APPENDIX F – ENERGY EFFICIENT HOMES EM&V REPORT

Ohio Edison Company
The Cleveland Electric Illuminating Company
The Toledo Edison Company

Energy Efficient Homes Program
Evaluation, Measurement, and Verification Report
2019

Prepared for FirstEnergy Ohio Companies:

The Cleveland Electric Illuminating Company
Ohio Edison Company
The Toledo Edison Company

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1 Executive Summary

During 2019, The Cleveland Electric Illuminating Company (CEI), Ohio Edison Company (OE), and The Toledo Edison Company (TE) (collectively Companies) implemented the Demand Side Management (DSM) Energy Efficient Homes Program for the Companies' residential customers in their respective service territories.

Under contract with the Companies, ADM Associates, Inc. (ADM) performed evaluation, measurement and verification (EM&V) activities for the Energy Efficient Homes Program. The procedures used to perform the EM&V activities described in this report were informed by the approved State of Ohio Energy Efficiency Technical Reference Manual (OH TRM)[1], State of Pennsylvania Energy Efficiency Technical Reference Manual (PA TRM)[2], and ADM's previous experience performing EM&V activities for the Companies' DSM programs.

This report describes the methodologies, procedures, and data tracking systems utilized to conduct program evaluation activities, including data gathering, sampling and analysis methods. Participation by subprogram and utility are detailed in Table 1-1.

Table 1-1: Program Rebates by Measure and Utility

Subprogram	CEI	OE	TE	Participants
Audits	9,626	12,689	3,952	26,267
EE Kits	30,142	49,206	19,370	98,718
School Education	7,283	9,578	4,229	21,090
Behavioral	64,873	107,837	36,546	209,256
Smart Thermostat	409	401	52	862
Total	**112,333**	**179,711**	**64,149**	**356,193**

Ex-post electric savings were calculated through detailed analysis of program tracking data and participant survey data. ADM conducted analyses of this data using technical reference manuals. ADM compared these results to the deemed savings values reported in the TRM. Per Ohio RC §4928.662, the methodology that generated higher energy savings was selected for each appliance category.

Annual ex-post verified electric savings were 108,260,852 kWh (a realization rate of 90 percent). Ex-post verified peak demand reduction was 12,840.24 kW (a realization rate of 83 percent).

[1] Vermont Energy Investment Corporation (VEIC), State of Ohio Energy Efficiency Technical Reference Manual, Prepared for Public Utilities Commission of Ohio, Draft of August 6,2010, Revised September 30, 2013.

[2] Pennsylvania Public Utility Commission, Technical Reference Manual 2016.

Detailed tables listing energy savings and demand reductions by subprogram can be found in Appendix A: Required Savings Tables. Ex-post gross energy savings (kWh) and peak demand reduction (kW) for the program for each electric distribution company (EDC) are compared to ex-ante estimates in Table 1-2.

Table 1-2: Overall Evaluation Results[3]

Subprogram	EDC	Ex-Ante Savings		Ex-Post Savings		RR	
		kWh	kW	kWh	kW	kWh	kW
School Kits	CEI	2,555,057	267.23	2,207,724	208.06	86%	78%
School Kits	OE	3,360,200	351.44	2,903,417	273.63	86%	78%
School Kits	TE	1,483,638	155.17	1,281,953	120.82	86%	78%
School Education	**Total**	**7,398,895**	**773.83**	**6,393,094**	**602.51**	**86%**	**78%**
EE Kits	CEI	11,973,732	1,300.03	10,912,170	1,230.03	91%	95%
EE Kits	OE	20,261,309	2,218.90	18,291,959	2,080.08	90%	94%
EE Kits	TE	7,924,398	866.06	7,145,877	810.57	90%	94%
EE Kits	**Total**	**40,159,439**	**4,384.99**	**36,350,007**	**4,120.67**	**91%**	**94%**
Audits	CEI	3,446,067	596.72	2,964,424	390.89	86%	66%
Audits	OE	3,525,740	447.21	4,129,938	558.04	117%	125%
Audits	TE	1,086,810	132.61	1,227,108	168.26	113%	127%
Audits & Education	**Total**	**8,058,617**	**1,176.53**	**8,321,470**	**1,117.16**	**103%**	**95%**
Behavioral	CEI	22,109,000	3,542.15	20,297,626	2494.38	92%	70%
Behavioral	OE	34,986,000	4,570.75	31,078,349	3802.50	89%	83%
Behavioral	TE	6,703,000	1,025.32	5,612,800	702.99	84%	69%
Behavioral	**Total**	**63,798,000**	**9,138.22**	**56,988,775**	**6,999.87**	**89%**	**77%**
Smart Thermostats	CEI	103,804	0.00	98,208	0.00	95%	-
Smart Thermostats	OE	101,773	0.00	96,378	0.00	95%	-
Smart Thermostats	TE	13,198	0.00	12,921	0.00	98%	-
Smart Thermostats	**Total**	**218,775**	**-**	**207,507**	**-**	**95%**	**-**
Program Total		**119,633,726**	**15,473.57**	**108,260,852**	**12,840.24**	**90%**	**83%**

A comprehensive process evaluation was performed during the 2019 program year and the key findings can be found in each of the following subsections.

[3] All savings in this report are calculated at the retail level and do not include line losses.

2 Introduction and Purpose of Study

Under contract with the FirstEnergy's Ohio Utilities, The Cleveland Electric Illuminating Company (CEI), Ohio Edison Company (OE), and The Toledo Edison Company (TE) (collectively Companies), ADM Associates, Inc. (ADM) has performed evaluation, measurement, and verification (EM&V) activities to confirm the energy savings (kWh) and demand reduction (kW) achieved through the energy efficiency programs that the Companies implemented in Ohio.

The purpose of this report is to present the results of the impact evaluation effort undertaken by ADM to verify the energy savings and peak demand reductions that resulted from the Energy Efficient Homes Program during 2019. Additionally, this report presents the results of a process evaluation of the program. The process evaluation, completed by ADM, focused on participant and program staff perspectives regarding the program's implementation.

2.1 Percent of Savings from Income Qualified Customers

Questions were added to the evaluation survey to assess low income participation in this program. The survey was administered so that the customer disclosed their annual income range from a series of categories. Customers also reported the number of occupants in their household. This information was used to support the determination of whether the household is above or below 150% of Federal Poverty Level (FPL). Respondents were classified as low-income-qualified if the stated incomes were below 150% of FPL (Table 2-1).

Table 2-1: 2019 Federal Poverty levels and 150% of the FPL

Persons in Household	2019 Federal Poverty Level	150% Federal Poverty Level
1	$12,490	$18,735
2	$16,910	$25,365
3	$21,330	$31,995
4	$25,750	$38,625
5	$30,170	$45,255
6	$34,590	$51,885
7	$39,010	$58,515
8	$43,430	$65,145

The phone and online survey results were sorted by the number of people reported in each household as well as by reported household income ranges. For each of these groupings of occupants and incomes, ADM further broke down the data by reported

participants in each Electric Distribution Company (EDC) and by measure type. Participants that fell below the 150% Federal Poverty Level, shown in Table 2-1, were used to derive the low income program participation rates, a calculation that is feasible since the surveys represent a statically valid sample for the program population. Finally, to calculate the savings for the low-income portion of program participants, the ex-post energy and demand savings are multiplied by the percentage of low-income participants by EDC.

3 Impact Evaluation Objectives

The primary deemed savings and/or engineering algorithm source for determining program impacts for the Energy Efficiency Homes Program was the OH TRM. The PA TRM was used as a secondary calculation source for all measures not listed in the OH TRM. ADM also utilized the analysis of consumption data to estimate energy savings and demand impacts for the Audits & Education and Behavioral modification subprograms.

Per Ohio RC §4928.662, for all measure types listed in the OH TRM; all installation rates, deemed savings, and hours of use were calculated per the OH TRM (Deemed). In addition, ADM calculated gross savings for measures in the program with "as found" baseline conditions, hours of use, and in-service rates (ISR). The values reported for both ex-ante and ex-post energy savings (kWh) and peak demand reduction (kW) represent the higher calculated value obtained from both methodologies.

The impact evaluation component of this report estimates annual gross energy savings (kWh) and peak demand reduction (kW) as framed by the following five research questions:

- How many customers participated in the program?
- How many and which measure types were installed through the program?
- What percentage of each measure type can be verified as installed?
- What were the kWh savings achieved by the program?
- What was the kW reduction achieved by the program?

The methodology used to address each of these questions is provided in detail in each subprogram chapter.

4 Process Evaluation Objectives

The process evaluation is designed to research and document the program delivery mechanisms as well as the collective experiences of program participants, partners, and staff. ADM uses such information to assess if implementation strategies and/or program design could be improved to better serve residential customers. Table 4-1 provides a summary of the research questions and corresponding data collection activities.

Table 4-1: Energy Efficient Homes Program Research Questions

Researchable Questions	Activity to Support the Question
Were there any significant program design changes? If so, what influenced the change(s) how did the change(s) impact the program?	▪ Program staff interviews
Is the program being administered effectively in terms of program oversight, communication, staffing, training, and/or reporting?	▪ Program staff interviews
Is the program being implemented effectively in terms of the participation processes, application tools and marketing and outreach?	▪ Program staff interviews ▪ Participant survey
Were the program participants satisfied with their experiences?	▪ Participant survey
What changes can be made to the program's design or delivery to improve its effectiveness in future program years?	▪ Program staff interview ▪ Participant survey

To address these researchable issues, ADM reviewed program documentation, administered program surveys, and completed in-depth interviews with program staff and implementation partners. ADM began the process evaluation in July of 2019 with the development of data collection instruments and a review of program documentation. Data collection and analysis occurred October 2019 through February 2020.

Program Documentation Review: Program materials are an important data source for the process evaluation. ADM began by requesting all available documentation from program staff. This list included any operating or process manuals, implementation contracts, resident and agency outreach and education materials, agency newsletters, and the current price sheet.

Program Staff In-Depth Interviews: ADM researchers conducted in-depth interviews with key program staff that work with each subprogram. The objective of these interviews is to better understand program design objectives and delivery mechanisms, elicit feedback and suggestions for program improvements.

Participant Survey: ADM both administered online surveys and phone surveys to customers that participated in the various Energy Efficient Homes subprograms. These

survey efforts also included control group surveys where appropriate. Table 4-2 below provides a summary of 2019 survey activity and number of completes.

Table 4-2: Energy Efficient Homes Surveys – Number of Completes

Subprogram	Number of Completes
School Education	
Parent/Participant Survey	225
Energy Efficiency Kits	
Participant Survey	222
Audits & Education	
Comprehensive Audit Survey	215
Online Participant Survey	168
Telephone Participant Survey	51
Behavioral	
Participant Survey	225

5 School Education

The purpose of this chapter is to present the findings from the evaluation of the School Education subprogram, which reflects impact and process evaluation efforts undertaken by ADM to verify the energy savings and peak demand reduction.

5.1 Description of School Education Subprogram

The School Education subprogram provides an opportunity for parents or guardians of students in grades kindergarten through 8th grade to request an Energy Efficiency Kit after the school has participated in the program. The program includes a 25-minute performance on energy conservation and corresponding curriculum for the classroom developed in partnership with AM Conservation and the National Theater for Children (NTC). Following these events, parents can request a kit of energy efficient measures through an electronic application on the Student Energy Kit website or request a kit through a permission slip provided by the teacher. Kits are shipped to the students' homes within a few weeks of the request. In 2019, the School Education Kits include the following energy efficiency measures:

Table 5-1: School Education Kits Energy Efficiency Measures

Measure	Quantity in Kit
3-Way LED	1
15W LED	2
11W LED	1
9W LED	3
LED Nightlights	2

The total number of kits distributed by the Companies in 2019 by type and operating company is shown in Table 5-2.

Table 5-2: Count of Kits Delivered per Operating Company

EDC	School Kits Delivered
CEI	7,283
OE	9,578
TE	4,229
Total	**21,090**

5.2 Sampling

ADM completed a census review of all measures listed in the tracking system to ensure there were no data entry errors or duplicate entries.

The sample size for the follow-up surveys in each service territory achieved a relative precision of ±10% at the 90% confidence interval. The sample size calculation for achieving 90% confidence with 10% precision is shown in the formula below.

Equation 5-1: Minimum Sample Size Formula for 90 Percent Confidence

$$n_0 = \frac{N \times \frac{1}{4}}{(N-1) \times \frac{D^2}{Z^2_{\alpha/2}}}$$

Where:

n_0	= Minimum sample size
N	= Population size, assumed to be 100,000 or greater
$Z^2_{\alpha/2}$	= Z value at 90% confidence interval, 1.645
¼	= The maximum value of p(1-p) at p=1/2, a conservative estimate for sample size
D	= Relative Precision (0.10)

ADM surveyed 225 school education customers with respondents across the various EDCs. Surveying took place during the fourth quarter of 2019 with sample sizes that meet the requirement for ±10 percent precision at the 90 percent confidence level for each company. The sampling plan is shown in Table 5-3.

Table 5-3: Sampling Plan 2019 School Education Kits Participants

EDC	Sampling Proportion	Sample Size: School Kits
CEI	0.33	n = 75
OE	0.33	n = 75
TE	0.33	n = 75
Total	**1.00**	**n = 225**

5.3 Energy Savings and Peak Demand Reduction Calculations

5.3.1 Data Collection

ADM audited a census of the School Education Kits data and found the data to be adequate for impact evaluation. The average ex-ante estimates of kWh savings and kW reduction for the School Education Kits are shown in Table 5-4.

Table 5-4: School Kits: Ex-Ante Annual kWh & kW per Unit

Measure	Quantity per Kit	CEI		OE		TE	
		Ex-Ante kWh	Ex-Ante kW	Ex-Ante kWh	Ex-Ante kW	Ex-Ante kWh	Ex-Ante kW
3-Way LED	1	65.58	0.005	65.58	0.005	65.58	0.005
15W LED	2	116.82	0.014	116.82	0.014	116.82	0.014
11W LED	1	43.04	0.005	43.04	0.005	43.04	0.005
9W LED	3	104.52	0.012	104.52	0.012	104.52	0.012
LED Nightlights	2	21.02	0.000	21.02	0.000	21.02	0.000
Total Per Kit		**350.98**	**0.037**	**350.98**	**0.037**	**350.98**	**0.037**

5.3.2 Customer Surveys

Data from the sample of school kits participants were collected through an online survey delivered via email. The survey was distributed to determine measure specific installations as well as bulb installation quantities by room type. The data was used to calculate in service rates (ISRs), hours of use (HOU), and coincidence factors (CF) for peak demand.

5.3.3 Impact Analysis

The primary deemed savings and/or engineering algorithm source for determining program impacts was the OH TRM. The PA TRM was used as a secondary calculation source for all measures not listed in the OH TRM.

Per Ohio RC §4928.662, for all measure types listed in the OH TRM, all installation rates, deemed savings, and hours of use were calculated per the OH TRM (Deemed). In addition, ADM calculated gross savings for measures in the program with “as found” baseline conditions, hours of use, and installation rates. The values reported for both ex-ante and ex-post energy savings (kWh) and peak demand reduction (kW) represent the higher calculated value obtained from both methodologies.

The measures distributed in each kit and the source of the method utilized by ADM to determine energy and demand savings are presented in Table 5-5 on the following page.

Table 5-5: School Kit Analysis Sources

Measure Type	Source for Analysis Method
9W LED	PA TRM
11W LED	PA TRM
15W LED	PA TRM
3 Way LED	PA TRM
LED Nightlights	PA TRM

Detailed below are the analysis methods used to calculate kWh and kW savings for the measures included in the School Kits.

LED Nightlights

The OH TRM does not specify an algorithm for LED nightlights, so energy savings were calculated using the PA TRM algorithm as follows:

Equation 5-2: LED Nightlights Calculation of Energy Savings

$$\Delta kWh = \frac{(Watts_{base} - Watts_{NL}) * (NL_{hours} * 365)}{1000} * ISR$$

Where:

Watts$_{base}$ = Wattage of baseline nightlight

= 7W

Watts$_{NL}$ = Wattage of LED nightlight

= 1W

NL$_{hours}$ = Average hours of use per day per Nightlight

= *12 hrs*

ISR = In Service Rate[4]

According to the PA TRM, there is no measurable peak demand savings attributed to LED nightlights.

LED Bulbs

For LEDs, the kWh savings per measure were calculated per the procedures set out in the PA TRM and OH TRM using Equation 5-3 and Equation 5-4.

[4] This rate was determined by ADM through participant surveys.

Equation 5-3: LED Bulb Calculation of Energy Savings

$$\Delta kWh = \frac{Watts_{base} - Watts_{EE}}{1000} * HOU * (1 + WHF_e) * ISR$$

Equation 5-4: Calculation of Peak Demand Savings

$$\Delta kW = \frac{Watts_{base} - Watts_{EE}}{1000} * CF * (1 + WHF_d) * ISR$$

Where:

$Watts_{base}$	= Wattage of baseline bulb
$Watts_{EE}$	= Wattage of new bulb
ISR	= In Service Rate (i.e., percentage of units provided by the program that are actually installed as estimated by the lighting verification survey)
Hours	= Average hours of use per year
	= Calculated from participant survey and PA TRM
WHF_e	= Waste Heat Factor for energy - to account for cooling savings from efficient lighting
	= 1.07
WHF_d	= Waste Heat Factor for demand – to account for cooling savings from efficient lighting
	= 1.21
CF	= Coincidence Factor
	= Calculated from participant survey and PA TRM

5.4 Detailed Impact Evaluation Findings

This section presents the findings of the impact evaluation of the School Education subprogram. The 2019 evaluation results for estimated gross kWh energy savings and kW peak demand reductions for the School Education subprogram in the Companies' service territories are summarized in Table 5-6 and Table 5-7. The subprogram level energy savings and demand reductions realization rates are 86% and 78% respectively.

The differences between the ex-ante and ex-post savings calculations were primarily caused by differences between the TRM ISRs (used to calculate the ex-ante values) and survey reported ISRs (used to calculate the ex-post values). Overall, the survey reported ISRs for the measures included in the School Kits were approximately 15% lower than the TRM assumed ISRs, causing an appreciable offset between the ex-ante and ex-post calculated values. The ex-ante estimate used a deemed ISR of 92% from the PA TRM while the ex-post ISRs for LED bulbs ranged from 63% (3-Way LED bulbs) and 90% (11 Watt bulbs). The ex-ante input for hours of use was the deemed hours of use from the

OH TRM. The ex-post hours of use were calculated from a weighted average of the installation locations reported in the participant survey and hours use by room type from the PA TRM.

Table 5-6: School Kits Ex-Post Annual kWh Savings by Operating Company

EDC	Ex-Ante kWh	Ex-Post kWh	Realization Rate
CEI	2,555,057	2,207,724	86%
OE	3,360,200	2,903,417	86%
TE	1,483,638	1,281,953	86%
Total	**7,398,895**	**6,393,094**	**86%**

Table 5-7: School Kits Ex-Post Annual kW Reduction by Operating Company

EDC	Ex-Ante kW	Ex-Post kW	Realization Rate
CEI	267.23	208.06	78%
OE	351.44	273.63	78%
TE	155.17	120.82	78%
Total	**773.83**	**602.51**	**78%**

5.4.1 In Service Rates

The ISR for each measure in the School Education Kit is shown in Table 5-8.

Table 5-8: Impact Evaluation ISRs Determined by Survey (Schools Kits)

Measure	N – Bulbs in Service	ISR
9W LED	47,200	75%
11W LED	18,914	90%
15W LED	28,254	67%
3-way LED	13,233	63%
LED Nightlight	18,747	44%

5.5 Detailed Process Evaluation Findings

The following section provides detailed findings from the process evaluation for the School Education subprogram of the Energy Efficient Homes Program.

5.5.1 Subprogram Operations Perspective

This section provides an overview of the School Education subprogram's operations. It was developed through in-depth discussions with key subprogram staff. ADM interviewed the Companies' residential program energy efficiency manager, the Companies' subprogram manager, and a senior account executive as well as a senior director of sales at AM Conservation Group (AMCG). The AMCG staff noted that they were the subprogram's co-directors. The interviews addressed topics such as staff roles and responsibilities, 2019 subprogram operations and changes, marketing and outreach, subprogram communication, successes, and future changes to the subprogram.

Roles and Responsibilities

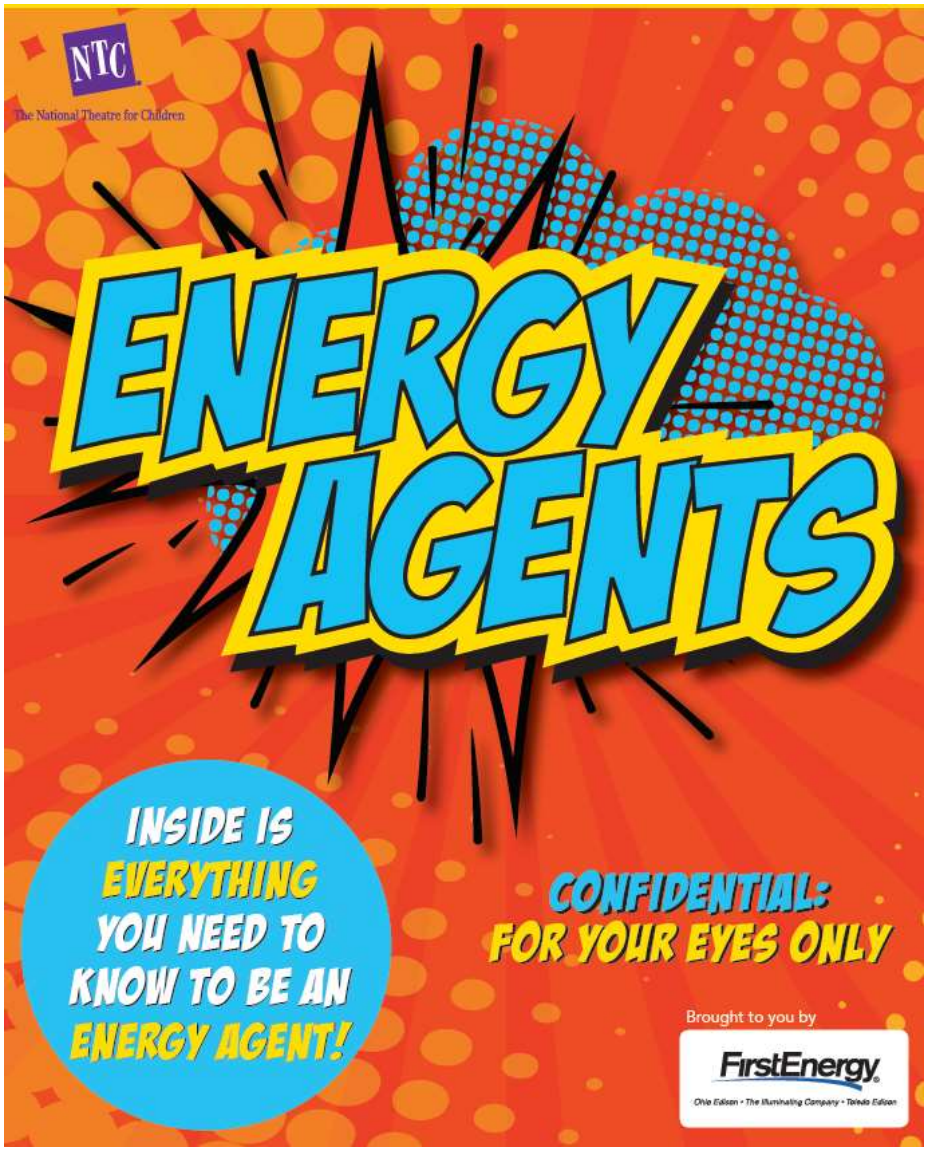
Subprogram staff explained each of their roles and responsibilities as they relate to the subprogram. The subprogram's manager began overseeing this subprogram in May 2019. She explained that her role with the subprogram remained consistent with the past subprogram manager's role. The Companies' subprogram manager stated she is responsible for forecasting, marketing, reporting, and overseeing the program implementation contractor. AMCG staff said that their role was to partner with National Theatre for Children (NTC) to implement the program. They stated that they monitor the goals, manage orders, and work with the Companies and NTC to effectively administer the subprogram.

AMCG and Company staff noted that the subprogram's administration remained largely unchanged from 2018 to 2019. AMCG staff noted that they continued to work closely with the NTC to deliver the subprogram offerings to the schools. NTC manages a call center responsible for contacting schools, developing the initial curriculum, as well as scheduling and conducting the live performances at participating schools.

Program Goals and Design

AMCG and the Companies' subprogram staff noted that the most significant change to the program's design in 2019 was the inclusion of middle schools in the subprogram (previously, participation had only been offered to elementary schools in the Companies' service territory). AMCG staff noted that the middle school material is developed for an older audience and that the NTC performance uses a more improvisational style to engage with the students. Both the Companies' and AMCG staff noted that the expansion of the subprogram had been a success and expressed satisfaction with the expanded reach of the subprogram and its content. Figure 5-1 displays a sample of material that AMCG staff shared, which is used for middle school students.

Figure 5-1: Energy Agents Middle School Workbook Cover



AMCG and staff from the Companies confirmed that the subprogram curriculum did not change for the 2019 program year and is comprised of the following for each classroom:

- A teacher guide that includes recommendations for before and after the performance, keywords, class activities, and critical thinking questions;
- A poster for the classroom;
- Booklets and activities for the students;
- A Business Reply Card for parents to provide feedback about their experience and what they installed; and
- Order cards for the school education kit.

The school education kit includes:

- (1) Three-Way LED Bulb
- (3) 9W LED Bulbs
- (1) 11W LED Bulb
- (2) 15W LED Bulbs
- (2) LED Nightlights
- (1) LED Glow Ring Toy

Program Strengths

The interviewees provided overwhelmingly positive sentiments regarding the subprogram's design, communication, implementation, and marketing. The subprogram manager noted that the School Education subprogram was successfully implemented in 2019 with no issues. AMCG's senior director of sales observed that parents and students are satisfied with the no-cost kits, curriculum, and NTC performances provided through the subprogram and noted those aspects as the main strengths of the subprogram. The subprogram manager related that the School Education subprogram's strengths included NTC actors' performance and AMCG's knowledge and effort as the subprogram implementor.

5.5.2 School Education Participant Survey

This section presents key findings from surveys, administered online by the evaluation group, completed by 225 parents/guardians whose children participated in the 2019 School Education Program. The survey gathered information regarding parents' perspectives, program awareness, measures installed/in-service, decision making, and overall program satisfaction.

School Education Kit Contents

Seventy-seven percent of survey respondents reported that their household received one kit. The remaining respondents noted that their household received 2 (20%) or 3 or more kits (3%). Of the respondents that reported receiving multiple kits, nearly all of them (96%) observed that the kits they received had the same contents.

Table 5-9 displays information on the measures that survey respondents reported receiving in their school education kit. Nearly all the respondents indicated that they received the LED nightlights in their kits, and a majority of the respondents indicated that they received all measures that were in the school education kit.

Table 5-9: School Education Kit Measures Received by Participants[5]

Measures	CEI	OE	TE	Total
	Percent (n=75)	Percent (n=75)	Percent (n=75)	Percent (n=225)
(2) LED nightlights	95%	95%	96%	95%
(1) 15W LED light bulb	87%	87%	91%	88%
(1) 11W LED light bulb	83%	75%	85%	81%
(3) 9W LED light bulbs	79%	80%	92%	84%
(1) Three-way LED light bulb	81%	72%	83%	79%

Customer Installation of Measures

Participants provided feedback on the contents of the school education kit that they installed. Forty-three percent of participants surveyed reported installing all measures, 56% of participants reported installing some of the measures, and only one respondent reported not installing any measures. Most participants that reported not installing some measures noted that they were waiting for light bulbs to burn out (87%). Other respondents mentioned the lights not fitting into any of their fixtures (6%), not being bright enough (4%), or being too bright (3%). Other respondents mentioned the light bulbs or other measures did not meet their needs in some other way.

Respondents also noted which measures they installed. Table 5-10 displays the count and percentage of respondents who reported installing at least one of the various measures. Seventy-nine percent of survey respondents indicated that they had installed one or more LED nightlights. Forty-one percent of respondents who installed a nightlight did so in a location previously occupied by a standard-efficiency nightlight. Seventy-seven percent of respondents installed at least one of the three 9W LEDs, 58% of respondents installed the 11W bulb, and 57% of respondents installed at least one 15W bulb. Thirty-two percent of respondents indicated that they had installed the Three-Way LED bulb.

Table 5-10: Participant Installation of School Education Kit Measures

Measures	Number of Respondents Reporting Installing At Least One Measure	Percentage of Respondents
LED nightlight (n=214)	168	79%
9W LED (n=188)	145	77%
11W LED (n=182)	106	58%
15W LED (n=198)	113	57%
Three-Way LED (n=177)	57	32%

Note: Percentages may exceed 100% because respondents could choose more than one response.

[5] This table does not include respondents who reported receiving multiple kits

Customer Satisfaction

Survey respondents rated their satisfaction with school education kit features. Most respondents reported the highest rating for both questions, with 87% reporting that rating for the kit contents and 77% for the time it took to receive the kit. No respondents indicated any negative level of satisfaction for the kit contents or the time it took to receive their school education kit.[6]

Respondents were also surveyed on the usefulness of the individual kit materials on a similar 5-point scale. LED nightlights had the highest frequency of positive answers (ratings of 4 or 5; 91%), followed by the 15W LED (90%) and the 9W LED bulbs (87%) (see Table 5-11 below).

Table 5-11: Usefulness of School Education Kit Contents

Measures	Percentage of Respondents* (n=225)
LED nightlights	91%
15W LED light bulb	90%
9W LED light bulbs	87%
11W LED light bulb	85%
Three-Way LED light bulb	78%

**Note: This table shows the percent of respondents that rated each kit item as a 4 or 5 on a scale where 1 meant "not at all useful" and 5 meant "very useful."*

Participant Motivations and Preferences

Respondents provided information on the factors that influenced their decision to participate. Respondents most frequently indicated that they chose to participate because of their child's interest in the kit (64%), followed by an interest in saving money (62%), the fact that the kit was provided at no additional cost (62%), and an interest in saving energy (61%). Table 5-12 displays the results from this portion of the survey.

[6] Rated their satisfaction on a 5-point scale, from 1 (very dissatisfied) to 5 (very satisfied).

Table 5-12: Factors Motivating Participation in School Education Kit Subprogram

Motivating Factors	Percentage of Respondents (n=222)
My child's interest in the kit	64%
Interested in saving money	62%
It had no additional cost	62%
I was looking for ways to save energy in my home	61%
The kit looked useful	57%
Recommendation from a friend	7%
Other (Write-In Required)	5%

Note: Summed percentages may exceed 100% because respondents could choose more than one response.

Respondents also provided feedback regarding their knowledge of and familiarity with energy efficiency behaviors and measures. Ninety-seven percent of respondents indicated that their knowledge of energy saving methods had increased to some extent after receiving the school education kit, with over half rating their increase in knowledge a 4 (36%) or 5 (20%).[7] Seventy percent of respondents who reported installing all measures said they had a substantial increase in knowledge versus 46% of respondents who only installed some measures or who did not install any measures.[8]

Cross Program Awareness and Participation

Respondents provided feedback about their awareness of discounts and rebates offered by the Companies to help them purchase energy-efficient equipment and save energy in their home. Forty-three percent were aware of the Companies' discounts and rebates and, within that group, 30% reported the school education kit as the source of their awareness.

Survey respondents were asked whether they had purchased and installed any additional measures because of their experience with the Schools Education subprogram. Thirty-three percent of survey-takers reported purchasing and installing additional energy efficiency measures because of information provided in the school education kit. Thirty-seven percent of respondents who reported installing all of the measures they received in the school kit said they had purchased and installed additional measures because of their experience with the subprogram, whereas 27% of respondents who only installed

[7] The question asked respondents to rate their increase in knowledge on a scale from 1 (not at all) to 5 (a lot).
[8] Rated their increase in knowledge a 4 or 5 on a scale from 1 ("not at all") to 5 ("a lot"). ADM compared the two proportions with a two-proportion t-test. The difference is significant with an alpha of 0.05.

some measures or did not install any measures reported purchasing and installing additional measures because of their experience with the subprogram. [9]

Of the respondents that indicated that they did purchase and install additional energy efficient items, 87% reported purchasing and installing energy-efficient light bulbs. Thirty-four percent of these respondents reported purchasing energy efficient appliances. The results of this question are displayed by Table 5-13 below, multiple answers were accepted.

Table 5-13: EE Installations After School Education Program Participation

Type of Additional Measure Installed	Percentage of Respondents (n=70)
Energy-efficient light bulbs	87%
Energy-efficient appliances (e.g., refrigerators, clothes washer/dryers)	34%
Energy-efficient nightlights	26%
Energy-efficient HVAC equipment	3%

Note: Percentages may exceed 100% because respondents could choose more than one response.

Of the respondents who had purchased and installed additional energy efficient measures, only two respondents (8%) applied for a rebate for their appliance. The respondents who reported installing additional energy efficient measures but who did not apply for incentives cited the rebate's being too small for the process (88%) and not knowing about the rebate (8%) as their reasons for not applying for a rebate.[10]

Participant Home Characteristics

The characteristics of participants' homes are categorized in Table 5-14. Most respondents (88%) live in single-family, detached construction homes. Seventy-seven percent of respondents own their home.

[9] ADM compared the two proportions with a two-proportion t-test. The difference is significant with an alpha of 0.05.

[10] One respondent (4%) did not know why they had not applied for incentives for the additional energy efficient measures.

Table 5-14: School Education Kit Participants' Home Characteristics

Characteristic	Percentage of Respondents
Home Type (n=221)	
Single-family home, detached construction	88%
Single-family home, factory manufactured/modular	5%
Apartment with 4+ units	3%
Apartment with 2 or 3 units	2%
Mobile home	1%
Other	1%
Own or Rent (n=225)	
Own	77%
Rent	23%
Year Built (n=225)	
Before 1960	36%
1960-1969	11%
1970-1979	12%
1980-1989	8%
1990-1999	9%
2000-2009	12%
2010 or later	5%
Don't know	6%
Square Footage of Residence (n=225)	
Less than 1,000 square feet	10%
1,000 to less than 2,000 square feet	58%
2,000 to less than 3,000 square feet	20%
3,000 to less than 4,000 square feet	2%
4,000 to less than 5,000 square feet	1%
Don't know	9%
Heating Type (n=203)	
Natural gas heating	83%
Electric heating	15%
Don't know	2%

6 Energy Efficiency Kits

The purpose of this chapter is to present the results of the Energy Efficiency Kits subprogram impact and process evaluations. The objective was to verify the energy savings and peak demand reduction achieved during the 2019 program year.

6.1 Description of the Energy Efficiency Kits Subprogram

The Energy Efficiency Kit subprogram provides the Companies' customers with energy efficiency measures and educational materials to encourage residential energy usage reduction. The target market for the program is residential single-family homeowners.

The Companies contracted with Power Direct to deliver the Energy Efficiency Kits subprogram. Residential energy efficiency (EE) kits are provided to customers upon request. Two types of kits are distributed, with the contents of kits varying slightly depending on the customers' water heating fuel source.[11] Participants receive measure descriptions and installation guidelines with their kits and can choose which measures to install. The energy efficiency kits also contain educational materials regarding residential energy-saving behaviors, which encourage kit recipients to further reduce their electricity usage. Additionally, the kits include promotional materials for other energy efficiency incentive opportunities offered by the Companies such as appliance recycling rebates and ENERGY STAR® appliance rebates. This practice takes advantage of the unique kit distribution marketing channel and encourages cross-participation in multiple programs sponsored by the Companies.

The Energy Efficiency Kit subprogram requires customers to request kits via the electronic application on OhioEnergyKit.com or by calling a toll-free telephone number. The Companies verify that the prospective participant is a customer of one of the participating EDCs and that they have not already received a kit during the 2017-2019 program years. Kits are typically shipped to customers within a few weeks of the request date. The energy efficiency kits include a help line telephone number that allows participants to report measure defects or ask questions regarding the program and specific measures. Table 6-1, on the following page, details the measures included in each of the EE kits during PY2019.

[11] Customers that state that they have an electric water heater receive an all-electric residential EE kit which includes a low-flow showerhead and low-flow faucet aerator; while customers stating they do not have an electric water heater receive a standard residential EE kit.

Table 6-1: Contents of EE Kits by Measure Type

Measures	Electric Kits	Standard Kits
3-Way CFL or LED Bulb	1	1
15W LED Bulb(s)	1	2
9W LED Bulbs	3	3
LED Nightlights	2	3
Furnace Whistle	1	1
Swivel Faucet Aerator	1	
Low Flow Showerhead	1	

Between May and July 3-Way CFL bulbs were replaced with 3-Way LED bulbs in distributed kits. The kits with 3-way CFL bulbs, distributed earlier in the year, account for 36% of all-electric kits and 28% of standard kits. The remaining kits distributed contained 3-way LED bulbs.

The total number of kits distributed by the Companies in 2019 by type and operating company is shown in Table 6-2.

Table 6-2: Count of EE Kit Types Delivered by Operating Company

Kit Type	Operating Company			
	CEI	OE	TE	Total
Electric	9,591	20,120	7,409	37,120
Standard	20,551	29,086	11,961	61,598
Total	**30,142**	**49,206**	**19,370**	**98,718**

6.2 Sampling

ADM completed a census review of all measures listed in the tracking system to ensure there were no data entry errors or duplicate entries.

The sample size for the follow-up surveys in each service territory achieved a relative precision of ±10% at the 90% confidence interval. The sample size calculation for achieving 90% confidence with 10% precision is shown in the formula below.

Equation 6-1: Minimum Sample Size Formula for 90 percent Confidence

$$n_0 = \frac{N \times \frac{1}{4}}{(N-1) \times \frac{D^2}{Z^2_{\alpha/2}}}$$

Where:

n_0 = Minimum sample size

N = Population size, assumed to be 100,000 or greater

$Z^2_{\alpha/2}$ = Z value at 90% confidence interval, 1.645

¼ = The maximum value of p(1-p) at p=1/2, a conservative estimate for sample size

D = Relative Precision (0.10)

ADM surveyed 222 residential EE kit customers with respondents across the various EDCs. Surveying was conducted during the 4th quarter of 2019 with sample sizes that meet the requirement for ±10 percent precision (Table 6-3).

Table 6-3: Sampling Plan 2019 EE Kits Participants

EDC	Sampling Proportion	Sample Size: EE Kits
CEI	0.33	n = 73
OE	0.34	n = 75
TE	0.33	n = 74
Total	1.00	n = 222

6.3 Energy Savings and Peak Demand Reduction Calculations

6.3.1 Data Collection

ADM audited a census of the EE Kits data and found the data to be adequate for impact evaluation. The average ex-ante estimates of kWh savings and kW reduction for the EE Kits are shown on the following page in Table 6-4. The ex-ante savings values are divided by standard and electric kits and provide two savings summaries for each kit type: one for those kits that included a 3-way CFL and another for those kits that included a 3-way LED.

Table 6-4: EE Kits Ex-Ante Annual kWh & kW per Unit

Kit Type	Measure	Quantity Per Kit	CEI		OE		TE	
			Ex-Ante kWh	Ex-Ante kW	Ex-Ante kWh	Ex-Ante kW	Ex-Ante kWh	Ex-Ante kW
Electric	3-way CFL	1	71.54	0.009	71.54	0.009	71.54	0.009
	3-way LED	1	90.18	0.011	90.18	0.011	90.18	0.011
	15w LED	1	58.41	0.007	58.41	0.007	58.41	0.007
	9w LED	3	104.52	0.012	104.52	0.012	104.52	0.012
	LED Nightlight	2	21.02	0.000	21.02	0.000	21.02	0.000
	Furnace Whistle	1	11.75	0.000	11.75	0.000	11.75	0.000
	Low Flow Showerhead	1	177.97	0.023	177.97	0.023	177.97	0.023
	Low Flow Swivel Aerator	1	44.90	0.006	44.90	0.006	44.90	0.006
	Total (Kit w/ CFL)[12]		**490.11**	**0.057**	**490.11**	**0.057**	**490.11**	**0.057**
	Total (Kit w/ LED)		**508.75**	**0.059**	**508.75**	**0.059**	**508.75**	**0.059**
Standard	3-way CFL	1	71.54	0.009	71.54	0.009	71.54	0.009
	2-way LED	1	90.18	0.011	90.18	0.011	90.18	0.011
	15w LED	2	116.82	0.014	116.82	0.014	116.82	0.014
	9w LED	3	104.40	0.012	104.40	0.012	104.40	0.012
	LED Nightlight	3	31.54	0.000	31.54	0.000	31.54	0.000
	Furnace Whistle	1	11.75	0.000	11.75	0.000	11.75	0.000
	Total (Kit w/ CFL)[12]		**336.05**	**0.035**	**336.05**	**0.035**	**336.05**	**0.035**
	Total (Kit w/ LED)		**354.69**	**0.037**	**354.69**	**0.037**	**354.69**	**0.037**

6.3.2 Customer Surveys

Data from the sample of energy efficiency kits participants was collected through an online survey, administered via email. The survey was distributed to determine measure specific installations, bulb quantities by room type. This data was used to calculate ISRs, HOU, and coincidence factors for peak demand.

[12] Per kit total savings for kits distributed before May and July, after which point most kits included a 3-way LED bulb instead of a 3-way CFL bulb.

6.3.3 Impact Analysis

The primary deemed savings and/or engineering algorithm source for determining program impacts was the OH TRM. The PA TRM was used as a secondary calculation source for all measures not listed in the OH TRM.

Per Ohio RC §4928.662, for all measure types listed in the OH TRM; all installation rates, deemed savings, and hours of use were calculated per the OH TRM (Deemed). In addition, ADM calculated gross savings for measures in the program with "as found" baseline conditions, hours of use, and installation rates. The values reported for both ex-ante and ex-post energy savings (kWh) and peak demand reduction (kW) represent the higher calculated value obtained from both methodologies.

The measures distributed in each kit and the source of the method utilized by ADM to determine energy and demand savings are presented in Table 6-5.

Table 6-5: EE Kits Analysis Sources

Measure Type	Source for Analysis Method
9W LED	PA TRM
15W LED	PA TRM
3-Way CFL	OH TRM
3-Way LED	PA TRM
LED Nightlights	PA TRM
Furnace Whistle	PA TRM
Aerators	PA TRM
Showerhead	OH TRM

Detailed below are the analysis methods used to calculate kWh and kW savings for the measures included in the Energy Efficiency Kits.

Furnace Whistles

The OH TRM does not specify an algorithm for furnace whistles, so energy savings are calculated using the PA TRM algorithms as follows:

Equation 6-2: Furnace Whistle Calculation of Energy Savings

$$\Delta kWh = MkW * EFLH * EI * ISR$$

Equation 6-3: Calculation of Peak Demand Savings

$$\Delta kW = \frac{\Delta kWh/yr_{cool}}{EFLH_{cool}} * CF$$

Where:

MkW = Average motor full load electric demand (kW)

= 0.5 kW

EFLH = Estimated Full Load Hours (Heating and Cooling) [13]

= Will be taken from OH TRM

EI = Efficiency Improvement

=15%

ISR = In Service Rate[14]

CF = Coincident Factor

= 0.647

Previous versions of the PA TRM did not include peak demand reductions for furnace whistles. However, the 2016 PA TRM specifies Peak Demand Savings per Equation 6-3.

LED Nightlights

The OH TRM does not specify an algorithm for LED nightlights, so energy savings were calculated using the PA TRM algorithm as follows:

Equation 6-4: LED Nightlights Calculation of Energy Savings

$$\Delta kWh = \frac{(Watts_{base} - Watts_{NL}) * (NL_{hours} * 365)}{1000} * ISR$$

Where:

$Watts_{base}$ = Wattage of baseline nightlight

$Watts_{NL}$ = Wattage of LED nightlight

NL_{hours} = Average hours of use per day per Nightlight

ISR = In Service rate[15]

According to the PA TRM, there is no measurable peak demand savings attributed to LED nightlights.

[13] This is a location dependent variable which depends on customer's location (defined by zip code) and corresponding EFLH value in look-up table.
[14] This rate will be determined by ADM through participant surveys.
[15] This rate will be determined by ADM through participant surveys.

LED Bulbs

The OH TRM does not specify a savings algorithm for LED bulbs. The kWh savings per measure were therefore calculated per procedures set out in the PA TRM using Equation 6-5 and Equation 6-6.

Equation 6-5: LED Bulb Calculation of Energy Savings

$$\Delta kWh = \frac{Watts_{base} - Watts_{EE}}{1000} * HOU * (1 + WHF_e) * ISR$$

Equation 6-6: Calculation of Peak Demand Savings

$$\Delta kW = \frac{Watts_{base} - Watts_{EE}}{1000} * CF * (1 + WHF_d) * ISR$$

Where:

$Watts_{base}$	= Wattage of baseline bulb
$Watts_{EE}$	= Wattage of new bulb
ISR	= In Service Rate (i.e., percentage of units provided by the program that are actually installed as estimated by the lighting verification survey)
HOU	= Average Hours Of Use per year
	= Weighted average based on installation locations and PA TRM
WHF_e	= Waste Heat Factor for energy - to account for cooling savings from efficient lighting
	=1.07
WHF_d	= Waste Heat Factor for demand – to account for cooling savings from efficient lighting
	= 1.21
CF	= Coincidence Factor
	= Weighted average based on installation locations and PA TRM

3-Way CFL Bulbs

Savings algorithms were taken from the OH TRM.

Equation 6-7: 3-Way CFL Bulb Calculation of Energy Savings

$$\Delta kWh = \frac{\Delta Watts}{1000} * HOU * (1 + IE_{kWh}) * 365.25 * ISR$$

Where:

$\Delta Watts$	= Compact Fluorescent Watts * 3.25
HOU	= Average hours of use per day = 2.85

IE_{kWh} = HVAC Interactive effect

ISR = In Service Rate determined from participant survey

Equation 6-8: Calculation of Peak Demand Savings

$$\Delta kW = \frac{\Delta Watts}{1000} * (1 + IE_{kW}) * CF * ISR$$

Where:

IE_{kW} = HVAC Interactive effect

CF = Summer Peak Coincidence Factor

= Determined from installation locations and PA TRM

Low Flow Showerhead

Savings algorithms were taken from the OH TRM.

Equation 6-9: Low Flow Showerhead Calculation of Energy Savings

$$\Delta kWh = ISR * (GPM_{base} - GPM_{low}) * kWh/GPM_{reduced}$$

Where:

GPM_{base} = Gallons per minute of baseline showerhead

= 2.87

GPM_{low} = Gallons per minute of low flow showerhead

ISR = In Service Rate

$kWh/GPM_{reduced}$

= Assumed kWh savings per GPM Reduction

= 173

Equation 6-10: Calculation of Peak Demand Savings

$$\Delta kW = \Delta kWh/hours * CF$$

Where:

hours = (Gal/person * # people * days/y) / SH/home / GPM / 60

Gal/person = Average gallons per day used for showering

= 11.6

 # people = Average number of people per household

SH/home = Average number of showers in the home

= 2.1

CF = Summer Peak Coincidence Factor for measure

= 0.0037

Faucet Aerator

Energy savings for faucet aerators included in EE Kits were calculated using the PA TRM algorithm as follows:

Equation 6-11: Faucet Aerator Calculation of Energy Savings

$$\Delta\, kWh/yr = ISR \times ELEC \times \left[\frac{(GPM_{base} - GPM_{low}) \times T_{person/day} \times N_{persons} \times 365\frac{days}{yr} \times DF \times (T_{out} - T_{in}) \times 8.3\frac{Btu}{gal \cdot °F}}{\#_{faucets} \times 3412\frac{Btu}{kWh} \times RE}\right]$$

Where:

ISR = In-Service rate of measure from participant survey

ELEC = Percentage of homes with electric water heater, from participant survey

GPM_{base} = Gallons per minute of baseline faucet aerator

= 2.2

GPM_{low} = Gallons per minute of low-flow faucet aerator

$T_{person/day}$ = Average time of hot water usage per person per day

= 7.8 min/day

$N_{persons}$ = Average number of persons per home

DF = Percentage of water flowing down drain

= 75%

T_{out} = Average mixed water temp flowing from faucet

= 93°F (for Kitchen)

T_{in} = Average mixed water temp entering home

= 55°F

$\#_{faucets}$ = Average number of faucets in home

= 1.0 (for Kitchen)

RE = Recovery efficiency of electric water heater

= 0.98

Equation 6-12: Calculation of Peak Demand Savings

$$\Delta kW_{peak} = \Delta\, kWh/yr \times ETDF$$

Where:

ETDF = *CF/HOU*

$$CF = \frac{\%_{faucet\ use,peak} \times \mathrm{T}_{\mathrm{person/day}} \times \mathrm{N}_{\mathrm{persons}}}{\#_{\mathrm{faucets}} \times 240\frac{minutes}{daily\ peak}}$$

$$HOU = \frac{\mathrm{T}_{\mathrm{person/day}} \times \mathrm{N}_{\mathrm{persons}} \times 365\frac{days}{yr}}{\#_{\mathrm{faucets}} \times 60\frac{minutes}{hour}}$$

$\%_{faucet\ use,\ peak}$ = Percentage of daily faucet use during PJM peak period

= 19.5%

6.4 Detailed Impact Evaluation Findings

This section presents the findings of the impact evaluation of the Energy Efficiency Kits subprogram.

The 2019 evaluation results for estimated gross kWh energy savings and kW peak demand reductions for the Energy Efficiency Kits subprogram in the Companies' service territories are summarized in Table 6-6 and Table 6-7, respectively, on the following page. The subprogram level kWh realization rate is 91%; the kW realization rate is 94%.

The survey reported ISRs for the measures included in the residential EE kits differed from the TRM assumed ISRs. The survey reported ISRs for nightlights, furnace whistles, and faucet aerators were higher than the TRM values used for the ex-ante estimates. LED nightlights had survey reported ISRs of 73% and 82% for the standard and all-electric kits respectively, compared to an assumed rate of 40% in the TRM. Faucet aerators were found to have an ISR of 41%, compared to a default ISR of 23%, and furnace whistles were found to have an ISR of 23%, while the default ISR from the PA TRM was 10%.

Conversely, the ISRs for the 3-way CFL bulbs, low-flow shower heads, and LED bulbs were lower than the TRM assumed rates of 86%, 81%, and 92% respectively (PA TRM). The survey reported ISRs were 59% for 3-way CFL bulbs, 51% for showerheads, and ranged from 61% to 74% for LED bulbs.

As with the School Kits, another key difference between the ex-ante and ex-post lighting savings and demand reductions came from the hours of use values and coincident factors used: the ex-ante input for hours of use and coincident factors was taken from the PA and OH TRMs, whereas the ex-post value was calculated by allocating the percentage of installation by specific room type and assigning values per room type from the PA TRM. An additional difference between the ex-ante and ex-post savings calculations can be attributed to the estimated full load hours ("EFLH") used to evaluate the furnace whistle

savings. For the ex-ante estimate, this value uses Cleveland as a reference city; however, for ex-post savings this value was calculated as a weighted average of reference EFLHs (OH TRM) distributed based on survey participants' home zip codes.

The ex-post analysis realization rates ("RR") from the 2019 surveying effort are reported in Table 6-6.

Table 6-6: EE Kits Ex-Post Annual kWh Savings by Kit Type

EDC	Kit Type	Ex-Ante kWh	Ex-Post kWh	Realization Rate
CEI	Electric	4,802,822	4,172,759	87%
	Standard	7,170,910	6,739,411	94%
	Total	**11,973,732**	**10,912,171**	**91%**
OE	Electric	10,097,983	8,753,615	87%
	Standard	10,163,327	9,538,344	94%
	Total	**20,261,309**	**18,291,959**	**90%**
TE	Electric	3,729,458	3,223,436	87%
	Standard	4,194,941	3,922,442	94%
	Total	**7,924,398**	**7,145,878**	**91%**
Grand Total		**40,159,439**	**36,350,007**	**91%**

On the following page, Table 6-7 shows the ex-post Annual kW demand savings by kit type for each EDC.

Table 6-7: EE Kits Ex-Post Annual kW Reduction by Kit Type

EDC	Kit Type	Ex-Ante kW	Ex-Post kW	Realization Rate
CEI	Electric	548.75	497.01	91%
	Standard	751.28	733.02	98%
	Total	**1,300.03**	**1,230.03**	**95%**
OE	Electric	1,153.90	1,042.63	90%
	Standard	1,065.01	1,037.45	97%
	Total	**2,218.90**	**2,080.08**	**94%**
TE	Electric	426.23	383.94	90%
	Standard	439.83	426.63	97%
	Total	**866.06**	**810.57**	**94%**
Grand Total		**4,384.99**	**4,120.67**	**94%**

6.4.1 In Service Rates

The EE Kit ISR, as determined from the participant survey, for each measure is shown in Table 6-8.

Table 6-8: EE Kit Measures' In-Service Rates

Measure	N – Measures In-Service	ISR
Three-way CFL	19,342	63.4%
Three-way LED	46,762	68.5%
15W LED	99,676	62.2%
9W LED	221,128	74.7%
LED nightlights	201,337	77.7%
Furnace whistle	23,184	23.5%
Faucet aerator	15,360	41.4%
Low-flow showerhead	18,837	50.7%

6.5 Detailed Process Evaluation Findings

The following section provides detailed findings from the process evaluation for the Energy Efficiency Kits ("EE Kits") subprogram of the Energy Efficient Homes Program.

6.5.1 Subprogram Operations Perspective

This section provides an overview of the EE Kits subprogram's operations constructed through in-depth discussions with subprogram staff and the subprogram implementation contractor. The interviews addressed topics such as staff roles and responsibilities, 2019 operations and changes, marketing and outreach, as well as communication between the Companies and the subprogram implementation contractor, Power Direct. ADM also discussed the end of the subprogram as implemented through Power Direct.

Roles and Responsibilities

In August 2019 ADM interviewed the implementation contractor and subprogram staff. ADM interviewed Power Direct's director of operations and the Companies' residential program manager. Neither the Companies' subprogram manager nor the director of operations at Power Direct noted any changes to their roles or responsibilities regarding the kit program since ADM last spoke to them in January 2019. Both the implementation contractor and the Companies' staff shared that operations had remained largely unchanged.

Program Goals and Design

There were no significant changes to the subprogram's design or goal development methodology in 2019. One minor change to the program was the kit contents. The director of operations at Power Direct noted that in April 2019 the kit 3-way CFL was replaced with a 3-way LED.

ADM confirmed the kits' contents with program staff and the Power Direct staff. The contents vary for customers with electric water heating and gas water heating – for customers with the latter receive what is referred to below as a "Standard" energy efficiency kit. The measures included in each kit type are listed on the following page.

Both Electric and Standard Customer Kits:

- (1) Three-Way CFL or LED light bulb
- (3) 9W LED light bulbs
- Furnace whistle

Electric Kits:

- (1) 15W LED light bulb
- (2) LED nightlights
- (1) Low flow showerhead
- (1) Faucet aerator

Standard Kits:

- (2) 15W LED light bulbs
- (3) LED nightlights

Program Implementation

At the time of the interview, the Companies' subprogram manager stated that the subprogram had achieved its goals for each EDC and had stopped accepting customer requests for kits. She stated that the last kits were planned to be sent by the end of September 2019. The director of operations at Power Direct also confirmed that the subprogram had specific goals for each operating company and had achieved those goals early in 2019.

ADM inquired with the Companies' subprogram manager about the ending of the program's implementation through Power Direct. The subprogram manager described that there had been meetings related to the end of Power Direct's delivery of the program to ensure a smooth transition. Power Direct's director of operations stated that call center staff is directing customers to EnergySaveOhio.com for other energy conservation programs that are available to them. The EE Kits' subprogram website is currently

directing customers to EnergySaveOhio.com as well. Figure 6-1 displays a screenshot of OhioEnergyKit.com from August 2019.

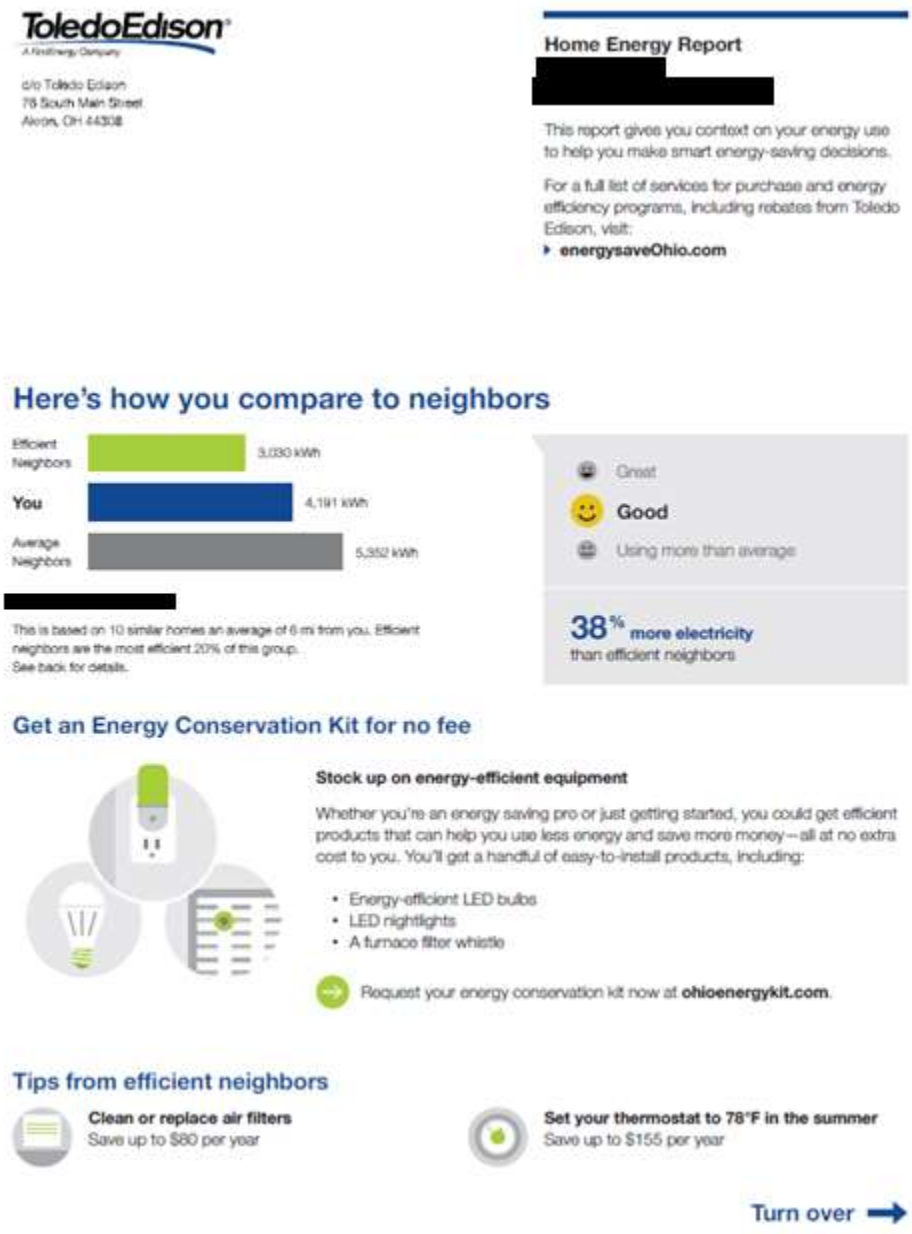
Figure 6-1: Screenshot of OhioEnergyKit.com

The Companies' subprogram manager stated that if customers call the call center expressing discontent or disappointment and their call is "elevated," the call center staff will specifically share information regarding the Comprehensive Audit subprogram as another option for improving the customer's home's energy efficiency.

The subprogram recruited participants through targeted emails, outbound calls, Facebook ads, targeted marketing in Home Energy Reports (HERs), and word-of-mouth referrals. A final targeted email and HER message were sent in July 2019 to promote the kit. Power Direct stopped including referral slips in the kits in late spring. Additionally, Power Direct ceased outbound calling from their call center to recruit customers to participate in the program during the same time period. Figure 6-2 displays a screenshot of a sample HER with a marketing module that was sent in July 2019.

Staff reported that Power Direct would no longer be contracted to provide EE Kits or assistance related to the EE Kits subprogram after December 31, 2019. The Companies' subprogram manager stated that she had been coordinating the transition of the program with Power Direct and that the Companies' staff would handle any lingering issues if they arose after December 31, 2019. The director of operations at Power Direct stated that they would provide the Companies with 15 of each kit type once they have ceased operations. Neither the Companies' staff nor Power Direct foresaw issues arising with Power Direct no longer implementing the EE Kits subprogram.

Figure 6-2: Screenshot of July 2019 HER with EE Kits Marketing Module



Program Strengths and Challenges

ADM asked both interviewees to reflect on the EE Kits subprogram and its strengths, challenges, and successes. Both the director of operations at Power Direct and the Companies subprogram manager stated that the subprogram had run smoothly and expressed exceedingly positive sentiments regarding its design and implementation as well as customer satisfaction with the subprogram.

The director of operations at Power Direct noted that she felt that developing an invitation code was an early, notable success for the subprogram. She stated that account numbers

are considered sensitive data and therefore they could not publish them or use them in marketing materials; alternatively, assigning and using unique invitation codes for each customer simplified enrollment and tracking. She also shared that using the name of the customer's specific EDC in marketing efforts improved their email outreach effort.

The subprogram manager shared that the program did not have any major failures or challenges, but she did share that the subprogram improved continuously with minor adjustments and fixes throughout its implementation. She stated that developing FAQs and strong scripts for the call center was important. She also shared that understanding the data was crucial. To successfully implement the EE Kits subprogram it was important to understand the difference between service addresses and mailing addresses as well as to understand that the Companies' tracking data may not be up to date and it is necessary to verify information, such as water heating type, with customers.

6.5.2 Energy Efficiency Kits Participant Survey

This section presents key findings from a survey administered online by ADM to 222 subprogram participants. The survey gathered information regarding subprogram awareness, measures installed/in-service, decision making, and overall subprogram satisfaction.

Order Method and Kit Contents

ADM inquired with survey-takers regarding how they heard about the energy efficiency kit. The highest portion of survey respondents reported learning about the energy efficient kit from either social media (23%) or word-of-mouth (16%). Other respondents mentioned receiving direct mail (11%), a phone call (10%), or an email from their utility (5%). Eighteen percent of survey respondents recalled learning about the program through bill insert advertisements, however, the program has not been advertised through bill inserts since 2015.

Eighty-one percent of survey respondents reported that they requested their kit online, 14% requested it via telephone, and 5% did not recall how they requested it.

ADM inquired with survey respondents regarding the types of measures they received in their energy efficiency kit. Over half of respondents (58%) noted that they received an electric kit; the remaining respondents (42%) noted they received a standard kit. Table 6-9 and Table 6-10, on the following page, display the measures that respondents noted receiving in their kits.

Table 6-9: EE Measures Received by Electric Kit Participants

Electric Kit Measure	CEI	OE	TE	Total
	Percentage of Respondents (n=25)	Percentage of Respondents (n=39)	Percentage of Respondents (n=41)	Percentage of Respondents (n=94)
(1) Three-way CFL light bulb	44%	44%	29%	43%
(1) Three-way LED light bulb	60%	54%	49%	60%
(3) 9W LED light bulbs	36%	67%	51%	60%
(2) 15W LED light bulbs	56%	59%	39%	56%
(3) LED nightlights	80%	82%	63%	83%
(1) Furnace whistle	56%	56%	44%	57%
(1) Low-flow showerhead	64%	69%	59%	71%
(1) Faucet aerator	60%	54%	54%	62%
Don't know	12%	5%	7%	9%

Note: Percentages exceed 100% because respondents could choose more than one response.

Table 6-10: EE Measures Received by Standard Kit Participants

Standard Kit Measure	CEI	OE	TE	Total
	Percentage of Respondents (n=48)	Percentage of Respondents (n=39)	Percentage of Respondents (n=41)	Percentage of Respondents (n=128)
(1) Three-way CFL light bulb	33%	44%	27%	34%
(1) Three-way LED light bulb	56%	62%	54%	57%
(3) 9W LED light bulbs	54%	59%	59%	57%
(1) 15W LED light bulb	65%	69%	71%	68%
(2) LED nightlights	69%	79%	85%	77%
(1) Furnace whistle	60%	67%	66%	64%
Don't know	19%	10%	10%	13%

Note: Percentages exceed 100% because respondents could choose more than one response.

Respondents were asked if they had any suggestions for additional kit measures. Most either voiced thankfulness for the kits and overall approval for the choice in kit contents or did not share any suggestions. A few provided more specific comments. The most common positive measure-specific comment was that they appreciated the nightlights and would appreciate additional ones (8%). Although only a few, the most common negative measure-specific comment was that the furnace whistle was either difficult to install or that they did not find it useful (5%).

Customer Installation of Measures

Survey questions also enabled participants to provide feedback regarding the installation of the kit contents. About one-third of respondents (32%) noted they installed all kit measures received. Sixty-seven percent of respondents stated they installed some of the products and only 2% of respondents said they installed none of the measures they received.[16]

The reported reasons participants did not install all the kit measures are detailed in Table 6-11. Of the respondents who reported that they had not installed all the kit measures (n=152), 63% of respondents indicated they were waiting for bulbs to burn out. Fourteen percent of respondents noted that they had not installed all the products because they did not fit into any fixture or had some other issue with product installation such as the showerhead, furnace whistle, or aerator not fitting or being a challenge to install. A significant portion of respondents (24%) mentioned other reasons for choosing not to install all the products in the kit, including disliking the products, not having sufficient time, and not needing the measures. Two survey respondents (1%) noted that some of the products they received were broken; neither of those customers reported contacting the Companies regarding replacement items.

Table 6-11: Reasons Participants Did Not Install All Kit Measures

Reason	Total	
	n	Percent (n=152)
Waiting for light bulbs to burn out	95	63%
Does not fit into any fixture/other installation issue	22	14%
Don't know	10	7%
Bulbs were not bright enough	4	3%
Some of the products were broken	2	1%
Bulbs were too bright	2	1%
Other*	37	24%

The measures most frequently installed by customers were the LED nightlights and the 9W LED bulbs (92% for both). Table 6-12 displays the percent and number of respondents who reported installing at least one of each measure they received in their kit.

[16] The percentages shown here do not sum to exactly 100% due to rounding.

Table 6-12: Participant Installation of EE Kit Measures

Measure	Number of Respondents	Percentage of All Respondents (n=222)
LED nightlight	177	92%
9W LED light bulb	115	92%
Three-Way LED light bulb	85	66%
15W LED light bulb	92	66%
Three-Way CFL light bulb	84	61%
Low flow showerhead	34	51%
Faucet aerator	24	41%
Furnace whistle	31	23%

Note: Percentages may exceed 100% because respondents could choose more than one response.

Most respondents reported installing the nightlights where there had been none previously. Of the 346 nightlights respondents reported installing, they reported that 228 (66%) were installed in locations where there was no nightlight previously and 34% stated that they had replaced a standard efficiency nightlight.

About half of respondents (52%) reported installing all three of the 9 watt LED bulbs that they received in their kits. Fifty-five percent of respondents recalled installing the 9 watt LED bulbs to replace incandescent light bulbs.

Participant Motivations and Preferences

Survey respondents' reported motivations for requesting an energy efficiency kit mirrored previous years. The most frequently cited reasons for requesting a kit was that it was provided at no additional cost, customer interest in saving money, and interest in saving energy. Table 6-13 displays survey respondents reported motivations for requesting the kit.

Table 6-13: Factors Motivating Participation in EE Kits Subprogram

Motivating Factors	Percentage of Respondents (n=222)
Provided at no additional cost	65%
Looking for ways to save energy	58%
Interested in saving money	59%
The kit looked useful	53%
Recommendation from a friend	15%
Other	3%

Note: Percentages may exceed 100% because respondents could choose more than one response.

ADM asked survey respondents which item they perceived to be the most useful. The highest proportion of respondents (29%) indicated the LED nightlight(s) were most useful; the furnace whistle (4%) and faucet aerator (1%) were the least useful items. Table 6-14 below shows the results.

Table 6-14: Usefulness of Individual EE Kit Measures

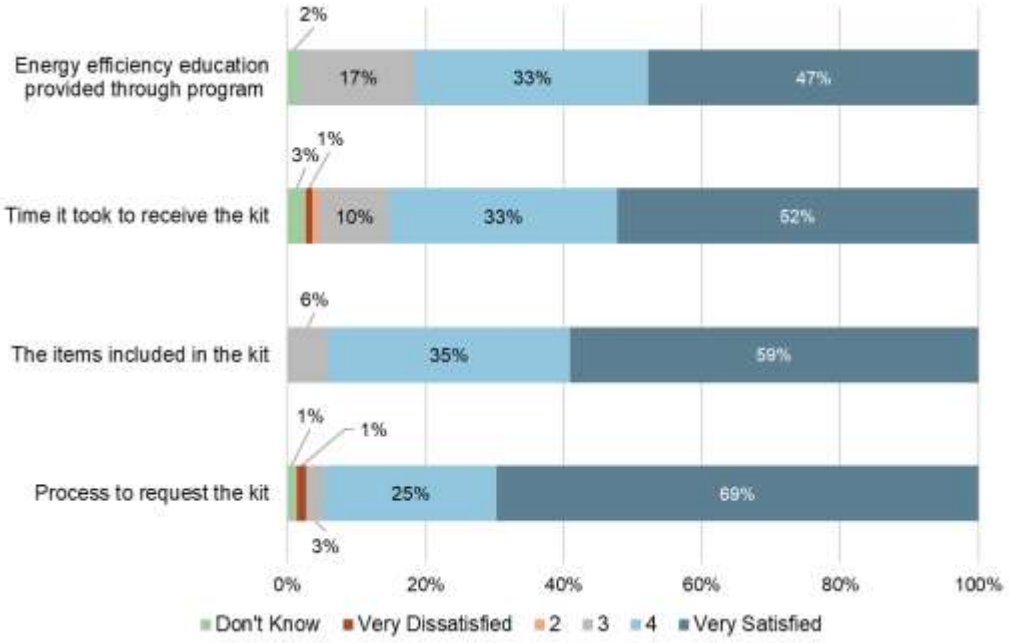
Most Useful Item	Number of Respondents	Percentage of Respondents (n=198)
LED nightlight/s	57	29%
15W LED light bulb/s	49	25%
Three-way LED light bulb	35	18%
9W LED light bulb/s	24	12%
Three-way CFL light bulb	17	9%
Furnace whistle	8	4%
Low-flow showerhead	5	3%
Faucet aerator	2	1%

Customer Satisfaction and Knowledge of Energy Efficiency

Survey respondents rated their satisfaction on several subprogram aspects. Participants' responses were recorded on a 5-point scale, from 1 ("very dissatisfied") to 5 ("very satisfied"; see Figure 6-3). Most survey respondents rated their satisfaction a 4 or 5 on all aspects of the subprogram, indicating that they were satisfied or very satisfied. Ninety-three percent of respondents rated were satisfied with the items included in the kit.[17] Eighty-five percent of respondents were satisfied with the time it took to receive the kit.[18] Figure 6-3 displays survey-takers satisfaction with several aspects of the EE kits subprogram.

[17] Rated their satisfaction as a 4 (35%) or 5 (59%).
[18] Rated their satisfaction as a 4 (33%) or 5 (52%).

Figure 6-3: Participant Satisfaction with EE Kits Subprogram



Subprogram Participation Effects

Survey respondents were asked about their participation in the subprogram. Sixty-eight percent of respondents indicated that participation in this subprogram had increased their knowledge of ways to save energy either significantly (18%) or somewhat (50%). Almost three-quarters of survey respondents noted that their participation had increased their satisfaction with their utility.[19]

Forty-five percent of respondents noted that they were aware of other rebates or discounts that the Companies offer to help customers purchase energy efficient equipment to help save energy. Of all survey participants (n=222), 17% reported learning about other rebates or discounts through their participation in this subprogram and 23% were already aware of these offerings (5% did not recall how they learned of the other offerings). Therefore, the subprogram increased awareness of other efficiency rebates and discounts by approximately 70%.

Twenty-eight percent of survey respondents noted that they had purchased additional energy efficient items because of the information provided in their kit. Most respondents that reported purchasing and installing additional equipment reported purchasing and installing energy efficient lighting (81%) or appliances such as refrigerators, clothes dryers, or washers (40%). Other respondents noted purchasing and installing energy efficient HVAC equipment (16%), nightlights (15%), and other measures such as water heaters and items for weatherization (8%).

[19] Rated their satisfaction as having increased somewhat (48%) or greatly (26%)

Home Characteristics

Participants' home characteristics are categorized on the following page in Table 6-15. Almost three-quarters of recipients lived in single-family detached homes (73%) and a similar proportion owned their home (69%). Respondents also reported on the number of people that lived in their home; seventy-six percent of respondents reported that three or fewer people lived in their home.

Table 6-15: EE Kit Participants' Home Characteristics

Characteristic	Percentage of Respondents
Home Type (n=221)	
Single-family home, detached construction	73%
Apartment with 4+ units	9%
Single-family home, factory manufactured/modular	6%
Apartment with 2 or 3 units	5%
Condominium	3%
Townhouse	3%
Mobile home	1%
Other - Write In (Required)	1%
Own or Rent (n=222)	
Own	69%
Rent	29%
Don't know	1%
Year Built (n=222)	
Before 1960	33%
1960-1969	8%
1970-1979	14%
1980-1989	12%
1990-1999	9%
2000-2009	11%
2010 or Later	5%
Don't know	9%
Above Ground Living Space (n=222)	
Less than 1,000 square feet	15%
1,000 to less than 2,000 square feet	45%
2,000 to less than 3,000 square feet	25%
3,000 to less than 4,000 square feet	3%
4,000 to less than 5,000 square feet	1%
5,000 square feet or greater	1%
Don't Know	9%
Heating Type (n=222)	
Natural gas heating	73%
Electric heating	17%
Other	8%
Don't know	2%

7 Audits & Education

The purpose of this chapter is to present, in detail, the evaluation of the Audits & Education subprogram of the EE Homes program.

A total of 26,267 customers participated in the Audits & Education subprogram in 2019 as shown in Table 7-1. Of these customers, approximately 30% completed a comprehensive audit, 63% conducted an online audit, and 7% participated in an audit administered by telephone.

Table 7-1: Participation by Audit Type and EDC

EDC	Comprehensive Audit	Online Audit		Totals
		Online Method	Telephone Method	
CEI	2,956	6,070	600	**9,626**
OE	3,689	8,118	882	**12,689**
TE	1,213	2,485	254	**3,952**
Total Program	**7,858**	**16,673**	**1,736**	**26,267**

ADM also found that approximately 3% of customers that interacted with the audit tool, engaged with the tool more than once during the program year, as shown in Table 7-2. Almost all participants that engaged with the audit tool more than once during the program year were found to have interacted with the tool two times.

Table 7-2: Online Audit Engagement Activity in 2019

Engagement Activity	CEI		OE		TE		Totals
	Online	Telephone	Online	Telephone	Online	Telephone	
PY2019 Participants	6,462	649	8,711	937	1,492	158	**18,409**
PY2019 Participants that Engaged with the Audit Tool 2 or more times in 2019	168	26	242	36	62	10	**544**

7.1 Description of the Audits & Education Subprogram

There are two types of audits in the Audits & Education subprogram: Comprehensive and Online. The Comprehensive Audit entails an in-home visit and the Online Audit is taken online by a participant or indirectly through a telephone call with support from a

representative. Both Comprehensive and Online Audits include a report recommending specific energy-saving measures.

7.1.1 Comprehensive Audits

The target market for the Comprehensive Home Audit (CHA) are residential single-family homeowners, multi-family residences, and manufactured homes. The subprogram provides a comprehensive home energy audit with air infiltration testing using a blower door diagnostic test to improve the building envelope's thermal integrity. The subprogram also evaluates home appliance, lighting, and HVAC system efficiencies.

In the CHA subprogram, customers pay a discounted fee and can elect to have energy efficiency measures installed during the time of the audit and/or home improvement measures installed later by participating contractors. Customers who implement eligible energy savings measures are entitled to additional rebates from the Companies.

The CHA includes:

- An evaluation of the home's heating and cooling system, insulation levels, windows, doors, appliances, and lighting;
- A blower door diagnostic test to detect air leaks in the home's building envelope; and
- An energy audit report that recommends specific energy-saving measures appropriate for the home. Customers who implement the recommended measures are entitled to rebates from the Companies.

Energy efficiency measures that can be installed during the audit include:

- LED Bulbs and Nightlights
- Low Flow Showerheads
- Faucet Aerators (kitchens and bathrooms)
- Pipe Wrap Insulation
- Smart Strip Power Strips

Additional home improvement measures that may be recommended during a residential energy audit include the following items:

- Roof and Ceiling Insulation
- Wall Insulation
- Energy Star® Qualified Windows

- Air Sealing
- Duct Sealing

7.1.2 Online Audits

The Online Audit subprogram allows residential customers in single-family and multi-family homes to analyze their home's energy use. Customers can learn of the Online Audit subprogram on the Companies' website as well as on the Energy Save Ohio website.

Customers can take a home energy audit at any time during the year. Home energy audits can be conducted in one of two ways: (a) using a personal computer to directly access the online software application (Home Energy Analyzer) on the Companies' website or (b) by phone with the assistance of a Companies' Contact Center Representative ("CSR"), who administers the online software audit over the phone and provides energy savings tips.

A home energy audit done by phone is typically initiated when a customer calls the Companies' CSR with questions about an electricity bill. A CSR explains the bill to the customer in terms of the key factors that contribute to the customer's energy use. The customer is offered a home energy audit that includes a review of the customer's billing history.

Upon completion of the Online Audit tool, a pie chart is displayed with categories of annual energy usage and where customers use the most energy in their home. Customers are then encouraged to explore tips on how to reduce energy usage in the category where they have the highest usage. These tips also lead to other program recommendations. After reviewing the tip category where the annual energy usage is the highest, customers can review the library of all Ways to Save tips.

A telephone audit resembles an online audit in that the customer gets a review of usage history and feedback on basic ways to save energy. Customers receiving a telephone audit are offered a brochure on tips for saving energy in the home.

7.2 Sampling

ADM completed a census review of all measures listed in the tracking comprehensive audits tracking data to ensure there were no data entry errors or duplicate entries. ADM completed a similar census review of the online audit subprogram tracking data to ensure there were no duplicates, data entry errors, or double counted participants.

The sample size for the follow-up surveys in each service territory achieved a relative precision of ±10% at the 90% confidence interval. The sample size calculation for achieving 90% confidence with 10% precision is shown in Equation 7-1 on the following page.

Equation 7-1: Minimum Sample Size Formula for 90 percent Confidence

$$n_0 = \frac{N \times \frac{1}{4}}{(N-1) \times \frac{D^2}{Z^2_{\alpha/2}}}$$

Where:

n_0	= Minimum sample size
N	= Population size, assumed to be 100,000 or greater
$Z^2_{\alpha/2}$	= Z value at 90% confidence interval, 1.645
¼	= The maximum value of p(1-p) at p=1/2, a conservative estimate for sample size
D	= Relative Precision (0.10)

ADM targeted surveying 70 comprehensive audit customers from each of the EDCs in addition to 70 online audit customers from each of the EDCs[20]. Surveys were conducted in the 1st quarter of 2019 with sample sizes that meet the requirement for ±10 percent precision (Table 7-3).

Table 7-3: Sampling Plan 2019 Audits & Education Participants

EDC	Comprehensive Audits		Online Audits			
			Online Method		Telephone Method	
	Sampling Proportion	Sample Size	Sampling Proportion	Sample Size	Sampling Proportion	Sample Size
CEI	0.33	n = 72	0.33	n = 55	0.33	n = 17
OE	0.34	n = 73	0.35	n = 58	0.33	n = 17
TE	0.33	n = 70	0.33	n = 55	0.33	n = 17
Total	1.00	n = 215	1.00	n = 168	1.00	n = 51

7.3 Energy Savings and Peak Demand Reduction Calculations

This section describes ADM's approach to determine the energy savings and peak demand reduction realized by the Audits & Education subprogram.

[20] For online audits, ADM collected approximately 75% of surveys from customers that participated in their audit online and 25% of surveys from customers that completed their audit over the phone with the help of a customer service representative. This proportioning was based on realized savings from PY2018.

7.3.1 Comprehensive Audit

Data Collection

ADM audited a census of the Comprehensive Audits data and found the data to be adequate for impact evaluation. The average ex-ante estimates of kWh savings and kW reduction per individual audit are shown in Table 7-4. These "per audit" savings values represent the average impact of each audit, calculated by dividing the cumulative, measure-level ex-ante savings for the entire Comprehensive Audits subprogram by the total number of audits performed.

Table 7-4: Comprehensive Audit Ex-Ante Average per Audit kWh & kW

EDC	Ex-Ante kWh	Ex-Ante kW
CEI	566	0.07
OE	608	0.07
TE	533	0.06

Customer Surveys

A survey was distributed to determine measure specific installations and bulb quantities by room type. The data collected was used to calculate ISRs, HOU, and coincidence factors for peak demand. Any other measures installed by the subprogram were also verified with customers. A random sample of customers were invited to participate in an online survey distributed via email.

On-Site Verification Visits

ADM conducted site visits in the homes of surveyed participants who agreed to a follow-up visual verification visit. The goal of these visits was to confirm the installation of various measures in customers' homes by the subprogram. Data collected via these site visits was used to confirm self-reported responses from surveys and evaluate overall program operations.

Impact Analysis

The primary deemed savings and/or engineering algorithm source for determining program impacts was the OH TRM. The PA TRM was used as a secondary calculation source for all measures not listed in the OH TRM.

Per Ohio RC §4928.662, for all measure types listed in the OH TRM; all installation rates, deemed savings, and hours of use were calculated per the OH TRM ("Deemed"). In addition, ADM calculated gross savings for measures in the program with "as found" baseline conditions, hours of use, and installation rates. The values reported for both ex-

ante and ex-post energy savings (kWh) and peak demand reduction (kW) represent the higher calculated value obtained from both methodologies.

The measures distributed during audits, their ex-ante energy and demand savings, and the source of the method utilized to determine these are presented on the following page in Table 7-5. Following this table are detailed descriptions of the analysis methods used to calculate kWh and kW savings for the measures included in the Comprehensive Audits.

Table 7-5: Comprehensive Audit Analysis Sources

Measure Type	Source for Analysis Method	CEI		OE		TE	
		Ex-Ante per unit kWh	Ex-Ante per unit kW	Ex-Ante per unit kWh	Ex-Ante per unit kW	Ex-Ante per unit kWh	Ex-Ante per unit kW
11w BR30 LED	PA TRM	55.3	0.007	55.3	0.007	55.3	0.007
11w LED	PA TRM	43.0	0.005	43.0	0.005	43.0	0.005
15w LED	PA TRM	58.4	0.007	58.4	0.007	58.4	0.007
3-way LED	PA TRM	68.3	0.008	68.3	0.008	68.3	0.008
4w LED	PA TRM	25.6	0.003	25.6	0.003	25.6	0.003
5.5w LED	PA TRM	35.4	0.004	35.4	0.004	35.4	0.004
6w LED	PA TRM	34.8	0.004	34.8	0.004	34.8	0.004
9w Flood LED	PA TRM	47.1	0.006	47.1	0.006	47.1	0.006
9w LED	PA TRM	34.8	0.004	34.8	0.004	34.8	0.004
2 pin LED	PA & OH TRMs	22.5	0.003	22.5	0.003	22.5	0.003
4 pin LED	PA & OH TRMs	9.2	0.001	9.2	0.001	9.2	0.001
T8, Hallway	PA & OH TRMs	17.4	0.002	17.4	0.002	17.4	0.002
T8, Kitchen	PA & OH TRMs	17.4	0.002	17.4	0.002	17.4	0.002
LED Nightlight	PA TRM	10.5	0.000	10.5	0.000	10.5	0.000
1/2 Pipe Wrap	OH TRM	16.7	0.002	16.7	0.002	16.7	0.002
3/4 Pipe Wrap	OH TRM	25.0	0.003	25.0	0.003	25.0	0.003
Faucet Aerator	OH TRM	30.9	0.004	30.9	0.004	30.9	0.004
Low-flow Showerhead	OH TRM	237.0	0.030	237.0	0.030	237.0	0.030
Power Strip	OH TRM	56.5	0.006	56.5	0.006	56.5	0.006
LED Exit Sign	OH TRM	179.9	0.022	179.9	0.022	179.9	0.022
Air Sealing	OH TRM	810.7	0.025	3,336.2	0.030	1,346.8	0.009
Insulation	OH TRM	1,986.6	0.165	2,323.4	0.226	780.0	0.037
Windows	OH TRM	332.5	0.063	323.0	0.063	323.0	0.063

LED Bulbs

For LEDs, the kWh savings and kW reduction per measure will be calculated per procedures set out in the PA TRM and OH TRM using Equation 7-2 and Equation 7-3.

Equation 7-2: LED Calculations for kWh Savings

$$\Delta kWh = \frac{Watts_{base} - Watts_{EE}}{1000 \frac{W}{kW}} \times Hours \times WHFe \times ISR$$

Equation 7-3: Calculations for Summer Peak Demand Reduction

$$\Delta kW = \frac{Watts_{base} - Watts_{EE}}{1000 \frac{W}{kW}} \times CF \times WHFd \times ISR$$

Where:

Watts$_{base}$ = Deemed wattage of existing bulb

Watts$_{EE}$ = Watts of LED

ISR = In Service Rate or percentage of units rebated that get installed (from participant surveys and site visits)

HOU = Average hours of use per year = 1,040 (from Ohio TRM)

WHFe = Waste Heat Factor for energy - to account for cooling savings from efficient lighting = 1.07 (from Ohio TRM)

CF = Demand coincidence factor

LED Nightlights

The OH TRM does not specify an algorithm for LED nightlights, so energy savings will be calculated using Equation 7-4 from the PA TRM algorithm.

Equation 7-4: LED Nightlights Calculation of kWh Savings

$$\Delta kWh = \frac{Watts_{base} - Watts_{NL}}{1000 \frac{W}{kW}} \times NL_{hours} * 365 \times ISR$$

Where:

Watts$_{base}$ = Wattage of baseline nightlight, from program tracking data

Watts$_{NL}$ = Wattage of new bulb, from program tracking data

ISR = In Service Rate or percentage of units rebated that get installed (from participant surveys)

NL_{hours} = Average hours of use per day per nightlight

= 12 (per the PA TRM)

Per the PA TRM, there is no measurable kW reduction attributed to LED nightlights.

Low Flow Showerheads

For residential low flow showerheads, in which the subprogram intends for auditors to implement a direct installation/early replacement[21] policy, the kWh savings and kW savings per measure will be calculated using Equation 7-5 and Equation 7-6 from the OH TRM. Only savings pertaining to electric hot water heating will be calculated.

Equation 7-5: Low Flow Showerhead Calculation of Energy Savings

$$\Delta kWh = ISR * (GPM_{base} - GPM_{low}) * kWh/GPM_{reduced}$$

Equation 7-6: Calculation of Peak Demand Savings

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

Where:

GPM_{base} = Gallons per minute of baseline showerhead

= 2.87

GPM_{low} = Gallons per minute of low flow showerhead

=1.60

ISR = In Service Rate (i.e., percentage of units provided by the program that are actually installed as estimated by the lighting verification survey)

$kWh/GPM_{reduced}$= Assumed kWh savings per GPM reduction

= 173

Hours = Average number of hours per year spent using showerhead

= 29

CF = Summer Peak Coincidence Factor

= 0.00371

Faucet Aerators

Energy and demand savings for faucet aerators will be calculated using the Ohio TRM algorithms for residential low flow faucet aerators in which the subprogram intends for auditors to implement a direct installation/early replacement[22] policy. Only savings

[21] See Ohio TRM, pp. 93-96.
[22] See Ohio TRM, pp. 89-92.

pertaining to electric hot water heating will be calculated using Equation 7-7 and Equation 7-8. The subprogram may install aerators for either kitchen or bathroom faucets, or both.

Equation 7-7: Faucet Aerators Calculation of Energy Savings

$$\Delta kWh = ISR * \frac{\frac{\left(\left(\frac{GPM_{base} - GPM_{low}}{GPM_{base}}\right) * \#people * \frac{gals}{day} * \frac{days}{year} * DR\right)}{F/_{home}} * 8.3 * \frac{(T_{ft} - T_{mains})}{1{,}000{,}000}}{(DHW\ Recovery\ Efficiency/_{.003412})}$$

Where:

ISR	= In Service Rate as verified by ADM onsite visits and surveys
GPMbase	= Gallons per minute of baseline faucet
	= 2.2[23]
GPM_{low}	= Gallons per minute[24] of low flow faucet[25]
# people	= Average number of people per household
	= 2.46[26]
Gals/day	= Average gallons per person per day used by all faucets in the home
	= 10.9[27]
Days/year	= 365
DR	= Percentage of water flowing down the drain
	= 63%[28]
F/home	= Average number of faucets in the home
	= 3.5[29]
8.3	= Constant to convert gallons to pounds

[23] As stipulated by the Ohio TRM; see footnote 227 on p.90 of the Ohio TRM.
[24] This rate was captured by ADM through install verification visits and participant surveys.
[25] Assumed value is 1.5 for kitchen faucets and 1.0 for bathroom faucets, based on Program installation policy.
[26] As stipulated by the Ohio TRM; see footnote 228 on p.90 of the Ohio TRM.
[27] As stipulated by the Ohio TRM; see footnote 229 on p.90 of the Ohio TRM.
[28] If water is collected in a sink, a faucet aerator will not result in any saved water.
[29] As stipulated by the Ohio TRM; see footnote 231 on p.90 of the Ohio TRM.

T_{ft} = Assumed temperature of the water used by faucet
= 80[30]

T_{mains} = Assumed temperature of water entering house
= 57.8[31]

DHW Recovery Efficiency
= Recovery efficiency of electric hot water heater
= 0.98

0.003412 = Constant to convert MMBtu to kWh

Equation 7-8: Calculation of Summer Coincident Peak Demand Savings

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

Where:

Hours = 21

CF = Summer Peak Coincidence Factor
= 0.00262

Pipe Wrap

Energy and demand savings for adding insulation to un-insulated domestic hot water pipes will be calculated using the Ohio TRM algorithms for domestic hot water pipe insulation in which the subprogram intends for auditors to implement a direct installation/early replacement[32] policy. Only savings pertaining to electric hot water heating will be calculated using Equation 7-9 and Equation 7-10. Care will be taken that savings are not over reported due to interactive effects.

Equation 7-9: Pipe Wrap Calculation of Energy Savings

$$\Delta kWh = \frac{\left(\left(\frac{1}{R_{exist}} - \frac{1}{R_{new}}\right) * (L * C) * \Delta T * 8760\right)}{\eta \mathrm{DHW} / 3413}$$

Where:

R_{exist} = R-value of un-insulated pipe = 1.0[33]

R_{new} = R-value of hot water pipe after being wrapped with insulation.

L = Length of pipe wrapped by insulation from water heater up to the first elbow

[30] As stipulated by the Ohio TRM; see footnote 232 on p.90 of the Ohio TRM.
[31] As stipulated by the Ohio TRM; see footnote 233 on p.90 of the Ohio TRM.
[32] See Ohio TRM pp. 97-99.
[33] See Ohio TRM, p. 97, footnote 250.

C = Circumference of pipe wrapped by insulation in feet,

ΔT = 65º F [34]

8,760 = Number of hours in a year.

ηDHW = Recovery efficiency of electric hot water heater = 0.98[35]

3,413 = Conversion from Btu to kWh.

Equation 7-10: Calculation of Summer Coincident Peak Demand Savings

$$\Delta\text{kW} = \frac{\Delta\text{kWh}}{8760}$$

Where:

ΔkWh = Savings from pipe wrap installation

8760 = Number of hours in a year

Smart Strip Power Strips

Energy savings for smart strip power strips are deemed per the Ohio TRM[36] and demand savings are determined using Equation 7-11. This measure characterization provides savings for a 5-plug strip and a 7-plug strip.

Energy Savings: ΔkWh5-Plug = 56.5 kWh

ΔkWh7-Plug = 102.8 kWh

Equation 7-11: Calculation of Summer Coincident Peak Demand Savings

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

Where:

Hours = Annual number of hours during which the controlled standby loads are turned off by the Smart Strip.

= 7,129

CF = Summer Peak Coincidence Factor for measure

= 0.8

ΔkW5-Plug = 56.5 / 7129 * 0.8

= 0.0063 kW

[34] Average temperature difference between supplied water and outside air temperature = (see Ohio TRM, p. 97, footnote 251).
[35] See Ohio TRM, p.97, footnote 252.
[36] See Ohio TRM, p. 76.

ΔkW7-Plug = 102.8 / 7129 * 0.8

= 0.012 kW

LED Exit Signs

Energy savings for LED exit signs for multifamily common areas are deemed per the Ohio TRM[37], determined by Equation 7-12, and likewise demand savings are determined using Equation 7-13.

Equation 7-12: Calculation of Energy Savings

$$\Delta kWh = kW_{save} * HOU * ISR * (1 + WHF_e)$$

Equation 7-13: Calculation of Summer Coincident Peak Demand Savings

$$\Delta kW = kW_{save} * ISR * (1 + WHF_d)$$

Where:

kW_{save} = The difference in connected load between baseline equipment and efficient equipment

= ((0.5 * 0.040) + (0.5 * 0.012)) – 0.006

= 0.020

HOU = Hours of Use - the average annual operating hours of the baseline lighting equipment

ISR = In service rate, the percentage of rebated units that are actually in service.

WHF_e = Waste heat factor for energy; accounts for cooling savings from efficient lighting.

= 0.5 * 0.095 (conditioned) + 0.5 *0.0 (non-conditioned)

= 0.0475

WHF_d = Waste heat factor for demand to account for cooling savings from efficient lighting

= 0.5 *0.2 (conditioned) + 0.5 * 0.0 (non-conditioned)

= 0.10

[37] See Ohio TRM, p. 195.

Air Sealing

For air sealing, or otherwise referred to as air infiltration, the kWh savings and kW reduction per measure will be calculated per procedures set out in the Ohio TRM[38] calculated using Equation 7-14 and Equation 7-15.

Equation 7-14: Calculation of Energy Savings

$$\Delta kWh = \frac{\left(\frac{CFM50_{exist} - CFM50_{new}}{N - factor}\right) * 60 * CDH * DUA * 0.018}{1000 * \eta cool}$$

Where:

CFM50$_{exist}$ = Existing Cubic Feet per Minute at 50 Pascal pressure differential as measured by the blower door before air sealing

= actual recorded

CFM50$_{new}$ = New Cubic Feet per Minute at 50 Pascal pressure differential as measured by the blower door after air sealing

= actual recorded

N-Factor = Conversion factor to convert 50-pascal air flows to natural airflow

= 29.4

60 = Constant to convert cubic feet per minute to cubic feet per hour

CDH = Cooling Degree Hours

DUA = Discretionary Use Adjustment to account for the fact that people do not always operate their air conditioning system when the outside temperature is greater than 75°F

= 0.75

0.018 = The volumetric heat capacity of air (Btu/ft^3°F)

η_{cool} = Efficiency of Air Conditioning equipment

= actual recorded

Equation 7-15: Calculation of Summer Coincident Peak Demand Savings

$$\Delta kW = \frac{\Delta kWh}{FLH_{cool}} * CF$$

Where:

FLH$_{cool}$ = Full load cooling hours

[38] See Ohio TRM, p. 104.

CF = Summer Peak Coincidence Factor for measure

= 0.5

Insulation

Energy savings for attic insulation and wall insulation are deemed per the Ohio TRM[39] and are determined using Equation 7-16 and Equation 7-17.

Equation 7-16: Calculation of Energy Savings

$$\Delta kWh = \frac{\left(\frac{1}{R_{exist}} - \frac{1}{R_{new}}\right) * CDH * DUA * Area}{1000 * \eta cool}$$

Where:

R_{exist} = Existing effective whole-assembly thermal resistance value or R-value

= actual recorded

R_{new} = New total effective whole-assembly thermal resistance value or R-value

= actual recorded

CDH = Cooling Degree Hours

DUA = Discretionary Use Adjustment to account for the fact that people do not always operate their air conditioning system when the outside temperature is greater than 75°F

= 0.75

Area = Square footage of insulated area

= actual recorded

η_{cool} = Efficiency of Air Conditioning equipment

= actual recorded

Equation 7-17: Calculation of Summer Coincident Peak Demand Savings

$$\Delta kW = \frac{\Delta kWh}{FLH_{cool}} * CF$$

Where:

FLHcool = Full load cooling hours

[39] See Ohio TRM, p. 36 for attic insulation and p. 100 for wall insulation.

CF = Summer Peak Coincidence Factor for measure

= 0.5

Windows

For ENERGY STAR® windows, the total energy savings is considered the sum of savings determined from the Heating kWh savings[40] and Cooling kWh Savings, calculation shown in Equation 7-18, and, and the calculation of kW reduction per measure is shown in Equation 7-19. Both calculations are per procedures set out in the Ohio TRM[41].

Equation 7-18: Calculation of Cooling Energy Savings

$$Cooling\ kWh\ Savings = \%CoolKWHSav * \frac{FLH_{cool} * BtuH * \left(\frac{1}{SEER}\right)}{1000}$$

Where:

%CoolKWHSav = Percentage of cooling energy savings per 100 square feet of window

= 7%

FLH_{cool} = Full load cooling hours

= 552

BtuH = Size of equipment in Btuh

= 36,000

SEER = Assumed SEER efficiency of central AC unit

= 11

Equation 7-19: Calculation of Summer Coincident Peak Demand Savings

$$\Delta kWcooling = \%CoolKWSav * \frac{BtuH * \left(\frac{1}{EER}\right)}{1000} * CF$$

Where:

%CoolKWSav = Percentage of cooling energy savings per 100 square feet of window

= 3.7%

[40] TRM Deemed Values: Savings for this measure are based on REMRate modeling of a typical home in Columbus, Ohio climate with electric resistance or air source heat pump (COP 2.0), and assuming SEER 11 air conditioning (algorithm not available).

[41] See Ohio TRM, p. 115.

EER	= Assumed EER efficiency of central AC unit
	= 10.5
CF	= Summer Peak Coincidence Factor for measure
	= 0.5

7.3.2 Online Audit

The impact evaluation addressed the following research questions.

- How much energy savings do online, and telephone audit participants achieve when compared to non-participants?
- How do the two energy audit methods – online vs. telephone – compare in producing electric energy savings for customers?
- How effective is the program for online audit users compared to telephone audit users?

Data Cleaning and Quality Control

ADM checked, cleaned and incorporated the following data into the datasets used in the linear panel regression model:

- Monthly kWh consumption billing data provided by the Companies, for all treatment and control group samples for the period January 1, 2018, through January 17, 2020.
- Customer data which included:
  - Utility customer ID (Account Number)
  - Service Address Zip Code
  - Beginning and end dates of monthly electric bills, and number of days billed.
- Audits & Education subprogram delivery data which includes completion dates for each audit and audit method type (online vs. telephone).

ADM performed the following steps to prepare the data:

- Verified 2019 participants using the program delivery data.
- Merged the participant dataset with the raw billing data provided by the Companies.
- Cleaned the billing data of duplicate bills and information placed in the wrong columns.
- Removed nearly zero monthly consumption values.
- Assigned a single kWh value for each month for each Premise ID.

- Monthly billing data is reported in inconsistent time periods, ADM uses the energy usages and time periods to assign a daily kWh value that was then averaged into a monthly kWh value.

- Filtered out statistical outliers by keeping premises where the average daily consumption (ADC) values were larger than 3 kWh and less than two standard deviations from the mean (ADC).
- Removed program participants who also participated in other energy savings programs (cross-participants).

Mixed Effects Model

The mixed effects model specified in the equation below was used to determine daily average energy (kWh) savings for treatment group members in the Online Audits subprogram. A mixed effects model is referred to as a difference-in-difference model, as the difference in electricity usage between both a pre-period and a post-period, as well as the treatment and controls, is determined.

Equation 7-20: Mixed Effects Model

$$AEC_{i,t} = \beta_1 Post_{i,t} + \beta_2 Treat_{i,t} + \beta_3 CDD_{i,t} + \beta_4 HDD_{i,t} + \beta_5 Post_{i,t} Treat_{i,t} + \beta_6 Post_{i,t} CDD_{i,t} + \beta_7 Treat_{i,t} CDD_{i,t} + \beta_8 Post_{i,t} HDD_{i,t} + \beta_9 Treat_{i,t} HDD_{i,t} + \beta_{10} Post_{i,t} Treat_{i,t} CDD_{i,t} + \beta_{11} Post_{i,t} Treat_{i,t} HDD_{i,t} + \text{Customer}_i + E_{i,t}$$

For the mixed effects panel model, the subscript i denotes individual customers and $t = 1, \ldots, T(i)$ serves as a time index, where $T(i)$ is the number of bills available for customer i. The model is defined as "mixed effects" because the model decomposes its parameters into fixed-effects (i.e. Post, Treat, and its various interactions) and random effects (i.e. the individual customer's base usage). A fixed effect is assumed to be constant and independent of the sample, while random effects are assumed to be sources of variation (other than natural measurement error) that are uncorrelated with the fixed effects. The variables included in the regression model are specified below.

Where:

Average Electricity Consumption $AEC_{i,t}$

= Average daily use of electricity for period t for a customer (determined by dividing total usage over a billing period by number of days in that period).

Customer = Unique random intercept for each customer to control for any customer specific random effects.

Cooling Degree Days ($CDD_{i,t}$)

= Cooling degree days per period (determined by dividing total cooling degree days over a billing period by number of days in that period).

Heating Degree Days ($HDD_{i,t}$)

= Heating degree days per period (determined by dividing total heating degree days over a billing period by number of days in that period).

Post = Post is a dummy variable that is 0 if the monthly period is before the customer received their first HER, 1 if the monthly period is after the customer received their first HER and 9 if the monthly period is in which the customer received their first HER (commonly referred to as the "deadband" period). Deadband periods are dropped prior to running the model.

Treat = Treat is a dummy variable that is 0 if the customer is a member of the control group and a 1 if the customer is a member of the treatment group.

Control Group Selection

The control group serves as a baseline on energy consumption for the subprogram participants during the pre and post period in the modeling analysis. ADM requested monthly billing data and assessor data for a pool of control group candidates from the Companies. The data was used to identify a control group that has similar property characteristics and energy consumption. Propensity score matching will then be used to match the participant and control properties based on average daily consumption during the summer and winter season.

Propensity score matching is a method by which the control group is "matched" to the treatment group via a propensity score, which is derived from observed characteristics of a customer's likelihood of participating in the Online Audit subprogram. The probit model in Equation 7-21 below was used to estimate the propensity scores for all customers.

Equation 7-21: Propensity Score Matching for Online Audit Controls

$$Participation = \alpha + \beta[SummerkWh] + \rho[WinterkWh] + \varepsilon$$

Where:

Participation = a binary variable that is 1 if the customer is an Online Audit program participant and 0 if they are a non-participant;

SummerkWh	= a continuous variable that captures the customer's pre-assessment, weather normalized, average daily consumption during the summer months;
WinterkWh	= a continuous variable that captures the customer's pre-assessment, weather normalized average daily consumption during the summer months;
ε	= an error term;
β	= a coefficient showing the changes in propensity to participate in the Online Audit program that occurs for a change in the SummerkWh variable; and
ρ	= a coefficient showing the changes in propensity to participate in the Online Audit program that occurs for a change in the WinterkWh variable.

This process is designed to select, for each treatment premise, the handful of homes in the control group that match the participating premise's pre-treatment consumption patterns as closely as possible. The resulting matched control group is significantly better fit to the treatment group than a random sample of control premises. The mean average daily consumption of the matched treatment and control groups in the pre- and post-period is shown in Figure 7-1 below.

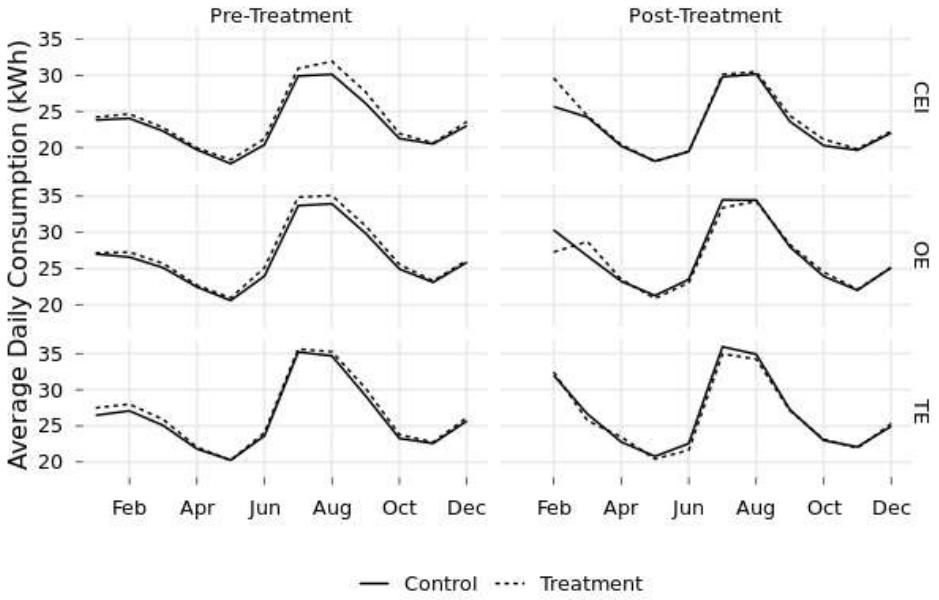


Figure 7-1: Average Daily Consumption for Online Audits, Matched Treatment and Control Groups

Energy Savings and Peak Demand Reduction Analysis

ADM combined all the Audits & Education treatment participants and using the associated (pre-treatment) control group calculated the average daily savings for the period between January 1, 2019 through December 31, 2019. Base on program participation levels in 2019 and in order to maintain statistically valid models, the two methods for conducting the online audits subprogram were evaluated together. ADM used the participant counts for each EDC and audit method to calculate the savings attributable to the subsets. Estimates of savings will be developed for two groups of customers as defined by type of audit. The two groups are as follows:

- Telephone audits
- Online audits

Summarized, the steps in the kWh calculation are as follows:

- For Step 1, assumed the estimated regression model represents "typical" customer behavior. The savings coefficient (daily savings per customer) can be estimated using Equation 7-22;

Equation 7-22: Online Audits Savings Coefficient

$$\Delta kWh = \beta_4 + {\beta_{10}}/{CDD_{avg}} + {\beta_{11}}/{HDD_{avg}}$$

where CDD_{avg} and HDD_{avg} are the average cooling and heating degree days, respectively, over the treatment period.

- For Step 2, multiplied the savings coefficient ($\Delta\mathrm{kWh}$) by 365 to get annual savings per participant.
- In Step 3, determined program-level kWh savings for each audit group and utility company by multiplying the per-participant kWh savings value for a group by the number of participants in that group.

The calculation of kW reductions will be based on the kWh savings values. The steps in the calculation of kW reductions are as follows.

- In Step 1, determined the per-participant kW reduction by multiplying the annualized savings from Step 3 of the kWh calculation by a coincident factor. The coincident factor is derived from the Savings Curve for Home Audits in 2019. The coincident factor is the average savings over all peak hours (3 PM – 6PM) in the months of June, July, and August on non-holiday weekdays.
- In Step 2, determined program-level kW reductions for each audit group for each utility company by multiplying the per-participant kW reduction value for a group by the number of participants in that group.

7.4 Detailed Impact Evaluation Findings

7.4.1 Comprehensive Audits

This section presents the findings of the impact evaluation of the Comprehensive Audits subprogram.

The 2019 evaluation results for estimated gross kWh energy savings and kW peak demand reductions for the Companies' service territories are summarized in Table 7-6 and Table 7-7. The subprogram level kWh realization rate is 112% and kW is 107%.

The variation in the ex-ante and ex-post savings calculation was primarily caused by the ISRs and allocation of LED bulb quantities by room type. For example, the ex-ante estimate used a deemed ISR of 92% from the PA TRM while the ex-post relied on data collected though the evaluation surveying efforts. The ex-post analysis ISRs from the 2019 surveying effort are reported in Table 7-6. Additionally, the ex-ante input for hours of use was the deemed hours of use from the OH TRM. The ex-post input for hours of use was calculated by allocating the percentage of installation by specific room type and assigning hours use by room type from the PA TRM.

Table 7-6: Comprehensive Audit Ex-Post Annual kWh Savings by Operating Company

EDC	Ex-Ante kWh	Ex-Post kWh	Realization Rate
CEI	1,678,517	1,898,393	113%
OE	2,247,740	2,497,925	111%
TE	648,570	716,236	110%
Total	**4,574,827**	**5,112,554**	**112%**

Table 7-7 below shows the ex-post Annual kW demand savings by Operating Company.

Table 7-7: Comprehensive Audit Ex-Post Annual kW Reduction by Operating Company

EDC	Ex-Ante kW	Ex-Post kW	Realization Rate
CEI	196.52	212.28	108%
OE	267.21	284.60	107%
TE	77.83	82.66	106%
Total	**541.56**	**579.54**	**107%**

In Service Rates

The Comprehensive Audits ISRs determined from the participant survey are shown in Table 7-8.

Table 7-8: Comprehensive Audits Measures' In-Service Rates Determined by Survey

Measure	N	ISR
Indoor LED	4,770	99%
LED Nightlight	97	98%
Aerator	61	97%
Showerhead	44	98%
Pipe Wrap	12	100%
Power Strip	12	92%

On-Site Verification Visits

ADM completed site visits at a total of 19 participants' homes. Data recorded by ADM field staff during the site visits verified installation and location of various measures (such as specific wattage LEDs). Such information could potentially enable more accurate calculations of values such as HOU, since survey tool does not require participants to differentiate between various wattage LEDs when indicating where the auditor installed program bulbs in their home. ADM field staff were able to verify approximately eighty percent of program installed LEDs; however, due to participants' lack of memory as to which LEDs were installed by the auditor and which they installed themselves, ADM could not directly confirm installation of all program LEDs. Since program participants were able to confirm in the survey that they had not removed the installed measures since the auditor's visit, and they were less able to accurately identify where specific measures were installed in their homes during visits later in the year, ADM determined that the ISR calculated from survey data was more reflective of the program installed measures.

7.4.2 Online Audits

This section details the impact evaluation results for the 2019 Online Audits subprogram. The linear regression model for the Online Audits subprogram had an adjusted R-Squared = 0.683 and showed an average daily savings 0.478 kWh per person per day across all three EDCs. The energy savings of the Online Audits subprogram for each EDC are presented in Table 7-9 and Table 7-10.

Table 7-9: Ex-Post kWh Savings per Online Audit Participant

CEI	Totals
kWh saved per participant	159.8
Number of participants	6,670
Total kWh saved	**1,066,031**
OE	Totals
kWh saved per participant	181.3
Number of participants	9,000
Total kWh saved	**1,632,013**
TE	Totals
kWh saved per participant	186.5
Number of participants	2,739
Total kWh saved	**510,872**
Combined Totals	Totals
Number of participants	18,409
Total kWh saved	3,208,916

Table 7-10: Ex-Post kW Savings per Online Audit Participant

CEI	**Totals**
kW reduction per participant	0.027
Number of participants	6,670
Total kW reduction	**178.61**
OE	Totals
kW reduction per participant	0.030
Number of participants	9,000
Total kW reduction	**273.44**
TE	Totals
kW reduction per participant	0.031
Number of participants	2,739
Total kW reduction	**85.60**
Combined Totals across Utilities	Totals
Number of participants	18,409
Total kW reduction	**537.65**

As shown in Table 7-9 verified ex-post electric savings were 3,208,916 kWh for all home energy audits combined. Of the total kWh savings, 91% were from online audits and 9% were from telephone audits. Table 7-10 shows that verified critical peak demand reduction was 537.65 kW. The realization rate is not equal to 100% due differences in weather and consumption patterns from the assumed values, and perhaps also the use of a set group of pre-defined control homes for the ex-post evaluation (as opposed to the ex-ante analysis, which employed pre-treatment data from participant homes for a control group).

Table 7-11: Ex-Post kWh & kW by Online Audit Type

EDC & Audit Type	Ex-Ante Savings		Ex-Post Savings		RR	
	kWh	kW	kWh	kW	kWh	kW
CEI Online	1,608,550	364.20	970,136	162.54	60%	45%
CEI Telephone	159,000	36.00	95,895	16.07	60%	45%
All CEI	**1,767,550**	**400.20**	**1,066,031**	**178.61**	**60%**	**45%**
OE Online	1,152,756	162.36	1,472,076	246.64	128%	152%
OE Telephone	125,244	17.64	159,937	26.80	128%	152%
All OE	**1,278,000**	**180.00**	**1,632,013**	**273.44**	**128%**	**152%**
TE Online	397,600	49.70	463,496	77.66	117%	156%
TE Telephone	40,640	5.08	47,375	7.94	117%	156%
All TE	**438,240**	**54.78**	**510,872**	**85.60**	**117%**	**156%**
Total	**3,483,790**	**634.98**	**3,208,916**	**537.65**	**92%**	**85%**

7.5 Detailed Process Evaluation Findings

The following section provides detailed findings from the process evaluation for the Audits and Education subprogram of the Energy Efficient Homes Program. The Audits and Education subprogram consists of both Online Audits and Comprehensive In-Home Audits.

7.5.1 Comprehensive Audits Program Operations Perspective

ADM researchers interviewed the Companies' program manager and the senior program manager at Franklin Energy ("Franklin") in October 2019. Franklin is the implementation contractor for the Comprehensive In-Home Audit program. This subprogram includes residential single-family audits, as well as multi-family audits in properties that are individually metered. This section summarizes the key elements of the subprogram's design, management, marketing and outreach, project implementation, and quality control and verification.

Staff Roles and Responsibilities

The Companies' program manager and the senior program manager for Franklin confirmed that their roles and responsibilities had not changed in 2019. The senior program manager for Franklin reported that her role was to oversee the Companies' audit programs. The Companies' program manager stated that she manages the audits program in Ohio and works with Franklin to ensure energy savings goals are achieved. In addition to the program staff at the Companies and Franklin, the subprogram is supported by office staff at the Companies that includes IT, operations, marketing, and communications. The Franklin senior program manager stated that there are currently four auditors and one field supervisor for single-family residential audits and three teams of two auditors and one field supervisor for multi-family audits. She stated that the number of single-family auditors would increase from four to six soon and that Franklin had additional resources the program could request to support the program if needed. The training requirements for auditors did not change in 2019. Single-family auditors are required to be BPI (Building Performance Institute) certified and new auditors are required to participate in onsite training with the field supervisor for their first two weeks. Multi-family auditors conduct audits for both commercial and residential customers and must undergo at least a week of onsite training with a field supervisor overseeing them.

Program Goals and Design

Both interviewees observed that the program was on track to achieve its energy savings goals for the Comprehensive In-Home Audit program. Regarding the program's overall design, neither interviewee identified significant changes in 2019, though both alluded to minor changes that were made to improve implementation. The senior program manager for Franklin stated that in April 2019 the program moved from an opt-in process to an opt-out process for residential multi-family participants. Previously the program required residents that pay their own electric bills in multi-family apartment buildings to opt in to participate in the program. The Companies' program manager stated that, because of this requirement, the program previously had been able to gain access only to a fraction of units in these types of buildings; the change to an opt-out process had increased participation to around 90% for multi-family, individually metered premises. She stated that they have not had any complaints about this change. The senior program manager for Franklin stated that residents at multi-family properties are informed of program participation by the property's management through a letter and poster that the Companies provide that informs residents of the program.

Program Implementation and Participation

The interviewees stated that the program was being implemented as designed and there were no major implementation changes in 2019. Franklin's senior program manager observed that the program was continually making small implementation improvements.

She specifically cited adding additional measures to the program as the field staff encountered different fixture types in multi-family residences.

Franklin's senior program manager stated that program tracking and quality control procedures had not changed in 2019. She stated that in addition to an automated quality assurance check that is built into their user interface she also checks data periodically each week and communicates with field staff if any inputs seem inaccurate or abnormal. The Companies' program manager reported that there were no data quality concerns. She stated that reports are generated monthly, though if any issues arise, they are identified and corrected within days.

The Companies' program manager and Franklin's senior program manager both noted that there was strong internal communication for the program. They stated that they are in daily contact with each other through both email and phone calls. Franklin's senior program manager stated that she also attended monthly in-person meetings at the Companies' offices. Regarding internal communication at Franklin Energy, the senior program manager mentioned that she spoke with the field supervisors daily to address any issues that arise (for example customer-service-related issues or unique or new measures at participating customer properties).

Marketing and Outreach

ADM researchers inquired with the Companies' program manager and Franklin's senior program manager regarding outreach and marketing strategies. Franklin's senior program manager noted that the program has had success with different strategies for the single-family and multi-family markets.

The interviewees observed that email blasts and targeted Facebook ads were more successful for marketing and outreach to single-family customers. Franklin's senior program manager stated that they had to pause their Facebook advertising for the audit program because there was such significant interest in the program that their 60-day pipeline for scheduling audits was filled.

Program Strengths and Challenges

Both interviewees provided positive sentiments regarding the program's design, plan, and implementation. The Companies' program manager said that the program's design is a strong aspect of the program because it allows for the program staff to work closely with the implementation staff to adapt and continuously improve the program.

Franklin's senior program manager observed that multi-family properties present unique challenges for program participation including required long lead times, dealing with housing authorities/boards, rescheduling requests, and existing energy efficiency contracts these buildings may have in place. She also stated that scheduling visits to multi-family properties is a challenge on occasion as the program requires property staff

to be on site while they are performing improvements. Both interviewees also mentioned initial outreach to multi-family customers was a barrier to program participation. Franklin's senior program manager observed that the same challenges exist for multi-family individually metered properties as for multi-family master metered properties.

Franklin's senior program manager stated that they have received overwhelmingly positive feedback from single-family residential customers and that a common refrain from customers is that they appreciate auditors explaining energy use and helping them to understand their electric bills. The senior program manager at Franklin and the Companies' program manager both stated that they felt the marketing and outreach for the program was a strength for both single-family and multi-family audits. Both interviewees related that they had determined the strongest tactics for each market through trial and error and have figured out which methods to use to effectively recruit participants in the different segments during this and past program years. In addition, the Companies' program manager mentioned both communication with Franklin staff and the field staffs' training as program strengths.

7.5.2 Comprehensive Audits - Participant Survey

This section presents key findings from a survey administered online by ADM to participants in the Comprehensive Audits subprogram of the EE Homes Program. The surveys collected data from 215 subprogram participants on their subprogram awareness, experience, energy-savings behaviors, equipment installed, satisfaction, and home characteristics.

Subprogram Awareness

Table 7-12 displays survey respondents' sources of program awareness. The most common sources of subprogram awareness that respondents cited were bill inserts and direct mail. A significant portion of respondents noted that they heard about the program through a method that was not listed ("other") and that included direct email from the Companies (4%) or being contacted by their building or property owner or manager (5%).

Table 7-12: Sources of Comprehensive Audit Program Awareness

Source of Awareness	CEI		OE		TE		Total	
	Count (n=72)	Percent	Count (n=73)	Percent	Count (n=70)	Percent	Count (n=215)	Percent
Bill Insert	24	33%	17	23%	22	31%	63	29%
Direct Mail *	21	29%	20	27%	21	30%	62	29%
Utility website	12	17%	12	16%	7	10%	31	14%
Word-of-Mouth	5	7%	13	18%	10	14%	28	13%
Don't Know	5	7%	4	5%	6	9%	15	7%
Social Media	3	4%	2	3%	2	3%	7	3%
Contractor	0	0%	1	1%	2	3%	3	1%
Print Ad	1	1%	1	1%	0	0%	2	1%
TV	0	0%	1	1%	0	0%	1	0%
Other	8	11%	9	12%	9	13%	26	12%

Note: Percentages exceed 100% because respondents could choose more than one response.
** From the electric company.*

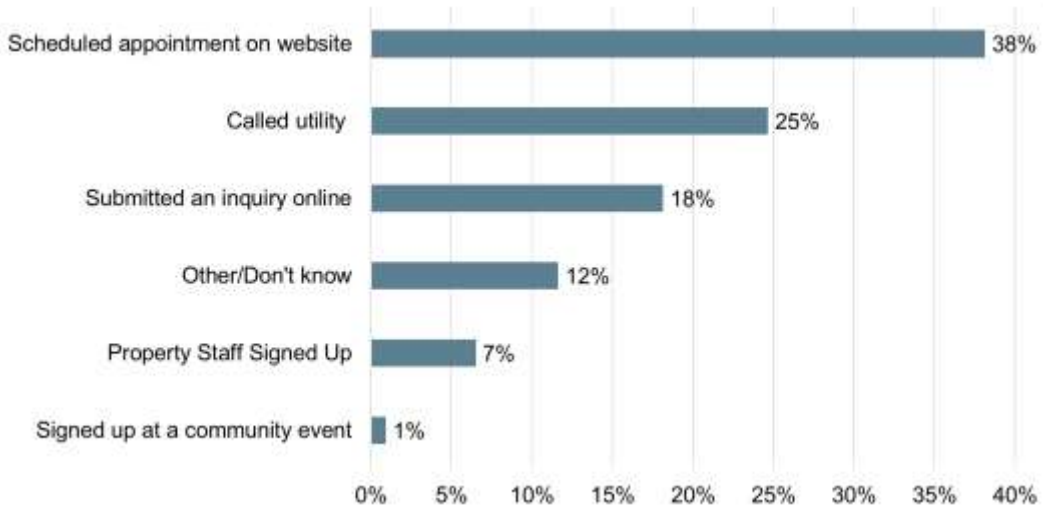
ADM asked respondents to rate the importance of various factors in their decision to participate in the subprogram. Respondents were asked to rate the importance of factors on a scale from 0 (“not at all important”) to 10 (“critically important”). Eighty-nine percent of respondents rated reducing their monthly utility bill a 7 or higher, while 74% rated learning more about their home’s energy use an eight or higher. A smaller portion of respondents (64%) rated helping save the environment an 8, 9, or 10.

Only 13% of respondents noted that a friend, neighbor, or relative had recommended the subprogram to them. Of those respondents that noted the subprogram had been recommended to them, 74% rated the recommendation a 7 or higher on the same importance scale, indicating that the recommendation had played a role in their decision to participate in the subprogram. Nine (4%) of the survey respondents recalled a contractor recommending the subprogram; six of these respondents rated the importance of this recommendation a 7 or higher.

Audit Experience

Regarding the method in which survey respondents signed up to participate, they most frequently cited scheduling an appointment themselves online. Figure 7-2 displays the methods in which they signed up to participate in the subprogram.

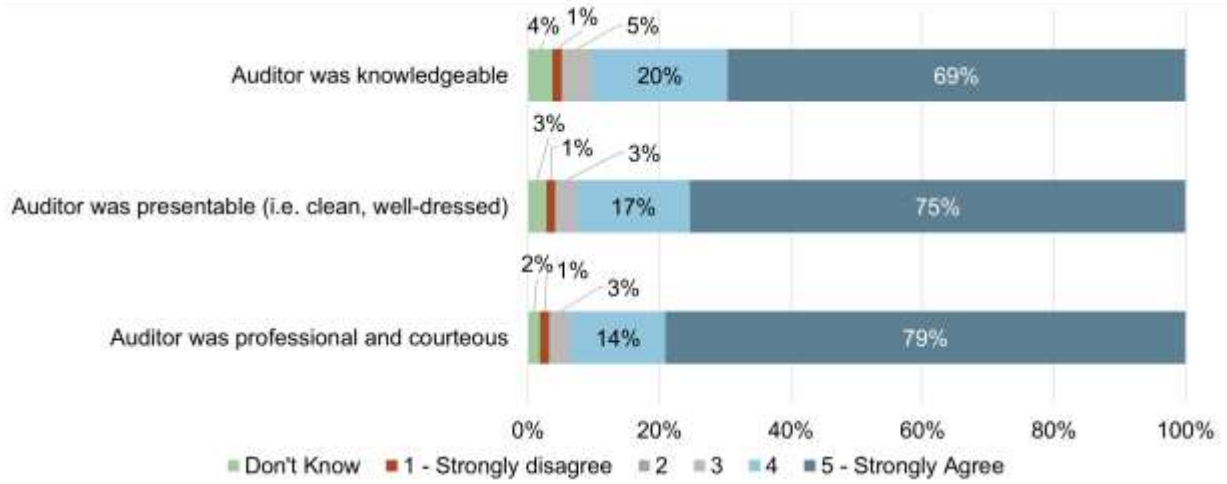
Figure 7-2: Comprehensive Audit Sign Up Method



Seventy-eight percent of survey respondents noted that they received an email or phone call two days before the audit. The remaining respondents could not recall (13%) or said they did not receive a reminder (8%).[42] Nearly all respondents (89%) reported that their home auditor was on time and most of the remaining respondents (10%) could not recall if they were on time. Two respondents (1%) reported that their auditor was not on time. Ninety-one percent of respondents rated their satisfaction with scheduling their audit as a 4 (21%) or 5 (70%) out of 5.

Figure 7-3, below, displays respondents' level of agreement with statements regarding their home auditor with 1 representing "strongly disagree" and 5 representing "strongly agree". Survey respondents generally agreed that their auditors were knowledgeable, presentable, and professional.

Figure 7-3: Respondents' Ratings of Experience with Auditor



[42] Percentages do not sum to 100% because of rounding.

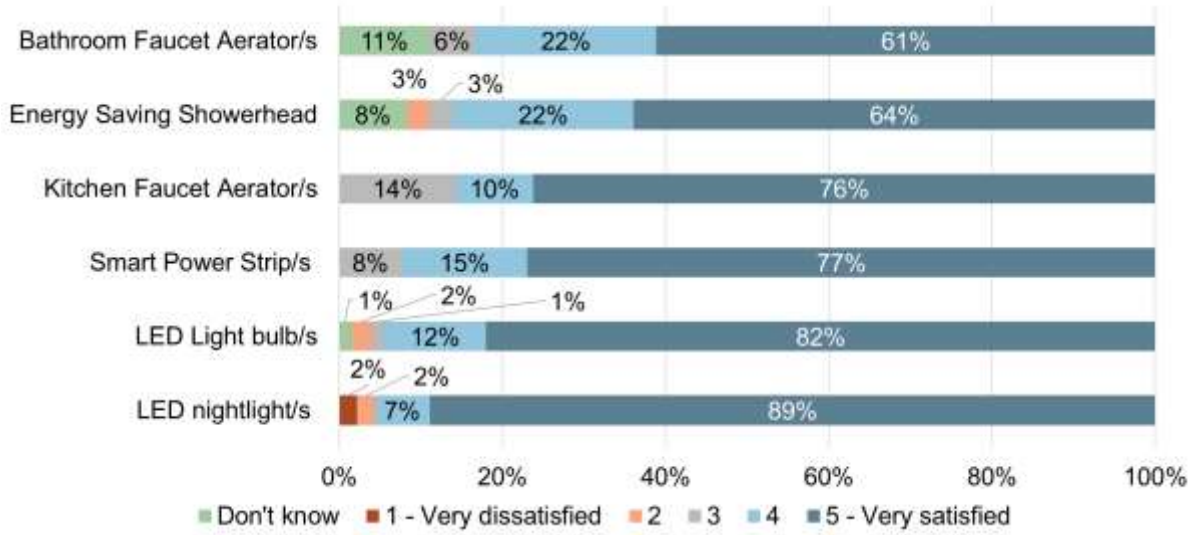
ADM inquired with survey-takers regarding the items that were installed during their audits and whether these items remained installed. Table 7-13 displays the survey results and includes an In-Service Rate. In addition to the items installed during the audit and listed in the table below, about half of survey-takers (46%) reported having a blower door test as part of their audit and 1% (2 respondents) confirmed receiving attic or wall insulation.

Table 7-13: In-Service Rate of Improvements Made During Comprehensive Audits

Measure Installed	Number of Measures Confirmed Installed	Number of Measures Still Installed	In-Service Rate
Pipe Wrap Insulation	12	12	100%
Low Flow Showerhead(s)	45	44	98%
Bathroom Faucet Aerator(s)	25	24	96%
LED Light bulb(s)	4,807	4,770	99%
Kitchen Faucet Aerator(s)	38	37	97%
Smart Power Strip(s)	13	12	92%
LED nightlight(s)	99	97	98%

Respondents were largely satisfied with the individual measures they received through the subprogram. On the following page, Figure 7-4 displays respondent satisfaction with each measure on a 1 to 5 scale, with 5 indicating the highest satisfaction.

Figure 7-4: Respondent Satisfaction with Audit Measures



Seventy percent of survey-takers noted that their auditor also recommended additional energy saving home improvements during their audit. Ninety-five percent of these

respondents rated were satisfied with these recommendations.[43] The remaining respondents rated the recommendations at a 3 out of 5 (3%) or did not know how to rate them (1%).

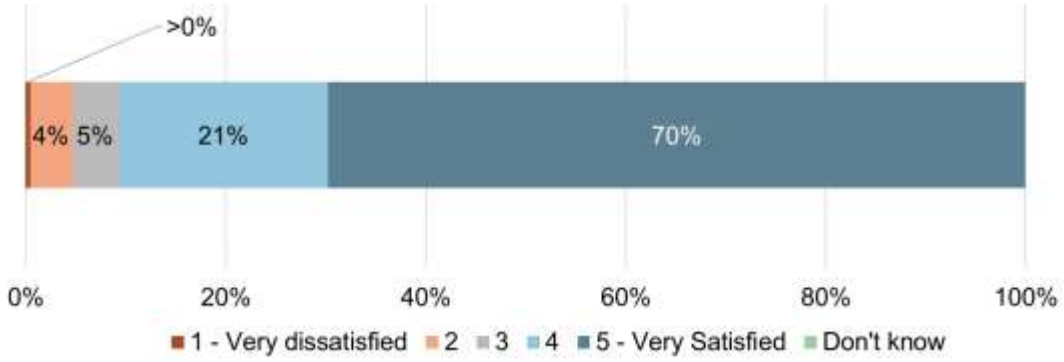
Of the respondents who reported receiving LED lightbulbs through the subprogram, 59% noted that they had LEDs installed prior to participating in the audit. This percentage was higher for survey-takers living in single-family homes (67%) compared to those residing in multi-family properties (33%).[44] However, despite the lack of experience with LEDs reported by multi-family participants, a high percentage of both single-family and multi-family groups noted that they would buy LEDs in the future (94% and 89%, respectively).

Two-thirds of respondents who said they received LED lightbulbs through the subprogram reported that the LEDs replaced incandescent bulbs. About one-third of LED lightbulb recipients said the LEDs replaced CFL bulbs. The remaining respondents reported that the program-sponsored bulbs replaced other LEDs (9%), were installed in a new fixture (2%), or did not know the type of lightbulb the LEDs replaced.

Overall, 88% of survey respondents rated their satisfaction with various aspects of the audit highly.[45] The remaining respondents rated their satisfaction as a 3 (7%), 2 (3%), or 1 (1%) out of 5. Respondents that rated their overall experience as a 3 or lower were asked to provide additional feedback. These respondents provided various comments including not feeling that the audit was all-encompassing (i.e. did not address certain energy efficiency issues).

Respondents also rated their experience with the subprogram highly, as shown in Figure 7-5. Only about 9% of respondents rated their overall experience as a 3 or lower. Nearly three-quarters (73%) of respondents stated that they had recommended the subprogram to others.

Figure 7-5: Overall Satisfaction with Comprehensive Audits Subprogram



[43] Rated their satisfaction as a 4 (12%) or 5 (83%) out of 5.
[44] ADM compared the two proportions with a two-proportion t-test. The difference is significant with an alpha of 0.05.
[45] Rated their satisfaction with their experience as a 4 (17%) or 5 (71%) out of 5.

Home Characteristics

Respondents provided limited information regarding their home and demographic background. Table 7-14 on the following page displays respondents' reported home and water heating type. A higher portion of multi-family respondents said they had electric home and water heating.

Table 7-14: Comprehensive Audit Participants' Water and Space Heating Fuel Types

End Use	Fuel Type	Percentage of Multi-Family Respondents (n=54)	Percentage of Single-Family Respondents (n=161)	Percentage of All Respondents (n=215)
Water Heating	Natural gas	22%	70%	58%
	Electricity	63%	25%	34%
	Propane	0%	2%	2%
	Other	2%	2%	2%
	Don't know	13%	1%	4%
Space Heating	Natural gas	30%	73%	62%
	Electricity	54%	20%	28%
	Propane	0%	4%	3%
	Other	2%	3%	3%
	Don't know	15%	1%	4%

Table 7-15 and Table 7-16 on the following pages record additional respondent self-reported home characteristics. Most survey respondents described their homes as single-family, detached (69%; Table 7-16) residences which they owned (66%; Table 7-15). About half of the respondents reported that their home had 2,000 square feet or fewer of above ground living space. Nearly one-third of respondents noted that their home had been built before 1960. Seventy-nine percent of survey respondents reported that three or fewer people lived in their home. A higher portion of multi-family respondents did not know or were not able to recall various home characteristics.[46]

ADM compared respondents' reported home type with subprogram tracking data. ADM noted some minor discrepancies between respondents' reported home type and their home type as recorded in subprogram tracking data. For example, thirteen respondents reported living in an apartment, while tracking data indicated they lived in a single-family home. Tracking data indicated that 75% of survey-takers live in single-family homes and 25% live in multi-family homes.

[46] ADM compared the proportions with a two-proportion t-test. The differences noted in the text are significant with an alpha of 0.05.

Table 7-15: Comprehensive Audit Participants' Home Characteristics

Home Characteristics	Percentage of Multi-Family Respondents (n=54)	Percentage of Single-Family Respondents (n=161)	Percentage of All Respondents (n=215)
Own or Rent			
Own	6%	94%	72%
Rent	94%	6%	28%
Year Built			
Before 1960	9%	38%	31%
1960-1969	11%	8%	9%
1970-1979	11%	14%	13%
1980-1989	4%	7%	7%
1990-1999	4%	12%	10%
2000-2009	6%	16%	13%
2010 or later	2%	2%	2%
Don't know/Refused	54%	3%	16%
Above Ground Living Space			
Less than 600 square feet	15%	1%	4%
600 to less than 800 square feet	17%	1%	5%
800 to less than 1,000 square feet	19%	7%	10%
1,000 to less than 2,000 square feet	6%	48%	38%
2,000 to less than 3,000 square feet	4%	25%	20%
3,000 to less than 4,000 square feet	2%	5%	4%
4,000 to less than 5,000 square feet	0%	2%	1%
5,000 square feet or greater	0%	1%	1%
Don't Know	39%	9%	17%
Below Ground Living Space			
Less than 600 square feet	44%	24%	29%
600 to less than 800 square feet	9%	36%	29%
800 to less than 1,000 square feet	4%	22%	17%
1,000 to less than 2,000 square feet	0%	5%	4%
2,000 to less than 3,000 square feet	0%	0%	0%
3,000 to less than 4,000 square feet	0%	1%	0%
4,000 to less than 5,000 square feet	0%	0%	0%
5,000 square feet or greater	0%	0%	0%
Don't know	43%	13%	20%

Table 7-16: Comprehensive Audit Participants' Home Types

Self-Reported Home Type (n=215)	Percentage of Respondents
Single-family home, detached construction	69%
Apartment with 4+ units	16%
Apartment with 2 or 3 units	5%
Condominium	4%
Single-family home, factory manufactured/modular	2%
Townhouse	2%
Mobile home	1%
Other	1%

7.5.3 Online Audits Subprogram Operations Perspective

The following section provides findings from the process evaluation for the Online Audits subprogram of the Energy Efficient Homes Program. ADM staff spoke with the Companies' residential program energy efficiency manager (the "residential energy efficiency manager") and the Online Audits subprogram manager (the "subprogram manager") in November 2019. This section provides highlights from that conversation regarding the 2019 subprogram year and the program's design, implementation, challenges, and strengths.

The subprogram manager stated that she entered the position in the Fall of 2019 and that her roles and responsibilities were consistent with those of the previous subprogram manager – specifically, that she provided general oversight, budget and program tracking, and communication with the subprogram's vendor. She observed that the subprogram remained largely unchanged from 2018 in its design, implementation, and marketing in 2019.

Although several key factors of the subprogram remained generally unchanged, the Companies' selection of Oracle as the vendor in 2018 had increased synergy between the Behavioral subprogram and the other residential subprograms. The residential energy efficiency manager mentioned that, as Oracle is the vendor for both the Behavioral and online audit subprograms, Behavioral participants who take an online audit benefit from receiving more personalized and accurate energy saving tips and modules in their Behavioral reports. The residential energy efficiency manager also noted that the subprogram was now sharing customer contact information, gathered through the online audit tool, with implementors and program staff for other Companies' residential energy efficiency programs. For example, she noted that customers who completed the online audit that would benefit from appliance recycling are now contacted by the Companies' contractor for that program. Previously the online audit subprogram did not share its

customer contact information with other programs. She also stated that customer contact information was shared with the in-home audit program as well as to the program implementor for the Energy Efficient Products program when appropriate.

The subprogram manager observed that the current vendor was performing effectively and had met or exceeded their expectations for program implementation in 2019. The Companies have a reoccurring weekly meeting with the vendor and communicate with them frequently via email and phone calls. The Companies' staff noted that Oracle was responsive, helpful, and receptive to their needs.

Both contacts said that the Online Audits subprogram completed a data and tracking process improvement in 2019. The residential energy efficiency manager noted that there previously was a manual process for connecting the Companies' internal system with the vendor's tracking data, and this year they had worked to better manage the data with Oracle.

She observed that one minor change made to the subprogram in 2019 was that they added, removed, and updated energy efficiency tips provided through the online audit based on factors such as the time of the year and the available programs. She also noted that they were currently working with the subprogram vendor to add questions regarding electric vehicles to the online audit.

The subprogram manager noted that the subprogram's strength was its tips and how they direct customers to other energy efficiency programs that the Companies offer. The residential energy efficiency manager mentioned the subprogram's user interface as well as the ease in working with the subprogram's vendor as program strengths. Neither contact noted any challenges or areas in need of improvement for the subprogram.

7.5.4 Online Audits - Participant Survey

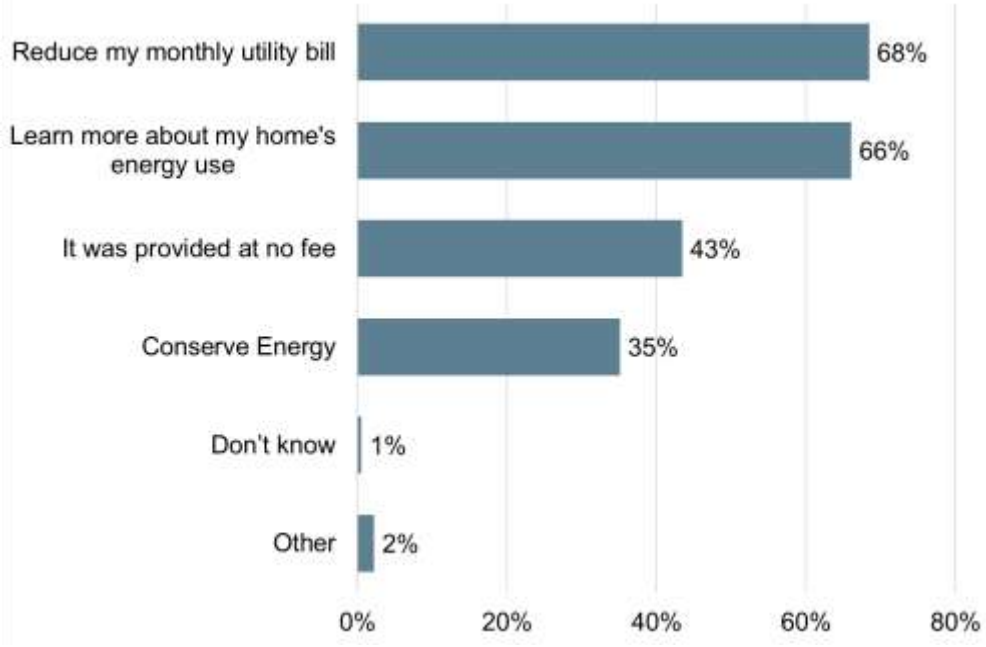
This section presents key findings from an online survey, administered by ADM, that was completed by 168 Online Audit subprogram participants. The surveys collected data on subprogram awareness and experience, including use of the Home Energy Analyzer tool, energy-savings behaviors and equipment installed, satisfaction, and home characteristics.

Subprogram Awareness and Experience

Most 2019 survey respondents (82%) indicated that they learned about the Home Energy Analyzer on the Companies' website. Other respondents noted learning of the subprogram through word-of-mouth (2%), an email from the Companies (4%), or through some other method including through a message in the mail, Facebook, their bill, or the radio (4%). Eight percent of respondents could not recall how they learned about the Home Energy Analyzer.

Most respondents indicated that they completed the online home energy audit because they wanted to learn more about their home's energy use, or they wanted to reduce their utility bill. Figure 7-6 displays survey-takers' reasons for completing an online audit (respondents could select more than one reason for completing an audit).

Figure 7-6: Reason for Completing Online Audit



Sixty-one percent of respondents noted completing the entire online audit. Thirty-six percent of respondents said they were unsure whether they had completed their online audit. Only three percent of respondents stated that they had not completed their online audit. The respondents who said they did not complete the audit either ran out of time or felt satisfied with the portion of the audit they did complete. The majority of respondents (70%) reported that they found the information provided in the Home Energy Analyzer helpful.[47] Only nine percent of respondents did not find the online audit helpful and noted issues such as the audit not seeming accurate or the Analyzer having "obvious" recommendations that participants either could not or were not willing to follow.

Energy Savings Actions and Satisfaction

ADM asked survey-takers what activities they completed during their online audit (e.g. review of bills/ energy use, questions about appliances, or questions about home weatherization measures). Sixty-six percent of respondents said they reviewed changes in their energy usage over time. Sixty-seven percent said they answered questions about their home appliances and 40% answered questions about weatherizing their home while using the Analyzer. About half of respondents (51%) reported that they received detailed energy saving ideas for their home. Seven percent of respondents did not know or could

[47] Rated the usefulness of the information a 4 or 5 on a scale from 1 (not at all helpful) to 5 (very helpful).

not recall what they did through the Home Energy Analyzer. A small portion of survey-takers (2%) noted that they used the tool to compare their usage to their neighbor's energy usage.

Eighty-one percent of survey-takers noted that they had taken some sort of energy-saving action (e.g. behavioral changes, home appliance upgrades, or weatherization improvements) as a result of using the Home Energy Analyzer (see Table 7-17). Multiple answers per respondent could be selected for this question.

Table 7-17: Energy-Saving Actions Taken as Result of Online Audit

Action	CEI		OE		TE		Total	
	N	Percent	N	Percent	N	Percent	N	Percent
Behavioral changes	38	69%	43	74%	35	64%	116	69%
Upgraded home appliance(s) or equipment	19	35%	16	28%	13	24%	48	29%
Weatherization improvements	16	29%	8	14%	13	24%	37	22%
No changes made	10	18%	9	16%	11	20%	30	18%
Don't know	0	0%	0	0%	1	2%	1	1%

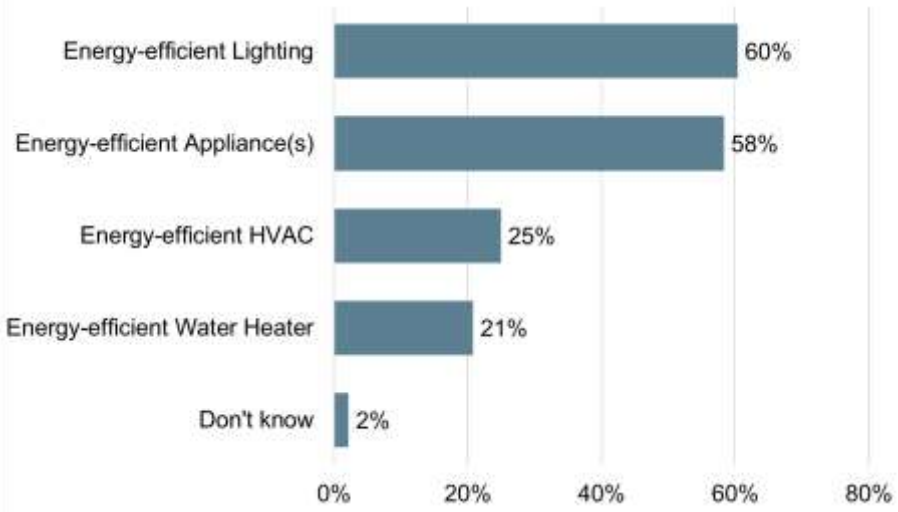
Note: Percentages may exceed 100% because respondents could choose more than one response.

Of the 37 respondents that noted making weatherization improvements, 25 (76%) noted installing attic or wall insulation, 7 (21%) said they installed new energy efficient doors or windows or improved the air sealing in their home, 3 (9%) said they installed radiant barriers, and 2 (6%) said they installed knee wall insulation. Of the 37 respondents who reported weatherization improvements after their participation in the online audit, 31 (84%) indicated that they were satisfied with the improvements they had made.[48]

Of the 48 survey-takers that said they upgraded their appliances or home equipment to ones that are more energy efficient, most indicated that they purchased more energy efficient appliances or lighting (see Figure 7-7 on the following page).

[48] Rated their level of satisfaction with their weatherization improvements as a 4 or 5 on a scale from 1 (very dissatisfied) to 5 (very satisfied).

Figure 7-7: EE Installations Made by Online Audit Participants



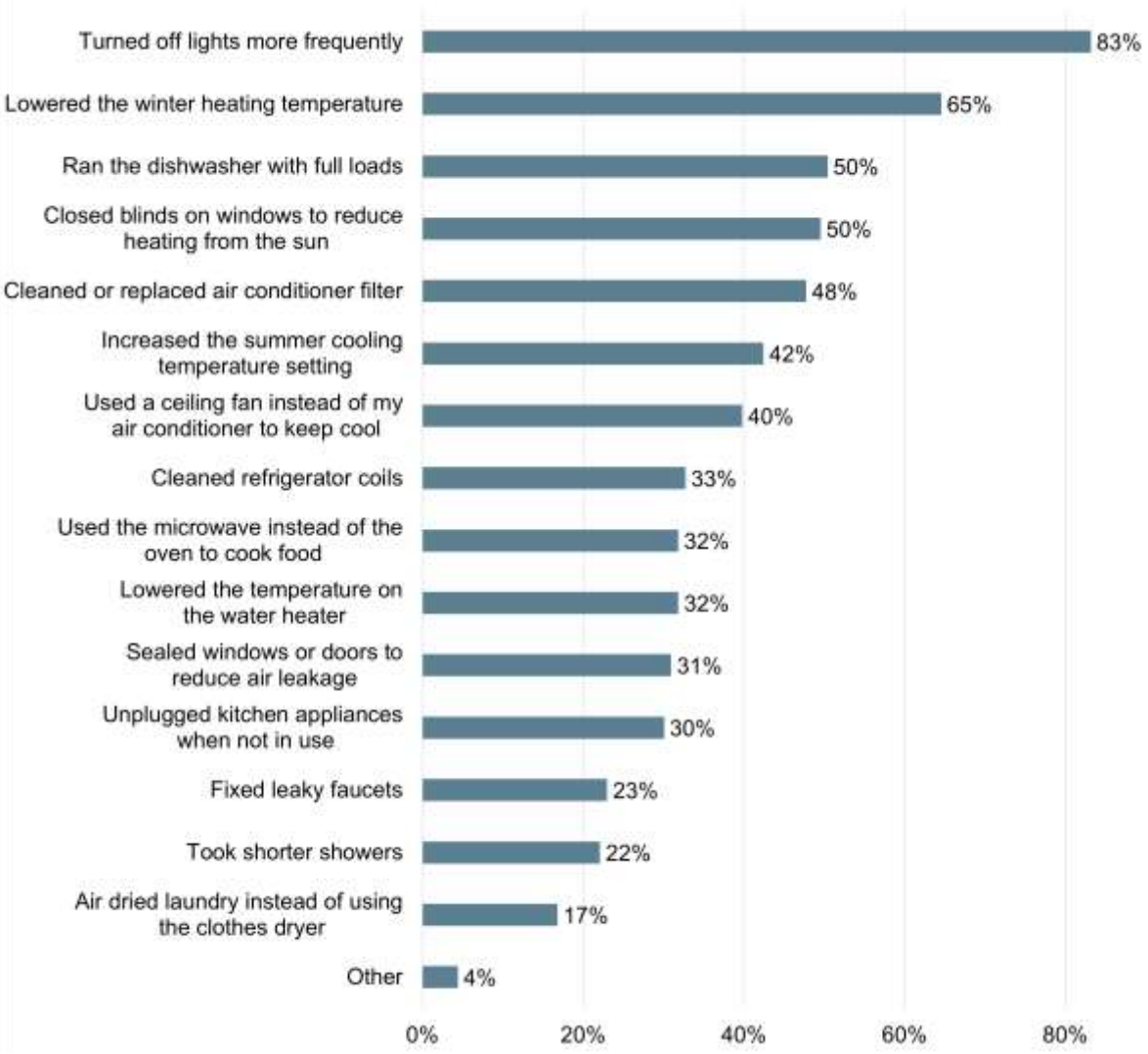
Note: Percentages may exceed 100% because respondents could choose more than one response.

Nearly all (98%) of those that upgraded appliances/equipment indicated the equipment was still installed and nearly all respondents (96%) that had installed a new appliance indicated they were satisfied with their new appliances/equipment.[49]

The most frequent behavioral change participants reported making in 2019 after using the Home Energy Analyzer tool was turning off their lights more frequently, followed by lowering the winter heating temperature (see Figure 7-8 on the following page). All respondents that noted making behavioral changes since using the Home Energy Analyzer tool stated that they still were practicing those behavioral changes.

[49] Rated their level of satisfaction with their appliance/equipment as a 4 or 5 on a scale from 1 (very dissatisfied) to 5 (very satisfied).

Figure 7-8: Behavioral Changes Made by Online Audit Participants



Note: Percentages may exceed 100% because respondents could choose more than one response.

When asked whether they had noticed a decrease in their electric bill since they had made behavioral changes, appliance/equipment upgrades, or weatherization improvements, 42% of survey-takers said they had noticed a decrease, 28% had not, 28% indicated it was too soon to tell, and 3% stated that they did not know.[50] Of those that did notice a decrease, 91% were satisfied with the savings.

Overall, most survey-respondents (68%) indicated they were satisfied with their experience with the Home Energy Analyzer. [51] The respondents that shared dissatisfaction noted ways in which the tool could be improved, such as:

[50] Percentages do not sum to 100% because of rounding.
[51] Rated their overall level of satisfaction as a 4 or 5 on a scale from 1 (very dissatisfied) to 5 (very satisfied).

- Including a section with customer-supplied energy savings tips (i.e. provide customers with the opportunity to comment how they have saved energy or money on their utility bill and share these customer-provided tips with other Online Audit takers);
- Adding an “energy usage predictor” for future usage under different scenarios;
- Providing recommendations that are tailored to customers’ income level; and
- Adding troubleshooting tips for customers that had not seen energy use reductions from implementing the recommended tips.

Home Characteristics

Respondent home characteristics are summarized on the following page in Table 7-18. About half of respondents (54%) noted that they lived in a household with two or three people. The remaining respondents reported living in a household with four or more people (26%), living alone (17%), or preferring not to share that information.

Table 7-18: Online Audit Participants' Home Characteristics

Characteristic	Percentage of Respondents
Home Type (n=168)	
Single-family home, detached	81%
Condominium	7%
Apartment	6%
Single-family home, manufactured	3%
Townhouse	2%
Mobile home	1%
Other	1%
Own or Rent (n=166)	
Own	87%
Rent	13%
Year Built (n=167)	
Before 1960	40%
1960-1969	7%
1970-1979	16%
1980-1989	10%
1990-1999	10%
2000-2009	9%
2010 or Later	4%
Don't know/Refused	4%
Above Ground Living Space (n=168)	
Less than 1,000 square feet	8%
1,000 to less than 2,000 square feet	51%
2,000 to less than 3,000 square feet	30%
3,000 to less than 4,000 square feet	5%
4,000 to less than 5,000 square feet	1%
Don't know	4%

7.5.5 Telephone Audits - Participant Survey

This section summarizes feedback received from 51 customers who participated in the Audits and Education subprogram through the Companies' customer call center. ADM completed surveys with these customers with its inhouse survey call team.

Call Center Experience

Participants were asked to share the initial reason they contacted the customer call center. Fifty-seven percent of participants reached out because of a high-bill complaint. Other reasons that customers cited included power outages (18%), meter issues (12%), paying their bill (6%), switching their service (4%), inquiring about a rebate or other utility program (4%), concern about a scam in their neighborhood (2%), or could not recall the reason for their call (2%). Multiple answers per respondent could be selected for this question.

ADM asked customers if they discussed various topics on their phone call with the Companies. Table 7-19 displays the surveyed participants' responses. Multiple answers per respondent could be selected for this question.

Table 7-19: Topics Telephone Audit Participants Discussed with the Call Center

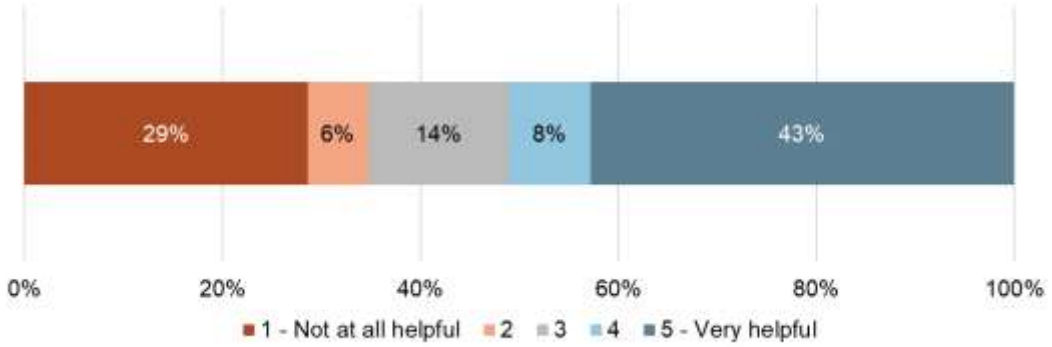
Reasons for Contacting Call Center	Percentage of Respondents (n=51)
Review changes in bill/usage over time	51%
Answer questions about home appliances	49%
Ways you could save energy in home	44%
Find out about top 3 home energy uses	39%
Offer literature about saving energy at home	35%

Note: Percentages may exceed 100% because respondents could choose more than one response.

ADM asked survey-takers whether the customer service representative they spoke with sent them any materials. Forty-five percent of respondents reported that a brochure with energy saving tips was sent to them after their call. Of the 23 respondents who reported receiving a brochure, 11 (46%) said the tips they received in the brochure were helpful.[52] Fifty-one percent of participants thought the information provided by the customer service center was helpful (see Figure 7-9 on the following page).[53] .

[52] Rated the helpfulness of information as a 4 or 5 on a scale from 1 (not at all helpful) to 5 (very helpful).
[53] Rated the helpfulness of information as a 4 or 5 on a scale from 1 (not at all helpful) to 5 (very helpful).

Figure 7-9: Helpfulness of Information Provided by Customer Call Center



EE Behaviors and Upgrades

Seven customers (14%) noted that they had completed appliance upgrades, weatherization improvements, or made behavioral changes since their phone call with the Companies' Customer Service Representative. Of seven of these survey-takers, four said their electric bill had decreased since making these changes.

Of the respondents that reported making behavioral changes (n=6), reported changes included turning off lights more frequently, unplugging appliances when not in use, and turning off their furnace. The respondents who noted purchasing appliances to improve their homes' energy efficiency (n=2) both noted purchasing LED lighting. The respondent that noted making weatherization improvements said they installed windows.

Home Characteristics

ADM asked survey-takers to provide feedback regarding their home characteristics. A summary of the information ADM collected from this portion of the survey is provided in Table 7-20 on the following page.

Table 7-20: Telephone Audit Participants' Home Characteristics

Characteristic	Percentage of Respondents
Home Type (n=51)	
Single-family home, detached construction or factory manufactured	86%
Apartment	14%
Own or Rent (n=51)	
Own	71%
Rent	29%
Year Built (n=51)	
Before 1960	14%
1960-1969	8%
1970-1979	12%
1980-1989	8%
1990-1999	12%
2000-2005	8%
2006 or Later	6%
Don't know/Refused	33%
Above Ground Living Space (n=51)	
Less than 1,000 square feet	18%
1,000 to less than 2,000 square feet	41%
2,000 to less than 3,000 square feet	10%
3,000 to less than 4,000 square feet	4%
5,000 square feet or greater	27%
Number of Residents (n=51)	
1	31%
2	27%
3	12%
4	18%
5	6%
Don't know/Refused	6%

8 Behavioral Modification

The purpose of this chapter is to present the results of the Behavioral Modification (Behavioral) subprogram impact and process evaluations. The objective was to verify the energy savings and peak demand reduction achieved during the 2019 program year.

8.1 Description of Behavioral Modification Subprogram

The residential Behavioral subprogram targets energy savings by educating customers on energy saving behavior and low-cost energy efficient measures they can install in their homes. The subprogram accomplishes this via a measure known as a home energy report (HER). HERs consist of two primary components:

- A monthly usage report containing information about a participant's current and historical energy use, and how their energy use compares to that of a group of similar households (both "typical" and "most efficient" neighbors); and
- A list of "tips and tricks" including low-cost energy efficient measures that customers can install or energy saving practices and behaviors that participants can adopt.

For the 2019 program year, Oracle Corporation (Oracle) served as the implementer of this subprogram. Oracle administered the program via HERs delivered to homes as a mailout with an optional web-based portal. A total of 209,256 customers participated in the Behavioral subprogram in 2019. Participating customers received a total of 6 mailed HERs and 6 emailed, electronic HERs (eHERs) during the 2019 program year.

Table 8-1 below details participant counts by operating company.[54]

Table 8-1: Participation Levels for 2019 Behavioral Subprogram by Company

EDC	Participants
CEI	64,873
OE	107,837
TE	36,546
Total	**209,256**

The Behavioral subprogram uses a randomized control trial (RCT) design—a type of experimental design in which customers from a single sample frame are randomly assigned to either a treatment or control group, resulting in two groups that are similar in

[54] Participation counts determined from data supplied by the implementation contractor. Reported participation counts are from the beginning of the program year. Participants may be lost due to attrition over the course of the program year.

nature to one another that can be compared over time. After randomization, the treatment group went on to receive the HER, while the control group did not receive the HER. The Companies targeted high energy users as the target population for the Behavioral subprogram.[55] The program was administered as an opt-out program—treatment group participants automatically began receiving the HER measure at the beginning of the treatment period and could un-enroll from receiving future HERs at any point in time.

8.2 Sampling

Sampling for this subprogram occurred at the implementation level for the purpose of selecting customers for the treatment and control groups. A full census of treatment and control group billing data was used to perform a pooled billing data regression for the purpose of impact evaluation.

The following steps detail, at a high-level, Oracle's process for developing treatment and control groups at the time of implementation:

1 Oracle developed an initial sample frame by selecting a random pool of potential participants. Oracle then filtered these participants based on:

- Whether customers had a valid mailing address; and
- Whether customer billing data appeared to be an outlier relative to the rest of the sample frame.

2 After developing the initial sample frame, Oracle then selected the top users in the initial sample based their historical energy usage.

3 These participants were then randomly assigned to the treatment group or control group. The size of the treatment group was determined based on the number of treatment participants needed to reach savings targets.

4 Treatment and control groups developed at one particular time are referred to as a "cohort." An initial cohort who began receiving treatment in July of 2013 was developed for all three Companies. A secondary cohort was developed who began receiving treatment in May of 2017 for all three Companies. A third cohort was added in January of 2019 for Toledo Edison, resulting in a total of seven cohorts across all three Companies.

Customers could opt-out of the program at any time by going online or calling the customer experience call center, however, customers who opt-out of receiving home energy reports were still included in the treatment group for the purpose of tracking

[55] It is important to note that targeting of high-use customers will produce savings estimates that are not representative of the full customer population and should not be extrapolated beyond the calculation of energy savings for this program.

program savings.[56] As customers moved out (for either the participant or control groups) they were prospectively dropped from the RCT; meaning that any additional data for that customer that may be in the billing data beyond their move-out date was filtered out from the data set but all data leading up to that date was retained.

8.3 Energy Savings and Peak Demand Reduction Calculations

Impact evaluation for the program used a pooled regression analysis of monthly billing data. The regression model compares the monthly energy usage of the treatment group to that of a control group while, simultaneously, controlling for individual variability in the pre-treatment period. The main purpose of the regression analysis is to isolate and quantify the treatment effect on monthly energy usage. The following section describes ADM's gross impact evaluation methodology.

8.3.1 Data Gathering

Monthly billing data dating back to 12 months prior to each experimental cohort's treatment start date through December 2019 was requested from the Companies for all participants. ADM used a map of account numbers to treatment or control group and cohort assignment to categorize monthly billing data. Additionally, ADM obtained all downstream residential program participation data dating back to the treatment start date for each cohort to make adjustments for cross-program participation.

8.3.2 Data Preparation

Most of the Companies' residential customers have standard electricity meters, which are read monthly. On occasion, meter reads are not available at the time a customer is billed; therefore, the Companies generate an estimated meter read based on building load profiles and customer's historical usage. The customer's subsequent metered bill features an adjustment factor to accommodate for any differences between the estimated read and the actual read.

As part of the data preparation process, ADM corrected for estimated reads and adjusted actual reads by using a "true-up" process. For each metered read and all estimated reads immediately preceding it, ADM totaled the billed usage and number of days spanning those bills. The total billed usage for that cumulative period was then divided by the total number of days to generate an average usage per day value. This average usage per day value was then multiplied by the number of days in each individual bill to generate a corrected usage value. Because the number of estimated reads per actual read is inconsistent, the number of estimated reads prior to the first actual read in the provided dataset could not be assumed. Therefore, the first metered read and all estimated reads

[56] The lifetime of HERS measures are not currently well-understood—therefore, participants who opt-out of the program are still considered part of the treatment group.

preceding it were excluded from the dataset. Similarly, estimated reads that did not have a corresponding actual read (generally towards the tail end of provided billing data) were also excluded from analysis. The following equation provides the equation for calculating the adjusted usage for billing data after the first metered read and all prior estimated reads have been excluded:

Equation 8-1: Billing Data Adjustment Calculation

$$Adjusted\ usage = \sum_{i}^{n} Billed\ usage \times \frac{Billing\ days_m}{\sum_{i}^{n} Billing\ days}$$

Where:

i = First estimated bill in a sequence of estimated bills leading to a metered bill.

n = A metered bill providing an adjustment factor for preceding estimated bills.

m = The billing month of interest.

$Billed\ usage$ = The total kWh billed in a monthly bill.

$Billing\ days$ = The total number of days in a monthly bill's billing period.

Billing periods for customers do not fall on consistent dates between participants. For example, one customer's June bill may run from May 16th to June 17th while another's may run from May 20th to June 20th. Furthermore, the billing periods do not correspond to calendar months. To make the monthly billing data consistent between participants, ADM calendarized the data. Calendarization is the process of correcting monthly billing data to match calendar dates. For example, if 15 days in a billing period belonged to June and 15 days belonged to July; 50% of the billed usage would be attributed to June and 50% attributed to July. The proportionated usage and number of days that fall under a given calendar month are then summed to generate a calendarized usage value and the number of billed days for that month. The following equation provides the method for calculating the monthly usage by calendar month:

Equation 8-2: Monthly Billing Data Calculation

$$Monthly\ usage_m = \sum_{i}^{n} \left(Adjusted\ usage_i \times \frac{Month\ days_i}{Billing\ days_i} \right)$$

Where:

i = First bill containing the month of interest.

n = Last bill containing the month of interest.

m = The month of interest.

$Monthly\ usage$ = The calendarized monthly usage for a given month.

$Month\ days$ = The number of days belonging to the month of interest in a billing period.

$Billing\ days$ = The number of days in a billing period.

After calendarization was completed, an average daily usage value was calculated by dividing the monthly usage by the number of billed days in a month. Additionally, data was filtered using the following criteria:

- Customer months that had less than one billed day or exceed the total number of days in that calendar month for that year were excluded from analysis—months that meet these criteria have overlapping bills and are unreliable for analysis.
- Months that were present after a customer's move out date were also excluded from analysis.
- Customer months in which average daily usage exceeded 300 kWh or was less than -300 kWh were considered outliers and were excluded from analysis.
- Pre-treatment data was limited to the 12 months prior to the treatment start date for each experimental cohort.

8.3.3 Billing Analysis

ADM utilized a post-only regression model known as the lagged seasonal (LS) model. The LS model predicts average daily usage in the post-period using a series of variables constructed from their pre-treatment usage and an interaction of the treatment impact over time.[57] Given the need to correct for estimated meter reads, ADM used broader seasonal lag-terms instead of using a month-specific lag-term. The control variables constructed were average daily pre-use, average daily pre-use during summer, and average daily pre-use during winter. Summer months were defined as the months of June - September, and winter months were defined as the months of December - March.

[57] The Uniform Methods Project presents multiple regression specifications that can be used in the estimation of Residential Behavioral Program savings. All models should converge on similar results, however, post-only models, such as the LS-model, can sometimes result in better model precision over a fixed effects model with customer-specific intercept terms (https://www.nrel.gov/docs/fy17osti/68573.pdf, pg. 18).

Equation 8-3: Regression Model

$$daily_{usage_{it}} = \beta_0 +$$

$$\beta_{t\_Jan} treatment_i \cdot month_{Jan} + \cdots + \beta_{t\_Dec} treatment_i \cdot month_{Dec} +$$

$$\beta_{a\_Jan} \cdot month_{Jan} \cdot avg\_preusage_i + \cdots + \beta_{a\_Dec} \cdot month_{Dec} \cdot avg\_preusage_i +$$

$$\beta_{s\_Jan} \cdot month_{Jan} \cdot avg\_preusage\_summer_i + \cdots + \beta_{s\_Dec} \cdot month_{Jan} \cdot avg\_preusage\_summer_i +$$

$$\beta_{w\_Jan} \cdot month_{Jan} \cdot avg\_preusage\_winter_i + \cdots + \beta_{w\_Dec} \cdot month_{Dec} \cdot avg\_preusage\_winter_i +$$

$$\beta_{m\_Jan} \cdot month_{Jan} + \cdots + \beta_{m\_Dec} \cdot month_{Dec} +$$

$$\beta_{pa} \cdot avg\_preusage_i + \beta_{ps} \cdot avg\_preusage\_summer_i + \beta_{pw} \cdot avg\_preusage\_winter_i + \varepsilon$$

Where:

$daily\_usage_{it}$ = the average daily usage for customer i in month t,

$treatment_i$ = a dummy variable – 1 if customer i is in treatment group, 0 if in control group,

$month_{Jan}$ to $month_{Dec}$= a series of dummy variables representing the months present in the dataset,

$avg\_preusage_i$,

$avg\_preusage\_summer_i$,

$avg\_preusage\_winter_i$ = the three pre-usage variables for customer i,

β_0 = the intercept,

β_{t_Jan} to β_{t_Jan}= a series of regression coefficients representing the difference in average daily usage between the treatment group and the control group in a given month,

β_{a_Jan} to β_{a_Dec}= a series of regression coefficients controlling for individual variability in the predicted kWh as a function of each participants' annual pre-treatment usage.

β_{s_Jan} to β_{s_Dec}= a series of regression coefficients controlling for individual variability in the predicted kWh as a function of each participants' summer pre-treatment usage.

β_{w_Jan} to β_{w_Dec}= a series of regression coefficients controlling for individual variability in the predicted kWh as a function of each participants' winter pre-treatment usage.

β_{m_Jan} to β_{m_Dec}= a series of regression coefficients controlling the main effect of month.

β_{pa}, β_{ps}, and β_{pw} to = a series of regression coefficients controlling for the main effect of the pre-usage variables.

ε = the error term.

Because the treatment effect is interacted with the time variable, the data set can be truncated to observations corresponding only to the months of interest without any impact to the savings calculation.

By default, the model specification is fitted using standard OLS regression, which treats the variability of each observation as independent. However, because multiple observations are taken per participant over the course of time, observations from the same participant do not vary independently. Therefore, the standard error of the regression coefficient must be adjusted appropriately prior to interpreting the statistical significance of any given regression coefficient. ADM used a standard cluster-robust standard error correction to correct for the variation attributable to panel-data observations.[58]

8.3.4 Method for Calculating Program Level Savings

Monthly kWh savings are then taken by using the following equation:

Equation 8-4: Monthly kWh Savings

$$monthly\_savings_t = -1 \cdot \beta_{1t} \cdot days_t \cdot participants_t$$

Where:

t = a given month in the program year,

β_{1t} = the regression coefficient for the treatment effect of month t

$days_t$ = the number of days in the given month

$participants_t$ = the number of active participants in month t

Because the regression equation predicts average daily usage as a function of the treatment effect, and the treatment indicator has been coded as "1", the regression

[58] Arai, Mahmood (2015). Cluster-robust standard errors using R. Department of Economics, Stockholm University, Stockholm, Sweden. URL https://www.ne.su.se/polopoly_fs/1.216115.1426234213!/menu/standard/file/clustering1.pdf.

coefficient for the treatment effect of a given month should be negative if savings occurs. Therefore, multiplying the savings calculation by -1 will correct the sign of the results.

Cross-Program Participation Correction

Participants in both the treatment and control groups participate in other FirstEnergy OH EDC energy efficiency programs. Furthermore, the HER may cause treatment group participants to seek out other programs and measures offered in the Companies' efficiency portfolio more than the control group. To the extent that the treatment group participates in other Company energy efficiency programs at a rate above and beyond that of the control group, those incremental savings will be reflected in the gross energy savings calculated using the method above. However, savings for these items will also have been attributed to their respective programs and subprograms. ADM corrected for cross-program participation that occurred after treatment began to the extent that the treatment group participated at a higher rate than the control group.

Adjustment for Downstream Measures

For downstream measures, ADM conducted a review of the tracking and reporting system for each experimental cohort to identify energy efficiency program participation that occurred from the treatment start date onwards. The following steps detail the process of correcting for these measures:

- The measures for the treatment group and control group were assigned to an appropriate month based on the reported date of installation for measures installed after the treatment start date.
- For each month of the program year, the annual savings for all measures installed prior to the month of interest dating back to the treatment start date that had not yet reached the end of their effective useful life were summed for all active participants for each group. For measures installed prior to 2019, ADM used verified savings for dual participation analysis. For measures installed during 2019, ADM utilized reported savings due to verification activities occurring concurrently to the evaluation of the Behavioral program.
- The totaled savings for each group was then divided by 365.25 and then divided by the number of active customers in each group to create a daily average dual participation savings value per home.
- For each month, the daily average dual participation savings value per home for the control group was then subtracted from the daily average dual participation savings value per home from the treatment group. This resulted in an adjustment factor which was then multiplied by the number of active participants in the treatment group and subtracted from the monthly kWh savings.

Adjustment for Upstream Measures

Customer identifying information is not captured for point-of-sale rebates (commonly referred to as upstream measures). As with downstream program participation, participating in the Behavioral subprogram may encourage participants to seek out additional cost-saving measures via the Companies' residential upstream portfolio. The Evaluation Framework for Pennsylvania Act 129[59] provides an approximation of the effect of Behavioral program participation on upstream program participation and flat multipliers that can be used to discount the impact of upstream program participation on Behavioral Modification subprogram savings.

The following table provides the multiplier used as a function of the number of years since the treatment start date:

Table 8-2: Participation Levels for 2019 Behavioral Subprogram by Utility

Years Since Enrollment	Multiplier
1	99.25%
2	98.50%
3	97.75%
4 or more	97.00%

The multiplier is applied after downstream program participation has already been accounted for.

Method for Calculating kW Reduction

Annual savings for the Behavioral subprogram is assumed to be primarily driven by reducing end use energy consumption (e.g., reducing HVAC usage or reducing interior lighting usage). On average, we can anticipate that the savings curve for the Behavioral subprogram is directly related to the underlying end use load profiles from these primary savings drivers. Residential end use profiles tend to be collinear with one another, with weather-dependent loads closely resembling HVAC load profiles and plug-loads resembling residential lighting profiles. Therefore, although references are made to these two load profiles, these profiles are intended to best-approximate other, collinear end uses. Therefore, ADM used these two load profiles to generate peak demand savings. To generate peak demand savings, ADM used the following method:

[59] NMR Group, Inc., EcoMetric Consulting, LLC, & Demand Side Analytics, LLC (2016). Evaluation Framework for Pennsylvania Act 129 Phase III Energy Efficiency and Conservation Programs. Pennsylvania Public Utility Commission. Pennsylvania. URL http://www.puc.state.pa.us/Electric/pdf/Act129/SWE_PhaseIII-Evaluation_Framework102616.pdf.

Step 1: Normalize kWh Savings

ADM normalized the kWh savings value predicted by the impact evaluation regression model into a percent savings value by dividing each month's savings by the total annual savings as follows:

Equation 8-5: Normalization kWh Usage

$$\%\ savings_{my} = {kWh\ savings_{my}}\Big/{kWh\ savings_{y}}$$

Step 2: Calculate Monthly Load Factors for Component Variables

The model assumes a linear relationship between the end uses of interest and the percent savings calculated above. Because load shape information is available for multiple residential end uses at an 8,760 resolution, ADM can estimate the relationship between end use load shapes and percent savings to estimate total demand savings. To make sure that the model is interpretable, hourly load factors must be aggregated to a monthly resolution, providing a monthly load shape with 12 data points. To calculate monthly load shapes, ADM will take the sum of all hourly loads in a given month for each end use of interest.

Step 3: Fixed Multivariate Regression

To determine the relationship between the percent savings and the residential end uses, ADM used a multivariate regression approach. Because the model was used to assign weights to each end use, ADM held the intercept constant at 0 to ensure that the model produced percent weights for each end use. The following equation provides the model specification used:

Equation 8-6: Fixed Multivariate Regression

$$\%\ savings_{my} = \beta_1 end\ use_{heat\ pump} + \beta_2 end\ use_{interior\ lighting}$$

The regression coefficients for the above regression equation represent the relationship of each of the component variables to percent savings. Because both independent and dependent variables are calculated in units of months, the numerator of the regression weights are time invariant and can be used to estimate the percent contribution across any unit of time.

Step 4: Demand Savings Calculation

After obtaining the percent weight of each of the three end uses, the 8,760 end use load profiles are then scaled by applying the percent weight to the normalized end use load profile. The total normalized whole house load can then be assumed to be the sum of the weighted load of the two end uses at a given hour. Averaging this value for all hours of the peak demand window will provide an average peak demand whole building load. Multiplying this value by the total annual kWh savings will then predict the kW savings for the program year.

As with gross energy savings, ADM anticipates that some participants in the treatment group will also participate in other Company programs. Because the peak demand savings is predicted from the dual participation adjusted monthly savings, an additional adjustment does not need to be made.

8.4 Detailed Impact Evaluation Findings

The sections below detail the impact evaluation results for the Behavioral subprogram in 2019.

For all participants in across all service territories during 2019, ex-ante expected annual savings were 63,798,000 kWh. The ex-post verified annual electricity savings for all participants in 2019 were 56,988,775 kWh. The realization rate for electric savings was 89 percent.

For all participants combined across all service territories during 2019, ex-ante expected critical peak demand reduction was 9,138.22 kW. The ex-post verified critical peak demand reduction was 6,999.87 kW. The realization rate for demand savings was 77 percent.

Table 8-3 Shows program-level results for kWh savings and kW reductions for the 2019 Behavioral subprogram for each of the Companies.

Table 8-3: Program Level Results for 2019 Behavioral Modification Subprogram

EDC	Ex-Ante Savings		Ex-Post Savings		Realization Rate	
	kWh	kW	kWh	kW	RR kWh	RR kW
CEI	22,109,000	3,542.15	20,297,626	2,494.38	92%	70%
OE	34,986,000	4,570.75	31,078,349	3,802.50	89%	83%
TE	6,703,000	1,025.32	5,612,800	702.99	84%	69%
Total	**63,798,000**	**9,138.22**	**56,988,775**	**6,999.87**	**89%**	**77%**

Ex-ante kWh and ex-post kWh differed from one another primarily due to correction for cross-program participation in other Company energy efficiency programs. The Uniform Methods Project advises evaluators to make corrections for participation in other portfolio

offerings that may be induced by behavioral program participation in order to avoid double-counting of savings. Ex-ante kWh savings and ex-ante kW savings do not currently correct for cross-savings, thus resulting in a greater reduction in realization rate. The total savings attributable to cross-program participation was 4,735,382 kWh (or roughly 7% of ex-ante kWh). Without excluding cross-program participation savings, ADM's ex-post verified annual electricity savings would be 61,724,157 kWh (or 97% of ex-ante expected annual savings). Additional differences may stem from program participation counts. Ex-ante kWh savings are based off an assumed treatment group population of 209,256 customers at the start of the program year. Beginning in 2019, the Companies began submitting all residential customer billing to ADM through an automated SFTP feed. Using this data set, ADM verified 206,586 customer accounts still active at the start of the program year. The number of verified customer accounts was used to generate ex-post kWh and therefore contributes to lower realized savings.

These two sources of differences were passed through to peak demand savings, thus contributing to lower realized savings. Without excluding cross-program participation savings from peak demand savings, ADM's peak demand savings estimate is 7,584.98, or 83% of ex-ante savings, however, CEI had a realization rate of only 75% while OE had a realization rate as high as 91%. Discrepancies between ex-ante and ex-post savings may also stem from differences in the savings estimation used by Oracle and ADM.

As an implementer for HER programs nationally, Oracle has calculated peak demand savings for HERs programs using advanced metering infrastructure (AMI) data for service territories in which AMI data is present, including territories in a similar geographical region as the Companies. Leveraging data from the AMI-based HER programs that they implement, Oracle has noted good correspondence between 8,760 whole building residential load shapes and peak demand savings. Oracle has established a method for estimating peak demand savings by using the ratio of average daily peak demand to average daily usage that can be used to estimate peak demand savings for HERs for utilities that do not have AMI data available. This coincidence factor is approximately 1.40 for OE, 1.42 for TE, and 1.38 for CEI.

Conversely, ADM currently calculates ex-post savings estimates for peak demand for HER programs in Ohio using residential end-use load shapes. Due to a lack of territory specific end-use load shapes, ADM utilizes load shapes extrapolated from a third-party system (Portfolio Pro). Due to collinearity between residential end-use load shapes, ADM uses two end-use load shapes (air source heat pumps and interior lighting) to approximate all residential end-use load shapes. Using the monthly energy savings observed for the program, ADM estimates a relative weight for each of the two end-use load shapes using a regression of the monthly savings on the monthly end-use loads. These weights are then applied to the respective 8,760 curves and the two curves are super-imposed to approximate an 8,760-efficiency curve for the program. Demand

savings are then estimated by applying total annual program savings to the 8,760-efficiency curve and taking the average demand savings during the peak demand window.

It should be noted that both ex-ante and ex-post peak demand savings are estimates rather than measurements of peak demand savings. This is because data resolution for the three EDCs cannot currently support the necessary resolution of data needed to produce accurate measurements of peak demand savings. In general, ignoring cross-program participation, the realization rate for the program is currently 122%, with the lowest being TE at 91%. Both methods have benefits and potential drawbacks. Oracle's ex-ante estimation benefits from being able to leverage AMI data from other utility territories to approximate the relationship between peak demand savings and peak to non-peak usage. ADM's estimation method benefits from attempting to calculate a true-peak using end-use loads in absence of 8,760 data, however, due to the non-regional nature of the end-use loads, there may be some shifts in the end-use load data that cannot currently be accounted for. Despite the differences in method, in absence of AMI data, both methods provide similar savings estimates.

8.4.1 Household-Level kWh and kW Savings

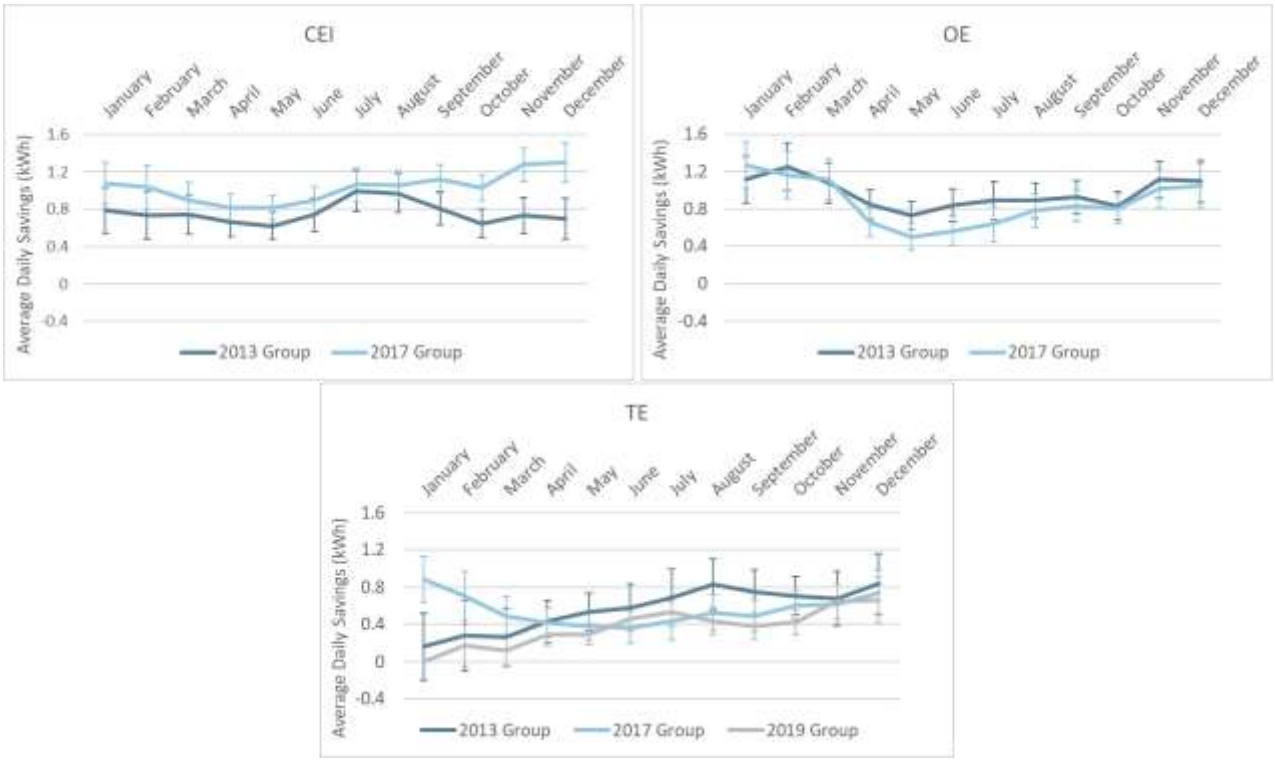
The results from the regressions reported in Table 8-4 were used to determine annual kWh savings and kW reductions at the program level by month.

Table 8-4: Behavioral Ex-Post Annual Savings and Reductions per Customer by EDC

EDC	Annual Savings (kWh/year)	Peak Demand Savings (kW)	Number of Participants	Average Savings Per Household (kWh/year)	Average Peak Demand Savings per Household (kW)
CEI	20,297,626	2,494.38	64,873	312.88	0.04
OE	31,078,349	3,802.50	107,837	288.20	0.04
TE	5,612,800	702.99	36,546	153.58	0.02
Total	**56,988,775**	**6,999.87**	**209,256**	**272.34**	**0.03**

The 2019 program was administered from January 2019 through December 2019. Average savings was obtained by dividing the program-level savings by the total number of participants. Average savings per home for TE were generally lower than the average savings observed for the other two EDCs. A review of the regression' savings coefficients, plotted on the following page in Figure 8-1 for each cohort with bars indicating standard error, show lower savings in winter months for TE while winter month savings for both OE and CEI were high. The monthly savings profiles are consistent with differences in space heating technology, with TE most likely having a high saturation of non-electric space heating relative to the other two EDCs. Further research may be necessary to determine the impact of space heating fuel-type on EDC-level savings.

Figure 8-1: Behavioral Savings Coefficients by Month



8.4.2 Subprogram-Level kWh Savings

Subprogram-level savings were determined by multiplying the average daily treatment effect by the number of days in that month and the number of active customers in that month. The ex-post monthly subprogram-level kWh savings by utility are shown on the following page in Table 8-5. Total kWh savings is 56,988,775 kWh for 2019.

Table 8-5: Behavioral Ex-Post Subprogram-Level Electric Energy Savings (kWh)

Month	CEI	OE	TE	Total
	Monthly Savings (kWh/month)	Monthly Savings (kWh/month)	Monthly Savings (kWh/month)	Monthly Savings (kWh/month)
January	1,875,622	3,844,615	499,285	6,219,522
February	1,607,396	3,333,937	429,744	5,371,077
March	1,579,639	3,411,631	326,821	5,318,091
April	1,378,820	2,039,146	359,184	3,777,150
May	1,379,399	1,605,500	370,158	3,355,057
June	1,486,009	1,767,996	403,413	3,657,417
July	1,887,467	2,028,249	492,746	4,408,461
August	1,845,593	2,333,011	529,121	4,707,725
September	1,770,290	2,388,615	458,874	4,617,780
October	1,611,663	2,321,026	532,421	4,465,109
November	1,907,098	2,934,570	574,283	5,415,950
December	1,968,631	3,070,053	636,751	5,675,435
Total kWh	**20,297,626**	**31,078,349**	**5,612,800**	**56,988,775**

8.4.3 Subprogram-Level Critical Peak Demand Impacts

Subprogram-level ex-post peak demand savings were calculated using the method detailed in the methodology section above.

Table 8-6: Behavioral Ex-Post Subprogram-Level Peak Reduction (kW)

EDC	Program Demand Reductions (kW)
CEI	2,494.38
OE	3,802.50
TE	702.99
Total kW	**6,999.87**

8.4.4 Results of Regression Analysis

The regression coefficients for the treatment effect, the standard error of the coefficient, and the R-squared of the model are reported below by month for all cohorts by operating company. The model specification and variable definitions can be found in the methodology section above.

Table 8-7: Average Daily Treatment Effect by Month and Cohort

Month	CEI		OE		TE		
	2013 Group	**2017 Group**	**2013 Group**	**2017 Group**	**2013 Group**	**2017 Group**	**2019 Group**
January	-0.783 (0.246)	-1.076 (0.223)	-1.114 (0.250)	-1.269 (0.248)	-0.163 (0.359)	-0.882 (0.248)	NA[60]
February	-0.735 (0.255)	-1.034 (0.235)	-1.252 (0.255)	-1.163 (0.256)	-0.277 (0.381)	-0.706 (0.259)	-0.176 (0.221)
March	-0.742 (0.208)	-0.894 (0.191)	-1.078 (0.213)	-1.117 (0.216)	-0.261 (0.307)	-0.488 (0.213)	-0.117 (0.169)
April	-0.662 (0.153)	-0.818 (0.141)	-0.848 (0.155)	-0.661 (0.156)	-0.430 (0.223)	-0.414 (0.159)	-0.291 (0.126)
May	-0.621 (0.147)	-0.813 (0.129)	-0.734 (0.147)	-0.499 (0.144)	-0.532 (0.203)	-0.381 (0.146)	-0.292 (0.116)
June	-0.739 (0.182)	-0.895 (0.150)	-0.838 (0.176)	-0.565 (0.165)	-0.579 (0.251)	-0.365 (0.172)	-0.465 (0.135)
July	-0.993 (0.223)	-1.063 (0.178)	-0.890 (0.204)	-0.639 (0.188)	-0.682 (0.310)	-0.437 (0.208)	-0.536 (0.163)
August	-0.971 (0.202)	-1.053 (0.162)	-0.891 (0.189)	-0.781 (0.180)	-0.830 (0.278)	-0.525 (0.189)	-0.430 (0.149)
September	-0.808 (0.179)	-1.123 (0.151)	-0.927 (0.172)	-0.829 (0.167)	-0.746 (0.242)	-0.492 (0.169)	-0.381 (0.141)
October	-0.646 (0.153)	-1.031 (0.137)	-0.833 (0.151)	-0.803 (0.158)	-0.707 (0.210)	-0.605 (0.152)	-0.422 (0.133)
November	-0.734 (0.194)	-1.277 (0.181)	-1.114 (0.199)	-1.018 (0.214)	-0.676 (0.289)	-0.617 (0.213)	-0.647 (0.188)
December	-0.694 (0.220)	-1.297 (0.210)	-1.096 (0.224)	-1.045 (0.240)	-0.834 (0.320)	-0.741 (0.241)	-0.657 (0.247)
R-Squared	**0.5107**	**0.7057**	**0.5272**	**0.7105**	**0.5195**	**0.6743**	**0.6830**

8.5 Detailed Process Evaluation Findings

The following section provides an overview of the Behavioral subprogram's design and implementation in 2019 with a focus on subprogram changes during the year. The following section provides detailed findings from the process evaluation for the Behavioral subprogram of the Energy Efficient Homes Program.

[60] An insufficient number of data points were present post-calendarization to obtain an estimate of savings for January 2019 for the 2019 Toledo Edison cohort. For the purpose of evaluation, ADM assumed a 0 kWh savings for the month of January as previous work has indicated that savings near the date of treatment onset is close to 0 kWh and that savings attributable to HERs program increases linearly over the course of the first year (http://www.cadmusgroup.com/wp-content/uploads/2014/11/Cadmus_Home_Energy_Reports_Winter2014.pdf, pg. 3).

8.5.1 Subprogram Operations Perspective

ADM spoke with the Companies' subprogram implementation staff and Oracle program implementation staff. The evaluation team conducted interviews with the Companies' residential program energy efficiency manager (the "residential energy efficiency manager"), the Companies' subprogram manager, and a delivery manager for the implementation contractor in November 2019. This section summarizes those conversations with a focus on describing subprogram progress toward goals, changes, perceived strengths, and changes in design or implementation.

The subprogram manager noted that there had been no change to energy saving goals in 2019 and that the design of subprogram goals had remained consistent with 2017 and 2018. They noted that in addition to energy saving goals, there are also budgetary goals that they manage..

The residential energy efficiency manager noted that the subprogram had added 15,000 participants in TE and the interviewees noted that the addition of these participants put the program on track to meet its goals in 2019 in TE. They also noted that OE and CEI were on track to meet their goals as well.

The interviewees noted that there had been no substantial changes to the subprogram's design, implementation, tracking, or quality control procedures in 2019. They stated that the 2019 subprogram year ran smoothly and there had been very few customers that had opted out of the subprogram. The interviewees noted that there were six Home Energy Reports (HERs) sent in 2019 and six "eHERs" (electronic, emailed HERs) sent bi-monthly, unless customers chose to opt out.

The implementation contractor's program delivery manager mentioned that the main changes to the program related to the information provided within the HERs and the various modules or promotions that were chosen to be distributed to Behavioral subprogram participants. They noted that there had been promotions or "modules" for smart thermostats, HVAC tune-ups, and in-home audits in the HERs this year. The Companies' residential program energy efficiency manager mentioned cross-promotion for the EE Kits program, Low-Income program and Appliance Turn-In. They stated that the energy saving tips included in HERs are made specific and relevant to customers if possible and the modules that are included in the HER are broader in their relevance. Figure 8-2 displays an example of a module that was included in a HER to cross-promote the Appliance Turn In program.

Figure 8-2 Example of HER Module Cross Promoting the Appliance Turn In Program

The Companies' residential program energy efficiency manager observed that the Behavioral subprogram benefited from its synergy with the Online Audits subprogram. Oracle's program delivery manager stated that if a customer takes the Online Audit, that information is then incorporated into their HER and such customers receive more detailed information in the report. Oracle's program delivery manager noted that there had not been any tips added to their library in 2019, but that their tip library had hundreds of tips that are chosen to be included in individual HERs based on an algorithm and a customer's past reported behaviors or decisions. He also noted that Oracle uses this information and information provided by the Companies to ensure the HERs do not include information that is not relevant to individual customers.

Oracle's program delivery manager stated that subprogram tracking and reporting had not changed in 2019. Oracle provides the Companies with information regarding email open rates and the customers that interact with different aspects of the HER. The Company's subprogram manager observed that the subprogram's reporting and communication had not changed with the implementation contractor in 2019. They noted that there was a weekly call and ad hoc email and phone communication, and that the subprogram had strong communication and reporting.

The subprogram manager observed that the subprogram's strengths included its ability to achieve its goals and to help customers to save energy and learn about their energy usage. Oracle's program delivery manager mentioned that customer satisfaction with the HERs was a subprogram strength. He noted that the subprogram's most significant challenge had been meeting its savings goals in TE's operating area, but that challenge had been addressed this year with the addition of new participants.

8.5.2 Behavioral Modification Participant Survey

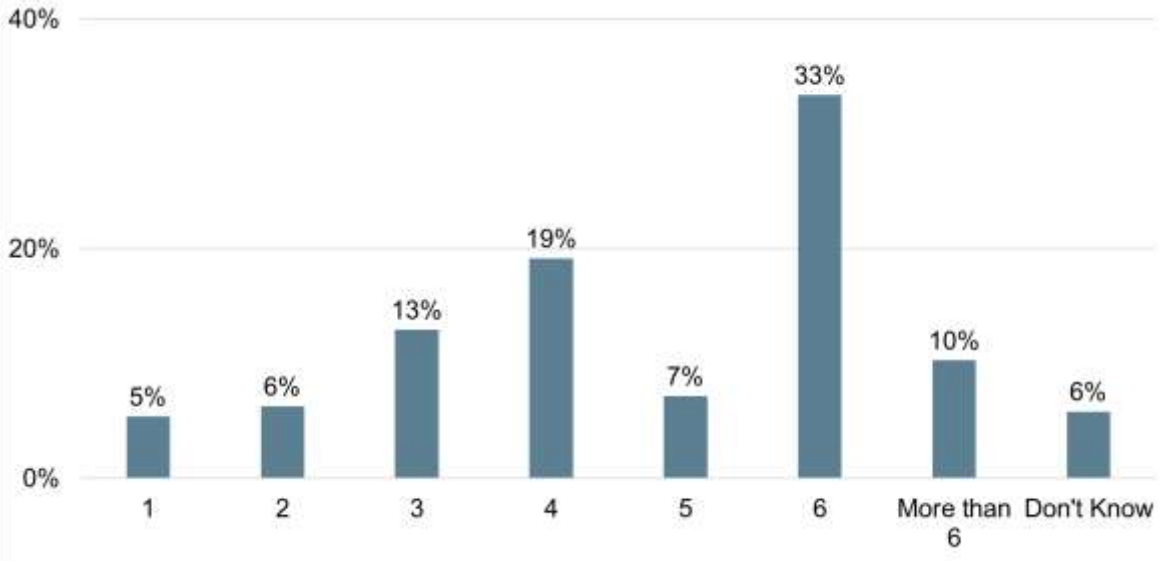
In this section, ADM presents key findings from participant surveys administered online by ADM in December 2019. The surveys collected data on 225 participants (75 from each

of the Companies). ADM inquired with survey respondents regarding their subprogram experiences, energy efficiency knowledge, experiences with installed equipment and energy efficiency behaviors, cross program awareness, satisfaction, and home characteristics.

Subprogram Experiences

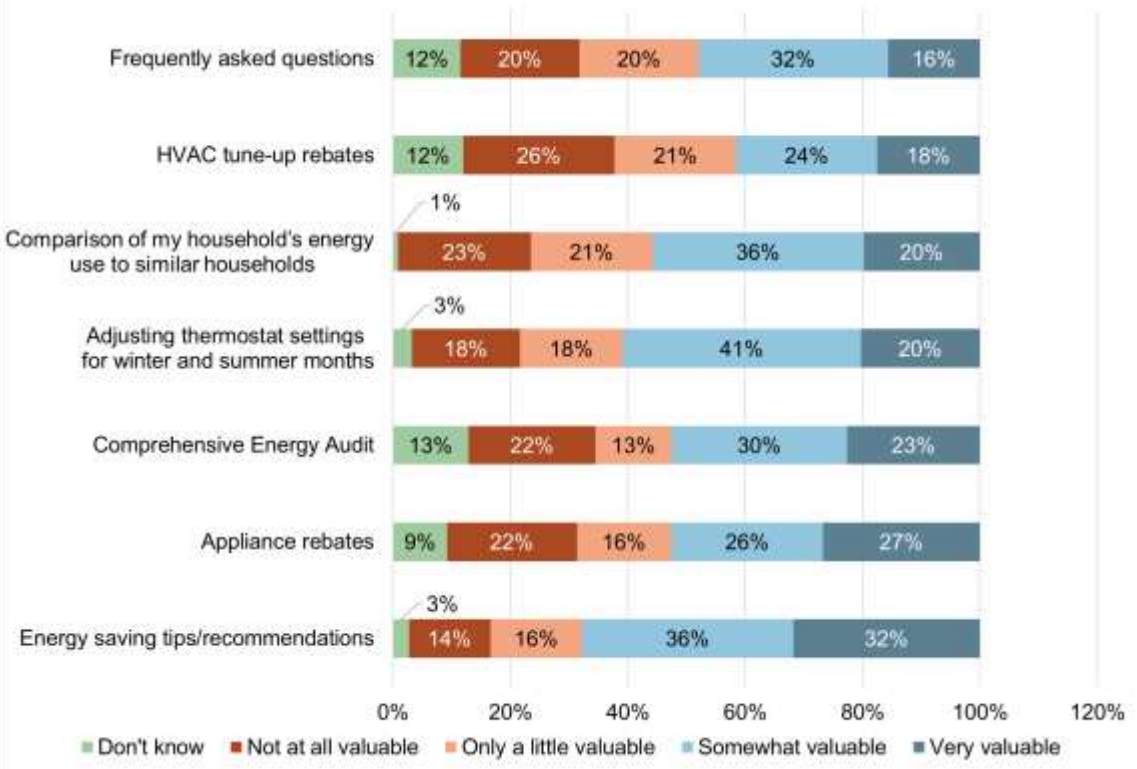
ADM asked HERs subprogram participants how many reports they recalled receiving in 2019. Figure 8-3 displays the percent of respondents that reported receiving each number of HERs in 2019. Seventy-one percent of people surveyed said they had read all or most of the reports they received. Twenty-six percent of respondents said they read some of the reports. One percent of respondents said they did not read any of the reports and 2% said they were unsure of how often they read the reports.

Figure 8-3: Number of HERs Program Participants Recall Receiving in 2019



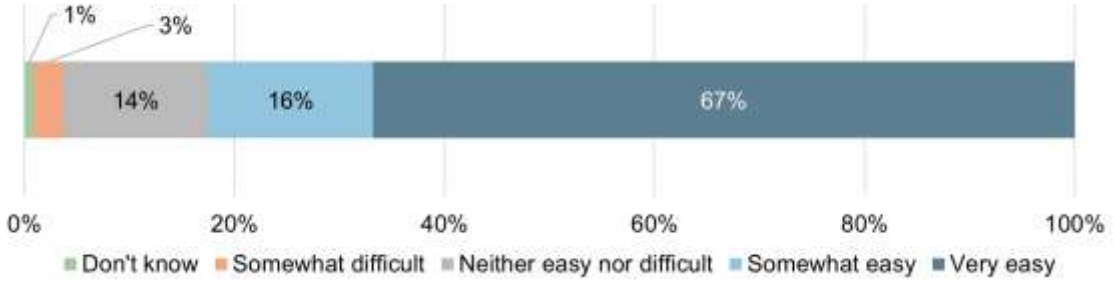
The 217 respondents that reported that they had read at least some of their HERs were asked how valuable they found various aspects of the reports (see Figure 8-4). Respondents reported that they found the energy saving tips and recommendations the most useful and the information on HVAC tune up rebates and Frequently Asked Questions the least useful. Of the respondents that read reports, about one-quarter (54 respondents) were unsure about the value of some aspect of the HER. In response to a follow-up question, about two-thirds (63%) of those 54 respondents clarified that their uncertainty of the value of that aspect of the report meant they did not pay much attention to it while the other respondents (37%) said they truly had no opinion on it.

Figure 8-4: Value of Information Provided in HERs



Respondents were also asked to rate the ease of understanding their HERs. Most respondents rated the reports as easy and very few (3%) said they were difficult. Figure 8-5 displays the survey respondents' ease of understanding their HERs.

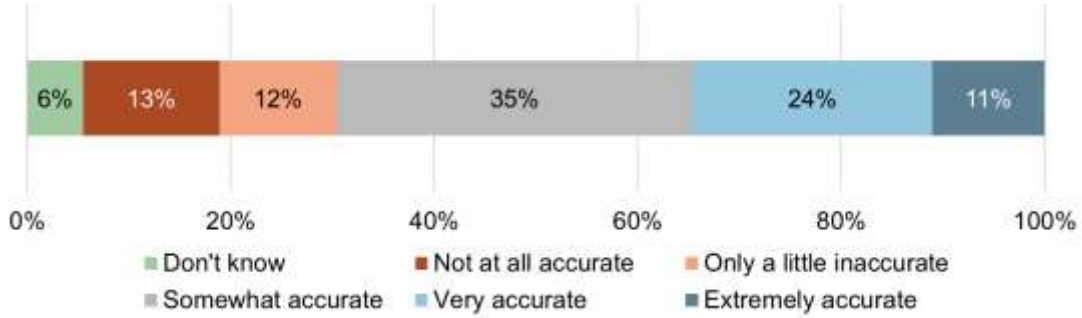
Figure 8-5: Ease of Understanding HERs



About one-third of respondents reported finding their HERs to be accurate.[61] Figure 8-6 displays respondents' perceived accuracy of their HERs. Respondents that noted their reports were not accurate noted issues such as their home characteristics not being accurate and not being compared to similar homes or similar types of energy users (e.g. electric car drivers, retirees).

[61] These participants rated their HERs' accuracy as very or extremely accurate.

Figure 8-6: Participants' Rating of HERs Accuracy



Three-quarters of survey respondents also recalled receiving emails with energy saving tips in addition to receiving the HERs. Ninety-two percent of respondents that received emails with tips said they had read all (37%) or at least some (56%) of the emails. Seven percent of these respondents (12 respondents) reported not having read any of these emails and 1% of respondents could not recall if they had read them. Of the twelve respondents who said they had not read these emails, four said they already know enough about saving energy. Other reasons that respondents gave for not reading these emails included a lack of interest (2 respondents), lack of time (3 respondents), not checking email regularly (1 respondent), assuming they said the same thing as the reports (1 respondent), or being lazy (1 respondent). Most respondents that had read the tips sent via email said they were at least somewhat valuable.[62]

Most respondents (75%) reported that they had never visited the energysaveOhio.com website to access their home's energy use information or were unaware whether they had (6%). Table 8-8 displays how the 44 respondents that had gone to the energysaveOhio.com website described their experiences on the website. Of the 22 respondents that report having logged into the website with their account number to review unique tips and information, 11 said they logged in multiple times, 10 reported logging in once, and 1 respondent could not recall how many times they had logged in.

[62] Seventy-six percent of respondents rated the usefulness of the emails with tips at a 3 (60%) or 4 (17%) on a scale from 1 (not at all valuable) to 4 (very valuable).

Table 8-8: Experience with energysaveOhio.com

Experience Description	Percentage of Respondents
You logged in on the website with your utility account number and reviewed energy use information and tips that were unique to your home.	50%
You have not created an account on the website, but you visited the website site and reviewed the general energy savings tips.	25%
Other	11%
Don't know	14%

Regarding their motivation for going to the subprogram's website, about half of website visitors (48%) noted that they were satisfied with the information they were receiving in their HER but wanted to supplement it and learn more by going to the website. Three respondents (7%) noted that they thought their HER was not providing enough information and were seeking additional information on the website. Three other respondents noted different reasons for going to the website, including trying to opt out of the subprogram, completing a school assignment for their child, and attempting to check their utility bill. The remaining 34% of respondents (15 respondents) who reported having gone to the energysaveOhio.com website did not note a reason for their visit. Most respondents that reported logging into the website with their account number or visiting the website for another reason said the tips and information on energysaveOhio.com were at least somewhat valuable.[63]

Of the survey respondents that had read at least some of the tips provided in subprogram emails or that had reported going to the energysaveOhio.com website, only 6% (9 respondents) noted having any difficulty implementing the energy saving tips that were provided. The difficulties that these respondents noted were that they were not able to afford the recommended actions (5 respondents), the tips were not relevant or possible (4 respondents), or they already had completed the recommended actions (2 respondents).

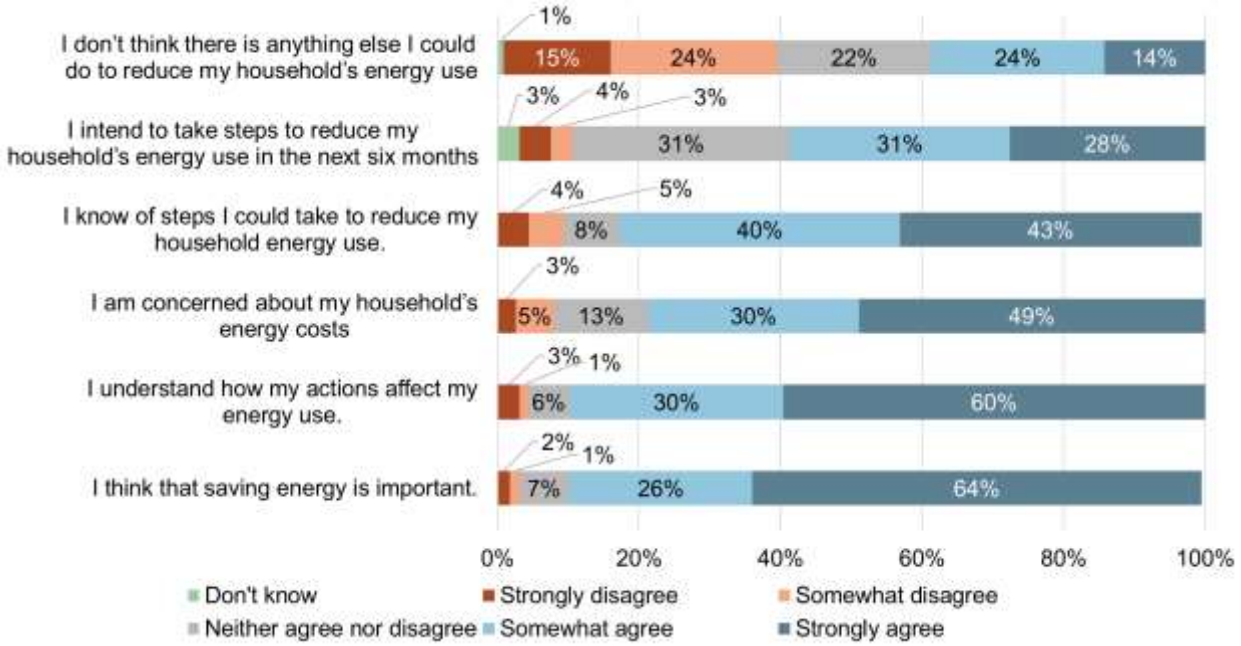
[63] Sixty-six percent of respondents rated the usefulness of the emails with tips as a 3 (39%) or 4 (26%) on a scale from 1 (not at all valuable) to 4 (very valuable).

Energy Efficiency Knowledge and Behaviors

Most survey-takers indicated that they thought they were knowledgeable regarding ways to save energy in their homes.[64] Regarding their efforts to save energy in their homes, about half rated themselves as having done almost everything they could have done.[65]

ADM asked HERs participants about their level of agreement with various statements regarding energy efficiency attitudes and behaviors (see Figure 8-7). Respondents most strongly agreed that saving energy is important, that their actions affect their energy use, and that they are concerned with their household's energy use.

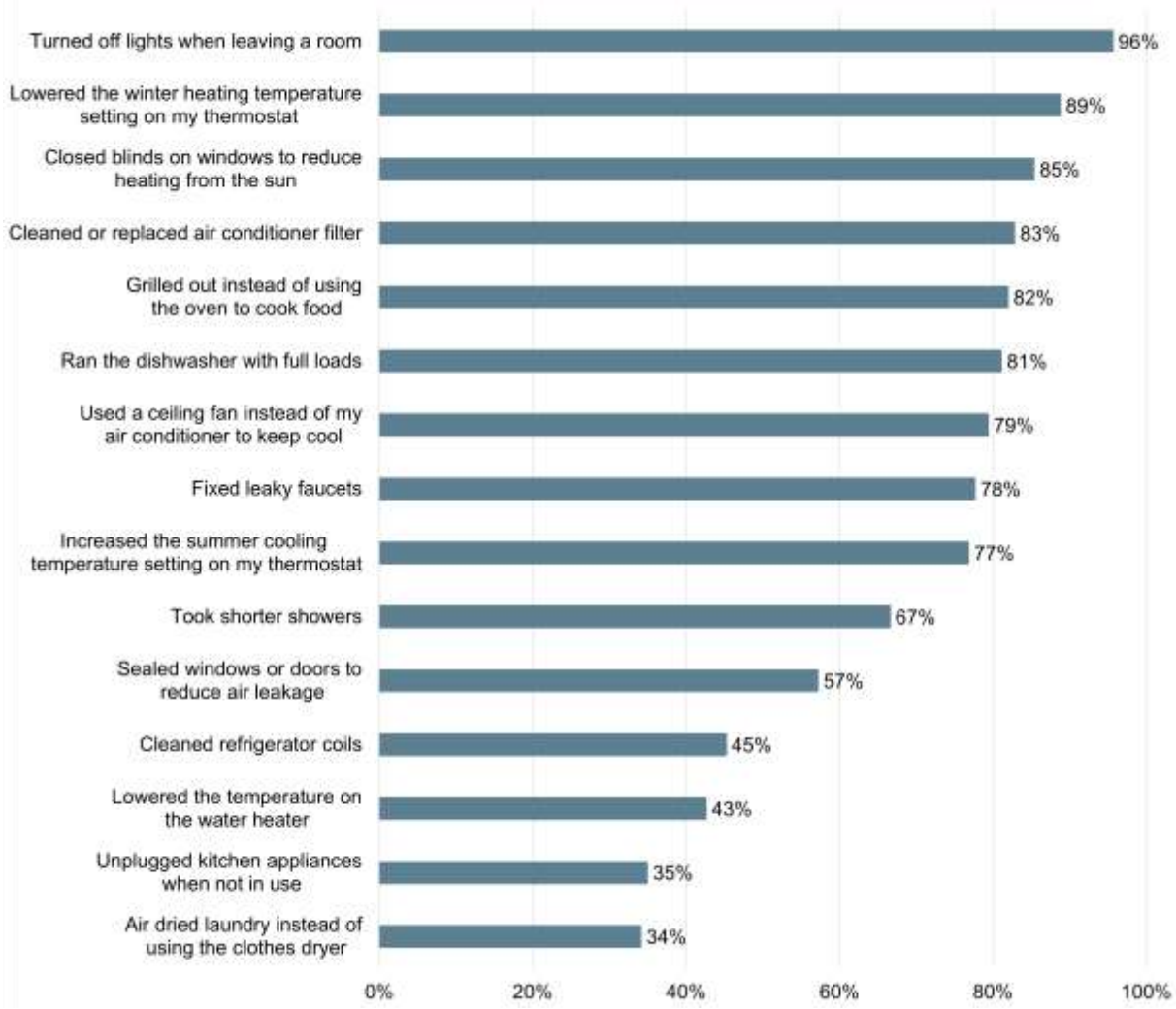
Figure 8-7: HERs Recipients' Energy Efficiency Knowledge and Intent



ADM asked survey-takers whether they had taken any action or changed any of their behaviors in 2019 to reduce their energy usage based on the information they had received through the Home Energy Reports they received in 2019. About half (52%), 117 respondents, answered affirmatively. Sixty-one percent of the respondents that reported having taken energy saving actions said that the information provided through the HERs, tips emails, or subprogram website were important in their decision to take actions to save energy in 2019.[66] Respondents' specific actions they reported taking in the past six months to save energy are highlighted on the following page in Figure 8-8.

[64] Ninety-five percent of respondents rated their level of knowledge as a 3 or 4 regarding ways to save energy on a scale from 1 (not at all knowledgeable) to 4 (very knowledgeable).
[65] Fifty-six percent of respondents rated their household's efforts to save energy as a 4 or 5 on a scale from 1 (have not done anything) to 5 (have done almost everything they can).
[66] Rated the importance as a 4 (38%) or 5 (23%) on a scale from 1 (not at all important) to 5 (very important).

Figure 8-8: Energy Reducing Actions Taken by HERs Recipients



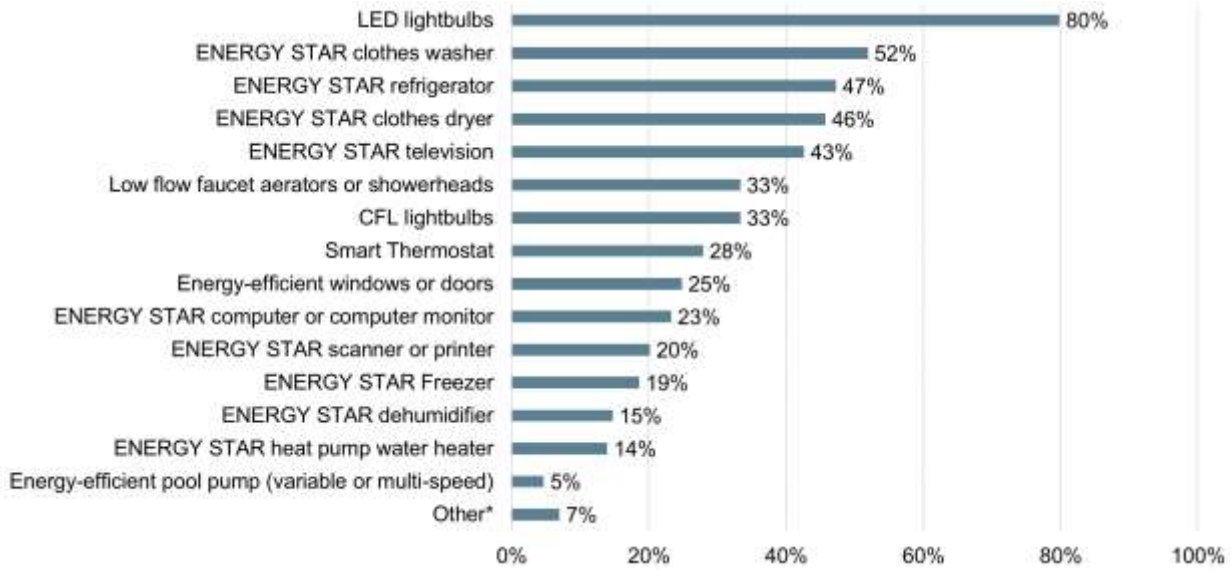
Fifty-seven percent of survey-takers (129 respondents) indicated that they had installed energy-efficient equipment/appliances or made energy efficiency improvements in 2019 (see Figure 8-9 on the following page). Over half of these respondents reported that they installed LED lightbulbs and/or ENERGY STAR® clothes washers.

About a quarter (23%) of respondents who bought an ENERGY STAR® refrigerator reported applying for a Company rebate, compared to 16% of those who bought an ENERGY STAR® clothes washer and 8% of those who bought an ENERGY STAR® dryer.

Of those who did not apply for rebates, most respondents (60%) said it was because they were not aware of the Companies' available rebates. Others said they forgot to apply (13%), the timing of their purchase did not allow them to apply (9%), the available rebates were too small (7%), the paperwork was too onerous (3%), someone else purchased the equipment (3%), or they did not know why they had not applied for a rebate (5%).

Of those who installed energy-efficient equipment/ appliances or made energy efficiency improvements in 2019, 43% said the information provided through the home energy reports, tips emails, or subprogram website was important in that decision.[67]

Figure 8-9: Energy Efficient Equipment Installed by HERs Recipients



**Oher equipment or improvements include attic insulation, energy efficient furnaces, ENERGY STAR® dishwashers, microwaves, and air conditioners.*

Cross Program Awareness and Participation

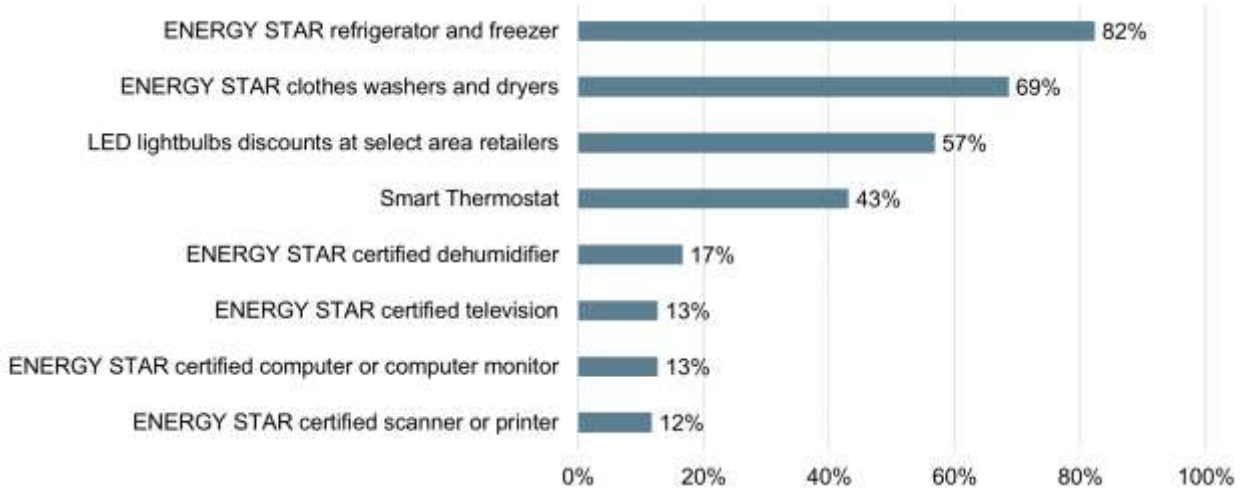
Behavioral subprogram participants also were asked about their awareness of other offerings provided by the Companies.

Twenty percent of all survey-takers (45 respondents) said they were aware of the Companies' Home Energy Analyzer tool. Of those respondents, 56% said they learned about the tool from a Company email. The other respondents found out about it while browsing the Companies' website (38%), during an in-home audit (2%), or could not recall how they learned about it (4%). Only 18% of those who were aware of the tool (8 individuals) said they had used it in the last six months.

Forty-five percent of respondents said that before taking ADM's survey they were aware that the Companies offered discounts and rebates on energy-efficient equipment for their home. On the following page, Figure 8-10 displays the discounts or rebates these respondents noted being aware of before ADM's survey.

[67] Rated the importance as a 4 or 5 on a scale from 1 (not at all important) to 5 (very important).

Figure 8-10: HERs Recipients' Awareness of EE Equipment Discounts/Rebates



Survey-takers learned of rebates and discounts in several ways. Sources of rebate or discount awareness are displayed in Table 8-9.

Table 8-9: Sources of HERs Recipients' Rebate/Discount Awareness

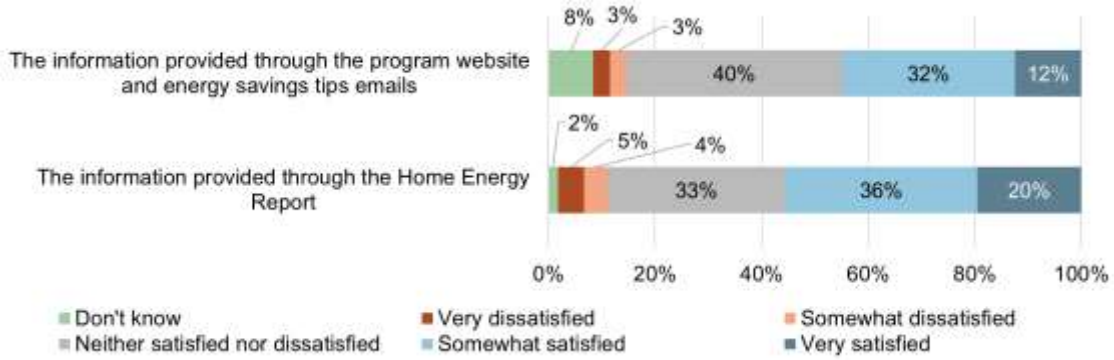
Source of Awareness	Percentage of Respondents (n=86)
Email from the Companies	44%
Home Energy Report	39%
Print advertisement	21%
Companies' website	16%
Don't know	13%
Internet search	9%
Friend, family, or colleague	8%
Service provider or contractor	7%
Other	4%

Note: Percentages exceed 100% because respondents could choose more than one response.

Subprogram Satisfaction

About half of respondents in the subprogram indicated they were satisfied with the information provided at the Company website or in Company emails as well as in their HERs. Figure 8-11 displays respondent satisfaction with subprogram information.

Figure 8-11: HERs Recipients' Satisfaction with Subprogram Information



Home Characteristics

Survey respondents provided feedback regarding their homes' characteristics, such as overall home sizes and types of fuel used to heat their homes. Most program participants (77%) lived in a home with approximately 3,000 square feet or less of living space and use natural gas to heat both water (51%) and their homes (58%). See Table 8-10 on the following page for further detail on home characteristics reported by surveyed participants.

Table 8-10: HERs Recipients' Home Characteristics

Characteristics	Percent of Respondents
Space Heating Fuel (n=224)	
Natural gas	58%
Electricity	29%
Propane	8%
Other (Oil, Geothermal, Wood, Mixture of Fuels)	4%
Don't Know	1%
Water Heating Fuel (n=224)	
Natural gas	51%
Electricity	42%
Propane	5%
Geothermal	1%
Don't know	1%
Number of people Living in Home (n=224)	
1	10%
2	44%
3	16%
4	19%
5	6%
6 or more	3%
Don't Know/Refused	1%
Above Ground Living Space (n=222)	
Less than 1,000 square feet	5%
1,000 to less than 2,000 square feet	36%
2,000 to less than 3,000 square feet	36%
3,000 to less than 4,000 square feet	14%
4,000 to less than 5,000 square feet	4%
5,000 square feet or greater	1%
Don't Know	5%

9 Programmable/Smart Thermostats

This chapter will present the results of the Smart Thermostat subprogram impact evaluations. The objective was to verify the energy savings resulting from the 2019 Smart Thermostat subprogram.

9.1 Description of the Smart Thermostats Subprogram

The Smart Thermostat subprogram deploys Smart (or Connected) Thermostat technology in order to optimize HVAC usage and reduce energy consumption. Programmable thermostats save energy by allowing the user to adjust temperature setpoints at scheduled times (e.g. at night or when the space is unoccupied). Smart thermostats allow for additional savings by allowing the users to adjust setpoints using a smartphone or other connected device. In some cases, smart thermostats may also "learn" the consumer's behavior and optimize HVAC usage in order to save energy.

The companies provided incentives to an Ohio competitive energy service provider for the installation of a Google Nest Learning Thermostat in homes of FirstEnergy electric customers. The total number of thermostats incentivized through the program is shown in Table 9-1.

Table 9-1: Count of Thermostats Incentivized per EDC

EDC	Count of Thermostats
CEI	409
OE	401
TE	52
Total	**862**

9.1.1 Upstream Measures Survey

ADM relied on data collected via the Energy Efficient Products upstream program survey in 2019 to support M&V analysis for the smart thermostats subprogram in 2019. In total, 1,502 upstream customers completed the survey from December 2019 through February 2020; 111 of these participants reported having recently purchased a smart thermostat. The survey instrument developed for the Energy Efficient Products upstream program survey collected information characterizing the heating and cooling systems installed in customers' homes and the type of thermostats previously installed in addition to household and demographic information.

9.2 Impact Analysis

ADM used deemed values for energy savings and peak demand reduction per Pennsylvania Interim Measure Protocol (IMP) guidelines for thermostats.[68] The following savings algorithms were used to calculate detailed energy savings:

Equation 9-1: Annual Energy Savings Programmable/Smart Thermostats

$$\Delta kWh/yr = \Delta kWh_{cool} + \Delta kWh_{heat}$$

Equation 9-2: Annual Cooling Energy Savings Programmable/Smart Thermostats

$$\Delta kWh_{cool} = \frac{CAPY_{cool}}{1000\frac{W}{kW}} \times \frac{1}{SEER \times Eff_{duct}} \times EFLH_{cool} \times ESF_{cool}$$

Equation 9-3: Annual Heat Pump Energy Savings Programmable/Smart Thermostats

$$\Delta kWh_{heat.heatpump} = \frac{CAPY_{heat}}{1000\frac{W}{kW}} \times \frac{1}{HSPF_{heatpump} \times Eff_{duct}} \times EFLH_{heat} \times ESF_{heat}$$

Equation 9-4: Annual Electric Furnace Heat Energy Savings Programmable/Smart Thermostats

$$\Delta kWh_{heat.electricfurn} = \frac{CAPY_{heat}}{1000\frac{W}{kW}} \times \frac{1}{HSPF_{other} \times Eff_{duct}} \times EFLH_{heat} \times ESF_{heat} \times DF$$

Equation 9-5: Annual Baseboard Heat Energy Savings Programmable/Smart Thermostats

$$\Delta kWh_{heat.baseboard} = \frac{CAPY_{heat}}{1000\frac{W}{kW}} \times \frac{1}{HSPF_{other}} \times EFLH_{heat} \times ESF_{heat} \times DF$$

Equation 9-6: Annual Fuel Furnace Heat Energy Savings Programmable/Smart Thermostats

$$\Delta kWh_{heat.fuelfurn} = \frac{HP_{motor} \times (746\frac{W}{HP}) \times EFLH_{heat}}{\eta_{motor} \times 1000\frac{W}{kW}} \times ESF_{heat}$$

Equation 9-7: Peak Demand Savings Programmable/Smart Thermostats

$$\Delta kWpeak = 0$$

[68] The Pennsylvania Residential Thermostats IMP (02/26/2018) can be provided upon request

Where:

$CAPY_{cool}$	= Capacity of air conditioning unit
	= 32,000
$CAPY_{heat}$	= Normal heat capacity of Heat Pump/Electric Furnace
	= 32,000
$SEER$	= Seasonal Energy Efficiency Ratio
	= 11.9
$HSPF_{heat\ pump}$	= Heating Seasonal Performance Factor of heat pump
	= 3.412 (equivalent to electric furnace COP of 1)
$HSPF_{other}$	=Heating Seasonal Performance Factor for other electric heating systems
	= 3.412
Eff_{duct}	= Duct System Efficiency
	= 0.8
ESF_{cool}	= Cooling Energy Saving factor[69]
ESF_{heat}	= Heating Energy Saving Factor[70]
$EFLH_{cool}$	= Full load cooling hours.
	= Dependent on location, as specified in the OH TRM
$EFLH_{heat}$	= Full Load heating hours.
	= Dependent on location, as specified in the OH TRM
HP_{motor}	= Gas furnace blower motor horsepower
	= 0.5 HP
η_{motor}	= Efficiency of furnace blower motor
	= 50%
DF	= Derate Factor for Electric Heating Systems
	= 0.85

Cooling and heating Energy Savings Factors (ESF) were derived using the proportions of manual and conventional baseline thermostat and heating and cooling types reported

[69] Cooling energy savings factors were determined based on Table 4, page 7 of the IMP.
[70] Heating energy savings factors were determined based on Table 5, page 8 of the IMP.

in the Upstream Measures survey. All thermostats in this program were reported as being "self-installed" by customers.

9.3 Detailed Impact Evaluation Findings

This section presents the findings from the Smart Thermostat Subprogram impact analysis.

The 2019 results for kWh energy savings in the Companies' service area are summarized in Table 9-2. The subprogram level annual savings totaled 207,507 kWh (240.7 kWh per participant), which equates to a realization rate of 95%. In accordance with the PA TRM, there are no kW demand reductions associated with these thermostats.

Table 9-2: Ex-Ante and Ex-Post kWh Savings per EDC

EDC	Participation	Ex-Ante kWh	Ex-Post kWh	Realization Rate
CEIC	409	103,804	98,208	95%
TE	52	13,198	12,921	98%
OE	401	101,773	96,378	95%
Total	**862**	**218,775**	**207,507**	**95%**

10 Low-Income Program Participation

The Companies expanded their evaluation, measurement and verification effort to identify participation and savings from low income customers in the residential programs. A low-income customer was defined by household income below 150% of the 2019 Federal Poverty Level.

On the following page, Table 10-1 shows the quantity of units, kWh, and kW that can be attributed to low income population participation in the EE Homes Program.

Table 10-1: Savings Attributable to Low-Income Customers

EDC	Subprogram		Percentage of Low-Income Purchasers	Quantity	kWh Savings	kW Savings
CEI	Online Audits		5%	334	53,381	8.94
	Comprehensive Audits		8%	247	158,199	17.69
	Behavioral		3%	1,730	541,270	66.52
	Energy Efficiency Kits	Standard	17%	3,509	1,150,631	125.15
		Electric	15%	1,439	625,914	74.55
	School Education		23%	1,645	498,518	46.98
	Smart Thermostats		19%	78	18,706	0.00
	Sub-Total		**8%**	**8,982**	**3,046,621**	**339.83**
OE	Online Audits		9%	1,071	194,210	32.54
	Comprehensive Audits		21%	758	513,272	58.48
	Behavioral		11%	11,503	3,315,024	405.60
	Energy Efficiency Kits	Standard	18%	5,133	1,683,237	183.08
		Electric	24%	4,878	2,122,088	252.76
	School Education		21%	1,972	597,762	56.34
	Smart Thermostats		16%	64	15,333	0.00
	Sub-Total		**14%**	**25,378**	**8,440,926**	**988.79**
TE	Online Audits		12%	238	44,391	7
	Comprehensive Audits		37%	451	266,030	30.70
	Behavioral		16%	5,847	898,048	112.48
	Energy Efficiency Kits	Standard	36%	4,349	1,426,342	155.14
		Electric	17%	1,277	555,765	66.20
	School Education		31%	1,306	395,897	37.31
	Smart Thermostats		15%	8	1,938	0.00
	Sub-Total		**21%**	**13,476**	**3,588,412**	**409.26**
Totals	Online Audits		9%	1,643	291,982	48.92
	Comprehensive Audits		19%	1,455	937,502	106.87
	Behavioral		9%	19,080	4,754,342	584.60
	Energy Efficiency Kits	Standard	23%	12,991	4,260,211	463.37
		Electric	20%	7,594	3,303,767	393.51
	School Education		25%	4,923	1,492,178	140.63
	Smart Thermostats		16%	142	35,977	0.00
	EE Homes Program Total		**13%**	**47,828**	**15,075,959**	**1,737.89**

11 Conclusions and Recommendations

The major conclusions and recommendations for each Home Performance subprogram are summarized below.

11.1 School Education Conclusions

- ADM interviews with program and implementation staff suggest that the School Education subprogram remained largely unchanged in 2019. The most significant change to the subprogram was the expansion of the curriculum and kit offering to include middle school students in addition to elementary school students. The subprogram is well established, and the subprogram staff and implementation contractor have developed strong processes and procedures to effectively and successfully administer the subprogram.
- Results from the survey confirm that participants continue to have a high level of satisfaction with the subprogram. Participants found the LED nightlights, 15W LEDs, and 9W LEDs to be the most useful measures in the kits they received; however, more than three quarters of survey participants rated all measures in the kit as useful.
- Children's interest in the kit as well as its lack of cost were important factors that parents described as motivating their participation in the program. Equally important motivators were an interest in saving money as well as energy. Survey responses also indicated that parent/guardian knowledge of energy efficiency increased with receipt of the kit.
- More than half of surveyed participants reported installing only some of the measures included in the kit. Most of these participants noted that this was because they were waiting for light bulbs to burn out. That said, most surveyed participants who reported purchasing and installing additional energy efficiency measures stated that they went on to purchase and install energy efficient light bulbs because of information provided in the school education kit.

11.2 Energy Efficiency Kits Conclusions

- Findings from program staff interviews and participant surveys indicate that the EE Kits subprogram was implemented successfully in 2019 with no significant changes.
- The subprogram achieved its energy saving goals in 2019. Interviews indicate that the subprogram's closing with Power Direct had been well organized, and the Companies and program implementation contractor had worked to effectively coordinate the process. An established procedure for informing interested

customers or redirecting customers to energy saving programs that were still available was also devised to support the transition.

- Findings from both the participant surveys and staff interviews suggest that the subprogram was well-designed and had been effectively implemented. Subprogram staff reflected on several successes including creative solutions to marketing the subprogram, developing call center scripting and customer FAQs, and ensuring subprogram tracking data was understood and utilized properly.
- Results from the participant survey indicate that most participants requested their kits online. Surveyed participants rated their satisfaction with the program very high, with many respondents voicing their appreciation of the kits and almost three-quarters of respondents noting that the program had increased their satisfaction with their utility.
- Program participation facilitated increased awareness of other efficiency rebates and discounts; nevertheless, fewer than one third of participants that reported having purchased energy efficiency appliances or equipment applied for rebates from the Companies.
- Similar to previous program years, approximately two-thirds of kit recipients did not install every measure included in the kit. Nearly 100 surveyed participants reported that their reason for not installing all kit measures was their reluctance to replace operational, inefficient bulbs with new LEDs. That said, several surveyed participants noted that they had not installed all the products because not all products fit or because they had trouble with product installation.

11.3 Comprehensive Audits Conclusions

- Findings from staff interviews indicate that the single-family portion of the subprogram was implemented successfully in 2019 with minimal changes.
- Both interviews with staff and customer surveys indicate that there were high levels of satisfaction for both single-family and multi-family program participants in 2019.
- Recruitment and participation of multi-family properties has been a challenge for various reasons including dealing with housing authorities/boards, reschedule requests, and existing energy efficiency contracts buildings may have in place. However, a design change from an opt-in to an opt-out system resulted in an increase in the participation rate for individual units at multi-family residential properties this year.
- Program and implementation staff interviews indicate the subprogram's management is well-coordinated and the Companies and implementation

contractor have a strong working relationship. Neither interviewee noted any issues with data tracking, quality control, our subprogram communications.

- Results from the participant survey show that nearly two-thirds of program participants learned of the audit subprogram via mail received from the Companies. Almost all surveyed participants noted that saving money on their utility bills and learning more about their home's energy use as their primary motivators for participating in the program and many rated their experiences with the auditors positively.
- Participants surveyed by ADM noted that they were most satisfied with the LED nightlights and LED light bulbs they received through the program, though more than eighty percent of surveyed participants were satisfied with all measures installed and over ninety percent of all measures were reported as still installed at the time of surveying.

11.4 Online Audits Conclusions

- According to staff interviews the subprogram's strengths include the Home Energy Analyzer's user interface, the tips provided informing customers of other energy efficiency programs that the Companies offer, and the working relationship between the vendor and the Companies.
- Results from the participant survey indicate that most participants find the Home Energy Analyzer tool useful; however, survey responses indicate that a significant portion of online audit respondents are unsure of whether they completed their audit.
- A significant portion of respondents indicated that their experience with the Home Energy Analyzer prompted them to take action to reduce their home's energy usage through behavioral changes, weatherization improvements, or appliance / equipment upgrades. The most frequent behavioral change participants reported making after using the Home Energy Analyzer tool was turning off their lights more frequently, followed by lowering the winter heating temperature. Based on the survey results, these behavioral changes have been thoroughly adopted by participants (all respondents that noted making behavioral changes since using the Home Energy Analyzer tool stated that they still were practicing those behaviors).
- Just over half of telephone audit participants contacted to take ADM's survey reported that they initially phoned the customer call center to discuss a high bill. Less than half of respondents reported that a brochure with energy saving tips was sent to them after their call. Of those who reported receiving a brochure, nearly half said the tips they received in the brochure were helpful.

- Though over fifty percent of survey participants indicated that they found the information provided by the call center helpful, less than fifteen percent noted that they had completed appliance upgrades, weatherization improvements, or made behavioral changes since their phone audit.

11.5 Behavioral Modification Conclusions

- The Behavioral subprogram was implemented in 2019 without issue. Neither the design nor implementation of the subprogram underwent any significant changes.
- In 2019 the Behavioral subprogram was able to achieve its savings goals in all three operating areas.
- The Behavioral subprogram benefits from its synergy with the Online Audits subprogram. If a customer takes the Online Audit, that information is then incorporated into their HER.
- Results from the participant survey indicated that over two-thirds of HERs recipients read all or most of the reports they received in 2019. Respondents reported that they found the HERs easy to understand and that the energy saving tips and recommendations were the most useful components of the reports. Conversely, respondents noted that the information on HVAC tune up rebates and Frequently Asked Questions the least useful portion of the HER.
- Approximately half of those surveyed reported that they had taken actions to reduce their energy use based on the information received in the HERs and over half of those reported that the information provided through the HERs were important in their decision to do so.
- Three-quarters of respondents reported that they had never visited the energysaveOhio.com website to access their home's energy use information. Of those who did visit the webpage, about half noted that they were satisfied with the information they were receiving in their HER but wanted to supplement it and learn more by going to the website.
- Two-thirds of respondents perceived the HERs to be only somewhat or less than somewhat accurate. Respondents that noted their reports were not accurate listed issues such as their home characteristics not being correct or not being compared to similar homes and/or similar types of energy users (e.g. electric car drivers, retirees).
- A small number of survey respondents noted a desire to opt out of receiving HERs, indicating the opt out process is not clear to all participants.

11.6 Recommendations

ADM offers the following recommendations for consideration for future program cycles.

11.6.1 School Education Recommendations:

- Continue working with AMCG and NTC for subprogram delivery. Expansion of the subprogram to reach additional students was a success in 2019.
- Consider expanding and/or revising the kit contents to contain additional measures such as smart strip power strips for middle school students.
- Explore additional ways to include marketing materials in the kits to advertise other programs sponsored by the Companies.
- Investigate ways to further develop the educational material included within the kits to reinforce the energy savings possible by replacing old, inefficient bulbs prior to burnout. Of the surveyed participants that reported installing only some of the measures included in the kit, the most common reason was because they were waiting for installed light bulbs to burn out.

11.6.2 Energy Efficiency Kits Recommendations:

- Continue the EE kits subprogram and consider expanding the measures provided. Participant survey responses indicate overwhelmingly positive feedback and appreciation for this subprogram offering. Survey responses indicate that this subprogram serves as a gateway for customers to learn about energy efficiency, take actions to reduce their energy use through behaviors, purchase energy efficient products, and participate in other energy efficiency programs offered by the Companies.
- Explore additional ways to advertise and promote other programs sponsored by the Companies via the kit contents. Despite increasing awareness of other efficiency rebates offered by the Companies, a small percentage of participants went on to purchase energy efficient appliances or equipment.
- Investigate ways to further develop the kit contents to reinforce the energy savings possible by replacing old, inefficient bulbs prior to burnout. Of the surveyed participants that reported installing only some of the measures included in the kit, the most common reason was because they were waiting for existing light bulbs to burn out.

11.6.3 Comprehensive Audits Recommendations:

- Continue working with Franklin Energy for subprogram delivery. Expansion of the subprogram to reach additional multi-family units was a success in 2019 with the change from an opt-in to an opt-out process for signing up.

- Build upon the successes that the subprogram has had with recruiting multi-family participants through outreach targeted at building owners and property managers and through networks established in the subprograms first years of implementation. The subprogram's core strength is its single-family component, but this year's implementation has shown it has potential to continue to grow and serve additional customers.

11.6.4 Online Audits Recommendations:

- Explore ways in which online audit participants can track their progress through the tool's modules or can recognize completion of the online audit. Survey responses indicate some uncertainty regarding when their audit was complete or if they had in fact finished their online audit; however, this uncertainty may be linked to the period of time elapsed between participants' audit and their interaction with the survey.
- Develop a follow-up strategy for subprogram participants that complete their audit through the call center. Less than half of telephone audit participants recalled receiving follow-up material and a small number of participants reported implementing energy efficiency changes following their telephone audit. Follow-up mail could include participant-specific results from the telephone audit, additional educational information, and/or promotional materials for other efficiency programs sponsored by the Companies.

11.6.5 Behavioral Modification Recommendations:

- Consider adding an opportunity for customers to share details regarding demographics such as how often they are home during week days or how many people reside with them full-time to the Online Audit to improve the energy usage comparison aspect of the HER as well as customer perceptions of the HERs accuracy.
- Consider making the opt out process more clear or direct for subprogram participants that no longer wish to participate.
- Consider ways to communicate the potential cost savings of other programs, such as HVAC Tune-Up rebates, Appliance rebates, and the Comprehensive Energy Audit, more impactfully. Assisting participants in creating an "action plan" for the future could be a helpful way to repackage this information and increase customer engagement.

12 Appendix A: Required Savings Tables

Tables showing measure-level participation counts and savings for the Program were provided in various locations throughout this report. This appendix provides additional tables summarizing savings results. Lifetime savings were calculated as shown in Equation 12-1 below.

Equation 12-1: Normalization kWh Usage

Lifetime Savings = Measure Life x Annualized Savings

12.1 School Education

Table 12-1: School Education Program Annual kWh & kW Savings by Operating Company

EDC	Ex-Ante Savings		Ex-Post Savings		RR	
	kWh	kW	kWh	kW	kWh	kW
CEI	2,555,057	267.23	2,207,724	208.06	86%	78%
OE	3,360,200	351.44	2,903,417	273.63	86%	78%
TE	1,483,638	155.17	1,281,953	120.82	86%	78%
Total	**7,398,895**	**773.83**	**6,393,094**	**602.51**	**86%**	**78%**

Table 12-2: School Education Program Annual Ex-Post & Lifetime Savings

EDC	Ex-Post Savings		Lifetime
	kWh	kW	kWh
CEI	2,207,724	208.06	31,924,132
OE	2,903,417	273.63	41,983,981
TE	1,281,953	120.82	18,537,300
Total	**6,393,094**	**602.51**	**92,445,412**

12.2 Energy Efficient Kits

Table 12-3: EE Kits Program Annual kWh & kW Savings by Operating Company

EDC	Ex-Ante Savings		Ex-Post Savings		RR	
	kWh	kW	kWh	kW	kWh	kW
CEI	11,973,732	1,300.03	10,912,171	1,230.03	91%	95%
OE	20,261,309	2,218.90	18,291,959	2,080.08	90%	94%
TE	7,924,398	866.06	7,145,878	810.57	91%	94%
Total	**40,159,439**	**4,384.98**	**36,350,007**	**4,120.67**	**91%**	**94%**

Table 12-4: EE Kits Program Annual Ex-Post & Lifetime Savings

EDC	Ex-Post Savings		Lifetime
	kWh	kW	kWh
CEI	10,912,170	1,230.03	125,673,015
OE	18,291,959	2,080.08	212,248,370
TE	7,145,877	810.57	82,739,548
Total	**36,350,007**	**4,120.67**	**420,660,933**

12.3 Audits & Education

12.3.1 Comprehensive Audits

Table 12-5: Comprehensive Audits Program Annual kWh & kW Savings by Operating Company

EDC	Ex-Ante Savings		Ex-Post Savings		RR	
	kWh	kW	kWh	kW	kWh	kW
CEI	1,678,517	196.52	1,898,393	212.28	113%	108%
OE	2,247,740	267.21	2,497,925	284.60	111%	107%
TE	648,570	77.83	716,236	82.66	110%	106%
Total	**4,574,827**	**541.56**	**5,112,554**	**579.54**	**112%**	**107%**

Table 12-6: Comprehensive Audits Program Annual Ex-Post & Lifetime Savings

EDC	Ex-Post Savings		Lifetime
	kWh	kW	kWh
CEI	1,898,393	212.28	27,580,935
OE	2,497,925	284.60	33,929,810
TE	716,236	82.66	8,932,595
Total	**5,112,554**	**579.54**	**70,443,340**

12.3.2 Online Audits

Table 12-7: Online Audits Program Annual kWh & kW Savings by Operating Company

EDC	Ex-Ante Savings		Ex-Post Savings		RR	
	kWh	kW	kWh	kW	kWh	kW
CEI	1,767,550	400.20	1,066,031	178.61	60%	45%
OE	1,278,000	180.00	1,632,013	273.44	128%	152%
TE	438,240	54.78	510,872	85.60	117%	156%
Total	**3,483,790**	**634.98**	**3,208,916**	**537.65**	**92%**	**85%**

Table 12-8: Online Audits Program Annual Ex-Post & Lifetime Savings

EDC	Ex-Post Savings		Lifetime
	kWh	kW	kWh
CEI	1,066,031	178.61	3,198,093
OE	1,632,013	273.44	4,896,038
TE	510,872	85.60	1,532,616
Total	**3,208,916**	**537.65**	**9,626,747**

12.4 Behavioral Modification

Table 12-9: Behavioral Program Annual kWh & kW Savings by Operating Company

EDC	Ex-Ante Savings		Ex-Post Savings		RR	
	kWh	kW	kWh	kW	kWh	kW
CEI	22,109,000	3,542.15	20,297,626	2,494.38	92%	70%
OE	34,986,000	4,570.75	31,078,349	3,802.50	89%	83%
TE	6,703,000	1,025.32	5,612,800	702.99	84%	69%
Total	**63,798,000**	**9,138.22**	**56,988,775**	**6,999.87**	**89%**	**77%**

Table 12-10: Behavioral Program Annual Ex-Post & Lifetime Savings

EDC	Ex-Post Savings		Lifetime
	kWh	kW	kWh
CEI	20,297,626	2,494.38	20,297,626
OE	31,078,349	3,802.50	31,078,349
TE	5,612,800	702.99	5,612,800
Total	**56,988,775**	**6,999.87**	**56,988,775**

12.5 Smart Thermostats

Table 12-11: Smart Thermostats Program Annual kWh & kW Savings by Operating Company

EDC	Ex-Ante Savings		Ex-Post Savings		RR	
	kWh	kW	kWh	kW	kWh	kW
CEI	103,804	0.00	98,208	0.00	95%	-
OE	101,773	0.00	96,378	0.00	95%	-
TE	13,198	0.00	12,921	0.00	98%	-
Total	**218,775**	**0.00**	**207,507**	**0.00**	**95%**	-

Table 12-12: Smart Thermostats Program Annual Ex-Post & Lifetime Savings

EDC	Ex-Post Savings		Lifetime
	kWh	kW	kWh
CEI	98,208	0.00	1,080,289
OE	96,378	0.00	1,060,155
TE	12,921	0.00	142,132
Total	**207,507**	**0.00**	**2,282,576**

13 Appendix B: School Education Survey Instrument

13.1 School Education Participant Survey

Survey Variables [DO NOT DISPLAY]

Variable	Definition
UTILITY	Name of EDC

Energy Conservation Kit Verification

1. Do you recall receiving an Energy Conservation Kit though your child's school containing a variety of energy efficient light bulbs?

    1. Yes
    2. No **[TERMINATE SURVEY]**

2. How many kits did your household receive in total?

    1. 1
    2. 2
    3. 3 or more

[SHOW Q3 IF Q2=2 or 3]

3. Did all the kits you received contain the same items?

    1. Yes
    2. No

4. Which of the following did you receive in the energy conservation kit(s)? Please check all items you received in each kit. Be sure to check an item **only** if you received the number of that item indicated. For example, if a kit contained only 1 15W LED light bulb, **do not** check that item for that kit. **[Check all that apply] [grid format, first kit, kit 2, kit 3]**

    1. (1) Three-way LED light bulb
    2. (2) 15W LED light bulb
    3. (1) 11W LED light bulb
    4. (3) 9W LED light bulbs
    5. (2) LED nightlights

[SHOW Q5 IF Q3=2]

5. Were the kits different in any other ways? If so, how were they different?

   [OPEN ENDED]

Measure Installation Verification

6. Did you install *all* of the products you received in the Energy Conservation Kit?

   1. Yes, I installed everything
   2. No, I installed only some of the products I received
   3. No, I did not install any of the products I received

[SHOW Q7 IF Q6=2 or 3]

7. Why did you not install any/some of the products? **[Check all that apply]**

   1. Some of the bulbs were broken
   2. Waiting for light bulbs to burn out
   3. Bulbs were too bright
   4. Bulbs were not bright enough
   5. Bulbs did not fit into any fixture
   97. Other (Please Specify)
   98. Don't know

[SHOW Q8 IF Q7 = 1]

8. Did you contact the [UTILITY] about the broken items?

   1. Yes
   2. No
   98. Don't Know

[SHOW Q9 IF Q8 = 1]

9. Were the broken items replaced?

   1. Yes
   2. No
   98. Don't Know

IF NO ITEMS INSTALLED, [Q6=3], SKIP TO SATISFACTION

[SHOW Q10 IF Q4=4]

10. How many of the 9W LED Bulbs you received through the program are currently installed in your home?

    1. 0
    2. 1
    3. 2
    4. 3
    5. 4
    6. 5
    7. 6
    8. 7
    9. 8
    10. 9
    11. 10 or more
    98. Don't know

[SHOW Q11 IF Q10=2, 3, 4, 5, 6, 7, 8, 9 10, OR 11]

11. Where did you install the 9W LED bulb(s)? **[grid format, first bulb, second bulb, etc. Only display appropriate number of bulbs based on Q10]**

    1. Basement
    2. Bathroom
    3. Bedroom
    4. Closet
    5. Dining Room
    6. Outside
    7. Hallway
    8. Kitchen
    9. Living Room
    10. Office
    11. Laundry Room
    97. Other
    98. Don't know

[SHOW Q12 IF Q4=3]

12. How many of the 11W LEDs you received are currently installed in your home?

    1. 0
    2. 1
    3. 2
    4. 3 or more
    98. Don't Know

[SHOW Q13 IF Q12 = 2, 3, OR 4]

13. Where did you install the 11W bulb(s)? **[grid format, first bulb, second bulb, etc. Only display appropriate number of bulbs based on Q12]**

    1. Basement
    2. Bathroom
    3. Bedroom
    4. Closet
    5. Dining Room
    6. Outside
    7. Hallway
    8. Kitchen
    9. Living Room
    10. Office
    11. Laundry Room
    97. Other
    98. Don't know

[SHOW Q14 IF Q4=2]

14. How many of the 15W LED bulb(s) are currently installed in your home?

    1. 0
    2. 1
    3. 2
    4. 3
    5. 4
    6. 5
    7. 6 or more
    98. Don't know

[SHOW Q15 IF Q14= 2, 3, 4, 5, 6, OR 7]

15. Where did you install the 15W LED bulb(s)? **[grid format, first bulb, second bulb, etc. Only display appropriate number of bulbs based on Q14]**

    1. Basement
    2. Bathroom
    3. Bedroom
    4. Closet
    5. Dining Room
    6. Outside
    7. Hallway
    8. Kitchen
    9. Living Room
    10. Office
    11. Laundry Room
    97. Other
    98. Don't know

[SHOW Q16-Q17 IF Q4=1]

16. How many of the 3-Way LED(s) are currently installed in your home?
    1. 0
    2. 1
    3. 2
    4. 3 or more
    98. Don't Know

[SHOW Q17 IF Q16=2, 3, OR 4]

17. Where did you install the 3-Way LED bulb? **[grid format, first bulb, second bulb, etc. Only display appropriate number of bulbs based on Q16]**

    1. Basement
    2. Bathroom
    3. Bedroom
    4. Closet
    5. Dining Room
    6. Outside
    7. Hallway
    8. Kitchen
    9. Living Room
    10. Office
    11. Laundry Room
    97. Other
    98. Don't know

[SHOW Q18 IF Q4=5]

18. How many of the LED nightlights you received are currently installed in your home?

    1. 0
    2. 1
    3. 2
    4. 3
    5. 4
    6. 5
    7. 6 or more
    98. Don't know

[SHOW Q19 IF Q18= 2 - 7]

19. Where did you install the LED nightlight(s)? **[grid format, first bulb, second bulb, etc. Only display appropriate number of bulbs based on Q18]**

    1. Where there was no nightlight before (new nightlight)
    2. Where a standard nightlight was previously installed
    98. Don't know

[SHOW Q20 IF Q18=1]

20. Why are you not using the LED nightlight(s)?

    1. I had no use for it
    2. I already had LED nightlight(s)
    3. It was too bright
    4. It was not bright enough
    97. Other (Specify)
    98. Don't know

Satisfaction

21. Do you have any suggested changes that should be made to the items included in the kit?

    [OPEN ENDED]

22. Please rate the usefulness of the following kit items.

    1. 3-Way LED bulb
    2. 15W LED bulbs
    3. 11W LED bulb
    4. 9W LED bulbs
    5. LED nightlights

23. Using a scale of 1-5, where 1 means “very dissatisfied” and 5 means “very satisfied,” how satisfied or dissatisfied are you with each of the following program components?

    a. The items included in the kit
    b. The energy efficiency educational materials received through the program

[SHOW Q24 IF Q23 a-b = 1 or 2 or 3]

24. What is the reason you were not satisfied?

    [OPEN ENDED]

25. What factors influenced your decision to request a kit through this program? [Select all that apply]

    1. My child’s interest in the kit
    2. I was looking for ways to save energy in my home
    3. Recommendation from a friend
    4. The kit looked useful
    5. It had no additional cost
    6. Interested in saving money
    97. Other (Write-In Required)
    98. Don’t know

[SHOW Q26 IF Q25 = 5 AND NO OTHER ITEM IS CHECKED]

26. What other factors influenced your decision to request a kit through this program? [Select all that apply]

    1. My child’s interest in the kit
    2. I was looking for ways to save energy in my home
    3. Recommendation from a friend
    4. The kit looked useful
    5. Interested in saving money
    97. Other (Write-In Required)
    98. Don’t know

27. To what extent do you think your knowledge of ways to save energy has increased since receiving the kit? Use a scale where 1 represents “not at all” and 5 represents “a lot”.

    1. Not at all
    2. Not much
    3. A little bit
    4. Quite a bit
    5. A lot
    98. Don’t know

28. How would you say your participation in the School Education Program has affected your satisfaction with [UTILITY], if at all? Please use a scale from 1 to 5, where 1 is "greatly decreased satisfaction" and 5 is "greatly increased satisfaction" with [UTILITY].

    1. Greatly increased your satisfaction with [UTILITY]
    2. Somewhat increased your satisfaction with [UTILITY]
    3. Did not affect your satisfaction with [UTILITY]
    4. Somewhat decreased your satisfaction with [UTILITY]
    5. Greatly decreased your satisfaction with [UTILITY]
    98. Don’t know

Program Awareness & Cross Program Participation

29. Are you aware that [UTILITY] offers discounts and rebates to help its customers purchase energy efficient equipment to help them save energy in their homes?

    1. Yes
    2. No
    98. Don’t know

[SHOW Q30 if Q29 = 1]

30. Did you become aware of any of these discounts and rebates through receiving the energy conservation kit?

    1. Yes
    2. No
    98. Don’t know

31. Have you purchased and installed any additional energy-efficient items because of the information provided to you in the kit?

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

[SHOW Q32 IF Q31 = 1]

32. What did you purchase and install? [Select all that apply]

    1. Energy-efficiency light bulbs
    2. Energy-efficient nightlights
    3. Energy-efficient appliances such as refrigerators, clothes washer/dryers
    4. Energy-efficient heating and/or cooling equipment
    97. Other (Please Specify)
    98. Don't know

[SHOW Q33 IF Q32 = 3]

33. Did you apply for a rebate from [UTILITY] for the appliance(s)?

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

[SHOW Q34 IF Q33 = 2]

34. Why didn't you apply for a rebate?

    1. I did not know about the rebate
    2. The rebate was too small to go through the process
    3. I forgot to apply
    97. Other (Specify)
    98. Don't know

Demographic Information

A few questions about your home and income level follow. These are anonymous and will be used solely for the purpose of combining different customers' responses.

35. Which of the following best describes this residence?

    1. Single-family home, detached construction
    2. Single-family home, factory manufactured/modular
    3. Mobile home
    4. Apartment with 2 or 3 units
    5. Apartment with 4+ units
    6. Condominium
    7. Townhouse
    8. Other (Please Specify)

36. Approximately when was your home built?

    1. Before 1960
    2. 1960-1969
    3. 1970-1979
    4. 1980-1989
    5. 1990-1999
    6. 2000-2009
    7. 2010 or Later
    98. Don't know

37. What is the approximate square footage of this residence?

    1. Less than 1,000 square feet
    2. 1,000-2,000 square feet
    3. 2,000-3,000 square feet
    4. 3,000-4,000 square feet
    5. 4,000-5,000 square feet
    6. Greater than 5,000 square feet
    98. Don't know

38. Do you own or rent your residence?

    1. Own
    2. Rent
    98. Don't know

39. What type of heating system does this residence have?

    1. Natural gas heating
    2. Electric heating
    97. Other (Please Specify)
    98. Don't know

40. Including yourself, how many people currently live in this residence year-round?

    1. 1
    2. 2
    3. 3
    4. 4
    5. 5
    6. 6
    7. 7
    8. 8
    9. 9
    10. 10
    11. 11 or more
    99. Prefer not to Answer

41. What is your approximate total household income?
    1. Less than $19,000
    2. $19,000 to less than $25,000
    3. $25,000 to less than $32,000
    4. $32,000 to less than $39,000
    5. $39,000 to less than $45,000
    6. $45,000 to less than $52,000
    7. $52,000 to less than $59,000
    8. $59,000 to less than $65,000
    9. $65,000 to less than $72,000
    10. $72,000 to less than $79,000
    11. $79,000 to less than $86,000
    12. $86,000 to less than $93,000
    13. $93,000 or more
    98. Don't know
    99. Prefer not to say

Customer Contact Information

42. Thank you for your time in answering questions regarding the Energy Conservation Kits Program in Ohio. We are finished at this time. We would like to provide you with a $5 gift card for your participation. To do that, we will need your name and an email address where we can send you a link to your gift card.

    1. First Name and Last Name:
    2. Email Address

    You should be receiving an email with the link to your gift card in 10 days or less. If you have any questions regarding this survey or would like to know the status of your gift card, please send an email to adm-surveys2019@admenergy.com. Once again thank you for your participation on behalf of [UTILITY]. Have a great day!

14 Appendix C: Energy Efficiency Kits Reference Materials and Survey Instrument

14.1 Marketing and Kit Literature


FirstEnergy
Ohio Edison • The Illuminating Company • Toledo Edison
Refer Friends and Family
Invite fellow customers of FirstEnergy's Ohio utilities to receive a kit! They can enroll by calling 800-735-1872 or online at www.ohioenergykit.com.
Be sure to tell them there is no fee to receive the kit!
One kit per account. Customers who have received a kit since July 2017 are not eligible for another kit at this time. Your participation in these programs reduces demand for electricity, which results in the creation of energy efficiency resource credits. Through your participation in these programs, you agree to allow your utility to take ownership of and sell these credits to reduce the costs charged to our customers to administer energy efficiency programs. The costs of this program may be recovered through customer rates in accordance with Ohio law. For a complete list of commercial, industrial, residential and low income energy efficiency programs, please visit www.energysaveOhio.com

From:
Sent:
To:
Subject: Sign up for your Energy Conservation Kit from Ohio Edison

FirstEnergy

Ohio Edison • The Illuminating Company • Toledo Edison

Sign up for your energy conservation kit today!

BIDGET WOODS,

These easy to-install components from your FirstEnergy Ohio utility will help you **save energy and money** and there is **no fee to receive this kit**.

CLICK HERE TO SIGN UP FOR A KIT

Your invitation code:

Your kit will include:

Several LED light bulbs

One 3-way CFL

LED nightlight

A furnace filter whistle

and other valuable components

Visit

ohioenergykit.com

or call

800-248-0270

to start saving energy and money!

Our Energy Efficiency Efforts

support state mandates to reduce customers' annual usage and peak demand for electricity, building on our long-standing commitment to encourage the wise use of electricity.

For more information and a complete listing of our programs, please visit **www.energysaveOhio.com** or call

Ohio Edison
1-800-633-4766

Toledo Edison
1-800-447-3333

The Illuminating Company
1-800-589-3101

Your first source for

Energy Savings

FirstEnergy's Ohio utilities – Ohio Edison, Toledo Edison and The Illuminating Company – offer a wide variety of energy efficiency programs designed to help customers better manage their energy use and save money.

FirstEnergy

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Residential Programs

Appliance Turn-In

Customers receive an incentive to reduce their energy usage by turning in old, inefficient refrigerators, freezers, room air conditioners and dehumidifiers that are still in working condition. These appliances will be picked up by a contractor, and about 95 percent of each unit will be recycled, with the rest disposed of in an environmentally sound manner.

Energy Conservation Kit

This program allows customers to request an Energy Conservation Kit filled with LEDs and other energy-saving measures for their home.

Educational Programs

School visits educate students about using energy wisely. Parents/guardians of students will also have the opportunity to request a kit that includes LEDs and other valuable energy-saving components.

Home Energy Audits

The Residential Comprehensive Energy Audit Program provides a comprehensive energy assessment. Customers meet with a qualified home energy expert to learn how to reduce energy costs and increase the comfort and efficiency of their home. The customer may then be eligible to receive rebates for making improvements based on the recommendations of their audit report.

An online energy audit tool is also available to evaluate household energy usage and calculate cost savings based on customer responses to questions about their homes.

Lighting Discount Program

Customers are encouraged to purchase energy-efficient lighting products from participating retailers at discounted prices. Energy-efficient lighting products use up to 90 percent less energy than traditional lighting and last 15 times longer with equivalent light output.*

Appliance Rebate Program

This program offers rebates on the purchase of certain ENERGY STAR® certified appliances and other items that will help customers save energy and money. ENERGY STAR certified appliances can use four times less power than older appliances.*

Residential HVAC Program

This program provides a rebate to customers who service their existing HVAC system. Maintenance tune ups of central air conditioners and/or heat pumps can improve your unit's performance and save money on utility bills.

Energy Conservation Program For Low-Income Customers

FirstEnergy's Ohio utilities can help low-income homeowners and renters reduce their electricity use and keep their homes more comfortable in the winter and summer months. Income eligibility guidelines and program requirements are available online at www.energysaveOhio.com under the Community Connections program. For no out-of-pocket cost, eligible customers could receive energy-saving home improvements that include:

- Sealing air leaks in attics, walls or foundations
- Attic and/or wall insulation
- Appliance testing and possible replacement
- Energy-saving light bulbs
- Electric water heater inspection and possible replacement
- Faucet aerators and showerheads
- Energy education

The specific improvements will be determined during the home energy evaluation. There are no out-of-pocket costs for qualified low-income customers or their landlords for services provided.

Costs of these programs may be recovered through customer rates in accordance with Ohio law. For a complete list of commercial, industrial, residential and low income energy efficiency programs, please visit www.energysaveOhio.com.

* Source – energystar.gov

14.2 Residential Energy Efficiency Kits Participant Survey

Survey Variables [DO NOT DISPLAY]

Variable	Definition
CUSTOMER NAME	Name of customer
UTILITY	Name of EDC
TYPE	1=Standard; 2=Electric
EMAIL	Email address
TELEPHONE	10 digit phone number

Energy Conservation Kit Verification

1. Do you recall receiving an Energy Conservation Kit containing a variety of energy efficient light bulbs among other items?
    1. Yes
    2. No **[TERMINATE SURVEY]**
    98. Don't know **[TERMINATE]**

2. How did you hear about the Energy Conservation Kit?

    1. Contractor
    2. Call from Utility
    3. Social Media
    4. Bill Insert
    5. Direct Mail from electric company
    6. Energy Save Ohio website
    7. Print Ad
    8. TV
    9. Word-of-Mouth
    97. Other (Specify)
    98. Don't know

3. How did you request the kit?

    1. Online
    2. Telephone
    98. Don't know

[SHOW Q4 IF TYPE = 2]

4. Which of the following did you receive in your Energy Conservation Kit? **[Check all that apply]**

    1. (1) Three-way CFL light bulb
    2. (1) Three-way LED light bulb
    3. (1) 15W LED light bulb
    4. (3) 9W LED light bulbs
    5. (2) LED nightlights
    6. (1) Furnace whistle
    7. (1) Faucet aerator
    8. (1) Low-flow showerhead
    98. Don't know

[SHOW Q5 IF TYPE = 1]

5. Which of the following did you receive in your Energy Conservation Kit? **[Check all that apply]**

    1. (1) Three-way CFL light bulb
    2. (1) Three-way LED light bulb
    3. (2) 15W LED light bulb
    4. (3) 9W LED light bulbs
    5. (3) LED nightlights
    6. (1) Furnace whistle
    98. Don't know

Measure Installation Verification

6. Did you install *all* of the products you received in the Energy Conservation Kit?

    1. Yes, I installed everything
    2. No, I installed only some of the products I received
    3. No, I did not install any of the products I received
    98. Don't know

[SHOW Q7 IF Q6 = 2 OR 3; Check all that apply]

7. Why did you not install all of the products?

    1. Some of the products were broken
    2. Products were difficult to install
    3. Waiting for light bulbs to burn out
    4. Bulbs were too bright
    5. Bulbs were not bright enough
    6. Does not fit into any fixture
    97. Other (Specify)
    98. Don't know

[SHOW Q8 IF Q7 = 1]

8. Did you contact [UTILITY] about the broken items?

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

[SHOW Q9 IF Q8 = 1]

9. Were the broken items replaced?

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

Verification for All Customers

[SHOW Q10 IF Q4 = 1 OR 9 or Q5 = 1 OR 7]

10. Is the 3-Way CFL currently installed in your home?

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

[SHOW Q11 IF Q10 = 1]

11. Where did you install the 3-Way CFL bulb?

    1. Basement
    2. Bathroom
    3. Bedroom
    4. Closet
    5. Dining Room
    6. Outside
    7. Hallway
    8. Kitchen
    9. Living/Family Room
    10. Garage
    11. Office
    12. Laundry Room
    97. Other
    99. Don't know

[SHOW Q12 IF Q4 = 2 OR 9 or Q5=2 OR 7]

12. Is the 3-Way LED currently installed in your home?

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

[SHOW Q13 IF Q12 = 1]

13. Where did you install the 3-Way LED bulb?

    1. Basement
    2. Bathroom
    3. Bedroom
    4. Closet
    5. Dining Room
    6. Outside
    7. Hallway
    8. Kitchen
    9. Living/Family Room
    10. Garage
    11. Office
    12. Laundry Room
    97. Other
    98. Don't know

[SHOW Q14 IF Q12 = 1]

14. Did the 3-Way LED bulb replace a traditional incandescent light bulb, a CFL, another LED, or was it installed in a new fixture?

    1. Incandescent
    2. CFL
    3. LED
    4. Installed in new fixture
    98. Don't know

[SHOW Q15 IF Q4 = 4 OR 9 or Q5=4 OR 7]

15. How many of the 9 Watt LED Bulb/s are currently installed in your home (up to a maximum of 3 bulbs)?

    0. 0
    1. 1
    2. 2
    3. 3
    98. Don't know

[SHOW Q11 IF Q15 = 2, 3, or 4]

16. Where did you install the 9W LED bulb/s? **[GRID FORMAT, 1st BULB, 2nd BULB, ETC.]**

    1. Basement
    2. Bathroom
    3. Bedroom
    4. Closet
    5. Dining Room
    6. Outside
    7. Hallway
    8. Kitchen
    9. Living/Family Room
    10. Garage
    11. Office
    12. Laundry Room
    97. Other
    98. Don't know

[SHOW Q17 IF Q15 = 2, 3, OR 4]

17. Did the 9 Watt LEDs replace traditional incandescent light bulb(s), CFLs, other LED(s), or were they installed in new fixture(s)? [SELECT ALL THAT APPLY]

    1. Incandescent
    2. CFL
    3. LEDs
    4. Installed in new fixture
    98. Don't know

[SHOW Q18 IF Q4 = 6 OR 9 OR Q5 = 6 OR 7]

18. Is the furnace whistle currently installed in your home?

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

Verification for Electric Customers

[SHOW Q12 IF Q4 = 2 OR 9]

19. Is the 15 Watt LED currently installed in your home?

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

[SHOW Q20 IF Q12 = 1]

20. Where did you install the 15 Watt LED bulb?

    1. Basement
    2. Bathroom
    3. Bedroom
    4. Closet
    5. Dining Room
    6. Outside
    7. Hallway
    8. Kitchen
    9. Living/Family Room
    10. Garage
    11. Office
    12. Laundry Room
    97. Other

98. Don’t know

[SHOW Q21 IF Q12 = 1]

21. Did the 15 Watt LED replace a traditional incandescent light bulb, a CFL, another LED, or was it installed in a new fixture?

    1. Incandescent
    2. CFL
    3. LEDs
    4. Installed in new fixture
    98. Don’t know

[SHOW Q22 IF Q4 = 5 OR 9]

22. How many of the two LED nightlights are currently installed in your home?

    0. 0
    1. 1
    2. 2
    98. Don’t know

[SHOW Q23 IF Q22 = 2 or 3]

23. Please describe where the first nightlight was installed.

    1. Where there was no nightlight before (new nightlight)
    2. Where a standard nightlight was previously installed
    98. Don’t know

[SHOW Q24 IF Q22 = 3]

24. Please describe where the second nightlight was installed.

    1. Where there was no nightlight before (new nightlight)
    2. Where a standard nightlight was previously installed
    98. Don’t know

[SHOW Q25 IF Q4 = 8 OR 9]

25. Is the low flow showerhead currently installed in your home?

    1. Yes
    2. No
    98. Don’t know

[SHOW Q26 IF Q4 = 7 OR 9]

26. Is the faucet aerator currently installed in your home?

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

Verification for Customers with Gas Water Heater

[SHOW Q27 IF Q5 = 2]

27. How many of the 15 watt LED Bulbs are currently installed in your home (up to a maximum of 2 bulbs)?

    0. 0
    1. 1
    2. 2
    98. Don't know

[SHOW Q28 IF Q27 = 2 or 3]

28. Where did you install the 15W LED bulb/s? **[GRID FORMAT, 1st BULB, 2nd BULB, ETC.]**

    1. Basement
    2. Bathroom
    3. Bedroom
    4. Closet
    5. Dining Room
    6. Outside
    7. Hallway
    8. Kitchen
    9. Living/Family Room
    10. Garage
    11. Office
    12. Laundry Room
    97. Other
    98. Don't know

[SHOW Q29 IF Q27= 2 OR 3]

29. Did the 15 Watt LED(s) replace traditional incandescent light bulbs, CFLs, other LEDs, or were they installed in new fixtures?

    1. Incandescent
    2. CFL
    3. LEDs
    4. Installed in new fixture
    98. Don't know

[SHOW Q30 IF Q5 = 5]

30. How many of the three LED nightlights are currently installed in your home?

    1. 0
    2. 1
    3. 2
    4. 3
    98. Don't know

[SHOW Q31 IF Q30 = 2, 3 or 4]

31. Please describe where the first nightlight was installed.

    1. Where there was no nightlight before (new nightlight)
    2. Where a standard nightlight was previously installed
    98. Don't know

[SHOW Q32 IF Q30 = 3 or 4]

32. Please describe where the second nightlight was installed.

    1. Where there was no nightlight before (new nightlight)
    2. Where a standard nightlight was previously installed
    98. Don't know

[SHOW Q33 IF Q30 = 4]

33. Please describe where the third nightlight was installed.

    1. Where there was no nightlight before (new nightlight)
    2. Where a standard nightlight was previously installed
    98. Don't know

Satisfaction

34. Which of the following kit items was the MOST useful to you?

    1. Three-way CFL light bulb **[SHOW IF Q4 = 1 OR Q5 = 1]**
    2. Three-way LED light bulb **[SHOW IF Q4 = 2 OR Q5 = 2]**
    3. 15W LED light bulb/s **[SHOW IF Q4 = 3 OR Q5 = 3]**
    4. 9W LED light bulb/s **[SHOW IF Q4 = 4 OR Q5 = 4]**
    5. LED nightlight/s **[SHOW IF Q4 = 5 OR Q5 = 5]**
    6. Furnace whistle **[SHOW IF Q4 = 6 OR Q5 = 6]**
    7. Faucet aerator **[SHOW IF Q4 = 7]**
    8. Low-flow showerhead **[SHOW IF Q4 = 8]**

35. Do you have any suggested changes to the items included in the kit?

    [OPEN ENDED]

36. Using a scale of 1-5 where 1 means very dissatisfied, and 5 means very satisfied, how satisfied or dissatisfied are you with each of the following program components?

    a. Process to request the kit
    b. Time it took to receive the kit
    c. The items included in the kit
    d. The energy efficiency education provided through the program

[SHOW Q24 IF Q23a-d = 1 OR 2]

37. Why were you dissatisfied?

    - [OPEN ENDED]

38. What factors influenced your decision to request a kit through this program? **[Check all that apply]**

    1. I was looking for ways to save energy in my home
    2. Recommendation from a friend
    3. The kit looked useful
    4. It was provided at no fee
    5. Interested in saving money
    97. Other (Specify)
    98. Don't know

39. Since receiving the kit, would you say that your knowledge of ways to save energy has:

    1. Increased significantly
    2. Increased somewhat
    3. Remained the same
    4. Decreased somewhat
    5. Decreased significantly
    98. Don't know

40. Would you say your participation in the Energy Conservation Kit Program has:

    1. Greatly decreased your satisfaction with [UTILITY]
    2. Somewhat decreased your satisfaction with [UTILITY]
    3. Did not affect your satisfaction with [UTILITY]
    4. Somewhat increased your satisfaction with [UTILITY]
    5. Greatly increased your satisfaction with [UTILITY]
    98. Don't know

Home Information

41. The following questions are about you and your home where you installed the Energy Conservation Kit measures. These are anonymous and will be used solely for the purpose of combining different customers' responses. You can choose to not answer any of these questions.

    Which of the following best describes this residence?

    1. Single-family home, detached construction
    2. Single-family home, factory manufactured/modular
    3. Mobile home
    4. Apartment with 2 or 3 units
    5. Apartment with 4+ units
    6. Condominium
    7. Townhouse
    98. Other (Please Specify)

42. What is your zip code? Please enter the zip code where you installed the measures.

    [OPEN ENDED]

43. Approximately when was this residence built?

    1. Before 1960

2. 1960-1969
3. 1970-1979
4. 1980-1989
5. 1990-1999
6. 2000-2009
7. 2010 or Later
98. Don't know

44. What is the approximate square footage of this residence?

1. Less than 1,000 square feet
2. 1,000 to less than 2,000 square feet
3. 2,000 to less than 3,000 square feet
4. 3,000 to less than 4,000 square feet
5. 4,000 to less than 5,000 square feet
6. 5,000 square feet or greater
98. Don't know

45. Do you own or rent your residence?

1. Own
2. Rent
98. Don't know

46. Does your home have central cooling?

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

47. What type of heating system does this residence have?

1. Natural gas heating
2. Electric heating
97. Other (Specify)
98. Don't know

48. What kind of water heater is in your home?

1. Electric
2. Gas
97. Other (Specify)
98. Don't know

49. Including yourself, how many people currently live in this residence year-round?

    1. 1
    2. 2
    3. 3
    4. 4
    5. 5
    6. 6
    7. 7
    8. 8
    9. 9
    10. 10
    11. 11 or more
    98. Don’t know
    99. Prefer not to answer

50. Including wages, salaries, pensions, Social Security and other sources of income for all members of your household, what was your total household income before taxes in 2019? Please select from the following categories.

    1. Less than $19,000
    2. $19,000 to less than $25,000
    3. $25,000 to less than $32,000
    4. $32,000 to less than $39,000
    5. $39,000 to less than $45,000
    6. $45,000 to less than $52,000
    7. $52,000 to less than $59,000
    8. $59,000 to less than $65,000
    9. $65,000 to less than $72,000
    10. $72,000 to less than $79,000
    11. $79,000 to less than $86,000
    12. $86,000 to less than $93,000
    13. $93,000 or more
    98. Don’t know
    99. Prefer not to Say

Customer Contact Information

51. Thank you for your time in answering questions regarding the Energy Conservation Kits Program in Ohio. We are finished at this time. We would like to provide you with a $5 gift card for your participation. To do that, we will need your name and an email address where we can send you a link to your gift card.

1. First Name and Last Name
2. Email Address

You should be receiving an email with the link to your gift card in 10 days or less. If you have any questions regarding this survey or would like to know the status of your gift card, please send an email to adm-surveys2019@admenergy.com. Once again thank you for your participation on behalf of [UTILITY]. Have a great day!

15 Appendix D: Audits & Education Survey Instruments

15.1 Comprehensive Audit Participant Survey

Program Awareness & Cross-Program Participation

52. Are you aware that [UTILITY] offers discounts and rebates to help its customers purchase energy-efficient equipment to help them save energy in their homes?

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

[SHOW Q30 IF Q29 = 1]

53. Did you become aware of any of these discounts and rebates through receiving the Energy Conservation Kit?

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

54. Have you purchased and installed any additional energy-efficient items because of the information provided to you in the kit?

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

[SHOW Q32 IF Q31 = 1]

55. What did you purchase and install? **[Select all that apply]**

    1. Energy-efficient light bulbs
    2. Energy-efficient nightlights
    3. Energy-efficient appliances such as refrigerators, clothes washer/dryers
    4. Energy-efficient HVAC equipment
    97. Other (Specify)
    98. Don't know

[SHOW Q33 IF Q32 = 3]

56. Did you apply for a rebate for the appliance(s)?

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

[SHOW Q34 IF Q33 = 2]

57. Why didn't you apply for a rebate? **[Select all that apply]**

    1. I did not know about the rebate
    2. The rebate was too small to go through the process
    3. I forgot to apply
    97. Other (Specify)
    98. Don't know

58. Do you have any other comments you would like to provide about your experience with this program, [UTILITY], or energy efficiency in general?

    [OPEN ENDED]

Survey Variables [DO NOT DISPLAY]

Variable	Definition
CUSTOMER_NAME	Name of customer
UTILITY	Name of EDC
EMAIL	Email address
TELEPHONE	10 digit phone number
DATE	Installation date (date audit occurred)
LEDS	1 = measure installed, 0 = measure not installed
AERATORS	1 = measure installed, 0 = measure not installed
SHOWERHEADS	1 = measure installed, 0 = measure not installed
PIPEWRAP	1 = measure installed, 0 = measure not installed
SPS	1 = measure installed, 0 = measure not installed
NIGHTLIGHTS	1 = measure installed, 0 = measure not installed
INSULATION	1 = measure installed, 0 = measure not installed
DUCT SEALING	1 = measure installed, 0 = measure not installed
AIR INFILTRATION	1 = measure installed, 0 = measure not installed
LED_QTY	LED quantity
BATHROOM_AERATOR_QTY	Bathroom aerator quantity
KITCHEN_AERATOR_QTY	Kitchen aerator quantity
SHOWERHEAD_QTY	Showerhead quantity
SPS_QTY	Smart Power strip quantity
NIGHTLIGHT_QTY	LED nightlight quantity

Program Participation Verification and Awareness

1. Do you recall having a First Energy Ohio sponsored comprehensive home energy audit at [ADDRESS] on or around [DATE]?

   During a Comprehensive Energy Audit an auditor may have come to your home and installed LED bulbs, showerheads, and/or pipe wrap. They also may have inspected your insulation, windows, and ducts.

   1. Yes
   2. No [Terminate survey]

2. How did you hear about the Comprehensive Home Audit Program? [SELECT ALL]

   1. Contractor
   2. Social media
   3. Bill insert
   4. Direct mail from electric company
   5. Utility website
   6. Print ad
   7. TV
   8. Word-of-Mouth
   97. Other (Specify)
   98. Don't Know

3. How important was each of the following factors in your decision to participate in the program? Please answer on a scale from 0, meaning not at all important, to 10, meaning critically important.

   1. To learn more about my home's energy use
   2. To reduce my monthly utility bill
   3. To help save the environment

4. Did someone you know, like a friend, neighbor, or relative, recommend this program to you?

   1. Yes
   2. No
   98. Don't recall
   99. Prefer not to answer

5. How important was that recommendation in your decision to participate in the program? Please answer on a scale from 0, meaning not at all important, to 10, meaning critically important.

[INSERT 0-10 SCALE, LABELED AS ABOVE, WITH DON'T KNOW AND PREFER NOT TO ANSWER OPTIONS]

6. Did a contractor recommend this program to you?

    1. Yes
    2. No
    98. Don't recall
    99. Prefer not to answer

7. How important was that recommendation in your decision to participate in the program? Please answer on a scale from 0, meaning not at all important, to 10, meaning critically important.

    [INSERT 0-10 SCALE, LABELED AS ABOVE, WITH DON'T KNOW AND PREFER NOT TO ANSWER OPTIONS]

Scheduling

8. How did you request a comprehensive home energy audit?

    1. Scheduled my appointment myself, on website
    2. Submitted an inquiry online
    3. Signed up in-person at a local community event
    4. Called my utility
    97. Other (Specify)
    98. Don't Know

9. How many days after you first contacted the program about the home audit did the audit happen?

    1. Number of days _____
    98. Don't Know

10. Did you receive an email or phone call 2 days before the audit as an appointment confirmation?

    1. Yes
    2. No
    98. Don't Know

11. Was your home auditor on time for your appointment?

    1. Yes
    2. No

98. Don’t Know

12. On a scale from 1 to 5, where 1 is "very dissatisfied" and 5 is "very satisfied", how satisfied or dissatisfied were you with the scheduling of your comprehensive home energy audit?

    1. Very dissatisfied
    2. Somewhat Dissatisfied
    3. Neither satisfied or dissatisfied
    4. Somewhat Satisfied
    5. Very satisfied
    98. Don’t Know

[DISPLAY Q13 IF Q12 < 3]

13. Why weren’t you satisfied with scheduling?

    [OPEN ENDED]

14. On a scale from 1 to 5, where 1 is “strongly disagree” and 5 is “strongly agree”, please rate your level of agreement with the following statements regarding your home auditor

    1. Strongly Disagree
    2. Disagree
    3. Neither Agree or Disagree
    4. Agree
    5. Strongly Agree
    98. Don’t Know/Can’t Recall

    a. The home auditor was knowledgeable.
    b. The home auditor was professional and courteous during the visit.
    c. The home auditor was presentable (that is, clean, well-dressed).

[DISPLAY Q15 IF ANY Q14A-C< 4]

15. Could you please elaborate on those ratings of the home auditor?

    [OPEN ENDED]

16. On a scale from 1 to 5, where 1 is “very dissatisfied” and 5 is “very satisfied”, please rate your overall level of satisfaction with the Comprehensive Home Audit.

    1. Very Dissatisfied
    2. Somewhat Dissatisfied
    3. Neither Satisfied nor Dissatisfied
    4. Somewhat Satisfied
    5. Very Satisfied
    98. Don’t Know/Can’t Recall

[DISPLAY Q17 IF Q16< 4]

17. Could you please elaborate on your rating of your overall experience?

    [OPEN ENDED]

Program Installation Verification

18. Program records show that you had a blower door test performed by the home energy auditor. Is that correct?

    1. Yes
    2. No
    98. Don’t Know/Can’t Recall

[DISPLAY Q19 IF Q18 = 2]

19. Why was the blower door test not performed?
    [OPEN ENDED]

20. Program records show that you had the following measures directly installed in your home by a home energy auditor. Is this correct?

	Yes, this is correct. -1	No, this is not correct. -2	I do not know/recall. -98
A. [LED_QTY] Light bulb/s B. [BATHROOM_AERATOR_QTY] Bathroom Faucet Aerator/s C. [KITCHEN_AERATOR_QTY] Kitchen Faucet Aerator/s D. [SHOWERHEAD_QTY] Low Flow Showerhead/s E. Pipe Wrap Insulation F. [SPS_QTY] Smart Power Strip/s G. [NIGHTLIGHT_QTY] LED nightlight/s H. Insulation (Attic/Wall) I. Duct Sealing J. Air Infiltration **(display row variables depending on customer characteristics—use binary pre-populated variables>0 for logic & only show if they received)**			

[DISPLAY Q21 IF Q18A = 2]

21. What is the correct number of LED light bulbs that were installed?

    1. Open ended: _____
    2. None Installed

[DISPLAY Q22 IF Q18B = 2]

22. What is the correct number of bathroom faucet aerators that were installed?

    1. Open ended: _____
    2. None Installed

[DISPLAY Q23 IF Q18C = 2]

23. What is the correct number of kitchen faucet aerators that were installed?

    1. Open ended: _____
    2. None Installed

[DISPLAY Q24 IF Q18D = 2]

24. What is the correct number of low flow showerheads that were installed by the auditor?

    1. Open ended: _____
    2. None Installed

[DISPLAY Q25 IF Q18F = 2]

25. What is the correct number of smart power strips that were installed?

    1. Open ended: _____
    2. None Installed

[DISPLAY Q26 IF Q18G = 2]

26. What is the correct number of LED nightlights that were installed?

    1. Open ended: _____
    2. None Installed

27. Since your home energy audit, have you removed any of the measures you received?

	All Still Installed. - 1	Some or All Removed - 2	I do not know/recall. -98
A. Light bulb/s B. Bathroom Faucet Aerator/s C. Kitchen Faucet Aerator/s D. Low Flow Showerhead/s E. Pipe Wrap Insulation F. Smart Power Strip/s G. LED nightlight/s **(display row variables A-G depending on customer characteristics—use Q18 and Q21-Q26 & only show if they received & confirmed at least one measure)**			

[DISPLAY Q28 IF Q27A = 2]

28. How many of the LED bulbs have you removed?

    [OPEN ENDED]

[DISPLAY Q29 IF Q27B = 2]

29. How many of the bathroom faucet aerators have you removed?

[OPEN ENDED]

[DISPLAY Q30 IF Q27C = 2]

30. How many of the kitchen faucet aerators have you removed?

[OPEN ENDED]

[DISPLAY Q31 IF Q27D = 2]

31. How many of the low flow showerheads have you removed?

[OPEN ENDED]

[DISPLAY Q32 IF Q27F = 2]

32. How many of the smart power strips have you removed?

[OPEN ENDED]

[DISPLAY Q33 IF Q27G = 2]

33. How many of the LED nightlights have you removed?

[OPEN ENDED]

34. On a scale from 1 to 5, where 1 is "very dissatisfied" and 5 is "very satisfied", how satisfied or dissatisfied are you with the measures you received through the home audit? Would you say you are…

    1. Very dissatisfied
    2. Somewhat dissatisfied
    3. Neither satisfied or dissatisfied
    4. Somewhat satisfied
    5. Very satisfied
    98. Don't Know

[DISPLAY ROW VARIABLES A-G DEPENDING ON CUSTOMER CHARACTERISTICS—USE Q18 AND Q19-Q24 & ONLY SHOW IF THEY RECEIVED & CONFIRMED]

a. [LED_QTY] Light bulb/s

b. [BATHROOM_AERATOR_QTY] Bathroom Faucet Aerator/s

c. [KITCHEN_AERATOR_QTY] Kitchen Faucet Aerator/s

d. [SHOWERHEAD_QTY] Low Flow Showerhead/s

e. [SPS_QTY] Smart Power Strip/s

f. [NIGHTLIGHT_QTY] LED nightlight/s

[SHOW Q35 IF Q34A = 1 OR 2]

35. Why are you dissatisfied with your new LED light bulb/s?

    [OPEN ENDED]

[SHOW Q36 IF Q34B = 1 OR 2]

36. Why are you dissatisfied with your new bathroom faucet aerator/s?

    [OPEN ENDED]

[SHOW Q37 IF Q34C = 1 OR 2]

37. Why are you dissatisfied with your new kitchen faucet aerator/s?

    [OPEN ENDED]

[SHOW Q38 IF Q34D = 1 OR 2]

38. Why are you dissatisfied with your new low flow showerhead/s?

    [OPEN ENDED]

[SHOW Q39 IF Q34E = 1 OR 2]

39. Why are you dissatisfied with your new smart power strip/s?

    [OPEN ENDED]

[SHOW Q40 IF Q34F = 1 OR 2]

40. Why are you dissatisfied with your new LED night light/s?

    [OPEN ENDED]

[SHOW Q41 IF Q20E=1]

41. Was an insulating tank blanket installed in addition to the pipe wrap installation?

    1. Yes, the auditor installed an insulating tank blanket
    2. No, there was a preexisting tank blanket
    3. No, heater is tankless
    4. No, there was no existing insulating tank blanket and the auditor didn't install one

    98. Don't Know

LED Specific Questions

[SHOW Q42 IF Q18A=1 and Q21=1]

[DISPLAY # of LEDS ACCORDING TO LED_QTY. DO NOT DISPLAY IF Q14=2]

42. Where did you install the LED bulbs? **[grid format, first bulb, second bulb, etc. Only display appropriate number of bulbs based on LED_QTY]**

    [Please select the room type where each bulb is installed. If you have removed some of the LEDs our records indicate you've received, select "Not Installed".]

    1. Basement
    2. Bathroom
    3. Bedroom
    4. Closet
    5. Dining Room
    6. Outside
    7. Hallway
    8. Kitchen
    9. Living/Family Room
    10. Garage
    11. Office
    12. Laundry Room
    13. Not Installed
    97. Other
    98. Don’t Know

[SHOW Q43 IF Q18A=1 and Q21=1]

43. Did the LEDs replace traditional incandescent light bulbs, CFL, replace another LED, or were they installed in a new fixture? [Select all that apply]

    1. Incandescent
    2. CFL
    3. LEDs
    4. Installed in new fixture
    98. Don’t Know

[SHOW Q44 IF Q43 = 1]

44. How many watts were the old incandescent bulbs? **[Select all that apply]**

    1. 60 watts or higher
    2. Less than 60 watts
    98. Don’t Know

[SHOW Q45 IF Q43 = 3]

45. How many of the new LEDs were installed in a new light fixture?

    [OPEN ENDED]

[SHOW Q46 IF Q18A=1 and Q21=1]

46. Before the LEDs were installed by the home energy auditor, did you have any LEDs installed in your home?

    1. Yes
    2. No
    98. Don't Know
    99. Refused

[SHOW Q47 IF Q46 = 1]

47. How many LEDs were installed in your home before the home energy audit?

    [OPEN ENDED]

[SHOW Q48 IF Q18A=1 and Q21=1]

48. Would you purchase LEDs in the future?

    1. Yes
    2. No
    98. Don't Know

Retrofit Recommendations

49. Did the auditor make recommendations for additional energy saving home improvements such as installing insulation, new windows, or duct sealing?

    1. Yes
    2. No
    98. Don't Know

[SHOW Q50 IF Q49 = 1]

50. On a scale from 1 to 5, where 1 is "very dissatisfied" and 5 is "very satisfied", how satisfied or dissatisfied are you with the recommendations made by the auditor?

    1. Very dissatisfied
    2. Somewhat Dissatisfied
    3. Neither satisfied or dissatisfied
    4. Somewhat Satisfied
    5. Very satisfied
    98. Don’t Know

[SHOW Q51 IF Q50 = 1 OR 2]

51. Why are you dissatisfied with the recommendations made by the auditor?

    [OPEN ENDED]

52. During your audit, the technician may have recommended that you change your water heater’s setpoint or they may have physically changed it for you. Was your water heater’s setpoint changed as a result of your participation in this program?

    1. My water heater’s setpoint was decreased
    2. My water heater’s setpoint was increased
    3. My setpoint did not change
    98. Don’t Know/Can’t recall

Customer Satisfaction

53. How much savings have you noticed on your monthly utility bill since having the home audit? Please answer on a scale of 1 to 5, where 1 means "no savings" and 5 means "substantial savings."

    1. No Savings
    2.
    3.
    4.
    5. Substantial Savings
    98. Don’t Know

54. Which of the following, if any, has occurred since the home improvements were done through this program: (Select all that apply)

    1. The weather became hotter where you live.
    2. The weather became colder where you live.
    3. The number of people staying in your house increased.
    4. The number of people staying in your house decreased.
    5. You bought and installed additional energy-using equipment that you now use in addition to similar equipment you previously had (e.g., you added a new TV).
    6. You bought an electric vehicle that you charge at home.

[DISPLAY Q55 IF Q53=1]

55. Has your utility bill gone up since weatherizing your home?

    1. Yes
    2. No
    98. Don't Know

56. On a scale from 1 to 5, where 1 is "very dissatisfied" and 5 is "very satisfied", overall how satisfied or dissatisfied are you with the home audit?

    1. Very dissatisfied
    2. Somewhat dissatisfied
    3. Neither satisfied nor dissatisfied
    4. Somewhat satisfied
    5. Very satisfied
    98. Don't Know

57. Could you please elaborate on your rating of your overall experience with the home audit?

    [OPEN ENDED]

Have you recommended the program to others?

    1. Yes
    2. No
    98. Don't Know/Can't recall

58. If you could change or improve one thing about your experience with the [UTILITY] Comprehensive Audit Program, what would it be?

    [OPEN ENDED]

59. Do you have any other comments you would like to provide about your experience with this program, [UTILITY], or energy efficiency in general?

    [OPEN ENDED]

Home Demographics

A few questions about your home and income level follow. These questions will be used to assess how well our survey represents the utility customer population and so see how home characteristics relate to customers' needs.

60. What type of fuel is used to heat water for your home?

    1. Natural gas
    2. Electricity
    3. Propane
    97. Other (Please Specify)
    98. Don't Know

61. What type of fuel is used to heat your home?

    1. Natural gas
    2. Electricity
    3. Propane
    97. Other (Specify)
    98. Don't Know

62. From the following items, please select the one that best describes this house, apartment, or mobile home:

    1. You or someone in this household owns it with a mortgage or loan, including a home equity loan.
    2. You or someone in this household owns it free and clear (without a mortgage or loan).
    3. You rent it.
    4. You occupy it without paying rent or a mortgage.
    98. Don't Know

63. How many people, including you, currently live in your household?

    1. 1
    2. 2
    3. 3
    4. 4
    5. 5
    6. 6
    7. 7
    8. 8
    9. 9
    10. 10
    11. 11 or more
    98. Don’t Know
    99. Prefer not to answer

64. Including wages, salaries, pensions, Social Security and other sources of income for all members of your household, what will be your total household income before taxes in 2019? Please select from the following categories.

    1. Less than $19,000
    2. $19,000 to less than $25,000
    3. $25,000 to less than $32,000
    4. $32,000 to less than $39,000
    5. $39,000 to less than $45,000
    6. $45,000 to less than $52,000
    7. $52,000 to less than $59,000
    8. $59,000 to less than $65,000
    9. $65,000 to less than $72,000
    10. $72,000 to less than $79,000
    11. $79,000 to less than $86,000
    12. $86,000 to less than $93,000
    13. $93,000 or more
    98. Don’t Know
    99. Prefer not to say

65. Which of the following best describes your residence?

1. Single-family home, detached construction
2. Single-family home, factory manufactured/modular
3. Mobile home
4. Apartment with 2 or 3 units
5. Apartment with 4+ units
6. Condominium
7. Townhouse

97. Other (Please Specify)

66. Do you own or rent this residence?

1. Own
2. Rent

98. Don't Know

67. Approximately when was your residence built?

1. Before 1960
2. 1960-1969
3. 1970-1979
4. 1980-1989
5. 1990-1999
6. 2000-2009
7. 2010 or Later

98. Don't Know

68. About how much above-ground living space do you have in your residence?

1. Less than 600 square feet
2. 600 to less than 800 square feet
3. 800 to less than 1,000 square feet
4. 1,000 to less than 2,000 square feet
5. 2,000 to less than 3,000 square feet
6. 3,000 to less than 4,000 square feet
7. 4,000 to less than 5,000 square feet
8. 5,000 square feet or greater

98. Don't Know

69. About how much below-ground living space do you have in your residence?

    1. My residence does not have below ground living space
    2. Less than 1,000 square feet
    3. 1,000 to less than 2,000 square feet
    4. 2,000 to less than 3,000 square feet
    5. 3,000 to less than 4,000 square feet
    6. 4,000 to less than 5,000 square feet
    7. 5,000 square feet or greater
    98. Don't Know

Customer Contact Information

70. Would you allow us to contact you again to schedule a household visit to document the energy saving measures you described? You would receive an additional $20 gift card if you are selected and participate in the home visit.

    1. Yes
    2. No

[DISPLAY Q71 IF Q70 = 1]

71. What is the best way to contact you about scheduling the home verification visit if your home is selected, via phone or email? Please enter a phone number or email address

    1. If Telephone preferred, please enter: _____
    2. If Email preferred, please enter: _____

[DISPLAY Q72 IF Q70 = 1]

72. What day of the week and time would work best for you?

    1. Day: _____
    2. Time: _____
    98. Don't Know

73. You made it! Thank you for your time in answering questions regarding the Comprehensive Audits Program in Ohio! We would like to provide you with a $5 gift card for your participation. To do that, we will need your name and an email address where we can send you a link to your gift card. Thanks again, we appreciate your time and effort!

Enter "NA" or "No Thank You" if you would prefer not to receive a gift card.

1. First and Last name
2. Email address

You should be receiving an email with the link to your gift card in the next few days. If you have any questions regarding this survey or would like to know the status of your gift card, please send an email to mike.soszynski@admenergy.com. Once again thank you for your participation on behalf of [question('value'), id='63']. Have a great day!

15.2 Online Audit Participant Survey

Survey Variables [DO NOT DISPLAY]

Variable	Definition
NAME	Name of customer
UTILITY	Name of EDC
EMAIL	Email address
REPORTING_DATE	Reporting date - mm/dd/yyyy

Background

1. According to our records you used the Home Energy Analyzer on or around [DATE] to complete a home energy audit. Do you recall doing so?

   1.Yes
   2. No **[TERMINATE SURVEY]**

2. How did you hear about the Home Energy Analyzer?

   1. [UTILITY] website
   2. Word-of-Mouth
   97. Other (Please Write In)
   98. Don’t know

3. Why did you decide to do an online home energy audit? **[Select all that apply]**

    1. Learn more about my home's energy use
    2. Reduce my monthly utility bill
    3. It was provided at no fee
    4. Conserve Energy
    97. Other - (Please Write In)
    98. Don't know

Participation Experience

4. Which of the following activities did you do when you used the Home Energy Analyzer? [**Select all that apply]**

    1. Reviewed changes in my bill/usage over time
    2. Answered questions about my home appliances
    3. Answered questions about weatherizing my home
    4. Got detailed energy saving ideas for my home
    97. Other - (Please Write In)
    98. Don't know

5. Did you complete the entire online audit?

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

[SHOW Q6 IF Q5 = 2]

6. What made you stop the online audit when you did?

    1. Completed the entire survey
    2. Was satisfied with the results
    3. Ran out of time
    4. Further improvements were out of budget
    97. Other - (Please Write In)
    98. Don't know

7. What kind of detailed energy-saving suggestions did you receive? Please select all that apply:

    1. No-cost /low-cost ways to save energy immediately
    2. Ways to save requiring investment but will pay off
    3. Ways to save that would not be cost-justified
    97. Other - (Please Write In)

98. Don’t know/Can’t recall

8. On a scale from 1 to 5, where 1 is "not at all helpful" and 5 is "very helpful", how helpful was the information provided by the Home Energy Analyzer?

    1. Not at all helpful
    2. Somewhat unhelpful
    3. Neither helpful nor unhelpful
    4. Somewhat helpful
    5. Very helpful
    98. Don't know

[SHOW Q9 IF Q8 = 1 OR 2]

9. What aspects were not helpful? Why?

    [OPEN ENDED]

[SHOW Q10 IF Q8 = 2, 3, 4, OR 5]

10. What aspect of the Home Energy Analyzer was most helpful to you? Why?

    [OPEN ENDED]

11. What energy saving actions did you take, if any, as a result of using the Home Energy Analyzer? Please select all that apply.

    1. Improved the energy efficiency of my home through weatherization improvements such as added insulation, air sealing, and/or high efficiency doors/windows
    2. Upgraded home appliance(s) or equipment to ones that are more energy efficient (such as kitchen appliances, lighting, or HVAC equipment)
    3. I’ve made behavioral changes (turn off the lights when leaving a room, adjust the thermostat before leaving the house)
    4. No changes made yet
    98. Don't know

[SHOW Q10 IF Q11 = 1]

12. What home weatherization improvements have you made? Please select all that apply. **[Select all that apply]**

    1. Wall insulation
    2. Attic insulation
    3. Knee wall insulation
    4. Radiant barrier
    97. Other - (Please Write In)

98. Don’t know

[SHOW Q13 IF Q11 = 1]

13. On a scale from 1 to 5, where 1 is “very dissatisfied” and 5 is “very satisfied”, how satisfied are you with the home weatherization improvements you made?

    1. Very dissatisfied
    2. Somewhat dissatisfied
    3. Neither satisfied nor dissatisfied
    4. Somewhat satisfied
    5. Very satisfied
    98. Don't know

[SHOW Q14 IF Q11 = 2]

14. What appliances and/or equipment did you upgrade? **[Select all that apply]**

    1. Energy-efficient Appliance(s)
    2. Energy-efficient HVAC
    3. Energy-efficient Lighting
    4. Energy-efficient Water Heater
    97. Other - (Please Write In)
    98. Don’t know

[SHOW Q15 IF Q11 = 2]

15. Are the appliance(s) and the equipment that you just mentioned still installed?

    1. Yes, it’s still installed
    2. No, I removed it/took it out
    98. Don't know

[SHOW Q14 IF Q11= 2]

16. On a scale from 1 to 5, where 1 is “very dissatisfied” and 5 is “very satisfied”, how satisfied are you with your new appliances or equipment?

    1. Very dissatisfied
    2. Somewhat dissatisfied
    3. Neither satisfied nor dissatisfied
    4. Somewhat satisfied
    5. Very satisfied
    98. Don't know

[SHOW Q17 IF Q11 = 3]

17. What behavioral changes did you make? Please select all that apply. **[Randomize options]**

    1. Turned off lights more frequently
    2. Cleaned or replaced air conditioner filter
    3. Lowered the winter heating temperature setting on my thermostat (so that the heater ran less)
    4. Increased the summer cooling temperature setting on my thermostat (so that the air conditioner ran less)
    5. Used a ceiling fan instead of my air conditioner to keep cool
    6. Unplugged kitchen appliances when not in use
    7. Cleaned refrigerator coils
    8. Sealed windows or doors to reduce air leakage
    9. Lowered the temperature on the water heater
    10. Closed blinds on windows to reduce heating from the sun
    11. Air dried laundry instead of using the clothes dryer
    12. Fixed leaky faucets
    13. Grilled out instead of using the oven to cook food
    14. Ran the dishwasher with full loads
    15. Took shorter showers
    97. Other (Specify)

[SHOW Q18 IF Q11 = 3]

18. Are you continuing to do the behavioral changes you identified?

    1. Yes, I am still practicing that behavior.
    2. No, I stopped doing that

[SHOW Q19 IF Q11 = 2 or 3]

19. Have you noticed any savings on your electric bill since you made these changes?
    1. Yes, my electric bill has decreased
    2. No, there does not seem to be a change in my electric bill
    3. Not sure or too soon to tell
    98. Don't know

[SHOW Q20 IF Q19 = 1]

20. On a scale from 1 to 5, where 1 is “very dissatisfied” and 5 is “very satisfied”, how satisfied are you with the savings you noticed on your electric bill since making these changes?

    1. Very dissatisfied
    2. Somewhat dissatisfied
    3. Neither satisfied nor dissatisfied
    4. Somewhat satisfied
    5. Very satisfied
    98. Don't know

21. Overall, how satisfied are you with the Home Energy Analyzer Program? Use a scale from 1 to 5, where 1 is “very dissatisfied” and 5 is “very satisfied”.

    1. Very dissatisfied
    2. Somewhat dissatisfied
    3. Neither satisfied nor dissatisfied
    4. Somewhat satisfied
    5. Very satisfied
    98. Don't know

[SHOW Q22 IF Q21 = 1 or 2]

22. Why do you give it that rating?

    [OPEN ENDED]

23. Do you have any suggestions to improve the Home Energy Analyzer?

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

[SHOW Q24 IF Q23 = 1]

24. What are your suggestions for improving the Home Energy Analyzer?

    [OPEN ENDED]

25. Do you have any other comments you would like to provide about your experience with this program, [UTILITY], or energy efficiency in general?

    [OPEN ENDED]

Demographic Information

Before we finish, we'd like to ask you a few questions about your home and income level follow. These are anonymous and will be used solely for the purpose of combining different customers' responses.

26. Which of the following best describes your home?

    1. Single-family home, detached construction
    2. Single-family home, factory manufactured/modular
    3. Mobile home
    4. Apartment with 2 or 3 units
    5. Apartment with 4+ units
    6. Condominium
    7. Townhouse
    97. Other (Please Specify)

27. Do you own or rent this residence?

    1. Own
    2. Rent
    98. Don't know

28. Approximately when was your home built?

    1. Before 1960
    2. 1960-1969
    3. 1970-1979
    4. 1980-1989
    5. 1990-1999
    6. 2000-2009
    7. 2010 or Later
    98. Don't know

29. About how many square feet would you estimate your above-ground living space to be?

    1. Less than 1,000 square feet
    2. 1,000 to less than 2,000 square feet
    3. 2,000 to less than 3,000 square feet
    4. 3,000 to less than 4,000 square feet
    5. 4,000 to less than 5,000 square feet
    6. 5,000 square feet or greater
    98. Don't know

30. Do you have any below-ground living space like a converted basement?
    1. Yes
    2. No
    98. Don't know

[SHOW Q31 IF Q30 = 1]

31. About how many square feet do you estimate the below-ground living space to be?

    1. Less than 1,000 square feet
    2. 1,000-2,000 square feet
    3. 2,000-3,000 square feet
    4. 3,000-4,000 square feet
    5. 4,000-5,000 square feet
    6. Greater than 5,000 square feet
    98. Don't know

32. How many people, including you, currently live in your household?

    1. 1
    2. 2
    3. 3
    4. 4
    5. 5
    6. 6
    7. 7
    8. 8
    9. 9
    10. 10
    11. 11 or more
    98. Don’t know
    99. Prefer not to answer

33. Including wages, salaries, pensions, Social Security and other sources of income for all members of your household, what was your total household income before taxes in 2019? Please select from the following categories.

    1. Less than $19,000
    2. $19,000 to less than $25,000
    3. $25,000 to less than $32,000
    4. $32,000 to less than $39,000
    5. $39,000 to less than $45,000
    6. $45,000 to less than $52,000
    7. $52,000 to less than $59,000
    8. $59,000 to less than $65,000
    9. $65,000 to less than $72,000
    10. $72,000 to less than $79,000
    11. $79,000 to less than $86,000
    12. $86,000 to less than $93,000
    13. $93,000 or more
    98. Don't know
    99. Prefer not to say

Customer Contact Information

34. You made it! Thank you for your time in answering questions regarding the Online Audits Program in Ohio. We would like to provide you with a $5 gift card for your participation. To do that, we will need your name and an email address where we can send you a link to your gift card. Thanks again, we appreciate your time and effort!

    1. First Name and Last Name
    2. Email Address

    You should be receiving an email with the link to your gift card in 10 days or less. If you have any questions regarding this survey or would like to know the status of your gift card, please send an email to adm-surveys2019@admenergy.com. Once again thank you for your participation on behalf of [UTILITY]. Have a great day!

15.3 Telephone Audit Participant Survey

Survey Variables [DO NOT DISPLAY]

Variable	Definition
CUSTOMER NAME	Name of customer
UTILITY	Name of EDC
EMAIL	Email address
TELEPHONE	10 digit phone number
DATE	Reporting date - mm/dd/yyyy

[REPEAT INTRODUCTION AND CONTINUE]

(If the correct person) Do you have 5 to 10 minutes to complete a survey regarding your experiences with the call and information provided?

1. Yes
2. No **[TERMINATE SURVEY]**

1. Our records indicate that you called the Customer Service Center on or around [DATE]. Can you tell me why you called the Customer Service Center? What were your concerns?

   [Check all that apply, Prompt if necessary]

   1. High Bill Complaint
   2. Meter Issue
   3. Power Outage
   4. Interested in ways to conserve energy
   98. Other (Specify)
   99. Don't Know

2. What did the Customer Service Center Representative discuss with you?

   [Open Ended _____]

3. Did the Customer Service Representative discuss any of the following:

Topics	Yes	No	Don't Know
a) Review changes in your bill/usage over time	1	2	98
b) Answer questions about your home appliances	1	2	98
c) Ways you could save energy in your home	1	2	98
d) Find out about your top 3 home energy uses	1	2	98
e) Offer literature about saving energy at home	1	2	98

4. On a scale from 1 to 5, where 1 is "not at all helpful" and 5 is "very helpful", how helpful was the information provided over the phone?

   [Read Responses]

   1. Not at all Helpful
   2. Somewhat Unhelpful
   3. Neither Helpful nor Unhelpful
   4. Somewhat Helpful
   5. Very Helpful
   98. Don't know

[SHOW Q5 IF Q4 = 1 or 2]

5. What aspects of the phone conversation with Customer Service were not helpful?

   [Open Ended _____]

6. Did the Customer Service Representative send you any of the following? **[Check all that apply]**

   1. Brochure(s) on Energy Savings Tips
   2. PC Link to Home Energy Analyzer software
   3. Nothing was sent
   97. Other (please specify what was sent)

[SHOW Q7 IF Q6 = 1]

7. On a scale from 1 to 5, where 1 is “not at all helpful” and 5 is “very helpful”, how helpful were the Energy Saving Tips?

   [Read Responses]

   1. Not at all helpful
   2. Somewhat unhelpful
   3. Neither helpful nor unhelpful
   4. Somewhat helpful
   5. Very helpful
   98. Don't know

[SHOW Q8 IF Q6 = 2]

8. Have you viewed the Online Energy Analyzer from the link that was sent to you? If so, have you used it?

   [Do Not Read Responses]

   1. Yes, I viewed but have not used it
   2. Yes, I have viewed it and I have used it
   3. No, I have not viewed it
   98. Don't Know

9. What energy-saving actions were you able to take, if any, as a result of your telephone call to the Customer Service Center?

   [Read Responses, Check all that apply]

   1. Improved the energy efficiency of my home through weatherization improvements such as added insulation, air sealing, and/or high efficiency doors/windows
   2. Upgraded home appliance(s) to ones that are more energy efficient (such as kitchen appliances, lighting, or HVAC equipment)
   3. I’ve made Behavioral changes (turn off the lights when leaving a room, adjust the thermostat before leaving the house)
   4. No changes made yet
   99. Don't know

[SHOW Q10 IF Q9 = 1]

10. What home weatherization improvements have you made?

[Read Responses, Check all that apply]

1. Wall insulation
2. Attic insulation
3. Knee wall insulation
4. Radiant barrier
97. Other (Specify)
98. Don't know

[SHOW Q11 IF Q9 = 1]

11. On a scale from 1 to 5, where 1 is "very unlikely" and 5 is "very likely", how likely would you have been to make those home weatherization improvements if had you NOT called the Customer Call Center?

[Read Responses]

1. Very unlikely (Meaning you definitely *would not* have made those improvements if you had not called)
2. Somewhat unlikely
3. Neutral
4. Somewhat likely
5. Very likely (You definitely *would have* made those improvements anyway)
98. Don't know

[SHOW Q12 IF Q9 = 2]

12. What appliances and/or equipment did you purchase...

[Read Responses, Check all that apply]

1. Energy Efficient Appliance(s)
2. Energy Efficient HVAC
3. Energy Efficient Lighting such as LED light bulbs
4. Energy Efficient Water Heater
98. Don't know
99. Refused

[SHOW Q13 IF Q12 = 1, 2, 3, OR 4]

13. Are the appliance(s) and the equipment you just mentioned still installed?

[Do Not Read Responses]

1. Yes, they are still installed
2. No, I removed it/took it out
98. Don't know

[SHOW Q14 IF Q12 = 1, 2, 3, OR 4]

14. On a scale from 1 to 5, where 1 is “very dissatisfied” and 5 is “very satisfied”, how satisfied are you with your new appliances or equipment?

    [Read Responses]

    1. Very dissatisfied
    2. Somewhat dissatisfied
    3. Neither satisfied nor dissatisfied
    4. Somewhat satisfied
    5. Very satisfied
    98. Don't know

[SHOW Q15 IF Q12 = 1, 2, 3, OR 4]

15. On a scale from 1 to 5, where 1 is “very unlikely” and 5 is “very likely”, how likely would you have been to install those appliances or equipment had you NOT called the Customer Call Center?

    1. Very unlikely (Meaning you definitely *would not* have made those improvements if you had not called)
    2. Somewhat unlikely
    3. Neutral
    4. Somewhat likely
    5. Very likely (You definitely *would have* made those improvements anyway)
    98. Don’t know
    99. Refused

[SHOW Q16 IF Q9 = 3]

16. What behavioral changes did you make?

[Do Not Read Responses, Check all that apply]

1. Turned off lights more frequently
2. Cleaned or replaced air conditioner filter
3. Lowered the winter heating temperature setting on my thermostat (so that the heater ran less)
4. Increased the summer cooling temperature setting on my thermostat (so that the air conditioner ran less)
5. Used a ceiling fan instead of my air conditioner to keep cool
6. Unplugged kitchen appliances when not in use
7. Cleaned refrigerator coils
8. Sealed windows or doors to reduce air leakage
9. Lowered the temperature on the water heater
10. Closed blinds on windows to reduce heating from the sun
11. Air dried laundry instead of using the clothes dryer
12. Fixed leaky faucets
13. Grilled out instead of using oven to cook food
14. Ran the dishwasher with full loads
15. Took shorter showers
97. Other (Specify)
98. Don't Know

[SHOW Q17 IF Q9 = 3]

17. Are you continuing to do the behavioral changes you identified?

[Do Not Read Responses]

1. Yes, behavior still practiced
2. No, I stopped doing that
98. Don't know

[SHOW Q18 IF Q9 = 1, 2, OR 3]

18. Have you noticed any savings on your electric bill since you made these changes?

[Do Not Read Responses]

1. Yes, my electric bill has decreased
2. No, there does not seem to be a change in my electric bill
3. Too soon to tell
98. Don't know

[SHOW Q19 IF Q18 = 1]

19. On a scale from 1 to 5, where 5 is “very satisfied” and 1 is “very dissatisfied”, how satisfied are you with the savings you noticed on your electric bill since making these changes?

    [Read Responses]

    1. Very dissatisfied
    2. Somewhat dissatisfied
    3. Neither satisfied nor dissatisfied
    4. Somewhat satisfied
    5. Very satisfied
    98. Don't know
    99. Refused

[SHOW Q20 IF Q9 = 3]

20. On a scale from 1 to 5, where 1 is “very unlikely” and 5 is “very likely”, how likely would you have been to make those behavioral changes had you NOT called the Customer Call Center?

    [Read Responses]

    1. Very unlikely (Meaning you definitely *would not* have made those changes if you had not called)
    2. Somewhat unlikely
    3. Neutral
    4. Somewhat likely
    5. Very likely (You definitely *would have* made those changes anyway)
    98. Don’t know
    99. Refused

21. Do you have any other comments you would like to provide about your experience with this program, [UTILITY], or energy efficiency in general?

    [Open ended: _____]

Demographic Information

22. Which of the following best describes your home?

[Read Responses]

1. Single-family home, detached construction
2. Single-family home, factory manufactured/modular
3. Mobile home
4. Apartment with 2 or 3 units
5. Apartment with 4+ units
6. Condominium
7. Townhouse

97. Other (Please Write In)

23. Do you own or rent this residence?

1. Own
2. Rent

98. Don't know

24. Approximately when was your home built?

1. Before 1960
2. 1960-1969
3. 1970-1979
4. 1980-1989
5. 1990-1999
6. 2000-2009
7. 2010 or Later

98. Don’t know

25. Would you estimate the above-ground living space is about:

1. Less than 1,000 square feet
2. 1,000 to less than 2,000 square feet
3. 2,000 to less than 3,000 square feet
4. 3,000 to less than 4,000 square feet
5. 4,000 to less than 5,000 square feet
6. 5,000 square feet or greater

98. Don’t know

26. How many people, including you, currently live in your household?
    1. 1
    2. 2
    3. 3
    4. 4
    5. 5
    6. 6
    7. 7
    8. 8
    9. 9
    10. 10
    11. 11 or more
    98. Don’t know
    99. Prefer not to answer

27. Including wages, salaries, pensions, Social Security and other sources of income for all members of your household, what was your total household income before taxes in 2019? Please select from the following categories.

    [Read Responses]

    1. Less than $19,000
    2. $19,000 to less than $25,000
    3. $25,000 to less than $32,000
    4. $32,000 to less than $39,000
    5. $39,000 to less than $45,000
    6. $45,000 to less than $52,000
    7. $52,000 to less than $59,000
    8. $59,000 to less than $65,000
    9. $65,000 to less than $72,000
    10. $72,000 to less than $79,000
    11. $79,000 to less than $86,000
    12. $86,000 to less than $93,000
    13. $93,000 or more
    98. Don’t know
    99. Prefer not to say

Customer Contact Information [DO NOT DISPLAY]

28. Thank you for your time in answering questions regarding the Online Audits Program in Ohio. We are finished at this time. We would like to provide you with a $5 gift card of your choice for your participation. To do that, we will need your name and an email address where we can send you a link to your gift card.

    3. First Name and Last Name
    4. Email Address

    You should be receiving an email with the link to your gift card in 10 days or less. If you have any questions regarding this survey or would like to know the status of your gift card, please send an email to adm-surveys2019@admenergy.com. [REPEAT EMAIL ADDRESS] Once again thank you for your participation on behalf of [UTILITY] . Have a great day!

16 Appendix E: Behavioral Survey Instrument

16.1 Behavioral Participant Survey

Survey Variables [DO NOT DISPLAY]

Variable	Definition
CUSTOMER_NAME	Name of customer
UTILITY	Name of EDC
EMAIL	Email address
PHONE	10 digit phone number

Home Energy Reports, Tips, Emails, and Website

1. According to our records you have received Home Energy Reports from [UTILITY] with information on your household's energy use and tips on how to save energy. Do you recall receiving these reports during 2019?

    1. Yes
    2. No **[TERMINATE SURVEY]**

[SHOW Q2 IF Q1 = 1]

2. In 2019, about how many reports do you recall receiving? Your best guess is fine.

    1. 1
    2. 2
    3. 3
    4. 4
    5. 5
    6. 6
    97. Other _____
    98. Don't know

[SHOW Q3 IF Q2 = 98]

3. You previously stated you do not know how many reports you received, do you recall if you received fewer than 6 reports?

    1. Yes, I received fewer than 6 reports
    2. No, I received more than 6 reports
    98. Don’t know

[SHOW Q4 IF Q3 =1]

4. Did you receive fewer than 4 reports?

    1. Yes, I received fewer than 4 reports
    2. No, I received more than 4 reports
    98. Don’t know

[SHOW Q5 IF Q3 =2]

5. Did you receive fewer than 9 reports?

    1. Yes, I received fewer than 9 reports
    2. No, I received more than 9 reports
    98. Don’t know

6. Which of the following best describes how often you read the reports?

    1. I have read all or most of them
    2. I have read some of them
    3. I have not read any of them
    98. Don’t know

[SHOW Q7 IF Q6 = 1 OR 2]

7. Using a scale from 1 to 4, where 1 is “not at all valuable” and 4 is “very valuable”, please indicate how valuable you find information on the following topics provided in the reports. **[SCALE: 1 (Not at all valuable) – 4 (Very valuable), 98 = Don’t know]**
    1. Not at all valuable
    2. Only a little valuable
    3. Somewhat valuable
    4. Very valuable
    98. Don’t know

    a. The comparison of my household’s energy use to similar households
    b. Adjusting thermostat settings for winter and summer months
    c. Appliance rebates
    d. HVAC tune-up rebates
    e. Comprehensive Energy Audit
    f. Energy saving tips/recommendations
    g. Frequently asked questions

[SHOW Q8 IF ANY Q7= 98]

8. You indicated that you don’t know how valuable you found some of the information in your reports. Just to clarify, do you mean you had no opinion on that information or that you didn’t pay much attention to it?

    1. Had no opinion
    2. Did not pay much attention to it

[SHOW Q9 IF Q6 = 1 OR 2]

9. On a scale from 1 to 5, where 1 is “very difficult” and 5 is “very easy”, how easy or difficult would you say the information in the Home Energy Report was to understand?

    1. Very difficult
    2. Somewhat difficult
    3. Neither easy nor difficult
    4. Somewhat easy
    5. Very easy
    98. Don't know

[SHOW Q10 IF Q6 = 1 OR 2]

10. On a scale from 1 to 5, where 1 is “not at all accurate” and 5 is “very accurate”, how accurate do you think the information on your home energy usage is?

    1. Not at all accurate
    2. Only a little inaccurate
    3. Somewhat accurate
    4. Very accurate
    5. Extremely accurate
    98. Don’t know

[SHOW Q11 IF Q10 = 1 OR 2]

11. In what way was it not accurate?

    [OPEN ENDED]

[SHOW Q12 IF Q6 = 1 OR 2]

12. Do you have any suggestions for improving the Home Energy Report?

    [OPEN ENDED]

13. In addition to the Home Energy Report, [UTILITY] also sends emails with energy-saving tips. Do you recall receiving any of these emails?

    1. Yes
    2. No

[SHOW Q14 IF Q13 = 2]

14. The emails are going to [EMAIL]. Do you monitor emails at that address?

    1. Yes
    2. No

[SHOW Q15 IF Q14 = 2]

15. Which of the following might be a reason you don't recall seeing those emails? **[MULTI-SELECT]**

1. You don't check emails at that address very often
2. When checking emails at that address, you mainly look for those from someone you know
3. The emails might be going into your spam or junk folder

97. Other (Please Write In)

[SHOW Q16 IF Q13 = 1]

16. Which of the following best describes how often you read the tips emails?

1. I have read all or most of them
2. I have read some of them
3. I have not read any of them

98. Don't know

[SHOW Q17 IF Q16= 3]

17. Which of the following best describes why you have not read the tips emails?

1. I am not interested
2. I know enough about saving energy
3. I don't have the time

97. Other (Please Specify)

[SHOW Q18 IF Q16 = 1 OR 2]

18. Using a scale from 1 to 4, where 1 is "not at all valuable" and 4 is "very valuable", how valuable would you say the energy-saving tips emails are? **[SCALE: 1 (Not at all valuable) – 4 (Very valuable), 98 = Don't know]**

1. Not at all valuable
2. Only a little valuable
3. Somewhat valuable
4. Very valuable

98. Don't know

19. In addition to the Home Energy Report, you can access your home's energy use information and additional energy savings tips via the program website at energysaveOhio.com. Have you ever visited this website?

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

[SHOW Q20 IF Q19 = 1 AND Q16=1 OR 2 AND Q6=1 OR 2]

20. What were the reasons you went to energysaveOhio.com? **[MULTI-SELECT]**

    1. I didn't think I was getting the information I needed from the other home energy reports or emails
    2. I thought the information from the other home energy reports and emails was not clear
    3. I was satisfied with the information from the other home energy reports and emails, *but* I was curious about what additional information was on the website.
    97. Other (Please Specify)

[SHOW Q21 IF Q19 = 1]

21. Which of the following best describes your experience(s) with the program website? **[Select all that apply]**

    1. I logged in to the website with my utility account number and reviewed energy use information and tips that were unique to my home.
    2. I have not created an account on the website, but I visited the website site and reviewed the general energy savings tips.
    97. Other (Specify)
    98. Don't know

[SHOW Q22 IF Q21 = 1]

22. Which of the following best describes how often you log in to the program website to view information on your home's energy use?

    1. I've logged in multiple times
    2. I've logged in just once
    98. Don't know

[SHOW Q23 IF Q21 = 1 OR 2 OR 97]

23. Using a scale from 1 to 4, where 1 is “not at all valuable” and 4 is “very valuable”, how valuable would you say the energy-savings tips and information, available on the website, are? **[SCALE: 1 (Not at all valuable) – 5 (Very valuable), 98 = Don’t know]**

    1. Not at all valuable
    2. Only a little valuable
    3. Somewhat valuable
    4. Very valuable
    98. Don’t know

[SHOW Q24 IF Q16 = 1 OR 2 OR Q21= 1 OR 2 OR 97]

24. Have you had any difficulty following any of the energy-saving tips or recommendations?

    1. Yes
    2. No
    98. Don’t know

[SHOW Q25 IF Q24 = 1]

25. What difficulties have you had?

    [OPEN ENDED]

[SHOW Q26 IF Q13 = 1 OR Q21 = 1 OR 2 OR 97]

26. Do you have any suggestions for improving the energy-savings tips and information provided on the program website or via email?

    [OPEN ENDED]

Energy Efficiency Attitudes, Knowledge, and Intent

27. Overall, on a scale of 1 to 4, where 1 means “Not at all knowledgeable” and 4 means “very knowledgeable”, how knowledgeable are you about ways to save energy in your home?

    [SCALE: 1 (Not at all knowledgeable) – 4 (Very knowledgeable, 98 = DON’T KNOW]

28. How would you rate your household's efforts to save energy in your home in the last year? Using a scale of 1 to 5, with 1 meaning "You have not done anything" and 5 meaning "You have done almost everything you can" to lower your monthly electric bill in your home. **[SCALE: 1 (You have not done anything) – 5 (You have done almost everything you can), 98 = DON’T KNOW]**

29. On a scale from 1 to 5, where 1 is “Strongly disagree” and 5 is “Strongly Agree”, please rate the extent to which you agree or disagree with the following statements. **[SCALE: 1 = Strongly disagree, 2 = Somewhat disagree, 3 = Neither agree nor disagree, 4 = Somewhat agree, 5 = Strongly agree, 98 = Don’t know]**

    a. I understand how my actions affect my energy use
    b. I know of steps I could take to reduce my household energy use
    c. I think that saving energy is important
    d. I am concerned about my household’s energy costs
    e. I intend to take steps to reduce my household’s energy use in the next six months
    f. I don’t think there is anything else I could do to reduce my household’s energy use

Energy Efficiency Behaviors

30. Have you taken any action to reduce your energy usage based on information you received through the Home Energy Reports you received in 2019?

    1. Yes
    2. No
    98. Don’t know

[SHOW Q31 IF Q30 = 1]

31. What actions have you taken? **[SCALE: 1 = Have done this, 2 = Have not done this, 3= Not applicable, there have been no hot months since starting the program, 4= Not applicable, there have been no cold months since starting the program]**

    a. Cleaned or replaced air conditioner filter
    b. Lowered the winter heating temperature setting on my thermostat (so that the heater ran less)
    c. Increased the summer cooling temperature setting on my thermostat (so that the air conditioner ran less)
    d. Used a ceiling fan instead of my air conditioner to keep cool
    e. Unplugged kitchen appliances when not in use
    f. Cleaned refrigerator coils
    g. Sealed windows or doors to reduce air leakage
    h. Lowered the temperature on the water heater
    i. Closed blinds on windows to reduce heating from the sun
    j. Air dried laundry instead of using the clothes dryer
    k. Fixed leaky faucets
    l. Grilled out instead of using the oven to cook food
    m. Ran the dishwasher with full loads
    n. Took shorter showers
    o. Turned off lights when leaving a room

32. In 2019, have you installed any energy-efficient equipment/appliances or made any energy-efficiency improvements?

    1. Yes
    2. No
    98. Don’t know

[SHOW Q33 IF Q30 = 1]

33. Did you take any additional actions not listed?

    1. Yes
    2. No

[SHOW Q34 IF Q33 = 1]

34. What additional actions have you taken?

    [OPEN ENDED]

[SHOW Q35 IF Q30 = 1]

35. Thinking about the actions you took to save energy in 2019, how important was the information provided through the Home Energy Reports, tips emails, or program website in your decision to take those actions? **[SCALE: 1 (Not at all important) - 5 (Very important)]**

[SHOW Q36 IF Q30 = 1]

36. What energy-efficient equipment or appliances have you installed? **[Select all that apply]]**

    1. ENERGY STAR® clothes dryer
    2. ENERGY STAR® clothes washer
    3. ENERGY STAR® refrigerator
    4. ENERGY STAR® freezer
    5. Energy-efficient pool pump (variable or multi-speed)
    6. Smart Thermostat (e.g., Nest, Lyric, Ecobee, Sensi)
    7. Energy-efficient windows or doors
    8. LED (light emitting diode) lightbulbs
    9. CFL (compact fluorescent) lightbulbs
    10. Low flow faucet aerators or showerheads
    11. ENERGY STAR® heat pump water heater
    12. ENERGY STAR® dehumidifier
    13. ENERGY STAR® computer or computer monitor
    14. ENERGY STAR® scanner or printer
    15. ENERGY STAR® television
    97. Other (Specify)

[SHOW Q37 IF Q36 = 1, 2, OR 3] [REPEATED FOR EACH 1,2, or 3 selected]

37. Did you apply for a rebate from [UTILITY] for the [ANSWER Q36]?

    1. Yes
    2. No
    98. Don’t know

[SHOW Q38 IF Q37 = 2]

38. Why did you not apply for or receive a rebate for that equipment?

    1. I was not aware rebates were available
    2. The rebate amount was too low
    3. I forgot
    4. Other (Specify)
    98. Don't know

[SHOW Q39 IF Q36 = 1]

39. Thinking about the energy-efficient equipment you installed in 2019, how important was the information provided through the home energy reports, tips emails or program website in your decision to install that equipment? Use a scale from 1 to 5, where 1 is "Not at all important" and 5 is "very important". **[SCALE: 1 (Not at all important) – 5 (Very important)]**

Awareness of Home Energy Advisor and Rebates

40. In addition to being able to access on the [UTILITY] website to see information on your home's energy use and energy saving tips, [UTILITY] provides a separate online tool called the Home Energy Analyzer to help customers understand and manage their household energy use. Before this survey, did you know about that tool?

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

[SHOW Q41 IF Q40 = 1]

41. How did you learn of the Home Energy Analyzer online tool?

    1. [UTILITY] email
    2. Found it while browsing [UTILITY] website
    3. Friend, family, or colleague
    97. Other (Specify)
    98. Don't know

[SHOW Q42 IF Q40 = 1]

42. Have you logged onto the Home Energy Analyzer online tool in the past six months?

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

43. Prior to this survey, were you aware that [UTILITY] offers discounts and rebates on energy-efficient equipment for your home?

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

[SHOW Q44 IF Q43 = 1]

44. Which of the following types of energy-efficient equipment rebates or discounts were you aware of? **[Select all that apply]**

    1. LED lightbulbs discounts at select area retailers
    2. ENERGY STAR® clothes washers and dryers
    3. ENERGY STAR® refrigerator and freezer
    4. Smart Thermostat (e.g., Nest, Lyric, Ecobee, Sensi)
    5. ENERGY STAR® certified dehumidifier
    6. ENERGY STAR® certified computer or computer monitor
    7. ENERGY STAR® certified scanner or printer
    8. ENERGY STAR® certified television
    97. Another [UTILITY] rebate or discount (Please describe)

45. How did you learn of the rebates and discounts that [UTILITY] provides? [Select all that apply]

    1. Home Energy Report
    2. Email from [UTILITY]
    3. Internet search
    4. [UTILTIY] website
    5. Print advertisement
    6. Service provider or contractor
    7. Friend, family, or colleague
    8. Recorded phone message
    97. Other (Please Write In)
    98. Don't know

Satisfaction

46. Using the scale below, how satisfied or dissatisfied are you with the following: **[SCALE: 1 = very dissatisfied, 2 = somewhat dissatisfied, 3 = neither satisfied nor dissatisfied, 4 = somewhat satisfied, 5 = very satisfied, 98 = Don't know]**

    a. The information provided through the Home Energy Report
    b. The information provided through the program website and energy savings tips emails

[SHOW Q47 IF ANY IN Q46= 1 OR 2]

47. Why are you dissatisfied?

    [OPEN ENDED]

Home Characteristics

- A few questions about your home and income level follow. These are anonymous and will be used solely for the purpose of combining different customers' responses. You can choose to not answer any of these questions.

48. What type of fuel is used to heat water for your home?

    4. Natural gas
    5. Electricity
    6. Propane
    97. Other (Specify)
    98. Don't know

49. What type of fuel is used to heat your home?

    4. Natural gas
    5. Electricity
    6. Propane
    97. Other (Specify)
    98. Don't know

50. What is the approximate square footage of the living space of your home? Your best guess is ok.

    1. Less than 1,000 square feet
    2. 1,000 to less than 2,000 square feet
    3. 2,000 to less than 3,000 square feet
    4. 3,000 to less than 4,000 square feet
    5. 4,000 to less than 5,000 square feet
    6. 5,000 square feet or greater
    98. Don't Know

51. Including yourself, how many people currently live in this residence year-round?

    1. 1
    2. 2
    3. 3
    4. 4
    5. 5
    6. 6
    7. 7
    8. 8
    9. 9
    10. 10
    11. 11 or more
    98. Don't Know
    99. Prefer not to Answer

52. What is your approximate total household income?

    1. Less than $19,000
    2. $19,000 to less than $25,000
    3. $25,000 to less than $32,000
    4. $32,000 to less than $39,000
    5. $39,000 to less than $45,000
    6. $45,000 to less than $52,000
    7. $52,000 to less than $59,000
    8. $59,000 to less than $65,000
    9. $65,000 to less than $72,000
    10. $72,000 to less than $79,000
    11. $79,000 to less than $86,000
    12. $86,000 to less than $93,000
    13. $93,000 or more
    98. Don't know
    99. Prefer not to say

53. Do you have any other comments you would like to provide about your experience with this program, [UTILITY], or energy efficiency in general?

    [OPEN ENDED]

54. Thank you for your time in answering questions regarding the Home Energy Reports Program in Ohio. We are finished at this time. We would like to provide you with a $5 gift card for your participation. To do that, we will need your name and an email address where we can send you a link to your gift card.

    1. First Name and Last Name
    2. Email Address:

    You should be receiving an email with the link to your gift card in 10 days or less. If you have any questions regarding this survey or would like to know the status of your gift card, please send an email to adm-surveys2019@admenergy.com. Once again thank you for your participation on behalf of [UTILITY]. Have a great day!