ATTACHMENT 5-
Energy Efficiency Education for Schools Program Evaluation

REPORT

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Energy Efficiency Education in Schools Program Year 2017 - 2018 Evaluation Report

Submitted to Duke Energy Ohio
in partnership with Research into Action

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1 Executive Summary

1.1 Program Summary

The Energy Efficiency Education in Schools Program is a Duke Energy Ohio (DEO) energy efficiency program 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 DEO NTC program conducted by the evaluation team, collectively Nexant Inc. and our subcontracting partner, Research into Action, for the school and program year of August 2017 through May 2018.

1.2.1 Impact Evaluation

The evaluation team conducted the evaluation as detailed in this report to estimate energy and demand savings attributable to the 2017-2018 DEO NTC program. The evaluation was divided into two research areas - to determine gross and net savings (or impacts). Gross impacts are energy and demand savings estimated at a participant's home that are the direct result of the homeowner's installation of a measure included in the Duke Energy home kit. Net impacts reflect the degree to which the gross savings are a result of the program efforts and funds. Table 1-1 and Table 1-2 present the summarized findings of the impact evaluation.

Table 1-1: 2017-2018 Energy Savings per Kit

Measurement	Reported	Realization Rate	Gross Verified	Net-to-Gross Ratio	Net Verified
Energy (kWh)	499.0	37.1%	185.0	1.13	209.3
Demand (kW)	0.134	15.4%	0.021		0.023

Table 1-2: 2017-2018 Program Level Energy Savings

Measurement	Reported	Realization Rate	Gross Verified	Net-to-Gross Ratio	Net Verified
Energy (kWh)	3,225,037	37.1%	1,195,598	1.13	1,343,181
Demand (kW)	867.7	15.4%	133.4		150.4

Figure 1-1 provides the verified energy saving share by measure, and Table 1-3 provides gross verified energy and demand savings by measure and net to gross ratio details.

Figure 1-1: 2017-2018 DEO NTC Gross Verified Energy Savings

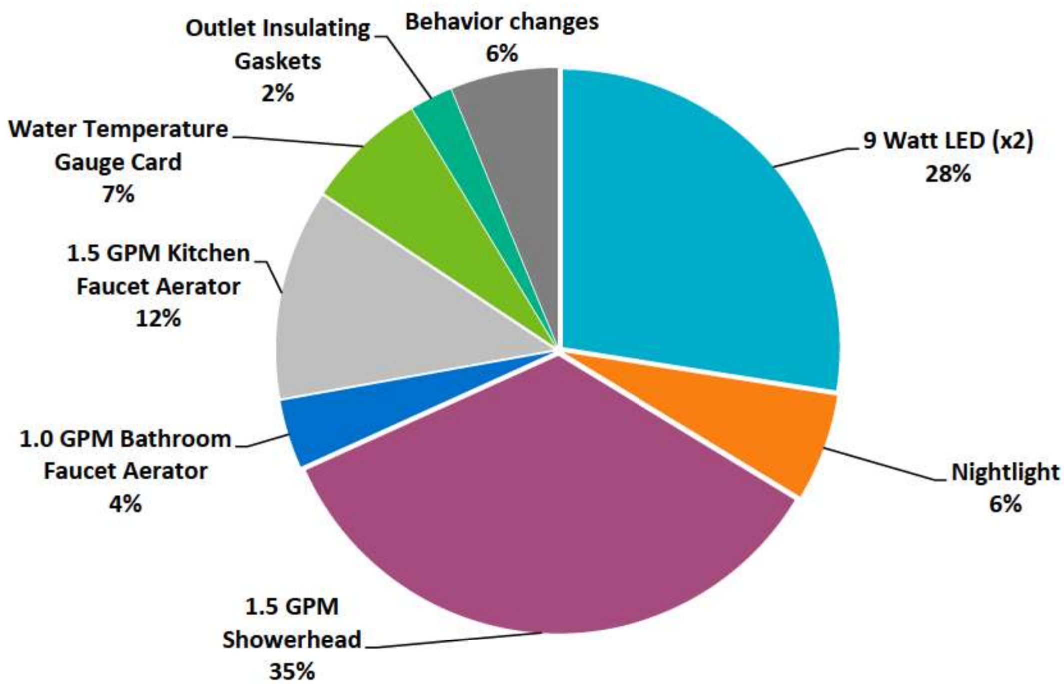


Table 1-3: DEO NTC Program Year 2017-2018 Verified Impacts by Measure

Measure	Gross Energy Savings per unit (kWh)	Gross Demand per unit (kW)	Free Ridership	Spillover	Net to Gross Ratio
9 Watt LED*	50.9	0.006	0.15	0.28	1.13
Nightlight	11.5	0.000			
1.5 GPM Showerhead	63.9	0.010			
1.0 GPM Bathroom Faucet Aerator	7.3	0.001			
1.5 GPM Kitchen Faucet Aerator	22.5	0.001			
Water Temperature Gauge Card	12.9	0.002			
Outlet Insulating Gaskets	4.5	0.001			
Behavioral Changes	11.5	0.001	-	-	-
Total Kit and Behavioral Impacts	**185.0**	**0.021**	**0.15**	**0.28**	**1.13**

*Reflects savings for two 9 watt LEDs bulbs

1.2.2 Senate Bill 310 Compliance

In the state of Ohio, electric distribution utilities (EDUs), including DEO, are required to achieve a cumulative annual energy savings of more than 22% by 2027 per Ohio Senate Bill (SB) 310 . SB 310 also introduced new mechanisms that adjust how EDUs may estimate their energy savings achieved through demand side management programs. Specifically, SB 310 requires the Ohio Public Utilities Commission (PUC) to permit EDUs to account for energy-efficiency savings estimated on an "as-found" or a deemed basis. That is, an EDU may claim savings based on the baseline operating conditions found at the location where the energy-efficiency measure was installed, or the EDU may claim a deemed savings estimate. For example, if a DEO customer installed a LED light bulb, DEO can claim energy savings based on its own assumed deemed or calculated energy savings value associated with the lamp upgrade irrespectively of third party evaluation, measurement, and verification, which could show a higher or lower level of energy savings from observed conditions. The relevant language from SB 310 is provided in Appendix C.

Table 1-4 provides the gross savings per measure that DEO will claim per SB 310 for the Energy Efficiency Education School Kit for the 2017-2018 program year.

Table 1-4: SB 310 Compliance Gross Savings per Measure

Program	Claimed Gross Savings (kWh)	Claimed Gross Savings (kW - summer)	Claimed Gross Savings (kW - winter)	Source
Energy Efficiency Education School Kit	499.0	0.134	0.132	DEO program reported savings

1.2.3 Process Evaluation

The process evaluation assessed opportunities for improving the program's design and delivery in DEO service territory. 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 conducted phone (n=72) and web surveys (n=95) with student families that received a kit (n=167) and teachers who attended the performance (n=19). The team also conducted in-depth interviews with utility staff, NTC staff, and five teachers who completed the web survey.

Program Successes

The 2017-2018 DEO NTC program evaluation found successes in the following areas:

Teachers and parents awareness of DEO sponsorship of the kits. Almost all parents (90%) and most teachers (84%) knew that DEO sponsored the kits. Parents became aware of DEO sponsorship via the materials their children brought home (63%), information in the kit (31%), or via communications from the teacher or school (21%). Teachers became aware largely via communication from other teachers or from Duke Energy marketing materials associated with the kits and performance.

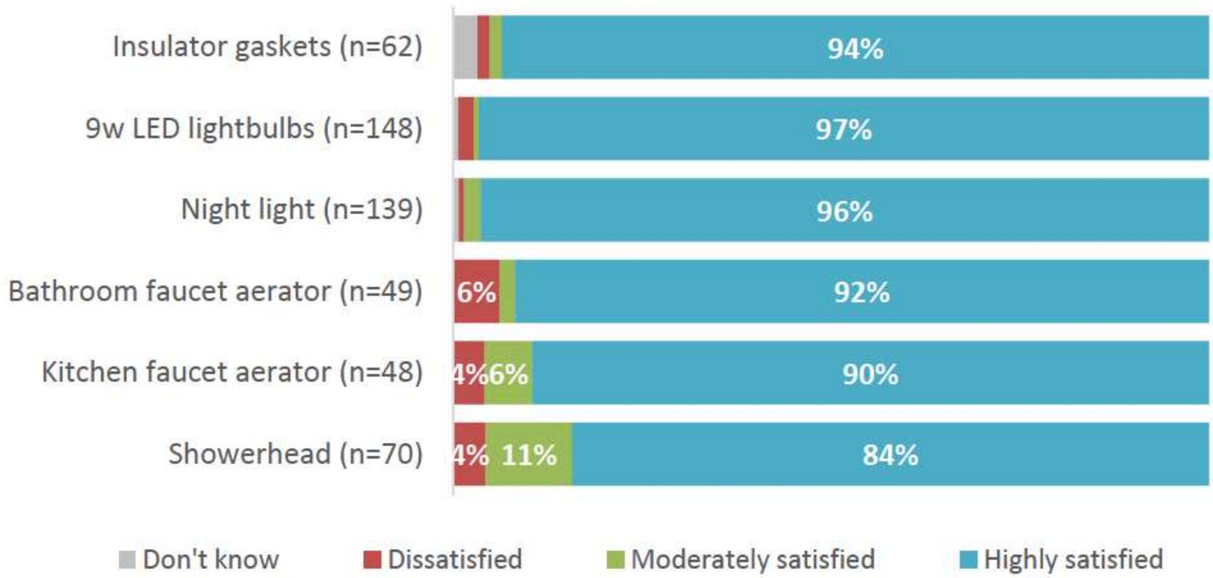
Parents largely learned about DEO kits from materials brought home by child. About three-quarters (74%) of parents learned about the kits from the materials their children brought home. Lesser reported ways included school newsletters (17%) and emails from their children's teacher or school (10%).

Teachers were highly satisfied with performance, reporting that the performance was not missing important components, was age appropriate for most students, and engaged the students. Nearly all (17 of 19) stated they were "highly satisfied", most (17) noted the performance was not missing important concepts, and 18 of 19 noted the performance was age appropriate. All interviewed teachers reported the performance was engaging, humorous, and effective.

Distribution of kit request forms goes well. Teachers reported no problems receiving kit request forms and all noted they distributed the forms to their students, typically immediately after the performance.

Student families are highly satisfied with kit items. Respondents were highly satisfied with all measures, especially the lighting items. (Figure 1-2)

Figure 1-2: Kit Recipient Satisfaction with Installed Measures



Many kit recipients value the educational information in the kit. Two-thirds of respondents read the energy saving educational information in the kit and most of those reported it was "highly helpful."

The program influenced some families to adopt energy saving behaviors. Half of parents reported taking an energy saving action and over half (57%) of respondents reported their child has adopted new energy saving behaviors since receiving their kit. Parents most commonly said that they had changed their thermostat settings and that their child now turns off lights when not using a room (45%)..

Program Challenges

The 2017-2018 DEO NTC program evaluation met some challenges in the following areas:

Instructional material use is limited. Teachers reported distributing kit request forms to their students yet noted limited use of the instructional materials associated with the kit request forms. Twelve of the 19 respondents (five elementary and seven middle school teachers) reported receiving the educational materials and those that received them either did not use the materials or used them in a limited way. Of those that used the materials, teachers deemed them "moderately useful" at best.

There is variation in the emphasis individual teachers put on the value of kits. All teachers encouraged their students to request kits, but they varied in the tenacity of their approach. Almost all reported vocally encouraging students to request a kit, but far fewer reported taking additional actions like sending reminders to parents or awarding prizes to kids that get parents to request a kit.

Getting more families to install all measures in the kits. Parent respondents noted they installed at least one measure in the kit, but few install all measures. Most respondents installed the LED lights and the nightlights, however far fewer installed the water saving measures and the insulator gaskets.

1.3 Evaluation Conclusions and Recommendations

Based on evaluation findings, the evaluation team concluded the following and provides several recommendations for program improvement:

Conclusion 1: NTC performances satisfy teachers by engaging students. It is less clear that the performances are linked to classroom learning, awareness at home, or change in behavior. Teachers reported high satisfaction with the performance and recalled that the performance engaged students. However, curriculum materials were not always distributed or remembered by teachers whose use of the materials was limited. Those that did use the materials determined they were, at best, "moderately useful."

Parents were often not aware the performance occurred and about half of parents reported changes in their or their children's energy use behavior since receiving the kits, but those changes in behavior were limited.

Recommendation: Find ways to increase use of materials, such as:

- making sure teachers are aware, NTC aligns their materials with state science standards, and
- concentrating scheduled performances around the time schools are covering similar topics, such as around Earth Day

Conclusion 2: There is an opportunity to greater emphasize the kits and get more families to request and install kits. About one-third of teachers follow-up with students to see if parents requested kits, but there is great variation in how much emphasis teachers place on promoting the kits. Additionally, two-thirds of parents did not know kits were associated with a performance and instructional materials.

Recommendation: Provide schools with information or pre-written messaging they can use to communicate the value of the kits to parents.

Conclusion 3: The program influences families to save energy. Families save energy they would not have saved without receiving the kits and nearly all respondents installed at least one kit measure. Very few would have installed the kit measures without the prompt from their child and about one-fifth of parent respondents indicated a spillover action. Over half of parent respondents said they or their children adopted new energy saving behaviors since receiving the kit.

> **Recommendation:** Continue engaging student family households with the Education program.

Conclusion 4: The Education program could be a good "gateway" program to generate even more energy savings. Kit recipients could be good targets for other Duke Energy efficiency program promotions, as they:

- demonstrated willingness to save energy in their home
- expressed interest in installing additional kit items or other energy saving measures (many of which Duke Energy currently incents)
- are highly likely to read any information included with the kit
- are predominantly single family homeowners

Recommendations: Leverage kits to promote other Duke Energy efficiency programs, such as targeting these households for direct mail campaigns or including information on Smart $aver or the Online Savings Store in the kit.

2 Introduction and Program Description

2.1 Program Description

2.1.1 Overview

The Energy Efficiency Education in Schools Program is an energy efficiency program sponsored by Duke Energy Ohio (DEO). The program provides free in-school performances by the National Theatre for Children (NTC) that teach elementary and middle school students about energy and conservation concepts in a humorous and engaging format. This report will hereafter refer to the program as the NTC program.

In addition to the NTC performance, 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 (kit) from DEO; 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 fill out the kit form.

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 evaluation scope (the kit includes additional educational items described in section 0 below).

Table 2-1: 2017-2018 Kit Measures

Measures	Details
9 Watt LED	2 bulbs
Nightlight	1 LED plug-in nightlight
1.5 GPM Showerhead	1 low-flow showerhead
1.0 GPM Bathroom Faucet Aerator	1 low-flow faucet aerator
1.5 GPM Kitchen Faucet Aerator	1 low-flow kitchen aerator
Water Temperature Gauge Card	1 temperature card indicating water heat temperature
Outlet Insulating Gaskets	8 outlet and 4 light switch gaskets

2.2 Program Implementation

2.2.1 School Recruitment

Duke Energy sends NTC a list of approved schools in DEO territory, which NTC uses to contact schools to schedule NTC performances. NTC ships curriculum materials to participating schools approximately two weeks prior to the performance date.

2.2.2 NTC Performance

NTC has two age-appropriate shows for DEO's NTC program: Kilowatt Kitchen for elementary age students (Kindergarten through sixth grade) and The E-Team for middle school age students (6th through 8th 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 (renewable and nonrenewable sources)
- How energy is used
- How energy is wasted
- Energy efficiency and conservation

Performers also discuss how DEO offers students and their families free energy efficiency starter kits, and how the items in the kit can save energy in their homes.

2.2.3 DEO Kit Form Promotion and Distribution

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. To encourage participation, those requesting kits are automatically entered in drawings to win cash prizes for their household ($1,000) or their school ($10,000). DEO uses two vendors to fulfill kit requests. The participant's eligibility is confirmed by the firm R1 who sends the fulfillment request to AM Conservation who ships the kit to eligible homes that signed up for the program. The Process Flow Map in Appendix C outlines this process.

2.2.4 DEO Kit Eligibility

Student families can only receive a kit once every 36 months. Additionally, parents/guardians must fill out the survey included on the kit request form in order to receive a kit. The kit contents will differ if a family is a DEO customer versus a non-Duke Energy customer (Table 2-2).

Table 2-2: Measures Received by Customer Type

Measures	DEO Customer	Non-Duke Energy Customer
1.5 GPM Showerhead	✓	
1.5 GPM Kitchen Faucet Aerator	✓	
1.0 GPM Bathroom Faucet Aerator	✓	
Water flow meter bag	✓	
Water Temperature Gauge Card	✓	✓
13 Watt CFL	✓	
18 Watt CFL	✓	
LED Nightlight	✓	✓
Outlet Insulating Gaskets	✓	✓
Energy savers booklet	✓	✓
Product information and instruction sheet	✓	
Glow ring toy	✓	✓

2.2.5 Participation

For the defined evaluation period of August 2017 through May 2018, the program recorded a total of 6,463 kit recipients. During survey recruitment, no participants notified the evaluation team that their kits never arrived.

2.3 Key Research Objectives

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 DEO NTC program:

- Quantify accurate and supportable energy (kWh) and demand (kW) savings[1] for energy efficient measures implemented in participants' homes;
- 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 other Duke similar programs in other jurisdictions.

2.3.2 Process

The process evaluation assessed opportunities for improving the design and delivery of the program in DEO 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 the DEO sponsorship of the program?
  - Is there a need to increase this awareness?
- **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?

[1] The quantification of program impacts was initially attempted through a utility bill regression analysis. However, the program impacts could not be isolated due to the small size of the impact relative to annual consumption. Therefore, the impact analysis relied on engineering algorithms to assess the program's savings impacts. Please see section 3.5 for additional detail.

    - 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 goals outlined:

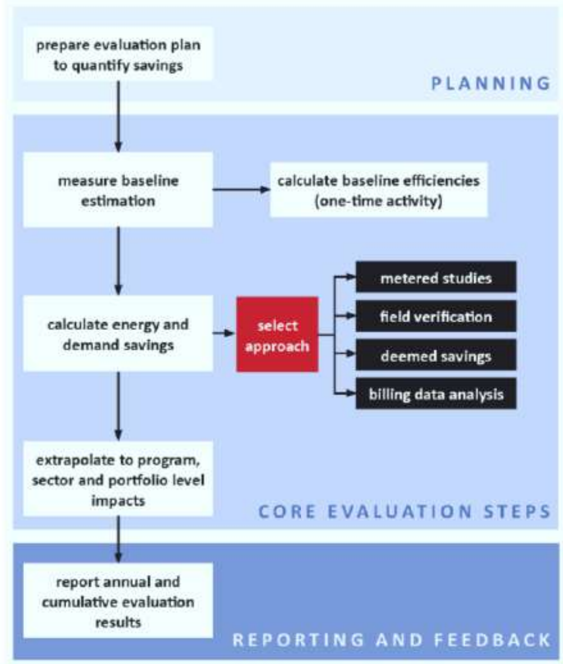
- **Task 1** – Develop and manage evaluation work plan to describe the processes that will be followed to complete the evaluation tasks outlined in this project;
- **Task 2** – Conduct a process review to determine how successfully the programs are being delivered to participants and to identify opportunities for improvement;
- **Task 3** – Verify gross and net energy and peak demand savings resulting from the NTC program through verification activities of a sample of 2017-2018 program participants.

2.4.1 Impact Evaluation

The primary determinants of impact evaluation costs are the sample size and the level of rigor employed in collecting the data used in the impact analysis. The accuracy of the study findings is in turn dependent on these parameters. Techniques that we used to conduct our evaluation, measurement, and verification (EM&V) activities, and to meet the goals for this evaluation, included telephone and web-based surveys with program participants, best practice review, and interviews with implementation and program staff.

Figure 2-1 demonstrates the principal evaluation team steps organized through planning, core evaluation activities, and final reporting.

Figure 2-1: Impact Evaluation Process



The evaluation is generally comprised of the following steps, which are described in further detail throughout this report:

- Participant Surveys:
  - The file review for all sampled and reviewed program participation concluded with a telephone and web-based survey with the participating families.
- Process evaluation examines and documents:
  - Program operations
  - Stakeholder satisfaction
  - Opportunities to improve the efficiency and effectiveness of program delivery

To satisfy the evaluation, measurement, and verification (EM&V) objectives for this research effort, the evaluation team reviewed program documents and conducted telephone and 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 2-3 provides a summary of the** activities the evaluation team conducted as part of the DEO NTC program process and impact evaluation.
- Table 2-3 below summarizes the number of surveys and on-site inspections completed. The samples were drawn to meet a 90% confidence and 10% precision level based upon the expected and actual significance (or magnitude) of program participation, the level of certainty of savings, and the variety of measures.

- **Calculate Impacts and Analyze Load Shapes:** Data collected via surveys enabled the evaluation team to calculate gross verified energy and demand savings for each measure.
- **Estimate Net Savings**: Net impacts are a reflection of the degree to which the gross savings are a result of the program efforts and incentives. The evaluation team estimated free-ridership and spillover based on self-report methods through surveys with program participants. The ratio of net verified savings to gross verified savings is the net-to-gross ratio as an adjustment factor to the reported savings.

2.4.2 Process Evaluation

Process evaluation examines and documents:

- Program operations
- Stakeholder satisfaction
- Opportunities to improve the efficiency and effectiveness of program delivery

To satisfy the evaluation, measurement, and verification (EM&V) objectives for this research effort, the evaluation team reviewed program documents and conducted telephone and 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 2-3 provides a summary of the activities the evaluation team conducted as part of the DEO NTC program process and impact evaluation.

Table 2-3: DEO NTC Summary of Evaluation Activities

Target Group	2017-2018 Survey Population	Sample	Confidence /Precision	Method
Impact Activities				
Participants	6,463	167	90/6	Telephone/Web Survey
Process Activities				
DEO Program Staff	N/A	1	N/A	Telephone IDI
Implementer Staff: NTC	N/A	1	N/A	Telephone IDI
Implementer Staff: R1	N/A	1	N/A	Telephone IDI
Teachers who attended a NTC workshop	81	19	90/17	Web Survey
Participating teacher follow-up interviews	Unknown	5	N/A	Telephone In-Depth Interview (IDI)
Participants – student families who received a kit and are DEO customers	6,463	167[2]	90/6	Telephone/Web Survey

[2] 95 phone surveys, 72 web surveys

3 Impact Evaluation

3.1 Methodology

The evaluation team's impact analysis focused on the energy and demand savings attributable to the NTC program for the period of August 2017 through May 2018. The evaluation was divided into two research areas: to determine gross and net savings (or impacts). Gross impacts are energy and demand savings estimated at a participant's home that are the direct result of the homeowner's installation of a measure included in the program-provided energy saving kit. Net impacts are a reflection of the degree to which the gross savings are a result of the program efforts and funds. The evaluation team verified energy and demand savings attributable to the program by conducting the following impact evaluation activities:

- Review of DEO participant database.
- Completion of telephone and web-based surveys to verify key inputs into savings calculations.
- Estimation of gross verified savings using primary data collected from participants.
- Comparison of the gross-verified savings to program-evaluated results to determine kit-level realization rates.
- Application of attribution survey data to estimate net-to-gross ratios and net-verified savings at the program level.
- Compare the verified savings to the claimed savings to determine which impacts should apply to comply with SB 310.

3.2 Database and Historical Evaluation Review

DEO provided the evaluation team with a program database for the NTC program participation. The program database provided participant contact information including account number, address, phone number, and email address, if available, and whether or not the participant was willing to be contacted. Since DEO was able to provide both phone numbers and email addresses, we were able to design a sampling approach that could take advantage of both phone and web-based surveying.

DEO provided ex-ante, or deemed, savings values at the kit-level; however, it did not have measure-level ex-ante savings available. Because measure-level savings were not provided, realization rates could only be calculated at the kit-level.

Despite the unavailability of measure-level ex-ante savings, the evaluation team conducted a benchmarking review of the uncertainty of ex-ante savings estimates by comparing multiple technical reference manuals (TRMs) and prior Energy Efficiency Education in Schools evaluations conducted in Duke Energy Ohio and other Duke Energy jurisdictions. The details of the benchmarking review are referenced in Table 3-1. The listed savings values include the impact of in-service rates.

Table 3-1: Comparison of Ex-Ante DEO NTC Energy Savings (kWh) to Peer Group Estimates

Measure	Duke Energy Indiana 2015-2016 NTC Education evaluation[1]	Ohio 2010 TRM[2]	Indiana 2016 TRM[3]	Illinois 2017 TRM[54]	Pennsylvania 2016 TRM[5]
9 Watt LED	N/A	17.7	18.2	18.0	20.2
Nightlight	7.5	N/A	10.2	N/A	11.3
1.5 GPM Showerhead	142.4	100.5	93.1	161.5	177.4
1.0 GPM Bathroom Faucet Aerator	19.1	13.8	10.7	7.1	7.4
1.5 GPM Kitchen Faucet Aerator	57.0	9.1	69.8	48.8	72.8
Water Temperature Gauge Card	13.7	N/A	N/A	13.4	27.2
Outlet Insulating Gaskets	1.9	N/A	N/A	N/A	N/A

[1]Duke Energy Indiana Energy Efficiency in Schools Program evaluation. Nexant. July 28, 2017

[2]State of Ohio Technical Reference Manual. August, 2010.
[3]Indiana Technical Reference Manual, version 2.2. January, 2016.
[4]Illinois Statewide Technical Reference Manual for Energy Efficiency, version 6.0, February, 2017.
[5]State of Pennsylvania Technical Reference Manual. June, 2016.

While Table 3-1 does illustrate variation in deemed savings among each source for each given measure, much of this variation reflects different in-service rate assumptions. Also of note is that the Ohio TRM does not differentiate parameter assumptions between bathroom and kitchen faucet aerators (the Ohio TRM varies savings only on flow rate). For this reason, the evaluation team ultimately used assumptions outlined by the Indiana and Pennsylvania TRMs (see section 3.4.4) to capture different usage patterns between each aerator location.

3.3 Sampling Plan and Achievement

To provide representative results and meet program evaluation goals, a sampling plan was created to guide all evaluation activity. A random sample was created to target 90/10 confidence and precision at the program level, assuming a coefficient of variation (C_v) equal to 0.5. After reviewing the program database, the evaluation team identified a population of 6,463 participants within our defined evaluation period.

Based on the population of 6,463 participants, the evaluation team established sub-sample frames for phone and web-based survey administration. As illustrated in Table 3-2 below, we completed a total of 167 surveys. This sample size resulted in an achieved confidence and precision of 90/6.3.

Table 3-2: DEO NTC Impact Sampling

Survey Mode	Population*	Sampled Participants	Achieved Confidence/ Precisions**
Phone	2,084	72	90/6.3
Web-based	3,503	95	
Total	**5,587**	**167**	

*Sampling population represents participants not flagged as "do not contact"
**Based on full population of 6,463 participants

3.4 Description of Analysis

3.4.1 Telephone and web-based surveys

The evaluation team performed telephone and web-based surveys to gain key pieces of information used in the savings calculations. Results of the 167 completed surveys were used to inform our program-wide assumptions as detailed in Table 3-3.

Table 3-3: Participant Data Collected and Used for Analysis

Measure	Data Collected	Assumption
9 Watt LEDs Nightlight	Units Installed	In-Service Rate
	Units Later Removed	
	Room Where Installed	Hours of Use
	Original Lamp Removed	Baseline Wattage
1.5 GPM Showerhead 1.0 GPM Bathroom Faucet Aerator 1.5 GPM Kitchen Faucet Aerator	Units Installed	In-Service Rate
	Units Later Removed	
	Hot Water Fuel Type	% Electric DHW
Water Temperature Gauge Card	Gauge Cards Used	In-Service Rate
	Thermostats Reverted	
	Hot Water Fuel Type	% Electric DHW
Outlet Insulating Gaskets	Units Installed	In-Service Rate
	Units Later Removed	

3.4.2 In-Service Rate

The in-service rate (ISR) represents the ratio of equipment installed and operable to the total pieces of equipment distributed and eligible for installation. For example, if 15 telephone surveys were completed for customers receiving 1 LED each, and five customers reported to still have the LED installed and operable, the ISR for this measure would be five out of 15 or 33%. In some instances equipment was installed but may have been removed later due to homeowner preferences. In these cases the equipment is no longer operable and therefore contributes negatively to the ISR. In-service rates for each measure from all 167 eligible survey respondents are detailed in Table 3-4.

Table 3-4: DEO NTC In-Service Rates

Measure	Distributed	Installed	Removed	ISR
9 Watt LEDs[1]	334	267	3	79%
Nightlight	167	139	7	79%
1.5 GPM Showerhead	167	70	5	39%
1.0 GPM Bathroom Faucet Aerator	167	49	3	28%
1.5 GPM Kitchen Faucet Aerator	167	48	3	27%
Water Temperature Gauge Card	167	38	0	23%
Outlet Insulating Gaskets[2]	2,004	351	2	17%

[1]Note that two 9 watt LEDs were included in each kit.

[2]Note that 12 outlet insulating gaskets were included in each kit. The evaluation team calculated the ISR based on the total count of equipment distributed and installed.

3.4.3 Lighting

The two lighting measures in the kit include a 9W LED and an LED nightlight. Equation 3-1 and Equation 3-2 outline the algorithms utilized to estimate savings accrued by the lighting measures, with key parameters defined in Table 3-5.

Equation 3-1: Lighting Measures Energy Savings

$$\Delta kWh = \frac{Watts_{BASE} - Watts_{EE}}{1000\frac{W}{kW}} \times HOU \times (1 + IE_{kWh}) \times 365.25\frac{days}{year} \times ISR$$

Equation 3-2: Lighting Measures Demand Savings

$$\Delta kW = \frac{Watts_{BASE} - Watts_{EE}}{1000\frac{W}{kW}} \times CF \times (1 + IE_{kW}) \times IS$$

Table 3-5: Inputs for Lighting Measures Savings Calculations

Input	Units	Value	Source
$Watts_{BASE}$	Watts	LED: 39.6 Nightlight: 3.1	LED: Federal minimum standards; Survey responses Nightlight: Survey responses
$Watts_{EE}$	Watts	LED: 9 Nightlight: 0.03	Equipment specifications
HOU	Hours	LED: 2.7 Nightlight: 12	Duke Energy Ohio 2017 Residential LED Hours of Use Study;Tennessee Valley Authority 2016 TRM; Survey responses; Equipment specifications
CF	N/A	LED: 0.10 Nightlight: 0.00	LED: Duke Energy Ohio 2017 Residential LED Hours of Use Study Nightlight: Pennsylvannia 2016 TRM
IE_{kWh}	N/A	+7%	Ohio 2010 TRM
IE_{kW}	N/A	+21%	Ohio 2010 TRM
ISR	N/A	LED: 79% Nightlight: 79%	Survey responses

The evaluation team paid careful attention to the effects of the Energy Independence and Security Act (EISA), which mandated higher-efficiency technologies for incandescent bulbs. In the analysis of LED bulbs, the evaluation team used participant-reported lamp types and assigned the EISA-compliant bulb that would produce the same lumen output as the 9W LEDs from the kits. This resulted in the use of a 53W baseline for halogen lamps, a 43W baseline for incandescent and CFLs, and a 9W baseline for LEDs. Nightlights, however, are not affected by EISA, and as such were evaluated using a baseline wattage dependent on what the participant specified as the removed lamp.

Hours of use (HOU) for LED lighting was based mainly on the Duke Energy Ohio 2017 Residential LED Hours of Use Study, which estimated hours of use for 9 different room types. Two additional room types, den and garage, were not included in the DEO Residential LED Hours of Use Study, but were added from the Tennessee Valley Authority 2016 TRM. Based on installation locations from survey responses the evaluation estimated an average lighting hours of use of 2.69.

Using the engineering algorithm and assumptions described above, we determined the gross energy and demand savings value for each lighting measure provided in the kit as summarized in Table 3-6.

Table 3-6: DEO NTC Energy Savings, Lighting Measures

Kit Measure	Gross per kit energy savings (kWh)	Gross per kit demand savings (kW)
9W LED*	50.9	0.006
Nightlight	11.5	0.000

*Reflects savings for two 9 watt LEDs bulbs

3.4.4 Water Heating

The four water heating measures in the kit include a low-flow kitchen faucet aerator, a low-flow bathroom faucet aerator, a low-flow showerhead, and a water temperature gauge card which encouraged participants to set back their hot water heater thermostats. The equations below outline the algorithms utilized to estimate savings accrued by the domestic water heating measures with parameters defined in Table 3-7.

Equation 3-3: Aerator Energy Savings

$$\Delta kWh = ISR \times ELEC \times \left[\frac{\Delta GPM \times T_{person/day} \times N_{persons} \times 365 \frac{days}{year} \times DF \times \Delta T \times 8.3 \frac{BTU}{gal \cdot {}^{\circ}F}}{\#_{faucets} \times 3{,}412 \frac{BTU}{kWh} \times RE} \right]$$

Equation 3-4: Showerhead Energy Savings

$$\Delta kWh = ISR \times ELEC \times \left[\frac{\Delta GPM \times T_{person/day} \times N_{persons} \times 365 \frac{days}{year} \times N_{showers-day} \times \Delta T \times 8.3 \frac{BTU}{gal \cdot {}^{\circ}F}}{\#_{showers} \times 3{,}412 \frac{BTU}{kWh} \times RE} \right]$$

Equation 3-5: Water Heater Setback Energy Savings

$$\Delta kWh = ISR \times ELEC \times \left[\frac{A_{tank} \times \Delta T \times 8760 \frac{hrs}{yr}}{R_{tank} \times RE \times 3{,}412 \frac{Btu}{kWh}} + \frac{V_{HW} \times \left(8.3 \frac{lb}{gal}\right) \times \left(365 \frac{days}{yr}\right) \times \left(1 \frac{Btu}{{}^{\circ}F \cdot lb}\right) \times \Delta T}{\left(3412 \frac{Btu}{kWh}\right) \times EF_{WH}} \right]$$

Equation 3-6: Water Heating Measures Demand Savings

$$\Delta kW = ETDF \times \Delta kWh$$

Table 3-7: Inputs for Water Heating Measures Savings Calculations

Input	Units	Value	Source
ISR	N/A	Bath: 28% Kitchen: 27% Shower: 39% Setback: 23%	Survey responses
ELEC	N/A	Bath: 42% Kitchen: 47% Shower: 45% Setback: 38%	Survey responses
ΔGPM	GPM	Bath: 1.2 Kitchen: 0.7 Shower: 1.0	Product specification sheet compared against federal code minimum
$T_{person/day}$	Minutes	Bath: 1.6 Kitchen: 4.5 Shower: 7.8	Indiana 2016 TRM
$N_{persons}$	Persons	Bath: 4.2 Kitchen: 3.7 Shower: 4.2	Survey responses
$N_{showers\text{-}day}$	Showers per Day	Shower: 0.6	Indiana 2016TRM
DF	N/A	Bath: 90% Kitchen: 75% Shower: 100%	Pennsylvania 2016 TRM
ΔT	°F	Bath: 22.2 Kitchen: 22.2 Shower: 43.2 Setback: 10.0	Ohio 2010 TRM; Indiana 2016 TRM
$\#_{faucets}$	Units	Bath: 2.28 Kitchen: 1.0 Shower: 2.1	Bathroom: 2013 RASS Data[1] Kitchen: Pennsylvania 2016 TRM Showerhead: Ohio 2010 TRM
ETDF	N/A	Bath: 0.00015 Kitchen: 0.000025 Shower: 0.00016	Ohio 2010 TRM; Pennsylvania 2016 TRM; Survey Responses; Ratio of calculated lighting measure demand to energy savings
RE	N/A	98%	Ohio 2010 TRM
A_{tank}	Ft^2	24.99	Pennsylvania 2016 TRM
R_{tank}	$°F \cdot ft^2 \cdot hr/BTU$	8.3	Pennsylvania 2016 TRM
V_{HW}	GPD	7.3	Pennsylvania 2016 TRM
EF_{WH}	N/A	0.904	Pennsylvania 2016 TRM

[1] Duke Energy 2013 Residential Appliance Saturation Survey. Ohio respondents.

The evaluation team determined that the 2016 Indiana and Pennsylvania's TRM provided the most applicable and rigorous algorithm by including factors such as standby losses and water volume savings, differentiating between kitchen and bathroom water use, and more comprehensive algorithms. Where the Ohio 2010 TRM made appropriate distinctions, the evaluation team used the Ohio TRM parameter assumptions due to its geographic relevance to the DEO territory. However, where the Ohio TRM lacked granularity, the evaluation team elected to use the Indiana or Pennsylvania TRM as the secondary data source for estimating savings.

Using the applicable engineering algorithm and assumptions described above, the gross energy and demand savings value were estimated for each domestic hot water measure provided in the kit as summarized in Table 3-8.

Table 3-8: DEO NTC Gross Energy Savings, Water Heating Measures

Kit Measure	Gross per unit energy savings (kWh)	Gross per unit energy savings (kW)
1.5 GPM Showerhead	63.9	0.010
1.0 GPM Bathroom Faucet Aerator	7.3	0.001
1.5 GPM Kitchen Faucet Aerator	22.5	0.001
Water Temperature Gauge Card	13.9	0.002

3.4.5 Air Infiltration

Equation 3-7 and Equation 3-8 outline the algorithms utilized to estimate savings accrued by the outlet insulating gaskets. The parameters are defined in Table 3-9.

Equation 3-7: Air Infiltration Energy Savings

$$\Delta kWh = ISR \times exterior\ to\ interior\ wall\ adjustment\ factor \times gaskets \times \frac{\Delta CFM}{gasket} \times \frac{kWh}{CFM}$$

Equation 3-8: Air Infiltration Demand Savings

$$\Delta kW = \frac{\Delta kWh}{8{,}760}$$

Table 3-9: Inputs for Air Infiltration Measures Savings Calculations

Input	Units	Value	Source
ISR	N/A	17.4%	Survey responses
Exterior to Interior Wall Adjustment Factor*	%	0.31	National Association of Home Builders[1]
Gaskets per kit	N/A	12	Duke Energy Kit Materials
ΔCFM/gasket	CFM	.307	2015 DEK NEED Evaluation Final Report
kWh/CFM	kWh/CFM	22.76	2016 Duke Energy Progress RASS Data, 2008 DEK NEED Evaluation Final Report

*The exterior to interior wall adjustment factor takes into consideration that only outlet gaskets installed on exterior walls achieve enegy savings since infiltration reductions only occur in areas that communicate directly with unconditioned space.[3]

[1]Derived from Table 4 of the National Associations of Builders report, "Spaces in New Homes." October 1, 2013.

Since very few regional or national studies exist that document outlet gasket savings this analysis used parameters estimated from a prior evaluation of the Energy Efficiency Education in Schools program conducted in the Duke Energy Kentucky service territory. This previous evaluation estimated reduction in infiltration as a factor of cubic feet per minute (CFM) due to the installation of a gasket. We also considered the previous evaluation's modeled energy savings for reduced infiltration and calibrated the savings value based on the saturation of heating and cooling equipment technologies reported in Duke Energy's 2016 residential appliance saturation study to ensure the savings value represented the NTC program participants. All Ohio responses recorded in the saturation study were used for model calibration.

Using the engineering algorithm described above, we determined the gross energy and demand savings value for outlet insulating gaskets provided in the kit as summarized in Table 3-10.

Table 3-10: DEO NTC Gross Energy Savings, Air Infiltration Measures

Kit Measure	Gross per kit energy savings (kWh)	Gross per kit energy savings (kW)
Outlet Gaskets*	4.5	0.001

*Reflects savings for the 12 outlet gaskets per kit

[3] CL&P and UI Program Savings Documentation, Connecticut Light & Power, Program Year 2008.

3.4.6 Behavioral Analysis

Similarly to how we conducted the impact evaluation of the actual kit measures, the evaluation team estimated the behavioral impacts using the results of the completed surveys in conjunction with engineering algorithms. The survey contained the following questions from which we gauged what sort of behavioral changes were induced by the kit:

- Since your child learned about energy conservation at school and signed up for your energy kit from Duke Energy, what new behaviors has your child adopted to help save energy in your home?
- Since receiving your energy kit from Duke Energy, what new behaviors have you adopted to help save energy in your home?

Survey participants were encouraged to answer as an open-response, rather than choosing behaviors from a list. The typical responses included turning off lights when not in a room, turning off electronics when not in use, taking shorter showers, turning off water when brushing teeth or washing hands, turning off heating and air conditioning when not home, changing thermostat settings, and using fans instead of air conditioning.

The evaluation team estimated the initial impacts of these behavioral changes for the proportion of participants who confirmed taking action (i.e., the in-service rate for the behavioral change) using engineering algorithms similar to those algorithms used to estimate the impacts of the kit measures. We then adjusted these initial savings according to the results of some key survey questions such as:

- 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 your decision to make changes in your energy using behaviors?
- Did you read the information about how to save energy in the booklet that came in the kit?
- During the school year, did you receive any Home Energy Reports from Duke Energy?

The savings calculation methodologies and adjustment factors are detailed in the following subsections.

3.4.6.1 Adjustment factors

Several adjustments were made to the initial calculated savings associated with each behavior to more accurately reflect the extent to which the behaviors were a result of the energy saving kit.

In-Service Rate (ISR)

Similar to kit measure ISRs, the behavioral ISR reflects what percentage of the known population is expected to have adopted this behavior. Separate ISR values were calculated for parent and children adoption rates, which are summarized in Table 3-11.

Table 3-11: Behavioral Savings In-Service Rates

Behavior	Child Adoption Rate	Parent Adoption Rate
Turn off lights	45%	16%
Turn off electronics	19%	10%
Take shorter showers	15%	10%
Turn off heat / CAC	N/A	11% / 13%
Change thermostat settings	N/A	7%
Use fans instead of CAC	N/A	22%

Kit Influence

We then adjusted the savings by how the level of reported influence the kit had on each respondent's behavioral changes. Participants were asked to rate how heavily the kit influenced their behavioral changes on a scale of 0 to 10. The kit influence adjustment factor was set at the weighted average of participant responses as shown in Table 3-12.

Table 3-12: Behavioral Savings Kit Influence Adjustment Factor

Influence Score	Response Rate
0	0.9%
1	0.0%
2	2.7%
3	1.8%
4	2.7%
5	3.5%
6	8.8%
7	16.8%
8	23.0%
9	8.8%
10	31.0%
Weighted	**78%**

Kit Informational Materials

The energy saving kit came with some literature on various other ways participants could save energy in their homes. While participants did self-report the level of influence the kit had on their decision, many respondents who claimed to be influenced by the program also responded that they did not read the kit informational materials, which seems counterintuitive. Nexant used the kit informational materials adjustment factor to correct for apparent bias in the self-reported answers on kit influence. Nexant found that 113 out of 167 respondents read the provided literature and set the adjustment factor at 68%.

MyHER Program Overlap

Duke Energy runs a simultaneous behavioral-based energy saving program in which participants elect to receive regular My Home Energy Reports (MyHER). The report summarizes a customer's consumption and benchmarks it against other energy users of similar home characteristics and demographics. The goal of the program is to influence participants to change their energy consumption habits through increased knowledge.

Participation in the MyHER program does not exclude customers from also receiving the kit from this NTC program. Because of this, the evaluation team used the MyHER program overlap adjustment factor to adjust the behavioral savings to account for the percentage of influence that came from the alternate MyHER program. Based on survey results regarding the MyHER program participation and influence, we estimated the overlap to be 13%, and set the adjustment factor at 87%[4].

Persistence

While behavioral changes designed to increase energy efficiency or conservation can result in immediate impacts, the initial activity is expected to wane in the absence of consistent intervention. This decay of energy savings resulting from a change in behavior has been carefully documented through random control trials of Home Energy Report programs such as Duke Energy's MyHER program or program's implemented in other jurisdictions by Oracle (formally Opower). The rate at which energy savings persists after a customer receives a report depends on the frequency and longevity that a customer receives follow-up reports.

Because the kit provides information to educate and encourage participants to reduce their energy impacts, the evaluation team felt it was prudent to estimate a persistence rate based on this one-time exposure. We relied on a literature review to estimate how savings may persist based on the NTC program design. Typical persistence rates for Home Energy Report programs ranges from 80% - 90%, i.e., a participant's estimated savings from behavioral changes is expected to decay approximately 10% - 20% per year if no more Home Energy Reports are provided. This persistence rate is based on two consecutive years of receiving monthly reports. However, if a participant receives minimal follow-up after the initial report, the persistence of any initial behavioral impacts is expected to dissipate rapidly. Because participants in the NTC program are treated only once with regard to behavioral changes, the evaluation team estimated a persistence rate of 28%[5]. This estimate is based on research which

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[4] Based on survey responses, the evaluation team found that approximately 34% of respondents reported receiving a report from the MyHER program. Of those respondents, 93% affirmed reading the report; however, only 43% claimed to have taken a behavioral action to increase their energy conservation.

[5] The persistence rate is calculated based on the ratio of the daily estimated savings impact (0.114 kWh) to the the daily rate of decay of savings (0.409 kWh). This ratio is 28%.

modeled the persistence of customers who received four quarterly Home Energy Reports after which treatment was ceased[6]. For this evaluation, we calculated the persistence rate as the ratio of the expected average behavioral savings per day (0.114 kWh) to the decay coefficient (0.409 kWh) associated with customers receiving four quarterly reports. Therefore, it is expected the initial impact generated from behavioral changes in the NTC program would fully dissipate approximately three to four months after receiving the kit.

Adjustment Factor Summary

Table 3-13 below provides the adjustment factors which are applied to the behavioral savings described in Section 3.4.6.2.

Table 3-13: Behavorial Savings Adjustment Factors

Adjustment Factor	Percent
In-service rate	Varies by measure
Kit influence	78%
Kit informational materials	68%
MyHER program overlap	87%
Persistence	28%

3.4.6.2 Behavioral Savings Calculations

Turn off lights

The evaluation team calculated the savings associated with the behavior of turning off lights after exiting a room by estimating the likely reduction in lighting operating hours. The reduction in hours was used in lieu of the hours of use term in the standard lighting equations (Equation 3-1 and Equation 3-2) as illustrated in Equation 3-9 and Equation 3-10.

Equation 3-9: Turn Off Lights Energy Savings

$$\Delta kWh = \frac{Watts_{BASE}}{1000\frac{W}{kW}} \times HOU_{reduced} \times (1 + IE_{kWh}) \times 365.25\frac{days}{year} \times Adj.Factors$$

Equation 3-10: Turn Off Lights Demand Savings

$$\Delta kW = ETDF * kWh\ savings \times Adj.Factors$$

The calculations assumed the wattage of the lamps associated with the reported behavioral change was equivalent to the average reported baseline lamp wattage found in the lighting

[6] Allcott, H, Rogers, T., The Short-Run and Long-Run Effects of Behavioral Interventions: Experimental Evidence from Energy Conservation. American Economic Review 2014, 104(10): 3003-3037.

analysis of 39.6 watts.. The hours of use term in the standard lighting equations relied on survey responses as to where the light bulbs were installed. Each possible room within the home had an associated daily hours of use as provided by the DEO 2017 Residential LED Lighting Hours of Use Study and the TVA 2016 TRM. The likely reduction in operating hours was determined by calculating each possible difference in lighting hours between room types (e.g. the difference in the living room HOU and the dining room HOU) as shown below in Figure 3-1.

Figure 3-1: Calculation of Likely Lighting HOU Reduction

Possible Reduction in Hours		Living Room	Dining Room	Bedroom	Kitchen	Bathroom	Den	Hallway	Basement
		3.17	**3.39**	**1.91**	**4.33**	**1.40**	**2.30**	**1.50**	**2.88**
Living Room	**3.17**	0.00	0.22	0.00	1.16	0.00	0.00	0.00	0.00
Dining Room	**3.39**	0.00	0.00	0.00	0.94	0.00	0.00	0.00	0.00
Bedroom	**1.91**	1.26	1.48	0.00	2.42	0.00	0.39	0.00	0.97
Kitchen	**4.33**	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Bathroom	**1.40**	1.77	1.99	0.51	2.93	0.00	0.90	0.10	1.48
Den	**2.30**	0.87	1.09	0.00	2.03	0.00	0.00	0.00	0.58
Hallway	**1.50**	1.67	1.89	0.41	2.83	0.00	0.80	0.00	1.38
Basement	**2.88**	0.29	0.51	0.00	1.45	0.00	0.00	0.00	0.00
Outdoors	**4.40**	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Don't Know	**1.93**	1.24	1.46	0.00	2.40	0.00	0.37	0.00	0.95

The evaluation team calculated the likely reduction in daily runtime to be 0.59 hours, or 214 hours annually. The savings were calculated and adjusted based on this key assumption.

Energy savings were calculated at 9.1 kWh (before applying adjustment factors). Because this behavioral change was completed by both children and parents, we applied adjustment factors and calculated adjusted savings separately for children and parents using their respective ISR. The parameter inputs and final savings are detailed in Table 3-14.

Table 3-14: Behavioral Savings Achieved by Turning off Lights (per home)

Input	Units	Value	Source	
Watts	Watts	39.6	Federal minimum standards	
$HOU_{Reduced}$	Hours	0.59	DEO 2017 Residential LED Lighting Hours of Use Study; Tennessee Valley Authority 2016 TRM	
IE_{kWh}	N/A	7%	Ohio 2010 TRM	
Energy to Demand Factor (ETDF)	N/A	0.00012	Ohio 2010 TRM; DEO 2017 Residential LED Lighting Hours of Use Study; Survey Responses; Ratio of calculated lighting measure demand to energy savings	
Energy Savings	**kWh**	**9.1**	**Calculated from algorithm**	
Demand Savings	**kW**	**0.001**	**Calculated from algorithm**	
Adjustment Factors				
ISR	Influence	MyHER	Kit Info.	Persistence
Child: 45% Parent: 16%	78%	87%	68%	28%
			Savings from child behavior:	**0.5 kWh; 0.0001 kW**
			Savings from parent behavior:	**0.2 kWh; 0.000 kW**
			Total Energy Savings:	**0.7 kWh**
			Total Demand Savings:	**0.0001 kW**

Turn off electronics

The evaluation team used evaluations for "Smart Strips" or "Controlled Power Strips" in order to estimate savings achieved by turning off electronics when not in use. Smart strips are multi-plug power strips with the ability to automatically disconnect specific connected loads depending upon the power draw of a control load which is also plugged into the strip. Power is disconnected from the controlled outlets when the control load power draw is reduced below a certain adjustable threshold, thus turning off all accompanying appliances plugged into the strip.

We researched current studies on smart strip savings (summarized in Table 3-15) and used the average value as the calculated savings amount for this behavioral change.

Table 3-15: Smart Strip Savings

Source	Savings (kWh)
Ameren Missouri Evaluation	52.00
Duke Energy Potential Study	74.46
Illinois 2016 TRM	79.75
Mid-Atlantic 2016 TRM	47.4
Pennsylvania 2016 TRM	61.05
Average	**62.93**

The demand savings were calculated from the energy savings using an assumed hours of use value of 7,300 and an assumed coincidence factor of 90%, both from the Pennsylvania 2016 TRM. Equation 3-11 and Equation 3-12 present the algorithms used to calculate energy and demand savings for the behavior change of turning off electronics.

Equation 3-11: Turn Off Electronics Energy Savings

$$\Delta kWh = Average\ of\ deemed\ savings \times Adj.Factors$$

Equation 3-12: Turn Off Electronics Demand Savings

$$\Delta kW = kWh\ savings/HOU \times CF \times Adj.Factors$$

Energy savings (before applying adjustment factors) were calculated at 62.9 kWh. Because this behavioral change was completed by both children and parents, we applied adjustment factors and calculated adjusted savings separately for children and parents using their respective ISR. The final savings are detailed in Table 3-16.

Table 3-16: Behavioral Savings Achieved by Turning off Electronics

Input	Units	Value	Source	
Coincidence factor (CF)	N/A	0.9	Pennsylvania 2016 TRM	
HOU	hours	7,300	Pennsylvania 2016 TRM	
Energy Savings	**kWh**	**62.9**	**Average of TRMs and prior studies (see Table 3-15)**	
Demand Savings	**kW**	**0.008**	**Calculated from algorithm**	
ISR	**Influence**	**MyHER**	**Kit Info.**	**Persistence**
Child: 19% Parent: 10%	78%	87%	68%	28%
			Savings from child behavior:	**1.5 kWh; 0.0002 kW**
			Savings from parent behavior:	**0.8 kWh; 0.0001 kW**
			Total Energy Savings:	**2.3 kWh**
			Total Demand Savings:	**0.0003 kW**

Take shorter showers

To determine savings achieved by a reduction in shower time, the evaluation team estimated how much time could be reduced based on actual shower length data. To do this, we utilized data provided by Aquacraft's 2011 Analysis of Water Use in New Single-Family Homes[7] (summarized in left two columns of Table 3-17.

We set the target shower length equal to the typical length used in national energy efficiency evaluations (7.8 to 8.4 minutes[8]) and calculated how much opportunity existed in the data for people to reduce their shower times to the national average. Energy and demand savings were calculated based on Equation 3-13 and Equation 3-14, respectively.

Equation 3-13: Take Shorter Shower Energy Savings

$$\Delta kWh = ELEC \times GPM_{retrofit} \times T_{person/day} \times N_{showers-day} \times 365\frac{days}{year} \times \left[\frac{\Delta T \times 8.33\frac{BTU}{gal \cdot {}^{\circ}F}}{3,412\frac{BTU}{kWh} \times RE}\right] \times Adj.Factors$$

Equation 3-14: Take Shorter Shower Demand Savings

$$\Delta kW = ETDF \times Energy\ Savings \times Adj.Factors$$

[7] http://www.aquacraft.com/wp-content/uploads/2015/10/Analysis-of-Water-Use-in-New-Single-Family-Homes.pdf

[8] Based on reported shower times from 2016 Indiana TRM, 2015 Illinois TRM, 2012 TVA Saturation Survey, 2015 Maine TRM, and the 2016 Pennsylvania TRM.

Table 3-17: Reduction in Shower Time Data and Calculation

Shower Length (minutes)	Responses	Possible Reduction (minutes)
2	0%	-
4	2%	-
6	17%	-
8	35%	GOAL
10	24%	2
12	14%	4
14	4%	6
16	2%	8
18	0%	10
20	1%	12
	Weighted Average	**3.47**

We calculated the likely reduction in shower length to be 3.47 minutes per shower, or 12.7 hours per person annually. The savings were calculated and adjusted based on this key assumption as detailed in Table 3-18.

Table 3-18: Behavioral Savings Achieved by Taking Shorter Showers

Input	Units	Value	Source	
GPM	GPM	1.88	Survey responses, Federal minimum standards	
$T_{person/day}$	Minutes	3.47	Aquacraft 2011 Report	
$N_{persons/day}$	Showers/Person/Day	0.6	Indiana 2016 TRM	
365	Days/Year	365	-	
ΔT	°F	43.2	Indiana 2016 TRM; Ohio 2010 TRM	
ELEC	%	43%	Duke Energy 2016 RASS Data	
RE	N/A	98%	Ohio 2010 TRM	
Energy to Demand Factor (ETDF)	N/A	0.00016	Ohio 2010 TRM; Pennsylvania 2016 TRM; Survey Responses; Ratio of calculated lighting measure demand to energy savings	
Energy Savings	**kWh**	**65.8**	**Calculated**	
Demand Savings	**kW**	**0.010**	**Calculated**	
ISR	**Influence**	**MyHER**	**Kit Info.**	**Persistence**
15% (Child) 10% (Parent)	78%	87%	68%	28%
			Savings from child behavior:	**1.3 kWh; 0.0002 kW**
			Savings from parent behavior:	**0.8 kWh; 0.0001kW**
			Total Energy Savings:	**2.1 kWh**
			Total Demand Savings:	**0.0003 kW**

Turn off furnace or central air conditioner (CAC) or use fan instead of CAC

To emulate the impacts of the behavior of customers who turned off the heating or cooling mode of their HVAC system, the evaluation team used the effects of a smart thermostat as a proxy. A smart thermostat is a Wi-Fi enabled programmable thermostat that typically includes multiple functionalities that allow for a reduction in energy use. Most notably the devices are a part of the home's network and regularly check to see what other items are connected to the network as well as utilize motion detectors. In the event that no users are actively connected to the home's network and minimal movement is detected, the thermostat will go into auto away mode. Given this functionality, the evaluation team believes this measure to be an appropriate proxy for the behavior observed by participants of turning off their furnace or air conditioner.

Equation 3-15 and Equation 3-16 present the algorithms used to calculate energy savings for reduced cooling and heating loads. Demand savings were deemed as zero based on assumptions provided in multiple TRMs including the 2016 Indiana TRM and 2016 Pennsylvania.

Equation 3-15: Turn off CAC or use fan mode energy savings algorithm

$$\Delta kWh_{cool} = EUI_{cool} \times Area \times Tstat_{cool} \times Adj.Factors$$

Equation 3-16: Turn off furnace energy savings algorithm

$$\boldsymbol{\Delta kWh_{heat} = EUI_{heat} \times Area \times Tstat_{heat} \times ELEC \times Adj.Factors}$$

The evaluation team researched current studies on smart thermostat savings (summarized in Table 3-19). The baseline for all selected studies was a manual mercury thermostat. The median savings observed in the data was then applied to the annual electric heating and cooling consumption for homes in Ohio as provided in the US Energy Information Administration's 2009 Residential Energy Consumption Survey (RECS).

Table 3-19: Smart Thermostat Savings

Study Location	Cooling Savings	Heating Savings
Vectren Indiana[1]	13.9%	12.5%
NIPSCO[2]	16.1%	13.4%
National Grid[3]	10%	N/A
Median	**13.9%**	**13.0%**

[1] Evaluation of 2013–2014 Programmable and Smart Thermostat Program for Vectren Corporation. The Cadmus Group, January 2015

[2] Evaluation of the 2013–2014 Programmable and Smart Thermostat Program for Northern Indiana Public Service Company. The Cadmus Group, January 2015

[3] Evaluation of 2013- 2014 Smart Thermostat Pilots: Home Energy Monitoring, Automatic Temperature Control, Demand Response. The Cadmus Group, July 2015

The calculated savings for turning off the air conditioning and for using fans instead of air conditioning are based on the cooling savings only, while the calculated savings for turning off the furnace is based on the heating savings only. We calculated and adjusted savings based on the key assumptions as detailed in Table 3-20 and Table 3-21.

Table 3-20: Behavioral Savings Achieved by Changing AC Use Patterns

Input	Units	Value	Source	
Cooling Energy Use Intensity (EUI_{cool})	kWh/ft^2	0.5612	2009 RECS Data, Ohio and Indiana	
Average Cooled Area ($Area_{cool}$)	ft^2	1,343	2009 RECS Data, Ohio and Indiana	
T-stat $savings_{cool}$	%	13.9%	Multiple Smart Thermostat Studies as noted above	
Energy Savings	**kWh**	**104.8**	**Calculated**	
Demand Savings	**kW**	**0.000**	**Deemed**	
Turning off Air Conditioning when Not Home				
ISR	**Influence**	**MyHER**	**Kit Info.**	**Persistence**
13%	78%	87%	68%	28%
			Total Energy Savings:	**1.7 kWh**
			Total Demand Savings:	**0.000 kW**
Using Fans Instead of Air Conditioning				
ISR	**Influence**	**MyHER**	**Kit Info.**	**Persistence**
22%	78%	87%	68%	28%
			Total Energy Savings:	**2.9 kWh**
			Total Demand Savings:	**0.000 kW**

Table 3-21: Behavioral Savings Achieved by Changing Heating Use Patterns

Input	Units	Value	Source	
Heating Energy Use Intensity	kWh/ft^2	0.6465	2009 RECS Data, Ohio and Indiana	
Average Heated Area	ft^2	1,943	2009 RECS Data, Ohio and Indiana	
Savings	%	13.0%	Multiple Smart Thermostat Studies as noted above	
ELEC	%	45%	Duke Energy 2016 RASS Data	
Energy Savings	**kWh**	**73.8**	**Calculated**	
Demand Savings	**kW**	**0.000**	**Deemed**	
ISR	**Influence**	**MyHER**	**Kit Info.**	**Persistence**
11%	78%	87%	68%	28%
			Total Energy Savings:	**1.0 kWh**
			Total Demand Savings:	**0.000 kW**

Adjust thermostat set points

The evaluation team again relied on current smart thermostat studies to estimate the savings achieved by adjusting thermostat set points. An additional function of smart thermostats is their ability to learn set points by trending regular changes made by the user in a trial period following installation. The evaluation team believes this increased precision in thermostat set points to be analogous to the behavioral change analyzed here.

Equation 3-17 presents the algorithm used to calculate energy savings for reduced cooling and heating loads. Demand savings were deemed as zero based on assumptions provided in multiple TRMs including the 2016 Indiana TRM and 2016 Pennsylvania.

Equation 3-17: Adjust thermostat set points energy savings algorithm

$$\Delta kWh_{cool} = (EUI_{cool} \times Area \times Tstat_{cool}) + (EUI_{heat} \times Area \times Tstat_{heat} \times ELEC) \times Adj.Factors$$

In our review of smart thermostat data, we also explored studies with mixed baselines (manual and programmable thermostats) in order to better isolate the impact of set point adjustments as opposed to the auto-away function. The sources and their associated savings are detailed in Table 3-22.

Table 3-22: Smart Thermostat Savings

Study Location	Cooling Savings	Heating Savings
Vectren Corporation[1]	N/A	5.0%
NIPSCO[2]	N/A	7.8%
Xcel Energy[3]	4.6%	N/A
Commonwealth Edison[4]	4.8%	6.7%
Median	**4.7%**	**6.7%**

[1] Evaluation of 2013–2014 Programmable and Smart Thermostat Program for Vectren Corporation. The Cadmus Group, January 2015

[2] Evaluation of the 2013–2014 Programmable and Smart Thermostat Program for Northern Indiana Public Service Company. The Cadmus Group, November 2014

[3] In-Home Smart Device Pilot. Public Service Company of Colorado. EnerNOC, Inc., April, 2014

[4] Commonwealth Edison Residential Smart Thermostats. Navigant Consulting, February 2016

The savings were calculated and adjusted based on these key assumptions as detailed in Table 3-23.

Table 3-23: Behavioral Savings Achieved by Changing Thermostat Settings

Input	Units	Value	Source	
Heating Energy Use Intensity	kWh/ft^2	0.6465	2009 RECS Data, Ohio and Indiana	
Average Heated Area	ft^2	1,943	2009 RECS Data, Ohio and Indiana	
ELEC	%	45%	Duke Energy 2016 RASS Data	
Heating Savings	%	6.7%	Multiple Smart Thermostat Studies as noted above	
Cooling Energy Use Intensity	kWh/ft^2	0.5612	2009 RECS Data, Ohio and Indiana	
Average Cooled Area	ft^2	1,343	2009 RECS Data, Ohio and Indiana	
Savings	%	4.7%	Multiple Smart Thermostat Studies as noted above	
Energy Savings	**kWh**	**73.6**	**Calculated**	
Demand Savings	**kW**	**0.000**	**Calculated**	
ISR	**Influence**	**MyHER**	**Kit Info.**	**Persistence**
7%	79%	87%	68%	28%
			Total Energy Savings:	**0.7 kWh**
			Total Demand Savings:	**0.000 kW**

Summary of behavioral impacts

Table 3-24 below presents the total energy savings derived from the behavioral component of the program.

Table 3-24: Energy savings from behavioral impacts

Behavior	kWh savings
Turn off lights	0.7
Turn off electronics	2.3
Take shorter showers	2.1
Turn off furnace	1.0
Turn off AC	1.7
Use fan mode	2.9
Adjust thermostat set points	0.7
Total	**11.5**

*Total may not sum to due to rounding

3.5 Billing Regression Analysis

While the NTC program provides participants with kits that include energy efficiency measures, the program also teaches children and families ways to conserve electricity which can lead to behavioral savings. In addition to engineering analysis, the evaluation team attempted to estimate energy savings by analyzing energy use patterns before and after participation in the NTC program – commonly referred to as billing analysis. After a thorough investigation, which is described in more detail below, we concluded that, absent a randomized control trial (RCT), billing analysis was unable to reliably detect energy savings associated with the kit or education effort. When the percent change in household energy use is small, as with the education and kit, the only reliable way to estimate energy savings using billing analysis is through a randomized control trial with large treatment and control groups and pre-and post-data. The most critical component of a well-designed RCT is to guarantee there are no differences between the treatment and control groups. This is necessary to ensure that the analysis is able to accurately estimate the counterfactual – or what would have happened absent the treatment. If inherent differences exist between the treatment group and control group, any changes in the post-treatment period could be due to these differences, rather than the treatment itself. In order to verify that effects are purely the result of the treatment intervention, the two groups must be ostensibly identical in every way except for the intervention.

Guaranteeing homogeneity between treatment and control groups is not achievable with an opt-in enrollment. The fact that one group of customers chose to enroll in the program while the other did not implies that some intrinsic difference between them does exist. These difference may include:

- Behavioral preferences or predispositions for energy efficiency measures
- Information about the program that is not accessible to non-enrollees
- Higher energy needs and therefore a greater incentive to curb their consumption

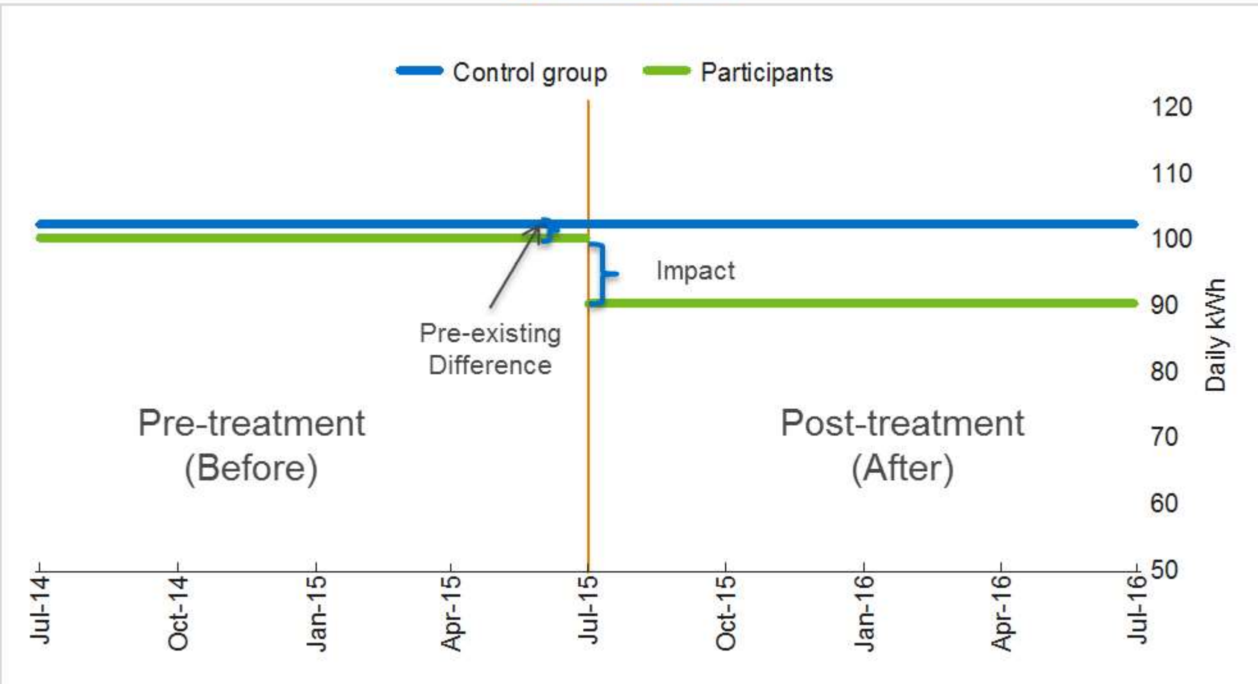
Any of these characteristics are likely to contribute to consumption responses or patterns that cannot be attributable to the program intervention. In order to be effective, a RCT includes randomly selected customers in the treatment and control groups, thereby ensuring that the analysis avoids adverse effects of selection bias and/or lurking confounding variables. Due to these variables RCTs are impractible for opt-in programs. Thus, the evaluation team's recommendation is to rely on the engineering analysis and findings as the source of the verified gross and net savings for the program. Below we discuss how we attempted to complete a billing analysis and how we ultimately determined such an analysis was not feasible.

To estimate energy savings with billing data, it is necessary to estimate what energy consumption would have occurred in the absence of NTC program —the counterfactual or baseline. To infer that the education component of the program led to energy savings, it is necessary to systematically eliminate plausible alternative explanations for differences in electricity use patterns such as random chance.

The basic framework for the analysis the evaluation team used is illustrated in Figure 3-2 and relies on both a control group and pre- and post-data. The analysis is implemented via the difference-in-differences technique which removes any pre-existing differences between the participant and the control group. If the kit and behavioral changes leads to reductions in consumption, we should observe:

- A change in consumption for households that participated in the NTC program
- No similar change for the control group
- The timing of the change should coincide with the receipt of kits

Figure 3-2: Framework for Billing Analysis with a Control Group and Pre-Post Data and Expected Results



While the NTC program did not have a randomly assigned control group, the evaluation team did develop a comparison group to use in its analysis. However, there were several key challenges to producing reliable energy savings estimates using billing analysis, which are summarized in Figure 3-3. The two challenges that could not be addressed despite the use of a comparison group were the small effect size and selection bias. On a percentage basis, the expected energy savings from each kit were less than 2% of annual household energy consumption, and therefore it proved difficult to isolate the impacts of the program from other potential explanations, including random chance. Second, households that signed up for the kit had young children that self-selected from their peers. Households with young children are typically in the growth period of a household life cycle and, thus, may have higher year-to-year energy consumption. Despite using a comparison group, it could only account for observable characteristics – pre-treatment energy use patterns, geographic location, and concurrent participation in the DEO's My Home Energy Report (MyHER) program. There was no way to identify households with young children in the comparison group without postponing the evaluation to identify future participating schools from which a comparison group could be developed. As result, while the participant and comparison group may have had similar energy use patterns in the pre-treatment period, their energy use trajectories were not necessarily the same absent program participation due to differences in the household life cycles.

Figure 3-3: Billing Analysis Evaluation Challenges

In order to assess if the billing analysis produced reliable results, we implemented a series of placebo pressure tests. The approach consisted of including fake transitions prior to actual participation in the program and assessing if the models detected an effect when using data from the fake "pre" period to estimate the counterfactual for the fake "post" period. Because the transition was fictitious and actual post periods were excluded, we knew impacts were actually zero and any estimated impacts were due to modeling error. The evaluation team used two years of pre-treatment data for the placebo test and each participant's enrollment date was faked to have occurred between three to nine months prior to actual participation, in increments of one month. The placebo tests were implemented using both a pre-post panel regression model with fixed effects and time effects (but not the comparison group) and a difference-in-differences panel regression that made use of the comparison group.

Figure 3-4 shows the results from the placebo pressure tests. Rather than produce zero impacts, the models estimated that the fake transitions led to changes in energy use when in fact no intervention had taken place. Moreover, the models incorrectly concluded that the erroneous impacts were statistically significant in several instances – an example of false precision. The pre-post model without a comparison group consistently estimated both energy savings and increases, when impacts were in fact zero. The difference-in-differences model that made use of the comparison group had less variable results, but it estimated energy increases in the range of roughly 2% when no intervention had taken place. Hence, neither method produced reliable energy savings estimates.

Figure 3-4: Placebo Pressure Test Results (Pre-Post)

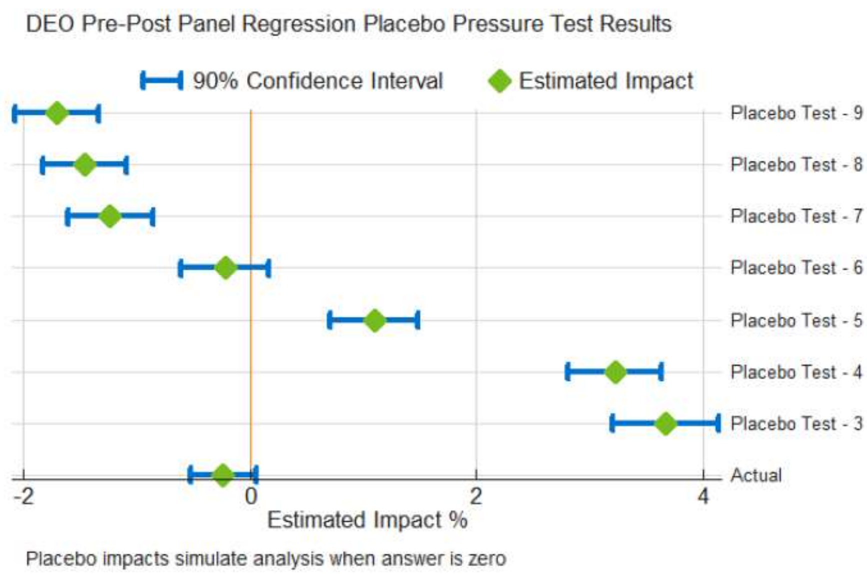
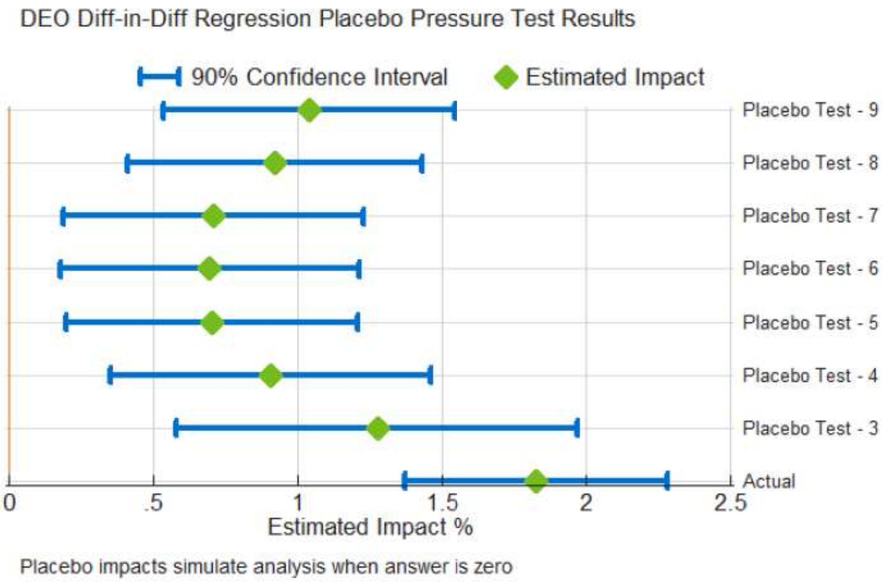


Figure 3-5: Placebo Pressure Test Results (Difference in Differences)



Appendix F provides additional detail including comparison of the program participants and comparison group.

The evaluation team's conclusion is not that there were no energy savings generated by the NTC program, but rather that billing analysis was not the correct tool for estimating the small percent energy savings from the program. Thus, the evaluation team's recommendation is to rely on the engineering analysis and findings as the source of our verified gross and net savings for the programs.

3.6 Targeted and Achieved Confidence and Precision

We developed the NTC program evaluation plan with the goal of achieving a target of 10% relative precision at the 90% confidence interval for the program as a whole. The evaluation team was able to achieve this target through the combination of web-based and phone surveys to ultimately achieve a precision of +/- 6.3% at the 90% confidence level (Table 3-25)

Table 3-25: Targeted and Achieved Confidence and Precision

Program	Targeted Confidence/Precision	Achieved Confidence/Precision
DEO NTC	90/10.0	90/6.3

3.7 Results

Measure-level and kit-level energy savings values are detailed in Figure 3-6 and

Table 3-26.

Figure 3-6: 2017-2018 DEO NTC Gross Verified Energy Savings

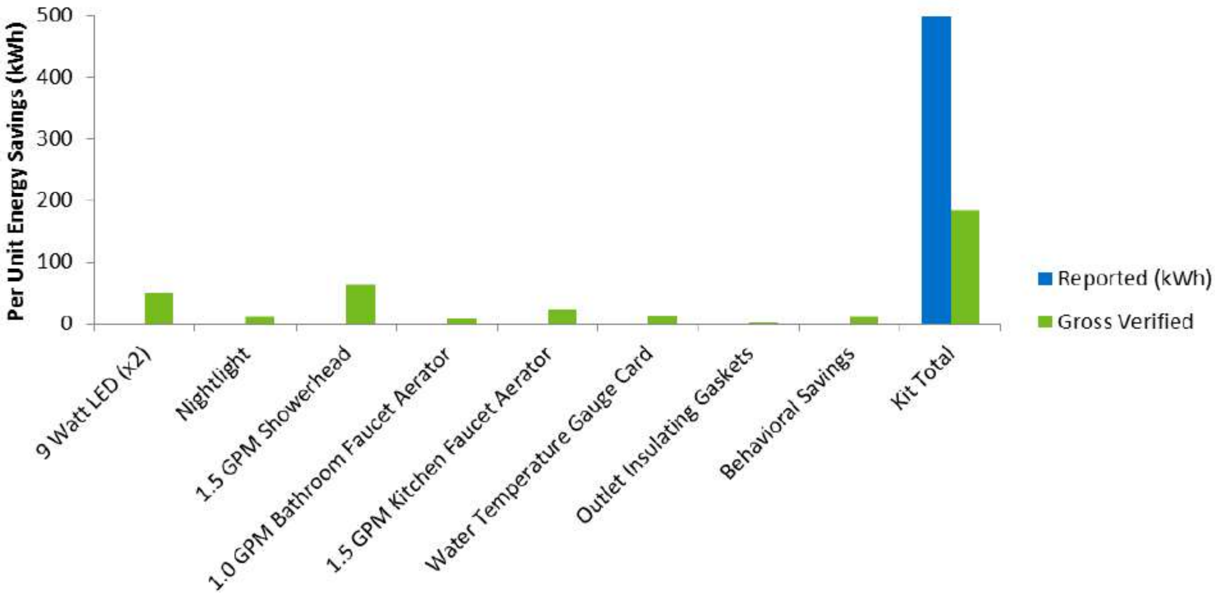


Table 3-26: Measure-Level Reported and Verified Gross Energy Savings

Measure	Reported Energy Savings, per unit (kWh)	Realization Rate	Verified Gross Energy Savings, per unit (kWh)	Total Verified Gross Energy Savings (kWh)
CFL (18W)	N/A	N/A	50.9	328,805
Nightlight			11.5	74,041
Low-flow Showerhead			63.9	412,945
Low-flow Bathroom Aerator			7.3	47,159
Low-flow Kitchen Aerator			22.5	145,343
Water Heater Setback			12.9	83,647
Outlet Gaskets			4.5	29,196
Behavioral Changes			11.5	74,461
Total	**499.0**	**37.1%**	**185.0**	**1,195,598**

Measure-level and kit-level demand savings are detailed in Table 3-27.

Table 3-27: Measure-Level Reported and Verified Demand Gross Savings

Measure	Reported Demand Savings, per unit (kW)	Realization Rate	Verified Gross Demand Savings, per unit (kW)	Total Verified Gross Demand Savings (kW)
CFL (18W)	N/A	N/A	0.006	37.8
Nightlight			0.000	0.0
Low-flow Showerhead			0.010	64.2
Low-flow Bathroom Aerator			0.001	6.9
Low-flow Kitchen Aerator			0.001	3.7
Water Heater Setback			0.002	13.0
Outlet Gaskets			0.001	3.3
Behavioral Changes			0.001	4.5
Total	**0.134**	**15.4%**	**0.021**	**133.4**

The impact evaluation for the 2017-2018 program resulted in a program energy realization rate of 112% and a demand realization rate of 156% as presented in Table 3-28.

Table 3-28: 2017-2018 Energy Savings per Kit

Measurement	Reported	Realization Rate	Gross Verified
Energy (kWh)	499.0	37.1%	185.0
Demand (kW)	0.134	15.4%	0.021

Table 3-29 presents the reported and verified energy and demand savings for the 2017-2018 program year.

Table 3-29: 2017-2018 Program Level Energy Savings

Measurement	Reported	Realization Rate	Gross Verified
Energy (kWh)	3,225,037	37.1%	1,195,598
Demand (kW)	867.7	15.4%	133.4

3.7.1 Senate Bill 310 Compliance

As noted in Section 1.2.1.1, DEO may claim alternate savings values for each program measure per the terms of Ohio Senate Bill 310 in order to comply with its energy savings goals. The relevant language from Senate Bill 310 is provided in Appendix C.

Table 3-30 provides the gross savings per measure that DEO will claim per SB 310 for the Energy Efficiency Education School Kit for the 2017-2018 program year.

Table 3-30: SB 310 Compliance Gross Savings per Measure

Program	Claimed Gross Savings (kWh)	Claimed Gross Savings (kW - summer)	Claimed Gross Savings (kW - winter)	Source
Energy Efficiency Education School Kit	499.0	0.134	0.132	DEO program reported savings

4 Net-to-Gross Methodology and Results

The evaluation team used student family survey data to calculate a net-to-gross (NTG) ratio for the NTC program. NTG reflects the effects of free ridership (FR) and spillover (SO) on gross savings. Free ridership refers to the portion of energy savings that participants would have achieved in the absence of the program through their own initiatives and expenditures (U.S. DOE, 2014).[9] Spillover refers to the program-induced adoption of additional energy-saving measures by participants who did not receive financial incentives or technical assistance for the additional measures installed (U.S. DOE, 2014). The evaluation team used the following formula to calculate the NTG ratio:

$$NTG = 1 - FR + SO$$

The evaluation team calculated the mean FR separately for water end-use measures and light bulbs, and aggregated those values to the program level. The team calculated spillover at the program level only.

4.1 Free Ridership

Free ridership estimates how much the program influenced participants to install the energy-saving items included in the energy efficiency kit. Free ridership ranges from 0 to 1, 0 being no free ridership and 1 being total free ridership, with values in between representing varying degrees of partial free ridership.

The evaluation team used participant survey data to estimate free ridership. The survey used several questions to identify items that a given participant installed and did not later uninstall:

- For items that came one to a kit (showerhead, kitchen and bathroom faucet aerators, and night light), the survey asked whether the participant installed the item and, if so, whether the participant later uninstalled the item.
- For insulator gaskets, which came 12 to a kit, the survey asked how many the participant installed and if the participant later uninstalled them.
- For the LEDs, the survey first asked whether the participant installed one, both, or neither. The survey then asked whether the participant uninstalled the bulbs.

The evaluation team's methodology for calculating free ridership consists of two components, free ridership change (FRC) and free ridership influence (FRI), both of which range from 0 to .5 in value.

[9] The U.S. Department of Energy (DOE) (2014). *The Uniform Methods Project: Methods for Determining Energy Efficiency Savings for Specific Measures. Chapter 23: Estimating Net Savings: Common Practices.* Retrieved August 29, 2016 from http://energy.gov/sites/prod/files/2015/02/f19/UMPChapter23-estimating-net-savings_0.pdf.

$$FR = FRC + FRI$$

4.1.1 Free Ridership Change

FRC reflects what participants reported they would have done if the program had not provided the items in the kit. For each respondent, the survey assessed FRC for each measure that the respondent installed and did not later uninstall.

Specifically, the survey asked respondents which, if any, of the currently installed items they would have purchased and installed on their own within the next year if DEO had not provided them. For each measure, the evaluation team assigned one of the FRC values shown in the Table 4-1, based on the respondents' responses.

Table 4-1: Free Ridership Change Values

What Respondent Would Have Done Absent the Program*	FRC Value
Would ***not*** have purchased and installed the item within the next year	0.00
Would have purchased and installed the item within the next year	0.50
Don't know	0.25

*Survey response to: If you had not received the free efficiency items in the kit, would you have purchased and installed any of these same items within the next year?

4.1.2 Free Ridership Influence

FRI assesses how much influence the program had on a participant's decision to install (and keep installed) the items in the kit. The survey asked respondents to rate how much influence five program-related factors had on their respective decisions to install the measures, using a scale from 0 ("not at all influential") to 10 ("extremely influential"). The program-related factors included:[10]

- The fact that the items were free
- The fact that the items were sent to their home
- Information in the kit about how the items would save energy
- Information that their child brought home from school
- Other information or advertisements from DEO, including its website

Asking respondents to separately rate the influence of each of the five above items had on the decision to install each measure would have been overly burdensome. Therefore, while the survey assessed FRC for each measure, it assessed influence at the end-use level once for all water-saving measures and once for the light bulbs.

[10] To reduce response fatigue, we only asked respondents to rate program influence on their decision to install: a) efficient light bulbs (as a whole), and b) water saving measures (as a whole). Thus, we did not collect separate influence data for each CFL (13W and 18W) nor for each water saving measure (showerhead, bathroom aerator, and kitchen aerator).

For each end-use (water-saving and light bulbs), the highest-rated item for each respondent represents the overall program influence. The evaluation team assigned the following FRI scores, based on that rating (Table 4-2). The evaluation team calculated up to two FRI scores for each respondent: one FRI score for water-saving measures and one FRI score for light bulbs.[11]

Table 4-2: Free Ridership Influence Values

Highest Influence Rating	FRI Value
0	0.50
1	0.45
2	0.40
3	0.35
4	0.30
5	0.25
6	0.20
7	0.15
8	0.10
9	0.05
10	0.00

4.1.3 End-Use-Specific Total Free Ridership

The evaluation team calculated total free ridership by end use, one for water saving measures, one for infiltration measures, and one for light bulbs, by:

- Calculating measure-specific FR scores for each respondent by summing each measure-specific FRC score with the corresponding end-use-specific FRI score.
- Calculating the mean FR score for each measure from the individual measure-specific FR scores.[12]
- Calculating a savings-weighted mean of the measure-specific FR means for water-saving measures and a separate savings-weighted mean of the measure-specific FR means for light bulbs. These two savings-weighted means represent the FR estimates for the two end-uses.

Table 4-3 presents the end-use FR estimates.

[11] Respondents were only asked to rate program influence on end-uses they installed and did not later uninstall. Thus, if a respondent installed both a showerhead and a light bulb, but later uninstalled the light bulb, the evaluation team only asked them to rate program influence on their decision to install the showerhead. Thus in this example, the evaluation team would only calculate a water end-use FRI score for this respondent.

[12] Since respondents were only asked about program influence on their decision to install the light bulbs and water saving items, infiltration measures leveraged the average influence score (FRI) across those two end uses. However, the FRC score used for infiltration measures was specific to that end use.

Table 4-3: End-Use-Level Free Ridership Scores

End-use	End-Use Free Ridership
Light bulbs	0.25
Water saving measures	0.11
Infiltration measures	0.10

4.1.4 Program-Level Free Ridership

The evaluation team estimated program-level free ridership by calculating a savings-weighted mean of the end-use FR scores presented in Table 4-3. Overall free ridership for the NTC kits is an estimated 15%.

4.2 Spillover

Spillover estimates energy savings from additional energy improvements made by participants who are influenced by the program to do so and is used to adjust gross savings. Since behavioral actions are considered gross impacts, spillover calculations only include additional installations of energy saving technologies. The evaluation team used participant survey data to estimate spillover. The survey asked respondents to indicate what energy-saving measures they had implemented since participating in the program. The evaluation team then asked participants to rate the influence the NTC program had on their decision to purchase these additional energy-saving measures on a scale of 0 to 10, where 0 means “not at all influential” and 10 means “extremely influential.”

The evaluation team converted the ratings to a percentage representing the program-attributable percentage of the measure savings, from 0% to 100%. The team then applied the program-attributable percentage to the savings associated with each reported spillover measure to calculate the participant measure spillover (PMSO) for that measure. We defined the per unit energy savings for the reported spillover measures based on ENERGY STAR® calculators as well as algorithms and parameter assumptions listed in the in the 2010 Ohio, 2016 Pennsylvania TRM, and outputs from this impact evaluation.

Lighting measures (namely, LEDs and CFLs) were commonly reported spillover measures. Since Duke Energy offered discounted lighting through their Online Savings Store, we asked respondents to confirm they did not use Duke Energy’s website to purchase discounted lighting. As to not double-count these savings, we adjusted lighting spillover savings to account for the proportion of respondents that said they used Duke Energy’s website to purchase discounted lighting measures.

Participant measure spillover (PMSO) is calculated as follows:

$$PMSO = Deemed\ Measure\ Savings * Program\ Attributable\ Percentage$$

Table 4-4 exhibits the PMSO by measure category.

Table 4-4: DEO PMSO, by Measure Category

Measure Category	Total kWh for Category	Percent Share of kWh
LEDs	7,651	88%
CFLs	17	<1%
Appliances	891	10%
Windows	109	1%
Total	**8,667**	**100%**

The evaluation team summed all PMSO values and divided them by the sample's gross program savings to calculate an estimated spillover percentage for the NTC program:

$$Program\ SO = \frac{\sum Program\ PMSO}{\sum Sample's\ Gross\ Program\ Savings}$$

These calculations produced a spillover estimate of 30% for the program.

4.3 Net-to-Gross

Inserting the FR and SO estimates into the NTG formula (NTG = 1 – FR + SO) produces an NTG value for the program of 1.13 (Table 4-5). The evaluation team applied the NTG ratio of 1.13 to program-wide verified gross savings to calculate NTC kit net savings.

Table 4-5: Net-to-Gross Results

Free Ridership	Spillover	NTG
0.15	0.28	1.13

5 Process Evaluation

5.1 Summary of Data Collection Activities

The process evaluation is based on telephone and web interviews and surveys with program and implementer staff, teachers, 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	19	81	90/17
Participating teacher follow-up interviews	Phone in-depth interview	5	Unknown	N/A
Student families who received DEO kit and are customers of DEO	Phone/Web survey	167[1]	5,587	90/6

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 2018, the evaluation team surveyed 19 teachers who attended NTC performances between September 7, 2017 and February 26, 2018. Of the 19 teacher respondents, 9 taught elementary school and 10 taught middle school. We report elementary and middle school findings together unless a meaningful difference emerged between school types.

In May 2018, 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 served to get a deeper understanding of topics uncovered in the web survey and to provide additional details about

[1] 72 phone surveys, 95 web surveys

their experience. The evaluation team completed interviews with five of these teachers. Three taught at elementary schools (one, kindergarten, and two, first grade) and two taught at middle schools (one, fifth grade, and one, seventh and eighth grades).

5.1.2 Survey of Student Families Who Received the DEO Kit

In April and May 2018, the evaluation team surveyed 167 families who received energy efficiency kits from DEO between August 2017 and May 2018 (Table 5-2). During that period, DEO distributed a total of 5,587[2] kits to families who completed the kit request form their child brought home from school. The evaluation team attempted to contact a random sample frame of 5,296 households, sending email survey invitations to 3,736 households and attempting to call 1,560 households for which program records provided an email address and/or a phone number. Ultimately, the data collection effort achieved a 3.0% response rate, providing a sample with 90/6 confidence/precision. Comparisons with census data demonstrate that the sample is largely representative of housing characteristics and ownership status for the region. Respondents reported greater educational attainment, higher income, and larger household than that of the region.[3]

Table 5-2: DEO Student Family Survey Response Rates

Mode	Population Size	Sample Frame Size	Completed Surveys	Response Rate	Confidence/ Precision
Web-based	5,587	3,736	95	2.5%	90/6
Phone		1,560	72	4.6%	
Total		**5,296**	**167**	**3.0%**	

5.2 Process Evaluation Findings

5.2.1 Awareness of DEO Sponsorship of the Program

Teachers and student families were aware of DEO's sponsorship of the program. A majority of teachers (84%) reported they were aware of DEO's sponsorship. The 16 teachers who knew of DEO's sponsorship most often learned about it through another staff member at their school (9) or DEO marketing materials (6) (Table 5-3).

[2] The survey sample frame is smaller than the number of distributed kits (N = 6,463) due participants who requested they not be contacted.

[3] Region comparisons come from 2016 American Community Survey (Census) 5-year period estimates data for Butler, Warren, Hamilton, Clermont, and Brown counties.

Table 5-3: How Teachers Learned of DEO's Sponsorship (Multiple Responses Allowed; n=16)

Source	Number of Teachers
Another staff person at school	9
Duke Energy marketing materials	6
The National Theatre for Children materials	2
The National Theatre for Children staff	2
Prior performance at school	2
Duke Energy staff	1

Awareness among student families was high, with 150 respondents (90%) stating they knew the kit was sponsored by Duke Energy. Nearly two-thirds (63%) indicated they learned about Duke's sponsorship via the classroom materials their child brought home. Other common ways that families learned about Duke Energy sponsorship were material included in the kit (31%) and communications from their child's teacher or school (21%).

About one-third (31%) of respondents said they knew about the energy-related classroom activities and NTC performance at their child's school. Of those, most (71%) said they found out about the NTC activities from their child.

5.2.2 Parent Awareness of DEO Kit Opportunity

Classroom materials sent home with the student were the key source of awareness of kits for families, with most student families (74%) hearing about the opportunity to receive a Duke Energy kit in that way. Other respondents learned about the kits from various communications from the school (Table 5-4).

Table 5-4: Parents Awareness of Kits

Kit Awareness	Count (n=167)
Classroom materials	74%
School newsletter	17%
Email from teacher/school	10%
School website or web portal	3%
Poster at school	3%
Conversations with teacher	1%
After hour event at school	1%
Other	11%

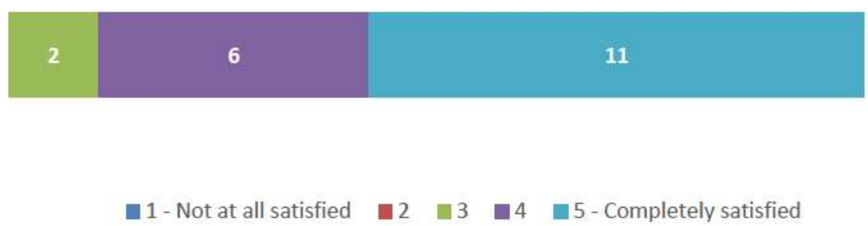
5.2.3 Teacher Experience with the Program

NTC Performance

Teachers were pleased with the NTC performance. They specified that the content was age-appropriate and the performance itself was engaging, and they reported overall high satisfaction with it.

Overall, teachers were largely satisfied with the performance, with 89% (17 of 19) rating their satisfaction as a “4” or “5” on a one-to-five scale. The remaining two respondents were neither satisfied nor dissatisfied providing a response of “3” on the five-point scale.

Figure 5-1: Overall Teacher Satisfaction with NTC Performance (n=19)



More than three-quarters of the surveyed teachers (15 of 19) said the explanation of energy-related concepts was “about right” for most of their students. Of the other four, three teachers (fifth, sixth, and seventh grade) reported the material was too basic while one fifth grade teacher said the vocabulary was too advanced for their students (Table 5-5).

Table 5-5: Manner in Which Performance Explained Energy-Related Concepts (n=19)

Explanation	Number of Teachers	Percent of Teachers
Too advanced	1	5%
About right	15	79%
Too basic	3	16%
Total	19	100%

Comments from the five interviewed teachers corroborated and expanded on the survey findings. The five interviewed teachers identified several themes associated with the performance: conservation (4 mentions), energy (4 mentions), recycling (2 mentions), and actions families could take to conserve resources (2 mentions). Four of the five interviewed teachers mentioned that the performers covered the energy-saver kits and kit request forms, while the fifth did not remember hearing the performers discuss the kits or kit forms.

Three of those interviewed teachers commented on how the material covered in the performance related to what they were teaching. Of those, two liked that the performance reinforced material they were covering in their classroom. The third commented that the overall message that the performers communicated – conservation – was an important lesson for their students that was not provided elsewhere in their curriculum.

Regarding age appropriateness, the comments from the interviewed teachers echoed the findings from the online survey. Four of the five interviewed teachers – those teaching grades K through 5 – said the performance was age appropriate and kept their students' attention. One particularly mentioned liking that the performance was easy to follow and understand. By comparison, the seventh-grade teacher reported that the performance may have been better suited for older Middle School students, such as their class, but some younger students that attended the performance may have struggled with the material.

Three teachers commented on the quality of the performance, specifically that the performance was engaging and the performers were humorous. Two of those three particularly liked that students were brought on stage during the performance and one liked that performers conducted call-and-response with the audience.

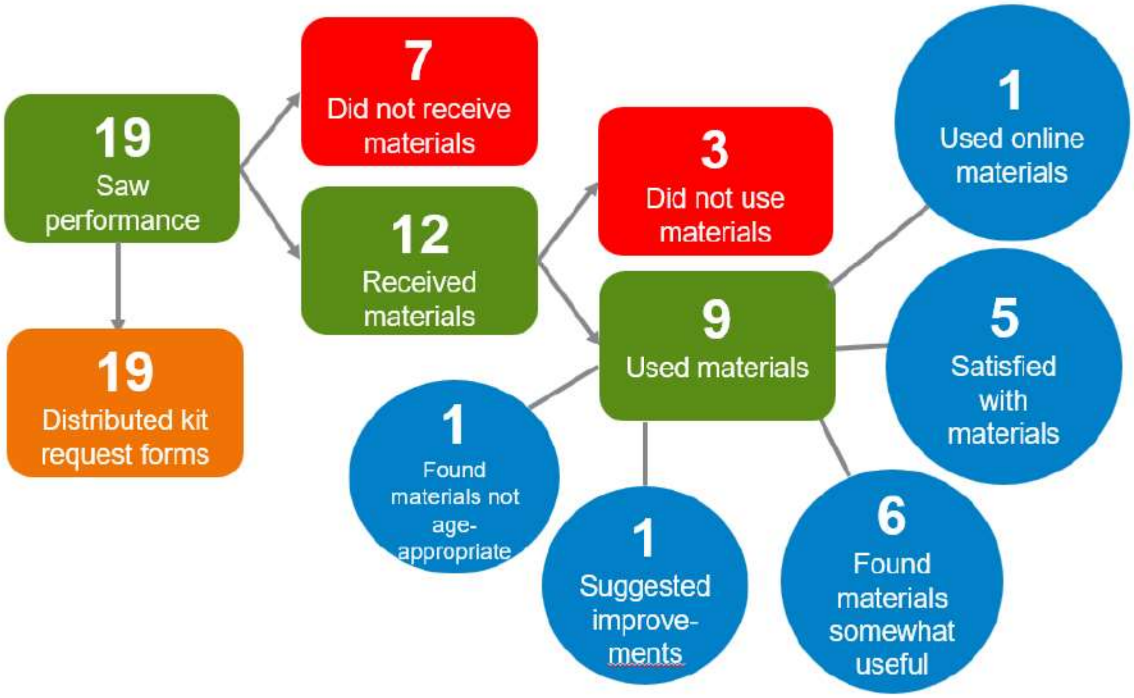
Three surveyed teachers offered suggestions for improving the performance:

- Include more visuals: One suggested providing more visuals such as posters to help students with concepts and vocabulary.
- Provide a toy lanyard: According to one respondent that had seen multiple performances, providing students a toy lanyard that included the kit request form was helpful. Past performances had a toy lanyard and, according to this respondent, these lanyards were popular with students and encouraged them to take the kit form home.
- Have performers in more professional attire: The seventh-grade teacher indicated the performers could have had a more professional appearance – fewer jeans and t-shirts and more business casual attire.

Curriculum and Instructional Materials

A notable percentage of teachers reported not receiving or using the curriculum materials despite reporting that they distributed kit request forms to all students (see section ***Kit Request Forms*** below) and the forms and materials were given to schools simultaneously by NTC. About two-thirds of teachers (12 of 19) reported receiving the curriculum and instructional materials, while five said they did *not* receive the materials and two said they did not know whether they had received them. Of the 12 who reported receiving the materials, three reported not using them "at all" because they did not have time to use them (2 mentions) or because the materials were at "too low a level" for their students.

Figure 5-2: Teachers Use of Forms and Instructional Materials



Of the nine teachers reporting use of the instructional materials, only seven could report on the materials' usefulness, age-appropriateness, alignment with state science standards, or concepts children had trouble understanding. From their comments, the following observations emerged:

- Use of materials was limited: Seven teachers characterized their use as "a little" and two used the materials "moderately." One of these respondents reported using the online aspect of the curriculum.
- Materials were somewhat useful: When asked to rate the usefulness of the materials, from 1 (not at all useful) to 5 (highly useful), four provided the middle rating and the other three gave a rating one level higher or lower.
- Materials were age-appropriate: Six reported the material was age-appropriate, while the fifth-grade teacher reported it was somewhat too advanced.
- Most respondents said they varied in their thoughts about the alignment of materials with state science standards: Three reported the curriculum "completely" or "mostly" aligned with state science standards, three stated it "somewhat" aligned, and one reported the materials did not align at all with the standards.
- No teacher reported any specific concepts or topics children had trouble understanding.

The seven teachers reporting "a little" use explained their rationale for limited use of the material. None of the comments focused on the quality of the materials per se. Rather, the reason for minimal use was because the materials did not align with pre-determined curricula or their teaching priorities at that time.

No teacher specified any concepts the workbooks should have covered to make it more useful Five reported being satisfied with the materials (scored a "4" or "5" on a five-point scale) and three were neither satisfied or dissatisfied with the materials (scored a "3" on a five-point scale).

Three of the five interviewed teachers said they used the curriculum materials. Of those, three used the workbooks in their classroom as part of a lesson and one reported tying the materials to actions kids can take in the classroom, such as turning off lights to save energy. One simply reported sending the materials home with students.

Kit Request Forms

As Figure 5-2 above suggests, there was a disconnect among teachers between the kit request forms and the instructional materials. Teachers largely reported limited use of the instructional materials, yet they reported they distributed all kit request forms, which were connected to the instructional materials. This suggests that teachers viewed the materials as tangential to the kit requests.

Of the surveyed teachers, all 19 distributed the kit request forms to their students and all took actions to encourage or promote the kits to their students. The interviewed teachers reported no challenges related to receiving or distributing the kit request forms, with three of the five reporting receiving the forms ahead of the performance, and all noted ways they encouraged students to receive the kit (Table 5-6).

Table 5-6: Actions Taken to Encourage Students To Receive Kit (multiple responses allowed; n=19)

Actions	Teacher Survey Responses	Interview Mentions
Vocally encouraged students to sign up for a kit	17	4
Emailed parents to encourage them to sign up for a kit	8	3
Pinned up MyEnergyKit.org poster	7	-
Used my classroom web portal to encourage families to sign up for a kit	5	-
Spoke with parents in person to encourage them to sign up for a kit	2	-
Had school or principal send reminders	-	2
Awarded prizes to kids that get parents to request kit	-	1
Explained to students and parents the school would get award from Duke if enough households enrolled for kit	-	1

Six of the 19 surveyed teachers reported following up with students to find out whether their household requested a kit. Of those six teachers, one estimated that 61% to 70% of their students ordered a kit and the other five estimated that fewer than half their student households ordered a kit.[4]; on average, teachers reported that 32% of their students sent for a kit.[5]

5.2.4 Student Family Experience with the Program

Installation and Use Rates

Almost all participants used at least one measure in the kit, and use of the measures varied by type. Ninety-six percent of the surveyed kit recipients installed at least one measure, installing an average of three measures from their kit. Most kit recipients installed the lighting measures; far fewer used the water related measures, which were also uninstalled more often than lighting measures. Most of the respondents who chose to uninstall kit measures reported dissatisfaction with the measure performance.

The majority of those installing light bulbs (74%) said they installed both bulbs included in the kit and they typically replaced incandescent bulbs.

Of those who did not install all items in the kit, fewer than half (38%) said they do not plan to install any of the items they had not yet installed. Respondents said they would not install the remaining items because the currently installed item is still working, they already had an efficient measure installed, or they had not "gotten around to it."

Measure Satisfaction

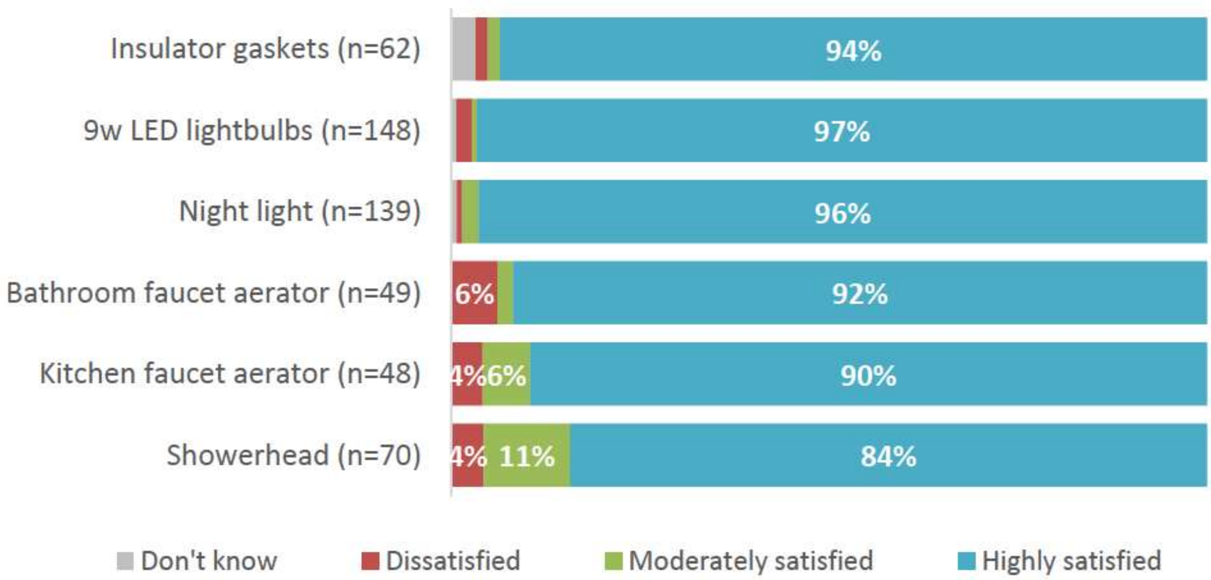
Nearly all kit recipients reported high satisfaction with the items they installed from their kit (

Figure 5-3). To best gauge the experience with the measures, we asked respondents to rate their satisfaction with all measures they installed, including those they later uninstalled. Respondents explained that any dissatisfaction they had with water measures was due to low water pressure.

[4] One respondent each reported 0-10%, 11-20%, 21-30%, 31-40%, 41-50%.

[5] 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%.

Figure 5-3: Kit Recipient Satisfaction with Measures They Installed*



* Respondents rated their satisfaction with the measures on a 0 ("very dissatisfied") to 10 ("very satisfied") scale. Dissatisfied indicates 0-3 ratings, moderately satisfied indicates 4-6 ratings, and highly satisfied indicates 7-10 ratings.

Energy Saving Educational Materials in the Kit

Most respondents reported reading the educational materials included in the kit, and most reported they were very helpful. 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 (68%) respondents said they read the booklet, most of whom (81%) found it highly helpful.[6] The other respondents rated the booklet as moderately helpful (16%) or not very helpful (3%). Those not finding the booklet helpful stated they already knew the information presented in the booklet.

Additional Energy Saving Actions

Parents and children reported adopting new energy-saving actions since their involvement in the program. Half of parents reported taking an energy-saving action and more than half (57%) of respondents 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 (45%), and parents reported changing thermostat settings (Table 5-7). More than three-quarters

[6] 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"). Eighty one percent of respondents who reported reading the booklet gave a rating of 7 or higher. 16% gave ratings of 5 or 6, and 3% gave ratings of 0 through 4.

(78%) of respondents reporting new energy saving behaviors said the DEO-sponsored kit and materials were "highly influential" in their adoption of those behaviors.[7]

Table 5-7: New Behaviors Adopted by Parents and Children Since Involvement in Program (multiple responses allowed; n=167)

New Behaviors Child Has Adopted	Parents	Children
Adopted new behaviors since receiving kit	50%	57%
Changed thermostat settings to use less energy	22%	-
Turn off lights when not in a room	16%	45%
Takes shorter shower	14%	15%
Turn off electronics when not using them	13%	19%
Turning water heater thermostat down	11%	-
Using fans instead of air conditioning	10%	-
Turning off air conditioning when not home	10%	-
Turning off furnace when not home	7%	-
Other reason	7%	10%
Refused	0%	1%

The kit measures drove a desire for more energy efficiency equipment. Most student families reported a desire to receive more kit measures (89%) specifying interest in LEDs (76%), nightlights (53%), gasket insulators (17%), showerheads (14%), bathroom aerators (13%), and kitchen aerators (10%). Their preference for requesting additional measures was by internet (67%) or using pre-paid postcards (32%).

Many respondents reported they want to purchase additional products. More than half (61%) of respondents reported an interest in purchasing at least one of the following products or services:

- New efficient lighting (46%)
- Energy efficient appliances (21%)
- Air leak sealing (19%)
- Efficient windows (14%)
- Connected or smart thermostats (14%)
- Insulation (14%)

The kit motivated some respondents to purchase energy efficient equipment or services. More than a quarter (29%) of respondents reported purchasing or installing additional energy

[7] 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"). Seventy-eight percent of respondents (or, 90 of 115) who reported behavior changes gave a rating of 7 or higher.

efficiency measures since receiving their kit. Efficient light bulbs were the most commonly reported measure (mentioned by 29 respondents), with 28 respondents specifying LEDs and one mentioning CFLs. Six respondents reported getting a Duke Energy rebate for their measure, four of whom received rebates for purchasing LEDs, one who received a rebate for buying an energy efficient appliance, and another who received an incentive for their efficient heating or cooling equipment. Most (29 of 48) respondents said the Duke Energy schools program was at least partially influential on their decision to purchase and install additional energy saving measures (Table 5-8).

Table 5-8: Additional Energy Saving Measures Purchased (multiple responses allowed)

	Count of Respondents Reporting Purchases After Receiving the Kit	Count That Received Duke Rebates for the Purchase/Measure	Count Reporting at Least Some DEO Program Influence on Purchase*
At least one measure	48	6	29
Bought LEDs	28	4	22
Bought energy efficient appliances	14	1	8
Added insulation	12	0	6
Other	10	0	1
Sealed air leaks	6	0	5
Bought efficient heating or cooling equipment	5	1	1
Bought efficient windows	5	0	0
Installed an energy efficient water heater	3	0	2
Moved into an ENERGY STAR home	1	0	0
Sealed ducts	1	0	0
Bought CFLs	1	0	1

*Respondents that rated the influence of the DEO program as 7 or higher on 10 point scale where 1 was not at all influenced and 10 was highly satisfied.

6 Conclusions and Recommendations

The evaluation findings, led to the following conclusions and recommendations for the program.

Conclusion 1: NTC performances satisfy teachers by engaging students. It is less clear that the performances are linked to classroom learning, awareness at home, or change in behavior. Teachers reported high satisfaction with the performance and recalled that the performance engaged students. However, curriculum materials were not always distributed or remembered by teachers and use of the materials was limited and those that did use the materials determined they were, at best, "moderately useful."

Parents were often not aware the performance occurred and about half of parents reported changes in their or their children's energy use behavior since receiving the kits but those changes in behavior were limited.

Recommendation: Find ways to increase use of materials, such as:

- making sure teachers are aware that NTC aligns their materials with state science standards, and
- concentrating scheduled performances around the time schools are covering similar topics, such as around Earth Day

Conclusion 2: There is an opportunity to greater emphasize the kits and get more families to request and install kits. About one-third of teachers follow-up with students to see if parents requested kits, but there is great variation in how much emphasis teachers place on promoting the kits. Additionally, two-thirds of parents did not know kits were associated with a performance and instructional materials.

Recommendation: Provide schools with information or pre-written messaging that they can use to communicate the value of the kits to parents.

Conclusion 3: The program influences families to save energy. Families save energy they would not have saved without receiving the kits and nearly all respondents installed at least one kit measure. Very few would have installed the kit measures without the prompt from their child and about one-fifth of parent respondents indicated a spillover action. Over half of parent respondents said they or their children adopted new energy saving behaviors since receiving the kit

Recommendation: Continue engaging student family households with the Education program.

Conclusion 4: The Education program could be a good "gateway" program to generate

even more energy savings. Kit recipients could be good targets for other Duke Energy efficiency program promotions, as they:

- demonstrated willingness to save energy in their home
- expressed interest in installing additional kit items or other energy saving measures (many of which Duke Energy currently incents)
- are highly likely to read any information included with the kit
- are predominantly single family homeowners

Recommendations: Leverage kits to promote other Duke Energy efficiency programs, such as targeting these households for direct mail campaigns or including information on Smart $aver or the Online Savings Store in the kit.