~90%) of homes visited the switches were entirely non-functional, whether as a result of poorly executed installation, or due to being disabled by the customer.

The findings of this field work are summarized in Table 6-6 below.

**Table 6-6: Summary of Field Verifications of Heat Strip Participants**

| EM&V Issue Category | # Participants | % Participants | % Excluding "No Technical Issues" |
|---|---|---|---|
| No Technical Issues Preventing Curtailment Found | 0 | 0% | N/A |
| Switch Topology Addressing - Paging Issue | 3 | 7% | 7% |
| Field Install Issue | 15 | 33% | 33% |
| Customer Disabled | 22 | 48% | 48% |
| Event Paging Issue | 1 | 2% | 2% |
| Finaled or Closed Account | 0 | 0% | 0% |
| Headend Application Issue | 0 | 0% | 0% |
| Switch Inoperable | 2 | 4% | 4% |
| Switch Missing | 2 | 4% | 4% |
| Switch Deactivated | 1 | 2% | 2% |
| **Total Issues to Date** | **46** | | |

Of the 46 participants in this category visited by Duke Energy field personnel:

- None were without any technical issues affecting the switch.
- 42 (>90%) were equipped with switches that were completely non-functional (field install issue and customer disabled).

This very high rate of non-functioning switches – inconsistent with findings of the fieldwork conducted in 2017 to support the 2017/2018 evaluation – is, naturally, of great concern to Duke Energy. Duke Energy has engaged its field work contractor to begin a comprehensive audit and remediation of *all* heat strip switches installed in participant homes. Participants that do not consent to on-site verification of the condition of their switch will be removed from the program.

If the sample above is an accurate representation of program population it would suggest that in addition to the paging problems that appear to have substantially reduced water heater impacts, a major cause of reduced heat strip capability may be due to a substantial increase in the number of deactivated or disabled switches in the four years since the Guidehouse field work in support of the 2017/2018 winter evaluation.

Guidehouse

# EM&V Report for the Duke Energy Small Business Energy Saver Program 2019-2020

**Prepared for:**

DUKE ENERGY®

**Duke Energy Carolinas and Duke Energy Progress**

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November 23, 2021

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# 1. Evaluation Summary

## 1.1 Program Summary

The Small Business Energy Saver (SBES) program is a direct install program offered to qualifying commercial customers with an average annual demand of 180 kW or less. Participating customers receive an energy assessment at their facility, and subsequently a set of recommended energy efficient measure retrofits. Customers receive information about the proposed measure installation and project costs including utility incentives of up to 80 percent for lighting and refrigeration, and HVAC measures. Once approved, the direct installation is scheduled and completed with minimal disruption to business operations.

The following measures are currently included in the SBES program:

1. Lighting Measures: LED interior and exterior lighting solutions.
2. Refrigeration Measures: lighting, motors, and controls for refrigeration cases.
3. HVAC Measures: HVAC controls, thermostats, and tune-ups

Lime Energy is the current Implementation Contractor that administers the SBES program in the Duke Energy Carolinas (DEC) and Duke Energy Progress (DEP) jurisdictions. Lime Energy provides integrated energy audits, equipment procurement, and payment services to participating customers. Measure installation is performed by Lime Energy or a subcontractor of Lime Energy.

## 1.2 Evaluation Objectives and Program Level Findings

This evaluation provides an independent assessment of program impacts and performance for participation that occurred between 1/1/2019 and 6/30/2020. Guidehouse used an engineering-based approach to calculate program impacts, similar to previous evaluation cycles with some differences pertaining to data collection activities. Due to the ongoing COVID-19 pandemic, Guidehouse replaced the previous onsite field study activities with virtual verification to collect information necessary for impact calculations.

Evaluation objectives include the following:

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

2. Net-to-Gross Analysis:
    a. Assess the Net-to-Gross ratio by addressing spillover and free-ridership via customer online surveys.

3. Process Evaluation:
    a. Conduct phone interviews with program management and implementation contractor(s) and to collect data for use in process analysis.

b. Administer customer online surveys to collect data for use in process analysis. Evaluate the strengths and weaknesses of current program processes and customer perceptions, with special consideration for effects of the COVID-19 pandemic.

By performing both impact and process components of the EM&V effort, Guidehouse provides Duke Energy with verified energy and demand impacts, as well as a set of recommendations that are intended to aid Duke Energy with improving or maintaining the satisfaction with program delivery while meeting energy and demand reduction targets in a cost-effective manner. Guidehouse found that Duke Energy is successfully delivering the SBES Program to customers, participant satisfaction is generally favorable, and the reported measure installations are relatively accurate.

For the evaluation period covered by this report, there were a total of 1,964 projects comprised of roughly 21,909 measures installed through the program in the DEC jurisdiction and a total of 1,583 projects with roughly 16,853 measures installed through the program in the DEP jurisdiction. The program-level evaluation findings are presented in Table 1-1 and Figure 1-1 for DEC, and Table 1-2 and Figure 1-2 for DEP.

Guidehouse found the realization rate for gross energy savings to be 100 and 101 percent for DEC and DEP, respectively, meaning that total verified gross energy savings were found to be similar to the claimed in the tracking database provided by Duke Energy. Virtual impact assessments found the measure installation rate (ISR) to be 96 percent for both jurisdictions, meaning participants self-reported small differences between the measures indicated in the tracking data and those received or currently operating at their facilities. However, the ISR was offset by the addition of HVAC interactive effects during the engineering analysis, which was the main driver for the final realization rate for energy. The realization rate for DEC and DEP jurisdictions' gross demand savings however were found to both be 99 percent for summer coincident peak demand and 98 percent for winter coincident peak demand. The addition of coincidence factors to demand savings calculations is the main driver of the slightly lowered realization rate.

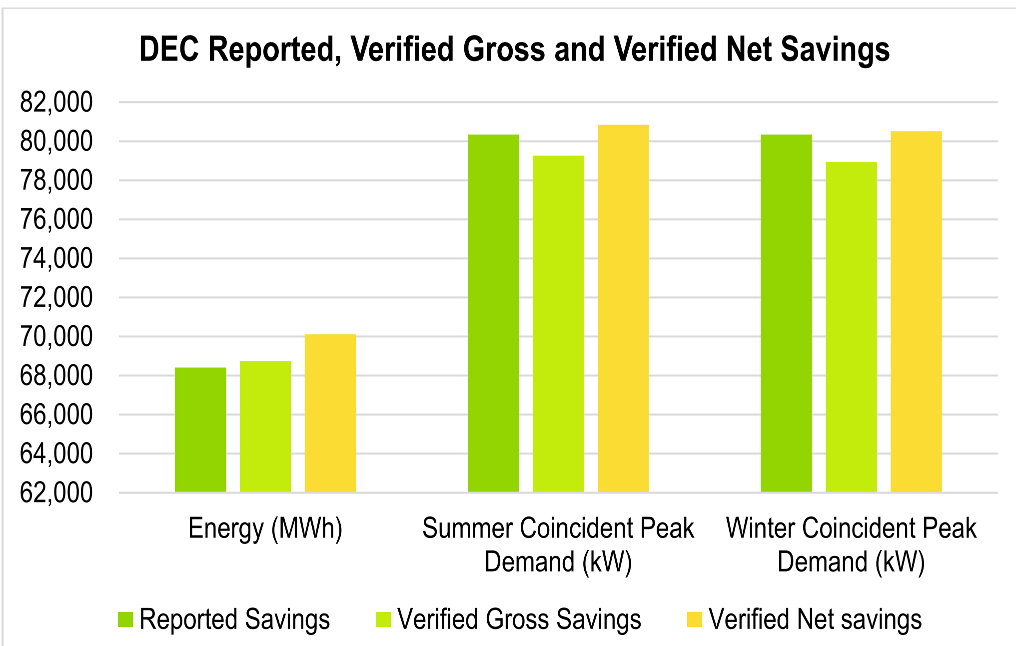
Guidehouse found the net-to-gross (NTG) ratio to be 1.02 for both DEC and DEP jurisdictions, meaning that for every 100 kWh of reported energy savings, 102 kWh can be attributed directly to the program. By multiplying the verified gross energy and demand savings by the NTG ratio, Guidehouse calculated the net energy and demand impacts shown in Table 1-1 for DEC and Table 1-2 for DEP. These findings will be discussed in greater detail throughout this report.

**Table 1-1. SBES Reported, Verified Gross and Verified Net Savings - DEC**

| Parameter | Energy (MWh) | Summer Coincident Peak Demand (kW) | Winter Coincident Peak Demand (kW) |
|---|---|---|---|
| Reported Savings | 68,413 | 80,343 | 80,343 |
| Realization Rate | 100% | 99% | 98% |
| Verified Gross Savings | 68,738 | 79,256 | 78,936 |
| Net-to-Gross | 102% | 102% | 102% |
| Verified Net savings | 70,113 | 80,841 | 80,515 |

*Source: Guidehouse analysis, values subject to rounding.*

**Figure 1-1 Reported, Verified Gross and Net Energy and Demand Savings - DEC**



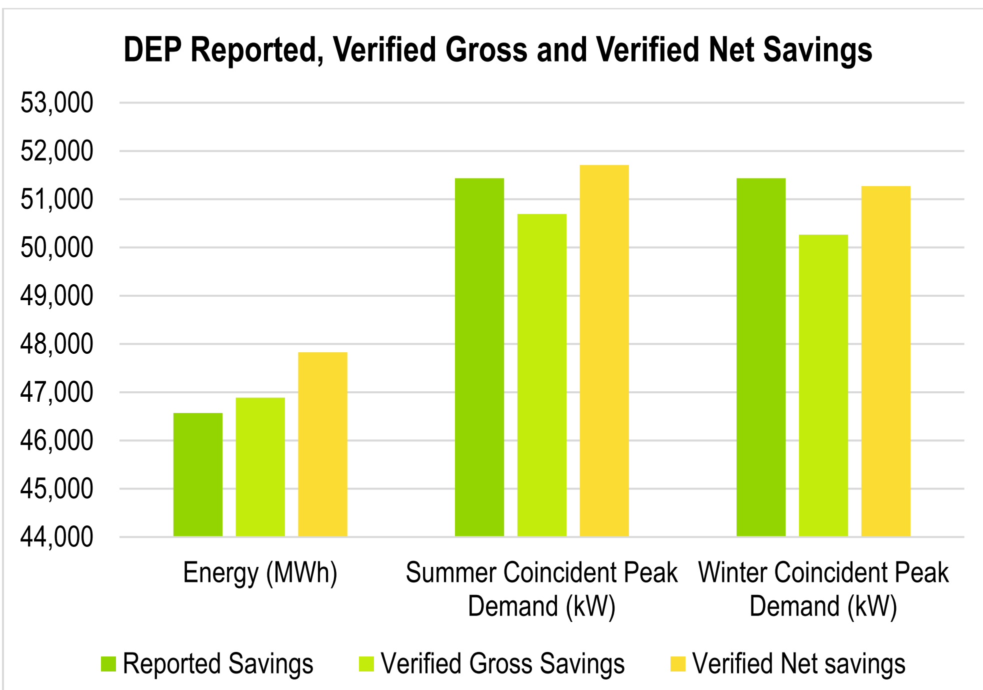

*Source: Guidehouse analysis, values subject to rounding.*

**Table 1-2 SBES Reported, Verified Gross and Verified Net Savings – DEP**

| Parameter | Energy (MWh) | Summer Coincident Peak Demand (kW) | Winter Coincident Peak Demand (kW) |
|---|---|---|---|
| Reported Savings | 46,571 | 51,433 | 51,433 |
| Realization Rate | 101% | 99% | 98% |
| Verified Gross Savings | 46,889 | 50,696 | 50,267 |
| Net-to-Gross | 102% | 102% | 102% |
| Verified Net savings | 47,827 | 51,710 | 51,272 |

*Source: Guidehouse analysis, values subject to rounding.*

**Figure 1-2 Reported, Verified Gross and Net Energy and Demand Savings – DEP**




*Source: Guidehouse analysis, values subject to rounding.*

## 1.3 Evaluation Parameters and Sample Period

To accomplish the evaluation objectives, Guidehouse performed a variety of research and analysis activities, including:

- Engineering review of measure savings algorithms
- Virtual verification to assess installed measure quantities and characteristics
- Participant surveys with customers to evaluate satisfaction and decision-making.

Table 1-3 summarizes the evaluated parameters. The targeted sampling confidence and precision was 90 percent ± 10 percent, and the achieved was 90 percent ± 2.5 percent.

**Table 1-3. Evaluated Parameters**

| Evaluated Parameter | Description | Details |
|---|---|---|
| In-Service Rates | The percentage of program measures in use as compared to reported | Virtual verification assessments completed by participants |
| Satisfaction | Customer satisfaction | Process Surveys (Satisfaction with program elements Satisfaction with implementation contractor) |
| Free Ridership | Fraction of reported savings that would have occurred anyway, even in the absence of the program | NTG surveys |
| Spillover | Additional, non-reported savings that occurred as a result of participation in the program | NTG surveys |

*Source: Guidehouse*

The evaluation covers program participation from 1/1/2019 and 6/30/2020. Table 1-4 shows the start and end dates of Guidehouse' s sample period for evaluation activities.

**Table 1-4. EM&V Sample Period Start and End Dates**

| Activity | Start Date | End Date |
|---|---|---|
| Virtual Verification | 2/8/2021 | 3/05/2021 |
| Process and NTG surveys | 2/1/2021 | 2/26/2021 |

*Source: Guidehouse*

## 1.4 Evaluation Considerations and Recommendations

The evaluation team recommends a few actions for improving the SBES Program, based on insights gained through the evaluation effort. These recommendations are intended to assist Duke Energy with enhancing the program delivery and customer experience, as well as to possibly increase program impacts. Further explanation for each recommendation can be found later in this report.

1. **Consider introducing additional equipment choices in the program.** There were a subset of customers reporting that the program was unable to provide all the energy efficiency equipment they wanted. Duke Energy should consider introducing more equipment choices in the program to include additional outdoor lighting and HVAC measures. This also presents an opportunity for channeling to other Duke Energy programs or education about measures that are not offered through the SBES program.
2. **Increase and improve program communications.** This is the most common challenge or drawback received from participants, indicating that customers were sometimes unclear about the various stages of the program process and did not receive proper communication and guidance from the implementer and/or Duke Energy. Additional education from both Lime Energy and Duke Energy account managers should help customers better understand the program participation process.
3. **Consider using TRM algorithms for HVAC measures.** Lime Energy and Duke Energy developed deemed savings estimates using regional data for HVAC measures. Although the methodology for developing these estimates was accurate, Guidehouse recommends Duke Energy consider using TRM algorithms too and substituting the variables in these algorithms using regional values to estimate savings. This may enhance the transparency of the impact estimates for these measures.
4. **The Program Net-to-Gross Ratio is high**. This indicates that the program is providing a key service to small business customers in helping them manage their energy use.

# 2. Program Description

## 2.1 Program Design

The SBES Program is available to qualifying commercial customers with average demand less than 180 kilowatts (kW) demand service. After completing the program application to assess participation eligibility, customers receive a free energy assessment to identify equipment for upgrade. Lime Energy reviews the energy assessment results with the customer, who then chooses which equipment upgrades to perform. Qualified contractors complete the equipment installations at the convenience of the customer.

The SBES Program recognizes that customers with lower savings potential may benefit from a streamlined, one-stop, turnkey delivery model and relatively high incentives to invest in energy efficiency. Additionally, small businesses may lack internal staffing dedicated to energy management and can benefit from energy audits and installations performed by an outside vendor.

The program offers incentives in the form of a discount for the installation of measures, including high-efficiency lighting, refrigeration and HVAC equipment. These incentives increase adoption of efficient technologies beyond what would occur naturally in the market. During the period included in this evaluation, the SBES Program achieved the majority of program savings from lighting measures, which tend to be the most cost-effective and easiest to market to potential participants. The SBES program also achieved program savings from HVAC and refrigeration measures.

The program offers a performance-based incentive up to 80 percent of the total project cost, inclusive of both materials and installation. Multiple factors drive the total project cost, including selection of equipment and unique installation requirements.

## 2.2 Reported Program Participation and Savings

Duke Energy and the implementation contractor maintain a tracking database that identifies key characteristics of each project, including participant data, installed measures, and estimated energy and peak demand reductions based on assumed (“deemed”) savings values. In addition, this database contains measure level details that are useful for EM&V activities. Table 2-1 provides a summary of the gross reported energy and demand savings and participation for 2019-2020.

**Table 2-1. Reported Participation and Gross Savings Summary**

| Reported Metrics | DEC | DEP |
|---|---|---|
| Projects | 1,964 | 1,583 |
| Measures Installed | 21,909 | 16,853 |
| Gross Annual Energy Savings (MWh) | 68,413 | 46,571 |
| Average Quantity of Measures per Project | 11 | 10 |
| Average Gross Savings Per Project (MWh) | 34.83 | 29.41 |

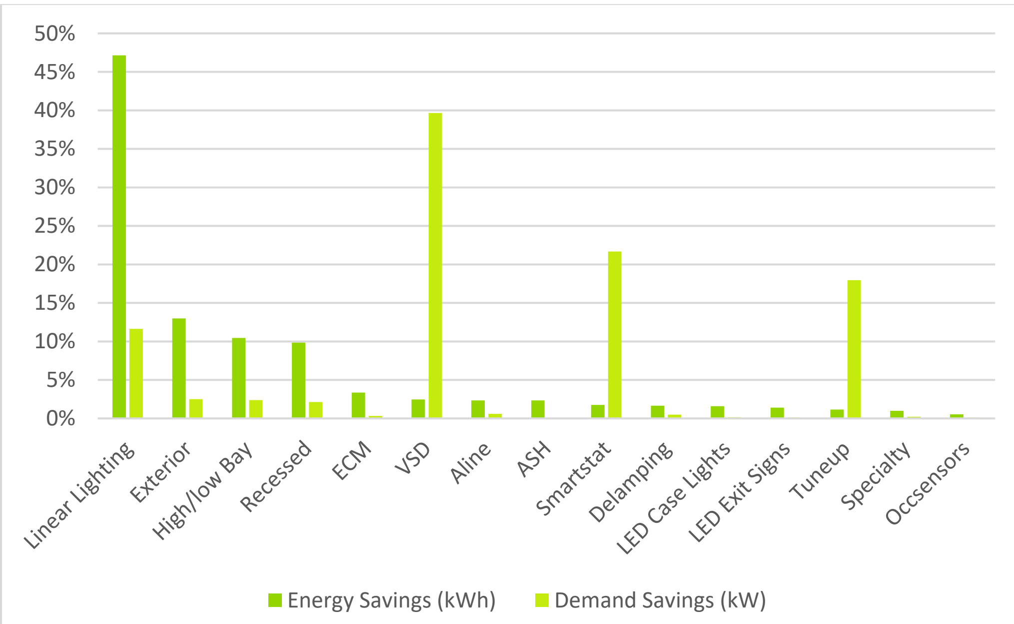
*Source: SBES Tracking Database*

Duke Energy uses assumptions and algorithms primarily from the New York Technical Resource Manual[1] (TRM) as the basis for energy and demand savings calculations[2] for lighting and refrigeration measures. This TRM is robust, well-established, and follows industry best practices for the measures found in the SBES program. The evaluation team believes the NY TRM is an appropriate basis for estimating savings in the DEC and DEP jurisdictions based on Guidehouse' s assessment of the underlying energy savings assumptions. Lime Energy worked with Duke Energy to develop the HVAC measures' deemed savings using regional data, Guidehouse reviewed the methodology for developing deemed savings estimates for these measures and think the deemed savings values are appropriate and agree with their use.

### 2.2.1 Program Summary by Measure

Efficient LED linear lighting retrofits were the highest contributor to program energy savings in 2019 -2020, followed by exterior lighting measures and a variety of LED lighting measures for DEC and DEP as seen in Figure 2-1 and Figure 2-2. However, HVAC measures such as VSD, Smart Thermostats and HVAC tune-ups contributed the most to demand savings for both jurisdictions. In addition, refrigeration measures (including EC motors, LED case lighting, and anti-sweat heaters) also contributed to savings. Overall, lighting measures contribute 86 percent of reported program energy savings, refrigeration measures contribute 9 percent and HVAC measures contribute the remaining 5 percent.

**Figure 2-1. DEC Reported Gross Energy and Demand Savings by Measure Category**

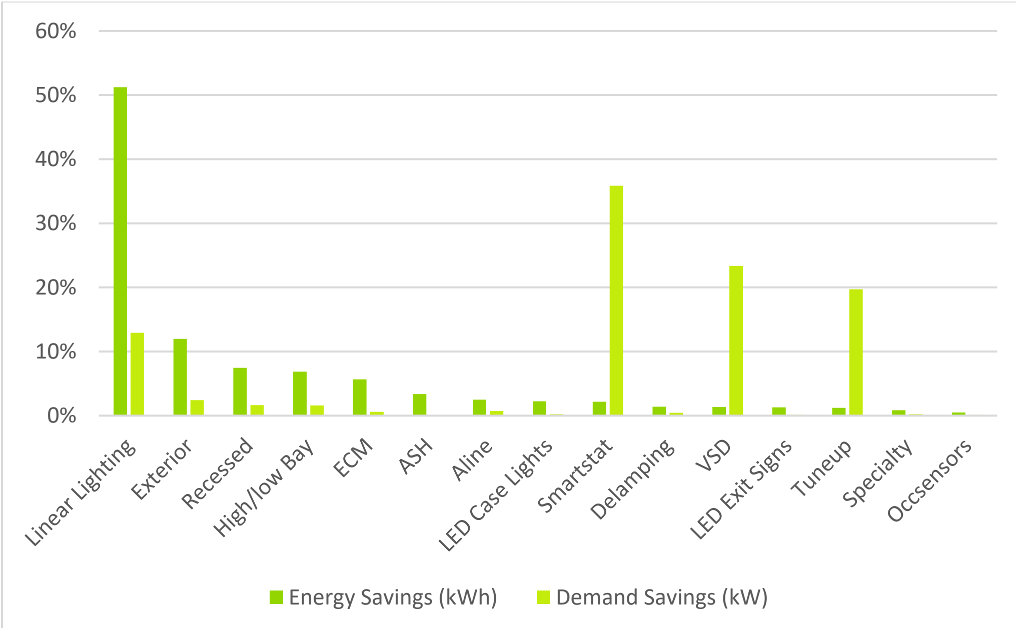



*Source: SBES Tracking Database*

[1] New York Standard Approach for Estimating Energy Savings from Energy Efficiency Programs - Residential, Multi-Family, and Commercial/Industrial, known as the Technical Resource Manual (TRM), Version 7, April 15, 2019

[2] The Pennsylvania Technical Reference Manual, 2016 is used for the anti-sweat heater control measure's algorithms and assumptions

**Figure 2-2. DEP Reported Gross Energy and Demand Savings by Measure Category**



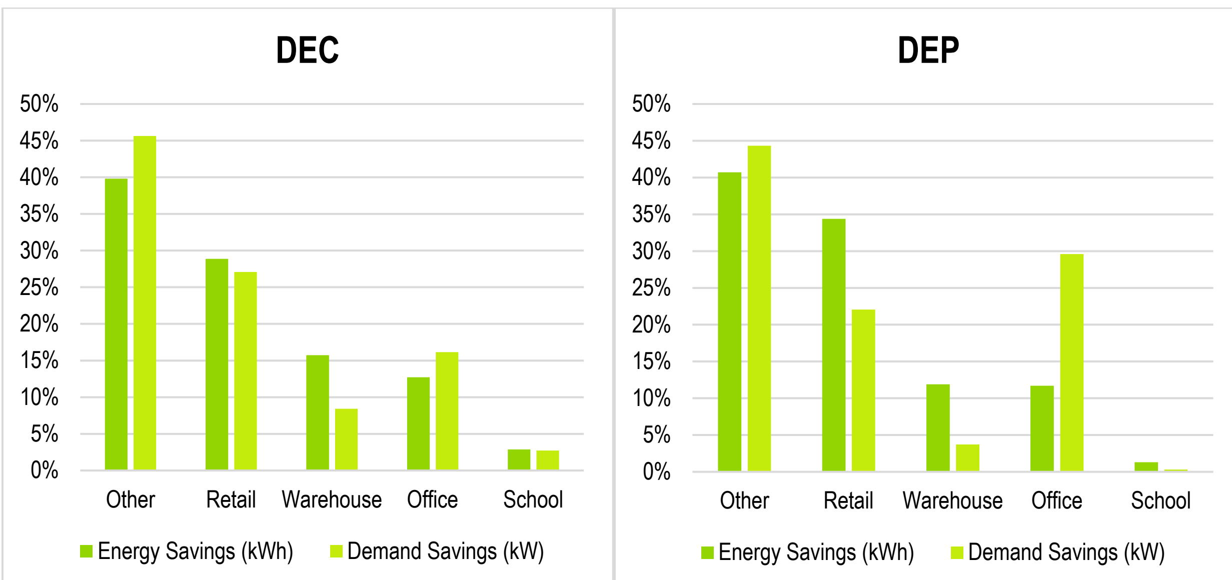

*Source: SBES Tracking Database*

### 2.2.2 Savings by Facility Type

Guidehouse reviewed the business type information in the tracking database to understand the participant demographics. The tracking data included SIC codes for each project, resulting in many unique detailed building types. As part of the engineering analysis for this evaluation, Guidehouse used the NEEP Mid-Atlantic TRM[3] to make impact adjustments to account for factors such as HVAC interactive effects and coincidence factors. To accomplish this, Guidehouse mapped the SIC codes from the tracking data to the facility types detailed in the TRM.

These facility types are shown below in Figure 2-3. Note that the largest category is "other", which indicates either the SIC code was not populated or a suitable TRM facility type was not found. The distribution of facility types is representative of a large variety of small business customers, indicating that the program is successfully recruiting participants across several sectors. The "other", retail, restaurant and warehouse facilities represent the largest contributors of energy and demand savings in both jurisdictions.

**Figure 2-3. Reported Energy Savings by Facility Type**




*Source: SBES Tracking Database*

[3] NEEP TRM (April 2020, v10), https://neep.org/sites/default/files/media-files/trmv10.pdf

# 3. Impact Evaluation

## 3.1 Impact Results

Table 3-1 shows the program-level results for gross energy and demand savings for DEC and DEP. The subsequent tables, Table 3-2, Table 3-3, and Table 3-4 show the end use level results for gross energy and demand savings for DEC and DEP. Guidehouse estimates gross realization rates of 100%, 99% and 98% for DEC energy, summer coincident demand, and winter coincident demand, respectively. The gross realization rates for DEP are estimated as 101%, 99% and 98% for energy, summer coincident demand, and winter coincident demand, respectively. The realization rates in these tables have been determined according to the in-service rates calculated based on the findings of the virtual verification survey as well as an engineering/deemed savings review of the algorithms.

**Table 3-1 Reported and Verified Program-Level Impacts**

| Program | Parameter | Energy (kWh) | Summer Coincident Peak Demand (kW) | Winter Coincident Peak Demand (kW) |
|---|---|---|---|---|
| DEC | Reported Savings | 68,413,344 | 80,343 | 80,343 |
| | Realization Rate | 100.4% | 98.6% | 98.2% |
| | Verified Gross Savings | 68,737,750 | 79,256 | 78,936 |
| DEP | Reported Savings | 46,571,185 | 51,433 | 51,433 |
| | Realization Rate | 100.7% | 98.6% | 97.7% |
| | Verified Gross Savings | 46,888,802 | 50,696 | 50,267 |

*Source: Guidehouse analysis, values subject to rounding*

**Table 3-2 Reported and Verified Lighting Impacts**

| Program | Parameter | Energy (kWh) | Summer Coincident Peak Demand (kW) | Winter Coincident Peak Demand (kW) |
|---|---|---|---|---|
| DEC | Reported Savings | 59,789,384 | 16,221 | 16,221 |
| | Realization Rate | 100.5% | 93.3% | 91.3% |
| | Verified Gross Savings | 60,113,791 | 15,134 | 14,814 |
| DEP | Reported Savings | 39,117,872 | 10,390 | 10,390 |
| | Realization Rate | 100.8% | 92.9% | 88.8% |
| | Verified Gross Savings | 39,435,490 | 9,652 | 9,223 |

*Source: Guidehouse analysis, values subject to rounding*

**Table 3-3 Reported and Verified HVAC Impacts**

| Program | Parameter | Energy (kWh) | Summer Coincident Peak Demand (kW) | Winter Coincident Peak Demand (kW) |
|---|---|---|---|---|
| DEC | Reported Savings | 3,666,767 | 63,700 | 63,700 |
| | Realization Rate | 100.8% | 92.9% | 88.8% |
| | Verified Gross Savings | 3,666,767 | 63,700 | 63,700 |
| DEP | Reported Savings | 2,197,861 | 40,590 | 40,590 |
| | Realization Rate | 100.0% | 100.0% | 100.0% |
| | Verified Gross Savings | 2,197,861 | 40,590 | 40,590 |

*Source: Guidehouse analysis, values subject to rounding*

**Table 3-4 Reported and Verified Refrigeration Impacts**

| Program | Parameter | Energy (kWh) | Summer Coincident Peak Demand (kW) | Winter Coincident Peak Demand (kW) |
|---|---|---|---|---|
| DEC | Reported Savings | 4,957,192 | 422 | 422 |
| | Realization Rate | 100.0% | 100.0% | 100.0% |
| | Verified Gross Savings | 4,957,192 | 422 | 422 |
| DEP | Reported Savings | 5,255,451 | 453 | 453 |
| | Realization Rate | 100.0% | 100.0% | 100.0% |
| | Verified Gross Savings | 5,255,451 | 453 | 453 |

*Source: Guidehouse analysis, values subject to rounding*

Table 3-5 below presents the energy, summer peak and winter peak impacts by the different measure categories in the DEC SBES program. Table 3-6 presents the same impacts by measure category for the DEP SBES program.

**Table 3-5 Reported and Verified Measure-Level Impacts - DEC**

| Measure Category | Reported Savings (kWh) | Verified Energy Savings (kWh) | Energy Realization Rate | Reported Savings (kW) | Verified Demand Savings (Summer kW) | Summer Demand Realization Rate | Verified Demand Savings (Winter kW) | Winter Demand Realization Rate |
|---|---|---|---|---|---|---|---|---|
| A-Line Lamps | 1,605,753 | 1,697,337 | 106% | 482 | 580 | 120% | 591 | 123% |
| Anti Sweat Heater | 1,602,710 | 1,597,708 | 100% | 38 | 38 | 100% | 38 | 100% |
| De-lamping | 1,137,371 | 1,105,993 | 97% | 390 | 416 | 107% | 306 | 79% |
| ECM | 2,302,550 | 2,302,550 | 100% | 263 | 263 | 100% | 263 | 100% |
| Exterior Lights | 8,886,092 | 8,440,067 | 95% | 2,007 | 0 | 0% | 1,896 | 94% |
| Bay Lights | 7,146,435 | 6,898,134 | 97% | 1,909 | 2,256 | 118% | 2,256 | 118% |
| LED Tubes | 32,263,196 | 32,956,441 | 102% | 9,349 | 9,471 | 101% | 7,312 | 78% |
| LED Case Lighting | 1,084,809 | 1,084,809 | 100% | 121 | 121 | 100% | 121 | 100% |
| LED Exit Signs | 955,181 | 991,480 | 104% | 110 | 140 | 128% | 140 | 128% |
| Occupancy Sensors | 356,876 | 346,393 | 97% | 89 | 72 | 80% | 72 | 80% |
| Recessed Lighting | 6,729,790 | 6,941,007 | 103% | 1,706 | 1,986 | 116% | 2,024 | 119% |
| Smart Thermostat | 1,199,650 | 1,199,650 | 100% | 17,415 | 17,415 | 100% | 17,415 | 100% |
| Specialty Lights | 675,811 | 709,064 | 105% | 178 | 213 | 119% | 217 | 122% |
| Tune-up | 786,372 | 786,372 | 100% | 14,425 | 14,425 | 100% | 14,425 | 100% |
| VSD | 1,680,745 | 1,680,745 | 100% | 31,860 | 31,860 | 100% | 31,860 | 100% |
| **Grand Total** | **68,413,344** | **68,737,750** | **100%** | **80,343** | **79,256** | **99%** | **78,936** | **98%** |

*Source: Guidehouse analysis, values subject to rounding*

**Table 3-6 Reported and Verified Measure-Level Impacts – DEP**

| Measure Category | Reported Savings (kWh) | Verified Energy Savings (kWh) | Energy Realization Rate | Reported Savings (kW) | Verified Demand Savings (Summer kW) | Summer Demand Realization Rate | Verified Demand Savings (Winter kW) | Winter Demand Realization Rate |
|---|---|---|---|---|---|---|---|---|
| A-Line Lamps | 1,161,239 | 1,223,170 | 105% | 372 | 446 | 120% | 455 | 122% |
| Anti Sweat Heater | 1,571,502 | 1,571,502 | 100% | 35 | 35 | 100% | 35 | 100% |
| De-lamping | 644,442 | 577,129 | 90% | 226 | 221 | 98% | 163 | 72% |
| ECM | 2,636,283 | 2,636,283 | 100% | 302 | 302 | 100% | 302 | 100% |
| Exterior Lights | 5,579,037 | 5,156,972 | 92% | 1,237 | 0 | 0% | 1,139 | 92% |
| Bay Lights | 3,188,803 | 3,088,653 | 97% | 815 | 953 | 117% | 953 | 117% |
| LED Tubes | 23,850,441 | 24,499,920 | 103% | 6,650 | 6,755 | 102% | 5,216 | 78% |
| LED Case Lighting | 1,047,666 | 1,047,666 | 100% | 117 | 117 | 100% | 117 | 100% |
| LED Exit Signs | 603,599 | 634,030 | 105% | 69 | 89 | 129% | 89 | 129% |
| Occupancy Sensors | 228,693 | 212,761 | 93% | 57 | 47 | 82% | 47 | 82% |
| Recessed Lighting | 3,466,657 | 3,626,739 | 105% | 845 | 997 | 118% | 1,016 | 120% |
| Smart Thermostat | 1,008,250 | 1,008,250 | 100% | 18,439 | 18,439 | 100% | 18,439 | 100% |
| Specialty Lights | 394,961 | 416,116 | 105% | 119 | 143 | 120% | 146 | 122% |
| Tune-up | 563,167 | 563,167 | 100% | 10,137 | 10,137 | 100% | 10,137 | 100% |
| VSD | 626,444 | 626,444 | 100% | 12,014 | 12,014 | 100% | 12,014 | 100% |
| **Grand Total** | **46,571,185** | **46,888,802** | **101%** | **51,433** | **50,696** | **99%** | **50,267** | **98%** |

*Source: Guidehouse analysis, values subject to rounding*

The following sections provide more details on the results, the methodology, and findings for the DEC and DEP impact evaluation.

## 3.2 Impact Evaluation Methodology

Guidehouse conducted an engineering-based analysis using standard savings algorithms to estimate the energy and demand impacts achieved by the program. The analysis was informed by virtual verification to validate measure quantities and characteristics as compared with information in the program tracking data. Additionally, Guidehouse reviewed relevant engineering parameters, such as HVAC interactive effects, and incorporated updates using the NEEP Mid-Atlantic TRM and 2016 Guidehouse logger analysis. The following subsections describe the methodology used for each element of this process, and the results are discussed in detail in Section 3.3.

### 3.2.1 Deemed Savings Review

Guidehouse conducted a deemed savings review to evaluate the energy and demand impacts reported in the tracking database for each measure type and category. Guidehouse evaluated all program measures and supporting data parameters. During the time period covered by this evaluation cycle, Lime Energy was the implementation contractor.

Guidehouse conducted a detailed review of the tracking data and impact estimates included within the documents provided by Duke Energy. Guidehouse replicated impact estimates using engineering calculations based on algorithms provided by Lime Energy and using measure parameters from the tracking data where available. Guidehouse also calculated preliminary ex post impacts for lighting measures that included basic modifications to include HVAC interactive effects and coincidence factors[4]. Based on these ex post impacts, Guidehouse calculated an "Engineering Review (ER)" verified realization rate which is the ratio of the savings calculated through the deemed savings review and the reported savings. See Section 3.3.1 for more information and findings from the deemed savings review.

### 3.2.2 Sample Design

The participation data provided by Duke Energy indicated that the vast majority of energy savings are from lighting measures, with a small contribution of energy savings from refrigeration and HVAC measures. Guidehouse analyzed the program tracking data to characterize the trends in equipment and project size. Similar to previous evaluation cycles, Guidehouse stratified the evaluation sample by project size for lighting and grouped together refrigeration and HVAC measures. This allowed for a proper assessment of a range of projects while maximizing the proportion of total program savings that is represented by the evaluation. It should be noted that for calculations and reporting, HVAC and refrigeration measures were separated out of their combined strata.

Guidehouse used a combined sampling approach but considered strata-level characteristics of each jurisdiction. The combined sample design for both jurisdictions can be seen in Table 3-7 below. The original launch of the virtual verification did not produce the adequate amount of responses to fit the sample design, so more projects were needed to be added to the sample.

In addition to working with the Lime Energy database to create the sample population, the file was analyzed to create reported quantity totals for the lighting, HVAC, and refrigeration

[4] HVAC interactive effects in the savings calculations for indoor lighting measures were sourced from the NEEP Mid-Atlantic TRM and were based on building type, with an assumption of AC and non-electric heating to be conservative

measures. This allowed the virtual verification to ask customers to confirm the quantity installed or provide a reason for a different verified quantity value.

Guidehouse targeted a 90/10 sampling confidence and relative precision for virtual verification at the program level. This expected sample size was approximately 107 projects for verification, seen in the tables below. This was based on a coefficient of variation of 0.5 for all strata, found in past field verification activities for this program. Guidehouse received a total of 90 completed impact surveys back from the sample, representing approximately 6,000 measures. The targeted sampling confidence and precision was 90 percent ± 10 percent, and the achieved was 90 percent ± 2.5 percent

**Table 3-7 DEC Expected Sampling Summary**

| Stratum | Population Project Count | Verification Sample Size |
|---|---|---|
| Lighting Large | 118 | 15 |
| Lighting Medium | 396 | 20 |
| Lighting Small | 1,969 | 21 |
| HVAC and Refrigeration | 1,065 | 51 |
| **Total** | **3,548** | **107** |

*Source: Guidehouse analysis of DEC-DEP program tracking data*

### 3.2.3 Virtual Verification

Guidehouse conducted verification for a sample of program participants to evaluate the consistency of measure characteristics with the program tracking database. Data collection was structured to gather the information necessary to inform the engineering algorithms used to estimate program impacts.

Guidehouse sent email invitations to a sample of participants. The virtual verification link was personalized so each participant only filled in the information relevant to their project. The virtual verification survey was designed to take about 15-20 minutes for a participant to complete while present at their project location. Participants received an incentive of $25-$50 to compensate them for the time required to complete the virtual verification.

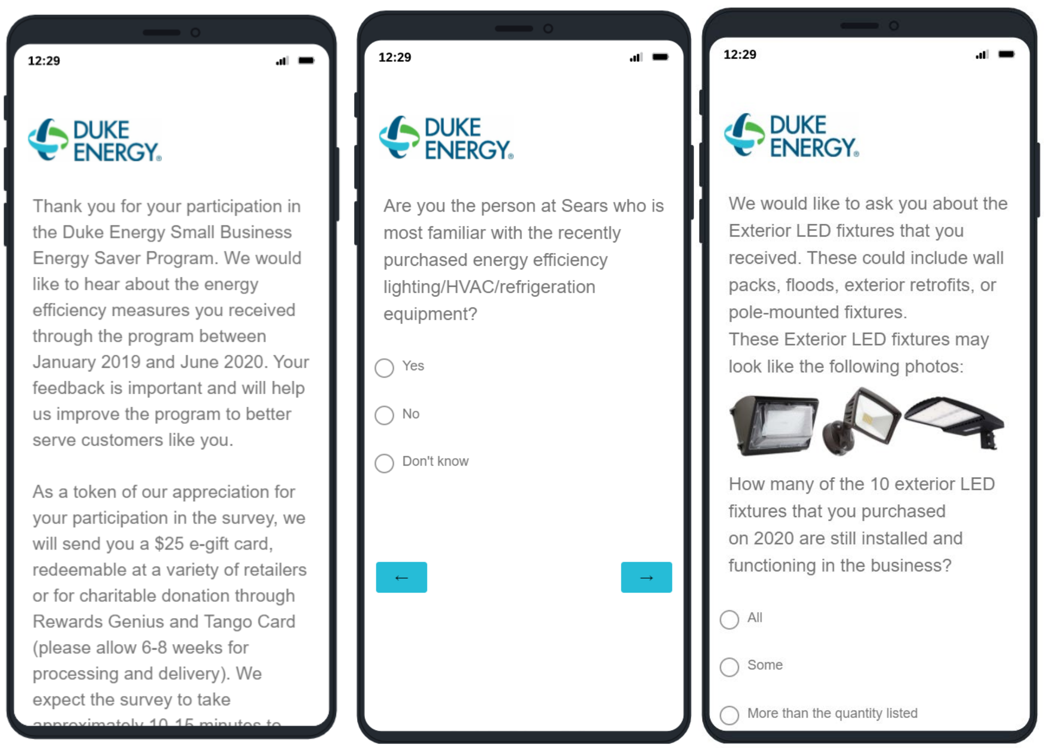
Guidehouse conducted a soft launch of the virtual assessment for a smaller sample of customers to test the process and determine response rates. Early feedback allowed for adjustments to maximize responses. Participants received reminders to complete the assessment. Guidehouse monitored the progress of completes relative to targets and designed a back-up sample to receive invitations when targets were not being met by the initial sample.

Guidehouse used the Qualtrics platform to create the virtual verification interface that participants used to collect key project information. The virtual verification requested photo documentation of certain project characteristics. Customers used a mobile device, such as a smartphone or tablet, to complete the verification process. The virtual verification included general questions about facility features and detailed questions about selected equipment.

Guidehouse asked questions about building HVAC characteristics, operating schedules, measure quantity, lamp/fixture wattage, and efficiency characteristics during the virtual verification. Due to the response rates for these various questions, Guidehouse only used verified measure quantities to update project savings. Guidehouse compared responses associated with heating and cooling system types and hours of operation to the database for consistency checks.

Figure 3-1 shows an example of the Qualtrics virtual verification platform. Participants used their mobile device to access the personalized link and open the interface in a web browser. In the equipment section, participants were prompted to upload pictures of the installed equipment using the camera on their mobile device. Guidehouse used a combination of participant-reported and documentation-based information to inform the verified energy and demand impact calculations.

**Figure 3-1 Virtual Verification Platform Example**




*Source: Guidehouse Virtual Verification Qualtrics Survey*

Survey invitations were sent to 2,202 participants between 2/08/2021 and 3/05/2021, with multiple reminders and escalating incentives. This includes all participants who did not receive invites for the process survey. Guidehouse also contacted 150 customers via phone which resulted in 7 additional customers taking the virtual verification survey. Ultimately, 302 participants began the survey, and 90 participants completed the questions in entirety. The 90 completed virtual impact surveys represented almost 6,000 individual measures.

Table 3-8 shows the virtual verification response summary by measure and includes the reported and verified measure quantities.

**Table 3-8 Virtual Verification Response Summary by Measure**

| Measure | Number of Responses by Measure* | Reported Measure Quantity | Verified Measure Quantity |
|---|---|---|---|
| Specialty Lamps | 6 | 56 | 56 |
| LED Tubes | 76 | 5,127 | 5,115 |
| Tune-up | 9 | 28 | 28 |
| Bay Lights | 3 | 91 | 26 |
| Lighting Controls and Exit Signs | 18 | 116 | 115 |
| A-Line Lamps | 20 | 167 | 156 |
| Exterior Lights | 14 | 75 | 75 |
| Recessed Lights | 10 | 236 | 233 |
| VSD | 3 | 12 | 12 |
| De-lamping | 1 | 8 | 8 |
| Anti-Sweat Heaters | 1 | 5 | 5 |
| ECM | 7 | 49 | 49 |
| LED Case Lighting | 4 | 9 | 9 |
| **Total** | **172** | **5,979** | **5,887** |

*Source: Guidehouse Virtual Verification*
**Respondents often had multiple measure categories in their projects*

## 3.3 Impact Evaluation Findings

This section examines findings from the deemed savings review and discusses the main drivers of the savings realization rates. Guidehouse calculates the realization rate as the verified savings divided by the reported savings by measure, which is driven by a combination of the in-service rate, the HVAC interactive effects, and the coincidence factors, described as follows:

1. In-Service Rate (ISR) is the ratio of the verified (i.e., installed) quantity to the reported quantity from the program tracking data.

2. HVAC Interactive Effects are multipliers that reflect effects on space heating and cooling loads caused by a reduction in heat output from efficient lighting. HVAC interactive effects only impact lighting measures. Note that the implementer did not apply HVAC interactive effects for any measures, so this adjustment is equal to the average HVAC interactive effect itself. There are separate adjustments for energy savings and demand savings.

3. Coincidence Factor (CF) represents the portion of installed lighting that is on during the peak utility hours. This affects only demand reductions, not energy savings.

Overall, in-service rates tend to result in minor decreases to the verified energy savings, while HVAC interactive effects result in an increase in savings for lighting measures. Generally, the application of coincidence factor results in decreased demand savings for lighting measures.

### 3.3.1 Deemed Savings Review

Guidehouse reviewed the program tracking data provided by Duke Energy to assess program activity and the availability of key data fields necessary to support the evaluation. The pre- and post-retrofit measure descriptions summarize the equipment details for each line item in the database, and Guidehouse was able to identify the fields that correspond to ex ante (i.e., reported) energy and demand impacts.

The lighting controls, anti-sweat heater controls, LED case lighting, and refrigeration ECM motor measures were initially lacking information in the Lime Energy tracking data. Lime Energy then provided additional documentation to assist in the review of the program tracking data. Guidehouse used this to confirm that the Lime Energy lighting and refrigeration measure savings in the tracking data align with the algorithms from the New York and Pennsylvania Technical Reference Manuals, as in prior evaluations of this program.

Lime Energy also provided their HVAC measure deemed savings table and provided some background on how those values were developed.

#### *3.3.1.1 Anti-Sweat Heater Controls*

Lime Energy calculated the anti-sweat heater controls measure savings using the algorithms from the Pennsylvania TRM.

**Refrigerator/Cooler**

$$\mathrm{D}kWh_{per\ unit} = \frac{kW_{coolerbase}}{DoorFt} \times \left(8{,}760 \times CHA_{off}\right) \times \left(1 + \frac{R_h}{COP_{cool}}\right)$$

$$\Delta kW_{peak\ per\ unit} = \frac{kW_{coolerbase}}{DoorFt} \times CHP_{off} \times \left(1 + \frac{R_h}{COP_{cool}}\right) \times DF$$

**Freezer**

$$\mathrm{D}kWh_{per\ unit} = \frac{kW_{freezerbase}}{DoorFt} \times \left(8{,}760 \times FHA_{off}\right) \times \left(1 + \frac{R_h}{COP_{freeze}}\right)$$

$$\Delta kW_{peak\ per\ unit} = \frac{kW_{freezerbase}}{DoorFt} \times FHP_{off} \times \left(\frac{R_h}{COP_{freeze}}\right) \times DF$$

**where:**

| | |
|---|---|
| $N$ | = Number of doors or case length in linear feet having ASH controls installed |
| $R_h$ | = Residual heat fraction; estimated percentage of the heat produced by the heaters that remains in the freezer or cooler case and must be removed by the refrigeration unit |
| $Unit$ | = Refrigeration unit |

| | |
|---|---|
| 8,760 | = Hours in a year |
| $kW_{cooler\ base}$ | = Per door power consumption of cooler case ASHs without controls |
| $CHP_{off}$ | = Percent of time cooler case ASH with controls will be off during the peak period |
| $CHA_{off}$ | = Percent of time cooler case ASH with controls will be off annually |
| $DF_{cool}$ | = Demand diversity factor of cooler, accounting for the fact that not all anti-sweat heaters in all buildings in the population are operating at the same time. |
| $COP_{cool}$ | = Coefficient of performance of cooler |
| $kW_{freezerbase}$ | = Per door power consumption of freezer case ASHs without controls |
| $FHP_{off}$ | = Percent of time freezer case ASH with controls will be off during the peak period |
| $FHA_{off}$ | = Percent of time freezer case ASH with controls will be off annually |
| $DF_{freeze}$ | = Demand diversity factor of freezer, accounting for the fact that not all anti-sweat heaters in all buildings in the population are operating at the same time. |
| $COP_{freeze}$ | = Coefficient of performance of freezer |

#### *3.3.1.2 Electronically Commutated Motors*

Lime Energy calculated the electronically commutated motor for Walk-In/Reach-In units measure savings using the algorithms from the New York TRM.

*Annual Electric Energy Savings*

$$\Delta kWh = \Delta kWh_{EFan} + \Delta kWh_{RH}$$

$$\Delta kWh_{EFan} = units \times \left(\frac{A_{EFan} \times V_{EFan} \times \sqrt{Phase_{EFan}}}{1{,}000}\right) \times F_{PA} \times F_{EFan} \times hrs_{EFan}$$

$$\Delta kWh_{RH} = \Delta kWh_{EFan} \times Comp_{Eff} \times 0.284$$

*Summer Peak Coincident Demand Savings*

$$\Delta kW = \Delta kW_{EFan} + \Delta kW_{RH}$$

$$\Delta kW_{EFan} = units \times \left(\frac{A_{EFan} \times V_{EFan} \times \sqrt{Phase_{EFan}}}{1{,}000}\right) \times F_{PA} \times F_{EFan} \times CF$$

$$\Delta kW_{RH} = \Delta kW_{EFan} \times Comp_{Eff} \times 0.284$$

**where:**

| | |
|---|---|
| $\Delta kWh$ | = Annual electric energy savings |
| $\Delta kW$ | = Peak coincident demand electric savings |
| $\Delta therms$ | = Annual gas energy savings |
| $\Delta kWh_{EFan}$ | = Annual electric savings due to evaporator fan motor replacement |
| $\Delta kWh_{RH}$ | = Annual electric savings due to reduced heat from evaporator fan motor replacement |
| $\Delta kW_{EFan}$ | = Summer Peak Coincident Demand Savings due to evaporator fan motor replacement |
| $\Delta kW_{RH}$ | = Summer Peak Coincident Demand Savings due to reduced heat from evaporator fan motor replacement |
| units | = Number of measures installed under the program |
| $A_{EFan}$ | = Nameplate amperage of existing evaporator fan motor |
| $V_{EFan}$ | = Nameplate voltage of existing evaporator fan motor |
| $Phase_{EFan}$ | = Phase of existing evaporator fan |
| 1,000 | = Conversion factor, one kW equals 1,000 W |
| $F_{PA}$ | = Power factor |
| $F_{EFan}$ | = Reduction of load by replacing evaporator fan motor |
| $hrs_{EFan}$ | = Evaporator fan annual operating hours |
| $Comp_{Eff}$ | = Efficiency of the cooler/freezer compressor (kW/Ton) |
| 0.284 | = Conversion factor from kW to Tons of refrigeration (Tons/kW) |
| CF | = Coincidence factor |

### *3.3.1.3 Refrigerated LED Case Lighting*

Lime Energy calculated the refrigerated LED case lighting measure savings using the algorithms from the New York TRM.

*Annual Electric Energy Savings*

$$\Delta kWh = \left(\frac{(W \times units)_{baseline} - (W \times units)_{ee}}{1{,}000}\right) \times hrs \times (1 + (Comp_{eff} \times 0.284))$$

*Summer Peak Coincident Demand Savings*

$$\Delta kW = \left(\frac{(W \times units)_{baseline} - (W \times units)_{ee}}{1{,}000}\right) \times CF \times (1 + (Comp_{Eff} \times 0.284))$$

**where:**

| | |
|---|---|
| ΔkWh | = Annual electricity energy savings |
| ΔkW | = Peak coincident demand electric savings |
| Δtherms | = Annual gas energy savings |
| units | = Number of measures installed under the program |
| W | = Rated wattage of lamp or fixture (Watts) |
| baseline | = Baseline condition or measure |
| ee | = Energy efficient condition or measure |
| 1,000 | = Conversion factor, one kW equals 1,000 Watts |
| hrs | = Lighting operating hours |
| CF | = Coincidence factor |
| $Comp_{Eff}$ | = Efficiency of the cooler/freezer compressor (kW/Ton) |
| 0.284 | = Conversion factor from kW to Tons of refrigeration (Tons/kW) |

#### *3.3.1.4 HVAC Measures Deemed Savings*

Lime Energy worked with Duke Energy to determine the deemed savings for the HVAC measures: fan motor VSDs, HVAC tune-ups, and smart thermostats. For VSDs, Lime Energy provided engineering algorithm(s) used to calculate the energy savings values to support the determination of deemed savings values. For smart thermostats and HVAC tune-ups, deemed savings values were provided to Lime Energy. Lime Energy's regional adjustment methodology for smart thermostats and HVAC tune-ups used 5 years of cooling degree day comparisons with a base temperature of 60 degrees Fahrenheit. There was no adjustment for the VSD measure since VSDs have very little weather dependence.

Since Lime Energy worked with Duke Energy to develop the HVAC measures' deemed savings using regional data, we think the deemed savings values are appropriate and agree with their use.

#### *3.3.1.5 Lighting Controls*

Lime Energy also shared the following algorithm used to calculate the lighting control measure energy savings:

$$kWh = \left[kW_{before} * Qty_{before} * \left(Hours * (1 - ReductionFactor)\right)\right] - \left[kW_{after} * Qty_{after} * \left(Hours * (1 - ReductionFactor)\right)\right]$$

The ReductionFactor variable Lime Energy used is equal to 0.3. Guidehouse was unable to replicate the lighting control savings since baseline wattage data was not provided.

#### *3.3.1.6 Lighting Measures*

As outlined in previous EM&V reports and in following the best practices for commercial lighting impact verification, Table 3-9 shows the algorithms used by Guidehouse to calculate the savings for the lighting measures. These algorithms are similar to those commonly found in technical reference manuals for commercial lighting measures and match the methodology outlined in the New York TRM. Lime Energy followed similar algorithms to calculate lighting measure savings but did not include HVAC interactive effects or coincidence factors (for demand savings only). A discussion on each impact parameter is included after the table.

**Table 3-9 Engineering Algorithms for Lighting Measures**

| Measure | Energy Savings Algorithm | Coincident Peak Demand Savings Algorithm |
|---|---|---|
| Lighting Measures | $kWh = ISR * \frac{(W_b * Qty_b) - (W_{ee} * Qty_{ee})}{1000} * HOU * IF\_Energy$ | $kW = ISR * \frac{(W_b * Qty_b) - (W_{ee} * Qty_{ee})}{1000} * CF * IF\_Demand$ |
| ISR = in-service rate* | | |
| Qty_b = baseline quantity of equipment | | |
| Qty_ee = efficient quantity of equipment | | |
| HOU = operating hours | | |
| Watts_b = baseline watts | | |
| Watts_ee = efficient watts | | |
| CF = coincidence factor | | |
| IF_Energy = heating, ventilating, and air conditioning (HVAC) interaction factor for energy savings calculations | | |
| IF_Demand = interaction factor for demand savings calculations | | |

**Guidehouse did not apply an ISR to the preliminary ex post impacts. ISRs were applied based on findings from evaluation activities. Source: Guidehouse analysis*

### Baseline and Efficient Wattage

Based on the measure descriptions in the tracking database, estimates for baseline and efficient wattage appeared to be reasonable and are likely accurate records of project equipment and specifications. The virtual verification survey supported the wattage information provided in the tracking database, as a small subset of respondents provided wattage information.

### HVAC Interactive Effects for Energy and Demand

The HVAC interactive effects represent additional HVAC impacts due to changes in heating and cooling load for lighting measures located in conditioned spaces. The tracking databases did not apply HVAC interactive effects for any lighting measures, which resulted in adjustments to the energy and demand savings during Guidehouse’ s engineering review. The HVAC Interactive effects by building type as presented in Table 3-6 were applied from the NEEP Mid-Atlantic TRM to the verified savings as calculated from the engineering review.

### Coincidence Factor (CF)

The tracking database included a single demand savings field for lighting measures, which does not incorporate a coincidence factor. Guidehouse interpreted the demand impacts in the tracking data as non-coincident impacts, and the evaluation incorporated summer and winter coincidence factors to calculate kW impacts for reporting purposes. Table 3-7 and Table 3-8 present the summer and winter peak coincident factors that were used in the calculation of the verified demand savings stemming from the engineering review.

### 3.3.2 HVAC Interactive Effects

HVAC interactive effects are the lighting-HVAC interaction factors that represent the reduced space cooling requirements due to the reduction of waste heat rejected by efficient lighting. Because of this, HVAC interactive effects are not applicable to exterior lighting measures. The evaluation team applied HVAC interactive effects to both the energy and demand savings calculations for the interior lighting measures. The HVAC interactive effects shown in Table 3-10 are sourced from Appendix E (Commercial & Industrial Lighting Waste Heat Factors) in the NEEP Mid-Atlantic TRM and are based on building type[5]. Note that the implementor did not apply HVAC interactive effects for any of the lighting measures claimed in the program year. The HVAC interactive effects adjustment is between 1.00 and 1.10 for energy and 1.00 and 1.44 for demand.

**Table 3-10 HVAC Interactive Effects Multipliers from the NEEP Mid-Atlantic TRM**

| Building Type | WHFe | WHFd |
|---|---|---|
| Office | 1.10 | 1.36 |
| Retail | 1.06 | 1.27 |
| School | 1.10 | 1.44 |
| Warehouse | 1.02 | 1.23 |
| Other | 1.08 | 1.35 |

*Source: NEEP Mid-Atlantic TRM*

HVAC interactive effects and coincidence factors are the main reason for discrepancy between the reported and verified savings in interior lighting measures. The addition of HVAC interactive effects to the energy savings calculations resulted in an increase of savings. The addition of the HVAC interactive effects to the demand savings resulted in an increase in demand savings.

### 3.3.3 Coincidence Factors

To develop summer and winter coincidence factors for the lighting measures, Guidehouse used findings from the lighting logger measurements conducted during the 2016 DEC-DEP evaluation. Coincidence factors account for the fact that not all lights are on for the duration of the peak demand period. Coincidence factors range from 0.0 and 1.0, based on measure type, and are detailed in Table 3-11 below. The implementer did not apply coincidence factors to the demand savings for lighting measures. LED exit signs that are on all day receive a summer and winter coincidence factor on 1.0, while exterior lights receive a summer coincidence factor of 0.0 and winter coincidence factor of 1.0.

Lighting controls have a separate set of coincidence factors based on building type, similar to the HVAC interactive effects. There coincidence values come from the NEEP Mid-Atlantic TRM Appendix E (Commercial & Industrial Lighting Waste Heat Factors) and can be found in Table 3-12.

[5] NEEP TRM (April 2020, v10), https://neep.org/sites/default/files/media-files/trmv10.pdf . The HVAC interactive effects (or waste heat factors) used are for Maryland buildings with AC and non-electric heat.

**Table 3-11 Summer and Winter Coincidence Factors for Lighting Measures from DEC-DEP 2016 Logger Analysis**

| Measure | Summer Coincidence Factor | Winter Coincidence Factor |
|---|---|---|
| LED Exit Sign | 1 | 1 |
| A Line Lamp | 0.914 | 0.931 |
| Recessed Light | 0.914 | 0.931 |
| Specialty Light | 0.914 | 0.931 |
| LED Tube | 0.802 | 0.619 |
| High/low Bay | 1 | 1 |
| Delamping | 0.902 | 0.664 |
| Exterior Light | 0 | 1 |

*Source: DEC-DEP 2016 logger data analysis.*

**Table 3-12 Coincidence Factors for Lighting Controls from the NEEP Mid-Atlantic TRM**

| Building Type | Coincidence Factor |
|---|---|
| Office | 0.70 |
| Retail | 0.83 |
| School | 0.35 |
| Warehouse | 0.80 |
| Other | 0.62 |

*Source: NEEP Mid-Atlantic TRM*

### 3.3.4 Engineering Review (ER) Realization Rate

During the engineering review process, Guidehouse used the HVAC interactive effects as well as summer and winter peak coincident factors to adjust the deemed impacts.

On average the addition of HVAC interactive effects resulted in an increase of 5% in energy savings and 25% in demand savings. The addition of coincident peak demand factors resulted in an average decrease of 20% in summer peak demand savings and 25% in winter peak demand savings.

**Table 3-13** and Table 3-14 show the realization rates stemming from the engineering review for energy, summer peak and winter peak demand savings for each stratum.

**Table 3-13 DEC Engineering Review (ER) Realization Rate**

| Stratum | Energy Realization Rate | Summer Peak Demand Realization Rate | Winter Peak Demand Realization Rate |
|---|---|---|---|
| Lighting Large | 105% | 97% | 98% |
| Lighting Medium | 106% | 96% | 97% |
| Lighting Small | 106% | 101% | 93% |
| HVAC | 100% | 100% | 100% |
| Refrigeration | 100% | 100% | 100% |
| **Total** | **105%** | **100%** | **99%** |

*Source: Guidehouse Engineering Review*

**Table 3-14 DEP Engineering Review (ER) Realization Rate**

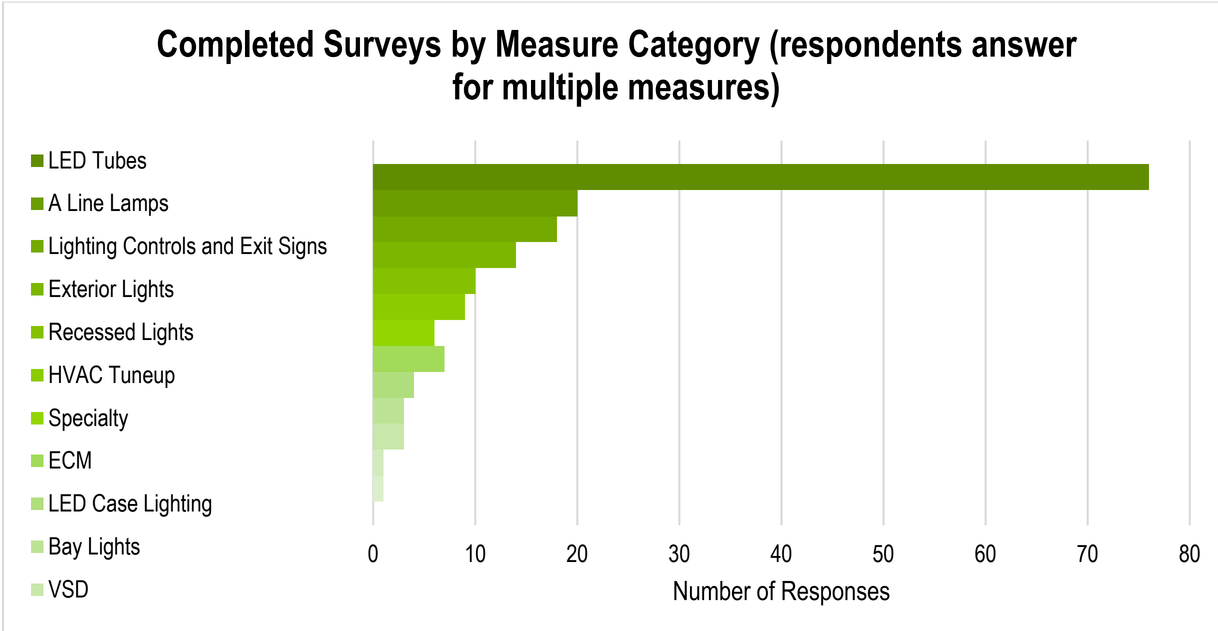
| Stratum | Energy Realization Rate | Summer Peak Demand Realization Rate | Winter Peak Demand Realization Rate |
|---|---|---|---|
| Lighting Large | 104% | 88% | 108% |
| Lighting Medium | 106% | 96% | 99% |
| Lighting Small | 107% | 104% | 87% |
| HVAC | 100% | 100% | 100% |
| Refrigeration | 100% | 100% | 100% |
| **Total** | **105%** | **99%** | **99%** |

*Source: Guidehouse Engineering Review*

### 3.3.5 In-Service Rates (ISR)

Guidehouse analyzed the responses to the virtual verification survey to identify the verified quantities of equipment installed. Guidehouse calculated the ISR as a ratio between the findings from the virtual verification and the quantities reported in the program-tracking databases. As seen in Figure 3-2, Guidehouse received responses to questions representing the majority of program measure categories.

**Figure 3-2 Survey Responses by Measure Category**




*Source: Guidehouse Virtual Verification*

Table 3-15 shows the reported and verified quantities by stratum as collected from the virtual verification survey. Although the number of completed virtual assessments was slightly lower than Guidehouse' s target, this did not impact the precision goals of the evaluation. This is because in-service rates (ISR) at the site level were still extremely high within the sample group, with a 96% realization rate ISR from the survey alone. A table of ISR by stratum can be seen below in Table 3-16.

**Table 3-15 Response Summary by Stratum**

| Stratum | Sample Size | Sample Reported Quantity | Sample Verified Quantity |
|---|---|---|---|
| Lighting Large | 3 | 1,039 | 965 |
| Lighting Medium | 9 | 2,549 | 2,546 |
| Lighting Small | 53 | 2,288 | 2,273 |
| HVAC | 14 | 40 | 40 |
| Refrigeration | 11 | 63 | 63 |
| **Total** | **90** | **5,979** | **5,887** |

*Source: Guidehouse Virtual Verification*

**Table 3-16 Verification Energy Realization Rate ISR**

| Stratum | ISR |
|---|---|
| Lighting Large | 85% |
| Lighting Medium | 100% |
| Lighting Small | 100% |
| HVAC | 100% |
| Refrigeration | 100% |
| **Total** | **96%** |

*Source: Guidehouse Virtual Verification*

As shown in Table 3-17 below, the ISR for each measure varied from 29% to 100%. The high/low bay lights measure had the lowest ISR of 29% while the rest of the measures had ISR between 93% and 100%. 11 out of the 13 measure categories had an ISR between 99% and 100%.

**Table 3-17 Virtual Verification In-Service Rates Findings**

| Measure | ISR |
|---|---|
| Specialty Lamps | 100% |
| LED Tubes | 100% |
| Tune-up | 100% |
| Bay Lights | 29% |
| Lighting Controls and Exit Signs | 99% |
| A-Line Lamps | 93% |
| Exterior Lights | 100% |
| Recessed Lights | 99% |
| VSD | 100% |
| De-lamping | 100% |
| Anti-Sweat Heaters | 100% |
| ECM | 100% |
| LED Case Lighting | 100% |

*Source: Guidehouse Virtual Verification*

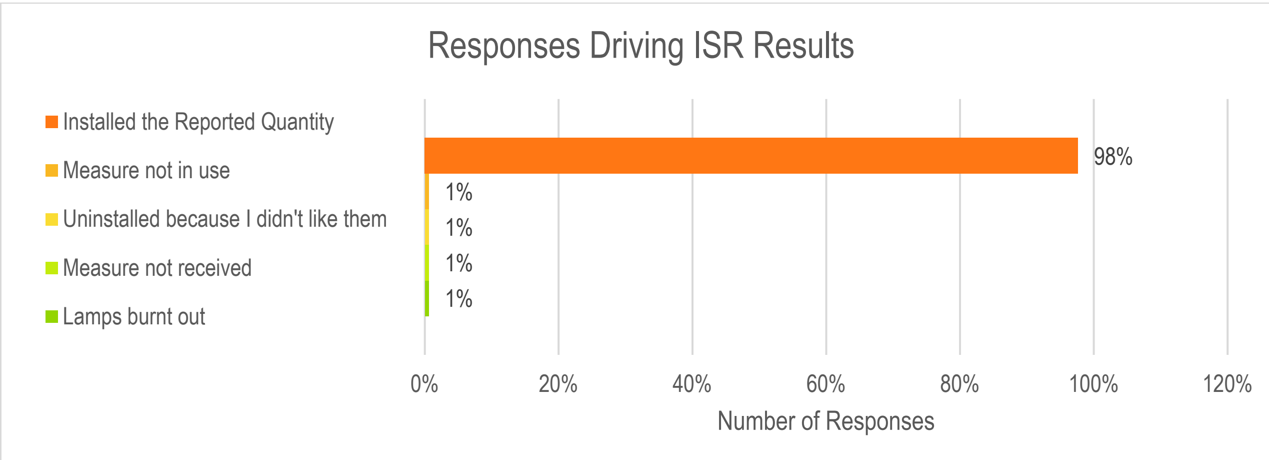
**90 virtual verification surveys were completed, with respondents answering questions about multiple measures*

The majority of respondents (98%) reported that they installed the quantity of their measure that was reported in the program tracking data, as shown in Figure 3-3. Four percent of the respondents said that the quantities reported in the program tracking data for their measure were either no longer installed or were never installed. One percent of respondents said the measure is no longer in use, with no further explanation. One percent of respondents said they uninstalled the measure because they didn't like it. One percent said they never received the measure and the last 1% said their lamps burnt out, so they are no longer installed.

Overall, the ISR values are high and indicate the program is accurately tracking installed measures. Additionally, even though the ISRs decreased for some measures, overall energy savings increased through the application of HVAC interactive effects that were added in during the engineering review. The lighting large strata was the only strata that saw an overall decrease in energy savings due to the ISR.

**Figure 3-3 Responses Driving ISR Results**




*Source: Guidehouse Virtual Verification*

## 3.1 Verified Realization Rates based on ISR and ER

This section presents the overall realization rates based on verified gross savings, separated out by jurisdiction. This process includes merging the realization rates calculated based on the engineering review and in-service rates from the virtual verification assessments.

Table 3-18 presents the overall realization rates for DEC, and Table 3-20 presents the DEP overall realization rates. Table 3-19 and Table 3-21 present the realization rates by end use for DEC and DEP respectively. As mentioned in earlier sections, the virtual verification assessments were used to determine in-service rates (ISRs) for each category.  Guidehouse calculated separate impacts using an engineering review (ER) process that included applying algorithms from the New York and Pennsylvania TRMs and measure characteristics from the program tracking data. The total realization rates were obtained using both the verified quantity from the surveyed customers and the engineering review calculations. The ER energy realization rate was 105% for DEC and DEP and the ISRs was 96%.

These realization rates were impacted by the interactive effects in the engineering review calculations. For both programs, these interactive effects increased the verified savings above the reported savings, and the ISR from the virtual verification decreased the verified savings slightly to bring both realization rates to their final values of 100% and 101%. Figure 3-4 and Figure 3-5 show how each calculation method impacted the realization rate for each stratum, as well as the jurisdictions' overall realization rate.

### Table 3-18 Energy Installation Rate by Strata – DEC

| Stratum | ER | ISR | Total Energy Realization Rate |
|---|---|---|---|
| Lighting Large | 105% | 85% | 89% |
| Lighting Medium | 106% | 100% | 106% |
| Lighting Small | 106% | 100% | 106% |
| HVAC | 100% | 100% | 100% |
| Refrigeration | 100% | 100% | 100% |
| **Total** | **105%** | **96%** | **100%** |

*Source: Guidehouse analysis, values subject to rounding.*

### Table 3-19 Energy Installation Rate by End Use – DEC

| End Use | ER | ISR | Total Energy Realization Rate |
|---|---|---|---|
| Lighting Large | 106% | 96% | 101% |
| HVAC | 100% | 100% | 100% |
| Refrigeration | 100% | 100% | 100% |
| **Total** | **105%** | **96%** | **100%** |

*Source: Guidehouse analysis, values subject to rounding.*

### Table 3-20. Energy Realization Rate by Strata – DEP

| Stratum | ER | ISR | Total Energy Realization Rate |
|---|---|---|---|
| Lighting Large | 104% | 85% | 89% |
| Lighting Medium | 106% | 100% | 106% |
| Lighting Small | 107% | 100% | 107% |
| HVAC | 100% | 100% | 100% |
| Refrigeration | 100% | 100% | 100% |
| **Total** | **105%** | **96%** | **101%** |

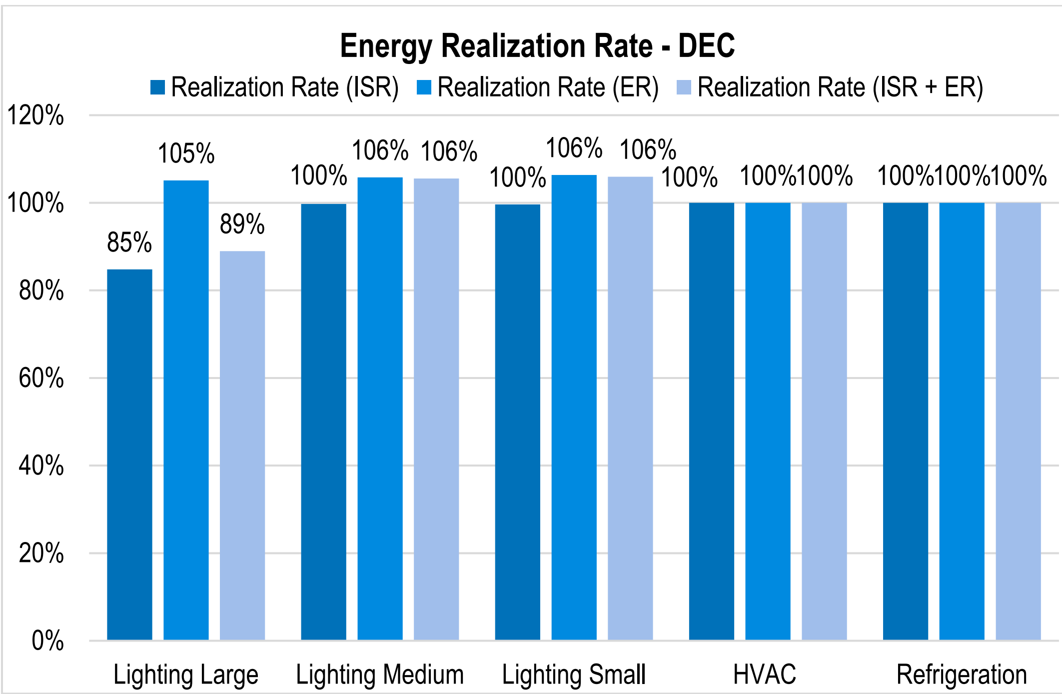
*Source: Guidehouse analysis, values subject to rounding.*

**Table 3-21 Energy Installation Rate by End Use – DEP**

| End Use | ER | ISR | Total Energy Realization Rate |
|---|---|---|---|
| Lighting | 106% | 96% | 101% |
| HVAC | 100% | 100% | 100% |
| Refrigeration | 100% | 100% | 100% |
| **Total** | **105%** | **96%** | **101%** |

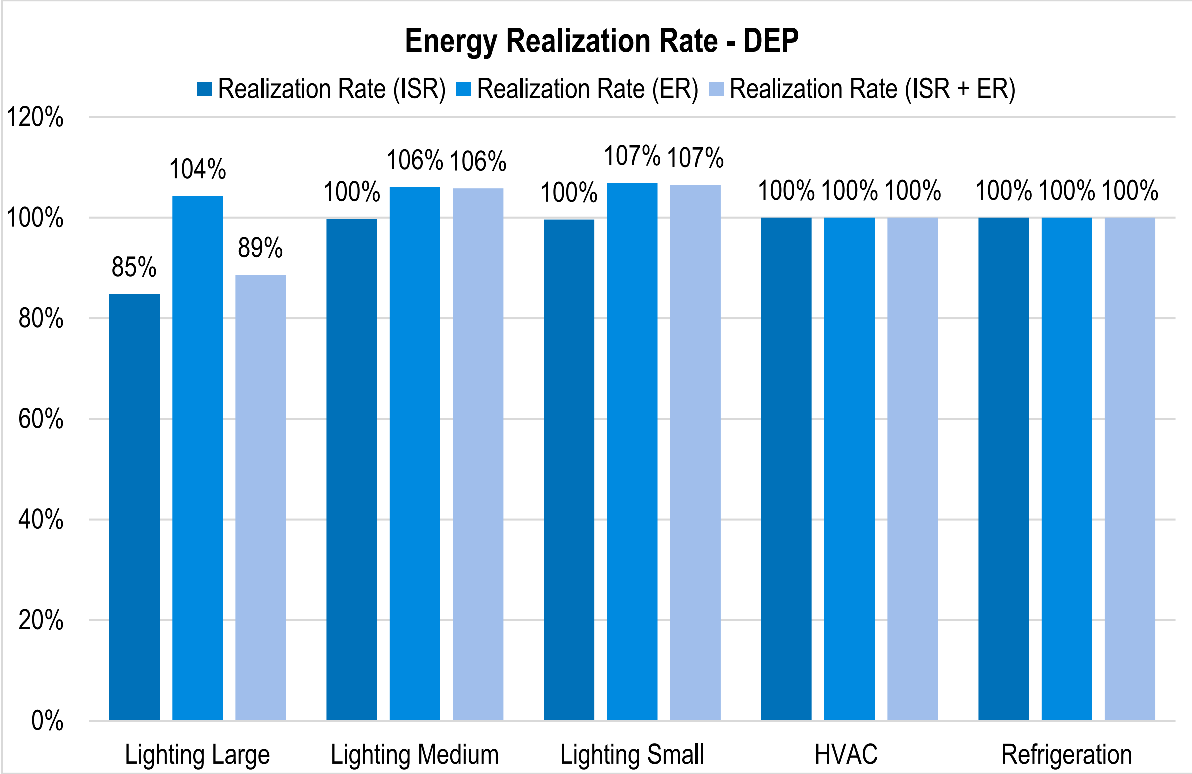
*Source: Guidehouse analysis, values subject to rounding.*

**Figure 3-4 Comparison of Energy Savings Realization Rates by Strata - DEC**




*Source: Guidehouse analysis, values subject to rounding.*

**Figure 3-5 Comparison of Energy Savings Realization Rates by Strata – DEP**




*Source: Guidehouse analysis, values subject to rounding.*

The summer and winter peak overall realization rates are shown in the tables below, broken out by jurisdiction. The in-service rates for DEC and DEP demand savings were relatively high at 99% for both summer and winter. The ER realization rates for summer and winter peak are impacted by the HVAC interactive effects and coincidence factors (summer and winter).The total realization rate combines these two verification savings methods. Table 3-22 to Table 3-29 below lay out the jurisdictions' realization rates by season, strata and end use.

For the DEC jurisdiction, the overall summer demand realization rate is 99%. This is because the interactive effects and summer coincidence factors increased or held the realization rate close to 100% while the verified quantities significantly reduced the Lighting Large realization rate, so the factors balanced each other out in the final realization rate. The jurisdiction's overall winter demand realization rate was slightly lower at 98% due to a stronger impact on the Lighting Small strata in addition to the summer realization rate's reasoning, resulting in an overall winter peak realization rate of 98%. Figure 3-6 and Figure 3-8 show how each calculation method impacted the summer and winter realization rate for each of DEC's stratum, respectively.

The DEP jurisdiction has an overall summer demand realization rate of 99% because the interactive effects, summer coincidence factors, and verified quantities once again balanced one another out. The 99% comes from those interactive effects and coincidence factors having a slightly higher influence on the realization rates than the verified quantities. The jurisdiction's overall winter demand realization rate was 98% because the winter demand coincidence factors decreased the Lighting strata's realization rates, producing a slightly lower overall winter peak realization rate. Figure 3-7 and Figure 3-9 show how the calculation methods impacted DEP's summer and winter realization rate for each stratum, respectively.

**Table 3-22 Summer Peak Demand Realization Rates by Strata – DEC**

| Stratum | ER | ISR | Total Summer Demand Realization Rate (ER +ISR) |
|---|---|---|---|
| Lighting Large | 97% | 83% | 80% |
| Lighting Medium | 96% | 100% | 96% |
| Lighting Small | 101% | 100% | 101% |
| HVAC | 100% | 100% | 100% |
| Refrigeration | 100% | 100% | 100% |
| **Total** | **100%** | **99%** | **99%** |

*Source: Guidehouse analysis, values subject to rounding.*

**Table 3-23 Summer Peak Demand Realization Rates by End Use – DEC**

| Stratum | ER | ISR | Total Summer Demand Realization Rate (ER +ISR) |
|---|---|---|---|
| Lighting | 98% | 96% | 93% |
| HVAC | 100% | 100% | 100% |
| Refrigeration | 100% | 100% | 100% |
| **Total** | **100%** | **99%** | **99%** |

*Source: Guidehouse analysis, values subject to rounding.*

**Table 3-24 Summer Peak Demand Realization Rates by Strata - DEP**

| Stratum | ER | ISR | Total Winter Demand Realization Rate (ER +ISR) |
|---|---|---|---|
| Lighting Large | 88% | 83% | 73% |
| Lighting Medium | 96% | 100% | 96% |
| Lighting Small | 104% | 100% | 104% |
| HVAC | 100% | 100% | 100% |
| Refrigeration | 100% | 100% | 100% |
| **Total** | **99%** | **99%** | **99%** |

*Source: Guidehouse analysis, values subject to rounding.*

**Table 3-25 Summer Peak Demand Realization Rates by End Use – DEP**

| End Use | ER | ISR | Total Summer Demand Realization Rate (ER +ISR) |
|---|---|---|---|
| Lighting | 97% | 96% | 93% |
| HVAC | 100% | 100% | 100% |
| Refrigeration | 100% | 100% | 100% |
| **Total** | **99%** | **99%** | **99%** |

*Source: Guidehouse analysis, values subject to rounding.*

**Table 3-26 Winter Peak Demand Realization Rates by Strata – DEC**

| Stratum | ER | ISR | Total Winter Demand Realization Rate (ER +ISR) |
|---|---|---|---|
| Lighting Large | 98% | 83% | 81% |
| Lighting Medium | 97% | 100% | 97% |
| Lighting Small | 93% | 100% | 93% |
| HVAC | 100% | 100% | 100% |
| Refrigeration | 100% | 100% | 100% |
| **Total** | **99%** | **99%** | **98%** |

*Source: Guidehouse analysis, values subject to rounding.*

**Table 3-27 Winter Peak Demand Realization Rates by End Use – DEC**

| End Use | ER | ISR | Total Winter Demand Realization Rate (ER +ISR) |
|---|---|---|---|
| Lighting | 96% | 96% | 91% |
| HVAC | 100% | 100% | 100% |
| Refrigeration | 100% | 100% | 100% |
| **Total** | **99%** | **99%** | **98%** |

Source: Guidehouse analysis, values subject to rounding

**Table 3-28 Winter Peak Demand Realization Rates by Strata – DEP**

| Stratum | ER | ISR | Total Winter Demand Realization Rate (ER +ISR) |
|---|---|---|---|
| Lighting Large | 94% | 83% | 79% |
| Lighting Medium | 95% | 100% | 95% |
| Lighting Small | 91% | 100% | 90% |
| HVAC | 100% | 100% | 100% |
| Refrigeration | 100% | 100% | 100% |
| **Total** | **99%** | **99%** | **98%** |

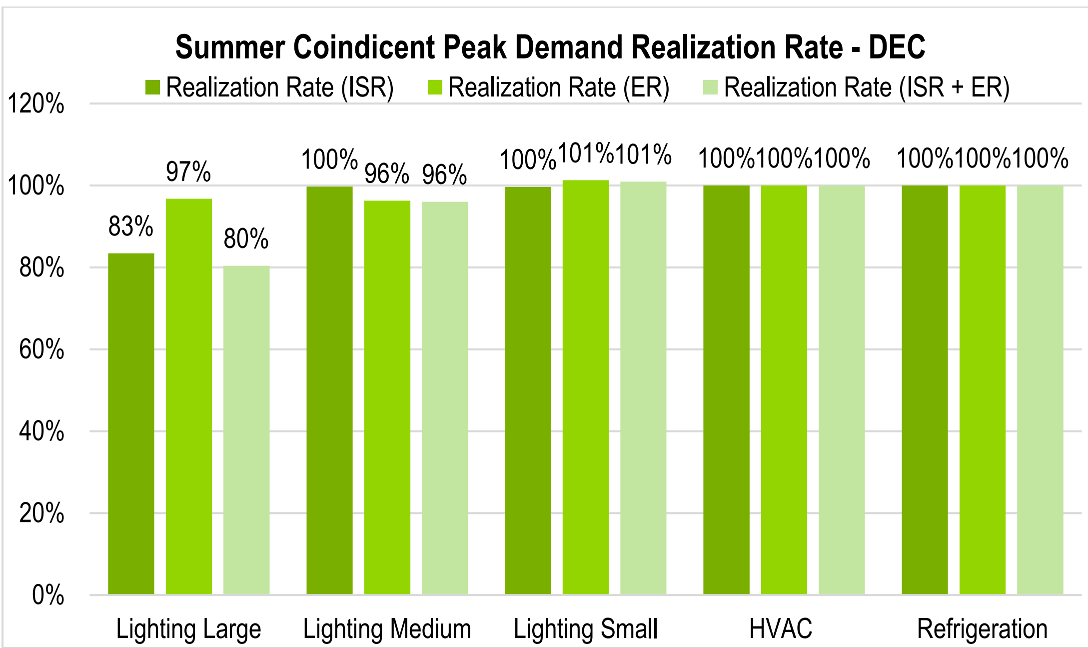
*Source: Guidehouse analysis, values subject to rounding.*

**Table 3-29 Winter Peak Demand Realization Rates by End Use – DEP**

| End Use | ER | ISR | Total Winter Demand Realization Rate (ER +ISR) |
|---|---|---|---|
| Lighting | 93% | 96% | 89% |
| HVAC | 100% | 100% | 100% |
| Refrigeration | 100% | 100% | 100% |
| **Total** | **99%** | **99%** | **98%** |

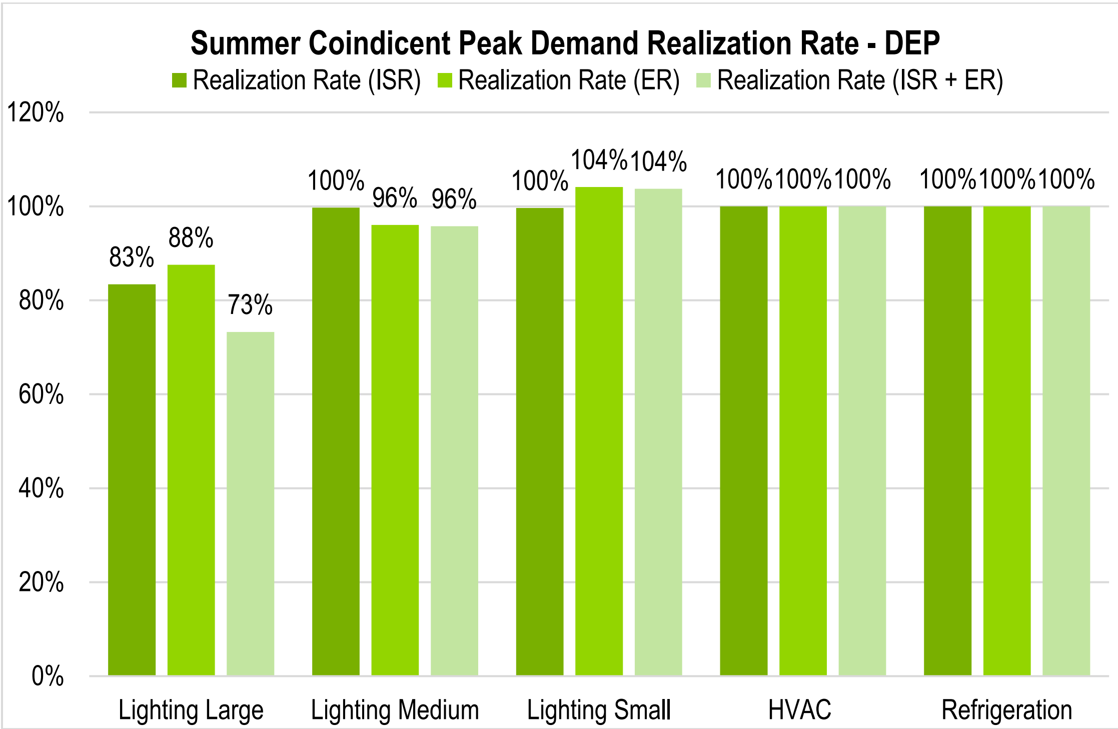
Source: Guidehouse analysis, values subject to rounding

**Figure 3-6 Comparison of Summer Peak Demand Savings Realization Rates by Strata - DEC**



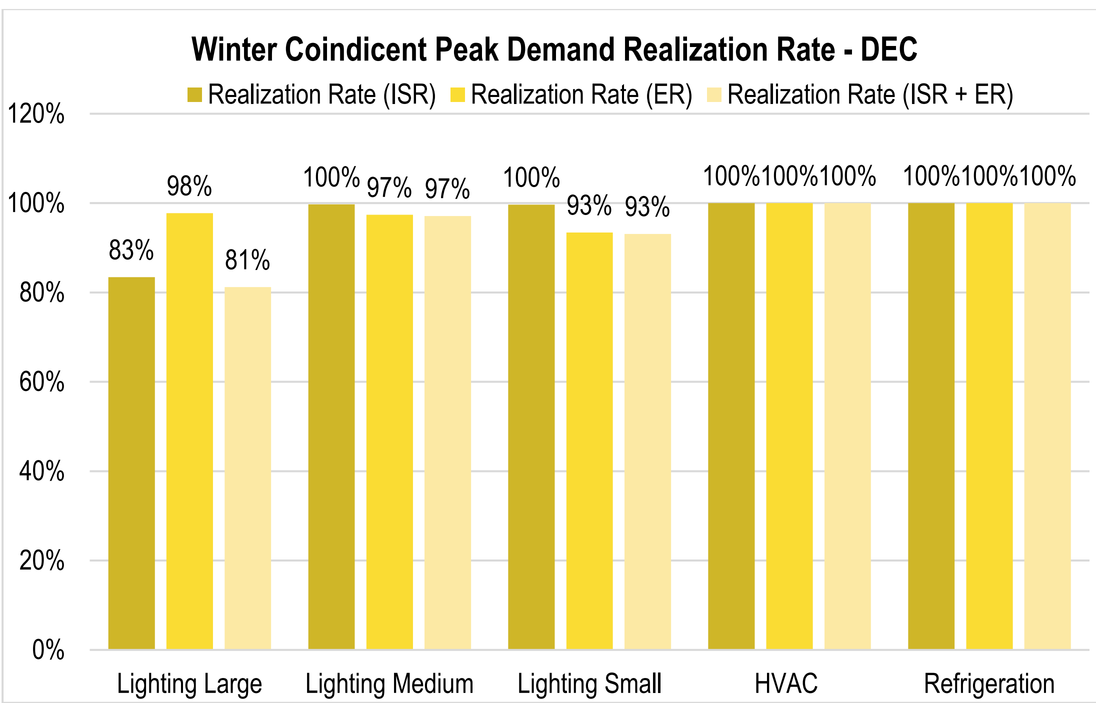

*Source: Guidehouse analysis, values subject to rounding.*

**Figure 3-7 Comparison of Summer Peak Demand Savings Realization Rates by Strata – DEP**



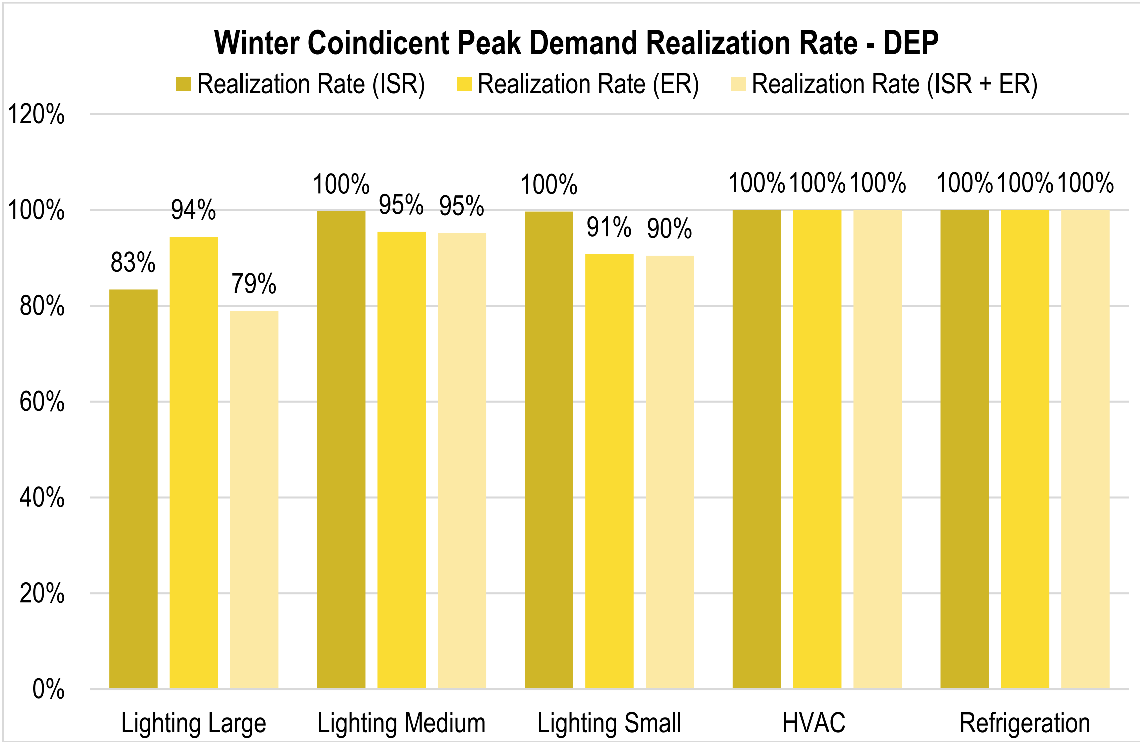

*Source: Guidehouse analysis, values subject to rounding.*

**Figure 3-8 Comparison of Winter Peak Demand Savings Realization Rates by Strata - DEC**




*Source: Guidehouse analysis, values subject to rounding.*

**Figure 3-9 Comparison of Winter Peak Demand Savings Realization Rates by Strata – DEP**




*Source: Guidehouse analysis, values subject to rounding.*

# 4. Process Evaluation

The purpose of the process evaluation is to understand, document and provide feedback on the program implementation components and customer experience.

## 4.1 Process Methodology

The evaluation team conducted in-depth interviews with SBES Program staff and implementation contractor (IC) staff as well as conducting customer participant surveys, as noted previously. The process findings summarized in this document are based on the results of:

- Participant surveys with 97 program participants.
- Program review, including interviews with the Duke Energy Program Manager and the IC staff; and a review of the program documentation.

Due to the COVID-19 pandemic, Guidehouse performed both the impact and process evaluation activities using online survey platforms, rather than prior evaluations where onsite field verification was used for the impact assessment. To accomplish the virtual assessments, Guidehouse randomly divided the population of participants into separate groups to receive invitations for process and impact-related surveys, such that participants would not be inundated with multiple requests. Email addresses were also not available for all participants. The response status of all process survey participants is outlined in Table 4-1.

**Table 4-1. Response Status – Process Survey**

| Status | Number of Responses |
|---|---|
| Email Failed | 325 |
| Email Hard Bounce | 11 |
| Email Not Sent | 35 |
| Email Opened | 1 |
| Email Sent | 536 |
| Email Soft Bounce | 15 |
| Survey Finished | 97 |
| Survey Partially Finished | 25 |
| Survey Started | 300 |
| **Total** | **1,345** |

*Source: Guidehouse*

## 4.2 Participant Survey

Guidehouse designed the surveys to ask specific questions about the program measure categories. The measure families as a part of this evaluation period are lighting, HVAC, and refrigeration. Participants received an email invitation to complete an online survey that was designed to collect detailed information about program experience and satisfaction. The survey was 15-20 minutes long and participants received an incentive of $10-$40 based on the timing of participation.

The survey effort successfully completed surveys with 97 customers to assess:

- Participation experience and satisfaction
- Participant channel and awareness
- Feedback about program components
- Program improvements
- Program benefits and challenges
- Satisfaction associated with implementation contractors
- Free-ridership, Inside and Outside Spillover

## 4.3 Program Review

The evaluation team designed the program review task to understand changes and updates to the program design, implementation and energy and demand savings assumptions. Guidehouse reviewed program literature and Duke Energy's website, interviewed the Duke Energy program team, and had several conversations with Lime Energy regarding the energy and demand savings included in the program tracking database. The key program characteristics include the following:

- **Program Design** – The SBES program is designed to offer high incentives (up to 80 percent of the total cost of the project) on efficient equipment to reduce energy use and peak demand. It specifically targets small business customers that are difficult to reach and often do not pursue energy efficiency on their own.
- **Program Implementation** – A third-party contractor, Lime Energy administers the SBES program on Duke Energy's behalf. The IC handles all aspects of the program, including customer recruitment, facility assessments, equipment installation (through independent installers contracted by the IC), and payment and incentive processing. The IC reports energy and peak demand reduction estimates to Duke Energy. The IC has continued to refine their processes to ensure that savings estimates are reasonable and customer complaints are handled in a timely manner.
- **Incentive Model** – The IC offers potential participants a recommended package of energy efficiency measures along with equipment pricing and installation costs. The incentive is proportional to estimated energy savings and can be as high as 80 percent of the total cost of the project.
- **Savings Estimates** – Energy and peak demand savings are estimated on a per-measure basis, considering existing equipment, proposed equipment, and operational characteristics unique to each customer.

## 4.4 Participant Survey Findings

The following sections detail the process findings from all relevant sources of program information, including interviews with Duke Energy and IC staff and the results of the customer surveys, organized by topic. The feedback received indicates that the SBES Program serves Duke Energy's customers well and represents an important component of Duke Energy's portfolio of business energy efficiency programs. Key findings are as follows:

- A majority of SBES participants were satisfied with the program. On a scale of 0 to 10, where 0 indicates “not satisfied at all” and 10 indicates “extremely satisfied”:
    - 82 percent of respondents indicated 8-10 for satisfaction with overall program experience.
    - 90 percent of respondents indicated 8-10 for satisfaction with Lime Energy
- Sixty-six percent of respondents stated that equipment offered through the program allowed them to upgrade all of the equipment they wanted at the time.
- Eighty-two percent of respondents mentioned that they are extremely likely to participate in this program or a similar Duke Energy program again.
- Sixty-three percent of respondents mentioned that that their attitude towards Duke Energy is more positive after participating in the program.
- Over Fifty percent of respondents stated that they had recommended the program to other businesses. On average, respondents recommended the program to an average of three other businesses.

The following sections details the process findings and addresses the following topics:

1. Overall customer experience.
2. Implementation contractor.
3. Program challenges.
4. Program benefits.
5. Suggested improvements.

### 4.4.1 Customer Experience

Customers reported very high satisfaction with their overall program experience as shown in Figure 4-1. Only four percent of the participants rated their overall satisfaction as less than 5, and 82% rated their satisfaction as an 8, 9, or 10.

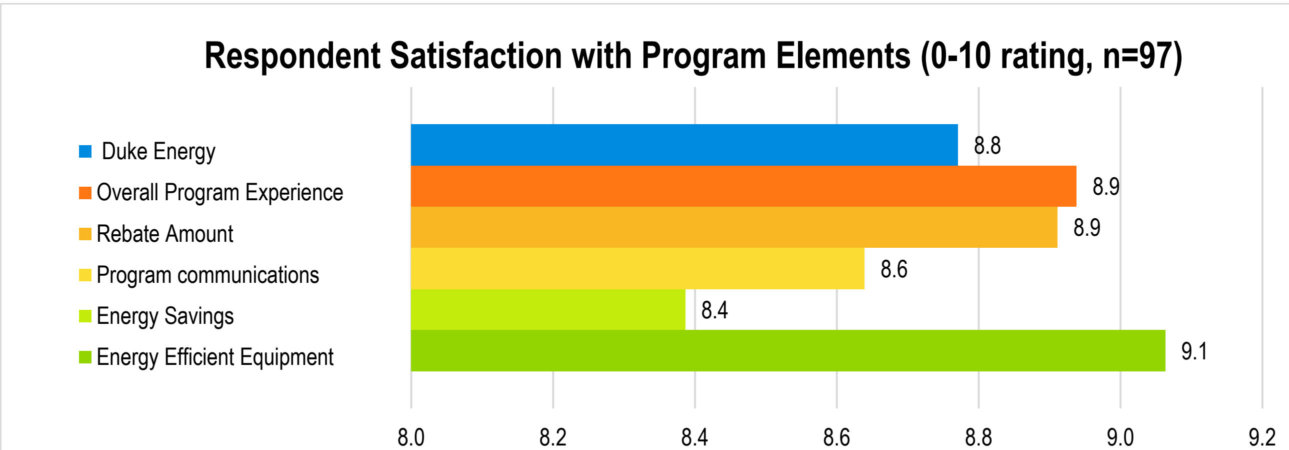
Guidehouse identified some correlations with overall program satisfaction that provide insight into drivers of high satisfaction:

- Customers with overall high program satisfaction were more satisfied on average with every program element, but the difference was particularly noticeable on two program elements:
    - **The energy savings resulting from the new equipment**: highly satisfied customers gave an average rating of 9.4 vs 4.9 among less satisfied customers. Five respondents mentioned that they have not seen any significant savings from the new equipment which is why they provided a lower rating.
    - **Program communications**: highly satisfied customers gave an average rating of 9.4 vs 5.7 among less satisfied customers. Three respondents mentioned that there could be clearer communication between their internal team and Duke Energy.

Around **63%** respondents mentioned that their attitude towards Duke Energy is more positive after participating in the program. These findings indicate both high program satisfaction and an opportunity to continue to market energy efficiency programs to previous participants to achieve deeper savings.

Participation in the SBES program generally served to improve customers' satisfaction with Duke Energy overall.

**Figure 4-1. Program Satisfaction (n=97)**




*Source: Guidehouse analysis*

### 4.4.2 Implementation Contractor

As mentioned in the previous section, customers are highly satisfied with the services provided by the implementation contractor, Lime Energy and that high satisfaction translates to high overall program satisfaction.

Nearly all (97%) said that the proposal was clear about the scope of work to be performed, and 99% of customers said that the proposal was clear about their share of project costs.

A large majority (89%) of customers said they knew who to contact if they had any questions or concerns about their project or any aspect of the program.

Respondents report high level of satisfaction with all different aspects of project implementation from the first assessment of energy efficiency at the project site to post installation clean-up as shown in Figure 4-2. 90% of respondents rated their satisfaction with different aspects of the project implementation at an 8 or higher, on a scale of 0 to 10.

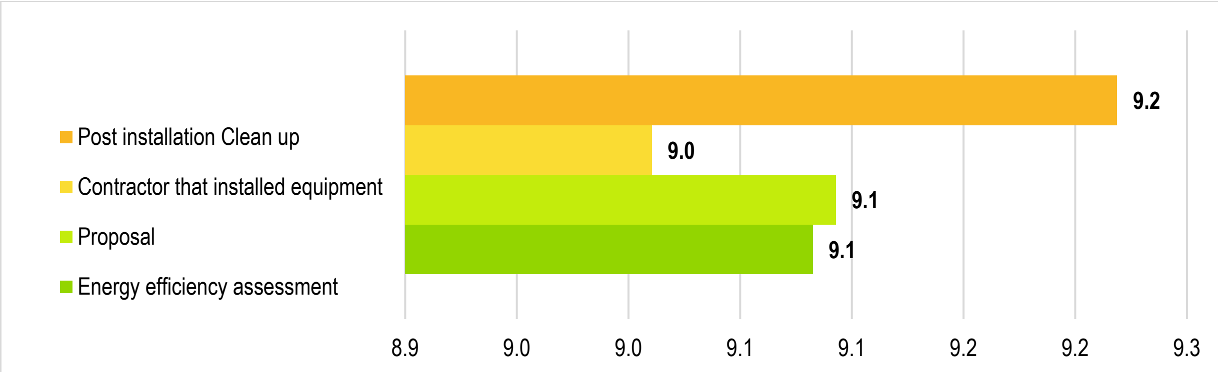
Some verbatim responses from the respondents supporting the high satisfaction:

"The program was excellent and allowed me to afford
the upgrade of lighting in my store. It has cut my monthly bill by every bit of the projection I was given. I am very thankful. Thank you!"

"They worked very well during COVID19 restrictions"

"It was fantastic. I recommended this service to a friend who is also a business owner and he did it as well and was equally thrilled."

**Figure 4-2. Implementer and Contractor Satisfaction (n=97)**




*Source: Guidehouse analysis*

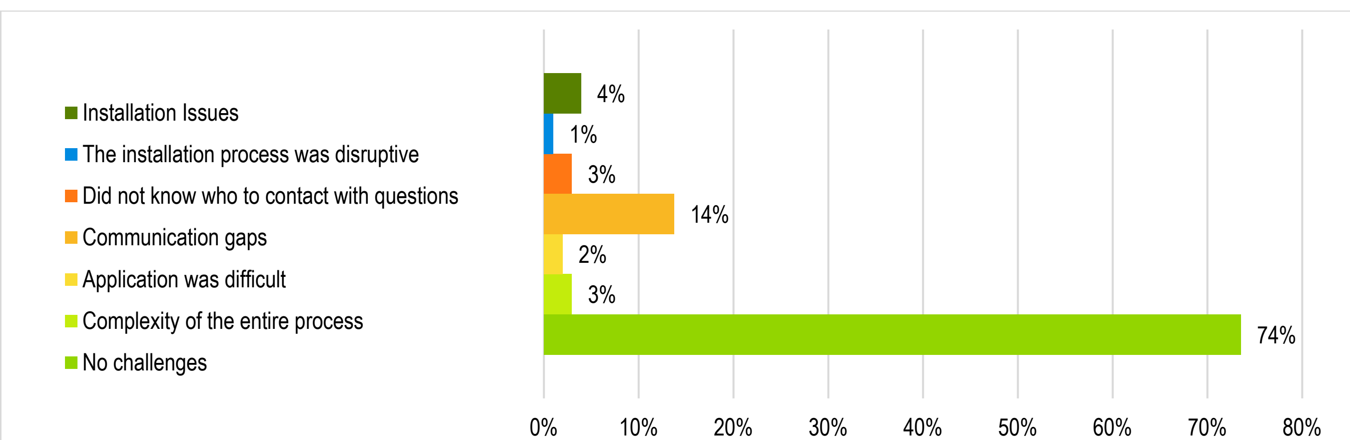
Customers are highly satisfied with the energy efficiency assessment conducted by Lime Energy as well as the proposal prepared by Lime Energy, with 90% rating their satisfaction as an 8 or higher for both program elements.

A similar percentage of customers, 89% rated their satisfaction with the inspection as an 8 or higher with the post installtion cleanup conducted by Lime Energy. Only one customer rated this aspect less than 5 out of 10.

### 4.4.3 Program Challenges

As seen in Figure 4-3, almost 74% of respondents did not experience any challenges with different program components. Fourteen respondents mentioned that there were communication gaps between Duke Energy, the implementation team and their internal team. Four respondents mentioned that installations of measures was not correct or incomplete. Five respondents mentioned that the application was difficult, and the process was too complex. Only one respondent mentioned that that the installation process was disruptive to their work.

**Figure 4-3:Program Challenges/Drawbacks, (n=97)**



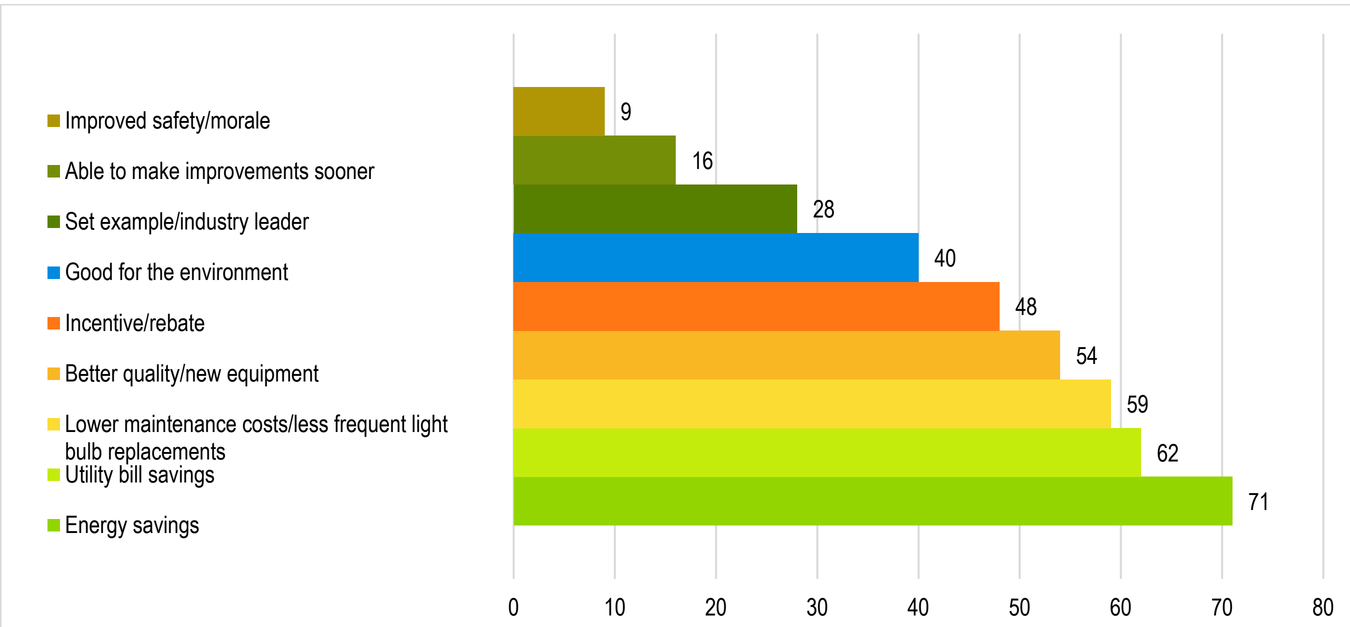

*Source: Guidehouse analysis*

### 4.4.4 Program Benefits

As shown in Figure 4-4, a majority of customers identified the energy savings and associated utility bill savings as the top benefit of participating in the SBES program. Better quality equipment and lower maintenance hassle were also significant benefits to many customers. Another important survey finding was that 66 percent of customers stated that the equipment offered through the program allowed them to upgrade all of the equipment they wanted at the time of the project, rather than piecing together the upgrades in multiple phases.

Majority of respondents (82%) mentioned that they are extremely likely to participate in this program or a similar Duke Energy program again.

**Figure 4-4:Program Benefits, (n=97)**

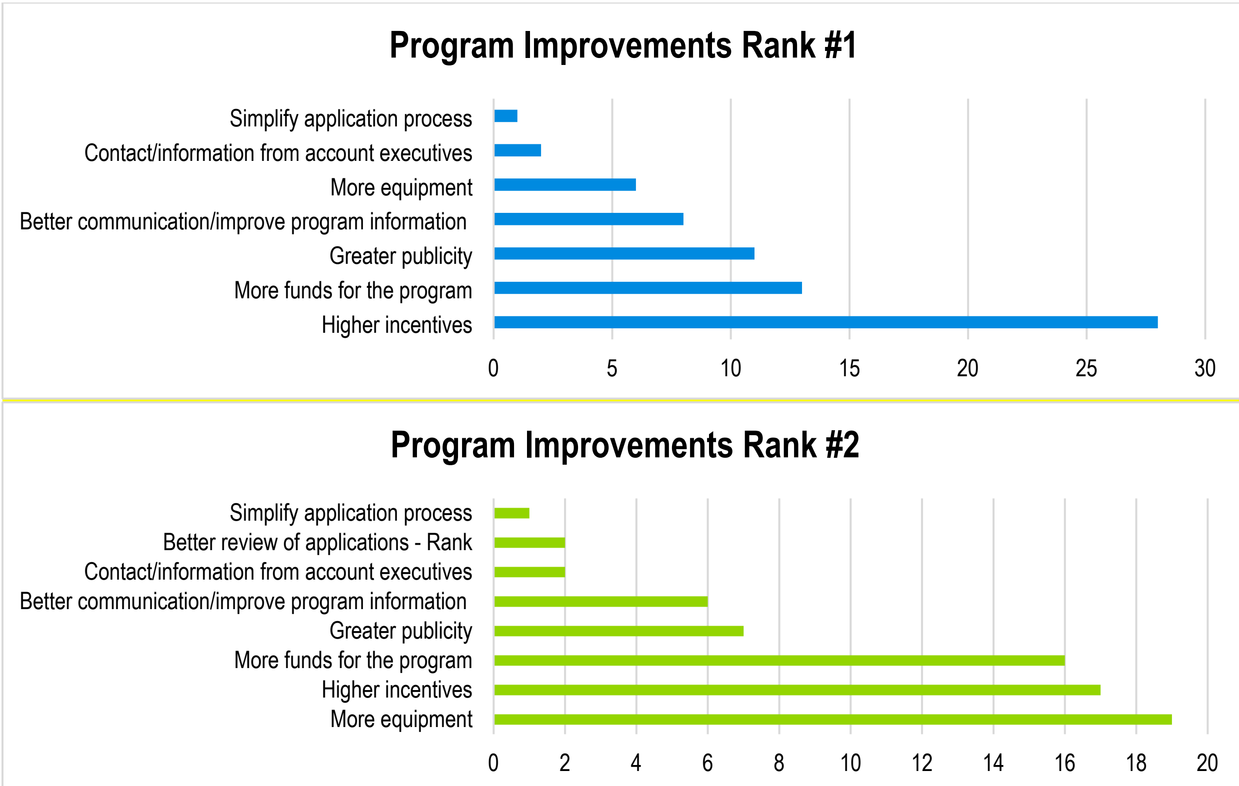



*Source: Guidehouse analysis*

### 4.4.5 Suggested Improvements

Overall program satisfaction is very high, but some customers had minor complaints or identified drawbacks of the program. Guidehouse asked respondents to rank the top 3 program improvements they would like to see in future programs. The two charts in Figure 4-5 show the different program improvements and how they were ranked by the respondents. As expected, higher incentive was ranked as the #1 program improvement requested by the majority of the respondents. More choice of equipment/measures and more funds for the program was the second and third highest ranked improvement requested by majority of the respondents.

**Figure 4-5:Program Improvements**




*Source: Guidehouse analysis*

# 5. Net-to-Gross Analysis

The impact analysis described in the preceding sections addresses *gross program savings*, based on program records, modified by an engineering review and virtual verification of measure installations. *Net savings* incorporate the influence of free ridership (savings that would have occurred even in the absence of the program) and spillover (additional savings influenced by the program, but not captured in program records) and are commonly expressed as a NTG ratio applied to the verified gross savings values.

Table 5-1 shows the results of Guidehouse' s NTG analysis. In aggregate, the NTG results are very similar to findings from the prior evaluation.

**Table 5-1. 2019-2020 Net-to-Gross Results**

| | Lighting | Refrigeration | HVAC | Lighting, HVAC & Refrigeration |
|---|---|---|---|---|
| Estimated Free Ridership | 0.06 | 0.14 | 0.01 | 0.06 |
| Estimated Spillover | 0.08 | 0.08 | 0.06 | 0.07 |
| **Estimated NTG** | **1.02** | **0.94** | **1.05** | **1.02** |

*Source: Guidehouse analysis, totals subject to rounding.*

This report provides definitions, methods, and further detail on the analysis and findings of the net savings assessment. The discussion is divided into the following three sections:

- Defining free ridership, spillover, and net-to-gross (NTG) ratio
- Methods for estimating free ridership and spillover
- Results for free ridership, spillover, and NTG ratio

## 5.1 Defining Free Ridership, Spillover, and Net-to-Gross Ratio

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

**Free ridership** is the share of the gross savings that is due to actions participants would have taken even in the absence of the program (i.e., actions that the program did not induce). This is meant to account for naturally occurring adoption of energy efficient technology. The SBES program covers a range of energy efficient lighting and refrigeration measures and is designed to move the overall market for energy efficiency forward. However, it is likely that some participants would have wanted to install, for various reasons, some high efficiency equipment (possibly a subset of those installed under the SBES Program), even if they had not participated in the program or been influenced by the program in any way.

**Spillover** captures program savings that go beyond the measures installed through the program. Spillover adds to a program's measured savings by incorporating indirect (i.e., non-incentivized) savings and effects that the program has had on the market above and beyond the directly incentivized or directly induced program measures.

Total spillover is a combination of non-reported actions to be taken at the project site itself (*within-facility spillover*) and at other sites (*outside-facility spillover*). Each type of spillover is meant to capture a different aspect of the energy savings caused by the program, but not included in program records.

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

The basic equation is shown in Equation 1.

**Equation 1. Net-to-Gross Ratio**

$$NTG = 1 - Free\ Ridership + Spillover$$

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

## 5.2 Methods for Estimating Free Ridership and Spillover

### 5.2.1 Estimating Free Ridership

Data to assess free ridership were gathered through the self-report method—a series of survey questions asked of SBES participants. Free ridership was asked in both direct questions, which aimed at obtaining respondent estimates of the appropriate free ridership rate that should be applied to them, and in supporting or influencing questions, which could be used to verify whether the direct responses are consistent with participants' views of the program's influence.

Respondents were asked three categories of program-influence questions:

- **Likelihood:** to estimate the likelihood that they would have incorporated lighting measures "of the same high level of efficiency," if not for the assistance of the SBES Program. In cases where respondents indicated that they might have incorporated some, but not all, of the measures, they were asked to estimate the share of measures that would have been incorporated anyway at high efficiency. This flexibility in how respondents could conceptualize and convey their views on free ridership allowed respondents to give their most informed response, thus improving the accuracy of the free-ridership estimates.
- **Prior planning:** to further estimate the probability that a participant would have implemented the measures without the program. Participants were asked the extent to which they had considered installing the same level of energy-efficient lighting prior to participating in the program. The general approach holds that if customers were not definitively planning to install all of the efficiency lighting prior to participation, then the program can reasonably be credited with at least a portion of the energy savings resulting from the high-efficiency lighting. Strong free ridership is reflected by those participants who indicated they had already allocated funds for the purchase and selected the lighting and an installer.

- **Program importance:** to clarify the role that program components (e.g., information, incentives) played in decision-making, and to provide supporting information on free ridership. Responses to these questions were analyzed for each respondent, not just in aggregate, and were used to identify whether the direct responses on free ridership were consistent with how each respondent rated the "influence" of the program.

Free-ridership scores were calculated for each of these categories[6] and then averaged and divided by 100 to convert the scores into a free-ridership percentage. Next, a timing multiplier was applied to the average of the three scores to reflect the fact that respondents indicating that their energy efficiency actions would not have occurred until far into the future may be overestimating their level of free ridership. Participants were asked, without the program, when they would have installed the equipment. Respondents who indicated that they would not have installed the lighting for at least two years were not considered free riders and had a timing multiplier of 0. If they would have installed at the same time as they did, they had a timing multiplier of 1; within one year, 0.67; and between one and two years, 0.33. Participants were also asked when they learned about the financial incentive; if they learned about it after the equipment was installed, then they had a free ridership ratio of 1.

### 5.2.2 Estimating Spillover

The basic method for assessing participant spillover (both within-facility and outside-facility) was an approach that asked a set of questions to determine the following:

- **Whether spillover exists at all.** These were yes/no questions that asked, for example, whether the respondent incorporated energy efficiency measures or designs that were not recorded in program records. Questions related to extra measures installed at the project site (within-facility spillover) and to measures installed in non-program projects (outside-facility spillover) within the service territory.
- **The share of those savings that could be attributed to the influence of the program.** Participants were asked if they could estimate the energy savings from these additional extra measures to be less than, similar to, or more than the energy savings from the SBES program equipment.

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[6] Scores were calculated by the following formulas:

» Likelihood: The likelihood score is 0 for those that "definitely would NOT have installed the same energy efficient measure" and 1 for those that "definitely WOULD have installed the same energy efficient measure." For those that "MAY HAVE installed the same energy efficient measure," the likelihood score is their answer to the following question: "On a scale of 0 to 10 where 0 is DEFINITELY WOULD NOT have installed and 10 is DEFINITELY WOULD have installed the same energy efficient measure, can you tell me the likelihood that you would have installed the same energy efficient measure?" If more than one measure was installed in the project, then this score was also multiplied by the respondent's answer to what share they would have done.

» Prior planning: If participants stated they had considered installing the measure prior to program participation, then the prior planning score is the average of their answers to the following two questions: "On a scale of 0 to 10, where 0 means you 'Had not yet planned for equipment and installation' and 10 means you 'Had identified and selected specific equipment and the contractor to install it', please tell me how far along your plans were" and "On a scale of 0 to 10, where 0 means 'Had not yet budgeted or considered payment' and 10 means 'Already had sufficient funds budgeted and approved for purchase', please tell me how far along your budget had been planned and approved."

» Program importance: This score was calculated by taking the maximum importance on a 0 to 10 scale of the four program importance questions and subtracting from 10 (i.e., the higher the program importance, the lower the influence on free ridership).

- **Program importance.** Estimates were derived from a question asking the program importance, on a 0 to 10 scale. Participants were also asked how the program influenced their decisions to incorporate additional energy efficiency measures.

If respondents said no, they did not install additional measures, they received a zero score for spillover. If they said yes, then the individual's spillover was estimated as the self-reported savings as a share of project savings, multiplied by the program-influence score. Then, a 50 percent discount was applied to reflect uncertainty in the self-reported savings and divided by 10 to convert the score to a spillover percentage.

### 5.2.3 Combining Results across Respondents

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

- Individual respondents, by evaluating the responses to the relevant questions and applying the rules-based approach discussed above
- Measure categories:
    - For free ridership: by taking the average of each respondent's score within each category, weighted by the respondent's share of savings within the measure category
    - For spillover: by taking the sum of the individual spillover results (in kWh) for each measure category and dividing by the category's total program savings in the sample
- The program as a whole, by combining measure-level results:
    - For free ridership: measure category results were subsequently weighted by each category's share of total program savings
    - For spillover: similarly, measure category results were subsequently weighted by each category's share of total program savings

## 5.3 Results for Free Ridership, Spillover, and Net-to-Gross

This section presents the results of the attribution analysis for the SBES Program. Specifically, results are presented for free ridership and spillover (within-facility and outside-facility), which are used collectively to calculate an NTG ratio.

### 5.3.1 Review of Data Collection Efforts for Attribution Analysis

Guidehouse conducted 96[7] surveys with SBES participants to estimate free ridership, spillover, and NTG ratios. Table 5-2 shows the number of completions, by measure group.

**Table 5-2. Participant Survey Completes by Project Type**

| Measure Category | Surveys |
|---|---|
| Lighting | 64 |
| Refrigeration | 16 |
| HVAC | 16 |
| **Total** | **96** |

*Source: Guidehouse analysis*

### 5.3.2 Free-Ridership Results

Guidehouse asked participants a series of questions regarding the likelihood, scope, and timing of the investments in energy-efficient lighting if the respondent had not participated in the program. The purpose of the surveys was to elicit explicit estimates of free ridership and perspectives on the influence of the program. Guidehouse estimates free-ridership for the SBES Program at six percent of program-reported savings.

Guidehouse developed the free ridership estimate presented above based on responses to a variety of questions that related to survey respondents' intentions prior to participating in the program and to the influence of the program itself. Below are summaries by scoring component.

***Prior Planning:*** Fifty out of 96 respondents indicated they had **prior plans to install energy efficient** equipment at their facilities before participating in the program. However, only 12 of the 50 respondents indicated their plans were **well-developed** (7 or higher on a scale of 0 to 10) in terms of identifying equipment for installation and 9 out of 28 respondents had budgeted for installing the equipment.

***Program Importance:*** Respondents provided an average rating of 9 out of 10 for how important the financial incentive offered through the SBES program was in **influencing their decision** to upgrade their equipment.

***Likelihood:*** Respondents were asked in the absence of the program, if they would have had at least some of the work done (in terms of both quantity of measures and the efficiency of measures installed). Five respondents indicated they would have installed about **32%** of the same energy efficiency equipment in the absence of the program.

***Timing:*** Without the program, 29 respondents said that they would have installed the measures at the **same time or within 1-2 years, and the remainder would have delayed longer**.

[7]The survey was combined with process and NTG sections. One respondent did not complete the NTG section of the combined survey.

### 5.3.3 Spillover Results

The SBES Program influenced approximately five percent of participants to install additional energy efficiency measures on-site and influenced two percent of participants to install additional measures at other locations. Based on the survey findings, the evaluation team estimates the overall program spillover to be seven percent of program-reported savings. Participants reported a variety of spillover measures installed, including lighting (most common) and HVAC.

#### *5.3.3.1 Inside Spillover*

Table 5-3 shows the inside (within facility) spillover by measure type. The inside spillover for the program was estimated at **six** percent.

**Program Importance: 32** out of 96 respondents indicated the program influenced them to install additional measures or change their behavior to be more energy efficient.

**Qualified for Spillover: 19** out of the 32 respondents qualified for inside spillover based on information provided.

**Spillover Savings Measures:** Most respondents indicated retrofits to LED lights but a select few upgraded HVAC equipment like ductless mini split heat pumps and packaged HVAC units due to the program's influence. Their main rationale for not applying for an incentive was lack of awareness of incentives through the program or the measures not qualifying for an incentive through the program.

**Table 5-3. Inside Spillover by Measure Type**

| Measure Family | Inside Spillover |
|---|---|
| Lighting | 5.5% |
| Refrigeration | 7.9% |
| HVAC | 6.0% |
| **Total** | **5.7%** |

*Source: Guidehouse analysis, totals subject to rounding*

#### *5.3.3.2 Outside Spillover*

Table 5-4 shows the outside (outside facility) spillover by measure type. The outside spillover for the program was estimated at two percent.

**Program Importance: Only ten out** of 97 respondents indicated the program influenced them to install additional measures or change their behavior to be more energy efficient, but the resulting impacts were relatively small.

**Qualified for Spillover: Only five** out of the ten respondents qualified for outside spillover based on information provided**.**

**Spillover Savings Measures:** All respondents contributing to spillover indicated retrofits to LEDs due to the program's influence. Their main rationale for not applying for an incentive was lack of awareness of incentives through the program or the measures not qualifying for an incentive through the program.

**Table 5-4. Outside Spillover by Measure Type**

| Measure Family | Outside Spillover |
|---|---|
| Lighting | 2.3% |
| Refrigeration | 0.0% |
| HVAC | 0.0% |
| **Total** | **2.0%** |

*Source: Guidehouse analysis, totals subject to rounding*

#### *5.3.3.3 Total Spillover*

Total spillover is the sum of inside and outside spillover. Adding the result of 5.4% for inside spillover and 2.0% for outside spillover, Guidehouse found a total spillover of 7.4%.

### 5.3.4 Net-to-Gross Ratio

As stated above, the NTG ratio is defined as follows in Equation 2 below.

**Equation 2. Net-to-Gross Ratio**

$$NTG = 1 - \text{free ridership} + \text{spillover}$$

Using the overall free ridership value of two percent and the overall spillover value of nine percent, the NTG ratio is 1 – 0.06 + 0.07 = 1.02[8]. The estimated NTG ratio of 1.02 implies that for every 100 megawatt-hours (MWh) of realized savings recorded in SBES records, 102 MWh is attributable to the program. Table 5-5 shows the final NTG results.

**Table 5-5. SBES Free Ridership, Spillover, and NTG Ratio**

| | Free Ridership | Spillover | NTG Ratio |
|---|---|---|---|
| SBES Program Total | 0.06 | 0.07 | 1.02 |

*Source: Guidehouse analysis, totals subject to rounding.*

Table 5-6 and Table 5-7 shows the verified net savings after applying the impact realization rate as well as the NTG ratio for energy and demand savings DEC and DEP respectively.

[8] The total is subject to rounding. The weighted average calculation of the overall NTG value is causing the rounding error.

**Table 5-6. DEC SBES Reported, Verified Gross and Verified Net Savings**

| Parameter | Energy (MWh) | Summer Coincident Peak Demand (kW) | Winter Coincident Peak Demand (kW) |
|---|---|---|---|
| Reported Savings | 68,413 | 80,343 | 80,343 |
| Realization Rate | 100% | 99% | 98% |
| Verified Gross Savings | 68,738 | 79,256 | 78,936 |
| Net-to-Gross | 102% | 102% | 102% |
| Verified Net savings | 70,113 | 80,841 | 80,515 |

*Source: Guidehouse analysis, totals subject to rounding.*

**Table 5-7. DEP SBES Reported, Verified Gross and Verified Net Savings**

| Parameter | Energy (MWh) | Summer Coincident Peak Demand (kW) | Winter Coincident Peak Demand (kW) |
|---|---|---|---|
| Reported Savings | 46,571 | 51,433 | 51,433 |
| Realization Rate | 101% | 99% | 98% |
| Verified Gross Savings | 46,889 | 50,696 | 50,267 |
| Net-to-Gross | 102% | 102% | 102% |
| Verified Net savings | 47,827 | 51,710 | 51,272 |

*Source: Guidehouse analysis, totals subject to rounding.*

# 6. Conclusions and Recommendations

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

1. **Consider introducing additional equipment choices in the program.** A subset of customers reported that the program was unable to provide all the energy efficiency equipment they wanted. Duke Energy should consider introducing more equipment choices in the program to include outdoor lighting and HVAC measures. This also presents an opportunity for channeling to other Duke Energy programs or education about measures that are not offered through the SBES program.
2. **Increase and improve program communications.** This is the most common challenge or drawback received from participants, indicating that customers were sometimes unclear about the various stages of the program process and did not receive proper communication and guidance from the implementer and/or Duke Energy. Additional education from both Lime Energy and Duke Energy account managers should help customers better understand the program participation process.
3. **Consider using TRM algorithms for HVAC measures.** Lime Energy and Duke Energy developed deemed savings estimates using regional data for HVAC measures. Although the methodology for developing these estimates was accurate, Guidehouse recommends Duke Energy consider using TRM algorithms too and substituting the variables in these algorithms using regional values to estimate savings. This may enhance the transparency of the impact estimates for these measures.
4. **The Program Net-to-Gross Ratio is high**. This indicates that the program is providing a key service to small business customers in helping them manage their energy use.

# 7. Summary Form

## *Small Business Energy Saver*

Completed EMV Fact Sheet

### *Description of program*

Duke Energy's Small Business Energy Saver Program provides energy efficient equipment to eligible small business customer at up to an 80 percent discount. The program is delivered through an implementation contractor that coordinates all aspects of the program, from the initial audit, ordering equipment, coordinating installation, and invoicing.
The program consists of lighting, HVAC, and refrigeration measures.

- **Lighting measures:** LED lamps and fixtures, LED exit signs, occupancy sensors.
- **Refrigeration measures:** LED case lighting, EC motor upgrades, anti-sweat heater controls,
- **HVAC Measures:** HVAC controls, thermostats, and tune-ups

### Evaluation Methodology

The evaluation team used engineering analysis and virtual impact assessments as the primary basis for estimating program impacts. Additionally, online surveys were conducted with participants to assess customer satisfaction and determine a net-to-gross ratio.

#### Impact Evaluation Details

- **Virtual verification surveys were completed by 90 participants.** Guidehouse designed the virtual impact assessment survey tool to collect data about project and measure characteristics for comparison to tracking records and for engineering analysis.
- **In-Service rates (ISRs) varied by equipment type.** The evaluation team found ISRs ranging from 0.29 to 1.00 depending on the equipment type.
- **Participants achieved an average of 35 MWh and 29 MWh of energy savings per year for DEC and DEO respectively.** The program is accurately characterizing energy and demand impacts.

| | |
|---|---|
| **Date** | July 07, 2021 |
| **Region(s)** | Duke Energy Progress<br>Duke Energy Carolinas |
| **Evaluation Period** | DEC 1/1/2019 – 6/30/2020<br>DEP 1/1/2019 – 6/30/2020 |
| **Annual net MWh Savings** | DEC 70,113 MWh<br>DEP 47,827 MWh |
| **Per Participant net MWh Savings** | DEC 34.83 MWh<br>DEP 29.41 MWh |
| **Coincident MW Impact** | DEC 79.25MW<br>DEP 50.69 MW |
| **Net-to-Gross Ratio** | 1.02 |
| **Previous Evaluation(s)** | 2016, 2015, 2014, 2013 |

# 8. Measure Level Inputs for Duke Energy Analytics

The SBES program estimates deemed savings on a per-fixture basis that takes into account specific operational characteristics. This approach differs from a more traditional prescriptive approach that applies deemed parameters by measure type and building type.

For the lighting measures, the EM&V team applied HVAC interactive effects and coincident factors in the analysis that differed from those used by the IC; the values used are shown in Table 8-1, Table 8-2 and Table 8-3. Note that for this evaluation the EM&V team applied the coincidence factors for both summer and winter peak demand reductions by lamp type from the logger data analysis completed in 2016. For lighting controls, these values were taken from the NEEP Mid-Atlantic TRM, v10[9].

**Table 8-1 HVAC Interactive Effects Multipliers from the NEEP Mid-Atlantic TRM**

| Building Type | WHFe | WHFd |
|---|---|---|
| Office | 1.10 | 1.36 |
| Retail | 1.06 | 1.27 |
| School | 1.10 | 1.44 |
| Warehouse | 1.02 | 1.23 |
| Other | 1.08 | 1.35 |

*Source: NEEP Mid-Atlantic TRM, V10*

**Table 8-2 Summer and Winter Coincidence Factors for Lighting Measures from DEC-DEP 2016 Logger Analysis**

| Measure | Summer Coincidence Factor | Winter Coincidence Factor |
|---|---|---|
| LED Exit Sign | 1 | 1 |
| A Line Lamp | 0.914 | 0.931 |
| Recessed Light | 0.914 | 0.931 |
| Specialty Light | 0.914 | 0.931 |
| LED Tube | 0.802 | 0.619 |
| High/low Bay | 1 | 1 |
| Delamping | 0.902 | 0.664 |
| Exterior Light | 0 | 1 |

*Source: DEC-DEP 2016 logger data analysis.*

[9]NEEP TRM (April 2020, v10), https://neep.org/sites/default/files/media-files/trmv10.pdf

**Table 8-3 Coincidence Factors for Lighting Controls from the NEEP Mid-Atlantic TRM**

| Building Type | Coincidence Factor |
|---|---|
| Office | 0.70 |
| Retail | 0.83 |
| School | 0.35 |
| Warehouse | 0.80 |
| Other | 0.62 |

*Source: NEEP Mid-Atlantic TRM, V10*

Additionally, the Duke Energy DSMore table is embedded below for reference.

DSMore table - DEC
DEP SBES - 11 22 21.x

# Appendix A. Process and NTG Survey Guide

**DEC/DEP Small Business Energy Saver (SBES) Program**
**Commercial & Industrial (C&I)**

Introduction and Confirmation

Guidehouse is evaluating Duke Energy's Small Business Energy Saver program, and our records show your business participated in this program during this past one or two years. This survey will help Duke Energy better understand the experience and impacts this program had on your business . Your responses are completely confidential.

Landing Page

Thank you for your willingness to complete this survey! Before you get started, just a few notes:

- This survey will ask about your experience with Duke Energy's Small Business Energy Saver program and the different type of energy efficiency equipment installed in your business.
- We are offering a $10 e-gift card for completing the survey. This gift card will be emailed to you within two weeks of completing the survey.

S1. Thanks in advance for your time. Our records indicate your business received **[INSERT SAMPLE_MEASURE_FAMILY]** from the Small Business Energy Saver program on [INSERT INSTALLDATE) , at **[INSERT SAMPLE_CUSTOMER_ADDR1, "in" SAMPLE_CUSTOMER_CITY]**. Is this correct?

| | |
|---|---|
| Yes | 1 **[SKIP TO S3]** |
| No | 2 **[CONTINUE]** |
| Don't know | 3 **[CONTINUE]** |

S1a. Is there anyone available who might know about your company's participation in the program and the energy efficiency **[INSERT SAMPLE_MEASURE_FAMILY]** done at **[INSERT SAMPLE_CUSTOMER_ADDR1, "in" SAMPLE_CUSTOMER_CITY]**?

| | |
|---|---|
| Yes | 1 **[CONTINUE]** |
| No | 2 **[THANK AND TERMINATE]** |

S2. Can you provide an email address for that person?

| | |
|---|---|
| Yes, Please enter email address | 1 **[GO BACK TO S1]** |
| No | 2 **[THANK AND TERMINATE]** |
| Don't know | 3 **[THANK AND TERMINATE]** |

**[FOR TERMINATIONS]**: These are all the questions we have for you. Thank you for your time.

S3. Our records show that you had the following energy efficiency improvements installed AT THIS SITE: **[INSERT SAMPLE_MEASURE(S)]**. Is this correct?

Yes 1 **[GO TO S4]**

No 2 **[GO TO S3a]**

Don't know 3 **[THANK AND TERMINATE]**

S3a. Was any other energy efficiency equipment installed at this site?

Yes 1 **[GO TO S3b]**

No 2 **[THANK AND TERMINATE]**

Don't know 3 **[THANK AND TERMINATE]**

**[FOR TERMINATIONS**. These are all the questions we have for you. Thank you for your time.

S3b. Please tell me what energy efficiency equipment was installed at your facility through the DUKE ENERGY program

________________________________________**[OPEN END]**

For the purposes of this survey, the questions will focus on just the **[INSERT MEASURE_FAMILY] which you had installed and not the other measures, and we will just refer to them as "energy efficient equipment."**

S4. How did you learn about the Small Business Energy Saver program? (LIST OPTIONS; ACCEPT MULTIPLE RESPONSES.)

Contacted by my DUKE ENERGY account representative or other DUKE ENERGY staff ........ 1

I contacted my DUKE ENERGY account representative to find out about possible programs ........ 2

Contacted by a LIME ENERGY representative ........ 3

Contacted by a trade ally, vendor, or contractor ........ 4

Energy efficiency conference or workshop ........ 5

Advertising by vendor or contactor ........ 6

Word of mouth through a business colleague ........ 7

Word of mouth through a family, friend, or neighbor ........ 8

Through a trade organization or professional organization/association ........ 9
Mailer or other print materials sent by the program ........ 10
At a trade show ........ 11
Participation in other DUKE ENERGY programs ........ 12
Internet research/DUKE ENERGY website ........ 13
Social media/online ad ........ 14
Duke Energy call center ........ 15
Email/e-newsletter from Duke Energy ........ 16
Print material/flyer dropped off at my business ........ 17
Other (Please specify) ........ 18
Don't know ........ 19

S5. Prior to participating in the Small Business Energy Saver program, what concerns did you have about participation, if any?

Cost of project ........ 1
Access to financing/loan for project ........ 2
Disruption to business during installation ........ 3
Quality/performance of new equipment ........ 4
Other (Please specify) ........ 5
Don't know ........ 6

Contractor and Proposal Module

The next few questions will be about your experiences with the program implementer, Lime Energy, and the equipment installer.

CP1. On a scale of 0 to 10, with 0 being "Not at all satisfied" and 10 being "Extremely satisfied", how satisfied would you say you are with …? [MATRIX STYLE QUESTION]

| Items | Not at all satisfied (0) | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | Completely satisfied (10) | Don't know |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CP1a. The energy efficiency assessment conducted by Lime Energy at your business site | | | | | | | | | | | | |
| CP1b. The proposal prepared for you by Lime Energy | | | | | | | | | | | | |

CP2. Was the proposal clear about the scope of work to be performed?

Yes 1 **[SKIP TO CP3]**

No 2

Don't know ........................................................................... ..3 **[SKIP TO CP3]**

CP2a. Why not?

________________________________________**[OPEN END]**

CP3. Was the proposal clear about your share of the project's final cost?

Yes 1

No 2

Don't know 3

CP4. If you had any questions or concerns about any aspect of your project or the DUKE ENERGY program, did you know who to contact?

Yes 1

No 2

Don't know 3

CP5. On a scale of 0 to 10, with 0 being “Not at all satisfied” and 10 being “Extremely satisfied”, how satisfied would you say you are with …? [MATRIX STYLE QUESTION]

| Items | Not at all satisfied (0) | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | Completely satisfied (10) | Don’t know |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CP5a. The contractor that installed the equipment | | | | | | | | | | | | |
| CP5b. The post-installation cleanup | | | | | | | | | | | | |

CP6. Do you have any comments to share, good or bad, about the installation contractor or the post-installation cleanup?
______________________________________________**[OPEN END]**

Net to Gross Module

Next are questions relating to your decision to purchase <u>energy efficient</u> equipment for this site.

Free Ridership/Prior Plans

P1. Prior to participating in the program, <u>had you considered installing</u> energy efficient **[INSERT SAMPLE_MEASURE_FAMILY]**?

Yes ............................................................................ 1

No ............................................................................ 2 **[SKIP TO RC1]**

Don’t know ................................................................ 3

P1a. Please describe any plans that you had to install the efficient **[INSERT SAMPLE_MEASURE_FAMILY]** prior to participating in the program.
______________________________________________**[OPEN END]**

P2a. Again, please think about <u>before</u> your involvement with the program. On a scale of 0 to 10, where 0 means you “Had not yet planned for equipment and installation” and 10 means you “Had identified and selected specific equipment and the contractor to install it”, please tell me how far along your plans were.

| Had not yet planned for equipment and installation | | | | | | | | | | Identified and selected specific equipment and the contractor to install it | Don’t know |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 98 |

P2b. Still thinking about your plans prior to program participation, on a scale of 0 to 10, where 0 means “Had not yet budgeted or considered payment” and 10 means "Already had sufficient funds budgeted and approved for purchase”, please tell me how far along your budget had been planned and approved?

| Had not yet budgeted or considered payment | | | | | | | | | | Already had sufficient funds budgeted and approved for purchase |
|---|---|---|---|---|---|---|---|---|---|---|
| 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 |

**Role of Contractor**

RC1. Did Lime Energy help you with your choice of the energy efficient **[INSERT SAMPLE_MEASURE_FAMILY]** equipment installed?
Yes 1
No.......................................................................................... 2 **[SKIP TO IC1]**
Don’t know ........................................................................... 3**[SKIP TO IC1]**

RC1a. On a scale of 0 to 10, where 0 is “Not at all important” and 10 is “Extremely important,” how important was the recommendation from Lime Energy in your decision to install the energy efficient **[INSERT SAMPLE_MEASURE_FAMILY]**?

| Not at all important | | | | | | | | | | Extremely important | Don’t know |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 98 |

Importance: Categories

IC1. Please tell me in your own words how the program influenced your decision to install the energy-efficient **[INSERT SAMPLE_MEASURE_FAMILY]**?
______________________________________________**[OPEN END]**

Now I want to ask you a few questions about the importance of two different elements of the program to your decision to install the new equipment. Both questions ask you to rate the importance using a 0 to 10 scale where 0 means "Not at all important" and 10 means "Extremely important".

IC2. How important was the program's financial incentive or project discount in your decision to install the energy efficient **[INSERT SAMPLE_MEASURE_FAMILY]**?

| Not at all important | | | | | | | | | | Extremely important | Don't know |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 98 |

IC3. How important were the program's advertising and information resources (including the energy efficiency assessment itself) in your decision to install the energy efficient **[INSERT SAMPLE_MEASURE_FAMILY]**?

| Not at all important | | | | | | | | | | Extremely important | Don't know |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 98 |

Likelihood

**[IF SAMPLE_MEASURE_FAMILY = "Lighting" THEN ASK L1, ELSE SKIP TO L2.]**

L1. Given everything you've just said about the program, what is the likelihood that you **would have installed the same energy-efficient lighting** (in the same quantity and the same level of efficiency) without the program and its financial and technical assistance.

Definitely would NOT have installed the same energy efficient lighting ........................ 1

MAY HAVE installed the same energy efficient lighting, even without the program .... 2

Definitely WOULD have installed the same energy efficient lighting anyway ............... 3

Don't know ........................ 4

**[IF L1 = 2, 3, or 4, CONTINUE. OTHERWISE, SKIP TO IO1.]**

L1a. As best you can, please estimate the percent of the Lighting you think you would have installed at the same high level of efficiency had the program not been available. (USE "998" FOR DON'T KNOW.)

___ % **[RECORD 0-100 OR 998 FOR DON'T KNOW]**

**[IF SAMPLE_MEASURE_FAMILY = "Refrigeration" THEN ASK L2, OTHERWISE, SKIP TO IO1.]**

L2. Given everything you've just said about the program, on a scale of 0 to 10 where 0 is definitely would not have installed and 10 is definitely would have installed, what is the likelihood that you would have installed the same energy-efficient **[INSERT SAMPLE_MEASURE_FAMILY]** equipment had the program not been available?

__________ **[RECORD 0-10 OR 98 FOR DON'T KNOW]**

**[IF SAMPLE_MEASURE_FAMILY = "HVAC and Refrigeration" THEN ASK L3, OTHERWISE, SKIP TO IO1.]**

L3. Given everything you've just said about the program, on a scale of 0 to 10 where 0 is definitely would not have installed and 10 is definitely would have installed, what is the likelihood that you would have installed the same energy-efficient **[INSERT SAMPLE_MEASURE_FAMILY]** equipment had the program not been available?

__________ **[RECORD 0-10 OR 98 FOR DON'T KNOW]**

Importance: Overall

IO1. Given everything you've just told me about the program, please tell me how important the program was in your decision to install the energy efficient **[INSERT SAMPLE_MEASURE_FAMILY] equipment**? Please use a 0 to 10 scale where 0 is "Not at all important" and 10 is "Extremely important".

| Not at all important | | | | | | | | | | Extremely important | Don't know |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 98 |

Timing

T1. Without the program, when would you have installed the efficient **[INSERT SAMPLE_MEASURE_FAMILY]**? Would it have been…(READ LIST)?

At the same time as you did 1

Within 1 year of the time you did 2

Between 1 and 2 years 3

Sometime after 2 years 4

Would have never installed without the program 5

Spillover (Inside Spillover)

Now we have a few questions concerning any **non-incentivized equipment** you may have also installed at this location.

IS1. Did your experience with the program in any way influence you to incorporate additional energy efficiency equipment where you did not receive a program incentive at this site?

Yes 1 **[CONTINUE]**

No 2 **[SKIP TO OS1]**

Don't know 3 **[SKIP TO OS1]**

IS2. Please briefly describe how the program has influenced your decisions to incorporate additional energy efficiency equipment that were not part of a program incentive.
_______________________________________________ **[OPEN END]**

IS3. On a scale of 0 to 10, where 0 is "Not at all important" and 10 is "Extremely important", how important was your participation in the program in your decision to install additional energy efficiency equipment?

| Not at all important | | | | | | | | | | Extremely important | Don't know |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 98 |

**[IF IS3 >5, CONTINUE, ELSE SKIP TO OS1]**

IS4. What type of energy-efficient equipment did you install without program incentives, and what were the approximate quantities and project costs? Estimates are fine.

| | Energy-Efficient Equipment Types | Equipment Characteristics | |
|---|---|---|---|
| | (Please describe the equipment as specifically as possible.) (1) | Quantity (1) | Project Cost ($) (2) |

| | | | |
|---|---|---|---|
| Equipment Type 1 (1) | | | |
| Equipment Type 2 (if applicable) (2) | | | |
| Equipment Type 3 (if applicable) (3) | | | |
| Equipment Type 4 (if applicable) (4) | | | |

IS5. Now, please think only about the additional energy efficiency equipment not installed through the program (which received no incentives). Would you estimate the energy savings from these additional non-incentivized equipment to be less than, similar to, or more than the energy savings from the SBES program equipment?

Less than the SBES project 1

Similar to the savings from the SBES project 2

More than the SBES project 3

Don't know 4

IS6. Why didn't you apply for a program incentive for the additional energy efficiency equipment?

__________________________________________[OPEN END]

Outside Spillover

This next set of questions asks about any **non-incentivized energy efficiency equipment** you may have installed at **other** locations within the Duke Energy service territory.

OS1. Did your experience with the program in any way influence you to incorporate energy efficiency equipment at other facilities that did not receive program rebates yet are also served by DUKE ENERGY? Do not include projects that participated in any DUKE ENERGY program.

Yes 1

No 2

Don't know 3

**[IF OS1 = 1, CONTINUE, OTHERWISE, SKIP TO BB1.]**

OS1a. About how many other facilities were influenced that did not participate in the program? (USE 98 FOR DON'T KNOW.)

INSERT NUMBER OF FACILITIES **[RECORD 1-100]** ___

OS2. Please briefly describe how the program has influenced your decisions to incorporate additional high-efficiency equipment at other facilities that did not participate in the program.

________________________________________ **[OPEN END]**

OS3. On a scale of 0 to 10, where 0 is "Not at all important" and 10 is "Extremely important," how important was your participation in the program in your decision to install additional energy efficiency equipment at other facilities

| Not at all important | | | | | | | | | | Extremely important | Don't know |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 98 |

**[IF OS3 > 5, CONTINUE. OTHERWISE, SKIP TO BB1]**

OS4. What type of energy-efficient equipment did you install without program incentives, and what were the approximate quantities and project costs? Estimates are fine.

| | Energy-Efficient Equipment Types | Equipment Characteristics |
|---|---|---|

| | (Please describe the equipment as specifically as possible.) (1) | Quantity (1) | Project Cost ($) (2) |
|---|---|---|---|
| Equipment Type 1 (1) | | | |
| Equipment Type 2 (if applicable) (2) | | | |
| Equipment Type 3 (if applicable) (3) | | | |
| Equipment Type 4 (if applicable) (4) | | | |

OS5. On average, would you estimate the energy savings from these other non-program facilities to be less than, similar to or more than the energy savings from the energy efficiency equipment installed through the program?

Less than the SBES project 1

Similar to savings from the SBES project 2

More than the SBES project 3

Don't know ..4

OS6. Why didn't you apply for a program incentive for the additional energy efficiency equipment?

____________________________________________ **[OPEN END]**

Benefits and Barriers

Before wrapping up, we have a few more questions related to participation and satisfaction.

BB1. Did you experience any problems, delays or difficulties with the program, and if so what were they? (OPEN ENDED – CODED IN ANALYSIS)

The process took too long 1

Too many delays between steps in the process 2

The process was too complex 3

The application materials were difficult to understand 4

Lack of coordination and communication among program staff 5

Did not know who to contact with questions 6

The program staff was not responsive/unable to get needed information or status updates 7

The program staff was not knowledgeable 8

The incentives were less than I expected 9

I do not like the equipment installed 10

I was not given a choice on the specific equipment installed 11

The installation process was disruptive 12

Things were damaged during the installation 13

The post-installation clean-up took too long 14

The equipment failed/required repairs/did not work well 15

The equipment installed was sized incorrectly 16

Energy savings were not as significant as expected 17

I don’t know where to buy replacement bulbs 18

Other (Please specify) 19

Don’t know 20

No problems experienced **[EXCLUSIVE]** 22

**[Ask if BB1<> 21]**

BB1a. How easy or difficult was it to resolve the problem(s) that you experienced? Please rate on a scale of 0 to 10 in which 0 means very difficult and 10 means very easy.

| Very difficult (0) | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | Very easy (10) | Don't know | Problems were not resolved |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | | | | |

BB2. If you could change anything about the entire program process, from the audit to signoff to payment, what would you change?

________________________________________________ **[OPEN END]**

BB3. On a scale of 0 to 10, with 0 being "Not at all satisfied" and 10 being "Extremely satisfied", how satisfied would you say you are with …? **[MATRIX STYLE QUESTION; RANDOMIZE a-e]**

| Items | Not at all satisfied (0) | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | Completely satisfied (10) | Don't know |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| BB3a. The energy efficiency equipment installed through the program | | | | | | | | | | | | |
| BB3b. The energy savings resulting from the new equipment | | | | | | | | | | | | |
| BB3c. **[If lighting]** The quality of the light produced by the new light fixtures/bulbs | | | | | | | | | | | | |
| BB3d. Program communications | | | | | | | | | | | | |
| BB3e. The amount of the rebate | | | | | | | | | | | | |
| BB3f. The overall program experience | | | | | | | | | | | | |
| BB3g. Duke Energy | | | | | | | | | | | | |

**[IF ANY RESPONSE TO BB3a-g < 5, CONTINUE. OTHERWISE, SKIP TO BB4]**

BB3h. Why did you rate [BB3a-BB3g] as you did?

________________________________________________ **[OPEN END]**

BB4. How did participation in the Small Business Energy Saver program affect your attitude toward Duke Energy? Relative to before the program, is your attitude toward Duke Energy?

.................................................................Much more positive 1

Somewhat more positive 2

About the same 3

Somewhat more negative, or 4

Much more negative 5

Other (Please specify) 6

Don't know 7

BB5. On a scale of 0 to 10, with 0 being "Not at all likely and 10 being "Extremely likely", given the chance, how likely would you be to participate in this or a similar program again?

| Not at all likely | | | | | | | | | | Extremely likely | Don't know |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 98 |

**[IF BB4 < 7, ASK BB5a. OTHERWISE, SKIP TO BB6]**

BB5a. What—if anything—would persuade you to definitely participate in the program again? ________________________________________________**[OPEN END]**

BB7. Have you recommended the program to other businesses?
Yes; how many? [ENTER NUMBER] 1

No 2

Don't know 3

BB8. What do you see as the main benefits to participating in the Small Business Energy Saver program? (OPEN ENDED – CODED IN ANALYSIS)
Energy savings 1

Utility bill savings 2

Lower maintenance costs/less frequent light bulb replacements 3

Better quality/new equipment 4

Incentive/rebate 5

Good for the environment 6

Improved safety/morale 7

Set example/industry leader 8

Able to make improvements sooner 9

Other (Please specify) 10

Don't know 11

**Feedback and Recommendations**

FR1. Do you have any suggestions on how the Small Business Energy Saver program could be improved? (RANK IN ORDER BY IMPORTANCE FOR YOUR ORGANIZATION) (OPEN ENDED – CODED IN ANALYSIS.)

Higher incentives 1

More equipment 2

Greater publicity 3

Better communication/improve program information 4

Contact/information from account executives 5

Longer time period to complete project 6

Better review of applications 7

Simplify application process 8

Electronic applications 9

More funds for the program 10

Other (Please specify) 11

No recommendations **[EXCLUSIVE]** 12

Don't know 13

FR2. Did the equipment offered through the program allow you to upgrade all of the energy efficiency equipment you wanted at the time?

Yes 1 **[SKIP TO FG1]**

No 2

Don't know 3 **[SKIP TO FG1]**

**[IF FR2 < 7, ASK FR2a. OTHERWISE, SKIP TO BB6]**

FR2a. What other energy efficiency equipment did you want to upgrade?

_______________________________________________**[OPEN END]**

Firmographics

Finally, I'd like to ask you a few general questions about your company, specifically the facility at **[INSERT SAMPLE_CUSTOMER_ADDR1, "in" SAMPLE_CUSTOMER_CITY]**.

FG1. Does your organization own or lease the space located at **[INSERT SAMPLE_CUSTOMER_ADDR1, "in" SAMPLE_CUSTOMER_CITY]**?

Own 1

Lease 2

Own part and lease part 3

Don't know 4

FG2. Who in your company makes decisions about how energy is managed at this facility?
I DO (describe role) **[OPEN END]**…… ……………………………………14

Proprietor/Owner 1

President/CEO 2

Facilities Manager 3

Building/Store Manager 4

Energy Manager 5

Facilities Management/Maintenance Position 6

Chief Financial Officer 7

Other Financial/Administrative Position 8

Sales Staff 9

Lessor 10

Other (Please specify) 11

Don't know 12

FG3. What is the principal activity or type of business that is conducted at this location? This may not be the main activity of your organization, but should be the main activity that occurs at this location. For example, is it an office, a warehouse, a store?

Office 1

Retail (non-food) 2

School 3

Grocery Store 4

Convenience Store 5

Restaurant 6

Health Care/Hospital 7

Hotel or Motel 8

Warehouse 9

Personal Service .................................................................... 10
Community Service/Church/Temple/Municipality.......................... 11
Industrial Electronic & Machinery.................................................. 12
Other Industrial ........................................................................... 13
Agricultural .................................................................................. 14
Condo Association/Apartment Management................................. 15
Other (Please specify)................................................................... 16
Don't know ................................................................................... 17

FG 4. Please enter your preferred email address so that we can send you your $10 e-gift card through TangoCard Rewards Genius. You can select from a variety of retailers or donate your incentive to charity. Please allow 4-6 weeks to receive the incentive email.

○ Email address: (1) ________________________________________________

○ No thanks - I do not wish to receive the e-gift card incentive (2)

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Closing

Those are all of the questions we have for you. Your responses are very important to Duke Energy and will help as we design future energy efficiency programs. Thank you for participating in this survey!

Holbrook Exhibit C
Docket No. E-2, Sub 1294

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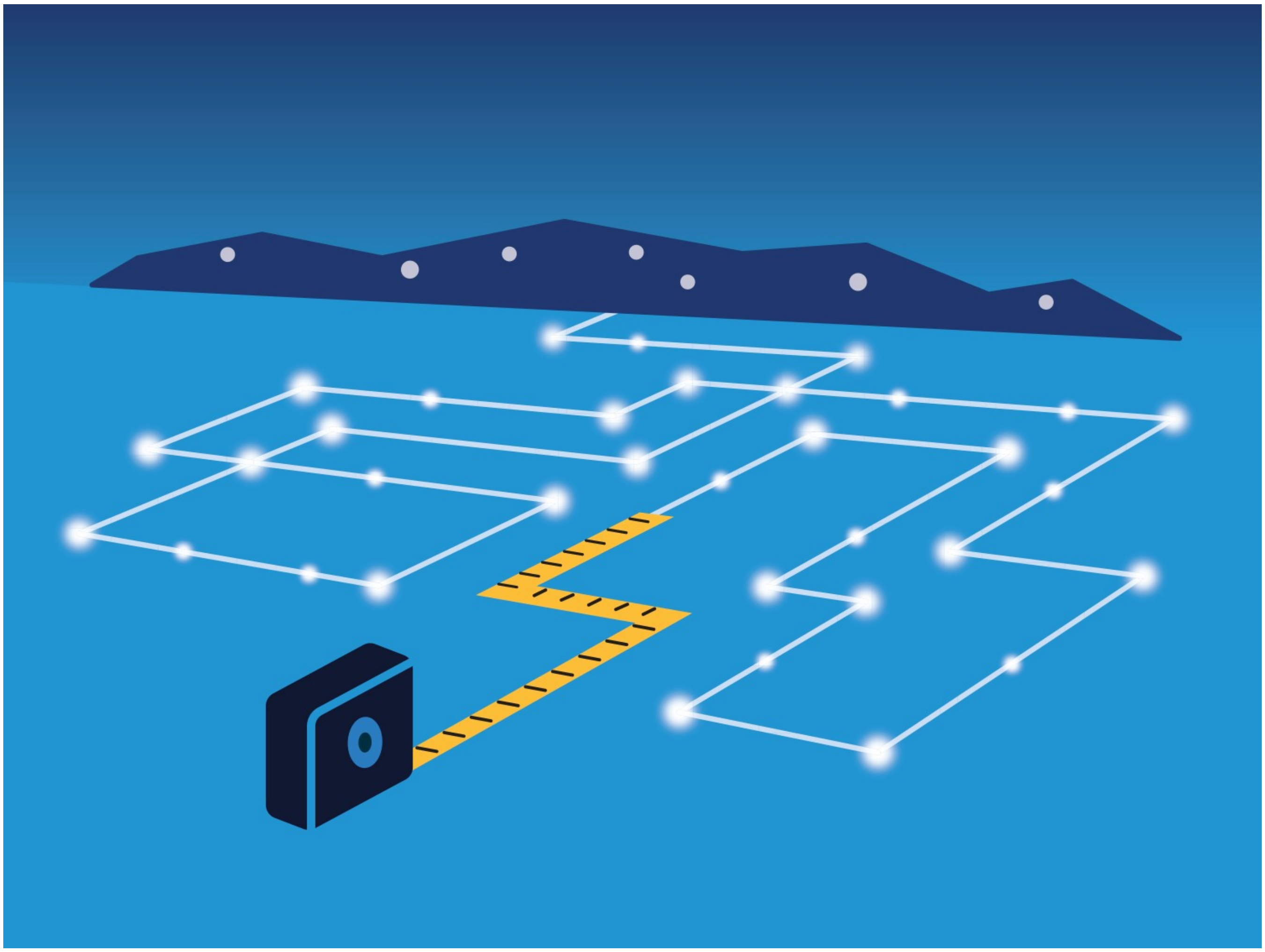

# Duke Energy Carolinas & Duke Energy Progress Online Savings Store Program

## 2021 Evaluation Report – Final

November 30, 2021

Opinion Dynamics

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# 1. Evaluation Summary

This report provides results of an impact and process evaluation of the Duke Energy Carolinas (DEC) and Duke Energy Progress (DEP) Online Savings Store (OSS) Program. The program period under evaluation is January 1, 2019 through March 31, 2021. We refer to this period as the evaluation period throughout the remainder of this report.

## 1.1 Program Summary

Duke Energy's OSS Program offers a wide range of point-of-sale (POS)-discounted LED lighting and advanced thermostats as well as several other consumer electronics and water-saving measures including advanced power strips, low-flow showerheads, thermostatic shower valves (TSV), dehumidifiers, and air purifiers. Incentivized LED lighting includes a variety of specialty bulb shapes and wattages as well as several types of fixtures, and advanced thermostats include a range of different models at different price points from leading brands. The non-lighting measures reflect an expansion of the OSS Program, which began exclusively distributing energy-efficient lighting in April 2013. Customers can purchase the discounted products online through a designated website operated by Energy Federation Inc. (EFI).

## 1.2 Evaluation Objectives

This evaluation included process and impact assessments and had several key objectives:

- Assess the program's performance and estimate gross and net annual energy (kWh) and peak summer and winter demand (kW) savings associated with program activity
  - Review program tracking data for completeness and accuracy, and discuss implications of any errors or inconsistencies for program savings estimates
  - Review deemed savings estimates used to track program performance, and provide recommendations for updates to assumptions, where necessary
  - Verify product installation and persistence, and estimate in-service rates (ISRs) by product category based on participant survey responses
  - Develop net-to-gross ratios (NTGRs) based on participant survey responses
  - Estimate ex post gross and net annual energy (kWh) and peak summer and winter demand (kW) savings and realization rates
- Gauge customer preferences as well as current and expected market trends to provide recommendations for how future implementation strategies can maximize customer engagement and minimize free ridership (FR)
- Assess the program's implementation processes and marketing strategies to identify key successes and opportunities for improvement

## 1.3 High Level Findings

From January 1, 2019 through March 31, 2021, Duke Energy's OSS Program sold 613,990 discounted energy-efficient products to DEC customers and 252,091 to DEP customers, achieving program-tracked ex ante energy savings of 32.1 GWh for DEC and 13.5 GWh for DEP. Table 1 provides a summary of program sales and ex ante energy savings.

Table 1. Online Savings Store Program Performance by Jurisdiction

| Product Category | DEC | | | | DEP | | | |
|---|---|---|---|---|---|---|---|---|
| | Units Sold | % of Sales | Ex Ante Gross kWh Savings | % of Savings | Units Sold | % of Sales | Ex Ante Gross kWh Savings | % of Savings |
| Specialty LED | 283,299 | 46% | 9,444,683 | 29% | 125,641 | 50% | 4,212,587 | 31% |
| Reflector LED | 217,718 | 35% | 10,159,269 | 32% | 80,792 | 32% | 3,778,285 | 28% |
| Standard LED | 74,703 | 12% | 1,600,138 | 5% | 25,679 | 10% | 550,044 | 4% |
| LED Fixture | 1,184 | <1% | 149,207 | <1% | 794 | <1% | 107,321 | 1% |
| Advanced Thermostat | 27,828 | 5% | 10,503,122 | 33% | 15,427 | 6% | 4,728,221 | 35% |
| Advanced Power Strip | 8,663 | 1% | 159,572 | <1% | 3,417 | 1% | 62,941 | <1% |
| Showerhead with TSV | 387 | <1% | 82,040 | <1% | 230 | <1% | 63,059 | <1% |
| Standalone TSV | 197 | <1% | 10,991 | <1% | 102 | <1% | 7,359 | <1% |
| Dehumidifier | 10 | <1% | 1,530 | <1% | 9 | <1% | 1,377 | <1% |
| Air Purifier | 1 | <1% | 403 | <1% | 0 | 0% | 0 | 0% |
| **Total** | **613,990** | **100%** | **32,110,956** | **100%** | **252,091** | **100%** | **13,511,195** | **100%** |

Note: Specialty LEDs include globe, decorative, and three-way bulbs; reflector LEDs include both indoor and outdoor bulbs; LED fixtures include portable, direct wire, and photocell products.

### 1.3.1 Impact Evaluation

The DEC program realized 30.9 GWh in ex post gross energy savings, 6.5 MW in summer peak demand savings, and 4.5 MW in winter peak demand savings during the evaluation period. In the same period, the DEP program achieved 15.4 GWh in ex post gross energy savings, 3.3 MW in summer peak demand savings, and 2.8 MW in winter peak demand savings.

Gross realization rates for the DEC program are 96% for energy savings, 204% for summer peak demand savings, and 287% for winter peak demand savings, while the DEP program saw gross realization rates of 114% for energy savings, 259% for summer peak demand savings and 437% for winter peak demand savings. In both jurisdictions, realization rates are slightly below 100% for LED lighting, which accounts for more than half of ex post gross energy savings. For DEP energy savings, this is more than offset by a 138% realization rate for advanced thermostats, while for DEC energy savings, the advanced thermostat realization rate is also slightly below 100%. For demand savings, advanced thermostats are the primary driver of high overall realization rates, as these products were not assigned ex ante demand savings but account for more than half of ex post gross summer and winter demand savings.

After applying NTGRs established by the current evaluation, the DEC offering achieved 12.6 GWh in ex post net energy savings, 3.3 MW in summer peak demand savings, and 2.6 MW in winter peak demand ex post net savings. The DEP program meanwhile achieved 7.9 GWh in ex post net energy savings, 2.0 MW in summer peak demand savings, and 1.9 MW in winter peak demand ex post net savings.

Table 2 summarizes total ex ante, ex post gross, and ex post net savings for each jurisdiction.

Table 2. Online Savings Store Program Performance by Jurisdiction

| Jurisdiction | Metric | Ex Ante | Gross RR | Ex Post Gross | Effective NTGR | Ex Post Net |
|---|---|---|---|---|---|---|
| DEC | Energy Savings (kWh) | 32,110,956 | 96% | 30,872,979 | 0.409 | 12,631,646 |
| | Summer Peak Demand Savings (kW) | 3,179 | 204% | 6,493 | 0.507 | 3,293 |
| | Winter Peak Demand Savings (kW) | 1,569 | 287% | 4,496 | 0.578 | 2,600 |
| DEP | Energy Savings (kWh) | 13,511,195 | 114% | 15,359,753 | 0.513 | 7,882,578 |
| | Summer Peak Demand Savings (kW) | 1,291 | 259% | 3,341 | 0.589 | 1,969 |
| | Winter Peak Demand Savings (kW) | 644 | 437% | 2,814 | 0.659 | 1,854 |

Note: NTGR values were developed by product category and jurisdiction. While NTGRs do not vary across energy and demand savings, the effective NTGRs (estimated as jurisdiction level ex post net savings divided by ex post gross savings) do as a result of varying contributions of each product category to energy and summer and winter demand savings.

Table 3 provides NTGR results by product category and jurisdiction developed as part of the current evaluation. The evaluation team produced NTGR estimates that account for both FR and participant spillover (PSO). We estimated FR separately for each product category and jurisdiction and developed PSO estimates for the program population overall for each jurisdiction. The NTGR results shown here are applied to ex post gross savings to produce ex post net savings estimates.

Table 3. NTGR Results

| Product Category | DEC | | | DEP | | |
|---|---|---|---|---|---|---|
| | FR | PSO | NTGR | FR | PSO | NTGR |
| LED Lighting | 0.777 | 0.002 | 0.225 | 0.695 | 0.007 | 0.312 |
| Advanced Thermostats | 0.263 | | 0.739 | 0.257 | | 0.750 |
| Advanced Power Strips | 0.031 | | 0.971 | 0.013 | | 0.994 |
| Showerheads and TSVs | 0.125 | | 0.877 | 0.046 | | 0.961 |
| Dehumidifiers | 0.140 | | 0.862 | 0.105 | | 0.902 |
| Air Purifiers | 0.140 | | 0.862 | 0.105 | | 0.902 |

## 1.3.2 Process Evaluation

The evaluation team identified the following high-level process findings based on research conducted as part of the current evaluation:

- Participants are highly satisfied with program-discounted products, key program elements, and the program overall, contributing to an image of a smoothly functioning program that consistently delivers on customer expectations.
- Around half of all participants first learned of the OSS offering from a bill insert or mailing (49% for DEC, 54% for DEP), and approximately one-third found out about the offering on the Duke Energy website (36% for DEC, 31% for DEP).

- Among participants who purchased non-lighting products, many had not been considering a comparable purchase prior to learning of the program's available discounts. This finding was particularly prominent among advanced power strip recipients (73% for DEC, 90% for DEP) and low-flow showerhead and TSV participants (63% for DEC, 79% for DEP) and suggests that other similar products may be especially good candidates for promotion through the program.
- As the market for LED lighting nears transformation, FR continues to rise, reflecting an increase in customer knowledge of and preference for LED bulbs paired with the increased availability and steadily decreasing prices of these products. Most of the remaining program influence (i.e., non-FR) identified by the current evaluation for these products is attributable to the program's role in motivating customers to replace still-working less efficient lighting with LEDs sooner than they otherwise would have.
- Many participants are unsure whether they had received free or reduced shipping, but among those who did, more than 80% considered it highly influential on their decision to purchase program-discounted products, suggesting it may be an especially valuable point of emphasis for future program marketing and an effective tool for encouraging energy-efficient purchases.
- Most advanced thermostat recipients purchased the new thermostat to replace a programmable thermostat (76% for DEC, 62% for DEP), while nearly all the others were replacing manual thermostats (20% for DEC, 38% for DEP). Although many customers reported having previously owned programmable thermostats, virtually all reported they primarily relied on manual adjustments or set the thermostat to a single temperature for entire seasons. Meanwhile, around two-thirds of participants reported they primarily use a programmed schedule and/or self-optimization features on their new thermostat (61% for DEC, 67% for DEP).
- First-year ISRs of less than 80% for advanced thermostats and advanced power strips indicate that substantive portions of participants are not installing their program-discounted products within several months of purchasing. Among respondents who did not have all of their new products installed, most indicated that they had not yet needed or had not yet gotten around to installing.
- Many advanced thermostat participants reported noticeable benefits of their new program-discounted products in terms of increased comfort and reduced electricity bills. Among LED lighting participants, more than half suggested the quality of light in their home had been improved.

## 1.4 Evaluation Recommendations

Based on the findings of this evaluation, the evaluation team identified the following opportunities for program improvement:

- Although there is a high rate of customer uncertainty regarding whether they received discounted shipping, those who did reported that it influenced their decision to purchase a program-discounted product. Therefore, we recommend that program marketing highlight discounted or free shipping, when available, both in outreach materials and on the program website.
- To support increases to first-year ISR, we recommend that the program continue to include collateral with orders encouraging customers to install their new energy-efficient products. The program could also consider additional outreach to recent participants encouraging them to install their new products, particularly for advanced thermostats. This has the potential to help the program maximize first-year savings.
- Program tracking data should include the necessary product infomation to enable application of appropriate savings assumptions for all product categories, as it did for all products sold during the

current evaluation period with the exception of air purifiers. For air purifiers, future program tracking data should include the product's size (i.e., clean air delivery rate) to ensure the accuracy of savings estimates.

- We recommend the program continue to explore possible expansions of the OSS Program and continue using the offering to promote less common energy-efficient products, some of which have already been introduced to the program (including advanced power strips, faucet aerators, air purifiers, dehumidifiers, or other household appliances). Our evaluation found that participants often purchase these products as a direct result of information made available by the OSS offering, as exhibited by their relatively low FR estimates.

# 2. Program Description

This section provides an overview of the design, implementation, and performance of the DEC and DEP Online Savings Store Program. The program period under evaluation is January 1, 2019 through March 31, 2021.

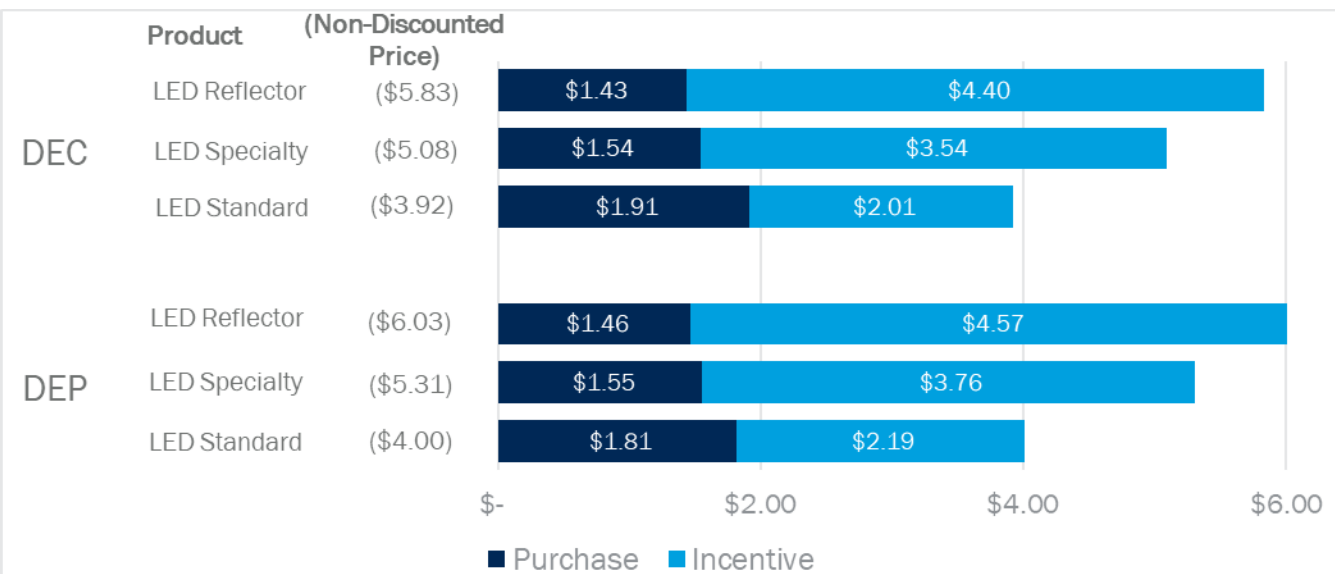
## 2.1 Program Design

Duke Energy's OSS Program offers a wide range of POS-discounted LED lighting and advanced thermostat products as well as several other consumer electronics and water-saving measures including advanced power strips, low-flow showerheads, TSVs, air purifiers, and dehumidifiers. Incentivized LED lighting includes a variety of specialty bulb shapes and wattages as well as several types of fixtures, and advanced thermostats include a range of different models at varying price points from leading brands.

The non-lighting measures reflect an expansion of the OSS Program, which began exclusively distributing energy-efficient lighting in April 2013. Customers can purchase the discounted products online through a designated website operated by EFI.

Program discounts varied considerably across products and throughout the evaluation period. Among incented LED bulbs for which program tracking data included pricing information,[1] average discounts amounted to more than 50% of non-discounted pricing for each category, with discounts averaging as high as 78% of non-discounted pricing for reflector bulbs. Figure 1 shows average per-unit pricing and incentive amounts for type of LED bulb sold through the program.

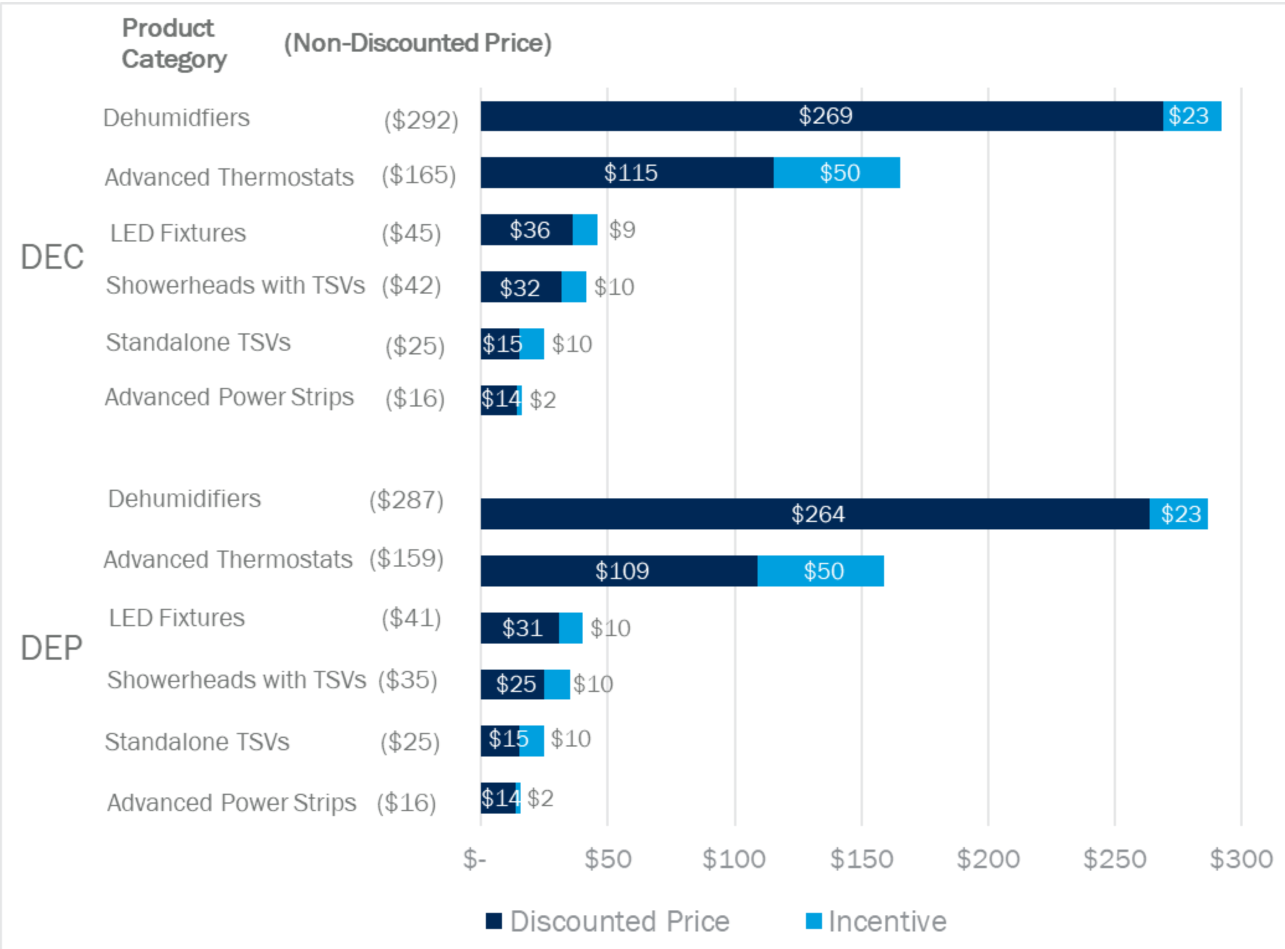
Figure 1. LED Bulb Per-Unit Pricing




[1] Pricing information was unavailable from program tracking data for most purchases made prior to mid-2020.

Figure 2 illustrates the average per-unit costs and program discounts associated with other higher-cost product categories among records for which program tracking data included pricing information. The program typically offered $50 incentives on advanced thermostats, $10 incentives on low-flow showerheads and TSVs, and $2 on advanced power strips. The small number of dehumidifiers sold during the evaluation period were each discounted by $23, amounting to 8% of their non-discounted price. LED fixture discounts ranged from $5 for lower-cost portable fixtures to $10 for photocell fixtures and $12 for direct wire fixtures, averaging $9 to $10 per-unit.

Figure 2. Non-Lighting and LED Fixture Per-Unit Pricing




## 2.2 Program Implementation

Duke Energy staff manage the OSS Program offerings and are responsible for overseeing program design, marketing, and operations. EFI has implemented the offering on behalf of Duke Energy since the program's inception. EFI is responsible for facilitating customer orders, warehousing products, maintaining inventory, handling order fulfillment and shipping logistics, and managing program invoicing and data tracking.

## 2.3 Program Performance

From January 1, 2019 through March 31, 2021, Duke Energy's OSS Program sold 613,990 discounted energy-efficient products to DEC customers and 252,091 to DEP customers, achieving ex ante gross energy savings of 32.1 GWh for DEC and 13.5 GWh for DEP. LED lighting dominated the OSS Program sales in both jurisdictions, representing more than 90% of total units sold and more than 50% of ex ante gross energy savings. Non-lighting measures were first distributed by the program in March 2019, shortly before standard LEDs were dropped from the list of available products. Advanced thermostats accounted for 5% of DEC and 6% of DEP sales but for 33% and 35% of savings, respectively. Other non-lighting products accounted for small shares of sales and savings (2% or less).

Table 4 provides a summary of program sales and ex ante energy savings.

Table 4. Online Savings Store Program Performance by Jurisdiction

| Product Category | DEC | | | | DEP | | | |
|---|---|---|---|---|---|---|---|---|
| | Units Sold | % of Sales | Ex Ante Gross kWh Savings | % of Savings | Units Sold | % of Sales | Ex Ante Gross kWh Savings | % of Savings |
| Specialty LED | 283,299 | 46% | 9,444,683 | 29% | 125,641 | 50% | 4,212,587 | 31% |
| Reflector LED | 217,718 | 35% | 10,159,269 | 32% | 80,792 | 32% | 3,778,285 | 28% |
| Standard LED | 74,703 | 12% | 1,600,138 | 5% | 25,679 | 10% | 550,044 | 4% |
| LED Fixture | 1,184 | <1% | 149,207 | <1% | 794 | <1% | 107,321 | 1% |
| Advanced Thermostat | 27,828 | 5% | 10,503,122 | 33% | 15,427 | 6% | 4,728,221 | 35% |
| Advanced Power Strip | 8,663 | 1% | 159,572 | <1% | 3,417 | 1% | 62,941 | <1% |
| Showerhead with TSV | 387 | <1% | 82,040 | <1% | 230 | <1% | 63,059 | <1% |
| Standalone TSV | 197 | <1% | 10,991 | <1% | 102 | <1% | 7,359 | <1% |
| Dehumidifier | 10 | <1% | 1,530 | <1% | 9 | <1% | 1,377 | <1% |
| Air Purifier | 1 | <1% | 403 | <1% | 0 | 0% | 0 | 0% |
| **Total** | **613,990** | **100%** | **32,110,956** | **100%** | **252,091** | **100%** | **13,511,195** | **100%** |

Some OSS program participants also purchased non-incented LED lighting products from the OSS website in addition to program-discounted ones. Participants who reached the program's limit of 36 bulbs or fixtures were able to purchase additional LED products at non-discounted prices, amounting to 3,200 units for DEC and 650 units for DEP. These non-discounted OSS purchases are not included in program sales summaries or considered part of program ex ante or ex post gross savings, but are instead evaluated as potential PSO (see discussion in Sections 5.1.2 and 5.2.2).

# 3. Overview of Evaluation Activities

To answer the evaluation objectives outlined in Section 1.2, Opinion Dynamics performed a range of data collection and analytic activities, including the following:

- Program staff interviews
- Data and deemed savings review
- Participation survey
- Engineering analysis

## 3.1 Program Staff Interviews

The evaluation team conducted an in-depth qualitative telephone interview with Duke Energy program staff in April 2021 to (1) obtain a full understanding of the OSS Program, including implementation processes, eligibility requirements, and available program-tracked participant information; (2) obtain program staff's perspective on current and past program successes and challenges; and (3) identify program staff's priorities for the process evaluation, including researchable questions.

## 3.2 Data and Deemed Savings Review

As part of this evaluation, we reviewed program tracking data, assessed its completeness and accuracy, and identified errors or inconsistencies. We discuss our findings and their implications for program-tracked savings in Section 4.2 of this report. We also conducted a detailed review of deemed savings estimates used to track program performance, assumptions behind those values, and sources of those assumptions. We performed manual lookups of product specifications in a small number of cases where the necessary detail was unavailable from the tracking database or where information in the data appeared inconsistent and used those lookups to inform the application of savings assumptions. We delivered a memorandum presenting the findings of this review and recommended updates to per-unit savings, which is included in Appendix B.

## 3.3 Participant Survey

The evaluation team conducted an online survey with a sample of OSS participants to gauge installation and usage behavior with products purchased through the OSS offering, solicit feedback regarding experiences with the program, and collect information relevant to estimating gross and net savings not available from program tracking data or applicable secondary sources. This included key household characteristics, heating and cooling equipment, and information needed to develop estimates of ISR, FR, and PSO.

### Sample Design and Fielding

We designed the survey sample to enable the development of robust ISR and FR estimates by product category for each jurisdiction, where possible. To avoid participant recall issues, we limited the sample frame for the survey to participants who made their purchase no more than twelve months prior to survey fielding.

We stratified the sample by product category and randomly selected up to 650 participants with purchases of each product category to include in the sample. For product categories with fewer than 650 participants who made their purchase within twelve months prior to survey fielding, which included advanced power strips and low-flow showerheads and TSVs, we attempted a census of all participants with available contact information. We excluded standard LEDs, dehumidifiers, and air purifiers given their very limited or non-existent participation during the twelve months preceding survey fielding. We reached out to each sampled participant up to three times via email inviting them to complete the online survey between July 30, 2021 and August 12, 2021.[2]

In total, 298 DEC participants and 172 DEP participants completed the survey. Table 5 summarizes the total count of participants and the number of survey respondents by product category for each jurisdiction.

Table 5. Participant Survey Sample Summary

| Product Category | DEC | | DEP | |
|---|---|---|---|---|
| | Participants in Population | Survey Completes | Participants in Population | Survey Completes |
| Specialty LEDs | 3,646 | 68 | 1,716 | 41 |
| Reflector LEDs | 2,858 | 63 | 1,302 | 34 |
| Advanced Thermostats | 8,237 | 64 | 5,160 | 35 |
| Advanced Power Strips[A] | 439 | 88 | 205 | 48 |
| Showerheads and TSVs[A] | 73 | 15 | 59 | 14 |
| **Total** | **15,473** | **298** | **8,491** | **172** |

[A] We attempted a census of advanced power strip and low-flow showerhead and TSV participants.

## 3.4 Engineering Analysis

We estimated annual energy and demand savings for each product sold through the OSS Program by applying the outputs of our deemed savings review (i.e., product category-specific per-unit savings) and ISR analysis to product quantities in the program tracking database.

[2] We also conducted a truncated supplementary fielding effort from August 31, 2021 to September 10, 2021 to collect information from advanced power strip participants necessary for developing estimates of FR.

# 4. Gross Impact Evaluation

The gross impact evaluation of the DEC and DEP OSS Program consisted of two distinct steps: (1) review of per-unit deemed savings values for incented products; and (2) verification of product installation and continued operation. This section describes the methodologies and results of both steps.

It should be noted that this evaluation did not include a consumption analysis of advanced thermostats given the timing of evaluation activities relative to the measure's introduction to the program. We plan to conduct a consumption analysis as part of the next evaluation, when sufficient post-installation consumption data is available for participants who installed advanced thermostats.

## 4.1 Methodology

We employed the research methods described in this section to validate program tracking data, review and update deemed savings assumptions, verify product installation and persistence, and calculate ex post gross energy and demand savings for products sold through the DEC and DEP OSS Program.

### 4.1.1 Data and Deemed Savings Review

We began by reviewing all available program tracking data, assessing its completeness and accuracy, and identifying all available to inform estimation of per-unit savings. To develop per-unit savings, we used several resources. Since neither North Carolina nor South Carolina has a statewide TRM, we relied on the Mid-Atlantic TRM, where possible, and used other TRMs (including the Illinois and Indiana TRMs) and other secondary sources, as needed, for algorithms and assumptions. Where available, our engineering team used inputs from the program tracking data and from our survey of program participants. For more information on the algorithms and inputs used to develop deemed per-unit savings estimates for each product category, see Appendix B.

### 4.1.2 In-Service Rate

To develop first-year ISR estimates, we relied on responses to the participant survey that asked customers to verify receipt and installation of purchased products. For lighting purchases, most products not installed at the time of the survey are placed in storage and installed in future years, so the ISR analysis used a discounted savings approach to claim savings associated with those future installations. The following sections detail the methods employed to estimate first-year and effective ISRs for both lighting and non-lighting products sold through the DEC and DEP OSS Program.

### LED Bulb First-Year ISRs

The evaluation team calculated ISRs for LED bulbs using responses to a series of survey questions that asked respondents to report the number of bulbs they received, the number of bulbs they installed, and the number of bulbs that were installed and then removed. We calculated the received rate as the number of bulbs received divided by the number of bulbs appearing in program tracking data, the installed rate as the number of bulbs installed divided by the number of bulbs received, and the persistence rate as the number of bulbs still installed divided by number of bulbs initially installed. The first-year ISR is a product of the receipt, installation, and persistence rates, as shown in Figure 3.

Figure 3. LED Bulb First-Year ISR Development

| | |
|---|---|
| Reported | # of bulbs purchased according to program tracking data |
| %Received | # of bulbs confirmed received by customers / # reported |
| %Installed | # of bulbs confirmed installed by customers / # received |
| %Persisting | # of bulbs confirmed remaining installed / # initially installed |
| First-Year ISR | %Received x %Installed x %Persisting |

### LED Bulb Future Installations

Research studies across the country have found that residential customers often purchase more LED bulbs than immediately needed and continue to install these bulbs from storage in subsequent years. The two main approaches to claiming savings from these later installations are (1) staggering the savings over time and claiming some in later years, and (2) claiming the savings in the evaluation period the product was sold but discounting savings by a societal or utility discount rate. While the "staggered" approach allows program administrators to more accurately capture the timing of the realized savings, the "discounted savings" approach allows for the simplicity of claiming all costs and benefits during the evaluation period and eliminates the need to keep track of and claim savings from future installations.

The evaluation team used a discounted savings approach to account for savings from future installations. To allocate installations over time, we relied on the installation trajectory recommended by the Uniform Methods Project (UMP) whereby 24% of remaining bulbs are installed in each subsequent year, for a total of five years. For example, if the Year 1 ISR is 80%, an additional 4.8% of bulbs would be installed in Year 2 ([1 – 80%] x 24%; or 20% x 24%) and an additional 3.6% of bulbs would be installed in Year 3 ([1 – 80% - 4.8%] x 24%; 15.2% x 24%).

These future installations are then discounted using Equation 1 to derive the net present value (NPV) of savings associated with future installs of LED bulbs.

Equation 1. Net Present Value Formula for Future LED Bulb Savings

$$NPV = \frac{R_t}{(1+i)^t}$$

*Where:*

*R* = Savings
*i* = Discount rate
*t* = Number of years in the future that savings take place

## Non-Lighting First-Year ISRs

The evaluation team developed ISRs for non-lighting products based on two sets of survey questions asking respondents to confirm the number of products received and to report the number of those products installed at the time of the survey. We calculated the receipt rate as the number of units received by the customer divided by the number appearing in program tracking data and the persistence rate as the number of units installed at the time of the survey divided by the number received. The first-year ISR is a product of the receipt and persistence rates, as shown in Figure 4.

Figure 4. Non-Lighting First-Year ISR Development

| | |
|---|---|
| Reported | # of units purchased according to program tracking data |
| %Received | # of units confirmed received by customers / # reported |
| %Persisting | # of units confirmed currently installed by customers / # received |
| First-Year ISR | %Received x %Persisting |

## 4.2 Gross Impact Results

This section provides gross energy and demand savings estimates for each product category offered by the DEC and DEP OSS Program and program-level savings, by jurisdiction, during the evaluation period.

### 4.2.1 Program Tracking Data Review

Opinion Dynamics received two types of program tracking data extracts for each jurisdiction. One type contained product and shipment information while the other contained customer contact information and product pricing. We combined the two sets of data extracts and analyzed the combined dataset for gaps and inconsistencies. As a part of the analysis, we performed the following steps:

- Checked core data fields for missing values
- Checked data for temporal gaps
- Checked key data fields for reasonableness and consistency

In reviewing the data, we found the data fields were clean and fully populated for the most part. Program tracking data included the necessary product specifications to inform TRM-based savings calculations for all product categories with the exception of air purifiers. Incorporating air purifier product size or clean air delivery rates into program tracking data would enable application of appropriate savings assumptions. Contact information and product pricing was included for all recent participation records but was mostly unavailable for purchases made prior to mid-2020. Among records where pricing information was provided, we did not observe any anomalous incentive amounts or total non-discounted pricing.

### 4.2.2 Per-Unit Deemed Savings

Duke Energy provided per-unit ex ante savings values in the form of spreadsheets containing DSMore outputs for each product category, jurisdiction, and state. Per-unit ex ante savings values are consistent for each product category across jurisdictions and states with the exception of advanced thermostats, low-flow showerheads, and TSVs, which vary by jurisdiction. Savings values were provided as energy, summer peak, and winter peak demand savings across six LED bulb types, three LED fixture types, and five non-lighting product categories.

Ex ante savings for LED lighting products are drawn directly from the most recent prior evaluation of the DEC OSS Program. These values reflect average per-unit ex post savings across the mix of products included in that product category during the prior evaluation period and incorporate ISRs from the prior evaluation. To allow for a better comparison of engineering assumptions, we backed out the prior LED lighting ISRs and developed ex post per-unit values that are also exclusive of ISRs.[3] For non-lighting products, exact parameters and sources used to develop ex ante per-unit savings were not readily available.

[3] The 2018 DEC OSS Program evaluation applied an effective ISR of 87.7% to develop ex-post savings, which were then provided by program staff as ex ante per-unit savings for LED bulbs in the current OSS Program. We therefore divided the ex ante values provided by program staff by 87.7% to produce the ex ante values shown here.

Differences between ex ante and ex post per-unit savings for LED lighting are primarily attributable to shifts in the mix of specific products and LED wattages within each category, with the exception of three-way bulbs, for which ex post savings reflect baseline wattage assumptions assigned based on mid-level lumen output rather than maximum lumen output. The product categories with the largest differences between ex ante and ex post gross per-unit savings are advanced power strips, where ex post savings are more than six times ex ante per-unit savings and advanced thermostats, for which ex ante demand savings were not claimed. In the absence of additional information on the sources of non-lighting ex ante assumptions, the reasons for differences between non-lighting ex ante and ex post per-unit savings estimates remain unknown.

Table 6 and Table 7 provide ex ante and ex post per-unit savings for all products sold through the DEC and DEP OSS Program. Additional detail on parameters and algorithms used to develop per-unit savings are provided in the deemed savings review memorandum included in Appendix B.

Table 6. Comparison of Per-Unit Deemed Savings (Net of ISR) for DEC

| Product Category | Energy (kWh) | | Summer Demand (kW) | | Winter Demand (kW) | |
|---|---|---|---|---|---|---|
| | Ex Ante | Ex Post | Ex Ante | Ex Post | Ex Ante | Ex Post |
| A-Line LED[A] | 24.42 | 28.62 | 0.0036 | 0.0042 | 0.0017 | 0.0020 |
| Recessed LED[A] | 54.16 | 54.04 | 0.0080 | 0.0080 | 0.0039 | 0.0039 |
| Recessed Outdoor LED[A] | 47.67 | 48.85 | 0.0071 | 0.0072 | 0.0034 | 0.0035 |
| Globe LED[A] | 36.61 | 34.99 | 0.0054 | 0.0052 | 0.0026 | 0.0025 |
| Decorative LED[A] | 35.21 | 31.76 | 0.0052 | 0.0047 | 0.0025 | 0.0023 |
| Three-Way LED[A] | 83.01 | 54.19 | 0.0122 | 0.0080 | 0.0059 | 0.0039 |
| LED Fixture – Direct Wire | 39.62 | 48.37 | 0.0052 | 0.0071 | 0.0043 | 0.0035 |
| LED Fixture – Portable | 20.99 | 32.85 | 0.0027 | 0.0048 | 0.0023 | 0.0024 |
| LED Fixture – Photocell | 227.91 | 213.48 | 0.0000 | 0.0000 | 0.0050 | 0.0072 |
| Advanced Thermostat | 377.43 | 517.19 | 0.0000 | 0.1804 | 0.0000 | 0.1553 |
| Advanced Power Strip | 18.42 | 112.30 | 0.0015 | 0.0100 | 0.0023 | 0.0100 |
| Showerhead with TSV | 211.99 | 195.10 | 0.0683 | 0.0153 | 0.0683 | 0.0306 |
| Standalone TSV | 55.79 | 45.00 | 0.0180 | 0.0057 | 0.0180 | 0.0114 |
| Dehumidifier | 153.02 | 114.73 | 0.0347 | 0.0260 | 0.0000 | 0.0000 |
| Air Purifier[B] | 403.00 | 403.00 | 0.0462 | 0.0462 | 0.0462 | 0.0462 |

[A] Ex ante per-unit values shown here for LED bulbs have been adjusted to omit ISR, whereas original ex ante values provided by program staff and shown elsewhere in this report have ISRs embedded.

[B] Only one air purifier was sold during the evaluation period and tracking data did not provide sufficient detail to inform the deemed savings review. For the purposes of this evaluation, we set ex post values equal to ex ante values for air purifiers.

Table 7. Comparison of Per-Unit Deemed Savings (Net of ISR) for DEP

| Product Category | Energy (kWh) | | Summer Demand (kW) | | Winter Demand (kW) | |
|---|---|---|---|---|---|---|
| | Ex Ante | Ex Post | Ex Ante | Ex Post | Ex Ante | Ex Post |
| A-Line LED[A] | 24.42 | 28.81 | 0.0036 | 0.0043 | 0.0017 | 0.0021 |
| Recessed LED[A] | 54.16 | 54.62 | 0.0080 | 0.0081 | 0.0039 | 0.0039 |
| Recessed Outdoor LED[A] | 47.67 | 51.03 | 0.0071 | 0.0075 | 0.0034 | 0.0037 |
| Globe LED[A] | 36.61 | 35.01 | 0.0054 | 0.0052 | 0.0026 | 0.0025 |
| Decorative LED[A] | 35.21 | 31.70 | 0.0052 | 0.0047 | 0.0025 | 0.0023 |
| Three-Way LED[A] | 83.01 | 51.48 | 0.0122 | 0.0076 | 0.0059 | 0.0037 |
| LED Fixture – Direct Wire | 39.62 | 44.26 | 0.0052 | 0.0065 | 0.0043 | 0.0032 |
| LED Fixture – Portable | 20.99 | 32.95 | 0.0027 | 0.0049 | 0.0023 | 0.0024 |
| LED Fixture – Photocell | 227.91 | 210.15 | 0.0000 | 0.0000 | 0.0050 | 0.0071 |
| Advanced Thermostat | 306.49 | 594.55 | 0.0000 | 0.1886 | 0.0000 | 0.1983 |
| Advanced Power Strip | 18.42 | 112.30 | 0.0015 | 0.0100 | 0.0023 | 0.0100 |
| Showerhead with TSV | 274.17 | 213.60 | 0.0874 | 0.0177 | 0.0874 | 0.0355 |
| Standalone TSV | 72.15 | 49.26 | 0.0230 | 0.0066 | 0.0230 | 0.0132 |
| Dehumidifier | 153.02 | 113.94 | 0.0347 | 0.0258 | 0.0000 | 0.0000 |
| Air Purifier[B] | 403.00 | 403.00 | 0.0462 | 0.0462 | 0.0462 | 0.0462 |

[A] Ex ante per-unit values shown here for LED bulbs have been adjusted to omit ISR, whereas original ex ante values provided by program staff and shown elsewhere in this report have ISRs embedded.

[B] Only one air purifier was sold during the evaluation period, and tracking data did not provide sufficient detail to inform the deemed savings review. For the purposes of this evaluation, we set ex post values equal to ex ante values for air purifiers.

### 4.2.3 In-Service Rates

Table 8 summarizes survey-based first-year ISRs for LED bulbs. The first-year ISR is a product of the receipt, installation, and persistence rates, as detailed in Section 4.1.2. Analysis results show that participants confirmed receipt of almost all discounted LED purchases (99% of DEC, 98% for DEP) and that once installed, LED bulbs generally remained in place (92% for DEC, 99% for DEP). However, consistent with typical trends for this type of program, not all bulbs are installed within the first year, resulting in installation rates well below 100% (68% for DEC, 74% for DEP) and overall first-year ISRs of 62% for DEC and 72% for DEP.

Table 8. LED Bulb First-Year ISR Development

| Rate | DEC (n=131) | DEP (n=75) |
|---|---|---|
| % Received | 98.7% | 98.1% |
| % Installed | 68.0% | 74.2% |
| % Persisting | 92.2% | 98.6% |
| **First-Year ISR** | **61.8%** | **71.7%** |

Table 9 provides cumulative installations of LED bulbs by year using the discounted approach discussed above (i.e., incremental installations of 24% of bulbs that remain uninstalled for a total of five additional years). The values shown here are discounted to represent the net present value of installations that occur in each year. The resulting effective ISRs are 86.1% for DEC and 89.7% for DEP.

Table 9. LED Bulb Cumulative Discounted ISR

| Year | Cumulative Discounted ISR | |
|---|---|---|
| | DEC | DEP |
| 2021 (Year 1) | 61.8% | 71.7% |
| 2022 (Year 2) | 70.5% | 78.3% |
| 2023 (Year 3) | 76.6% | 82.7% |
| 2024 (Year 4) | 80.8% | 85.9% |
| 2025 (Year 5) | 83.9% | 88.1% |
| 2026 (Year 6) | 86.1% | 89,7% |
| **Total** | **86.1%** | **89.7%** |

Table 10 provides the survey-based values used to calculate first-year ISRs for advanced thermostats, advanced power strips, and low-flow showerheads and TSVs by jurisdiction. First-year ISRs for non-lighting products are calculated by multiplying the percent of the program-tracked quantity confirmed received by the percent of received bulbs confirmed installed at the time of the survey.

Table 10. Non-Lighting First-Year ISR Development

| Rate | DEC | | | DEP | | |
|---|---|---|---|---|---|---|
| | Advanced Thermostats (n=64) | Advanced Power Strips (n=84) | Showerheads and TSVs (n=12) | Advanced Thermostats (n=35) | Advanced Power Strips (n=48) | Showerheads and TSVs (n=14) |
| % Received | 97.6% | 99.3% | 85.7% | 100% | 100% | 100% |
| % Installed | 70.7% | 73.9% | 100% | 71.1% | 79.1% | 75.0% |
| **First-Year ISR** | **69.0%** | **73.4%** | **85.7%** | **71.1%** | **79.1%** | **75.0%** |

Table 11 summarizes effective ISR values by product category and jurisdiction. The effective ISR for LED bulbs is reflective of the discounted savings approach detailed earlier in this report, while other values either reflect survey-based estimates of first-year ISR or are deemed at 100% (in cases where products are assumed to be installed or participation levels did not support survey sampling). Relative precision around the point estimates for product categories where sampling error applies range from 8.3% to 14.0% at 90% confidence.

Table 11. Final Effective ISR Summary

| Product Category | DEC | | | DEP | | |
|---|---|---|---|---|---|---|
| | ISR | n | Relative Precision | ISR | n | Relative Precision |
| LED Bulbs | 86.1% | 131 | 8.3% | 89.7% | 75 | 9.4% |
| LED Fixtures[A] | 100.0% | N/A | N/A | 100.0% | N/A | N/A |
| Advanced Thermostats | 69.0% | 64 | 10.7% | 71.1% | 35 | 14.0% |
| Advanced Power Strips[B] | 73.4% | 84 | N/A | 79.1% | 48 | N/A |
| Showerheads and TSVs[B] | 85.7% | 12 | N/A | 75.0% | 14 | N/A |
| Dehumidifiers[A] | 100.0% | N/A | N/A | 100.0% | N/A | N/A |
| Air Purifiers[A] | 100.0% | N/A | N/A | 100.0% | N/A | N/A |

[A] ISR is assumed to be 100% for dehumidifiers, air purifiers, and LED fixtures.

[B] Because we attempted a census of advanced power strip and low-flow showerhead and TSV participants, the concept of sampling error does not apply for these product categories.

As expected, lighting participants who did not have all of their new LED products installed at the time of the survey (54% of DEC and 52% of DEP respondents) overwhelmingly reported that they had not yet needed them and were waiting for other bulbs to burn out (94% for both DEC and DEP). Most of the remaining 6% reported that the new LEDs had already burnt out, that they did not like the light quality, or that they were the wrong size for the intended socket.

Among surveyed advanced thermostat participants, around one-quarter (27% for DEC, 23% for DEP) had not installed their new thermostat(s) at the time of the survey. The most common reasons included having not yet gotten around to it (62%) and the item being incompatible with their current setup (23%). Just over one-quarter (29% for both DEC and DEP) of participants who purchased advanced power strips had not installed them all at the time of the survey. Most of these respondents similarly indicated that they had not yet needed or not yet gotten around to installing (53%), while another third of respondents indicated that the product was incompatible with their current setup (33%). Among the six respondents who had not installed their program-discounted low-flow showerhead or TSVs (19% of respondents who received these items), two had not gotten around to doing so, two reported they gave the product to a friend or family member, and two said that they did not like the product and therefore uninstalled.

These ISRs, especially for non-lighting products such as advanced thermostats and advanced power strips, indicate that a substantive portion of participants who purchase these products have yet to install or use them for several months after purchasing. Additional outreach or prompts to future participants may help encourage installation of these products and improve first-year ISRs and, subsequently, first-year savings from these products.

### 4.2.4 Total Ex Post Gross Savings

Table 12, Table 13, and Table 14 present total ex ante and ex post gross energy, summer peak demand, and winter peak demand savings and realization rates, by product category and jurisdiction. The DEC program realized 30.9 GWh in ex post gross energy savings, 6.5 MW in summer peak demand savings, and 4.5 MW in winter peak demand savings during the evaluation period. In the same period, the DEP program achieved 15.4 GWh in ex post gross energy savings, 3.3 MW in summer peak demand savings, and 2.8 MW in winter peak demand savings.

Gross realization rates for the DEC program are 96% for energy savings, 204% for summer peak demand savings, and 287% for winter peak demand savings, while the DEP program saw gross realization rates of 114% for energy savings, 259% for summer peak demand savings and 437%for winter peak demand savings. In both jurisdictions, realization rates are slightly below 100% for LED lighting, which accounts for more than half of ex post gross energy savings. For DEP energy savings, this is more than offset by a 138% realization rate for advanced thermostats, while for DEC energy savings, the advanced thermostat realization rate is also slightly below 100%. For demand savings, advanced thermostats are the primary driver of high overall realization rates, as these products were not assigned ex ante demand savings but account for more than half of ex post gross summer and winter demand savings.

Table 12. Detailed Energy Savings Gross Impacts Results

| Product Category | DEC | | | DEP | | |
|---|---|---|---|---|---|---|
| | Ex Ante kWh | Gross RR | Ex Post Gross kWh | Ex Ante kWh | Gross RR | Ex Post Gross kWh |
| Specialty LED | 9,444,683 | 88% | 8,282,108 | 4,212,587 | 91% | 3,837,885 |
| Reflector LED | 10,159,269 | 98% | 9,907,775 | 3,778,285 | 103% | 3,900,243 |
| Standard LED | 1,600,138 | 115% | 1,837,992 | 550,044 | 121% | 662,946 |
| LED Fixture | 149,207 | 85% | 126,444 | 107,321 | 86% | 92,131 |
| Advanced Thermostat | 10,503,122 | 95% | 9,930,731 | 4,728,221 | 138% | 6,521,379 |
| Advanced Power Strip | 159,572 | 447% | 714,075 | 62,941 | 482% | 303,530 |
| Showerhead with TSV | 82,040 | 79% | 64,707 | 63,059 | 58% | 36,846 |
| Standalone TSV | 10,991 | 69% | 7,597 | 7,359 | 51% | 3,768 |
| Dehumidifier | 1,530 | 75% | 1,147 | 1,377 | 74% | 1,025 |
| Air Purifier | 403 | 100% | 403 | 0 | N/A | 0 |
| **Total** | **32,110,956** | **96%** | **30,872,979** | **13,511,195** | **114%** | **15,359,753** |

Table 13. Detailed Summer Peak Demand Savings Gross Impacts Results

| Product Category | DEC | | | DEP | | |
|---|---|---|---|---|---|---|
| | Ex Ante kW | Gross RR | Ex Post Gross kW | Ex Ante kW | Gross RR | Ex Post Gross kW |
| Specialty LED | 1,396 | 88% | 1,222 | 622 | 91% | 566 |
| Reflector LED | 1,498 | 98% | 1,462 | 557 | 103% | 576 |
| Standard LED | 239 | 113% | 271 | 82 | 119% | 98 |
| LED Fixture | 2 | 129% | 3 | 1 | 130% | 2 |
| Advanced Thermostat | 0 | N/A | 3,464 | 0 | N/A | 2,069 |
| Advanced Power Strip | 13 | 489% | 64 | 5 | 527% | 27 |
| Showerhead with TSV | 26 | 19% | 5 | 20 | 15% | 3 |
| Standalone TSV | 4 | 27% | 1 | 2 | 22% | 1 |
| Dehumidifier | 0 | 75% | 0 | 0 | 74% | 0 |
| Air Purifier | 0 | 100% | 0 | 0 | N/A | 0 |
| **Total** | **3,179** | **204%** | **6,493** | **1,291** | **259%** | **3,341** |

Table 14. Detailed Winter Peak Demand Savings Gross Impacts Results

| Product Category | DEC | | | DEP | | |
|---|---|---|---|---|---|---|
| | Ex Ante kW | Gross RR | Ex Post Gross kW | Ex Ante kW | Gross RR | Ex Post Gross kW |
| Specialty LED | 674 | 88% | 593 | 301 | 91% | 275 |
| Reflector LED | 727 | 97% | 709 | 271 | 103% | 279 |
| Standard LED | 112 | 117% | 132 | 39 | 123% | 47 |
| LED Fixture | 5 | 103% | 5 | 3 | 108% | 4 |
| Advanced Thermostat | 0 | N/A | 2,982 | 0 | N/A | 2,175 |
| Advanced Power Strip | 20 | 319% | 64 | 8 | 344% | 27 |
| Showerhead with TSV | 26 | 38% | 10 | 20 | 30% | 6 |
| Standalone TSV | 4 | 54% | 2 | 2 | 43% | 1 |
| Dehumidifier | 0 | N/A | 0 | 0 | N/A | 0 |
| Air Purifier | 0 | 100% | 0 | 0 | N/A | 0 |
| **Total** | **1,569** | **287%** | **4,496** | **644** | **437%** | **2,814** |

Table 15 summarizes per-unit ex post gross energy, summer peak demand, and winter peak demand savings by product category and jurisdiction. These values are reflective of deemed per-unit savings presented in Section 4.2.2 adjusted to apply effective ISR values presented in Section 4.2.3.

Table 15. Per-Unit Savings Gross Impact Results

| Product Category | DEC | | | DEP | | |
|---|---|---|---|---|---|---|
| | Energy (kWh) | Summer Demand (kW) | Winter Demand (kW) | Energy (kWh) | Summer Demand (kW) | Winter Demand (kW) |
| A-Line LED | 24.60 | 0.0036 | 0.0018 | 25.82 | 0.0038 | 0.0018 |
| Recessed LED | 46.43 | 0.0069 | 0.0033 | 48.93 | 0.0072 | 0.0035 |
| Recessed Outdoor LED | 41.98 | 0.0062 | 0.0030 | 45.72 | 0.0067 | 0.0033 |
| Globe LED | 30.06 | 0.0044 | 0.0022 | 31.37 | 0.0046 | 0.0022 |
| Decorative LED | 27.28 | 0.0040 | 0.0020 | 28.39 | 0.0042 | 0.0020 |
| Three-Way LED | 46.53 | 0.0069 | 0.0033 | 46.12 | 0.0068 | 0.0033 |
| LED Fixture – Direct Wire | 41.46 | 0.0061 | 0.0030 | 39.58 | 0.0058 | 0.0028 |
| LED Fixture – Portable | 28.13 | 0.0042 | 0.0020 | 29.53 | 0.0044 | 0.0021 |
| LED Fixture – Photocell | 183.47 | 0.0000 | 0.0062 | 188.03 | 0.0000 | 0.0063 |
| Advanced Thermostat | 356.86 | 0.1245 | 0.1072 | 422.73 | 0.1341 | 0.1410 |
| Advanced Power Strip | 82.43 | 0.0073 | 0.0073 | 88.83 | 0.0079 | 0.0079 |
| Showerhead with TSV | 167.20 | 0.0131 | 0.0262 | 160.20 | 0.0133 | 0.0266 |
| Standalone TSV | 38.56 | 0.0049 | 0.0098 | 36.95 | 0.0050 | 0.0099 |
| Dehumidifier | 114.73 | 0.0260 | 0.0000 | 113.94 | 0.0258 | 0.0000 |
| Air Purifier [A] | 403.00 | 0.0462 | 0.0462 | N/A | N/A | N/A |

[A] Only one air purifier was sold during the evaluation period and tracking data did not provide sufficient detail to inform the deemed savings review. For the purposes of this evaluation, we set ex post values equal to ex ante values for air purifiers.

## 4.3 References

Illinois Statewide Technical Reference Manual, Version 9.0.

Indiana Technical Reference Manual, Version 2.2, July 28, 2015.

Michigan Evaluation Working Group Showerhead and Faucet Aerator Meter Study Memorandum, June 2013.

Mid-Atlantic Technical Reference Manual, Version 10.0, May 2020.

National Renewable Energy Laboratory (NREL). *The Uniform Methods Project: Methods for Determining Energy Efficiency Savings for Specific Measures. Chapter 6: Residential Lighting Protocol.* October, 2017. https://www.nrel.gov/docs/fy17osti/68562.pdf.

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Navigant Consulting, Inc. and Apex Analytics, LLC. *EM&V Report for the 2012 Energy Efficient Lighting Program.* Prepared for Duke Energy Progress. July 12, 2013.

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US Energy Information Administration, 2015 Residential Energy Consumption Survey (RECS), Mid-Atlantic.

# 5. Net-to-Gross Analysis

This section describes our approach for estimating the net savings for the DEC and DEP OSS Program and presents the resulting NTGRs and net impacts.

## 5.1 Methodology

The NTGR represents the portion of the gross energy savings associated with a program-supported measure or behavior change that would not have been realized in the absence of the program. In other words, the NTGR represents the share of gross savings that can be considered program-induced or attributed to the program. The NTGR consists of FR and SO and is calculated as (1 – FR + SO).

FR is the proportion of the program-achieved verified gross savings that would have been realized absent the program. There are two types of SO: participant (PSO) and non-participant (NPSO). PSO occurs when participants take additional energy-saving actions that are influenced by program interventions but that did not receive program support. Non-participant SO is the result of energy-saving actions taken by customers who did not participate in the program but were somehow influenced by its existence. The scope of this evaluation included estimation of FR and PSO.[4]

Both FR and PSO components of the NTGR are derived from self-reported information from the participant web survey. The final NTGR is the percentage of gross program savings that can be attributed to the program. The following sections provide a general overview of the methods for developing FR and PSO estimates. Appendix C and Appendix D accompanying this report contain the participant survey instrument and additional detail behind FR algorithms and PSO estimation.

### 5.1.1 Free Ridership

As part of the participant survey, we asked a series of structured and open-ended questions about the influence of the program on customers' decisions to purchase and install program-discounted products. The survey questions gauged program influence in the following areas:

- Influence on efficiency: whether participants would have purchased comparably energy-efficient products without the program
- Influence on quantity: for relevant measures where participants purchased multiple units, whether participants would have purchased the same quantity without the program
- Influence on timing: whether participants would have delayed their purchase in the absence of the program-discounted products

We developed FR scores by jurisdiction and product category. All respondents who provided valid responses to FR questions were assigned a FR score ranging from 0 (non-free rider) to 1 (full free rider). In addition, we asked customers to provide an open-ended response summarizing how the program influenced their purchase decisions, which we reviewed to identify contradictory responses and adjust FR scores as needed. Appendix D provides additional detail on methods employed to develop FR estimates for both lighting and non-lighting products.

[4] Non-participant SO activities are challenging to quantify and identifying cases where they exist would warrant extensive additional research outside of the scope of this evaluation effort.

### 5.1.2 Participant Spillover

As a result of positive experience with program-discounted products or information from program marketing, some participants purchase additional energy-efficient products on their own. PSO represents energy savings from such additional energy-saving actions taken by participants (expressed as a percent of total program savings) that were influenced but not directly incentivized by the program. This evaluation quantified PSO savings from two different groups of spillover purchases:

1. **Additional energy-efficient products purchased outside the OSS offering.** The participant survey contained a series of questions designed to gauge the impact of the program on participants' subsequent purchases of energy-efficient products made outside of the OSS offering. Participants who reported a high level of program influence on non-discounted energy-efficient purchases made at other retailers were considered candidates for PSO. In these cases, the survey asked participants to provide additional detail on the non-discounted products they purchased and explain how their experience with the program influenced the purchase. Appendix D provides additional detail on survey-based methods employed to identify and quantify PSO.

2. **Non-discounted energy-efficient purchases made through the OSS offering.** Some OSS Program participants also purchased non-incented LED lighting products from the OSS website in addition to program-discounted ones. Participants who reached the program's limit of 36 bulbs or fixtures were able to purchase additional LED products at non-discounted prices. These non-discounted OSS purchases are not considered part of program gross savings but do represent a source of potential PSO. For these sales, we developed estimates of total ex post gross savings associated with the products and adjusted those savings based on lighting-specific FR estimates established by the current evalution to represent the portion of these sales attributable to the OSS Program.[5]

[5] Note that two survey respondents had additional, non-incented LED purchases through the OSS offering. These two respondents did not report their non-discounted OSS purchases as PSO; as such, there is no double-counting of PSO savings from the two types of spillover measures.

## 5.2 NTG Results

The evaluation team developed NTGR estimates that account for both FR and PSO. We estimated FR separately for each product category and jurisdiction and developed PSO estimates by jurisdiction. Table 16 summarizes NTGR results by product category and jurisdiction.

Table 16. NTGR Results

| Product Category | DEC | | | DEP | | |
|---|---|---|---|---|---|---|
| | FR | PSO | NTGR | FR | PSO | NTGR |
| LED Lighting | 0.777 | 0.002 | 0.225 | 0.695 | 0.007 | 0.312 |
| Advanced Thermostats | 0.263 | | 0.739 | 0.257 | | 0.750 |
| Advanced Power Strips | 0.031 | | 0.971 | 0.013 | | 0.994 |
| Low-Flow Showerheads and TSVs | 0.125 | | 0.877 | 0.046 | | 0.961 |
| Dehumidifiers | 0.140 | | 0.862 | 0.105 | | 0.902 |
| Air Purifiers | 0.140 | | 0.862 | 0.105 | | 0.902 |

### 5.2.1 Free Ridership

Table 17 below summarizes FR results for each product category, which range from less than 5% for advanced power strips to 70% or more for LED lighting. With the exception of LED lighting, FR is less than 30% for each measure category. Relative precision around the point estimates for product categories where sampling error applies range from 8.0% to 12.9% at 90% confidence. In cases where participation levels were too low to support survey sampling, we apply FR results from other lighting or non-lighting product categories, respectively.

Table 17. FR Results

| Product Category | DEC | | | DEP | | |
|---|---|---|---|---|---|---|
| | Respondents | FR | Relative Precision | Respondents | FR | Relative Precision |
| LED Lighting[A] | 76 | 0.777 | 8.0% | 40 | 0.695 | 12.3% |
| Advanced Thermostats | 64 | 0.263 | 11.7% | 35 | 0.257 | 12.9% |
| Advanced Power Strips[B] | 30 | 0.031 | N/A | 29 | 0.013 | N/A |
| Low-Flow Showerhead and TSVs[B] | 13 | 0.125 | N/A | 14 | 0.046 | N/A |
| Dehumidifiers[A] | N/A | 0.140 | N/A | N/A | 0.105 | N/A |
| Air Purifiers[A] | N/A | 0.140 | N/A | N/A | 0.105 | N/A |

[A] Due to limited participation, the survey did not include FR questions for standard LEDs, LED fixtures, dehumidifiers, or air purifiers. FR values for these measures represent the averages of other lighting and non-lighting product categories, respectively.

[B] Because we attempted a census of advanced power strip and low-flow showerhead and TSV participants, the concept of sampling error does not apply for these product categories.

The survey also asked LED lighting participants what they would have expected to purchase in the absence of discounts provided by the OSS offering. More than three-quarters of respondents claimed that without the program discounts they would have bought fewer LED bulbs than they did (78% for DEC, 88% for DEP). However, among these respondents, nearly 80% claimed they still would have purchased LEDs the next time they needed bulbs (78% for DEC, 79% for DEP). This represents a sharp increase from the corresponding results of the prior DEC OSS Program evaluation, where just 53% of respondents indicated they would have purchased LEDs the next time they needed bulbs.

Figure 5 summarizes participant responses regarding how many of the program-discounted bulbs they would have purchased at full price, and Figure 6 provides the type of bulbs they would have expected to buy instead.

Figure 5. Portion of Program LEDs Participants Would Have Purchased Without Program Discount

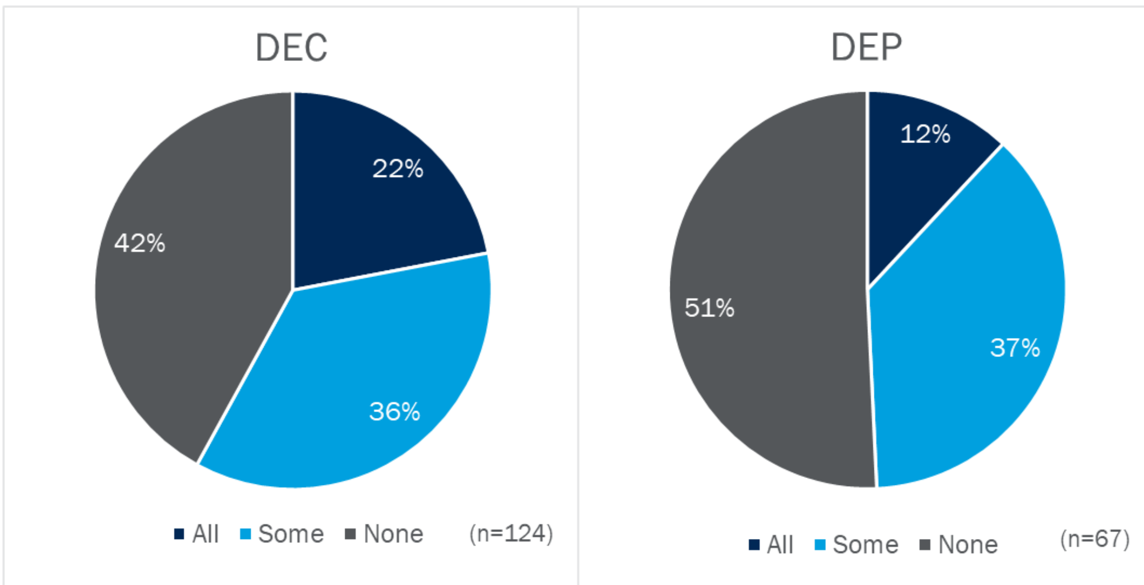
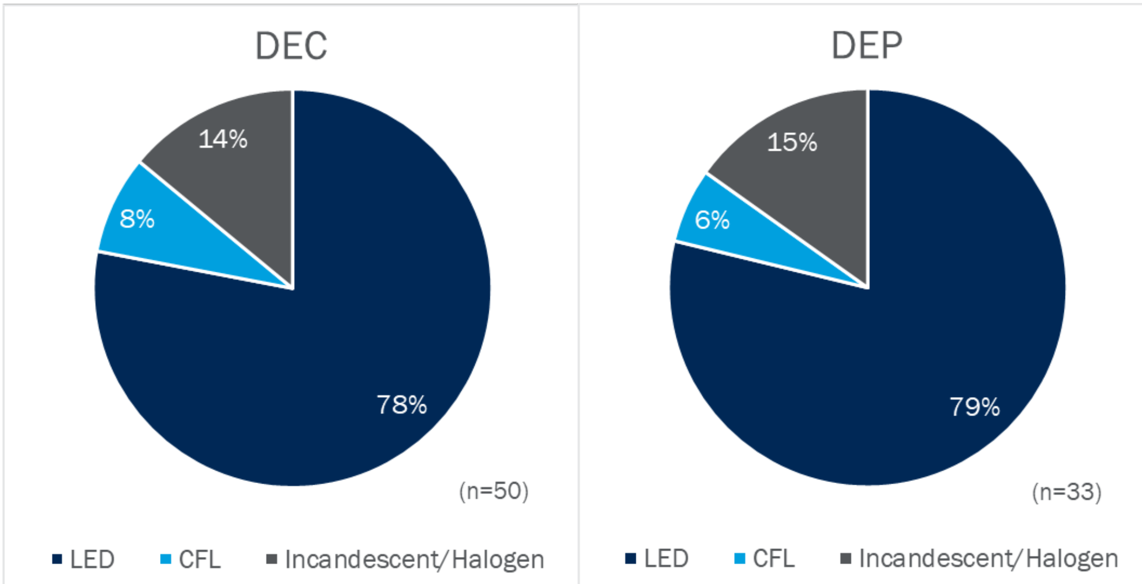


Figure 6. Types of Bulbs Customers Would Have Purchased if Not Buying Program LEDs




The survey also asked non-lighting participants whether they had been looking to purchase a comparable product prior to learning of the available Duke Energy discounts; if they had not previously considered such a purchase, they are assumed to be non-free riders. Sizeable portions of non-lighting participants indicated they had not been planning to purchase a similar product prior to learning about the Duke Energy discounts available, resulting in their being assigned a FR value of 0%. This finding was somewhat more pronounced among low-flow showerhead and TSV participants (62% for DEC, 79% for DEP) and advanced power strip participants (73% for DEC, 90% for DEP) compared to advanced thermostat participants (33% for DEC, 51% for DEP).

### 5.2.2 Participant Spillover

Two DEC and four DEP survey respondents qualified for PSO by purchasing additional energy-efficient products outside of the OSS since participating in the program and attributing these purchases to their experience with the OSS offering. Table 18 summarizes the products reported as spillover by participants responding to the survey, including the quantity purchased and the associated savings.

Table 18. Survey-Based PSO Savings

| Product Type | DEC | | DEP | |
|---|---|---|---|---|
| | Purchase Quantity | kWh | Purchase Quantity | kWh |
| LED Lighting | 5 | 142.50 | 1 | 28.50 |
| Refrigerator | | | 1 | 51.10 |
| Advanced Power Strip | | | 2 | 224.60 |
| Low-Flow Showerhead | | | 1 | 185.50 |
| Low-Flow Faucet Aerator | | | 1 | 13.28 |
| **Total** | **5** | **142.50** | **5** | **502.98** |

Table 19 outlines the calculation of jurisdiction-level PSO rates based on self-reported qualifying purchases, where total spillover savings associated with purchases made outside of the OSS are divided by total savings associated with participants responding to the survey.

Table 19. Survey-Based PSO Results

| Jurisdiction | Spillover Savings from Non-OSS Purchases (kWh) | Total Respondent Savings (Ex Post Gross kWh)[A] | Survey-Based PSO Rate |
|---|---|---|---|
| DEC | 142.50 | 132,371 | 0.1% |
| DEP | 502.98 | 79,071 | 0.6% |

[A] Represents total ex post gross savings associated with respondents who provided valid participant survey responses, including those who did not report a spillover purchase.

Table 20 summarizes the calculation of PSO attributable to non-incented LED purchases made on the OSS website, where total program-attributable savings from non-discounted purchases are divided by total program-wide gross savings.[6]

Table 20. Non-Incented OSS Sales PSO Results

| Jurisdiction | Spillover Savings from Non-Incented OSS Sales (kWh) | Total Program Savings (Ex Post Gross kWh) | Non-Incented OSS Sales PSO Rate |
|---|---|---|---|
| DEC | 22,493.3 | 30,872,979 | 0.1% |
| DEP | 6,542.1 | 15,359,753 | <0.1% |

The sum of the survey-based PSO rate and PSO rate associated with non-discounted OSS sales is 0.2% for DEC and 0.7% for DEP, as shown in Table 21.

Table 21. Combined PSO Results

| Jurisdiction | Survey-Based PSO | Non-Incented OSS Sales PSO | Final PSO |
|---|---|---|---|
| DEC | 0.1% | 0.1% | 0.2% |
| DEP | 0.6% | <0.1% | 0.7% |

[6] Program-attributable savings from non-discounted OSS purchases reflect ex post gross savings assumptions, including deemed savings updates and ISR application, adjusted to account for program influence by excluding the portion of savings attributable to FR (77.7% for DEC and 69.5% for DEP).

## 5.3 Net Impact Results

Table 22, Table 23, and Table 24 present the ex post net impacts for energy, summer peak demand, and winter peak demand savings, respectively, that result from applying the evaluation NTGRs to ex post gross savings. The DEC program realized 12.6 GWh in net energy savings, 3.3 MW in net summer peak demand savings, and 2.6 MW in net winter peak demand during the evaluation period. In the same period, the DEP program achieved 7.9 GWh in net energy savings, 2.0 MW in net summer peak demand savings, and 1.9 MW in net winter peak demand.

Table 22. Detailed Energy Savings Net Impact Results

| Product Category | DEC | | | DEP | | |
|---|---|---|---|---|---|---|
| | Ex Post Gross kWh Savings | NTGR | Ex Post Net kWh Savings | Ex Post Gross kWh Savings | NTGR | Ex Post Net kWh Savings |
| Specialty LED | 8,282,108 | 0.225 | 1,863,474 | 3,837,885 | 0.312 | 1,197,420 |
| Reflector LED | 9,907,775 | | 2,229,249 | 3,900,243 | | 1,216,876 |
| Standard LED | 1,837,992 | | 413,548 | 662,946 | | 206,839 |
| LED Fixture | 126,444 | | 28,450 | 92,131 | | 28,745 |
| Advanced Thermostat | 9,930,731 | 0.739 | 7,338,810 | 6,521,379 | 0.750 | 4,891,035 |
| Advanced Power Strip | 714,075 | 0.971 | 693,367 | 303,530 | 0.994 | 301,709 |
| Showerhead with TSV | 64,707 | 0.877 | 56,748 | 36,846 | 0.961 | 35,409 |
| Standalone TSV | 7,597 | | 6,663 | 3,768 | | 3,621 |
| Dehumidifier | 1,147 | 0.862 | 989 | 1,025 | 0.902 | 925 |
| Air Purifier | 403 | | 347 | 0 | N/A | 0 |
| **Total** | **30,872,979** | **0.409** | **12,631,646** | **15,359,753** | **0.513** | **7,882,578** |

Note: Overall NTGRs are estimated as jurisdiction level ex post net savings divided by ex post gross savings.

Table 23. Detailed Summer Peak Demand Savings Net Impacts Results

| Product Category | DEC | | | DEP | | |
|---|---|---|---|---|---|---|
| | Ex Post Gross kW Savings | NTGR | Ex Post Net kW Savings | Ex Post Gross kW Savings | NTGR | Ex Post Net kW Savings |
| Specialty LED | 1,222 | 0.225 | 275 | 566 | 0.311 | 177 |
| Reflector LED | 1,462 | | 329 | 576 | | 180 |
| Standard LED | 271 | | 61 | 98 | | 31 |
| LED Fixture | 3 | | 1 | 2 | | 1 |
| Advanced Thermostat | 3,464 | 0.739 | 2,560 | 2,069 | 0.749 | 1,552 |
| Advanced Power Strip | 64 | 0.971 | 62 | 27 | 0.993 | 27 |
| Showerhead with TSV | 5 | 0.877 | 4 | 3 | 0.960 | 3 |
| Standalone TSV | 1 | | 1 | <1 | | <1 |
| Dehumidifier | <1 | 0.862 | <1 | <1 | 0.901 | <1 |
| Air Purifier | <1 | | <1 | 0 | N/A | 0 |
| **Total** | **6,493** | **0.507** | **3,293** | **3,341** | **0.588** | **1,969** |

Note: Overall NTGRs are estimated as jurisdiction level ex post net savings divided by ex post gross savings.

Table 24. Detailed Winter Peak Demand Savings Net Impacts Results

| Product Category | DEC | | | DEP | | |
|---|---|---|---|---|---|---|
| | Ex Post Gross kW Savings | NTGR | Ex Post Net kW Savings | Ex Post Gross kW Savings | NTGR | Ex Post Net kW Savings |
| Specialty LED | 593 | 0.225 | 133 | 275 | 0.312 | 86 |
| Reflector LED | 709 | | 160 | 279 | | 87 |
| Standard LED | 132 | | 30 | 47 | | 15 |
| LED Fixture | 5 | | 1 | 4 | | 1 |
| Advanced Thermostat | 2,982 | 0.739 | 2,204 | 2,175 | 0.750 | 1,631 |
| Advanced Power Strip | 64 | 0.971 | 62 | 27 | 0.994 | 27 |
| Showerhead with TSV | 10 | 0.877 | 9 | 6 | 0.961 | 6 |
| Standalone TSV | 2 | | 2 | 1 | | 1 |
| Dehumidifier | 0 | N/A | 0 | 0 | N/A | 0 |
| Air Purifier | <1 | 0.862 | <1 | 0 | N/A | 0 |
| **Total** | **4,496** | **0.578** | **2,600** | **2,814** | **0.659** | **1,854** |

Note: Overall NTGRs are estimated as jurisdiction level ex post net savings divided by ex post gross savings.

# 6. Process Evaluation

This section details research questions, evaluation activities, and key findings from the process evaluation of the DEC and DEP OSS Program.

## 6.1 Research Questions

The evaluation team developed the following process-oriented research questions with input from OSS program staff.

- How effective are program implementation and data-tracking practices?
- How do participants learn about the program?
- Are participants satisfied with their program experience?
- What factors, if any, are preventing customers from installing program-discounted products or prompting their removal?
- How do customers use program-discounted products, and what are the implications for savings attributable to those measures, for advanced thermostats in particular?
- Which measures or customer segments can the program target to maximize its influence and minimize free ridership?
- What role does free or discounted shipping play in motivating customers to purchase program-discounted products?
- What information is currently collected from program participants, and what participant information or eligibility requirements would enable the program to maximize savings for measures where household characteristics are especially relevant?
- What other energy-efficient measures could the program consider offering?
- What are the program's strengths or key successes and in what areas are there potential opportunities for improvement?
- What non-energy impacts, if any, do OSS participants realize as a result of their participation?

## 6.2 Methodology

The process evaluation relied on the following data collection and analytic activities:

- In-depth interviews with program staff
- Analysis of program tracking data
- Participant survey (n=470)

## 6.3 Key Findings

The following sections present key findings regarding the evaluation's process-oriented research questions.

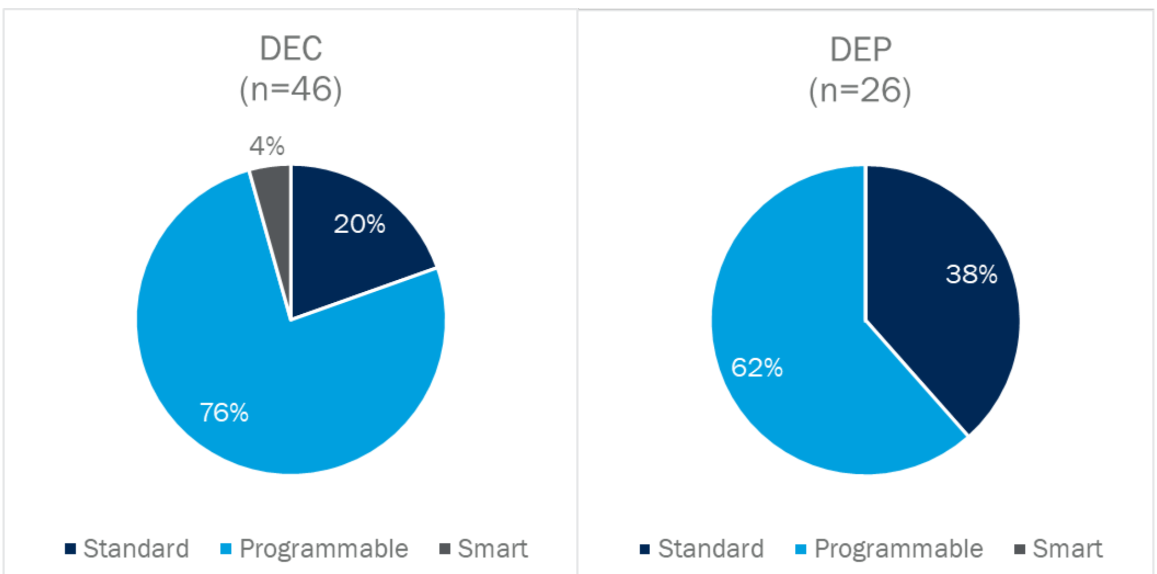
### 6.3.1 Thermostat Usage Behavior

Two key determinants of savings from advanced thermostats are (1) the type of thermostat participants used prior to the installation of their program-discounted thermostats and (2) how participants used their old thermostats and are using their new ones. The participant survey explored both topics.

Most respondents reported that their new smart thermostats replaced a programmable thermostat (76% for DEC, 62% for DEP), with the rest mostly replacing manual thermostats (20% for DEC, 38% for DEP). A small number of thermostat participants reported they were replacing a previously owned smart thermostat (4% for DEC, 0% for DEP). Ex post per-unit savings do not allow savings for advanced thermostats that replace other advanced thermostats, resulting in a small decrease to per-unit savings for DEC.

Figure 7 summarizes the types of thermostats being replaced by program-discounted advanced thermostats in each jurisdiction.

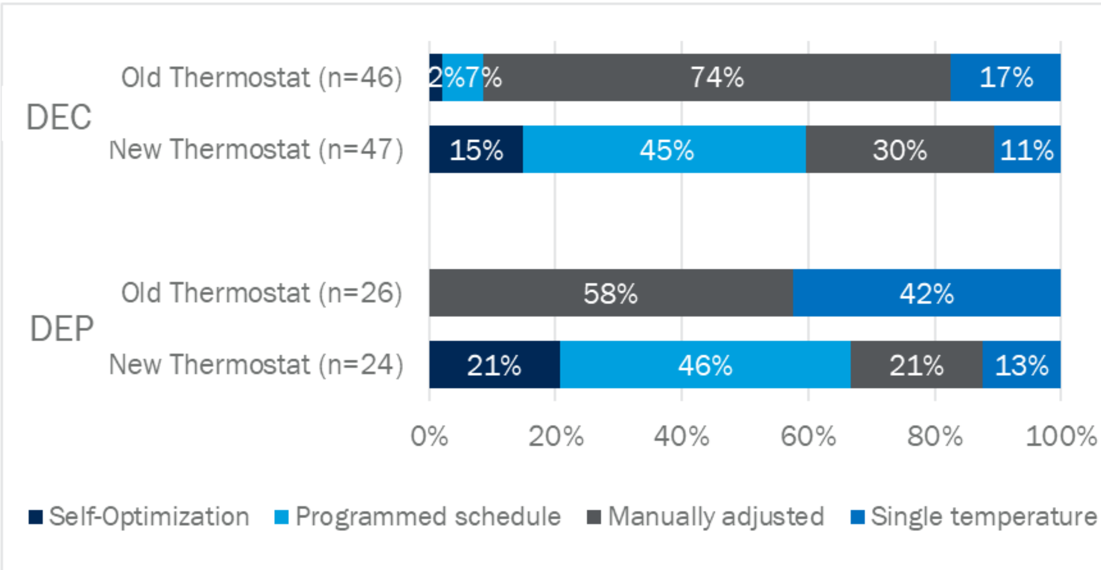
Figure 7. Previous Thermostat Replacement




Thermostat usage patterns are often varied and dependent on a variety of factors, making them challenging to gauge via survey self-report. The participant survey nevertheless explored how customers typically set the temperature on their previous and new thermostats in the summer months to get a sense of how their behavior may have changed. Although the engineering algorithm for advanced thermostats does not explicitly incorporate self-reported usage behaviors, understanding such tendencies can provide important insights into whether application of prior billing analysis results are justified and what savings might be expected from future billing analyses for this program.

Perhaps most notably, few to none of the participants in either jurisdiction typically had a programmed schedule set on their previous thermostat despite most of them having programmable thermostats installed. Conversely, more than half of these respondents claimed that they were either taking advantage of their new advanced thermostat's self-optimization function (15% for DEC, 21% for DEP) or programming their new thermostat on a schedule (45% for DEC, 46% for DEP). Figure 8 illustrates these findings regarding how thermostat participants most typically used their previous and program-discounted thermostats.

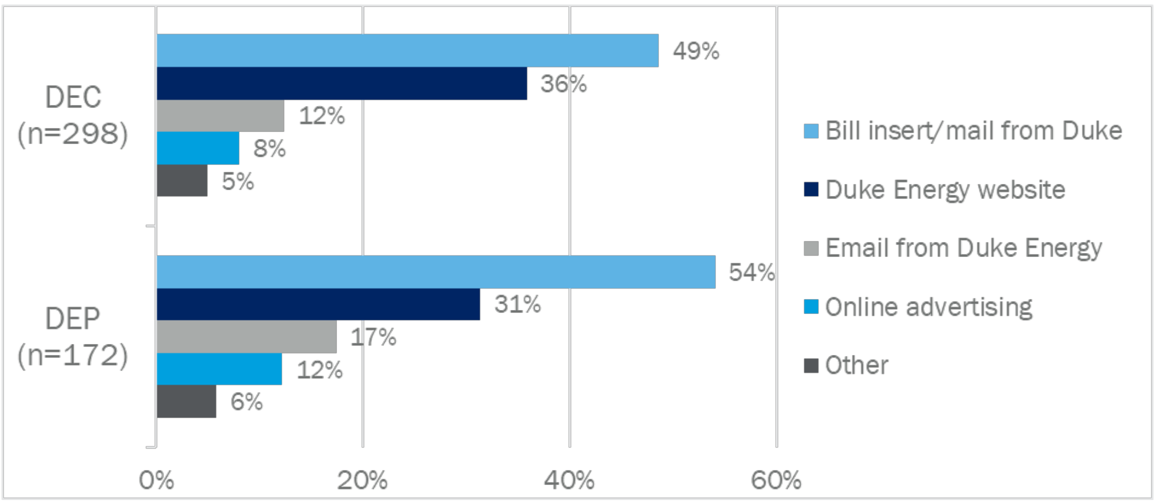
Figure 8. Thermostat Usage Behavior



### 6.3.2 Program Marketing and Outreach

We asked all participants how they first learned about the Online Savings Store offering. Around half of respondents in each jurisdiction reported they learned about the offering through a bill insert or physical mailing from Duke (49% for DEC, 54% for DEP). The Duke Energy website was the second most common source of program awareness (36% for DEC, 31% for DEP) and emails from Duke were third (12% for DEC, 17% for DEP). Other sources of information reported by participants included family and friends, social media, and hired contractors. Figure 9 summarizes how participants first heard about the OSS offering.

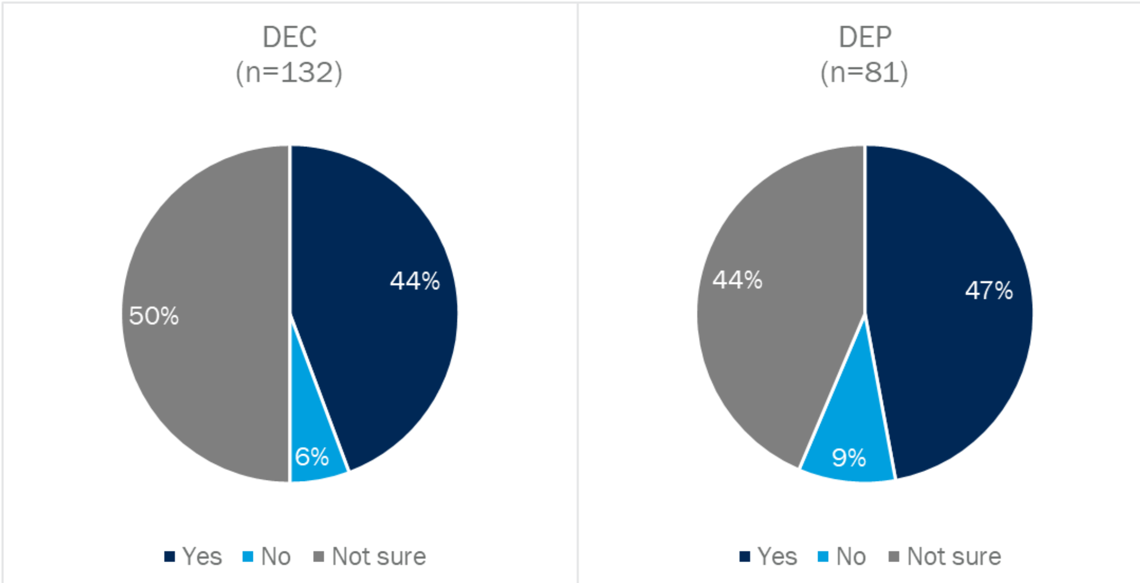
Figure 9. Sources of Awareness




### 6.3.3 Value of Discounted Shipping

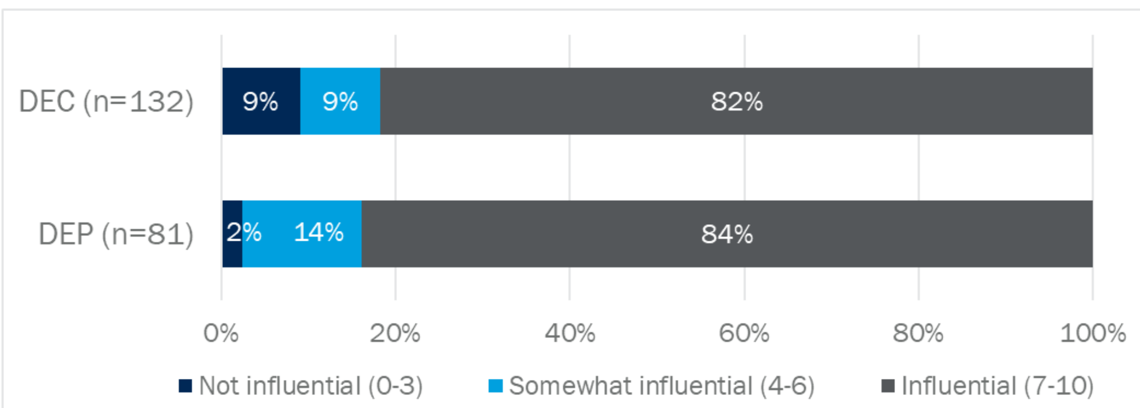
As part of the participant survey, the evaluation sought to gauge the importance of discounted shipping to respondents and better understand the role it plays in motivating customers to purchase program-discounted products. About half of survey respondents reported receiving discounted shipping for the OSS purchase (44% for DEC, 47% for DEP), but about as many indicated they were unsure whether they received free or discounted shipping (50% for DEC, 44% for DEP). Figure 10 illustrates these responses, highlighting a high degree of participant uncertainty as to whether they received free or reduced shipping.

Figure 10. Discounted Shipping Breakdown




Those who did recall receiving free or discounted shipping mostly indicated that it was highly influential in their decision to purchase a product through the program, with more than 80% rating the influence at least 7 on a zero to ten scale (where zero means "Not at all influential" and ten means "Extremely influential"). Figure 11 shows respondents' ratings of how influential discounted shipping was on their decision to make a purchase.

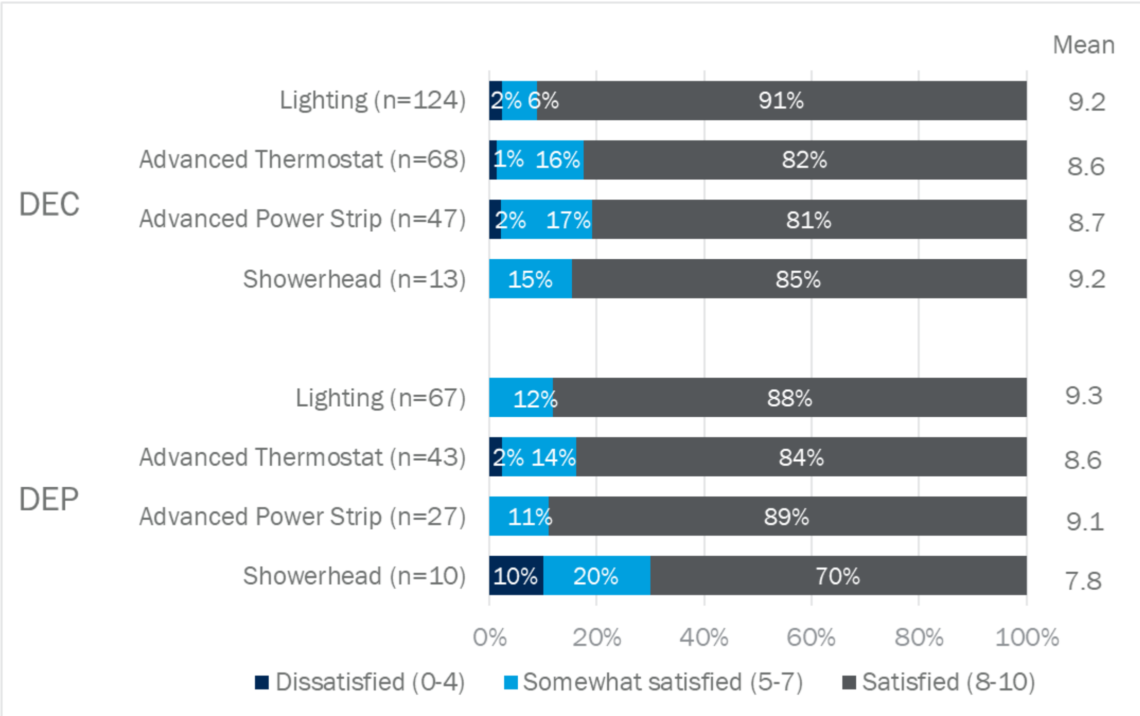
Figure 11. Influence of Shipping Discount




### 6.3.4 Program Delivery and Participant Satisfaction

Across the board, participants indicated high satisfaction with their discounted products, with average scores of eight or nine for nearly all products in both jurisdictions. The only specific complaints from respondents were two instances of defective advanced power strips and one participant who ordered an LED fixture thinking it was an LED bulb. These findings suggest that the program is effectively targeting high-quality products that customers enjoy using. Figure 12 summarizes participant satisfaction with each type of program-discounted product by jurisdiction.

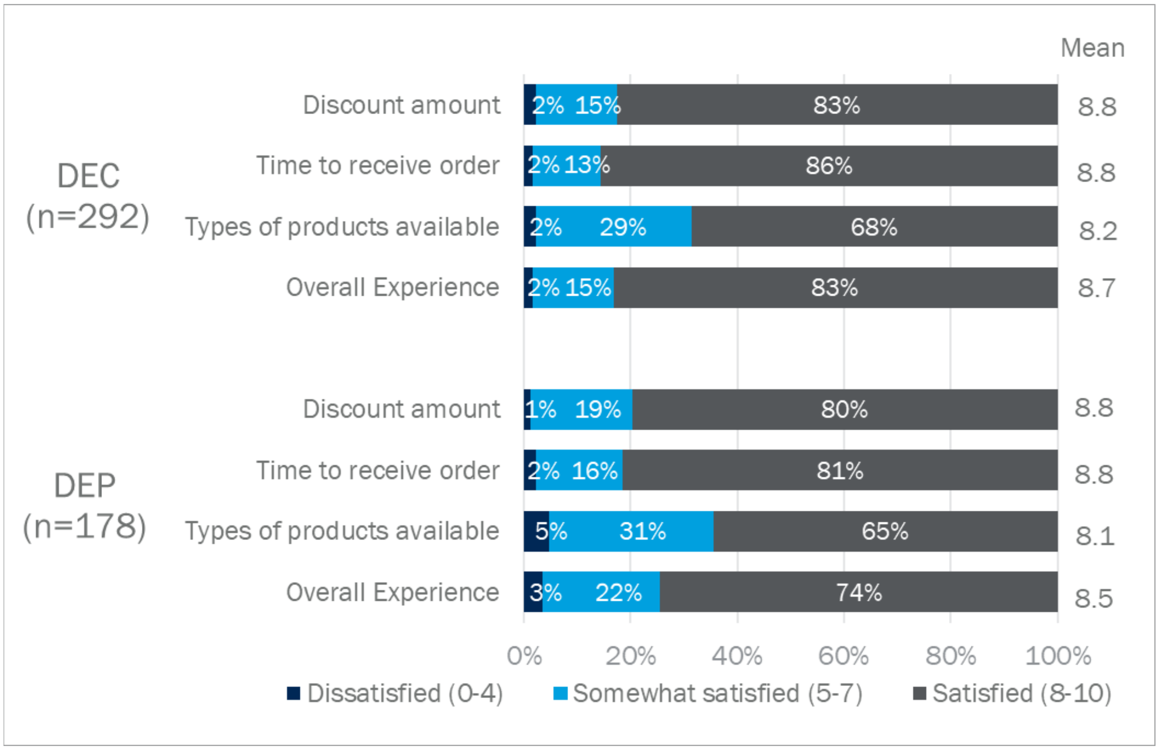
Figure 12. Participant Satisfaction with Program-Discounted Products




Satisfaction with various elements of the program's implementation was also exceptionally high with customers providing mean ratings of between eight and nine out of ten for each aspect of the program and for the program overall. The only suggested improvements offered by participants came from three respondents who indicated the website was difficult to navigate and three who indicated they would have appreciated a larger variety of LED bulbs to choose from. These high satisfaction ratings contribute to an image of a smoothly functioning program that consistently delivers on customer expectations.

Figure 13 provides participant satisfaction ratings associated with key program elements for each jurisdiction.

Figure 13. Participant Satisfaction with Key Program Elements




### 6.3.5 Non-Energy Impacts

NEIs include a range of occupant health, safety, and economic outcomes that participants may realize beyond the energy and cost savings of energy-efficient upgrades. NEIs can provide significant additional benefits to participants and can be a powerful motivator for program participation.

The participant survey included questions about changes in electricity bills and in different aspects of the home's comfort following program participation, and many participants reported both electric bill and non-energy benefits. Among those who purchased and installed new advanced thermostats, nearly half claimed their winter electricity bills were lower (44% for DEC, 45% for DEP) and at least one-third reported lower electricity bills in the summer (38% for DEC, 33% for DEP). Similarly, at least one-third of advanced thermostat participants reported their home was more comfortable during the winter months since installing the new thermostat (38% for DEC, 33% for DEP), and a similar pattern plays out for summer months with between a quarter and a third of customers reporting higher comfort (37% for DEC, 26% for DEP). Among respondents who purchased LED lighting, a majority reported that the quality of lighting in their homes had improved since installing the new products (55% for DEC, 59% for DEP).

Table 25 summarizes feedback from advanced thermostat and LED lighting participants regarding changes to their home's electricity bills, comfort, and lighting quality since installing program-discounted products.

Table 25. Impacts Reported by Participants

| Jurisdiction | Impact | Positive Change | No Change | Negative Change |
|---|---|---|---|---|
| DEC | **Advanced Thermostat Participants** | | | |
| | Electricity bills in summer (n=34) | 38% *Bills are lower* | 59% | 3% *Bills are higher* |
| | Electricity bills in winter (n=33) | 44% *Bills are lower* | 52% | 4% *Bills are higher* |
| | Home comfort in summer (n=41) | 37% *More comfortable* | 61% | 2% *Less comfortable* |
| | Home comfort in winter (n=29) | 38% *More comfortable* | 62% | 0% *Less comfortable* |
| | **LED Lighting Participants** | | | |
| | Lighting quality (n=116) | 55% *Better* | 43% | 2% *Worse* |
| DEP | **Advanced Thermostat Participants** | | | |
| | Electricity bills in summer (n=15) | 33% *Bills are lower* | 53% | 13% *Bills are higher* |
| | Electricity bills in winter (n=11) | 45% *Bills are lower* | 45% | 9% *Bills are higher* |
| | Home comfort in summer (n=23) | 26% *More comfortable* | 61% | 13% *Less comfortable* |
| | Home comfort in winter (n=15) | 33% *More comfortable* | 53% | 13% *Less comfortable* |
| | **LED Lighting Participants** | | | |
| | Lighting quality (n=64) | 59% *Better* | 39% | 2% *Worse* |

These findings suggest the OSS Program provides value to participants beyond energy savings. Increased home comfort relating to temperature control could be beneficial for customer health and safety. Improved lighting also provides a higher sense of safety in and around the home. Lower energy bills can also help alleviate energy burdens and allow customers to spend their money on essential items, such as food or medicine.

# 7. Conclusions and Recommendations

This section presents conclusions and recommendations resulting from the process and impact evaluations of the DEC and DEP OSS Program.

## 7.1 Conclusions

From January 1, 2019 through March 31, 2021, Duke Energy's OSS Program sold 613,990 discounted energy-efficient products to DEC customers and 252,091 to DEP customers, achieving ex ante gross energy savings of 32.1 GWh for DEC and 13.5 GWh for DEP. LED lighting dominated OSS Program sales in both jurisdictions, representing more than 90% of total units sold and more than 50% of ex ante gross energy savings. Non-lighting measures were first distributed by the program in March 2019, shortly before standard LEDs were dropped from the list of available products. Advanced thermostats accounted for 5% of DEC and 6% of DEP sales but for 33% and 35% of savings, respectively. Other non-lighting products accounted for small shares of sales and savings (2% or less). Table 26 provides a summary of program sales and ex ante energy savings.

Table 26. Online Savings Store Program Performance by Jurisdiction

| Product Category | DEC | | | | DEP | | | |
|---|---|---|---|---|---|---|---|---|
| | Units Sold | % of Sales | Ex Ante Gross kWh Savings | % of Savings | Units Sold | % of Sales | Ex Ante Gross kWh Savings | % of Savings |
| Specialty LED | 283,299 | 46% | 9,444,683 | 29% | 125,641 | 50% | 4,212,587 | 31% |
| Reflector LED | 217,718 | 35% | 10,159,269 | 32% | 80,792 | 32% | 3,778,285 | 28% |
| Standard LED | 74,703 | 12% | 1,600,138 | 5% | 25,679 | 10% | 550,044 | 4% |
| LED Fixture | 1,184 | <1% | 149,207 | <1% | 794 | <1% | 107,321 | 1% |
| Advanced Thermostat | 27,828 | 5% | 10,503,122 | 33% | 15,427 | 6% | 4,728,221 | 35% |
| Advanced Power Strip | 8,663 | 1% | 159,572 | <1% | 3,417 | 1% | 62,941 | <1% |
| Showerhead with TSV | 387 | <1% | 82,040 | <1% | 230 | <1% | 63,059 | <1% |
| Standalone TSV | 197 | <1% | 10,991 | <1% | 102 | <1% | 7,359 | <1% |
| Dehumidifier | 10 | <1% | 1,530 | <1% | 9 | <1% | 1,377 | <1% |
| Air Purifier | 1 | <1% | 403 | <1% | 0 | 0% | 0 | 0% |
| **Total** | **613,990** | **100%** | **32,110,956** | **100%** | **252,091** | **100%** | **13,511,195** | **100%** |

The DEC program realized 30.9 GWh in ex post gross energy savings, 6.5 MW in summer peak demand savings, and 4.5 MW in winter peak demand savings during the evaluation period. In the same period, the DEP program achieved 15.4 GWh in ex post gross energy savings, 3.3 MW in summer peak demand savings, and 2.8 MW in winter peak demand savings.

Gross realization rates for the DEC program are 96% for energy savings, 204% for summer peak demand savings, and 287% for winter peak demand savings, while the DEP program saw gross realization rates of 114% for energy savings, 259% for summer peak demand savings and 437% for winter peak demand savings. In both jurisdictions, realization rates are slightly below 100% for LED lighting, which accounts for more than half of ex post gross energy savings. For DEP energy savings, this is more than offset by a 138% realization rate for advanced thermostats, while for DEC energy savings, the advanced thermostat realization rate is also slightly below 100%. For demand savings, advanced thermostats are the primary driver of high overall realization rates, as these products were not assigned ex ante demand savings but account for more than half of ex post gross summer and winter demand savings.

After applying NTGRs established by the current evaluation, the DEC offering achieved 12.6 GWh in ex post net energy savings, 3.3 MW in summer peak demand savings, and 2.6 MW in winter peak demand ex post net savings. The DEP program meanwhile achieved 7.9 GWh in ex post net energy savings, 2.0 MW in summer peak demand savings, and 1.9 MW in winter peak demand ex post net savings.

Table 27 summarizes total ex ante, ex post gross, and ex post net savings for each jurisdiction.

Table 27. Online Savings Store Program Performance by Jurisdiction

| Jurisdiction | Metric | Ex Ante | Gross RR | Ex Post Gross | NTGR | Ex Post Net |
|---|---|---|---|---|---|---|
| DEC | Energy Savings (kWh) | 32,110,956 | 96% | 30,872,979 | 0.409 | 12,631,646 |
| | Summer Peak Demand Savings (kW) | 3,179 | 204% | 6,493 | 0.507 | 3,293 |
| | Winter Peak Demand Savings (kW) | 1,569 | 287% | 4,496 | 0.578 | 2,600 |
| DEP | Energy Savings (kWh) | 13,511,195 | 114% | 15,359,753 | 0.513 | 7,882,578 |
| | Summer Peak Demand Savings (kW) | 1,291 | 259% | 3,341 | 0.589 | 1,969 |
| | Winter Peak Demand Savings (kW) | 644 | 437% | 2,814 | 0.659 | 1,854 |

Note: NTGR values were developed by product category and jurisdiction. While NTGRs do not vary across energy and demand savings, the effective NTGRs (estimated as jurisdiction level ex post net savings divided by ex post gross savings) do as a result of varying contributions of each product category to energy and summer and winter demand savings.

## Implementation and Data Tracking

Program implementation processes appear to run smoothly and effectively, as evidenced by high levels of customer satisfaction with the products offered and the program overall. In particular, participants expressed high degrees of satisfaction with the size of discounts being offered, the speed with which they received purchased products, and the range of products the program allowed them to choose from.

Program tracking data was generally clean, accurate, fully populated, and included the necessary product specifications to inform TRM-based savings calculations for nearly all products with air purifiers being the notable exception.

## Marketing and Outreach

Despite the OSS Program being implemented as an online platform, around half of participants learned about the offering through a bill insert or physical mailing from Duke, suggesting these outreach channels remain an effective method of communicating the program's availability.

Discounted shipping may be an especially valuable point of emphasis for program marketing and an effective tool for encouraging energy-efficient purchases. Many customers expressed uncertainty about whether their order received discounted shipping, but those who did recall receiving it often indicated that it was highly influential in their decision to purchase a product through the program.

## Program Influence

The OSS Program provides an easily accessible platform for encouraging customers to consider adopting energy-efficient household items. Participant feedback suggests that many of those who purchased less widely popular measures such as low-flow showerheads or advanced power strips only considered purchasing such a product because of information they received about program offerings. This finding suggests that other less common products that have very recently or not yet been introduced to the program may be especially good candidates for promotion through the program, including faucet aerators, air purifiers, dehumidifiers, or other household appliances.

Conversely, the lighting market appears to be nearing transformation, and limited opportunity remains for program discounts to spur LED purchases that would not have occurred in their absence. Utility programs like this one have helped the lighting market near transformation with many customers indicating LEDs as their preferred product. As the market continues to shift, we expect LEDs will be an increasingly popular and affordable option, further limiting the power of program discounts to motivate LED purchases that would not have otherwise occurred.

### Thermostat Usage

Nearly all advanced thermostat participants replaced previously installed programmable or manual thermostats, but the majority of previously installed thermostats were programmable, suggesting there may be limited potential for savings if customers are already conserving energy by way of programmed thermostat schedules. However, almost none of these participants reported primarily relying on a programmed schedule to set the temperature of their home with their previous thermostat. Meanwhile, a majority of respondents indicated that they do use a programmed schedule and/or advanced features of their new thermostat, which offers some support for savings assumptions being applied to these measures as part of the current evaluation.

### Installation Behavior

First-year ISRs of less than 80% for advanced thermostats and advanced power strips indicate that substantive portions of participants are not installing their program-discounted products within twelve months of purchasing. Among those with uninstalled products, the vast majority report they have not yet gotten around to or have not yet needed to install their new products. The program may therefore be able to maximize savings by conducting additional outreach or providing materials to participants encouraging them or reminding them to install the new products, as discussed in the following section.

### Non-Energy Impacts

In addition to the energy savings achieved by the OSS Program, many customers reported other benefits of their new program-discounted products. More than half of LED lighting participants reported the quality of lighting in their home had been improved and between one-third and half of advanced thermostat participants suggested their homes were more comfortable or their electricity bills were lower since installing their new thermostats.

## 7.2 Recommendations

Based on the findings of this evaluation, the evaluation team identified the following opportunities for program improvement:

- Although there is a high rate of customer uncertainty regarding whether they received discounted shipping, those who did reported that it influenced their decision to purchase a program-discounted product. Therefore, we recommend that program marketing highlight discounted or free shipping, when available, both in outreach materials and on the program website.
- To support increases to first-year ISR, we recommend that the program continue to include collateral with orders encouraging customers to install their new energy-efficient products. The program could

also consider additional outreach to recent participants encouraging them to install their new products, particularly for advanced thermostats. This has the potential to help the program maximize first-year savings.

- Program tracking data should include the necessary product infomation to enable application of appropriate savings assumptions for all product categories, as it did for all products sold during the current evaluation period with the exception of air purifiers. For air purifiers, future program tracking data should include the product's size (i.e., clean air delivery rate) to ensure the accuracy of savings estimates.
- We recommend the program continue to explore possible expansions of the OSS Program and continue using the offering to promote less common energy-efficient products, some of which have already been introduced to the program (including advanced power strips, faucet aerators, air purifiers, dehumidifiers, or other household appliances). Our evaluation found that participants often purchase these products as a direct result of information made available by the OSS offering, as exhibited by their relatively low FR estimates.

# 8. Summary Form

## Duke Energy Carolinas and Duke Energy Progress Online Savings Store Program

*Completed EM&V Fact Sheet*

### Program Description

Duke Energy's Online Savings Store (OSS) Program offers a wide range of point-of-sale-discounted specialty LED lighting and advanced thermostats as well as several other consumer electronics and water-saving measures including advanced power strips, low-flow showerheads, TSVs, dehumidifiers, and air purifiers. The non-lighting measures reflect an expansion of the OSS Program, which began exclusively distributing energy-efficient lighting in April 2013. Customers can purchase the discounted products online through a designated website operated by Energy Federation Inc. (EFI).

| | |
|---|---|
| Date | November 30, 2021 |
| Region(s) | Duke Energy Carolinas (DEC)<br>Duke Energy Progress (DEP) |
| Evaluation Period | January 1, 2019–<br>March 31, 2021 |
| Annual kWh Savings (Ex Post Net) | DEC: 12,632 MWh<br>DEP: 7,883 MWh |
| Coincident kW Impact (Ex Post Net) | DEC: 3.3 MW (Summer),<br>2.6 MW (Winter)<br>DEP: 2.0 MW (Summer),<br>1.9 MW (Winter) |
| Measure Life | Not Evaluated |
| Net-to-Gross Ratio | DEC: 0.403<br>DEP: 0.513 |
| Process Evaluation | Yes |
| Previous Evaluation(s) | DEC Online Savings Store Program Evaluation. October 4, 2018. |

### Evaluation Methodology

In support of the **gross impact evaluation**, we first reviewed program tracking data and ex ante per-unit deemed savings values for incented products. We then developed updated per-unit deemed savings based on review of secondary sources and results of a survey fielded with program participants. We also verified product installation and persistence based on participant survey responses. Based on these evaluated ex post per-unit deemed savings values and survey-based ISRs, we calculated ex post gross energy and demand savings for products sold through the DEC and DEP OSS Program.

The **net impact evaluation** relied on responses to the participant survey to quantify free ridership and participant spillover. We estimated free ridership by measure category and jurisdiction and developed jurisdiction-level participant spillover rates. The resulting net-to-gross ratios were multiplied by ex post gross savings to determine net program impacts.

We also conducted a **process evaluation** focused on participant experiences and satisfaction with the program, product usage behaviors, program marketing and outreach, and implications of participant-reported influence of key program elements on their decision to purchase program-discounted energy-efficient products.

# 9. DSMore Table

The Excel spreadsheet containing measure-level inputs for Duke Energy Analytics is provided below. Per-measure savings values in the spreadsheet are based on the gross and net impact analyses reported above. The evaluation scope did not include updates to measure life assumptions.

[DSMore Table provided as a separate file]

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Now a part of Resource Innovations




# K12 Education Program 2019-2020 Evaluation Report

Submitted to Duke Energy Carolinas and Duke Energy Progress

December 2, 2021

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# 1 Executive Summary

## 1.1 Program Summary

The Energy Efficiency Education in Schools (K12 Education) Program is a Duke Energy Carolinas and Duke Energy Progress (DEC/DEP) program offering implemented by the National Theatre for Children (NTC). The program provides age-appropriate school performances by NTC's professional actors that teach students about energy and energy conservation in a humorous, engaging, and entertaining format. NTC also provides participating schools with classroom curriculum to coincide with the performance, which includes energy efficiency kit request forms that student families can use to receive free energy efficiency measures to install in their home.

## 1.2 Evaluation Objectives and Results

This report presents the results and findings of evaluation activities for the DEC/DEP K12 Education Program conducted by Nexant (now a part of Resource Innovations) for the program year of August 2019 through July 2020.

### 1.2.1 Impact Evaluation

The primary objective of the impact evaluation is to estimate energy and demand savings attributable to the 2019-2020 DEC/DEP K12 Education Program. The 2019-2020 impact evaluation was based on an advanced metering infrastructure (AMI) consumption data analysis using a matched control group made up of non-participants. One of the benefits of using a matched control group in this approach is that it yields net savings estimates, and eliminates the need to address factors such as freeridership and spillover that are typically accounted for in a net-to-gross (NTG) adjustment.

The 2019-2020 EE Education program generated significant energy savings among participating households, but did not show meaningful load demand reductions during the peak periods.

Table 1-1 presents the summarized findings of the 2019-2020 impact evaluation.

**Table 1-1: Ex Post Annual Energy and Peak Demand Savings Summary**

| | | 2019-2020 Per Houshold Savings | 2019-2020 Program Savings |
|---|---|---|---|
| DEC | | *Program Population = 20,852* | |
| | Energy Savings | 475 kWh | 9,905 MWh |
| | Summer Demand Impact | -0.081 kW | -1.689 MW |
| | Winter Demand Impact | 0.003 kW | 0.062 MW |
| DEP | | *Program Population = 5,348* | |
| | Energy Savings | 475 kWh | 2,540 MWh |
| | Summer Demand Impact | -0.081 kW | -0.433 MW |
| | Winter Demand Impact | 0.003 kW | 0.016 MW |

*Negative value denotes a load increase

### 1.2.2 Process Evaluation

The process evaluation assessed opportunities for improving the program's design and delivery in DEC and DEP's service territories. It specifically documented teacher, student, and parent experiences by investigating: 1) teachers' assessments of the NTC performance, quality of curriculum materials, and the kit request form distribution procedure; and 2) student families' responses to the energy efficiency kits and the extent to which the kits effectively motivate families to save energy.

The evaluation team reviewed program documents and web surveys with student families that received a kit (*DEC n*= 300, *DEP n*= 215) and teachers who attended the performance (*DEC n*= 34, *DEP n* = 21). The team also conducted in-depth interviews with utility staff, NTC staff, and eight teachers who completed the web survey.

Overall, the DEC/DEP K12 Education Program performed effectively during the 2019-2020 school year. Key findings from the process evaluation include:

**Awareness:**

- Both teachers and parents were aware of Duke Energy's sponsorship of the K12 Education Program; 97% of teachers and 88% of parents in DEC, and 95% of teachers and 91% of parents in DEP indicated that they were aware of this fact.
- Teachers in DEC primarily learned about Duke Energy's sponsorship of the program through material provided by NTC about the program, NTC staff or Duke marketing materials. Similarly, teachers in DEP learned about the sponsorship of the program most often through Duke marketing materials and materials provided by the NTC.
- Most parents in both DEC and DEP reported that they learned of Duke's involvement in the program through informational material provided in the kit, followed by educational material provided by NTC and brought home from school by their child.

- Parents are largely unaware of the NTC performances and program related classroom activities with 25% of them in DEC and 18% of them in DEP reporting knowledge of these activities.
- Awareness of digital materials, performances, and the Kilowatt Krush app is inconsistent for teachers.
- Kilowatt Krush app usage by students is increasing, though still relatively low; elementary students are most likely to have used it.
- While 19 of 34 teachers in DEC reported that NTC staff or materials mentioned the Kilowatt Krush app, 7 reported that their students were using it. In DEP more teachers reported that their students were using it than not; 12 of 21 teachers stated that NTC staff or materials mentioned the app, and 9 teachers said that their students were using it.
- In DEC, 275 of 300 student families reported that either the student had not downloaded the Kilowatt Krush app, or that they were not sure if they had or not. In DEP, 194 of 215 families stated that their child had not downloaded the app or they were unsure.

**Program Experience and Satisfaction:**

- Teacher satisfaction with the performances and interactions with NTC staff was very high with 32 of 34 DEC teachers and 20 of 21 DEP teachers rating the performance a 4 or a 5, or "highly satisfied".
- Parents reported high levels of satisfaction with the measures provided in the efficiency kits. Measure satisfaction was highest amongst parents who installed LED bulbs; 81% of DEC and 91% of DEP respondents said that they were "highly satisfied" with the measure. Satisfaction measures were lowest with bathroom faucet aerators; 71% of parents in DEC and 74% of parents in DEP reported that they were "highly satisfied" with this measure.

**In-Service Rates:**

- An average of 3.2 measures from the kit were installed per household in DEC, and an average of 3.4 measures were installed in DEP. Nineteen respondents (6%) in DEC installed all of the items, and 42 respondents (14%) installed none of the items. In DEP, 21 respondents (10%) installed all items and 19 respondents (9%) installed none of the items.
- The lighting measures provided in the kit were installed more often than the water saving measures. When asked why they did not install water saving measures, respondents most frequently reported low water pressure or that the measures didn't fit or match their fixture. Concerns about lighting measures were minimal and limited to night lights, where most of the respondents who didn't install the measure reported that they did not need it.
- Large majorities of parents (79% and 81% in DEC and DEP) and children (DEC: 74%, DEP: 67%) changed their behaviors after receiving the kit or seeing the performance. The most commonly changed behavior was turning off lights when not

in the room and was shared amongst parents and children in both territories. Almost as many parents in DEC stated that they changed their thermostat settings as said turned lights off when leaving a room.

### 1.2.3 Conclusions and Recommendations

Based on evaluation findings, the evaluation team concluded the following and provides several recommendations for program improvement:

**Conclusion:** The use of AMI meter data as the primary input in the impact analysis was effective in reliably estimating savings attributable to the program.

> **Recommendation:** When proven to be feasible, continue to use an AMI-based consumption analysis approach in future EE Education program evaluations.

**Conclusion:** Teachers are highly satisfied with NTC performances and materials, although many teachers are unable to effectively utilize the materials within their curriculum due to timing issues. Some teachers additionally reported that they were unaware of the availability of online resources.

> **Recommendation:** Though the amount of online content has increased, it is important to prioritize making teachers aware of the availability of these online resources, including assuring these resources are prominently included in performances, instructional materials, and promotional materials. This may help address any problems stemming from the misalignment of these lessons. Additionally, ensuring that teachers are aware of any online content will be of particular importance in cases of remote learning, when traditional materials cannot be distributed as effectively.

**Conclusion:** A majority of parents who received energy efficiency kits installed at least one measure. Light bulbs and night lights were much more popular than water saving measures and were widely cited as items that respondents would like to receive more of. Parents primarily indicated that they would prefer to request additional kit items via the internet.

> **Recommendation:** Consider including additional lightbulbs in the efficiency kits, as they are relatively inexpensive and can enhance savings rates.

**Conclusion:** Large numbers of parents and students adopted energy saving behaviors as a result of tips and materials included in the kit.

> **Recommendation:** Expand behavioral guidance in both student and parent materials to maximize effects of the program. Parents in particular indicated that the primary reason for not finding energy saving tips useful was previous knowledge of those tips, suggesting that more advanced behavioral guidance (e.g. utilizing the scheduling feature of their thermostat to cool or heat the house in off peak periods) may be beneficial.

**Conclusion:** Teachers at smaller schools noted that reaching the 100 kit request threshold that qualifies for the $250 enrollment bonus is difficult. The program is also highly reliant on engaged teachers to drive performances and distribution of kits/student materials.

> **Recommendation:** Consider adjusting the award structure to encourage more teachers to become "champions" at unenrolled schools and drive more sign-ups. In addition, consider altering the incentive framework for schools that reach 100 kit requests and receive the $250 enrollment bonus to a proportion-based system, using quantity of received kit requests and student enrollment. This will make it easier for smaller schools to receive the enrollment bonus, and thus be more likely to be motivated to join and remain in the program. It is the evaluator's understanding that an adjustment to the incentive structure was implemented for the 2021-2022 School Year that rewards teachers with $50 that reach 20 kit requests.

**Conclusion:** It is not clear how many teachers are attending performances, which makes estimating population parameters of evaluation and tracking data for this group difficult.

> **Recommendation:** Evaluate data gathering and tracking protocols to ensure that accurate teacher and student attendance is gathered at each school. This might include teacher sign-in sheets.

# 2 Introduction and Program Description

## 2.1 Program Description

### 2.1.1 Overview

The K12 Education Program is an energy efficiency program sponsored by Duke Energy Carolinas and Duke Energy Progress (DEC/DEP). The program provides free in-school performances by the National Theatre for Children (NTC) that teach elementary, middle, and high school students about energy and conservation concepts in a humorous and engaging format.

In addition to the NTC performance, NTC provides teachers with: 1) student workbooks that reinforce topics taught in the NTC performance, including a take-home form that students and parents can complete to receive an energy efficiency starter kit from Duke Energy; and 2) lesson plans associated with the content in the student workbooks. All workbooks, assignments and activities meet state curriculum requirements. The NTC performers encourage students to have their parents request the kits.

The program can achieve energy savings in two ways:

1. Through the installation of specific energy efficiency measures provided in the kit.

2. By increasing students' and their families' awareness about energy conservation and engaging them to change behaviors to reduce energy consumption.

### 2.1.2 Energy Efficiency Kit Measures

Table 2-1 lists the kit's contents included in the impact evaluation scope.

**Table 2-1: Kit Measures**

| Measures | Details |
|---|---|
| 9 Watt LED* | 2 bulbs |
| Nightlight | 1 LED plug-in nightlight |
| Showerhead | 1 low-flow showerhead |
| Bathroom Faucet Aerator | 1 low-flow faucet aerator |
| Kitchen Faucet Aerator | 1 low-flow kitchen aerator |
| Water Temperature Gauge Card | 1 temperature card indicating water heater temperature |
| Outlet Insulating Gaskets | 8 outlet and 4 light switch gaskets |
| Behavioral Changes | Informational materials provided in the kit offer energy savings opportunities by changing patterns of energy consumption |

*In January 2020 the program transitioned from offering two 9W LEDs to two 5W LEDs.

# 2.2 Program Implementation

## 2.2.1 Program Marketing and School Recruitment

Duke Energy sends NTC a list of approved schools in each utility territory, which NTC's communications staff uses to contact schools to schedule NTC performances. These communications include phone calls, emails, and postcards describing the program. An example of one of these postcards distributed to elementary school students can be seen in Figure 2-1. Once a school has agreed to participate, NTC ships curriculum materials to participating schools approximately two weeks prior to the performance date, at the request of the teacher. These teachers are often the contact at the school who organizes the involvement of other teachers.

**Figure 2-1: NTC Recruitment Postcard for Elementary Students (K-5)**


## 2.2.2 NTC Performance

NTC has four age-appropriate shows: two for elementary age students (Kindergarten through 2$^{nd}$ grade, and 3$^{rd}$ through 5$^{th}$ grade), one for middle school age students (6th through 8th grade), and one for high school students (9$^{th}$ through 12$^{th}$ grade). Two actors perform in each show, where they use an entertaining, humorous, and interactive format to educate students on four general areas:

- Sources of energy
- How energy is used
- How energy is wasted
- Energy efficiency and conservation

Performers also discuss how DEC and DEP offers students and their families free energy efficiency starter kits, how the items in the kit can save energy in their homes, and will hand out collateral to remind students of these tips, and ways to sign up for the kit.

Due to the emergence of the COVID-19 pandemic, NTC ceased live performances in mid-March, 2020. After about a month of subsequent preparation, NTC was able to provide elementary schools access to an educational video that included topics covered in the live performance. Due to this, the program was not able to meet pre-established kit sign-up goals.

In the performance, the actors explain to students that they must fill out the kit request form to receive their kit. Following the performance, teachers give their students the NTC workbooks that – in addition to educational activities to reinforce the concepts from the NTC performance – include a detachable postage-prepaid postcard kit request form. Students take the form home to their parents or guardians, who complete and mail the form. Parents or guardians may also request a kit via a toll-free telephone number or by signing up at MyEnergyKit.org, the program website administered by Relationship1, with content provided by NTC. The latter mode of sign up was the most popular in 2019-2020. To encourage participation, for every 100 parents to sign up, their childrens' school receives $250, and the six schools whose student's families' request the most kits each semester earn prizes ranging from $1,000-$2,500. In addition, student families who request a kit are entered into a drawing for a $1,000 cash prize.

### 2.2.3 Kit Distribution

Duke Energy uses two vendors to fulfill kit requests: R1 and AM Conservation. The participant's eligibility is confirmed by the firm R1 who manages and processes kit requests (both paper and online), removes non-Duke customers from the eligibility list, and sends this to Duke Energy, who also cleans this data and verifies the participant's eligibility and contact information. Once this is complete, the cleaned participation list is sent back to R1, as well as AM Conservation. A fulfillment request is then sent to AM Conservation who has 9 business days to ship the kits. Customers are told to expect 4-6 weeks for delivery of their energy kit, though this will generally happen much more quickly.

### 2.2.4 Energy Kit Eligibility

Student families can only receive a kit once every 36 months, and must be Duke Energy customers. The schools where the performances occur must also be a Duke Energy customer. These eligibility requirements present challenges in finding and motivating new schools, as well as new student families, to participate.

### 2.2.5 Participation

For the defined evaluation period of August 2019 through July 2020, the program recorded a total of 26,200 kit recipients. Customers in DEC accounted for 20,852 of the total, and the remaining 5,348 kit recipients were in DEP.

### 2.2.6 Program Changes

In January of 2020, the program changed out the general service LEDs that had historically been part of the kit, to candelabra-style LEDs, due to internal research indicating the former were too close to nearing saturation to legitimize their inclusion.

Duke Energy designed and launched a smart phone app called "Kilowatt Krush" in 2018. This app is geared toward students, and was designed to increase kit signups by 4%, and increase engagement and energy saving behaviors. Due to unanticipated data privacy issues, kit signups via Kilowatt Krush were not available in PY 2018-2019. However, this issue was resolved in 2019-2020, and student families were able to sign up with the app, as the verification codes were sent to the parents' emails so the student or family member could complete the signup process.

Lastly, starting in October 2018, high school performances piloted in other jurisdictions were added to the DEC/DEP program.

## 2.3 Key Research Objectives

The over-arching project goals will follow the definition of impact evaluation established in the "Model Energy-Efficiency Program Impact Evaluation Guide – A Resource of the National Action Plan for Energy Efficiency," November 2007:

> "Evaluation is the process of determining and documenting the results, benefits, and lessons learned from an energy-efficiency program. Evaluation results can be used in planning future programs and determining the value and potential of a portfolio of energy-efficiency programs in an integrated resource planning process. It can also be used in retrospectively determining the performance (and resulting payments, incentives, or penalties) of contractors and administrators responsible for implementing efficiency programs."

Evaluation has two key objectives:

1) To document and measure the effects of a program and determine whether it met its goals with respect to being a reliable energy resource.
2) To help understand why those effects occurred and identify ways to improve the program.

### 2.3.1 Impact

As part of evaluation planning, the evaluation team outlined the following activities to assess the impacts of the DEC/DEP K12 Education Program:

- Quantify accurate and supportable energy (kWh) and demand (kW) savings for energy efficient measures implemented in participants' homes;

- If necessary, assess the rate of free riders from the participants' perspective and determine spillover effects;
- Benchmark verified measure-level energy impacts to applicable technical reference manual(s) and similar Duke programs in other jurisdictions.

### 2.3.2 Process

The process evaluation assessed opportunities for improving the design and delivery of the program in DEC/DEP service territory. It specifically documented teacher, student, and parent experiences by investigating: 1) teachers' assessments of the NTC performance, program materials, and curriculum in terms of quality of content, and ability to engage and motivate students to save energy; and 2) student families' responses to the energy efficiency kits and the extent to which the kits effectively motivate families to save energy.

The evaluation team assessed several elements of the program delivery and customer experience, including:

- **Awareness:**
  - How aware are teachers and student families of DEC/DEP's sponsorship of the program?
  - How did they become aware?
- **Program experience and satisfaction:**
  - How satisfied are teachers with the NTC performance and program curriculum in terms of ease of use, ability to engage, and motivate students to conserve energy at home?
  - How satisfied are student families with the measures in the kit and to what extent do the kits motivate families to save energy?
- **Challenges and opportunities for improvement:**
  - Are there any inefficiencies or challenges associated with program delivery?
  - How engaged are teachers in implementing the curriculum and motivating student families to request program kits?
  - What are teachers' assessments of the NTC performance, program information, and curriculum?
- **Student family characteristics:**
  - What are the demographic characteristics of kit recipients?

## 2.4 Evaluation Overview

The evaluation team divided its approach into key tasks to meet the outlined goals:

- **Task 1 –** Develop and manage an evaluation work plan to describe the processes that were followed to complete the evaluation tasks outlined in this report;

- **Task 2 –** Verify gross and net energy and peak demand savings resulting from the K12 Education Program through verification activities of a sample of 2019 - 2020 program participants;
- **Task 3 –** Conduct a process review to determine how successfully the program is being delivered to participants and to identify opportunities for improvement.

### 2.4.1 Impact Evaluation

The impact evaluation utilized a consumption data-based approach using AMI meter data. This methodology differs from the approach used in the previous evaluation, which calculated program savings based on engineering algorithms. While a consumption analysis was attempted as part of the previous evaluation, the evaluation team ultimately determined that it was not feasible at the time. At the time of the previous evaluation, AMI meters had not been fully deployed in DEC and DEP territories and only monthly billed consumption data was available for analysis. Since then, Duke Energy has deployed AMI meters to virtually all of its residential customers in the DEC and DEP territories, which offer more comprehensive usage data. With AMI data now accessible, a consumption analysis offers enhanced analytical capabilities to estimate household-level energy and demand savings.

A consumption analysis allows for accurate measurement of household (or equipment-level) electric usage before and after a program intervention is introduced. Unlike an engineering algorithm, consumption analysis is able to capture behavioral effects of the program, in addition to the effects of the equipment measures installed.

The impact evaluation involved the following steps:

1) Conduct a series of false experiments to test the feasibility of directly estimating energy savings using customers' AMI consumption data.
2) Having verified that consumption analysis is effective, apply a difference-in-differences regression modeling approach to estimate average household-level energy savings at the annual and monthly intervals.
3) Utilizing hourly load data, apply a similar regression modeling approach to estimate summer and winter peak demand impacts.

### 2.4.2 Process Evaluation

The process evaluation examined and documented:

- Program operations
- Stakeholder satisfaction
- Opportunities to improve the efficiency and effectiveness of program delivery

To satisfy the EM&V objectives for this research effort, the evaluation team reviewed program documents and conducted web surveys with participating student families and teachers who attended the performance. These surveys served both the process and impact evaluation work.

The team also held in-depth interviews (IDI) with utility staff, implementation staff, and teachers. Table 2-2 provides a summary of the evaluation team activities.

**Table 2-2: Summary of Process Evaluation Activities**

| Target Group | Method | Sample Size | Population | Confidence / Precision |
|---|---|---|---|---|
| Duke Energy program staff | Phone in-depth interview | 1 | n/a | n/a |
| Implementation staff: NTC | Phone in-depth interview | 1 | n/a | n/a |
| Implementation staff: R1 | Phone in-depth interview | 1 | n/a | n/a |
| Teachers who attended NTC performance | Web survey | 72 (DEC:43, DEP: 29) | unknown | 90% ± 9.7% |
| Participating teacher follow-up interviews | Phone in-depth interview | 8 | unknown | n/a |
| Student families who received DEC/DEP kit and are customers of DEC/DEP | Web survey | 515 (DEC: 300, DEP: 215) | 25,982 | 90% ± 3.6% |

# 3 Impact Evaluation

## 3.1 Background

Prior to 2020, impact evaluation was based on an engineering approach, where estimated energy and demand savings were derived using a combination of customer survey responses and measure-specific assumptions that were applied to savings algorithms found in region-specific technical reference manuals.

Energy and demand savings are ideally estimated using empirical household consumption data. A consumption analysis allows for accurate measurement of household (or equipment-level) electric usage before and after a program intervention is introduced. Unlike an engineering algorithm, consumption analysis is able to capture behavioral effects of the program, in addition to the impacts of equipment measures installed.

The 2017-2018 impact evaluation of Duke's Energy Efficiency Education Program attempted a consumption analysis based on customers' monthly billing data. However, due to a range of factors, billing analysis was found to be an ineffective tool for estimating savings. One of the primary contributing factors was the inability of monthly data to detect small program savings of 2% to 3%. As a result, the 2017-2018 analysis applied an engineering approach to calculate estimated savings.

As of mid-2019, Duke Energy had fully deployed advanced meters to virtually all of its residential customers in the DEC territory, as well as to a portion of its customers in the DEP territory. AMI data offer more granular information about customers' electric usage at daily or hourly intervals and enables enhanced analysis methodologies beyond the capability of monthly billed usage data. Specifically, the more robust datasets granted by AMI data result in more precise savings estimates and enables the analysis to better detect small effect sizes. In addition, having hourly AMI load data allows for the estimation of load reduction during the system's summer and winter peak periods.

## 3.2 Methodology

The 2019-2020 impact evaluation was based on a consumption analysis using AMI consumption data. This approach differs from the engineering approach used in 2017-2018 in a few key aspects:

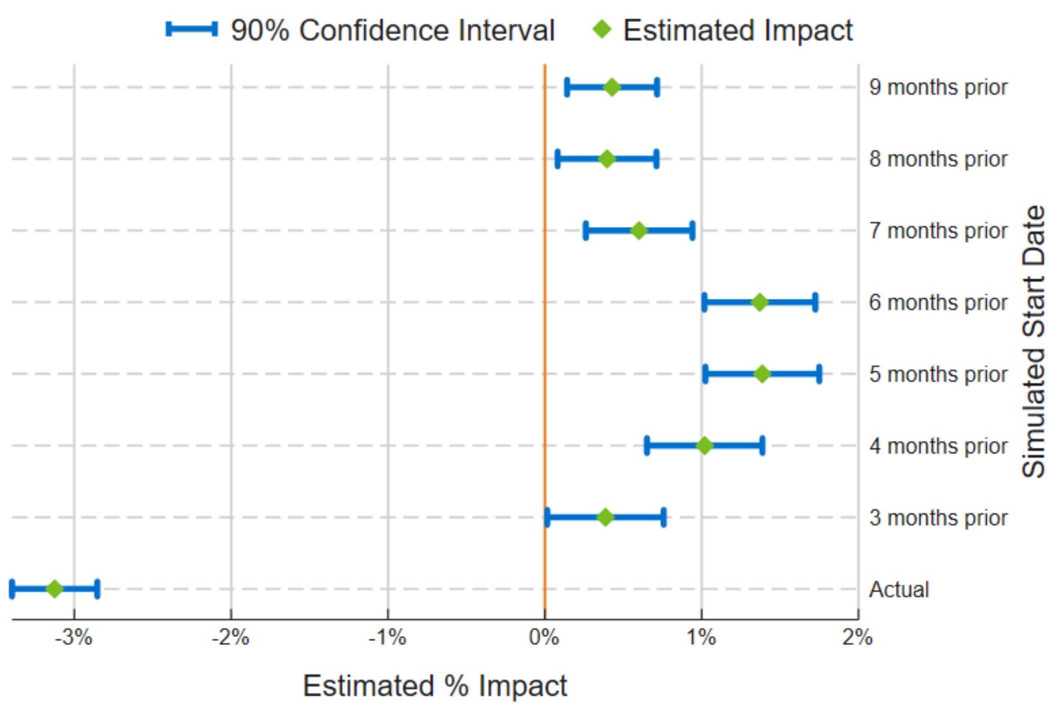
1) As mentioned previously, consumption analysis accounts for the behavioral component of the program by capturing program effects at the whole-house level, rather than at the equipment level. The savings estimates are comprehensive and comprise both the behavioral effects stemming from the educational component of the program, as well as savings derived from the kit equipment.

2) Consumption analysis is unable to disaggregate savings to the measure-level.
3) The savings estimates are not subject to assumptions gathered from a sample of customer surveys and/or taken from secondary sources such as TRMs.

The first step of the impact analysis was to verify the feasibility of an AMI-based consumption analysis approach for estimating energy savings. This involved conducting a series of false experiments where fake enrollment dates were simulated for program participants, and savings were estimated for fake post-treatment periods. The premise of these false experiments is that, because enrollment dates are fictitious and actual post-enrollment data are excluded, the savings are known to be zero.

The results of the false experiments, shown in Figure 3-1, provide assurance that the estimation approach is effective in detecting program effects. Specifically, when customers' enrollment start dates are simulated and fake treatment periods are used, the model correctly estimates near-zero savings when none are expected.

**Figure 3-1: Results of False Experiments**




We know that the true effects resulting from the false experiments are zero. However, the model estimates slight changes in the range of 0.5% to 1.5%, as indicated by the green markers to the right of the orange line in Figure 3-1. These changes, which we know are not program-related, are presumed to be due to natural increases in consumption over time among participating households that are not netted out by the matched control group. This concept is discussed in further detail in Section 3.6.

Having demonstrated that the consumption analysis modeling approach is effective via the false experiments, the next step of the impact evaluation was to apply the same modeling technique to the actual data in order to estimate annual savings attributable to the program. The model specification used to estimate energy savings is shown below.

**Equation 3-1: Energy Savings Model Specification**

$$kWh = \beta_0 + \beta_1(month) + \beta_2(partpost) + \varepsilon$$

The key output of the model is $\beta_2$, the coefficient on the *partpost* term. This coefficient represents the estimated change in average daily consumption among EE Education participants in the post-enrollment period. Because the modeling approach applies a difference-in-differences methodology, the estimated savings are considered net savings since any changes not related to the program are accounted for by the matched control group.

In addition to estimating annual energy savings, Nexant also assessed savings at the monthly level in order to determine any trends in savings achieved over time. This is often particularly helpful for gauging the savings from equipment measures that are expected to be seasonal or weather-dependent. The model specification used to estimate monthly savings is shown in Equation 3-2.

**Equation 3-2: Monthly Energy Savings Model Specification**

$$kWh = \beta_0 + \beta_1(moyr) + \beta_2(partpost) + \beta_3(moyr \times partpost) + \varepsilon$$

The monthly model specification includes an independent variable for month-year and interacts it with the *partpost* variable. The individual coefficients determined for each of those interactions, expressed by $\beta_3$ *in Equation 3-2,* represent the estimated change in average daily consumption in each month of the post period.

The final step of the impact evaluation was to estimate hourly load impacts during the summer and winter peak periods. This was done by applying a similar difference-in-differences regression modeling approach that was used to estimate energy savings, and based on the same set of customers making up the treatment and control groups. The model specification used to estimate hourly peak load impacts is shown below.

**Equation 3-3: Peak Load Demand Impacts Model Specification**

$$kW = \beta_0 + \beta_1(post) + \beta_2(partpost) + \varepsilon$$

The demand model controls for unobserved changes in usage over time through the addition of the *post* term. Similar to the energy model, the key output of the model is $\beta_2$, the coefficient on the *partpost* term, which represents the estimated change in hourly load among program participants.

## 3.3 Data Requirements

The impact evaluation utilized five primary data components.

### 3.3.1 Program Participation

An extract of 2019-2020 EE Education program participants was provided by Duke Energy. The dataset included key customer information and household characteristics, including unique account identifier, jurisdiction (DEC vs. DEP), premise type, heating type, school assignment, and enrollment date (i.e., date kit was sent).

### 3.3.2 Cross-Program Participation

In addition to EE Education program participation, Duke Energy provided records of customers' participation in other energy efficiency programs offered by Duke Energy during or prior to the 2019-2020 program year. This is important for isolating savings that are directly attributable to the EE Education program, and not due to efficiency measures introduced as part of other programs.

### 3.3.3 Participating Schools

In addition to a record of participating households, Duke Energy provided a list of schools that participated in the EE Education program during the 2019-2020 school year. The dataset included school identifers (i.e., account number, name, identification number), school characteristics (e.g., public vs. private, grades, number of students, etc), and performance date.

### 3.3.4 Consumption Data

The primary data input used in the impact analysis is customers' AMI data at either daily or hourly intervals. Data were obtained both for the population of EE Education program participants and for a matched control group made up of MyHER customers. Daily data were applied for the annual energy (kWh) savings analysis while the peak demand impact analysis utilized hourly load data. The data covered the date range from January 2018 through January 2021.

### 3.3.5 MyHER Customer Data

Nexant used existing customers from Duke Energy's MyHER program to populate the matched control group. The primary reason for using MyHER participants for the control group is the prevalence of the MyHER program among Duke Energy's residential customer population. Normally, the analysis would be restricted to customers who participated in EE Education and no other programs, in order to properly isolate the program's effects. However, because so many EE Education program participants also participate in MyHER, the integrity of the analysis would have been compromised had MyHER customers been excluded. Using MyHER accounts as control customers, and performing the group matching appropriately, assures a net savings result that is directly attributable to participating in the EE Education program.

## 3.4 Data Cleaning and Validation

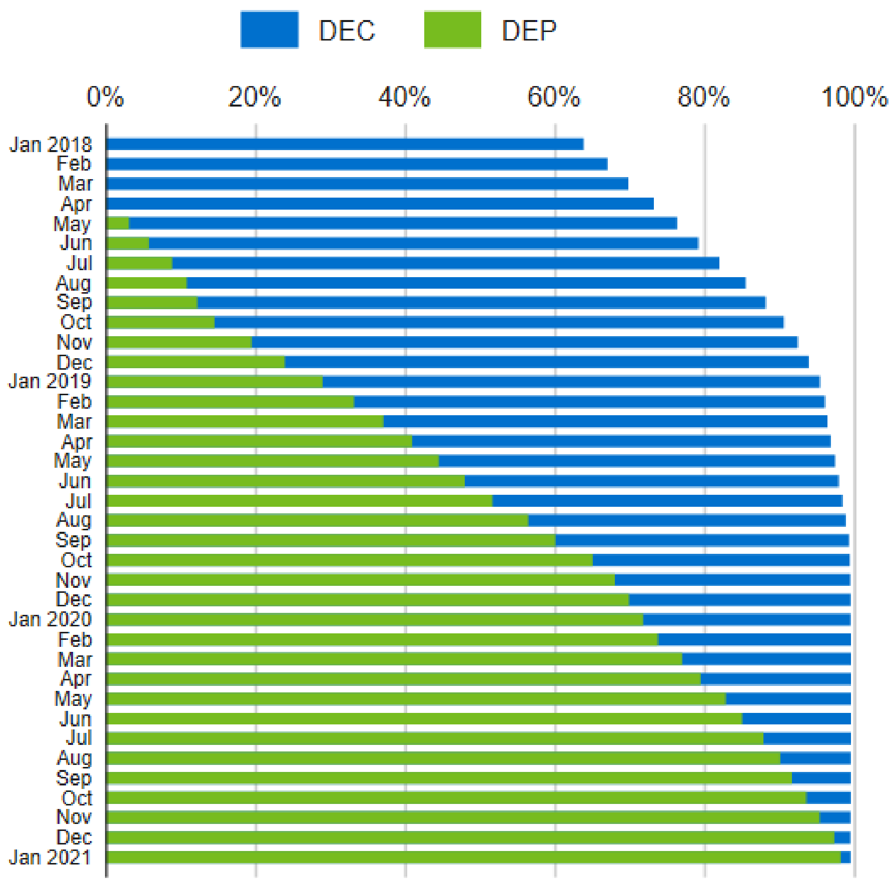
After all raw data sources were compiled and organized, steps were taken to ensure that the refined datasets used in the analysis excluded any spurious, duplicate, and/or unneeded data. The evaluation team applied a rigorous data cleaning process that involved initial, detailed assessments of each data file, followed by a system of checks and filters designed to detect and eliminate any observations not integral to the analysis.

- **Cross-program participants.** The evaluation team removed approximately 7,000 customers from the EE Education participant population who also participated in other Duke Energy efficiency program(s) during the period of consumption data used in the analysis (2018-2021). Removing these accounts ensures that any change in consumption found by the analysis is categorically attributable to the EE Education program, and not due to interventions introduced by other program(s).
- **Accounts with missing or insufficient consumption data.** Customers who did not have at least 12 consecutive months of consumption data prior to the program's enrollment period were removed from the analysis. These customers could not be used in the control group matching process, which was designed to require a complete year of pre-program data in order to establish a stable and representative baseline period.
- **Duplicates and outliers.** Any duplicated data observations were removed. In addition, the evaluation team identified and removed all negative and large outlier usage records. Outliers were defined as usage observations greater than three standard deviations above the mean value.
- **Control group cleaning.** A similar set of checks and filters was applied to the control group (MyHER) datasets.

## 3.5 Analysis Limitations

The impact evaluation faced a few limitations related to data availability and program design. First, while AMI meters had been deployed to a majority of households in the DEC territory by mid-2018, they were only partially deployed by that point in the DEP territory. Because the consumption analysis requires at least 12 months of pre-enrollment usage data, only households having valid AMI meter data as of August 2018 are able to be included in the analysis.

**Figure 3-2: Share of Program Participants with AMI Data, by Month**




By August 2018, roughly 85% of participating households in the DEC territory had active AMI meter data, while only 10% of households in DEP had active data. As a result, the set of customers available for analysis is heavily weighted with households from the DEC territory. The most affecting consequence of having such a lopsided analysis population is that savings estimates could not be determined for the DEC and DEP jurisdictions separately. Only 3% of the analyzed program participants came from the DEP jurisdiction, which is too few to produce valid, DEP-specific savings results. For this reason, the evaluation team applied the singular DEC-DEP combined savings results to both jurisdictions uniformly.

A second limitation of the evaluation has to do with forming a dependable baseline against which to measure post-enrollment consumption. Normally, one of the analysis methodologies tested would be an approach known as within-subjects. This approach involves a comparison of weather-normalized consumption prior to enrollment to consumption after enrollment for program participants only (i.e., no control group). In this case, the baseline is defined by the pre-enrollment consumption patterns among program particpants.

There are two specific aspects that compromise the baseline of a within-subjects analysis. First, the post-enrollment period for 2019-2020 program participants contains a substantial period of time affected by the COVID-19 pandemic. The effects of the pandemic have included significant and persistent changes to household occupancy and energy use patterns, particularly resulting from stay-at-home orders, telecommuting, and school closures. These external, non-weather circumstances were introduced during the evaluation period and present significant differences between the pre-enrollment and post-enrollment periods that influence household energy consumption. In other words, even absent the program, consumption still would have differed among participants due to the effects of COVID-19.

Second, households participating in the EE Education program are known to be families with school-aged children and are likely to experience inherent growth in energy usage over time. As family size, household occupancy, and ages of children grow, so does the household's energy needs. This again leads to a natural change in household consumption that is not related to the program.

## 3.6 Control Group Matching

The first step of the impact analysis is to develop a matched control group consisting of non-participating customers that resemble the participant population in pre-enrollment consumption patterns. To perform the match, each participant is paired with the non-participant whose pattern of electric usage during the 12 months prior to enrollment in the program is most similar. Comparing participants to matched non-participants helps to ensure there are no exogenous differences between the participants and matched control customers that would cause changes in consumption, other than the program's effects.

A difference-in-differences methodology that uses a matched control group has advantages over the within-subjects approach which is applied to program participants only. First, it establishes a reliable baseline for estimating savings attributable to the program. The non-participating customers serve as the baseline for a "no program" alternative. By assuring the control group's consumption is closely similar to that of the program's participants, we are able to assume that their usage in the post-enrollment period represents what would have happened absent the program. The estimated savings attributable to the program, therefore, is calculated as the average difference between the post-treatment consumption among participants and non-participants.

As described earlier, the control group was made up of existing MyHER customers due to the prevalence of the program in the DEC and DEP territories. The MyHER program, which is implemented as a randomized control trial (RCT) program, contains both treatment accounts (those who receive MyHER reports) and control accounts (those who do not receive reports). Furthermore, among the MyHER treatment customers, there are a total of 13 separate cohorts, each with a different release date that defines the time at which customers within that cohort started receiving MyHER reports. Meanwhile, the population of EE Education participants also includes a significant share of MyHER participants from among the 13 treatment cohorts, as well as a number of MyHER control customers and customers who have not participated in MyHER. In order to ensure a well-balanced match, where similarities between treatment and matched control groups are optimized, Nexant performed a segmented match using a number of key characteristics data points, including jurisdiction, premise type, and MyHER cohort.

Households participating in the EE Education program, who are also treatment customers in MyHER, were matched to similar households from among the MyHER control pool in the same cohort. Likewise, EE Education participants who did not participate in MyHER or were MyHER control customers were matched to non-participants from the MyHER control group. This system of targeted matching helps to maximize the homogeneity between groups in ways unobserved through household consumption data.

Groups were matched using monthly consumption data during the 12-month period prior to the start of program enrollment, or the period August 2018 through July 2019. An examination of the matching results indicates that treatment and control groups are highly similar in terms of household consumption during this period.

**Figure 3-3: Group Matching Results**

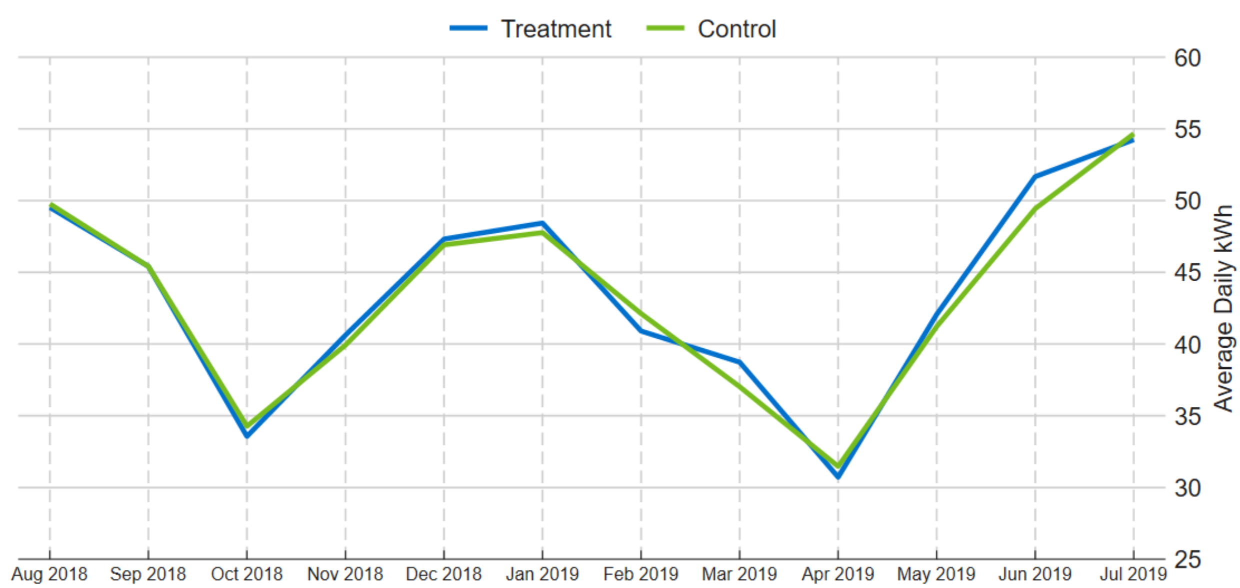



Figure 3-3 shows a strong correlation between groups in terms of pre period consumption patterns; however, three of the months (February, March, and June) show a small disparity between the groups' usage. These slight inconsistencies are not wholly unexpected given they are matched on monthly consumption values, which can fluctuate within the population.

## 3.7 Energy Savings Results

Energy savings estimates for the 2019-2020 EE Education program in the DEC and DEP territories are presented in Table 3-1. Results are presented as average daily kWh savings per household. Throughout this section, negative values refer to savings.

**Table 3-1: Average Daily Energy Savings Summary**

| Program | Base kWh | Impact (kWh) | Std. Err. | Lower Bound | Upper Bound | Percent Impact | % Lower Bound | % Upper Bound |
|---|---|---|---|---|---|---|---|---|
| EE Education | 41.65 | -1.30 | 0.07 | -1.42 | -1.12 | -3.13% | -3.40% | -2.85% |

The impact analysis shows that the program generates an average of 1.3 kWh per day per household. This translates to approximately 475 kWh annual savings, or 3.13%. These results are statistically significant at the 90% confidence level.

A monthly regression analysis reveals the trends in savings observed over the extended duration of the post period. The results indicate that program savings occur predominantly during the first six to seven months of the school year (August 2019 through February 2020). The timing of the savings generally coincides with program enrollments (defined by the kit sent dates), where a large portion of the program's participation, roughly 70% of enrollments, occurred during the first half of the school year.

Figure 3-4 presents the estimated monthly percent energy savings profile for the time period August 2019 through December 2020. The trend shown in Figure 3-4 suggests that program effects diminish over time, perhaps due to customer fatigue and/or lack of interest.

**Figure 3-4: Monthly Energy Savings Profile, %**

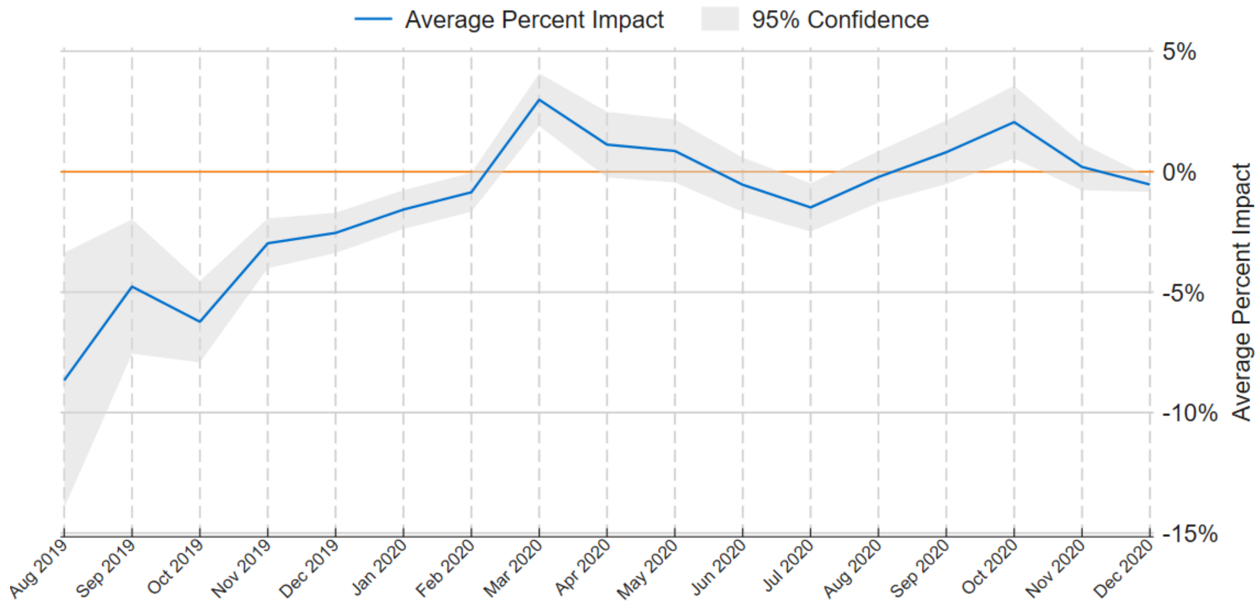



Table 3-2 shows kWh and percent savings by month for the period August 2019 through December 2020. The average percent savings over the first six months of the program year (August 2019 through January 2020) is 4.7%.

**Table 3-2: Monthly Energy Savings Results**

| Month | Impact (kWh) | Lower Bound | Upper Bound | % Impact | % Lower Bound | % Upper Bound |
|---|---|---|---|---|---|---|
| Aug 2019 | **-3.58** | -5.71 | -1.45 | **-8.9%** | -14.1% | -3.6% |
| Sep 2019 | **-2.13** | -3.33 | -0.94 | **-5.0%** | -7.7% | -2.2% |
| Oct 2019 | **-1.90** | -2.39 | -1.41 | **-6.6%** | -8.3% | -4.9% |
| Nov 2019 | **-1.22** | -1.62 | -0.82 | **-3.2%** | -4.3% | -2.2% |
| Dec 2019 | **-1.14** | -1.50 | -0.78 | **-2.7%** | -3.5% | -1.8% |
| Jan 2020 | **-0.72** | -1.07 | -0.37 | **-1.7%** | -2.5% | -0.9% |
| Feb 2020 | **-0.42** | -0.76 | -0.08 | **-1.0%** | -1.9% | -0.2% |
| Mar 2020 | **0.98** | 0.61 | 1.36 | **2.9%** | 1.8% | 4.0% |
| Apr 2020 | **0.31** | -0.12 | 0.73 | **1.0%** | -0.4% | 2.4% |
| May 2020 | **0.26** | -0.19 | 0.72 | **0.8%** | -0.5% | 2.1% |
| Jun 2020 | **-0.27** | -0.79 | 0.26 | **-0.6%** | -1.7% | 0.6% |
| Jul 2020 | **-0.85** | -1.42 | -0.28 | **-1.5%** | -2.5% | -0.5% |
| Aug 2020 | **-0.09** | -0.63 | 0.45 | **-0.2%** | -1.3% | 0.9% |
| Sep 2020 | **0.28** | -0.21 | 0.77 | **0.7%** | -0.6% | 2.1% |
| Oct 2020 | **0.58** | 0.14 | 1.02 | **2.0%** | 0.5% | 3.5% |
| Nov 2020 | **0.06** | -0.26 | 0.39 | **0.2%** | -0.8% | 1.2% |
| Dec 2020 | **-0.25** | -0.40 | -0.10 | **-0.5%** | -0.8% | -0.2% |

## 3.8 Demand Impacts Results

A key benefit of AMI meter deployment in the DEC and DEP territories is the availability of hourly load data for residential customers. Accessibility of hourly data enables the analysis to measure changes in load during specific periods of interest, such as when system demand is greatest. These times when system load is greatest, known as peak periods, occur at different times of day during the summer and winter seasons.

**Table 3-3: Peak Period Definitions**

| Season | Peak Period Definition |
|---|---|
| Summer | July Weekdays<br>4:00 PM to 5:00 PM |
| Winter | January Weekdays<br>7:00 AM to 8:00 AM |

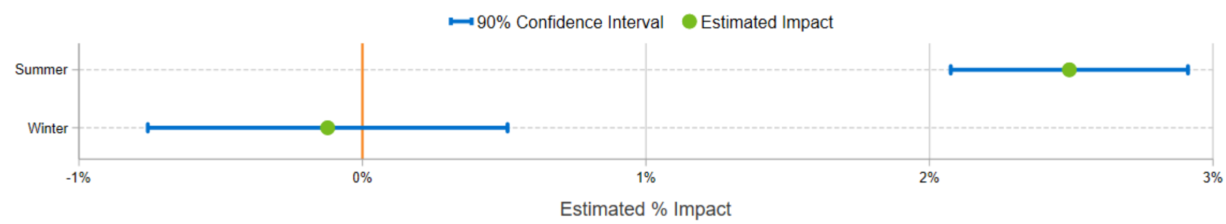
In DEC and DEP territories, summer peak occurs during the one-hour period from 4:00 PM to 5:00 PM on non-holiday weekdays in July. Winter peak occurs between 7:00 AM and 8:00 AM on non-holiday weekdays in January.To estimate the per household load reduction during these defined peak periods, Nexant applied a similar difference-in-differences regression modeling approach based on the same sets of customers used to make up the treatment and control groups for the energy savings analysis.

Results of the demand analysis are shown in Table 3-4 and Figure 3-5.

**Table 3-4: Estimated Peak Demand Impacts, by Season**

| Season | Base kW | Impact (kW) | Std. Err. | Lower Bound | Upper Bound | % Impact | % Lower Bound | % Upper Bound |
|---|---|---|---|---|---|---|---|---|
| Summer | 3.239 | 0.081 | 0.008 | 0.067 | 0.094 | 2.4% | 2.1% | 2.9% |
| Winter | 2.189 | -0.003 | 0.008 | -0.017 | -0.011 | -0.1% | -0.8% | 0.5% |

**Figure 3-5: Estimated Peak Demand Impacts, by Season**




The results show that the EE Education program does not generate notable load reductions during peak periods. The estimated change in load during the summer peak hour is an increase of 0.081 kW, or a 2.4% load growth. The estimated winter peak impact is a load decrease of 0.003 kW, or 0.1% load reduction.

The lack of significant peak load impacts, specifically during the summer season, can be explained by a few possible factors:

- The types of measures included in the efficiency kit are not measures that are typically associated with generating meaningful peak load reduction. Specifically, the water-related measures contained in the kits (low-flow showerheads, faucet aerators, temperature gauge) have very little effect on summertime peak loads.
- The Duke-defined peak periods occur at times when household load is predominantly space heating/cooling. Equipment measures contained in the kit are not designed to reduce space conditioning load.
- The summer peak period occurs in July, generally six to nine months after customers enroll in the program (i.e., view the performance, receive their kits, etc). By the time summer occurs, customer fatigue may have set in and participants may not be as motivated to conserve energy.
- Household loads are likely to be larger during summer months, when children are home from school and energy needs are greater.

## 3.9 Summary & Key Findings

The 2019-2020 EE Education program generated significant energy savings among participating households, but did not show meaningful load demand reductions during the peak periods. The gains in energy savings shown compared to the previous evaluation were enough to offset the reduced program participation levels in DEC; however, the aggregate program-level savings dropped in DEP due to the decline in participation in 2019-2020.

### 3.9.1 Summary of Program Savings

The total estimated savings generated by the EE Education Program for the 2019-2020 program year is 9,905 MWh for the DEC jurisdiction and 2,540 MWh for the DEP jurisdiction. The aggregate, program-level load change during summer peak demand period is an increase of 1.69 MW in DEC and 0.43 MW in DEP. The program's winter peak demand impact is a decrease of 0.06 MW in DEP and 0.02 MW in DEP.

**Table 3-5: Summary of Program Savings, 2017-2018 vs. 2019-2020**

| | | 2017-2018 Engineering Analysis | 2017-2018 Program Savings | 2019-2020 AMI Data Analysis | 2019-2020 Program Savings |
|---|---|---|---|---|---|
| DEC | | *Program Population = 23,161* | | *Program Population = 20,852* | |
| | Energy Savings | 254 kWh | 5,884 MWh | 475 kWh | 9,905 MWh |
| | Summer Demand Impact | 0.031 kW | 0.723 MW | -0.081 kW | -1.689 MW |
| | Winter Demand Impact | 0.045 kW | 1.036 MW | 0.003 kW | 0.062 MW |
| DEP | | *Program Population = 9,025* | | *Program Population = 5,348* | |
| | Energy Savings | 317 kWh | 2,866 MWh | 475 kWh | 2,540 MWh |
| | Summer Demand Impact | 0.038 kW | 0.343 MW | -0.081 kW | -0.433 MW |
| | Winter Demand Impact | 0.059 kW | 0.534 MW | 0.003 kW | 0.016 MW |

Table 3-5 provides a summary comparison of the current 2019-2020 AMI-based impact evaluation results to the previous 2017-2018 engineering analysis results. In both jurisdictions, the annual per household energy savings increased significantly from the previous findings. These differences are judged to be primarily due to the differences in the methodologies used to produce them. Specifically, the prior estimates relied on a set of assumptions needed to estimate savings via an engineering approach, while the current estimates utilized empirical measurements. Whereas an engineering approach relies on algorithm input variables that may be estimated or assumed based on secondary sources, an AMI data analysis approach is able to take advantage of requiring only measured and/or observed data. Because there was insufficient AMI data available for the DEP jurisdiction, results of the energy and demand consumption analyses are applied uniformly across both DEC and DEP.

### 3.9.2 Key Findings

Key findings from the impact evaluation include:

- The program produced significant energy savings. Annual per household energy savings increased by 87% and 50% in the DEC and DEP jurisdictions, respectively, from the 2017-2018 savings estimates.
- The program did not generate any meaningful load demand reductions during summer or winter peak periods.
- The lack of demand impacts may be due to a combination of factors, including the type of measures included in the kit and the timing of observed summer peak periods relative to the start of the program year.

# 4 Net-to-Gross Methodology and Results

The impacts of the K12 Education Program on energy consumption and demand were measured by comparing the energy consumption and demand of customers who received the kits with that of customers who did not (the matched control group). Naturally occurring energy consumption or demand changes that happen during the period of study are reflected in the energy consumption and demand observed for the control group. The impact of the K12 Education Program is measured as the difference in differences between the treatment and control groups before, during, and after exposure to the program. This difference is net of any naturally occurring changes, so there is no need to perform a net-to-gross adjustment.

# 5 Process Evaluation

## 5.1 Summary of Data Collection Activities

The process evaluation is based on telephone interviews with Duke Energy program staff, and implementer staff, and teachers who had attended an NTC performance. The process evaluation is also based on web surveys with teachers who had attended an NTC performance and student families who received a kit during the program evaluation year (Table 5-1).

**Table 5-1: Summary of Process Evaluation Data Collection Activities**

| Target Group | Method | Sample Size | Population | Confidence / Precision |
|---|---|---|---|---|
| Duke Energy program staff | Phone in-depth interview | 1 | n/a | n/a |
| Implementation staff: NTC | Phone in-depth interview | 1 | n/a | n/a |
| Implementation staff: R1 | Phone in-depth interview | 1 | n/a | n/a |
| Teachers who attended NTC performance | Web survey | 72 (DEC:43, DEP: 29) | unknown | 90% ± 9.7% |
| Participating teacher follow-up interviews | Phone in-depth interview | 8 | unknown | n/a |
| Student families who received efficiency kit and are customers of DEC or DEP | Web survey | 515 (DEC: 300, DEP: 215) | 25,982 | 90% ± 3.6% |

### 5.1.1 Teacher Surveys and Follow-Up Interviews

The evaluation team surveyed and interviewed teachers who attended NTC performances to better understand program success and delivery and to gather an educator perspective on what could be improved.

In April and May 2021, the evaluation team contacted a total of 752 teachers who attended NTC performances via email (547 in DEC and 205 in DEP) and ultimately surveyed 55 teachers who saw performances between September 10, 2020 and April 30, 2021. Thirty-four of the 55 teacher respondents taught at schools within DEC's service territory; 11 were elementary school teachers, 14 taught middle school and 9 taught high school. The remaining 21 respondents within DEP's territory were comprised of 6 elementary and 14 middle school teachers, and one high school teacher. We report grade level findings together unless a meaningful difference emerged between school types. Response rates are reported in Table 5-2.

In June 2021 the evaluation team contacted teachers who completed the web survey and indicated interest in being interviewed about their experience. The evaluation team requested their participation in a follow-up in-depth interview (IDI) about their experience with the performance, curriculum materials, and kit request forms. These IDIs allowed the evaluation team to get a deeper understanding of topics uncovered in the web survey and to provide additional details about the teacher's experience with the program. The evaluation team completed interviews with eight of these teachers.

**Table 5-2: Survey Response Rates**

| Survey Group | Population Size | Sample Frame Size | Completed Surveys | Completion Rate | Confidence/ Precision |
|---|---|---|---|---|---|
| Teachers | Unknown | 752 | 55 | 7.3% | n/a |
| Student Parents | 25,982 | 11,517 | 515 | 4.5% | 90/4 |

### 5.1.2 Survey of Student Families Who Received the DEC/DEP Kit

In April and May 2021 the evaluation team surveyed 515 families who received energy efficiency kits from DEC or DEP between August 2019 and July 2020 (Table 5-2). During that period, DEC and DEP distributed a total of 26,200 kits to families who completed the kit request form their child brought home from school. Through email survey invitations, the evaluation team attempted to contact a random sample of 11,534 households for which program records provided an email address. Ultimately, the data collection effort achieved an 8.8% response rate and a 4.5% completion rate, providing a sample with 90/4 confidence/precision. Comparisons with census data demonstrate that the sample is largely representative of ownership status for the region, with rates in both DEC (70%) and DEP (72%) falling slightly above the regional average of 68%. However, respondents in both DEP and DEC noted higher educational attainment and larger-sized households than typical of the region. Income levels were slightly higher in DEC than what is typical of the region, and slightly lower in DEP.[1]

## 5.2 Process Evaluation Findings

### 5.2.1 Awareness of DEC/DEP Sponsorship of the Program

Teachers and student families were largely aware of Duke Energy's sponsorship of the program. Almost all teachers in both DEC and DEP reported they were aware of Duke Energy's sponsorship (DEC = 97%, DEP = 95%). The 33 teachers who knew of DEC's sponsorship most often learned about it through NTC materials (13), NTC staff (12) or DEC marketing materials (12); Table 5-3 provides a full breakdown of teacher awareness.  DEP teachers also stated DEP marketing materials (7 of 20 teachers) and NTC materials (7 of 20 teachers) were the most common way of learning about Duke Energy's sponsorship.

[1] Region comparisons come from and average of 2019 American Community Survey (Census) 1-year period estimates data for North Carolina and South Carolina.

**Table 5-3: How Teachers Learned of Duke Energy's Sponsorship (Multiple Responses Allowed; DEC n = 33, DEP n = 20)**

| Source | Number of Teachers | |
|---|---|---|
| | DEC | DEP |
| The National Theatre for Children Materials | 13 | 7 |
| Duke Energy Marketing Materials | 12 | 7 |
| The National Theatre for Children Staff | 12 | 4 |
| Another teacher | 5 | 1 |
| Other | 4 | 4 |
| Duke Energy Staff | 1 | 0 |
| Don't Know | 1 | 0 |

Awareness of Duke Energy sponsorship among student families was also high, with 88% of DEC parents and 91% of DEP parents stating they knew the kit was sponsored by Duke Energy. Parents indicated they learned about Duke's sponsorship most frequently via information included in or on the kit (DEC: 53%, DEP: 53%). Other common ways that families learned about Duke Energy sponsorship were classroom materials their child brought home (DEC: 51%, DEP: 47%), and communications from their child's teacher or school (DEC: 25%, DEP: 28%).

About one-quarter (26%) of DEC and just under one in five (18%) of DEP student family respondents said they knew about the energy-related classroom activities and NTC performance at their child's school. A majority of the DEC parents who were aware of the performance (60%) said they found out about the NTC activities from their child; a similar proportion (56%) of DEP parents also found out through their child. Of the remaining parents, most stated that they found out about NTC activities from a teacher or school administrator (DEC: 28%, DEP: 33%) or on Duke Energy's website (DEC: 8%, DEP: 8%).

### 5.2.2 Parent Awareness of DEC/DEP Kit Opportunity

Classroom materials sent home with students were the key source of awareness of kits for families, with about half of student families in both DEC (49%) and DEP (47%) hearing about the opportunity to receive a Duke Energy kit via this medium. Other respondents learned about the kits through various communications from the school (Table 5-4).

**Table 5-4: Sources of Parental Awareness of Kits (Multiple Responses Allowed; DEC n = 300, DEP n = 215)**

| Source of Kit Awareness | Rate (Percent) | |
|---|---|---|
| | DEC | DEP |
| Classroom materials | 49% | 48% |
| Email from teacher/school | 16% | 14% |
| School newsletter | 11% | 10% |

| Source of Kit Awareness | Rate (Percent) | |
|---|---|---|
| | DEC | DEP |
| School website or web portal | 8% | 10% |
| Other | 5% | 8% |
| Poster at school | 1% | 1% |
| Conversations with teacher | 1% | 1% |
| After hour event at school | 1% | 1% |
| Don't know | 7% | 8% |

### 5.2.3 Teacher Experience with the Program

***NTC Performance***

Overall, teachers were largely satisfied with the performance, with 32 of 34 DEC teachers and 20 of 21 DEP teachers surveyed rating their satisfaction as a "4" or "5" on a one-to-five scale. Notably, 71% of DEC teachers and 68% of DEP teachers rated the performance as a "5". When asked about the content of the performances, the response from the majority of teachers was also positive. Interviewed teachers all noted the skill with which the performers engaged the students, by asking them to participate, and generally making the material humorous and accessible to students.

In addition, a large majority of the surveyed teachers (DEC: 82%, DEP: 86%) said the explanation of energy-related concepts was "about right" for most of their students. The remaining teachers in DEC (6) and DEP (3) all stated that the content was slightly too basic for their students. Two of the six DEC teachers and all three remaining teachers in DEP taught middle school. Of the final three DEC teachers, two taught high school and one taught elementary school. Teachers who thought the concepts were too basic for their students commented that the material seemed to be more geared towards younger audiences, and that the middle and high school students weren't as engaged.

Figure 5-1: DEC Age-Appropriateness of NTC Performance (n = 34)

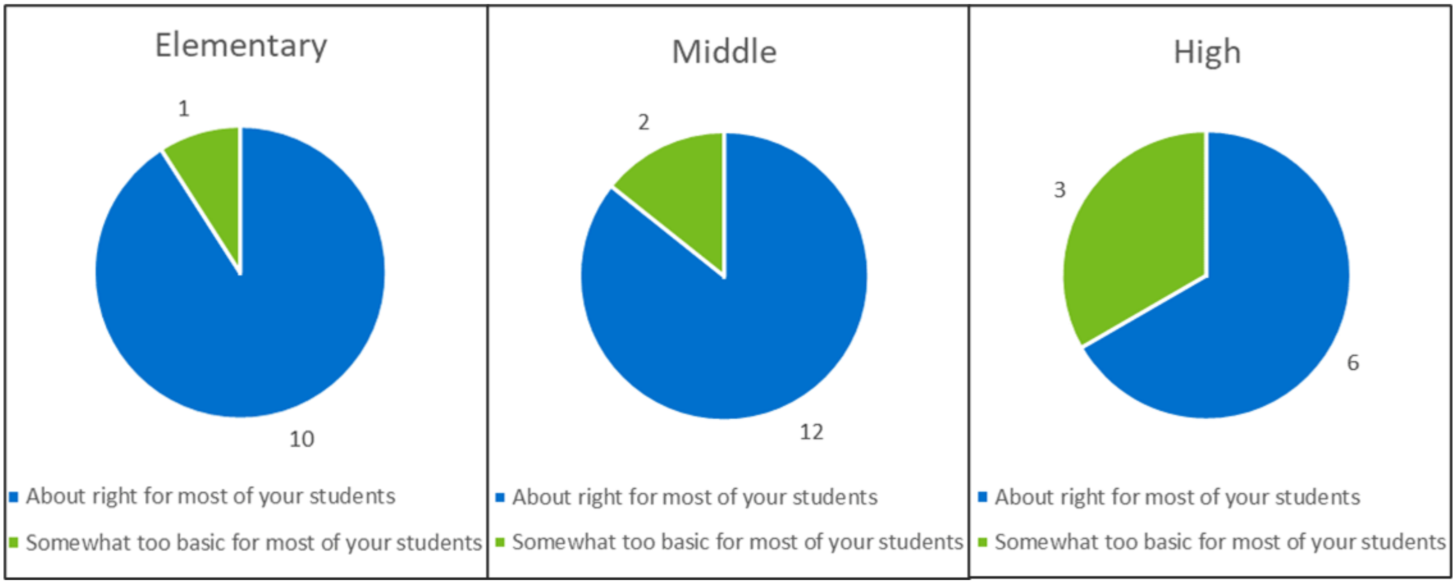
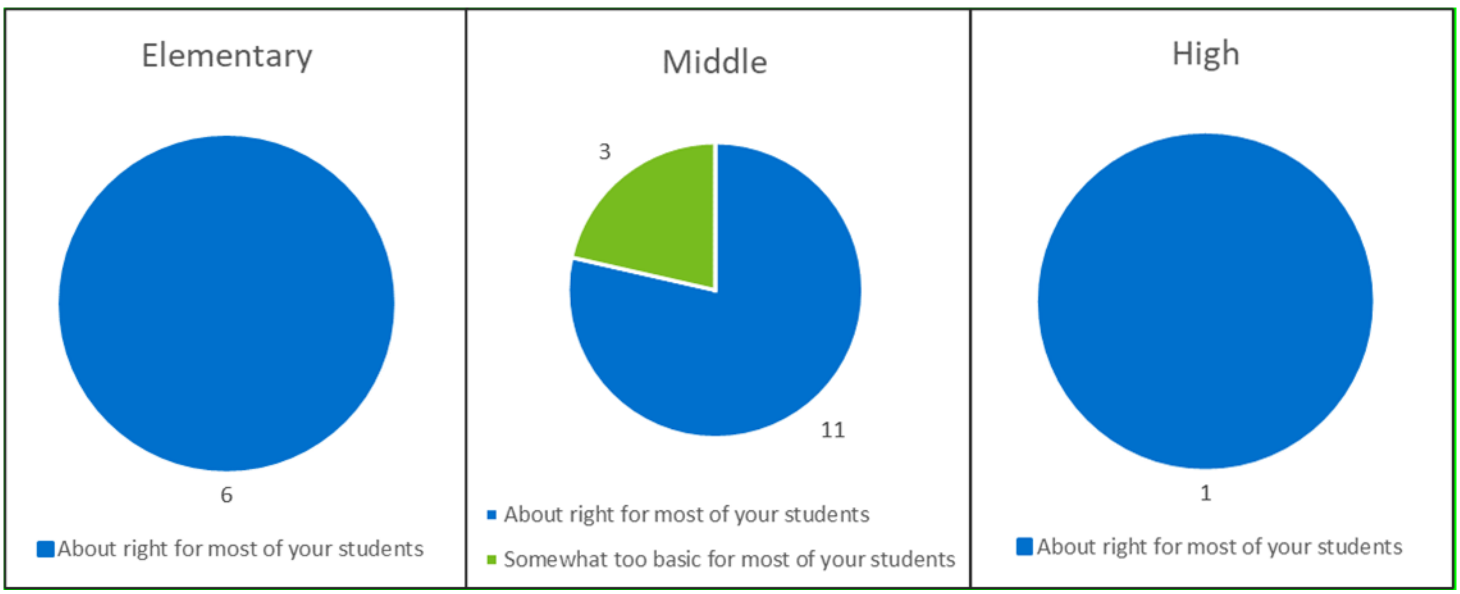



Figure 5-2: DEP Age-Appropriateness of NTC Performance (n = 21)




Regarding age appropriateness, the comments from the interviewed teachers echoed the findings from the online survey. All interviewed teachers said the performance was age appropriate and kept their students' attention, save one teacher that reported the performance for middle school students appeared to be a little juvenile for their age.

The interviewed teachers commented on the quality of the performance, specifically that the performance was engaging, humorous, and informative. When asked how performances might be improved, teachers generally did not offer suggestions, though one urged the performers to be sure they were finishing up the performance in the alloted time.

### *Curriculum and Instructional Materials*

About two-thirds of teachers in both DEC and DEP reported receiving or using the materials, in addition to most reporting that they distributed kit request forms to their students (see Kit Request Forms section below). Sixty-eight percent of surveyed teachers (23 of 34) in DEC reported receiving the curriculum and instructional materials (Figure 5-3), and 62% (13 of 21) of teachers in DEP stated the same (Figure 5-4). Of the eleven remaining teachers in DEC, nine had not received the materials and the final two teachers didn't know if they had received them or not. All eight DEP teachers who reported not using the materials had not received them. All of the 23 DEC teachers who reported receiving the materials used them to some degree, but 10 of these teachers (44%) only used the materials "a little". DEP teachers were split along similar lines, with 46% (6 of 13) teachers stating that they used the materials "a little" and the remainder using the materials a moderate amount.

Teachers who stated that they used the educational material infrequently were asked to describe why; the most common responses were that teachers did not receive the educational material at the right time in the school year. In DEC and DEP, five teachers from each territory stated that the timing of receiving the materials was the main reason for not using materials more. To a lesser degree, teachers commented on the challenges of utilizing the materials effectively within the context of virtual learning; two teachers in DEC and an additional teacher in DEP referenced this as their main challenge to disseminating materials. Both of these response groups highlight that the educational material is regularly not used in conjunction with the presentation and their lessons as intended. It's important to note that while the transition to remote learning was due to external factors, it has exacerbated an existing issue and as such should not be discounted.

**Figure 5-3: DEC Teachers Use of Forms and Instructional Materials**

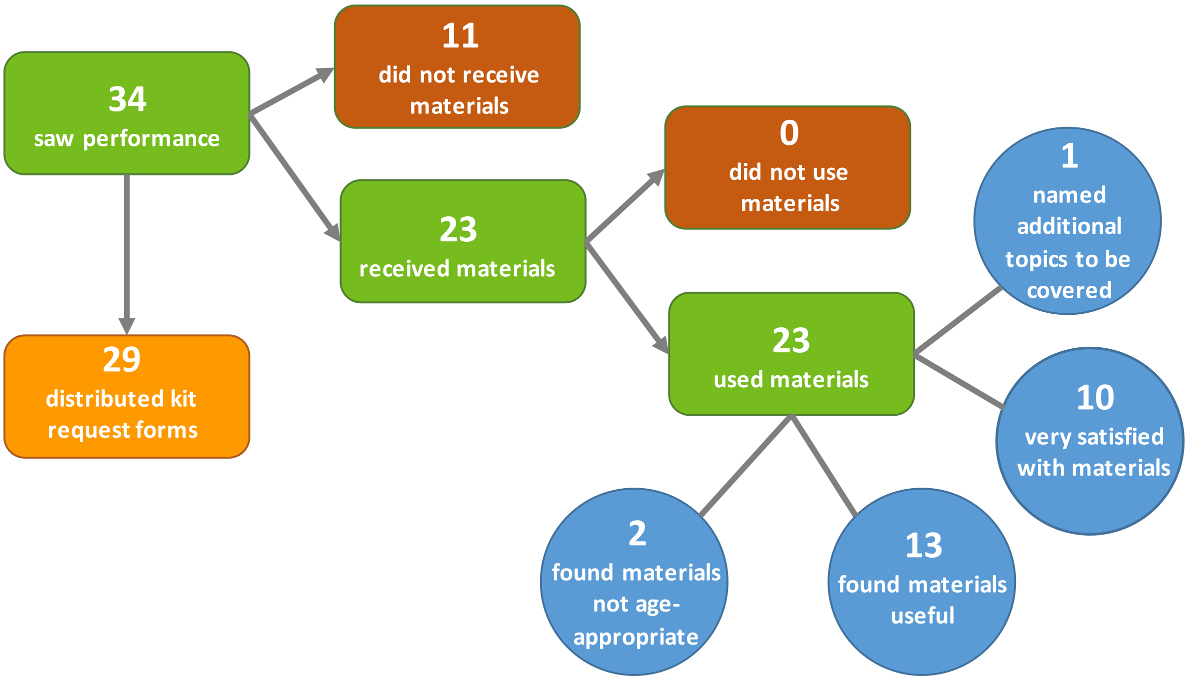
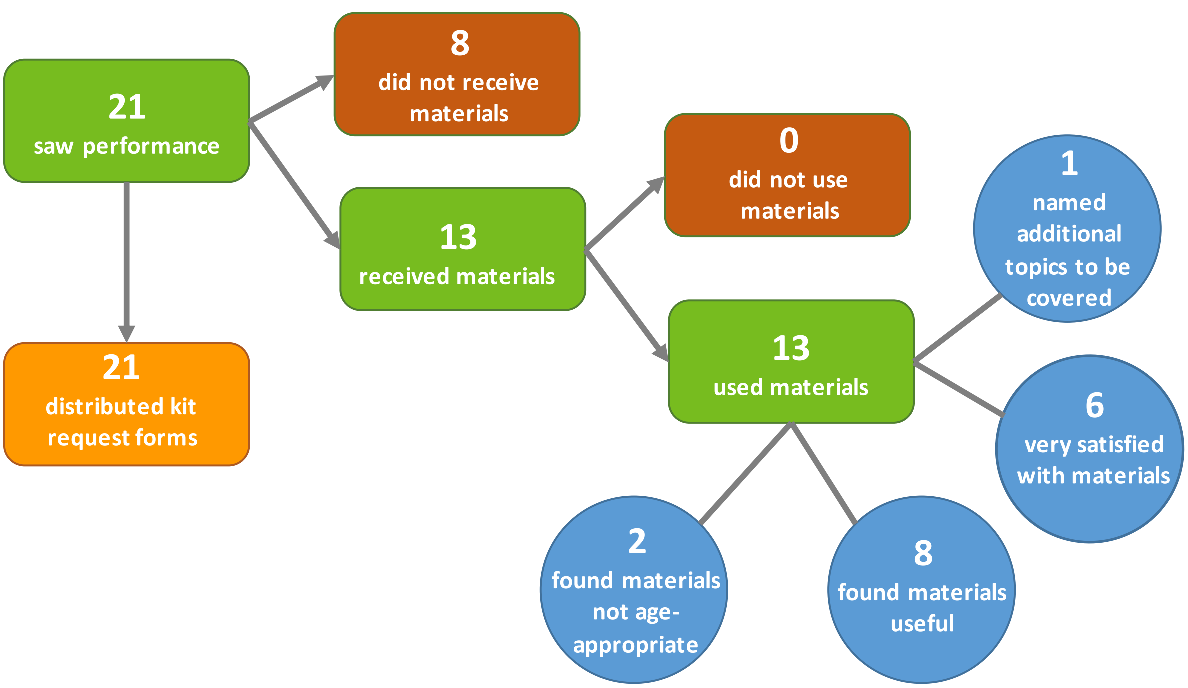



**Figure 5-4: DEP Teachers Use of Forms and Instructional Materials**




Twenty-three teachers in DEC and 13 teachers in DEP reported use of the instructional materials; they were subsequently surveyed on the materials' usefulness, age-appropriateness, alignment with state science standards, or concepts children had trouble understanding. From their comments, also reflected in interview findings, the following observations emerged:

- Use of materials was minimal to moderate in both territories: Ten teachers in DEC and six in DEP characterized their use as "a little". A further 12 teachers from DEC and and the remaining seven DEP teachers used the materials "moderately." Only one respondent from DEC reported using the materials extensively.
- Materials were useful: When asked to rate the usefulness of the materials, from "1" (not at all useful) to "5" (highly useful), over half of respondents in both DEC (13 of 23) and DEP (8 of 13) rated the usefulness as a "4" or "5". The remaining respondents respondents in DEC and DEP scored the usefulness as a "2" or "3", with the exception of one DEP teacher who did not know how useful the materials were.
- Materials were age-appropriate: Nineteen DEC teachers reported the material was age-appropriate; one high school science teacher reported it was somewhat too basic, and an elementary school science teacher reported that it was somewhat too advanced. In DEP, 11 teachers thought that the materials were age appropriate while two middle school teachers – a math/social studies teacher and a science teacher– thought that the material was too basic.
- Around half of respondents said that the materials aligned with state science standards: Thirteen DEC respondents reported the curriculum "mostly" aligned with state science standards, while eight stated it "somewhat" aligned, and two did not know if the materials aligned. DEP teachers stated that the materials were less in alignment with state standards; four reported that the curriculum "mostly" aligned and eight stated that it "somewhat" aligned, while one did not know if the materials aligned.

The teachers reporting "a little" use explained their rationale for limited use of the material. None of the comments in either survey focused on the quality of the materials per se. Rather, the reason for minimal use was because the materials did not align with their teaching priorities at that time (DEC and DEP, five mentions each) and alternative methods of distributing the workbooks, such as sending the materials home with children to review with their parents (DEC only, two mentions). Additionally, two DEC teachers and one DEP teacher reported that challenges surrounding virtual learning hindered their use of classroom materials. Some interviewed teachers also indicated that they were not aware that digital resources (student workbooks) were available.

The DEP middle school science teacher who thought the materials were too basic also stated that for the workbooks to be more useful, they should have covered "safety". Although they had rated the materials as being about right for their students, a middle school science teacher in DEC also stated that more information on "energy transformation" would enhance the materials. Twenty of twenty-three DEC teachers and eight of thirteen DEP teachers reported being satisfied with the materials (scored a "4" or "5" on a five-point scale), indicating that the material was found to be generally acceptable in the capacity that they were using it.

***Kit Request Forms***

As Figures Figure 5-3 and Figure 5-4 show, teachers reported sending kit request forms home with children. However, teachers also indicated in interviews that student families predominantly requested kits online.

About 85% of survey teachers in DEC and all of the surveyed teachers in DEP distributed the kit request forms to their students. Of the teachers who distributed the forms, just over half (55%) of DEC teachers distributed the the kit request form separately from the workbook and the remainder distributed workbooks with the kit request form included. Even more DEP teachers distributed the kit request form separately, with 71% of teachers stating that this was how they sent the form to their students, while the remainder distributed forms as a part of the workbook.

Just under half of the teachers in both territories (DEC: 45%, DEP: 48%) reported following up with students to find out whether their household requested a kit. Of those, teachers in DEC estimated between 0% and 90% of families ordered a kit, and teachers in DEP estimated between 0% and 70% of families ordered a kit. This results in an estimated average of 25% of DEP student families and 18% of student families in DEP that requested a kit.[2] Two interviewed teachers expressed a desire to receive more communication after the performance—reminders for them to check in with students about signing up.

***Kilowatt Krush App***

About half (DEC: 19 of 34, DEP: 12 of 21) teachers reported that either the performers or instructional material had mentioned the Kilowatt Krush app. A majority of DEC teachers (12 of 19) reported that they didn't know if students had downloaded the app, while a quarter of DEP teachers (3 of 12) weren't sure. In both DEC and DEP, all remaining teachers estimated that less than 40% of students had downloaded the app. In addition, some interviewed teachers mentioned that they did not recall seeing or hearing about the app. Observations from parents support the low estimates from teachers; 228 parents (of 300 surveyed) in DEC reported that their children did not download it, while another 47 were not sure. The numbers in DEP were similarly low, 160 out of 215 parents stated that their child had not downloaded the app and an additional 34 parents were unsure. Of the parents who noticed their child using the app, most of those children (DEC: 22 of 25, DEP: 19 of 21) were in elementary school.

### 5.2.4 Student Family Experience with the Program

***Installation and Use Rates***

Almost all (DEC: 86%, DEP: 91%) participants used at least one measure in the kit; DEC parents installed an average of 3.2 measures, and DEP parents installed 3.4 measures on average. Table 5-5 details the installation rates of all kit measures for both jurisdictions; most kit recipients in DEC and DEP installed the lighting measures including LEDs (DEC: 98%, DEP: 95%) and nightlights (DEC: 89%, DEP: 87%); far fewer used the insulator gaskets and water

[2] The Evaluation Team calculated the mean of the mid-point values of each teacher's selected range. For example, if one teacher selected 81%-90% and another selected 91%-100%, the mid-points are 85% and 95%, and the mean is 90%.

related measures (ranging from 36% to 51% in DEC and 34% to 60% in DEP). Water related measures were also removed more often than lighting measures, at up to 3 times the rate in both DEC and DEP. Most of the respondents who chose to remove kit measures reported dissatisfaction with the measure performance or stated that the measure was removed due to other circumstances (e.g. purchasing a new sink that had a faucet pre-attached).

**Table 5-5: Installation Rates**

| Measure | DEC (n = 258) | DEP (n = 197) |
|---|---|---|
| Showerhead | 51% | 60% |
| Kitchen Faucet Aerator | 47% | 49% |
| Bathroom Faucet Aerator | 47% | 48% |
| Night Light | 89% | 87% |
| Energy Efficient Light Bulbs (LEDs) | 98% | 95% |
| Insulator Gaskets | 36% | 34% |

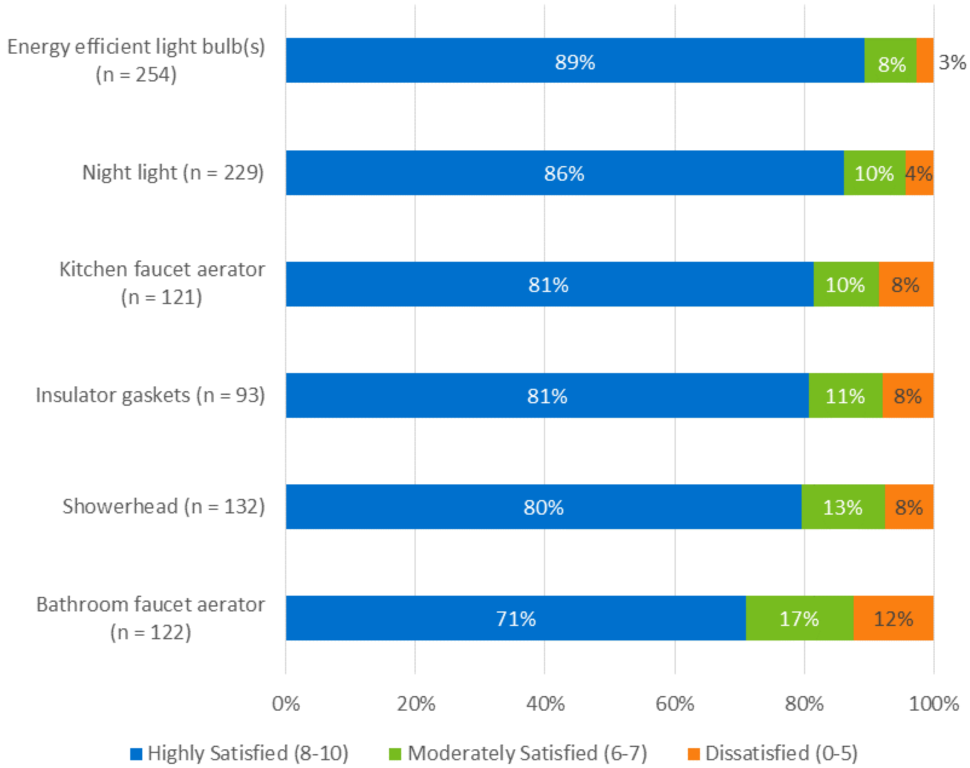
The large majority of those installing light bulbs said they installed both bulbs included in the kit (90% in DEC and 88% in DEP). Parents in both DEC and DEP reported that the LEDs typically replaced incandescent lightbulbs (DEC: 44%, DEP: 49%) and CFLs (DEC: 29%, DEP: 20%).

Of those who did not install all items in the kit, around two in five respondents (43% in DEC and 40% in DEP) said they do not plan to install any of the items they had not yet installed. Respondents generally said they would not install the remaining items because the currently installed item is still working, they already had an efficient measure installed, they attempted to install the measure but it didn't fit, or they had not "gotten around to it."

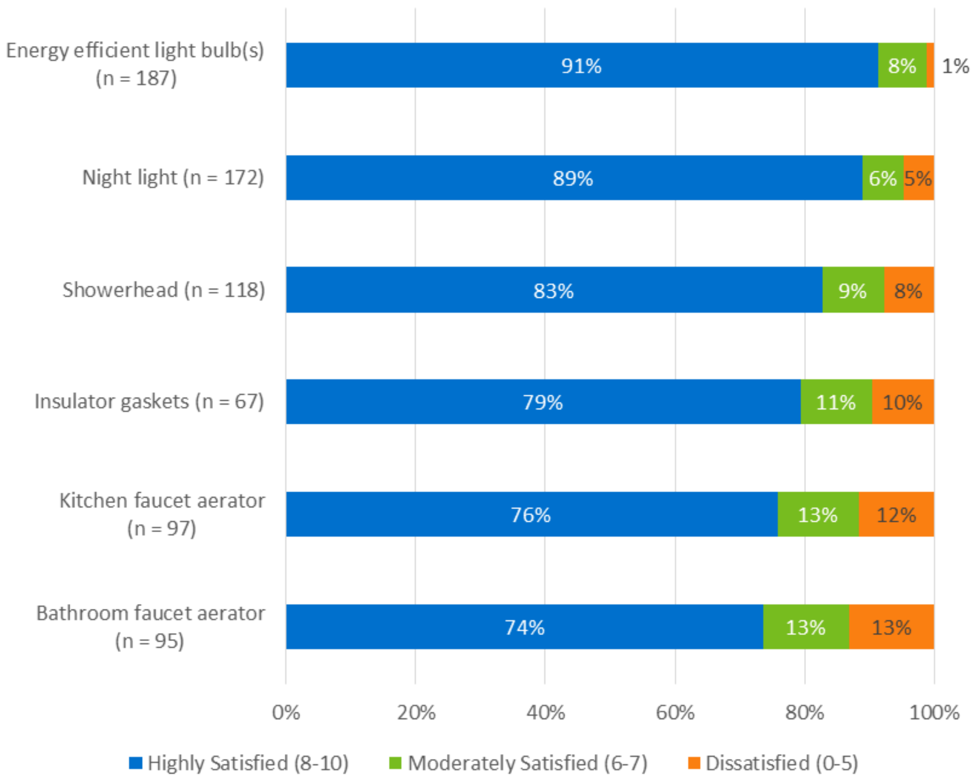
***Measure Satisfaction***

Nearly all kit recipients reported high satisfaction with the items they installed from their kit in both Duke territories (Figure 5-5 and Figure 5-6). To best gauge the experience with the measures, we asked respondents to rate their satisfaction with all measures they installed, including those they later removed. Respondents explained that any dissatisfaction they had with water measures was due to low water pressure (DEC: 22 customers, DEP: 14 customers) or that the measures did not fit properly (8 customers each in DEC and DEP).

## Figure 5-5: DEC Kit Recipient Satisfaction with Installed Measures




## Figure 5-6: DEP Kit Recipient Satisfaction with Installed Measures



### *Energy Saving Educational Materials in the Kit*

The Energy Efficiency Kit includes a Duke Energy-labeled Department of Energy (DOE) Energy Saver Booklet that includes educational information on saving energy at home. Most (DEC: 70%, DEP: 75%) respondents said they read the booklet. Of the kit recepients who read the energy saving booklet, approximately two-thirds in DEC and just over half in DEP found the information to be very helpful.[3] Those not finding the booklet helpful stated they already knew the information presented in the booklet or that information in the booklet could have been presented more concisely.

### *Additional Energy Saving Actions*

Parents and children reported adopting new energy-saving actions since their involvement in the program. About eight in ten parents (DEC: 79%, DEP: 81%) reported taking an energy-saving action and a large majority (74% in DEC and 67% in DEP) reported their child has adopted new energy saving behaviors since receiving their kit. Parents most commonly said that their child now turns off lights when not using a room (DEC: 64%, DEP: 59%) or that they turn off electronic devices when not in use (DEC: 48%, DEP: 42%) (Table 5-6). More than half of respondents (57% in DEC and 50% in DEP) reporting new energy saving behaviors said the Duke Energy sponsored kit and materials were "highly influential" on their adoption of those behaviors.[4]

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[3] We asked respondents to rate the helpfulness of the Duke Energy-labeled DOE Energy Saver Booklet on a scale from "0" ("not at all helpful") to "10" ("very helpful"). In DEC 65% percent of respondents who reported reading the booklet gave a rating of "8" or higher. 23% gave ratings of "6" or "7", and 11% gave ratings of "0" through "5". DEP respondents were shifted a bit closer to the middle; 55% of respondents provided ratings of "8" and above, 30% provided ratings of "6" or "7", and 15% provided ratings of "0" through "5".

[4] We asked respondents to rate the influence of Duke Energy's kit and energy saving educational materials on their reported behavior changes, using a scale from "0" ("not at all influential") to "10" ("extremely influential"). Fifty-seven percent of respondents in DEC (or, 135 out of 235) who reported behavior changes gave a rating of "8" or higher; 50% of respondents in DEP (86 out of 171) gave a rating of "8" or higher

**Table 5-6: New Behaviors Adopted by DEC Parents and Children since Receiving Kit (Multiple Responses Allowed; DEC n = 300, DEP n = 215)**

| New Behaviors Child Has Adopted | DEC | | DEP | |
|---|---|---|---|---|
| | Parents | Children | Parents | Children |
| Adopted new behaviors since receiving kit | 79% | 74% | 81% | 67% |
| Turn off lights when not in a room | 62% | 64% | 60% | 59% |
| Changing thermostat settings to use less energy | 53% | - | 53% | - |
| Turning off electronics when not in use | 49% | 48% | 43% | 42% |
| Using fans instead of air conditioning | 35% | - | 35% | - |
| Turning off air conditioning when not home | 26% | - | 27% | - |
| Taking shorter showers | 23% | 21% | 29% | 18% |
| Turning off furnace when not home | 15% | - | 16% | - |
| Turning water heater thermostat down | 10% | - | 12% | - |
| Other reason | 2% | 3% | 1% | 3% |

Receiving a kit may drive a desire to make additional energy efficiency improvements. Most student families reported a desire to receive more kit measures (98% in DEC, 97% in DEP), specifying interest in LEDs (DEC: 86%, DEP: 83%), nightlights (DEC: 68%, DEP: 67%), showerheads (25% in both DEC and DEP), bathroom and kitchen aerators (17% for both measures in DEC and 15% for both measures in DEP), and gasket insulators (16% in both territories). Parents indicated that they would prefer requesting additional measures via the internet (73% in both DEC and DEP) or pre-paid postcards (DEC: 18%, DEP: 17%).

The kit motivated some respondents to purchase energy efficient equipment or services (Table 5-7). About one-third of customers in DEC (34%) reported purchasing or installing additional energy efficiency measures since receiving their kit, while slightly more than two out of every five customers in DEP (45%) stated that they had purchased or installed additional measures. Efficient light bulbs were the most commonly reported measure, mentioned by 87 respondents in DEC and 76 in DEP.

Fourteen respondents in DEC reported receiving a Duke Energy rebate for their measure, eleven of whom said they received rebates for purchasing LEDs, five for efficient appliances, three for their efficient heating or cooling equipment, one for efficient windows and another customer who received an incentive for purchasing a smart thermostat.

Fifteen respondents in DEP stated that they received a rebate from Duke Energy for their measure. Of those, five received rebates for purchasing LEDs, three for smart thermostats, two each for energy efficient water heaters, efficient heating equipment and products to seal air leaks, and one each for additional insulation and energy efficient appliances. Around half of customers in both territories (DEC: 52 in 103, DEP: 43 in 96) said the Duke Energy schools program was at least partially influential on their decision to purchase and install additional energy saving measures.

**Table 5-7: Additional Energy Saving Measures Purchased (Multiple Responses Allowed; DEC n= 103, DEP n = 96)**

| | DEC Parents | | | DEP Parents | | |
|---|---|---|---|---|---|---|
| | Count of Respondents Reporting Purchases After Receiving the Kit | Count Reporting Duke Rebates for Measure | Count Reporting High Program Influence on Purchase* | Count of Respondents Reporting Purchases After Receiving the Kit | Count Reporting Duke Rebates for Measure | Count Reporting High Program Influence on Purchase* |
| At least one measure | 103 | 14 | 52 | 96 | 15 | 43 |
| Bought LEDs and/or CFLs | 87 | 11 | 45 | 76 | 5 | 33 |
| Bought energy efficient appliances | 46 | 5 | 19 | 35 | 1 | 17 |
| Sealed air leaks | 22 | - | 8 | 29 | 2 | 12 |
| Added insulation | 15 | - | 3 | 15 | 1 | 7 |
| Bought efficient heating or cooling equipment | 15 | 3 | 7 | 12 | 2 | 5 |
| Installed an energy efficient water heater | 15 | - | 4 | 6 | 2 | 3 |
| Bought efficient windows | 11 | 1 | 5 | 7 | - | 2 |
| Sealed ducts | 6 | - | 1 | 5 | - | 3 |
| Other | 4 | 1 | 3 | 7 | 3 | 1 |

*Respondents that rated the influence of the program as “8” or higher on 10-point scale, where “0” was not at all influential and “10” was extremely influential.

## 5.3 Key Findings

Overall, the DEC/DEP K12 Education Program performed effectively during the 2019-2020 school year. Key findings from the process evaluation include:

**Awareness:**

- Both teachers and parents were aware of Duke Energy's sponsorship of the K12 Education Program; 97% of teachers and 88% of parents in DEC, and 95% of teachers and 91% of parents in DEP indicated that they were aware of this fact.
- Teachers in DEC primarily learned about Duke Energy's sponsorship of the program through material provided by NTC about the program, NTC staff or Duke marketing materials. Similarly, teachers in DEP learned about the sponsorship of the program most often through Duke marketing materials and materials provided by the NTC.
- Most parents in both DEC and DEP reported that they learned of Duke's involvement in the program through informational material provided in the kit, followed by educational material provided by NTC and brought home from school by their child.
- Parents are largely unaware of the NTC performances and program related classroom activities with 25% of them in DEC and 18% of them in DEP reporting knowledge of these activities.
- Awareness of digital materials, performances, and the Kilowatt Krush app is inconsistent for teachers.
- Kilowatt Krush app usage by students is increasing, though still relatively low; elementary students are most likely to have used it.
- While 19 of 34 teachers in DEC reported that NTC staff or materials mentioned the Kilowatt Krush app, 7 reported that their students were using it. In DEP more teachers reported that their students were using it than not; 12 of 21 teachers stated that NTC staff or materials mentioned the app, and 9 teachers said that their students were using it.
- In DEC, 275 of 300 student families reported that either the student had not downloaded the Kilowatt Krush app, or that they were not sure if they had or not. In DEP, 194 of 215 families stated that their child had not downloaded the app or they were unsure.

**Program Experience and Satisfaction:**

- Teacher satisfaction with the performances and interactions with NTC staff was very high with 32 of 34 DEC teachers and 20 of 21 DEP teachers rating the performance a 4 or a 5, or "highly satisfied".
- Parents reported high levels of satisfaction with the measures provided in the efficiency kits. Measure satisfaction was highest amongst parents who installed LED bulbs; 81% of DEC and 91% of DEP respondents said that they were "highly

satisfied" with the measure. Satisfaction measures were lowest with bathroom faucet aerators; 71% of parents in DEC and 74% of parents in DEP reported that they were "highly satisfied" with this measure.

**In-Service Rates:**

- An average of 3.2 measures from the kit were installed per household in DEC, and an average of 3.4 measures were installed in DEP. Nineteen respondents (6%) in DEC installed all of the items, and 42 respondents (14%) installed none of the items. In DEP, 21 respondents (10%) installed all items and 19 respondents (9%) installed none of the items.
- The lighting measures provided in the kit were installed more often than the water saving measures. When asked why they did not install water saving measures, respondents most frequently reported low water pressure or that the measures didn't fit or match their fixture. Concerns about lighting measures were minimal and limited to night lights, where most of the respondents who didn't install the measure reported that they did not need it.
- Large majorities of parents (79% and 81% in DEC and DEP) and children (DEC: 74%, DEP: 67%) changed their behaviors after receiving the kit or seeing the performance. The most commonly changed behavior was turning off lights when not in the room and was shared amongst parents and children in both territories. Almost as many parents in DEC stated that they changed their thermostat settings as said turned lights off when leaving a room.

# 6 Conclusions and Recommendations

Based on evaluation findings, the evaluation team concluded the following and provides several recommendations for program improvement:

**Conclusion:** The use of AMI meter data as the primary input in the impact analysis was effective in reliably estimating savings attributable to the program.

> **Recommendation:** When proven to be feasible, continue to use an AMI-based consumption analysis approach in future EE Education program evaluations.

**Conclusion:** Teachers are highly satisfied with NTC performances and materials, although many teachers are unable to effectively utilize the materials within their curriculum due to timing issues. Some teachers additionally reported that they were unaware of the availability of online resources.

> **Recommendation:** Though the amount of online content has increased, it is important to prioritize making teachers aware of the availability of these online resources, including assuring these resources are prominently included in performances, instructional materials, and promotional materials. This may help address any problems stemming from the misalignment of these lessons. Additionally, ensuring that teachers are aware of any online content will be of particular importance in cases of remote learning, when traditional materials cannot be distributed as effectively.

**Conclusion:** A majority of parents who received energy efficiency kits installed at least one measure. Light bulbs and night lights were much more popular than water saving measures and were widely cited as items that respondents would like to receive more of. Parents primarily indicated that they would prefer to request additional kit items via the internet.

> **Recommendation:** Consider including additional lightbulbs in the efficiency kits, as they are relatively inexpensive and can enhance savings rates.

**Conclusion:** Large numbers of parents and students adopted energy saving behaviors as a result of tips and materials included in the kit.

> **Recommendation:** Expand behavioral guidance in both student and parent materials to maximize effects of the program. Parents in particular indicated that the primary reason for not finding energy saving tips useful was previous knowledge of those tips, suggesting that more advanced behavioral guidance (e.g. utilizing the scheduling feature of their thermostat to cool or heat the house in off peak periods) may be beneficial.

**Conclusion:** Teachers at smaller schools noted that reaching the 100 kit request threshold that qualifies for the $250 enrollment bonus is difficult. The program is also highly reliant on engaged teachers to drive performances and distribution of kits/student materials.

> **Recommendation:** Consider adjusting the award structure to encourage more teachers to become “champions” at unenrolled schools and drive more sign-ups. In addition, consider altering the incentive framework for schools that reach 100 kit requests and receive the $250 enrollment bonus to a proportion-based system, using quantity of received kit requests and student enrollment. This will make it easier for smaller schools to receive the enrollment bonus, and thus be more likely to be motivated to join and remain in the program. It is the evaluator’s understanding that an adjustment to the incentive structure was implemented for the 2021-2022 School Year that rewards teachers with $50 that reach 20 kit requests.

**Conclusion:** It is not clear how many teachers are attending performances, which makes estimating population parameters of evaluation and tracking data for this group difficult.

> **Recommendation:** Evaluate data gathering and tracking protocols to ensure that accurate teacher and student attendance is gathered at each school. This might include teacher sign-in sheets.

# Appendix A Summary Forms

## *DEC Summary Form*

### *Description of program*

The K12 Education Program is an energy efficiency program that provides free in-school performances by the National Theatre for Children (NTC) that teach elementary, middle, and high school students about energy and conservation concepts in a humorous and engaging format. NTC provides teachers with: 1) student workbooks that reinforce topics taught in the NTC performance, which include a take-home form that students and parents can complete to receive an energy efficiency starter kit from DEC/DEP and 2) lesson plans associated with the content in the student workbooks.

| | |
|---|---|
| Date | November 30, 2021 |
| Region(s) | Carolinas |
| Evaluation Period | August 1, 2019 – July 31, 2020 |
| Annual kWh Savings | 9,904,700 kWh |
| Per Household kWh Savings | 475 kWh |
| Annual Summer kW Savings | -1,689 kW |
| Annual Winter kW Savings | 62 kW |
| Net-to-Gross Ratio | Not applicable |
| Process Evaluation | Yes |
| Previous Evaluation(s) | 2015-2016, 2017-2018 |

## Evaluation Methodology

**Impact Evaluation Activities**

- *AMI consumption data analysis via difference-in-differences regression modeling with matched control group.*

**Impact Evaluation Findings**

- *The program produced significant energy savings of 475 kWh annually per household. Program-level savings in DEC were 9,900 MWh.*
- *The program did not generate meaningful load reductions during peak periods.*

**Process Evaluation Activities**

- *300 web surveys with student families and analysis of 6 unique measures.*
- *43 web surveys with teachers from participating schools; 5 in-depth follow up interviews*
- *1 in-depth interview with program staff*
- *1 in-depth interview with NTC implementation staff*
- *1 in-depth interview with R1 implementation staff*

**Process Evaluation Findings**

- *Teachers are highly satisfied with the performance*
- *Parents largely learning about performances, kits, and materials from their children*
- *Student families are generally satisfied with kit items, although lighting measures are more popular than water measures*
- *The NTC program is successfully influencing families to adopt energy saving behaviors*

# DEP Summary Form

## Description of program

The K12 Education Program is an energy efficiency program that provides free in-school performances by the National Theatre for Children (NTC) that teach elementary, middle, and high school students about energy and conservation concepts in a humorous and engaging format. NTC provides teachers with: 1) student workbooks that reinforce topics taught in the NTC performance, which include a take-home form that students and parents can complete to receive an energy efficiency starter kit from DEC/DEP and 2) lesson plans associated with the content in the student workbooks.

| | |
|---|---|
| Date | November 30, 2021 |
| Region(s) | Progress |
| Evaluation Period | August 1, 2019 – July 31, 2020 |
| Annual kWh Savings | 2,540,300 kWh |
| Per Household kWh Savings | 475 kWh |
| Annual Summer kW Savings | -433 kW |
| Annual Winter kW Savings | 16 kW |
| Net-to-Gross Ratio | Not applicable |
| Process Evaluation | Yes |
| Previous Evaluation(s) | 2015-2016, 2017-2018 |

## Evaluation Methodology

### Impact Evaluation Activities

- *AMI consumption data analysis via difference-in-differences regression modeling with matched control group.*

### Impact Evaluation Findings

- *The program produced significant energy savings of 475 kWh annually per household. Program-level savings in DEP were 2,540 MWh.*
- *The program did not generate meaningful load reductions during peak periods.*

### Process Evaluation Activities

- *215 web surveys with student families and analysis of 6 unique measures*
- *29 web surveys with teachers from participating schools; 3 in-depth follow up interviews*
- *1 in-depth interview with program staff*
- *1 in-depth interview with NTC implementation staff*
- *1 in-depth interview with R1 implementation staff*

### Process Evaluation Findings

- *Teachers are highly satisfied with the performance*
- *Parents largely learning about performances, kits, and materials from their children*
- *Student families are generally satisfied with kit items, although lighting measures are more popular than water measures*
- *The NTC program is successfully influencing families to adopt energy saving behaviors*

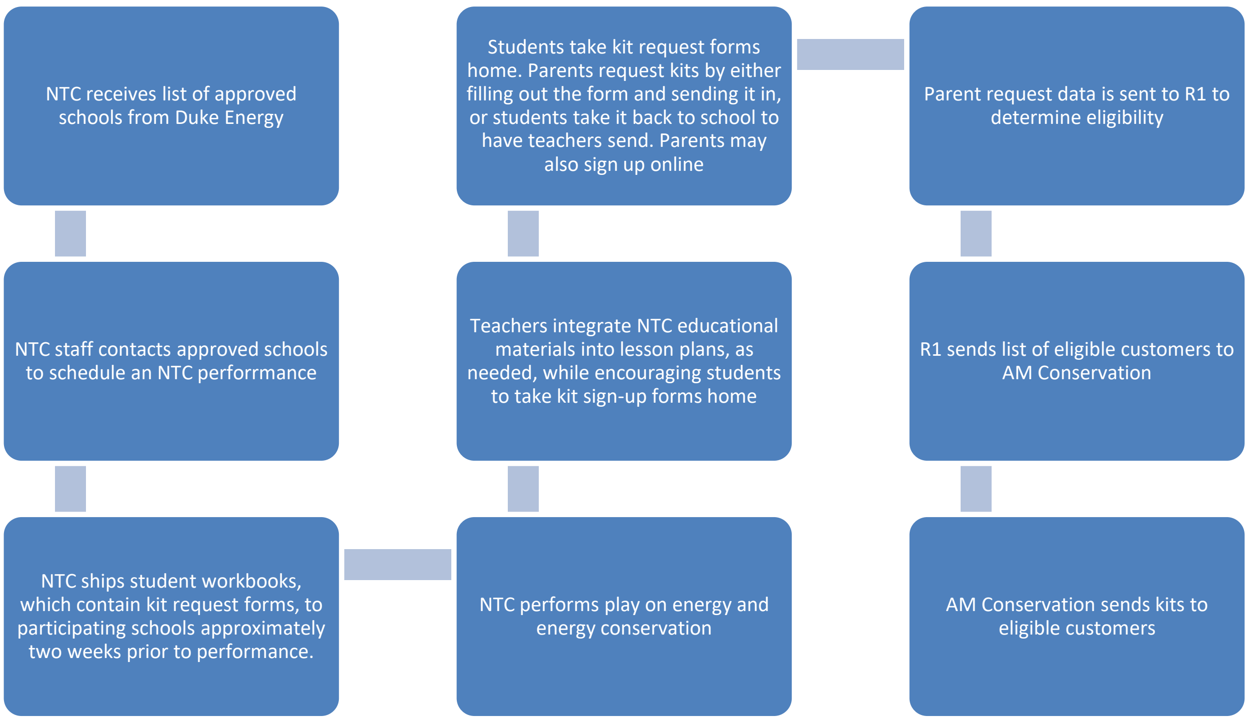
# Appendix B Measure Impact Results

**Table B-1: DEP and DEP Program Year 2019-2020 per Unit Verified Impacts by Measure – Key Measure Parameters**

| Measure | Gross Energy Savings (kWh) | Gross Summer Demand (kW) | Gross Winter Demand (kW) | Realization Rate (Energy) | Free Ridership | Spillover | Net to Gross Ratio* | M&V Factor (Energy) (RR x NTG) | Measure Life |
|---|---|---|---|---|---|---|---|---|---|
| Energy Efficiency Kit - DEC | 475.21 | -0.08075 | 0.002685 | N/A | N/A | N/A | N/A | N/A | N/A |
| Energy Efficiency Kit - DEP | 475.21 | -0.08075 | 0.002685 | N/A | N/A | N/A | N/A | N/A | N/A |

*The impact analysis approach performed in this evaluation yields a savings estimate that is net of any naturally occurring changes, so there is no need to perform a net-to-gross adjustment

# Appendix C  Program Process Flow Chart



# Appendix D Program Performance Metrics

## Figure D-1: DEC Student Family Demographics Reach PPIs

### Housing Type

| | |
|---|---|
| Detached | 74% |
| Attached | 18% |
| Mobile | 8% |

### Ownership Status

| | |
|---|---|
| Own | 69% |
| Rent | 30% |
| Occupy Rent-free | 1% |

### Number of People in Home

| | |
|---|---|
| One | 4% |
| Two | 19% |
| Three | 22% |
| Four | 33% |
| Five+ | 22% |

### Highest Educational Attainment

| | |
|---|---|
| Exited before/during High school | 2% |
| High school/Trade school | 18% |
| Some college | 32% |
| Bachelors Degree | 25% |
| Some graduate school | 2% |
| Graduate/Professional Degree | 18% |
| Doctorate | 3% |

### Income

| | |
|---|---|
| <$35k | 31% |
| $35k to $50k | 18% |
| $50k to $75k | 19% |
| $75k to $150k | 22% |
| $150k+ | 10% |

## Figure D-2: DEP Student Family Demographics Reach PPIs

### Housing Type

| | |
|---|---|
| Detached | 69% |
| Attached | 17% |
| Mobile | 14% |
| Other | <1% |

### Ownership Status

| | |
|---|---|
| Own | 72% |
| Rent | 27% |
| Occupy Rent-free | 1% |

### Number of People in Home

| | |
|---|---|
| One | 3% |
| Two | 10% |
| Three | 30% |
| Four | 30% |
| Five+ | 27% |

### Highest Educational Attainment

| | |
|---|---|
| Exited before/during High school | 3% |
| High school/Trade school | 21% |
| Some college | 29% |
| Bachelors Degree | 24% |
| Some graduate school | 2% |
| Graduate/Professional Degree | 17% |
| Doctorate | 4% |

### Income

| | |
|---|---|
| <$35k | 29% |
| $35k to $50k | 17% |
| $50k to $75k | 18% |
| $75k to $150k | 30% |
| $150k+ | 6% |

# Appendix E Instruments

## E.1 Program Staff In-Depth Interview Guide

### Introduction

Today, we'll be discussing your role in the Energy Efficiency Education Program in the Duke Energy **Carolina and Progress** territories. We would like to learn about your experiences in administering this program in the 2019-2020 school year. Your comments are confidential. If I ask you about areas you don't know about, please feel free to tell me that and we will move on.

Your comments are confidential. If I ask you about areas you don't know about, please feel free to tell me that and we will move on. Also, if you want to refer me to specific documents to answer any of my questions, that's great – I'm happy to look things up if I know where to get the information.

Also, I would like to record this interview for my note-taking purposes. Do I have your permission? Do you have any questions before we start?

### Roles and Responsibilities

Q1. Has anything changed regarding your role in Duke Energy's Energy Efficiency Education Program since we last spoke? (Program Manager)

Q2. Has Duke Energy's role changed in terms of program delivery since we last spoke?

### Delivery and Operations

Q3. What were your targets for the 2019-2020 school year for the following metrics, and were you successful in meeting them?:

1. Number of schools recruited:
2. Number of students involved:
3. Use of curricula by teachers:
4. Number of kit requests:
5. Savings:
6. Subcontractor SLAs (NTC, R1, AMC):

Q4. Has the delivery process changed since 2018-2019, prior to any forced upon the program by COVID-19? Separately, how did COVID-19 affect program delivery, if at all, in terms of the (ask respondent to describe established protocols as necessary):

1. Recruitment, Marketing, Outreach, Website (request materials):
2. Curriculum and Performance:
3. App (KiloWatt Krush):
4. Kit: contents, request process, delivery schedule (how long):

Q5. Any noteworthy concerns about the age appropriateness of the materials and performances, or has that largely been addressed?

Q6. In what ways, if at all, does the delivery strategy for the high school program differ from the others?

Q7. Can you talk a bit about the development of the high school delivery strategy? What were the priorities, goals, etc.?

Q8. How has the high school program been going generally in NC and SC? Have there been any significant challenges or successes specific to the high school program in 2019-2020? How have these been addressed?

Q9. Are there any changes, beyond those caused by COVID-19, that you have implemented in the 2020-2021 school year? Any planned for 2021-2022?

Q10. Does the operational staff still gather on weekly calls (NTC, R1, Duke Energy)? Are there any other established communication protocols? Any changes there?

Q11. Has anything changed with staffing or management of the program (communications, staff, budget, program goals, data management, subcontractor perfomance, etc.) since we last spoke? If so, how has this affected program delivery or operations? Any problems with any of these?

**Wrap Up**

Q12. What would you say were the greatest strengths of the program in 2019-2020?

Q13. What would you say were the biggest challenges in administering this program in 2019-2020? Is this specific to he DEC/P jurisdictions? Last time, for DEI, you primarily discussed difficulties with recruitment—both schools and student families.

Q14. Do you have any other thoughts about the program that we didn't discuss that you think may be important?

Q15. Is there anything in particular you'd like to learn from the program evaluation?

**Thank you for your time. Have a great day!**

## E.2 NTC Staff In-Depth Interview Guide

### Introduction

Today, we'll be discussing your role in the Energy Efficiency Education Program in the Duke Energy **Carolina and Progress** territories. We would like to learn about your experiences in administering this program in the 2019-2020 school year. Your comments are confidential. If I ask you about areas you don't know about, please feel free to let me know and we will move on.

Also, I would like to record this interview for my note-taking purposes. Do I have your permission? Do you have any questions before we start?

### Roles and Responsibilities

Q1. Can you describe your title, and your role in NTCs work with the Duke Energy Energy Efficiency Education in Schools program?

Q2. Has NTC's role changed in terms of program delivery? Last time we spoke you told me that NTC's role primarily involves designing and distributing classroom materials (including kit request forms), recruiting schools, and designing and executing the performances. Is there anything else?

### Delivery and Operations

Q3. Has the delivery process changed since 2018-2019, prior to any forced upon the program? Separately, how did COVID-19 affect program delivery, if at all, in terms of (ask respondent to describe established protocols as necessary):

1. Marketing and outreach (Can you provide recruitment materials?):
2. Curriculum:
3. Performance:
4. Kit request process:

Q4. In what ways, if at all, does the delivery strategy for the high school program differ from the others?

Q5. Can you talk a bit about the development of the high school delivery strategy, including how this applies to materials, performances, etc.?

Q6. Have there been any significant challenges or successes specific to the high school program in 2019-2020? How have these been addressed?

Q7. Do you have copies of the 2019-2020 materials for all three programs that you could send me?

Q8. Are there any changes, beyond those caused by COVID-19, that you have implemented in the 2020-2021 school year? Any planned for 2021-2022?

Q9. Does the operational staff still gather on weekly calls (NTC, R1, Duke Energy)? Are there any other established communication protocols? Any changes there?

Q10. Has anything changed with staffing/management at NTC (communications, content creation, admin, or management staff)? If so, how has this affected program delivery or operations?

**Wrap Up**

Q11. What would you say were the greatest strengths of the program in 2019-2020?

Q12. What would you say were the biggest challenges in administering this program in 2019-2020? Is this specific to the DEC/P jurisdictions? Last time, for DEI, you discussed a few things: the finite number of schools to work with, the eligibility window for kits, and the existence of non-Duke Energy customers.

Q13. Do you have any other thoughts about the program that we didn't discuss that you think may be important?

**Thank you for your time. Have a great day!**

## E.3 R1 Staff In-Depth Interview Guide

### Introduction

Today, we'll be discussing your role in the Energy Efficiency Education Program in the Duke Energy **Carolinas and Progress** territories. We would like to learn about your experiences in administering this program in the 2019-2020 school year. Your comments are confidential. If I ask you about areas you don't know about, please feel free to tell me that and we will move on. Also, I would like to record this interview for my note-taking purposes. Do I have your permission? Do you have any questions before we start?

### Roles and Responsibilities

Q1. Has anything changed regarding your position at R1 and your role in Duke Energy's Energy Efficiency Education Program since we last spoke? (VP of IT)

Q2. Has R1's role changed in terms of program delivery? Last time we spoke you told me that R1's role primarily involves maintaining the program website (for kit delivery), maintaining the customer database, and processing paper applications.

### Delivery and Operations

Q3. Has anything changed in this delivery process? (Prompts: relationship with AMC, data verification and transfer with Duke Energy, (hand) processing of paper applications)

Q4. Does all the operational staff still gather on weekly calls? Can you briefly describe communication protocols?

### Challenges and Successes

Q5. Have you experienced any issues due to the introduction of the high school program?

Q6. Have you experienced any issues due to COVID?

Q7. Were there any other challenges or successes in program delivery from your perspective in the 2019-2020 program year?

Q8. What would you say are the greatest strengths of this program?

### Wrap Up

Q9. Do you have any other thoughts about the program that we didn't discuss that you think may be important?

**Thank you for your time. Have a great day!**

## E.4 Teacher Survey

### Landing Page Introduction

Thank you for agreeing to take this survey. It starts with a few questions about what grades and subjects you teach, which we need for our analysis of the survey responses. The survey then asks for your feedback on various elements of the program.

### Grades and Subjects Taught

Q1. What grade(s) did you teach during the 2019-2020 school year? *Please select all that apply.*

[multiple response]

1. Pre-K – TERMINATE
2. Kindergarten
3. Grade 1
4. Grade 2
5. Grade 3
6. Grade 4
7. Grade 5
8. Grade 6 [SKIP TO Q3]
9. Grade 7 [SKIP TO Q3]
10. Grade 8 [SKIP TO Q3]
11. Grade 9 [SKIP TO Q3)
12. Grade 10 [SKIP TO Q3)
13. Grade 11 [SKIP TO Q3)
14. Grade 12 [SKIP TO Q3)
15. Other, please specify: [Open-ended response] – Collect open end response- then TERMINATE
16. None; I did not teach last year [TERMINATE]

[IF Q1= 1-Kindergarten to 7- Grade 5 AND Q1 <> 8-Grade 6 to 14- Grade 12]

Q2. Are you a home room teacher?

[SINGLE RESPONSE]

1. Yes
2. No [TERMINATE]

[IF Q1= 8-Grade 6 to 14-Grade 12]

Q3. What subjects do you teach? *Please select all that apply.(TEST)*

[MULTIPLE RESPONSE]

1. Math
2. Natural sciences
3. English/language arts
4. Social studies/social sciences/history
5. Music
6. Art
7. Physical education

8. Other – please specify: [OPEN-ENDED RESPONSE]

[IF Q2=1 or Q3<>1 or 2]
Q4. Do you teach any topics on energy (electricity, gas, coal, etc.) generation, transformation, use, or conservation (including, but not limited to, topics/materials provided by the Energy Efficiency for Schools program)?
[SINGLE RESPONSE]
1. Yes
2. No [TERMINATE]

Q5. Have you previously taken a survey (not fielded by NTC) regarding your participation in this program?
[SINGLE RESPONSE]
1. Yes
2. No
98. Don't know

**Performance Seen**

[IF Q1=2-Kindergarten to 7- Grade 5 AND Q1<> 8-Grade 6 to 14-Grade 12]
Q6. Did you attend The National Theatre for Children performance for elementary school students in [PERFORMANCE_MONTH] of [PERFORMANCE_YEAR]?
1. Yes
2. No [TERMINATE]
98. Don't know/ Can't recall [TERMINATE]

[IF Q6 = 1]
Q7. Did your students see a performance even more specific to their grade level?
1. Yes, they saw the K-2 performance
2. Yes, they saw the performance for grades 3-5
3. No, they saw the K-5 performance
4. Don't know / Can't recall

[IF Q1= 8- Grade 6 to 10- Grade 8]
Q8. Did you see the National Theatre for Children performance for middle school students in [PERFORMANCE_MONTH] of [PERFORMANCE_YEAR]?
1. Yes
2. No [TERMINATE]
98. Don't know/ Can't recall [TERMINATE]

[IF Q1= 11- Grade 9 to 14- Grade 12]
Q9. Did you see the National Theatre for Children performance for high school students in [PERFORMANCE_MONTH] of [PERFORMANCE_YEAR]?
1. Yes
2. No [TERMINATE]
98. Don't know/ Can't recall [TERMINATE]

[TERMINATION SCREEN TEXT: We have determined that you do not meet the qualification criteria for this study. Thank you for your time!]

Awareness of Duke Energy Sponsorship

Q10. Before today, were you aware that Duke Energy sponsored the National Theatre for Children performance(s) in your school?

1. Yes
2. No [SKIP TO Q14]
98. Don't know [SKIP TO Q14]

[If Q10= 1 (YES)]
Q11. How did you learn of Duke Energy's involvement with the National Theatre for Children program? *Please select all that apply.*
[MULTIPLE RESPONSE]

1. Another teacher
2. Duke Energy marketing materials
3. Duke Energy staff
4. National Theatre for Children staff
5. National Theatre for Children materials
6. Other, please describe: [OPEN-ENDED RESPONSE]
98. Don't know

Q12. Are you (one of) the decision-maker(s) regarding the NTC performances at your school?

1. Yes
2. No [SKIP TO Q14]
3. Don't know [SKIP TO Q14]

[IF Q132= 1 (YES)]
Q13. Do you recall how the importance of the program was communicated to you? If so, how was it communicated to you?

1. Yes: [OPEN-ENDED RESPONSE]
2. No

**Program Experience and Satisfaction**

The next few questions are about the **performance(s)** that National Theatre for Children presented to your school.

Q14. Thinking back to the school performance, would you say that energy related concepts presented in the performance were:
[SINGLE RESPONSE]

1. Far too advanced for most of your students
2. Somewhat too advanced for most of your students
3. About right for most of your students
4. Somewhat too basic for most of your students

5. Far too basic for most of your students
96 Other, please specify: [Open-ended response]
98. Don't know

[IF Q14= 1 or 2]
Q15. What about the performance was too advanced for most of your students?
1. [OPEN-ENDED RESPONSE]

[IF Q14= 4 or 5]
Q16. What about the performance was too basic for most of your students?
1. [OPEN-ENDED RESPONSE]

Q17. Were there any concepts that the performance(s) did not cover that *should have been* covered?
1. Yes
2. No [SKIP TO Q19]
98. Don't know [SKIP TO Q19]

[IF Q17= 1 (YES)]
Q18. What concepts were not covered that *should have been* covered?
1. [OPEN ENDED]

Q19. Please estimate your student's overall engagement level with the National Theatre for Children **performance** on the following scale WHERE 1=NOT AT ALL ENGAGED AND 5=COMPLETELY ENGAGED, with DK; LABEL ONLY THE END POINTS (1 AND 5) – DISPLAY AS HORIZONTAL GRID:

| Not at all Engaged | | | | Completely Engaged | Don't Know |
|---|---|---|---|---|---|
| 1 | 2 | 3 | 4 | 5 | 98 |

Q20. Please rate your overall satisfaction with the National Theatre for Children **performance** on the following scale. [Single response; insert 1-5 scale WHERE 1=NOT AT ALL SATISFIED AND 5=COMPLETELY SATISFIED, with DK; LABEL ONLY THE END POINTS (1 AND 5) – DISPLAY AS HORIZONTAL GRID

| Not at all Satisfied | | | | Completely Satisfied | Don't Know |
|---|---|---|---|---|---|
| 1 | 2 | 3 | 4 | 5 | 98 |

Q21. Please explain why you offered this satisfaction rating.
1. [OPEN ENDED]

The next few questions are about the **curriculum or instructional materials** that you may have received from the National Theatre for Children around the time of the performance.

Q22. Did you receive curriculum or instructional materials, such as student workbooks, related to energy and energy conservation from National Theatre for Children for the Fall 2019-Spring 2020 school year?

1. Yes
2. No [SKIP TO Q36]
98. Don't know [SKIP TO Q36]

[IF Q22= 1 (YES)]
Q23. To what degree did you use the curriculum or instructional materials in teaching your students about energy?
[Single response]

1. Not at all [SKIP TO Q35]
2. A little
3. Moderately
4. A lot
5. Extensively
98. Don't know [SKIP TO Q36]

[IF Q23= 2 (A little)]
Q24. Why did you only use the curriculum or instructional materials “a little” in teaching your students about energy?

1. [OPEN-ENDED RESPONSE]

[IF Q23= 2 through 5]
Q25. Thinking about how the student workbooks explained energy-related concepts, would you say that the material was generally:
[SINGLE RESPONSE]

1. Far too advanced for most of your students
2. Somewhat too advanced for most of your students
3. About right for most of your students
4. Somewhat too basic for most of your students
5. Far too basic for most of your students
96. Other, please specify: [Open-ended response]
98. Don't know
99. Refused

[IF Q23= 2, 3, 4, or 5]
Q26. Please rate how useful the materials were to you in teaching your students about energy. [Single response; insert 1-5 scale WHERE 1=NOT AT ALL USEFUL AND 5=EXTREMELY USEFUL, with DK

| Not at all Useful | | | | Extremely Useful | Don't Know |
|---|---|---|---|---|---|
| 1 | 2 | 3 | 4 | 5 | 98 |

[IF Q23= 2, 3, 4, or 5]

Q27. Please rate the degree to which the topics in the workbook aligned with your state's science standards for the grade(s) you teach.

1. Completely aligned
2. Mostly aligned
3. Somewhat aligned
4. Poorly aligned
5. Not aligned at all
6. N/A – no science standards for my grade(s)
98. Don't know
99. Refused

[IF Q27= 4 or 5]

Q28. Which topic(s) was or were poorly aligned or not aligned at all with your state's science standards? In what way(s)?

1. [OPEN-ENDED RESPONSE]

[IF Q23= 2, 3, 4, or 5]

Q29. Were there any concepts covered in the curriculum or instructional materials that your students had challenges with?

1. Yes
2. No [SKIP TO Q31]
98. Don't know [SKIP TO Q31]
99. Refused [SKIP TO Q31]

[IF Q29= 1 (yes)]

Q30. What concepts did your students have challenges with?

1. [OPEN-ENDED RESPONSE]

[IF Q23= 2, 3, 4, or 5]

Q31. Were there any concepts that the materials did not cover that *should have been* covered?

1. Yes
2. No [SKIP TO Q33]
98. Don't know [SKIP TO Q33]
99. Refused [SKIP TO Q33]

[IF Q31= 1 (YES)]

Q32. What concepts were not covered that *should have been* covered?

1. [OPEN-ENDED RESPONSE]

[IF Q23= 2 through 5]

Q33. Please rate your overall satisfaction with curriculum or instructional materials you received from the National Theatre for Children program using the following scale. [Single response; insert 1-5 scale WHERE 1=NOT AT ALL SATISFIED AND 5=COMPLETELY SATISFIED with DK; LABEL ONLY END POINTS (1 and 5)]

| Not at all Satisfied | | | | Completely Satisfied | Don't Know |
|---|---|---|---|---|---|
| 1 | 2 | 3 | 4 | 5 | 98 |

[IF Q22= 1 (YES)]
Q34. Do you have any additional input regarding the **curriculum or instructional materials** received from the National Theatre for Children that you would like to provide, including other things you liked or think could be improved? This might include things like overall presentation, length, level of detail, messaging, or anything else.
1. [OPEN ENDED]

[IF Q23= 1 (NOT AT ALL)]
Q35. Why did you *not* use the curriculum or instructional materials in teaching your students about energy?
1. [OPEN ENDED]

**Interactions with NTC Staff**

Q36. Did you have any interactions with anyone from the National Theatre for Children regarding the curriculum or instructional materials?
1. Yes
2. No [SKIP TO Q39]
98. Don't know [SKIP TO Q39]

[IF Q36= 1 (YES)]
Q37. What did those interactions involve?
1. [OPEN-ENDED RESPONSE]

[IF Q36= 1 (YES)]
Q38. Using the scale provided, how satisfied were you with:
a. Your interactions with the National Theatre for Children staff, overall
b. The professionalism and courtesy of the National Theatre for Children staff
c. The National Theatre for Children staff's knowledge about the topics you discussed with them

[Single response; for each item, insert 1-5 scale WHERE 1=NOT AT ALL SATISFIED AND 5=COMPLETELY SATISFIED with; LABEL ONLY THE END POINTS (1 AND 5)]

| Not at all Satisfied | | | | Completely Satisfied | Don't Know |
|---|---|---|---|---|---|
| 1 | 2 | 3 | 4 | 5 | 98 |

### Encouragement of Students to Complete Kit Request Form; Use of App

In the student workbooks provided by the National Theatre for Children there is a form that parents can fill out to receive a kit from Duke Energy. The kit contains energy efficient bulbs, low flow showerheads, and a few additional items that students and their parents can install in their home to save energy.

Q39. Did you distribute the kit request form to your students?

1. Yes – I distributed the workbooks, which included the kit request form
2. Yes – I distributed the kit request form separately
3. No [SKIP TO Q44]
98. Don't recall [SKIP TO Q43]

[IF Q39= 1 OR 2 (YES)]
Q40. On average, about what percentage of your students took the kit request form home? Your best estimate is fine.

1. 0% to 10%
2. 11% to 20%
3. 21% to 30%
4. 31% to 40%
5. 41% to 50%
6. 51% to 60%
7. 61% to 70%
8. 71% to 80%
9. 81% to 90%
10. 91% to 100%
98. Don't know

[IF Q39Q39= 1 OR 2 (YES)]
Q41. After students take the kit form home, do you follow up with students later to find out if their parents completed the form or signed up online?

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

[IF Q39= 1 OR 2 (YES)]
Q42. About what percentage of your students either brought the kit form back to you to mail, or reported their parents completed and sent the form to Duke Energy to receive their kit?

1. 0% to 10%
2. 11% to 20%
3. 21% to 30%
4. 31% to 40%
5. 41% to 50%
6. 51% to 60%

7. 61% to 70%
8. 71% to 80%
9. 81% to 90%
10. 91% to 100%
98. Don't know

Q43. About what percentage of student families who had signed up for kits signed up on the website?

1. 0% to 10%
2. 11% to 20%
3. 21% to 30%
4. 31% to 40%
5. 41% to 50%
6. 51% to 60%
7. 61% to 70%
8. 71% to 80%
9. 81% to 90%
10. 91% to 100%
98. Don't know

[IF Q39= 3 (NO)]
Q44. Why didn't you distribute the kit request forms to your students?

1. [OPEN-ENDED]

Q45. Did the NTC performers or the instructional materials mention the "Kilowatt Krush" app?

1. Yes
2. No [SKIP TO Q48]
98. Don't know [SKIP TO Q48]

[IF Q45= 1 (YES)]
Q46. About what percentage of students would you say downloaded and used the app?

1. 0% to 10%
2. 11% to 20%
3. 21% to 30%
4. 31% to 40%
5. 41% to 50%
6. 51% to 60%
7. 61% to 70%
8. 71% to 80%
9. 81% to 90%
10. 91% to 100%
98. Don't know

Q47. Do you have any suggestions to improve the app or how it was presented to students?
1. Yes; [OPEN ENDED RESPONSE]
2. No

**Challenges and Opportunities for Improvement**

Q48. Did government or organizational responses to COVID-19 offer any challenges for you regarding your participation in this program, other than those you've already discussed? If so, what were they, and how do you think they might best be addressed moving forward?
1. Yes: [OPEN-ENDED RESPONSE]
2. No
98. Don't know

Q49. Do you have any additional feedback regarding this program or Duke Energy that you would like to provide?
1. Yes; [OPEN ENDED RESPONSE]
2. No

Q50. Would you be willing to participate in an interview, so we might learn more about you and your students' experience with the program?
1. Yes
2. No [SKIP TO CLOSE]
98. Don't know [SKIP TO CLOSE]

[IF Q50= 1 (YES)]
Q51. Thank you for your willingness to be interviewed! We will be in touch with you regarding scheduling.

**Thank you for your time completing this survey. Your responses have been recorded. Have a great day!**

## E.5 Teacher Interview Guide

**Awareness, Grades and Subjects Taught, Type of Performance Seen**

Q1. What grade(s) and subject(s) do you teach?

Q2. What type of performance did you see? In-person(live) or online(recorded)?

Q3. Do you recall how you heard about the program?

Q4. Do you know how performances are scheduled for your school? Are you involved with this? If so, in what way? [IF NOT ADDRESSED IN Q3]

Q5. Do you have any suggestions regarding recruitment and/or performance scheduling that might improve these processes?

**Program Experience and Satisfaction**

Q6. What topics were covered in the performance?

Q7. Do you think any of the topics could have been better emphasized or explained? If so, which ones and why?

Q8. Should any topics be removed from the performance? If so, which ones and why?

Q9. What about age appropriateness – was the content appropriate for all ages [ELEMENTARY, MIDDLE, OR HIGH]? If not, what was not age appropriate? How could that be improved?

Q10. Did the performance keep your students' attention? If not, how could the content be improved to keep the students entertained and attentive?

Q11. What did you like the most about the performance?

Is there anything you disliked?

Q12. How did your students respond to the performance?

- *Probes:* What did students say about the performance? Did they like it? What specifically did they like most about it?

Q13. One of the goals of the NTC program is for performers to get students' families to sign up for energy efficiency kits from Duke Energy that contain energy efficient bulbs, low-flow shower heads, and other items that students' families can install in their home to save energy. Did the performers talk about the kits, and/or how to sign up?

- [*If* yes] What did they say?

Q14. How many NTC performances have you seen? [*If they saw multiple NTC performances:*] When did you see that/these performance(s)? How did the latest performance compare to the prior performance(s)?

Q15. On a scale of 1 to 5, where 1 is "not at all interested" and 5 is "very interested", how interested would you be in using virtual or recorded performances in your classroom?

Q16. Do you have any suggestions that might improve the National Theatre for Children performance(s)?

Q17. NTC provides student workbooks that contain educational materials and a form to get an energy saver kit for their home. Have you distributed these workbooks to your students? [THESE NOW ARE AVAILABLE FULLY ELECTRONIC, IF THE TEACHER HAS OPTED OUT OF PRINTED MATERIAL]

- [*If no:*] Why not?
- [*If yes:*] How does the workbook distribution work? Do the students get them in a class?
  - Did you print them yourselves, view it online, or were paper copies delivered?
  - How did you use the workbooks in your classroom?

Q18. Did you get any teacher-facing instructional material from NTC? [*If* yes] What was it? How did you receive it? [*Probe: Left in your box, emailed if in digital form, or in some other way?*] To what extent did you use that material?

- [*If material was not used:*] Why haven't you used the material(s)? What would make you more likely to use them?
- [*If used:*] Using a 1 to 5 scale where 1 means "not at all useful" and 5 means "extremely useful," how useful was the instructional material? Why did you give that rating? What was most/least useful about them?

Q19. Were any other materials handed out by the performers before, during, or after the performance? If so, what was handed out? Did you use these materials in your classroom, or did the students take them home? *[probe about value of these materials]*

Q20. Thinking about the educational materials NTC provided…

- In what ways, if any, did you incorporate the material into your lesson plans? [*IF NOT* MENTIONED] That is, did you extensively use it – such as weaving it into your course work over the year – or did you briefly utilize it in the time surrounding the performance? Please explain how extensively you used the material.

- Was the content age appropriate? Or was it too advanced or too basic? What was too basic/advanced? Is it age appropriate for all ages (ELEMENTARY, MIDDLE, HIGH) How effective is it in teaching kids about energy concepts?

Q21. Do you have any suggestions that might improve the classroom materials received from the National Theatre for Children?

Q22. Did anyone or any of the materials you received emphasize the value of the kits to you? If so, what did they say?

Q23. In the online survey you said you [DID / DID NOT] distribute the kit request form to your students.

- [*IF DISTRIBUTED*] What challenges, if any, did you encounter when trying to distribute the kit forms? Did you have to coordinate with other faculty or staff? If so, can you describe this process and how well the process worked? What can NTC or Duke Energy do to make this process easier for you?
- [*IF NOT DISTRIBUTED*] Why did you not distribute the kit forms? What can NTC or Duke Energy do to make this process easier for you?

Q24. What, if anything, did you say or do to encourage your students to take the kit form and have their parents fill it out? Did you encourage your students to sign up online? If so, what did you say or do in doing so?

Q25. Do you have suggestions that might improve the distribution of the kit forms to students, or the online sign-up process?

Q26. In what ways did the performers or the materials mention the Kilowatt Krush app, if at all? Did your students report using it? Do you have any feedback about the app or how its communicated to participants?

Q27. Thinking about the performance and curriculum as a whole, in what ways, if any, did your students subsequently demonstrate knowledge on the topics presented? [*IF NOT* MENTIONED] What were some of their main takeaways? What is the evidence of their increased knowledge? (test scores, etc.?)

**Wrap Up**

Q28. Do you have any other thoughts about the program that we didn't discuss that you think may be important?

**Thank you for your time. Have a great day!**

## E.6 Student Parent Survey

Landing Page Introduction

Thank you for agreeing to take this survey. It starts with a few questions about your experience in the program. The survey then asks for your feedback on various elements of the kit you received.

**Introduction/Screening**

Q1. [IF OUTBOUND CATI] Hi, I'm _______ , calling on behalf of Duke Energy, may I please speak with [CONTACT NAME]? We're returning your call regarding the survey about an energy efficiency educational program that Duke Energy sponsored in your child's school during the **2019-2020 school year.**

We would like to know about your participation in an energy efficiency educational program that Duke Energy sponsored in your child's school during the **2019-2020 school year**. In addition to sponsoring classroom activities, Duke Energy sent a kit containing energy saving items to your home. This kit included light bulbs, a showerhead, and other items that help you save energy in your home. Do you recall receiving this kit?

1. Yes
2. No [IF WEB: TERMINATE] [IF CATI: If no: Can I speak with another adult who may know something about this kit?]
98. Don't know [IF WEB: TERMINATE] [IF CATI: If DK: Can I speak with someone who may know something about this kit?]
99. Refused [TERMINATE]

[IF CATI: INTERVIEWER INSTRUCTIONS: *If no adults are able to speak about the kit, thank and terminate.*]

Q1.1 [IF Q1 = 1]. Were you aware of this program, prior to your child's involvement, due to your work at an elementary, middle, or high school?

1. Yes [→ TERMINATE]
2. No

**Program Experience**

Q2. Before today, did you know the kit you received was sponsored by Duke Energy?

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

[IF Q2 = 1]

Q3. How did you learn that the kit was sponsored by Duke Energy? *[Select all that apply]*

1. Classroom materials brought home by child
2. My child's teacher/school
3. Information material included in/on the kit
4. Other (specify: ___________)
98. Don't know
99. Refused

Q4. How did you hear about the opportunity to receive the kit from Duke Energy? *[Select all that apply]*

1. Classroom materials brought home by child
2. School newsletter
3. Email from my child's teacher/school
4. School website or school web portal
5. In-person conversations with my child's teacher
6. Saw a poster at my child's school
7. After hours event at my child's school
8. Other (specify: ___________)
98. Don't know
99. Refused

Q4b. How did you request your kit?

1. Program's website (www.myenergykit.org)
2. Sign-up form in the classroom materials my child brought home
3. By calling the toll-free number
4. Via the "Kilowatt Krush" app on my smartphone
98. Don't know
99. Refused

Q4c. Has your child used the "Kilowatt Krush" app on any smartphone in your household?

1. Yes
2. No [SKIP TO Q5]
98. Don't know [SKIP TO Q5 ]
99. Refused [SKIP TO Q5]

Q4d. About how often would you say that your child uses the "Kilowatt Krush" app?

1. They used it once
2. They used it a few times
3. They use it daily
4. They use it weekly
5. Other: [OPEN-ENDED RESPONSE]
98. Don't know
99. Refused

Q4e. Have you noticed your child engaging in energy saving behaviors you can attribute to their use of the "Kilowatt Krush" app?

1. Yes [Q4e.1 What energy saving behaviors have you noticed? OPEN-ENDED RESPONSE]
2. No
3. Don't know

Q4f. Do you have any feedback that might help improve the "Kilowatt Krush" app?

1. Yes [Q4f.1 What might improve the app? [OPEN-ENDED RESPONSE 98 Don't Know 99 = Refused]
2. No

98. Don't know
99. Refused

Q5. Did you read any of the Energy Savers booklet that came in the kit? This is the 44-page booklet with information about how to save energy in the home.

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

[ASK Q6 IF Q5 = 1]

Q6. On a scale from 0 to 10 where 0 is not at all helpful and 10 is very helpful, how helpful was the Energy Savers booklet in identifying ways your household could save energy at home?

0. Not at all helpful
1.
2.
3.
4.
5.
6.
7.
8.
9.
10. Very helpful
98. Don't know
99. Refused

[ASK Q7 IF Q6 < 7]

Q7. What might have made the information more helpful?

[OPEN-ENDED RESPONSE] 98=Don't Know 99= Refused

Q8. In addition to sending the energy saving kits, Duke Energy sponsored a program about energy and energy efficiency at your child's school, which included classroom materials and an in-school performance by the National Theatre for Children. Were you aware of this program before today?
*[IF CATI: Interviewer: Record 'yes' if the respondent reported any awareness of any aspect of the school program]*

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

[ASK IF Q8 = 1]

Q9. From who or where did you hear about this program?

[MULTIPLE RESPONSE]

1. From my child/children
2. From a teacher/school administrator
3. On Duke Energy website

4 Other, please specify: Q94.1 From who or where did you hear about this program? [OPEN-ENDED RESPONSE]
98 Don't Know
99. Refused

**Assessing Energy Saver Kit Installation**

We'd like to ask you about the energy saving items included in your kit.
The kit contained an energy-efficient showerhead, faucet aerators for the bathroom and kitchen, energy efficient light bulbs, a night light, and some insulator gaskets for light switches and electricity outlets.
IF CATI: [*IF NEEDED:* The bathroom and kitchen faucet aerators are small metal pieces that you can screw into a sink faucet to reduce water flow. The insulator gaskets are made of foam and are the size and shape of a light switch or electric outlet.]
IF WEB: (The bathroom and kitchen faucet aerators are small metal pieces that you can screw into a sink faucet to reduce water flow. The insulator gaskets are made of foam and are the size and shape of a light switch or electric outlet.)

Q10. Have you or anyone else installed any of those items in your home, even if they were taken out later?
*[IF CATI: Interviewer: Throughout interview, remind respondent as needed to report whether someone else in the home installed or uninstalled any items]*

[SINGLE RESPONSE]

1. Yes
2. No [→Q18]
98. Don't know [→ TERMINATE]
99. Refused [→ TERMINATE]

[ASK IF Q10 = 1]
Q11. Which of the items did you install, even if they were taken out later?
*[IF CATI: Interviewer: Record each response, then prompt with the list items.]*

| Item | Response |
|---|---|
| Q11a Showerhead | 1. Yes 2. No 98. DK 99. REF |
| Q11b Kitchen faucet aerator | 1. Yes 2. No 98. DK 99. REF |
| Q11c Bathroom faucet aerator | 1. Yes 2. No 98. DK 99. REF |
| Q11d Night light | 1. Yes 2. No 98. DK 99. REF |
| Q11e Energy efficient light bulb(s) (LEDs) | 1. Yes 2. No 98. DK 99. REF |
| Q11f Insulator gaskets for light switches and electricity outlets | 1. Yes 2. No 98. DK 99. REF |

[ASK IF Q11e (ENERGY EFFICIENT LIGHT BULB(S)) = 1 (YES)]
Q12. In addition to the night light, there were two LED light bulbs in the kit. Did you install one or both LED light bulbs in the kit?

[SINGLE RESPONSE]

1. I installed both LEDs
2. I installed only one LED light bulb
98. Don't know
99. Refused

[ASK IF Q11f = 1]
Q13. How many of the light switch and electric outlet gasket insulators from the kit di*d you, or someone else,* install in your home?

[SINGLE RESPONSE]

1. None
2. One
3. Two
4. Three
5. Four
6. Five
7. Six
8. Seven
9. Eight
10. Nine
11. Ten
12. Eleven
13. Twelve
98. Don't know
99. Refused

[ASK IF ANY PART OF Q11 = 1]
Q14. Overall, how satisfied are you with the item[s] you installed? Please use 0 to 10 scales, where 0 is very dissatisfied and 10 is very satisfied. How satisfied are you with...?

| DISPLAY IF | Item | Rating |
|---|---|---|
| Q11a = 1 | Q14a Showerhead | 0-10 with 98=DK, 99=REF |
| Q11b = 1 | Q14b Kitchen faucet aerator | 0-10 with 98=DK, 99=REF |
| Q11c = 1 | Q14c Bathroom faucet aerator | 0-10 with 98=DK, 99=REF |
| Q11d = 1 | Q14d Night light | 0-10 with 98=DK, 99=REF |
| Q11e = 1 | Q14e Energy efficient light bulbs (LEDs) | 0-10 with 98=DK, 99=REF |
| Q11f = 1 | Q14f Insulator gaskets | 0-10 with 98=DK, 99=REF |

[ASK IF ANY ITEMS IN Q14a - Q14f < 7]
Q14.1. Can you please explain any dissatisfaction you had with the [DISPLAY ALL ITEMS IN Q14 THAT ARE <7]?

Q14.1a [IF Q14a < 7] Showerhead
Q14.1b [IF Q14b < 7] Kitchen Faucet aerator
Q14.1c [IF Q14c <7] Bathroom faucet aerator
Q14.1d [IF Q14d< 7] Night light
Q14.1e [IF Q14e <7] Energy efficient light bulbs (LEDs)
Q14.1f [IF Q14f < 7] Insulator gaskets
[OPEN END: RECORD VERBATIM]

[ASK IF Q11a OR Q11b OR Q11c OR Q11d OR Q11e OR Q11f = 1]
Q15. Have you since uninstalled any of the items from the kit that you had previously installed?

[SINGLE RESPONSE]

1. Yes

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

[ASK IF Q15 = 1]
Q16. Which of the items did you uninstall?
*[IF CATI: Interviewer: Record the response, then prompt with the list items.]*

[MULTIPLE RESPONSE]

1. [DISPLAY IF Q11a = 1] Showerhead
2. [DISPLAY IF Q11b = 1] Kitchen faucet aerator
3. [DISPLAY IF Q11c = 1] Bathroom faucet aerator
4. [DISPLAY IF Q11d = 1] Night light
5. [DISPLAY IF Q11e = 1] Energy efficient light bulbs(LEDs)
6. [DISPLAY IF Q11f = 1] Insulator gaskets
98. Don't know
99. Refused

[ASK IF Q16 1-6 OPTIONS WERE SELECTED]
Q17. Why were those items uninstalled? Let's start with…
[IF CATI: *Interviewer: Read each item*]

| | Item | Reason |
|---|---|---|
| IF Q16 = 1 | Q17a Showerhead | Repeat reason options |
| IF Q16 = 2 | Q17b Kitchen faucet aerator | Repeat reason options |
| IF Q16 = 3 | Q17c Bathroom faucet aerator | Repeat reason options |
| IF Q16 = 4 | Q17d Night light | Repeat reason options |
| IF Q16 = 5 | Q17e Energy efficient light bulbs | Repeat reason options |
| IF Q16 = 6 | Q17f Insulator gaskets | Repeat reason options |

Response options:

[MULTIPLE RESPONSE]

1. It was broken
2. I didn't like how it worked
3. I didn't like how it looked
4. Other: (specify)
98. Don't Know
99. Refused

[ASK IF Q11a OR Q11b OR Q11c OR Q11d OR Q11e OR Q11f = 2 OR Q10 = 2]
Q18. You said you haven't installed [INPUT ONLY THOSE ITEMS IN Q11 IF Q11a-f = 2] OR [IF Q10=2, RECALL "any of the items"]. Which of those items do you plan to install in the next three months?
*[IF CATI: READ LIST - SELECT ALL THAT APPLY].]*

[MULTIPLE RESPONSE] [DISPLAY ALL IF = 2]

1 [ IF Q10 = 2 OR Q11a = 2] Showerhead
2 [ IF Q10 = 2 OR Q11b = 2] Kitchen faucet aerator
3 [ IF Q10 = 2 OR Q11c = 2] Bathroom faucet aerator

4 [ IF Q10 = 2 OR Q11d = 2] Night light
5 [ IF Q10 = 2 OR Q11e = 2] Energy efficient light bulbs(LEDs)
6 [IF Q10 =2 OR Q11f = 2] Insulator gaskets
98. None
99. Refused

[ASK IF ANY 1-6 OPTIONS WERE NOT SELECTED IN Q18 OR OPTION 98 "NONE" WAS SELECTED]

Q19. What's preventing you from installing those items? Let's start with….
[IF CATI: *Interviewer: Read items*]

[MULTIPLE RESPONSE]

| DISPLAY IF | Item | Reason |
|---|---|---|
| SKIP IF Q18=1,98,99 | Q19a Showerhead | Use multiple response options below |
| SKIP IF Q18=2,98,99 | Q19b Kitchen faucet aerator | Use multiple response options below |
| SKIP IF Q18=3,98,99 | Q19c Bathroom faucet aerator | Use multiple response options below |
| SKIP IF Q18=4,98,99 | Q19d Night light | Use multiple response options below |
| SKIP IF Q18=5,98,99 | Q19e Energy efficient light bulbs | Use multiple response options below |
| SKIP IF Q18=6,98,99 | Q19f Insulator gaskets | Use multiple response options below |

[MULTIPLE RESPONSE OPTIONS FOR Q19]

1. Didn't know what that was
2. Tried it, didn't fit
3. Tried it, didn't work as intended (Please specify: ______________________________)
4. Haven't gotten around to it
5. Current one is still working
6. Takes too much time to install it/No time/Too busy
7. Too difficult to install it, don't know how to do it
8. Don't have the tools I need
9. Don't have the items any longer (threw away, gave away)
10. [DISPLAY IF Q18.5 was not selected] Already have energy efficient light bulbs
11. [DISPLAY IF Q18.1 was not selected] Already have efficient showerhead
12. [DISPLAY IF Q18.2 was not selected] Already have efficient kitchen faucet aerator
13. [DISPLAY IF Q18.3 was not selected] Already have efficient bathroom faucet aerators
96. Other, please specify: [OPEN-ENDED RESPONSE]
98. Don't know
99. Refused

[IF ANY PART OF Q11 = 1 AND IT'S NOT THE CASE THAT ALL PARTS OF Q16=SELECTED (THAT IS, THEY INSTALLED ANYTHING AND DID NOT UNINSTALL EVERYTHING THEY INSTALLED)]

[SKIP Q20 IF Q10=2]

Q20. Thinking of the items you installed, would you be interested in receiving any more of them from Duke Energy? If so, which ones?
[MULTIPLE RESPONSES]

1. [IF Q11a = 1 AND Q16 <> 1 ] Yes, I would like another energy-efficient showerhead
2. [IF Q11b = 1 AND Q16 <> 2 ] Yes, I would like another kitchen faucet aerator
3. [IF Q11c = 1 AND Q16 <> 3 ] Yes, I would like more bathroom faucet aerators

4. [IF Q11d = 1 AND Q16 <>4 ] Yes, I would like more night lights
5. [IF Q11e = 1 AND Q16 <> 5 Yes, I would like more energy-efficient light bulbs (LEDs)
6. [IF Q11f = 1 AND Q16 <>6 Yes, I would like more switch/outlet gasket insulators
7. No, I am not interested in receiving any more of the items
98. Don't know
99. Refused

[IF Q20=1-6]

Q21. What would be your preferred way to request these additional items? [MULTIPLE RESPONSES]

1. Internet
2. Telephone
3. Pre-paid postcard
4. Other, please specify: [OPEN-ENDED RESPONSE]
98. Don't know
99. Refused

[ASK IF Q11a (SHOWERHEAD)) = 1 (YES) AND Q16 <>1 (SHOWERHEAD); THAT IS, SHOWERHEAD WAS INSTALLED AND NOT UNINSTALLED]

Q22. On average, what is the typical shower length in your household?

[SINGLE RESPONSE]

1. One minute or less
2. Two to four minutes
3. Five to eight minutes
4. Nine to twelve minutes
5. Thirteen to fifteen minutes
6. Sixteen to twenty minutes
7. Twenty-one to thirty minutes
8. More than thirty minutes
98. Don’t know
99. Refused

[ASK IF Q11a (SHOWERHEAD)) = 1 (YES) AND Q16 <>1 (SHOWERHEAD); THAT IS, SHOWERHEAD WAS INSTALLED AND NOT UNINSTALLED]

Q23. Thinking of the efficient showerhead currently installed in your home…on average, how many showers per day are taken in this shower?

[SINGLE RESPONSE]

1. Fewer than one
2. One
3. Two
4. Three
5. Four
6. Five
7. Six
8. Seven
9. Eight
98. Don't know
99. Refused

[ASK IF Q11d = 1 AND Q16 <>4 NIGHT LIGHT OPTION WAS NOT SELECTED]
Q24. YOU SAID YOU INSTALLED THE NIGHT LIGHT. Did the night light replace an existing night light?

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

[ASK IF Q24= 1]
Q25. Did the old nightlight have a bulb that you could take out and replace once it burned out?

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

[ASK IF (Q11e = 1 AND Q16 <> 5 (ENERGY EFFICIENT LIGHTS WERE NOT SELECTED)]
Q26. You said you installed at least one of the energy efficient lights. What type of bulb(s) did you replace with the energy efficient lightbulbs?

1. All incandescent [IF CATI: *Interviewer: describe as an old-fashioned light bulb - likely purchased more than two years ago*]
2. All halogen [IF CATI: *Interviewer: describe as bulb that looks like an incandescent, but has a glass tube inside of the bulb*]
3. All CFL [IF CATI: *Interviewer: describe as spiral, or twisty shape bulb that fit into ordinary light fixtures]*
4. All LED [IF CATI: *Interviewer: describe as a new bulb type that uses little electricity and lasts a long time*]
5. Some combination; Please describe: [OPEN-ENDED RESPONSE]
98. Don't know
99. Refused

[ASK IF (Q11e = 1 AND Q16 <> 5 (ENERGY EFFICIENT LIGHT BULBS NOT SELECTED)]
Q27. In what rooms did you install the energy efficient lightbulbs that were included in the kit? [MULTIPLE RESPONSE] [IF CATI: *Interviewer: If the respondent gives more than two responses, remind them that there were only two bulbs.]*

1. Living room
2. Dining room
3. Bedroom
4. Kitchen
5. Bathroom
6. Den
7. Garage
8. Hallway
9. Basement
10. Outdoors
11. Other area (please specify):_______
12. Don’t Know
13. Refused

Q28. Have you adjusted the temperature of your water heater based on the Hot Water Gauge Card included in your kit?

1. Yes
2. No
3. Don't recall seeing the Hot Water Gauge Card
98. Don't know
99. Refused

[ASK IF Q28 = 1]
Q29. Do you know what the old temperature setting on your hot water heater was? (Numeric answers only, please)

1. Yes (please type in previous temperature setting here)
2. No

[ASK IF Q28 = 1]
Q30. And what was the new temperature setting you set your hot water heater to? (Numeric answers only, please)

[Record response]

98. Don't know

[ASK IF Q28 = 1]
Q31. Is the new water heater temperature setting still in place?

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

[IF Q31 = 2]
Q32. Why did you change the water heater temperature a second time?

[Record response]

Q33. What is the fuel type of your water heater?

1. Electricity
2. Natural Gas
3. Other, please specify: [OPEN-ENDED RESPONSE]
98. Don't know
99. Refused

Q34. How old is your water heater?

1. Less than five years old
2. Five to nine years old
3. Ten to fifteen years old
4. More than fifteen years old
98. Don't know

**NTG**

[IF ANY PART OF Q11 = 1 AND IT'S NOT THE CASE THAT ALL PARTS OF Q16 =SELECTED (THAT IS, THEY INSTALLED ANYTHING AND DID NOT UNINSTALL EVERYTHING THEY INSTALLED)]

ASK Q35 IF [Q11a = 1 AND Q16<>1 ]OR [Q11b = 1 AND Q16 <>2 ] OR [Q11c = 1 AND Q16 <> 3] OR [Q11d = 1 AND Q16 <>4] OR Q11e = 1 AND Q16 <> 5] OR [Q11f = 1 AND Q16 <>6]

Q35. If you had not received the free efficiency items in the kit, how likely is it that you would have purchased and installed any of these same items within the next six months?

| 0 – Not at all likely | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 – Extremely likely | 98 DK | 99 RF |
|---|---|---|---|---|---|---|---|---|---|---|---|---|

Q35_1. [DISPLAY IF Q11a = 1 AND Q16 <>1] Energy-Efficient Showerhead
Q35_2. [DISPLAY IF Q11b = 1 AND Q16 <> 2] Kitchen Faucet Aerator
Q35_3. [DISPLAY IF Q11c = 1 AND Q16 <>3] Bathroom Faucet Aerator
Q35_4. [DISPLAY IF Q11d = 1 AND Q16 <>4] Energy-Efficient Night Light
Q35_5. [DISPLAY IF Q11e = 1 AND Q16 <> 5] Energy-Efficient Light Bulbs (LEDs)
Q35_6. [DISPLAY IF Q11f = 1 AND Q16 <>6] Switch/Outlet Gasket Insulators

[ASK Q36 IF Q35_4 > 4 AND Q12 = 1]

Q36. If you had not received them for free in the kit, how many LED light bulbs would you have purchased?

1. One
2. Two
98. Don't know
99. Refused

[IF (Q11a = 1 AND Q16 <> 1 ) OR (Q11b = 1 AND Q16 <> 2 ) OR (Q11c = 1 AND Q16 <> 3 )]

Q37. Now, thinking about the water savings items that were provided in the kit - using a scale from 0 to 10, where 0 means "not at all influential" and 10 means "extremely influential" how influential were the following factors on your decision to install the **water saving items (showerhead and faucet aerators)** from the kit? *How influential was…*

1[ *97 = Not Applicable 98= Don't Know 99 = Refused* [MATRIX QUESTION: SCALE]

| **Elements** | **Responses** |
|---|---|
| The fact that the items were free | 0-10 scale with DK and REF options |
| The fact that the items were mailed to your house | 0-10 scale with DK and REF options |
| Information in the kit about how the items would save energy | 0-10 scale with DK and REF options |
| Information that your child brought home from school | 0-10 scale with DK and REF options |
| Other information or advertisements from Duke Energy, including its website | 0-10 scale with DK and REF options |

[ASK Q38 IF Q11e = 1 AND Q16 <> 5]

Q38. Using a scale from 0 to 10, where 0 means "not at all influential" and 10 means "extremely influential" how influential were the following factors on your decision to install the **lightbulb(s)** from the kit? *How influential was…*

1 *97 = Not Applicable 98= Don't Know 99 = Refused* [MATRIX QUESTION: SCALE]

| **Elements** | **Responses** |
|---|---|
| The fact that the items were free | 0-10 scale with DK and REF options |
| The fact that the items were mailed to your house | 0-10 scale with DK and REF options |
| Information in the kit about how the items would save energy | 0-10 scale with DK and REF options |
| Information that your child brought home from school | 0-10 scale with DK and REF options |
| Other information or advertisements from Duke Energy, including its website | 0-10 scale with DK and REF options |

Q39. Since your child learned about energy conservation at school and signed up for your energy kit from Duke Energy, has **your child** adopted any **new behaviors** to help save energy in your home? This would only include new energy saving **behaviors** that your child adopted since receiving the kit.

[MULTIPLE RESPONSE]

1. Not applicable - no new behaviors
2. Turning off lights when not in a room
3. Turning off electronics when not using them
4. Taking shorter showers
5. Other (specify: ____________)
98. Don't know
99. Refused

Q39b. [IF =2 OR 3 OR 4 OR 5] Before receiving the kit, was your child already… [DISPLAY ITEMS SELECTED IN Q39]

Q39b.2 [Display IF Q39 = 2] Turning off lights when not in a room
Q39b.3 [Display IF Q39 = 3] Turning off electronics when not using them
Q39b.4 [Display if Q39 = 4] Taking shorter showers
Q39b.5 [ Display IF Q39 = 5 [Insert Q39 "other" ]__________)

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

Q40. Since receiving your energy kit from Duke Energy, have **you** adopted or increased any of the following **behaviors** to help save energy in your home?

[MULTIPLE RESPONSE]

1. Not applicable - no new behaviors
2. Turning off lights when not in a room

3. Turning off furnace when not home
4. Turning off air conditioning when not home
5. Changing thermostat settings so heating or cooling system uses less energy
6. Using fans instead of air conditioning
7. Turning off electronics when not using them
8. Taking shorter showers
9. Turning water heat thermostat down
10. Other (specify: ____________)
98. Don't know
99. Refused

Q40b. [IF Q40 = 2-10] Before receiving the kit, were you already…

[DISPLAY ITEMS SELECTED IN Q40- [Question labels: Q40b2 – Q40b10]

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

[ASK Q41 IF Q40b2 OR Q40b3 OR Q40b4 OR Q40b5 OR Q40b6 OR Q40b7 OR Q40b8 OR Q40b9 OR Q40b10 = 2]

Q41. On a scale of 0 to 10, where 0 means "not at all influential" and 10 means "extremely influential," how much influence did Duke Energy's kit and materials on saving energy have on this change of energy using behaviors?

| | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 0 – Not at all influential | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 – Extremely influential | 98 DK | 99 RF |

Q42. Since receiving your energy kit from Duke Energy, have you purchased and installed any other **products** or made any improvements to your home to help save energy?

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

[If Q42b= 1] [IF Q42 = 2, 98, 99 SKIP TO Q60]

Q43. What **products** have you purchased and installed to help save energy in your home?

*[IF CATI: Do not read list. After each response, ask, "Anything else?"]* [MULTIPLE RESPONSE]

1. Energy efficient appliances
2. Efficient heating or cooling equipment
3. Efficient windows
4. Insulation
5. Products to seal air leaks in your home
6. Products to seal ducts
7. LEDs and/or CFLs

8. Energy efficient water heater
9. None – no other actions taken
96. Other, please specify: ____________________
98. Don't know
99. Refused

[ASK IF Q43 <> 9, 98, OR 99]
Q44. Did you get a rebate from Duke Energy for any of those products or services? If so, which ones?

| [LOGIC] Item | Response |
|---|---|
| Q44.1 [IF Q43.1 IS SELECTED] 1. Energy efficient appliances | Yes, No DK REF |
| Q44.2 [IF Q43.2 IS SELECTED] 2. Efficient heating or cooling equipment | Yes, No DK REF |
| Q44.3 [IF Q43.3 IS SELECTED] 3. Efficient windows | Yes, No DK REF |
| Q44.4 [IF Q43.4 IS SELECTED] 4. Additional insulation | Yes, No DK REF |
| Q44.5 [IF Q43.5 IS SELECTED] 5. Products to seal air leaks in your home | Yes, No DK REF |
| Q44.6 [IF Q43.6 IS SELECTED] 6. Products to seal ducts | Yes, No DK REF |
| Q44.7 [IF Q43.7 IS SELECTED] 7. LEDs and/or CFLs | Yes, No DK REF |
| Q44.8 [IF Q43.8 IS SELECTED] 8. Install an energy efficient water heater | Yes, No DK REF |
| Q44.96 [IF Q43.96 IS SELECTED] 96 [**Q43 OPEN ENDED RESPONSE]** | Yes, No DK REF |

[ASK IF ANY ITEM IN Q43 WAS SELECTED]
Q45. On a scale of 0 to 10, where 0 means “not at all influential” and 10 means “extremely influential”, how much influence did the Duke Energy schools program have on your decision to…

[MATRIX QUESTION: SCALE]

| [LOGIC] Item | Response |
|---|---|
| Q45.1 [IF Q43.1 IS SELECTED] 1. Buy energy efficient appliances | 0-10 scale with DK and REF |
| Q45.2 [IF Q43.2 IS SELECTED] 2. Buy efficient heating or cooling equipment | 0-10 scale with DK and REF |
| Q45.3 [IF Q43.3 IS SELECTED] 3. Buy efficient windows | 0-10 scale with DK and REF |
| Q45.4 [IF Q43.4 IS SELECTED] 4. Buy additional insulation | 0-10 scale with DK and REF |
| Q45.5 [IF Q43.5 IS SELECTED] 5. Seal air leaks in your home | 0-10 scale with DK and REF |
| Q45.6 [IF Q43.6 IS SELECTED] 6. Seal ducts | 0-10 scale with DK and REF |
| Q45.7[IF Q43.7 IS SELECTED] 7. Buy LEDs and/or CFLs | 0-10 scale with DK and REF |
| Q45.8 [IF Q43.8 IS SELECTED] 8. Install an energy efficient water heater | 0-10 scale with DK and REF |
| Q45.96[IF Q43.96 IS SELECTED] **[Q45 open ended response]** | 0-10 scale with DK and REF |

[ASK IF Q43.1 IS SELECTED AND Q45.1 <> 0, DK, REF]
Q46. What kinds of appliance(s) did you buy?

1*[IF CATI: Do not read list]* [MULTIPLE RESPONSE]

1. Refrigerator
2. Stand-alone Freezer
3. Dishwasher
4. Clothes washer
5. Clothes dryer
6. Oven
7. Microwave
96. Other, please specify: ____________
98. Don’t know
99. Refused

[ASK *Q47* IF Q46 = 1-96] [REPEAT *Q47* FOR EACH ITEM MENTIONED IN Q46]

Q47. Was the [INSERT Q46 RESPONSE] an ENERGY STAR or high-efficiency model?

[SINGLE RESPONSE]

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

[ASK IF Q46 = 5]
Q48. Does the new clothes dryer use natural gas?

1 Yes - it uses natural gas
2 No – does not use natural gas
98. Don’t know
99. Refused

[ASK IF Q43 = 2 AND Q45.2 > 0]
Q49. What type of heating or cooling equipment did you buy?

*[Do not read list]* [MULTIPLE RESPONSE]

1. Central air conditioner
2. Window/room air conditioner unit
3. Wall air conditioner unit
4. Air source heat pump
5. Geothermal heat pump
6. Boiler
7. Furnace
8. WIFI-enabled thermostat
96. Other, please specify: _______________
98. Don't know
99. Refused

[ASK IF Q49 = 6-7]
Q50. Does the new [INSERT RESPONSE] use natural gas?

1. Yes - it uses natural gas
2. No – does not use natural gas
98. Don’t know
99. Refused

[ASK IF Q49 = 1-8, 96] QUESTION LABELS: Q51.1, Q51.2, Q51.3, Q51.4, Q51.5, Q51.6, Q51.7, Q51.96

Q51. Was the heating or cooling equipment an ENERGY STAR or high-efficiency model?

[SINGLE RESPONSE]

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

[REPEAT Q51 FOR EACH ITEM MENTIONED IN Q49, EXCLUDING 49=8 WIFI -enabled thermostat]

[ASK IF Q43 = 3 AND Q45.3 > 0]

Q52. HOW MANY WINDOWS DID YOU INSTALL?

1. [ _______________][Numeric Response 1-30
1. Don’t know
99. Refused

[ASK IF Q43 = 4 AND Q45.4 > 0]

Q53. Did you add insulation to your attic, walls, or below the floor?

*[IF CATI: Do not read list]* [MULTIPLE RESPONSE]

1. Attic
2 Walls
3 Below the floor
98. Don't know
99. Refused

[ASK IF Q53 <> 98-99]
[PROGRAMMER: REPEAT Q54 FOR EACH ITEM MENTIONED IN Q53] Q54.1 = ATTIC Q54.2 = WALLS Q54.3 = BELOW THE FLOOR]

Q54. Approximately what proportion of the [ITEM MENTIONED IN Q53] SPACE DID YOU ADD INSULATION TO? Your best estimate is fine.

1 [RECORD AS % ] [NUMERIC RANGE 1 – 100]
98 Don’t know
99. Refused

[ASK IF Q43 = 7 AND Q45.7 > 0]

Q55. How many of LEDs and CFLs did you install in your property?

[IF NEEDED: *Your best estimate is fine]*

1. [NUMERIC RESPONSE 1- 100 ]
1. Don’t know

99. Refused

[ASK IF Q55 > 50)

Q56. You said that you installed [Q55 RESPONSE] LED and CFL bulbs on your property. Is this the correct number?

1. Yes, this is number of LED and CFL bulbs I installed
2. No, the correct number is: (Numeric answers only, please) _______
98. Don't know
99. Refused

[ASK IF Q43 = 8 IS SELECTED AND Q45.8 > 0]
Q57. Does the new water heater use natural gas?

1Yes - it uses natural gas
2. No – does not use natural gas
98. Don't know
99. Refused

[ASK IF Q43 = 8 IS SELECTED AND Q45.8 > 0]
Q58. Which of the following water heaters did you purchase?

1. A traditional water heater with a large tank that holds the hot water
2. A tankless water heater that provides hot water on demand
3. A solar water heater
4. Other, please specify: _______________
98. Don't know
99. Refused

[ASK IF Q43 = 8 AND Q45.8 > 0]
Q59. Is the new water heater an ENERGY STAR model?

[SINGLE RESPONSE]

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

**Demographics**

Q60. Which of the following types of housing units would you say best describes your home?

1 Single-family detached house
2 Single-family attached home (such as a townhouse or condo)
3 Duplex, triplex or four-plex
4 Apartment or condominium with 5 units or more
5 Manufactured or mobile home
6 Other ______________
98. Don't know
99. Refused

Q61. How many showers are in your home? Please include both stand-up showers and bathtubs with showerheads.

1. One
2. Two

3. Three
4. Four
5. Five or more
98. Don't know
99. Refused

Q62. How many square feet of living space are there in your residence, including bathrooms, foyers and hallways (exclude garages, unfinished basements, and unheated porches)?

1 Less than 500 square feet

2 500 to under 1,000 square feet
3 1,000 to under 1,500 square feet
4 1,500 to under 2,000 square feet
5 2,000 to under 2,500 square feet
6 2,500 to under 3,000 square feet
7 Greater than 3,000 square feet
98. Don't know
99. Refused

Q63. Do you or members of your household own your home, or do you rent it?

1. Own / buying
2. Rent / lease
3. Occupy rent-free
98. Don't know
99. Refused

Q64. Including yourself, how many people currently live in your home year-round

1 I live by myself
2 Two people
3 Three people
4 Four people
5 Five people
6 Six people
7 Seven people
8 Eight or more people
98. Don't know
99. Refused

Q65. What was your total annual household income for 2020, before taxes?

1 Under $15,000
2 15 to under $25,000
3 25 to under $35,000
4 35 to under $50,000
5 50 to under $75,000
6 75 to under $100,000
7 100 to under $150,000
8 150 to under $200,000
9 $200,000 or more
98. Don't know
99. Prefer not to say

Q66. In what year were you born?

1. [ NUMERIC RESPONSE – FIELD WIDTH =4, 1900-2003 ]
98. Don't know
99. Prefer not to say

Q67. What is the highest level of education achieved among those living in your household?

1 Less than high school
2 Some high school
3 High school graduate or equivalent (such as GED)
4 Trade or technical school
5 Some college (including Associate degree)
6 College degree (Bachelor’s degree)
7 Some graduate school
8 Graduate degree, professional degree
9 Doctorate
98 Don't know
99. Prefer not to say

Q68. Lastly, did the COVID-19 pandemic, or government or organizational responses to it, offer any challenges to you regarding your participation in this program? If so, what were these challenges, and how do you think they might best be addressed moving forward?

1 Yes: [OPEN-ENDED RESPONSE]
2 No
98 Don't know

**Thank you for your time completing this survey. Your responses have been recorded. Have a great day!**

# Appendix F Survey Results

## F.1 Teacher Survey - DEC

Q1.What grade(s) do you teach?

| | # of responses | Percent |
|---|---|---|
| PreK-2nd | 1 | **2%** |
| PreK-5th | 7 | **16%** |
| PreK-8th | 1 | **2%** |
| Kindergarten | 1 | **2%** |
| K-5th | 1 | **2%** |
| K-6th | 1 | **2%** |
| 1st | 1 | **2%** |
| 1st-12th | 1 | **2%** |
| 3rd | 1 | **2%** |
| 3rd-5th | 1 | **2%** |
| 4th | 3 | **7%** |
| 5th & 6th | 1 | **2%** |
| 6th | 6 | **14%** |
| 6th-8th | 4 | **9%** |
| 7th | 2 | **5%** |
| 7th & 8th | 1 | **2%** |
| 8th | 1 | **2%** |
| 9th & 10th | 1 | **2%** |
| 9th-11th | 2 | **5%** |
| 9th-12th | 3 | **7%** |
| 9th, 10th & 12th | 1 | **2%** |
| 10th-12th | 2 | **5%** |
| Total | 43 | **100%** |

Q2. Are you a home room teacher?

| Group | Yes | No | Total |
|---|---|---|---|
| **Elementary** | 8 | 12 | 20 |
| ***Percent*** | **40%** | **60%** | **100%** |
| **Middle** | 0 | 14 | 14 |
| ***Percent*** | **0%** | **100%** | **100%** |
| **High** | 0 | 9 | 9 |
| ***Percent*** | **0%** | **100%** | **100%** |
| **Total** | 8 | 35 | 43 |
| ***Percent*** | **19%** | **81%** | **100%** |

Q3. What subject(s) do you teach?

| Group | Art, Other | English/ language arts, Other | English/language arts, Social studies/social sciences/history | Natural Sciences | Natural Sciences, Social studies/social sciences/history | Other | Social studies/social sciences/history | Total |
|---|---|---|---|---|---|---|---|---|
| **Elementary** | 0 | 0 | 2 | 0 | 0 | 0 | 1 | 3 |
| ***Percent*** | **0%** | **0%** | **66%** | **0%** | **0%** | **0%** | **33%** | **100%** |
| **Middle** | 1 | 0 | 0 | 8 | 1 | 3 | 1 | 14 |
| ***Percent*** | **7%** | **0%** | **0%** | **57%** | **7%** | **21%** | **7%** | **100%** |
| **High** | 0 | 1 | 0 | 7 | 0 | 1 | 0 | 9 |
| ***Percent*** | **0%** | **11%** | **0%** | **78%** | **0%** | **11%** | **0%** | **100%** |
| **Total** | 1 | 1 | 2 | 15 | 1 | 4 | 2 | 26 |
| ***Percent*** | **4%** | **4%** | **8%** | **58%** | **4%** | **15%** | **8%** | **100%** |

Q4. Do you teach any topics on energy (electricity, gas, coal, etc.) generation, transformation, use, or conservation (including, but not limited to, topics/materials provided by the Energy Efficiency for Schools Program)?

| Group | Yes | No | Total |
|---|---|---|---|
| **Elementary** | 11 | 0 | 11 |
| ***Percent*** | **100%** | **0%** | **100%** |
| **Middle** | 5 | 0 | 5 |
| ***Percent*** | **100%** | **0%** | **100%** |
| **High** | 2 | 0 | 2 |
| ***Percent*** | **100** | **0%** | **100%** |
| **Total** | 18 | 0 | 18 |
| ***Percent*** | **100%** | **0%** | **100%** |

Q5. Have you previously taken a survey (not fielded by the National Theatre for Children) regarding your participation in this program?

| Group | Yes | No | Don't Know/ Can't Recall | Total |
|---|---|---|---|---|
| **Elementary** | 0 | 10 | 1 | 11 |
| ***Percent*** | **0%** | **91%** | **9%** | **100%** |
| **Middle** | 1 | 9 | 4 | 14 |
| ***Percent*** | **7%** | **64%** | **29%** | **100%** |
| **High** | 0 | 5 | 4 | 9 |
| ***Percent*** | **0%** | **56%** | **44%** | **100%** |
| **Total** | 1 | 24 | 9 | 34 |
| ***Percent*** | **3%** | **71%** | **26%** | **100%** |

Q6. Did you attend The National Theatre for Children performance for elementary school students in [performance_month] of [performance_year]?

| | Yes | No | Don't Know | Total |
|---|---|---|---|---|
| **# of responses** | 8 | 0 | 0 | 8 |
| ***Percent*** | **100%** | **0%** | **0%** | **100%** |

Q7. Did your students see a performance event more specific to their grade level?

| | Yes, they saw the K-2 performance | Yes, they saw the performance for Grades 3-5 | No, they saw the K-5 performance | Don't know/ Can't recall | Total |
|---|---|---|---|---|---|
| **# of responses** | 3 | 5 | 0 | 0 | 8 |
| ***Percent*** | **37%** | **63%** | **0%** | **0%** | **100%** |

Q8. Did you see the National Theatre for Children performance for middle school students in [performance_month] of [performance_year]?

| Group | Yes | No | Don't Know/ Can't Recall | Total |
|---|---|---|---|---|
| **Elementary** | 3 | 0 | 0 | 3 |
| ***Percent*** | **100%** | **0%** | **0%** | **100%** |
| **Middle** | 14 | 0 | 0 | 14 |
| ***Percent*** | **100%** | **0%** | **0%** | **100%** |
| **High** | 0 | 0 | 0 | 0 |
| ***Percent*** | **0%** | **0%** | **0%** | **100%** |
| **Total** | 17 | 0 | 0 | 17 |
| ***Percent*** | **100%** | **0%** | **0%** | **100%** |

Q9. Did you see the National Theatre for Children performance for high school students in [performance_month] of [performance_year]?

| Group | Yes | No | Don't Know/ Can't Recall | Total |
|---|---|---|---|---|
| **Elementary** | 1 | 0 | 0 | 1 |
| ***Percent*** | **100%** | **0%** | **0%** | **100%** |
| **Middle** | 0 | 0 | 0 | 0 |
| ***Percent*** | **0%** | **0%** | **0%** | **0%** |
| **High** | 9 | 0 | 0 | 0 |
| ***Percent*** | **100%** | **0%** | **0%** | **100%** |
| **Total** | 17 | 0 | 0 | 17 |
| ***Percent*** | **100%** | **0%** | **0%** | **100%** |

Q10. Before today, were you aware the Duke Energy sponsored the National Theatre for Children performance(s) in your schoool?

| Group | Yes | No | Don't Know/ Can't Recall | Total |
|---|---|---|---|---|
| **Elementary** | 11 | 0 | 0 | 11 |
| ***Percent*** | **100%** | **0%** | **0%** | **100%** |
| **Middle** | 14 | 0 | 0 | 14 |
| ***Percent*** | **100%** | **0%** | **0%** | **0%** |
| **High** | 8 | 1 | 0 | 9 |
| ***Percent*** | **89%** | **11%** | **0%** | **100%** |
| **Total** | 33 | 1 | 0 | 34 |
| ***Percent*** | **97%** | **3%** | **0%** | **100%** |

Q11. How did you learn of Duke Energy's involvement with the National Theatre for Children program?

| | Elementary | *Percent* | Middle | *Percent* | High | *Percent* | Total | *Percent* |
|---|---|---|---|---|---|---|---|---|
| Another teacher | 2 | **18%** | 2 | **14%** | 0 | **0%** | 4 | **12%** |
| Another teacher; Duke Energy marketing materials | 0 | **0%** | 1 | **7%** | 0 | **0%** | 1 | **3%** |
| Don't know | 0 | **0%** | 1 | **7%** | 0 | **0%** | 1 | **3%** |
| Duke Energy marketing materials | 3 | **27%** | 2 | **14%** | 0 | **0%** | 5 | **15%** |
| Duke Energy marketing materials; National Theatre for Children materials | 1 | **9%** | 0 | **0%** | 1 | **13%** | 2 | **6%** |
| Duke Energy marketing materials; National Theatre for Children staff | 0 | **0%** | 0 | **0%** | 1 | **13%** | 1 | **3%** |
| Duke Energy marketing materials; National Theatre for Children staff; National Theatre for Children materials | 1 | **9%** | 0 | **0%** | 2 | **25%** | 3 | **9%** |
| Duke Energy staff; National Theatre for Children staff; National Theatre for Children materials | 0 | **0%** | 1 | **7%** | 0 | **0%** | 1 | **3%** |
| National Theatre for Children materials | 2 | **18%** | 2 | **14%** | 0 | **0%** | 4 | **12%** |
| National Theatre for Children staff | 0 | **0%** | 2 | **14%** | 2 | **25%** | 4 | **12%** |
| National Theatre for Children staff; National Theatre for Children materials | 0 | **0%** | 1 | **7%** | 2 | **25%** | 3 | **9%** |
| Other | 2 | **18%** | 2 | **14%** | 0 | **0%** | 4 | **12%** |
| Total | 11 | **100%** | 14 | **100%** | 8 | **100%** | 33 | **100%** |

Q12. Are you (one of) the decision-maker[s] regarding the NTC performances at your school?

| Group | Yes | No | Don't Know/ Can't Recall | Total |
|---|---|---|---|---|
| **Elementary** | 9 | 1 | 1 | 11 |
| ***Percent*** | **82%** | **9%** | **9%** | **100%** |
| **Middle** | 14 | 0 | 0 | 14 |
| ***Percent*** | **100%** | **0%** | **0%** | **0%** |
| **High** | 8 | 0 | 0 | 8 |
| ***Percent*** | **100%** | **0%** | **0%** | **100%** |
| **Total** | 31 | 1 | 1 | 33 |
| ***Percent*** | **94%** | **3%** | **3%** | **100%** |

Q13. Do you recall how the importance of the program was communicated to you?

| Group | Yes | No | Total |
|---|---|---|---|
| **Elementary** | 5 | 4 | 9 |
| ***Percent*** | **56%** | **44%** | **100%** |
| **Middle** | 9 | 5 | 14 |
| ***Percent*** | **64%** | **36%** | **100%** |
| **High** | 6 | 2 | 8 |
| ***Percent*** | **75%** | **25%** | **100%** |
| **Total** | 20 | 11 | 31 |
| ***Percent*** | **65%** | **35%** | **100%** |

Q14. Thinking back to the school performance, would you say that energy related concepts presented in the performance were:

| Group | Far too advanced for most of your students | Somewhat too advanced for most of your students | About right for most of your students | Somewhat too basic for most of your students | Far too basic for most of your students | Other | Don't know | Total |
|---|---|---|---|---|---|---|---|---|
| **Elementary** | 0 | 0 | 10 | 1 | 0 | 0 | 0 | 11 |
| ***Percent*** | **0%** | **0%** | **91%** | **9%** | **0%** | **0%** | **0%** | **100%** |
| **Middle** | 0 | 0 | 12 | 2 | 0 | 0 | 0 | 14 |
| ***Percent*** | **0%** | **0%** | **86%** | **14%** | **0%** | **0%** | **0%** | **100%** |
| **High** | 0 | 0 | 6 | 3 | 0 | 0 | 0 | 9 |
| ***Percent*** | **0%** | **0%** | **67%** | **33%** | **0%** | **0%** | **0%** | **100%** |
| **Total** | 0 | 0 | 28 | 6 | 0 | 0 | 0 | 34 |
| ***Percent*** | **0%** | **0%** | **82%** | **18%** | **0%** | **0%** | **0%** | **100%** |

Q15. What about the performance was too advanced for most of your students?

***Open-ended response type; no tabulation available***

Q16. What about the performance was too basic for most of your students?

***Open-ended response type; no tabulation available***

Q17. Were there any concepts that the performance(s) did not cover that SHOULD HAVE BEEN covered?

| Group | Yes | No | Don't Know/ Can't Recall | Total |
|---|---|---|---|---|
| **Elementary** | 0 | 10 | 1 | 11 |
| ***Percent*** | **0%** | **91%** | **9%** | **100%** |
| **Middle** | 0 | 10 | 4 | 14 |
| ***Percent*** | **0%** | **71%** | **29%** | **100%** |
| **High** | 1 | 8 | 0 | 9 |
| ***Percent*** | **11%** | **89%** | **0%** | **100%** |
| **Total** | 1 | 28 | 5 | 34 |
| ***Percent*** | **3%** | **82%** | **15%** | **100%** |

Q18. What concepts were not covered that SHOULD HAVE BEEN covered?

***Open-ended response type; no tabulation available***

Q19. Please estimate your student's overall engagement level with the National Theatre for Children performance on the following scale.

| Group | 1 | 2 | 3 | 4 | 5 | Don't know | Total |
|---|---|---|---|---|---|---|---|
| **Elementary** | 0 | 0 | 1 | 6 | 4 | 0 | 11 |
| ***Percent*** | **0%** | **0%** | **9%** | **55%** | **37%** | **0%** | **100%** |
| **Middle** | 0 | 1 | 1 | 7 | 5 | 0 | 14 |
| ***Percent*** | **0%** | **7%** | **7%** | **50%** | **36%** | **0%** | **100%** |
| **High** | 0 | 0 | 3 | 4 | 2 | 0 | 9 |
| ***Percent*** | **0%** | **0%** | **33%** | **44%** | **22%** | **0%** | **100%** |
| **Total** | 0 | 1 | 5 | 17 | 11 | 0 | 34 |
| ***Percent*** | **0%** | **3%** | **15%** | **50%** | **32%** | **0%** | **100%** |

Q20. Please rate your overall satisfaction with the National Theatre for Children performance on the following scale.

| Group | 1 | 2 | 3 | 4 | 5 | Don't know | Total |
|---|---|---|---|---|---|---|---|
| **Elementary** | 0 | 0 | 0 | 3 | 8 | 0 | 11 |
| ***Percent*** | **0%** | **0%** | **0%** | **27%** | **73%** | **0%** | **100%** |
| **Middle** | 0 | 0 | 1 | 2 | 11 | 0 | 14 |
| ***Percent*** | **0%** | **0%** | **7%** | **14%** | **79%** | **0%** | **100%** |
| **High** | 0 | 0 | 1 | 4 | 4 | 0 | 9 |
| ***Percent*** | **0%** | **0%** | **11%** | **44%** | **44%** | **0%** | **100%** |
| **Total** | 0 | 0 | 2 | 9 | 23 | 0 | 34 |
| ***Percent*** | **0%** | **0%** | **6%** | **26%** | **68%** | **0%** | **100%** |

Q21. Please explain why you offered this satisfaction rating

***Open-ended response type; no tabulation available***

Q22. Did you receive curriculum or instructional materials, such as student workbooks, related to energy and energy conservation from National Theatre for Children for the Fall 2019 - Spring 2020 school year?

| Group | Yes | No | Don't Know/ Can't Recall | Total |
|---|---|---|---|---|
| **Elementary** | 9 | 1 | 1 | 11 |
| ***Percent*** | **82%** | **9%** | **9%** | **100%** |
| **Middle** | 9 | 4 | 1 | 14 |
| ***Percent*** | **64%** | **29%** | **7%** | **100%** |
| **High** | 5 | 4 | 0 | 9 |
| ***Percent*** | **56%** | **44%** | **0%** | **100%** |
| **Total** | 23 | 9 | 2 | 34 |
| ***Percent*** | **68%** | **26%** | **6%** | **100%** |

Q23. To what degree did you use the curriculum or instructional materials in teaching your students about energy?

| Group | Not at all | A little | Moderately | A lot | Extensively | Don't know | Total |
|---|---|---|---|---|---|---|---|
| **Elementary** | 0 | 6 | 3 | 0 | 0 | 0 | 9 |
| ***Percent*** | **0%** | **67%** | **33%** | **0%** | **0%** | **0%** | **100%** |
| **Middle** | 0 | 3 | 6 | 0 | 0 | 0 | 9 |
| ***Percent*** | **0%** | **33%** | **67%** | **0%** | **0%** | **0%** | **100%** |
| **High** | 0 | 1 | 3 | 1 | 0 | 0 | 5 |
| ***Percent*** | **0%** | **20%** | **60%** | **20%** | **0%** | **0%** | **100%** |
| **Total** | 0 | 10 | 12 | 1 | 0 | 0 | 23 |
| ***Percent*** | **0%** | **43%** | **53%** | **3%** | **0%** | **0%** | **100%** |

Q24. Why did you only use the workbooks "a little" in teaching your students about energy?

***Open-ended response type; no tabulation available***

Q25. Thinking about how the student workbooks explained energy related concepts, would you say that the materials were generally:

| Group | Far too advanced for most of your students | Somewhat too advanced for most of your students | About right for most of your students | Somewhat too basic for most of your students | Far too basic for most of your students | Other | Don't know | Refused | Total |
|---|---|---|---|---|---|---|---|---|---|
| **Elementary** | 0 | 1 | 7 | 0 | 0 | 0 | 1 | 0 | 9 |
| ***Percent*** | **0%** | **11%** | **78%** | **0%** | **0%** | **0%** | **11%** | **0%** | **100%** |
| **Middle** | 0 | 0 | 8 | 0 | 0 | 1 | 0 | 0 | 9 |
| ***Percent*** | **0%** | **0%** | **89%** | **0%** | **0%** | **11%** | **0%** | **0%** | **100%** |
| **High** | 0 | 0 | 4 | 1 | 0 | 0 | 0 | 0 | 5 |
| ***Percent*** | **0%** | **0%** | **80%** | **20%** | **0%** | **0%** | **0%** | **0%** | **100%** |
| **Total** | 0 | 1 | 19 | 1 | 0 | 1 | 1 | 0 | 23 |
| ***Percent*** | **0%** | **4%** | **83%** | **4%** | **0%** | **4%** | **4%** | **0%** | **100%** |

Q26. Please rate how useful the materials were to you in teaching your students about energy.

| Group | 1 | 2 | 3 | 4 | 5 | Don't know | Total |
|---|---|---|---|---|---|---|---|
| **Elementary** | 0 | 2 | 4 | 2 | 1 | 0 | 9 |
| ***Percent*** | **0%** | **22%** | **44%** | **22%** | **11%** | **0%** | **100%** |
| **Middle** | 0 | 1 | 1 | 3 | 3 | 1 | 9 |
| ***Percent*** | **0%** | **11%** | **11%** | **33%** | **33%** | **11%** | **100%** |
| **High** | 0 | 0 | 1 | 2 | 2 | 0 | 5 |
| ***Percent*** | **0%** | **0%** | **20%** | **40%** | **40%** | **0%** | **100%** |
| **Total** | 0 | 3 | 6 | 7 | 6 | 1 | 23 |
| ***Percent*** | **0%** | **13%** | **26%** | **30%** | **26%** | **4%** | **100%** |

Q27. Please rate the degree to which the topics in the workbook aligned with your state's science standards for the grade(s) you teach.

| Group | Completely aligned | Mostly aligned | Somewhat aligned | Poorly aligned | Not at all aligned | N/A - no science standards for my grade(s) | Don't know | Refused | Total |
|---|---|---|---|---|---|---|---|---|---|
| **Elementary** | 0 | 4 | 3 | 0 | 0 | 0 | 2 | 0 | 9 |
| ***Percent*** | **0%** | **44%** | **33%** | **0%** | **0%** | **0%** | **22%** | **0%** | **100%** |
| **Middle** | 0 | 6 | 3 | 0 | 0 | 0 | 0 | 0 | 9 |
| ***Percent*** | **0%** | **67%** | **33%** | **0%** | **0%** | **0%** | **0%** | **0%** | **100%** |
| **High** | 0 | 3 | 2 | 0 | 0 | 0 | 0 | 0 | 5 |
| ***Percent*** | **0%** | **60%** | **40%** | **0%** | **0%** | **0%** | **0%** | **0%** | **100%** |
| **Total** | 0 | 13 | 8 | 0 | 0 | 0 | 2 | 0 | 23 |
| ***Percent*** | **0%** | **57%** | **35%** | **0%** | **0%** | **0%** | **9%** | **0%** | **100%** |

Q28. Which topic(s) was or were poorly aligned or not aligned at all with your state's science standards? In what way(s)?

***Open-ended response type; no tabulation available***

Q29. Were there any concepts covered in the curriculum or instructional materials that your students had challenges with?

| Group | Yes | No | Don't Know/ Can't Recall | Refused | Total |
|---|---|---|---|---|---|
| **Elementary** | 0 | 6 | 3 | 0 | 9 |
| ***Percent*** | **0%** | **67%** | **33%** | **0%** | **100%** |
| **Middle** | 1 | 6 | 2 | 0 | 9 |
| ***Percent*** | **11%** | **67%** | **22%** | **0%** | **100%** |
| **High** | 0 | 3 | 2 | 0 | 5 |
| ***Percent*** | **0%** | **60%** | **40%** | **0%** | **100%** |
| **Total** | 1 | 15 | 7 | 0 | 23 |
| ***Percent*** | **4%** | **65%** | **30%** | **0%** | **100%** |

Q30. What concepts did your students have challenges with?

***Open-ended response type; no tabulation available***

Q31. Were there any concepts that the materials did not cover that SHOULD HAVE BEEN covered?

| Group | Yes | No | Don't Know/ Can't Recall | Refused | Total |
|---|---|---|---|---|---|
| **Elementary** | 0 | 7 | 2 | 0 | 9 |
| ***Percent*** | **0%** | **78%** | **22%** | **0%** | **100%** |
| **Middle** | 1 | 7 | 1 | 0 | 9 |
| ***Percent*** | **11%** | **78%** | **11%** | **0%** | **100%** |
| **High** | 0 | 4 | 1 | 0 | 5 |
| ***Percent*** | **0%** | **80%** | **20%** | **0%** | **100%** |
| **Total** | 1 | 18 | 4 | 0 | 23 |
| ***Percent*** | **4%** | **78%** | **17%** | **0%** | **100%** |

Q32. What concepts were not covered that SHOULD HAVE BEEN covered?

***Open-ended response type; no tabulation available***

Q33. Please rate your overall satisfaction with curriculum or instructional materials you received from the National Theatre for Children program using the following scale.

| Group | 1 | 2 | 3 | 4 | 5 | Don't know | Total |
|---|---|---|---|---|---|---|---|
| **Elementary** | 0 | 0 | 2 | 5 | 2 | 0 | 9 |
| ***Percent*** | **0%** | **0%** | **22%** | **56%** | **22%** | **0%** | **100%** |
| **Middle** | 0 | 0 | 1 | 3 | 5 | 0 | 9 |
| ***Percent*** | **0%** | **0%** | **11%** | **33%** | **56%** | **0%** | **100%** |
| **High** | 0 | 0 | 0 | 2 | 3 | 0 | 5 |
| ***Percent*** | **0%** | **0%** | **0%** | **40%** | **60%** | **0%** | **100%** |
| **Total** | 0 | 0 | 3 | 10 | 10 | 0 | 23 |
| ***Percent*** | **0%** | **0%** | **13%** | **43%** | **43%** | **0%** | **100%** |

Q34. Do you have any additional input regarding the curriculum or instructional materials received from the National Theatre for Children that you would like to provide, including other things you liked or think could be improved? This might include things like overall presentation, length, level of detail, messaging, or anything else.

***Open-ended response type; no tabulation available***

Q35. Why did you NOT use the curriculum or instructional materials in teaching your students about energy?

***Open-ended response type; no tabulation available***

Q36. Did you have any interactions with anyone from the National Theatre for Children regarding the curriculum or instructional materials?

| Group | Yes | No | Don't Know/ Can't Recall | Total |
|---|---|---|---|---|
| **Elementary** | 5 | 6 | 0 | 11 |
| ***Percent*** | **45%** | **55%** | **0%** | **100%** |
| **Middle** | 5 | 8 | 1 | 14 |
| ***Percent*** | **36%** | **57%** | **7%** | **100%** |
| **High** | 4 | 5 | 0 | 9 |
| ***Percent*** | **44%** | **56%** | **0%** | **100%** |
| **Total** | 14 | 19 | 1 | 34 |
| ***Percent*** | **41%** | **56%** | **3%** | **100%** |

Q37. What did those interactions involve?

***Open-ended response type; no tabulation available***

Q38. Using the scale provided, how satisfied were you with:

***Your interactions with the National Theatre for Children staff, overall***

| Group | 1 | 2 | 3 | 4 | 5 | Don't know | Total |
|---|---|---|---|---|---|---|---|
| **Elementary** | 0 | 0 | 0 | 2 | 3 | 0 | 5 |
| ***Percent*** | **0%** | **0%** | **0%** | **40%** | **60%** | **0%** | **100%** |
| **Middle** | 0 | 0 | 0 | 0 | 5 | 0 | 5 |
| ***Percent*** | **0%** | **0%** | **0%** | **0%** | **100%** | **0%** | **100%** |
| **High** | 0 | 0 | 0 | 0 | 4 | 0 | 4 |
| ***Percent*** | **0%** | **0%** | **0%** | **0%** | **100%** | **0%** | **100%** |
| **Total** | 0 | 0 | 0 | 2 | 12 | 0 | 14 |
| ***Percent*** | **0%** | **0%** | **0%** | **14%** | **86%** | **0%** | **100%** |

***The professionalism and courtesy of the National Theatre for Children staff***

| Group | 1 | 2 | 3 | 4 | 5 | Don't know | Total |
|---|---|---|---|---|---|---|---|
| **Elementary** | 0 | 0 | 0 | 1 | 4 | 0 | 5 |
| ***Percent*** | **0%** | **0%** | **0%** | **20%** | **80%** | **0%** | **100%** |
| **Middle** | 0 | 0 | 0 | 0 | 5 | 0 | 5 |
| ***Percent*** | **0%** | **0%** | **0%** | **0%** | **100%** | **0%** | **100%** |
| **High** | 0 | 0 | 0 | 0 | 4 | 0 | 4 |
| ***Percent*** | **0%** | **0%** | **0%** | **0%** | **100%** | **0%** | **100%** |
| **Total** | 0 | 0 | 0 | 1 | 13 | 0 | 14 |
| ***Percent*** | **0%** | **0%** | **0%** | **7%** | **93%** | **0%** | **100%** |

***The National Theatre for Children staff's knowledge about the topics you discussed with them***

| Group | 1 | 2 | 3 | 4 | 5 | Don't know | Total |
|---|---|---|---|---|---|---|---|
| **Elementary** | 0 | 0 | 0 | 0 | 5 | 0 | 5 |
| ***Percent*** | **0%** | **0%** | **0%** | **0%** | **100%** | **0%** | **100%** |
| **Middle** | 0 | 0 | 0 | 0 | 5 | 0 | 5 |
| ***Percent*** | **0%** | **0%** | **0%** | **0%** | **100%** | **0%** | **100%** |
| **High** | 0 | 0 | 0 | 0 | 4 | 0 | 4 |
| ***Percent*** | **0%** | **0%** | **0%** | **0%** | **100%** | **0%** | **100%** |
| **Total** | 0 | 0 | 0 | 0 | 14 | 0 | 14 |
| ***Percent*** | **0%** | **0%** | **0%** | **0%** | **100%** | **0%** | **100%** |

Q39. Did you distribute the kit request form to your students?

| Group | Yes - I distributed the workbooks, which included the kit request form | Yes - I distributed the kit request forms separately | No | Don't Recall | Total |
|---|---|---|---|---|---|
| **Elementary** | 4 | 5 | 1 | 1 | 11 |
| ***Percent*** | **36%** | **45%** | **9%** | **9%** | **100%** |
| **Middle** | 5 | 6 | 2 | 1 | 14 |
| ***Percent*** | **36%** | **43%** | **14%** | **7%** | **100%** |
| **High** | 4 | 5 | 0 | 0 | 9 |
| ***Percent*** | **44%** | **56%** | **0%** | **0%** | **100%** |
| **Total** | 13 | 16 | 3 | 2 | 34 |
| ***Percent*** | **38%** | **47%** | **9%** | **6%** | **100%** |

Q40. On average, about what percentage of your students took the kit request form home?

| Group | 0% - 10% | 11% - 20% | 21% - 30% | 31% - 40% | 41% - 50% | 51% - 60% | 61% - 70% | 71% - 80% | 81% - 90% | 91% - 100% | Don't know | Total |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Elementary** | 0 | 0 | 2 | 0 | 1 | 0 | 0 | 0 | 1 | 5 | 0 | 9 |
| ***Percent*** | **0%** | **0%** | **22%** | **0%** | **11%** | **0%** | **0%** | **0%** | **11%** | **56%** | **0%** | **100%** |
| **Middle** | 2 | 1 | 1 | 0 | 2 | 3 | 0 | 0 | 1 | 1 | 0 | 11 |
| ***Percent*** | **18%** | **9%** | **9%** | **0%** | **18%** | **27%** | **0%** | **0%** | **9%** | **9%** | **0%** | **100%** |
| **High** | 0 | 1 | 2 | 3 | 0 | 0 | 0 | 0 | 3 | 0 | 0 | 9 |
| ***Percent*** | **0%** | **11%** | **22%** | **33%** | **0%** | **0%** | **0%** | **0%** | **33%** | **0%** | **0%** | **100%** |
| **Total** | 2 | 2 | 5 | 3 | 3 | 3 | 0 | 0 | 5 | 6 | 0 | 29 |
| ***Percent*** | **7%** | **7%** | **17%** | **10%** | **10%** | **10%** | **0%** | **0%** | **17%** | **21%** | **0%** | **100%** |

Q41. After students take the kit form home, do you follow up with students later to find out if their parents completed the form?

| Group | Yes | No | Don't Know/ Can't Recall | Total |
|---|---|---|---|---|
| Elementary | 2 | 5 | 2 | 9 |
| *Percent* | 22% | 56% | 22% | 100% |
| Middle | 7 | 3 | 1 | 11 |
| *Percent* | 64% | 27% | 9% | 100% |
| High | 4 | 5 | 0 | 9 |
| *Percent* | 44% | 56% | 0% | 100% |
| Total | 13 | 13 | 3 | 29 |
| *Percent* | 45% | 45% | 10% | 100% |

Q42. About what percentage of your students either brought the kit form back to you to mail, or reported their parents completed and sent the form to Duke Energy to receive their kit?

| Group | 0% - 10% | 11% - 20% | 21% - 30% | 31% - 40% | 41% - 50% | 51% - 60% | 61% - 70% | 71% - 80% | 81% - 90% | 91% - 100% | Don't know | Total |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Elementary | 0 | 3 | 2 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 3 | 9 |
| *Percent* | 0% | 33% | 22% | 0% | 11% | 0% | 0% | 0% | 0% | 0% | 33% | 100% |
| Middle | 4 | 1 | 3 | 1 | 0 | 0 | 2 | 0 | 0 | 0 | 0 | 11 |
| *Percent* | 36% | 9% | 27% | 9% | 0% | 0% | 18% | 0% | 0% | 0% | 0% | 100% |
| High | 1 | 3 | 2 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 2 | 9 |
| *Percent* | 11% | 33% | 22% | 0% | 0% | 0% | 0% | 0% | 11% | 0% | 22% | 100% |
| Total | 5 | 7 | 7 | 1 | 1 | 0 | 2 | 0 | 1 | 0 | 5 | 29 |
| *Percent* | 17% | 24% | 24% | 3% | 3% | 0% | 7% | 0% | 3% | 0% | 17% | 100% |

Q43. About what percentage of student families who had signed up for kits signed up on the website?

| Group | 0% - 10% | 11% - 20% | 21% - 30% | 31% - 40% | 41% - 50% | 51% - 60% | 61% - 70% | 71% - 80% | 81% - 90% | 91% - 100% | Don't know | Total |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Elementary** | 0 | 2 | 1 | 0 | 1 | 0 | 0 | 1 | 0 | 0 | 4 | 9 |
| ***Percent*** | 0% | 22% | 11% | 0% | 11% | 0% | 0% | 11% | 0% | 0% | 44% | 100% |
| **Middle** | 3 | 0 | 2 | 0 | 0 | 1 | 1 | 0 | 0 | 1 | 3 | 11 |
| ***Percent*** | 27% | 0% | 18% | 0% | 0% | 9% | 9% | 0% | 0% | 9% | 27% | 100% |
| **High** | 0 | 3 | 1 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 4 | 9 |
| ***Percent*** | 0% | 33% | 11% | 0% | 0% | 0% | 0% | 11% | 0% | 0% | 44% | 100% |
| **Total** | 3 | 5 | 4 | 0 | 1 | 1 | 1 | 2 | 0 | 1 | 11 | 29 |
| ***Percent*** | 10% | 17% | 14% | 0% | 3% | 3% | 3% | 7% | 0% | 3% | 38% | 100% |

Q44. Why didn't you distribute the kit request forms to your students?

***Open-ended response type; no tabulation available***

Q45. Did the NTC performers or the instructional materials mention the "Kilowatt Krush" app?

| Group | Yes | No | Don't Know/ Can't Recall | Total |
|---|---|---|---|---|
| **Elementary** | 7 | 1 | 3 | 11 |
| ***Percent*** | **64%** | **9%** | **27%** | **100%** |
| **Middle** | 8 | 4 | 2 | 14 |
| ***Percent*** | **57%** | **29%** | **14%** | **100%** |
| **High** | 4 | 0 | 5 | 9 |
| ***Percent*** | **44%** | **0%** | **56%** | **100%** |
| **Total** | 19 | 5 | 10 | 34 |
| ***Percent*** | **56%** | **15%** | **29%** | **100%** |

Q46. About what percentage of students would you say downloaded and used the app?

| Group | 0% - 10% | 11% - 20% | 21% - 30% | 31% - 40% | 41% - 50% | 51% - 60% | 61% - 70% | 71% - 80% | 81% - 90% | 91% - 100% | Don't know | Total |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Elementary** | 0 | 2 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 5 | 7 |
| ***Percent*** | **0%** | **29%** | **0%** | **0%** | **0%** | **0%** | **0%** | **0%** | **0%** | **0%** | **71%** | **100%** |
| **Middle** | 3 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 4 | 8 |
| ***Percent*** | **38%** | **0%** | **0%** | **13%** | **0%** | **0%** | **0%** | **0%** | **0%** | **0%** | **50%** | **100%** |
| **High** | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 3 | 4 |
| ***Percent*** | **0%** | **0%** | **0%** | **25%** | **0%** | **0%** | **0%** | **0%** | **0%** | **0%** | **75%** | **100%** |
| **Total** | 3 | 2 | 0 | 2 | 0 | 0 | 0 | 0 | 0 | 0 | 12 | 19 |
| ***Percent*** | **16%** | **11%** | **0%** | **11%** | **0%** | **0%** | **0%** | **0%** | **0%** | **0%** | **63%** | **100%** |

Q47. Do you have any suggestions to improve the app or how it was presented to students?

***Open-ended response type; no tabulation available***

Q48. Did government or organizational responses to COVID-19 offer any challenges for you regarding your participation in this program, other than those you've already discussed? If so, what were they, and how do you think they might best be addressed moving forward?

***Open-ended response type; no tabulation available***

Q49. Do you have any additional feedback regarding this program or Duke Energy that you would like to provide?

***Open-ended response type; no tabulation available***

Q50. Would you be willing to participate in an interview, so that we might learn more about you and your students' experience with the program?

| Group | Yes | No | Don't Know/ Can't Recall | Total |
|---|---|---|---|---|
| **Elementary** | 3 | 4 | 4 | 11 |
| ***Percent*** | **27%** | **36%** | **36%** | **100%** |
| **Middle** | 5 | 9 | 0 | 14 |
| ***Percent*** | **36%** | **64%** | **0%** | **100%** |
| **High** | 5 | 4 | 0 | 9 |
| ***Percent*** | **56%** | **44%** | **0%** | **100%** |
| **Total** | 13 | 17 | 4 | 34 |
| ***Percent*** | **38%** | **50%** | **12%** | **100%** |

## F.2 Teacher Survey - DEP

Q1.What grade(s) do you teach?

| | # of responses | Percent |
|---|---|---|
| PreK & Kindergarten | 1 | **3%** |
| PreK-1st | 1 | **3%** |
| PreK-2nd | 1 | **3%** |
| PreK-3rd | 1 | **3%** |
| PreK-5th | 2 | **7%** |
| PreK-6th | 1 | **3%** |
| PreK-9th | 1 | **3%** |
| Kindergarten | 2 | **7%** |
| 1st-3rd | 1 | **3%** |
| 2nd | 1 | **3%** |
| 3rd | 2 | **7%** |
| 5th | 1 | **3%** |
| 6th | 4 | **14%** |
| 6th-12th | 1 | **3%** |
| 7th | 2 | **7%** |
| 8th | 6 | **21%** |
| 9th-11th | 1 | **3%** |
| Total | 29 | **100%** |

Q2. Are you a home room teacher?

| Group | Yes | No | Total |
|---|---|---|---|
| **Elementary** | 6 | 8 | 14 |
| ***Percent*** | **43%** | **57%** | **100%** |
| **Middle** | 1 | 13 | 14 |
| ***Percent*** | **7%** | **93%** | **100%** |
| **High** | 0 | 1 | 1 |
| ***Percent*** | **0%** | **100%** | **100%** |
| **Total** | 7 | 22 | 29 |
| ***Percent*** | **24%** | **76%** | **100%** |

Q3. What subject(s) do you teach?

| Group | Math | Math, Natural Sciences | Math, Other | Math, Social studies/social sciences/history | Natural Sciences | Other | Total |
|---|---|---|---|---|---|---|---|
| **Elementary** | 0 | 0 | 0 | 0 | 1 | 0 | 1 |
| ***Percent*** | **0%** | **0%** | **0%** | **0%** | **100%** | **0%** | **100%** |
| **Middle** | 1 | 2 | 0 | 1 | 8 | 1 | 13 |
| ***Percent*** | **8%** | **15%** | **0%** | **8%** | **62%** | **8%** | **100%** |
| **High** | 0 | 0 | 1 | 0 | 0 | 0 | 1 |
| ***Percent*** | **0%** | **0%** | **100%** | **0%** | **0%** | **0%** | **100%** |
| **Total** | 1 | 2 | 1 | 1 | 9 | 1 | 15 |
| ***Percent*** | **7%** | **13%** | **7%** | **7%** | **60%** | **7%** | **100%** |

Q4. Do you teach any topics on energy (electricity, gas, coal, etc.) generation, transformation, use, or conservation (including, but not limited to, topics/materials provided by the Energy Efficiency for Schools Program)?

| Group | Yes | No | Total |
|---|---|---|---|
| **Elementary** | 6 | 0 | 6 |
| ***Percent*** | **100%** | **0%** | **100%** |
| **Middle** | 2 | 0 | 2 |
| ***Percent*** | **100%** | **0%** | **100%** |
| **High** | 0 | 0 | 0 |
| ***Percent*** | **0%** | **0%** | **0%** |
| **Total** | 8 | 0 | 8 |
| ***Percent*** | **100%** | **0%** | **100%** |

Q5. Have you previously taken a survey (not fielded by the National Theatre for Children) regarding your participation in this program?

| Group | Yes | No | Don't Know/ Can't Recall | Total |
|---|---|---|---|---|
| **Elementary** | 0 | 5 | 2 | 7 |
| ***Percent*** | **0%** | **71%** | **29%** | **100%** |
| **Middle** | 0 | 10 | 4 | 14 |
| ***Percent*** | **0%** | **71%** | **29%** | **100%** |
| **High** | 0 | 1 | 0 | 1 |
| ***Percent*** | **0%** | **100%** | **0%** | **100%** |
| **Total** | 0 | 16 | 6 | 22 |
| ***Percent*** | **0%** | **73%** | **27%** | **100%** |

Q6. Did you attend The National Theatre for Children performance for elementary school students in [performance_month] of [performance_year]?

| | Yes | No | Don't Know | Total |
|---|---|---|---|---|
| **# of responses** | 7 | 0 | 0 | 7 |
| ***Percent*** | **100%** | **0%** | **0%** | **100%** |

Q7. Did your students see a performance event more specific to their grade level?

| | Yes, they saw the K-2 performance | Yes, they saw the performance for Grades 3-5 | No, they saw the K-5 performance | Don't know/ Can't recall | Total |
|---|---|---|---|---|---|
| **# of responses** | 4 | 0 | 1 | 2 | 7 |
| ***Percent*** | **57%** | **0%** | **14%** | **29%** | **100%** |

Q8. Did you see the National Theatre for Children performance for middle school students in [performance_month] of [performance_year]?

| Group | Yes | No | Don't Know/ Can't Recall | Total |
|---|---|---|---|---|
| **Elementary** | 0 | 0 | 0 | 0 |
| ***Percent*** | **0%** | **0%** | **0%** | **0%** |
| **Middle** | 13 | 0 | 0 | 13 |
| ***Percent*** | **100%** | **0%** | **0%** | **100%** |
| **High** | 0 | 0 | 0 | 0 |
| ***Percent*** | **0%** | **0%** | **0%** | **0%** |
| **Total** | 13 | 0 | 0 | 13 |
| ***Percent*** | **100%** | **0%** | **0%** | **100%** |

Q9. Did you see the National Theatre for Children performance for high school students in [performance_month] of [performance_year]?

| Group | Yes | No | Don't Know/ Can't Recall | Total |
|---|---|---|---|---|
| **Elementary** | 0 | 0 | 0 | 0 |
| ***Percent*** | **0%** | **0%** | **0%** | **0%** |
| **Middle** | 1 | 0 | 0 | 1 |
| ***Percent*** | **100%** | **0%** | **0%** | **100%** |
| **High** | 1 | 0 | 0 | 1 |
| ***Percent*** | **100%** | **0%** | **0%** | **100%** |
| **Total** | 2 | 0 | 0 | 2 |
| ***Percent*** | **100%** | **0%** | **0%** | **100%** |

Q10. Before today, were you aware the Duke Energy sponsored the National Theatre for Children performance(s) in your schoool?

| Group | Yes | No | Don't Know/ Can't Recall | Total |
|---|---|---|---|---|
| **Elementary** | 5 | 1 | 0 | 6 |
| ***Percent*** | **83%** | **17%** | **0%** | **100%** |
| **Middle** | 14 | 0 | 0 | 14 |
| ***Percent*** | **100%** | **0%** | **0%** | **100%** |
| **High** | 1 | 0 | 0 | 1 |
| ***Percent*** | **100%** | **0%** | **0%** | **100%** |
| **Total** | 20 | 1 | 0 | 21 |
| ***Percent*** | **95%** | **5%** | **0%** | **100%** |

Q11. How did you learn of Duke Energy's involvement with the National Theatre for Children program?

| | Elementary | *Percent* | Middle | *Percent* | High | *Percent* | Total | *Percent* |
|---|---|---|---|---|---|---|---|---|
| Another teacher; Duke Energy marketing materials; National Theatre for Children staff | 0 | **0%** | 1 | **7%** | 0 | **0%** | 1 | **5%** |
| Duke Energy marketing materials | 0 | **0%** | 5 | **36%** | 0 | **0%** | 5 | **25%** |
| Duke Energy marketing materials; National Theatre for Children materials | 0 | **0%** | 1 | **7%** | 0 | **0%** | 1 | **5%** |
| National Theatre for Children materials | 2 | **40%** | 4 | **29%** | 0 | **0%** | 6 | **30%** |
| National Theatre for Children staff | 1 | **20%** | 2 | **14%** | 0 | **0%** | 3 | **15%** |
| Other | 2 | **40%** | 1 | **7%** | 1 | **100%** | 4 | **20%** |
| Total | 5 | **100%** | 14 | **100%** | 1 | **100%** | 20 | **100%** |

Q12. Are you (one of) the decision-maker[s] regarding the NTC performances at your school?

| Group | Yes | No | Don't Know/ Can't Recall | Total |
|---|---|---|---|---|
| Elementary | 4 | 1 | 0 | 5 |
| *Percent* | 80% | 20% | 0% | 100% |
| Middle | 13 | 1 | 0 | 14 |
| *Percent* | 93% | 7% | 0% | 100% |
| High | 0 | 0 | 1 | 1 |
| *Percent* | 0% | 0% | 100% | 100% |
| Total | 17 | 2 | 1 | 20 |
| *Percent* | 85% | 10% | 5% | 100% |

Q13. Do you recall how the importance of the program was communicated to you?

| Group | Yes | No | Total |
|---|---|---|---|
| Elementary | 3 | 1 | 4 |
| *Percent* | 75% | 25% | 100% |
| Middle | 10 | 3 | 13 |
| *Percent* | 77% | 23% | 100% |
| High | 0 | 0 | 0 |
| *Percent* | 0% | 0% | 100% |
| Total | 13 | 4 | 17 |
| *Percent* | 76% | 24% | 100% |

Q14. Thinking back to the school performance, would you say that energy related concepts presented in the performance were:

| Group | Far too advanced for most of your students | Somewhat too advanced for most of your students | About right for most of your students | Somewhat too basic for most of your students | Far too basic for most of your students | Other | Don't know | Total |
|---|---|---|---|---|---|---|---|---|
| Elementary | 0 | 0 | 6 | 0 | 0 | 0 | 0 | 6 |
| *Percent* | 0% | 0% | 100% | 0% | 0% | 0% | 0% | 100% |
| Middle | 0 | 0 | 11 | 3 | 0 | 0 | 0 | 14 |
| *Percent* | 0% | 0% | 79% | 21% | 0% | 0% | 0% | 100% |
| High | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 1 |
| *Percent* | 0% | 0% | 100% | 0% | 0% | 0% | 0% | 100% |
| Total | 0 | 0 | 18 | 3 | 0 | 0 | 0 | 21 |
| *Percent* | 0% | 0% | 86% | 14% | 0% | 0% | 0% | 100% |

Q15. What about the performance was too advanced for most of your students?

***Open-ended response type; no tabulation available***

Q16. What about the performance was too basic for most of your students?

***Open-ended response type; no tabulation available***

Q17. Were there any concepts that the performance(s) did not cover that SHOULD HAVE BEEN covered?

| Group | Yes | No | Don't Know/ Can't Recall | Total |
|---|---|---|---|---|
| **Elementary** | 0 | 4 | 2 | 6 |
| ***Percent*** | **0%** | **67%** | **33%** | **100%** |
| **Middle** | 2 | 11 | 1 | 14 |
| ***Percent*** | **14%** | **79%** | **7%** | **100%** |
| **High** | 1 | 0 | 0 | 1 |
| ***Percent*** | **100%** | **0%** | **0%** | **100%** |
| **Total** | 3 | 15 | 3 | 21 |
| ***Percent*** | **14%** | **71%** | **14%** | **100%** |

Q18. What concepts were not covered that SHOULD HAVE BEEN covered?

***Open-ended response type; no tabulation available***

Q19. Please estimate your student's overall engagement level with the National Theatre for Children performance on the following scale.

| Group | 1 | 2 | 3 | 4 | 5 | Don't know | Total |
|---|---|---|---|---|---|---|---|
| **Elementary** | 0 | 0 | 0 | 2 | 4 | 0 | 6 |
| ***Percent*** | **0%** | **0%** | **0%** | **33%** | **67%** | **0%** | **100%** |
| **Middle** | 0 | 1 | 3 | 4 | 6 | 0 | 14 |
| ***Percent*** | **0%** | **7%** | **21%** | **29%** | **43%** | **0%** | **100%** |
| **High** | 0 | 0 | 0 | 1 | 0 | 0 | 1 |
| ***Percent*** | **0%** | **0%** | **0%** | **100%** | **0%** | **0%** | **100%** |
| **Total** | 0 | 1 | 3 | 7 | 10 | 0 | 21 |
| ***Percent*** | **0%** | **5%** | **14%** | **33%** | **48%** | **0%** | **100%** |

Q20. Please rate your overall satisfaction with the National Theatre for Children performance on the following scale.

| Group | 1 | 2 | 3 | 4 | 5 | Don't know | Total |
|---|---|---|---|---|---|---|---|
| **Elementary** | 0 | 0 | 0 | 2 | 4 | 0 | 6 |
| ***Percent*** | **0%** | **0%** | **0%** | **33%** | **67%** | **0%** | **100%** |
| **Middle** | 0 | 0 | 1 | 3 | 10 | 0 | 14 |
| ***Percent*** | **0%** | **0%** | **7%** | **21%** | **71%** | **0%** | **100%** |
| **High** | 0 | 0 | 0 | 0 | 1 | 0 | 1 |
| ***Percent*** | **0%** | **0%** | **0%** | **0%** | **100%** | **0%** | **100%** |
| **Total** | 0 | 0 | 1 | 5 | 15 | 0 | 21 |
| ***Percent*** | **0%** | **0%** | **5%** | **24%** | **71%** | **0%** | **100%** |

Q21. Please explain why you offered this satisfaction rating

***Open-ended response type; no tabulation available***

Q22. Did you receive curriculum or instructional materials, such as student workbooks, related to energy and energy conservation from National Theatre for Children for the Fall 2019 - Spring 2020 school year?

| Group | Yes | No | Don't Know/ Can't Recall | Total |
|---|---|---|---|---|
| **Elementary** | 5 | 1 | 0 | 6 |
| ***Percent*** | **83%** | **17%** | **0%** | **100%** |
| **Middle** | 7 | 7 | 0 | 14 |
| ***Percent*** | **50%** | **50%** | **0%** | **100%** |
| **High** | 1 | 0 | 0 | 1 |
| ***Percent*** | **100%** | **0%** | **0%** | **100%** |
| **Total** | 13 | 8 | 0 | 21 |
| ***Percent*** | **62%** | **38%** | **0%** | **100%** |

Q23. To what degree did you use the curriculum or instructional materials in teaching your students about energy?

| Group | Not at all | A little | Moderately | A lot | Extensively | Don't know | Total |
|---|---|---|---|---|---|---|---|
| **Elementary** | 0 | 3 | 2 | 0 | 0 | 0 | 5 |
| ***Percent*** | **0%** | **60%** | **40%** | **0%** | **0%** | **0%** | **100%** |
| **Middle** | 0 | 2 | 5 | 0 | 0 | 0 | 7 |
| ***Percent*** | **0%** | **29%** | **71%** | **0%** | **0%** | **0%** | **100%** |
| **High** | 0 | 1 | 0 | 0 | 0 | 0 | 1 |
| ***Percent*** | **0%** | **100%** | **0%** | **0%** | **0%** | **0%** | **100%** |
| **Total** | 0 | 6 | 7 | 0 | 0 | 0 | 13 |
| ***Percent*** | **0%** | **46%** | **54%** | **0%** | **0%** | **0%** | **100%** |

Q24. Why did you only use the workbooks "a little" in teaching your students about energy?

***Open-ended response type; no tabulation available***

Q25. Thinking about how the student workbooks explained energy related concepts, would you say that the materials were generally:

| Group | Far too advanced for most of your students | Somewhat too advanced for most of your students | About right for most of your students | Somewhat too basic for most of your students | Far too basic for most of your students | Other | Don't know | Refused | Total |
|---|---|---|---|---|---|---|---|---|---|
| **Elementary** | 0 | 0 | 5 | 0 | 0 | 0 | 0 | 0 | 5 |
| ***Percent*** | **0%** | **0%** | **100%** | **0%** | **0%** | **0%** | **0%** | **0%** | **100%** |
| **Middle** | 0 | 0 | 5 | 2 | 0 | 0 | 0 | 0 | 7 |
| ***Percent*** | **0%** | **0%** | **71%** | **29%** | **0%** | **0%** | **0%** | **0%** | **100%** |
| **High** | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 1 |
| ***Percent*** | **0%** | **0%** | **100%** | **0%** | **0%** | **0%** | **0%** | **0%** | **100%** |
| **Total** | 0 | 0 | 11 | 2 | 0 | 0 | 0 | 0 | 13 |
| ***Percent*** | **0%** | **0%** | **85%** | **15%** | **0%** | **0%** | **0%** | **0%** | **100%** |

Q26. Please rate how useful the materials were to you in teaching your students about energy.

| Group | 1 | 2 | 3 | 4 | 5 | Don't know | Total |
|---|---|---|---|---|---|---|---|
| Elementary | 0 | 0 | 2 | 1 | 2 | 0 | 5 |
| *Percent* | 0% | 0% | 40% | 20% | 40% | 0% | 100% |
| Middle | 0 | 1 | 1 | 5 | 0 | 0 | 7 |
| *Percent* | 0% | 14% | 14% | 71% | 0% | 0% | 100% |
| High | 0 | 0 | 0 | 0 | 0 | 1 | 1 |
| *Percent* | 0% | 0% | 0% | 0% | 0% | 100% | 100% |
| Total | 0 | 1 | 3 | 6 | 2 | 1 | 13 |
| *Percent* | 0% | 8% | 23% | 46% | 15% | 8% | 100% |

Q27. Please rate the degree to which the topics in the workbook aligned with your state's science standards for the grade(s) you teach.

| Group | Completely aligned | Mostly aligned | Somewhat aligned | Poorly aligned | Not at all aligned | N/A - no science standards for my grade(s) | Don't know | Refused | Total |
|---|---|---|---|---|---|---|---|---|---|
| Elementary | 0 | 1 | 4 | 0 | 0 | 0 | 0 | 0 | 5 |
| *Percent* | 0% | 20% | 80% | 0% | 0% | 0% | 0% | 0% | 100% |
| Middle | 0 | 3 | 4 | 0 | 0 | 0 | 0 | 0 | 7 |
| *Percent* | 0% | 43% | 57% | 0% | 0% | 0% | 0% | 0% | 100% |
| High | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 1 |
| *Percent* | 0% | 0% | 0% | 0% | 0% | 0% | 0% | 100% | 100% |
| Total | 0 | 4 | 8 | 0 | 0 | 0 | 0 | 1 | 13 |
| *Percent* | 0% | 31% | 62% | 0% | 0% | 0% | 0% | 8% | 100% |

Q28. Which topic(s) was or were poorly aligned or not aligned at all with your state's science standards? In what way(s)?

***Open-ended response type; no tabulation available***

Q29. Were there any concepts covered in the curriculum or instructional materials that your students had challenges with?

| Group | Yes | No | Don't Know/ Can't Recall | Refused | Total |
|---|---|---|---|---|---|
| Elementary | 1 | 4 | 0 | 0 | 5 |
| *Percent* | 20% | 80% | 0% | 0% | 100% |
| Middle | 0 | 6 | 1 | 0 | 7 |
| *Percent* | 0% | 86% | 14% | 0% | 100% |
| High | 0 | 0 | 1 | 0 | 1 |
| *Percent* | 0% | 0% | 100% | 0% | 100% |
| Total | 1 | 10 | 2 | 0 | 13 |
| *Percent* | 8% | 77% | 15% | 0% | 100% |

Q30. What concepts did your students have challenges with?

***Open-ended response type; no tabulation available***

Q31. Were there any concepts that the materials did not cover that SHOULD HAVE BEEN covered?

| Group | Yes | No | Don't Know/ Can't Recall | Refused | Total |
|---|---|---|---|---|---|
| **Elementary** | 0 | 5 | 0 | 0 | 5 |
| ***Percent*** | **0%** | **100%** | **0%** | **0%** | **100%** |
| **Middle** | 1 | 4 | 2 | 0 | 7 |
| ***Percent*** | **14%** | **57%** | **29%** | **0%** | **100%** |
| **High** | 0 | 0 | 1 | 0 | 1 |
| ***Percent*** | **0%** | **0%** | **100%** | **0%** | **100%** |
| **Total** | 1 | 9 | 3 | 0 | 13 |
| ***Percent*** | **8%** | **69%** | **23%** | **0%** | **100%** |

Q32. What concepts were not covered that SHOULD HAVE BEEN covered?

***Open-ended response type; no tabulation available***

Q33. Please rate your overall satisfaction with curriculum or instructional materials you received from the National Theatre for Children program using the following scale.

| Group | 1 | 2 | 3 | 4 | 5 | Don't know | Total |
|---|---|---|---|---|---|---|---|
| **Elementary** | 0 | 0 | 2 | 0 | 3 | 0 | 5 |
| ***Percent*** | **0%** | **0%** | **40%** | **0%** | **60%** | **0%** | **100%** |
| **Middle** | 0 | 0 | 2 | 2 | 3 | 0 | 7 |
| ***Percent*** | **0%** | **0%** | **29%** | **29%** | **43%** | **0%** | **100%** |
| **High** | 0 | 0 | 0 | 0 | 0 | 1 | 1 |
| ***Percent*** | **0%** | **0%** | **0%** | **0%** | **0%** | **100%** | **100%** |
| **Total** | 0 | 0 | 4 | 2 | 6 | 1 | 13 |
| ***Percent*** | **0%** | **0%** | **31%** | **15%** | **46%** | **8%** | **100%** |

Q34. Do you have any additional input regarding the curriculum or instructional materials received from the National Theatre for Children that you would like to provide, including other things you liked or think could be improved? This might include things like overall presentation, length, level of detail, messaging, or anything else.

***Open-ended response type; no tabulation available***

Q35. Why did you NOT use the curriculum or instructional materials in teaching your students about energy?

***Open-ended response type; no tabulation available***

Q36. Did you have any interactions with anyone from the National Theatre for Children regarding the curriculum or instructional materials?

| Group | Yes | No | Don't Know/ Can't Recall | Total |
|---|---|---|---|---|
| **Elementary** | 2 | 4 | 0 | 6 |
| ***Percent*** | **33%** | **67%** | **0%** | **100%** |
| **Middle** | 1 | 11 | 2 | 14 |
| ***Percent*** | **7%** | **79%** | **14%** | **100%** |
| **High** | 0 | 0 | 1 | 1 |
| ***Percent*** | **0%** | **0%** | **100%** | **100%** |
| **Total** | 3 | 15 | 3 | 21 |
| ***Percent*** | **14%** | **71%** | **14%** | **100%** |

Q37. What did those interactions involve?

***Open-ended response type; no tabulation available***

Q38. Using the scale provided, how satisfied were you with:

***Your interactions with the National Theatre for Children staff, overall***

| Group | 1 | 2 | 3 | 4 | 5 | Don't know | Total |
|---|---|---|---|---|---|---|---|
| **Elementary** | 0 | 0 | 0 | 0 | 2 | 0 | 2 |
| ***Percent*** | **0%** | **0%** | **0%** | **0%** | **100%** | **0%** | **100%** |
| **Middle** | 0 | 0 | 0 | 0 | 1 | 0 | 1 |
| ***Percent*** | **0%** | **0%** | **0%** | **0%** | **100%** | **0%** | **100%** |
| **High** | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| ***Percent*** | **0%** | **0%** | **0%** | **0%** | **0%** | **0%** | **0%** |
| **Total** | 0 | 0 | 0 | 0 | 3 | 0 | 3 |
| ***Percent*** | **0%** | **0%** | **0%** | **0%** | **100%** | **0%** | **100%** |

***The professionalism and courtesy of the National Theatre for Children staff***

| Group | 1 | 2 | 3 | 4 | 5 | Don't know | Total |
|---|---|---|---|---|---|---|---|
| **Elementary** | 0 | 0 | 0 | 0 | 2 | 0 | 2 |
| ***Percent*** | **0%** | **0%** | **0%** | **0%** | **100%** | **0%** | **100%** |
| **Middle** | 0 | 0 | 0 | 0 | 1 | 0 | 1 |
| ***Percent*** | **0%** | **0%** | **0%** | **0%** | **100%** | **0%** | **100%** |
| **High** | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| ***Percent*** | **0%** | **0%** | **0%** | **0%** | **0%** | **0%** | **0%** |
| **Total** | 0 | 0 | 0 | 0 | 3 | 0 | 3 |
| ***Percent*** | **0%** | **0%** | **0%** | **0%** | **100%** | **0%** | **100%** |

***The National Theatre for Children staff's knowledge about the topics you discussed with them***

| Group | 1 | 2 | 3 | 4 | 5 | Don't know | Total |
|---|---|---|---|---|---|---|---|
| **Elementary** | 0 | 0 | 0 | 0 | 2 | 0 | 2 |
| ***Percent*** | **0%** | **0%** | **0%** | **0%** | **100%** | **0%** | **100%** |
| **Middle** | 0 | 0 | 0 | 0 | 1 | 0 | 1 |
| ***Percent*** | **0%** | **0%** | **0%** | **0%** | **100%** | **0%** | **100%** |
| **High** | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| ***Percent*** | **0%** | **0%** | **0%** | **0%** | **100%** | **0%** | **100%** |
| **Total** | 0 | 0 | 0 | 0 | 3 | 0 | 3 |
| ***Percent*** | **0%** | **0%** | **0%** | **0%** | **100%** | **0%** | **100%** |

Q39. Did you distribute the kit request form to your students?

| Group | Yes - I distributed the workbooks, which included the kit request form | Yes - I distributed the kit request forms separately | No | Don't Recall | Total |
|---|---|---|---|---|---|
| **Elementary** | 2 | 4 | 0 | 0 | 6 |
| ***Percent*** | **33%** | **67%** | **0%** | **0%** | **100%** |
| **Middle** | 3 | 11 | 0 | 0 | 14 |
| ***Percent*** | **21%** | **79%** | **0%** | **0%** | **100%** |
| **High** | 1 | 0 | 0 | 0 | 1 |
| ***Percent*** | **100%** | **0%** | **0%** | **0%** | **100%** |
| **Total** | 6 | 15 | 0 | 0 | 21 |
| ***Percent*** | **29%** | **71%** | **0%** | **0%** | **100%** |

Q40. On average, about what percentage of your students took the kit request form home?

| Group | 0% - 10% | 11% - 20% | 21% - 30% | 31% - 40% | 41% - 50% | 51% - 60% | 61% - 70% | 71% - 80% | 81% - 90% | 91% - 100% | Don't know | Total |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Elementary** | 0 | 1 | 1 | 0 | 0 | 0 | 0 | 1 | 0 | 3 | 0 | 6 |
| ***Percent*** | **0%** | **17%** | **17%** | **0%** | **0%** | **0%** | **0%** | **17%** | **0%** | **50%** | **0%** | **100%** |
| **Middle** | 0 | 3 | 3 | 0 | 0 | 3 | 0 | 2 | 0 | 3 | 0 | 14 |
| ***Percent*** | **0%** | **21%** | **21%** | **0%** | **0%** | **21%** | **0%** | **14%** | **0%** | **21%** | **0%** | **100%** |
| **High** | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 1 |
| ***Percent*** | **0%** | **0%** | **0%** | **0%** | **0%** | **0%** | **0%** | **0%** | **0%** | **0%** | **100%** | **100%** |
| **Total** | 0 | 4 | 4 | 0 | 0 | 3 | 0 | 3 | 0 | 6 | 1 | 21 |
| ***Percent*** | **0%** | **19%** | **19%** | **0%** | **0%** | **14%** | **0%** | **14%** | **0%** | **29%** | **5%** | **100%** |

Q41. After students take the kit form home, do you follow up with students later to find out if their parents completed the form?

| Group | Yes | No | Don't Know/ Can't Recall | Total |
|---|---|---|---|---|
| **Elementary** | 2 | 4 | 0 | 6 |
| ***Percent*** | **33%** | **67%** | **0%** | **100%** |
| **Middle** | 8 | 5 | 1 | 14 |
| ***Percent*** | **57%** | **36%** | **7%** | **100%** |
| **High** | 0 | 1 | 0 | 1 |
| ***Percent*** | **0%** | **100%** | **0%** | **100%** |
| **Total** | 10 | 10 | 1 | 21 |
| ***Percent*** | **48%** | **48%** | **5%** | **100%** |

Q42. About what percentage of your students either brought the kit form back to you to mail, or reported their parents completed and sent the form to Duke Energy to receive their kit?

| Group | 0% - 10% | 11% - 20% | 21% - 30% | 31% - 40% | 41% - 50% | 51% - 60% | 61% - 70% | 71% - 80% | 81% - 90% | 91% - 100% | Don't know | Total |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Elementary** | 2 | 2 | 0 | 1 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 6 |
| ***Percent*** | **33%** | **33%** | **0%** | **17%** | **0%** | **17%** | **0%** | **0%** | **0%** | **0%** | **0%** | **100%** |
| **Middle** | 6 | 2 | 3 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 1 | 14 |
| ***Percent*** | **43%** | **14%** | **21%** | **7%** | **7%** | **0%** | **0%** | **0%** | **0%** | **0%** | **7%** | **100%** |
| **High** | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 1 |
| ***Percent*** | **0%** | **0%** | **0%** | **0%** | **0%** | **0%** | **0%** | **0%** | **0%** | **0%** | **100%** | **100%** |
| **Total** | 8 | 4 | 3 | 2 | 1 | 1 | 0 | 0 | 0 | 0 | 2 | 21 |
| ***Percent*** | **38%** | **19%** | **14%** | **10%** | **5%** | **5%** | **0%** | **0%** | **0%** | **0%** | **10%** | **100%** |

Q43. About what percentage of student families who had signed up for kits signed up on the website?

| Group | 0% - 10% | 11% - 20% | 21% - 30% | 31% - 40% | 41% - 50% | 51% - 60% | 61% - 70% | 71% - 80% | 81% - 90% | 91% - 100% | Don't know | Total |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Elementary** | 1 | 2 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 1 | 1 | 6 |
| ***Percent*** | **17%** | **33%** | **0%** | **0%** | **17%** | **0%** | **0%** | **0%** | **0%** | **17%** | **17%** | **100%** |
| **Middle** | 7 | 1 | 2 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 2 | 14 |
| ***Percent*** | **50%** | **7%** | **14%** | **7%** | **7%** | **0%** | **0%** | **0%** | **0%** | **0%** | **14%** | **100%** |
| **High** | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 1 |
| ***Percent*** | **0%** | **0%** | **0%** | **0%** | **0%** | **0%** | **0%** | **0%** | **0%** | **0%** | **100%** | **100%** |
| **Total** | 8 | 3 | 2 | 1 | 2 | 0 | 0 | 0 | 0 | 1 | 4 | 21 |
| ***Percent*** | **38%** | **14%** | **10%** | **5%** | **10%** | **0%** | **0%** | **0%** | **0%** | **5%** | **19%** | **100%** |

Q44. Why didn't you distribute the kit request forms to your students?

***Open-ended response type; no tabulation available***

Q45. Did the NTC performers or the instructional materials mention the "Kilowatt Krush" app?

| Group | Yes | No | Don't Know/ Can't Recall | Total |
|---|---|---|---|---|
| **Elementary** | 4 | 0 | 2 | 6 |
| ***Percent*** | **67%** | **0%** | **33%** | **100%** |
| **Middle** | 8 | 3 | 3 | 14 |
| ***Percent*** | **57%** | **21%** | **21%** | **100%** |
| **High** | 0 | 0 | 1 | 1 |
| ***Percent*** | **0%** | **0%** | **100%** | **100%** |
| **Total** | 12 | 3 | 6 | 21 |
| ***Percent*** | **57%** | **14%** | **29%** | **100%** |

Q46. About what percentage of students would you say downloaded and used the app?

| Group | 0% - 10% | 11% - 20% | 21% - 30% | 31% - 40% | 41% - 50% | 51% - 60% | 61% - 70% | 71% - 80% | 81% - 90% | 91% - 100% | Don't know | Total |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Elementary** | 0 | 0 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 2 | 4 |
| ***Percent*** | **0%** | **0%** | **25%** | **25%** | **0%** | **0%** | **0%** | **0%** | **0%** | **0%** | **50%** | **100%** |
| **Middle** | 3 | 3 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 8 |
| ***Percent*** | **38%** | **38%** | **0%** | **13%** | **0%** | **0%** | **0%** | **0%** | **0%** | **0%** | **13%** | **100%** |
| **High** | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| ***Percent*** | **0%** | **0%** | **0%** | **0%** | **0%** | **0%** | **0%** | **0%** | **0%** | **0%** | **0%** | **0%** |
| **Total** | 3 | 3 | 1 | 2 | 0 | 0 | 0 | 0 | 0 | 0 | 3 | 12 |
| ***Percent*** | **25%** | **25%** | **8%** | **17%** | **0%** | **0%** | **0%** | **0%** | **0%** | **0%** | **25%** | **100%** |

Q47. Do you have any suggestions to improve the app or how it was presented to students?

***Open-ended response type; no tabulation available***

Q48. Did government or organizational responses to COVID-19 offer any challenges for you regarding your participation in this program, other than those you've already discussed? If so, what were they, and how do you think they might best be addressed moving forward?

***Open-ended response type; no tabulation available***

Q49. Do you have any additional feedback regarding this program or Duke Energy that you would like to provide?

***Open-ended response type; no tabulation available***

Q50. Would you be willing to participate in an interview, so that we might learn more about you and your students' experience with the program?

| Group | Yes | No | Don't Know/ Can't Recall | Total |
|---|---|---|---|---|
| **Elementary** | 3 | 2 | 1 | 6 |
| ***Percent*** | **50%** | **33%** | **17%** | **100%** |
| **Middle** | 5 | 7 | 2 | 14 |
| ***Percent*** | **36%** | **50%** | **14%** | **100%** |
| **High** | 0 | 1 | 0 | 1 |
| ***Percent*** | **0%** | **100%** | **0%** | **100%** |
| **Total** | 8 | 10 | 3 | 21 |
| ***Percent*** | **38%** | **48%** | **14%** | **100%** |

## F.3 Student Parent Survey - DEC

Q1. This kit included light bulbs, a showerhead, and other items that help you save energy in your home. Do you recall receiving this kit?

| | Yes | No | Don't Know | Total |
|---|---|---|---|---|
| # of responses | 300 | 0 | 0 | 300 |
| **Percent** | **100%** | **0%** | **0%** | **100%** |

Q1.1) Were you aware of this program, prior to your child's involvement, due to your work at an elementary, middle or high school?

| | Yes | No | Don't Know | Total |
|---|---|---|---|---|
| # of responses | 0 | 300 | 0 | 300 |
| **Percent** | **0%** | **100%** | **0%** | **100%** |

Q2. Before today, did you know the kit you received was sponsored by Duke Energy?

| | Yes | No | Don't Know | Total |
|---|---|---|---|---|
| # of responses | 265 | 29 | 6 | 300 |
| **Percent** | **88%** | **10%** | **2%** | **100%** |

Q3. How did you learn that the kit was sponsored by Duke Energy?

| | # of responses | Percent |
|---|---|---|
| Classroom materials brought home by child | 76 | **29%** |
| Classroom materials brought home by child, Information material included in/on the kit | 30 | **11%** |
| Classroom materials brought home by child, My child's teacher/school | 8 | **3%** |
| Classroom materials brought home by child, My child's teacher/school, Information material included in/on the kit | 22 | **8%** |
| Information material included in/on the kit | 82 | **31%** |
| My child's teacher/school | 26 | **10%** |
| My child's teacher/school, Information material included in/on the kit | 7 | **3%** |
| Other | 10 | **4%** |
| Don't know | 4 | **2%** |
| Refused | 0 | **0%** |
| Total | 265 | **100%** |

Q4. How did you hear about the opportunity to receive the kit from Duke Energy?

| | # of responses | Percent |
|---|---|---|
| After hours event at my child's school | 3 | 1% |
| Classroom materials brought home by child | 140 | 47% |
| Classroom materials brought home by child, After hours event at my child's school | 1 | 0% |
| Classroom materials brought home by child, Email from my child's teacher/school | 16 | 5% |
| Classroom materials brought home by child, Email from my child's teacher/school, Saw a poster at my child's school | 1 | 0% |
| Classroom materials brought home by child, Email from my child's teacher/school, School website or school web portal | 4 | 1% |
| Classroom materials brought home by child, Other | 2 | 1% |
| Classroom materials brought home by child, Saw a poster at my child's school | 1 | 0% |
| Classroom materials brought home by child, School newsletter | 11 | 4% |
| Classroom materials brought home by child, School newsletter, Email from my child's teacher/school | 7 | 2% |
| Classroom materials brought home by child, School newsletter, Email from my child's teacher/school, In-person conversations with my child's teacher | 1 | 0% |
| Classroom materials brought home by child, School newsletter, Email from my child's teacher/school, Saw a poster at my child's school | 1 | 0% |
| Classroom materials brought home by child, School newsletter, Email from my child's teacher/school, School website or school web portal | 3 | 1% |
| Classroom materials brought home by child, School newsletter, Email from my child's teacher/school, School website or school web portal, In-person conversations with my child's teacher | 1 | 0% |
| Classroom materials brought home by child, School newsletter, Saw a poster at my child's school | 1 | 0% |
| Classroom materials brought home by child, School newsletter, School website or school web portal | 4 | 1% |
| Classroom materials brought home by child, School newsletter, School website or school web portal, In-person conversations with my child's teacher | 1 | 0% |
| Classroom materials brought home by child, School website or school web portal | 2 | 1% |
| Email from my child's teacher/school | 19 | 6% |
| Email from my child's teacher/school, Other | 1 | 0% |
| Email from my child's teacher/school, School website or school web portal | 5 | 2% |
| Email from my child's teacher/school, School website or school web portal, Other | 1 | 0% |
| In-person conversations with my child's teacher | 3 | 1% |
| Saw a poster at my child's school | 1 | 0% |
| School newsletter | 9 | 3% |
| School newsletter, Email from my child's teacher/school | 3 | 1% |

| | # of responses | Percent |
|---|---|---|
| School newsletter, Email from my child's teacher/school, Other | 1 | 0% |
| School newsletter, Saw a poster at my child's school | 1 | 0% |
| School newsletter, School website or school web portal | 1 | 0% |
| School website or school web portal | 12 | 4% |
| Other | 16 | 5% |
| Don't know | 27 | 9% |
| Refused | 0 | 0% |
| Total | 300 | 100% |

Q4b. How did you request your kit?

| | Program's website | Sign-up form in the classroom materials my child brought home | By calling the toll-free number | Via the "Kilowatt Krush" app on my smartphone | Don't know | Refused | Total |
|---|---|---|---|---|---|---|---|
| **# of responses** | 197 | 57 | 12 | 4 | 29 | 1 | 300 |
| ***Percent*** | **66%** | **19%** | **4%** | **1%** | **10%** | **0.3%** | **100%** |

Q4c. Has your child used the "Kilowatt Krush" app on any smartphone in your household?

| | Yes | No | Don't Know | Refused | Total |
|---|---|---|---|---|---|
| **# of responses** | 25 | 228 | 47 | 0 | 300 |
| ***Percent*** | **8%** | **76%** | **16%** | **0%** | **100%** |

Q4d. About how often would you say that your child uses the "Kilowatt Krush" app?

| | They used it once | They used it a few times | They use it daily | They use it weekly | Other | Don't know | Refused | Total |
|---|---|---|---|---|---|---|---|---|
| **# of responses** | 1 | 18 | 1 | 3 | 0 | 2 | 0 | 25 |
| ***Percent*** | **4%** | **72%** | **4%** | **12%** | **0%** | **8%** | **0%** | **100%** |

Q4e. Have you noticed your child engaging in energy saving behaviors you can attribute to their use of the "Kilowatt Krush" app?

| | Yes | No | Don't Know | Total |
|---|---|---|---|---|
| **# of responses** | 14 | 6 | 5 | 25 |
| ***Percent*** | **56%** | **24%** | **20%** | **100%** |

Q4f. Do you have any feedback that might help improve the "Kilowatt Krush" app?

| | Yes | No | Don't Know | Refused | Total |
|---|---|---|---|---|---|
| # of responses | 0 | 22 | 3 | 0 | 25 |
| ***Percent*** | **0%** | **88%** | **12%** | **0%** | **100%** |

Q5. Did you read any of the Energy Savers booklet that came in the kit?

| | Yes | No | Don't Know | Refused | Total |
|---|---|---|---|---|---|
| # of responses | 205 | 70 | 25 | 0 | 300 |
| ***Percent*** | **68%** | **23%** | **8%** | **0%** | **100%** |

Q6. On a scale from 0 to 10 where 0 is not at all helpful and 10 is very helpful, how helpful was the Energy Savers booklet in identifying ways your household could save energy at home?

| | 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | Don't know | Refused | Total |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| # of responses | 0 | 0 | 0 | 3 | 5 | 14 | 25 | 22 | 43 | 17 | 74 | 2 | 0 | 205 |
| ***Percent*** | **0%** | **0%** | **0%** | **1%** | **2%** | **7%** | **12%** | **11%** | **21%** | **8%** | **36%** | **1%** | **0%** | **100%** |

Q7. What might have made the information more helpful?

| | Provided response | Don't Know | Refused | Total |
|---|---|---|---|---|
| # of responses | 17 | 30 | 0 | 47 |
| ***Percent*** | **36%** | **64%** | **0%** | **100%** |

Q8. In addition to sending the energy saving kits, Duke Energy sponsored a program about energy and energy efficiency at your child's school, which included classroom materials and in in-school performance by the National Theatre for Children. Were you aware of the program before today?

| | Yes | No | Don't Know | Refused | Total |
|---|---|---|---|---|---|
| # of responses | 78 | 210 | 12 | 0 | 300 |
| ***Percent*** | **26%** | **70%** | **4%** | **0%** | **100%** |

Q9. From who or where did you hear about this program?

| | From a teacher/school administrator | From my child/children | From my child/children, From a teacher/school administrator | From my child/children, On Duke Energy Website | On Duke Energy Website | Other | Don't know | Refused | Total |
|---|---|---|---|---|---|---|---|---|---|
| # of responses | 15 | 43 | 10 | 1 | 6 | 2 | 1 | 0 | 78 |
| ***Percent*** | **19%** | **55%** | **13%** | **1%** | **8%** | **3%** | **1%** | **0%** | **100%** |

Q10. Have you or anyone else installed any of those items in your home, even if they were taken out later?

| | Yes | No | Don't Know | Refused | Total |
|---|---|---|---|---|---|
| # of responses | 258 | 42 | 0 | 0 | 300 |
| *Percent* | 86% | 14% | 0% | 0% | 100% |

Q11. Which of the items did you install, even if they were taken out later?

*Q11a. Showerhead*

| | Yes | No | Don't Know | Refused | Total |
|---|---|---|---|---|---|
| # of responses | 123 | 3 | 0 | 258 | 123 |
| *Percent* | 48% | 1% | 0% | 100% | 48% |

*Q11b. Kitchen faucet aerator*

| | Yes | No | Don't Know | Refused | Total |
|---|---|---|---|---|---|
| # of responses | 121 | 128 | 9 | 0 | 258 |
| *Percent* | 47% | 50% | 3% | 0% | 100% |

*Q11c. Bathroom faucet aerator*

| | Yes | No | Don't Know | Refused | Total |
|---|---|---|---|---|---|
| # of responses | 122 | 131 | 5 | 0 | 258 |
| *Percent* | 47% | 51% | 2% | 0% | 100% |

*Q11d. Night light*

| | Yes | No | Don't Know | Refused | Total |
|---|---|---|---|---|---|
| # of responses | 229 | 27 | 2 | 0 | 258 |
| *Percent* | 89% | 10% | 1% | 0% | 100% |

*Q11e. Energy efficient light bulb(s)*

| | Yes | No | Don't Know | Refused | Total |
|---|---|---|---|---|---|
| # of responses | 254 | 4 | 0 | 0 | 258 |
| *Percent* | 98% | 2% | 0% | 0% | 100% |

*Q11f. Insulator gaskets for light switches and electricity outlets*

| | Yes | No | Don't Know | Refused | Total |
|---|---|---|---|---|---|
| # of responses | 93 | 145 | 20 | 0 | 258 |
| *Percent* | 36% | 56% | 8% | 0% | 100% |

Q12. In addition to the night light, there were two LED light bulbs in the kit. Did you install one or both LED light bulbs in the kit?

| | I installed both LEDs | I installed only one LED bulb | Don't Know | Refused | Total |
|---|---|---|---|---|---|
| # of responses | 231 | 19 | 4 | 0 | 254 |
| ***Percent*** | **91%** | **7%** | **2%** | **0%** | **100%** |

Q13. How many of the light switch and electric outlet gasket insulators from the kit did you, or someone else, install in your home?

| | None | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | Don't know | Refused | Total |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| # of responses | 1 | 13 | 23 | 11 | 6 | 4 | 7 | 0 | 3 | 1 | 0 | 0 | 8 | 16 | 0 | 93 |
| ***Percent*** | **1%** | **14%** | **25%** | **12%** | **6%** | **4%** | **8%** | **0%** | **3%** | **1%** | **0%** | **0%** | **9%** | **17%** | **0%** | **100%** |

Q14. Overall, how satisfied are you with the item[s] you installed? Please use 0 to 10 scales, where 0 is very dissatisfied and 10 is very satisfied. How satisfied are you with...?

***Q14a. Showerhead***

| | 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | Don't know | Refused | Total |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| # of responses | 1 | 0 | 1 | 1 | 0 | 7 | 8 | 9 | 13 | 13 | 79 | 0 | 0 | 132 |
| ***Percent*** | **1%** | **0%** | **1%** | **1%** | **0%** | **5%** | **6%** | **7%** | **10%** | **10%** | **60%** | **0%** | **0%** | **100%** |

***Q14b. Kitchen faucet aerator***

| | 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | Don't know | Refused | Total |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| # of responses | 1 | 0 | 0 | 2 | 2 | 5 | 5 | 7 | 9 | 11 | 76 | 2 | 1 | 121 |
| ***Percent*** | **1%** | **0%** | **0%** | **2%** | **2%** | **4%** | **4%** | **6%** | **7%** | **9%** | **63%** | **2%** | **1%** | **100%** |

***Q14c. Bathroom faucet aerator***

| | 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | Don't know | Refused | Total |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| # of responses | 2 | 1 | 0 | 3 | 6 | 3 | 7 | 13 | 10 | 6 | 70 | 1 | 0 | 122 |
| ***Percent*** | **2%** | **1%** | **0%** | **2%** | **5%** | **2%** | **6%** | **11%** | **8%** | **5%** | **57%** | **1%** | **0%** | **100%** |

***Q14d. Night light***

| | 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | Don't know | Refused | Total |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| # of responses | 1 | 0 | 0 | 1 | 2 | 6 | 5 | 17 | 20 | 19 | 158 | 0 | 0 | 229 |
| ***Percent*** | **0%** | **0%** | **0%** | **0%** | **1%** | **3%** | **2%** | **7%** | **9%** | **8%** | **69%** | **0%** | **0%** | **100%** |

*Q14e. Energy efficient light bulb(s)*

| | 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | Don't know | Refused | Total |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| # of responses | 1 | 0 | 1 | 1 | 1 | 3 | 4 | 16 | 18 | 30 | 178 | 1 | 0 | 254 |
| Percent | 0% | 0% | 0% | 0% | 0% | 1% | 2% | 6% | 7% | 12% | 70% | 0% | 0% | 100% |

*Q14f. Insulator gaskets for light switches and electricity outlets*

| | 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | Don't know | Refused | Total |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| # of responses | 0 | 1 | 0 | 0 | 0 | 6 | 3 | 7 | 8 | 6 | 57 | 5 | 0 | 93 |
| Percent | 0% | 1% | 0% | 0% | 0% | 6% | 3% | 8% | 9% | 6% | 61% | 5% | 0% | 100% |

Q14.1 Can you please explain any dissatisfaction you had with the [X item]

***Q14.1a) Showerhead***

***Open-ended response type; no tabulation available***

***Q14.1b) Kitchen faucet aerator***

***Open-ended response type; no tabulation available***

***Q14.1c) Bathroom faucet aerator***

***Open-ended response type; no tabulation available***

***Q14.1d) Night light***

***Open-ended response type; no tabulation available***

***Q14.1e) Energy efficient light bulb(s)***

***Open-ended response type; no tabulation available***

***Q14.1f) Insulator gaskets for light switches and electricity outlets***

***Open-ended response type; no tabulation available***

Q15. Have you since uninstalled any of the items from the kit that you had previously installed?

| | Yes | No | Don't Know | Refused | Total |
|---|---|---|---|---|---|
| # of responses | 39 | 211 | 8 | 0 | 258 |
| Percent | 15% | 82% | 3% | 0% | 100% |

Q16. Which of the items did you uninstall?

| | # of responses | Percent |
|---|---|---|
| Bathroom faucet aerator | 5 | **13%** |
| Energy efficient light bulbs | 1 | **3%** |
| Kitchen faucet aerator | 9 | **23%** |
| Kitchen faucet aerator, Bathroom faucet aerator | 2 | **5%** |
| Kitchen faucet aerator, Night light | 1 | **3%** |
| Night light | 4 | **10%** |
| Showerhead | 8 | **21%** |
| Showerhead, Bathroom faucet aerator | 1 | **3%** |
| Showerhead, Kitchen faucet aerator | 3 | **8%** |
| Showerhead, Kitchen faucet aerator, Bathroom faucet aerator | 2 | **5%** |
| Showerhead, Kitchen faucet aerator, Bathroom faucet aerator, Insulator Gaskets | 1 | **3%** |
| Don't know | 1 | **3%** |
| Refused | 1 | **3%** |
| Total | 39 | **100%** |

Q17. Why were those items uninstalled? Let's start with...

***Q17a. Showerhead***

| | It was broken | I didn't like how it looked | I didn't like how it worked | I didn't like how it worked, Other | Other | Don't know | Refused | Total |
|---|---|---|---|---|---|---|---|---|
| **# of responses** | 0 | 1 | 11 | 1 | 2 | 0 | 0 | 15 |
| ***Percent*** | **0%** | **7%** | **73%** | **7%** | **13%** | **0%** | **0%** | **100%** |

***Q17b. Kitchen faucet aerator***

| | It was broken | I didn't like how it worked | I didn't like how it looked | Other | Don't Know | Refused | Total |
|---|---|---|---|---|---|---|---|
| **# of responses** | 0 | 8 | 2 | 8 | 0 | 0 | 18 |
| ***Percent*** | **0%** | **44%** | **11%** | **44%** | **0%** | **0%** | **100%** |

***Q17c. Bathroom faucet aerator***

| | It was broken | I didn't like how it worked | I didn't like how it looked | Other | Don't Know | Refused | Total |
|---|---|---|---|---|---|---|---|
| **# of responses** | 0 | 8 | 1 | 2 | 0 | 0 | 11 |
| ***Percent*** | **0%** | **73%** | **9%** | **18%** | **0%** | **0%** | **100%** |

*Q17d. Night light*

| | It was broken | I didn't like how it worked | I didn't like how it looked | Other | Don't Know | Refused | Total |
|---|---|---|---|---|---|---|---|
| # of responses | 1 | 0 | 1 | 3 | 0 | 0 | 5 |
| ***Percent*** | **20%** | **0%** | **20%** | **60%** | **0%** | **0%** | **100%** |

*Q17e. Energy efficient light bulb(s)*

| | It was broken | I didn't like how it worked | I didn't like how it looked | Other | Don't Know | Refused | Total |
|---|---|---|---|---|---|---|---|
| # of responses | 0 | 1 | 0 | 0 | 0 | 0 | 1 |
| ***Percent*** | **0%** | **100%** | **0%** | **0%** | **0%** | **0%** | **100%** |

*Q17f. Insulator gaskets for light switches and electricity outlets*

| | It was broken | I didn't like how it worked | I didn't like how it looked | Other | Don't Know | Refused | Total |
|---|---|---|---|---|---|---|---|
| # of responses | 0 | 1 | 0 | 0 | 0 | 0 | 1 |
| ***Percent*** | **0%** | **100%** | **0%** | **0%** | **0%** | **0%** | **100%** |

Q18. You said you haven't installed [X items]. Which of those items did you plan to install in the next three months?

| | # of responses | Percent |
|---|---|---|
| Bathroom faucet aerator | 11 | **4%** |
| Bathroom faucet aerator, Energy efficient light bulbs | 1 | **0%** |
| Bathroom faucet aerator, Insulator Gaskets | 4 | **1%** |
| Bathroom faucet aerator, Night light | 2 | **1%** |
| Bathroom faucet aerator, Night light, Energy efficient light bulbs | 1 | **0%** |
| Energy efficient light bulbs | 6 | **2%** |
| Insulator Gaskets | 25 | **9%** |
| Kitchen faucet aerator | 12 | **4%** |
| Kitchen faucet aerator, Bathroom faucet aerator | 4 | **1%** |
| Kitchen faucet aerator, Bathroom faucet aerator, Insulator Gaskets | 3 | **1%** |
| Kitchen faucet aerator, Bathroom faucet aerator, Night light, Energy efficient light bulbs | 1 | **0%** |
| Kitchen faucet aerator, Insulator Gaskets | 1 | **0%** |
| Kitchen faucet aerator, Night light, Energy efficient light bulbs | 1 | **0%** |
| Night light | 8 | **3%** |
| Night light, Energy efficient light bulbs | 10 | **4%** |
| Night light, Energy efficient light bulbs, Insulator Gaskets | 2 | **1%** |
| Showerhead | 14 | **5%** |
| Showerhead, Bathroom faucet aerator | 1 | **0%** |
| Showerhead, Energy efficient light bulbs | 2 | **1%** |
| Showerhead, Kitchen faucet aerator | 1 | **0%** |
| Showerhead, Kitchen faucet aerator, Bathroom faucet aerator | 1 | **0%** |
| Showerhead, Kitchen faucet aerator, Bathroom faucet aerator, Energy efficient light bulbs, Insulator Gaskets | 1 | **0%** |

| | # of responses | Percent |
|---|---|---|
| Showerhead, Kitchen faucet aerator, Bathroom faucet aerator, Night light, Energy efficient light bulbs, Insulator Gaskets | 4 | **1%** |
| Showerhead, Kitchen faucet aerator, Night light | 2 | **1%** |
| Showerhead, Night light | 2 | **1%** |
| Showerhead, Night light, Energy efficient light bulbs | 1 | **0%** |
| None | 148 | **55%** |
| Don't know | 0 | **0%** |
| Refused | 1 | **0%** |
| Total | 270 | **100%** |

Q19. What's preventing you from installing them? Let's start with...

***Q19a. Showerhead***

| | # of responses | Percent |
|---|---|---|
| Already have efficient showerhead | 33 | **24%** |
| Current one is still working | 26 | **19%** |
| Current one is still working; Already have efficient showerhead | 12 | **9%** |
| Current one is still working; Don't have the items any longer (threw away, gave away) | 1 | **1%** |
| Current one is still working; Don't have the items any longer (threw away, gave away); Already have efficient showerhead | 1 | **1%** |
| Current one is still working; Other, (please specify:___) | 1 | **1%** |
| Current one is still working; Takes too much time to install/No time/Too busy; Too difficult to install it, don't know how to do it; Already have efficient showerhead | 1 | **1%** |
| Current one is still working; Too difficult to install it, don't know how to do it; Don't have the tools I need | 1 | **1%** |
| Didn't know what that was | 3 | **2%** |
| Didn't know what that was; Haven't gotten around to it | 1 | **1%** |
| Didn't know what that was; Haven't gotten around to it; Current one is still working | 1 | **1%** |
| Didn't know what that was; Other, (please specify:___) | 1 | **1%** |
| Didn't know what that was; Too difficult to install it, don't know how to do it | 1 | **1%** |
| Don't have the tools I need | 1 | **1%** |
| Haven't gotten around to it | 11 | **8%** |
| Haven't gotten around to it; Already have efficient showerhead | 2 | **1%** |
| Haven't gotten around to it; Current one is still working; Already have efficient showerhead | 2 | **1%** |
| Other, (please specify:___) | 14 | **10%** |
| Takes too much time to install/No time/Too busy | 2 | **1%** |
| Too difficult to install it, don't know how to do it | 1 | **1%** |
| Too difficult to install it, don't know how to do it; Don't have the tools I need | 1 | **1%** |
| Tried it, didn't fit | 11 | **8%** |
| Tried it, didn't fit; Already have efficient showerhead | 1 | **1%** |
| Tried it, didn't fit; Current one is still working; Already have efficient showerhead | 1 | **1%** |
| Tried it, didn't fit; Current one is still working; Takes too much time to install/No time/Too busy; Already have efficient showerhead | 1 | **1%** |
| Tried it, didn't fit; Haven't gotten around to it; Current one is still working; Already have efficient showerhead | 1 | **1%** |
| Tried it, didn't work as intended | 3 | **2%** |
| Don't know | 1 | **1%** |
| Refused | 0 | **0%** |
| Total | 136 | **100%** |

***Q19b. Kitchen faucet aerator***

| | # of responses | Percent |
|---|---|---|
| Already have efficient kitchen faucet aerator | 33 | **24%** |
| Current one is still working | 20 | **14%** |
| Current one is still working; Already have efficient kitchen faucet aerator | 5 | **4%** |
| Current one is still working; Don't have the items any longer (threw away, gave away); Already have efficient kitchen faucet aerator | 1 | **1%** |
| Didn't know what that was | 13 | **9%** |
| Didn't know what that was; Already have efficient kitchen faucet aerator | 1 | **1%** |
| Didn't know what that was; Current one is still working; Takes too much time to install/No time/Too busy; Too difficult to install it, don't know how to do it | 1 | **1%** |
| Didn't know what that was; Haven't gotten around to it | 3 | **2%** |
| Didn't know what that was; Haven't gotten around to it; Current one is still working | 1 | **1%** |
| Don't have the items any longer (threw away, gave away) | 2 | **1%** |
| Don't have the tools I need | 1 | **1%** |
| Don't have the tools I need; Other, (please specify:___) | 1 | **1%** |
| Haven't gotten around to it | 11 | **8%** |
| Haven't gotten around to it; Current one is still working | 1 | **1%** |
| Takes too much time to install/No time/Too busy | 1 | **1%** |
| Too difficult to install it, don't know how to do it | 2 | **1%** |
| Too difficult to install it, don't know how to do it; Don't have the tools I need | 2 | **1%** |
| Tried it, didn't fit | 20 | **14%** |
| Tried it, didn't fit; Don't have the items any longer (threw away, gave away) | 1 | **1%** |
| Tried it, didn't fit; Too difficult to install it, don't know how to do it | 1 | **1%** |
| Tried it, didn't work as intended | 1 | **1%** |
| Other, (please specify:___) | 15 | **11%** |
| Don't know | 2 | **1%** |
| Refused | 0 | **0%** |
| Total | 139 | **100%** |

### *Q19c. Bathroom faucet aerator*

| | # of responses | Percent |
|---|---|---|
| Already have efficient bathroom faucet aerators | 27 | **19%** |
| Current one is still working | 17 | **12%** |
| Current one is still working; Already have efficient bathroom faucet aerators | 4 | **3%** |
| Current one is still working; Don't have the items any longer (threw away, gave away); Already have efficient bathroom faucet aerators | 1 | **1%** |
| Didn't know what that was | 11 | **8%** |
| Didn't know what that was; Haven't gotten around to it | 4 | **3%** |
| Didn't know what that was; Haven't gotten around to it; Current one is still working | 1 | **1%** |
| Didn't know what that was; Takes too much time to install/No time/Too busy; Too difficult to install it, don't know how to do it; Don't have the tools I need | 1 | **1%** |
| Didn't know what that was; Too difficult to install it, don't know how to do it | 1 | **1%** |
| Didn't know what that was; Tried it, didn't fit; Haven't gotten around to it; Takes too much time to install/No time/Too busy; Too difficult to install it, don't know how to do it | 1 | **1%** |
| Don't have the items any longer (threw away, gave away) | 2 | **1%** |
| Don't have the tools I need | 2 | **1%** |
| Haven't gotten around to it | 20 | **14%** |
| Takes too much time to install/No time/Too busy | 1 | **1%** |
| Takes too much time to install/No time/Too busy; Don't have the tools I need | 1 | **1%** |
| Too difficult to install it, don't know how to do it | 3 | **2%** |
| Too difficult to install it, don't know how to do it; Already have efficient bathroom faucet aerators | 1 | **1%** |
| Too difficult to install it, don't know how to do it; Don't have the tools I need | 1 | **1%** |
| Tried it, didn't fit | 22 | **16%** |
| Tried it, didn't fit; Don't have the items any longer (threw away, gave away) | 1 | **1%** |
| Tried it, didn't fit; Other, (please specify:___) | 2 | **1%** |
| Tried it, didn't fit; Too difficult to install it, don't know how to do it | 1 | **1%** |
| Other, (please specify:___) | 9 | **6%** |
| Don't know | 5 | **4%** |
| Refused | 0 | **0%** |
| Total | 139 | **100%** |

### *Q19d. Night light*

| | # of responses | Percent |
|---|---|---|
| Current one is still working | 6 | **17%** |
| Didn't know what that was | 2 | **6%** |
| Haven't gotten around to it | 11 | **31%** |
| Haven't gotten around to it; Current one is still working; Too difficult to install it, don't know how to do it | 1 | **3%** |
| Haven't gotten around to it; Too difficult to install it, don't know how to do it | 1 | **3%** |
| Takes too much time to install/No time/Too busy | 1 | **3%** |
| Other, (please specify:___) | 7 | **20%** |
| Don't know | 5 | **14%** |
| Refused | 1 | **3%** |
| Total | 35 | **100%** |

### *Q19e. Energy efficient light bulb(s)*

| | # of responses | Percent |
|---|---|---|
| Already have LEDs | 2 | **13%** |
| Current one is still working | 2 | **13%** |
| Current one is still working; Already have LEDs | 1 | **6%** |
| Didn't know what that was | 1 | **6%** |
| Haven't gotten around to it | 2 | **13%** |
| Takes too much time to install/No time/Too busy | 1 | **6%** |
| Tried it, didn't fit | 1 | **6%** |
| Other, (please specify:___) | 4 | **25%** |
| Don't know | 2 | **13%** |
| Refused | 0 | **0%** |
| Total | 16 | **100%** |

### *Q19f. Insulator gaskets*

| | # of responses | Percent |
|---|---|---|
| Current one is still working | 15 | **10%** |
| Didn't know what that was | 42 | **29%** |
| Didn't know what that was; Haven't gotten around to it | 9 | **6%** |
| Didn't know what that was; Haven't gotten around to it; Current one is still working; Too difficult to install it, don't know how to do it | 1 | **1%** |
| Didn't know what that was; Other, (please specify:___) | 1 | **1%** |
| Didn't know what that was; Too difficult to install it, don't know how to do it | 2 | **1%** |
| Don't have the items any longer (threw away, gave away) | 2 | **1%** |
| Haven't gotten around to it | 33 | **22%** |
| Haven't gotten around to it; Current one is still working | 1 | **1%** |
| Haven't gotten around to it; Takes too much time to install/No time/Too busy | 1 | **1%** |
| Takes too much time to install/No time/Too busy | 2 | **1%** |
| Takes too much time to install/No time/Too busy; Too difficult to install it, don't know how to do it | 1 | **1%** |
| Too difficult to install it, don't know how to do it | 7 | **5%** |
| Too difficult to install it, don't know how to do it; Don't have the tools I need | 1 | **1%** |
| Tried it, didn't fit | 6 | **4%** |
| Tried it, didn't work as intended | 1 | **1%** |
| Other, (please specify:___) | 7 | **5%** |
| Don't know | 14 | **10%** |
| Refused | 1 | **1%** |
| Total | 147 | **100%** |

Q20. Thinking of the items you installed, would you be interested in receiving any more of them from Duke Energy? If so, which ones?

| | # of responses | Percent |
|---|---|---|
| Bathroom faucet aerator; Night lights; Energy efficient light bulbs | 5 | 2% |
| Bathroom faucet aerator; Night lights; Energy efficient light bulbs; Insulator Gaskets | 1 | 0% |
| Energy efficient light bulbs | 42 | 16% |
| Energy efficient light bulbs; Insulator Gaskets | 8 | 3% |
| Insulator Gaskets | 1 | 0% |
| Kitchen faucet aerator | 1 | 0% |
| Kitchen faucet aerator; Bathroom faucet aerator; Energy efficient light bulbs | 1 | 0% |
| Kitchen faucet aerator; Bathroom faucet aerator; Night lights; Energy efficient light bulbs | 5 | 2% |
| Kitchen faucet aerator; Night lights | 1 | 0% |
| Kitchen faucet aerator; Night lights; Energy efficient light bulbs | 3 | 1% |
| Night lights | 12 | 5% |
| Night lights; Energy efficient light bulbs | 87 | 34% |
| Night lights; Energy efficient light bulbs; Insulator Gaskets | 13 | 5% |
| Night lights; Insulator Gaskets | 3 | 1% |
| Showerhead | 3 | 1% |
| Showerhead; Bathroom faucet aerator; Energy efficient light bulbs; Insulator Gaskets | 1 | 0% |
| Showerhead; Bathroom faucet aerator; Night lights; Energy efficient light bulbs | 2 | 1% |
| Showerhead; Bathroom faucet aerator; Night lights; Energy efficient light bulbs; Insulator Gaskets | 1 | 0% |
| Showerhead; Energy efficient light bulbs | 8 | 3% |
| Showerhead; Energy efficient light bulbs; Insulator Gaskets | 1 | 0% |
| Showerhead; Kitchen faucet aerator; Bathroom faucet aerator; Energy efficient light bulbs | 2 | 1% |
| Showerhead; Kitchen faucet aerator; Bathroom faucet aerator; Energy efficient light bulbs; Insulator Gaskets | 1 | 0% |
| Showerhead; Kitchen faucet aerator; Bathroom faucet aerator; Night lights | 1 | 0% |
| Showerhead; Kitchen faucet aerator; Bathroom faucet aerator; Night lights; Energy efficient light bulbs | 12 | 5% |
| Showerhead; Kitchen faucet aerator; Bathroom faucet aerator; Night lights; Energy efficient light bulbs; Insulator Gaskets | 7 | 3% |
| Showerhead; Kitchen faucet aerator; Energy efficient light bulbs | 2 | 1% |
| Showerhead; Kitchen faucet aerator; Night lights; Energy efficient light bulbs | 4 | 2% |
| Showerhead; Night lights | 4 | 2% |
| Showerhead; Night lights; Energy efficient light bulbs | 12 | 5% |
| Showerhead; Night lights; Energy efficient light bulbs; Insulator Gaskets | 3 | 1% |
| No, I am not interested in receiving any more of the items | 7 | 3% |
| Don't know | 4 | 2% |
| Refused | 0 | 0% |

| | # of responses | Percent |
|---|---|---|
| Total | 258 | **100%** |

Q21. What would be your preferred way to request these additional items?

| | # of responses | Percent |
|---|---|---|
| Internet | 177 | **72%** |
| Internet; Pre-paid postcard | 23 | **9%** |
| Internet; Pre-paid postcard; Other | 1 | **0%** |
| Internet; Telephone | 6 | **2%** |
| Internet; Telephone; Pre-paid postcard | 7 | **3%** |
| Pre-paid postcard | 20 | **8%** |
| Pre-paid postcard; Other | 1 | **0%** |
| Telephone | 5 | **2%** |
| Other | 3 | **1%** |
| Don't know | 4 | **2%** |
| Refused | 0 | **0%** |
| Total | 247 | **100%** |

Q22. On average, what is the typical shower length in your household?

| | # of responses | Percent |
|---|---|---|
| One minute or less | 0 | **0%** |
| Two to four minutes | 4 | **3%** |
| Five to eight minutes | 44 | **38%** |
| Nine to twelve minutes | 24 | **21%** |
| Thirteen to fifteen minutes | 24 | **21%** |
| Sixteen to twenty minutes | 13 | **11%** |
| Twenty-one to thirty minutes | 5 | **4%** |
| More than thirty minutes | 2 | **2%** |
| Don't know | 1 | **1%** |
| Refused | 0 | **0%** |
| Total | 117 | **100%** |

Q23. Thinking of the efficient showerhead currently installed on your home: on average, how many showers per day are taken in this shower?

| | Fewer than 1 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | Don't know | Refused | Total |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **# of responses** | 1 | 18 | 47 | 24 | 14 | 7 | 4 | 1 | 1 | 0 | 0 | 117 |
| ***Percent*** | **1%** | **15%** | **40%** | **21%** | **12%** | **6%** | **3%** | **1%** | **1%** | **0%** | **0%** | **100%** |

Q24. You said you installed the night light. Did the night light replace an existing night light?

| | Yes | No | Don't Know | Refused | Total |
|---|---|---|---|---|---|
| **# of responses** | 121 | 103 | 0 | 0 | 224 |

| | Yes | No | Don't Know | Refused | Total |
|---|---|---|---|---|---|
| ***Percent*** | **54%** | **46%** | **0%** | **0%** | **100%** |

Q25. Did the old nightlight have a bulb that you could take out and replace once it burned out?

| | Yes | No | Don't Know | Refused | Total |
|---|---|---|---|---|---|
| **# of responses** | 74 | 38 | 9 | 0 | 121 |
| ***Percent*** | **61%** | **31%** | **7%** | **0%** | **100%** |

Q26. You said you installed at least one of the energy efficient lights. What type of bulb(s) did you replace with the energy efficient lightbulbs?

| | All incandescent | All halogen | All CFL | All LED | Some combination | Don't Know | Refused | Total |
|---|---|---|---|---|---|---|---|---|
| **# of responses** | 111 | 15 | 74 | 33 | 4 | 16 | 0 | 253 |
| ***Percent*** | **44%** | **6%** | **29%** | **13%** | **2%** | **6%** | **0%** | **100%** |

Q27. In what rooms did you install the energy efficient lightbulbs that were included in the kit?

| | # of responses | Percent |
|---|---|---|
| Bathroom | 17 | **7%** |
| Bathroom; Hallway | 5 | **2%** |
| Bedroom | 25 | **10%** |
| Bedroom; Basement | 1 | **0%** |
| Bedroom; Bathroom | 12 | **5%** |
| Bedroom; Den | 1 | **0%** |
| Bedroom; Garage | 1 | **0%** |
| Bedroom; Hallway | 2 | **1%** |
| Bedroom; Kitchen | 4 | **2%** |
| Den | 1 | **0%** |
| Den; Outdoors | 1 | **0%** |
| Dining Room | 6 | **2%** |
| Dining Room; Bedroom | 6 | **2%** |
| Dining Room; Kitchen | 2 | **1%** |
| Garage | 1 | **0%** |
| Hallway | 3 | **1%** |
| Kitchen | 5 | **2%** |
| Kitchen; Bathroom | 10 | **4%** |
| Kitchen; Den | 1 | **0%** |
| Kitchen; Hallway | 1 | **0%** |
| Living Room | 41 | **16%** |
| Living Room; Bathroom | 7 | **3%** |
| Living Room; Bedroom | 51 | **20%** |
| Living Room; Den | 4 | **2%** |
| Living Room; Dining Room | 21 | **8%** |
| Living Room; Hallway | 1 | **0%** |
| Living Room; Kitchen | 13 | **5%** |
| Living Room; Other area | 1 | **0%** |
| Don't know | 8 | **3%** |
| Refused | 1 | **0%** |
| Total | 253 | **100%** |

Q28. Have you adjusted the temperature of your water heater based on the Hot Water Gauge Card included in your kit?

| | Yes | No | Don't recall seeing the Hot Water Gauge Card | Don't Know | Refused | Total |
|---|---|---|---|---|---|---|
| # of responses | 45 | 168 | 77 | 9 | 1 | 300 |
| ***Percent*** | **15%** | **56%** | **26%** | **3%** | **0%** | **100%** |

Q29. Do you know what the old temperature setting on your hot water heater was?

| | Yes | No | Total |
|---|---|---|---|
| # of responses | 12 | 33 | 45 |
| ***Percent*** | **27%** | **73%** | **100%** |

Q30. And what was the new temperature setting you set your hot water heater to?

| | Provided response | Don't Know | Total |
|---|---|---|---|
| # of responses | 12 | 33 | 45 |
| ***Percent*** | **27%** | **73%** | **100%** |

Q31. Is the new water heater temperature setting still in place?

| | Yes | No | Don't Know | Refused | Total |
|---|---|---|---|---|---|
| # of responses | 35 | 3 | 7 | 0 | 45 |
| ***Percent*** | **78%** | **7%** | **16%** | **0%** | **100%** |

Q32. Why did you change the water heater temperature a second time?

***No responses given***

Q33. What is the fuel type of your water heater?

| | Electricity | Natural Gas | Other | Don't Know | Refused | Total |
|---|---|---|---|---|---|---|
| # of responses | 181 | 110 | 0 | 8 | 1 | 300 |
| ***Percent*** | **60%** | **37%** | **0%** | **3%** | **0%** | **100%** |

Q34. How old is your water heater?

| | Less than 5 years old | 5 to 9 years old | 10 to 15 years old | More than 15 years old | Don't Know | Refused | Total |
|---|---|---|---|---|---|---|---|
| # of responses | 95 | 70 | 45 | 26 | 64 | 0 | 300 |
| ***Percent*** | **32%** | **23%** | **15%** | **9%** | **21%** | **0%** | **100%** |

Q35. If you had not received the free efficiency items in the kit, how likely is is that you would have purchased and installed any of these same items within the next six months?

***Q35a. Showerhead***

| | 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | Don't know | Refused | Total |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| # of responses | 51 | 6 | 6 | 6 | 10 | 10 | 3 | 4 | 1 | 3 | 15 | 2 | 0 | 117 |
| *Percent* | 44% | 5% | 5% | 5% | 9% | 9% | 3% | 3% | 1% | 3% | 13% | 2% | 0% | 100% |

***Q35b. Kitchen faucet aerator***

| | 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | Don't know | Refused | Total |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| # of responses | 50 | 7 | 5 | 6 | 6 | 8 | 4 | 3 | 2 | 1 | 10 | 1 | 0 | 103 |
| *Percent* | 49% | 7% | 5% | 6% | 6% | 8% | 4% | 3% | 2% | 1% | 10% | 1% | 0% | 100% |

***Q35c. Bathroom faucet aerator***

| | 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | Don't know | Refused | Total |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| # of responses | 56 | 8 | 6 | 2 | 5 | 7 | 6 | 3 | 4 | 3 | 10 | 1 | 0 | 111 |
| *Percent* | 50% | 7% | 5% | 2% | 5% | 6% | 5% | 3% | 4% | 3% | 9% | 1% | 0% | 100% |

***Q35d. Night light***

| | 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | Don't know | Refused | Total |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| # of responses | 84 | 11 | 10 | 9 | 6 | 26 | 10 | 18 | 10 | 7 | 29 | 4 | 0 | 224 |
| *Percent* | 38% | 5% | 4% | 4% | 3% | 12% | 4% | 8% | 4% | 3% | 13% | 2% | 0% | 100% |

***Q35e. Energy efficient light bulb(s)***

| | 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | Don't know | Refused | Total |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| # of responses | 46 | 5 | 4 | 9 | 4 | 21 | 16 | 21 | 22 | 13 | 89 | 3 | 0 | 253 |
| *Percent* | 18% | 2% | 2% | 4% | 2% | 8% | 6% | 8% | 9% | 5% | 35% | 1% | 0% | 100% |

***Q35f. Insulator gaskets for light switches and electricity outlets***

| | 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | Don't know | Refused | Total |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| # of responses | 51 | 8 | 2 | 3 | 2 | 9 | 1 | 5 | 2 | 2 | 6 | 1 | 0 | 92 |
| *Percent* | 55% | 9% | 2% | 3% | 2% | 10% | 1% | 5% | 2% | 2% | 7% | 1% | 0% | 100% |

Q36. If you had not received them for free in the kit, how many LED light bulbs would you have purchased?

| | One | Two | Don't Know | Refused | Total |
|---|---|---|---|---|---|
| # of responses | 1 | 53 | 43 | 0 | 97 |
| ***Percent*** | **1%** | **55%** | **44%** | **0%** | **100%** |

Q37. Now, thinking about the water savings items that were provided in the kit - using a scale from 0 to 10, where 0 means "not at all influential" and 10 means "extremely influential", how influential were the following factors on your decision to install the water saving items from the kit? How influential was...

***Q37a. The fact that the items were free***

| | 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | N/A | Don't know | Refused | Total |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| # of responses | 9 | 1 | 0 | 1 | 2 | 11 | 9 | 9 | 15 | 13 | 98 | 0 | 2 | 0 | 170 |
| ***Percent*** | **5%** | **1%** | **0%** | **1%** | **1%** | **6%** | **5%** | **5%** | **9%** | **8%** | **58%** | **0%** | **1%** | **0%** | **100%** |

***Q37b. The fact that the items were mailed to your house***

| | 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | N/A | Don't know | Refused | Total |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| # of responses | 4 | 0 | 1 | 0 | 2 | 9 | 5 | 11 | 15 | 12 | 108 | 0 | 3 | 0 | 170 |
| ***Percent*** | **2%** | **0%** | **1%** | **0%** | **1%** | **5%** | **3%** | **6%** | **9%** | **7%** | **64%** | **0%** | **2%** | **0%** | **100%** |

***Q37c. Information in the kit about how the items would save energy***

| | 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | N/A | Don't know | Refused | Total |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| # of responses | 4 | 1 | 2 | 4 | 2 | 10 | 5 | 9 | 17 | 17 | 98 | 0 | 1 | 0 | 170 |
| ***Percent*** | **2%** | **1%** | **1%** | **2%** | **1%** | **6%** | **3%** | **5%** | **10%** | **10%** | **58%** | **0%** | **1%** | **0%** | **100%** |

***Q37d. Information that your child brought home from school***

| | 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | N/A | Don't know | Refused | Total |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| # of responses | 15 | 0 | 3 | 2 | 3 | 10 | 8 | 13 | 19 | 15 | 77 | 3 | 2 | 0 | 170 |
| ***Percent*** | **9%** | **0%** | **2%** | **1%** | **2%** | **6%** | **5%** | **8%** | **11%** | **9%** | **45%** | **2%** | **1%** | **0%** | **100%** |

***Q37e. Other information or advertisements from Duke Energy, including its website***

| | 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | N/A | Don't know | Refused | Total |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| # of responses | 14 | 1 | 3 | 4 | 5 | 21 | 8 | 14 | 15 | 13 | 70 | 1 | 1 | 0 | 170 |
| *Percent* | 8% | 1% | 2% | 2% | 3% | 12% | 5% | 8% | 9% | 8% | 41% | 1% | 1% | 0% | 100% |

Q38. Using a scale from 0 to 10, where 0 means "not at all influential" and 10 means "extremely influential", how influential were the following factors in your decision to install the lightbulbs from the kit? How influential was...

***Q38a. The fact that the items were free***

| | 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | N/A | Don't know | Refused | Total |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| # of responses | 9 | 1 | 1 | 1 | 5 | 16 | 7 | 11 | 10 | 20 | 172 | 0 | 0 | 0 | 253 |
| *Percent* | 4% | 0% | 0% | 0% | 2% | 6% | 3% | 4% | 4% | 8% | 68% | 0% | 0% | 0% | 100% |

***Q38b. The fact that the items were mailed to your house***

| | 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | N/A | Don't know | Refused | Total |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| # of responses | 5 | 0 | 1 | 1 | 1 | 16 | 4 | 11 | 17 | 17 | 179 | 0 | 0 | 1 | 253 |
| *Percent* | 2% | 0% | 0% | 0% | 0% | 6% | 2% | 4% | 7% | 7% | 71% | 0% | 0% | 0% | 100% |

***Q38c. Information in the kit about how the items would save energy***

| | 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | N/A | Don't know | Refused | Total |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| # of responses | 14 | 0 | 1 | 3 | 6 | 15 | 13 | 21 | 18 | 20 | 141 | 0 | 1 | 0 | 253 |
| *Percent* | 6% | 0% | 0% | 1% | 2% | 6% | 5% | 8% | 7% | 8% | 56% | 0% | 0% | 0% | 100% |

***Q38d. Information that your child brought home from school***

| | 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | N/A | Don't know | Refused | Total |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| # of responses | 20 | 1 | 1 | 4 | 11 | 20 | 13 | 19 | 25 | 19 | 111 | 5 | 4 | 0 | 253 |
| *Percent* | 8% | 0% | 0% | 2% | 4% | 8% | 5% | 8% | 10% | 8% | 44% | 2% | 2% | 0% | 100% |

***Q38e. Other information or advertisements from Duke Energy, including its website***

| | 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | N/A | Don't know | Refused | Total |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| # of responses | 26 | 3 | 2 | 5 | 9 | 28 | 19 | 23 | 16 | 19 | 94 | 4 | 4 | 1 | 253 |
| *Percent* | 10% | 1% | 1% | 2% | 4% | 11% | 8% | 9% | 6% | 8% | 37% | 2% | 2% | 0% | 100% |

Q39. Since your child learned about energy conservation at school and signed up for your energy kit from Duke Energy, has your child adopted any new behaviors to help save energy in your home? This would only include new energy saving behaviors that your child adopted since receiving the kit.

| | # of responses | Percent |
|---|---|---|
| Not applicable - no new behaviors | 67 | **22%** |
| Taking shorter showers | 6 | **2%** |
| Turning off electronics when not using them | 13 | **4%** |
| Turning off electronics when not using them; Taking shorter showers | 3 | **1%** |
| Turning off lights when not in a room | 54 | **18%** |
| Turning off lights when not in a room; Taking shorter showers | 11 | **4%** |
| Turning off lights when not in a room; Turning off electronics when not using them | 83 | **28%** |
| Turning off lights when not in a room; Turning off electronics when not using them; Other | 2 | **1%** |
| Turning off lights when not in a room; Turning off electronics when not using them; Taking shorter showers | 42 | **14%** |
| Turning off lights when not in a room; Turning off electronics when not using them; Taking shorter showers; Other | 1 | **0%** |
| Other | 6 | **2%** |
| Don't know | 12 | **4%** |
| Refused | 0 | **0%** |
| Total | 300 | **100%** |

Q39b. Before receiving the kit, was your child already...

***39b.2) Turning off lights when not in a room***

| | Yes | No | Don't Know | Refused | Total |
|---|---|---|---|---|---|
| **# of responses** | 65 | 124 | 4 | 0 | 193 |
| ***Percent*** | **34%** | **64%** | **2%** | **0%** | **100%** |

***39b.3) Turning off electronics when not using them***

| | Yes | No | Don't Know | Refused | Total |
|---|---|---|---|---|---|
| **# of responses** | 40 | 99 | 5 | 0 | 144 |
| ***Percent*** | **28%** | **69%** | **3%** | **0%** | **100%** |

### 39b.4) Taking shorter showers

| | Yes | No | Don't Know | Refused | Total |
|---|---|---|---|---|---|
| # of responses | 18 | 45 | 0 | 0 | 63 |
| **Percent** | **29%** | **71%** | **0%** | **0%** | **100%** |

### 39b.5) "Other" reasons

| | Yes | No | Don't Know | Refused | Total |
|---|---|---|---|---|---|
| # of responses | 3 | 4 | 2 | 0 | 9 |
| **Percent** | **33%** | **44%** | **22%** | **0%** | **100%** |

Q40. Since receiving your energy kit from Duke Energy, have you adopted or increased any behaviors to help save energy in your home?

| | # of responses | Percent |
|---|---|---|
| Changing thermostat settings so heating or cooling system uses less energy | 12 | **4%** |
| Changing thermostat settings so heating or cooling system uses less energy; Taking shorter showers | 1 | **0%** |
| Changing thermostat settings so heating or cooling system uses less energy; Taking shorter showers; Turning water heat thermostat down | 1 | **0%** |
| Changing thermostat settings so heating or cooling system uses less energy; Turning off electronics when not using them | 4 | **1%** |
| Changing thermostat settings so heating or cooling system uses less energy; Turning water heat thermostat down | 1 | **0%** |
| Changing thermostat settings so heating or cooling system uses less energy; Using fans instead of air conditioning | 1 | **0%** |
| Changing thermostat settings so heating or cooling system uses less energy; Using fans instead of air conditioning Taking shorter showers | 1 | **0%** |
| Changing thermostat settings so heating or cooling system uses less energy; Using fans instead of air conditioning Turning off electronics when not using them | 1 | **0%** |
| Changing thermostat settings so heating or cooling system uses less energy; Using fans instead of air conditioning; Turning off electronics when not using them; Turning water heat thermostat down | 1 | **0%** |
| Taking shorter showers | 3 | **1%** |
| Turning off air conditioning when not home | 3 | **1%** |
| Turning off air conditioning when not home; Changing thermostat settings so heating or cooling system uses less energy | 1 | **0%** |
| Turning off air conditioning when not home; Changing thermostat settings so heating or cooling system uses less energy; Turning off electronics when not using them; Turning water heat thermostat down | 1 | **0%** |
| Turning off air conditioning when not home; Changing thermostat settings so heating or cooling system uses less energy; Using fans instead of air conditioning | 1 | **0%** |
| Turning off air conditioning when not home; Changing thermostat settings so heating or cooling system uses less energy; Using fans instead of air conditioning; Taking shorter showers | 2 | **1%** |
| Turning off air conditioning when not home; Changing thermostat settings so heating or cooling system uses less energy; Using fans instead of air conditioning; Turning off electronics when not using them | 1 | **0%** |
| Turning off electronics when not using them | 2 | **1%** |
| Turning off electronics when not using them; Taking shorter showers | 1 | **0%** |
| Turning off electronics when not using them; Turning water heat thermostat down | 1 | **0%** |
| Turning off furnace when not home | 1 | **0%** |
| Turning off furnace when not home; Turning off air conditioning when not home | 1 | **0%** |

| | # of responses | Percent |
|---|---|---|
| Turning off lights when not in a room | 21 | 7% |
| Turning off lights when not in a room; Changing thermostat settings so heating or cooling system uses less energy | 10 | 3% |
| Turning off lights when not in a room; Changing thermostat settings so heating or cooling system uses less energy; Taking shorter showers | 2 | 1% |
| Turning off lights when not in a room; Changing thermostat settings so heating or cooling system uses less energy; Turning off electronics when not using them | 14 | 5% |
| Turning off lights when not in a room; Changing thermostat settings so heating or cooling system uses less energy; Turning off electronics when not using them; Taking shorter showers | 5 | 2% |
| Turning off lights when not in a room; Changing thermostat settings so heating or cooling system uses less energy; Turning off electronics when not using them; Taking shorter showers; Turning water heat thermostat down | 1 | 0% |
| Turning off lights when not in a room; Changing thermostat settings so heating or cooling system uses less energy; Turning off electronics when not using them; Turning water heat thermostat down | 2 | 1% |
| Turning off lights when not in a room; Changing thermostat settings so heating or cooling system uses less energy; Using fans instead of air conditioning | 5 | 2% |
| Turning off lights when not in a room; Changing thermostat settings so heating or cooling system uses less energy; Using fans instead of air conditioning; Other | 1 | 0% |
| Turning off lights when not in a room; Changing thermostat settings so heating or cooling system uses less energy; Using fans instead of air conditioning; Taking shorter showers | 1 | 0% |
| Turning off lights when not in a room; Changing thermostat settings so heating or cooling system uses less energy; Using fans instead of air conditioning; Turning off electronics when not using them | 15 | 5% |
| Turning off lights when not in a room; Changing thermostat settings so heating or cooling system uses less energy; Using fans instead of air conditioning; Turning off electronics when not using them; Taking shorter showers | 12 | 4% |
| Turning off lights when not in a room; Changing thermostat settings so heating or cooling system uses less energy; Using fans instead of air conditioning; Turning off electronics when not using them; Taking shorter showers; Turning water heat thermostat down | 3 | 1% |
| Turning off lights when not in a room; Changing thermostat settings so heating or cooling system uses less energy; Using fans instead of air conditioning; Turning off electronics when not using them; Turning water heat thermostat down | 3 | 1% |
| Turning off lights when not in a room; Taking shorter showers | 1 | 0% |
| Turning off lights when not in a room; Turning off air conditioning when not home; Changing thermostat settings so heating or cooling system uses less energy | 1 | 0% |
| Turning off lights when not in a room; Turning off air conditioning when not home; Changing thermostat settings so heating or cooling system uses less energy; Taking shorter showers | 1 | 0% |
| Turning off lights when not in a room; Turning off air conditioning when not home; Changing thermostat settings so heating or cooling system uses less energy; Turning off electronics when not using them | 3 | 1% |
| Turning off lights when not in a room; Turning off air conditioning when not home; Changing thermostat settings so heating or cooling system uses less energy; Turning off electronics when not using them; Taking shorter showers | 3 | 1% |
| Turning off lights when not in a room; Turning off air conditioning when not home; Changing thermostat settings so heating or cooling system uses less energy; Using fans instead of air conditioning | 1 | 0% |
| Turning off lights when not in a room; Turning off air conditioning when not home; Changing thermostat settings so heating or cooling system uses less energy; Using fans instead of air conditioning; Turning off electronics when not using them | 5 | 2% |
| Turning off lights when not in a room; Turning off air conditioning when not home; Changing thermostat settings so heating or cooling system uses less energy; Using fans instead of air conditioning; Turning off electronics when not using them; Other | 1 | 0% |
| Turning off lights when not in a room; Turning off air conditioning when not home; Changing thermostat settings so heating or cooling system uses less energy; Using fans instead of air conditioning; Turning off electronics when not using them; Taking shorter showers | 3 | 1% |
| Turning off lights when not in a room; Turning off air conditioning when not home; Changing thermostat settings so heating or cooling system uses less energy; Using fans instead of air conditioning; Turning off electronics when not using them; Taking shorter showers; Turning water heat thermostat down | 2 | 1% |
| Turning off lights when not in a room; Turning off air conditioning when not home; Turning off electronics when not using them | 4 | 1% |
| Turning off lights when not in a room; Turning off air conditioning when not home; Using fans instead of air conditioning | 2 | 1% |
| Turning off lights when not in a room; Turning off air conditioning when not home; Using fans instead of air conditioning; Taking shorter showers | 1 | 0% |

| | # of responses | Percent |
|---|---|---|
| Turning off lights when not in a room; Turning off air conditioning when not home; Using fans instead of air conditioning; Turning off electronics when not using them | 1 | 0% |
| Turning off lights when not in a room; Turning off air conditioning when not home; Using fans instead of air conditioning; Turning off electronics when not using them; Taking shorter showers | 2 | 1% |
| Turning off lights when not in a room; Turning off electronics when not using them | 9 | 3% |
| Turning off lights when not in a room; Turning off electronics when not using them; Taking shorter showers | 2 | 1% |
| Turning off lights when not in a room; Turning off furnace when not home; Changing thermostat settings so heating or cooling system uses less energy; Turning off electronics when not using them | 1 | 0% |
| Turning off lights when not in a room; Turning off furnace when not home; Changing thermostat settings so heating or cooling system uses less energy; Using fans instead of air conditioning; Turning off electronics when not using them | 2 | 1% |
| Turning off lights when not in a room; Turning off furnace when not home; Changing thermostat settings so heating or cooling system uses less energy; Using fans instead of air conditioning; Turning off electronics when not using them; Taking shorter showers | 1 | 0% |
| Turning off lights when not in a room; Turning off furnace when not home; Turning off air conditioning when not home | 1 | 0% |
| Turning off lights when not in a room; Turning off furnace when not home; Turning off air conditioning when not home; Changing thermostat settings so heating or cooling system uses less energy | 3 | 1% |
| Turning off lights when not in a room Turning off furnace when not home; Turning off air conditioning when not home; Changing thermostat settings so heating or cooling system uses less energy; Turning off electronics when not using them | 5 | 2% |
| Turning off lights when not in a room; Turning off furnace when not home; Turning off air conditioning when not home; Changing thermostat settings so heating or cooling system uses less energy; Turning off electronics when not using them; Taking shorter showers | 2 | 1% |
| Turning off lights when not in a room; Turning off furnace when not home; Turning off air conditioning when not home; Changing thermostat settings so heating or cooling system uses less energy; Turning off electronics when not using them; Taking shorter showers; Turning water heat thermostat down | 1 | 0% |
| Turning off lights when not in a room; Turning off furnace when not home; Turning off air conditioning when not home; Changing thermostat settings so heating or cooling system uses less energy; Using fans instead of air conditioning | 2 | 1% |
| Turning off lights when not in a room; Turning off furnace when not home; Turning off air conditioning when not home; Changing thermostat settings so heating or cooling system uses less energy; Using fans instead of air conditioning; Turning off electronics when not using them | 6 | 2% |
| Turning off lights when not in a room; Turning off furnace when not home; Turning off air conditioning when not home; Changing thermostat settings so heating or cooling system uses less energy; Using fans instead of air conditioning; Turning off electronics when not using them; Taking shorter showers | 4 | 1% |
| Turning off lights when not in a room; Turning off furnace when not home; Turning off air conditioning when not home; Changing thermostat settings so heating or cooling system uses less energy; Using fans instead of air conditioning; Turning off electronics when not using them; Taking shorter showers; Turning water heat thermostat down | 8 | 3% |
| Turning off lights when not in a room; Turning off furnace when not home; Turning off air conditioning when not home; Changing thermostat settings so heating or cooling system uses less energy; Using fans instead of air conditioning; Turning off electronics when not using them; Taking shorter showers; Turning water heat thermostat down; Other | 1 | 0% |
| Turning off lights when not in a room; Turning off furnace when not home; Turning off air conditioning when not home; Changing thermostat settings so heating or cooling system uses less energy; Using fans instead of air conditioning; Turning off electronics when not using them; Turning water heat thermostat down | 1 | 0% |
| Turning off lights when not in a room; Turning off furnace when not home; Turning off air conditioning when not home; Turning off electronics when not using them | 1 | 0% |
| Turning off lights when not in a room; Turning off furnace when not home; Turning off air conditioning when not home; Using fans instead of air conditioning; Turning off electronics when not using them | 1 | 0% |
| Turning off lights when not in a room; Turning off furnace when not home; Turning off air conditioning when not home; Using fans instead of air conditioning; Turning off electronics when not using them; Taking shorter showers | 1 | 0% |
| Turning off lights when not in a room; Turning off furnace when not home; Turning off electronics when not using them | 1 | 0% |
| Turning off lights when not in a room; Turning off furnace when not home; Using fans instead of air conditioning | 1 | 0% |
| Turning off lights when not in a room; Turning off furnace when not home; Using fans instead of air conditioning; Turning off electronics when not using them; Taking shorter showers | 1 | 0% |
| Turning off lights when not in a room; Using fans instead of air conditioning | 1 | 0% |
| Turning off lights when not in a room; Using fans instead of air conditioning; Turning off electronics when not using them | 2 | 1% |
| Turning off lights when not in a room; Using fans instead of air conditioning; Turning off electronics when not using them; Taking shorter showers | 1 | 0% |

| | # of responses | Percent |
|---|---|---|
| Turning water heat thermostat down | 2 | **1%** |
| Using fans instead of air conditioning | 2 | **1%** |
| Using fans instead of air conditioning; Turning off electronics when not using them | 3 | **1%** |
| Using fans instead of air conditioning; Turning off electronics when not using them; Taking shorter showers | 2 | **1%** |
| Not applicable - no new behaviors | 55 | **18%** |
| Other | 3 | **1%** |
| Don't know | 6 | **2%** |
| Refused | 1 | **0%** |
| Total | 300 | **100%** |



Q40b. Before receiving the kit, were you already...

***40b.2) Turning off lights when not in a room***

| | Yes | No | Don't Know | Refused | Total |
|---|---|---|---|---|---|
| **# of responses** | 137 | 45 | 3 | 0 | 185 |
| ***Percent*** | **74%** | **24%** | **2%** | **0%** | **100%** |

***40b.3) Turning off furnace when not home***

| | Yes | No | Don't Know | Refused | Total |
|---|---|---|---|---|---|
| **# of responses** | 27 | 18 | 1 | 0 | 46 |
| ***Percent*** | **59%** | **39%** | **2%** | **0%** | **100%** |

***40b.4) Turning off air conditioning when not home***

| | Yes | No | Don't Know | Refused | Total |
|---|---|---|---|---|---|
| **# of responses** | 45 | 32 | 0 | 0 | 77 |
| ***Percent*** | **58%** | **42%** | **0%** | **0%** | **100%** |

***40b.5) Changing thermostat settings so heating or cooling system uses less energy***

| | Yes | No | Don't Know | Refused | Total |
|---|---|---|---|---|---|
| **# of responses** | 84 | 75 | 1 | 0 | 160 |
| ***Percent*** | **53%** | **47%** | **1%** | **0%** | **100%** |

*40b.6) Using fans instead of air conditioning*

| | Yes | No | Don't Know | Refused | Total |
|---|---|---|---|---|---|
| # of responses | 66 | 38 | 2 | 0 | 106 |
| *Percent* | 62% | 36% | 2% | 0% | 100% |

*40b.7) Turning off electronics when not using them*

| | Yes | No | Don't Know | Refused | Total |
|---|---|---|---|---|---|
| # of responses | 83 | 62 | 2 | 0 | 147 |
| *Percent* | 56% | 42% | 1% | 0% | 100% |

*40b.8) Taking shorter showers*

| | Yes | No | Don't Know | Refused | Total |
|---|---|---|---|---|---|
| # of responses | 20 | 49 | 1 | 0 | 70 |
| *Percent* | 29% | 70% | 1% | 0% | 100% |

*40b.9) Turning water heat thermostat down*

| | Yes | No | Don't Know | Refused | Total |
|---|---|---|---|---|---|
| # of responses | 9 | 19 | 1 | 0 | 29 |
| *Percent* | 31% | 66% | 3% | 0% | 100% |

*40b.10) Other*

| | Yes | No | Don't Know | Refused | Total |
|---|---|---|---|---|---|
| # of responses | 5 | 1 | 0 | 0 | 6 |
| *Percent* | 83% | 17% | 0% | 0% | 100% |

Q41. On a scale of 0 to 10, where 0 means "not at all influential" and 10 means "extremely influential", how much influence did Duke Energy's kit and materials on saving energy have on this change of energy using behaviors?

| | 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | Don't know | Refused | Total |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| # of responses | 7 | 4 | 2 | 5 | 7 | 24 | 20 | 28 | 35 | 21 | 79 | 3 | 0 | 235 |
| *Percent* | 3% | 2% | 1% | 2% | 3% | 10% | 9% | 12% | 15% | 9% | 34% | 1% | 0% | 100% |

Q42. Since receiving your energy kit from Duke Energy, have you purchased and installed any other products or made any improvements to your home to help save energy?

| | Yes | No | Don't Know | Refused | Total |
|---|---|---|---|---|---|
| **# of responses** | 103 | 173 | 24 | 0 | 300 |
| ***Percent*** | **34%** | **58%** | **8%** | **0%** | **100%** |

Q43. What products have you purchased and installed to help save energy in your home?

| | # of responses | Percent |
|---|---|---|
| Efficient heating or cooling equipment | 1 | **1%** |
| Efficient heating or cooling equipment; Insulation; LEDs and/or CFLs; Energy efficient water heater | 1 | **1%** |
| Efficient heating or cooling equipment; LEDs and/or CFLs | 1 | **1%** |
| Efficient heating or cooling equipment; Products to seal air leaks in your home; Products to seal ducts; LEDs and/or CFLs | 1 | **1%** |
| Efficient windows; Insulation; LEDs and/or CFLs | 2 | **2%** |
| Efficient windows; LEDs and/or CFLs | 1 | **1%** |
| Efficient windows; Other | 1 | **1%** |
| Energy efficient appliances | 4 | **4%** |
| Energy efficient appliances; Efficient heating or cooling equipment | 1 | **1%** |
| Energy efficient appliances; Efficient heating or cooling equipment; Efficient windows; Insulation; LEDs and/or CFLs; Energy efficient water heater | 1 | **1%** |
| Energy efficient appliances; Efficient heating or cooling equipment; Efficient windows LEDs and/or CFLs | 1 | **1%** |
| Energy efficient appliances; Efficient heating or cooling equipment; Efficient windows; Products to seal air leaks in your home; LEDs and/or CFLs; Energy efficient water heater | 1 | **1%** |
| Energy efficient appliances; Efficient heating or cooling equipment; Insulation; Products to seal air leaks in your home; LEDs and/or CFLs | 1 | **1%** |
| Energy efficient appliances; Efficient heating or cooling equipment; LEDs and/or CFLs | 5 | **5%** |
| Energy efficient appliances; Efficient heating or cooling equipment; Products to seal ducts; LEDs and/or CFLs | 1 | **1%** |
| Energy efficient appliances; Efficient windows; LEDs and/or CFLs | 1 | **1%** |
| Energy efficient appliances; Efficient windows; LEDs and/or CFLs; Energy efficient water heater | 1 | **1%** |
| Energy efficient appliances; Efficient windows; Products to seal air leaks in your home; LEDs and/or CFLs | 1 | **1%** |
| Energy efficient appliances; Efficient windows; Products to seal air leaks in your home; LEDs and/or CFLs; Energy efficient water heater | 1 | **1%** |
| Energy efficient appliances; Insulation | 1 | **1%** |
| Energy efficient appliances; Insulation; LEDs and/or CFLs; Energy efficient water heater | 2 | **2%** |
| Energy efficient appliances; Insulation; Products to seal air leaks in your home; LEDs and/or CFLs | 1 | **1%** |
| Energy efficient appliances; LEDs and/or CFLs | 11 | **11%** |
| Energy efficient appliances; LEDs and/or CFLs; Energy efficient water heater | 3 | **3%** |
| Energy efficient appliances; LEDs and/or CFLs; Other | 2 | **2%** |
| Energy efficient appliances; Other | 1 | **1%** |
| Energy efficient appliances; Products to seal air leaks in your home; LEDs and/or CFLs | 3 | **3%** |

| | # of responses | Percent |
|---|---|---|
| Energy efficient appliances; Products to seal air leaks in your home; Products to seal ducts; LEDs and/or CFLs | 1 | **1%** |
| Energy efficient appliances; Products to seal ducts; LEDs and/or CFLs | 2 | **2%** |
| Energy efficient water heater | 1 | **1%** |
| Insulation | 1 | **1%** |
| Insulation; LEDs and/or CFLs | 3 | **3%** |
| Insulation; Products to seal air leaks in your home; LEDs and/or CFLs | 2 | **2%** |
| LEDs and/or CFLs | 26 | **25%** |
| LEDs and/or CFLs; Energy efficient water heater | 3 | **3%** |
| Products to seal air leaks in your home | 4 | **4%** |
| Products to seal air leaks in your home; LEDs and/or CFLs | 4 | **4%** |
| Products to seal air leaks in your home; LEDs and/or CFLs; Other | 1 | **1%** |
| Products to seal air leaks in your home; Products to seal ducts; LEDs and/or CFLs | 1 | **1%** |
| None - no other actions taken | 1 | **1%** |
| Other | 2 | **2%** |
| Total | 103 | **100%** |

Q44. Did you get a rebate from Duke Energy for any of those products or services? If so, which ones?

***Q44.1) Buy energy efficient appliances***

| | Yes | No | Don't Know | Refused | Total |
|---|---|---|---|---|---|
| **# of responses** | 5 | 40 | 1 | 0 | 46 |
| ***Percent*** | **11%** | **87%** | **2%** | **0%** | **100%** |

***Q44.2) Buy efficient heating or cooling equipment***

| | Yes | No | Don't Know | Refused | Total |
|---|---|---|---|---|---|
| **# of responses** | 3 | 12 | 0 | 0 | 15 |
| ***Percent*** | **20%** | **80%** | **0%** | **0%** | **100%** |

***Q44.3) Buy efficient windows***

| | Yes | No | Don't Know | Refused | Total |
|---|---|---|---|---|---|
| **# of responses** | 1 | 10 | 0 | 0 | 11 |
| ***Percent*** | **9%** | **91%** | **0%** | **0%** | **100%** |

*Q44.4) Buy additional insulation*

| | Yes | No | Don't Know | Refused | Total |
|---|---|---|---|---|---|
| **# of responses** | 0 | 15 | 0 | 0 | 15 |
| ***Percent*** | **0%** | **100%** | **0%** | **0%** | **100%** |

*Q44.5) Products to seal air leaks in your home*

| | Yes | No | Don't Know | Refused | Total |
|---|---|---|---|---|---|
| **# of responses** | 0 | 20 | 2 | 0 | 22 |
| ***Percent*** | **0%** | **91%** | **9%** | **0%** | **100%** |

*Q44.6) Products to seal ducts*

| | Yes | No | Don't Know | Refused | Total |
|---|---|---|---|---|---|
| **# of responses** | 0 | 6 | 0 | 0 | 6 |
| ***Percent*** | **0%** | **100%** | **0%** | **0%** | **100%** |

*Q44.7) Buy LEDs and/or CFLs*

| | Yes | No | Don't Know | Refused | Total |
|---|---|---|---|---|---|
| **# of responses** | 11 | 69 | 5 | 0 | 85 |
| ***Percent*** | **13%** | **81%** | **6%** | **0%** | **100%** |

*Q44.8) Install an energy efficient water heater*

| | Yes | No | Don't Know | Refused | Total |
|---|---|---|---|---|---|
| **# of responses** | 0 | 13 | 1 | 0 | 14 |
| ***Percent*** | **0%** | **93%** | **7%** | **0%** | **100%** |

*Q44.96) "Other" [Q44 open-ended question]*

| | Yes | No | Don't Know | Refused | Total |
|---|---|---|---|---|---|
| **# of responses** | 1 | 6 | 0 | 0 | 7 |
| ***Percent*** | **14%** | **86%** | **0%** | **0%** | **100%** |

Q45. On a scale of 0 to 10, where 0 means "not at all influential" and 10 means "extremely influential", how much influence did the Duke Energy schools program have on your decision to...

### Q45.1) Buy energy efficient appliances

| | 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | Don't know | Refused | Total |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| # of responses | 10 | 0 | 3 | 1 | 0 | 10 | 3 | 0 | 3 | 2 | 14 | 0 | 0 | 46 |
| ***Percent*** | **22%** | **0%** | **7%** | **2%** | **0%** | **22%** | **7%** | **0%** | **7%** | **4%** | **30%** | **0%** | **0%** | **100%** |

### Q45.2) Buy efficient heating or cooling equipment

| | 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | Don't know | Refused | Total |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| # of responses | 7 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 1 | 0 | 6 | 0 | 0 | 15 |
| ***Percent*** | **47%** | **0%** | **0%** | **0%** | **0%** | **0%** | **0%** | **7%** | **7%** | **0%** | **40%** | **0%** | **0%** | **100%** |

### Q45.3) Buy efficient windows

| | 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | Don't know | Refused | Total |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| # of responses | 3 | 1 | 0 | 0 | 0 | 1 | 0 | 1 | 1 | 1 | 3 | 0 | 0 | 11 |
| ***Percent*** | **27%** | **9%** | **0%** | **0%** | **0%** | **9%** | **0%** | **9%** | **9%** | **9%** | **27%** | **0%** | **0%** | **100%** |

### Q45.4) Buy additional insulation

| | 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | Don't know | Refused | Total |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| # of responses | 4 | 1 | 2 | 0 | 0 | 3 | 1 | 1 | 2 | 0 | 1 | 0 | 0 | 15 |
| ***Percent*** | **27%** | **7%** | **13%** | **0%** | **0%** | **20%** | **7%** | **7%** | **13%** | **0%** | **7%** | **0%** | **0%** | **100%** |

### Q45.5) Products to seal air leaks in your home

| | 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | Don't know | Refused | Total |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| # of responses | 3 | 0 | 0 | 0 | 0 | 5 | 4 | 2 | 0 | 1 | 7 | 0 | 0 | 22 |
| ***Percent*** | **14%** | **0%** | **0%** | **0%** | **0%** | **23%** | **18%** | **9%** | **0%** | **5%** | **32%** | **0%** | **0%** | **100%** |

### Q45.6) Products to seal ducts

| | 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | Don't know | Refused | Total |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| # of responses | 3 | 0 | 0 | 0 | 0 | 2 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 6 |
| ***Percent*** | **50%** | **0%** | **0%** | **0%** | **0%** | **33%** | **0%** | **0%** | **0%** | **0%** | **17%** | **0%** | **0%** | **100%** |

### Q45.7) Buy LEDs and/or CFLs

| | 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | Don't know | Refused | Total |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| # of responses | 13 | 2 | 2 | 2 | 1 | 6 | 4 | 10 | 8 | 6 | 31 | 0 | 0 | 85 |
| *Percent* | 15% | 2% | 2% | 2% | 1% | 7% | 5% | 12% | 9% | 7% | 36% | 0% | 0% | 100% |

### Q45.8) ) Install an energy efficient water heater

| | 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | Don't know | Refused | Total |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| # of responses | 7 | 0 | 1 | 0 | 0 | 2 | 0 | 0 | 0 | 1 | 3 | 0 | 0 | 14 |
| *Percent* | 50% | 0% | 7% | 0% | 0% | 14% | 0% | 0% | 0% | 7% | 21% | 0% | 0% | 100% |

### Q45.96) [Q45 open-ended question]

| | 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | Don't know | Refused | Total |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| # of responses | 2 | 0 | 0 | 0 | 0 | 1 | 0 | 1 | 1 | 1 | 1 | 0 | 0 | 7 |
| *Percent* | 29% | 0% | 0% | 0% | 0% | 14% | 0% | 14% | 14% | 14% | 14% | 0% | 0% | 100% |

Q46. What kinds of appliance(s) did you buy?

| | # of responses | Percent |
|---|---|---|
| Clothes dryer | 1 | 3% |
| Clothes washer | 2 | 6% |
| Clothes washer; Clothes dryer | 1 | 3% |
| Clothes washer; Clothes dryer; Microwave | 1 | 3% |
| Clothes washer; Clothes dryer; Oven | 1 | 3% |
| Dishwasher | 3 | 8% |
| Dishwasher; Clothes washer; Clothes dryer | 1 | 3% |
| Dishwasher; Clothes washer; Microwave | 1 | 3% |
| Dishwasher; Clothes washer; Oven | 1 | 3% |
| Microwave | 1 | 3% |
| Oven | 2 | 6% |
| Refrigerator | 2 | 6% |
| Refrigerator; Clothes dryer | 1 | 3% |
| Refrigerator; Clothes washer; Clothes dryer; Oven; Microwave | 1 | 3% |
| Refrigerator; Dishwasher; Clothes washer; Clothes dryer; Microwave | 1 | 3% |
| Refrigerator; Dishwasher; Clothes washer; Clothes dryer; Oven; Microwave | 7 | 19% |
| Refrigerator; Dishwasher; Oven | 1 | 3% |
| Refrigerator; Microwave | 1 | 3% |
| Refrigerator; Oven | 1 | 3% |
| Refrigerator; Stand-alone Freezer; Clothes washer; Clothes dryer; Microwave | 1 | 3% |
| Refrigerator; Stand-alone Freezer; Dishwasher; Oven; Microwave | 2 | 6% |
| Stand-alone Freezer; Clothes washer; Clothes dryer | 2 | 6% |
| Other | 1 | 3% |
| Don't know | 0 | 0% |

| | # of responses | Percent |
|---|---|---|
| Refused | 0 | **0%** |
| Total | 36 | **100%** |

Q47. Was the [Q46 appliance] an ENERGY STAR or high efficiency model?

***Q47.1) Refrigerator***

| | Yes | No | Don't Know | Refused | Total |
|---|---|---|---|---|---|
| **# of responses** | 16 | 0 | 2 | 0 | 18 |
| ***Percent*** | **89%** | **0%** | **11%** | **0%** | **100%** |

***Q47.2) Stand-alone Freezer***

| | Yes | No | Don't Know | Refused | Total |
|---|---|---|---|---|---|
| **# of responses** | 5 | 0 | 0 | 0 | 5 |
| ***Percent*** | **100%** | **0%** | **0%** | **0%** | **100%** |

***Q47.3) Dishwasher***

| | Yes | No | Don't Know | Refused | Total |
|---|---|---|---|---|---|
| **# of responses** | 16 | 0 | 1 | 0 | 17 |
| ***Percent*** | **94%** | **0%** | **6%** | **0%** | **100%** |

***Q47.4) Clothes washer***

| | Yes | No | Don't Know | Refused | Total |
|---|---|---|---|---|---|
| **# of responses** | 19 | 0 | 1 | 0 | 20 |
| ***Percent*** | **95%** | **0%** | **5%** | **0%** | **100%** |

***Q47.5) Clothes dryer***

| | Yes | No | Don't Know | Refused | Total |
|---|---|---|---|---|---|
| **# of responses** | 17 | 0 | 1 | 0 | 18 |
| ***Percent*** | **94%** | **0%** | **6%** | **0%** | **100%** |

***Q47.6) Oven***

| | Yes | No | Don't Know | Refused | Total |
|---|---|---|---|---|---|
| **# of responses** | 13 | 0 | 3 | 0 | 16 |
| ***Percent*** | **81%** | **0%** | **19%** | **0%** | **100%** |

***Q47.7) Microwave***

| | Yes | No | Don't Know | Refused | Total |
|---|---|---|---|---|---|
| **# of responses** | 13 | 1 | 2 | 0 | 16 |
| ***Percent*** | **81%** | **6%** | **13%** | **0%** | **100%** |

***Q47.96) Other:***

| | Yes | No | Don't Know | Refused | Total |
|---|---|---|---|---|---|
| **# of responses** | 1 | 0 | 0 | 0 | 1 |
| ***Percent*** | **100%** | **0%** | **0%** | **0%** | **100%** |

Q48. Does the new clothes dryer use natural gas?

| | Yes - it uses natural gas | No - it does not use natural gas | Don't Know | Refused | Total |
|---|---|---|---|---|---|
| **# of responses** | 2 | 15 | 1 | 0 | 18 |
| ***Percent*** | **11%** | **83%** | **6%** | **0%** | **100%** |

Q49. What type of heating or cooling equipment did you buy?

| | # of responses | Percent |
|---|---|---|
| Central air conditioner | 2 | **25%** |
| Central air conditioner; Air source heat pump; Geothermal heat pump; Furnace; WIFI enabled thermostat | 1 | **13%** |
| Central air conditioner; Furnace; WIFI enabled thermostat | 1 | **13%** |
| WIFI enabled thermostat | 2 | **25%** |
| Window/room air conditioner unit; Other | 1 | **13%** |
| Don't know | 1 | **13%** |
| Refused | 0 | **0%** |
| Total | 8 | **100%** |

Q50. Does the new [Q53 equipment] use natural gas?

***Q50.6) Boiler***

*No responses given*

***Q50.7) Furnace***

| | Yes - it uses natural gas | No - it does not use natural gas | Don't Know | Refused | Total |
|---|---|---|---|---|---|
| **# of responses** | 0 | 1 | 1 | 0 | 2 |
| ***Percent*** | **0%** | **50%** | **50%** | **0%** | **100%** |

Q51. Was the heating or cooling equipment an ENERGY STAR or high-efficiency model?

***Q51.1) Central air conditioner***

| | Yes | No | Don't Know | Refused | Total |
|---|---|---|---|---|---|
| # of responses | 4 | 0 | 0 | 0 | 4 |
| *Percent* | 100% | 0% | 0% | 0% | 100% |

***Q51.2) Window/room air conditioner unit***

*No responses given*

***Q51.3) Wall air conditioner unit***

| | Yes | No | Don't Know | Refused | Total |
|---|---|---|---|---|---|
| # of responses | 1 | 0 | 0 | 0 | 1 |
| *Percent* | 100% | 0% | 0% | 0% | 100% |

***Q51.4) Air source heat pump***

| | Yes | No | Don't Know | Refused | Total |
|---|---|---|---|---|---|
| # of responses | 1 | 0 | 0 | 0 | 1 |
| *Percent* | 100% | 0% | 0% | 0% | 100% |

***Q51.5) Geothermal heat pump***

| | Yes | No | Don't Know | Refused | Total |
|---|---|---|---|---|---|
| # of responses | 1 | 0 | 0 | 0 | 1 |
| *Percent* | 100% | 0% | 0% | 0% | 100% |

***Q51.6) Boiler***

*No responses given*

***Q51.7) Furnace***

| | Yes | No | Don't Know | Refused | Total |
|---|---|---|---|---|---|
| # of responses | 2 | 0 | 0 | 0 | 2 |
| *Percent* | 100% | 0% | 0% | 0% | 100% |

***Q51.96) Other:***

| | Yes | No | Don't Know | Refused | Total |
|---|---|---|---|---|---|
| # of responses | 1 | 0 | 0 | 0 | 1 |
| ***Percent*** | **100%** | **0%** | **0%** | **0%** | **100%** |

Q52. How many windows did you install?

| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | Don't know | Refused | Total |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| # of responses | 0 | 1 | 1 | 0 | 0 | 1 | 0 | 1 | 1 | 1 | 1 | 1 | 0 | 8 |
| ***Percent*** | **0%** | **13%** | **13%** | **0%** | **0%** | **13%** | **0%** | **13%** | **13%** | **13%** | **13%** | **13%** | **0%** | **100%** |

Q53. Did you add insulation to your attic, walls, or below the floor?

| | Attic | Attic; Walls; Below the floor | Walls | Below the floor | Don't Know | Refused | Total |
|---|---|---|---|---|---|---|---|
| # of responses | 4 | 1 | 3 | 2 | 1 | 0 | 11 |
| ***Percent*** | **36%** | **9%** | **27%** | **18%** | **9%** | **0%** | **100%** |

Q54. Approximately what proportion of the [Q53 location] space did you add insulation?

***Q54.1) Attic***

| | 15% | 40% | 100% | Don't Know | Refused | Total |
|---|---|---|---|---|---|---|
| # of responses | 1 | 1 | 1 | 2 | 0 | 5 |
| ***Percent*** | **20%** | **20%** | **20%** | **40%** | **0%** | **100%** |

***Q54.2) Walls***

| | Don't Know | Refused | Total |
|---|---|---|---|
| # of responses | 3 | 0 | 3 |
| ***Percent*** | **100%** | **0%** | **100%** |

***Q54.3) Below the floor***

| | 100% | Don't Know | Refused | Total |
|---|---|---|---|---|
| # of responses | 1 | 3 | 0 | 4 |
| ***Percent*** | **25%** | **75%** | **0%** | **100%** |

Q55. How many LEDs and CFLs did you install in your property?

| | 3 | 4 | 5 | 6 | 8 | 10 | 11 | 12 | 14 | 15 | 18 | 20 | 25 | 30 | 70 | Don't know | Refused | Total |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| # of responses | 1 | 3 | 7 | 7 | 7 | 15 | 1 | 2 | 1 | 5 | 1 | 6 | 2 | 2 | 1 | 11 | 0 | 72 |
| *Percent* | 1% | 4% | 10% | 10% | 10% | 21% | 1% | 3% | 1% | 7% | 1% | 8% | 3% | 3% | 1% | 15% | 0% | 100% |

Q56. You said that you installed [Q55 response] LED and CFL bulbs on your propert. Is this the correct number?

| | Yes, this is the correct number of LED and CFL bulbs I installed | No, the correct number is: | Don't Know | Refused | Total |
|---|---|---|---|---|---|
| # of responses | 1 | 0 | 0 | 0 | 1 |
| *Percent* | 100% | 0% | 0% | 0% | 100% |

Q57. Does the new water heater use natural gas?

| | Yes - it uses natural gas | No - it does not use natural gas | Don't Know | Refused | Total |
|---|---|---|---|---|---|
| # of responses | 1 | 5 | 1 | 0 | 7 |
| *Percent* | 14% | 71% | 14% | 0% | 100% |

Q58. Which of the following water heaters did you purchase?

| | A traditional water heater | A tankless water heater | A solar water heater | Other | Don't know | Refused | Total |
|---|---|---|---|---|---|---|---|
| # of responses | 4 | 2 | 0 | 0 | 1 | 0 | 7 |
| *Percent* | 57% | 29% | 0% | 0% | 14% | 0% | 100% |

Q59. Is the new water heater an ENERGY STAR model?

| | Yes | No | Don't Know | Refused | Total |
|---|---|---|---|---|---|
| # of responses | 7 | 0 | 0 | 0 | 7 |
| *Percent* | 100% | 0% | 0% | 0% | 100% |

Q60. Which of the following types of housing units would you say best describes your home? Is it...

| | Single-family detached home | Single-family attached home (such as a townhouse or condo) | Duplex, triplex, or quadplex | Apartment or condominium with 5 units or more | Manufactured or mobile home | Other | Don't know | Refused | Total |
|---|---|---|---|---|---|---|---|---|---|
| # of responses | 220 | 16 | 5 | 34 | 23 | 0 | 1 | 1 | 300 |
| *Percent* | 73% | 5% | 2% | 11% | 8% | 0% | 0% | 0% | 100% |

Q61. How many showers are in your home? Please include both stand-up showers and bathtubs with showerheads.

| | 1 | 2 | 3 | 4 | 5 or more | Don't know | Refused | Total |
|---|---|---|---|---|---|---|---|---|
| **# of responses** | 70 | 169 | 42 | 14 | 4 | 0 | 1 | 300 |
| ***Percent*** | **23%** | **56%** | **14%** | **5%** | **1%** | **0%** | **0%** | **100%** |

Q62. How many square feet of living space are there in your residence, including bathrooms, foyers and hallways (exclude garages, unfinished basements, and unheated porches)?

| | Less than 500 sq. ft. | 500 to under 1,000 sq. ft. | 1,000 to under 1,500 sq. ft. | 1,500 to under 2,000 sq. ft. | 2,000 to under 2,500 sq. ft. | 2,500 to under 3,000 sq. ft. | Greater than 3,000 sq. ft. | Don't know | Refused | Total |
|---|---|---|---|---|---|---|---|---|---|---|
| **# of responses** | 2 | 32 | 75 | 64 | 30 | 39 | 35 | 22 | 1 | 300 |
| ***Percent*** | **1%** | **11%** | **25%** | **21%** | **10%** | **13%** | **12%** | **7%** | **0%** | **100%** |

Q63. Do you or members of your household own your home, or do you rent it?

| | Own/Buying | Rent/Lease | Occupy Rent-free | Don't know | Refused | Total |
|---|---|---|---|---|---|---|
| **# of responses** | 206 | 90 | 2 | 0 | 2 | 300 |
| ***Percent*** | **69%** | **30%** | **1%** | **0%** | **1%** | **100%** |

Q64. Including yourself, how many people currently live in your home year-round?

| | I live by myself | Two people | Three people | Four people | Five people | Six people | Seven people | Eight or more people | Don't know | Refused | Total |
|---|---|---|---|---|---|---|---|---|---|---|---|
| **# of responses** | 13 | 55 | 66 | 98 | 32 | 24 | 6 | 2 | 0 | 4 | 300 |
| ***Percent*** | **4%** | **18%** | **22%** | **33%** | **11%** | **8%** | **2%** | **1%** | **0%** | **1%** | **100%** |

Q65. What was your total annual household income for 2020, before taxes?

| | # of responses | Percent |
|---|---|---|
| Under $15,000 | 16 | **5%** |
| 15 to under $25,000 | 28 | **9%** |
| 25 to under $35,000 | 33 | **11%** |
| 35 to under $50,000 | 45 | **15%** |
| 50 to under $75,000 | 47 | **16%** |
| 75 to under $100,000 | 34 | **11%** |
| 100 to under $150,000 | 22 | **7%** |

| | # of responses | Percent |
|---|---|---|
| 150 to under $200,000 | 9 | **3%** |
| $200,000 or more | 17 | **6%** |
| Don't know | 5 | **2%** |
| Prefer not to say | 44 | **15%** |
| Total | 300 | **100%** |
| Under $15,000 | 16 | **5%** |

Q66. In what year were you born?

| | # of responses | Percent |
|---|---|---|
| 1940 | 1 | **0.3%** |
| 1945 | 1 | **0.3%** |
| 1947 | 2 | **0.7%** |
| 1948 | 2 | **0.7%** |
| 1949 | 1 | **0.3%** |
| 1951 | 1 | **0.3%** |
| 1952 | 1 | **0.3%** |
| 1954 | 4 | **1.3%** |
| 1955 | 3 | **1.0%** |
| 1956 | 1 | **0.3%** |
| 1957 | 2 | **0.7%** |
| 1958 | 4 | **1.3%** |
| 1959 | 1 | **0.3%** |
| 1960 | 2 | **0.7%** |
| 1961 | 4 | **1.3%** |
| 1962 | 2 | **0.7%** |
| 1963 | 6 | **2.0%** |
| 1964 | 2 | **0.7%** |
| 1966 | 5 | **1.7%** |
| 1967 | 2 | **0.7%** |
| 1968 | 6 | **2.0%** |
| 1969 | 11 | **3.7%** |
| 1970 | 7 | **2.3%** |
| 1971 | 9 | **3.0%** |
| 1972 | 4 | **1.3%** |
| 1973 | 5 | **1.7%** |
| 1974 | 11 | **3.7%** |
| 1975 | 7 | **2.3%** |
| 1976 | 2 | **0.7%** |
| 1977 | 16 | **5.3%** |
| 1978 | 11 | **3.7%** |
| 1979 | 15 | **5.0%** |
| 1980 | 12 | **4.0%** |
| 1981 | 4 | **1.3%** |
| 1982 | 8 | **2.7%** |
| 1983 | 10 | **3.3%** |
| 1984 | 8 | **2.7%** |
| 1985 | 11 | **3.7%** |
| 1986 | 11 | **3.7%** |
| 1987 | 8 | **2.7%** |
| 1988 | 8 | **2.7%** |

| | # of responses | Percent |
|---|---|---|
| 1989 | 8 | **2.7%** |
| 1990 | 2 | **0.7%** |
| 1991 | 4 | **1.3%** |
| 1992 | 3 | **1.0%** |
| 1993 | 2 | **0.7%** |
| 1994 | 5 | **1.7%** |
| 1996 | 2 | **0.7%** |
| Don't know | 1 | **0.3%** |
| Prefer not to say | 42 | **14.0%** |
| Total | 300 | **100%** |

Q67. What is the highest level of education achieved among those living in your household?

| | # of responses | Percent |
|---|---|---|
| Less than high school | 3 | **1%** |
| Some high school | 3 | **1%** |
| High school graduate or equivalent | 42 | **14%** |
| Trade or technical school | 9 | **3%** |
| Some college (including Associate's degree) | 94 | **31%** |
| College degree (Bachelor's degree) | 73 | **24%** |
| Some graduate school | 6 | **2%** |
| Graduate degree, professional degree | 51 | **17%** |
| Doctorate | 10 | **3%** |
| Don't know | 0 | **0%** |
| Prefer not to say | 9 | **3%** |
| Total | 300 | **100%** |

Q68. Lastly, did the COVID-19 pandemic, or government or organizational response to it, offer any challenges to you regarding your participation in this program? If so, what challenges, and how do you think they might best be addressed moving forward?

| | Yes | No | Don't Know | Refused | Total |
|---|---|---|---|---|---|
| **# of responses** | 9 | 251 | 40 | 0 | 300 |
| ***Percent*** | **3%** | **84%** | **13%** | **0%** | **100%** |

## F.4 Student Parent Survey - DEP

Q1. This kit included light bulbs, a showerhead, and other items that help you save energy in your home. Do you recall receiving this kit?

| | Yes | No | Don't Know | Total |
|---|---|---|---|---|
| **# of responses** | 215 | 0 | 0 | 215 |
| ***Percent*** | **100%** | **0%** | **0%** | **100%** |

Q1.1) Were you aware of this program, prior to your child's involvement, due to your work at an elementary, middle or high school?

| | Yes | No | Don't Know | Total |
|---|---|---|---|---|
| **# of responses** | 0 | 215 | 0 | 215 |
| ***Percent*** | **0%** | **100%** | **0%** | **100%** |

Q2. Before today, did you know the kit you received was sponsored by Duke Energy?

| | Yes | No | Don't Know | Total |
|---|---|---|---|---|
| **# of responses** | 195 | 18 | 2 | 215 |
| ***Percent*** | **91%** | **8%** | **1%** | **100%** |

Q3. How did you learn that the kit was sponsored by Duke Energy?

| | # of responses | Percent |
|---|---|---|
| Classroom materials brought home by child | 40 | **21%** |
| Classroom materials brought home by child; Information material included in/on the kit | 27 | **14%** |
| Classroom materials brought home by child; Information material included in/on the kit; Other | 2 | **1%** |
| Classroom materials brought home by child; My child's teacher/school | 8 | **4%** |
| Classroom materials brought home by child; My child's teacher/school; Information material included in/on the kit | 11 | **6%** |
| Information material included in/on the kit | 55 | **28%** |
| Information material included in/on the kit; Other | 2 | **1%** |
| My child's teacher/school | 27 | **14%** |
| My child's teacher/school; Information material included in/on the kit | 6 | **3%** |
| My child's teacher/school; Other | 1 | **1%** |
| Other | 11 | **6%** |
| Don't know | 5 | **3%** |
| Refused | 0 | **0%** |
| Total | 195 | **100%** |

Q4. How did you hear about the opportunity to receive the kit from Duke Energy?

| | # of responses | Percent |
|---|---|---|
| After hours event at my child's school | 1 | 0% |
| Classroom materials brought home by child | 93 | 43% |
| Classroom materials brought home by child; Email from my child's teacher/school | 10 | 5% |
| Classroom materials brought home by child; Email from my child's teacher/school; Saw a poster at my child's school | 1 | 0% |
| Classroom materials brought home by child; Email from my child's teacher/school; School website or school web portal | 2 | 1% |
| Classroom materials brought home by child; Other | 1 | 0% |
| Classroom materials brought home by child; Saw a poster at my child's school | 1 | 0% |
| Classroom materials brought home by child; School newsletter | 4 | 2% |
| Classroom materials brought home by child; School newsletter; Email from my child's teacher/school | 9 | 4% |
| Classroom materials brought home by child; School newsletter; Email from my child's teacher/school; School website or school web portal | 1 | 0% |
| Classroom materials brought home by child; School newsletter; Email from my child's teacher/school; School website or school web portal; After hours event at my child's school | 1 | 0% |
| Classroom materials brought home by child; School newsletter; Saw a poster at my child's school | 1 | 0% |
| Classroom materials brought home by child; School newsletter; School website or school web portal | 2 | 1% |
| Classroom materials brought home by child; School newsletter; School website or school web portal; Other | 1 | 0% |
| Classroom materials brought home by child; School website or school web portal | 7 | 3% |
| Classroom materials brought home by child; School website or school web portal; Other | 1 | 0% |
| Classroom materials brought home by child; School website or school web portal; Saw a poster at my child's school | 1 | 0% |
| Email from my child's teacher/school | 13 | 6% |
| Email from my child's teacher/school; In-person conversations with my child's teacher | 1 | 0% |
| Email from my child's teacher/school; School website or school web portal | 1 | 0% |
| In-person conversations with my child's teacher | 1 | 0% |
| School newsletter | 8 | 4% |
| School newsletter; Email from my child's teacher/school | 2 | 1% |
| School newsletter; School website or school web portal | 1 | 0% |
| School website or school web portal | 10 | 5% |
| Other | 19 | 9% |
| Don't know | 22 | 10% |
| Refused | 0 | 0% |
| Total | 215 | 100% |

Q4b. How did you request your kit?

| | Program's website | Sign-up form in the classroom materials my child brought home | By calling the toll-free number | Via the "Kilowatt Krush" app on my smartphone | Don't know | Refused | Total |
|---|---|---|---|---|---|---|---|
| # of responses | 136 | 49 | 8 | 1 | 21 | 0 | 215 |
| ***Percent*** | **63%** | **23%** | **4%** | **0%** | **10%** | **0%** | **100%** |

Q4c. Has your child used the "Kilowatt Krush" app on any smartphone in your household?

| | Yes | No | Don't Know | Refused | Total |
|---|---|---|---|---|---|
| # of responses | 21 | 160 | 34 | 0 | 215 |
| ***Percent*** | **10%** | **74%** | **16%** | **0%** | **100%** |

Q4d. About how often would you say that your child uses the "Kilowatt Krush" app?

| | They used it once | They used it a few times | They use it daily | They use it weekly | Other | Don't know | Refused | Total |
|---|---|---|---|---|---|---|---|---|
| # of responses | 4 | 12 | 1 | 3 | 1 | 1 | 0 | 22 |
| ***Percent*** | **18%** | **55%** | **5%** | **14%** | **5%** | **5%** | **0%** | **100%** |

Q4e. Have you noticed your child engaging in energy saving behaviors you can attribute to their use of the "Kilowatt Krush" app?

| | Yes | No | Don't Know | Total |
|---|---|---|---|---|
| # of responses | 13 | 9 | 0 | 22 |
| ***Percent*** | **59%** | **41%** | **0%** | **100%** |

Q4f. Do you have any feedback that might help improve the "Kilowatt Krush" app?

| | Yes | No | Don't Know | Refused | Total |
|---|---|---|---|---|---|
| # of responses | 2 | 17 | 3 | 0 | 22 |
| ***Percent*** | **9%** | **77%** | **14%** | **0%** | **100%** |

Q5. Did you read any of the Energy Savers booklet that came in the kit?

| | Yes | No | Don't Know | Refused | Total |
|---|---|---|---|---|---|
| # of responses | 158 | 41 | 16 | 0 | 215 |
| ***Percent*** | **73%** | **19%** | **7%** | **0%** | **100%** |

Q6. On a scale from 0 to 10 where 0 is not at all helpful and 10 is very helpful, how helpful was the Energy Savers booklet in identifying ways your household could save energy at home?

| | 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | Don't know | Refused | Total |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **# of responses** | 0 | 0 | 3 | 1 | 6 | 14 | 11 | 36 | 27 | 15 | 45 | 0 | 0 | 158 |
| ***Percent*** | **0%** | **0%** | **2%** | **1%** | **4%** | **9%** | **7%** | **23%** | **17%** | **9%** | **28%** | **0%** | **0%** | **100%** |

Q7. What might have made the information more helpful?

| | Provided response | Don't Know | Refused | Total |
|---|---|---|---|---|
| **# of responses** | 10 | 24 | 1 | 35 |
| ***Percent*** | **39%** | **69%** | **3%** | **100%** |

Q8. In addition to sending the energy saving kits, Duke Energy sponsored a program about energy and energy efficiency at your child's school, which included classroom materials and in in-school performance by the National Theatre for Children. Were you aware of the program before today?

| | Yes | No | Don't Know | Refused | Total |
|---|---|---|---|---|---|
| **# of responses** | 39 | 163 | 13 | 0 | 215 |
| ***Percent*** | **18%** | **76%** | **6%** | **0%** | **100%** |

Q9. From who or where did you hear about this program?

| | From a teacher/school administrator | From my child/children | From my child/children; From a teacher/school administrator | On Duke Energy Website | Other | Don't know | Refused | Total |
|---|---|---|---|---|---|---|---|---|
| **# of responses** | 7 | 18 | 9 | 4 | 1 | 0 | 0 | 39 |
| ***Percent*** | **18%** | **46%** | **23%** | **10%** | **3%** | **0%** | **0%** | **100%** |

Q10. Have you or anyone else installed any of those items in your home, even if they were taken out later?

| | Yes | No | Don't Know | Refused | Total |
|---|---|---|---|---|---|
| **# of responses** | 197 | 18 | 0 | 0 | 215 |
| ***Percent*** | **92%** | **8%** | **0%** | **0%** | **100%** |

Q11. Which of the items did you install, even if they were taken out later?

### *Q11a. Showerhead*

| | Yes | No | Don't Know | Refused | Total |
|---|---|---|---|---|---|
| **# of responses** | 118 | 76 | 2 | 1 | 197 |
| ***Percent*** | **60%** | **39%** | **1%** | **1%** | **100%** |

### *Q11b. Kitchen faucet aerator*

| | Yes | No | Don't Know | Refused | Total |
|---|---|---|---|---|---|
| **# of responses** | 97 | 94 | 5 | 1 | 197 |
| ***Percent*** | **49%** | **48%** | **3%** | **1%** | **100%** |

### *Q11c. Bathroom faucet aerator*

| | Yes | No | Don't Know | Refused | Total |
|---|---|---|---|---|---|
| **# of responses** | 95 | 95 | 6 | 1 | 197 |
| ***Percent*** | **48%** | **48%** | **3%** | **1%** | **100%** |

### *Q11d. Night light*

| | Yes | No | Don't Know | Refused | Total |
|---|---|---|---|---|---|
| **# of responses** | 172 | 18 | 6 | 1 | 197 |
| ***Percent*** | **87%** | **9%** | **3%** | **1%** | **100%** |

### *Q11e. Energy efficient light bulb(s)*

| | Yes | No | Don't Know | Refused | Total |
|---|---|---|---|---|---|
| **# of responses** | 187 | 8 | 2 | 0 | 197 |
| ***Percent*** | **95%** | **4%** | **1%** | **0%** | **100%** |

### *Q11f. Insulator gaskets for light switches and electricity outlets*

| | Yes | No | Don't Know | Refused | Total |
|---|---|---|---|---|---|
| **# of responses** | 67 | 116 | 14 | 0 | 197 |
| ***Percent*** | **34%** | **59%** | **7%** | **0%** | **100%** |

Q12. In addition to the night light, there were two LED light bulbs in the kit. Did you install one or both LED light bulbs in the kit?

| | I installed both LEDs | I installed only one LED bulb | Don't Know | Refused | Total |
|---|---|---|---|---|---|
| **# of responses** | 165 | 18 | 3 | 1 | 187 |
| ***Percent*** | **88%** | **10%** | **2%** | **1%** | **100%** |

Q13. How many of the light switch and electric outlet gasket insulators from the kit did you, or someone else, install in your home?

| | None | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | Don't know | Refused | Total |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **# of responses** | 1 | 6 | 16 | 7 | 10 | 4 | 4 | 1 | 2 | 1 | 1 | 0 | 4 | 10 | 0 | 67 |
| ***Percent*** | **1%** | **9%** | **24%** | **10%** | **15%** | **6%** | **6%** | **1%** | **3%** | **1%** | **1%** | **0%** | **6%** | **15%** | **0%** | **100%** |

Q14. Overall, how satisfied are you with the item[s] you installed? Please use 0 to 10 scales, where 0 is very dissatisfied and 10 is very satisfied. How satisfied are you with...?

***Q14a. Showerhead***

| | 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | Don't know | Refused | Total |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **# of responses** | 1 | 0 | 2 | 1 | 1 | 4 | 3 | 8 | 16 | 15 | 65 | 2 | 0 | 118 |
| ***Percent*** | **1%** | **0%** | **2%** | **1%** | **1%** | **3%** | **3%** | **7%** | **14%** | **13%** | **55%** | **2%** | **0%** | **100%** |

***Q14b. Kitchen faucet aerator***

| | 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | Don't know | Refused | Total |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **# of responses** | 1 | 0 | 3 | 0 | 2 | 5 | 2 | 10 | 11 | 6 | 55 | 1 | 1 | 97 |
| ***Percent*** | **1%** | **0%** | **3%** | **0%** | **2%** | **5%** | **2%** | **10%** | **11%** | **6%** | **57%** | **1%** | **1%** | **100%** |

***Q14c. Bathroom faucet aerator***

| | 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | Don't know | Refused | Total |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **# of responses** | 1 | 0 | 5 | 0 | 1 | 5 | 3 | 9 | 14 | 8 | 45 | 3 | 1 | 95 |
| ***Percent*** | **1%** | **0%** | **5%** | **0%** | **1%** | **5%** | **3%** | **9%** | **15%** | **8%** | **47%** | **3%** | **1%** | **100%** |

***Q14d. Night light***

| | 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | Don't know | Refused | Total |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **# of responses** | 1 | 0 | 2 | 0 | 2 | 3 | 4 | 7 | 18 | 20 | 114 | 1 | 0 | 172 |
| ***Percent*** | **1%** | **0%** | **1%** | **0%** | **1%** | **2%** | **2%** | **4%** | **10%** | **12%** | **66%** | **1%** | **0%** | **100%** |

*Q14e. Energy efficient light bulb(s)*

| | 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | Don't know | Refused | Total |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **# of responses** | 0 | 0 | 1 | 0 | 0 | 1 | 7 | 7 | 11 | 27 | 132 | 1 | 0 | 187 |
| ***Percent*** | **0%** | **0%** | **1%** | **0%** | **0%** | **1%** | **4%** | **4%** | **6%** | **14%** | **71%** | **1%** | **0%** | **100%** |

*Q14f. Insulator gaskets for light switches and electricity outlets*

| | 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | Don't know | Refused | Total |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **# of responses** | 0 | 0 | 2 | 0 | 1 | 3 | 3 | 4 | 8 | 9 | 33 | 4 | 0 | 67 |
| ***Percent*** | **0%** | **0%** | **3%** | **0%** | **1%** | **4%** | **4%** | **6%** | **12%** | **13%** | **49%** | **6%** | **0%** | **100%** |

Q14.1 Can you please explain any dissatisfaction you had with the [X item]

***Q14.1a) Showerhead***

***Open-ended response type; no tabulation available***

***Q14.1b) Kitchen faucet aerator***

***Open-ended response type; no tabulation available***

***Q14.1c) Bathroom faucet aerator***

***Open-ended response type; no tabulation available***

***Q14.1d) Night light***

***Open-ended response type; no tabulation available***

***Q14.1e) Energy efficient light bulb(s)***

***Open-ended response type; no tabulation available***

***Q14.1f) Insulator gaskets for light switches and electricity outlets***

***Open-ended response type; no tabulation available***

Q15. Have you since uninstalled any of the items from the kit that you had previously installed?

| | Yes | No | Don't Know | Refused | Total |
|---|---|---|---|---|---|
| **# of responses** | 28 | 160 | 8 | 0 | 196 |
| ***Percent*** | **14%** | **82%** | **4%** | **0%** | **100%** |

Q16. Which of the items did you uninstall?

| | # of responses | Percent |
|---|---|---|
| Bathroom faucet aerator | 2 | **7%** |
| Bathroom faucet aerator; Night light | 1 | **3%** |
| Energy efficient light bulbs | 3 | **3%** |
| Insulator Gaskets | 1 | **10%** |
| Kitchen faucet aerator | 2 | **3%** |
| Kitchen faucet aerator; Bathroom faucet aerator | 2 | **7%** |
| Kitchen faucet aerator; Insulator Gaskets | 1 | **7%** |
| Night light | 2 | **3%** |
| Night light; Energy efficient light bulbs | 1 | **7%** |
| Showerhead | 8 | **3%** |
| Showerhead; Bathroom faucet aerator | 1 | **28%** |
| Showerhead; Energy efficient light bulbs | 1 | **3%** |
| Showerhead; Kitchen faucet aerator | 1 | **3%** |
| Showerhead; Kitchen faucet aerator; Bathroom faucet aerator | 1 | **3%** |
| Showerhead; Kitchen faucet aerator; Insulator Gaskets | 1 | **3%** |
| Don't know | 1 | **3%** |
| Refused | 0 | **0%** |
| Total | 29 | **100%** |

Q17. Why were those items uninstalled? Let's start with...

***Q17a. Showerhead***

| | It was broken | It was broken; I didn't like how it looked | I didn't like how it worked | I didn't like how it worked; Other | I didn't like how it looked | Other | Don't know | Refused | Total |
|---|---|---|---|---|---|---|---|---|---|
| **# of responses** | 0 | 1 | 7 | 1 | 0 | 4 | 0 | 0 | 13 |
| ***Percent*** | **0%** | **8%** | **54%** | **8%** | **0%** | **31%** | **0%** | **0%** | **100%** |

***Q17b. Kitchen faucet aerator***

| | It was broken | I didn't like how it worked | I didn't like how it worked; Other | I didn't like how it looked | Other | Don't know | Refused | Total |
|---|---|---|---|---|---|---|---|---|
| **# of responses** | 0 | 4 | 1 | 0 | 3 | 0 | 0 | 8 |
| ***Percent*** | **0%** | **50%** | **13%** | **0%** | **38%** | **0%** | **0%** | **100%** |

***Q17c. Bathroom faucet aerator***

| | It was broken | I didn't like how it worked | I didn't like how it looked | Other | Don't Know | Refused | Total |
|---|---|---|---|---|---|---|---|
| **# of responses** | 0 | 5 | 0 | 2 | 0 | 0 | 7 |
| ***Percent*** | **0%** | **71%** | **0%** | **29%** | **0%** | **0%** | **100%** |

*Q17d. Night light*

| | It was broken | I didn't like how it worked | I didn't like how it looked | Other | Don't Know | Refused | Total |
|---|---|---|---|---|---|---|---|
| **# of responses** | 0 | 2 | 1 | 0 | 0 | 0 | 3 |
| ***Percent*** | **0%** | **67%** | **33%** | **0%** | **0%** | **0%** | **100%** |

*Q17e. Energy efficient light bulb(s)*

| | It was broken | I didn't like how it worked | I didn't like how it looked | Other | Don't Know | Refused | Total |
|---|---|---|---|---|---|---|---|
| **# of responses** | 0 | 1 | 1 | 2 | 0 | 0 | 4 |
| ***Percent*** | **0%** | **25%** | **25%** | **50%** | **0%** | **0%** | **100%** |

*Q17f. Insulator gaskets for light switches and electricity outlets*

| | It was broken | I didn't like how it worked | I didn't like how it looked | Other | Don't Know | Refused | Total |
|---|---|---|---|---|---|---|---|
| **# of responses** | 0 | 2 | 1 | 0 | 0 | 0 | 3 |
| ***Percent*** | **0%** | **67%** | **33%** | **0%** | **0%** | **0%** | **100%** |

Q18. You said you haven't installed [X items]. Which of those items did you plan to install in the next three months?

| | # of responses | Percent |
|---|---|---|
| Bathroom faucet aerator | 11 | **6%** |
| Bathroom faucet aerator; Energy efficient light bulbs; Insulator Gaskets | 1 | **1%** |
| Bathroom faucet aerator; Insulator Gaskets | 3 | **2%** |
| Bathroom faucet aerator; Night light | 1 | **1%** |
| Energy efficient light bulbs | 4 | **2%** |
| Energy efficient light bulbs; Insulator Gaskets | 1 | **1%** |
| Insulator Gaskets | 21 | **11%** |
| Kitchen faucet aerator | 4 | **2%** |
| Kitchen faucet aerator; Bathroom faucet aerator | 5 | **3%** |
| Kitchen faucet aerator; Bathroom faucet aerator; Insulator Gaskets | 4 | **2%** |
| Kitchen faucet aerator; Bathroom faucet aerator; Night light | 1 | **1%** |
| Kitchen faucet aerator; Bathroom faucet aerator; Night light; Energy efficient light bulbs | 1 | **1%** |
| Kitchen faucet aerator; Bathroom faucet aerator; Night light; Energy efficient light bulbs; Insulator Gaskets | 1 | **1%** |
| Kitchen faucet aerator; Insulator Gaskets | 1 | **1%** |
| Kitchen faucet aerator; Night light | 1 | **1%** |
| Night light | 5 | **3%** |
| Night light; Energy efficient light bulbs | 5 | **3%** |
| Night light; Insulator Gaskets | 1 | **1%** |
| Showerhead | 14 | **8%** |
| Showerhead; Bathroom faucet aerator | 1 | **1%** |
| Showerhead; Bathroom faucet aerator; Insulator Gaskets | 1 | **1%** |
| Showerhead; Insulator Gaskets | 1 | **1%** |
| Showerhead; Kitchen faucet aerator; Bathroom faucet aerator; Insulator Gaskets | 1 | **1%** |
| Showerhead; Kitchen faucet aerator; Bathroom faucet aerator; Night light; Energy efficient light bulbs; Insulator Gaskets | 1 | **1%** |
| Showerhead; Night light; Energy efficient light bulbs | 1 | **1%** |

| | # of responses | Percent |
|---|---|---|
| Don't know | 92 | **50%** |
| Refused | 2 | **1%** |
| Total | 185 | **100%** |

Q19. What's preventing you from installing them? Let's start with...

### *Q19a. Showerhead*

| | # of responses | Percent |
|---|---|---|
| Already have efficient showerhead | 20 | **27%** |
| Already have efficient showerhead; Other; (please specify:___) | 3 | **4%** |
| Current one is still working | 17 | **23%** |
| Current one is still working; Already have efficient showerhead | 4 | **5%** |
| Current one is still working; Takes too much time to install/No time/Too busy | 1 | **1%** |
| Current one is still working; Too difficult to install it; don't know how to do it | 1 | **1%** |
| Didn't know what that was; Haven't gotten around to it | 1 | **1%** |
| Don't have the items any longer (threw away; gave away) | 2 | **3%** |
| Don't have the tools I need; Don't have the items any longer (threw away; gave away) | 1 | **1%** |
| Haven't gotten around to it | 6 | **8%** |
| Haven't gotten around to it; Current one is still working | 1 | **1%** |
| Haven't gotten around to it; Too difficult to install it; don't know how to do it; Don't have the tools I need | 1 | **1%** |
| Takes too much time to install/No time/Too busy | 2 | **3%** |
| Too difficult to install it; don't know how to do it | 2 | **3%** |
| Tried it; didn't fit | 4 | **5%** |
| Tried it; didn't fit; Already have efficient showerhead | 1 | **1%** |
| Tried it; didn't fit; Current one is still working | 1 | **1%** |
| Tried it; didn't fit; Takes too much time to install/No time/Too busy; Too difficult to install it; don't know how to do it; Don't have the tools I need | 1 | **1%** |
| Tried it; didn't work as intended | 1 | **1%** |
| Other; (please specify:___) | 4 | **5%** |
| Don't know | 0 | **0%** |
| Refused | 0 | **0%** |
| Total | 74 | **100%** |

### *Q19b. Kitchen faucet aerator*

| | # of responses | Percent |
|---|---|---|
| Already have efficient kitchen faucet aerator | 13 | **14%** |
| Current one is still working | 20 | **22%** |
| Current one is still working; Already have efficient kitchen faucet aerator | 1 | **1%** |
| Didn't know what that was | 3 | **3%** |
| Didn't know what that was; Haven't gotten around to it | 2 | **2%** |
| Don't have the items any longer (threw away, gave away) | 3 | **3%** |
| Don't know | 4 | **4%** |
| Haven't gotten around to it | 8 | **9%** |
| Haven't gotten around to it; Current one is still working | 1 | **1%** |
| Haven't gotten around to it; Takes too much time to install/No time/Too busy; Too difficult to install it, don't know how to do it; Don't have the tools I need | 2 | **2%** |
| Takes too much time to install/No time/Too busy | 1 | **1%** |
| Takes too much time to install/No time/Too busy; Too difficult to install it, don't know how to do it | 1 | **1%** |
| Too difficult to install it, don't know how to do it | 4 | **4%** |
| Too difficult to install it, don't know how to do it; Don't have the tools I need; Already have efficient kitchen faucet aerator | 1 | **1%** |

| | # of responses | Percent |
|---|---|---|
| Tried it, didn't fit | 17 | **18%** |
| Tried it, didn't fit; Already have efficient kitchen faucet aerator | 1 | **1%** |
| Tried it, didn't work as intended | 1 | **1%** |
| Other, (please specify:___) | 9 | **10%** |
| Don't know | 0 | **0%** |
| Refused | 0 | **0%** |
| Total | 92 | **100%** |

*Q19c. Bathroom faucet aerator*

| | # of responses | Percent |
|---|---|---|
| Already have efficient bathroom faucet aerators | 10 | **12%** |
| Current one is still working | 13 | **16%** |
| Current one is still working; Too difficult to install it; don't know how to do it; Don't have the tools I need | 1 | **1%** |
| Didn't know what that was | 4 | **5%** |
| Didn't know what that was; Current one is still working; Don't have the items any longer (threw away; gave away) | 1 | **1%** |
| Didn't know what that was; Haven't gotten around to it | 3 | **4%** |
| Didn't know what that was; Haven't gotten around to it; Takes too much time to install/No time/Too busy; Too difficult to install it; don't know how to do it; Don't have the tools I need | 1 | **1%** |
| Didn't know what that was; Too difficult to install it; don't know how to do it | 1 | **1%** |
| Don't have the items any longer (threw away; gave away) | 3 | **4%** |
| Don't know | 7 | **9%** |
| Haven't gotten around to it | 6 | **7%** |
| Haven't gotten around to it; Takes too much time to install/No time/Too busy; Too difficult to install it; don't know how to do it; Don't have the tools I need | 1 | **1%** |
| Takes too much time to install/No time/Too busy; Too difficult to install it; don't know how to do it | 1 | **1%** |
| Too difficult to install it; don't know how to do it | 5 | **6%** |
| Too difficult to install it; don't know how to do it; Don't have the tools I need; Already have efficient bathroom faucet aerators | 1 | **1%** |
| Tried it; didn't fit | 13 | **16%** |
| Tried it; didn't fit; Current one is still working | 1 | **1%** |
| Tried it; didn't fit Too difficult to install it; don't know how to do it | 1 | **1%** |
| Other; (please specify:___) | 8 | **10%** |
| Don't know | 0 | **0%** |
| Refused | 0 | **0%** |
| Total | 81 | **100%** |

*Q19d. Night light*

| | # of responses | Percent |
|---|---|---|
| Current one is still working | 1 | **6%** |
| Didn't know what that was | 2 | **11%** |
| Didn't know what that was; Haven't gotten around to it | 1 | **6%** |
| Haven't gotten around to it | 3 | **17%** |
| Tried it, didn't fit | 1 | **6%** |
| Other, (please specify:___) | 8 | **44%** |
| Don't know | 2 | **11%** |
| Refused | 0 | **0%** |
| Total | 18 | **100%** |

### Q19e. Energy efficient light bulb(s)

| | # of responses | Percent |
|---|---|---|
| Already have LEDs | 3 | **27%** |
| Current one is still working | 2 | **18%** |
| Didn't know what that was; Haven't gotten around to it | 1 | **9%** |
| Haven't gotten around to it | 2 | **18%** |
| Tried it, didn't fit | 2 | **18%** |
| Other, (please specify:___) | 0 | **0%** |
| Don't know | 0 | **0%** |
| Refused | 1 | **9%** |
| Total | 11 | **100%** |

### Q19f. Insulator gaskets

| | # of responses | Percent |
|---|---|---|
| Current one is still working | 14 | **14%** |
| Didn't know what that was | 21 | **22%** |
| Didn't know what that was; Haven't gotten around to it | 1 | **1%** |
| Didn't know what that was; Haven't gotten around to it; Takes too much time to install/No time/Too busy; Too difficult to install it, don't know how to do it; Don't have the tools I need | 1 | **1%** |
| Didn't know what that was; Haven't gotten around to it; Too difficult to install it, don't know how to do it | 1 | **1%** |
| Don't have the items any longer (threw away, gave away) | 4 | **4%** |
| Haven't gotten around to it | 15 | **15%** |
| Haven't gotten around to it; Takes too much time to install/No time/Too busy | 1 | **1%** |
| Haven't gotten around to it; Takes too much time to install/No time/Too busy; Too difficult to install it, don't know how to do it; Don't have the tools I need | 1 | **1%** |
| Takes too much time to install/No time/Too busy | 3 | **3%** |
| Too difficult to install it, don't know how to do it | 10 | **10%** |
| Tried it, didn't fit | 5 | **5%** |
| Tried it, didn't fit; Current one is still working | 1 | **1%** |
| Other, (please specify:___) | 8 | **8%** |
| Don't know | 11 | **11%** |
| Refused | 0 | **0%** |
| Total | 97 | **100%** |

Q20. Thinking of the items you installed, would you be interested in receiving any more of them from Duke Energy? If so, which ones?

| | # of responses | Percent |
|---|---|---|
| Bathroom faucet aerator | 2 | **1%** |
| Bathroom faucet aerator; Night lights | 1 | **1%** |
| Bathroom faucet aerator; Night lights; Energy efficient light bulbs | 5 | **3%** |
| Bathroom faucet aerator; Night lights; Energy efficient light bulbs; Insulator Gaskets | 1 | **1%** |
| Energy efficient light bulbs | 33 | **17%** |
| Energy efficient light bulbs; Insulator Gaskets | 3 | **2%** |
| Insulator Gaskets | 2 | **1%** |
| Kitchen faucet aerator; Bathroom faucet aerator; Energy efficient light bulbs | 1 | **1%** |
| Kitchen faucet aerator; Bathroom faucet aerator; Night lights; Energy efficient light bulbs | 3 | **2%** |
| Kitchen faucet aerator; Bathroom faucet aerator; Night lights; Energy efficient light bulbs; Insulator Gaskets | 3 | **2%** |
| Kitchen faucet aerator; Bathroom faucet aerator; Night lights Insulator Gaskets | 1 | **1%** |

| | # of responses | Percent |
|---|---|---|
| Kitchen faucet aerator; Night lights; Energy efficient light bulbs | 5 | **3%** |
| Night lights | 9 | **5%** |
| Night lights; Energy efficient light bulbs | 51 | **26%** |
| Night lights; Energy efficient light bulbs; Insulator Gaskets | 7 | **4%** |
| Night lights; Insulator Gaskets | 3 | **2%** |
| Showerhead | 2 | **1%** |
| Showerhead; Bathroom faucet aerator; Night lights; Energy efficient light bulbs; Insulator Gaskets | 1 | **1%** |
| Showerhead; Energy efficient light bulbs | 6 | **3%** |
| Showerhead; Kitchen faucet aerator; Bathroom faucet aerator | 1 | **1%** |
| Showerhead; Kitchen faucet aerator; Bathroom faucet aerator; Energy efficient light bulbs | 2 | **1%** |
| Showerhead; Kitchen faucet aerator; Bathroom faucet aerator; Energy efficient light bulbs; Insulator Gaskets | 1 | **1%** |
| Showerhead; Kitchen faucet aerator; Bathroom faucet aerator; Night lights; Energy efficient light bulbs | 10 | **5%** |
| Showerhead; Kitchen faucet aerator; Bathroom faucet aerator; Night lights; Energy efficient light bulbs; Insulator Gaskets | 4 | **2%** |
| Showerhead; Kitchen faucet aerator; Energy efficient light bulbs; Insulator Gaskets | 1 | **1%** |
| Showerhead; Kitchen faucet aerator; Night lights | 1 | **1%** |
| Showerhead; Kitchen faucet aerator; Night lights; Energy efficient light bulbs | 2 | **1%** |
| Showerhead; Kitchen faucet aerator; Night lights; Energy efficient light bulbs; Insulator Gaskets | 1 | **1%** |
| Showerhead; Night lights | 3 | **2%** |
| Showerhead; Night lights; Energy efficient light bulbs | 13 | **7%** |
| Showerhead; Night lights; Energy efficient light bulbs; Insulator Gaskets | 3 | **2%** |
| No, I am not interested in receiving any more of the items | 8 | **4%** |
| Don't know | 7 | **4%** |
| Refused | 0 | **0%** |
| Total | 196 | **100%** |

Q21. What would be your preferred way to request these additional items?

| | # of responses | Percent |
|---|---|---|
| Internet | 128 | **71%** |
| Internet; Other | 1 | **1%** |
| Internet; Pre-paid postcard | 22 | **12%** |
| Internet; Pre-paid postcard; Other | 1 | **1%** |
| Internet; Telephone | 4 | **2%** |
| Internet; Telephone; Pre-paid postcard | 2 | **1%** |
| Internet; Telephone; Pre-paid postcard; Other | 1 | **1%** |
| Pre-paid postcard | 11 | **6%** |
| Telephone | 5 | **3%** |
| Telephone; Pre-paid postcard; Other | 1 | **1%** |
| Other | 2 | **1%** |
| Don't know | 2 | **1%** |
| Refused | 1 | **1%** |
| Total | 181 | **100%** |

Q22. On average, what is the typical shower length in your household?

| | # of responses | Percent |
|---|---|---|
| One minute or less | 0 | **0%** |
| Two to four minutes | 7 | **7%** |
| Five to eight minutes | 38 | **36%** |
| Nine to twelve minutes | 33 | **31%** |
| Thirteen to fifteen minutes | 15 | **14%** |
| Sixteen to twenty minutes | 7 | **7%** |
| Twenty-one to thirty minutes | 4 | **4%** |
| More than thirty minutes | 0 | **0%** |
| Don't know | 1 | **1%** |
| Refused | 0 | **0%** |
| Total | 105 | **100%** |

Q23. Thinking of the efficient showerhead currently installed on your home: on average, how many showers per day are taken in this shower?

| | Fewer than 1 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | Don't know | Refused | Total |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **# of responses** | 3 | 13 | 42 | 21 | 11 | 6 | 4 | 3 | 1 | 1 | 0 | 105 |
| ***Percent*** | **3%** | **12%** | **40%** | **20%** | **10%** | **6%** | **4%** | **3%** | **1%** | **1%** | **0%** | **100%** |

Q24. You said you installed the night light. Did the night light replace an existing night light?

| | Yes | No | Don't Know | Refused | Total |
|---|---|---|---|---|---|
| **# of responses** | 92 | 76 | 0 | 0 | 168 |
| ***Percent*** | **55%** | **45%** | **0%** | **0%** | **100%** |

Q25. Did the old nightlight have a bulb that you could take out and replace once it burned out?

| | Yes | No | Don't Know | Refused | Total |
|---|---|---|---|---|---|
| **# of responses** | 64 | 24 | 4 | 0 | 92 |
| ***Percent*** | **70%** | **26%** | **4%** | **0%** | **100%** |

Q26. You said you installed at least one of the energy efficient lights. What type of bulb(s) did you replace with the energy efficient lightbulbs?

| | All incandescent | All halogen | All CFL | All LED | Some combination | Don't Know | Refused | Total |
|---|---|---|---|---|---|---|---|---|
| **# of responses** | 90 | 14 | 36 | 22 | 3 | 17 | 0 | 182 |
| ***Percent*** | **49%** | **8%** | **20%** | **12%** | **2%** | **9%** | **0%** | **100%** |

Q27. In what rooms did you install the energy efficient lightbulbs that were included in the kit?

| | # of responses | Percent |
|---|---|---|
| Bathroom | 5 | **3%** |
| Bathroom; Den | 1 | **1%** |
| Bathroom; Other area | 1 | **1%** |
| Bedroom | 24 | **13%** |
| Bedroom; Bathroom | 6 | **3%** |
| Bedroom; Den | 2 | **1%** |
| Bedroom; Garage | 1 | **1%** |
| Bedroom; Hallway | 1 | **1%** |
| Bedroom; Kitchen | 5 | **3%** |
| Den | 4 | **2%** |
| Dining Room | 6 | **3%** |
| Dining Room; Bedroom | 3 | **2%** |
| Dining Room; Kitchen | 3 | **2%** |
| Garage | 1 | **1%** |
| Hallway | 4 | **2%** |
| Kitchen | 7 | **4%** |
| Kitchen; Bathroom | 7 | **4%** |
| Kitchen; Hallway | 1 | **1%** |
| Living Room | 41 | **23%** |
| Living Room; Basement | 1 | **1%** |
| Living Room; Bathroom | 5 | **3%** |
| Living Room; Bedroom | 27 | **15%** |
| Living Room; Den | 1 | **1%** |
| Living Room; Dining Room | 10 | **5%** |
| Living Room; Hallway | 1 | **1%** |
| Living Room; Kitchen | 7 | **4%** |
| Don't know | 7 | **4%** |
| Refused | 0 | **0%** |
| Total | 182 | **100%** |

Q28. Have you adjusted the temperature of your water heater based on the Hot Water Gauge Card included in your kit?

| | Yes | No | Don't recall seeing the Hot Water Gauge Card | Don't Know | Refused | Total |
|---|---|---|---|---|---|---|
| **# of responses** | 34 | 122 | 48 | 10 | 1 | 215 |
| ***Percent*** | **16%** | **57%** | **22%** | **5%** | **0%** | **100%** |

Q29. Do you know what the old temperature setting on your hot water heater was?

| | Yes | No | Total |
|---|---|---|---|
| **# of responses** | 7 | 27 | 34 |
| ***Percent*** | **21%** | **79%** | **100%** |

Q30. And what was the new temperature setting you set your hot water heater to?

| | Provided response | Don't Know | Total |
|---|---|---|---|
| **# of responses** | 10 | 24 | 34 |
| ***Percent*** | **29%** | **71%** | **100%** |

Q31. Is the new water heater temperature setting still in place?

| | Yes | No | Don't Know | Refused | Total |
|---|---|---|---|---|---|
| **# of responses** | 26 | 3 | 5 | 0 | 34 |
| ***Percent*** | **76%** | **9%** | **15%** | **0%** | **100%** |

Q32. Why did you change the water heater temperature a second time?

***Open-ended response type; no tabulation available***

Q33. What is the fuel type of your water heater?

| | Electricity | Natural Gas | Other | Don't Know | Refused | Total |
|---|---|---|---|---|---|---|
| **# of responses** | 170 | 34 | 2 | 9 | 0 | 215 |
| ***Percent*** | **79%** | **16%** | **1%** | **4%** | **0%** | **100%** |

Q34. How old is your water heater?

| | Less than 5 years old | 5 to 9 years old | 10 to 15 years old | More than 15 years old | Don't Know | Refused | Total |
|---|---|---|---|---|---|---|---|
| **# of responses** | 58 | 62 | 39 | 16 | 40 | 0 | 215 |
| ***Percent*** | **27%** | **29%** | **18%** | **7%** | **19%** | **0%** | **100%** |

Q35. If you had not received the free efficiency items in the kit, how likely is is that you would have purchased and installed any of these same items within the next six months?

*Q35a. Showerhead*

| | 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | Don't know | Refused | Total |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| # of responses | 42 | 7 | 4 | 8 | 7 | 7 | 3 | 4 | 3 | 2 | 15 | 3 | 0 | 105 |
| ***Percent*** | **40%** | **7%** | **4%** | **8%** | **7%** | **7%** | **3%** | **4%** | **3%** | **2%** | **14%** | **3%** | **0%** | **100%** |

*Q35b. Kitchen faucet aerator*

| | 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | Don't know | Refused | Total |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| # of responses | 48 | 5 | 5 | 2 | 4 | 5 | 3 | 1 | 1 | 1 | 12 | 2 | 0 | 89 |
| ***Percent*** | **54%** | **6%** | **6%** | **2%** | **4%** | **6%** | **3%** | **1%** | **1%** | **1%** | **13%** | **2%** | **0%** | **100%** |

*Q35c. Bathroom faucet aerator*

| | 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | Don't know | Refused | Total |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| # of responses | 47 | 5 | 4 | 3 | 4 | 6 | 2 | 2 | 4 | 0 | 9 | 2 | 0 | 88 |
| ***Percent*** | **53%** | **6%** | **5%** | **3%** | **5%** | **7%** | **2%** | **2%** | **5%** | **0%** | **10%** | **2%** | **0%** | **100%** |

*Q35d. Night light*

| | 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | Don't know | Refused | Total |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| # of responses | 62 | 9 | 6 | 10 | 7 | 23 | 8 | 4 | 9 | 2 | 25 | 3 | 0 | 168 |
| ***Percent*** | **37%** | **5%** | **4%** | **6%** | **4%** | **14%** | **5%** | **2%** | **5%** | **1%** | **15%** | **2%** | **0%** | **100%** |

*Q35e. Energy efficient light bulb(s)*

| | 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | Don't know | Refused | Total |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| # of responses | 24 | 3 | 2 | 6 | 7 | 17 | 13 | 14 | 18 | 17 | 56 | 5 | 0 | 182 |
| ***Percent*** | **13%** | **2%** | **1%** | **3%** | **4%** | **9%** | **7%** | **8%** | **10%** | **9%** | **31%** | **3%** | **0%** | **100%** |

*Q35f. Insulator gaskets for light switches and electricity outlets*

| | 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | Don't know | Refused | Total |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| # of responses | 34 | 6 | 2 | 4 | 0 | 4 | 3 | 1 | 3 | 0 | 4 | 3 | 0 | 64 |
| ***Percent*** | **53%** | **9%** | **3%** | **6%** | **0%** | **6%** | **5%** | **2%** | **5%** | **0%** | **6%** | **5%** | **0%** | **100%** |

Q36. If you had not received them for free in the kit, how many LED light bulbs would you have purchased?

| | One | Two | Don't Know | Refused | Total |
|---|---|---|---|---|---|
| # of responses | 3 | 28 | 29 | 0 | 60 |
| *Percent* | 5% | 47% | 48% | 0% | 100% |

Q37. Now, thinking about the water savings items that were provided in the kit - using a scale from 0 to 10, where 0 means "not at all influential" and 10 means "extremely influential", how influential were the following factors on your decision to install the water saving items from the kit? How influential was...

***Q37a. The fact that the items were free***

| | 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | N/A | Don't know | Refused | Total |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| # of responses | 7 | 1 | 0 | 4 | 1 | 7 | 7 | 4 | 14 | 10 | 89 | 1 | 1 | 0 | 146 |
| *Percent* | 5% | 1% | 0% | 3% | 1% | 5% | 5% | 3% | 10% | 7% | 61% | 1% | 1% | 0% | 100% |

***Q37b. The fact that the items were mailed to your house***

| | 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | N/A | Don't know | Refused | Total |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| # of responses | 5 | 1 | 0 | 2 | 3 | 8 | 3 | 2 | 14 | 12 | 93 | 2 | 1 | 0 | 146 |
| *Percent* | 3% | 1% | 0% | 1% | 2% | 5% | 2% | 1% | 10% | 8% | 64% | 1% | 1% | 0% | 100% |

***Q37c. Information in the kit about how the items would save energy***

| | 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | N/A | Don't know | Refused | Total |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| # of responses | 7 | 1 | 0 | 1 | 1 | 12 | 6 | 10 | 17 | 20 | 70 | 0 | 1 | 0 | 146 |
| *Percent* | 5% | 1% | 0% | 1% | 1% | 8% | 4% | 7% | 12% | 14% | 48% | 0% | 1% | 0% | 100% |

***Q37d. Information that your child brought home from school***

| | 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | N/A | Don't know | Refused | Total |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| # of responses | 14 | 1 | 1 | 2 | 5 | 15 | 10 | 10 | 12 | 12 | 56 | 6 | 2 | 0 | 146 |
| *Percent* | 10% | 1% | 1% | 1% | 3% | 10% | 7% | 7% | 8% | 8% | 38% | 4% | 1% | 0% | 100% |

***Q37e. Other information or advertisements from Duke Energy, including its website***

| | 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | N/A | Don't know | Refused | Total |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| # of responses | 14 | 2 | 2 | 5 | 7 | 20 | 12 | 16 | 5 | 10 | 42 | 7 | 4 | 0 | 146 |
| *Percent* | 10% | 1% | 1% | 3% | 5% | 14% | 8% | 11% | 3% | 7% | 29% | 5% | 3% | 0% | 100% |

Q38. Using a scale from 0 to 10, where 0 means "not at all influential" and 10 means "extremely influential", how influential were the following factors in your decision to install the lightbulbs from the kit? How influential was...

*Q38a. The fact that the items were free*

| | 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | N/A | Don't know | Refused | Total |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| # of responses | 5 | 1 | 1 | 2 | 1 | 9 | 4 | 7 | 17 | 11 | 122 | 1 | 1 | 0 | 182 |
| *Percent* | 3% | 1% | 1% | 1% | 1% | 5% | 2% | 4% | 9% | 6% | 67% | 1% | 1% | 0% | 100% |

*Q38b. The fact that the items were mailed to your house*

| | 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | N/A | Don't know | Refused | Total |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| # of responses | 3 | 1 | 0 | 3 | 1 | 4 | 6 | 10 | 11 | 16 | 123 | 2 | 2 | 0 | 182 |
| *Percent* | 2% | 1% | 0% | 2% | 1% | 2% | 3% | 5% | 6% | 9% | 68% | 1% | 1% | 0% | 100% |

*Q38c. Information in the kit about how the items would save energy*

| | 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | N/A | Don't know | Refused | Total |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| # of responses | 8 | 3 | 1 | 3 | 0 | 16 | 5 | 20 | 18 | 15 | 88 | 0 | 5 | 0 | 182 |
| *Percent* | 4% | 2% | 1% | 2% | 0% | 9% | 3% | 11% | 10% | 8% | 48% | 0% | 3% | 0% | 100% |

*Q38d. Information that your child brought home from school*

| | 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | N/A | Don't know | Refused | Total |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| # of responses | 14 | 3 | 0 | 5 | 5 | 24 | 12 | 14 | 18 | 12 | 64 | 5 | 6 | 0 | 182 |
| *Percent* | 8% | 2% | 0% | 3% | 3% | 13% | 7% | 8% | 10% | 7% | 35% | 3% | 3% | 0% | 100% |

*Q38e. Other information or advertisements from Duke Energy, including its website*

| | 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | N/A | Don't know | Refused | Total |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| # of responses | 22 | 4 | 3 | 3 | 15 | 25 | 11 | 16 | 10 | 11 | 48 | 4 | 10 | 0 | 182 |
| *Percent* | 12% | 2% | 2% | 2% | 8% | 14% | 6% | 9% | 5% | 6% | 26% | 2% | 5% | 0% | 100% |

Q39. Since your child learned about energy conservation at school and signed up for your energy kit from Duke Energy, has your child adopted any new behaviors to help save energy in your home? This would only include new energy saving behaviors that your child adopted since receiving the kit.

| | # of responses | Percent |
|---|---|---|
| Not applicable - no new behaviors | 58 | **27%** |
| Taking shorter showers | 4 | **2%** |
| Turning off electronics when not using them | 10 | **5%** |
| Turning off electronics when not using them; Taking shorter showers | 1 | **0%** |
| Turning off lights when not in a room | 40 | **19%** |
| Turning off lights when not in a room; Other | 1 | **0%** |
| Turning off lights when not in a room; Taking shorter showers | 5 | **2%** |
| Turning off lights when not in a room; Taking shorter showers; Other | 1 | **0%** |
| Turning off lights when not in a room; Turning off electronics when not using them | 51 | **24%** |
| Turning off lights when not in a room; Turning off electronics when not using them; Other | 1 | **0%** |
| Turning off lights when not in a room; Turning off electronics when not using them; Taking shorter showers | 26 | **12%** |
| Turning off lights when not in a room; Turning off electronics when not using them; Taking shorter showers; Other | 1 | **0%** |
| Other | 3 | **1%** |
| Don't know | 12 | **6%** |
| Refused | 1 | **0%** |
| Total | 215 | **100%** |

Q39b. Before receiving the kit, was your child already...

***39b.2) Turning off lights when not in a room***

| | Yes | No | Don't Know | Refused | Total |
|---|---|---|---|---|---|
| **# of responses** | 41 | 84 | 1 | 0 | 126 |
| ***Percent*** | **33%** | **67%** | **79%** | **0%** | **100%** |

***39b.3) Turning off electronics when not using them***

| | Yes | No | Don't Know | Refused | Total |
|---|---|---|---|---|---|
| **# of responses** | 20 | 66 | 3 | 1 | 90 |
| ***Percent*** | **22%** | **73%** | **3%** | **1%** | **100%** |

***39b.4) Taking shorter showers***

| | Yes | No | Don't Know | Refused | Total |
|---|---|---|---|---|---|
| **# of responses** | 6 | 32 | 0 | 0 | 38 |
| ***Percent*** | **16%** | **84%** | **0%** | **0%** | **100%** |

***39b.5) "Other" reasons***

| | Yes | No | Don't Know | Refused | Total |
|---|---|---|---|---|---|

| | | | | | |
|---|---|---|---|---|---|
| **# of responses** | 2 | 4 | 0 | 1 | 7 |
| ***Percent*** | **29%** | **57%** | **0%** | **14%** | **100%** |

Q40. Since receiving your energy kit from Duke Energy, have you adopted or increased any behaviors to help save energy in your home?

| | # of responses | Percent |
|---|---|---|
| Changing thermostat settings so heating or cooling system uses less energy | 9 | **4%** |
| Changing thermostat settings so heating or cooling system uses less energy; Other | 1 | **0%** |
| Changing thermostat settings so heating or cooling system uses less energy; Taking shorter showers | 2 | **1%** |
| Changing thermostat settings so heating or cooling system uses less energy; Turning off electronics when not using them | 2 | **1%** |
| Changing thermostat settings so heating or cooling system uses less energy; Turning off electronics when not using them; Taking shorter showers | 1 | **0%** |
| Changing thermostat settings so heating or cooling system uses less energy; Turning water heat thermostat down | 1 | **0%** |
| Changing thermostat settings so heating or cooling system uses less energy; Using fans instead of air conditioning | 3 | **1%** |
| Changing thermostat settings so heating or cooling system uses less energy; Using fans instead of air conditioning; Turning off electronics when not using them; Taking shorter showers | 2 | **1%** |
| Changing thermostat settings so heating or cooling system uses less energy; Using fans instead of air conditioning; Turning water heat thermostat down | 1 | **0%** |
| Taking shorter showers | 2 | **1%** |
| Taking shorter showers; Turning water heat thermostat down | 1 | **0%** |
| Turning off air conditioning when not home | 2 | **1%** |
| Turning off air conditioning when not home; Changing thermostat settings so heating or cooling system uses less energy | 2 | **1%** |
| Turning off air conditioning when not home; Changing thermostat settings so heating or cooling system uses less energy; Using fans instead of air conditioning; Turning off electronics when not using them; Taking shorter showers | 1 | **0%** |
| Turning off air conditioning when not home; Changing thermostat settings so heating or cooling system uses less energy; Using fans instead of air conditioning; Turning water heat thermostat down | 1 | **0%** |
| Turning off electronics when not using them | 2 | **1%** |
| Turning off electronics when not using them; Taking shorter showers | 1 | **0%** |
| Turning off furnace when not home; Turning off air conditioning when not home | 1 | **0%** |
| Turning off furnace when not home; Turning off air conditioning when not home; Changing thermostat settings so heating or cooling system uses less energy; Turning off electronics when not using them; Turning water heat thermostat down | 1 | **0%** |
| Turning off furnace when not home; Turning off air conditioning when not home; Changing thermostat settings so heating or cooling system uses less energy; Using fans instead of air conditioning; Turning off electronics when not using them | 1 | **0%** |
| Turning off furnace when not home; Turning off air conditioning when not home; Using fans instead of air conditioning; Turning off electronics when not using them; Other | 1 | **0%** |
| Turning off lights when not in a room | 9 | **4%** |
| Turning off lights when not in a room; Changing thermostat settings so heating or cooling system uses less energy | 8 | **4%** |
| Turning off lights when not in a room; Changing thermostat settings so heating or cooling system uses less energy; Taking shorter showers | 4 | **2%** |
| Turning off lights when not in a room; Changing thermostat settings so heating or cooling system uses less energy; Turning off electronics when not using them | 9 | **4%** |
| Turning off lights when not in a room; Changing thermostat settings so heating or cooling system uses less energy; Turning off electronics when not using them; Taking shorter showers | 4 | **2%** |
| Turning off lights when not in a room; Changing thermostat settings so heating or cooling system uses less energy; Turning water heat thermostat down | 1 | **0%** |
| Turning off lights when not in a room; Changing thermostat settings so heating or cooling system uses less energy; Using fans instead of air conditioning | 2 | **1%** |
| Turning off lights when not in a room; Changing thermostat settings so heating or cooling system uses less energy; Using fans instead of air conditioning; Taking shorter showers | 2 | **1%** |
| Turning off lights when not in a room; Changing thermostat settings so heating or cooling system uses less energy; Using fans instead of air conditioning; Taking shorter showers; Turning water heat thermostat down | 1 | **0%** |

| | # of responses | Percent |
|---|---|---|
| Turning off lights when not in a room; Changing thermostat settings so heating or cooling system uses less energy; Using fans instead of air conditioning; Turning off electronics when not using them | 7 | 3% |
| Turning off lights when not in a room; Changing thermostat settings so heating or cooling system uses less energy; Using fans instead of air conditioning; Turning off electronics when not using them; Taking shorter showers | 5 | 2% |
| Turning off lights when not in a room; Changing thermostat settings so heating or cooling system uses less energy; Using fans instead of air conditioning; Turning off electronics when not using them; Taking shorter showers; Turning water heat thermostat down | 2 | 1% |
| Turning off lights when not in a room; Changing thermostat settings so heating or cooling system uses less energy; Using fans instead of air conditioning; Turning off electronics when not using them; Turning water heat thermostat down | 1 | 0% |
| Turning off lights when not in a room; Turning off air conditioning when not home | 2 | 1% |
| Turning off lights when not in a room; Turning off air conditioning when not home; Changing thermostat settings so heating or cooling system uses less energy | 1 | 0% |
| Turning off lights when not in a room; Turning off air conditioning when not home; Changing thermostat settings so heating or cooling system uses less energy; Turning off electronics when not using them | 2 | 1% |
| Turning off lights when not in a room; Turning off air conditioning when not home; Changing thermostat settings so heating or cooling system uses less energy; Turning off electronics when not using them; Taking shorter showers | 2 | 1% |
| Turning off lights when not in a room; Turning off air conditioning when not home Changing thermostat settings so heating or cooling system uses less energy; Turning off electronics when not using them; Turning water heat thermostat down | 2 | 1% |
| Turning off lights when not in a room; Turning off air conditioning when not home; Changing thermostat settings so heating or cooling system uses less energy; Using fans instead of air conditioning | 1 | 0% |
| Turning off lights when not in a room; Turning off air conditioning when not home; Changing thermostat settings so heating or cooling system uses less energy; Using fans instead of air conditioning; Taking shorter showers | 1 | 0% |
| Turning off lights when not in a room; Turning off air conditioning when not home; Changing thermostat settings so heating or cooling system uses less energy; Using fans instead of air conditioning; Turning off electronics when not using them; Taking shorter showers | 5 | 2% |
| Turning off lights when not in a room; Turning off air conditioning when not home; Changing thermostat settings so heating or cooling system uses less energy; Using fans instead of air conditioning; Turning off electronics when not using them; Taking shorter showers; Turning water heat thermostat down | 2 | 1% |
| Turning off lights when not in a room; Turning off air conditioning when not home; Turning off electronics when not using them | 1 | 0% |
| Turning off lights when not in a room; Turning off air conditioning when not home; Turning off electronics when not using them; Taking shorter showers | 1 | 0% |
| Turning off lights when not in a room; Turning off air conditioning when not home; Turning off electronics when not using them; Turning water heat thermostat down | 1 | 0% |
| Turning off lights when not in a room; Turning off air conditioning when not home; Using fans instead of air conditioning; Taking shorter showers | 1 | 0% |
| Turning off lights when not in a room; Turning off air conditioning when not home; Using fans instead of air conditioning; Turning off electronics when not using them | 2 | 1% |
| Turning off lights when not in a room; Turning off air conditioning when not home; Using fans instead of air conditioning; Turning off electronics when not using them; Taking shorter showers | 2 | 1% |
| Turning off lights when not in a room; Turning off air conditioning when not home; Using fans instead of air conditioning; Turning off electronics when not using them; Turning water heat thermostat down | 1 | 0% |
| Turning off lights when not in a room; Turning off electronics when not using them | 1 | 0% |
| Turning off lights when not in a room; Turning off electronics when not using them; Taking shorter showers | 3 | 1% |
| Turning off lights when not in a room; Turning off electronics when not using them; Taking shorter showers; Turning water heat thermostat down | 1 | 0% |
| Turning off lights when not in a room; Turning off furnace when not home; Changing thermostat settings so heating or cooling system uses less energy; Taking shorter showers | 1 | 0% |
| Turning off lights when not in a room; Turning off furnace when not home; Changing thermostat settings so heating or cooling system uses less energy; Turning off electronics when not using them; Taking shorter showers | 1 | 0% |
| Turning off lights when not in a room; Turning off furnace when not home; Changing thermostat settings so heating or cooling system uses less energy; Turning off electronics when not using them; Taking shorter showers; Turning water heat thermostat down | 1 | 0% |
| Turning off lights when not in a room; Turning off furnace when not home; Changing thermostat settings so heating or cooling system uses less energy; Using fans instead of air conditioning | 1 | 0% |
| Turning off lights when not in a room; Turning off furnace when not home; Changing thermostat settings so heating or cooling system uses less energy; Using fans instead of air conditioning; Taking shorter showers | 1 | 0% |

| | # of responses | Percent |
|---|---|---|
| Turning off lights when not in a room; Turning off furnace when not home; Changing thermostat settings so heating or cooling system uses less energy; Using fans instead of air conditioning; Turning off electronics when not using them | 1 | 0% |
| Turning off lights when not in a room; Turning off furnace when not home; Taking shorter showers | 1 | 0% |
| Turning off lights when not in a room; Turning off furnace when not home; Turning off air conditioning when not home | 2 | 1% |
| Turning off lights when not in a room; Turning off furnace when not home; Turning off air conditioning when not home; Changing thermostat settings so heating or cooling system uses less energy | 4 | 2% |
| Turning off lights when not in a room; Turning off furnace when not home; Turning off air conditioning when not home; Changing thermostat settings so heating or cooling system uses less energy; Turning off electronics when not using them | 2 | 1% |
| Turning off lights when not in a room; Turning off furnace when not home; Turning off air conditioning when not home; Changing thermostat settings so heating or cooling system uses less energy; Turning off electronics when not using them; Taking shorter showers | 1 | 0% |
| Turning off lights when not in a room; Turning off furnace when not home; Turning off air conditioning when not home; Changing thermostat settings so heating or cooling system uses less energy; Turning off electronics when not using them; Turning water heat thermostat down | 1 | 0% |
| Turning off lights when not in a room; Turning off furnace when not home; Turning off air conditioning when not home; Changing thermostat settings so heating or cooling system uses less energy; Using fans instead of air conditioning | 3 | 1% |
| Turning off lights when not in a room; Turning off furnace when not home; Turning off air conditioning when not home; Changing thermostat settings so heating or cooling system uses less energy; Using fans instead of air conditioning; Turning off electronics when not using them | 1 | 0% |
| Turning off lights when not in a room; Turning off furnace when not home; Turning off air conditioning when not home; Changing thermostat settings so heating or cooling system uses less energy; Using fans instead of air conditioning; Turning off electronics when not using them; Taking shorter showers | 1 | 0% |
| Turning off lights when not in a room; Turning off furnace when not home; Turning off air conditioning when not home; Changing thermostat settings so heating or cooling system uses less energy; Using fans instead of air conditioning; Turning off electronics when not using them; Taking shorter showers; Turning water heat thermostat down | 4 | 2% |
| Turning off lights when not in a room; Turning off furnace when not home; Turning off air conditioning when not home; Changing thermostat settings so heating or cooling system uses less energy; Using fans instead of air conditioning; Turning off electronics when not using them; Turning water heat thermostat down | 1 | 0% |
| Turning off lights when not in a room; Turning off furnace when not home; Turning off air conditioning when not home; Turning off electronics when not using them | 1 | 0% |
| Turning off lights when not in a room; Turning off furnace when not home; Using fans instead of air conditioning; Turning off electronics when not using them | 1 | 0% |
| Turning off lights when not in a room; Turning off furnace when not home; Using fans instead of air conditioning; Turning off electronics when not using them; Taking shorter showers | 1 | 0% |
| Turning off lights when not in a room; Turning water heat thermostat down | 1 | 0% |
| Turning off lights when not in a room; Using fans instead of air conditioning | 2 | 1% |
| Turning off lights when not in a room; Using fans instead of air conditioning; Taking shorter showers | 1 | 0% |
| Turning off lights when not in a room; Using fans instead of air conditioning; Turning off electronics when not using them | 4 | 2% |
| Turning off lights when not in a room; Using fans instead of air conditioning; Turning off electronics when not using them; Taking shorter showers | 3 | 1% |
| Turning water heat thermostat down | 1 | 0% |
| Using fans instead of air conditioning | 4 | 2% |
| Using fans instead of air conditioning; Turning off electronics when not using them | 1 | 0% |
| Using fans instead of air conditioning; Turning off electronics when not using them; Taking shorter showers | 1 | 0% |
| Not applicable - no new behaviors | 38 | 18% |
| Other | 1 | 0% |
| Don't know | 3 | 1% |
| Refused | 0 | 0% |
| Total | 215 | 100% |

Q40b. Before receiving the kit, were you already...

***40b.2) Turning off lights when not in a room***

| | Yes | No | Don't Know | Refused | Total |
|---|---|---|---|---|---|

| | | | | | |
|---|---|---|---|---|---|
| **# of responses** | 101 | 26 | 1 | 0 | 128 |
| ***Percent*** | **79%** | **20%** | **78%** | **0%** | **100%** |

### *40b.3) Turning off furnace when not home*

| | Yes | No | Don't Know | Refused | Total |
|---|---|---|---|---|---|
| **# of responses** | 15 | 18 | 1 | 0 | 34 |
| ***Percent*** | **44%** | **53%** | **3%** | **0%** | **100%** |

### *40b.4) Turning off air conditioning when not home*

| | Yes | No | Don't Know | Refused | Total |
|---|---|---|---|---|---|
| **# of responses** | 31 | 26 | 0 | 1 | 58 |
| ***Percent*** | **53%** | **45%** | **0%** | **2%** | **100%** |

### *40b.5) Changing thermostat settings so heating or cooling system uses less energy*

| | Yes | No | Don't Know | Refused | Total |
|---|---|---|---|---|---|
| **# of responses** | 58 | 52 | 4 | 0 | 114 |
| ***Percent*** | **51%** | **46%** | **4%** | **0%** | **100%** |

### *40b.6) Using fans instead of air conditioning*

| | Yes | No | Don't Know | Refused | Total |
|---|---|---|---|---|---|
| **# of responses** | 48 | 28 | 0 | 0 | 76 |
| ***Percent*** | **63%** | **37%** | **0%** | **0%** | **100%** |

### *40b.7) Turning off electronics when not using them*

| | Yes | No | Don't Know | Refused | Total |
|---|---|---|---|---|---|
| **# of responses** | 49 | 41 | 2 | 0 | 92 |
| ***Percent*** | **53%** | **45%** | **2%** | **0%** | **100%** |

### *40b.8) Taking shorter showers*

| | Yes | No | Don't Know | Refused | Total |
|---|---|---|---|---|---|
| **# of responses** | 20 | 43 | 0 | 0 | 63 |
| ***Percent*** | **32%** | **68%** | **1%** | **0%** | **100%** |

### *40b.9) Turning water heat thermostat down*

| | Yes | No | Don't Know | Refused | Total |
|---|---|---|---|---|---|
| # of responses | 5 | 21 | 0 | 0 | 26 |
| *Percent* | 19% | 81% | 0% | 0% | 100% |

### *40b.10) Other*

| | Yes | No | Don't Know | Refused | Total |
|---|---|---|---|---|---|
| # of responses | 0 | 3 | 0 | 0 | 3 |
| *Percent* | 0% | 100% | 0% | 0% | 100% |

Q41. On a scale of 0 to 10, where 0 means "not at all influential" and 10 means "extremely influential", how much influence did Duke Energy's kit and materials on saving energy have on this change of energy using behaviors?

| | 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | Don't know | Refused | Total |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| # of responses | 3 | 0 | 1 | 3 | 4 | 23 | 13 | 36 | 23 | 14 | 49 | 2 | 0 | 171 |
| *Percent* | 2% | 0% | 1% | 2% | 2% | 13% | 8% | 21% | 13% | 8% | 29% | 1% | 0% | 100% |

Q42. Since receiving your energy kit from Duke Energy, have you purchased and installed any other products or made any improvements to your home to help save energy?

| | Yes | No | Don't Know | Refused | Total |
|---|---|---|---|---|---|
| # of responses | 96 | 108 | 11 | 0 | 215 |
| *Percent* | 45% | 50% | 5% | 0% | 100% |

Q43. What products have you purchased and installed to help save energy in your home?

| | # of responses | Percent |
|---|---|---|
| Efficient heating or cooling equipment | 1 | 1% |
| Efficient heating or cooling equipment; Insulation | 1 | 1% |
| Efficient heating or cooling equipment; LEDs and/or CFLs | 2 | 2% |
| Efficient heating or cooling equipment; LEDs and/or CFLs; Other | 1 | 1% |
| Efficient heating or cooling equipment; Products to seal air leaks in your home; LEDs and/or CFLs | 1 | 1% |
| Efficient windows; Insulation; LEDs and/or CFLs | 1 | 1% |
| Efficient windows; LEDs and/or CFLs | 1 | 1% |
| Efficient windows; Products to seal air leaks in your home; LEDs and/or CFLs | 3 | 3% |
| Energy efficient appliances | 1 | 1% |
| Energy efficient appliances; Efficient heating or cooling equipment; Insulation; Energy efficient water heater | 1 | 1% |

| | # of responses | Percent |
|---|---|---|
| Energy efficient appliances; Efficient heating or cooling equipment; Insulation; Products to seal air leaks in your home; LEDs and/or CFLs; Energy efficient water heater | 1 | **1%** |
| Energy efficient appliances; Efficient heating or cooling equipment; LEDs and/or CFLs | 1 | **1%** |
| Energy efficient appliances; Efficient heating or cooling equipment; LEDs and/or CFLs; Energy efficient water heater | 1 | **1%** |
| Energy efficient appliances; Efficient heating or cooling equipment; Products to seal air leaks in your home | 1 | **1%** |
| Energy efficient appliances; Efficient windows; Insulation; Products to seal air leaks in your home; LEDs and/or CFLs | 1 | **1%** |
| Energy efficient appliances; Efficient windows; Products to seal air leaks in your home; LEDs and/or CFLs | 1 | **1%** |
| Energy efficient appliances; Energy efficient water heater | 1 | **1%** |
| Energy efficient appliances; Insulation; LEDs and/or CFLs | 1 | **1%** |
| Energy efficient appliances; Insulation; Products to seal air leaks in your home; Products to seal ducts; LEDs and/or CFLs | 1 | **1%** |
| Energy efficient appliances; LEDs and/or CFLs | 17 | **18%** |
| Energy efficient appliances; LEDs and/or CFLs; Other | 1 | **1%** |
| Energy efficient appliances; Products to seal air leaks in your home | 2 | **2%** |
| Energy efficient appliances; Products to seal air leaks in your home; LEDs and/or CFLs | 2 | **2%** |
| Energy efficient appliances; Products to seal air leaks in your home; LEDs and/or CFLs; Energy efficient water heater | 1 | **1%** |
| Energy efficient appliances; Products to seal air leaks in your home; Products to seal ducts; LEDs and/or CFLs | 1 | **1%** |
| Insulation | 3 | **3%** |
| Insulation; LEDs and/or CFLs | 2 | **2%** |
| Insulation; Products to seal air leaks in your home; LEDs and/or CFLs | 1 | **1%** |
| Insulation; Products to seal air leaks in your home; Products to seal ducts; LEDs and/or CFLs | 1 | **1%** |
| Insulation; Products to seal ducts; Energy efficient water heater | 1 | **1%** |
| LEDs and/or CFLs | 23 | **24%** |
| LEDs and/or CFLs; Other | 1 | **1%** |
| Products to seal air leaks in your home | 2 | **2%** |
| Products to seal air leaks in your home; LEDs and/or CFLs | 9 | **9%** |
| Products to seal air leaks in your home; Products to seal ducts; LEDs and/or CFLs | 1 | **1%** |
| None - no other actions taken | 1 | **1%** |
| Other | 5 | **5%** |
| Total | 96 | **100%** |

Q44. Did you get a rebate from Duke Energy for any of those products or services? If so, which ones?

***Q44.1) Buy energy efficient appliances***

| | Yes | No | Don't Know | Refused | Total |
|---|---|---|---|---|---|
| **# of responses** | 1 | 32 | 2 | 0 | 35 |
| ***Percent*** | **3%** | **91%** | **6%** | **0%** | **100%** |

### Q44.2) Buy efficient heating or cooling equipment

| | Yes | No | Don't Know | Refused | Total |
|---|---|---|---|---|---|
| # of responses | 2 | 8 | 1 | 0 | 11 |
| *Percent* | 18% | 73% | 9% | 0% | 100% |

### Q44.3) Buy efficient windows

| | Yes | No | Don't Know | Refused | Total |
|---|---|---|---|---|---|
| # of responses | 0 | 6 | 1 | 0 | 7 |
| *Percent* | 0% | 86% | 14% | 0% | 100% |

### Q44.4) Buy additional insulation

| | Yes | No | Don't Know | Refused | Total |
|---|---|---|---|---|---|
| # of responses | 1 | 14 | 0 | 0 | 15 |
| *Percent* | 7% | 93% | 0% | 0% | 100% |

### Q44.5) Products to seal air leaks in your home

| | Yes | No | Don't Know | Refused | Total |
|---|---|---|---|---|---|
| # of responses | 2 | 24 | 3 | 0 | 29 |
| *Percent* | 7% | 83% | 10% | 0% | 100% |

### Q44.6) Products to seal ducts

| | Yes | No | Don't Know | Refused | Total |
|---|---|---|---|---|---|
| # of responses | 0 | 5 | 0 | 0 | 5 |
| *Percent* | 0% | 100% | 0% | 0% | 100% |

### Q44.7) Buy LEDs and/or CFLs

| | Yes | No | Don't Know | Refused | Total |
|---|---|---|---|---|---|
| # of responses | 5 | 65 | 6 | 0 | 76 |
| *Percent* | 7% | 86% | 8% | 0% | 100% |

### Q44.8) Install an energy efficient water heater

| | Yes | No | Don't Know | Refused | Total |
|---|---|---|---|---|---|
| # of responses | 2 | 3 | 1 | 0 | 6 |
| *Percent* | 33% | 50% | 17% | 0% | 100% |

*Q44.96) "Other" [Q44 open-ended question]*

| | Yes | No | Don't Know | Refused | Total |
|---|---|---|---|---|---|
| # of responses | 3 | 4 | 1 | 0 | 8 |
| *Percent* | 38% | 50% | 13% | 0% | 100% |

Q45. On a scale of 0 to 10, where 0 means "not at all influential" and 10 means "extremely influential", how much influence did the Duke Energy schools program have on your decision to...

*Q45.1) Buy energy efficient appliances*

| | 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | Don't know | Refused | Total |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| # of responses | 9 | 0 | 1 | 1 | 1 | 3 | 0 | 3 | 4 | 3 | 10 | 0 | 0 | 35 |
| *Percent* | 26% | 0% | 3% | 3% | 3% | 9% | 0% | 9% | 11% | 9% | 29% | 0% | 0% | 100% |

*Q45.2) Buy efficient heating or cooling equipment*

| | 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | Don't know | Refused | Total |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| # of responses | 5 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 2 | 1 | 2 | 0 | 0 | 11 |
| *Percent* | 45% | 0% | 0% | 0% | 0% | 9% | 0% | 0% | 18% | 9% | 18% | 0% | 0% | 100% |

*Q45.3) Buy efficient windows*

| | 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | Don't know | Refused | Total |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| # of responses | 3 | 0 | 0 | 0 | 0 | 1 | 0 | 1 | 0 | 1 | 1 | 0 | 0 | 7 |
| *Percent* | 43% | 0% | 0% | 0% | 0% | 14% | 0% | 14% | 0% | 14% | 14% | 0% | 0% | 100% |

*Q45.4) Buy additional insulation*

| | 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | Don't know | Refused | Total |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| # of responses | 4 | 0 | 0 | 0 | 1 | 1 | 2 | 0 | 1 | 2 | 4 | 0 | 0 | 15 |
| *Percent* | 27% | 0% | 0% | 0% | 7% | 7% | 13% | 0% | 7% | 13% | 27% | 0% | 0% | 100% |

*Q45.5) Products to seal air leaks in your home*

| | 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | Don't know | Refused | Total |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| # of responses | 6 | 1 | 0 | 1 | 0 | 3 | 3 | 2 | 1 | 3 | 8 | 1 | 0 | 29 |
| *Percent* | 21% | 3% | 0% | 3% | 0% | 10% | 10% | 7% | 3% | 10% | 28% | 3% | 0% | 100% |

*Q45.6) Products to seal ducts*

| | 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | Don't know | Refused | Total |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **# of responses** | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 1 | 1 | 1 | 0 | 0 | 5 |
| ***Percent*** | **20%** | **0%** | **0%** | **0%** | **0%** | **20%** | **0%** | **0%** | **20%** | **20%** | **20%** | **0%** | **0%** | **100%** |

*Q45.7) Buy LEDs and/or CFLs*

| | 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | Don't know | Refused | Total |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **# of responses** | 12 | 0 | 0 | 2 | 2 | 10 | 5 | 12 | 8 | 8 | 17 | 0 | 0 | 76 |
| ***Percent*** | **16%** | **0%** | **0%** | **3%** | **3%** | **13%** | **7%** | **16%** | **11%** | **11%** | **22%** | **0%** | **0%** | **100%** |

*Q45.8) ) Install an energy efficient water heater*

| | 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | Don't know | Refused | Total |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **# of responses** | 1 | 0 | 0 | 0 | 0 | 1 | 0 | 1 | 0 | 0 | 3 | 0 | 0 | 6 |
| ***Percent*** | **17%** | **0%** | **0%** | **0%** | **0%** | **17%** | **0%** | **17%** | **0%** | **0%** | **50%** | **0%** | **0%** | **100%** |

*Q45.96) [Q45 open-ended question]*

| | 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | Don't know | Refused | Total |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **# of responses** | 3 | 0 | 3 | 0 | 0 | 1 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 8 |
| ***Percent*** | **38%** | **0%** | **38%** | **0%** | **0%** | **13%** | **0%** | **0%** | **13%** | **0%** | **0%** | **0%** | **0%** | **100%** |

Q46. What kinds of appliance(s) did you buy?

| | # of responses | Percent |
|---|---|---|
| Clothes dryer | 1 | **4%** |
| Clothes washer; Clothes dryer | 2 | **8%** |
| Clothes washer; Microwave | 1 | **4%** |
| Dishwasher | 2 | **8%** |
| Dishwasher; Microwave | 2 | **8%** |
| Microwave | 2 | **8%** |
| Oven | 2 | **8%** |
| Refrigerator | 3 | **12%** |
| Refrigerator; Clothes washer | 1 | **4%** |
| Refrigerator; Clothes washer; Clothes dryer | 1 | **4%** |
| Refrigerator; Clothes washer; Clothes dryer; Oven; Microwave | 1 | **4%** |
| Refrigerator; Dishwasher; Clothes washer; Clothes dryer; Oven; Microwave | 1 | **4%** |
| Refrigerator; Dishwasher; Clothes washer; Oven; Microwave | 1 | **4%** |
| Refrigerator; Microwave | 1 | **4%** |
| Refrigerator; Stand-alone Freezer; Clothes washer; Clothes dryer; Microwave | 1 | **4%** |
| Refrigerator; Stand-alone Freezer; Clothes washer; Clothes dryer; Oven | 1 | **4%** |
| Refrigerator; Stand-alone Freezer; Microwave | 1 | **4%** |
| Other | 2 | **8%** |
| Don't know | 0 | **0%** |
| Refused | 0 | **0%** |
| Total | 26 | **100%** |

Q47. Was the [Q46 appliance] an ENERGY STAR or high efficiency model?

***Q47.1) Refrigerator***

| | Yes | No | Don't Know | Refused | Total |
|---|---|---|---|---|---|
| **# of responses** | 12 | 0 | 0 | 0 | 12 |
| ***Percent*** | **100%** | **0%** | **0%** | **0%** | **100%** |

***Q47.2) Stand-alone Freezer***

| | Yes | No | Don't Know | Refused | Total |
|---|---|---|---|---|---|
| **# of responses** | 3 | 0 | 0 | 0 | 3 |
| ***Percent*** | **100%** | **0%** | **0%** | **0%** | **100%** |

***Q47.3) Dishwasher***

| | Yes | No | Don't Know | Refused | Total |
|---|---|---|---|---|---|
| **# of responses** | 5 | 0 | 1 | 0 | 6 |
| ***Percent*** | **83%** | **0%** | **17%** | **0%** | **100%** |

### Q47.4) Clothes washer

| | Yes | No | Don't Know | Refused | Total |
|---|---|---|---|---|---|
| # of responses | 10 | 0 | 0 | 0 | 10 |
| ***Percent*** | **100%** | **0%** | **0%** | **0%** | **100%** |

### Q47.5) Clothes dryer

| | Yes | No | Don't Know | Refused | Total |
|---|---|---|---|---|---|
| # of responses | 8 | 0 | 0 | 0 | 8 |
| ***Percent*** | **100%** | **0%** | **0%** | **0%** | **100%** |

### Q47.6) Oven

| | Yes | No | Don't Know | Refused | Total |
|---|---|---|---|---|---|
| # of responses | 6 | 0 | 0 | 0 | 6 |
| ***Percent*** | **0%** | **0%** | **0%** | **0%** | **100%** |

### Q47.7) Microwave

| | Yes | No | Don't Know | Refused | Total |
|---|---|---|---|---|---|
| # of responses | 8 | 1 | 2 | 0 | 11 |
| ***Percent*** | **73%** | **9%** | **18%** | **0%** | **100%** |

### Q47.96) Other:

| | Yes | No | Don't Know | Refused | Total |
|---|---|---|---|---|---|
| # of responses | 2 | 0 | 0 | 0 | 2 |
| ***Percent*** | **100%** | **0%** | **0%** | **0%** | **100%** |

Q48. Does the new clothes dryer use natural gas?

| | Yes - it uses natural gas | No - it does not use natural gas | Don't Know | Refused | Total |
|---|---|---|---|---|---|
| # of responses | 0 | 7 | 1 | 0 | 8 |
| ***Percent*** | **0%** | **88%** | **13%** | **0%** | **100%** |

Q49. What type of heating or cooling equipment did you buy?

| | # of responses | Percent |
|---|---|---|
| Central air conditioner | 1 | **17%** |
| Central air conditioner; Furnace; WIFI enabled thermostat | 1 | **17%** |
| Central air conditioner; WIFI enabled thermostat | 1 | **17%** |
| Other | 1 | **17%** |
| WIFI enabled thermostat | 1 | **17%** |
| Window/room air conditioner unit | 1 | **17%** |
| Don't know | 0 | **0%** |
| Refused | 0 | **0%** |
| Total | 6 | **100%** |

Q50. Does the new [Q53 equipment] use natural gas?

***Q50.6) Boiler***

***No responses given***

***Q50.7) Furnace***

| | Yes - it uses natural gas | No - it does not use natural gas | Don't Know | Refused | Total |
|---|---|---|---|---|---|
| **# of responses** | 0 | 1 | 0 | 0 | 1 |
| ***Percent*** | **0%** | **100%** | **0%** | **0%** | **100%** |

Q51. Was the heating or cooling equipment an ENERGY STAR or high-efficiency model?

***Q51.1) Central air conditioner***

| | Yes | No | Don't Know | Refused | Total |
|---|---|---|---|---|---|
| **# of responses** | 3 | 0 | 0 | 0 | 3 |
| ***Percent*** | **100%** | **0%** | **0%** | **0%** | **100%** |

***Q51.2) Window/room air conditioner unit***

| | Yes | No | Don't Know | Refused | Total |
|---|---|---|---|---|---|
| **# of responses** | 1 | 0 | 0 | 0 | 1 |
| ***Percent*** | **100%** | **0%** | **0%** | **0%** | **100%** |

***Q51.3) Wall air conditioner unit***

***No responses given***

***Q51.4) Air source heat pump***

***No responses given***

***Q51.5) Geothermal heat pump***

*No responses given*

***Q51.6) Boiler***

*No responses given*

***Q51.7) Furnace***

| | Yes | No | Don't Know | Refused | Total |
|---|---|---|---|---|---|
| # of responses | 1 | 0 | 0 | 0 | 1 |
| *Percent* | 100% | 0% | 0% | 0% | 100% |

***Q51.96) Other:***

| | Yes | No | Don't Know | Refused | Total |
|---|---|---|---|---|---|
| # of responses | 1 | 0 | 0 | 0 | 1 |
| *Percent* | 100% | 0% | 0% | 0% | 100% |

Q52. How many windows did you install?

| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 18 | Don't know | Refused | Total |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| # of responses | 0 | 1 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 4 |
| *Percent* | 0% | 25% | 25% | 25% | 0% | 0% | 0% | 0% | 0% | 0% | 25% | 0% | 0% | 100% |

Q53. Did you add insulation to your attic, walls, or below the floor?

| | Attic | Walls | Below the floor | Walls; Below the floor | Don't Know | Refused | Total |
|---|---|---|---|---|---|---|---|
| # of responses | 3 | 0 | 5 | 1 | 2 | 0 | 11 |
| *Percent* | 27% | 0% | 45% | 9% | 18% | 0% | 100% |

Q54. Approximately what proportion of the [Q53 location] space did you add insulation?

***Q54.1) Attic***

| | 50% | Don't Know | Refused | Total |
|---|---|---|---|---|
| # of responses | 2 | 1 | 0 | 3 |
| *Percent* | 67% | 33% | 0% | 100% |

*Q54.2) Walls*

| | 50% | Don't Know | Refused | Total |
|---|---|---|---|---|
| # of responses | 1 | 0 | 0 | 2 |
| ***Percent*** | **100%** | **0%** | **0%** | **100%** |

*Q54.3) Below the floor*

| | 10% | 35% | 50% | 75% | Don't Know | Refused | Total |
|---|---|---|---|---|---|---|---|
| # of responses | 1 | 1 | 2 | 1 | 1 | 0 | 6 |
| ***Percent*** | **17%** | **17%** | **33%** | **17%** | **17%** | **0%** | **100%** |

Q55. How many LEDs and CFLs did you install in your property?

| | 2 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 15 | 16 | 20 | 25 | 30 | 40 | 50 | Don't know | Refused | Total |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| # of responses | 3 | 8 | 7 | 8 | 1 | 5 | 1 | 8 | 1 | 1 | 2 | 1 | 5 | 1 | 4 | 1 | 1 | 6 | 0 | 64 |
| ***Percent*** | 5% | 13% | 11% | 13% | 2% | 8% | 2% | 13% | 2% | 2% | 3% | 2% | 8% | 2% | 6% | 2% | 2% | 9% | 0% | 100% |

Q56. You said that you installed [Q55 response] LED and CFL bulbs on your propert. Is this the correct number?

***No responses given***

Q57. Does the new water heater use natural gas?

| | Yes - it uses natural gas | No - it does not use natural gas | Don't Know | Refused | Total |
|---|---|---|---|---|---|
| # of responses | 1 | 4 | 0 | 0 | 5 |
| ***Percent*** | **20%** | **80%** | **0%** | **0%** | **100%** |

Q58. Which of the following water heaters did you purchase?

| | A traditional water heater | A tankless water heater | A solar water heater | Other | Don't know | Refused | Total |
|---|---|---|---|---|---|---|---|
| # of responses | 4 | 1 | 0 | 0 | 0 | 0 | 5 |
| ***Percent*** | **80%** | **20%** | **0%** | **0%** | **0%** | **0%** | **100%** |

Q59. Is the new water heater an ENERGY STAR model?

| | Yes | No | Don't Know | Refused | Total |
|---|---|---|---|---|---|
| # of responses | 4 | 0 | 1 | 0 | 5 |
| ***Percent*** | **80%** | **0%** | **20%** | **0%** | **100%** |

Q60. Which of the following types of housing units would you say best describes your home? Is it...

| | Single-family detached home | Single-family attached home (such as a townhouse or condo) | Duplex, triplex, or quadplex | Apartment or condominium with 5 units or more | Manufactured or mobile home | Other | Don't know | Refused | Total |
|---|---|---|---|---|---|---|---|---|---|
| # of responses | 147 | 13 | 6 | 17 | 29 | 1 | 2 | 0 | 215 |
| ***Percent*** | **68%** | **6%** | **3%** | **8%** | **13%** | **0%** | **1%** | **0%** | **100%** |

Q61. How many showers are in your home? Please include both stand-up showers and bathtubs with showerheads.

| | 1 | 2 | 3 | 4 | 5 or more | Don't know | Refused | Total |
|---|---|---|---|---|---|---|---|---|
| # of responses | 41 | 114 | 43 | 9 | 7 | 1 | 0 | 215 |
| ***Percent*** | **19%** | **53%** | **20%** | **4%** | **3%** | **0%** | **0%** | **100%** |

Q62. How many square feet of living space are there in your residence, including bathrooms, foyers and hallways (exclude garages, unfinished basements, and unheated porches)?

| | Less than 500 sq. ft. | 500 to under 1,000 sq. ft. | 1,000 to under 1,500 sq. ft. | 1,500 to under 2,000 sq. ft. | 2,000 to under 2,500 sq. ft. | 2,500 to under 3,000 sq. ft. | Greater than 3,000 sq. ft. | Don't know | Refused | Total |
|---|---|---|---|---|---|---|---|---|---|---|
| # of responses | 3 | 21 | 52 | 39 | 31 | 21 | 25 | 23 | 0 | 215 |
| ***Percent*** | **1%** | **10%** | **24%** | **18%** | **14%** | **10%** | **12%** | **11%** | **0%** | **100%** |

Q63. Do you or members of your household own your home, or do you rent it?

| | Own/Buying | Rent/Lease | Occupy Rent-free | Don't know | Refused | Total |
|---|---|---|---|---|---|---|
| # of responses | 153 | 58 | 2 | 1 | 1 | 215 |
| ***Percent*** | **71%** | **27%** | **1%** | **0%** | **0%** | **100%** |

Q64. Including yourself, how many people currently live in your home year-round?

| | I live by myself | Two people | Three people | Four people | Five people | Six people | Seven people | Eight or more people | Don't know | Refused | Total |
|---|---|---|---|---|---|---|---|---|---|---|---|
| # of responses | 7 | 22 | 64 | 63 | 32 | 17 | 5 | 3 | 0 | 2 | 215 |
| ***Percent*** | **3%** | **10%** | **30%** | **29%** | **15%** | **8%** | **2%** | **1%** | **0%** | **1%** | **100%** |

Q65. What was your total annual household income for 2020, before taxes?

| | # of responses | Percent |
|---|---|---|
| Under $15,000 | 10 | **5%** |
| 15 to under $25,000 | 19 | **9%** |
| 25 to under $35,000 | 18 | **8%** |
| 35 to under $50,000 | 28 | **13%** |
| 50 to under $75,000 | 29 | **13%** |
| 75 to under $100,000 | 27 | **13%** |
| 100 to under $150,000 | 23 | **11%** |
| 150 to under $200,000 | 3 | **1%** |
| $200,000 or more | 7 | **3%** |
| Don't know | 4 | **2%** |
| Prefer not to say | 47 | **22%** |
| Total | 215 | **100%** |
| Under $15,000 | 10 | **5%** |

Q66. In what year were you born?

| | # of responses | Percent |
|---|---|---|
| 1950 | 1 | **0%** |
| 1951 | 2 | **1%** |
| 1956 | 3 | **1%** |
| 1957 | 2 | **1%** |
| 1959 | 1 | **0%** |
| 1960 | 1 | **0%** |
| 1961 | 2 | **1%** |
| 1962 | 1 | **0%** |
| 1963 | 2 | **1%** |
| 1964 | 2 | **1%** |
| 1965 | 2 | **1%** |
| 1966 | 4 | **2%** |
| 1967 | 1 | **0%** |
| 1968 | 3 | **1%** |
| 1969 | 4 | **2%** |
| 1970 | 5 | **2%** |
| 1971 | 8 | **4%** |
| 1972 | 6 | **3%** |
| 1973 | 5 | **2%** |
| 1974 | 9 | **4%** |
| 1975 | 7 | **3%** |

| | # of responses | Percent |
|---|---|---|
| 1976 | 10 | **5%** |
| 1977 | 7 | **3%** |
| 1978 | 8 | **4%** |
| 1979 | 11 | **5%** |
| 1980 | 2 | **1%** |
| 1981 | 10 | **5%** |
| 1982 | 8 | **4%** |
| 1983 | 7 | **3%** |
| 1984 | 11 | **5%** |
| 1985 | 7 | **3%** |
| 1986 | 7 | **3%** |
| 1987 | 4 | **2%** |
| 1988 | 3 | **1%** |
| 1989 | 3 | **1%** |
| 1990 | 2 | **1%** |
| 1991 | 3 | **1%** |
| 1992 | 4 | **2%** |
| 1993 | 1 | **0%** |
| Don't know | 3 | **1%** |
| Prefer not to say | 33 | **15%** |
| Total | 215 | **100%** |

Q67. What is the highest level of education achieved among those living in your household?

| | # of responses | Percent |
|---|---|---|
| Less than high school | 1 | **0%** |
| Some high school | 5 | **2%** |
| High school graduate or equivalent | 31 | **14%** |
| Trade or technical school | 13 | **6%** |
| Some college (including Associate's degree) | 59 | **27%** |
| College degree (Bachelor's degree) | 49 | **23%** |
| Some graduate school | 4 | **2%** |
| Graduate degree, professional degree | 36 | **17%** |
| Doctorate | 9 | **4%** |
| Don't know | 0 | **0%** |
| Prefer not to say | 8 | **4%** |
| Total | 215 | **100%** |

Q68. Lastly, did the COVID-19 pandemic, or government or organizational response to it, offer any challenges to you regarding your participation in this program? If so, what challenges, and how do you think they might best be addressed moving forward?

| | Yes | No | Don't Know | Refused | Total |
|---|---|---|---|---|---|
| **# of responses** | 7 | 189 | 19 | 0 | 215 |
| ***Percent*** | **3%** | **88%** | **9%** | **0%** | **100%** |