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May 15, 2015

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RE: *In the Matter of the Annual Portfolio Status Report Under Rule 4901:1-39-05(C), Ohio Administrative Code, by Ohio Power Company,* Case No. 15-0919-EL-EEC.

Dear Ms. McNeal:

Ohio Power Company ("OPCo," "the Company" or "AEP Ohio") submits the enclosed 2014 Portfolio Status Report, pursuant to Rule 4901:1-39-05(C), Ohio Administrative Code (OAC).

In Case Nos. 11-5568-EL-POR, et al., the Commission approved the Stipulation and Recommendation on March 21, 2012, and granted the requested waiver of Rule 4901:1-39-05(C), OAC, such that AEP Ohio may file its annual portfolio status report on May 15 instead of March 15 during each year of the EE/PDR Action Plan in order to provide sufficient time for adequate evaluation, measurement and verification of plan results.

Please note that the Report is broken into three volumes, due to the size of the supporting documentation. Volume I contains the narrative body of the Report; the supporting affidavit of Jon Williams (the compliance affidavit required by Rule 4901:1-39-05(C)(1)(c), OAC); and Report Appendices A through E. Volume II contains Report Appendices F through L and Volume III contains the remaining Report Appendices M through R.

Thank you for your attention to this matter.

Respectfully Submitted,

/s/ Steven T. Nourse
Steven T. Nourse

2014 Portfolio Status Report of the Energy Efficiency and Peak Demand Response Programs

VOLUME I

2014 PORTFOLIO STATUS REPORT

AFFIDAVIT OF JON WILLIAMS

APPENDICES A - E

AEP OHIO®

A unit of American Electric Power

Table of Contents

Table of Figures 2
Table of Appendices 3
Introduction 4
Demonstration of Compliance 5
  Benchmark Updates 5
  Achieved Savings 6
  Cost Effectiveness 8
  Banking of Energy Efficiency Achievements 10
  Summary 10
Program Activity Descriptions 11
  Residential Programs 12
  Business Programs 22
  Transmission and Distribution Projects 33
Recommendations to the Commission 35
  Residential Programs 35
  Business Programs 36

TABLE OF FIGURES

Figure 1: Adjusted Energy Usage Baselines 5
Figure 2: Adjusted Peak Demand Baselines 6
Figure 3: Achieved Annual Energy Savings, by Segment, 2014 7
Figure 4: Achieved Peak Demand Savings, by Source, 2014 8
Figure 5: Portfolio Ex ante Benefit-Cost Ratios and TRC Levelized Cost, 2014 9
Figure 6: Total Resource Cost Ratios and Levelized Costs, 2014 9
Figure 7: Banking of Energy Efficiency Achievements 10
Figure 8: Summary of Direct Program Costs and Benefits, 2014 12
Figure 9: Efficient Products Incented or Provided, 2014 13
Figure 10: Efficient Products Program Summary, 2014 14
Figure 11: Appliances Recycled, 2014 14
Figure 12: Appliance Recycling Program Summary, 2014 15
Figure 13: Items Included in *e³smart*SM Kits, 2014 16
Figure 14: *e³smart*SM Program Summary, 2014 17
Figure 15: In-Home Energy Measures Installed, 2014 18
Figure 16: In-Home Energy Program Summary, 2014 19
Figure 17: Measures Installed through Community Assistance Program, 2014 20
Figure 18: Community Assistance Program Summary, 2014 20
Figure 19: EfficiencyCraftedSM New Homes Program Summary, 2014 21
Figure 20: Home Energy Reports Program Summary, 2014 22
Figure 21: Measures Installed through Prescriptive Program, 2014 23
Figure 22: Prescriptive Program Summary, 2014 23
Figure 23: Measures Installed through Custom Program, 2014 24
Figure 24: Custom Program Summary, 2014 25
Figure 25: Measures Incented through Self Direct Program, 2014 26
Figure 26: Self Direct Program Summary, 2014 26
Figure 27: Measures Installed through Business New Construction Program, 2014 27
Figure 28: Business New Construction Program Summary, 2014 27
Figure 29: Measures Installed through Express Program, 2014 28
Figure 30: Express Program Summary, 2014 29
Figure 31: Measures Implemented through Retro-Commissioning Program, 2014 30
Figure 32: Retro-Commissioning Program Summary, 2014 30
Figure 33: Continuous Energy Improvement Program Summary, 2014 31
Figure 34: Measures Installed through Data Center Program, 2014 32
Figure 35: Data Center Program Summary, 2014 32
Figure 36: Bid to Win Program Summary, 2014 33

Table of Appendices

A. Detailed Measures Installed by Program
B. Efficient Products Program Evaluation Report
C. Appliance Recycling Program Evaluation Report
D. *e³smart*℠ Program Evaluation Report
E. In-Home Energy Program Evaluation Report
F. Community Assistance Program Evaluation Report
G. EfficiencyCrafted℠ New Homes Program Evaluation Report
H. Home Energy Reports Program Evaluation Report
I. Prescriptive Program Evaluation Report
J. Custom Program Evaluation Report
K. Self Direct Program Evaluation Report
L. Business New Construction Program Evaluation Report
M. Express Program Evaluation Report
N. Retro-Commissioning Program Evaluation Report
O. Data Center Program Evaluation Report
P. Continuous Energy Improvement Program Evaluation Report
Q. Bid to Win Program Evaluation Report
R. Transmission and Distribution Program Evaluation Report

Introduction

In Docket No. 08-888-EL-UNC, the Public Utilities Commission of Ohio ("the Commission") approved Rules for Energy Efficiency and Peak Demand Reduction Programs of electric utilities ("the Green Rules"). These Green Rules first became effective December 10, 2009. In accordance with Amended Substitute Senate Bill 221 (S.B. 221), the Rules require that each electric utility in the Commission's jurisdiction implement energy efficiency and peak demand reduction programs and file an annual Portfolio Status Report, originally due March 15 of each year but extended to May 15 in the March 21, 2012 order in Docket Nos. 11-5568-EL-POR and 11-5569-EL-POR for AEP Ohio.

In 2012, the General Assembly enacted Senate Bill 315 (S.B. 315) which, among other items, classified combined heat and power projects as energy efficiency projects. In 2014, the General Assembly then enacted Senate Bill 310 (S.B. 310) which froze energy efficiency targets at the 2014 levels for two years. S.B. 310 allows utilities the choice between amending its plan in effect for the remainder of the freeze period when 2014 cumulative benchmarks are achieved or continuing its plan under existing rules for the remainder of the freeze period. AEP Ohio has continued its plan without amendment.

Per Ohio Administrative Code (OAC) 4901:1-39-05(C), these Status Reports are required to address all approved energy efficiency and peak demand reduction (EE/PDR) programs' performance over the prior calendar year. The Ohio Power Company ("the Company" or "AEP Ohio") filed a Program Portfolio Plan for 2012-2014 under Docket Nos. 11-5568-EL-POR and 11-5569-EL-POR, which the Commission approved March 21, 2012.

AEP Ohio submits this 2014 Portfolio Status Report in compliance with the above-cited Rules. In accordance with OAC 4901:1-39-05(C)(2)(b), AEP Ohio has contracted with Navigant Consulting, Inc. ("Navigant") to review the Company's programs; perform the impact and process evaluations; and provide evaluation, measurement, and verification reports.

This report is divided into three major sections: The first section covers how the Company has met all the requirements in the Green Rules in 2014 and achieved its S.B. 221 benchmark requirements. The second section reviews each of AEP Ohio's EE/PDR programs and how they have performed this past year. The third and final section contains Ohio Power Company's recommendations going forward for each of the programs.

Attached with this report are 18 appendices: Appendix A lists individual units incented and measures installed, at a detailed level, under each of Ohio Power Company's EE/PDR programs. Appendices B through Q contain the Evaluation Reports of each program from Navigant. Finally, Appendix R covers transmission and distribution projects related to EE/PDR.

Demonstration of Compliance

Benchmark Updates

AEP Ohio filed its Initial Benchmark Report on February 8, 2010[1] and has made regular updates in its intervening Portfolio Status Reports for both energy usage and peak demand. The Company has adjusted both its gross energy sales and peak demand to include the impacts of mercantile[2] customers' energy efficiency resource commitments and economic development. These adjusted figures are shown in Figures 1 and 2 below.

The annual benchmark target is calculated as the average of the prior three years' adjusted load, multiplied by yearly statutory benchmark requirements from S.B. 221. The amounts for 2014 are 1.0 percent incremental energy reduction and 4.75 percent cumulative demand reduction.

For purposes of this compliance filing for the 2014 benchmark adjustments for economic growth (and the Company's intention going forward), the Company has only included the associated kWh captured in the Economic Development Rider.

Figure 1 below shows the calculation of the adjusted 2014 benchmark for energy usage savings: 431.8 gigawatt-hours (GWh). Figure 2 shows the calculation for the adjusted 2014 benchmark for peak demand savings: 425.3 megawatts (MW).

FIGURE 1: ADJUSTED ENERGY USAGE BASELINES

Year	Actual Retail Sales	Econ. Devel. Adj.*	2009-13 Merc. Savings	2014 Merc. Savings	Adjusted Retail Sales
2011	48,433.3	-4,688.6	214.5	3.4	43,962.5
2012	46,906.1	-4,164.2	228.6	5.6	42,976.1
2013	44,714.7	-2,353.4	230.0	6.2	42,597.5
				Three-Year Average:	**43,178.7**
				Benchmark Rate:	**1.00%**
				2014 Benchmark Target:	**431.8**

All figures are in GWh.
*This adjustment differs from the AEPS baseline file in 14-559-EL-ACP to reflect actual program participation by reasonable arrangement customers.

[1] *In the Matter of the Initial Benchmark Report of Columbus Southern Power Company and Ohio Power Company*, Case No. 10-153-EL-EEC, February 8, 2010.

[2] "Mercantile customer" means a commercial or industrial customer if the electricity consumed is for nonresidential use and the customer consumes more than seven hundred thousand kilowatt hours per year or is part of a national account involving multiple facilities in one or more states. See Ohio Revised Code § 4928.01(A)(19).

FIGURE 2: ADJUSTED PEAK DEMAND BASELINES

Year	Coincident Peak Demand	Econ. Devel. Adj.	2009-13 Merc. Savings	2014 Merc. Savings	Adjusted Peak Demand
2011	9,812.0	-541.4	38.6	0.2	9,309.3
2012	9,380.0	-540.4	40.5	0.7	8,880.8
2013	9,004.0	-371.9	40.8	0.8	8,673.7
				Three-Year Average:	**8,954.6**
				Benchmark Rate:	**4.75%**
				2014 Benchmark Target:	**425.3**

All figures are in MW.

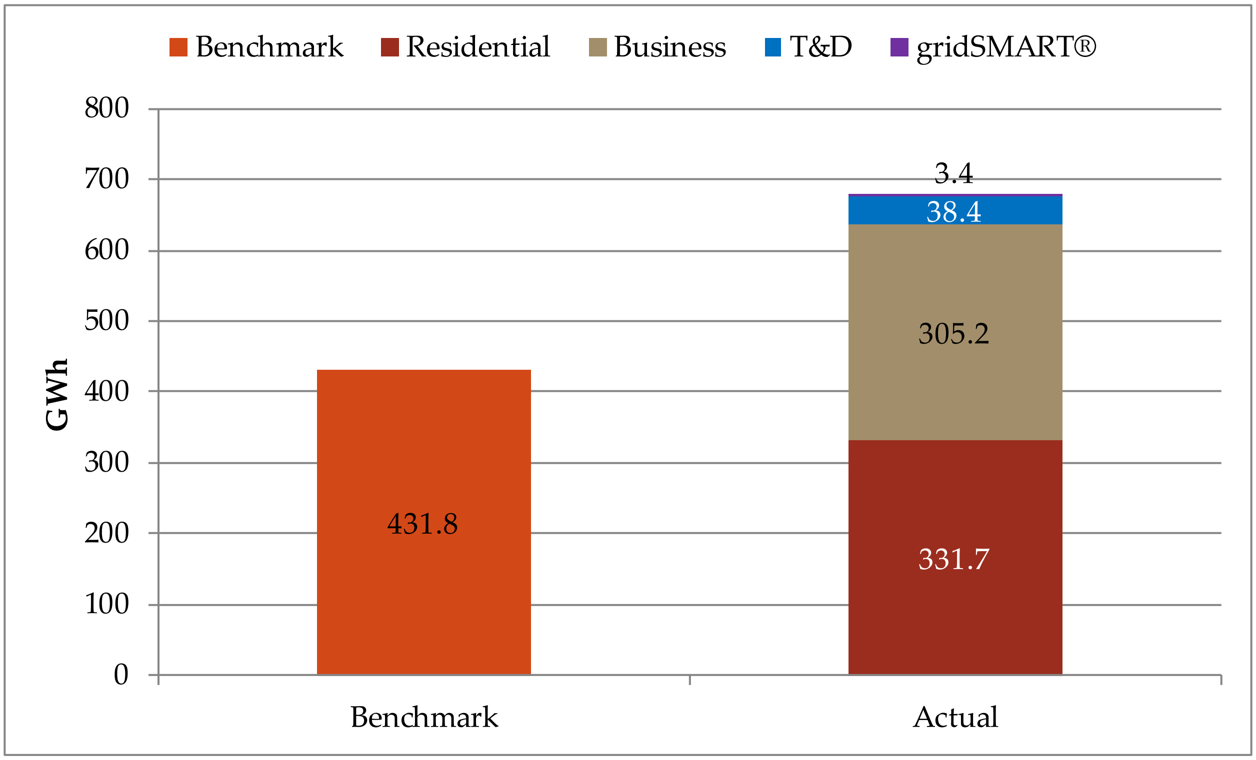
Achieved Savings

The Company has met all its EE/PDR benchmarks for both energy and demand savings for 2014, with all of Ohio Power's EE/PDR programs saving a combined 636.9 GWh of energy.[3]

AEP Ohio is also permitted to add savings resulting from transmission and distribution (T&D) projects that reduce losses. (See page 33.) In 2014, the Company saved 38.4 GWh of energy from T&D projects. Additionally, 2014 savings from Home Energy Reports for gridSMART® Phase 1 customers (see page 21) totaled 3.4 GWh. Together, this yielded a grand total of 678.7 GWh, well above the benchmark target. Figure 3 below illustrates the breakout of these savings between residential programs, business programs, T&D improvements, and gridSMART®. The majority of energy savings in 2014 came from residential programs (48.9 percent). Business programs, T&D projects, and gridSMART® accounted for 45.0 percent, 5.7 percent, and 0.5 percent of the total, respectively.

[3] All achieved energy and demand savings figures in this report are *ex ante*.

FIGURE 3: ACHIEVED ANNUAL ENERGY SAVINGS, BY SEGMENT, 2014

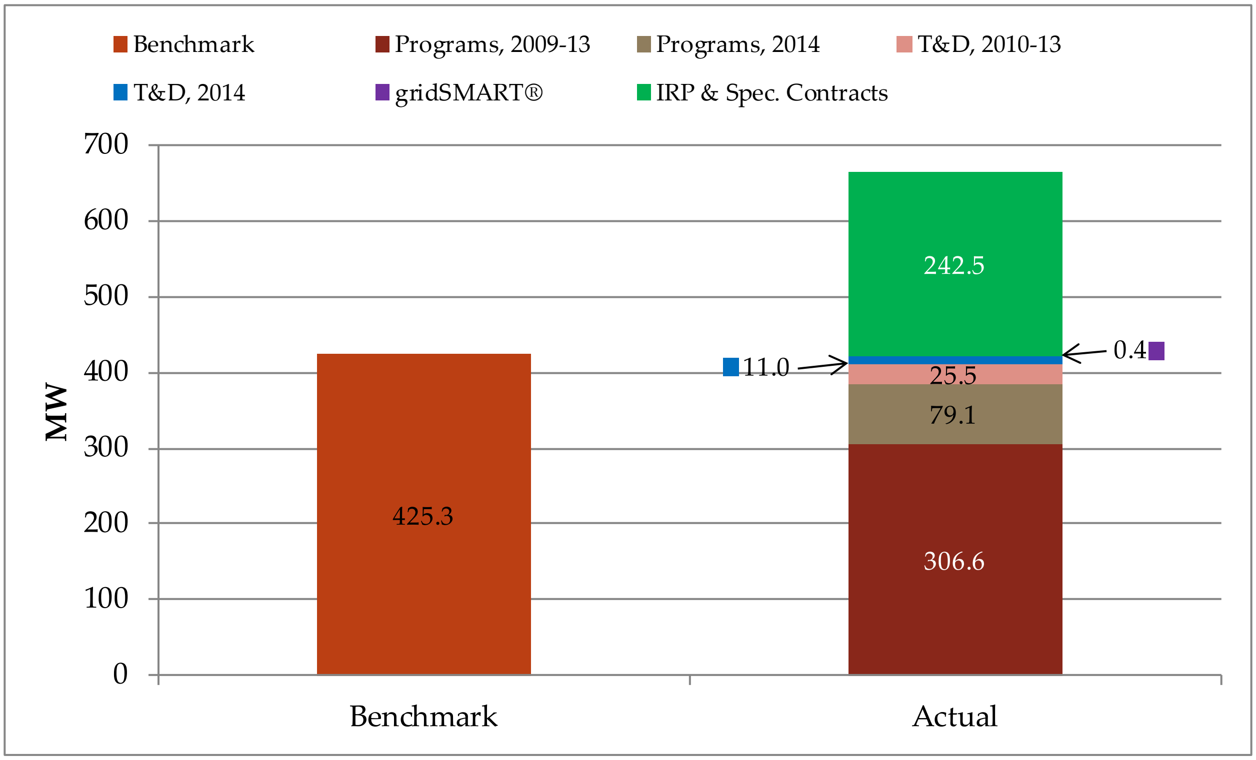


The Company's portfolio yielded 79.1 MW in permanent peak demand reductions in 2014, shown in Figure 4 below. The cumulative permanent peak demand reduction impact of programs from 2009 through 2013 was 306.6 MW.[4] Combined with other sources of demand reduction, including past year T&D projects (25.5 MW),[5] current year T&D projects (11.0 MW), special contracts and interruptible tariffs (242.5 MW), and gridSMART® Phase 1 (0.4 MW) AEP Ohio reduced peak demand by 665.1 MW in total.

[4] The Company erroneously counted prior-year demand savings in its 2013 Portfolio Status Report from special contracts worth approximately 62 MW. Figure 4 has been corrected to include demand savings only from energy efficiency programs. Even without these savings, the Company still achieved its benchmark target in 2013. Since this correction does not affect energy savings, the Company's banked achievements remain unchanged.

[5] In past years, the Company neglected to count permanent peak demand reduction from prior years' T&D projects. Coincident peak demand savings for each year (combining the two predecessor companies where needed) were 0.2 MW in 2010, 8.3 MW in 2011, 6.1 MW in 2012, and 11.0 MW in 2013. Again, because this correction does not affect energy savings, the Company's banked achievements remain unchanged.

FIGURE 4: ACHIEVED PEAK DEMAND SAVINGS, BY SOURCE, 2014



Cost Effectiveness

The Company's portfolio of EE/PDR programs has been cost-effective. There are four common tests to determine cost effectiveness, differing in which costs and benefits are included and for whom:

- **Participant Test (PCT):** Participation is cost effective from this perspective if the reduced electric costs to the participating customer from the measure exceed the after-incentive cost of the measure to the customer.
- **Utility Cost Test (UCT):** Programs are cost effective from this perspective if the costs avoided by the program's energy and demand savings are greater than the utility's EE/PDR program costs to promote the program, including customer incentives.
- **Ratepayer Impact Measure (RIM) Test:** Programs are cost effective from this perspective if their avoided costs are greater than the sum of the EE/PDR program costs and the "lost revenues" caused by the program.
- **Total Resource Cost (TRC) Test:** Programs are cost effective from this perspective if their avoided costs are greater than the sum of the measures cost and the EE/PDR program administrative costs.

Figure 5 below shows benefit-cost ratios for each of the cost effectiveness tests listed above. These ratios are based on *ex ante* savings estimates. A ratio higher than one indicates that net benefits are greater than net costs, and the portfolio is beneficial by the test's standards. Also included is the TRC levelized cost of energy.

FIGURE 5: PORTFOLIO EX ANTE BENEFIT-COST RATIOS AND TRC LEVELIZED COST, 2014

Test	Ratio or Cost
Total Resource Cost	1.9
Participant Cost	4.4
Ratepayer Impact	0.5
Utility Cost	4.0
TRC Levelized Cost per kWh (¢)	3.5

Total resource cost ratios and levelized energy costs for each individual program are shown in Figure 6 below. Again, a ratio greater than one indicates that the program's benefits exceed its costs. Note that the ratios presented in this table are based on *ex ante* savings estimates and may differ from the *ex post* figures contained in Appendices B through Q.

FIGURE 6: TOTAL RESOURCE COST RATIOS AND LEVELIZED COSTS, 2014

Program	Benefit-Cost Ratio	Levelized Cost per kWh (¢)
Efficient Products	3.5	1.9
Appliance Recycling	2.9	0.8
*e*³ *smart*℠	1.7	3.8
In-Home Energy	0.8	8.3
Community Assistance	0.7	9.3
EfficiencyCrafted℠ New Homes	1.0	9.5
Home Energy Reports	1.9	2.5
Prescriptive	0.9	7.7
Custom	2.7	2.6
Self Direct	1.8	4.0
Business New Construction	3.8	2.1
Express	1.8	5.0
Retro-Commissioning	2.9	2.0
Data Center	1.3	5.3
Bid to Win	2.6	2.7
Continuous Energy Improvement	2.8	2.0

Banking of Energy Efficiency Achievements

In accordance with the Order and Stipulation in Case Nos. 09-1089-EL-POR and 09-1090-EL-POR, AEP Ohio presents its banking methodology. The Company reserves the right to bank all achievement exceeding the benchmark. At a minimum for 2009-14, Ohio Power is banking all achievement in excess of 115 percent of benchmark, shown in Figure 7 below.

FIGURE 7: BANKING OF ENERGY EFFICIENCY ACHIEVEMENTS

Year	GWh
2009	141.9
2010	103.3
2011	148.7
2012	252.6
2013	186.5
2014	182.2
Total	**1,015.2**

Summary

In 2014, Ohio Power Company met its benchmark targets for both energy usage and peak demand. The Company's EE/PDR portfolio as a whole was cost-effective.

Program Activity Descriptions

This section of the report discusses program activity from January 1 through December 31, 2014. AEP Ohio operated sixteen programs this year, not counting T&D improvements:

Residential Programs:

- Efficient Products
- Appliance Recycling
- *e³smart*SM
- In-Home Energy
- Community Assistance
- EfficiencyCraftedSM New Homes
- Home Energy Reports

Business Programs:

- Prescriptive
- Custom
- Self Direct
- Business New Construction
- Express
- Retro-Commissioning
- Continuous Energy Improvement
- Data Center
- Bid to Win

Figure 8 summarizes each program's direct and allocated department costs to AEP Ohio; the number of participants or units sold; and estimated energy and demand savings. Descriptions of each program follow Figure 8.

FIGURE 8: SUMMARY OF DIRECT PROGRAM COSTS AND BENEFITS, 2014

Program	Customer Incentives	Third Party Costs	Utility Admin. Costs*	Total Costs	Number of Participants / Units	Coincident Peak MW Saved	Annual GWh Saved
Efficient Products	$11,840.0	$2,040.9	$1,294.7	$15,175.6	4,584,840	25.6	210.5
Appliance Recycling	2,136.0	830.5	296.1	3,262.5	17,734	3.8	24.0
*e³ smart*SM	650.2	250.7	67.8	968.7	25,600	0.5	4.3
In-Home Energy	2,172.0	2,458.9	433.4	5,064.3	22,270	1.5	10.0
Community Assistance	8,971.8	1,766.3	971.0	11,709.1	10,829	1.4	15.9
EfficiencyCraftedSM New Homes	486.7	811.2	175.4	1,473.4	1,723	1.0	3.8
Home Energy Reports	771.4	637.1	155.6	1,564.1	393,549	8.2	63.2
Prescriptive	9,117.0	2,866.8	1,311.2	13,295.0	2,570	16.7	106.8
Custom	3,307.1	2,064.9	560.8	5,932.8	97	7.4	86.6
Self Direct	231.4	406.6	88.2	726.1	43	0.8	6.2
Business New Construction	2,626.6	1,105.3	343.2	4,075.1	142	6.5	36.7
Express	1,580.1	175.6	200.3	1,955.9	567	1.8	7.2
Retro-Commissioning	354.0	247.9	140.3	742.1	27	0.3	4.5
Data Center	1,083.1	720.1	192.4	1,995.6	36	1.6	13.6
Bid to Win	180.9	421.7	51.3	653.9	1	0.4	3.4
Demand Response	0.0	0.0	0.0	0.0	0	0.0	0.0
Continuous Energy Improvement	849.8	3,048.7	450.2	4,348.6	49	1.7	40.2
Total	**$46,358.1**	**$19,853.0**	**$6,731.7**	**$72,942.7**	**5,060,077**	**79.1**	**636.9**
Education and Media				1,621.9			
Pilot Programs, Research & Development				2,011.8			
Grand Total				**$76,576.4**			

*Programs' utility administrative costs include allocated departmental costs.
All cost figures are in thousands of dollars. Columns may not total due to rounding.

RESIDENTIAL PROGRAMS

EFFICIENT PRODUCTS

This program provides incentives and marketing support through retailers to encourage purchases of ENERGY STAR®-approved lighting and appliances. The Efficient Products program contains three main savings paths: The first is customer rebates at the point of sale. Over 342 participating retailers in the Company's service territory are equipped to offer instant rebates on certain ENERGY STAR®-approved lighting devices. Other retailers without the capability to offer electronic markdowns may also offer retailer-reimbursed rebates on these same approved lighting products. These products include CFLs and LEDs. In addition, the program offers customers the opportunity to mail-in rebate applications for refrigerators, freezers, clothes washers, dehumidifiers, televisions, and heat pump water heaters. These applications are available from the retailer or on the AEP Ohio website. While not ENERGY STAR®-rated, AEP Ohio also offers rebates for high-efficiency electric water heaters. These rebates and incentives range from 97½ cents each for 13-watt CFLs to $500 for heat pump water heaters.

AEP Ohio has also provided over 219,800 CFLs to local food pantries along with informational pamphlets. All of these lamps are included in Figure 9 below.

As available technologies and ENERGY STAR® standards continue to evolve over time, AEP Ohio maintains and regularly updates the list of qualifying devices.

In addition, AEP Ohio offers marketing support to retailers. These services include in-store signage to promote efficient devices and training for sales associates to help them understand the benefits of energy-efficient lights and appliances.

Figure 9 below shows the number of products for which AEP Ohio provided incentives or distributed for free in 2014. Please see Appendix A for a detailed measure listing.

FIGURE 9: EFFICIENT PRODUCTS INCENTED OR PROVIDED, 2014

Product	Number	MWh	kW
CFLs	4,010,598	169,307.3	20,245.7
LEDs	528,023	32,409.6	3,874.5
Appliances	46,219	8,798.2	1,477.4
Total	**4,584,840**	**210,515.1**	**25,597.5**

Energy and demand savings were calculated using the Draft Ohio Technical Resource Manual (TRM)[6] when calculations were presented. The Draft Ohio TRM does not provide energy savings for electric water heaters, freezers, or televisions.

The calculations for electric water heaters is taken from the Company's 2012-2014 EE/PDR Action Plan[7] ("Action Plan"), volume 2, page 190. The calculation for televisions is taken from the same source, page 189. The calculation for freezers is taken from the ENERGY STAR® website.[8]

The Company's Action Plan goals for 2014 were 99.9 GWh of savings in energy consumption, and 12.9 MW of savings from peak demand. Figure 10 below shows the Efficient Products

[6] *In the Matter of the Protocols for the Measurement and Verification of Energy Efficiency and Peak Demand Reduction Measures*, Case No. 09-512-GE-UNC, August 6, 2010.

[7] *In the Matter of the Application of Ohio Power Company for Approval of its Program Portfolio Plan and Request for Expedited Consideration*, Case Nos. 11-5568-EL-POR and 11-5569-EL-POR, November 29, 2011.

[8] U.S. Department of Energy, "ENERGY STAR® program requirements, product specification for residential refrigerators and freezers, eligibility criteria version 4.1," http://www.energystar.gov/ia/partners/product_specs/program_reqs/Refrigerators_and_Freezers_Program_Requirements.pdf.

program's energy savings, demand savings, program costs, and average cost per first year energy savings during calendar year 2014.

FIGURE 10: EFFICIENT PRODUCTS PROGRAM SUMMARY, 2014

	Actual	Goal	Percent of Goal
Energy Savings (GWh)	210.5	99.9	210.7%
Demand Savings (MW)	25.6	12.9	198.4%
Program Costs ($M)	15.2	11.9	128.0%
First Year Cost per kWh Saved (¢)	7.2	11.9	60.7%

The Efficient Products program exceeded its goals for both energy and demand savings in 2014. The program saved 210.5 GWh of energy, more than double what was planned. The program also reduced peak demand by 25.6 MW, 98 percent more than planned. The program came in over budget last year at $15.2 million, yielding an average first year cost of 7.2 cents per kWh saved.

APPLIANCE RECYCLING

This program seeks to remove functioning but inefficient refrigerators and freezers from the power grid. Often, older appliances, especially refrigerators, remain in use as second or "backup" appliances—still plugged in and using an inordinate amount of energy. By removing these high-usage appliances from the grid, the Company reduces unnecessary load and usage. This program's primary focus is on these second refrigerators, but recycling for stand-alone freezers is also available. In return for recycling appliances, AEP Ohio paid the customer an incentive of $50 per unit in 2014.

Customers may enroll in the program either through the Company's website or over the phone and schedule an at-home pickup. Figure 11 below shows the number of appliances that were recycled through this program in 2014. Please see Appendix A for a detailed measure listing.

FIGURE 11: APPLIANCES RECYCLED, 2014

Appliances	Number	MWh	kW
Refrigerators	14,460	19,899.1	3,181.2
Freezers	3,274	4,074.2	654.8
Total	**17,734**	**23,973.3**	**3,836.0**

Energy and demand savings were calculated using the Draft Ohio TRM.

The Company's Action Plan goals for 2014 were 29.0 GWh of savings in energy consumption and 5.8 MW of savings from peak demand. Figure 12 below shows the Appliance Recycling program's energy savings, demand savings, program costs, and average cost per first year energy savings during calendar year 2014.

FIGURE 12: APPLIANCE RECYCLING PROGRAM SUMMARY, 2014

	Actual	Goal	Percent of Goal
Energy Savings (GWh)	24.0	29.0	82.6%
Demand Savings (MW)	3.8	5.8	65.8%
Program Costs ($M)	3.3	4.4	75.0%
First Year Cost per kWh Saved (¢)	13.6	15.0	90.8%

The Appliance Recycling program missed its goals for energy and demand savings for 2014. The program saved 24.0 GWh of energy, 17.4 percent below target. The program also reduced peak demand by 3.8 MW, 34.2 percent below goal. The program spent less than budgeted last year at $3.3 million, yielding an average first year cost of 13.6 cents per kWh saved.

e³smart℠

AEP Ohio offers an educational program covering energy efficiency for students in grades 4 through 12 in schools throughout the Company's service territory.[9] It includes a curriculum designed to meet state and national science standards for these grades, teacher training, and supplies for classroom instruction. Students served by the program will learn about different forms of energy, their sources, and how electric power reaches their homes. Students are then given a box of energy-efficient devices—CFLs, LED night lights, low-flow showerheads, faucet aerators, weather-stripping, and door sweeps—to install at home with their parents' or guardians' supervision. Kits also include tools students can use to measure energy use and efficiency losses.

In the 2013-2014 school year, there were 25,600 kits distributed to students in *e³smart*℠. (Of these, 19,104 students installed measures and returned surveys.) Figure 13 below shows how many of which items were included in their kits. Please see Appendix A for a detailed measure listing.

[9] A small number of 3rd grade students also participated in the program in 2014.

FIGURE 13: ITEMS INCLUDED IN *e³smart*SM KITS, 2014

Item	Number	MWh	kW
CFLs	40,102	1,703.2	203.7
Door Sweeps	8,192	576.9	100.3
Faucet Aerators	12,269	185.8	23.2
Hot Water Temp. Setback	3,860	225.9	0.0
LED Night Lights	5,494	113.1	0.0
Low-Flow Showerheads	7,628	818.9	104.8
Weather Stripping	7,547	83.8	10.4
Allocated Kits*	6,496	630.3	75.1
Total	**91,588**	**4,337.8**	**517.5**

*These are kits for participants who had not returned surveys; AEP Ohio reduced the installation rates of these cases.
Note: Water heating measures on this table includes measures that students installed in homes with gas water heating. No savings were claimed on these measures, and they are not tallied in Appendix A.

Energy and demand savings were calculated using the Draft Ohio TRM when calculations were available. The Draft Ohio TRM does not include calculations for door sweeps, LED night lights, and weather-stripping.

The calculation for LED night lights is taken from the 2012 Portfolio Status Report, Navigant Program Evaluation ("2012 Navigant Evaluation").[10]

The formula for door sweeps is shown below, where ΔE is energy savings in kWh; x_1 is maximum energy savings potential from weatherization measures; y_1 is average annual energy usage in all-electric residences; y_2 is average annual energy usage in non-all-electric residences; e is the percentage of homes that are all-electric; L_{door} is the fraction of air leaks through doors; L_{HT} is the fraction of total heat transfer due to air leaks; D_{save} is door sweep savings per door; and D_{avg} is the average number of doors per household.

$$\Delta E = x_1 \times \left((y_1 \times e) + \left(y_2 \times (1 - e)\right) \right) \times \frac{L_{\text{door}} \times L_{\text{HT}} \times D_{\text{save}}}{D_{\text{avg}}}$$

The formula for weather-stripping is shown below, where ΔE is energy savings in kWh; x_1 is maximum energy savings potential from weatherization measures; y_1 is average annual energy usage in all-electric residences; y_2 is average annual energy usage in non-all-electric residences; e is the percentage of homes that are all-electric; L_{shell} is the fraction of air leaks through windows, doors, ceilings, walls, and floors; L_{HT} is the fraction of total heat transfer due to air leaks; Q is total inches of weather-stripping applied; L_{wid} is the average width of the leakage area in inches; and L_{area} is the average leakage area per house in inches.

[10] *In the Matter of the Annual Portfolio Status Report Under Rule 4901:1-39-05(C), Ohio Administrative Code, by Ohio Power Company*, Case No. 13-1182-EL-EEC, May 15, 2013, Appendix E, page 22.

$$\Delta E = x_1 \times \left((y_1 \times e) + (y_2 \times (1 - e)) \right) \times L_{\text{shell}} \times L_{\text{HT}} \times \frac{Q \times L_{\text{wid}}}{L_{\text{area}}}$$

AEP Ohio's Action Plan goals for 2014 were 6.5 GWh of savings in energy consumption and 1.4 MW of savings from peak demand. Figure 14 below shows the *e³smart*℠ program's energy savings, demand savings, program costs, and average cost per first year energy savings during calendar year 2014.

FIGURE 14: *e³smart*℠ PROGRAM SUMMARY, 2014

	Actual	Goal	Percent of Goal
Energy Savings (GWh)	4.3	6.5	66.7%
Demand Savings (MW)	0.5	1.4	36.2%
Program Costs ($M)	1.0	1.1	90.4%
First Year Cost per kWh Saved (¢)	22.3	16.5	135.4%

The *e³smart*℠ program did not meet either its energy or demand goals for 2014. The program saved 4.3 GWh of energy, 33 percent below goal. The program also reduced peak demand by 0.5 MW, 63.8 percent below goal. The program came in slightly under budget last year at $1 million, yielding an average first year cost of 22.3 cents per kWh saved.

IN-HOME ENERGY

This program takes a long-term approach to energy efficiency by helping residential customers analyze and reduce their energy use from a whole-house perspective, identifying inefficiencies, and offering appropriate remedies.

AEP Ohio offers three levels of service to customers: The least-involved, *Online Energy Checkups*, is a free online tool available on AEP Ohio's website that customers may use to quickly identify their home energy costs, receive recommendations on how to save, and learn how to qualify for a kit of free energy-saving items. AEP Ohio provided 4,412 kits to Energy Checkup participants in 2014. Another option, *In-Home Energy Assessments*, includes an in-home visit, visual inspection, prioritized suggestions for efficiency improvements, and installation of several energy-saving devices, such as CFLs, programmable thermostats, or low-flow showerheads, at a subsidized price. In 2014, 5,043 customers had In-Home Assessments. The most thorough service available is the *In-Home Energy Audit*, which provides a more comprehensive house inspection and a blower door test to find air leaks at a subsidized price. In 2014, 1,215 customers had In-Home Audits. (This third option's availability is generally limited to customers with all-electric homes or a specially-identified group with high electric usage.)

Additionally, program implementers work with property managers in multi-family housing complexes to schedule home assessments and installations with residents, as well as to identify potential savings in common areas. All multi-family housing in AEP Ohio's service territory is eligible to participate. This part of the program receives some marketing assistance from property manager associations around the state. In 2014, 118 properties had assessments.

Under all options, the Company offers incentives on selected energy efficiency improvements to make them more affordable. Figure 15 below shows how many measures were installed in 2014.

FIGURE 15: IN-HOME ENERGY MEASURES INSTALLED, 2014

Item	Number	MWh	kW
Air Sealing	34,842	174.7	143.7
Ceiling Fans	53	8.9	1.0
Central Air Conditioning	1,017	235.0	197.5
Duct Sealing	12	8.6	0.2
Ductless Mini-Splits	9	11.1	1.7
Faucet Aerators	12,125	253.4	31.6
Heat Pumps	410	374.4	74.8
HVAC Motors	908	101.7	29.0
HVAC Tuneups	14	3.2	0.4
Insulation	524	114.6	4.9
Lighting	193,032	6,709.8	800.3
Low-Flow Showerheads	6,418	1,443.9	184.7
Pipe Wrap	2,052	233.8	26.7
Thermostats	1,349	334.9	0.0
Water Heaters	3	0.3	0.0
Windows	97	7.4	1.2
Total	**252,865**	**10,015.6**	**1,497.8**

Energy savings were calculated using the Draft Ohio TRM when calculations were available. The Draft Ohio TRM does not include calculations for thermostats, ECM motors, LED nightlights, window film, and weather-stripping.

Formulas for ECM motors, window film, weather-stripping (listed as "air sealing package"), and thermostats are from Ohio Power's Action Plan, page 190. The formula for LED night lights comes from the 2012 Navigant Evaluation, page 22.

The formulas for electric water heaters are listed below, where ΔE is total energy savings in kWh; ΔD is coincident peak demand savings in kW; 8.33 is the conversion constant from gallons to pounds; y_1 is average daily hot water usage in gallons; T_1 is assumed output hot water temperature in degrees Fahrenheit; T_2 is assumed input water temperature; E_{pre} is baseline efficiency; E_{post} is efficient-case efficiency; and 3,412 is the conversion constant from BTU to kWh.

$$\Delta E = 8.33 \times y_1 \times 365 \times (T_1 - T_2) \times \left(\frac{1}{E_{\text{pre}}} - \frac{1}{E_{\text{post}}}\right) \div 3412$$

$$\Delta D = \Delta E \div 8760 \times 0.5$$

Please see Appendix A for a detailed measure listing.

AEP Ohio's Action Plan goals for 2014 were 13.7 GWh of savings in energy consumption and 0.9 MW of savings from peak demand. Figure 16 below shows the In-Home Energy program's energy savings, demand savings, program costs, and average cost per first year energy savings during calendar year 2014.

FIGURE 16: IN-HOME ENERGY PROGRAM SUMMARY, 2014

	Actual	Goal	Percent of Goal
Energy Savings (GWh)	10.0	13.7	73.0%
Demand Savings (MW)	1.5	0.9	168.5%
Program Costs ($M)	5.1	7.2	70.7%
First Year Cost per kWh Saved (¢)	50.6	52.2	96.9%

The In-Home Energy program missed its energy savings goals but greatly exceeded its demand savings goals. The program saved 10.0 GWh of energy, 27 percent below target. The program also reduced peak demand by 1.5 MW, 68.5 percent above the goal amount. The program came in below budget last year at $5.1 million, yielding an average first year cost of 50.6 cents per kWh saved.

Community Assistance

This program offers energy efficiency services to those AEP Ohio customers with limited income to assist them in reducing their electric energy use and making their utility bills more manageable. Residential customers with incomes up to 200 percent of the federal poverty level are eligible to participate.[11] The program offers services similar to those of the In-Home Energy program, such as home assessments, efficient lighting, appliance replacement, health and safety repairs, and weatherization, at no cost to the customer.

[11] In 2014, this came to roughly $47,700 per year for a family of four. See U.S. Department of Health and Human Services, "2014 Poverty Guidelines," January 24, 2014, http://aspe.hhs.gov/poverty/14poverty.cfm.

In 2014, there were 10,829 jobs completed in the Community Assistance program. Figure 17 below shows which measures were installed. Please see Appendix A for a detailed measure listing.

FIGURE 17: MEASURES INSTALLED THROUGH COMMUNITY ASSISTANCE PROGRAM, 2014

Item	Number	MWh	kW
Appliance Recycling	36	47.8	7.3
Hot Water	10,898	330.4	82.5
HVAC	8,929	46.1	5.1
Insulation & Air Sealing	567,656	1,036.3	16.8
Lighting	163,495	5,789.9	794.4
Refrigerators & Freezers	8,272	8,184.0	462.1
Smart Strips	5,274	432.5	0.0
Total	**764,560**	**15,867.0**	**1,368.1**

Energy and demand savings were calculated using the Draft Ohio TRM when calculations were available. The Draft Ohio TRM does not include calculations for hot water temperature setbacks or smart strips.

The calculations for both smart strips and hot water setbacks come from the Company's Action Plan, volume 2, pages 189 and 190, respectively.

Ohio Power's Action Plan goals for 2014 were 10.9 GWh of savings in energy consumption and 1.1 MW of savings from peak demand. Figure 18 below shows the Community Assistance program's energy savings, demand savings, program costs, and average cost per first year energy savings during calendar year 2014.

FIGURE 18: COMMUNITY ASSISTANCE PROGRAM SUMMARY, 2014

	Actual	Goal	Percent of Goal
Energy Savings (GWh)	15.9	10.9	145.9%
Demand Savings (MW)	1.4	1.1	128.1%
Program Costs ($M)	11.7	10.7	109.0%
First Year Cost per kWh Saved (¢)	73.8	98.8	74.7%

The Community Assistance program exceeded both its energy and demand savings goals in 2014. The program saved 15.9 GWh of energy. The program also reduced peak demand by 1.4 MW. The program came in over budget last year at $11.7 million, yielding an average first year cost of 73.8 cents per kWh saved.

EfficiencyCrafted℠ New Homes

EfficiencyCrafted℠ New Homes (formerly known as ENERGY STAR® New Homes) seeks to effect the construction of single-family residences that meet specific ENERGY STAR® or EnergyPath standards. Such structures can use up to 35 percent less energy than residences built to the minimum code requirements. AEP Ohio will pay various incentives to participating builders of single-family residences to help offset incremental construction costs. In addition, builders receive training, marketing, and financial support, including site signage, consumer brochures, model home displays, advertising, and other consumer education tools. All new single-family residential construction that meets standards is eligible.

AEP Ohio has agreed to share program costs with Columbia Gas for gas-heated homes in those areas served by both companies. In 2014, this program incented the construction of 1,723 efficient single-family homes.

Energy and demand savings were calculated as the difference between a baseline residence constructed at the applicable code and the as-built *REM/Rate* model. *REM/Rate* is software that analyzes energy usage in residential buildings.

The Company's Action Plan goals for 2014 were 1.5 GWh of savings in energy consumption and 0.4 MW of savings from peak demand. Figure 19 below shows the program's energy savings, demand savings, program costs, and average cost per first year energy savings during calendar year 2014.

FIGURE 19: EFFICIENCYCRAFTED℠ NEW HOMES PROGRAM SUMMARY, 2014

	Actual	Goal	Percent of Goal
Energy Savings (GWh)	3.8	1.5	247.7%
Demand Savings (MW)	1.0	0.4	264.1%
Program Costs ($M)	1.5	1.0	143.4%
First Year Cost per kWh Saved (¢)	38.6	66.7	57.9%

The EfficiencyCrafted℠ New Homes program exceeded both its energy and demand savings goals in 2014. The program saved 3.8 GWh of energy, nearly two and a half times the goal level. The program also reduced peak demand by 1.0 MW, over two and a half times the target. The program came in over budget last year at $1.5 million, yielding an average first year cost of 38.6 cents per kWh saved.

Home Energy Reports

This program targets high-usage or low-income customers in the Company's service territory to receive a comparison mailing of how occupied homes of similar size and heating source use electricity. This is designed to spur these selected customers to save energy and use electricity more efficiently. Customers who wish to opt out of receiving these reports may call a toll-free number to do so. In 2014 there were 393,549 customers receiving reports.

Savings calculations for this program begin with the vendor using a proprietary model. AEP Ohio allocated the calculated savings to the accounts the vendor marked as included in the analysis. AEP Ohio then adjusted the savings calculations downward for premises that appeared to be double counted, were revealed to be outdoor lighting only, were not included in the regression model, or were receiving reports as part of gridSMART® Phase 1. While not incorporated in Home Energy Report program metrics, gridSMART® savings were counted toward 2014 baseline goals. (See page 6.), Savings in both energy and demand were therefore adjusted downward by 5.54 GWh and 720 kW, respectively.

AEP Ohio's Action Plan goals for 2014 were 46.3 GWh of savings in energy consumption and 6.2 MW of savings from peak demand. Figure 20 below shows the Home Energy Report program's energy savings, demand savings, program costs, and average cost per first year energy savings during calendar year 2014.

FIGURE 20: HOME ENERGY REPORTS PROGRAM SUMMARY, 2014

	Actual	Goal	Percent of Goal
Energy Savings (GWh)	63.2	46.3	136.4%
Demand Savings (MW)	8.2	6.2	133.0%
Program Costs ($M)	1.6	2.4	66.0%
First Year Cost per kWh Saved (¢)	2.5	5.1	48.4%

The Home Energy Report program exceeded both its energy and demand savings goals for 2014. The program saved 63.2 GWh of energy, 36.4 percent above goal. The program also reduced peak demand by 8.2 MW, 33 percent above goal. The program came in under budget last year at $1.6 million, yielding an average first year cost of 2.5 cents per kWh saved; however, unlike other residential programs, this program only has a one-year measure life.

Business Programs

Prescriptive

This program offers fixed incentives for the installation and implementation of certain pre-approved types of energy efficient lighting; heating, ventilation, and air conditioning (HVAC) systems; variable frequency drives (VFDs); motors; controls; refrigeration equipment; and compressed air systems, among other commercial- and industrial-grade equipment. Incentive amounts offered to customers range between 20 and 50 percent of the incremental cost to purchase energy-efficient equipment. All non-residential customers in AEP Ohio's service territory are eligible to participate.

In 2014, there were 2,570 projects completed in the Prescriptive program. Figure 21 below shows which measures were installed through these projects. A single project may involve multiple measures. Please see Appendix A for a detailed measure listing.

FIGURE 21: MEASURES INSTALLED THROUGH PRESCRIPTIVE PROGRAM, 2014

Type	Number	MWh	kW
Compressed Air	5,539	5,429.1	776.2
Comm. Kitchen	49	197.1	17.2
HVAC	1,372,864	7,599.1	1,323.6
Lighting	24,306,735	83,508.1	13,268.1
Motors	5,126	4,561.6	584.9
Refrigeration	12,482	5,131.9	749.8
Other	4,373	417.4	6.4
Total	**25,707,168**	**106,844.3**	**16,726.1**

Energy and demand savings for prescriptive measures were calculated using the vendor-internal TRM which is filed with the Commission annually.

The Company's Action Plan goals for 2014 were 219.6 GWh of savings in energy consumption and 36.6 MW of savings from peak demand. Figure 22 below shows the Prescriptive program's energy savings, demand savings, program costs, and average cost per first year energy savings during calendar year 2014.

FIGURE 22: PRESCRIPTIVE PROGRAM SUMMARY, 2014

	Actual	Goal	Percent of Goal
Energy Savings (GWh)	106.8	219.6	48.7%
Demand Savings (MW)	16.7	36.6	45.7%
Program Costs ($M)	13.3	20.1	66.1%
First Year Cost per kWh Saved (¢)	12.4	9.2	135.8%

The Prescriptive program did not meet either its energy or demand goals for 2014. The program saved 106.8 GWh of energy, 51.3 percent below goal. The program also reduced peak demand by 16.7 MW, 54.3 percent below goal. The program came in below budget last year at $13.3 million, yielding an average first year cost of 12.4 cents per kWh saved.

CUSTOM

This program is for cost-effective energy efficiency improvements in existing buildings that reduce energy consumption or peak demand and have more complicated measures that are not included in the Prescriptive program. All non-residential customers in the Company's service territory are eligible to participate. Customers work closely with their Ohio Power account managers and other employees to determine measure eligibility and verify energy savings. Customers receive an incentive customized to the specific results of the energy savings technologies implemented. Program management will assist commercial and industrial customers with the analysis and selection of high-efficiency equipment or processes.

There were 97 Custom projects completed in 2014. Figure 23 below summarizes the measures installed in these projects. A single project may involve multiple measures. Please see Appendix A for a detailed measure listing.

FIGURE 23: MEASURES INSTALLED THROUGH CUSTOM PROGRAM, 2014

Type	Number	MWh	kW
Compressed Air	465	8,681.0	1,050.3
Comm. Kitchen	1	2.5	0.3
Energy Mgt. System	5	16,868.8	2,090.8
HVAC	629	8,309.4	1,216.8
Lighting	496,593	4,207.1	526.6
Misc. Motors	28	12,266.5	1,080.0
Process	1,085	33,612.6	1,050.4
Refrigeration	4	2,604.9	345.6
Total	**498,810**	**86,552.8**	**7,360.7**

Energy and demand savings in the Custom program were individually computed for each measure in each project using methodologies consistent with the Draft Ohio TRM.

The Company's Action Plan goals for 2014 were 67.5 GWh of savings in energy consumption and 9.0 MW of savings from peak demand. Figure 24 below shows the Custom program's energy savings, demand savings, program costs, and average cost per first year energy savings during calendar year 2014.

FIGURE 24: CUSTOM PROGRAM SUMMARY, 2014

	Actual	Goal	Percent of Goal
Energy Savings (GWh)	86.6	67.5	128.3%
Demand Savings (MW)	7.4	9.0	81.8%
Program Costs ($M)	5.9	8.8	67.5%
First Year Cost per kWh Saved (¢)	6.9	13.0	52.6%

The Custom program met its savings goals for 2014 but missed its demand goal. The program saved 86.6 GWh of energy, 28.3 percent above goal. The program also reduced peak demand by 7.4 MW, 18.2 percent below goal. The program came in below budget in 2014 at $5.9 million, yielding an average first year cost of 6.9 cents per kWh saved.

Self Direct

This program is designed for large customers able to internally administer their own energy management initiatives. Participants design their own energy efficiency programs and submit an application documenting their energy savings. Customers may apply for inclusion in the Self Direct program up to three years *after* implementing their energy efficiency measures. All applications are subject to approval by both Ohio Power and the Commission. If approved, participants may either receive a one-time payment, up to 75 percent of an equivalent incentive under the Prescriptive or Custom programs, or an equivalent EE/PDR rider exemption. (The accounts may not participate in any other EE/PDR programs while under such an exemption.)

Participation in this program is limited to mercantile customers. In 2014, Ohio Power submitted 43 Self Direct applications to the Commission. Figure 25 below shows which measures were installed under these projects. A single project may involve multiple measures. For a detailed measure listing, see Appendix A.

FIGURE 25: MEASURES INCENTED THROUGH SELF DIRECT PROGRAM, 2014

Type	Number	MWh	kW
Compressed Air	4	567.6	83.1
Comm. Kitchen	3	171.4	0.3
HVAC	1,553	478.2	114.9
IT Equipment	1	104.5	11.9
Lighting	185,694	959.2	149.7
Process	1,257	3,545.6	299.9
Refrigeration	2	92.4	10.8
Whole Building Models	1	244.9	82.1
Total	**188,515**	**6,164.0**	**752.8**

Energy and demand savings in the Self-Direct program are calculated using the same methods employed in the Prescriptive and Custom programs.

AEP Ohio's Action Plan goals for 2014 were 20.0 GWh of savings in energy consumption and 2.5 MW of savings from peak demand. Figure 26 below shows the Self Direct program's energy savings, demand savings, program costs, and average cost per first year energy savings during calendar year 2014.

FIGURE 26: SELF DIRECT PROGRAM SUMMARY, 2014

	Actual	Goal	Percent of Goal
Energy Savings (GWh)	6.2	20.0	30.8%
Demand Savings (MW)	0.8	2.5	30.6%
Program Costs ($M)	0.7	3.0	24.2%
First Year Cost per kWh Saved (¢)	11.8	15.0	78.5%

The Self Direct program fell below both its energy and demand savings goals in 2014. The program saved 6.2 GWh of energy, 69.2 percent below goal. The program also reduced peak demand by 0.8 MW, 69.4 percent below the target level. The program came in under budget last year at $700 thousand, yielding an average first year cost of 11.8 cents per kWh saved.

Business New Construction

This program targets non-residential customers who are either building new facilities or making major renovations to existing sites, encouraging building owners, designers, and architects to exceed requirements in current construction practices and codes—specifically, measures that exceed the ASHRAE/IESNA 90.1-2004 minimum requirements. The program includes incentives for the installation of high-efficiency lighting, HVAC systems, building envelopes, industrial refrigeration equipment, and other equipment and controls. The New Construction program offers three tracks: prescriptive and custom, similar to what is offered in those respective programs, plus a "whole building" approach based on building simulation modeling. All non-residential customers building new facilities are eligible to participate.

There were 142 New Construction projects completed in 2014. Figure 27 below shows which measures were installed under these construction projects. A single project may involve multiple measures. A detailed measure list is available in Appendix A.

FIGURE 27: MEASURES INSTALLED THROUGH BUSINESS NEW CONSTRUCTION PROGRAM, 2014

Type	Number	MWh	kW
Appliances	1	36.1	4.0
Compressed Air	26	843.3	97.3
Comm. Kitchen	11	98.9	9.8
HVAC	3,135	1,496.8	327.7
Lighting	2,033,690	9,965.7	1,443.7
Motors/Process	2,143	16,070.8	3,065.8
Refrigeration	4,168	1,645.7	228.0
Whole Building Models	16	6,546.2	1,349.2
Total	**2,043,189**	**36,703.5**	**6,525.3**

Energy and demand savings were calculated using the same methods as employed in the Prescriptive and Custom programs, the ENERGY STAR® website, or with simulation calculations in projects using whole building models.

The Company's Action Plan goals for 2014 were 10.0 GWh of savings in energy consumption and 1.2 MW of savings from peak demand. Figure 28 below shows the New Construction program's energy savings, demand savings, program costs, and average cost per first year energy savings during calendar year 2014.

FIGURE 28: BUSINESS NEW CONSTRUCTION PROGRAM SUMMARY, 2014

	Actual	Goal	Percent of Goal
Energy Savings (GWh)	36.7	10.0	367.0%
Demand Savings (MW)	6.5	1.2	530.5%
Program Costs ($M)	4.1	2.0	207.8%
First Year Cost per kWh Saved (¢)	11.1	19.6	56.6%

The Business New Construction program exceeded both its energy and demand savings goals for 2014. The program saved 36.7 GWh of energy, over three and a half times the target level. The program also reduced peak demand by 6.5 MW, more than five times the goal level. The program did come in over budget this year at $4.1 million, yielding an average first year cost of 11.1 cents per kWh saved.

EXPRESS

This program provides a streamlined, one-stop, turn-key energy efficiency service for small businesses. The program implementer first conducts a free on-site assessment to identify potential energy-saving opportunities. Based on recommendations from this assessment the implementer provides the participant with a proposal for installing energy efficiency measures. If the customer approves, the implementer then hires local contractors to perform the installation work. Once the work is completed, and after the customer has signed off on the work performed, the implementer bills the participant directly, after applying incentives from AEP Ohio. Incentive levels are generally higher in this program than in the Prescriptive or Custom programs, up to 80 percent of project cost. This program is designed for small business customers with annual energy consumption levels no greater than 200 MWh or peak billing demands no higher than 100 kW.

Figure 29 below shows the number of measures installed through the Express program. Again, a single project may involve multiple measures. In total, there were 567 projects completed. See Appendix A for a complete listing of installed measures.

FIGURE 29: MEASURES INSTALLED THROUGH EXPRESS PROGRAM, 2014

Type	Number	MWh	kW
CFLs	1,251	136.3	50.9
LEDs	3,875	1,361.4	313.5
T5/T8	19,643	5,248.9	1,368.7
Exit Signs	612	163.4	15.7
Controls	570	28.7	0.0
Refrigeration	121	285.7	25.5
Total	**26,072**	**7,224.3**	**1,774.4**

Energy and demand savings are calculated using the New York TRM.[12]

The Company's Action Plan goals for 2014 were 11.1 GWh of savings in energy consumption and 1.8 MW of savings from peak demand. Figure 30 below shows the Express program's

[12] New York State Department of Public Service, *New York Standard Approach for Estimating Energy Savings from Energy Efficiency Programs: Residential, Multi-Family, and Commercial/Industrial Programs*, version 2, December 10, 2014.

energy savings, demand savings, program costs, and average cost per first year energy savings during calendar year 2014.

FIGURE 30: EXPRESS PROGRAM SUMMARY, 2014

	Actual	Goal	Percent of Goal
Energy Savings (GWh)	7.2	11.1	65.3%
Demand Savings (MW)	1.8	1.8	96.2%
Program Costs ($M)	2.0	3.8	51.1%
First Year Cost per kWh Saved (¢)	27.1	34.6	78.2%

The Express program missed its energy savings goals but met its demand savings goals for 2014. The program saved 7.2 GWh of energy, 34.7 percent below goal. The program also reduced peak demand by 1.8 MW, substantially meeting its goal. The program came in below budget last year at $2.0 million, yielding an average first year cost of 27.1 cents per kWh saved.

RETRO-COMMISSIONING

Differing from the capital-improvement-oriented programs above, Retro-Commissioning seeks to reduce energy use through low-cost or no-cost operational changes and improve the efficiency of buildings' existing systems. Examples of such systems include HVAC equipment optimization; lighting sensors and timers; and motor and process controls. The program targets medium to large commercial business customers, with an emphasis on office space and schools.

The program offered two tracks for customers: *Retro-Commissioning Lite* was available for facilities between 50,000 and 150,000 square feet and peak demand of at least 125 kW. Program contractors conducted short, targeted assessments of selected building systems and made recommendations for improvements. *Retro-Commissioning Comprehensive* was available for facilities with more than 150,000 square feet and peak demand of at least 500 kW. Assessments on this program track were much more detailed and covered all operating building systems. Participants who implemented *all* recommendations with a two-year payback period or shorter received a flat $5,000 incentive on *Lite* projects, or 10 cents per affected square foot on *Comprehensive* projects. *Comprehensive* projects could also earn an additional 5 cents per kWh saved from measures installed with a payback period longer than two years.

Figure 31 below shows which measures were implemented through the Retro-Commissioning program. A single project may involve multiple measures. In total, there were 27 projects completed in 2014. See Appendix A for a complete list of implemented measures.

FIGURE 31: MEASURES IMPLEMENTED THROUGH RETRO-COMMISSIONING PROGRAM, 2014

Type	Number	MWh	kW
HVAC Equip. Optimization	20	1,350.4	150.9
Other HVAC	30	3,092.0	183.9
Lighting Optimization	1	74.9	0.0
Total	**51**	**4,517.2**	**334.8**

Energy and demand savings were modeled individually for each project by the program implementer. Draft Ohio TRM calculations are unavailable.

AEP Ohio's Action Plan goals for 2014 were 7.3 GWh of savings in energy consumption and 1.5 MW of savings from peak demand. Figure 32 below shows the Retro-Commissioning program's energy savings, demand savings, program costs, and average cost per first year energy savings during calendar year 2014.

FIGURE 32: RETRO-COMMISSIONING PROGRAM SUMMARY, 2014

	Actual	Goal	Percent of Goal
Energy Savings (GWh)	4.5	7.3	61.8%
Demand Savings (MW)	0.3	1.5	22.4%
Program Costs ($M)	0.7	1.6	47.4%
First Year Cost per kWh Saved (¢)	16.4	21.4	76.7%

The Retro-Commissioning program missed both its energy and demand savings goals in 2014. The program saved 4.5 GWh of energy, 38.2 percent below goal. The program also reduced peak demand by 335 kW, 77.6 percent below goal. The program came in under budget last year at $742 thousand, yielding an average first year cost of 16.4 cents per kWh saved.

CONTINUOUS ENERGY IMPROVEMENT

The Continuous Energy Improvement program (CEI) is designed for large industrial customers using more than 10 GWh per year. Like Retro-Commissioning, CEI focuses on low-cost or no-cost measures to reduce usage, primarily through system efficiency and process optimization. Participants join a cohort of 10 to 20 companies, with care taken to avoid placing competitors in the same cohort, to protect participants' trade secrets. Each participant designates an internal team to act as *energy champions* and coordinate efforts within their companies to implement changes. Over a period of one year, energy champions attend workshops and work closely with program implementers to understand how their facilities' loads change and identify opportunities for reducing energy usage. Program implementers, using information on electric consumption, weather, and participants' internal metrics (such as production levels), develop a predictive model of energy usage for each participant. Subsequent usage levels below model predictions are counted as savings.

Incentives are structured to encourage participants to maintain their new energy practices after their first year is over. First-year energy savings pay an incentive of 2 cents per kWh. To the extent that these savings are sustained, participants can earn an additional 2 cents per kWh each in their second and third years.

At the close of 2014, there were 35 participating customers with a combined 49 accounts in four cohorts in the CEI program. Savings were estimated based on individual regression models for each participant and, in some cases, multiple premises.

The Company's Action Plan goals for 2014 were 20.0 GWh of savings in energy consumption and 2.5 MW of savings from peak demand. Figure 33 below shows the CEI program's energy savings, demand savings, program costs, and average cost per first-year energy savings during calendar year 2014.

FIGURE 33: CONTINUOUS ENERGY IMPROVEMENT PROGRAM SUMMARY, 2014

	Actual	Goal	Percent of Goal
Energy Savings (GWh)	40.2	20.0	201.1%
Demand Savings (MW)	1.7	2.5	68.0%
Program Costs ($M)	4.3	4.0	108.7%
First Year Cost per kWh Saved (¢)	10.8	20.0	54.1%

The CEI program exceeded its energy savings goals but missed its demand goals for 2014. The program saved 40.2 GWh of energy, more than double the target level. The program also saved 1.7 MW of demand, 32.0 percent below goal. The program slightly exceeded its budget at $4.3 million, yielding a first year cost of 10.8 cents per kWh saved.

DATA CENTER

The Data Center program is a capital improvement program specially geared toward the unique needs of business IT operations and space. Such equipment can be highly energy-intensive, incorporate heavy HVAC loads, and have strict uptime requirements. Measures covered under this program may include ENERGY STAR® servers and telecommunications equipment; high-efficiency uninterruptable power supplies; high-efficiency power rectifiers; server virtualization; high-efficiency computer room air conditioner units; variable-speed drives on chilled water pumps; and airflow management and controls to optimize data center cooling. An additional track covers IT load growth when measured against an industry standard baseline.

Figure 34 below shows which measures were implemented through the Data Center program. A single project may involve multiple measures. In total, there were 36 projects completed. Please see Appendix A for a complete list of installed measures.

FIGURE 34: MEASURES INSTALLED THROUGH DATA CENTER PROGRAM, 2014

Type	Number	MWh	kW
HVAC	244	5,094.2	577.6
IT Equipment	189	7,630.5	882.2
Uninterruptable Power	16	426.0	48.5
Other	9	420.8	48.0
Total	**458**	**13,571.5**	**1,556.3**

Energy and demand savings were modeled individually for each project by the program implementer.

The Company's Action Plan goals for 2014 were 8.0 GWh of savings in energy consumption and 1.0 MW of savings from peak demand. Figure 35 below shows the Data Center program's energy savings, demand savings, program costs, and average cost per first year energy savings during calendar year 2014.

FIGURE 35: DATA CENTER PROGRAM SUMMARY, 2014

	Actual	Goal	Percent of Goal
Energy Savings (GWh)	13.6	8.0	170.1%
Demand Savings (MW)	1.6	1.0	157.2%
Program Costs ($M)	2.0	1.9	106.4%
First Year Cost per kWh Saved (¢)	14.7	23.5	62.6%

The Data Center Program exceeded both its energy and demand savings goals for 2014. The program saved 13.6 GWh of energy, 70.1 percent above goal. The program also reduced peak demand by 1.6 MW, 57.2 percent above the goal. The program came in over budget last year at $2.0 million, yielding an average first year cost of 14.7 cents per kWh saved.

BID TO WIN

Bid to Win is a unique reverse bidding program in which non-residential customers and solution providers may offer their own proposals to implement large-scale energy efficiency projects, either at a single site or spread out among multiple sites. Bidding processes are conducted online, with competing bids placed in real time and the winning bid being that with the lowest cost per kilowatt-hour. The participant or participants with the winning bid or bids are then eligible to receive incentive payments for their projects' completion, up to $1 million.

In order to qualify, bidders must first respond to a Request for Qualifications, and all proposed projects must be pre-qualified as having a minimum 3 GWh of estimated energy savings, a payback period of at least one year, and an estimated useful life of at least ten years.

AEP Ohio's Action Plan goals for 2014 were 20.0 GWh of savings in energy consumption and 2.5 MW of savings from peak demand. Figure 36 below shows the auction program's energy savings, demand savings, program costs, and average cost per first year energy savings during calendar year 2014.

FIGURE 36: BID TO WIN PROGRAM SUMMARY, 2014

	Actual	Goal	Percent of Goal
Energy Savings (GWh)	3.4	20.0	16.8%
Demand Savings (MW)	0.4	2.5	16.4%
Program Costs ($M)	0.7	4.1	15.9%
First Year Cost per kWh Saved (¢)	19.5	20.5	95.2%

The Bid to Win program fell well below both its energy and demand savings targets for 2014. The program saved 3.4 GWh of energy, less than a fifth of the goal amount. The program also saved 404 kW of demand, only 16.4 percent of the target. The program came in below budget at $654 thousand, yielding an average first year cost of 19.5 cents per kWh saved.

TRANSMISSION AND DISTRIBUTION PROJECTS

Inherent in the operation of any electric power system is the electrical resistance of its various elements, such as conductors, transformers, or regulators. The greater the distance the power must travel from generation to end use, the greater the amount of power lost in this transfer. The Ohio Revised Code allows a utility to include transmission and distribution infrastructure improvements to reduce line losses to meet benchmarks,[13] and T&D projects are a major part of Ohio Power's plan for compliance. These projects include reconductoring, substation improvements, capacitor bank installation, and voltage regulator replacement.

- **Reconductoring** projects involve the replacement of existing wires with improved wires designed for lower losses at transmission or distribution voltages, lowering the system's resistance and the power lost over transmission to the end-user.

[13] Ohio Revised Code § 4928.66(A)(2)(d).

- **Substation improvements** typically include connecting previously unconnected T&D lines and the addition or upgrade of transformers and circuits, balancing loads between circuits, changing lines to multi-phase current, or the construction of altogether new substations. Such projects improve efficiency and reduce load losses by adding new transformation points closer to customers' loads. A greater portion of energy is carried in higher-voltage transmission lines than lower-voltage distribution lines.
- **Capacitor banks** reduce losses by improving system power factors closer to 100 percent.
- **Voltage regulators** assist in maintaining delivery voltage within the Commission's guidelines.

AEP Ohio had 27 distribution projects and 19 transmission projects completed in 2014 related to energy efficiency and peak demand reduction. These improvements prevented the loss of 38.4 GWh of energy and lowered peak demand by 11.0 MW. The report in Appendix R contains a complete list of the Company's 2014 T&D projects and their estimated impacts.

Recommendations to the Commission

Residential Programs

Efficient Products

For 2014, Efficient Products has again surpassed the Plan goal of delivered energy savings by a substantial margin. CFLs continue to provide the bulk of the savings with LEDs significantly increasing from 2% in 2013 to 12% in 2014. Tactics were implemented to increase LED awareness and education. ENERGY STAR® certified appliances such as clothes washers, freezers, refrigerators, high efficiency electric water heaters, and electric heat pump water heaters continue to grow with a 9% increase from 2013. AEP Ohio also started distributor/contractor training sessions for high efficiency heat pumps and water heaters. AEP Ohio recommends that the program continue as described in the Plan.

Appliance Recycling

The refrigerator/freezer recycling program continues to be successful and customer satisfaction and program awareness is high. Nearly 85,000 units have been recycled since program inception. Nearly 18,000 units were collected and recycled in 2014 alone. AEP Ohio and the contractor piloted a "Refer-a-Friend" program this year and it netted an additional 159 units. AEP Ohio recommends the program continue as described in the Plan.

In-Home Energy

This program continues to grow in awareness, customer participation and satisfaction. AEP Ohio adjusted incentives to capture more all electric homes to improve cost effectiveness, thus there was more marketing and focus on electric home audits in 2014. The program continues to provide strong multi-family direct installs as part of the overall program. AEP Ohio recommends this program continue as described in the Plan.

Community Assistance

This program, like previous years, provides low income customers energy saving measures to reduce energy costs and provide more comfort. The number of homes completed decreased in 2014 to 10,829 from 11,453 in 2013 and 8,579 in 2012. Any customers who are enrolled in the Percentage of Income Payment Plan (PIPP), Home Weatherization Assistance Plan (HWAP) or Home Energy Assistance Program (HEAP) are eligible to participate in AEP Ohio's Community Assistance Program. AEP Ohio recommends continuing this program as described in the Plan and will manage and support this program in-house.

EfficiencyCrafted℠ New Homes

The program exceeded the targeted savings goal. A total of 1,723 homes were completed with 110 registered builders within the program. AEP Ohio, along with Columbia Gas of Ohio, partnered with an advertising agency to develop a consumer website and over 10,000 visits from July through December resulted. Most of the program advertising was via digital media. AEP Ohio recommends the program continue as described in the Plan.

Home Energy Reports

In 2014, the Company had 393,549 customers participating and receiving home energy reports. In addition, this program provides an opportunity to educate our customers on all the residential energy efficiency programs they can participate in. AEP Ohio recommends the program continue as described in the Plan.

e³smart℠

This program continues to receive high satisfaction from teachers and students. AEP Ohio replaced one CFL with an LED in the student take-home kit to help advance LED awareness with students and parents. AEP Ohio recommends the program continue as described in the Plan.

Business Programs

Prescriptive

The Prescriptive program began June 1, 2009, focused in the first year on prescriptive lighting only. In addition and according to the Plan, AEP Ohio expanded the list of prescriptive measures in 2010 under this program beyond lighting, to include HVAC, motors, drives and other cost effective measures to simplify and market this program effectively. Over 200 prescriptive measures are currently offered. AEP Ohio recommends that the program continue as described in the Plan.

Custom

The Custom program is designed to be a “kitchen sink” program to handle customer energy efficiency projects not addressed through other business programs. Target segments may also be explored to engage more non-participants in AEP Ohio programs. Each targeted marketing effort will be monitored and listed as a subset of the Custom Program to track performance and participation. Since 2011, measures which show increased usage as technology develops, such as LED lighting, are moved to the Prescriptive Program to remove barriers to participation. AEP Ohio recommends that the program continue as described in the Plan.

DEMAND RESPONSE

The demand response program is used to supplement the peak demand reductions achieved from EE/PDR programs. Prior to 2012 and the merger of CSP and OPCo, additional demand response was needed in CSP. Post-merger, additional customer agreements were not needed to gain customer commitments for supplemental peak demand reduction. AEP Ohio recommends that the program continue as described in the Plan.

SELF DIRECT

This program has achieved significant impacts and participation since 2009. The Self Direct program has also helped drive participation in other programs through its unique allowance of previously completed projects and the option of either the payment of an energy efficiency credit or an exemption from the EE/PDR Rider. AEP Ohio recommends that the program continue as described in the Plan.

BUSINESS NEW CONSTRUCTION

The New Construction program started in 2011 with strong participation. In 2013 and 2014, participation continued to increase significantly as customer recognition of the program increased. New Construction continues to increase as the economy stabilizes and energy savings from new construction is a good opportunity for long lived savings. AEP Ohio recommends that the program continue as described in the Plan.

EXPRESS

The Express program changed in 2012 from a program marketed by local contractors, to a program with dedicated program marketing staff that would present signed contracts and materials to local contractors for installation. Results from 2014 show a higher participation rate with the 2012 change. AEP Ohio recommends that the program continue as described in the Plan.

RETRO-COMMISSIONING

The Retro-Commissioning program seeks to obtain energy savings through the identification and implementation of low-cost, operational adjustments that improve the efficiency of existing buildings' operating systems by optimizing the systems to meet the building's requirements, with a focus on building controls and HVAC systems. Trained retro-commissioning service providers (RSPs) started to grow the program throughout 2013 and 2014. AEP Ohio recommends that the program continue as described in the Plan.

Continuous Energy Improvement

The Continuous Energy Improvement program was a new program launched in early 2013. This program seeks to facilitate a comprehensive and enduring strategic approach to energy reduction at key customer facilities. Strong enlistment throughout 2013 indicated high acceptance of the program. In 2014, the first groups (cohorts) participated with exceptional no cost/low cost operational savings and very high satisfaction with the program. AEP Ohio recommends that the program continue as described in the Plan.

Data Center

The Data Center program was a new program launched in early 2013. This program is designed to assist customers in addressing energy efficiency opportunities in both new and existing data centers (facilities used to house computer systems and associated components). Activity in 2012 was the design and launch of the program. Activity with data centers in 2013 indicated good acceptance of the program. In 2014, activity was expanded for medium size data rooms and smaller data closets. AEP Ohio recommends that the program continue as described in the Plan.

Bid to Win

The Bid to Win program is a new program with the first auction held in late 2013 and the second auction held in the fall of 2014. This program seeks to introduce a competitive bidding approach to EE/PDR and lower the cost of energy efficiency incentives while also fitting customers' timing for capital improvement projects to improve opportunities for customers to include energy efficient options in those projects. It was expected that initial results would be lower than originally planned in 2014. With this type of program, there can be a significant delay between the auction and actual project completions. Significant improvements in results are expected in 2015 as projects from the 2013 and 2014 auctions are completed. AEP Ohio recommends that the program continue as described in the Plan.

SUPPORTING AFFIDAVIT

AFFIDAVIT OF JON F. WILLIAMS

State of Ohio :
: ss
County of Franklin :

Jon F. Williams, being first duly cautioned and sworn, states as follows:

1. I am the Manager of Energy Efficiency and Peak Demand Reduction for AEP Ohio.
2. I am responsible for the design, development and implementation of customer programs relating to Energy Efficiency (EE) and Peak Demand Reduction (PDR) for AEP Ohio, including overseeing compliance with the EE/PDR mandates of Amended Substitute Senate Bill 221 (S.B. 221) and the rules adopted by the Public Utilities Commission of Ohio (Commission) for inclusion in Ohio Administrative Code Chapter 4901:1-39 (Green Rules).
3. Based on my understanding of S.B. 221 and the Commission's Green Rules, AEP Ohio's energy baseline to be used for the 2014 reporting year is 43,178.7 GWh.
4. Based on my understanding of S.B. 221 and the Commission's Green Rules, AEP Ohio's 1.00% EE benchmark for the 2014 reporting year is 431.8 GWh.
5. Based on my understanding of S.B. 221 and the Commission's Green Rules, AEP Ohio complied with the EE benchmark for the 2014 reporting year.
6. Based on my understanding of S.B. 221 and the Commission's Green Rules, AEP Ohio's demand baseline to be used for the 2014 reporting year is 8,954.6 MW.
7. Based on my understanding of S.B. 221 and the Commission's Green Rules, AEP Ohio's 4.75% PDR benchmark for the 2014 reporting year is 425.3 MW. On that basis, AEP Ohio could achieve compliance for 2014 by either implementing

programs (including programs offered through a tariff) designed to achieve a peak demand reduction of 425.3 MW in 2014 or if peak demand is less than 8,529.3 MW (*i.e.,* 8,954.6 MW less 425.3 MW).

8. Based on my understanding of S.B. 221 and the Commission's Green Rules, AEP Ohio complied with the PDR benchmark for the 2014 reporting year.

FURTHER AFFIANT SAYETH NAUGHT.

Jon F. Williams

Sworn to before me and subscribed in my presence this 13 day of May, 2015.

Notary Public

NOTARIAL SEAL
STATE OF OHIO

MICHELLE L KISHA
NOTARY PUBLIC - OHIO
MY COMMISSION EXPIRES 1-21-2018

TABLE OF APPENDICES

A. Detailed Measures Installed by Program
B. Efficient Products Program Evaluation Report
C. Appliance Recycling Program Evaluation Report
D. *e³smart*SM Program Evaluation Report
E. In-Home Energy Program Evaluation Report

APPENDIX A

APPENDIX A -- Ohio Savings Terms FINAL **12/31/2014**

Program	Measure	Participation Count	Ex Ante Per unit kWh impact	Ex Ante Per unit kW impact	Gross Ex Ante kWh Savings	Gross Ex Ante kW Savings	Source Document
Efficient Products	Specialty Exterior LED 2 Watt	333	7	0.0009	8,525	0.0	Based on Draft Ohio 2010 Technical Reference Manual - Page 11
	Specialty Compact Fluorescent Lamp 7 Watt	6,730	25	0.0030	146,560	17.5	Based on Draft Ohio 2010 Technical Reference Manual - Page 11
	Specialty Compact Fluorescent Lamp 9 Watt	18,293	33	0.0039	512,190	61.2	Based on Draft Ohio 2010 Technical Reference Manual - Page 11
	Specialty Compact Fluorescent Lamp 11 Watt	10,502	40	0.0048	359,392	43.0	Based on Draft Ohio 2010 Technical Reference Manual - Page 11
	Specialty Compact Fluorescent Lamp 12 Watt	848	43	0.0052	31,658	3.8	Based on Draft Ohio 2010 Technical Reference Manual - Page 11
	Specialty Compact Fluorescent Lamp 13 Watt	5,072	47	0.0056	205,128	24.5	Based on Draft Ohio 2010 Technical Reference Manual - Page 11
	Specialty Compact Fluorescent Lamp 14 Watt	74,884	51	0.0061	3,261,523	390.0	Based on Draft Ohio 2010 Technical Reference Manual - Page 11
	Specialty Compact Fluorescent Lamp 15 Watt	98,404	54	0.0065	4,592,058	549.1	Based on Draft Ohio 2010 Technical Reference Manual - Page 11
	Specialty Compact Fluorescent Lamp 16 Watt	6,000	58	0.0069	298,658	35.7	Based on Draft Ohio 2010 Technical Reference Manual - Page 11
	Specialty Compact Fluorescent Lamp 18 Watt	330	65	0.0078	18,479	2.2	Based on Draft Ohio 2010 Technical Reference Manual - Page 11
	Specialty Compact Fluorescent Lamp 19 Watt	1,914	69	0.0082	113,135	13.5	Based on Draft Ohio 2010 Technical Reference Manual - Page 11
	Specialty Compact Fluorescent Lamp 20 Watt	126	72	0.0087	7,840	0.9	Based on Draft Ohio 2010 Technical Reference Manual - Page 11
	Specialty Compact Fluorescent Lamp 23 Watt	9,225	83	0.0099	660,081	78.9	Based on Draft Ohio 2010 Technical Reference Manual - Page 11
	Specialty Compact Fluorescent Lamp 25 Watt	210	90	0.0108	16,333	2.0	Based on Draft Ohio 2010 Technical Reference Manual - Page 11
	Specialty Compact Fluorescent Lamp 26 Watt	9,048	94	0.0112	731,862	87.5	Based on Draft Ohio 2010 Technical Reference Manual - Page 11
	Specialty Compact Fluorescent Lamp 27 Watt	34	98	0.0117	2,856	0.3	Based on Draft Ohio 2010 Technical Reference Manual - Page 11
	Specialty Compact Fluorescent Lamp 28 Watt	124	101	0.0121	10,801	1.3	Based on Draft Ohio 2010 Technical Reference Manual - Page 11
	Specialty Compact Fluorescent Lamp 29 Watt	347	105	0.0125	31,306	3.7	Based on Draft Ohio 2010 Technical Reference Manual - Page 11
	Specialty Compact Fluorescent Lamp 32 Watt	4,256	116	0.0138	423,697	50.7	Based on Draft Ohio 2010 Technical Reference Manual - Page 11
	Specialty Compact Fluorescent Lamp 33 Watt	297	119	0.0143	30,491	3.6	Based on Draft Ohio 2010 Technical Reference Manual - Page 11
	Specialty Compact Fluorescent Lamp 42 Watt	890	152	0.0182	116,290	13.9	Based on Draft Ohio 2010 Technical Reference Manual - Page 11
	Specialty Compact Fluorescent Lamp 55 Watt	161	199	0.0238	27,548	3.3	Based on Draft Ohio 2010 Technical Reference Manual - Page 11
	Specialty Compact Fluorescent Lamp 68 Watt	445	246	0.0294	94,140	11.3	Based on Draft Ohio 2010 Technical Reference Manual - Page 11
	Standard Compact Fluorescent Lamp 9 Watt	97,407	33	0.0039	2,727,319	326.1	Based on Draft Ohio 2010 Technical Reference Manual - Page 11
	Standard Compact Fluorescent Lamp 10 Watt	43,875	36	0.0043	1,364,962	163.2	Based on Draft Ohio 2010 Technical Reference Manual - Page 11
	Standard Compact Fluorescent Lamp 11 Watt	269	40	0.0048	9,206	1.1	Based on Draft Ohio 2010 Technical Reference Manual - Page 11
	Standard Compact Fluorescent Lamp 13 Watt	1,916,055	47	0.0056	78,938,720	9,439.4	Based on Draft Ohio 2010 Technical Reference Manual - Page 11
	Standard Compact Fluorescent Lamp 14 Watt	1,034,514	51	0.0061	45,057,566	5,388.0	Based on Draft Ohio 2010 Technical Reference Manual - Page 11
	Standard Compact Fluorescent Lamp 15 Watt	2,063	54	0.0065	96,271	11.5	Based on Draft Ohio 2010 Technical Reference Manual - Page 11
	Standard Compact Fluorescent Lamp 17 Watt	227	38	0.0045	7,388	0.9	Based on Draft Ohio 2010 Technical Reference Manual - Page 11
	Standard Compact Fluorescent Lamp 18 Watt	38,230	40	0.0048	1,317,428	157.5	Based on Draft Ohio 2010 Technical Reference Manual - Page 11
	Standard Compact Fluorescent Lamp 19 Watt	97,241	42	0.0051	3,537,146	423.0	Based on Draft Ohio 2010 Technical Reference Manual - Page 11
	Standard Compact Fluorescent Lamp 20 Watt	64,369	45	0.0053	2,464,658	294.7	Based on Draft Ohio 2010 Technical Reference Manual - Page 11
	Standard Compact Fluorescent Lamp 22 Watt	16	50	0.0060	694	0.1	Based on Draft Ohio 2010 Technical Reference Manual - Page 11
	Standard Compact Fluorescent Lamp 23 Watt	333,578	53	0.0063	15,129,076	1,809.1	Based on Draft Ohio 2010 Technical Reference Manual - Page 11
	Standard Compact Fluorescent Lamp 26 Watt	132,983	60	0.0071	6,817,995	815.3	Based on Draft Ohio 2010 Technical Reference Manual - Page 11
	Standard Compact Fluorescent Lamp 27 Watt	67	62	0.0074	3,567	0.4	Based on Draft Ohio 2010 Technical Reference Manual - Page 11
	Standard Compact Fluorescent Lamp 30 Watt	31	69	0.0082	1,834	0.2	Based on Draft Ohio 2010 Technical Reference Manual - Page 11
	Standard Compact Fluorescent Lamp 32 Watt	2	73	0.0088	126	0.0	Based on Draft Ohio 2010 Technical Reference Manual - Page 11
	Standard Compact Fluorescent Lamp 40 Watt	98	92	0.0110	7,730	0.9	Based on Draft Ohio 2010 Technical Reference Manual - Page 11
	Standard Compact Fluorescent Lamp 42 Watt	851	96	0.0115	70,480	8.4	Based on Draft Ohio 2010 Technical Reference Manual - Page 11
	Standard Compact Fluorescent Lamp 55 Watt	582	126	0.0151	63,121	7.5	Based on Draft Ohio 2010 Technical Reference Manual - Page 11
	Specialty LED 2 Watt	3,371	26	0.0031	86,299	10.3	Based on Draft Ohio 2010 Technical Reference Manual - Page 11
	Specialty LED 4 Watt	2,586	40	0.0048	103,622	12.4	Based on Draft Ohio 2010 Technical Reference Manual - Page 11
	Specialty LED 5 Watt	31,341	39	0.0047	1,220,963	146.0	Based on Draft Ohio 2010 Technical Reference Manual - Page 11
	Specialty LED 7 Watt	530	59	0.0071	31,266	3.7	Based on Draft Ohio 2010 Technical Reference Manual - Page 11
	Specialty LED 8 Watt	73,256	58	0.0069	4,240,021	507.0	Based on Draft Ohio 2010 Technical Reference Manual - Page 11
	Specialty LED 9 Watt	571	73	0.0088	41,947	5.0	Based on Draft Ohio 2010 Technical Reference Manual - Page 11
	Specialty LED 10 Watt	28,133	72	0.0087	2,035,405	243.4	Based on Draft Ohio 2010 Technical Reference Manual - Page 11
	Specialty LED 11 Watt	3,188	71	0.0085	227,101	27.2	Based on Draft Ohio 2010 Technical Reference Manual - Page 11
	Specialty LED 12 Watt	17,232	98	0.0117	1,687,873	201.8	Based on Draft Ohio 2010 Technical Reference Manual - Page 11
	Specialty LED 13 Watt	36,323	97	0.0116	3,517,406	420.6	Based on Draft Ohio 2010 Technical Reference Manual - Page 11
	Specialty LED 14 Watt	335	96	0.0114	32,067	3.8	Based on Draft Ohio 2010 Technical Reference Manual - Page 11

Program	Measure	Participation Count	Ex Ante Per unit kWh impact	Ex Ante Per unit kW impact	Gross Ex Ante kWh Savings	Gross Ex Ante kW Savings	Source Document
Efficient Products	Specialty LED 15 Watt	2,377	95	0.0113	224,890	26.9	Based on Draft Ohio 2010 Technical Reference Manual - Page 11
	Specialty LED 16 Watt	1,040	93	0.0112	97,238	11.6	Based on Draft Ohio 2010 Technical Reference Manual - Page 11
	Specialty LED 17 Watt	2,780	92	0.0110	256,829	30.7	Based on Draft Ohio 2010 Technical Reference Manual - Page 11
	Specialty LED 18 Watt	6,619	91	0.0109	604,126	72.2	Based on Draft Ohio 2010 Technical Reference Manual - Page 11
	Specialty LED 19 Watt	3,980	90	0.0108	358,831	42.9	Based on Draft Ohio 2010 Technical Reference Manual - Page 11
	Specialty LED 20 Watt	4,655	89	0.0106	414,506	49.6	Based on Draft Ohio 2010 Technical Reference Manual - Page 11
	Specialty LED 23 Watt	730	141	0.0169	103,192	12.3	Based on Draft Ohio 2010 Technical Reference Manual - Page 11
	Standard LED 6 Watt	9,264	60	0.0072	556,819	66.6	Based on Draft Ohio 2010 Technical Reference Manual - Page 11
	Standard LED 7 Watt	1,644	59	0.0071	96,984	11.6	Based on Draft Ohio 2010 Technical Reference Manual - Page 11
	Standard LED 8 Watt	21,189	58	0.0069	1,226,409	146.7	Based on Draft Ohio 2010 Technical Reference Manual - Page 11
	Standard LED 9 Watt	10,759	49	0.0059	526,922	63.0	Based on Draft Ohio 2010 Technical Reference Manual - Page 11
	Standard LED 10 Watt	164,380	48	0.0057	7,867,540	940.8	Based on Draft Ohio 2010 Technical Reference Manual - Page 11
	Standard LED 11 Watt	22,116	47	0.0056	1,033,897	123.6	Based on Draft Ohio 2010 Technical Reference Manual - Page 11
	Standard LED 12 Watt	23,980	67	0.0080	1,601,482	191.5	Based on Draft Ohio 2010 Technical Reference Manual - Page 11
	Standard LED 13 Watt	10,447	66	0.0079	686,065	82.0	Based on Draft Ohio 2010 Technical Reference Manual - Page 11
	Standard LED 14 Watt	33,124	65	0.0077	2,138,416	255.7	Based on Draft Ohio 2010 Technical Reference Manual - Page 11
	Standard LED 15 Watt	366	63	0.0076	23,221	2.8	Based on Draft Ohio 2010 Technical Reference Manual - Page 11
	Standard LED 16 Watt	301	62	0.0075	18,762	2.2	Based on Draft Ohio 2010 Technical Reference Manual - Page 11
	Standard LED 17 Watt	155	61	0.0073	9,489	1.1	Based on Draft Ohio 2010 Technical Reference Manual - Page 11
	Standard LED 19 Watt	695	59	0.0071	41,000	4.9	Based on Draft Ohio 2010 Technical Reference Manual - Page 11
	Standard LED 20 Watt	36	58	0.0069	2,084	0.2	Based on Draft Ohio 2010 Technical Reference Manual - Page 11
	Standard LED 23 Watt	343	141	0.0169	48,486	5.8	Based on Draft Ohio 2010 Technical Reference Manual - Page 11
	Standard LED 24 Watt	816	140	0.0168	114,441	13.7	Based on Draft Ohio 2010 Technical Reference Manual - Page 11
	Standard LED 38 Watt	9,028	125	0.0149	1,125,463	134.6	Based on Draft Ohio 2010 Technical Reference Manual - Page 11
	Clothes Washer Tier 1/2	2,370	202	0.0284	478,538	67.3	Draft Ohio 2010 Technical Reference Manual - Page 59
	Clothes Washer Tier 3	15,120	233	0.0328	3,521,096	495.2	Draft Ohio 2010 Technical Reference Manual - Page 59
	Dehumidifier > 25 to ≤35 Pints/Day	481	117	0.0270	56,277	13.0	Draft Ohio 2010 Technical Reference Manual - Page 64
	Dehumidifier > 54 to ≤ 75 Pints/Day	2,714	185	0.0420	501,905	113.9	Draft Ohio 2010 Technical Reference Manual - Page 64
	Dehumidifier > 35 to ≤45 Pints/Day	781	213	0.0480	166,353	37.5	Draft Ohio 2010 Technical Reference Manual - Page 64
	Dehumidifier > 45 to ≤ 54 Pints/Day	1,698	297	0.0680	504,306	115.5	Draft Ohio 2010 Technical Reference Manual - Page 64
	Dehumidifier > 75 to ≤ 185 Pints/Day	2	374	0.0850	748	0.2	Draft Ohio 2010 Technical Reference Manual - Page 64
	Energy Star Freezer	1,971	67	0.0076	131,990	15.1	Energy Star website
	Refrigerator - Energy Star Top Freezer	906	100	0.0180	90,500	16.3	Draft Ohio 2010 Technical Reference Manual - Page 53
	Refrigerator - Energy Star Bottom Freezer	964	119	0.0210	114,716	20.2	Draft Ohio 2010 Technical Reference Manual - Page 53
	Refrigerator - CEE Tier 2 Top Freezer	3,878	124	0.0220	480,376	85.2	Draft Ohio 2010 Technical Reference Manual - Page 53
	Refrigerator - Energy Star Side by Side	109	142	0.0250	15,478	2.7	Draft Ohio 2010 Technical Reference Manual - Page 53
	Refrigerator - CEE Tier 2 Bottom Freezer	6,832	149	0.0260	1,017,521	177.6	Draft Ohio 2010 Technical Reference Manual - Page 53
	Refrigerator - CEE Tier 2 Side by Side	3,957	177	0.0310	700,035	122.6	Draft Ohio 2010 Technical Reference Manual - Page 53
	Heat Pump Water Heater - Heat Pump/Electric Heat	200	746	0.1020	148,547	20.3	Based Ohio 2010 Technical Reference Manual - Page 86
	Heat Pump Water Heater - Gas Heat	220	2,076	0.2800	456,720	61.6	Draft Ohio 2010 Technical Reference Manual - Page 86
	Electric Water Heater	15	182	0.0139	2,736	0.2	2012 to 2014 Plan - Exhibit B, Page 190
	TV	4,026	102	0.0281	410,346	113.0	2012 to 2014 Plan - Exhibit B, Page 189
	TOTAL				**210,515,086**	**25,597.5**	

APPENDIX A -- Ohio Savings Terms FINAL 12/31/2014

Program	Measure	Participation Count	Ex Ante Per unit kWh impact	Ex Ante Per unit kW impact	Gross Ex Ante kWh Savings	Gross Ex Ante kW Savings	Source Document
Appliance Recycling	Freezer	3,274	1,244	0.2000	4,074,166	654.8	Draft Ohio 2010 Technical Reference Manual - Page 23
	Refrigerator	14,460	1,376	0.2200	19,899,129	3,181.2	Draft Ohio 2010 Technical Reference Manual - Page 23
	TOTAL				**23,973,295**	**3,836.0**	
In Home Retrofit[1]	Direct Install Programmable Thermostat	69	142	0.0000	9,785	0.0	2012 to 2014 Plan - Exhibit B, Page 190
	Heat Pump Thermostat	389	526	0.0000	204,652	0.0	2012 to 2014 Plan - Exhibit B, Page 190
	Programmable Thermostat	891	135	0.0000	120,454	0.0	2012 to 2014 Plan - Exhibit B, Page 190
	Energy Star Air Source Heat Pump	406	894	0.1795	363,053	72.9	Draft Ohio 2010 Technical Reference Manual - Page 33
	Gas Furnace and CAC to AS Heat Pump	2	732	0.5068	1,464	1.0	Draft Ohio 2010 Technical Reference Manual - Page 33
	Air Source Heat Pump to Energy Star CAC	15	211	0.1672	3,173	2.8	Draft Ohio 2010 Technical Reference Manual - Page 30
	Energy Star AC Replacement	1,002	232	0.1947	231,859	194.7	Draft Ohio 2010 Technical Reference Manual - Page 30
	Ductless Mini Splits (Ductless Heat Pumps)	9	1,222	0.1799	11,079	1.7	Draft Ohio 2010 Technical Reference Manual - Page 33
	GS ENERGY STAR Heat Pump	2	4,918	0.4382	9,836	0.9	Draft Ohio 2010 Technical Reference Manual - Page 82
	Furnace with ECM Motor or ECM Motor Replacement	908	113	0.0321	101,711	29.0	2012 to 2014 Plan - Exhibit B, Page 190
	Duct Sealing	12	720	0.0159	8,642	0.2	Draft Ohio 2010 Technical Reference Manual - Page 108
	RCA Tune up	14	258	0.0320	3,199	0.4	Draft Ohio 2010 Technical Reference Manual - Page 26
	Faucet Aerator	12,125	22	0.0028	253,364	31.6	Draft Ohio 2010 Technical Reference Manual - Page 89
	Shower Heads	6,418	224	0.0286	1,443,900	184.7	Draft Ohio 2010 Technical Reference Manual - Page 89
	Electric DHW Tank Replacement	3	103	0.0085	309	0.0	http://energy.gov/eere/buildings/residential-buildings-integration
	Direct Install Pipe Insulation	2,052	114	0.0130	233,842	26.7	Draft Ohio 2010 Technical Reference Manual - Page 97
	PIN Based CFL Fixture (Outdoor)	89	38	0.0046	3,393	0.4	Based on Draft Ohio 2010 Technical Reference Manual - Page 11
	CFL Torchieres	1	43	0.0051	43	0.0	Based on Draft Ohio 2010 Technical Reference Manual - Page 11
	Direct Install CFL 13W	113,078	47	0.0056	4,307,362	515.1	Based on Draft Ohio 2010 Technical Reference Manual - Page 11
	Direct Install CFL 14W Globe	9,606	51	0.0061	394,058	47.1	Based on Draft Ohio 2010 Technical Reference Manual - Page 11
	Direct Install CFL 20W	8,525	45	0.0053	307,440	36.8	Based on Draft Ohio 2010 Technical Reference Manual - Page 11
	Direct Install CFL 23W	9,928	53	0.0063	424,095	50.7	Based on Draft Ohio 2010 Technical Reference Manual - Page 11
	Direct Install CFL 9W Globe	33,658	33	0.0039	887,607	106.1	Based on Draft Ohio 2010 Technical Reference Manual - Page 11
	PIN Based CFL Fixture (Indoor)	198	38	0.0045	7,516	0.9	Based on Draft Ohio 2010 Technical Reference Manual - Page 11
	Direct Install LED Night Light	17,949	21	0.0024	378,271	43.2	Based on 2012 Navigant Evaluation Result
	Energy Star Ceiling Fan	53	167	0.0190	8,851	1.0	Draft Ohio 2010 Technical Reference Manual - Page 48
	Air Sealing	288	253	0.0106	81,637	2.8	Draft Ohio 2010 Technical Reference Manual - Page 104
	Draft Stoppers	31,896	2	0.0021	53,160	66.5	2012 to 2014 Plan - Exhibit B, Page 190
	Energy Star Window Replacement	97	76	0.0128	7,372	1	Draft Ohio 2010 Technical Reference Manual - Page 115
	Weatherstripping	2,658	15	0.0280	39,870	74.4	2012 to 2014 Plan - Exhibit B, Page 190
	Attic Insulation	416	207	0.0082	87,872	3.4	Draft Ohio 2010 Technical Reference Manual - Page 36
	Floor Insulation	10	748	0.0219	7,475	0.2	Based on Draft Ohio 2010 Technical Reference Manual - Page 36
	Wall Insulation	98	173	0.0172	19,244	1.2	Draft Ohio 2010 Technical Reference Manual - Page 100
	TOTAL				**10,015,588**	**1,498**	

[1] Due to insufficient data, some measures were excluded from this program and not claimed as savings.

APPENDIX A -- Ohio Savings Terms FINAL **12/31/2014**

Program	Measure	Participation Count	Ex Ante Per unit kWh impact	Ex Ante Per unit kW impact	Gross Ex Ante kWh Savings	Gross Ex Ante kW Savings	Source Document
Efficiency Crafted New Homes	Energy Star Home	1,723	2,214.3	0.6	**3,815,325**	**998.4**	Residential Energy Modeling
E3Smart	HW Temp Setback	1,711	132.0	0.0	225,852	0.0	Standard Engineering Calculation
	Bathroom Faucet Aerator	2,820	42.0	0.0	118,440	14.8	Draft Ohio 2010 Technical Reference Manual - Page 89
	Kitchen Faucet Aerator	2,749	24.5	0.0	67,351	8.4	Draft Ohio 2010 Technical Reference Manual - Page 89
	Low Flow Showerhead	3,455	237.0	0.0	818,870	104.8	Draft Ohio 2010 Technical Reference Manual - Page 93
	13 Watt CFL Replacing 40W	4,753	30.1	0.0	142,841	17.1	Based on Draft Ohio 2010 Technical Reference Manual - Page 11
	13 Watt CFL Replacing 75W	1,786	44.5	0.0	79,518	9.5	Based on Draft Ohio 2010 Technical Reference Manual - Page 11
	13 Watt CFL Replacing 60W	10,037	52.3	0.0	525,077	62.8	Based on Draft Ohio 2010 Technical Reference Manual - Page 11
	13 Watt CFL Replacing 100W	905	65.7	0.0	59,432	7.1	Based on Draft Ohio 2010 Technical Reference Manual - Page 11
	23 Watt CFL Replacing 40W	4,060	18.9	0.0	76,824	9.2	Based on Draft Ohio 2010 Technical Reference Manual - Page 11
	23 Watt CFL Replacing 75W	3,204	33.4	0.0	106,988	12.8	Based on Draft Ohio 2010 Technical Reference Manual - Page 11
	23 Watt CFL Replacing 60W	9,362	41.2	0.0	385,560	46.1	Based on Draft Ohio 2010 Technical Reference Manual - Page 11
	23 Watt CFL Replacing 100W	5,995	54.5	0.0	326,969	39.1	Based on Draft Ohio 2010 Technical Reference Manual - Page 11
	LED Night Light	5,494	20.6	0.0	113,121	0.0	Based on 2013 Navigant Evaluation Result
	Door Sweep	8,192	70.4	0.0	576,881	100.3	Based on 2013 Navigant Evaluation Result
	Weather Stripping	7,547	11.1	0.0	83,772	10.4	Based on 2013 Navigant Evaluation Result
	Allocated Kits[2]	6,496	97.0	0.0	630,336	75.1	Calculation based on Program Year data
	TOTAL				**4,337,831**	**517.5**	
Behavioral[3]	Behavioral	393,549	160.6	0.0	**63,203,178**	**8,216.7**	Proprietary Regression Model
Low Income[3]	Retirement of additional freezer	13	1,244.0	0.2	16,172	2.6	Draft Ohio 2010 Technical Reference Manual - Page 23
	Retirement of additional refrigerator	23	1,376.0	0.2	31,648	4.7	Draft Ohio 2010 Technical Reference Manual - Page 23
	Efficient Freezer replacement	1,602	1,045.0	0.0	1,674,090	28.5	Underlying Draft Ohio 2010 Technical Reference Manual - Page 23
	Efficient Refrigerator replacement	6,670	976.0	0.1	6,509,920	433.6	Underlying Draft Ohio 2010 Technical Reference Manual - Page 23
	Miscellaneous approved Health/Safety items	14	0.0	0.0	0	0.0	Health and Safety - No savings acquired
	Misc time/material for electrical work	2	0.0	0.0	0	0.0	Health and Safety - No savings acquired
	Upgrade service entrance 100 to 200 amp	1	0.0	0.0	0	0.0	Health and Safety - No savings acquired
	Air Source Heat Pump	20	215.4	0.1	4,308	2.3	Draft Ohio 2010 Technical Reference Manual - Page 33
	Remove 1500w space heater	8	1,435.4	0.0	11,483	0.0	Based on Draft Ohio 2010 Technical Reference Manual - Page 33
	Duct Sealing per CFM reduction - Central Air Conditioning[4]	869	0.4	0.0	335	0.3	Draft Ohio 2010 Technical Reference Manual - Page 108
	Duct Sealing per CFM reduction - Heat Pump w/Gas Backup[4]	205	2.5	0.0	511	0.1	Draft Ohio 2010 Technical Reference Manual - Page 108
	Duct Sealing per CFM reduction - Electric Heat No AC[4]	909	3.4	0.0	3,086	0.0	Draft Ohio 2010 Technical Reference Manual - Page 108
	Duct Sealing per CFM reduction - Electric Heat w/AC[4]	6,177	3.8	0.0	23,352	2.2	Draft Ohio 2010 Technical Reference Manual - Page 108
	Duct Sealing per CFM reduction - Heat Pump w/Electric Heat[4]	471	5.9	0.0	2,773	0.2	Draft Ohio 2010 Technical Reference Manual - Page 108
	DHW Temp Setback[5]	(8)	146.0	0.0	(1,168)	0.0	Based on 2012 Navigant Evaluation Result
	Faucet Aerator	3,440	24.5	0.0	84,280	10.5	Draft Ohio 2010 Technical Reference Manual - Page 89
	Low flow showerhead	2,525	51.3	0.0	129,533	60.0	Draft Ohio 2010 Technical Reference Manual - Page 89
	Replace electric water heater	60	352.3	0.0	20,433	0.8	http://energy.gov/eere/buildings/residential-buildings-integration
	Water Pipe Insulation	4,625	16.7	0.0	77,145	8.8	Draft Ohio 2010 Technical Reference Manual - Page 97
	HW Tank Wrap	256	79.0	0.0	20,224	2.3	Draft Ohio 2010 Technical Reference Manual - Page 131
	CFL (100 watt replacement) outdoor	758	52.7	0.0	32,374	3.9	Based on Draft Ohio 2010 Technical Reference Manual - Page 11
	CFL (60 watt replacement) outdoor	3,890	47.0	0.0	148,131	16.6	Based on Draft Ohio 2010 Technical Reference Manual - Page 11

APPENDIX A -- Ohio Savings Terms FINAL **12/31/2014**

Program	Measure	Participation Count	Ex Ante Per unit kWh impact	Ex Ante Per unit kW impact	Gross Ex Ante kWh Savings	Gross Ex Ante kW Savings	Source Document
Low Income[3]	CFL (75 watt replacement) outdoor	3,447	36.7	0.0	102,410	21.8	Based on Draft Ohio 2010 Technical Reference Manual - Page 11
	CFL (75w floodlight replacement) outdoor	1,484	65.1	0.0	49,595	8.8	Based on Draft Ohio 2010 Technical Reference Manual - Page 11
	CFL (100 watt replacement) indoor	12,967	45.8	0.0	481,594	72.1	Based on Draft Ohio 2010 Technical Reference Manual - Page 11
	CFL (3-way 150w max. replacement) indoor	3,000	52.7	0.0	128,130	21.1	Based on Draft Ohio 2010 Technical Reference Manual - Page 11
	CFL (40w candelabra replacement) indoor	10,144	20.0	0.0	164,536	28.5	Based on Draft Ohio 2010 Technical Reference Manual - Page 11
	CFL (60 watt replacement) indoor	105,857	47.0	0.0	4,031,035	483.0	Based on Draft Ohio 2010 Technical Reference Manual - Page 11
	CFL (75 watt replacement) indoor	21,948	36.7	0.0	652,075	138.7	Based on Draft Ohio 2010 Technical Reference Manual - Page 11
	Smart Strips	5,274	82.0	0.0	432,468	0.0	2014 to 2014 Plan - Exhibit B, Page 190
	Shell Air Sealing per CFM reduction - Central Air Conditioning[4]	60,988	0.0	0.0	815	0.7	Draft Ohio 2010 Technical Reference Manual - Page 104
	Shell Air Sealing per CFM reduction - Heat Pump No AC[4]	897	1.1	0.0	974	0.0	Draft Ohio 2010 Technical Reference Manual - Page 104
	Shell Air Sealing per CFM reduction - Heat Pump w/AC[4]	19,836	1.1	0.0	21,799	0.2	Draft Ohio 2010 Technical Reference Manual - Page 104
	Shell Air Sealing per CFM reduction - Electric Heat No AC[4]	14,178	1.7	0.0	24,810	0.0	Draft Ohio 2010 Technical Reference Manual - Page 104
	Shell Air Sealing per CFM reduction - Electric Heat w/AC[4]	122,537	1.8	0.0	216,066	1.5	Draft Ohio 2010 Technical Reference Manual - Page 104
	Attic Insulation (R-5 -> R-38) - Central Air Conditioning[4]	19,510	0.1	0.0	1,480	1.3	Draft Ohio 2010 Technical Reference Manual - Page 36
	Attic Insulation (R-5 -> R-38) - Heat Pump w/AC[4]	4,395	3.2	0.0	13,991	0.3	Draft Ohio 2010 Technical Reference Manual - Page 36
	Attic Insulation (R-5 -> R-38) - Electric Heat No AC[4]	1,460	5.0	0.0	7,313	0.0	Draft Ohio 2010 Technical Reference Manual - Page 36
	Attic Insulation (R-5 -> R-38) - Electric Heat w/AC[4]	13,705	5.1	0.0	69,691	0.9	Draft Ohio 2010 Technical Reference Manual - Page 36
	Attic Insulation (R-11 -> R-38) - Central Air Conditioning[4]	29,265	0.0	0.0	825	0.7	Draft Ohio 2010 Technical Reference Manual - Page 36
	Attic Insulation (R-11 -> R-38) - Heat Pump No AC[4]	896	1.2	0.0	1,036	0.0	Draft Ohio 2010 Technical Reference Manual - Page 36
	Attic Insulation (R-11 -> R-38) - Heat Pump w/AC[4]	5,435	1.2	0.0	6,435	0.1	Draft Ohio 2010 Technical Reference Manual - Page 36
	Attic Insulation (R-11 -> R-38) - Electric Heat No AC[4]	2,776	1.9	0.0	5,172	0.0	Draft Ohio 2010 Technical Reference Manual - Page 36
	Attic Insulation (R-11 -> R-38) - Electric Heat w/AC[4]	46,947	1.9	0.0	88,784	1.2	Draft Ohio 2010 Technical Reference Manual - Page 36
	Attic Insulation (R-19 -> R-38) - Central Air Conditioning[4]	21,496	0.0	0.0	247	0.2	Draft Ohio 2010 Technical Reference Manual - Page 36
	Attic Insulation (R-19 -> R-38) - Heat Pump w/AC[4]	2,667	0.5	0.0	1,286	0.0	Draft Ohio 2010 Technical Reference Manual - Page 36
	Attic Insulation (R-19 -> R-38) - Electric Heat No AC[4]	4,844	0.8	0.0	3,676	0.0	Draft Ohio 2010 Technical Reference Manual - Page 36
	Attic Insulation (R-19 -> R-38) - Electric Heat w/AC[4]	28,999	0.8	0.0	22,343	0.3	Draft Ohio 2010 Technical Reference Manual - Page 36
	Attic Insulation (R-19 -> R-38) - Heat Pump w/AC & Electric He	950	1.2	0.0	1,179	0.0	Draft Ohio 2010 Technical Reference Manual - Page 36
	Attic Insulation (R-28 -> R-38) - Central Air Conditioning[4]	3,572	0.0	0.0	15	0.0	Draft Ohio 2010 Technical Reference Manual - Page 36
	Attic Insulation (R-28 -> R-38) - Heat Pump w/AC[4]	945	0.2	0.0	163	0.0	Draft Ohio 2010 Technical Reference Manual - Page 36
	Attic Insulation (R-28 -> R-38) - Electric Heat w/AC[4]	2,140	0.3	0.0	589	0.0	Draft Ohio 2010 Technical Reference Manual - Page 36
	Install R-11 Foundation wall insulation - Central Air Conditionin	651	0.1	0.0	39	0.0	Based on Draft Ohio 2010 Technical Reference Manual - Page 36
	Install R-11 Foundation wall insulation - Electric Heat w/AC[4]	329	4.0	0.0	1,324	0.0	Based on Draft Ohio 2010 Technical Reference Manual - Page 36
	Install R-11 Foundation wall insulation - Electric Heat No AC[4]	1,488	4.0	0.0	5,901	0.0	Based on Draft Ohio 2010 Technical Reference Manual - Page 36
	Insulate band joist to R-11 - Central Air Conditioning[4]	5,881	0.1	0.0	353	0.3	Based on Draft Ohio 2010 Technical Reference Manual - Page 36
	Insulate band joist to R-11 - Heat Pump w/AC[4]	337	2.5	0.0	849	0.0	Based on Draft Ohio 2010 Technical Reference Manual - Page 36
	Insulate band joist to R-11 - Electric Heat No AC[4]	2,136	4.0	0.0	8,471	0.0	Based on Draft Ohio 2010 Technical Reference Manual - Page 36
	Insulate band joist to R-11 - Electric Heat w/AC[4]	1,391	4.0	0.0	5,600	0.1	Based on Draft Ohio 2010 Technical Reference Manual - Page 36
	Mobile Home Rigid Window - Central Air Conditioning[4]	28	0.2	0.0	6	0.0	Draft Ohio 2010 Technical Reference Manual - Page 126
	Mobile Home Rigid Window - Electric Heat No AC[4]	28	15.0	0.0	420	0.0	Draft Ohio 2010 Technical Reference Manual - Page 126
	Mobile Home Rigid Window - Electric Heat w/AC[4]	84	15.2	0.0	1,275	0.0	Draft Ohio 2010 Technical Reference Manual - Page 126
	R11 Mobile home sidewall FG batts - Central Air Conditioning[4]	198	0.1	0.0	12	0.0	Draft Ohio 2010 Technical Reference Manual - Page 126
	R11 Mobile home sidewall FG batts - Electric Heat w/AC[4]	1,017	4.0	0.0	4,094	0.1	Draft Ohio 2010 Technical Reference Manual - Page 126

APPENDIX A -- Ohio Savings Terms FINAL **12/31/2014**

Program	Measure	Participation Count	Ex Ante Per unit kWh impact	Ex Ante Per unit kW impact	Gross Ex Ante kWh Savings	Gross Ex Ante kW Savings	Source Document
Low Income[3]	R15 Mobile Home blown FG 4` - Central Air Conditioning[4]	4,016	0.1	0.0	234	0.2	Draft Ohio 2010 Technical Reference Manual - Page 126
	R15 Mobile Home blown FG 4` - Heat Pump w/AC[4]	210	2.4	0.0	513	0.0	Draft Ohio 2010 Technical Reference Manual - Page 126
	R15 Mobile Home blown FG 4` - Electric Heat No AC[4]	1,711	3.8	0.0	6,580	0.0	Draft Ohio 2010 Technical Reference Manual - Page 126
	R15 Mobile Home blown FG 4` - Electric Heat w/AC[4]	8,598	3.9	0.0	33,564	0.5	Draft Ohio 2010 Technical Reference Manual - Page 126
	R23 Mobile Home blown FG 6` - Central Air Conditioning[4]	7,772	0.1	0.0	531	0.5	Draft Ohio 2010 Technical Reference Manual - Page 126
	R23 Mobile Home blown FG 6` - Heat Pump w/AC[4]	8,822	2.9	0.0	25,309	0.5	Draft Ohio 2010 Technical Reference Manual - Page 126
	R23 Mobile Home blown FG 6` - Electric Heat No AC[4]	3,930	4.5	0.0	17,741	0.0	Draft Ohio 2010 Technical Reference Manual - Page 126
	R23 Mobile Home blown FG 6` - Electric Heat w/AC[4]	42,488	4.6	0.0	194,705	2.6	Draft Ohio 2010 Technical Reference Manual - Page 126
	R23 Mobile Home blown FG 6` - Heat Pump w/AC & Electric H	1,340	7.4	0.0	9,893	0.1	Draft Ohio 2010 Technical Reference Manual - Page 126
	R30 Mobile home blown FG 8` - Central Air Conditioning[4]	3,690	0.1	0.0	269	0.2	Draft Ohio 2010 Technical Reference Manual - Page 126
	R30 Mobile home blown FG 8` - Heat Pump w/AC[4]	7,889	3.1	0.0	24,099	0.5	Draft Ohio 2010 Technical Reference Manual - Page 126
	R30 Mobile home blown FG 8` - Electric Heat No AC[4]	625	4.8	0.0	3,004	0.0	Draft Ohio 2010 Technical Reference Manual - Page 126
	R30 Mobile home blown FG 8` - Electric Heat w/AC[4]	19,573	4.9	0.0	95,509	1.3	Draft Ohio 2010 Technical Reference Manual - Page 126
	R30 Mobile home blown FG 8` - Heat Pump w/AC & Electric H	1,580	7.9	0.0	12,421	0.1	Draft Ohio 2010 Technical Reference Manual - Page 126
	R38 Mobile Home blown FG 10` - Heat Pump w/AC[4]	1,216	3.2	0.0	3,871	0.1	Draft Ohio 2010 Technical Reference Manual - Page 126
	R38 Mobile Home blown FG 10` - Electric Heat w/AC[4]	7,791	5.1	0.0	39,618	0.5	Draft Ohio 2010 Technical Reference Manual - Page 126
	R38 Mobile Home blown FG 10` - Heat Pump w/AC & Electric	488	8.2	0.0	3,998	0.0	Draft Ohio 2010 Technical Reference Manual - Page 126
	R45 Mobile Home blown FG 12` - Heat Pump w/AC[4]	820	3.3	0.0	2,672	0.1	Draft Ohio 2010 Technical Reference Manual - Page 126
	R45 Mobile Home blown FG 12` - Electric Heat w/AC[4]	980	5.2	0.0	5,101	0.1	Draft Ohio 2010 Technical Reference Manual - Page 126
	R45 Mobile Home blown FG 12` - Heat Pump w/AC & Electric	100	8.4	0.0	839	0.0	Draft Ohio 2010 Technical Reference Manual - Page 126
	Wall insulation- Framed siding(target R11) - Central Air Condit	11,703	0.1	0.0	703	0.6	Draft Ohio 2010 Technical Reference Manual - Page 100
	Wall insulation- Framed siding(target R11) - Heat Pump[4]	1,863	2.5	0.0	4,695	0.1	Draft Ohio 2010 Technical Reference Manual - Page 100
	Wall insulation- Framed siding(target R11) - Electric Heat No /	39	4.0	0.0	155	0.0	Draft Ohio 2010 Technical Reference Manual - Page 100
	Wall insulation- Framed siding(target R11) - Electric Heat w/A(	8,252	4.0	0.0	33,220	0.4	Draft Ohio 2010 Technical Reference Manual - Page 100
	Install R-7 duct insulation - Heat Pump w/CAC[4]	51	2.5	0.0	130	0.0	Underlying Draft Ohio 2010 Technical Reference Manual - Page 36
	Install R-7 duct insulation - Heat Pump w/Electric Heat[4]	12	3.9	0.0	47	0.0	Underlying Draft Ohio 2010 Technical Reference Manual - Page 36
	Install R-7 duct insulation - Central Air Conditioning[4]	186	0.4	0.0	71	0.1	Underlying Draft Ohio 2010 Technical Reference Manual - Page 36
	Install R-7 duct insulation - Electric Heat No AC[4]	13	2.2	0.0	28	0.0	Underlying Draft Ohio 2010 Technical Reference Manual - Page 36
	Install R-7 duct insulation - Heat Pump w/Gas Backup[4]	8	1.7	0.0	14	0.0	Underlying Draft Ohio 2010 Technical Reference Manual - Page 36
	Closable Foundation Vents	67	0.0	0.0	0	0.0	No Savings Acquired
	Install 12` roof vent	89	0.0	0.0	0	0.0	No Savings Acquired
	TOTAL				**15,867,039**	**1,368.1**	

[2] These are kits that have not had returned surveys, so a reduced installation rate was assigned for this units
[3] Due to insufficient data, some measures were excluded from this program and not claimed as savings.
[4] Insulation measures units are square footage installed, Sealing Measures are CFM Reduced.
[5] This measure was eliminated from the program,the value is negative due to credits back to the system.

Program	Measure	Participation Count	Ex Ante Per unit kWh impact	Ex Ante Per unit kW impact	Gross Ex Ante kWh Savings	Gross Ex Ante kW Savings	Source Document
Custom	Corn Oil Extraction	1	4,776,282.0	568.6050	4,776,282	568.6	All Custom Measures are individually calculated using methodology consistent with the Draft Ohio 2010 Technical Reference Manual.
	Corn Oil Extraction	1	5,171,024.2	615.5980	5,171,024	615.6	
	Customer has (3) compressors running off of each units local controller-Install new master system controller and 1060 gallons of additional storage. New controls operate most efficient combo of units based on demand	1	364,017.1	24.9200	364,017	24.9	
	Cycling CA dryer over prescriptive size (800 scfm)	1	7,167.3	0.8110	7,167	0.8	
	Installed 700 cfm cycling air dryer	1	4,769.9	0.5090	4,770	0.5	
	The Plant used 8 compressed air dryers to meet the needs of the compressed air systems. This includes 7 heatless purge dryers and 1 heated purge dryer. The plant will be installing a signle blower purge dryer to manage all 5,000 cfm if compressed air. This reduces losses by not using compressed air to purge the dessicant	1	337,601.0	12.1000	337,601	12.1	
	Comprehensive compressed air system improvement with new piping and re-setting of the controls and valve replacement on the #18 and #19 I-R Centac oil free centrifugal air compressors to allow for achieving full load power and operate more efficiently at part load	1	3,904,644.5	396.2310	3,904,645	396.2	
	Compressed Air System upgrade. New 150 HP VSD, new storage tank, piping, control system, zero loss drains, lower system pressure, fix air leaks, install valves to shut off carousel area when not in use, install nozzles	1	217,804.5	5.5800	217,805	5.6	
	Compressed air system upgrade	1	138,316.9	111.5600	138,317	111.6	
	1997 compressor fixed pressure with new floating	1	30,617.9	10.6900	30,618	10.7	
	Utilization of the PPC 900 cfm air dryer with the AMLOC sensing system to limit the purge air relative to compressed	1	22,271.6	0.0000	22,272	0.0	
	Replacing an existing ammonia compressors with a larger motor that will run less hours due to improved efficiency	1	117,995.9	21.7700	117,996	21.8	
	Replace 1 of 4 250HP load/unload compressors with 200HP VFD compressor	1	186,759.2	3.7000	186,759	3.7	
	Air compressor system upgrade	1	437,189.3	88.0110	437,189	88.0	
	Install Master Controller, 200 HP 2 Stage VSD compressor	1	610,032.6	96.2400	610,033	96.2	
	Multiple compressor system- removing 1 load/unload- replaced with new VFD compressor	1	885,083.0	103.2000	885,083	103.2	
	New trim compresser & optimized controls	1	219,490.8	6.5010	219,491	6.5	
	Compressed air expansion	1	63,828.6	7.2860	63,829	7.3	
	Replace old compressor with a new 200 hp variable speed compressor	1	206,563.8	33.9400	206,564	33.9	

Program	Measure	Participation Count	Ex Ante Per unit kWh impact	Ex Ante Per unit kW impact	Gross Ex Ante kWh Savings	Gross Ex Ante kW Savings	Source Document
Custom	Replaced load/unload compressor with VFD compressor	1	211,927.0	31.8400	211,927	31.8	All Custom Measures are individually calculated using methodology consistent with the Draft Ohio 2010 Technical Reference Manual.
	Low pressure drop filter (800 scfm capactiy)	1	10,680.3	1.2100	10,680	1.2	
	No Loss Condensate Drain	7	931.0	0.2033	6,517	1.4	
	Replacing old fryer with new more efficient equipment	1	2,516.4	0.3000	2,516	0.3	
	Vortex cabinet coolers running wild or improperly controlledVortex cabinet	1	428,980.9	0.0000	428,981	0.0	
	Temperatures are constant, church Sanctuary has one setpoint and two air handlers operating continuously. Nightsetback/Setup for whole building, deadband control and fan staging in Sanctuary per Level II energy audit.	1	92,008.0	14.6800	92,008	14.7	
	VAV box set to heating minimum year round based on electric heating coil requirement. - VAV box set to heating and cooling minimums to greatly reduce minimum airflow during cooling to only ventilation requirement	1	136,512.0	0.0000	136,512	0.0	
	Controls upgrade on the compressors	1	5,851,273.3	1008.5800	5,851,273	1,008.6	
	Heaters	1	152,240.2	5.7400	152,240	5.7	
	20,000 CFM leakage from Air Handlers. VFDs are on AHUs allowing for fan pow	1	340,352.7	41.0900	340,353	41.1	
	install new VFD chilled water pumps and and condenser water pumps. Also did full repiping of the central pump with valves change.	1	817,660.0	48.9400	817,660	48.9	
	VFD Centrifugal Chiller	1	142,948.8	19.6050	142,949	19.6	
	Daylighting controls for parking garage	1	25,754.4	4.9000	25,754	4.9	
	Daylighting controls for parking garage	1	28,072.3	5.3400	28,072	5.3	
	Daylighting controls for parking garage	1	29,654.4	5.6400	29,654	5.6	
	Daylighting controls for parking garage	1	30,132.7	5.7300	30,133	5.7	
	Daylighting controls for parking garage	1	38,116.5	7.2500	38,117	7.3	
	Daylighting controls for parking garage	1	44,040.0	8.3800	44,040	8.4	
	Daylighting controls for parking garage	1	44,812.7	8.5300	44,813	8.5	
	Daylighting controls for parking garage	1	55,887.1	10.6300	55,887	10.6	
	Freezer Lighting and Occ Sensors	1	164,457.7	33.4000	164,458	33.4	
	Replacing cooler room lighting	1	9,027.2	1.5500	9,027	1.6	
	Replacing freezer room lighting	1	68,723.2	11.8000	68,723	11.8	
	Retrofit metal halide with LED in climate control area	1	69,116.4	7.8900	69,116	7.9	
	Motors and Drives	1	291,685.1	70.2200	291,685	70.2	
	(2) 125 HP motors and (1) 150 HP motor are used to grind up scrap material. The motors run full out regardless of the quantity of material needing to be ground up. - Use photoeyes to determine the amount of material being ground up. When the demand is 0, the (2) 125 HP motors will be controlled to reduce their speed, and the (1) 150 HP motor.	1	181,287.3	6.1300	181,287	6.1	
	3 700HP 1 200 HP. Installing Drives on all units along with A	1	6,884,257.4	561.3000	6,884,257	561	

Program	Measure	Participation Count	Ex Ante Per unit kWh impact	Ex Ante Per unit kW impact	Gross Ex Ante kWh Savings	Gross Ex Ante kW Savings	Source Document
Custom	Variable frequency drives will be added to the 500 HP motors so that they can be controlled by the flow of flare gas in the	1	3,135,242.0	259.8400	3,135,242	259.8	All Custom Measures are individually calculated using methodology consistent with the Draft Ohio 2010 Technical Reference Manual.
	VFDs on refrigeration protocol unit scroll compressors.	1	7,460.1	1.1120	7,460	1.1	
	VFDs on refrigeration protocol unit scroll compressors.	1	7,876.3	0.6520	7,876	0.7	
	VFDs on refrigeration protocol unit scroll compressors.	1	15,390.4	1.2730	15,390	1.3	
	VFDs on refrigeration protocol unit scroll compressors.	1	15,390.4	1.2740	15,390	1.3	
	VFDs on refrigeration protocol unit scroll compressors.	1	16,201.7	1.3210	16,202	1.3	
	VFDs on refrigeration protocol unit scroll compressors.	1	19,823.8	1.6400	19,824	1.6	
	VFDs on refrigeration protocol unit scroll compressors.	1	31,143.5	2.5770	31,144	2.6	
	VFDs on refrigeration protocol unit scroll compressors.	1	40,196.1	3.3260	40,196	3.3	
	VFDs on refrigeration protocol unit scroll compressors.	1	41,473.8	3.4310	41,474	3.4	
	VFDs on refrigeration protocol unit scroll compressors.	1	45,650.3	3.7770	45,650	3.8	
	VFDs on refrigeration protocol unit scroll compressors.	1	47,260.4	3.9100	47,260	3.9	
	VFDs on refrigeration protocol unit scroll compressors.	1	51,391.5	4.2520	51,391	4.3	
	VFDs on refrigeration protocol unit scroll compressors.	1	53,266.3	4.4070	53,266	4.4	
	VFDs on refrigeration protocol unit scroll compressors.	1	65,848.5	5.4480	65,849	5.4	
	VFDs on refrigeration protocol unit scroll compressors.	1	66,615.6	5.5110	66,616	5.5	
	VFDs on refrigeration protocol unit scroll compressors.	1	73,802.2	14.8250	73,802	14.8	
	VFDs on refrigeration protocol unit scroll compressors.	2	74,435.7	6.1590	148,871	12.3	
	VFDs on refrigeration protocol unit scroll compressors.	1	119,111.8	9.9260	119,112	9.9	
	VFDs on refrigeration protocol unit scroll compressors.	1	147,969.3	12.2430	147,969	12.2	
	VFDs on refrigeration protocol unit scroll compressors.	1	171,829.4	14.3190	171,829	14.3	
	VFDs on refrigeration protocol unit scroll compressors.	1	176,545.3	14.7120	176,545	14.7	
	VFDs on refrigeration protocol unit scroll compressors.	1	179,576.6	14.8580	179,577	14.9	
	VFDs on refrigeration protocol unit scroll compressors.	1	231,356.8	45.3500	231,357	45.4	
	(10) old welders will be replaced with new ones	1	139,322.5	39.3720	139,322	39.4	
	ARS Upgrade #2	1	278,276.7	0.0000	278,277	0.0	
	Added a servo motor injection molding machine	1	97,778.2	8.3500	97,778	8.4	
	Adding (2) 650-Ton Servo IMM and (2) 850-Ton Servo IMM.	1	596,651.0	132.9300	596,651	132.9	
	Installing Servo Injection Molding Machines 950 ton	1	394,119.1	12.8500	394,119	12.9	
	Installing Servo Injection molding machines 1100 ton	1	169,765.0	18.2460	169,765	18.2	
	MS1800 Milacron hydrauluic molding machine to MGs 1800 servo hydraulic molding machine.	1	737,887.6	54.3600	737,888	54.4	
	None in place with 20 PFA units installed.	1	55,153.7	0.0000	55,154	0.0	
	Replace (1) 500-Ton hydraulic injection molding machine with (1) 500-Ton servo injection molding machine	1	94,732.0	9.8100	94,732	9.8	
	Replacing welders	1	96,726.6	15.2860	96,727	15.3	
	Roaster Process Improvement	1	15,095,227.6	(1092.0010)	15,095,228	(1,092.0)	
	servo molding machine 580 ton and 2600 ton	1	356,835.0	41.6000	356,835	41.6	
	Replacing 250hp 4180V motor with 250hp 480V motor and adding a VFD	1	735,840.0	84.0000	735,840	84.0	

Program	Measure	Participation Count	Ex Ante Per unit kWh impact	Ex Ante Per unit kW impact	Gross Ex Ante kWh Savings	Gross Ex Ante kW Savings	Source Document
Custom	New UV curing system will use 20,060 kWh annually considering last year's hours of 574 at full power and 64 at partial power. Growth in the product line using this equipment.	1	403,737.7	131.7600	403,738	131.8	All Custom Measures are individually calculated using methodology consistent with the Draft Ohio 2010 Technical Reference Manual.
	(1) 150-hp extruder# 16 motor VFD	1	35,670.6	5.2900	35,671	5.3	
	75HP Extruder fitted with VFD	1	25,890.3	3.8700	25,890	3.9	
	Operating a 400HP motor to drive a fan, without the use of a variable frequency drive with Operating a 500HP motor to drive a fan, with the control of a variable frequency drive.	1	732,891.7	83.5100	732,892	83.5	
	Retrofit (1) 100HP modulation and (1) 60HP load/unload compressors with (1)	1	157,074.7	38.4100	157,075	38.4	
	Retrofit constant speed motor with VSD on conveyor belts	1	1,020,365.5	61.5770	1,020,365	61.6	
	To Install VFD's on boiler combustion fans	1	557,600.0	58.2300	557,600	58.2	
	VFD upgrade	1	814,313.7	40.0190	814,314	40.0	
	Ammonia system upgrade- new pre chiller, adding a new 400 hp VSD compressor for trim load conditions, adding new evap condenser	1	193,236.6	14.8400	193,237	14.8	
	Refrigeration - Ammonia System Upgrade	1	736,561.4	84.0800	736,561	84.1	
	Old refrigerated cases were replaced by Hussman Protocol 8 Energy efficient system	1	308,936.0	12.4600	308,936	12.5	
	Replacing chillers with water cooling 75 hp pump with VFD	1	1,366,166.9	234.2300	1,366,167	234.2	
	Air Handling Units ran uncontrolled, relying entirely on chilling system for cooling with Economizer programming was installed so that outside air is used whenever outdoor air temperature is below that of the return air to the AHU.	1	538,635.7	0.0000	538,636	0.0	
	Custom EMS project	1	1,320,961.0	278.7230	1,320,961	278.7	
	Customer had been operating two original vacuum compression presses. With current part load, they would run about 8,100 hours/year each. - with -Customer purchased a new 350 ton vacuum compression press. This can complete the current part load in 7,450 hours.	1	146,480.8	58.6000	146,481	58.6	
	Operating ethanol plant as originally designed and built. While plant was at full production in 2008, it was using 1.28 kWh per gallon produced. - changed to - Operating plant after major modifications are made to maximize the benefit of variable frequecy drives and eliminate bottlenecks to throughput.	1	14,771,310.4	1753.4800	14,771,310	1,753.5	
	Replacing old pneumatic controls with new BAS. Setpoint and setback temperatures are incresed for cooling session. Also, %OA is reduced.	1	91,377.6	0.0000	91,378	0.0	
	New VFD Compressor[5]	250	1,732.3	0.2401	433,075	60.0	Vendor Internal TRM - Compressed Air
	Compressed Air Leak Repair 24hr Operation	189	1,400.0	0.1730	264,600	32.7	Vendor Internal TRM - Compressed Air

APPENDIX A -- Ohio Savings Terms FINAL 12/31/2014

Program	Measure	Participation Count	Ex Ante Per unit kWh impact	Ex Ante Per unit kW impact	Gross Ex Ante kWh Savings	Gross Ex Ante kW Savings	Source Document
Custom	Unitary&Split AC and ASHP (EER)[6]	15	89.2	0.0485	1,338	0.7	Vendor Internal TRM - Cooling
	VFD Chilled Water Pump[5]	30	187.0	0.1320	5,610	4.0	Vendor Internal TRM - Cooling
	VFD Chilled Water Pump[5]	40	596.9	0.2632	11,937	5.3	Vendor Internal TRM - Cooling
	VFD Cooling Tower Fan[5]	100	600.6	0.1674	60,060	16.7	Vendor Internal TRM - Cooling
	VFD Hot Water Pump[5]	3	486.7	0.0032	730	0.0	Vendor Internal TRM - Cooling
	VFD Other Non-HVAC Motor[5]	275	720.8	0.0727	203,246	22.5	Vendor Internal TRM - Cooling
	VFD Supply/Return Fan[5]	15	409.6	0.1837	6,144	2.8	Vendor Internal TRM - Cooling
	VFD Supply/Return Fan[5]	23	1,228.9	0.5512	9,217	4.1	Vendor Internal TRM - Cooling
	VFD Supply/Return Fan[5]	120	1,638.5	0.7350	49,155	22.0	Vendor Internal TRM - Cooling
	Interior Occupancy Sensor[7]	17,442	0.3	0.0003	25,493	3.9	Vendor Internal TRM - Lighting
	Interior Occupancy Sensor[7]	19,835	1.3	0.0003	26,423	4.4	Vendor Internal TRM - Lighting
	Exterior Non-Standard LED or Induction Equipment[7]	1,064	4.3	0.0000	4,575	0.0	Vendor Internal TRM - Lighting
	Exterior New T5/T8 Fluorescent Fixtures[7]	10,881	4.2	0.0000	45,276	0.0	Vendor Internal TRM - Lighting
	Exterior New T5/T8 Fluorescent Fixtures[7]	3,666	4.3	0.0000	15,764	0.0	Vendor Internal TRM - Lighting
	Garage (ES DLC) LED Lamp or Fixture[7]	38,808	8.8	0.0010	339,958	38.8	Vendor Internal TRM - Lighting
	Garage Non-Standard LED or Induction Equipment[7]	259,383	8.8	0.0010	2,272,195	259.4	Vendor Internal TRM - Lighting
	Interior LED, T-1, or Cold Cathode Exit Signs	3	328.7	0.0388	859	0.1	Vendor Internal TRM - Lighting
	Exterior ENERGY STAR and DesignLights Consortium (DLC) LED Lamp or Fixture[7]	15,917	4.3	0.0000	68,443	0.0	Vendor Internal TRM - Lighting
	Interior ENERGY STAR and DesignLights Consortium (DLC) LED Lamp or Fixture[7]	6,126	4.3	0.0009	31,302	6.3	Vendor Internal TRM - Lighting
	Interior Non-Standard LED or Induction Equipment[7]	2,171	4.3	0.0009	9,349	2.2	Vendor Internal TRM - Lighting
	Exterior Non-Standard Lighting Measure[7]	21,810	4.3	0.0000	93,783	0.0	Vendor Internal TRM - Lighting
	Interior New T5/T8 Fluorescent Fixtures[7]	31,538	4.3	0.0009	135,818	31.3	Vendor Internal TRM - Lighting
	Interior New T5/T8 Fluorescent Fixtures[7]	66,929	4.5	0.0010	449,836	69.2	Vendor Internal TRM - Lighting
	Exterior 1L 8-ft T12 to 2L 4-ft HP T8 Retrofit	1,008	79.6	0.0000	80,186	0.0	Vendor Internal TRM - Lighting
	Process Motor[7]	1,062	743.7	0.0827	1,069,460	118.8	Vendor Internal TRM - Motors and Drives
	TOTAL				**86,552,752**	**7,360.7**	

[5] Quantity is in Horsepower
[6] Per Unit values reported by Ton, will not match savings reported due to incremental increases in efficiency result in additional savings - Vendor Internal TRM - HVAC
[7] These measures are reported by the wattage that was reduced/controlled

APPENDIX A -- Ohio Savings Terms FINAL 12/31/2014

Program	Measure	Participation Count	Ex Ante Per unit kWh impact	Ex Ante Per unit kW impact	Gross Ex Ante kWh Savings	Gross Ex Ante kW Savings	Source Document
New Construction	Nitrogen Air Compressor	1	799,964	91.320	799,964	91.3	All Custom Measures are individually calculated using methodology consistent with the Draft Ohio 2010 Technical Reference Manual.
	Chiller and Tower	1	241,638	33.141	241,638	33.1	
	Process VFD - Final Cool Fan 1	1	648,270	149.520	648,270	149.5	
	Process VFD - Final Cool Fan 2	1	699,165	165.280	699,165	165.3	
	Process VFD - Fume Extraction Exhaust Fan 1	1	577,842	100.210	577,842	100.2	
	Process VFD - Fume Extraction Exhaust Fan 2	1	676,793	114.620	676,793	114.6	
	Motor operating controlled with VFD	1	573,427	97.410	573,427	97.4	
	Motor operating controlled with VFD	1	631,586	106.850	631,586	106.9	
	Process VFD - Rapid Cool Fan 1	1	2,333,454	392.410	2,333,454	392.4	
	Process VFD - Rapid Cool Fan 2	1	2,429,822	407.350	2,429,822	407.4	
	Process VFD - Rapid Cool Fan 3	1	1,342,165	230.020	1,342,165	230.0	
	Process VFD - Rapid Cool Fan 4	1	1,378,998	236.810	1,378,998	236.8	
	Process VFD - TDW Pump 1	1	111,371	17.600	111,371	17.6	
	Process VFD - TDW Pump 2	1	429,166	69.960	429,166	70.0	
	Process VFD - TDW Pump 3	1	674,780	77.430	674,780	77.4	
	Process VFD - TDW Pump 4	1	679,914	77.440	679,914	77.4	
	New construction Engine line: combination high efficient chiller design and geothermal process cooling	1	1,653,027	680.326	1,653,027	680.3	
	Energy Star residential appliances	1	36,120	4.040	36,120	4.0	Energy Star website
	Whole Building >30%	11	514,118	103.831	5,655,297	1,142.1	Individually modeled by Implementer
	Whole Building e10 and <20%	3	156,028	30.892	468,084	92.7	Individually modeled by Implementer
	Whole Building e20 and <30%	2	211,429	57.177	422,858	114.4	Individually modeled by Implementer
	VSD on Dairy Transfer Pump	116	142	0.013	16,518	1.5	Vendor Internal TRM - Agriculture
	VSD on Dairy Vacuum Pump	40	2,409	0.440	96,360	17.6	Vendor Internal TRM - Agriculture
	New VFD Compressor	25	1,732	0.240	43,308	6.0	Vendor Internal TRM - Compressed Air
	Air-Side Economizer[8]	34	437	0.000	14,676	0.0	Vendor Internal TRM - Cooling
	Chillers: Air-Cooled[8]	128	108	0.063	13,795	8.1	Vendor Internal TRM - Cooling
	Chillers: Air-Cooled[8]	180	160	0.148	28,717	26.7	Vendor Internal TRM - Cooling
	PTAC/PTHP[8]	184	186	0.106	34,216	19.5	Vendor Internal TRM - Cooling
	Room Air Conditioners[8]	3	22	0.013	74	0.0	Vendor Internal TRM - Cooling
	Unitary&Split AC and ASHP (EER)[8]	20	48	0.038	939	0.7	Vendor Internal TRM - Cooling
	Unitary&Split AC and ASHP (EER)[8]	30	61	0.034	1,836	1.0	Vendor Internal TRM - Cooling
	Unitary&Split AC and ASHP (EER)[8]	16	64	0.036	1,030	0.6	Vendor Internal TRM - Cooling
	Unitary&Split AC and ASHP (EER)[8]	67	73	0.051	4,882	3.4	Vendor Internal TRM - Cooling
	Unitary&Split AC and ASHP (EER)[8]	27	78	0.042	2,099	1.1	Vendor Internal TRM - Cooling
	Unitary&Split AC and ASHP (EER)[8]	14	82	0.046	1,171	0.7	Vendor Internal TRM - Cooling
	Unitary&Split AC and ASHP (EER)[8]	15	93	0.054	1,398	0.8	Vendor Internal TRM - Cooling
	Unitary&Split AC and ASHP (EER)[8]	51	121	0.080	3,091	2.0	Vendor Internal TRM - Cooling
	Unitary&Split AC and ASHP (EER)[8]	17	154	0.102	1,311	0.9	Vendor Internal TRM - Cooling
	Unitary&Split AC and ASHP (EER)[8]	35	154	0.102	2,700	1.8	Vendor Internal TRM - Cooling
	Unitary&Split AC and ASHP (EER)[8]	60	155	0.090	4,659	2.7	Vendor Internal TRM - Cooling
	Unitary&Split AC and ASHP (EER)[8]	24	182	0.120	1,473	1.0	Vendor Internal TRM - Cooling
	Unitary&Split AC and ASHP (EER)[8]	90	184	0.103	5,507	3.1	Vendor Internal TRM - Cooling
	Unitary&Split AC and ASHP (EER)[8]	135	185	0.065	24,912	8.8	Vendor Internal TRM - Cooling

Program	Measure	Participation Count	Ex Ante Per unit kWh impact	Ex Ante Per unit kW impact	Gross Ex Ante kWh Savings	Gross Ex Ante kW Savings	Source Document
New Construction	Unitary&Split AC and ASHP (EER)[8]	31	197	0.130	3,004	2.0	Vendor Internal TRM - Cooling
	Unitary&Split AC and ASHP (EER)[8]	15	209	0.118	1,569	0.9	Vendor Internal TRM - Cooling
	Unitary&Split AC and ASHP (EER)[8]	40	242	0.160	2,424	1.6	Vendor Internal TRM - Cooling
	Unitary&Split AC and ASHP (EER)[8]	45	246	0.138	3,685	2.1	Vendor Internal TRM - Cooling
	Unitary&Split AC and ASHP (EER)[8]	50	322	0.181	3,217	1.8	Vendor Internal TRM - Cooling
	Unitary&Split AC and ASHP (EER)[8]	50	328	0.184	4,128	2.3	Vendor Internal TRM - Cooling
	Unitary&Split AC and ASHP (EER)[8]	75	490	0.275	12,238	6.9	Vendor Internal TRM - Cooling
	Unitary&Split AC and ASHP (EER)[8]	100	606	0.400	6,060	4.0	Vendor Internal TRM - Cooling
	Unitary&Split AC and ASHP (IEER)[8]	17	118	0.067	1,971	1.1	Vendor Internal TRM - Cooling
	Unitary&Split AC and ASHP (IEER)[8]	15	123	0.069	1,843	1.0	Vendor Internal TRM - Cooling
	Unitary&Split AC and ASHP (IEER)[8]	5	123	0.081	615	0.4	Vendor Internal TRM - Cooling
	Unitary&Split AC and ASHP (IEER)[8]	13	131	0.074	1,703	1.0	Vendor Internal TRM - Cooling
	Unitary&Split AC and ASHP (IEER)[8]	24	257	0.145	1,568	0.9	Vendor Internal TRM - Cooling
	Unitary&Split AC and ASHP (SEER)[8]	16	103	0.089	843	0.7	Vendor Internal TRM - Cooling
	Unitary&Split AC and ASHP (SEER)[8]	12	119	0.067	1,426	0.8	Vendor Internal TRM - Cooling
	Unitary&Split AC and ASHP (SEER)[8]	5	123	0.081	591	0.4	Vendor Internal TRM - Cooling
	Unitary&Split AC and ASHP (SEER)[8]	5	131	0.073	627	0.4	Vendor Internal TRM - Cooling
	Unitary&Split AC and ASHP (SEER)[8]	3	136	0.074	391	0.2	Vendor Internal TRM - Cooling
	Unitary&Split AC and ASHP (SEER)[8]	2	142	0.077	327	0.2	Vendor Internal TRM - Cooling
	Unitary&Split AC and ASHP (SEER)[8]	6	144	0.082	416	0.2	Vendor Internal TRM - Cooling
	Unitary&Split AC and ASHP (SEER)[8]	8	154	0.088	384	0.2	Vendor Internal TRM - Cooling
	Unitary&Split AC and ASHP (SEER)[8]	2	190	0.151	180	0.1	Vendor Internal TRM - Cooling
	Unitary&Split AC and ASHP (SEER)[8]	12	224	0.148	2,714	1.8	Vendor Internal TRM - Cooling
	Unitary&Split AC and ASHP (SEER)[8]	5	231	0.134	1,155	0.7	Vendor Internal TRM - Cooling
	Unitary&Split AC and ASHP (SEER)[8]	8	259	0.151	2,073	1.2	Vendor Internal TRM - Cooling
	Unitary&Split AC and ASHP (SEER)[8]	6	297	0.209	892	0.6	Vendor Internal TRM - Cooling
	Unitary&Split AC and ASHP (SEER)[8]	3	354	0.281	531	0.4	Vendor Internal TRM - Cooling
	Unitary&Split AC and ASHP (SEER)[8]	6	356	0.200	1,069	0.6	Vendor Internal TRM - Cooling
	Unitary&Split AC and ASHP (SEER)[8]	5	398	0.316	995	0.8	Vendor Internal TRM - Cooling
	Unitary&Split AC and ASHP (SEER)[8]	9	407	0.222	1,182	0.6	Vendor Internal TRM - Cooling
	Unitary&Split AC and ASHP (SEER)[8]	15	461	0.263	2,307	1.3	Vendor Internal TRM - Cooling
	Unitary&Split AC and ASHP (SEER)[8]	1	517	0.282	388	0.2	Vendor Internal TRM - Cooling
	Unitary&Split AC and ASHP (SEER)[8]	17	564	0.322	846	0.5	Vendor Internal TRM - Cooling
	Unitary&Split AC and ASHP (SEER)[8]	3	738	0.421	1,107	0.6	Vendor Internal TRM - Cooling
	Unitary&Split AC and ASHP (SEER)[8]	6	758	0.603	569	0.5	Vendor Internal TRM - Cooling
	Unitary&Split AC and ASHP (SEER)[8]	12	1,025	0.585	3,076	1.8	Vendor Internal TRM - Cooling
	Unitary&Split AC and ASHP (SEER)[8]	70	1,794	1.023	3,589	2.0	Vendor Internal TRM - Cooling
	VFD for Kitchen Exhaust Fan - New Hood[9]	12	4,486	0.760	54,204	9.2	Vendor Internal TRM - Cooling
	VRF Air Conditioners[8]	16	171	0.136	1,369	1.1	Vendor Internal TRM - Cooling
	VSD Chilled Water Pump[9]	40	298	0.132	11,937	5.3	Vendor Internal TRM - Cooling
	VSD Chilled Water Pump[9]	40	354	0.264	7,080	5.3	Vendor Internal TRM - Cooling

Program	Measure	Participation Count	Ex Ante Per unit kWh impact	Ex Ante Per unit kW impact	Gross Ex Ante kWh Savings	Gross Ex Ante kW Savings	Source Document
New Construction	VSD Chilled Water Pump[9]	60	597	0.263	17,906	7.9	Vendor Internal TRM - Cooling
	VSD Chilled Water Pump[9]	40	1,178	0.263	23,563	5.3	Vendor Internal TRM - Cooling
	VSD Condenser Water Pump[9]	40	438	0.129	17,520	5.2	Vendor Internal TRM - Cooling
	VSD Cooling Tower Fan[9]	30	534	0.334	8,010	5.0	Vendor Internal TRM - Cooling
	VSD Cooling Tower Fan[9]	450	3,390	0.387	508,569	58.1	Vendor Internal TRM - Cooling
	VSD Cooling Tower Fan[9]	27	20,961	3.013	31,442	4.5	Vendor Internal TRM - Cooling
	VSD Hot Water Pump[9]	15	243	0.002	3,650	0.0	Vendor Internal TRM - Cooling
	VSD Hot Water Pump[9]	15	402	0.004	3,015	0.0	Vendor Internal TRM - Cooling
	VSD Hot Water Pump[9]	99	463	0.002	45,606	0.2	Vendor Internal TRM - Cooling
	VSD Hot Water Pump[9]	40	487	0.003	9,735	0.1	Vendor Internal TRM - Cooling
	VSD Other HVAC Motor[9]	10	315	0.123	2,988	1.2	Vendor Internal TRM - Cooling
	VSD Other HVAC Motor[9]	3	315	0.123	945	0.4	Vendor Internal TRM - Cooling
	VSD Other HVAC Motor[9]	80	474	0.123	37,912	9.8	Vendor Internal TRM - Cooling
	VSD Supply/Return Fan[9]	33	410	0.184	13,518	6.1	Vendor Internal TRM - Cooling
	VSD Supply/Return Fan[9]	6	953	0.184	5,716	1.1	Vendor Internal TRM - Cooling
	VSD Supply/Return Fan[9]	120	1,141	0.184	136,920	22.1	Vendor Internal TRM - Cooling
	VSD Supply/Return Fan[9]	2	1,905	0.367	1,905	0.4	Vendor Internal TRM - Cooling
	VSD Supply/Return Fan[9]	112	91,417	20.580	91,417	20.6	Vendor Internal TRM - Cooling
	Combination Oven	5	18,432	1.697	92,158	8.5	Vendor Internal TRM - Food Service
	Ice Maker	5	1,114	0.209	5,568	1.0	Vendor Internal TRM - Food Service
	Ice Maker	1	1,197	0.224	1,197	0.2	Vendor Internal TRM - Food Service
	Exterior LPD[10]	448,578	4	0.000	1,866,531	0.0	Vendor Internal TRM - Lighting
	Exterior New Construction - Lighting Power Density[10]	54,989	4	0.000	236,451	0.0	Vendor Internal TRM - Lighting
	Garage LPD[10]	15,315	9	0.001	134,163	15.3	Vendor Internal TRM - Lighting
	Interior Daylighting Controls[10]	3,431	0	0.001	3,363	2.6	Vendor Internal TRM - Lighting
	Interior Daylighting Controls[10]	4,536	1	0.001	4,110	3.3	Vendor Internal TRM - Lighting
	Interior LPD[10]	1,137,284	4	0.001	6,329,790	1,098.5	Vendor Internal TRM - Lighting
	Interior New Construction - Lighting Power Density[10]	346,926	4	0.001	1,370,695	320.9	Vendor Internal TRM - Lighting
	Suite LPD[10]	22,631	4	0.001	20,558	3.0	Vendor Internal TRM - Lighting
	Efficient Motors[9]	4	21	0.006	83	0.0	Vendor Internal TRM - Motors and Drives
	Efficient Motors[9]	5	30	0.008	91	0.0	Vendor Internal TRM - Motors and Drives
	Efficient Motors[9]	4	41	0.011	81	0.0	Vendor Internal TRM - Motors and Drives
	Efficient Motors[9]	40	223	0.049	893	0.2	Vendor Internal TRM - Motors and Drives
	Efficient Motors[9]	250	3,954	0.563	7,909	1.1	Vendor Internal TRM - Motors and Drives
	Process Motor[9]	805	744	0.083	466,300	50.3	Vendor Internal TRM - Motors and Drives
	Process Motor[9]	864	744	0.083	642,816	71.7	Vendor Internal TRM - Motors and Drives
	Anti-Sweat Heater Controls	686	528	0.060	362,208	41.2	Vendor Internal TRM - Refrigeration
	EC Motor for Reach-in Refrigerator cases and Freezer cases	635	625	0.071	396,875	45.1	Vendor Internal TRM - Refrigeration
	EC Motor for Walk-in Cooler and Freezer	60	1,250	0.143	75,000	8.6	Vendor Internal TRM - Refrigeration
	ENERGY STAR Solid Door Freezer	4	1,307	0.149	5,228	0.6	Vendor Internal TRM - Refrigeration
	ENERGY STAR Solid Door Refrigerator	5	637	0.073	3,185	0.4	Vendor Internal TRM - Refrigeration

Program	Measure	Participation Count	Ex Ante Per unit kWh impact	Ex Ante Per unit kW impact	Gross Ex Ante kWh Savings	Gross Ex Ante kW Savings	Source Document
New Construction	Glass Door Refrigerator	1	634	0.072	634	0.1	Vendor Internal TRM - Refrigeration
	LED Refrigeration Case Lighting - Open Cases	781	348	0.060	271,788	46.5	Vendor Internal TRM - Refrigeration
	LED Refrigeration Case Lighting - With Doors	1,162	394	0.064	457,828	73.8	Vendor Internal TRM - Refrigeration
	Lighting Controls for Freezers and Coolers with Doors	829	82	0.014	67,729	11.2	Vendor Internal TRM - Refrigeration
	Solid Door Freezer	3	1,307	0.149	3,921	0.4	Vendor Internal TRM - Refrigeration
	Solid Door Refrigerator	2	637	0.073	1,274	0.1	Vendor Internal TRM - Refrigeration
	TOTAL				**36,703,469**	**6,525.3**	

[8] Per Unit values reported by Ton, will not match savings reported due to incremental increases in efficiency result in additional savings - Vendor Internal TRM - HVAC

[9] Quantity is in Horsepower

[10] The Quantity reported is by the wattage that was reduced/controlled

Program	Measure	Participation Count	Ex Ante Per unit kWh impact	Ex Ante Per unit kW impact	Gross Ex Ante kWh Savings	Gross Ex Ante kW Savings	Source Document
Prescriptive[11]	Specialty Compact Fluorescent Bulb 14 Watts	24	54.1	0.0130	1,298	0.3	Standard Engineering Calculation
	Specialty Compact Fluorescent Bulb 14 Watts	100	67.6	0.0169	6,760	1.7	Standard Engineering Calculation
	Specialty Compact Fluorescent Bulb 14 Watts	2	95.7	0.0230	191	0.0	Standard Engineering Calculation
	Specialty Compact Fluorescent Bulb 14 Watts	24	119.6	0.0299	2,870	0.7	Standard Engineering Calculation
	Specialty Compact Fluorescent Bulb 14 Watts	6	120.0	0.0262	720	0.2	Standard Engineering Calculation
	Specialty Compact Fluorescent Bulb 14 Watts	4	178.9	0.0430	716	0.2	Standard Engineering Calculation
	Specialty Compact Fluorescent Bulb 14 Watts	6	253.6	0.0560	1,522	0.3	Standard Engineering Calculation
	Specialty Compact Fluorescent Bulb 15 Watts	23	72.8	0.0175	1,674	0.4	Standard Engineering Calculation
	Specialty Compact Fluorescent Bulb 15 Watts	20	91.0	0.0228	1,820	0.5	Standard Engineering Calculation
	Specialty Compact Fluorescent Bulb 15 Watts	10	103.4	0.0303	1,034	0.3	Standard Engineering Calculation
	Specialty Compact Fluorescent Bulb 15 Watts	13	117.0	0.0293	1,521	0.4	Standard Engineering Calculation
	Specialty Compact Fluorescent Bulb 15 Watts	1	127.6	0.0269	128	0.0	Standard Engineering Calculation
	Specialty Compact Fluorescent Bulb 15.4 Watts	2	103.2	0.0248	206	0.0	Standard Engineering Calculation
	Specialty Compact Fluorescent Bulb 15.4 Watts	46	129.0	0.0322	5,932	1.5	Standard Engineering Calculation
	Specialty Compact Fluorescent Bulb 15.4 Watts	1	195.4	0.0406	195	0.0	Standard Engineering Calculation
	Specialty Compact Fluorescent Bulb 15.4 Watts	5	273.5	0.0604	1,367	0.3	Standard Engineering Calculation
	Specialty Compact Fluorescent Bulb 16 Watts	280	127.4	0.0319	35,672	8.9	Standard Engineering Calculation
	Specialty Compact Fluorescent Bulb 16 Watts	30	144.8	0.0424	4,344	1.3	Standard Engineering Calculation
	Specialty Compact Fluorescent Bulb 16 Watts	10	234.8	0.0431	2,348	0.4	Standard Engineering Calculation
	Specialty Compact Fluorescent Bulb 23 Watts	12	174.2	0.0436	2,090	0.5	Standard Engineering Calculation
	Specialty Compact Fluorescent Bulb 23 Watts	6	189.9	0.0401	1,140	0.2	Standard Engineering Calculation
	Specialty Compact Fluorescent Bulb 26 Watts	18	192.4	0.0481	3,463	0.9	Standard Engineering Calculation
	Specialty Compact Fluorescent Bulb 9 Watts	48	80.6	0.0202	3,869	1.0	Standard Engineering Calculation
	Specialty LED 10 Watts	6	32.1	0.0080	193	0.0	Standard Engineering Calculation
	Specialty LED 10 Watts	1	38.7	0.0108	39	0.0	Standard Engineering Calculation
	Specialty LED 10 Watts	65	39.0	0.0098	2,535	0.6	Standard Engineering Calculation
	Specialty LED 10 Watts	19	40.7	0.0128	774	0.2	Standard Engineering Calculation
	Specialty LED 10 Watts	4	64.5	0.0000	258	0.0	Standard Engineering Calculation
	Specialty LED 10 Watts	30	97.0	0.0200	2,909	0.6	Standard Engineering Calculation
	Specialty LED 10 Watts	1	107.1	0.0265	107	0.0	Standard Engineering Calculation
	Specialty LED 10 Watts	6	117.8	0.0292	707	0.2	Standard Engineering Calculation
	Specialty LED 10 Watts	12	117.9	0.0048	1,415	0.1	Standard Engineering Calculation
	Specialty LED 10 Watts	1	129.0	0.0360	129	0.0	Standard Engineering Calculation
	Specialty LED 10 Watts	146	130.0	0.0325	18,980	4.7	Standard Engineering Calculation
	Specialty LED 10 Watts	7	135.8	0.0426	951	0.3	Standard Engineering Calculation
	Specialty LED 10 Watts	54	143.0	0.0358	7,722	1.9	Standard Engineering Calculation
	Specialty LED 10 Watts	43	149.4	0.0468	6,424	2.0	Standard Engineering Calculation
	Specialty LED 10 Watts	12	154.4	0.0465	1,853	0.6	Standard Engineering Calculation
	Specialty LED 10 Watts	58	215.0	0.0000	12,470	0.0	Standard Engineering Calculation
	Specialty LED 10 Watts	1	221.9	0.0697	222	0.1	Standard Engineering Calculation
	Specialty LED 10 Watts	12	234.0	0.0585	2,808	0.7	Standard Engineering Calculation
	Specialty LED 10 Watts	61	236.5	0.0000	14,427	0.0	Standard Engineering Calculation
	Specialty LED 10 Watts	1	244.5	0.0766	244	0.1	Standard Engineering Calculation
	Specialty LED 10 Watts	1	323.3	0.0668	323	0.1	Standard Engineering Calculation
	Specialty LED 10 Watts	8	387.0	0.0000	3,096	0.0	Standard Engineering Calculation

Program	Measure	Participation Count	Ex Ante Per unit kWh impact	Ex Ante Per unit kW impact	Gross Ex Ante kWh Savings	Gross Ex Ante kW Savings	Source Document
Prescriptive[11]	Specialty LED 11 Watts	162	115.7	0.0286	18,742	4.6	Standard Engineering Calculation
	Specialty LED 11 Watts	29	139.3	0.0389	4,039	1.1	Standard Engineering Calculation
	Specialty LED 11 Watts	1	232.2	0.0000	232	0.0	Standard Engineering Calculation
	Specialty LED 11 Watts	6	349.1	0.0722	2,095	0.4	Standard Engineering Calculation
	Specialty LED 11.1 Watts	16	164.8	0.0460	2,637	0.7	Standard Engineering Calculation
	Specialty LED 11.1 Watts	17	166.1	0.0415	2,824	0.7	Standard Engineering Calculation
	Specialty LED 11.1 Watts	90	173.6	0.0544	15,622	4.9	Standard Engineering Calculation
	Specialty LED 11.1 Watts	2	179.4	0.0540	359	0.1	Standard Engineering Calculation
	Specialty LED 11.1 Watts	23	187.2	0.0499	4,305	1.1	Standard Engineering Calculation
	Specialty LED 11.1 Watts	55	274.8	0.0000	15,112	0.0	Standard Engineering Calculation
	Specialty LED 11.1 Watts	42	299.5	0.0547	12,577	2.3	Standard Engineering Calculation
	Specialty LED 11.1 Watts	13	413.1	0.0854	5,371	1.1	Standard Engineering Calculation
	Specialty LED 12 Watts	6	135.0	0.0334	810	0.2	Standard Engineering Calculation
	Specialty LED 12 Watts	5	137.8	0.0345	689	0.2	Standard Engineering Calculation
	Specialty LED 12 Watts	1	148.8	0.0448	149	0.0	Standard Engineering Calculation
	Specialty LED 12 Watts	34	156.4	0.0387	5,317	1.3	Standard Engineering Calculation
	Specialty LED 12 Watts	2	162.5	0.0454	325	0.1	Standard Engineering Calculation
	Specialty LED 12 Watts	969	163.8	0.0410	158,722	39.7	Standard Engineering Calculation
	Specialty LED 12 Watts	1	206.4	0.0000	206	0.0	Standard Engineering Calculation
	Specialty LED 12 Watts	27	211.9	0.0664	5,721	1.8	Standard Engineering Calculation
	Specialty LED 12 Watts	2	213.8	0.0672	428	0.1	Standard Engineering Calculation
	Specialty LED 12 Watts	54	219.3	0.0000	11,842	0.0	Standard Engineering Calculation
	Specialty LED 12 Watts	10	227.0	0.0634	2,270	0.6	Standard Engineering Calculation
	Specialty LED 12 Watts	1	227.9	0.0000	228	0.0	Standard Engineering Calculation
	Specialty LED 12 Watts	15	228.8	0.0572	3,432	0.9	Standard Engineering Calculation
	Specialty LED 12 Watts	51	239.0	0.0749	12,191	3.8	Standard Engineering Calculation
	Specialty LED 12 Watts	10	247.1	0.0744	2,471	0.7	Standard Engineering Calculation
	Specialty LED 12 Watts	16	257.8	0.0687	4,124	1.1	Standard Engineering Calculation
	Specialty LED 12 Watts	40	329.7	0.0682	13,190	2.7	Standard Engineering Calculation
	Specialty LED 12 Watts	1	407.3	0.0842	407	0.1	Standard Engineering Calculation
	Specialty LED 12 Watts	4	569.0	0.1176	2,276	0.5	Standard Engineering Calculation
	Specialty LED 12.5 Watts	24	101.9	0.0319	2,445	0.8	Standard Engineering Calculation
	Specialty LED 13 Watts	18	99.6	0.0266	1,793	0.5	Standard Engineering Calculation
	Specialty LED 13 Watts	65	101.4	0.0254	6,591	1.6	Standard Engineering Calculation
	Specialty LED 13 Watts	54	146.2	0.0000	7,895	0.0	Standard Engineering Calculation
	Specialty LED 13 Watts	8	153.0	0.0507	1,224	0.4	Standard Engineering Calculation
	Specialty LED 14.5 Watts	2	109.7	0.0000	219	0.0	Standard Engineering Calculation
	Specialty LED 14.5 Watts	4	145.6	0.0272	582	0.1	Standard Engineering Calculation
	Specialty LED 17 Watts	17	267.8	0.0670	4,553	1.1	Standard Engineering Calculation
	Specialty LED 17 Watts	42	442.9	0.0000	18,602	0.0	Standard Engineering Calculation
	Specialty LED 17 Watts	1	665.9	0.1377	666	0.1	Standard Engineering Calculation
	Specialty LED 18 Watts	3	167.7	0.0556	503	0.2	Standard Engineering Calculation
	Specialty LED 19 Watts	1	434.3	0.0000	434	0.0	Standard Engineering Calculation
	Specialty LED 19 Watts	12	653.0	0.1350	7,836	1.6	Standard Engineering Calculation
	Specialty LED 19.5 Watts	58	245.4	0.0627	14,232	3.6	Standard Engineering Calculation

Program	Measure	Participation Count	Ex Ante Per unit kWh impact	Ex Ante Per unit kW impact	Gross Ex Ante kWh Savings	Gross Ex Ante kW Savings	Source Document
Prescriptive[11]	Specialty LED 20 Watts	42	206.3	0.0576	8,666	2.4	Standard Engineering Calculation
	Specialty LED 20 Watts	4	208.0	0.0520	832	0.2	Standard Engineering Calculation
	Specialty LED 20 Watts	10	234.3	0.0625	2,343	0.6	Standard Engineering Calculation
	Specialty LED 20 Watts	2	242.3	0.0619	485	0.1	Standard Engineering Calculation
	Specialty LED 20 Watts	2	456.7	0.0854	913	0.2	Standard Engineering Calculation
	Specialty LED 20 Watts	4	517.2	0.1069	2,069	0.4	Standard Engineering Calculation
	Specialty LED 20 Watts	1	628.7	0.0254	629	0.0	Standard Engineering Calculation
	Specialty LED 26 Watts	9	201.0	0.0630	1,809	0.6	Standard Engineering Calculation
	Specialty LED 3.5 Watts	48	116.4	0.0241	5,586	1.2	Standard Engineering Calculation
	Specialty LED 7 Watts	6	110.9	0.0310	665	0.2	Standard Engineering Calculation
	Specialty LED 7 Watts	43	111.8	0.0280	4,807	1.2	Standard Engineering Calculation
	Specialty LED 7 Watts	46	120.7	0.0363	5,554	1.7	Standard Engineering Calculation
	Specialty LED 8 Watts	9	88.4	0.0221	796	0.2	Standard Engineering Calculation
	Specialty LED 8 Watts	12	109.2	0.0273	1,310	0.3	Standard Engineering Calculation
	Specialty LED 8 Watts	46	146.2	0.0000	6,725	0.0	Standard Engineering Calculation
	Specialty LED 8 Watts	4	330.1	0.0133	1,320	0.1	Standard Engineering Calculation
	Specialty LED 8.9 Watts	42	145.9	0.0365	6,126	1.5	Standard Engineering Calculation
	Specialty LED 9 Watts	4	87.8	0.0217	351	0.1	Standard Engineering Calculation
	Specialty LED 9.5 Watts	101	131.3	0.0328	13,261	3.3	Standard Engineering Calculation
	Specialty LED 9.5 Watts	3	163.4	0.0513	490	0.2	Standard Engineering Calculation
	Standard Compact Fluorescent Bulb 10 Watts	40	85.0	0.0180	3,402	0.7	Standard Engineering Calculation
	Standard Compact Fluorescent Bulb 10 Watts	10	130.0	0.0325	1,300	0.3	Standard Engineering Calculation
	Standard Compact Fluorescent Bulb 13 Watts	1	122.2	0.0306	122	0.0	Standard Engineering Calculation
	Standard Compact Fluorescent Bulb 13 Watts	38	138.9	0.0406	5,277	1.5	Standard Engineering Calculation
	Standard Compact Fluorescent Bulb 13 Watts	6	269.2	0.0461	1,615	0.3	Standard Engineering Calculation
	Standard Compact Fluorescent Bulb 13 Watts	100	301.2	0.0121	30,117	1.2	Standard Engineering Calculation
	Standard Compact Fluorescent Bulb 14 Watts	120	119.6	0.0299	14,352	3.6	Standard Engineering Calculation
	Standard Compact Fluorescent Bulb 14 Watts	10	135.9	0.0398	1,359	0.4	Standard Engineering Calculation
	Standard Compact Fluorescent Bulb 14 Watts	24	181.2	0.0377	4,348	0.9	Standard Engineering Calculation
	Standard Compact Fluorescent Bulb 14 Watts	1	199.7	0.0342	200	0.0	Standard Engineering Calculation
	Standard Compact Fluorescent Bulb 14 Watts	1	294.8	0.0118	295	0.0	Standard Engineering Calculation
	Standard Compact Fluorescent Bulb 14 Watts	24	297.4	0.0615	7,138	1.5	Standard Engineering Calculation
	Standard Compact Fluorescent Bulb 15 Watts	87	117.0	0.0293	10,179	2.5	Standard Engineering Calculation
	Standard Compact Fluorescent Bulb 15 Watts	70	215.6	0.0396	15,094	2.8	Standard Engineering Calculation
	Standard Compact Fluorescent Bulb 15 Watts	100	248.1	0.0548	24,810	5.5	Standard Engineering Calculation
	Standard Compact Fluorescent Bulb 19 Watts	2	116.5	0.0280	233	0.1	Standard Engineering Calculation
	Standard Compact Fluorescent Bulb 19 Watts	4	145.6	0.0364	582	0.1	Standard Engineering Calculation
	Standard Compact Fluorescent Bulb 19 Watts	30	258.4	0.0564	7,752	1.7	Standard Engineering Calculation
	Standard Compact Fluorescent Bulb 19 Watts	5	362.1	0.0748	1,810	0.4	Standard Engineering Calculation
	Standard Compact Fluorescent Bulb 20 Watts	30	155.9	0.0329	4,677	1.0	Standard Engineering Calculation
	Standard Compact Fluorescent Bulb 20 Watts	1	161.8	0.0455	162	0.0	Standard Engineering Calculation
	Standard Compact Fluorescent Bulb 20 Watts	518	162.5	0.0475	84,183	24.6	Standard Engineering Calculation
	Standard Compact Fluorescent Bulb 20 Watts	40	303.2	0.0669	12,129	2.7	Standard Engineering Calculation
	Standard Compact Fluorescent Bulb 23 Watts	26	101.9	0.0245	2,650	0.6	Standard Engineering Calculation
	Standard Compact Fluorescent Bulb 23 Watts	26	127.4	0.0319	3,312	0.8	Standard Engineering Calculation

Program	Measure	Participation Count	Ex Ante Per unit kWh impact	Ex Ante Per unit kW impact	Gross Ex Ante kWh Savings	Gross Ex Ante kW Savings	Source Document
Prescriptive[11]	Standard Compact Fluorescent Bulb 23 Watts	10	270.2	0.0596	2,702	0.6	Standard Engineering Calculation
	Standard Compact Fluorescent Bulb 23 Watts	99	314.0	0.0126	31,084	1.2	Standard Engineering Calculation
	Standard Compact Fluorescent Bulb 26 Watts	146	95.7	0.0230	13,969	3.4	Standard Engineering Calculation
	Standard Compact Fluorescent Bulb 26 Watts	71	119.6	0.0299	8,492	2.1	Standard Engineering Calculation
	Standard Compact Fluorescent Bulb 26 Watts	12	135.4	0.0380	1,624	0.5	Standard Engineering Calculation
	Standard Compact Fluorescent Bulb 26 Watts	447	135.9	0.0398	60,757	17.8	Standard Engineering Calculation
	Standard Compact Fluorescent Bulb 26 Watts	160	181.2	0.0377	28,989	6.0	Standard Engineering Calculation
	Standard Compact Fluorescent Bulb 26 Watts	9	199.7	0.0342	1,797	0.3	Standard Engineering Calculation
	Standard Compact Fluorescent Bulb 26 Watts	42	214.4	0.0437	9,003	1.8	Standard Engineering Calculation
	Standard Compact Fluorescent Bulb 26 Watts	10	220.4	0.0404	2,204	0.4	Standard Engineering Calculation
	Standard Compact Fluorescent Bulb 26 Watts	790	253.6	0.0560	200,357	44.2	Standard Engineering Calculation
	Standard Compact Fluorescent Bulb 26 Watts	20	294.8	0.0118	5,895	0.2	Standard Engineering Calculation
	Standard Compact Fluorescent Bulb 26 Watts	30	297.4	0.0615	8,922	1.8	Standard Engineering Calculation
	Standard Compact Fluorescent Bulb 27 Watts	5	93.6	0.0225	468	0.1	Standard Engineering Calculation
	Standard Compact Fluorescent Bulb 27 Watts	120	117.0	0.0293	14,040	3.5	Standard Engineering Calculation
	Standard Compact Fluorescent Bulb 27 Watts	6	127.6	0.0269	765	0.2	Standard Engineering Calculation
	Standard Compact Fluorescent Bulb 27 Watts	9	288.4	0.0116	2,595	0.1	Standard Engineering Calculation
	Standard LED 11 Watts	12	127.4	0.0319	1,529	0.4	Standard Engineering Calculation
	Standard LED 11 Watts	20	133.1	0.0320	2,662	0.6	Standard Engineering Calculation
	Standard LED 11 Watts	6	137.1	0.0339	823	0.2	Standard Engineering Calculation
	Standard LED 11 Watts	98	165.1	0.0461	16,177	4.5	Standard Engineering Calculation
	Standard LED 11 Watts	433	166.4	0.0416	72,051	18.0	Standard Engineering Calculation
	Standard LED 11 Watts	41	173.9	0.0545	7,128	2.2	Standard Engineering Calculation
	Standard LED 11 Watts	101	179.7	0.0541	18,151	5.5	Standard Engineering Calculation
	Standard LED 11 Watts	22	187.5	0.0500	4,124	1.1	Standard Engineering Calculation
	Standard LED 11 Watts	125	193.9	0.0495	24,235	6.2	Standard Engineering Calculation
	Standard LED 11 Watts	6	210.7	0.0000	1,264	0.0	Standard Engineering Calculation
	Standard LED 11 Watts	171	275.2	0.0000	47,059	0.0	Standard Engineering Calculation
	Standard LED 11 Watts	8	316.8	0.0655	2,534	0.5	Standard Engineering Calculation
	Standard LED 11 Watts	20	385.1	0.0155	7,702	0.3	Standard Engineering Calculation
	Standard LED 11 Watts	43	413.8	0.0855	17,793	3.7	Standard Engineering Calculation
	Standard LED 11 Watts	162	503.0	0.0203	81,483	3.3	Standard Engineering Calculation
	Standard LED 13 Watts	18	132.0	0.0397	2,376	0.7	Standard Engineering Calculation
	Standard LED 19 Watts	1	136.7	0.0382	137	0.0	Standard Engineering Calculation
	Standard LED 19 Watts	6	137.8	0.0345	827	0.2	Standard Engineering Calculation
	Standard LED 5 Watts	69	52.0	0.0130	3,588	0.9	Standard Engineering Calculation
	Standard LED 7 Watts	12	85.8	0.0215	1,030	0.3	Standard Engineering Calculation
	Standard LED 7 Watts	10	141.9	0.0000	1,419	0.0	Standard Engineering Calculation
	Standard LED 7 Watts	60	259.4	0.0105	15,561	0.6	Standard Engineering Calculation
	Standard LED 8 Watts	60	62.4	0.0156	3,744	0.9	Standard Engineering Calculation
	T8 Lamp and Ballast 30 Watts	68	63.3	0.0175	4,302	1.2	Standard Engineering Calculation
	T8 Lamp and Ballast 44 Watts	24	77.1	0.0191	1,851	0.5	Standard Engineering Calculation
	T8 Lamp and Ballast 49 Watts	2	64.5	0.0155	129	0.0	Standard Engineering Calculation
	T8 Lamp and Ballast 49 Watts	109	66.4	0.0164	7,239	1.8	Standard Engineering Calculation
	T8 Lamp and Ballast 49 Watts	110	80.6	0.0202	8,866	2.2	Standard Engineering Calculation

Program	Measure	Participation Count	Ex Ante Per unit kWh impact	Ex Ante Per unit kW impact	Gross Ex Ante kWh Savings	Gross Ex Ante kW Savings	Source Document
Prescriptive[11]	T8 Lamp and Ballast 49 Watts	40	87.0	0.0262	3,482	1.0	Standard Engineering Calculation
	T8 Lamp and Ballast 49 Watts	13	93.9	0.0240	1,221	0.3	Standard Engineering Calculation
	T8 Lamp and Ballast 49 Watts	3	102.7	0.0286	308	0.1	Standard Engineering Calculation
	T8 Lamp and Ballast 49 Watts	71	130.7	0.0362	9,282	2.6	Standard Engineering Calculation
	T8 Lamp and Ballast 49 Watts	3	133.3	0.0000	400	0.0	Standard Engineering Calculation
	T8 Lamp and Ballast 49 Watts	10	200.4	0.0414	2,004	0.4	Standard Engineering Calculation
	T8 Lamp and Ballast 73 Watts	29	72.8	0.0180	2,112	0.5	Standard Engineering Calculation
	T8 Lamp and Ballast 73 Watts	4	88.4	0.0221	354	0.1	Standard Engineering Calculation
	T8 Lamp and Ballast 73 Watts	2	103.0	0.0263	206	0.1	Standard Engineering Calculation
	T8 Lamp and Ballast 73 Watts	25	143.4	0.0397	3,585	1.0	Standard Engineering Calculation
	T8 Lamp and Ballast 73 Watts	1	224.0	0.0471	224	0.0	Standard Engineering Calculation
	T8 Lamp and Ballast 97 Watts	301	96.4	0.0239	29,019	7.2	Standard Engineering Calculation
	T8 Lamp and Ballast 97 Watts	63	117.0	0.0293	7,371	1.8	Standard Engineering Calculation
	T8 Lamp and Ballast 97 Watts	1	126.4	0.0380	126	0.0	Standard Engineering Calculation
	T8 Lamp and Ballast 97 Watts	281	136.3	0.0348	38,306	9.8	Standard Engineering Calculation
	T8 Lamp and Ballast 97 Watts	37	149.1	0.0415	5,517	1.5	Standard Engineering Calculation
	T8 Lamp and Ballast 97 Watts	7	181.5	0.0570	1,271	0.4	Standard Engineering Calculation
	T8 Lamp and Ballast 97 Watts	84	189.8	0.0525	15,941	4.4	Standard Engineering Calculation
	T8 Lamp and Ballast 97 Watts	29	193.5	0.0000	5,612	0.0	Standard Engineering Calculation
	T8 Lamp and Ballast 97 Watts	2	210.9	0.0386	422	0.1	Standard Engineering Calculation
	T8 Lamp and Ballast 97 Watts	10	290.9	0.0601	2,909	0.6	Standard Engineering Calculation
	T8 Lamp and Ballast 97 Watts	1	296.5	0.0624	297	0.1	Standard Engineering Calculation
	T8 Linear Fluorescent 25 Watts	380	15.0	0.0037	5,699	1.4	Standard Engineering Calculation
	T8 Linear Fluorescent 25 Watts	1,080	18.2	0.0046	19,656	4.9	Standard Engineering Calculation
	T8 Linear Fluorescent 25 Watts	3,240	19.0	0.0060	61,609	19.3	Standard Engineering Calculation
	T8 Linear Fluorescent 25 Watts	180	23.2	0.0065	4,175	1.2	Standard Engineering Calculation
	T8 Linear Fluorescent 25 Watts	3,597	29.5	0.0082	106,186	29.4	Standard Engineering Calculation
	T8 Linear Fluorescent 28 Watts	252	8.3	0.0020	2,097	0.5	Standard Engineering Calculation
	T8 Linear Fluorescent 28 Watts	922	8.6	0.0021	7,901	2.0	Standard Engineering Calculation
	T8 Linear Fluorescent 28 Watts	380	10.4	0.0026	3,952	1.0	Standard Engineering Calculation
	T8 Linear Fluorescent 28 Watts	732	10.9	0.0034	7,954	2.5	Standard Engineering Calculation
	T8 Linear Fluorescent 28 Watts	144	11.2	0.0034	1,617	0.5	Standard Engineering Calculation
	T8 Linear Fluorescent 28 Watts	36	11.7	0.0031	422	0.1	Standard Engineering Calculation
	T8 Linear Fluorescent 28 Watts	90	12.1	0.0031	1,091	0.3	Standard Engineering Calculation
	T8 Linear Fluorescent 28 Watts	432	13.3	0.0037	5,726	1.6	Standard Engineering Calculation
	T8 Linear Fluorescent 28 Watts	24	13.8	0.0028	330	0.1	Standard Engineering Calculation
	T8 Linear Fluorescent 28 Watts	36	16.1	0.0051	581	0.2	Standard Engineering Calculation
	T8 Linear Fluorescent 28 Watts	212	16.9	0.0047	3,576	1.0	Standard Engineering Calculation
	T8 Linear Fluorescent 28 Watts	1,424	17.2	0.0000	24,493	0.0	Standard Engineering Calculation
	T8 Linear Fluorescent 28 Watts	100	18.7	0.0034	1,875	0.3	Standard Engineering Calculation
	T8 Linear Fluorescent 28 Watts	36	22.8	0.0043	822	0.2	Standard Engineering Calculation
	T8 Linear Fluorescent 28 Watts	3,852	26.4	0.0055	101,529	21.4	Standard Engineering Calculation
	T8 Linear Fluorescent 28 Watts	72	31.4	0.0013	2,263	0.1	Standard Engineering Calculation
	Compressed Air Engineered Nozzle	86	2,418.0	0.3350	207,948	28.8	Vendor Internal TRM - Compressed Air
	Compressed Air Leak Repair 24hr Operation	333	1,400.0	0.1730	250,200	57.6	Vendor Internal TRM - Compressed Air

Program	Measure	Participation Count	Ex Ante Per unit kWh impact	Ex Ante Per unit kW impact	Gross Ex Ante kWh Savings	Gross Ex Ante kW Savings	Source Document
Prescriptive[11]	Cycling Air Dryer[12]	2,280	25.6	0.0036	58,414	8.1	Vendor Internal TRM - Compressed Air
	New VFD Compressor[13]	2,831	1,732.3	0.2401	4,904,141	679.8	Vendor Internal TRM - Compressed Air
	No Loss Condensate Drain	9	931.0	0.2033	8,379	1.8	Vendor Internal TRM - Compressed Air
	Centralized Energy Management System Controls[14]	1,334,982	2.3	0.0000	3,083,808	0.0	Vendor Internal TRM - Cooling
	Air-Side Economizer[15]	786	436.9	0.0000	343,522	0.0	Vendor Internal TRM - Cooling
	Chillers: Air-Cooled[15]	207	116.2	0.0681	24,011	14.1	Vendor Internal TRM - Cooling
	Chillers: Air-Cooled[15]	120	171.8	0.0865	20,613	10.4	Vendor Internal TRM - Cooling
	Chillers: Air-Cooled[15]	350	183.8	0.0997	64,330	34.9	Vendor Internal TRM - Cooling
	Chillers: Air-Cooled[15]	155	240.8	0.1409	18,638	10.9	Vendor Internal TRM - Cooling
	Chillers: Air-Cooled[15]	289	381.0	0.1904	110,122	55.0	Vendor Internal TRM - Cooling
	Chillers: Water cooled, Scroll or Helical-Rotory[15]	249	50.6	0.0322	12,569	8.0	Vendor Internal TRM - Cooling
	Chillers: Water cooled, Scroll or Helical-Rotory[15]	200	117.7	0.0687	23,538	13.7	Vendor Internal TRM - Cooling
	Chillers: Water-Cooled, Centrifugal[15]	600	124.2	0.0660	74,501	39.6	Vendor Internal TRM - Cooling
	Chillers: Water-Cooled, Centrifugal[15]	550	189.5	0.0990	104,201	54.4	Vendor Internal TRM - Cooling
	Chillers: Water-Cooled, Centrifugal[15]	538	225.9	0.1081	121,519	58.1	Vendor Internal TRM - Cooling
	Chillers: Water-Cooled, Centrifugal[15]	500	229.8	0.1158	114,879	57.9	Vendor Internal TRM - Cooling
	Chillers: Water-Cooled, Centrifugal[15]	2,000	357.7	0.1266	357,685	126.6	Vendor Internal TRM - Cooling
	Chillers: Water-Cooled, Centrifugal[15]	860	390.2	0.1971	167,789	84.8	Vendor Internal TRM - Cooling
	Demand Control Ventilation for Office[14]	24,428	0.5	0.0000	12,499	0.0	Vendor Internal TRM - Cooling
	ECMs for HVAC - Heating and Cooling	8	656.0	0.4620	1,968	1.4	Vendor Internal TRM - Cooling
	PTAC/PTHP[15]	134	186.4	0.1061	24,896	14.2	Vendor Internal TRM - Cooling
	Room Air Conditioners[15]	23	22.0	0.0126	506	0.3	Vendor Internal TRM - Cooling
	Unitary&Split AC and ASHP (EER)[15]	10	60.6	0.0400	606	0.4	Vendor Internal TRM - Cooling
	Unitary&Split AC and ASHP (EER)[15]	30	61.0	0.0355	1,806	1.1	Vendor Internal TRM - Cooling
	Unitary&Split AC and ASHP (EER)[15]	17	74.2	0.0645	631	0.5	Vendor Internal TRM - Cooling
	Unitary&Split AC and ASHP (EER)[15]	10	76.3	0.0444	763	0.4	Vendor Internal TRM - Cooling
	Unitary&Split AC and ASHP (EER)[15]	12	84.8	0.0560	993	0.7	Vendor Internal TRM - Cooling
	Unitary&Split AC and ASHP (EER)[15]	9	98.5	0.0650	926	0.6	Vendor Internal TRM - Cooling
	Unitary&Split AC and ASHP (EER)[15]	15	99.2	0.0577	1,487	0.9	Vendor Internal TRM - Cooling
	Unitary&Split AC and ASHP (EER)[15]	24	104.5	0.0831	1,275	1.0	Vendor Internal TRM - Cooling
	Unitary&Split AC and ASHP (EER)[15]	8	104.6	0.0588	784	0.4	Vendor Internal TRM - Cooling
	Unitary&Split AC and ASHP (EER)[15]	50	109.9	0.0941	5,497	4.7	Vendor Internal TRM - Cooling
	Unitary&Split AC and ASHP (EER)[15]	37	121.2	0.0800	2,242	1.5	Vendor Internal TRM - Cooling
	Unitary&Split AC and ASHP (EER)[15]	15	151.5	0.1000	1,136	0.8	Vendor Internal TRM - Cooling
	Unitary&Split AC and ASHP (EER)[15]	25	154.3	0.1019	1,928	1.3	Vendor Internal TRM - Cooling
	Unitary&Split AC and ASHP (EER)[15]	30	160.9	0.0904	2,413	1.4	Vendor Internal TRM - Cooling
	Unitary&Split AC and ASHP (EER)[15]	25	163.8	0.0921	2,064	1.2	Vendor Internal TRM - Cooling
	Unitary&Split AC and ASHP (EER)[15]	30	198.3	0.1155	2,975	1.7	Vendor Internal TRM - Cooling
	Unitary&Split AC and ASHP (EER)[15]	88	245.7	0.1381	7,199	4.0	Vendor Internal TRM - Cooling
	Unitary&Split AC and ASHP (EER)[15]	20	257.4	0.1447	2,574	1.4	Vendor Internal TRM - Cooling
	Unitary&Split AC and ASHP (EER)[15]	133	414.1	0.2916	6,129	4.3	Vendor Internal TRM - Cooling

Program	Measure	Participation Count	Ex Ante Per unit kWh impact	Ex Ante Per unit kW impact	Gross Ex Ante kWh Savings	Gross Ex Ante kW Savings	Source Document
Prescriptive[11]	Unitary&Split AC and ASHP (EER)[15]	80	636.6	0.4648	6,366	4.6	Vendor Internal TRM - Cooling
	Unitary&Split AC and ASHP (IEER)[15]	60	59.7	0.0474	3,579	2.8	Vendor Internal TRM - Cooling
	Unitary&Split AC and ASHP (IEER)[15]	105	498.7	0.1760	52,360	18.5	Vendor Internal TRM - Cooling
	Unitary&Split AC and ASHP (SEER)[15]	3	63.2	0.0502	190	0.2	Vendor Internal TRM - Cooling
	Unitary&Split AC and ASHP (SEER)[15]	6	64.7	0.0352	378	0.2	Vendor Internal TRM - Cooling
	Unitary&Split AC and ASHP (SEER)[15]	8	94.3	0.0467	754	0.4	Vendor Internal TRM - Cooling
	Unitary&Split AC and ASHP (SEER)[15]	8	103.5	0.0563	824	0.4	Vendor Internal TRM - Cooling
	Unitary&Split AC and ASHP (SEER)[15]	3	118.8	0.0668	356	0.2	Vendor Internal TRM - Cooling
	Unitary&Split AC and ASHP (SEER)[15]	3	125.7	0.0622	377	0.2	Vendor Internal TRM - Cooling
	Unitary&Split AC and ASHP (SEER)[15]	3	135.8	0.0739	407	0.2	Vendor Internal TRM - Cooling
	Unitary&Split AC and ASHP (SEER)[15]	4	142.3	0.0775	632	0.3	Vendor Internal TRM - Cooling
	Unitary&Split AC and ASHP (SEER)[15]	2	144.6	0.0716	289	0.1	Vendor Internal TRM - Cooling
	Unitary&Split AC and ASHP (SEER)[15]	2	180.1	0.1541	360	0.3	Vendor Internal TRM - Cooling
	Unitary&Split AC and ASHP (SEER)[15]	4	237.6	0.1336	950	0.5	Vendor Internal TRM - Cooling
	Unitary&Split AC and ASHP (SEER)[15]	3	297.0	0.1670	891	0.5	Vendor Internal TRM - Cooling
	Unitary&Split AC and ASHP (SEER)[15]	2	323.4	0.1760	485	0.3	Vendor Internal TRM - Cooling
	Unitary&Split AC and ASHP (SEER)[15]	12	423.2	0.2669	1,270	0.8	Vendor Internal TRM - Cooling
	Unitary&Split AC and ASHP (SEER)[15]	10	458.7	0.3029	2,294	1.5	Vendor Internal TRM - Cooling
	Unitary&Split AC and ASHP (SEER)[15]	2	485.1	0.2641	970	0.5	Vendor Internal TRM - Cooling
	Unitary&Split AC and ASHP (SEER)[15]	40	492.3	0.3251	4,923	3.3	Vendor Internal TRM - Cooling
	VFD Chilled Water Pump[13]	25	187.0	0.1320	4,675	3.3	Vendor Internal TRM - Cooling
	VFD Chilled Water Pump[13]	70	374.0	0.2640	13,090	9.2	Vendor Internal TRM - Cooling
	VFD Chilled Water Pump[13]	70	495.6	0.1316	34,694	9.2	Vendor Internal TRM - Cooling
	VFD Chilled Water Pump[13]	45	576.2	0.3948	8,642	5.9	Vendor Internal TRM - Cooling
	VFD Chilled Water Pump[13]	8	586.1	0.1316	4,396	1.0	Vendor Internal TRM - Cooling
	VFD Chilled Water Pump[13]	40	596.9	0.2632	11,937	5.3	Vendor Internal TRM - Cooling
	VFD Chilled Water Pump[13]	60	991.3	0.2632	29,738	7.9	Vendor Internal TRM - Cooling
	VFD Chilled Water Pump[13]	60	1,172.1	0.2632	35,164	7.9	Vendor Internal TRM - Cooling
	VFD Chilled Water Pump[13]	150	1,486.9	0.3948	74,344	19.7	Vendor Internal TRM - Cooling
	VFD Condenser Water Pump[13]	40	293.1	0.2572	5,863	5.1	Vendor Internal TRM - Cooling
	VFD Condenser Water Pump[13]	150	439.7	0.3857	21,985	19.3	Vendor Internal TRM - Cooling
	VFD Condenser Water Pump[13]	225	1,348.7	0.3857	101,151	28.9	Vendor Internal TRM - Cooling
	VFD Condenser Water Pump[13]	900	5,559.7	0.2151	833,949	32.3	Vendor Internal TRM - Cooling
	VFD Cooling Tower Fan[13]	20	260.8	0.1674	5,216	3.3	Vendor Internal TRM - Cooling
	VFD Cooling Tower Fan[13]	30	405.3	0.1674	12,159	5.0	Vendor Internal TRM - Cooling
	VFD Cooling Tower Fan[13]	120	782.5	0.5021	31,298	20.1	Vendor Internal TRM - Cooling
	VFD Cooling Tower Fan[13]	45	1,801.8	0.5021	27,027	7.5	Vendor Internal TRM - Cooling
	VFD Cooling Tower Fan[13]	450	3,603.6	1.0042	270,270	75.3	Vendor Internal TRM - Cooling
	VFD Cooling Tower Fan[13]	12	9,316.1	1.3390	13,974	2.0	Vendor Internal TRM - Cooling
	VFD for Kitchen Exhaust Fan - Retrofit Hood[13]	20	4,486.0	0.7600	89,720	15.2	Vendor Internal TRM - Cooling
	VFD Hot Water Pump[13]	20	341.8	0.0032	3,418	0.0	Vendor Internal TRM - Cooling

Program	Measure	Participation Count	Ex Ante Per unit kWh impact	Ex Ante Per unit kW impact	Gross Ex Ante kWh Savings	Gross Ex Ante kW Savings	Source Document
Prescriptive[11]	VFD Hot Water Pump[13]	20	388.9	0.0016	7,777	0.0	Vendor Internal TRM - Cooling
	VFD Hot Water Pump[13]	10	486.7	0.0032	2,434	0.0	Vendor Internal TRM - Cooling
	VFD Hot Water Pump[13]	8	580.6	0.0016	4,354	0.0	Vendor Internal TRM - Cooling
	VFD Other Non-HVAC Motor[13]	375	721.0	0.0730	94,954	13.2	Vendor Internal TRM - Cooling
	VFD Supply/Return Fan[13]	398	409.6	0.1837	162,826	73.0	Vendor Internal TRM - Cooling
	VFD Supply/Return Fan[13]	99	444.9	0.1837	43,819	18.1	Vendor Internal TRM - Cooling
	VFD Supply/Return Fan[13]	20	491.4	0.1837	9,827	3.7	Vendor Internal TRM - Cooling
	VFD Supply/Return Fan[13]	40	889.7	0.3675	17,794	7.3	Vendor Internal TRM - Cooling
	VFD Supply/Return Fan[13]	70	982.7	0.3675	34,395	12.9	Vendor Internal TRM - Cooling
	VFD Supply/Return Fan[13]	3	1,077.0	0.1840	3,231	0.6	Vendor Internal TRM - Cooling
	VFD Supply/Return Fan[13]	30	1,272.6	0.1837	38,178	5.5	Vendor Internal TRM - Cooling
	VFD Supply/Return Fan[13]	15	1,310.0	0.3675	9,825	2.8	Vendor Internal TRM - Cooling
	VFD Supply/Return Fan[13]	45	1,334.6	0.5512	20,019	8.3	Vendor Internal TRM - Cooling
	VFD Supply/Return Fan[13]	16	1,435.1	0.3675	11,481	2.9	Vendor Internal TRM - Cooling
	VFD Supply/Return Fan[13]	45	1,474.1	0.5512	22,111	8.3	Vendor Internal TRM - Cooling
	VFD Supply/Return Fan[13]	15	1,511.0	0.1840	22,665	2.8	Vendor Internal TRM - Cooling
	VFD Supply/Return Fan[13]	120	1,638.5	0.7350	49,155	22.0	Vendor Internal TRM - Cooling
	VFD Supply/Return Fan[13]	300	1,779.4	0.7350	133,459	55.1	Vendor Internal TRM - Cooling
	VFD Supply/Return Fan[13]	16	1,905.4	0.3675	15,243	2.9	Vendor Internal TRM - Cooling
	VFD Supply/Return Fan[13]	30	2,152.6	0.5512	21,526	5.5	Vendor Internal TRM - Cooling
	VFD Supply/Return Fan[13]	10	2,154.0	0.3680	10,770	1.8	Vendor Internal TRM - Cooling
	VFD Supply/Return Fan[13]	20	2,619.9	0.7350	13,100	3.7	Vendor Internal TRM - Cooling
	VFD Supply/Return Fan[13]	27	2,858.1	0.5512	25,723	5.0	Vendor Internal TRM - Cooling
	VFD Supply/Return Fan[13]	20	2,870.2	0.7350	14,351	3.7	Vendor Internal TRM - Cooling
	VFD Supply/Return Fan[13]	15	3,274.9	0.9187	9,825	2.8	Vendor Internal TRM - Cooling
	VFD Supply/Return Fan[13]	15	3,817.8	0.5512	19,089	2.8	Vendor Internal TRM - Cooling
	VFD Supply/Return Fan[13]	60	4,305.2	1.1025	43,052	11.0	Vendor Internal TRM - Cooling
	VFD Supply/Return Fan[13]	200	4,448.6	1.8375	88,972	36.7	Vendor Internal TRM - Cooling
	VFD Supply/Return Fan[13]	120	5,740.3	1.4700	86,105	22.0	Vendor Internal TRM - Cooling
	VFD Supply/Return Fan[13]	24	9,114.0	1.1040	36,456	4.4	Vendor Internal TRM - Cooling
	VFD Supply/Return Fan[13]	40	13,099.5	3.6750	26,199	7.3	Vendor Internal TRM - Cooling
	VRF Air Conditioners[15]	25	352.8	0.2484	8,734	6.1	Vendor Internal TRM - Cooling
	VRF Air Conditioners[15]	8	484.8	0.3413	3,684	2.6	Vendor Internal TRM - Cooling
	VRF Air Conditioners[15]	23	490.8	0.3455	11,190	7.9	Vendor Internal TRM - Cooling
	VRF Air Conditioners[15]	31	744.5	0.5242	11,391	8.0	Vendor Internal TRM - Cooling
	VRF Air Conditioners[15]	27	778.0	0.5478	10,347	7.3	Vendor Internal TRM - Cooling
	VRF Air Conditioners[15]	42	889.5	0.6263	18,680	13.2	Vendor Internal TRM - Cooling
	Window Film	32	2.7	0.0012	8,672	3.8	Vendor Internal TRM - Cooling
	Beverage Machine Controls	26	1,612.0	0.0000	41,912	0.0	Vendor Internal TRM - Food Service
	Combination Oven	5	18,431.7	1.6973	92,158	8.5	Vendor Internal TRM - Food Service
	Ice Maker	1	960.3	0.1801	960	0.2	Vendor Internal TRM - Food Service

APPENDIX A -- Ohio Savings Terms FINAL **12/31/2014**

Program	Measure	Participation Count	Ex Ante Per unit kWh impact	Ex Ante Per unit kW impact	Gross Ex Ante kWh Savings	Gross Ex Ante kW Savings	Source Document
Prescriptive[11]	Ice Maker	6	1,113.6	0.2090	6,682	1.3	Vendor Internal TRM - Food Service
	Ice Maker	1	1,197.1	0.2245	1,197	0.2	Vendor Internal TRM - Food Service
	Snack Machine Controls	8	387.0	0.0000	3,096	0.0	Vendor Internal TRM - Food Service
	Steam Cookers	2	25,545.0	3.5261	51,090	7.1	Vendor Internal TRM - Food Service
	Exterior (ES DLC) LED Lamp or Fixture[16]	2,705,800	4.2	0.0000	11,258,867	0.0	Vendor Internal TRM - Lighting
	Exterior Bi-Level Exeterior or Garage Lighting Controls[16]	135,629	0.6	0.0000	84,653	0.0	Vendor Internal TRM - Lighting
	Exterior ENERGY STAR and DesignLights Consortium (DLC)	22,122	4.3	0.0000	95,125	0.0	Vendor Internal TRM - Lighting
	Exterior Exit Sign	24	78.8	0.0090	1,892	0.2	Vendor Internal TRM - Lighting
	Exterior HW CFL 29w or Less	6	137.3	0.0000	824	0.0	Vendor Internal TRM - Lighting
	Exterior New T5/T8 Fluorescent Fixtures[16]	96,986	4.2	0.0000	403,559	0.0	Vendor Internal TRM - Lighting
	Exterior New T5/T8 Fluorescent Fixtures[16]	5,244	4.3	0.0000	22,549	0.0	Vendor Internal TRM - Lighting
	Exterior Non-Standard LED or Induction Equipment[16]	1,211,366	4.2	0.0000	5,040,494	0.0	Vendor Internal TRM - Lighting
	Exterior Non-Standard LED or Induction Equipment[16]	47,621	4.3	0.0000	204,770	0.0	Vendor Internal TRM - Lighting
	Exterior Non-Standard Lighting Measure[16]	11,207	4.3	0.0000	48,190	0.0	Vendor Internal TRM - Lighting
	Exterior Other Lighting Measure[16]	293,670	4.2	0.0000	1,221,961	0.0	Vendor Internal TRM - Lighting
	Exterior Photocells + Timeclocks[16]	30,032	1.7	0.0000	52,226	0.0	Vendor Internal TRM - Lighting
	Exterior Photocells[16]	95,626	0.3	0.0000	31,434	0.0	Vendor Internal TRM - Lighting
	Exterior Photocells[16]	280	0.5	0.0000	131	0.0	Vendor Internal TRM - Lighting
	Exterior Screw In CFL 16w to 26w	34	137.3	0.0000	4,669	0.0	Vendor Internal TRM - Lighting
	Exterior Screw In CFL 27w to 40w	6	187.2	0.0000	1,123	0.0	Vendor Internal TRM - Lighting
	Exterior Time Clocks for Lighting[16]	10,119	0.4	0.0000	4,211	0.0	Vendor Internal TRM - Lighting
	Garage (ES DLC) LED Lamp or Fixture[16]	103,051	8.8	0.0010	902,727	103.1	Vendor Internal TRM - Lighting
	Garage Exit Sign	6	78.8	0.0090	473	0.1	Vendor Internal TRM - Lighting
	Garage New T5/T8 Fluorescent Fixtures[16]	26,190	8.8	0.0010	229,424	26.2	Vendor Internal TRM - Lighting
	Garage Non-Standard LED or Induction Equipment[16]	29,732	8.8	0.0010	260,452	29.7	Vendor Internal TRM - Lighting
	Garage Other Lighting Measure[16]	564	8.8	0.0010	4,941	0.6	Vendor Internal TRM - Lighting
	Green 12"	23	519.8	0.0593	11,956	1.4	Vendor Internal TRM - Lighting
	HW CFL 42 Watts	20	319.1	0.0934	6,382	1.9	Vendor Internal TRM - Lighting
	Interior (ES DLC) LED Lamp or Fixture[16]	3,476,092	4.5	0.0010	16,792,307	3,336.7	Vendor Internal TRM - Lighting
	Interior 1L 8-ft T12 to 2L 4-ft HP T8 Retrofit	1,052	81.3	0.0169	86,421	19.5	Vendor Internal TRM - Lighting
	Interior 3-ft T8 Lamp and Ballast T12 Base	4	61.5	0.0128	249	0.1	Vendor Internal TRM - Lighting
	Interior 4-ft HP Lamp and Ballast (Linear and U-Bend) T12 Ba	687	57.1	0.0119	39,658	8.9	Vendor Internal TRM - Lighting
	Interior 4-ft RW Lamp and Ballast (Linear and U-Bend) T12 Ba	78	76.9	0.0160	6,815	1.3	Vendor Internal TRM - Lighting
	Interior 4-ft T12 Lamp Removed	620	175.7	0.0365	120,944	27.6	Vendor Internal TRM - Lighting
	Interior Daylighting Controls[16]	32,626	0.3	0.0008	44,091	25.5	Vendor Internal TRM - Lighting
	Interior ENERGY STAR and DesignLights Consortium (DLC) L	16,345	4.3	0.0009	100,948	17.4	Vendor Internal TRM - Lighting
	Interior Exit Sign[16]	1,444	9.0	0.0113	137,408	16.7	Vendor Internal TRM - Lighting
	Interior HW CFL 30w to 60w	16	91.0	0.0910	4,019	0.9	Vendor Internal TRM - Lighting
	Interior LED, T-1, or Cold Cathode Exit Signs	109	328.7	0.0388	34,907	4.1	Vendor Internal TRM - Lighting
	Interior Linear Fluorescent Retrofit[16]	1,336,444	4.5	0.0010	5,630,562	1,270.8	Vendor Internal TRM - Lighting
	Interior New T5/T8 Fluorescent Fixtures[16]	292,833	4.3	0.0009	987,265	270.2	Vendor Internal TRM - Lighting
	Interior New T5/T8 Fluorescent Fixtures[16]	4,432,524	4.5	0.0010	20,452,338	4,071.3	Vendor Internal TRM - Lighting

Program	Measure	Participation Count	Ex Ante Per unit kWh impact	Ex Ante Per unit kW impact	Gross Ex Ante kWh Savings	Gross Ex Ante kW Savings	Source Document
Prescriptive[11]	Interior Non-Standard LED or Induction Equipment[16]	229,032	4.3	0.0009	1,362,673	228.8	Vendor Internal TRM - Lighting
	Interior Non-Standard LED or Induction Equipment[16]	934,246	4.5	0.0010	4,811,620	1,007.9	Vendor Internal TRM - Lighting
	Interior Non-Standard Lighting Measure[16]	43,310	4.3	0.0009	148,394	45.0	Vendor Internal TRM - Lighting
	Interior Occupancy + Daylighting Sensor[16]	3,721	0.3	0.0014	3,796	0.9	Vendor Internal TRM - Lighting
	Interior Occupancy Sensor[16]	2,901,733	0.3	0.0003	3,415,130	846.3	Vendor Internal TRM - Lighting
	Interior Occupancy Sensor[16]	458,793	1.3	0.0003	438,102	159.0	Vendor Internal TRM - Lighting
	Interior Other Lighting Measure[16]	756,823	4.5	0.0010	2,600,187	598.2	Vendor Internal TRM - Lighting
	Interior Reduced Wattage 8-ft Lamp and Ballast	8	107.6	0.0224	1,220	0.2	Vendor Internal TRM - Lighting
	Interior Screw In CFL 15w or Less	519	21.0	0.0210	42,704	8.9	Vendor Internal TRM - Lighting
	Interior Screw In CFL 16w to 26w	273	33.0	0.0330	36,336	6.9	Vendor Internal TRM - Lighting
	Interior Screw In CFL 27w to 40w	107	45.0	0.0450	16,302	3.6	Vendor Internal TRM - Lighting
	Interior Screw In Compact Fluorescent Lamps 15W or Less	524	134.3	0.0253	68,598	13.4	Vendor Internal TRM - Lighting
	Interior Specialty CFL	25	33.0	0.0330	3,816	0.8	Vendor Internal TRM - Lighting
	Interior Specialty CFL: GU-24 locking base, PAR, dimmable, o	10	230.8	0.0436	3,270	0.5	Vendor Internal TRM - Lighting
	Interior T12 to T5 Lamps and Electronic Ballast	587	37.3	0.0078	24,761	5.6	Vendor Internal TRM - Lighting
	Interior Time Clocks for Lighting[16]	44,395	0.4	0.0000	21,701	0.0	Vendor Internal TRM - Lighting
	Red 12"	23	693.8	0.0792	15,957	1.8	Vendor Internal TRM - Lighting
	Suite (ES DLC) LED Lamp or Fixture[16]	4,488,189	4.5	0.0010	4,080,962	664.5	Vendor Internal TRM - Lighting
	Suite Linear Fluorescent Retrofit[16]	1,140	4.5	0.0010	1,047	0.4	Vendor Internal TRM - Lighting
	High Efficiency Electric Hot Water Heater	2	809.3	0.1780	1,619	0.4	Vendor Internal TRM - Misc.
	Networked Power Management Software	3,584	99.0	0.0000	393,264	0.0	Vendor Internal TRM - Misc.
	Plug Load Occ Sensors	5	169.0	0.0000	845	0.0	Vendor Internal TRM - Misc.
	Three Phase Dry Type Low Voltage Transformers	225	1,482.0	0.3639	3,293	0.8	Vendor Internal TRM - Misc.
	Three Phase Dry Type Low Voltage Transformers	300	2,826.4	0.3929	6,096	0.8	Vendor Internal TRM - Misc.
	Three Phase Dry Type Low Voltage Transformers	225	3,272.3	0.4549	3,636	0.5	Vendor Internal TRM - Misc.
	Efficient Motors[13]	40	223.2	0.0487	893	0.2	Vendor Internal TRM - Motors and Drives
	Efficient Motors[13]	75	2,431.5	0.3377	2,432	0.3	Vendor Internal TRM - Motors and Drives
	Process Motor[13]	4,457	743.7	0.0827	3,693,357	484.7	Vendor Internal TRM - Motors and Drives
	Process Motor[13]	554	744.0	0.0830	864,903	99.6	Vendor Internal TRM - Motors and Drives
	Anti-Sweat Heater Controls	56	294.0	0.0340	16,464	1.9	Vendor Internal TRM - Refrigeration
	Anti-Sweat Heater Controls	1,637	528.0	0.0600	864,336	98.2	Vendor Internal TRM - Refrigeration
	EC Motor for Reach-in Refrigerator cases and Freezer cases	173	345.0	0.0330	59,685	5.7	Vendor Internal TRM - Refrigeration
	EC Motor for Reach-in Refrigerator cases and Freezer cases	997	625.0	0.0710	623,125	70.8	Vendor Internal TRM - Refrigeration
	EC Motor for Walk-in Cooler and Freezer	2	864.0	0.0986	1,728	0.2	Vendor Internal TRM - Refrigeration
	EC Motor for Walk-in Cooler and Freezer	25	1,250.0	0.1427	31,250	3.6	Vendor Internal TRM - Refrigeration
	ENERGY STAR Glass Door Freezer	1	2,076.0	0.2368	2,076	0.2	Vendor Internal TRM - Refrigeration
	ENERGY STAR Solid Door Freezer	37	1,307.0	0.1491	48,359	5.5	Vendor Internal TRM - Refrigeration
	ENERGY STAR Solid Door Refrigerator	15	637.0	0.0727	9,555	1.1	Vendor Internal TRM - Refrigeration
	Glass Door Freezer	5	2,076.0	0.2368	10,380	1.2	Vendor Internal TRM - Refrigeration
	LED Refrigeration Case Lighting - Open Cases	336	172.1	0.0260	57,826	8.7	Vendor Internal TRM - Refrigeration
	LED Refrigeration Case Lighting - Open Cases	1,545	348.0	0.0596	537,660	92.1	Vendor Internal TRM - Refrigeration
	LED Refrigeration Case Lighting - With Doors	210	215.9	0.0320	45,339	6.7	Vendor Internal TRM - Refrigeration
	LED Refrigeration Case Lighting - With Doors	7,018	394.0	0.0635	2,765,092	445.6	Vendor Internal TRM - Refrigeration
	Lighting Controls for Freezers and Coolers with Doors	358	81.7	0.0135	29,249	4.8	Vendor Internal TRM - Refrigeration

Program	Measure	Participation Count	Ex Ante Per unit kWh impact	Ex Ante Per unit kW impact	Gross Ex Ante kWh Savings	Gross Ex Ante kW Savings	Source Document
Prescriptive[11]	New Doors on Medium Temp Open Refrigerated Case	60	377.0	0.0430	22,620	2.6	Vendor Internal TRM - Refrigeration
	Solid Door Freezer	4	1,307.0	0.1491	5,228	0.6	Vendor Internal TRM - Refrigeration
	Solid Door Refrigerator	3	637.0	0.0727	1,911	0.2	Vendor Internal TRM - Refrigeration
	TOTAL				**106,844,304**	**16,726.1**	

[11] Due to insufficient data, some measures were excluded from this program and not claimed as savings.
[12] Quantity is CFM reduced
[13] Quantity is Horsepower
[14] Quantity is represented by Square Footage controlled
[15] Per Unit values reported by Ton, will not match savings reported due to incremental increases in efficiency result in additional savings - Vendor Internal TRM - HVAC
[16] These are reported by the wattage that was reduced/controlled

Program	Measure	Participation Count	Ex Ante Per unit kWh impact	Ex Ante Per unit kW impact	Gross Ex Ante kWh Savings	Gross Ex Ante kW Savings	Source Document
Self Direct	Cycling refrigerated dryer- over prescriptive size range.	1	23,547	2.3300	23,547	2.3	All Custom Measures are individually calculated using methodology consistent with the Draft Ohio 2010 Technical Reference Manual.
	Extruder # 19 150 hp VFD	1	27,537	5.5700	27,537	5.6	
	New 200HP VFD Comp.	1	515,614	74.9700	515,614	75.0	
	Commercial Dishwashing Machine. 15 years old to New commercial dishwashing Machine	1	169,754	0.0000	169,754	0.0	
	Hydraulic Injection Mold Machine with All-Electric Injection Mold Machine	1	7,193	1.1850	7,193	1.2	
	Hydraulic Injection Mold Machine with All-Electric Injection Mold Machine	1	70,385	11.5900	70,385	11.6	
	Hydraulic Injection Mold Machine with All-Electric Injection Mold Machine	1	93,709	15.4300	93,709	15.4	
	New all-electric IMM	1	38,693	11.2400	38,693	11.2	
	Server Consolidation/Virtualization. To 9 addtional servers installed to handle this load. 40 servers replaced from 2011-	1	104,536	11.9300	104,536	11.9	
	Replacing an electric steam based lubrication die system with a soap based dye system.	1	113,152	109.0000	113,152	109.0	
	(3) HYDRAULIC PUMP MOTORS AND (3) COOLING FAN MOTORS ON PIZZA LINES 1, 2, AND 4 TOTALING >80HP. (16) ELECTRIC CONVEYOR MOTORS ON PIZZA LINES 1, 2, AND 4 TOTALING <15HP	1	233,792	42.9500	233,792	43.0	
	Pizza lines 1&2 running sanitation 1.46 hours per day; and therefore increasing downtime by 3.5 hours per day.	1	1,663,501	0.0000	1,663,501	0.0	
	200 HP backward inclined fan with outlet damper flow conrol is replaced with 250 HP fan with VFD controls in a dust collection system	1	216,727	0.0000	216,727	0.0	
	New 75HP dough extruder with VFD installed	1	24,444	3.4900	24,444	3.5	
	Replaced (7) old refrigerated and freezer cases with new Hussmann refrigerated and freezer cases, retrofited outdated flourescent lamps with LEDs, added controls, and added doors to the existing cases	1	91,790	10.7020	91,790	10.7	
	VFD on 200-hp bio reactor	1	42,129	0.0000	42,129	0.0	
	VFDs on the Extruder 15 & 18 (150-hp each)	1	115,515	1.9800	115,515	2.0	
	Heat recovery wheel, cooling savings	1	6,416	0.0000	6,416	0.0	
	No Loss Condensate Drain	1	931	0.2033	931	0.2	Vendor Internal TRM - Compressed Air
	Ice Maker	2	847	0.1589	1,694	0.3	Vendor Internal TRM - Food Service
	Occupancy Sensor Control for HVAC Systems	180	655	0.0000	117,900	0.0	Vendor Internal TRM - Cooling
	Unitary&Split AC and ASHP (IEER)[17]	6	68	0.0337	409	0.2	Vendor Internal TRM - Cooling
	Unitary&Split AC and ASHP (IEER)[17]	15	136	0.0674	1,021	0.5	Vendor Internal TRM - Cooling
	Unitary&Split AC and ASHP (IEER)[17]	13	139	0.0687	1,733	0.9	Vendor Internal TRM - Cooling
	Unitary&Split AC and ASHP (IEER)[17]	10	153	0.0759	1,532	0.8	Vendor Internal TRM - Cooling
	Unitary&Split AC and ASHP (IEER)[17]	9	213	0.1054	1,809	0.9	Vendor Internal TRM - Cooling
	Unitary&Split AC and ASHP (IEER)[17]	15	392	0.1939	2,937	1.5	Vendor Internal TRM - Cooling
	Unitary&Split AC and ASHP (IEER)[17]	20	426	0.2107	4,256	2.1	Vendor Internal TRM - Cooling
	Unitary&Split AC and ASHP (IEER)[17]	200	1,554	0.7695	77,705	38.5	Vendor Internal TRM - Cooling

Program	Measure	Participation Count	Ex Ante Per unit kWh impact	Ex Ante Per unit kW impact	Gross Ex Ante kWh Savings	Gross Ex Ante kW Savings	Source Document
Self Direct	Unitary&Split AC and ASHP (SEER)[17]	10	251	0.1245	1,257	0.6	Vendor Internal TRM - Cooling
	Unitary&Split AC and ASHP (SEER)[17]	12	377	0.1867	1,509	0.7	Vendor Internal TRM - Cooling
	Unitary&Split AC and ASHP (SEER)[17]	2	390	0.1930	585	0.3	Vendor Internal TRM - Cooling
	Unitary&Split AC and ASHP (SEER)[17]	4	754	0.3735	1,509	0.7	Vendor Internal TRM - Cooling
	VFD Chilled Water Pump[18]	30	442	0.1316	13,268	3.9	Vendor Internal TRM - Cooling
	VFD Cooling Tower Fan[18]	35	261	0.1674	9,129	5.9	Vendor Internal TRM - Cooling
	VFD Hot Water Pump[18]	40	994	0.0016	39,765	0.1	Vendor Internal TRM - Cooling
	VFD Hot Water Pump[18]	23	2,982	0.0048	22,368	0.0	Vendor Internal TRM - Cooling
	VFD Other HVAC Motor[18]	15	474	0.1230	7,108	1.8	Vendor Internal TRM - Cooling
	VFD Supply/Return Fan[18]	15	3,423	0.5520	17,115	2.8	Vendor Internal TRM - Cooling
	Chillers: Water-Cooled, Centrifugal[17]	900	165	0.0586	148,881	52.8	Vendor Internal TRM - Cooling
	Interior Occupancy Sensor[19]	12,936	0	0.0003	26,877	2.9	Vendor Internal TRM - Lighting
	Interior Occupancy Sensor[19]	12,636	1	0.0003	23,598	2.8	Vendor Internal TRM - Lighting
	Exterior (ES DLC) LED Lamp or Fixture[19]	3,430	4	0.0000	14,272	0.0	Vendor Internal TRM - Lighting
	Exterior LPD[19]	17,092	4	0.0000	71,121	0.0	Vendor Internal TRM - Lighting
	Exterior Other Lighting Measure[19]	3,960	4	0.0000	16,478	0.0	Vendor Internal TRM - Lighting
	Garage LPD[19]	2,312	9	0.0010	20,253	2.3	Vendor Internal TRM - Lighting
	Interior Screw In CFL 15w or Less	23	21	0.0210	3,188	0.6	Vendor Internal TRM - Lighting
	Interior Screw In CFL 16w to 26w	14	33	0.0330	3,200	0.5	Vendor Internal TRM - Lighting
	Interior Exit Sign	9	9	0.0113	804	0.1	Vendor Internal TRM - Lighting
	Interior (ES DLC) LED Lamp or Fixture[19]	1,200	4	0.0010	7,775	1.6	Vendor Internal TRM - Lighting
	Interior LPD[19]	56,869	4	0.0010	278,952	56.0	Vendor Internal TRM - Lighting
	Interior Other Lighting Measure[19]	1,950	4	0.0010	13,505	1.9	Vendor Internal TRM - Lighting
	Interior New T5/T8 Fluorescent Fixtures[19]	9,835	4	0.0009	54,724	9.8	Vendor Internal TRM - Lighting
	Interior New T5/T8 Fluorescent Fixtures[19]	54,013	4	0.0010	331,192	57	Vendor Internal TRM - Lighting
	Interior 4-ft HP Lamp and Ballast (Linear and U-Bend) T12 Ba	443	57	0.0119	30,283	5.8	Vendor Internal TRM - Lighting
	Interior Linear Fluorescent Retrofit[19]	8,966	4	0.0010	62,096	8.8	Vendor Internal TRM - Lighting
	Interior Reduced Wattage 8-ft Lamp and Ballast	6	108	0.0224	915	0.1	Vendor Internal TRM - Lighting
	Whole Building e10 and <20%	1	244,861	82.1300	244,861	82.1	Individually modeled by Implementer
	Process Motor[18]	982	744	0.0827	729,981	81.1	Vendor Internal TRM - Motors and Drives
	Process Motor[18]	264	744	0.0830	196,416	21.9	Vendor Internal TRM - Motors and Drives
	Solid Door Refrigerator	1	637	0.0727	637	0.1	Vendor Internal TRM - Refrigeration
	Total				**6,163,981**	**752.8**	

[17] Per Unit values reported by Ton, will not match savings reported due to incremental increases in efficiency result in additional savings - Vendor Internal TRM - HVAC
[18] Quantity is reported in Horsepower
[19] These are reported by the wattage that was reduced/controlled

APPENDIX A -- Ohio Savings Terms FINAL **12/31/2014**

Program	Measure	Participation Count	Ex Ante Per unit kWh impact	Ex Ante Per unit kW impact	Gross Ex Ante kWh Savings	Gross Ex Ante kW Savings	Source Document
Express	Occupancy Sensor	568	50.3	0.0000	28,588	0.0	New York State TRM - Lighting
	Exterior CFL	11	521.1	0.1263	5,445	1.3	New York State TRM - Lighting
	Exterior LED	645	1,004.8	0.2289	615,699	140.3	New York State TRM - Lighting
	Garage Compact Fluorescent	7	127.4	0.0501	847	0.3	New York State TRM - Lighting
	Garage Exit Signs	6	119.9	0.0103	683	0.1	New York State TRM - Lighting
	Garage LED	16	112.3	0.0301	1,708	0.5	New York State TRM - Lighting
	Garage T5 Fluorescent	69	766.4	0.1487	50,234	9.7	New York State TRM - Lighting
	Garage T8 Fluorescent	1,314	551.2	0.1226	688,056	153.0	New York State TRM - Lighting
	Interior Compact Fluorescent	1,233	111.0	0.0421	130,005	49.3	New York State TRM - Lighting
	Interior Exit Signs	606	282.7	0.0272	162,751	15.7	New York State TRM - Lighting
	Interior LED	3,214	243.7	0.0566	744,006	172.8	New York State TRM - Lighting
	Interior T8 Fluorescent	18,260	260.0	0.0695	4,510,584	1,205.9	New York State TRM - Lighting
	Smart Power Strip	2	38.2	0.0000	76	0.0	New York State TRM - Misc
	Anti Sweat Heater Control	11	7,519.4	0.6411	82,713	7.1	New York State TRM - Refrigeration
	Evaporator Fans	8	6,752.8	0.2259	54,022	1.8	New York State TRM - Refrigeration
	Shut Off Novelty Unit Refrigeration	12	1,089.0	0.0000	13,068	0.0	New York State TRM - Refrigeration
	Refrigeration ECM	66	622.5	0.0754	41,083	5.0	New York State TRM - Refrigeration
	Refrigeration LED Case Lighting	24	3,949.1	0.4871	94,778	11.7	New York State TRM - Refrigeration
	TOTAL				**7,224,347**	**1,774.4**	
RetroCommissioning	Temperature setback	4	28,902.5	0.0000	115,610	0.0	Standard Engineering Calculation
	Chilled Supply/Return Water Temperature Reset	4	60,846.8	1.7275	243,387	6.9	Standard Engineering Calculation
	Equipment optimization	4	93,596.8	12.0000	374,387	48.0	Standard Engineering Calculation
	Equipment tuneup	2	99,366.5	0.0000	198,733	0.0	Standard Engineering Calculation
	Chilled Water Pump Optimization With VFD	1	24,621.0	0.0000	24,621	0.0	Standard Engineering Calculation
	Motor optimization	9	56,580.3	10.6644	509,223	96.0	Standard Engineering Calculation
	Schedule optimization	26	114,477.8	7.0731	2,976,424	183.9	Vendor Analysis
	Control optimization	1	74,864.0	0.0000	74,864	0.0	Standard Engineering Calculation
	TOTAL				**4,517,249**	**334.8**	
Data Center	Air Handling Unit Setback	1	45,037.0	0.0000	45,037	0.0	Standard Engineering Calculation
	Computer Room Air Conditioner	168	6,261.4	0.6220	1,051,908	104.5	Standard Engineering Calculation
	Computer Room Air Handler	21	118,824.9	13.5667	2,495,322	284.9	Standard Engineering Calculation
	Electric socket/control/occupancy or load sensor	8	26,852.8	3.0625	214,822	24.5	Standard Engineering Calculation
	HVAC Equipment Optimization	1	562,956.0	91.7000	562,956	91.7	Standard Engineering Calculation
	HVAC/control/disable reheat	20	3,775.8	0.4300	75,516	8.6	Standard Engineering Calculation
	HVAC/control/temperature setback	12	23,995.6	1.8500	287,947	22.2	Standard Engineering Calculation
	HVAC/equipment/variable frequency drive	21	27,405.2	3.1286	575,509	65.7	Standard Engineering Calculation
	IT/equipment/server	13	38,059.1	4.5692	494,768	59.4	Standard Engineering Calculation
	IT/equipment/storage	16	159,537.4	18.6688	2,552,598	298.7	Standard Engineering Calculation
	IT/equipment/virtualization	151	30,284.1	3.4629	4,572,902	522.9	Standard Engineering Calculation
	IT/hardware/server	9	1,133.4	0.1333	10,201	1.2	Standard Engineering Calculation
	Systemic/Equipment/Energy Management System	1	206,015.0	23.5000	206,015	23.5	Standard Engineering Calculation
	Uninterruptable Power Source	16	26,626.3	3.0313	426,021	48.5	Standard Engineering Calculation
	TOTAL				**13,571,522**	**1,556.3**	
Continuous Energy Improvement	Multivariate Linear Regression	49	820,875.9	34.1478	**40,222,920**	**1,673.2**	Individually modeled by Implementer
Bid to Win	VFD for Evaporators	4	337,503.2	40.7687	1,350,013	163.1	Pre and Post Metering
	VFD for Boilers	2	659,951.8	80.3685	1,319,904	160.7	Pre and Post Metering
	VFD for Dryers	2	340,493.8	40.1091	680,988	80.2	Pre and Post Metering
	TOTAL				**3,350,904**	**404.0**	

APPENDIX B

NAVIGANT

EFFICIENT PRODUCTS PROGRAM

2014 Evaluation Report

Prepared for:
AEP Ohio

AEP OHIO®
A unit of American Electric Power

May 7, 2015

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Table of Contents

Executive Summary **1**
ES.1 Program Summary 1
ES.2 Key Impact Findings 1
ES.3 Conclusions and Recommendations for Program Improvements 3
1 Introduction **6**
1.1 Program Description 6
1.2 Evaluation Objectives 8
2 Methodology **10**
2.1 Program Documentation Review 10
2.2 In-depth Staff Interviews 11
2.3 In-depth Contractor Interviews 11
2.4 Participant Telephone Survey 12
2.5 General Population Survey 13
2.6 Ex Post Savings Evaluation Methods 13
3 Detailed Evaluation Findings **14**
3.1 Program Activity 14
3.2 Combined Impacts of the Efficient Products Program 17
3.3 Lighting Impact Evaluation Findings 17
3.4 Detailed Appliance Impact Evaluation Findings 23
3.5 Process Evaluation Findings 31
3.6 Cost Effectiveness Review 47
4 Conclusions and Recommendations **49**
4.1 Conclusions and Recommendations for Program Improvements 49
Appendix A Detailed Process Evaluation Results and Survey Instruments **51**
A.1 Survey Dispositions 51
A.2 Tracking Data Review 52
A.3 Additional Lighting Impact Savings Findings 53
A.4 Additional Process Evaluation Results 54
A.5 Data Collection Instruments 61

List of Figures

Figure 3-1. Lighting Products Discounted by Month Invoiced 15
Figure 3-2. Distribution of Efficient Products Appliance Rebates by Month Invoiced 16
Figure 3-3. Program Satisfaction by Equipment Type (n = 397) 32
Figure 3-4. Influence of In-store Promotional Materials by Equipment Type 34
Figure 3-5. Respondent Ratings of Sales Associates' Knowledge by Equipment Type 35
Figure 3-6. Influence of the Sales Associate on Participants' Purchasing Decision (n = 246) 36
Figure 3-7. Customer Awareness of Efficient Products by Product Type (n = 385) 37
Figure 3-8. Sources of Awareness for the AEP Ohio Appliance Rebates (n = 58) 38
Figure 3-9. Sources of Awareness for Lighting Discounts (n=57) 38
Figure 3-10. Likelihood Customers Would Replace Current Water Heater with a Heat Pump Water Heater (n = 114) 39
Figure 3-11. Satisfaction with CFL and LED Performance 43
Figure 3-12. Likelihood Customers Would Replace Current CFL or LED with Another CFL or LED 44
Figure 3-13. Demand Curves for Directional and Omni-directional LEDs 45
Figure A-1. Distribution of Program CFL Wattage 53
Figure A-2. Distribution of Program LED Wattages 54
Figure A-3. General Population Awareness of Rebate Programs 55
Figure A-4. General Population Participation in Rebate Programs 55
Figure A-5. Reasons Customers Had Not Applied for Appliance Rebates (n = 48) 56
Figure A-6. General Population Satisfaction with AEP Ohio (n = 385) 57
Figure A-7. Participant Satisfaction with AEP Ohio (n = 397). 57
Figure A-8. Participant Satisfaction with Program Elements (n = 397) 58

List of Tables

Table ES-1. 2014 Program Savings and Realization Rates 1
Table ES-2. *Ex Post* Energy Savings for the 2014 Efficient Products Program 2
Table ES-3. *Ex Post* Demand Savings for the 2014 Efficient Products Program 3

Table 1-1. Program Appliance Rebate Amounts in 2014........ 7
Table 2-1. Summary of Data Review and Data Collection Activities 10
Table 2-2. In-Depth Staff Interviews 11
Table 2-3. In-Depth Contractor Interviews 12
Table 2-4. Participant Telephone Surveys 12
Table 2-5. General Population Surveys........ 13
Table 3-1. Efficient Products 2014 Activity 14
Table 3-2. Lighting Product 2014 Program Activity 15
Table 3-3. Combined Program Energy Savings and Realization Rates........ 17
Table 3-4. Combined Program Demand Savings and Realization Rates 17
Table 3-5. Lighting Energy Savings – 2014........ 18
Table 3-6. Lighting Demand Savings – 2014 18
Table 3-7. Draft 2010 Ohio TRM-Specified Values for CFLs Delta Watts Multiplier 20
Table 3-8. *Ex Ante* LED Baseline Wattage, by Program Measure Wattage 21
Table 3-9. *Ex Post* LED Baseline Wattage, by Program Measure Wattage 22
Table 3-10. Adjusted Baseline Wattages by Month and by Incandescent Wattage 22
Table 3-11. Key *Ex Ante* and *Ex Post* Parameters for LEDs 23
Table 3-12. Appliance Energy Savings – 2014........ 24
Table 3-13. Appliance Demand Savings – 2014 25
Table 3-14. Draft 2010 Ohio TRM Per-Unit Savings Values for Clothes Washers 25
Table 3-15. Percent of Program Clothes Washers by Draft 2010 Ohio TRM Efficiency Level 25
Table 3-16. Draft 2010 Ohio TRM Per-Unit Savings Values for Dehumidifiers 26
Table 3-17. Percent of Program Dehumidifiers by Capacity 26
Table 3-18. Draft 2010 Ohio TRM Per-Unit Savings Values for Refrigerators 27
Table 3-19. Percent of Program Refrigerators by Efficiency and Configuration........ 27
Table 3-20. Key *Ex Ante* and *Ex Post* Parameters for Freezers 28
Table 3-21 Key *Ex Ante* and *Ex Post* Parameters for Electric Water Heaters 29
Table 3-22. Draft 2010 Ohio TRM Per-Unit Savings Values for Heat Pump Water Heaters 29
Table 3-23. Percent of Program Heat Pump Water Heaters by Home Heating Type 30
Table 3-24. Key *Ex Ante* and *Ex Post* Parameters for Televisions........ 31
Table 3-25. Sources of Participant Awareness of Appliance Rebates 33
Table 3-26. Reported Barriers to Purchasing CFLs Among Residential Customers Who Have Already Purchased CFLs and Those Who Have Never Purchased CFLs 41
Table 3-27. Reported Barriers to Purchasing LEDs Among Residential Customers Who Have Already Purchased LEDs and Those Who Have Never Purchased LEDs 42
Table 3-28. Inputs to Cost-Effectiveness Model for Efficient Products Program........ 47

Table 3-29. Cost Effectiveness Results for the Efficient Products Program 48
Table A-1. General Population Survey Sample Disposition 51
Table A-2. Efficient Products Appliance Rebate Participant Survey Sample Disposition............................ 52

List of Equations

Equation 3-1. Draft 2010 Ohio TRM-Specified Energy Savings for CFLs 19
Equation 3-2. Draft 2010 Ohio TRM-Specified Demand Savings for CFLs 19

Executive Summary

This report describes the results of the impact and process evaluation of the 2014 AEP Ohio Efficient Products Program. The Executive Summary provides a high-level description of the program, key impact findings, conclusions, and recommendations stemming from these findings. Detailed methodology and findings are described in the body of the report following the Executive Summary.

ES.1 Program Summary

The objective of the AEP Ohio Efficient Products Program is to produce long-term energy and demand savings in the residential market by increasing the number of energy-efficient lighting products and appliances sold through retail sales channels. The program provides financial incentives to encourage customers to purchase and install energy-efficient lighting and appliances in their homes. Compared to 2013, the Efficient Products Program rebated almost triple the number of LED lighting products and six times the number of LED lighting units. Additional changes for 2014 included marketing the high efficiency electric water heater rebates through contractors and distributors, rather than retailers, and the addition of two new retailers to the overall program. Section 1.1 describes the program in more detail.

ES.2 Key Impact Findings

Table ES-1 shows the 2014 program goals, *ex ante* savings claimed by the program, and *ex post* savings. The *ex post* energy and demand savings for 2014 were 204,524 MWh and 25.4 MW, respectively. The realization rate for 2014 was 0.97 for energy and 0.99 for demand. The *ex post* energy and demand savings were 205 percent and 197 percent of the 2014 program goals.

Table ES-1. 2014 Program Savings and Realization Rates

	2014 Program Goals (a)	*Ex Ante* Savings (b)	*Ex Post* Savings (c)	Realization Rate RR = (c) / (b)	Percent Of Goal = (c) / (a)
Energy Savings (MWh)	100,000	210,515	204,524	0.97	205%
Demand Savings (MW)	12.904	25.598	25.370	0.99	197%

Note: Demand savings are shown to three decimal places to be consistent with individual per-unit values for each product shown in the body of the report. Showing only two decimal places would not allow for per-unit distinctions for many of the products.

Table ES-2 shows the breakdown of energy savings by product type. Lighting made up 96 percent of energy savings, with 83 percent from CFLs.

Table ES-2. *Ex Post* Energy Savings for the 2014 Efficient Products Program

Product Category	Energy Savings (MWh)	Percent of Total Savings
CFLs	169,307	82.78%
LEDs	26,663	13.04%
Total Savings for Lighting Products	195,970	95.82%
Clothes Washers	4,000	1.96%
Refrigerators	2,419	1.18%
Dehumidifiers	1,230	0.60%
Heat Pump Water Heaters	605	0.30%
Televisions	168	0.08%
Freezers	129	0.06%
Electric Water Heaters	3	< 0.01%
Total Savings for Appliances	8,554	4.18%
Savings Grand Total	204,524	100.00%

Table ES-3 shows demand savings broken down by product type. About 95 percent of demand savings were from lighting products, with about 80 percent from CFLs.

Table ES-3. *Ex Post* Demand Savings for the 2014 Efficient Products Program

Product Category	Demand Savings (MW)	Percent of Total Savings
CFLs	20.25	79.82%
LEDs	3.73	14.70%
Total Savings for Lighting Products	23.98	94.52%
Clothes Washers	0.56	2.21%
Refrigerators	0.42	1.66%
Dehumidifiers	0.28	1.10%
Heat Pump Water Heaters	0.08	0.32%
Televisions	0.03	0.12%
Freezers	0.01	0.04%
Electric Water Heaters	< 0.01	< 0.01%
Total Savings for Appliances	1.39	5.48%
Savings Grand Total	25.37	100.00%

Note: Individual product savings values do not sum exactly to Total Savings values due to rounding.

ES.3 Conclusions and Recommendations for Program Improvements

The 2014 evaluation of the Efficient Products Program resulted in five main conclusions.

1. **The program achieved roughly twice its savings goals for 2014.** The program achieved nearly 205 GWh of energy savings and 25.4 MW of demand savings, surpassing the goals of 100 GWh and 12.9 MW.

2. ***Ex post* savings differed from *ex ante* values for some products, leading to overall realization rates that are slightly less than 1.0.** Where the Draft 2010 Ohio TRM was used, *ex post* values matched *ex ante* values from the program tracking data. For products that were not covered by the Draft 2010 Ohio TRM, the evaluation team used an independent research-based savings approach, which resulted in different values for LEDs, freezers, televisions, and electric water heaters. In particular, the evaluation team used the ENERGY STAR lighting database to determine baseline wattage for LEDs, which was substantially lower than the baselines used for *ex ante* calculations. This, along with other differences in parameter estimates, resulted in an energy realization rate for LEDs of 0.82. However, due to the smaller proportion of savings for products not included in the Draft 2010 Ohio TRM (compared to CFLs and other products included in the TRM), the overall realization rates for energy and demand savings were 0.97 and 0.99, respectively.

- **Recommendation: Update the source used to determine baseline wattages for LEDs.** The evaluation team recommends matching baseline wattages with program wattages using the ENERGY STAR lighting database. The source should be updated annually to account for changes in product assortment and in federal standards. This approach would calculate savings more accurately and reduce risk of evaluation adjustments.

- **Recommendation: Update the parameter values used to calculate savings for products not specified in the Draft 2010 Ohio TRM.** For LEDs, the evaluation team recommends using the parameters included in this report for hours of use, coincidence factor, and in-service rate. Primary research studies with AEP Ohio customers were conducted to estimate these parameters, and using these values will increase the accuracy of LED savings. In addition, the evaluation team recommends updating deemed savings values for freezers and televisions based on recent changes in federal standards.

3. **Sales of LED lighting are dramatically increasing, but awareness and price are still barriers to adoption.** The program discounted about 528,000 LEDs in 2014, more than six times the number in 2013. LEDs are responsible for the second-highest portion of savings, accounting for 14 percent of energy and 16 percent of demand savings in 2014. These represent dramatic increases from previous years and indicate that LED lighting is becoming more common as prices decline. Nonetheless, the evaluation indicated that awareness of LEDs is still low, with 45 percent of general population customers not at all familiar with the technology. Price is still the primary barrier to purchase of LEDs; of customers who are aware of LEDs but have not purchased any, 49 percent reported price as a barrier. However, the evaluation team found that customers had fewer performance-related concerns regarding LEDs (11%) compared to CFLs (43%).

    - **Recommendation: Develop informational marketing for LED lighting.** The evaluation found that slightly more than half of residential customers are aware of LEDs, and price continues to be a barrier. Although in-store marketing efforts provide information about selecting efficient lighting in the form of in-store demonstrations, tear pads, and tip cards, customers may benefit from LED-specific versions of these materials. Additionally, using a mass marketing approach to advertise the benefits of LEDs may help increase familiarity and further increase sales. While focusing marketing inside the retail stores is effective for lower-cost CFLs, customers unfamiliar with the technology may benefit from information about LEDs prior to making a purchase decision at the store. Otherwise, customers who are unaccustomed to paying higher prices for lighting products may not consider LED options once they are inside the store.

4. **Overall, participants purchasing efficient appliances reported high levels of satisfaction with the program.** A very high percentage of program participants (96%) reported being at least "somewhat satisfied" with the Efficient Products Program, across equipment types. These participants also reported high levels of satisfaction with program processes, the rebate amount, energy savings, and time to receive their rebate. The evaluation team did not survey lighting participants in 2014.

5. **Customers appear to be interested in heat pump water heaters, but many plumbing contractors are unfamiliar with the technology.** A substantial percentage of customers reported being aware of heat pump water heaters. Nearly half – 48 percent of customers— said they had heard of heat pump water heaters, and 31 percent of customers said they were at least somewhat familiar with heat pump water heaters. Of the customers familiar with the technology, 36 percent said they were at least "somewhat likely" to purchase one if they needed to replace their water heater. However, most non-participant plumbing contractors interviewed (7 of 11) were unfamiliar or only vaguely familiar with heat pump water heaters. Additionally, only 33 percent of heat pump water heater participants reported using a contractor to install their equipment. In general, few contractors had strong opinions about heat pump water heaters as a technology and none were actively promoting it.

    - **Recommendation: Increase engagement with plumbing contractors to promote the heat pump water heater rebates.** Customer interest in heat pump water heaters appeared to be high, but our research with plumbing contractors suggested that many contractors are not familiar with the technology. Plumbing contractors play a key role in the water heater supply chain and often recommend equipment choices to residential customers. The disparity between customer interest and contractor knowledge represents an opportunity for AEP Ohio to engage more plumbing contractors and increase the volume of heat pump water heater rebates.

1 Introduction

This section provides a description of the AEP Ohio Efficient Products Program, as well as a brief discussion of the underlying program theory and logic. In addition, this section describes minor differences in how the 2014 program is implemented compared to the 2013 program, along with a description of the objectives of this evaluation.

1.1 Program Description

The objective of the AEP Ohio Efficient Products Program is to produce long-term energy and demand savings in the residential market by increasing the number of energy-efficient lighting products and appliances sold through retail sales channels. The program provides financial incentives to encourage customers to purchase and install energy-efficient lighting and energy-efficient appliances in their homes. The program targets all residential customers. Retail partners are recruited to promote these products by displaying marketing materials in their stores, and retail sales associates are provided training to help promote the program to customers.

The program implementation contractor provides turnkey implementation services, including recruiting manufacturers and retailers to participate in the program, designing and placing marketing materials in participating store locations, conducting promotional activities, and training participating retail staff at both independent and corporate retailers. The implementation contractor also conducts regular store visits to confirm that qualifying products are correctly labeled and that marketing materials are displayed. A subcontractor to the program implementation contractor handles the tracking of participation and sales data, payment of invoices to manufacturers and retailers for the lighting component of the program, and payment of rebates to customers for the appliance portion of the program.

In 2014, the program provided incentives to retailers and manufacturers for ENERGY STAR®-qualified lighting, including CFLs and LEDs for a variety of applications and fixture types. Incentives are passed directly to the customer at participating retail locations, in the form of markdowns or instant coupons used at the point of purchase. The program continued to expand the number of discounted LED lighting products in 2014, incentivizing nearly triple the number of LED lighting products as in the previous year and six times the number of LED lighting units. Altogether, LEDs made up 31 percent of incentive expenditures in 2014.

In addition to providing discounts and rebates on lighting products, the program also includes two additional lighting activities: (1) LED giveaways available to customers who submit an appliance rebate, and (2) CFL giveaways through food banks.

In 2014, AEP Ohio offered rebates on the same appliances as in 2013 – clothes washers, dehumidifiers, refrigerators, freezers, and electric heat pump water heaters. The rebate for high efficiency electric water heaters offered was eliminated from retail—offered only through contractors and distributors—due to the challenges in previous years with customers identifying eligible units. In 2014, rebates were offered in the amounts shown in Table 1-1. All rebates were offered from January through December of 2014. To qualify for a rebate, customers purchased a qualifying appliance and completed either an electronic or a mail-in form, which they then submitted along with their product receipt and a copy of their utility bill to the program implementation contractor.

Table 1-1. Program Appliance Rebate Amounts in 2014

Appliance Type	2014 Rebate Amount
Clothes Washers	$50
Dehumidifiers	$25
Freezers	$50
Refrigerators	$50
Televisions	$25
Water Heater - High Efficiency Electric	$50
Water Heater - Electric Heat Pump	$500

The implementation contractor provided training to in-store retail staff in 2014 so that they were knowledgeable about the program and equipped to promote the rebates and/or lighting discounts to customers. Lighting discounts were primarily marketed via displays at participating retailer locations. For appliance rebates, the implementation contractor placed point-of-purchase marketing materials (e.g., "clings" or stickers placed on qualifying appliances) in the retail stores. In 2014, three retailers began providing labeling showing the original price, the discount AEP Ohio provides, and the final price. Other in-store marketing materials included shelf signage, demonstration tables, tear pads, and tip cards. The appliance rebates were also promoted via the AEP Ohio website, outreach at community events, social media, and as a component of AEP Ohio's larger energy efficiency television and print marketing campaign.

In 2014, the program aimed to reduce energy usage by 100 GWh and peak demand by 12.9 MW. These goals account for 48 percent of AEP Ohio's 2014 consumer portfolio energy savings goal and 45 percent of the consumer portfolio demand savings goal. The vast majority of 2014 savings (96% of energy and 95% of demand) are from lighting. Of the savings from lighting, CFLs accounted for 86 percent of energy savings and 84 percent of demand savings, while LEDs accounted for 14 percent and 16 percent of energy and demand savings, respectively.

1.1.1 2014 Program Differences Compared to 2013

Although the core program processes and basic program theory of the 2014 program were very similar to 2013, there were a number of minor differences in the components and products offered in 2014, as follows:

Lighting

- The marketing messaging now leads with LEDs (i.e., it prominently features headlines regarding LEDs) and mentions CFLs, while in the past the reverse was true
- The program now includes two additional manufacturers of LEDs, and the selection of LED models has continued to expand, almost tripling from 2013
- The lighting program no longer incentivizes holiday lights
- Two additional retailers were added
- Three retailers now provide labeling showing the original price, the amount of discount AEP Ohio provides, and the final price

Appliance Rebates

- The program provided new point-of-purchase marketing materials focused on driving customers to the new AEP Ohio "Waste less" website (http://wastelessohio.com/), part of the 2014 marketing campaign
- The program promoted Heat Pump Water Heater rebates in-store through two retailers and through plumbing contractors. These plumbing contractors were made aware of the rebates for heat pump water heaters and high efficiency water heaters through participation in trainings coordinated by the program (run by GE) in 2014.
- The program began offering an online rebate option in addition to the mail-in rebate option
- The program now provides two-packs of LEDs for free to appliance rebate participants, replacing the previous offering of three-packs of CFLs

1.1.2 Program Theory

The basic program theory for lighting and appliance rebates remained unchanged: providing financial incentives encourages customers to purchase and install energy-efficient lighting and energy-efficient appliances in their homes, resulting in decreased energy usage and peak demand.

1.2 Evaluation Objectives

This report presents the findings from the impact and process evaluations of the 2014 AEP Ohio Efficient Products Program. The objectives of the evaluation were to: (1) quantify energy and peak demand savings impacts in 2014 for these products, (2) determine key process-related program strengths and weaknesses, and (3) provide recommendations to improve the program. The evaluation sought to answer the following research questions.

Impact Questions

1. How many CFLs and LEDs discounted through this program were sold, by category (wattage, size, specialty lamp types)? How many appliances were rebated through the program, by type?
2. What is the availability of 60-Watt, and 40-Watt standard incandescent lamps in the AEP Ohio service territory? How does this influence the baseline wattage for 60-Watt and 40-Watt equivalent CFLs and LEDs?
3. What are the energy (kWh) and summer peak demand (kW) savings per-unit, for each of the program products?

4. What are the annual energy (kWh) and summer peak demand (kW) impacts resulting from the program? Did the program meet its energy and demand goals?
5. What are the realization rates for the program? (Defined as evaluation-verified *ex post* savings divided by program-reported *ex ante* savings.)
6. What is the cost effectiveness of this program?

Process Questions

1. How do participants become aware of the program?
2. What proportion of AEP Ohio customers is aware of the various program components (i.e., lighting, appliance rebates, etc.)? How do customers become aware of the program?
3. What are key barriers to the purchase of CFLs and LEDs discounted through the program? What are consumers willing to pay for directional vs. omnidirectional general purpose LEDs?
4. Are plumbing contractors aware of the water heater rebates? If so, are they promoting these to their customers? If not, why not? What are contractors' opinions, awareness, and beliefs about efficient water heating technologies? What do contractors perceive as the key barriers to customers' purchase of heat pump water heaters incented by the program?
5. From the customer's perspective, what are the key barriers to the purchase of heat pump water heaters incentivized by the program?
6. Has the program as implemented changed from the original plan? If so, how, why, and was this an advantageous change?
7. What are the current program challenges and how are these being addressed?
8. What are the opportunities for program improvement?

2 Methodology

This chapter describes the methodology used to complete the process and impact evaluations. Table 2-1 summarizes the various activities undertaken for this evaluation. The evaluation team analyzed new program documentation for 2014 (the updated program website, the 2014 marketing materials look book, and the new online rebate form) and reviewed program tracking data, which contains information on all the lighting products and appliances incented or distributed through the Efficient Products Program. The evaluator did not address whether the tracking system is adequate for regulatory prudency reviews or corporate requirements

Primary data collection efforts included surveys with program participants and the general population of residential customers, in-depth telephone interviews with program staff at AEP Ohio and the program implementers, and in-depth interviews with plumbing contractors. In order to understand the availability of different lighting products to AEP Ohio customers, the evaluation team conducted a lighting shelf survey at both participating and non-participating lighting retailers to inform *ex post* energy savings calculations.

Table 2-1. Summary of Data Review and Data Collection Activities

Data Collection Type	Targeted Population	Supported Evaluation Activities
Tracking Data Review [(a)]	All program participants	Impact Evaluation
Program Documentation Review	Any new program documentation	Process Evaluation
In-depth Staff Interviews	Program staff and implementers	Process Evaluation
In-depth Contractor Interviews	Water heater contractors serving the AEP Ohio territory	Process Evaluation
Participant Telephone Survey	Program participants	Impact and Process Evaluation
General Population Survey	Residential customers	Process Evaluation

a. Tracking data review results are presented in Appendix A.2.

2.1 *Program Documentation Review*

The evaluation team focused the program documentation review on aspects of the 2014 program that were new, including:

- The online rebate form, new for 2014
- The 2014 Efficient Products look book, documenting in-store marketing materials
- Revised pages of the AEP Ohio Efficient Products Program website
- The 2012-2014 Energy Efficiency/Peak Demand Reduction Action Plan[1]

[1] *AEP Ohio 2012 to 2014 Energy Efficiency/Peak Demand Reduction (EE/PDR) Action Plan*, *Vols. 1 and 2*, November 29, 2011.

These documents were reviewed to understand the details of the 2014 program and to inform customer surveys.

2.2 In-depth Staff Interviews

In order to answer the key process evaluation research questions, the evaluation team conducted a series of in-depth interviews, as summarized in Table 2-2. The purpose of the staff interviews was to understand changes in program implementation, collect feedback on research priorities, and understand staff members' experiences with the program.

Table 2-2. In-Depth Staff Interviews

Targeted Population	Sample Frame	Sample Target	Sample Size	Timing
AEP Ohio Program Staff	Contacts from AEP Ohio	Program Manager Consumer Programs and Marketing Manager	2 (Conducted as a joint interview)	December 2014
Implementation Contractor Program Staff	Contacts from AEP Ohio	Program Manager Senior Manager	2 (Conducted as a joint interview)	December 2014

2.3 In-depth Contractor Interviews

As program tracking data did not contain plumbing contractors who had participated in the Efficient Products program, the evaluation team constructed a population of plumbing contractors using internet sources such as Yellow Pages, HomeAdvisor, and ThomasNet.[2] Through this research, the evaluation team identified 143 locations of plumbing companies that operate in AEP Ohio's territory.

[2] In the Home Advisor database (http://www.homeadvisor.com/), we searched for "Water Heater Pros." We used the "Water Heaters" category of the Yellow Pages (http://www.yellowpages.com/) and ThomasNet (http://www.thomasnet.com/).

In January of 2015, the evaluation team completed interviews with 11 plumbing companies as summarized in Table 2-3. Most were plumbing contractors who installed and serviced water heaters; one interviewee was a plumbing wholesaler and another was a plumbing manufacturer's representative/distributor.

Table 2-3. In-Depth Contractor Interviews

Targeted Population	Sample Frame	Sample Target	Sample Size	Timing
Plumbing Contractors	Databases including Yellow Pages, HomeAdvisor, and ThomasNet	Plumbing contractors working with Water Heaters	11	January 2015

2.4 *Participant Telephone Survey*

From December 2014 to January 2015, the evaluation team managed a telephone survey of participants in the appliance rebate portion of the program to answer key impact and process-related questions. The evaluation team designed the sample to attain a 95 percent level of confidence and +/- 5 percent relative precision at the program level and a 90 percent confidence and +/- 10 percent relative precision for each equipment type. The evaluation team used a stratified sample with a target of 68 completes per equipment type, with the exception of heat pump water heaters, which had a target of 57 completes due to a smaller population size. The total target for completed surveys was 397 participants. Survey results where an average was reported were weighted to reflect the prevalence of each appliance type in the entire program population (frequencies and counts were not weighted). The survey was conducted to gain insight on the following topics: appliance usage, awareness of the program, effectiveness of the in-store marketing, influence of water heater contractors, and customer satisfaction with the products and the program.

Table 2-4. Participant Telephone Surveys

Appliance Type	2014 Population Size	Survey Target Completes	Survey Completes	Sampling Error
Clothes Washers	17,481	68	68	11.8%(a)
Refrigerators	16,636	68	68	11.8%(a)
Dehumidifiers	5,675	68	68	11.8%(a)
Televisions	4,023	68	68	11.8%(a)
Freezers	1,970	68	68	11.8%(a)
Heat Pump Water Heaters	419	57	57	13.0%(b)
Electric Water Heaters	15	-	-	-
Total	46,219	397	397	4.9%

a. At 90 percent confidence, sampling error = 9.9 percent.
b. At 90 percent confidence, sampling error = 10.9 percent

2.5 General Population Survey

To assess key impact and process-related questions, the evaluation team managed a survey of AEP Ohio residential customers from December 2014 to January 2015. The survey targeted 385 customers with AEP Ohio Billing Data to attain 95 percent level of confidence and +/- 5 percent relative precision. The survey was conducted to gain insight on the following topics: program awareness and sources of awareness, CFL and LED saturation, consumer demand for LEDs, barriers to the purchase of CFLs and LEDs, and interest in heat pump water heaters.

Table 2-5. General Population Surveys

Target Population	2014 Population Size	Survey Target Completes	Survey Completes	Sampling Error
AEP Ohio Residential Customers	Sample of 8,000 contacts extracted by AEP Ohio from Billing Data	385	385	5.0%[(a)]

a. At 90 percent confidence, sampling error = 4.2 percent.

2.6 Ex Post Savings Evaluation Methods

For approximately half of the products offered through the Efficient Products Program, assumptions and methods for calculating savings are specified in the Draft 2010 Ohio TRM. The evaluation team applied Draft 2010 Ohio TRM assumptions to verify *ex ante* savings and to calculate *ex post* savings for CFLs, clothes washers, dehumidifiers, refrigerators, and heat pump water heaters.

Ex ante savings from products not covered by the Draft 2010 Ohio TRM (LEDs, freezers, electric water heaters, and televisions) were verified using AEP Ohio's assumptions. *Ex post* savings were calculated using an independent, research-based savings approach. This approach references the program tracking data, the participant telephone survey, ENERGY STAR databases, and market research studies that the evaluation team conducted in 2014.

3 Detailed Evaluation Findings

3.1 Program Activity

The evaluation team analyzed program data from all lighting and appliances invoiced during 2014 to summarize program activity. This section is divided into two sub-sections for lighting and appliances. Table 3-1 summarizes program activity across all products.

Table 3-1. Efficient Products 2014 Activity

Product	Number of Units in 2014	Percentage of Units
CFLs	4,010,598	88.4%
LEDs	528,023	11.6%
Total Lighting Products	4,538,621	100%
Clothes Washers	17,481	37.8%
Refrigerators	16,636	36.0%
Dehumidifiers	5,675	12.3%
Televisions	4,023	8.7%
Freezers	1,970	4.3%
Heat Pump Water Heaters	419	0.9%
Electric Water Heaters	15	< 0.1%
Total Appliances	46,219	100%

3.1.1 Lighting Activity

The evaluation team used program data for all of the lighting products invoiced during 2014 to characterize this component of the program, including lighting products discounted through the markdown and coupon delivery mechanisms, as well as CFLs distributed through food banks, and LEDs given away to appliance rebate participants. A total of 4,538,621 lighting products were invoiced in 2014. CFLs accounted for 88.4 percent of all lighting products and LEDs accounted for 11.6 percent, as shown in Table 3-2. The Efficient Products Program discounted more than six times as many LEDs as in 2013. Of all CFLs in 2014, 94 percent were markdown CFLs, as opposed to point of purchase CFLs using an instant coupon.

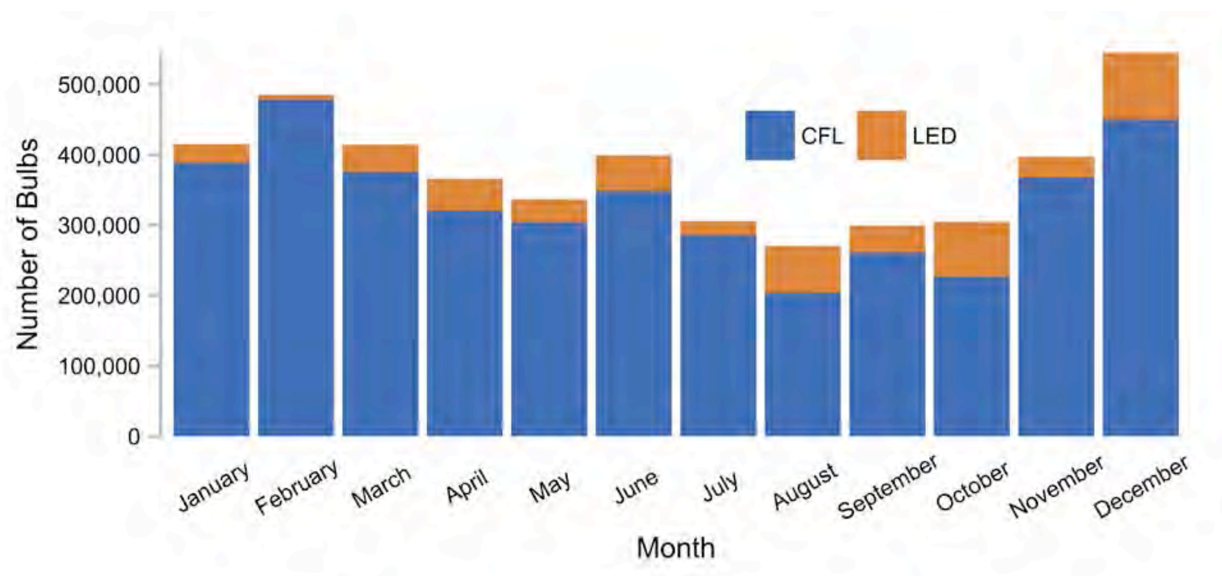
Table 3-2. Lighting Product 2014 Program Activity

Lighting Product Type	Markdown [(a)]	Coupon	Food Bank	Total Units in 2014	Percent
CFLs	3,789,629	1,169	219,800	4,010,598	88.4%
LEDs	528,023	-	-	528,023	11.6%
Total	4,317,652	1,169	219,800	4,538,621	100.0%

a. The Markdown data file also contained LEDs given away to appliance rebate participants.

Figure 3-1 shows the distribution of 2014 sales for program CFLs and LEDs by month.

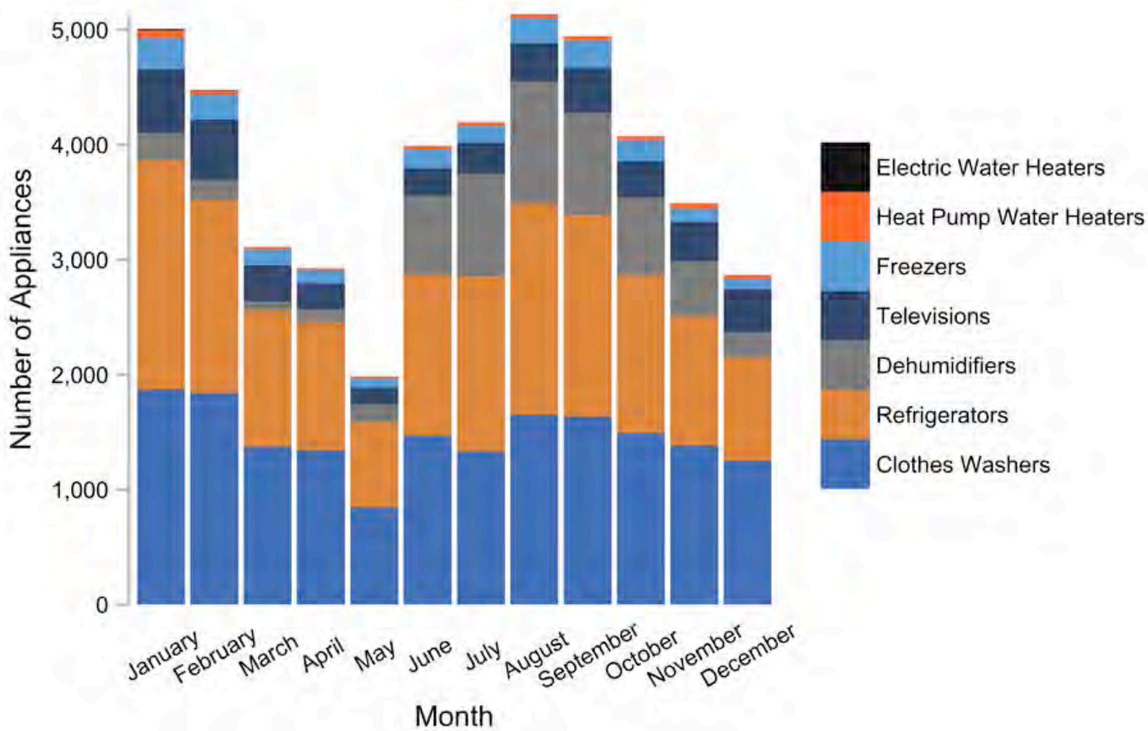
Figure 3-1. Lighting Products Discounted by Month Invoiced



3.1.2 Appliance Rebate Activity

The number of appliances incented varied from a low of 15 units for electric water heaters to 17,481 for clothes washers. Figure 3-2 shows the units per month for each appliance type. Participation was much higher for some appliances (clothes washers and refrigerators) than for others (heat pump water heaters and electric water heaters).

Figure 3-2. Distribution of Efficient Products Appliance Rebates by Month Invoiced



3.2 *Combined Impacts of the Efficient Products Program*

The 2014 AEP Ohio Efficient Products Program had total *ex post* energy savings of 204,524 MWh and demand savings of 25.4 MW. Lighting products accounted for 96 percent of energy savings and 95 percent of demand savings. Total realization rates are 0.97 for energy savings and 0.99 for demand savings. Total savings and realization rates are summarized in Table 3-3 and Table 3-4.

Table 3-3. Combined Program Energy Savings and Realization Rates

Product	Count	Average Energy Savings (kWh)	Total *Ex Ante* Energy Savings (MWh) (a)	Total *Ex Post* Energy Savings (MWh) (b)	Percent of *Ex Post* Energy Savings	Realization Rate RR = (b) / (a)
Lighting	4,538,621	43.2	201,717	195,970	95.8%	0.97
Appliances	46,219	185	8,798	8,554	4.2%	0.97
Total	4,584,840	44.6	210,515	204,524	100.0%	0.97

Table 3-4. Combined Program Demand Savings and Realization Rates

Product	Count	Average Demand Savings (kW)	Total *Ex Ante* Demand Savings (kW) (a)	Total *Ex Post* Demand Savings (kW) (b)	Percent of *Ex Post* Demand Savings	Realization Rate RR = (b) / (a)
Lighting	4,538,621	0.005	24,121	23,975	94.5%	0.99
Appliances	46,219	0.030	1,477	1,395	5.5%	0.94
Total	4,584,840	0.006	25,598	25,370	100.0%	0.99

3.3 *Lighting Impact Evaluation Findings*

This section provides a detailed description of impact findings for 2014 CFLs and LEDs. Overall impact findings are presented first, followed by the methodology and description of key impact parameters for each lighting product.

3.3.1 Overall Lighting Impact Findings

Ex post energy savings for the lighting portion of the AEP Ohio Efficient Products Program were 195,970 MWh and *ex post* demand savings for lighting were 24.1 MW. CFLs accounted for 86.4 percent of lighting energy savings and 84.4 percent of lighting demand savings. Table 3-5 and Table 3-6 show the overall lighting impact findings for energy and demand savings, respectively.

The overall lighting realization rates were 0.97 for energy and 0.99 for demand. The difference in *ex ante* savings and *ex post* savings is due to the different values used for calculating LED savings, as explained in Table 3-11.

Table 3-5. Lighting Energy Savings – 2014

Product	Count	Average Energy Savings (kWh)	Total *Ex Ante* Energy Savings (MWh) (a)	Total *Ex Post* Energy Savings (MWh) (b)	Percent of *Ex Post* Energy Savings	Realization Rate RR = (b) / (a)
CFL	4,010,598	42.2	169,307	169,307	86.4%	1.00
LED	528,023	50.5	32,410	26,663	13.6%	0.82
Total	4,538,621	43.2	201,717	195,970	100.0%	0.97

Table 3-6. Lighting Demand Savings – 2014

Product	Count	Average Demand Savings (kW)	Total *Ex Ante* Demand Savings (kW) (a)	Total *Ex Post* Demand Savings (kW) (b)	Percent of *Ex Post* Demand Savings	Realization Rate RR = (b) / (a)
CFL	4,010,598	0.005	20,246	20,246	84.4%	1.00
LED	528,023	0.007	3,875	3,729	15.6%	0.96
Total	4,538,621	0.005	24,121	23,975	100.0%	0.99

3.3.2 CFL Impact Methodology and Key Parameters

The Draft 2010 Ohio TRM specifies deemed values for CFL savings based on CFL wattages and delta watts multipliers, which capture the differences in wattages between various types of CFLs and their standard efficiency lighting equivalents. Equation 3-1 and Equation 3-2 specify the equations used to calculate energy and demand savings.

Equation 3-1. Draft 2010 Ohio TRM-Specified Energy Savings for CFLs

$$\textit{Annual kWh Savings} = (\text{ProgWatts} * \text{DeltaWattsMultiplier}) * \text{ISR} * \text{HOU} * 365 * \text{WHF}_E / 1{,}000$$

Equation 3-2. Draft 2010 Ohio TRM-Specified Demand Savings for CFLs

$$\textit{Summer Coincident Peak kW Savings} = (\text{ProgWatts} * \text{DeltaWattsMultiplier}) * \text{ISR} * \text{CF} * \text{WHF}_D / 1{,}000$$

For Draft 2010 Ohio TRM energy savings, the in-service rate (ISR) is 0.86, the estimated hours of use (HOU) is 2.85 hours per day (equivalent to 1,040.25 hours per year), and the interactive effects between lighting and cooling on energy use are captured by the waste heat factor (WHF_E) of 1.07. For demand savings, the in-service rate (ISR) is 0.86, the estimated coincidence factor (CF) is 0.11, and the interactive effects between lighting and cooling on demand is captured by the waste heat factor (WHF_D) of 1.21.

The evaluation team calculated the total energy and demand savings for CFLs by summing the savings for each invoice in the program tracking data. The evaluation team then divided the total savings by the number of units to determine the average per-unit 2014 energy and demand savings for CFLs, as shown previously in Table 3-5 and Table 3-6.

The Draft 2010 Ohio TRM specifies that the deemed delta watts multipliers are to change over time, to account for the effects of the federal Energy Independence and Security Act of 2007 (EISA) on incandescent wattages, as summarized in Table 3-7. The methodology used by AEP Ohio for calculating CFL savings deviates somewhat from the Draft 2010 Ohio TRM. AEP Ohio assumes that incandescent lighting will be available in the market place for one full year after being phased-out because of EISA. Thus, AEP Ohio uses the 2013 delta watts multiplier for standard CFLs in 2014. The only difference between the 2013 and 2014 Draft 2010 Ohio TRM values is for delta watts in the 15 watt or less range (40-Watt and 60-Watt incandescent equivalents). For these CFLs, AEP Ohio uses a 40-Watt or 60-Watt incandescent for the baseline (the 2013 delta watts multiplier of 3.25) rather than a 29-Watt or 43-Watt efficient halogen (the 2014 delta watts multiplier of 2.05). For specialty CFLs, AEP Ohio assumes the delta watts multiplier from before EISA was implemented in 2011, because EISA does not affect the baseline for specialty CFLs. The AEP Ohio methodology is supported in part by the shelf surveys completed by the evaluation team between 2012 and 2014, which found that EISA impacted wattages were still available for purchase until about one year after the phase-out.

Table 3-7. Draft 2010 Ohio TRM-Specified Values for CFLs Delta Watts Multiplier

CFL Wattage	Delta Watts Multiplier			
	2009 - 2011	2012	2013	2014 and Beyond
15 or less	3.25	3.25	3.25	2.05
16 – 20	3.25	3.25	2.00	2.00
21 or greater	3.25	2.06	2.06	2.06

Source: Residential ENERGY STAR Compact Fluorescent Lamp (CFL) (Time of Sale). Draft 2010 State of Ohio Energy Efficiency Technical Reference Manual, August 6, 2010. p. 11.

A key impact parameter for program CFLs is the wattage of discounted CFLs, or ProgWatts, as shown in the preceding equations. An analysis of 2014 program CFL wattages is provided in Appendix A.3.

3.3.3 LED Impact Methodology and Key Parameters

LEDs are not included in the Draft 2010 Ohio TRM. Instead, AEP Ohio uses the difference between program LED wattages and equivalent baseline wattages to calculate *ex ante* annual energy savings and coincident peak demand savings. The equations used to calculate LED *ex ante* energy and demand savings are equivalent to Equation 3-1 and Equation 3-2 for CFLs. The evaluation team used a similar methodology to calculate *ex post* savings, but used different parameters based on independent research.

In the calculation of LED *ex ante* savings, AEP Ohio uses an in-service rate (ISR) equal to 1.00; because of the higher cost of LEDs, AEP Ohio assumes that customers will not put them in storage, but will instead install them right away. The hours of use (HOU) value is 1,040.25 hours per year, which is equivalent to the 2.85 hours per day included in the Draft 2010 Ohio TRM for CFLs. The *ex ante* coincidence factor (CF) is 0.11, which is the same value used for CFLs. Interactive effects for LEDs are captured through the same waste heat factors as CFLs. AEP Ohio uses the Draft 2010 Ohio TRM value of 1.07 for the energy waste heat factor (WHF_E) and 1.21 for the demand waste heat factor (WHF_D).

Table 3-8 presents the baseline wattage values used by AEP Ohio to calculate *ex ante* savings for each program wattage range. The average baseline wattage for LEDs was 65.9 Watts.

Table 3-8. *Ex Ante* LED Baseline Wattage, by Program Measure Wattage

Program LED Measure Wattage	*Ex Ante* Baseline Wattage	Count
2 – 3	25	3,704
4 – 5	40	33,927
6 – 8	60	105,883
9 – 11	75 (specialty), 53 (standard)	229,147
12 – 20	100 (specialty), 72 (standard)	144,445
23 +	150	10,917
Total	-	528,023

Note: The baseline wattage for 75-Watt and 100-Watt equivalent standard LEDs was adjusted due to the EISA standards from 2013. This adjustment is equivalent to the adjustment made for CFLs as explained previously. The source AEP Ohio used to determine the *ex ante* baseline wattage assumptions is unknown.

The evaluation team calculated the total energy and demand savings for LEDs by summing the savings for each invoice in the program tracking data. The evaluation team then divided the total savings by the number of units to determine the average per-unit 2014 energy and demand savings for CFLs, as shown previously in Table 3-5 and Table 3-6.

The evaluation team followed a similar approach to calculate *ex post* energy and demand savings, but used different parameter values based on independent research results. Whereas the average baseline wattage for *ex ante* LED savings was 65.9 Watts, the average baseline wattage for *ex post* LED savings was 56.9 Watts. The evaluation team used the program tracking data and the ENERGY STAR-certified light bulbs database to determine the baseline wattage for LEDs. Baseline wattages were determined by matching ENERGY STAR-qualified, general purpose LED wattages with their equivalent incandescent wattage, as shown in Table 3-9.[3]

[3] Incandescent wattages were determined from the "Wattage Equivalency" column in the ENERGY STAR lighting database. Only general purpose replacement bulbs were considered. For each efficient wattage in the program tracking data, the equivalent incandescent wattage was determined by selecting the "Wattage Equivalency" that corresponded to the greatest number of models. When there were no data for a particular wattage, the next largest baseline wattage was used, which errs on the side of larger savings estimates. The ENERGY STAR lighting specification that describes the "Wattage Equivalency" column is:
ENERGY STAR Program Requirements for Lamps (Light Bulbs), Version 1.1, August 2014.
http://www.energystar.gov/sites/default/files/ENERGY%20STAR%20Lamps%20V1%201_Specification.pdf

Table 3-9. *Ex Post* LED Baseline Wattage, by Program Measure Wattage

Program LED Measure Wattage	*Ex Post* Baseline Wattage	Count
2 – 4	25	6,290
5 – 7	40 (specialty), standard bulbs adjusted by month	42,779
8 – 12	60 (specialty), standard bulbs adjusted by month	364,804
13 – 14	75 (specialty), 53 (standard)	80,229
15 +	100 (specialty), 72 (standard)	33,921
Total	-	528,023

Note: The baseline wattage for 40-Watt, 60-Watt, 75-Watt, and 100-Watt equivalent standard LEDs was adjusted due to the EISA standards from 2013 and the shelf survey findings. No ENERGY STAR general purpose LEDs had a baseline wattage above 100W. *Ex post* source: ENERGY STAR Certified Light Bulbs, downloaded Feb. 9, 2015. http://www.energystar.gov/productfinder/download/certified-light-bulbs/

The evaluation team adjusted the incandescent baseline wattages based on EISA standards and shelf survey findings. Table 3-10 shows the adjusted baseline wattage by month for 40W and 60W equivalents; these wattages were adjusted by month to account for the decreasing availability of these incandescent wattages over the course of 2014. Note that the baseline for 75W and 100W traditional-incandescent equivalent LEDs is now the efficient halogen wattage, which is 53W and 72W, respectively. Not shown in the table are 25W equivalent bulbs, since these were not affected by EISA.

Table 3-10. Adjusted Baseline Wattages by Month and by Incandescent Wattage

Month	310 – 749 Lumen Range (40 W)	750 – 1049 Lumen Range (60 W)	1050 – 1489 Lumen Range (75 W)	1490 – 2600 Lumen Range (100 W)
January	40.0 W	60.0 W	53.0 W	72.0 W
February	38.9 W	58.7 W		
March	37.8 W	57.4 W		
April	36.8 W	56.1 W		
May	35.7 W	54.8 W		
June	34.6 W	53.5 W		
July	33.5 W	52.2 W		
August	33.0 W	51.7 W		
September	32.6 W	51.2 W		
October	32.1 W	50.6 W		
November	31.7 W	50.1 W		
December	31.2 W	49.6 W		

The evaluation team used an installation rate (ISR) equal to 0.973 for LEDs based on a 2014 LED survey of 101 AEP Ohio customers.[4] The hours of use factor (HOU) was 1,051 hours per year and the coincidence factor (CF) was 0.13; these values were determined from a lighting metering study conducted by the evaluation team in 2013 - 2014.[5] The evaluation team assumed the same interactive effects factors for LEDs as for CFLs, which were 1.07 for energy (WHF_E) and 1.21 for demand (WHF_D). Table 3-11 summarizes the differences in savings parameters for *ex ante* and *ex post* savings.

Table 3-11. Key *Ex Ante* and *Ex Post* Parameters for LEDs

Parameter Description	Parameter	*Ex Ante* Value	*Ex Post* Value	*Ex Post* Source
Program Wattage	LEDWatts	10.7 (a)	10.7	Tracking Data
Standard Wattage	BaselineWatts	65.9 (b)	56.9 (d)	ENERGY STAR Database
In-Service Rate	ISR_{LED}	1.0 (b)	0.973	LED Survey
Hours of Use	HOU_{LED}	1,040.25 (c)	1,051	Lighting Metering Study
Coincidence Factor	CF_{LED}	0.11 (c)	0.13	Lighting Metering Study
Waste Heat Factor for Energy	WHF_E	1.07 (c)	1.07	Draft 2010 Ohio TRM
Waste Heat Factor for Demand	WHF_D	1.21 (c)	1.21	Draft 2010 Ohio TRM

a. Based on tracking data.
b. Based on AEP Ohio assumption.
c. Taken from the Draft 2010 Ohio TRM values for CFLs.
d. Adjusted by shelf survey results and EISA standards.

A key impact parameter for program LEDs is the wattage of discounted LEDs, or ProgWatts, as shown in the preceding equations. Appendix A.3 provides an analysis of 2014 program LED wattage.

3.4 Detailed Appliance Impact Evaluation Findings

This section provides a detailed description of impact findings for 2014 appliance rebates. Overall impact findings are presented first, followed by the methodology and description of key impact parameters for the following appliances:

- Clothes Washers
- Dehumidifiers
- Freezers
- Refrigerators
- Televisions
- Heat Pump Water Heaters
- Electric Water Heaters

[4] "Residential LED Market Research Survey Results," February 2015.
[5] Residential Lighting Metering Study (Final Report), March 25, 2015.

3.4.1 Overall Appliance Impact Findings

Ex post energy savings for appliances in the AEP Ohio Efficient Products Program were 8,554 MWh and *ex post* demand savings for appliances were 1.395 MW. Table 3-12 and Table 3-13 present the overall appliance impact findings for energy and demand savings, respectively. Clothes washers accounted for almost half (47%) of energy savings and 40 percent of demand savings. Refrigerators also contributed substantially to energy savings (28%) and demand savings (30%), as did dehumidifiers, at 14 percent of energy savings and 20 percent of demand savings.

Per-unit savings were largest for heat pump water heaters, at 1,444 kWh per unit for energy and 0.197 kW per unit for demand. Clothes washers had the second largest per-unit energy savings (229 kWh), and dehumidifiers had the second largest per-unit demand savings (0.049 kW). Clothes washers had the largest number of program units at 17,481, followed closely by refrigerators at 16,636.

The overall appliance realization rates were 0.97 for energy and 0.94 for demand. The difference in *ex ante* savings and *ex post* savings is due to the different methodologies in calculating savings for freezers, electric water heaters, and televisions as explained in the following sections.

Table 3-12. Appliance Energy Savings – 2014

Product	Count	Average Energy Savings (kWh)	Total *Ex Ante* Energy Savings (MWh) (a)	Total *Ex Post* Energy Savings (MWh) (b)	Percent of *Ex Post* Energy Savings	Realization Rate RR = (b) / (a)
Clothes Washers	17,481	229	4,000	4,000	46.8%	1.00
Refrigerators	16,636	145	2,419	2,419	28.3%	1.00
Dehumidifiers	5,675	217	1,230	1,230	14.4%	1.00
Heat Pump Water Heaters	419	1,444	605	605	7.1%	1.00
Televisions	4023	42	410	168	2.0%	0.41
Freezers	1970	65	132	129	1.5%	0.98
Electric Water Heaters	15	195	3	3	< 0.1%	1.07
Total	**46,219**	**185.06**	**8,79**	**8,554**	**100.0%**	**0.97**

Note: Totals may not sum due to rounding.

Table 3-13. Appliance Demand Savings – 2014

Product	Count	Per-Unit Demand Savings (kW)	Total *Ex Ante* Demand Savings (kW) (a)	Total *Ex Post* Demand Savings (kW) (b)	Percent of *Ex Post* Demand Savings	Realization Rate RR = (b) / (a)
Clothes Washers	17,481	0.032	562	562	40.3%	1.00
Refrigerators	16,636	0.025	424	424	30.4%	1.00
Dehumidifiers	5,675	0.049	280	280	20.1%	1.00
Heat Pump Water Heaters	419	0.197	83	83	5.9%	1.00
Televisions	4,023	0.008	113	31	2.2%	0.27
Freezers	1,970	0.007	15	15	1.1%	0.98
Electric Water Heaters	15	0.011	< 1	< 1	< 0.1%	0.79
Total	**46,219**	**0.030**	**1,477**	**1,395**	**100.0%**	**0.94**

Note. The realization rates for individual products were calculated using un-rounded savings values, thus the realization rates for freezers and electric water heaters are not 1.0.

3.4.2 Clothes Washer Impact Methodology and Key Parameters

According to the Draft 2010 Ohio TRM, savings for clothes washers are deemed for two levels of efficiency (ENERGY STAR and CEE Tier 3) using the per-unit savings shown in Table 3-14.

Table 3-14. Draft 2010 Ohio TRM Per-Unit Savings Values for Clothes Washers

Efficiency Level	Per-Unit Energy Savings	Per-Unit Demand Savings
ENERGY STAR	202 kWh	0.028 kW
CEE Tier 3	233 kWh	0.033 kW

Source: Clothes Washer – ENERGY STAR and CEE TIER 3 (Time of Sale), Draft 2010 State of Ohio Energy Efficiency Technical Reference Manual, August 6, 2010. p. 59.

Total clothes washer savings were calculated by summing the per-unit savings for each program unit in the program tracking data. Most of the savings were from CEE Tier 3 washers as shown in Table 3-15.

Table 3-15. Percent of Program Clothes Washers by Draft 2010 Ohio TRM Efficiency Level

Efficiency Level	Units	Percent of Units	Percent of Savings
ENERGY STAR (CEE Tier 1 and 2)	2,369	13.6%	12.0%
CEE Tier 3	15,112	86.4%	88.0 %
Total	**17,481**	**100.0%**	**100.0%**

3.4.3 Dehumidifier Impact Methodology and Key Parameters

According to the Draft 2010 Ohio TRM, savings for dehumidifiers are deemed based on the capacity of the dehumidifier using the ranges shown in Table 3-16.

Table 3-16. Draft 2010 Ohio TRM Per-Unit Savings Values for Dehumidifiers

Capacity (pints/day)	Per-Unit Energy Savings (kWh)	Per-Unit Demand Savings (kW)
≤ 25	54	0.012
> 25 to ≤ 35	117	0.027
> 35 to ≤ 45	213	0.048
> 45 to ≤ 54	297	0.068
> 54 to ≤ 75	185	0.042
> 75 to ≤ 185	374	0.085

Source: ENERGY STAR Dehumidifier (Time of Sale), Draft 2010 State of Ohio Energy Efficiency Technical Reference Manual, August 6, 2010. p. 64.

Total dehumidifier savings were calculated by summing the per-unit savings for each program unit. In 2014, AEP Ohio customers submitted rebate forms for 5,675 dehumidifiers. The mean capacity for program-rebated dehumidifiers was 57.1 pints, with capacity distributed as shown in Table 3-17.

Table 3-17. Percent of Program Dehumidifiers by Capacity

Capacity (pints/day)	Count	Percent of Units	Percent of Savings
≤ 25	0	0%	0%
> 25 to ≤ 35	481	8.5%	4.6%
> 35 to ≤ 45	781	13.8%	13.5%
> 45 to ≤ 54	1,698	29.9%	41.0%
> 54 to ≤ 75	2,713	47.8%	40.8%
> 75 to ≤ 185	2	0.0%	0.1%
Total	5,675	100%	100%

3.4.4 Refrigerator Impact Methodology and Key Parameters

AEP Ohio customers submitted rebate forms for 16,636 refrigerators during 2014. For refrigerators, the Draft 2010 Ohio TRM deemed savings values are based on whether they meet ENERGY STAR or CEE Tier 2 specifications. Savings are also based on the configuration of the unit using the criteria shown in Table 3-18.

Table 3-18. Draft 2010 Ohio TRM Per-Unit Savings Values for Refrigerators

Efficiency Level	Refrigerator Configuration	Per-Unit Energy Savings (kWh)	Per-Unit Demand Savings (kW)
ENERGY STAR	Bottom Freezer	119	0.021
	Top Freezer	100	0.018
	Side by Side	142	0.025
CEE Tier 2	Bottom Freezer	149	0.026
	Top Freezer	124	0.022
	Side by Side	177	0.031

Source: Efficient Refrigerator – ENERGY STAR and CEE TIER 2 (Time of Sale), Draft 2010 State of Ohio Energy Efficiency Technical Reference Manual, August 6, 2010. p. 53.

Table 3-19 shows the distribution of program units by unit configuration and ENERGY STAR/CEE Tier level. The Draft 2010 Ohio TRM does **not** include savings estimates for Tier 3 units, so in the table, Tier 3 units are included within the Tier 2 category. This approach likely underestimates savings for Tier 3 units, which are more efficient than Tier 2 units.

Table 3-19. Percent of Program Refrigerators by Efficiency and Configuration

Efficiency Level	Refrigerator Configuration	Count	Percent of Units	Percent of Savings
ENERGY STAR	Bottom Freezer	964	5.8%	4.7%
	Top Freezer [a]	905	5.4%	3.7%
	Side by Side	109	0.7%	0.6%
CEE Tier 2 [b]	Bottom Freezer	6,829	41.0%	42.1%
	Top Freezer	3,874	23.3%	19.9%
	Side by Side	3,955	23.8%	28.9%
Total		16,636	100%	100%

a. Refrigerators with other or unknown configurations were binned with ENERGY STAR Top Freezers as this provides the most conservative estimate for unit energy and demand savings.
b. The Draft 2010 Ohio TRM does not include savings estimates for Tier 3 units, so Tier 3 units are included within the Tier 2 category.
Note: Totals may not sum to 100% due to rounding

3.4.5 Freezer Impact Methodology and Key Parameters

AEP Ohio customers submitted rebate forms for 1,970 freezers during 2014. For *ex ante* savings, AEP Ohio calculated freezer savings using 67 kWh per unit for energy savings and 0.0076 kW per unit for demand savings. AEP Ohio derived the per-unit value for energy savings by subtracting the average annual energy use for freezers meeting the 2014 ENERGY STAR specification (488 kWh) from the average annual energy use for comparable standard freezers (555 kWh).[6] The kW peak value is equivalent to 67 kWh divided by 8,760 hours, the number of hours in one year.

For program freezers, the evaluation team calculated *ex post* savings using a similar approach to the *ex ante* approach used by AEP Ohio, which relies on the difference in annual unit energy consumption estimates for baseline and program units. However, where AEP Ohio used unit energy consumption values based on the average of all the freezer models included in the ENERGY STAR qualified list, the *ex post* calculations relied on model number matching of rebated units. The evaluation team determined unit energy consumption by matching individual models from program tracking data to the ENERGY STAR products lists.[7] Furthermore, the evaluation team determined a part use factor (PUF) and a peak demand factor (DF_{FRZ}) to calculate energy and demand savings, based on the 2014 appliance rebate participant survey; both of these factors were 1.0 and therefore did not affect the savings.[8] Table 3-20 presents the differences in key parameter values for *ex ante* and *ex post* calculations.

Table 3-20. Key *Ex Ante* and *Ex Post* Parameters for Freezers

Parameter Description	Parameter	*Ex Ante* Value	*Ex Post* Value	Units	*Ex Post* Source
Energy Consumption- Standard Unit	UEC_{STD}	555	619.2	kWh/year	ENERGY STAR Database [(a)]
Energy Consumption- Energy-Efficient Unit	UEC_{EE}	488	553.5	kWh/year	ENERGY STAR Database [(a)]
Peak Adjustment Demand Factor	DF_{FRZ}	None	1.0	-	2014 Appliance Rebate Survey
Part Use Factor	PUF	None	1.0	-	2014 Appliance Rebate Survey

a. ENERGY STAR Certified Residential Freezers, downloaded Feb. 4, 2014 and Feb. 10, 2015. http://www.energystar.gov/productfinder/download/certified-residential-freezers/

3.4.6 Electric Water Heater Impact Methodology and Key Parameters

AEP Ohio customers purchased and submitted rebate forms for 15 electric water heaters in 2014. Electric water heaters were no longer advertised at retail locations in 2014, but were rather promoted by contractors and plumbers, which may explain the small number of rebates for the year. *Ex ante* savings for electric water heaters were determined by AEP Ohio using 182.4 kWh per unit for energy savings and 0.0139 kW for demand savings.[9]

[6] These values are based on version 4.1 of the ENERGY STAR freezer standards and do not account for the newest ENERGY STAR freezer standards (version 5.0, effective September 15, 2014). The average energy use for freezers meeting the 5.0 specification is 342 kWh and the average for comparable standard freezers is 386 kWh, a difference of 44 kWh. More details available at http://www.energystar.gov/products/certified-products/detail/7603/partners.
[7] The evaluation team matched program models to the version 4.1 product list first. Models that did not match were then matched to the version 5.0 list.
[8] Both the *ex ante* and *ex post* methodologies assume that freezer demand does not increase during peak hours. This is a conservative assumption that may underestimate freezer demand savings, given that the space surrounding the freezer may be warmer than usual during peak hours.
[9] 2012-2014 AEP Ohio EE/PDR Action Plan, p. C-11 of Volume 2.

For program electric water heaters, the evaluation team calculated *ex post* savings using an engineering-based approach that takes into account the efficiency of program-rebated models as well as the federal standard for a model of equivalent capacity. This approach resulted in different values for *ex ante* and *ex post* unit energy and demand savings. Key differences in the values used for *ex ante* and *ex post* electric water heaters savings are summarized in Table 3-21.

Table 3-21 Key *Ex Ante* and *Ex Post* Parameters for Electric Water Heaters

Parameter Description	*Ex Ante* Value	Average *Ex Post* Value	*Ex Post* Source
Annual Unit Energy Consumption – Baseline Unit (UEC_{BASE})	-	4,857 kWh	ENERGY STAR Water Heater Market Profile
Efficiency – Energy-Efficient Unit (EF_{EE})	-	0.95	Tracking Data based on Model Number
Efficiency – Baseline Unit (EF_{BASE})	-	0.912	Federal Standard, adjusted by Unit Volume
Coincidence Factor (CF)	-	0.143	2014 Appliance Rebate Survey
Per-Unit Energy Savings	182.4 kWh	194.7 kWh	-
Per-Unit Demand Savings	0.0139 kW	0.011 kW	-

3.4.7 Heat Pump Water Heater Impact Methodology and Key Parameters

In 2014, AEP Ohio customers submitted rebate forms for 419 heat pump water heaters. For heat pump water heaters, deemed savings values specified in the Draft 2010 Ohio TRM depend on the type of home heating system where the new equipment is installed. Table 3-22 presents the per-unit savings values.

Table 3-22. Draft 2010 Ohio TRM Per-Unit Savings Values for Heat Pump Water Heaters

Home Heating System	Per-Unit Energy Savings (kWh)	Per-Unit Demand Savings (kW)
Electric Resistance Heat	499	0.068
Heat Pump	1,297	0.180
Fossil Fuel	2,076	0.280

Source: Heat Pump Water Heaters (Time of Sale), Draft 2010 State of Ohio Energy Efficiency Technical Reference Manual, August 6, 2010. p. 86.

The program tracking data indicated that slightly more than half (53%) of program heat pump water heaters were installed in homes with a fossil fuel heating system; the rest were installed in homes with some type of electric heating (either electric resistance or heat pump). AEP Ohio computed average per-unit energy and demand savings values for electrically-heated homes using data from the AEP Residential Appliance Saturation Survey (RASS) 2013 survey, which indicated that 31 percent of electric heating came from heat pumps and 69 percent came from electric resistance heaters. The weighted average energy savings value for electric heated homes was 746.467 kWh and the demand savings value was 0.102 kW.

Table 3-23 shows the home heating type breakdown for heat pump water heater participants.

Table 3-23. Percent of Program Heat Pump Water Heaters by Home Heating Type

Home Heating Type	Number of Units	Percent of Units	Percent of Savings
Electricity	199	47.5%	24.5%
Fossil Fuel	220	52.5%	75.5%
Total	419	100%	100%

3.4.8 Television Impact Methodology and Key Parameters

AEP Ohio customers purchased and submitted rebate forms for 4,023 televisions in 2014. The Draft 2010 Ohio TRM does not specify savings values for televisions. For *ex ante* savings, AEP Ohio calculated television savings using 102 kWh per unit for energy savings and 0.0281 kW for demand savings.[10]

For program televisions, the evaluation team calculated *ex post* savings by matching individual model numbers from program tracking data to the ENERGY STAR television products list. This model matching was used to determine unit energy consumption for both the qualified unit and the listed baseline in standby and operating modes. The evaluation team used this matched data to compute *ex post* energy and demand savings. Table 3-24 shows key differences in the parameters used for *ex ante* and *ex post* television savings.

[10] 2012-2014 AEP Ohio EE/PDR Action Plan, p. C-10 of Volume 2.

Table 3-24. Key *Ex Ante* and *Ex Post* Parameters for Televisions

Parameter Description	*Ex Ante* Savings Value	Average *Ex Post* Savings Value	Units	*Ex Post* Source
Active Mode Power Consumption – Baseline Unit	-	65.6	Watts	Tracking Data, ENERGY STAR [(a)]
Active Mode Power Consumption – Efficient Unit	-	45.2	Watts	Tracking Data, ENERGY STAR [(a)]
Standby Mode Power Consumption – Baseline Unit	-	1	Watts	ENERGY STAR [(a)]
Standby Mode Power Consumption – Efficient Unit	-	0.27	Watts	Tracking Data, ENERGY STAR [(a)]
Hours of Use in Active Mode (HOU_{active})	-	4.9	Hours per day	2014 Appliance Rebate Survey
Coincidence Factor	-	0.348	-	2014 Appliance Rebate Survey
Unit Energy Savings	102	42	kWh per year	-
Unit Demand Savings	0.0281	0.008	kW per year	-

a. TVs Key Product Criteria – On Mode Power Consumption Requirements, ENERGY STAR. https://www.energystar.gov/index.cfm?c=tv_vcr.pr_crit_tv_vcr

3.5 *Process Evaluation Findings*

The process evaluation of the Efficient Products Program focused on assessing the effectiveness of the appliance rebate program. The process evaluation was conducted via a telephone survey of appliance rebate participants. In addition, the evaluation team surveyed 385 customers from the general population of AEP Ohio residential customers to analyze awareness of efficient technologies and the Efficient Products Program, willingness to pay for efficient lighting, and barriers to the purchase and installation of efficient technologies. The evaluation team did not collect feedback from lighting discount participants, as these groups had been surveyed in previous years.

Overall, the program continues to run smoothly. Survey respondents reported high satisfaction with both the appliance rebate program (96% at least somewhat satisfied) and their new equipment (95% at least somewhat satisfied).

This section contains the following sections:

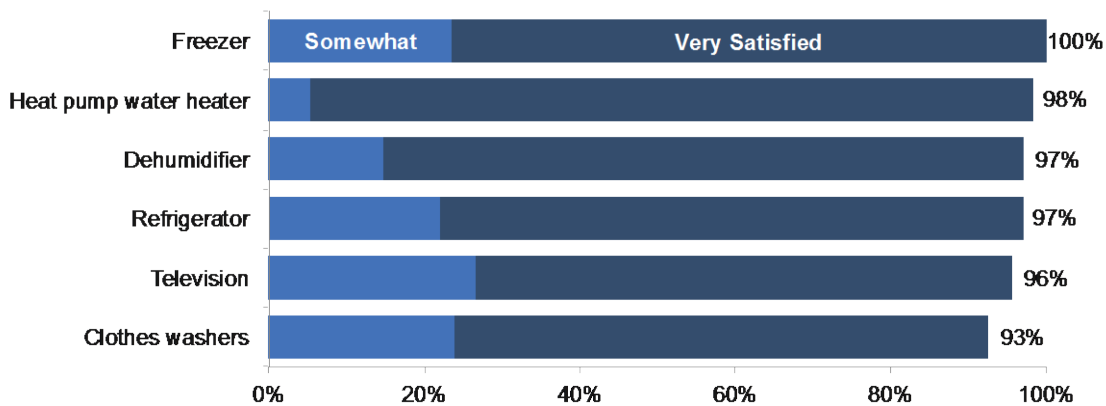
- Appliance Rebate Participant Satisfaction
- Marketing and Program Awareness
- Effectiveness of In-store Marketing Materials
- Appliance Retailer Knowledge and Promotion of Rebates
- Heat Pump Water Heater Contractors
- General Population Awareness of Energy Efficient Products
- General Population Awareness of Program Incentives

- General Population Knowledge of and Interest in Heat Pump Water Heaters
- Barriers and Misconceptions Regarding CFLs and LEDs
- Consumer Demand for and Satisfaction with LEDs and CFLs
- Plumbing (Heat Pump Water Heater) Contractor Interviews

3.5.1 Appliance Rebate Participant Satisfaction

Appliance rebate participants were very satisfied with the program, with 96 percent of all participants responding that they were somewhat or very satisfied. In addition, the majority of participants said they were very satisfied with the program for each equipment type (Figure 3-3). Notably, all of the participants who received a rebate for a freezer were satisfied with the program. The heat pump water heater rebates, on the other hand, had the highest percentage of participants who were very satisfied with the program (93%). Only 13 participants rated their satisfaction as "neither satisfied nor dissatisfied" or lower. Appendix A.4 provides detailed feedback from these participants.

Figure 3-3. Program Satisfaction by Equipment Type (n = 397)



Overall, participants reported being satisfied with all aspects of the program, from the process of applying for a rebate to the energy savings realized as a result of installing the new energy efficient appliances. For details on participant satisfaction with the program elements, see Appendix A.4.

3.5.2 Marketing and Program Awareness

This section summarizes sources of program and product awareness among participating customers. Appliance rebate program participants were first asked how they heard about the rebates available in an open-ended question. As a follow-up, respondents were asked whether they had heard of the rebates from a list of sources. Table 3-25 shows both how respondents first heard about the rebates and all of the ways in which they heard. All responses—including first heard and secondary sources—are represented in the right-most column. The largest proportion of respondents heard about the rebates at a retail store, either through in-store advertising (64%) or from a store employee (49%). This is consistent with the findings from previous years.

Table 3-25. Sources of Participant Awareness of Appliance Rebates

Source	First Heard of Program [(a)] (n = 397)	All Places Where Heard [(b)] (n = 397)
In-store advertising	35.5%	64.0%
Store employee	29.2%	48.9%
Mailing or bill insert	6.3%	31.0%
Word of mouth	5.8%	29.2%
AEP Ohio website	4.3%	18.6%
Internet or online search	3.3%	17.4%
All other comments	3.3%	4.5%
Television	2.8%	18.4%
Plumber or contractor	0.8%	5.8%
Newspaper	0.3%	7.1%
Community event	0.3%	2.5%
Email from AEP Ohio	0.3%	9.3%
Don't know	7.8%	7.8%
Total	100.0%	-

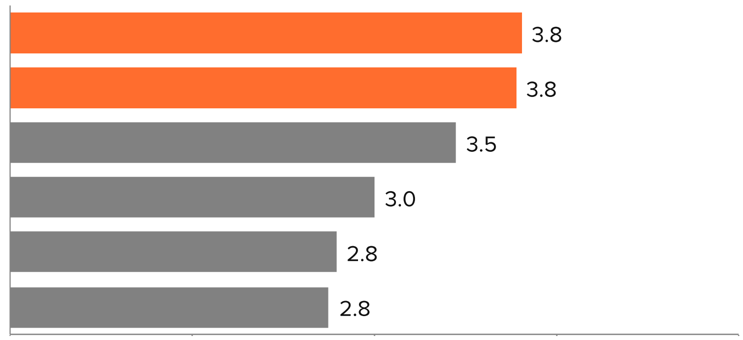
a. Open-ended question.

b. Combines responses from the open-ended question and a closed-ended, prompted question. Multiple responses were accepted; thus, responses total to greater than 100%.

3.5.3 Effectiveness of In-Store Marketing Materials

As indicated previously, in-store advertising was the most frequently mentioned source of awareness of the appliance rebates among surveyed program participants. In a prompted question, 277 appliance rebate participants (70%) reported seeing AEP Ohio energy efficiency promotional materials or informational displays at a retail store that mentioned appliance rebates.[11] Participants were asked a follow-up question to gauge the influence these promotional materials had over their decision to purchase the rebated appliance. Figure 3-4 shows how participant survey respondents who recalled seeing in-store promotional materials rated the influence of these materials. Participants who purchased water heaters or dehumidifiers found these materials to be more influential; the mean rating for heat pump water heaters (3.8) and dehumidifiers (3.8) was significantly greater than the mean for all other appliance types.[12]

Figure 3-4. Influence of In-store Promotional Materials by Equipment Type



Note. Only those who reported seeing AEP Ohio energy efficiency promotional materials (n = 277) were asked this question. Heat pump water heater and dehumidifier participants' ratings were significantly higher than other participants, as indicated by the orange bars.

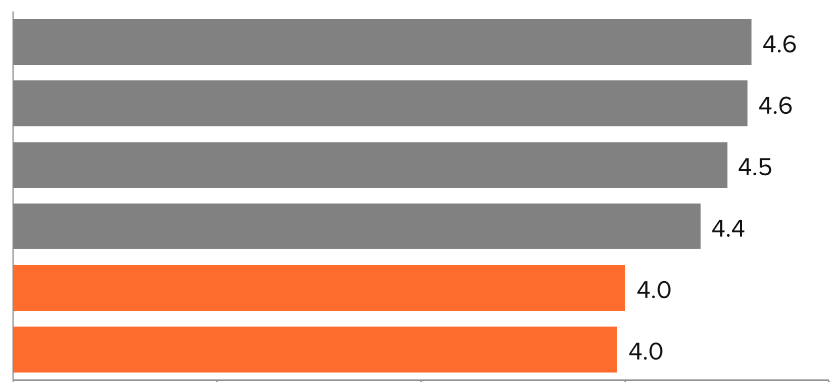
Overall, 48 percent of all participants across all appliance types reported that the in-store promotional materials had at least a moderate influence on their decision to purchase the ENERGY STAR appliance by reporting a rating of 4 or 5.

[11] This percentage is different from that in Table 3-25 because this percentage includes responses to a specific prompted question regarding promotional materials or informational displays at the store that mentioned the rebate.
[12] Heat pump water heaters: $p = 0.008$, $U = 3268.000$, $Z = -2.647$. Dehumidifiers: $p = 0.002$, $U = 4069.500$, $Z = -3.054$

3.5.4 Appliance Retailer Knowledge and Promotion of Rebates

In total, 63 percent of all appliance rebate survey respondents reported that a store associate spoke with them about the available rebate. Of those, 47 percent reported speaking to the sales associate about the rebates before choosing which appliance to purchase, while 40 percent heard after choosing the appliance.[13] Figure 3-5 shows the mean ratings for how knowledgeable sales associates were about the rebate program, divided by appliance type. Overall, appliance rebate participants believe appliance retailers are knowledgeable about the appliance rebate portion of the program. In fact, 81 percent of participants ranked the sales associate as either a 4 or 5 on a scale of 1 to 5 (1 meaning "not at all knowledgeable" and 5 meaning "very knowledgeable"). Participants who purchased a television or a heat pump water heater rated the sales associates' knowledge lower than those who purchased other appliances; however, these groups still rated the associates' knowledge highly.[14]

Figure 3-5. Respondent Ratings of Sales Associates' Knowledge by Equipment Type



Note. Only those who reported speaking with a sales associate (n = 246) were asked this question. Heat pump water heater and television participants' ratings were significantly lower than other participants, as indicated by the orange bars.

Nine participants reported that the sales associate was not knowledgeable about the rebates (i.e., those who gave a rating of less than "3"). Of these, only two participants gave suggestions on what other information they needed from the sales associate. These responses included that they would have liked to receive the information prior to when they were ready to purchase the equipment, that they would like the sales associate to know more than what they read about the equipment, and that the participant ended up having to ask someone else most of their questions. Appendix A.4 provides more details on these responses.

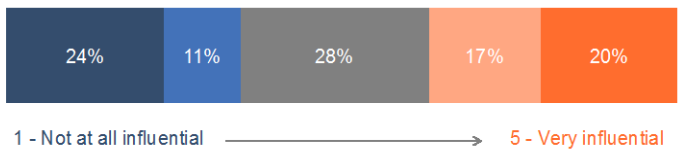
Participants were also asked to report the level of influence the sales associate had over their purchase of the ENERGY STAR appliance. On a scale of 1 to 5 (1 meaning "not at all influential" and 5 meaning

[13] An additional 13% didn't know when they spoke with the store associate.

[14] Heat pump water heater: $p = 0.010$, $U = 2168.500$, $Z = -2.582$. Television: $p = 0.006$, $U = 3278.500$, $Z = -2.737$

"very influential"), participants reported a mean influence of 2.88. Figure 3-6 highlights participants' responses on how influential the sales associate was on their decision to purchase the efficient appliance. The sales associates had a wide range of influence on participants' purchasing decision. Overall, 37 percent of participants rated the sales associate's influence as a 4 or 5.

Figure 3-6. Influence of the Sales Associate on Participants' Purchasing Decision (n = 246)



Note. Only those who reported seeing AEP Ohio energy efficiency promotional materials (n = 246) were asked this question.

3.5.5 Heat Pump Water Heater Contractors

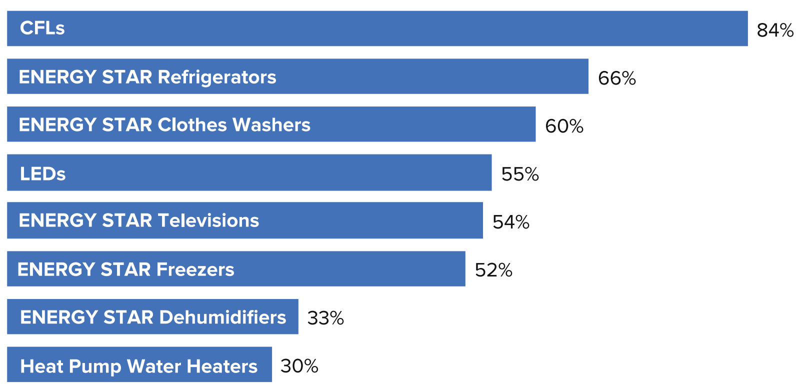
Participants who purchased heat pump water heaters were also asked a series of questions about the contractors they used to install the equipment. Of the 57 heat pump water heater participants surveyed, 19 (33%) used a contractor to install their equipment. Six of the participants said that they had heard about the rebate program through a contractor or plumber. However, when these participants were later asked if the heat pump water heater contractor who installed their equipment had talked to them about the program, all responded that they had not. This indicates that participants may be hearing of the rebate program through other sources, such as participating retailers or through contractors other than the ones who installed their equipment.

3.5.6 General Population Awareness of Energy Efficient Products

General population customers were asked about their awareness of different energy efficient products. Figure 3-7 shows the percent of customers who were at least "somewhat familiar" with each efficient lighting or appliance type. Overall, respondents were most aware of CFLs (84%), ENERGY STAR refrigerators (66%), and ENERGY STAR clothes washers (60%).

In 2014, 85 percent of respondents reported having heard of LEDs, compared to 78 percent in 2012 (the last year the survey was administered). Respondents were then asked a follow-up question to gauge their familiarity with LED technology for general-purpose lighting. The percent of respondents who said they were at least "somewhat familiar" with LEDs increased from 43 percent in 2012 to 55 percent in 2014. In 2014, 21 percent of respondents had installed LEDs in their home, compared to 8 percent in 2012.

Figure 3-7. Customer Awareness of Efficient Products by Product Type (n = 385)



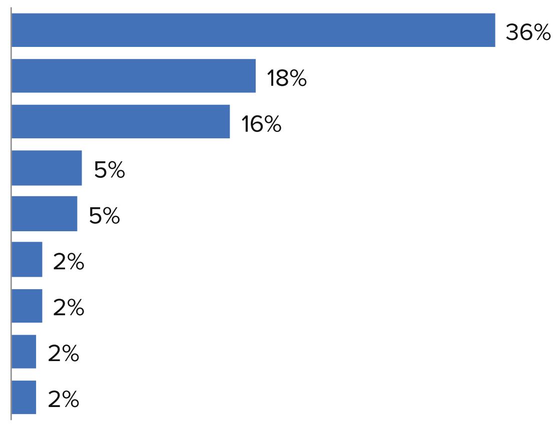
Note. Percentages include customers who were "somewhat familiar" or "very familiar" with each product type.

3.5.7 General Population Awareness of Program Incentives

Respondents to the residential general population survey were asked to report their awareness of residential incentives available to AEP Ohio customers. Thirty percent of respondents were aware of the appliance rebates offered by AEP Ohio and five percent reported receiving an appliance rebate through the Efficient Products Program. In addition, 15 percent of customers were aware of discounts for CFLs provided by AEP Ohio.

Customers who had heard of the appliance rebates provided through the Efficient Products Program were also asked how they first heard of the program. Figure 3-8 provides the responses to this question. Bill inserts were the top source of awareness for the appliance rebates offered through the Efficient Products Program. Few respondents mentioned in-store promotions from sales associates or demonstrations, which reflects the fact that most were non-participants and likely would not be exposed to these promotions if not shopping for an appliance.

Figure 3-8. Sources of Awareness for the AEP Ohio Appliance Rebates (n = 58)

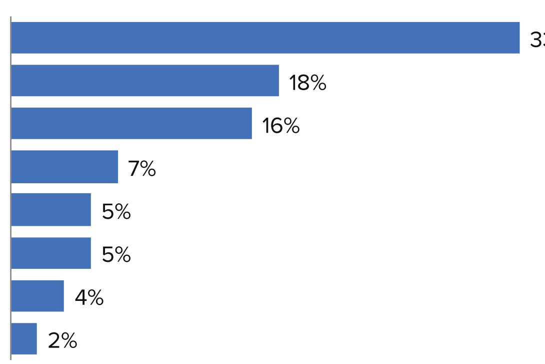


Note. This graph only contains the top nine responses.

Respondents who had not participated in the program were asked about their interest in participating. Of those who had heard of the appliance rebates but had not participated, 65 percent were interested (31 out of 48).

Respondents who had heard of AEP Ohio's CFL discounts were asked about how they became aware of the program, see Figure 3-9. Most frequently, customers responded that they had heard of the program through a bill insert (although no bill inserts were distributed in 2014). In-store signage and in-store demonstrations were much more influential for the lighting discounts than the appliance rebates.

Figure 3-9. Sources of Awareness for Lighting Discounts (n=57)



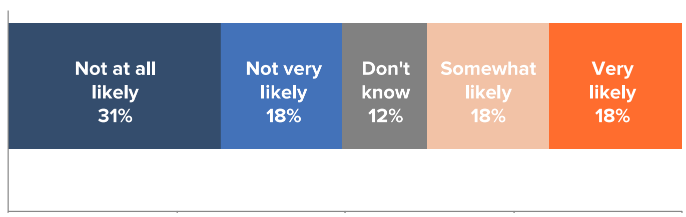
3.5.8 General Population Knowledge of and Interest in Heat Pump Water Heaters

All survey respondents were asked about their knowledge of and familiarity with heat pump water heaters. Of the 385 respondents, 48 percent had heard of heat pump water heaters. However, only 31 percent said they were "somewhat familiar" or "very familiar" with heat pump water heaters.[15] Of the 118 survey participants who were familiar with heat pump water heaters, 19 (16%) had installed heat pump water heaters.

Customers who did not currently have heat pump water heaters installed were asked about their plans to replace their water heaters. Of these 109 customers, four said that they had plans to replace their current water heater within the next two years. These customers were asked how likely they were to replace their current water heater with a heat pump water heater. Responses were mixed; two respondents said they were "not at all likely" to do so, and two said they were "very likely" to do so.

Customers who did not have heat pump water heaters and did not have plans to replace their current water heater were asked a hypothetical question about the likelihood that they would purchase a heat pump water heater if they decided to replace their current equipment. Figure 3-10 shows the responses to this question. Though responses were mixed, 36 percent of customers were at least "somewhat likely" to replace their water heater with a heat pump water heater.

Figure 3-10. Likelihood Customers Would Replace Current Water Heater with a Heat Pump Water Heater (n = 114)



Note. This question was only asked of customers who were aware of heat pump water heaters and had no current plans to replace their water heater.

Customers who said they were not likely to replace their water heater with a heat pump water heater were asked why they would not purchase a heat pump water heater. Of these 55 customers, the following reasons were most common:

- Heat pump water heaters cost too much to purchase or install (n = 12)
- The customer has gas heat, and does not want to switch to electric water heating (n = 12)
- The customer rents the building, and has no control over appliances (n = 5)
- The customer wants an on-demand, tankless water heater (n = 3)
- Heat pump water heaters don't work well with weather extremes (n = 3)

[15] The rest of the participants were "not at all familiar" with the heat pump water heaters. These customers were not asked any more questions about heat pump water heaters.

- The customer has a friend or acquaintance that has installed a heat pump water heater, and has heard that they don't work well (n = 3)

These findings suggest that among AEP Ohio residential customers, the largest barrier to heat pump water heaters is awareness of the technology. Among the customers who are aware of heat pump water heaters, the largest barrier is cost. In general, there does not appear to be a widespread concern with any one aspect of heat pump water heater technology.

3.5.9 Barriers and Misconceptions Regarding CFLs and LEDs

Survey respondents from the AEP Ohio residential general population were asked what factors were preventing them from installing CFLs and LEDs in their home. Because the respondents represented both purchasers and non-purchasers of each technology, the survey asked those who had already purchased either type what was preventing them from purchasing more CFLs or LEDs, while those who had not purchased CFLs or LEDs were asked what was preventing them from purchasing CFLs or LEDs in the first place. Those respondents who were not aware of the technologies were not asked this question, but their lack of awareness is noted as a barrier in the analysis.

The reported barriers to purchasing CFLs are presented in Table 3-26, in descending frequency for non-purchasers. Among the general population of residential customers, only 16 percent of customers (60 out of 385 survey respondents) were not familiar with CFLs. Among non-purchasers (24% of all respondents), the primary barrier was lack of awareness, indicated by 82 percent of these respondents. The most frequently reported barriers among those who had already purchased CFLs was that these cost too much (n = 71; 30%) or that they were waiting for their currently operating lamps to burn out (n = 66; 28%). Of those waiting for lamps to burn out, 79 percent reported that they were waiting for incandescent lamps to burn out, eleven percent said they were waiting for CFLs to burn out, and nine percent reported they were waiting for both incandescent and CFL lamps to burn out.

Cost was noted as a barrier to installing CFLs by 30 percent of previous purchasers. Among the 14 non-purchasers who were aware of the technology, 21 percent reported cost as a barrier. Previous purchasers also noted some additional reasons related to CFL performance, including: insufficient brightness (17%), a short lifespan (11%), being slow to warm up (10%), and poor color quality (7%).

A few misconceptions regarding CFL technology emerge from these responses, although these do not appear to be commonly held. First, eight respondents (3% of purchasers) said that they were not installing more CFLs in their home because they need lamps with 3-way and dimmable capabilities. However, there are plenty of CFLs on the market today with these functionalities, indicating that the general population might not be fully aware of the selection and variety of CFLs available. Additionally, mercury content was mentioned by four percent of non-purchasers as a barrier to purchasing CFLs.

Table 3-26. Reported Barriers to Purchasing CFLs Among Residential Customers Who Have Already Purchased CFLs and Those Who Have Never Purchased CFLs

	Purchasers (n = 240) [(a)]		Non-Purchasers (n = 77)	
Barriers to Purchasing CFLs Among General Population	Count	Percent	Count	Percent
Not at all familiar with CFLs	-	-	63 [(b)]	82%
Cost	71	30%	3	4%
Waiting for installed lamps (any type) to burn out	66	28%	-	-
CFLs aren't bright enough	41	17%	-	-
CFLs don't last long enough	27	11%	-	-
CFLs take too long to light up	23	10%	-	-
CFL light color isn't what I want	17	7%	1	1%
All fixtures already have CFLs	17	7%	-	-
Don't like the way CFLs fit in fixtures	11	5%	1	1%
CFLs contain mercury	10	4%	-	-
Nothing is preventing them from installing more CFLs	10	4%	2	3%
Don't fit in the fixtures	7	3%	1	1%
Need dimmable bulbs	5	2%	-	-
Don't like the way CFLs look in fixtures	4	2%	-	-
Need 3-way bulbs	3	1%	-	-
Haven't had enough time to install all CFLs	3	1%	-	-
Haven't seen enough energy savings	3	1%	-	-
Less availability in stores	2	1%	-	-
Other	12	5%	3	4%
Don't know	20	6%	-	-

Note: Multiple responses were accepted, so column totals sum to more than the number of respondents for each question.
a. Although 290 survey respondents reported having CFLs, only 240 were asked about barriers toward installing more CFLs because they also reported that not all of their sockets contained CFLs. Those who said that all the sockets in their home contained CFLs were not asked about barriers to installing more CFLs.
b. These 63 respondents were not specifically asked to report barriers toward purchasing CFLs because they reported being unaware of the technology. The remaining 14 respondents who were at least somewhat familiar with CFLs were asked to report barriers toward purchasing them.

As shown in Table 3-27, unlike CFLs, the majority of survey respondents (78%) had never purchased LEDs for residential use, so most of the barriers were reported from individuals who had no personal experience with LEDs in their home. The greatest barrier identified was lack of knowledge of the technology. Among the general population of residential customers, 45 percent of customers (174 out of all 385 survey respondents) were not familiar with LEDs. Of non-purchasers, 59 percent reported either being unaware of LEDs or stated that their lack of knowledge was a barrier toward purchasing LEDs. Among purchasers, cost was the overwhelming barrier toward the purchase of LEDs, reported by 46 percent of respondents. Among the 122 non-purchasers who were aware of the technology, 49 percent (or 20% of all non-purchasers) reported cost as a barrier. Additional barriers for both previous purchasers and non-purchasers included waiting for lamps to burn out and poor light quality.

Table 3-27. Reported Barriers to Purchasing LEDs Among Residential Customers Who Have Already Purchased LEDs and Those Who Have Never Purchased LEDs

	Purchasers (n = 84)		Non-Purchasers (n = 296)	
Barriers to Purchasing LEDs Among General Population	Count	Percent	Count	Percent
Not at all familiar with LEDs	-	-	174 [(a)]	59%
Cost	39	46%	60	20%
Waiting for installed lamps (any type) to burn out	23	27%	14	5%
Poor light quality	5	6%	8	3%
Insufficient brightness	3	4%	-	-
Need dimmable bulbs	2	2%	-	-
Need 3-way bulbs	2	2%	-	-
Don't like the way they look in fixtures	1	1%	1	0%
Take too long to warm up	1	1%	4	1%
Not enough information about LEDs	-	-	17	6%
No reason not to install LEDs	-	-	6	2%
No interest in LEDs	-	-	6	2%
Rent their apartment and can't install bulbs	-	-	4	1%
Availability	-	-	3	1%
Don't use the lights enough	-	-	2	1%
Other	8	10%	6	2%

Note. Multiple responses were accepted, so column totals sum to more than the number of respondents for each question.

a. These 174 respondents were not specifically asked to report barriers toward purchasing LEDs because they reported being unaware of the technology. The remaining 122 respondents who were aware of LEDs were asked to report barriers toward purchasing them.

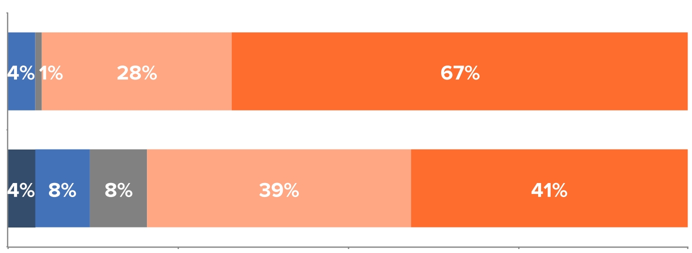
In general, customers reported fewer performance-related barriers for LEDs than for CFLs. Performance-related barriers include problems with the bulb's color, intensity, time to warm up, and lifespan. Of all respondents who were aware of CFLs (n = 254), 43 percent reported performance-related barriers. Of the 206 respondents who were aware of LEDs, 11 percent reported performance-related barriers.

3.5.10 Consumer Demand for and Satisfaction with LEDs and CFLs

All respondents who reported already having CFLs installed either inside or outside their home (n = 273) were asked to report on their satisfaction with the CFLs. Figure 3-10 shows customer satisfaction with CFLs, as compared to satisfaction with LEDs. Note that the products customers rated may not be program-incented products. Customers were satisfied with the CFLs that they purchased, with 80 percent rating their satisfaction as either "somewhat satisfied" or "very satisfied."

Respondents who purchased LEDs were asked to report their satisfaction with the LEDs and their interest in installing LEDs in their home in the future. As shown in Figure 3-11, customers were very satisfied with the LEDs they purchased, with 93 percent rating their satisfaction as either "somewhat satisfied" or "very satisfied." This is consistent with the findings from the 2014 LED Market Research Survey, which found that customers had extremely high levels of satisfaction with LEDs. In this survey, customers rated satisfaction with LEDs an average of 4.7 on a 1-to-5 scale.[16]

Figure 3-11. Satisfaction with CFL and LED Performance



Note: Customers were only asked this question if they had already installed LEDs or CFLs.

[16] For more information on satisfaction with LEDs, see the memorandum "Residential LED Market Research Survey Results," February 2015.

In addition, respondents who had CFLs installed in their home were asked to report on the likelihood that they would replace burned-out CFLs with additional CFLs on a scale of 1 ("not at all likely") to 5 ("very likely"); Figure 3-11 presents these results. Overall, 69 percent of respondents were likely to replace their CFLs with more CFLs, as indicated by a rating of 4 or higher on a 1-to-5 scale. These responses show decreased interest in CFLs from 2012.

Customers who purchased LEDs were also asked about the likelihood that they would replace burned-out LEDs with additional LEDs, see Figure 3-12. In 2014, 81 percent of these customers were likely to replace their LEDs with more LEDs when they burned out (as indicated by a rating of 4 or higher on a 1-to-5 scale). In 2012, only 50 percent of customers were likely to do so, demonstrating the increased interest in LEDs. Figure 3-12 shows respondents rated their average likelihood to replace their bulbs with LEDs as a 4.4.

Figure 3-12. Likelihood Customers Would Replace Current CFL or LED with Another CFL or LED

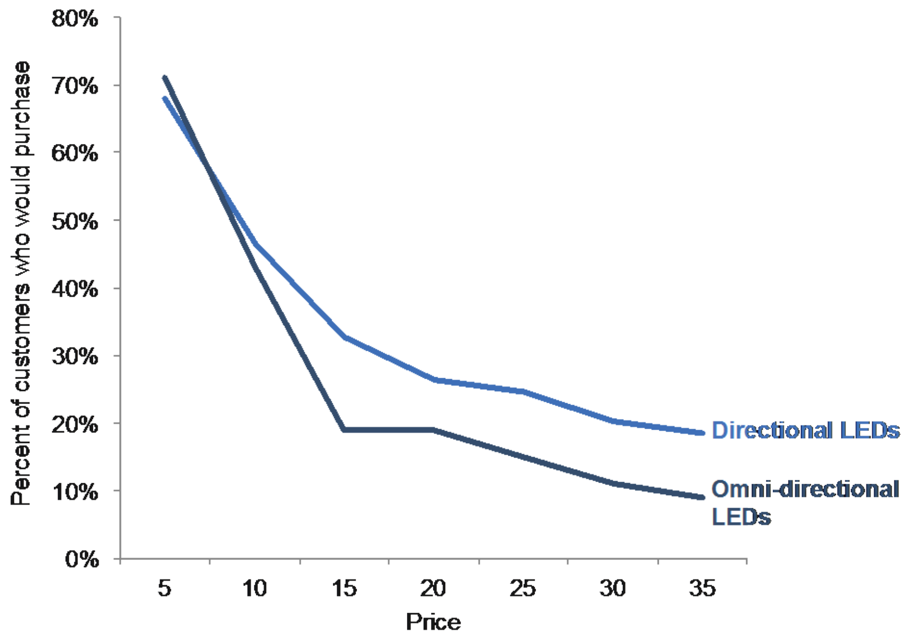
Note. Customers were only asked this question if they had already installed LEDs or CFLs. Customers who had purchased CFLs were asked how likely they were to replace the CFLs with more CFLs once they burned out. Customers who had purchased LEDs were asked how likely they were to replace the LEDs with more LEDs once they burned out.

In addition, customers who had not purchased LEDs but were aware of the technology were asked how interested they were in installing LEDs. Of these 129 participants, 30 percent said they were interested in installing LEDs, as indicated by a rating of 4 or higher on a 1-to-5 scale. In 2012, only 20 percent of non-purchasers were interested in installing LEDs.

Although interest in CFLs has fallen since 2012, the interest in and demand for LEDs has greatly increased. More customers are aware of LEDs than in 2012, which may contribute to the increased demand for LEDs, since awareness is the biggest barrier to their purchase. Customers are also more satisfied with LEDs than with CFLs, and are more likely to purchase additional LEDs than CFLs, underscoring the widespread satisfaction with LED performance.

Finally, customers who were aware of the LED technology were asked two prompted questions to determine how much they would be willing to pay for both omni-directional and directional LEDs. In these questions, customers were given a price, and asked if they'd be willing to pay that amount for the LED. The price points customers received for omni-directional and directional lighting were chosen at random from the following options: $5, $10, $15, $20, $25, $30, and $35. Approximately the same number of customers were prompted with each value. From these answers, the evaluation team was able to construct a demand curve for the products, presented in Figure 3-13. At the lowest price point, 5 dollars, 68 percent of customers were willing to purchase directional LEDs and 71 percent were willing to purchase omni-directional LEDs. At the next lowest price point, 10 dollars, 46 percent were willing to purchase directional LEDs and 43 percent were willing to purchase omni-directional LEDs. As shown in the figure, demand for omni-directional LEDs is higher than demand for directional LEDs at the lowest price point, 5 dollars. However, a higher percentage of customers are willing to pay for directional LEDs at higher price points, indicating that customers may expect to pay higher prices for directional lighting.

Figure 3-13. Demand Curves for Directional and Omni-directional LEDs



Note. All customers were asked this question (n=385). Each customer was prompted with one of seven prices ($5, $10, $15, $20, $25, $30, $35), which was randomly assigned. Between 53 and 58 customers were asked about each price.

3.5.11 Plumbing (Heat Pump Water Heater) Contractor Interviews

Interviewed plumbing contractors were generally very involved in the residential water heater market, although two out of eleven noted that they focused more on commercial plumbing. When asked how many residential water heater jobs their firm typically performed per year, responses ranged greatly, from ten to "thousands" of water heater jobs. In general, plumbing contractors were not aware of AEP Ohio energy efficiency programs. One interviewee noted that they had participated in AEP Ohio programs in the past, but had not participated for several years. The remaining interviewees were relatively unfamiliar with AEP Ohio energy efficiency programs.

Only one interviewee, a wholesaler, noted that they had recently sold a heat pump water heater for which their customer received a $500 rebate (although he did not confirm this was an AEP Ohio rebate). This interviewee noted that the customer specifically requested a heat pump water heater because the rebate reduced the payback period to four or five years; this interviewee was not involved with the program application process so could not provide any feedback. This interviewee also stated that they do not typically promote high-efficiency models unless the customer specifically requests it.

Most plumbing contractors were unfamiliar with heat pump water heater technology. Four interviewees were familiar and had worked with the technology before, although all four noted that they had sold or installed heat pump water heaters very infrequently over the past several years. The remaining interviewees were not familiar, or were only vaguely familiar (had heard of them, but had not worked with them and were not familiar with specifics on their operation).

Overall, contractors reported little demand for heat pump water heaters from their customer base. One interviewee noted, "I had bought one for stock, and sat on it for four years before we finally found a home for it. We don’t have the market for it. We almost gave it away." Contractors identified several reasons for this, one being a high incidence of gas water heating in their area they serve. Five interviewees mentioned that the majority of their service territory uses natural gas for water heating, and they have a smaller market for electric water heaters in general.

The second market barrier described by plumbing contractors was the high cost of heat pump water heaters. Interviewees with any familiarity with heat pump water heaters were asked if they felt that any heat pump water heater characteristics negatively impacted customer decision-making processes; these characteristics included their cost, size, installation requirements, noise, and operations in a cold climate. Six interviewees agreed that the comparatively high first cost of heat pump water heaters is an issue when customers are considering what to buy. One felt that a few customers paid attention to the long-term cost and payback and could afford the initial investment, but most could not. Another said of their market, "We have [customers] here where if you are a dollar more expensive, they will find someone else.”

When asked if their size or installation requirements are a concern, four contractors stated that heat pump water heaters are generally larger or taller than other water heaters, and three said they have slightly more complex configurations or installations (such as a return pipe or a drain). In terms of their noise level, contractors generally did not seem to think the noise of a heat pump water heater is an issue for customers. One stated that they had had one customer complain about it in the past; this customer's bedroom was directly over the heat pump water heater in their basement. Contractors also did not have extensive concerns about heat pumps operating in Ohio's relatively cold winters. Several mentioned the backup systems built into heat pump water heaters, which allow it to operate like a regular electric water heater, which can mitigate those concerns.

In general, few contractors had strong opinions about heat pump water heaters as a technology. However, one interviewee strongly disliked the heat pump water heater technology, and stated that they planned never to install it if possible. This interviewee felt this way for several reasons: because the heat pump water heaters are too complex, too expensive, and this interviewee doubted the payback period made it worth the purchase. Another interviewee said they felt there was a negative association with heat pumps, due to reliability issues, that has transferred to heat pump water heaters. This interviewee stated: "Heat pumps got a negative rap a few years ago. We’re still fighting that. Heat pumps didn’t last very long and the cost to repair was expensive. People are anxious that heat pump water heaters will have the same issues."

Finally, two interviewees specifically brought up upcoming federal standards that will change how contractors sell water heaters. According to one of these interviewees, the standards will essentially phase out all other electric water heaters except for heat pump water heaters. The remaining interviewee was only vaguely familiar with the standards, but understood that the cost of water heaters would be increasing significantly in the coming years. According to the US Department of Energy website, while these standards only slightly increase the Energy Factor requirements for smaller, standard tank water heaters (less than 55 gal) they dramatically increase the Energy Factor requirements for larger, 55+ gal water heaters.[17]

3.6 Cost Effectiveness Review

This section addresses the cost effectiveness of the Efficient Products Program. Cost effectiveness is assessed through the use of the Total Resource Cost (TRC) test. Table 3-28 summarizes the unique inputs used in the TRC test. Based on these inputs, the TRC ratio is 3.4. Therefore, the program passes the TRC test.

Table 3-28. Inputs to Cost-Effectiveness Model for Efficient Products Program

Input	Value
Average Measure Life	13
Units	4,584,865
Annual Energy Savings (kWh)	204,523,230
Coincident Peak Savings (kW)	25,370
Third Party Implementation Costs	2,040,894
Utility Administration Costs	1,294,655
Utility Incentive Costs	11,840,031
Participant Contribution to Incremental Measure Costs	23,794,472

[17] http://www1.eere.energy.gov/buildings/appliance_standards/product.aspx/productid/27

Table 3-29 summarizes the results of the cost-effectiveness tests. Results are presented for the Total Resource Cost test, the Participant test, the Ratepayer Impact Measure Test, and the Utility Cost Test.

Table 3-29. Cost Effectiveness Results for the Efficient Products Program

Test Results for Efficient Products	Value
Total Resource Cost	3.4
Participant Cost Test	6.7
Ratepayer Impact Measure	0.4
Utility Cost Test	6.0

At this time, additional benefits related to reduction of greenhouse gas emissions have not been quantified in the calculation of the TRC. These additional benefits would increase the given TRC benefit/cost ratio.

4 Conclusions and Recommendations

4.1 Conclusions and Recommendations for Program Improvements

The 2014 evaluation of the Efficient Products Program resulted in five main conclusions.

1. **The program achieved roughly twice its savings goals for 2014.** The program achieved nearly 205 GWh of energy savings and 25.4 MW of demand savings, surpassing the goals of 100 GWh and 12.9 MW.

2. ***Ex post* savings differed from *ex ante* values for some products, leading to overall realization rates that are slightly less than 1.0.** Where the Draft 2010 Ohio TRM was used, *ex post* values matched *ex ante* values from the program tracking data. For products that were not covered by the Draft 2010 Ohio TRM, the evaluation team used an independent research-based savings approach, which resulted in different values for LEDs, freezers, televisions, and electric water heaters. In particular, the evaluation team used the ENERGY STAR lighting database to determine baseline wattage for LEDs, which was substantially lower than the baselines used for *ex ante* calculations. This, along with other differences in parameter estimates, resulted in an energy realization rate for LEDs of 0.82. However, due to the smaller proportion of savings for products not included in the Draft 2010 Ohio TRM (compared to CFLs and other products included in the TRM), the overall realization rates for energy and demand savings were 0.97 and 0.99, respectively.

   - **Recommendation: Update the source used to determine baseline wattages for LEDs.** The evaluation team recommends matching baseline wattages with program wattages using the ENERGY STAR lighting database. The source should be updated annually to account for changes in product assortment and in federal standards. This approach would calculate savings more accurately and reduce risk of evaluation adjustments.

   - **Recommendation: Update the parameter values used to calculate savings for products not specified in the Draft 2010 Ohio TRM.** For LEDs, the evaluation team recommends using the parameters included in this report for hours of use, coincidence factor, and in-service rate. Primary research studies with AEP Ohio customers were conducted to estimate these parameters, and using these values will increase the accuracy of LED savings. In addition, the evaluation team recommends updating deemed savings values for freezers and televisions based on recent changes in federal standards.

3. **Sales of LED lighting are dramatically increasing, but awareness and price are still barriers to adoption.** The program discounted about 528,000 LEDs in 2014, more than six times the number in 2013. LEDs are responsible for the second-highest portion of savings, accounting for 14 percent of energy and 16 percent of demand savings in 2014. These represent dramatic increases from previous years and indicate that LED lighting is becoming more common. Nonetheless, the evaluation indicated that awareness of LEDs is still low, with 45 percent of general population customers not at

all familiar with the technology. Price is still the primary barrier to purchase of LEDs; of customers who are aware of LEDs but have not purchased any, 49 percent reported price as a barrier. However, the evaluation team found that customers had fewer performance-related concerns regarding LEDs (11%) compared to CFLs (43%).

- **Recommendation: Develop informational marketing for LED lighting.** The evaluation found that slightly more than half of residential customers are aware of LEDs, and price continues to be a barrier. Although in-store marketing efforts provide information about selecting efficient lighting in the form of in-store demonstrations, tear pads, and tip cards, customers may benefit from LED-specific versions of these materials. Additionally, using a mass marketing approach to advertise the benefits of LEDs may help increase familiarity and further increase sales. While focusing marketing inside the retail stores is effective for lower-cost CFLs, customers unfamiliar with the technology may benefit from information about LEDs prior to making a purchase decision at the store. Otherwise, customers who are unaccustomed to paying higher prices for lighting products may not consider LED options once they are inside the store.

4. **Overall, participants purchasing efficient appliances reported high levels of satisfaction with the program.** A very high percentage of program participants (96%) reported being at least "somewhat satisfied" with the Efficient Products Program, across equipment types. These participants also reported high levels of satisfaction with program processes, the rebate amount, energy savings, and time to receive their rebate. The evaluation team did not survey lighting participants in 2014.

5. **Customers appear to be interested in heat pump water heaters, but many plumbing contractors are unfamiliar with the technology.** A substantial percentage of customers reported being aware of heat pump water heaters. Nearly half – 48 percent of customers— said they had heard of heat pump water heaters, and 31 percent of customers said they were at least somewhat familiar with heat pump water heaters. Of the customers familiar with the technology, 36 percent said they were at least "somewhat likely" to purchase one if they needed to replace their water heater. However, most non-participant plumbing contractors interviewed (7 of 11) were unfamiliar or only vaguely familiar with heat pump water heaters. Additionally, only 33 percent of heat pump water heater participants reported using a contractor to install their equipment. In general, few contractors had strong opinions about heat pump water heaters as a technology and none were actively promoting it.

   - **Recommendation: Increase engagement with plumbing contractors to promote the heat pump water heater rebates.** Customer interest in heat pump water heaters appeared to be high, but our research with plumbing contractors suggested that many contractors are not familiar with the technology. Plumbing contractors play a key role in the water heater supply chain and often recommend equipment choices to residential customers. The disparity between customer interest and contractor knowledge represents an opportunity for AEP Ohio to engage more plumbing contractors and increase the volume of heat pump water heater rebates

Appendix A Detailed Process Evaluation Results and Survey Instruments

This Appendix describes additional details of findings for the process evaluation and survey instruments used for data collection for the 2014 evaluation of the AEP Ohio Efficient Products Program.

Appendix A includes the following sections:

- Survey Dispositions
- Tracking Data Review
- Additional Lighting Impact Savings Findings
- Additional Process Evaluation Results
- Data Collection Instruments

A.1 Survey Dispositions

This section provides details on the sampling dispositions for the General Population Survey and the Efficient Products Appliance Rebate Participant Survey. Table A-1 shows the final dispositions for the General Population Survey. As shown, the evaluation team completed surveys with 385 customers, reflecting an overall response rate of 10.2 percent.

Table A-1. General Population Survey Sample Disposition

Contact Disposition	Customers	Percent
Completes	385	10.2%
Unable to reach	2299	60.6%
Refusal	815	21.5%
Telephone number issue	130	3.4%
Non-specific callback/Appointment scheduled	61	1.6%
Language barrier	45	1.2%
Do not call	34	0.9%
Screened ineligible	22	0.6%
Total Participants Attempted to Contact	3791	100.0%

Table A-2 shows the final dispositions for the Efficient Products Appliance Rebate Participant Survey. As shown, the evaluation team completed surveys with 397 participants, reflecting an overall response rate of 12.3 percent.

Table A-2. Efficient Products Appliance Rebate Participant Survey Sample Disposition

Contact Disposition	Customers	Percent
Completes	397	12.3%
Unable to reach	2077	64.6%
Refusal	485	15.1%
Telephone number issue	122	3.8%
Non-specific callback/Appointment scheduled	68	2.1%
Did not recall buying an appliance	29	0.9%
Language barrier	20	0.6%
Electric company not AEP Ohio	17	0.5%
Total Participants Attempted to Contact	3,215	100.0%

A.2 Tracking Data Review

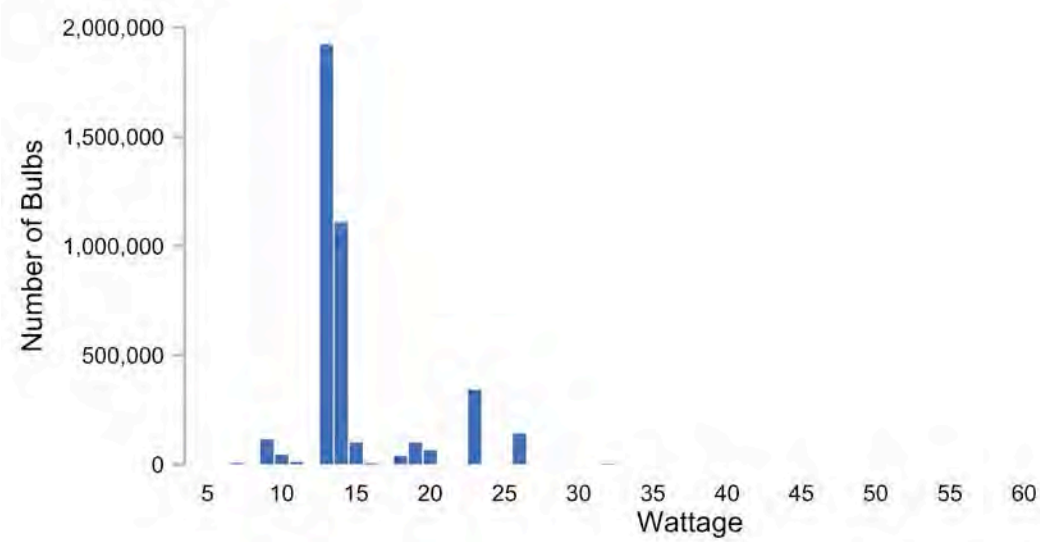
Because the program tracking data is critical for determining program impacts, the evaluation team completed a thorough review of the tracking data, which included three separate databases. Two databases were for lighting, including one for lighting products discounted through markdowns and another that contained products discounted through coupons. The markdown database also contained lighting "giveaways" through food banks and LED "giveaways" to appliance rebate customers. The third database contained all appliance rebates.

The evaluation team ran frequencies on each key variable to identify any missing data or inconsistencies. The evaluation team discovered some tracking data errors and inconsistencies, but these were resolved through discussion with AEP Ohio. These included appliances missing from the tracking data and a small number of invalid appliances due to incorrect account numbers. These issues were resolved and therefore are not discussed in the remainder of the report. The evaluator did not address whether the tracking system is adequate for regulatory prudency reviews or corporate requirements

A.3 Additional Lighting Impact Savings Findings

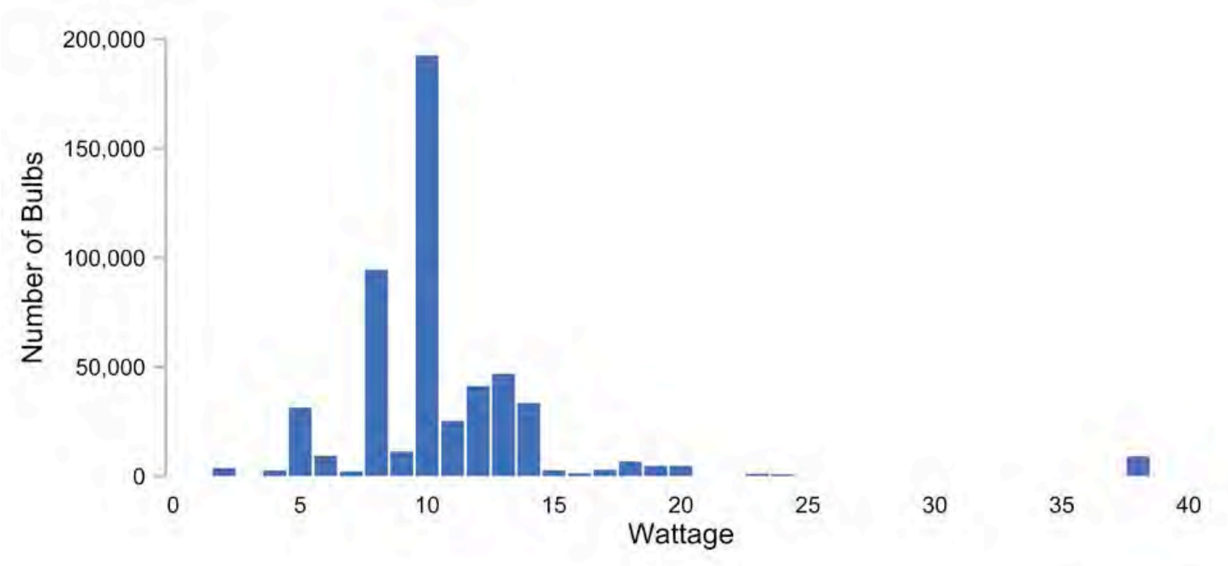
A key impact parameter for program CFLs is the wattage of discounted CFLs, or ProgWatts, as shown in Equation 3-1 and Equation 3-2. Figure A-1 shows the distribution of 2014 program CFL wattages. The most common CFL wattages were 14, 23, and 13 W, respectively. The average wattage of program CFLs was 16.90 Watts.

Figure A-1. Distribution of Program CFL Wattage



A key impact parameter for program LEDs is the wattage of discounted LEDs, or ProgWatts as shown in Equation 3-1 and Equation 3-2 in the report. The distribution of 2014 program LED wattages is shown in Figure A-2. The most common LED wattage was 10 W; the average wattage was 10.7 W, and the range was from 2 W to 38 W.

Figure A-2. Distribution of Program LED Wattages



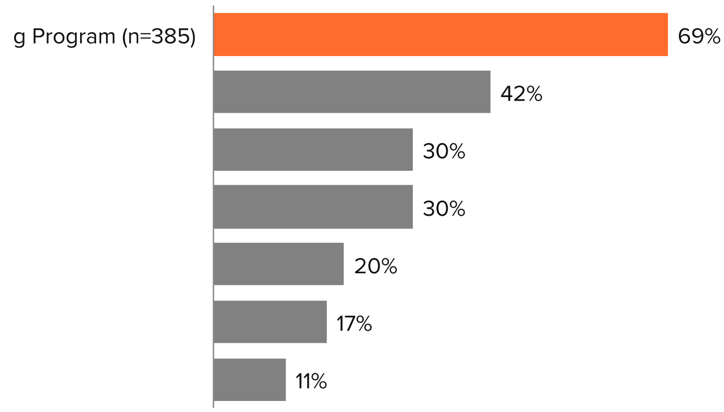
A.4 Additional Process Evaluation Results

This section contains additional results from the process evaluation. The section begins with results from the general population survey, including awareness of program incentives, participation in rebate programs, and satisfaction with AEP Ohio. Then, the section concludes with results from the participant survey, including satisfaction with AEP Ohio and satisfaction with the Efficient Products appliance rebates.

General Population Awareness of Program Incentives

Respondents to the residential general population survey were asked to report their awareness of residential incentives available to AEP Ohio customers. Every respondent was asked about their awareness of the Appliance Recycling Program to assess the effectiveness of AEP Ohio's targeted marketing efforts. In addition, respondents were asked about their awareness of two of the remaining six programs. Figure A-3 shows customer awareness of each of the residential efficiency programs. Customers were most aware of the Appliance Recycling Program, with more than two-thirds of the customers responding that they were either "somewhat familiar" or "very familiar" with the program.

Figure A-3. General Population Awareness of Rebate Programs

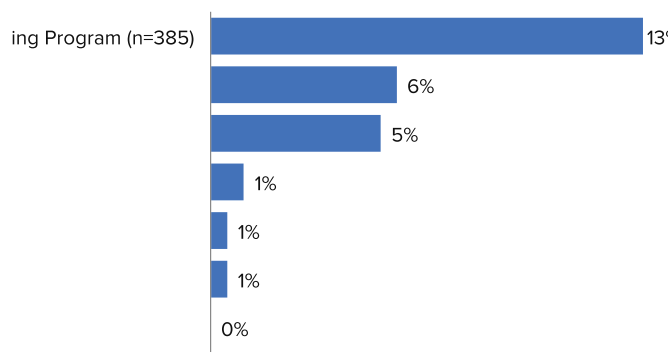


Note. Percentages include customers who were "somewhat familiar" or "very familiar" with each rebate program. Every customer was asked about the Appliance Recycling Program, and then was randomly assigned questions about two of the remaining six programs.

General Population Participation in Rebate Programs

Respondents to the residential general population survey were also asked about their participation in any of the residential energy efficiency programs. The responses for this question are presented in Figure A-4. The Appliance Recycling Program had the highest percent of respondents who had participated in the program. The next highest participation rates were for the In-home Energy Program and the Efficient Products appliance rebates.

Figure A-4. General Population Participation in Rebate Programs



Note. Customers were only asked this question if they reported that they were aware of the program. Customers who had not heard of the program were counted as non-participants.

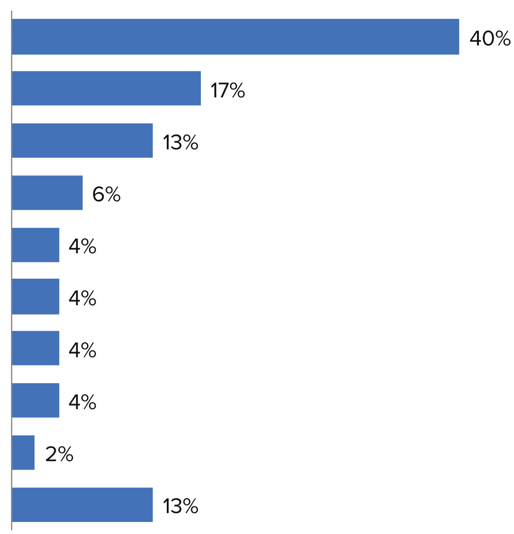
Participants who had not participated in the programs were asked about their interest in participating in the programs. Of those who had heard of the programs but had not participated, the following percent of customers were interested in participating:

- 65 percent were interested in the Efficient Products appliance rebates (out of 48)
- 57 percent were interested in the Appliance Recycling Program (out of 214)

- 56 percent were interested in the ENERGY STAR New Homes Program (out of 32)
- 37 percent were interested in the In-home Energy Program (out of 70)

Customers who were aware of but had not participated in the Efficient Products appliance rebates were also asked about the reasons why they chose not to participate in the program. Figure A-5 presetns the responses for this question. In general, customers had not participated because they did not need any new equipment and thus did not feel like they had a need for the program. In addition, four percent of customers said they had "no need" for the program, but did not provide any additional details on why. The "other" responses in Figure A-5 include responses that indicated the customer did not understand the program.

Figure A-5. Reasons Customers Had Not Applied for Appliance Rebates (n = 48)

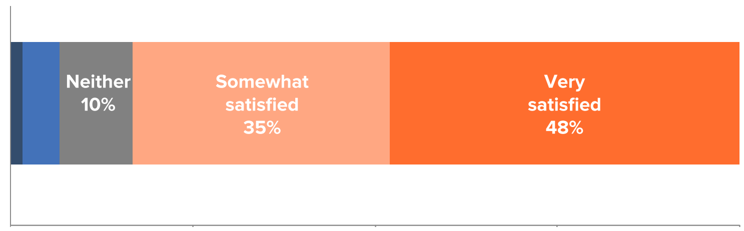


Note. Customers were only asked this question if they reported that they were aware of the program but had not participated in the program. Multiple responses were accepted, so the percentages may not sum to 100 percent.

Satisfaction with AEP Ohio

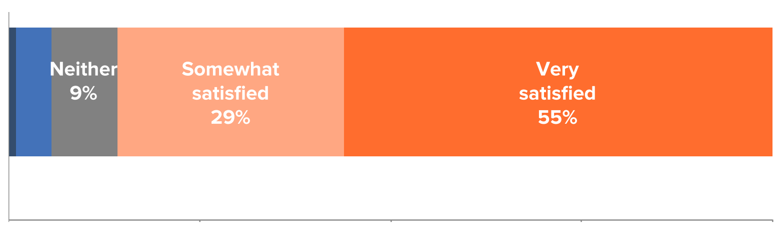
Respondents in the residential general population survey were asked about their satisfaction with AEP Ohio as a utility. As shown in Figure A-6, customers were satisfied with AEP Ohio's service. Of the 385 customers who completed the survey, 83 percent were at least "somewhat satisfied" with AEP Ohio. Nearly half of the customers were "very satisfied" with AEP Ohio.

Figure A-6. General Population Satisfaction with AEP Ohio (n = 385)



Participants who received an appliance rebate through the Efficient Products Program were also asked about their satisfaction with AEP Ohio as a utility. Figure A-7 shows participant satisfaction with AEP Ohio. In general, participants were very satisfied with the AEP Ohio as a utility. Over half of participants were "very satisfied" with AEP Ohio's service, and 84% were at least "somewhat satisfied" with AEP Ohio.

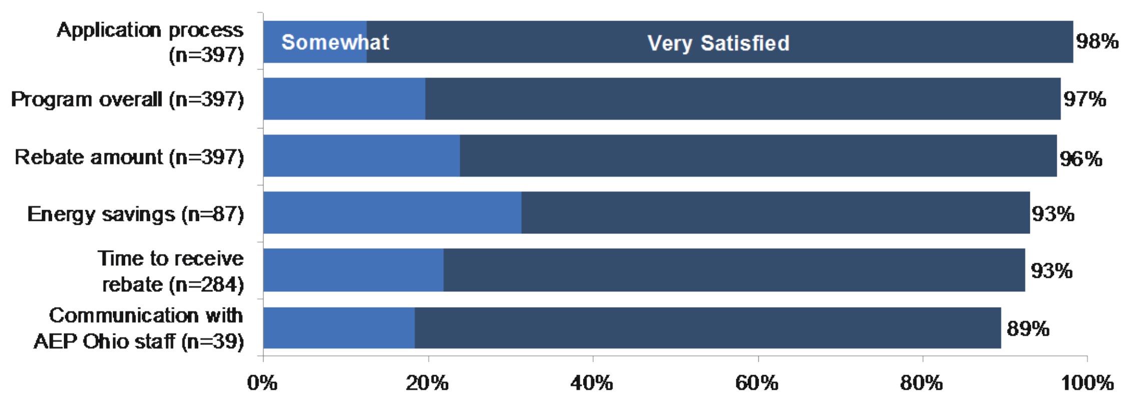
Figure A-7. Participant Satisfaction with AEP Ohio (n = 397).



Participant Satisfaction with the Efficient Products Appliance Rebates

Overall, participants reported being satisfied with all aspects of the program, from the process of applying for a rebate to the energy savings realized as a result of installing the new energy efficient appliances. Figure A-8 shows the percent of participants who were satisfied with each element of the program. Participants were very satisfied with all aspects of the program, and were especially satisfied with the application process and the rebate amount. There were no significant differences in satisfaction with any program element across the different equipment types.

Figure A-8. Participant Satisfaction with Program Elements (n = 397)



Note. Customers were only asked about energy savings if they saw energy savings, and were only asked about the communication with AEP Ohio staff if they reported communicating with AEP staff. These two elements have a smaller number of respondents, so results should be interpreted with caution.

A very small percent of participants were dissatisfied with the program. Thirteen participants (3%) rated their satisfaction as "neither satisfied nor dissatisfied" or lower. These participants listed the following reasons for why they were not satisfied with the program:

- There was a problem with their application and they did not receive a rebate (n = 2)[18]
- They have not received their rebate yet or did not recall receiving the rebate (n = 2)
- The rebate was too small (n = 1)
- The customer had to reschedule another six weeks for a pickup of their refrigerator (n = 1)[19]
- The customer needed the equipment regardless of what rebates were offered (n = 1)
- Three customers cited high electricity rates as a reason they were dissatisfied (n = 3)
- Three customers provided no explanation (n = 3)

[18] Survey contacts were taken from the program tracking data, which contains only rebates that have been fulfilled. However, one customer simply said that they are "not getting the rebate." The other customer said that they received a rebate for one piece of equipment, but that they tried to also purchase a refrigerator for their daughter, and the application was rejected. This customer claims that the same appliance was listed on AEP Ohio's website, but in a different color, and is upset that they will not get the rebate because of the color of their appliance.
[19] This customer did not provide any additional information about why they mentioned a pickup for their refrigerator.

Of the 397 participants, seven (2%) were not satisfied with the rebate application process, for the following reasons:

- It took too long to receive the rebate (n = 2)
- It needs to be easier to find the rebate on the website (n = 1)
- The rebate process should be entirely online (n = 1)
- They should be able to get a rebate for multiple pieces of equipment (n = 1)
- One customer could not recall the reason for their dissatisfaction (n = 1)

Twenty-one participants (7%) were not satisfied with the amount of time it took to receive the rebate. As expected, participants who reported that it took longer for them to receive their rebate also rated their satisfaction with the rebate timeline lower. While this was a statistically significant trend, the numbers were self-reported, so it is possible that some respondents inaccurately recalled how long it took to receive the rebate.[20] Participants who were not satisfied with the rebate timeline were also asked what a more acceptable timeline would be. The most frequent responses included:

- Two weeks (n = 7)
- Three weeks (n = 5)
- Four weeks (n = 2)
- Six weeks (n = 2)
- One week (n = 2)
- Next day (n = 1)

Twelve participants (4%) were not satisfied with the amount of their rebate. Of these, five had purchased clothes washers and four had purchased refrigerators. These participants were asked what an acceptable rebate amount would be. The responses, broken down by appliance type, were:

- Clothes washers (n = 5): $100 - $300, with an average requested rebate of $175
- Refrigerator (n = 4): $100 - $400, with an average requested rebate of $200
- Television (n = 2): $50
- Freezer (n = 1): $200

Additional Information from Sales Associates Requested by Participants

Participants (n = 9) who reported that the sales associate was not knowledgeable about the rebates (i.e., those who gave a rating of less than "3") were asked what additional information they would have liked to receive from the sales associate. Responses to this question included:

- They would have liked more information prior to when they were ready to purchase the equipment (n = 1)
- They would like the associate to know more than what they read about the equipment. The participant ended up having to ask someone else most of their questions (n = 1).
- Five participants said they did not need any more information from the sales associates (n = 5)

[20] Pearson correlation: -0.396, $p < 0.001$

- One participant said they did not know what information they needed (n = 1)
- One participant mentioned information on the receipt, rather than the sales associates (n = 1)

A.5 Data Collection Instruments

AEP Ohio Residential General Population Survey

Introduction

1	Yes	CONTINUE
2	No, schedule callback	Set up callback date and time, confirm contact name and phone number

A1. Is your electric company AEP Ohio, Ohio Power (OP), Columbus Southern Power (CSP) or another company?

1. AEP Ohio, Ohio Power (OP), or Columbus Southern Power (CSP)
2. Another company (SPECIFY____)**[THANK AND TERMINATE]**

-8. DON'T KNOW **[THANK AND TERMINATE]**
-9. REFUSED **[THANK AND TERMINATE]**

Awareness of CFL Technology

A2. Now I'd like to ask you a few questions about your awareness of different types of lighting. Before this call today had you ever heard of compact fluorescent light bulbs, or CFLs?

1. Yes **[SKIP TO A4]**
2. No

-8. DON'T KNOW
-9. REFUSED **[SKIP TO C1]**

A3. Compact fluorescent light bulbs– also known as CFLs – usually do not look like regular incandescent light bulbs. The most common type of CFL is made with a glass tube bent into a spiral, corkscrew shape and fits in a regular light bulb socket. Before today, were you familiar with this technology?

1. Yes
2. No **[CODE HAS_CFL = "NO" AND SKIP TO C1]**

-9. REFUSED **[CODE HAS_CFL = "NO" AND SKIP TO C1]**
-8. DON'T KNOW **[CODE HAS_CFL = "NO" AND SKIP TO C1]**

A4. Have **<u>you</u>** personally ever purchased **<u>any</u>** CFLs to use in your home?

1. Yes **[CODE HAS_CFL="YES" AND SKIP TO A6]**
2. No

-9. REFUSED

-8. DON'T KNOW

A5. Has anyone else in your household ever purchased any CFLs to use in your home?

1. Yes **[CODE HAS_CFL="YES".]**
2. No [CODE HAS_CFL="NO" **AND CONTINUE]**
-9. REFUSED **[CODE HAS_CFL = "NO" AND CONTINUE]**
-8. DON'T KNOW **[CODE HAS_CFL = "NO" AND CONTINUE]**

[PROGRAMMING NOTE: IF EITHER A4=1 or A5=1, CODE HAS_CFL = "YES" OTHERWISE CODE HAS_CFL = "NO"]

A6. How familiar are you with compact fluorescent lights? Would you say you are…
1. Not at all familiar?
2. Somewhat familiar, or
3. Very familiar
-9. REFUSED
-8. DON'T KNOW

Awareness of CFL Discounts

B1. Have you heard of the program AEP Ohio offers that provides discounts for purchasing CFLs at participating retail stores?
1. Yes
2. No **[SKIP TO B2]**
-9. REFUSED **[SKIP TO B2]**
-8. DON'T KNOW **[SKIP TO B2]**

B1a. How did you first become aware of the discounts on CFLs? **[DO NOT READ RESPONSE LIST.]**
1. Bill insert
2. In-store demonstration/booth
3. In-store signage
4. Store sales associate
5. Friend or family member
6. Television commercial
7. Radio commercial
8. Other advertisement
9. AEP Ohio website
97. Other **[RECORD VERBATIM]**
-9. REFUSED
-8. DON'T KNOW

Barriers to Installing CFLs

B2. **[ASK IF A3=1 AND A5= 2. NOTE: THOSE WHO HAVE PURCHASED CFLS ARE ASKED THIS QUESTION LATER IN D6.]**
What factors are preventing you from installing CFLs in your home?

[DO NOT READ, ALLOW MULTIPLE RESPONSES]

1. WAITING FOR INSTALLED BULBS TO BURN OUT
2. OPERATING HOURS—DON'T USE THE OTHER BULBS/LAMPS ENOUGH **[SKIP TO C1]**
3. CFLS ARE TOO EXPENSIVE/COST TOO MUCH **[SKIP TO C1]**
4. NEED DIMMABLE BULBS/CAN'T GET DIMMABLE CFLS/CAN'T USE CFLS WITH DIMMER SWITCHES **[SKIP TO C1]**
5. NEED 3-WAY BULBS/CAN'T GET 3-WAY CFLS/CAN'T USE CFLS IN MY 3-WAY FIXTURES/WHEN I USE REGULAR CFLS IN MY 3-WAY FIXTURES THEY DON'T WORK **[SKIP TO C1]**
6. DON'T LIKE THE WAY CFLS LOOK IN FIXTURES **[SKIP TO C1]**
7. DON'T LIKE THE WAY CFLS FIT IN FIXTURES **[SKIP TO C1]**
8. CFLS AREN'T BRIGHT ENOUGH **[SKIP TO C1]**
9. CFL LIGHT COLOR ISN'T WHAT I WANT/ISN'T RIGHT **[SKIP TO C1]**
10. CFLS TAKE TOO LONG TO LIGHT UP **[SKIP TO C1]**
11. CFLS CONTAIN MERCURY **[SKIP TO C1]**
12. ALL FIXTURES ALREADY HAVE CFLS **[SKIP TO C1]**
13. CFLS DON'T LAST LONG ENOUGH/SHORT LIFESPAN

97. OTHER [RECORD VERBATIM] **[SKIP TO C1]**
-9. REFUSED **[SKIP TO C1]**
-8. DON'T KNOW **[SKIP TO C1]**

B2b. **[ASK IF B2 = 1]** You said that you were waiting for bulbs to burn out before installing CFLs in your home. Are the bulbs that you are waiting to burn out traditional incandescent light bulbs, CFLs, or LEDs?

1. candescent light bulbs **[SKIP TO C1]**
2. CFLs **[SKIP TO C1]**
3. A mixture of incandescents and CFLs **[SKIP TO C1]**
4. LED light bulbs **[SKIP TO C1]**

97. Other (Specify___________) **[SKIP TO C1]**
-9. REFUSED **[SKIP TO C1]**
-8. DON'T KNOW **[SKIP TO C1]**

[ONLY ASK IF B1=1 AND A5=1 OR B1=1 AND A4=1, ELSE SKIP TO C1]

B3. You mentioned you or a household member have purchased CFLs. Have you purchased any CFLs that were discounted by AEP Ohio since January 2014?

1. Yes
2. No

-9. REFUSED
-8. DON'T KNOW

LED Awareness and Demand

C1. Now I would like to ask you a few questions about your awareness of a different type of light bulb. Before this call today had you ever heard of light-emitting diodes, or LED light bulbs?

1. Yes **[SKIP TO C2]**
2. No

-9. REFUSED
-8. DON'T KNOW

C1a. Light emitting diode light bulbs– also known as LEDs – come in a variety of shapes, and can look like a regular incandescent light bulb. LED light bulbs are more efficient than regular light bulbs, and have a much longer life than standard incandescent bulbs or CFLs. Before today, were you familiar with this technology?

1. Yes
2. No **[SKIP TO C6]**

-9. REFUSED **[SKIP TO C6]**
-8. DON'T KNOW **[SKIP TO C6]**

C2. How familiar are you with LEDs used for typical lighting in homes? **[READ IF NECESSARY: not for flashlights, nightlights, or holiday string lights]** Would you say you are…?

1. Not at all familiar **[SKIP TO C6**]
2. Somewhat familiar, or
3. Very familiar

-9. REFUSED
-8. DON'T KNOW

C3. Do you have any LED light bulbs currently installed in your home? This does not include nightlights, holiday string lights, or exterior lights.

1. Yes
2. No

-9. REFUSED
-8. DON'T KNOW

[ASK C4 IF C3≠1, ELSE SKIP TO C6]

C4. On a scale of 1 to 5, with 1 meaning "not at all interested" and 5 meaning "very interested," how interested are you in installing LED light bulbs in your home?

1 [NOT AT ALL INTERESTED]
2
3
4
5 [VERY INTERESTED]
-9. REFUSED
-8. DON'T KNOW

C5. What factors are preventing you from installing LEDs in your home?
[ALLOW MULTIPLE RESPONSES] (DO NOT READ)

1. WAITING FOR INSTALLED BULBS TO BURN OUT
2. OPERATING HOURS—DON'T USE THE OTHER BULBS/LAMPS
3. LEDS ARE TOO EXPENSIVE/COST TOO MUCH
4. NEED DIMMABLE BULBS/CAN'T GET DIMMABLE LEDS/CAN'T USE LEDS WITH DIMMER SWITCHES
5. NEED 3-WAY BULBS/CAN'T GET 3-WAY LEDS/CAN'T USE LEDS IN MY 3-WAY FIXTURES/WHEN I USE REGULAR LEDS IN MY 3-WAY FIXTURES THEY DON'T WORK
6. DON'T LIKE THE WAY LEDS LOOK IN FIXTURES
7. DON'T LIKE THE WAY LEDS FIT IN FIXTURES
8. LED LIGHT COLOR ISN'T WHAT I WANT/ISN'T RIGHT
9. LEDS TAKE TOO LONG TO LIGHT UP
10. ALL FIXTURES ALREADY HAVE LEDS

97. OTHER [RECORD VERBATIM]
-9. REFUSED
-8. DON'T KNOW

C6. Next, I want to ask you about how much you would pay for a few different types of LEDs, I will provide descriptions of each type. First, I'd like to ask you about **flood or reflector** LEDs. This bulb may be installed in "can lights" or recessed fixtures. It produces light in one direction and is often used outdoors or for spot lighting.
ENERGY STAR-qualified LED lighting uses at least 75% less energy and lasts 25 times longer than regular incandescent lighting. They also usually cost more than regular incandescent lighting. Would you be willing to pay [randomly select one price: $5 / $10 / $15 / $20 / $25 / $30 / $35] for a floor or reflector LED light bulb? [NOTE: THERE SHOULD BE APPROXIMATELY EQUAL NUMBERS OF RESPONDENTS WHO GET ASKED ABOUT EACH OF THE SEVEN DOLLAR AMOUNTS LISTED.]

[INTERVIEWER NOTE, DO NOT READ UNLESS RESPONDENT REQUIRES CLARIFICATION: This screws into a normal socket – they would not need to get a new fixture for it. It is usually used in recessed fixtures. They are also called directional LEDs because they emit light in only one direction.]

1. Yes
2. No

-9. REFUSED
-8. DON'T KNOW

C6b. What is the most you would be willing to pay for a flood or reflector LED light bulb that uses 75% less energy and lasts 25 times longer than incandescent lighting?

[NUMERIC OPEN END. RANGE: $0 - $100] **[SKIP TO C7]**
-7. WOULD NOT PURCHASE REGARDLESS OF PRICE

-9. REFUSED **[SKIP TO C7]**
-8. DON'T KNOW **[SKIP TO C7]**

C6c. Can you please tell me why you would not purchase a flood or reflector LED light bulb?

[OPEN ENDED. RECORD VERBATIM.]
-9. REFUSED
-8. DON'T KNOW

C7. Second, I'd like to ask you about **standard** LEDs, which provide light in all directions, and can be used to replace a standard screw-in bulb. Again, this lighting uses at least 75% less energy and lasts 25 times longer than regular incandescent lighting, and they usually cost more than regular incandescent lighting. Would you be willing to pay [randomly select one price: $5 / $10 / $15 / $20 / $25 / $30 / $35] for an omnidirectional LED light bulb? [NOTE: THERE SHOULD BE APPROXIMATELY EQUAL NUMBERS OF RESPONDENTS WHO GET ASKED ABOUT EACH OF THE SEVEN DOLLAR AMOUNTS LISTED.]

[INTERVIEWER NOTE, DO NOT READ UNLESS CUSTOMER REQUIRES CLARIFICATION: This screws into a standard socket – they would not need to get a special fixture for this lightbulb. It can be used to replace any standard incandescent or CFL light bulb. It is also called an A-shape bulb.]

1. YES
2. NO
-9. REFUSED
-8. DON'T KNOW

C7b. What is the most you would be willing to pay for a standard LED light bulb that uses 75% less energy and lasts 25 times longer than incandescent lighting?

NUMERIC OPEN END. RANGE: $0 - $100] **[SKIP TO D1]**
-7. WOULD NOT PURCHASE REGARDLESS OF PRICE
-9. REFUSED **[SKIP TO D1]**
-8. DON'T KNOW **[SKIP TO D1]**

C7c. Can you please tell me why you would not purchase a standard LED light bulb?

[OPEN ENDED. RECORD VERBATIM.]
-9. REFUSED
-8. DON'T KNOW

Lighting Installation

D1. The next few questions address the lighting in your home. Approximately how many light bulbs do you have in all the lamps and fixtures **inside** your home, including light bulbs installed inside any garages? Please include all types of light bulbs.

[NUMERICAL OPEN END RANGE 0-100]
[IF RESPONDENT IS UNSURE, ASK FOR THEIR BEST GUESS]

-9. REFUSED

D2. **[ASK ONLY IF HAS_CFL = "YES" AND D1>0]** Of all the light bulbs in your home, how many are compact fluorescent light bulbs (CFLs)? [MUST BE LESS THAN OR EQUAL TO D1 ANSWER]

[NUMERICAL OPEN END RANGE 0-100]
[IF RESPONDENT IS UNSURE, ASK FOR THEIR BEST GUESS]
-9. REFUSED

D2b. **[ASK ONLY IF C3=1 AND D1>0]** Of all the light bulbs in your home, how many are LED light bulbs? [MUST BE LESS THAN OR EQUAL TO D1 ANSWER]

[NUMERICAL OPEN END RANGE 0-100]
[IF RESPONDENT IS UNSURE, ASK FOR THEIR BEST GUESS]
-9. REFUSED

D3. Approximately how many light bulbs do you have in all the lamps and fixtures **outside** your home? Please include all types of light bulbs.

[NUMERICAL OPEN END RANGE 0-100]
[IF RESPONDENT IS UNSURE, ASK FOR THEIR BEST GUESS]
-9. REFUSED

D4. **[ASK ONLY IF HAS_CFL = "YES"AND D3>0]** Of all your outdoor light bulbs **outside** your home, how many are compact fluorescent light bulbs (CFLs)? **[MUST BE LESS THAN OR EQUAL TO D3 ANSWER]**

[NUMERICAL OPEN END RANGE 0-100]
[IF RESPONDENT IS UNSURE, ASK FOR THEIR BEST GUESS]
-9. REFUSED

D4b. **[ASK ONLY IF C3=1 AND D3>0]** Of all your outdoor light bulbs **outside** your home, how many are LED light bulbs? **[MUST BE LESS THAN OR EQUAL TO D3 ANSWER]**

[NUMERICAL OPEN END RANGE 0-100]
[IF RESPONDENT IS UNSURE, ASK FOR THEIR BEST GUESS]
-9. REFUSED

D5. **[ASK IF D2> 0 OR D4> 0]** I'm going to ask you a few questions about the compact fluorescent light bulbs you have installed in your home. How satisfied are you with the compact fluorescent light bulbs you have installed? Would you say you are …? (Read responses).

5. VERY SATISFIED
4. SOMEWHAT SATISFIED
3. NEITHER SATISFIED NOR DISSATISFIED
2. SOMEWHAT DISSATISFIED
1. VERY DISSATISFIED
-9. REFUSED
-8. DON'T KNOW

D6. **[ASK IF HAS_CFL = "YES" D2< D1 OR D4< D3]** What factors are preventing you from installing [MORE] CFLs in your home or outside your home? **[ALLOW MULTIPLE RESPONSES] [DO NOT READ]**

1. WAITING FOR INSTALLED BULBS TO BURN OUT
2. OPERATING HOURS—DON'T USE THE OTHER BULBS/LAMPS ENOUGH
3. CFLS ARE TOO EXPENSIVE/COST TOO MUCH
4. NEED DIMMABLE BULBS/CAN'T GET DIMMABLE CFLS/CAN'T USE CFLS WITH DIMMER SWITCHES
5. NEED 3-WAY BULBS/CAN'T GET 3-WAY CFLS/CAN'T USE CFLS IN MY 3-WAY FIXTURES/WHEN I USE REGULAR CFLS IN MY 3-WAY FIXTURES THEY DON'T WORK
6. DON'T LIKE THE WAY CFLS LOOK IN FIXTURES
7. DON'T LIKE THE WAY CFLS FIT IN FIXTURES
8. CFLS AREN'T BRIGHT ENOUGH
9. CFL LIGHT COLOR ISN'T WHAT I WANT/ISN'T RIGHT
10. CFLS TAKE TOO LONG TO LIGHT UP
11. CFLS CONTAIN MERCURY
12. ALL FIXTURES ALREADY HAVE CFLS
13. CFLS DON'T LAST LONG ENOUGH/SHORT LIFESPAN

97. OTHER [RECORD VERBATIM]
-9. REFUSED
-8. DON'T KNOW

D6b. **[ASK IF D6 = 1]** You said that you were waiting for bulbs to burn out before installing [more] CFLs in your home. Are the bulbs that you are waiting to burn out traditional incandescent light bulbs, CFLs, or LEDs?

1. Incandescent light bulbs
2. CFLs
3. A mixture of incandescents, CFLs, and LEDs
4. LEDs

97. Other (Specify___________)
-9. REFUSED
-8. DON'T KNOW

D7. **[IF D2> 0 OR D4> 0]** On a scale from 1 to 5, where 1 means "Not at all likely" and 5 means "Very likely," how likely is it that you will replace the CFLs in your home with more CFLs when they burn out?

1 [Not at all likely]
2
3
4
5 [Very likely]
-9. REFUSED
-8. DON'T KNOW

D5_LED. **[ASK IF D2b> 0 OR D4b> 0]** Now I'm going to ask you a few questions about the LED bulbs you have installed in your home. How satisfied are you with the LED bulbs you have installed? Would you say you are …? (Read responses).

5. Very satisfied
4. Somewhat satisfied
3. Neither satisfied nor dissatisfied
2. Somewhat dissatisfied
1. Very dissatisfied
-9. REFUSED
-8. DON'T KNOW

D6_LED. **[ASK IF C3=1, D2b< D1 OR D4b< D3]** What factors are preventing you from installing [MORE] LEDs in your home or outside your home? **[ALLOW MULTIPLE RESPONSES] [DO NOT READ]**

1. WAITING FOR INSTALLED BULBS TO BURN OUT
2. OPERATING HOURS—DON'T USE THE OTHER BULBS/LAMPS ENOUGH
3. LEDS ARE TOO EXPENSIVE/COST TOO MUCH
4. NEED DIMMABLE BULBS/CAN'T GET DIMMABLE LEDs/CAN'T USE LEDs WITH DIMMER SWITCHES
5. NEED 3-WAY BULBS/CAN'T GET 3-WAY LEDs /CAN'T USE LEDs IN MY 3-WAY FIXTURES/WHEN I USE REGULAR LEDs IN MY 3-WAY FIXTURES THEY DON'T WORK
6. DON'T LIKE THE WAY LEDs LOOK IN FIXTURES
7. DON'T LIKE THE WAY LEDs FIT IN FIXTURES
8. LEDs AREN'T BRIGHT ENOUGH
9. LED LIGHT COLOR ISN'T WHAT I WANT/ISN'T RIGHT
10. LEDs TAKE TOO LONG TO LIGHT UP
11. LEDs CONTAIN MERCURY
12. ALL FIXTURES ALREADY HAVE LEDs
13. LEDs DON'T LAST LONG ENOUGH/SHORT LIFESPAN

97. OTHER [RECORD VERBATIM]
-9. REFUSED

-8. DON'T KNOW

D6b_LED. **[ASK IF D6_LED = 1]** You said that you were waiting for bulbs to burn out before installing [more] LEDs in your home. Are the bulbs that you are waiting to burn out traditional incandescent light bulb, CFLs, or LEDs?

1. Incandescent light bulbs
2. CFLs
3. A mixture of incandescents, CFLs, and LEDs
4. LEDs

97. Other (Specify___________)
-9. REFUSED
-8. DON'T KNOW

D7_LED. **[IF D2b> 0 OR D4b> 0]** On a scale from 1 to 5, where 1 means "Not at all likely" and 5 means "Very likely," how likely is it that you will replace the LEDs in your home with more LEDs when they burn out?

1 [Not at all likely]
2
3
4
5 [Very likely]
-9. REFUSED
-8. DON'T KNOW

Refrigerator/Freezer Installation

RF1a. Next, I'd like to ask you about the appliances you have installed in your home.

Do you currently have a ***working stand-alone freezer*** in your home that is separate from your main refrigerator? By "working," I mean that the freezer effectively cools its contents. Please include any working stand-alone freezer, regardless of how often you use it and whether or not it is currently plugged in.

1. Yes
2. No
-8. DON'T KNOW
-9. REFUSED

RF1b. How many ***working refrigerators*** do you have in your home? By "working," I mean that the refrigerator effectively cools its contents. Please include any working refrigerator, regardless of how often you use it and whether or not it is currently plugged in.

[ENTER NUMBER] (RANGE 0 TO 10)
-8. DON'T KNOW
-9. REFUSED

RF1c. Have you shopped for or purchased a used refrigerator or freezer in the last year?

1. Yes **[Skip to HP1]**
2. No
-8. DON'T KNOW
-9. REFUSED

[ASK IF RF1c=2, -8, -9]
RF1d. Do you plan to purchase a used refrigerator or freezer in the next few months?

1. Yes
2. No **[Skip to HP1]**
-8. DON'T KNOW **[Skip to HP1]**
-9. REFUSED **[Skip to HP1]**

Water Heater Awareness and Demand

HP1. Now I would like to ask you a few questions about your awareness of efficient water heaters. Before this call today, had you ever heard of heat pump water heaters?

1. Yes **[SKIP TO HP2]**
2. No
-9. REFUSED
-8. DON'T KNOW

HP1a. Heat pump water heaters extract heat from the air to heat water, and in cold temperatures uses a built in heating element as a backup. They are two to three times more efficient than conventional electric water heaters. Before today, were you familiar with this technology?

1. Yes
2. No **[SKIP TO E1]**
-9. REFUSED **[SKIP TO E1]**
-8. DON'T KNOW **[SKIP TO E1]**

HP2. How familiar are you with heat pump water heaters? Would you say you are…?

1. Not at all familiar **[SKIP TO E1**]
2. Somewhat familiar, or
3. Very familiar

-9. REFUSED
-8. DON'T KNOW

HP3. Do you have a heat pump water heater currently installed in your home?

1. Yes
2. No

-9. REFUSED

-8. DON'T KNOW

HP4. Do you have plans to replace your current water heater within the next two years?
1. Yes
2. No **[SKIP TO HP5b]**
-9. REFUSED **[SKIP TO HP5b]**
-8. DON'T KNOW **[SKIP TO HP5b]**

[ASK IF HP4=1]
HP5a. How likely are you to replace your current water heater with a heat pump water heater? Would you say you are… (READ OPTIONS):
4. Very likely **[SKIP TO E1]**
3. Somewhat likely **[SKIP TO E1]**
2. Not very likely **[SKIP TO HP7]**
1. Not at all likely **[SKIP TO HP7]**
-9. REFUSED **[SKIP TO E1]**
-8. DON'T KNOW **[SKIP TO E1]**

[ASK IF HP4=2, -8 or -9]
HP5b. If you were going to replace your water heater, how likely would you be to replace it with a heat pump water heater? Would you say you are… (READ OPTIONS):
4. Very likely
3. Somewhat likely
2. Not very likely
1. Not at all likely
-9. REFUSED
-8. DON'T KNOW

HP7. Why would you be unlikely to replace your water heater with a heat pump water heater? [ASK AS OPEN END, RECORD VERBATIM]
1. [OPEN ENDED RESPONSE]
98. DK
99. REFUSED

Awareness of Efficient Appliances

E1. How familiar are you with the following energy efficient technologies? Please tell me if you are not at all familiar, somewhat familiar or very familiar with…? (RANDOMIZE ORDER OF ATTRIBUTES A through F)

1. Not at all Familiar,
2. Somewhat Familiar, or

3. Very Familiar with?
-9. REFUSED
-8. DON'T KNOW

A. ENERGY STAR Clothes Washers
B. ENERGY STAR Refrigerators
C. ENERGY STAR Dehumidifiers
D. ENERGY STAR Freezers
E. ENERGY STAR TVs.
F. Electric Heat Pump Water Heaters

Program Awareness & Participation

Now I am going to ask you about a few AEP Ohio energy efficiency programs.

[INTERVIEWER NOTE: WE WANT TO LEARN WHETHER MARKETING EFFORTS ARE SUCCEEDING SO 'UNAWARE' IS NOT A BAD RESPONSE. AVOID COACHING RESPONDENTS.]

[PROGRAMMING NOTE: ASK ALL RESPONDENTS FOR WHOM RF1A=1 or RF1b>0 ABOUT PROGRAM A (APPLIANCE RECYCLING). THEN PLEASE RANDOMLY SELECT THREE OF THE REMAINING SIX PROGRAMS TO ASK RESPONDENTS ABOUT. THERE SHOULD BE APPROXIMATELY EQUAL SETS OF RESPONDENTS WHO GET ASKED ABOUT EACH OF THE SEVEN PROGRAMS.]

[PROGRAMMING: ASK E3-E6b FOR EACH 'PROGRAM NAME X' BELOW:

A. The Appliance Recycling Program [Program Description: AEP Ohio picks up and recycles your old working secondary refrigerator or freezer and provides a $50 incentive.]
B. The Efficient Appliance Program [Program Description: AEP Ohio offers a cash rebates for the purchase of qualifying ENERGY STAR Appliances, such as clothes washers, refrigerators, televisions, and dehumidifiers.]
H. The In-home Energy Program. [Program description: AEP Ohio provides professional in-home assessments of energy use in your home for a small fee. Several energy-saving items are installed, and you are provided with recommendations for improvements to make your home more comfortable and energy efficient.]
I. Online Energy Checkup [Program description: AEP Ohio provides a free online tool to help you find ways to make your home more energy efficient. A free energy-efficiency kit is then mailed to your home.]
J. Community Assistance Program [Program description: Customers enrolled in an AEP Ohio payment assistance plan can receive free energy efficiency and repair services for their home.]
K. ENERGY STAR New Homes Program [Program description: If you are interested in building a new home, a participating builder works with you to build an ENERGY STAR® New Home, which can help you reduce your energy usage by as much as 35%.]
L. E3 Smart Program [Program description: AEP Ohio provides energy efficiency education curriculum to schools in the AEP Ohio service area for children in grades 5 through 12.]

E2. How aware of [PROGRAM NAME X] are you? For this program, [INSERT PROGRAM DESCRIPTION], would you say you are not at all aware, somewhat aware, or very aware of this program?

1. NOT AT ALL AWARE [**SKIP TO NEXT PROGRAM NAME]**
2. SOMEWHAT AWARE
3. VERY AWARE

-9. REFUSED [**SKIP TO NEXT PROGRAM NAME]**
-8. DON'T KNOW [**SKIP TO NEXT PROGRAM NAME]**

E3. How did you first become aware of this program? **[DO NOT READ RESPONSE LIST.]**

1. BILL INSERT
2. IN-STORE DEMONSTRATION/BOOTH
3. IN-STORE SIGNAGE
4. STORE SALES ASSOCIATE
5. FRIEND OR FAMILY MEMBER
6. TELEVISION COMMERCIAL
7. RADIO COMMERCIAL
8. OTHER ADVERTISEMENT
9. AEP OHIO WEBSITE

97. OTHER [RECORD VERBATIM]
-9. REFUSED
-8. DON'T KNOW

E4. [ASK ONLY FOR PROGRAMS A-I and K] Have you ever participated in the [PROGRAM NAME X]?

1. YES [**SKIP TO NEXT PROGRAM NAME]**
2. NO

-9. REFUSED [**SKIP TO NEXT PROGRAM NAME]**
-8. DON'T KNOW

E5. [ASK ONLY FOR PROGRAMS A-I and K] How interested would you be in participating in this program? Would you say you are: **[READ LIST 1-3]**

1. Not at all interested
2. Somewhat interested or
3. Very interested

-9. REFUSED
-8. DON'T KNOW

(ASK IF E4=2)
E6. **[ASK ONLY FOR PROGRAMS A – H]** Why haven't you participated in the [PROGRAM NAME X]? **[ACCEPT MULTIPLE ANSWERS] (DO NOT READ)**

1. HAD ALREADY PURCHASED PROGRAM EQUIPMENT
2. PROGRAM HAS EXPIRED

3. COST OF NEW APPLIANCE/CAPITAL CONSTRAINTS
4. EXISTING EQUIPMENT STILL WORKS
5. DON'T HAVE AN EXTRA APPLIANCE TO RECYCLE
6. COST EFFECTIVENESS CONCERNS
7. RELIABILITY CONCERNS
8. SAFETY CONCERNS
9. DON'T NEED PROGRAM EQUIPMENT
10. REBATES TAKE TOO LONG TO GET
11. TAKES TOO LONG TO GET APPLIANCES RECYCLED
12. RENT HOME/APARTMENT, AND LANDLORD TAKES CARE OF APPLIANCES
97. OTHER [SPECIFY REASON/RECORD VERBATIM]
-9. REFUSED
-8. DON'T KNOW

E6b. **[ASK ONLY FOR PROGRAMS I OR K AND IF E5 = 2 OR 3]** Would you like us to provide your contact information to AEP Ohio so they can send more information to you about this program?

1. YES
2. NO
-9. REFUSED
-8. DON'T KNOW

Satisfaction with AEP Ohio

S1. Based on your overall experience with AEP Ohio's service, how satisfied are you with having them as your electric company? Would you say you are…

5. Very satisfied [**SKIP TO F1]**
4. Somewhat satisfied [**SKIP TO F1]**
3. Neither satisfied nor dissatisfied
2. Somewhat dissatisfied
1. Very dissatisfied
-9. REFUSED [**SKIP TO F1]**
-8. DON'T KNOW [**SKIP TO F1]**

S2. Why did you rate it that way?

[RECORD VERBATIM]
-9. REFUSED
-8. DON'T KNOW

Background Information

I only have a few questions left. I just need to get a little information about your home.

F1. Which of the following describes your home / residence? Is it a:

1. Single-family home, detached construction [NOT A DUPLEX, TOWNHOME, OR APARTMENT; ATTACHED GARAGE IS OK]
2. Apartment (4 + families)
3. Condominium

97. Other [SPECIFY]
-9. REFUSED
-8. DON'T KNOW

F2. Do you own or rent this residence?

1. OWN **[SKIP TO F4]**
2. RENT

-9.REFUSED **[SKIP TO F4]**

F3. Do you pay your own electric bill or is it included in your rent?

1. PAY ELECTRIC BILL
2. INCLUDED IN RENT

-9. REFUSED
-8. DON'T KNOW

F4. What kind of heating do you use for your home? Do you use **(READ OPTIONS 1 - 7)** or something else?

1. Natural Gas
2. Electric
3. Geothermal
4. Fuel Oil
5. Propane
6. Wood
7. Kerosene

97. Other (SPECIFY)
-9. REFUSED
-8. DON'T KNOW

[ASK IF F4=2, ELSE GO TO F5]

F4b. What kind of electric heat do you use for your home? Do you use **(READ OPTIONS 1-3)** or something else?

1. A central forced air furnace
2. A heat pump
3. Baseboard or resistance heat

97. Other (SPECIFY)
-9. REFUSED
-8. DON'T KNOW

Thank You & Terminate

[PROGRAMMING NOTE: ASK 1 QUESTION OF F5 – F7. IF CUSTOMERS MEET MORE THAN ONE REQUIREMENT, SELECT ONE AND PRIORITIZE F5B, THEN F7, THEN F5 AND F6]

[ASK IF C3≠1]

F5. Finally, AEP Ohio is interested in gathering data about customers' experience with LEDs. As part of that effort, AEP Ohio is conducting a week-long study in which participants are given new LED light bulbs to install in their homes. Customers are then asked to record daily feedback on the bulbs. Would you be interested in participating in this study in exchange for a $50 incentive?

1. Yes
2. No
-8. Don't know
-9. Refused

[ASK IF HAS_CFL= "NO"]

F5b. Finally, AEP Ohio is interested in gathering data about customers' experience with CFLs. As part of that effort, AEP Ohio is conducting a week-long study in which participants are given new CFL light bulbs to install in their homes. Customers are then asked to record daily feedback on the bulbs. Would you be interested in participating in this study in exchange for a $50 incentive?

1. Yes
2. No
-8. Don't know
-9. Refused

[ASK IF C3=1]

F6. Finally, AEP Ohio is interested in gathering data about customers' use of LEDs. As part of that effort, AEP Ohio is surveying participants who have purchased and installed LED light bulbs in their homes. Would you be interested in participating in this study in exchange for a $25 incentive?

1. Yes
2. No
-8. Don't know
-9. Refused

[ASK IF RF1c=1 or RF1d=1]

F7. Finally, AEP Ohio is interested in gathering data from customers who have recently shopped for a used refrigerator or freezer or who are planning to shop for one in the next few months to better understand the used appliance market. Customers will be asked to fill out a short survey. Would you be interested in participating in this study in exchange for a $25 incentive?

1. Yes
2. No
-8. Don't know

-9. Refused

Those are all the questions that we have. On behalf of AEP Ohio, I'd like to thank you very much for taking the time to participate in this study.

A.5.1 AEP Ohio Efficient Products Program Appliance Rebate Participant Survey

Section A: Introduction

INTRO: May I please speak with **<CONTACT>**?

Hello, this is **<INTERVIEWER NAME>** from Blackstone Group, calling on behalf of AEP Ohio, your electric utility. We are contacting customers who received a rebate from AEP Ohio for purchasing a new **<PRODUCT TYPE>.**

Are you the person who was most involved and familiar with the use of the **<PRODUCT TYPE>**? **[IF NOT: May I please speak with the person who was most involved with how the appliance is used in your home? REPEAT INTRO WITH NEW PERSON]**

[CONTINUE WITH RIGHT PERSON]: We are conducting a study to evaluate AEP Ohio's appliance rebate program and would like to include your opinions. This is not a sales call.
It will take about 15 minutes.

This call may be monitored or recorded for quality purposes, but all of your responses are confidential and will only be reported anonymously.

A1. Is your electric company AEP Ohio, Ohio Power (OP), Columbus Southern Power (CSP) or another company?

1. AEP OHIO, OHIO POWER COMPANY (OPC) OR COLUMBUS SOUTHERN POWER (CSP)
2. ANOTHER COMPANY (SPECIFY)
98. DON'T KNOW
99. REFUSED **[TERMINATE]**

A2a. According to our records, you bought a/an **<PRODUCT TYPE>** at **<STORE NAME>** on **<PURCHASE DATE>**. Is that correct?
1. YES **[SKIP TO E1a]**
2. NO, I DID NOT PURCHASE A/AN **<PRODUCT TYPE>**
98 DON'T KNOW **[TERMINATE]**
99. REFUSED [**TERMINATE**]

A2b. Did someone in your household purchase a/an **<PRODUCT TYPE>** at **[STORE NAME]**?
1. YES
2. NO, DID NOT PURCHASE A/AN **<PRODUCT TYPE> [TERMINATE]**
98 DON'T KNOW **[TERMINATE]**
99. REFUSED [**TERMINATE**]

A2c. May I speak with them?

1. YES
2. NO **[ASK FOR A GOOD TIME TO CALL BACK]**

98 DON'T KNOW **[ASK FOR A GOOD TIME TO CALL BACK]**
99. REFUSED [**TERMINATE**]

A2d. According to our records, you bought a/an **<PRODUCT TYPE>** at **<STORE NAME>** on **<PURCHASE DATE>.** Is that correct?

1. YES
2. NO **[TERMINATE]**

98 DON'T KNOW **[TERMINATE]**
99. REFUSED [**TERMINATE**]

E1a. How did you **<u>first</u>** find out that AEP Ohio was offering rebates for the purchase of a/an **<PRODUCT TYPE>**?
[DO NOT READ; ACCEPT SINGLE RESPONSE ONLY]

1. UTILITY MAILING/BILL INSERT
2. THE AEP OHIO WEBSITE
3. SIGNS IN THE STORE, ON THE PRODUCT OR IN STORE AISLE
4. A STORE EMPLOYEE MADE ME AWARE OF THE DISCOUNT
5. TELEVISION
6. NEWSPAPER
7. COMMUNITY EVENT (SUCH AS HOME SHOW, FAIR, OR FESTIVAL)
8. PLUMBER OR CONTRACTOR
9. RADIO
10. EMAIL FROM AEP OHIO
11. INTERNET/WEB SEARCH
12. WORD OF MOUTH (SUCH AS FAMILY, FRIEND, COWORKER, OR NEIGHBOR)

97. OTHER **[SPECIFY: ____________]**
98 DON'T KNOW ~~**[SKIP TO A2e]**~~
99. REFUSED ~~**[SKIP TO A2e]**~~

E1b. Have you learned about the AEP Ohio appliance discounts from any of these other sources…? **READ RESPONSES 1 THROUGH 12; DON'T READ RESPONSE SELECTED IN E1a; MULTIPLE RESPONSES ACCEPTED FOR RESPONSE OPTIONS 1-12 AND 97]**

1. UTILITY MAILING/BILL INSERT
2. THE AEP OHIO WEBSITE
3. SIGNS IN THE STORE, ON THE PRODUCT OR IN STORE AISLE
4. A STORE EMPLOYEE
5. TELEVISION
6. NEWSPAPER
7. COMMUNITY EVENT (SUCH AS HOME SHOW, FAIR, OR FESTIVAL)
8. PLUMBER OR CONTRACTOR
9. RADIO
10. EMAIL FROM AEP OHIO
11. INTERNET/WEB SEARCH
12. WORD OF MOUTH (SUCH AS FAMILY, FRIEND, COWORKER, OR NEIGHBOR)

97. OR ANY OTHER WAY? **[SPECIFY: ____________]**

96. NONE/NO OTHER WAY

98 DON'T KNOW

99. REFUSED

Impact Evaluation

[Each respondent will be asked about one appliance type in Section B.]

[ASK IF <PRODUCT TYPE> = CLOTHES WASHER; ELSE SKIP TO BD.INTRO]

Clothes Washer Questions

BCW.INTRO. The next several questions concern the ENERGY STAR clothes washer for which you received a rebate from AEP Ohio.

BCW1a. Did the ENERGY STAR clothes washer replace an old clothes washer?

1. YES
2. NO **[SKIP TO BCW2]**

98 DON'T KNOW **[SKIP TO BCW2]**
99. REFUSED [**SKIP TO BCW2**]

BCW1b. Approximately how old was the old clothes washer that was replaced?

1. [NUMERIC OPEN END in YEARS]

98 DON'T KNOW
99. REFUSED

BCW2. On average, how many loads of laundry does your household wash in a typical week? One load is equal to one washer cycle.

1. [NUMERIC OPEN END]

98 DON'T KNOW
99. REFUSED

BCW3a. I'm now going to ask you about what percentage of washes your household does on the cold, warm, and hot settings. So first, what percentage of laundry loads does your household wash on the cold setting?

1. [NUMERIC OPEN END PERCENTAGE OF LOADS]

998 DON'T KNOW [**SKIP TO BCW4]**
999. REFUSED [**SKIP TO BCW4]**

BCW3b. And what percentage of laundry loads does your household wash on the warm setting?

1. [NUMERIC OPEN END PERCENTAGE OF LOADS]

998 DON'T KNOW [**SKIP TO BCW4]**
999. REFUSED [**SKIP TO BCW4]**

BCW3c. And what percentage of laundry loads does your household wash on the hot setting?

1. [NUMERIC OPEN END PERCENTAGE OF LOADS]
998 DON'T KNOW [**SKIP TO BCW4]**
999. REFUSED [**SKIP TO BCW4]**

[PERFORM CHECK – THE SUM OF BCW3A, BCW3B, AND BCW3C SHOULD EQUAL 100%]
IF SUM OF BCW3A, BCW3B, AND BCW3C = <u>LESS</u> THAN 100%, ASK: THAT ADDS UP TO A TOTAL OF [SUM OF BCW3A, BCW3B, AND BCW3C] %. HAVE I CAPTURED YOUR RESPONSES CORRECTLY FOR EACH TEMPERATURE SETTING? WHAT TEMPERATURE ARE THE OTHER LOADS USUALLY WASHED AT?
IF SUM OF BCW3A, BCW3B, AND BCW3C = <u>MORE</u> THAN 100%, ASK: ACCORDING TO MY NOTES, THAT ADDS UP TO A TOTAL OF [SUM OF BCW3A, BCW3B, AND BCW3C] %. HAVE I CAPTURED YOUR RESPONSES CORRECTLY FOR EACH TEMPERATURE SETTING?]

BCW4. Is your hot water heater electric, gas, propane, oil, or something else?

1. ELECTRIC
2. GAS
3. PROPANE
4. OIL
97. SOMETHING ELSE [OTHER: SPECIFY]____________]
98 DON'T KNOW
99. REFUSED

BCW5. During the summer, approximately what percent of your household's weekly clothes washing loads are done on <u>weekdays</u> between 3:00pm and 6:00pm?

1. [NUMERIC OPEN END]
98 DON'T KNOW
99. REFUSED

BCW6a. Do you have a clothes dryer?

1. YES
2. NO **[SKIP TO C2]**
99. REFUSED **[SKIP TO C2]**

BCW6b. Is your clothes dryer…
[READ FROM LIST]

1. ELECTRIC
2. GAS
3. PROPANE
97. SOMETHING ELSE? **[OTHER: SPECIFY____________]**
98 DON'T KNOW
99. REFUSED

BCW7. What percentage of your clothes does your household dry using your clothes dryer?

1. [NUMERIC OPEN END]
998 DON'T KNOW
999. REFUSED

[ASK IF <PRODUCT TYPE> = DEHUMIDIFIER; ELSE SKIP TO BFR.INTRO]

Dehumidifier Questions

BD.INTRO. The next several questions concern the ENERGY STAR dehumidifier for which you received a rebate from AEP Ohio.

BD2a. Will you use your new dehumidifier…
[READ FROM LIST]
1. YEAR ROUND OR
2. DURING PARTS OF THE YEAR
98 DON'T KNOW
99. REFUSED

BD2b. When you use your new dehumidifier, will you typically…
[READ FROM LIST]
1. TURN IT ON AND OFF MANUALLY DEPENDING ON THE TEMPERATURE OR HUMIDITY
2. SET IT TO A CERTAIN SETTING AND LET IT TURN ON AND OFF AUTOMATICALLY **[SKIP TO BD2d]**
3. OTHER **[SPECIFY_____________] [SKIP TO BD3a]**
98 DON'T KNOW **[SKIP TO BD3a]**
99. REFUSED **[SKIP TO BD3a]**

BD2c. At what outdoor temperature will you typically turn on your dehumidifier?
1. [NUMERIC OPEN END IN DEGREES FARENHEIT; RANGE 1-120] **[SKIP TO BD2e]**
150. [OTHER – NOTE TO RECORD RELATIVIVE HUMIDITY IF RESPONENT SAYS THAT THEY TURN ON THE DEHUMIDIFIER AT A CERTAIN HUMIDITY LEVEL] **[SKIP TO BD2e]**
998 DON'T KNOW **[SKIP TO BD2e]**
999. REFUSED **[SKIP TO BD2e]**

BD2d. What relative humidity level will you typically set your dehumidifier to?
1. [NUMERIC OPEN END IN PERCENT HUMIDITY; RANGE 1-100] **[SKIP TO BD3a]**
998 DON'T KNOW **[SKIP TO BD3a]**
999. REFUSED **[SKIP TO BD3a]**

BD2e. Will the fan on your dehumidifier typically cycle on and off, or does it run continuously?

1. FAN CYCLES ON AND OFF [AUTOMATIC]
2. FAN RUNS CONTINUOUSLY
98 DON'T KNOW
99. REFUSED

[ASK IF BD2a ≠ 1, ELSE SKIP TO BD3b]
BD3a. Given how you use the dehumidifier, can you estimate how many months per year you will use the dehumidifier, on average?
1. [NUMERIC OPEN END IN MONTHS; RANGE 0-12]
98 DON'T KNOW **[SKIP TO BD4]**
99. REFUSED **[SKIP TO BD4]**

[ASK IF BD2b = 1, ELSE SKIP TO BD3d]
BD3b. Can you estimate how many days per month, on average, that you turn on the dehumidifier?
1. [NUMERIC OPEN END in DAYS; RANGE 0-31, OPTION FOR "ALL"]
98 DON'T KNOW **[SKIP TO BD4]**
99. REFUSED **[SKIP TO BD4]**

BD3c. When operating, on average how many hours per day does your dehumidifier run?
1. [NUMERIC OPEN END in HOURS; RANGE 0-24] **[SKIP TO BD4]**
98 DON'T KNOW **[SKIP TO BD4]**
99. REFUSED **[SKIP TO BD4]**

[ASK IF BD2b = 2; ELSE SKIP TO BD4]
BD3d. During days that you use the dehumidifier, can you estimate the percentage of time the dehumidifier is running?
1. [NUMERIC OPEN END in PERCENTAGE]
998 DON'T KNOW
999. REFUSED

BD4. During the summer, is the dehumidifier typically in use on weekdays between 3:00pm and 6:00pm?
1. YES
2. NO
98 DON'T KNOW
99. REFUSED

BD5a. Did the ENERGY STAR dehumidifier replace an old dehumidifier?
1. YES
2. NO **[SKIP TO C2]**
98 DON'T KNOW **[SKIP TO SECTION C2]**
99. REFUSED [**SKIP TO SECTION C2**]

BD5b. Approximately how old was the old dehumidifier that was replaced?
1. Less than a year (if so, how many months?) [NUMERIC OPEN END in MONTHS]
2. [NUMERIC OPEN END in YEARS]
98 DON'T KNOW
99. REFUSED

BD6a. Would you have continued to use your old dehumidifier this year if you had not replaced it with a new one?
1. YES
2. NO **[SKIP TO C2]**
98 DON'T KNOW **[SKIP TO C2]**
99. REFUSED **[SKIP TO C2]**

BD6b. Would you have used your old dehumidifier **[READ FROM LIST]**
1. The same amount as your new dehumidifier **[SKIP TO C2]**
2. More frequently than your new dehumidifier **[SKIP TO E2A]**
3. Less frequently than your new dehumidifier **[SKIP TO E2A]**
98 DON'T KNOW **[SKIP TO C2]**
99. REFUSED **[SKIP TO C2]**

[ASK IF <PRODUCT TYPE> = FREEZER; ELSE SKIP TO BR.INTRO]

4.1.2 Freezer Questions

BF.INTRO: The next several questions concern the ENERGY STAR freezer for which you received a rebate from AEP Ohio.

BF1a. Thinking about how you will be using this new freezer, will this freezer be plugged in and running…?
[READ FROM LIST; RECORD ONLY ONE RESPONSE]
1. ALL THE TIME **[SKIP TO C2]**
2. FOR SPECIAL OCCASIONS ONLY
3. DURING CERTAIN MONTHS OF THE YEAR, ONLY
4. NEVER PLUGGED IN AND RUNNING **[SKIP TO C2]**
98 DON'T KNOW
99. REFUSED

BF1b. If you add up the total time that you plan on having your new freezer plugged in and running over the next 12 months, about how many total months will that be? Your best estimate is okay.

1. [OPEN ENDED, NUMBER OF MONTHS FROM 1-12]
13. LESS THAN 1 MONTH
98 DON'T KNOW
99. REFUSED

BF1c. Will you be using your freezer during the summer or will it mainly be running during other times of year?

[ONLY RECORD ONE RESPONSE]

1. RUNNING DURING THE SUMMER
2. MAINLY RUNNING OTHER TIMES OF THE YEAR
3. A MIX OF BOTH SUMMER AND OTHER TIMES OF YEAR
98 DON'T KNOW
99. REFUSED

BF2a. Where in your house is the freezer located?

[ONLY RECORD ONE RESPONSE; NOTE THAT RESPONSE LIST IS THE SAME FOR ALL APPLIANCES TO EASE CODING AND ANALYSIS, BUT WILL NOT BE READ TO RESPONDENT]

1. LIVING ROOM **[SKIP TO C2]**
2. BEDROOM **[SKIP TO C2]**
3. KITCHEN **[SKIP TO C2]**
4. BATHROOM **[SKIP TO C2]**
5. DEN/FAMILY ROOM **[SKIP TO C2]**
6. DINING ROOM **[SKIP TO C2]**
7. OFFICE/STUDY **[SKIP TO C2]**
8. GARAGE **[SKIP TO C2]**
9. PATIO/PORCH **[SKIP TO C2]**
10. BASEMENT
11. UTILITY ROOM/LAUNDRY ROOM
12. OTHER ROOM
98 DON'T KNOW **[SKIP TO C2]**
99. REFUSED **[SKIP TO C2]**

[ASK IF <PRODUCT TYPE> = REFRIGERATOR; ELSE SKIP TO BTV.INTRO]

Refrigerator Questions

BR.INTRO. The next several questions concern the ENERGY STAR refrigerator for which you received a rebate from AEP Ohio.

BR1. Do you use your new refrigerator as a…

[READ FROM LIST; RECORD ONLY ONE RESPONSE]

1. MAIN REFRIGERATOR **[SKIP TO C2]**
2. SECONDARY/SPARE REFRIGERATOR
98 DON'T KNOW **[SKIP TO C2]**
99. REFUSED **[SKIP TO C2]**

BR2a. Thinking about how you have been using this new refrigerator, has this refrigerator been plugged in and running…?
[READ FROM LIST; RECORD ONLY ONE RESPONSE]
1. ALL THE TIME **[SKIP TO C2]**
2. FOR SPECIAL OCCASIONS ONLY
3. DURING CERTAIN MONTHS OF THE YEAR, ONLY
4. NEVER PLUGGED IN AND RUNNING
98 DON'T KNOW
99. REFUSED

BR2b. If you add up the total time your new refrigerator has been plugged in and running since you purchased it, about how many total months would that be? Your best estimate is okay.
[OPEN ENDED, NUMBER OF MONTHS FROM 1-12]
01. LESS THAN 1 MONTH
98 DON'T KNOW
99. REFUSED

[ASK IF PURCHASE_MONTH = Jan through August; ELSE SKIP TO BR4C]
BR2c. Was the refrigerator running during this past summer or will it mainly be running during other times of year?
[ONLY RECORD ONE RESPONSE]
1. RUNNING DURING THE SUMMER
2. MAINLY RUNNING OTHER TIMES OF THE YEAR
3. A MIX OF BOTH SUMMER AND OTHER TIMES OF YEAR
98 DON'T KNOW
99. REFUSED

[ASK IF PURCHASE_MONTH = Sept through Dec; ELSE SKIP TO BR5A]
BR4c. Will you be using your refrigerator during the summer or will it mainly be running during other times of year?
[ONLY RECORD ONE RESPONSE]
1. RUNNING DURING THE SUMMER
2. MAINLY RUNNING OTHER TIMES OF THE YEAR
3. A MIX OF BOTH SUMMER AND OTHER TIMES OF YEAR
98 DON'T KNOW
99. REFUSED

[ASK IF BR1 = 2 (SPARE/SECONDARY); ELSE SKIP TO C2]

BR5a. Where in your house is this refrigerator located?

[ONLY RECORD ONE RESPONSE; NOTE THAT RESPONSE LIST IS THE SAME FOR ALL APPLIANCES TO EASE CODING AND ANALYSIS, BUT WILL NOT BE READ TO RESPONDENT]

1. LIVING ROOM **[SKIP TO C2]**
2. BEDROOM **[SKIP TO C2]**
3. KITCHEN **[SKIP TO C2]**
4. BATHROOM **[SKIP TO C2]**
5. DEN/FAMILY ROOM **[SKIP TO C2]**
6. DINING ROOM **[SKIP TO C2]**
7. OFFICE/STUDY **[SKIP TO C2]**
8. GARAGE **[SKIP TO C2]**
9. PATIO/PORCH **[SKIP TO C2]**
10. BASEMENT
11. UTILITY ROOM/LAUNDRY ROOM
12. OTHER ROOM

98 DON'T KNOW **[SKIP TO C2]**

99. REFUSED **[SKIP TO C2]**

BR5b. Is that a conditioned space, meaning that your air conditioner or heater is used in that space?

1. YES
2. NO

98 DON'T KNOW

99. REFUSED

[ASK IF <PRODUCT TYPE> = TELEVISION; ELSE SKIP TO BWH.INTRO]

Television Questions

BTV.INTRO: The next several questions concern the ENERGY STAR television for which you received a rebate from AEP Ohio.

BTV1. Where in your house is this television located?
[ONLY RECORD ONE RESPONSE; NOTE THAT RESPONSE LIST IS THE SAME FOR ALL APPLIANCES TO EASE CODING AND ANALYSIS, BUT WILL NOT BE READ TO RESPONDENT]

1. LIVING ROOM
2. BEDROOM
3. KITCHEN
4. BATHROOM
5. DEN/FAMILY ROOM
6. DINING ROOM
7. OFFICE/STUDY
8. GARAGE
9. PATIO/PORCH
10. BASEMENT
11. UTILITY ROOM/LAUNDRY ROOM
12. OTHER ROOM

98 DON'T KNOW
99. REFUSED

BTV2. Is this television plugged into a smart power strip that automatically shuts off the TV when not in use?

Yes
No
98. DON'T KNOW
99. REFUSE

BTV3. Please estimate the number of hours per day that this television is on during typical weekdays (Monday through Friday).

1. [NUMERIC OPEN END in HOURS; RANGE 0-24]

98 DON'T KNOW
-99 REFUSED

BTV4. Please estimate the number of hours per day that this television is on during typical weekend days (Saturday/Sunday).

1. [NUMERIC OPEN END in HOURS; RANGE 0-24]

98 DON'T KNOW
99. REFUSED

BTV5. During summer <u>weekday</u> afternoons between 3:00 PM and 6:00 PM, for how many hours on average is this television on?

1. [NUMERIC OPEN END in HOURS; RANGE 0-3]

-8. DON'T KNOW
9 REFUSED

[ASK IF <PRODUCT TYPE> = HEAT PUMP WATER HEATER, ELSE SKIP TO E2A]

Water Heater Questions

BWH.INTRO. The next several questions concern the heat pump water heater for which you received a rebate from AEP Ohio.

BWH1. In terms of gallons, what is the capacity of your new heat pump water heater?

1. 30 gallons
2. 40 gallons
3. 50 gallons
4. 55 gallons
5. 60 gallons
6. 66 gallons
7. 80 gallons

97. OTHER **[SPECIFY__________]**
98 DON'T KNOW
99. REFUSED

BWH2a. Between 3 PM and 6 PM on summer <u>weekdays</u>, does anyone in your household use any hot water? [IF NEEDED: Hot water might be used if you run the dishwasher, use the clothes washer, take a shower, or draw a bath.]

1. YES
2. NO **[SKIP TO BWH3]**
3. SOMETIMES

98 DON'T KNOW **[SKIP TO BWH3]**
99. REFUSED **[SKIP TO BWH3]**

BWH2b. Between 3 PM and 6 PM on a typical summer weekday, about how much time do you use hot water? Your best guess is fine. [IF NEEDED: Hot water might be used if you run the dishwasher, use the clothes washer, take a shower, or draw a bath.]

[ONLY RECORD ONE RESPONSE]

1. None (VERIFY 0 minutes; IF NECESSARY, CHANGE RESPONSE TO BWH2A TO "NO.")
2. 1 to 30 minutes
3. 31 minutes to an hour
4. One to two hours
5. Two to three hours
6. All the time (VERIFY HOT WATER IS USED ALL OF THE TIME FROM 3 PM TO 6 PM ON SUMMER WEEKDAYS)

98 DON'T KNOW
99. REFUSED

[ASK BWH3-BWH5 ONLY IF <PRODUCT TYPE>=HEAT PUMP WATER HEATER; ELSE SKIP TO BWH6]

BWH3. What mode is the water heater typically set in?

[READ RESPONSE OPTIONS 1-3 IF NEEDED]

1. HYBRID
2. HEAT PUMP ONLY
3. ELECTRIC RESISTANCE ONLY

97. OTHER; **[SPECIFY_____________]**
98 DON'T KNOW
99. REFUSED

BWH4. Where in your house is the heat pump water heater installed?

[ONLY RECORD ONE RESPONSE; NOTE THAT RESPONSE LIST IS THE SAME FOR ALL APPLIANCES TO EASE CODING AND ANALYSIS, BUT WILL NOT BE READ TO RESPONDENT]

1. LIVING ROOM **[SKIP TO BWH6]**
2. BEDROOM **[SKIP TO BWH6]**
3. KITCHEN **[SKIP TO BWH6]**
4. BATHROOM **[SKIP TO BWH6]**
5. DEN/FAMILY ROOM **[SKIP TO BWH6]**
6. DINING ROOM **[SKIP TO BWH6]**
7. OFFICE/STUDY **[SKIP TO BWH6]**
8. GARAGE **[SKIP TO BWH6]**
9. PATIO/PORCH **[SKIP TO BWH6]**
10. BASEMENT
11. UTILITY ROOM/LAUNDRY ROOM
12. OTHER ROOM

98 DON'T KNOW **[SKIP TO BWH6]**
99. REFUSED **[SKIP TO BWH6]**

BWH6. How was your heat pump water heater installed? Did you…

[READ RESPONSE OPTIONS 1-3]

1. INSTALL THE WATER HEATER YOURSELF
2. HAVE A CONTRACTOR OR PLUMBER INSTALL THE WATER HEATER
3. OR SOME OTHER WAY **[SPECIFY:__________________]**

98 DON'T KNOW

99. REFUSED

Section C: Heat Pump Water Heater Contractors

[ASK SECTION C IF <PRODUCT TYPE> = HEAT PUMP WATER HEATERS, ELSE SKIP TO E2A]

[ASK IF E1A ≠ 8 AND E1B ≠ 8; ELSE, SKIP TO C2AA]

C2. Did a contractor ever talk to you about the rebate available for the **<PRODUCT TYPE>**s?

1. YES
2. NO **[SKIP TO E2a]**

98 DON'T KNOW **[SKIP TO E2a]**

99. REFUSED **[SKIP TO E2a]**

C2aa. [SHOW IF E1A=8 or E1b=8: "At the beginning of the survey, you mentioned you heard about the program through a contractor or plumber."] Did the contractor tell you about the rebate before or after you had chosen the **<PRODUCT TYPE>** you ended up purchasing?

1. BEFORE
2. AFTER

98 DON'T KNOW

99. REFUSED

C2b. On a 1 to 5 scale, with 1 being not at all knowledgeable and 5 being very knowledgeable, how knowledgeable was the contractor about the rebate program?

1. 1: NOT AT ALL KNOWLEDGEABLE
2. 2
3. 3 **[SKIP TO C2D]**
4. 4 **[SKIP TO C2D]**
5. 5: VERY KNOWLEDGEABLE **[SKIP TO C2D]**

98 DON'T KNOW **[SKIP TO C2D]**

99. REFUSED **[SKIP TO C2D]**

C2c. What further information would you have liked to receive from the contractor?

97. **[OPEN ENDED RESPONSE]**

2. NOTHING MORE

98 DON'T KNOW

99. REFUSED

C2d. On a 1 to 5 scale, with 1 being not at all influential and 5 being very influential, how influential was the contractor in your decision to buy the **<PRODUCT TYPE>**?

1. NOT AT ALL INFLUENTIAL
2.
3.
4.
5. VERY INFLUENTIAL

98 DON'T KNOW

-99. REFUSED

Section E: Process Evaluation

[ASK IF E1A ≠ 4 AND E1B ≠ 4; ELSE, SKIP TO E2AA]

E2a. Did a sales associate at the store ever talk to you about the rebate available for the **<PRODUCT TYPE>**s?

1. YES
2. NO **[SKIP TO E3A]**

98 DON'T KNOW **[SKIP TO E3A]**

99. REFUSED **[SKIP TO E3A]**

E2aa. [SHOW IF E1A=4 or E1b=4: "At the beginning of the survey, you mentioned you heard about the program through a sales associate at the store."] Did the sales associate at the store tell you about the rebate before or after you had chosen the **<PRODUCT TYPE>** you ended up purchasing?

1. BEFORE
2. AFTER

98 DON'T KNOW

99. REFUSED

E2b. On a 1 to 5 scale, with 1 being not at all knowledgeable and 5 being very knowledgeable, how knowledgeable was the sales associate about the rebate program?

1. 1: NOT AT ALL KNOWLEDGEABLE
2. 2
3. 3 **[SKIP TO E2D]**
4. 4 **[SKIP TO E2D]**
5. 5: VERY KNOWLEDGEABLE **[SKIP TO E2D]**

98 DON'T KNOW **[SKIP TO E2D]**

99. REFUSED **[SKIP TO E2D]**

E2c. What further information would you have liked to receive from the sales associate?

97. **[OPEN ENDED RESPONSE]**

2. NOTHING MORE

98 DON'T KNOW

99. REFUSED

E2d. On a 1 to 5 scale, with 1 being not at all influential and 5 being very influential, how influential was the sales associate in your decision to buy the **<PRODUCT TYPE>**?

1. NOT AT ALL INFLUENTIAL
2.
3.
4.
5. VERY INFLUENTIAL

98 DON'T KNOW
99. REFUSED

[ASK IF E1A ≠ 3 AND E1B ≠ 3; ELSE, SKIP TO E3B]

E3a. Do you remember seeing any AEP Ohio energy efficiency promotional materials or informational displays at the store that mentioned the rebate for the **<PRODUCT TYPE>**s?

1. YES
2. NO **[SKIP TO E4A]**
98 DON'T KNOW **[SKIP TO E4A]**
99. REFUSED **[SKIP TO E4A]**

E3b. [SHOW IF E1A=3 or E1b=3: "At the beginning of the survey, you mentioned you heard about the program through in-store promotional materials."] On a 1 to 5 scale, with 1 being not at all influential and 5 being very influential, how influential were the in-store promotional materials in your decision to buy the **<PRODUCT TYPE>** that you purchased?

1. NOT AT ALL INFUENTIAL
2.
3.
4.
5. VERY INFLUENTIAL
98 DON'T KNOW
99. REFUSED

E4a. Next, I'd like you to rate your satisfaction with various aspects of the program. How satisfied were you with the process of applying for your rebate for the **<PRODUCT TYPE>**? Would you say you were…

[READ LIST]

5. VERY SATISFIED **[SKIP TO E5A]**
4. SOMEWHAT SATISFIED **[SKIP TO E5A]**
3. NEITHER SATISFIED NOR DISSATISFIED
2. SOMEWHAT DISSATISFIED
1. VERY DISSATISFIED
98 DON'T KNOW **[SKIP TO E5A]**
99. REFUSED **[SKIP TO E5A]**

E4b. What would have made you more satisfied with the rebate application process?

97. **[RECORD RESPONSE]**
98 DON'T KNOW
99. REFUSED

E5a. Once the rebate application was submitted, about how many weeks did it take for you to receive your rebate?

[RECORD ONLY ONE RESPONSE]

1. **[SPECIFY NUMBER OF WEEKS] ______________** RANGE[1-97]
98 DON'T KNOW **[SKIP TO E6A]**
99. REFUSED **[SKIP TO E6A]**

E5b. How satisfied were you with how long it took to receive your rebate? Would you say you were…?

5. VERY SATISFIED **[SKIP TO E6A]**
4. SOMEWHAT SATISFIED **[SKIP TO E6A]**
3. NEITHER SATISFIED NOR DISSATISFIED
2. SOMEWHAT DISSATISFIED
1. VERY DISSATISFIED
98 DON'T KNOW **[SKIP TO E6A]**
99. REFUSED **[SKIP TO E6A]**

E5c. What would have been an appropriate turn-around time for your rebate?

97. **[RECORD RESPONSE]**
98 DON'T KNOW
99. REFUSED

E6a. How satisfied are you with the rebate amount you received from AEP Ohio for the purchase of the **<PRODUCT TYPE>**? Would you say you are…
[READ LIST]

5. VERY SATISFIED **[SKIP TO E7A]**
4. SOMEWHAT SATISFIED **[SKIP TO E7A]**
3. NEITHER SATISFIED NOR DISSATISFIED
2. SOMEWHAT DISSATISFIED
1. VERY DISSATISFIED
98 DON'T KNOW **[SKIP TO E7A]**
99. REFUSED **[SKIP TO E7A]**

E6b. What would have been an appropriate amount for your rebate?

1. **[RECORD RESPONSE]**
98 DON'T KNOW
99. REFUSED

E7a. In the course of participating in the AEP Ohio program, how often did you contact AEP Ohio or program staff with questions?

1. NEVER **[SKIP TO E8A]**
2. ONCE
3. 2 OR 3 TIMES
4. 4 TIMES OR MORE

98 DON'T KNOW
99. REFUSED **[SKIP TO E8A]**

E7b. How did you contact them?
[CHECK ALL THAT APPLY]

1. PHONE
2. EMAIL OR FAX
3. LETTER
4. IN PERSON
5. THROUGH WEBSITE (AEP OHIO OR GRIDSMART)

98 DON'T KNOW
99. REFUSED

E7c. How satisfied are you with your communication with AEP Ohio and program staff? Would you say you were…
[READ LIST]

5. VERY SATISFIED **[SKIP TO E8A]**
4. SOMEWHAT SATISFIED **[SKIP TO E8A]**
3. NEITHER SATISFIED NOR DISSATISFIED
2. SOMEWHAT DISSATISFIED
1. VERY DISSATISFIED

98 DON'T KNOW **[SKIP TO E8A]**
-99. REFUSED **[SKIP TO E8A]**

E7d. Why were you dissatisfied?

97. **[RECORD EXACT RESPONSE]**

98 DON'T KNOW
99. REFUSED

E8a. Have you noticed any savings on your electric bill since installing your new **<PRODUCT TYPE>**?

1. YES
2. NO **[SKIP TO E9A]**

98 DON'T KNOW **[SKIP TO E9A]**
99. REFUSED **[SKIP TO E9A]**

E8b. How satisfied are you with any savings you noticed on your electric bill since installing your new **<PRODUCT TYPE>?** Would you say you were…
[READ FROM LIST]

5. VERY SATISFIED
4. SOMEWHAT SATISFIED
3. NEITHER SATISFIED NOR DISSATISFIED
2. SOMEWHAT DISSATISFIED
1. VERY DISSATISFIED
98 DON'T KNOW
99. REFUSED

E9a. How satisfied are you with your new **<PRODUCT TYPE>?** Would you say you are… **[READ LIST]**

5. VERY SATISFIED **[SKIP TO E10A]**
4. SOMEWHAT SATISFIED **[SKIP TO E10A]**
3. NEITHER SATISFIED NOR DISSATISFIED
2. SOMEWHAT DISSATISFIED
1. VERY DISSATISFIED
98 DON'T KNOW **[SKIP TO E10A]**
99. REFUSED **[SKIP TO E10A]**

E9b. Why aren't you satisfied?

97. **[RECORD VERBATIM]**
98 DON'T KNOW
99. REFUSED

E10a. If you were rating your overall satisfaction with the AEP Ohio Appliance Rebate Program, would you say you were…
[READ LIST]

5. VERY SATISFIED
4. SOMEWHAT SATISFIED
3. NEITHER SATISFIED NOR DISSATISFIED
2. SOMEWHAT DISSATISFIED
1. VERY DISSATISFIED
98 DON'T KNOW **[SKIP TO E11]**
99. REFUSED **[SKIP TO E11]**

E10b. Why do you give it that rating?

1. **[RECORD VERBATIM]**
98 DON'T KNOW
99 REFUSED

E11. What suggestions. If any, do you have to improve the program?

97. **[RECORD VERBATIM]**
2. NO SUGGESTIONS
98 DON'T KNOW
-99. REFUSED

E12a. Based on your overall experience with AEP Ohio's service, how satisfied are you with having them as your electric company? Would you say you are…

[READ LIST]

5. VERY SATISFIED **[SKIP TO F1.INTRO]**
4. SOMEWHAT SATISFIED **[SKIP TO F1.INTRO]**
3. NEITHER SATISFIED NOR DISSATISFIED
2. SOMEWHAT DISSATISFIED
1. VERY DISSATISFIED
98 DON'T KNOW **[SKIP TO F1.INTRO]**
99. REFUSED **[SKIP TO F1.INTRO]**

E12b. Why did you rate it that way?

97. **[RECORD RESPONSE]**
98 DON'T KNOW
99. REFUSED

Section F: Background

F1.INTRO. I have just a few questions left for background purposes only.

F1. Which of the following best describes your home/residence?

[READ LIST]

1. Single-family home, detached construction [NOT A DUPLEX, TOWNHOME, OR APARTMENT; ATTACHED GARAGE IS OK]
2. Factory manufactured/modular home [Single family]
3. Mobile home [Single family]
4. Row House
5. Two or Three family attached residence
6. Apartment building (4 + families)
7. Condominium
8. OTHER **[SPECIFY________________________________]**
98 DON'T KNOW
99. REFUSED

F2. Do you own or rent this residence?

1. OWN **[SKIP TO F4]**
2. RENT

98 DON'T KNOW **[SKIP TO F4]**

-99. REFUSED **[SKIP TO F4]**

F3a. Do you pay your own electric bill or is it included in your rent?

1. PAY BILL
2. INCLUDED IN RENT

98 DON'T KNOW

99. REFUSED

F4. What kind of heating do you use for your home? Do you use **(READ OPTIONS 1 - 7)** or something else?

1. Natural Gas
2. Electric
3. Fuel Oil
4. Propane
5. Geothermal
6. Wood
7. Kerosene

97. Other (SPECIFY)

99. REFUSED

98 DON'T KNOW

[ASK IF F4=2]

F4b. What kind of electric heat do you use for your home? Do you use **(READ OPTIONS 1-3)** or something else?

1. A central forced air furnace
2. A heat pump
3. Baseboard or resistance heat

97. Other (SPECIFY)

-99. REFUSED

98 DON'T KNOW

END. Those are all the questions I have for you today. I want to thank you for taking the time to answer my questions. Have a great day!

[THANK AND TERMINATE]

A.5.1 AEP Ohio Residential General Population Survey

Section A: Introduction

We are part of the Navigant Consulting team hired to evaluate AEP Ohio's water heater rebate program, and we're currently in the process of conducting interviews with contractors in order to improve our understanding of the Program. We are interested in asking you some questions about your experience so that we can get a sense of program successes and challenges, from your perspective.

A1. Have you partnered with the AEP Ohio Efficient Products rebate programs to offer rebates for Heat Pump Water Heaters to your customers?

A2. Approximately how many water heater jobs do you complete every year?

- For residential customers?
- For commercial customers?

Section B: Awareness of Rebates

B1. Can you describe how the program works? [Probe additional questions below]

- Can you describe your understanding of the rebates?
- How did you first hear about the rebates?
- Do you promote the rebates to customers?
- What are customer responses to the rebates?

B2. Have you or any of your customers received rebates from the heat pump water heater program? About how many?

B3. How would you describe your satisfaction with the program rebates?

B4. Do you have any suggestions for improving the program?

Section C: Efficient Water Heating Technologies

C1. What is your impression of efficient **heat pump** water heating technologies?

Probe in the following areas:

- Effectiveness
- Energy efficiency
- Cost
- Ease of installation

C2. Do you have any concerns about heat pump water heating technologies? Please explain.

Section D: Barriers to Customer Purchases

D1. Have you tried to influence customers to purchase heat pump water heaters? If so, how successful have you been? If not, why not?

D2. For customers who decide to purchase either high-efficiency electric models instead of heat pump water heaters, what are the primary reasons given by customers?

D2b For customers who decide to purchase either standard efficiency electric models instead of heat pump water heaters, what are the primary reasons given by customers?

D3. From your experience, do you see any of the following factors of **heat pump** water heaters as an issue impacting customer purchases? If so, how? [Probe/discuss potential factors below].

- Cost (typically ranges from $1,200 to $2,500)
- Complexity of installation (top vs. side controls, venting—especially for internal walls
- Physical size (ranges from 21" to 27" diameter for HP water heaters)
- Multiple technician requirements
- Sound concerns (55-65 decibels in room where HP water is located)
- Run time (HP run continuously for hours)
- Cold climate concerns (especially if located in unconditioned space)

D4. How have you addressed customer concerns about heat pump water heaters?

D5. What could the Program do to help address customer concerns?

Section E: Closing

Now that we are finished with the formal interview questions, do you have any additional comments or questions? Is there anything additional that would be useful for us to consider or know?

Thank you very much for taking the time to provide feedback on the program and your perspectives on the efficient heat pump technologies. If we come up with any additional questions, do you mind if I send you an email or give you a quick call?

APPENDIX C

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APPLIANCE RECYCLING PROGRAM

2014 Evaluation Report

Prepared for:
AEP Ohio

May 7, 2015

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NAVIGANT

Table of Contents

Executive Summary 1

ES.1 Program Summary 1
ES.2 Key Impact Evaluation Findings 1
ES.3 Conclusions from Program Year 2014 2

1 Introduction 4

1.1 Program Description 4
1.2 Evaluation Objectives 6

2 Methodology 8

2.1 Tracking Data Review 8
2.2 Program Documentation Review 9
2.3 Review of Successful Retailer Partnerships 9
2.4 Interviews with Participating Retail Sales Associates 10
2.5 In-depth Program Staff Interviews 10
2.6 Participant Survey 10
2.7 Ex Post Savings Evaluation Methods 12

3 Detailed Evaluation Findings 14

3.1 Program Activity 14
3.2 Impact Evaluation Findings 17
3.3 Process Evaluation Findings 18
3.4 Cost Effectiveness Review 38

4 Conclusions and Recommendations 40

4.1 Conclusions from Program Year 2014 40
4.2 Recommendations for Program Improvements 41

Appendix A Survey Instruments 42

A.1 Survey Instrument 42
A.2 General Population Survey Findings 55

NAVIGANT

List of Figures

Figure 3-1. Program Appliances Recycled by Age (in years) 15
Figure 3-2. Program Appliances Recycled by Month 15
Figure 3-3. Program Appliances Recycled by Size (in ft^3) 16
Figure 3-4. Where Survey Respondents Heard of the Appliance Recycling Program 21
Figure 3-5. Reported Satisfaction with Enrollment Experience 26
Figure 3-6. Percentage of Respondents at Least Somewhat Satisfied with Self-Reported Time to Receive Rebate 31
Figure A-1. General Population Awareness of Rebate Programs 55
Figure A-2. General Population Awareness Method for Appliance Recycling Program (n = 265). 56
Figure A-3. General Population Participation in Rebate Programs 56

List of Tables

Table ES-1. Program Savings and Realization Rate for Program Year 2014 1
Table 2-1. Summary of Data Review and Data Collection Activities 8
Table 2-2. Summary of In-depth Interviews 10
Table 2-3. 2014 Participant Survey Completions and Population-Level Sampling Error 11
Table 2-4. Participant Survey Sample Disposition 12
Table 2-5. Deemed Per-Unit Savings Values from Ohio TRM 12
Table 3-1. Appliance Recycling Program Year 2014 Activity 14
Table 3-2. *Ex Ante* and *Ex Post* Energy Savings and Realization Rates 17
Table 3-3. *Ex Ante* and *Ex Post* Demand Savings and Realization Rates 17
Table 3-4. Primary Program Awareness from Tracking Data and Survey 20
Table 3-5. Condition of Appliance Disposed Through the Program 23
Table 3-6. Primary Motivations for Participating in AEP Ohio Appliance Recycling Program Over Alternative Disposal Options 23
Table 3-7. Respondent-Reported Method of Program Enrollment 24
Table 3-8. Satisfaction with Time it Took Between Scheduling and Pickup 27
Table 3-9. Satisfaction with Appliance Collection Team 28
Table 3-10. Satisfaction with the Payment Amount 29
Table 3-11. Satisfaction with the Time to Receive Rebate 30
Table 3-12. Satisfaction with Communication 32
Table 3-13. Satisfaction with Energy Savings 33
Table 3-14. Satisfaction with AEP Ohio 34
Table 3-15. Effect of Program Participation on Favorability Toward AEP Ohio 34
Table 3-16. Appliance Recycling Programs with Retail Partnerships 35
Table 3-17. Participation and Dropout After Initial Enrollment in the Program 37
Table 3-18. Inputs to Cost-Effectiveness Model for Appliance Recycling Program 38

NAVIGANT

Table 3-19. Cost Effectiveness Results for the Appliance Recycling Program 38

NAVIGANT

Executive Summary

This report presents the results of the evaluation of the 2014 AEP Ohio Appliance Recycling Program. The Executive Summary provides a high-level description of the program, key impact findings, key process findings, and recommendations stemming from these findings. Detailed methodology and findings are contained in the body of the report following this Executive Summary.

ES.1 Program Summary

The objective of the AEP Ohio Appliance Recycling Program is to remove old, inefficient refrigerators and freezers from operation as secondary units in homes, and therefore reduce energy use and peak demand. The program also prevents existing primary appliances from being retained and used as secondary units after customers purchase new units. In 2014, the AEP Ohio Appliance Recycling Program collected a total of 17,734 appliances, which is a slight decrease from 2013.

Compared to the 2013 Appliance Recycling Program, there were no significant changes to the 2014 program. As in 2013, the customer incentive was $50 per appliance for most of the year. In 2014, the incentive amount was increased to $60 in July and August in an attempt to increase program participation mid-year. Another minor change in the program compared to 2013 was the discontinuation of the $15 to $20 "SPIF" (Sales Promotion Incentive Fund) incentive that was paid to retailer sales associates at one retailer in the fourth quarter of 2013.

ES.2 Key Impact Evaluation Findings

Table ES-1 shows the *ex ante* savings claimed by the program, the *ex post* savings, and the 2014 realization rates. The realization rate for 2014 was 1.00 for both energy and demand. Refrigerators accounted for 83 percent of the program savings in 2014 and freezers accounted for 17 percent. To estimate the *ex post* savings, the evaluation team independently applied the methods and assumptions outlined in the State of Ohio Energy Efficiency Technical Reference Manual (Ohio TRM). Due to lower volume of units recycled, the program did not meet its energy saving goals in 2014. In 2014, the program achieved 83 percent of the 29 GWh energy savings goal and achieved 66 percent of the peak demand goal of 5.8 MW.

Table ES-1. Program Savings and Realization Rate for Program Year 2014

	2014 Program Goals (a)	*Ex Ante* Savings (b)	*Ex Post* Savings (c)	Realization Rate RR = (c) / (b)	Percent of Goals = (c) / (a)
Energy Savings (MWh)	29,034	23,973	23,973	1.00	83%
Demand Savings (MW)	5.83	3.84	3.83	1.00	66%

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ES.3 Conclusions from Program Year 2014

The 2014 Appliance Recycling Program evaluation resulted in five primary conclusions:

1. ***Ex post* savings matched program *ex ante* values based on the Ohio TRM.** No issues surfaced in the review of savings calculations, which resulted in a realization rate of 1.00 for both energy and demand savings.

2. **The average age of recycled refrigerators (16.7 years) and freezers (19.9 years) continues to decrease.** The population of appliances currently being recycled is moving farther from the Ohio TRM assumptions, which assume the average age of recycled appliances is greater than 20 years.

3. **Overall, the Appliance Recycling Program is running very smoothly.** The program has not undertaken any significant changes since 2013, and customers continue to be highly satisfied.

4. **The program tracking data and the participant survey data do not align for the primary vs. secondary parameter.** While the data collection protocols used during the appliance pick-up appear to be sound (staff are directed to gather historical appliance use to determine whether it was primary or secondary), the participant survey found more than double the percentage of primary recycled refrigerators than is currently documented in the tracking database. One quarter of 2014 refrigerators were marked as primary in the tracking data, while 61 percent of participant survey respondents said the recycled refrigerator was their primary unit. While the evaluation team did not speak directly with pick-up staff for the 2014 evaluation, one possible reason for this may be inconsistent application of the data collection protocols by appliance pick-up staff while on-site.

5. **In spite of some remaining challenges with the retail partnerships, pickups via retailers increased considerably in 2014.** While in-store enrollments continue to represent a small portion of total enrollments (~1%), pickups via retailers increased to nearly 6 percent in 2014, according to program tracking data.[1] Additionally, more than a third of survey respondents had heard of the program at a retailer, and half of those heard from partnered retailers. This indicates that retailers are doing a good job educating customers on the program, even if retailers are not enrolling customers in-store.

ES.4 Recommendations for Program Improvements

The 2014 evaluation resulted in three main recommendations:

1. **Identify reasons preventing retail associates from effectively enrolling customers in-store.** As identified in the secondary research with peer utility programs, retailers can be an effective outreach arm and sign-up method; however, in-store enrollment for the AEP Ohio program is

[1] Participants have two enrollment options to have their appliance picked up by a retailer: in-store enrollment or enrolling for retailer pickup via the implementation contractor's call center.

low. Outreach to retailers from AEP Ohio program staff may shed some light on why few participants are enrolled in-store, despite an increase in the number of pickups from retailers.

2. **Ensure pick-up staff are consistently following data collection protocols when identifying whether a refrigerator is primary or secondary.** While the evaluation team did not interview pick-up staff in 2014, in the 2011 Appliance Recycling Program Evaluation Report it was identified that pick-up staff did not always consistently ask these questions of participants. However, while the survey questions are relatively similar to the questions asked by the program pick-up staff, future evaluations should more closely aligning the questions asked in surveys to the data collection protocols used on-site, to limit any difference in data collection methods that could be affecting these numbers. The consistency with which pickup staff gather this information should also be reviewed.

3. **Given the trend towards a younger population of appliances being recycled, develop a mitigation strategy should the Ohio TRM be updated in the future.** While this is not currently an issue for the program, should the TRM be updated to be more in-line with the observed program population (younger appliances, which provide lower energy savings), the program may need to adapt its approach in order to maintain cost effectiveness and meet energy savings goals. Examples of marketing strategies include specifically target older appliances, or offering higher incentives to collect more appliances.

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1 Introduction

This section provides a description of the AEP Ohio Appliance Recycling Program, as well as a brief discussion of the underlying program theory and logic. In addition, this section describes minor differences in how the 2014 program was implemented along with a comparison to the 2013 program. The reader is directed to the 2011 evaluation report[2] for a thorough review of the program processes and theory. The last part of this section describes the objectives of this evaluation.

1.1 *Program Description*

The objective of the AEP Ohio Appliance Recycling Program is to remove old, inefficient refrigerators and freezers from operation as secondary units in homes and therefore reduce energy use and peak demand. The program also prevents existing primary appliances from being retained and used as secondary units after customers purchase new units or sold into the secondary market.

AEP Ohio offers free removal and recycling of refrigerators and freezers and provides a cash incentive to customers who retire these appliances. The incentives include $50 per appliance (increased to a $60 payment in July and August of 2014) and free pickup of the old appliances. For a customer to qualify, the refrigerator and/or freezer must be between 10 and 30 cubic feet in size, empty, and operational at the time of pickup. In 2014, the program collected a total of 17,734 appliances (14,460 refrigerators and 3,274 freezers).

The implementation contractor provides complete implementation services, including verifying customer eligibility, scheduling appliance pickups, collecting appliances from customers' homes, transferring the appliances to a recycling facility (performed by subcontractor Appliance Distribution), and processing incentive payments. The implementation contractor also handles the development of marketing materials (through a marketing subcontractor), media placement, and promotion of the program, as well as data tracking and reporting for the appliance scheduling and collection.

In addition to direct pickup by a program contractor, the Appliance Recycling Program also recycles some units through a partnership with two retail chains in the AEP Ohio service territory, as working appliances picked up by these stores may otherwise find their way back into the secondary market. In the retailer partnership component of the program, the retailer promotes the program and enrolls customers who are purchasing new appliances from the retailer. Participants also have the option of calling the implementation contractor at a later time to request a retailer pickup. The retailer then collects the old appliance(s) when delivering the new appliance(s) to the customer; the old appliances are then picked up by the implementation contractor for recycling.

---

[2] *Program Year 2011 Evaluation Report: Appliance Recycling Program.* Navigant Consulting and Energy Market Innovations, Inc. May 8, 2012.

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In 2014, the program aimed to reduce energy usage by 29 GWh and peak demand by 5.8 MW. These goals account for 14 percent of AEP Ohio's 2014 residential consumer portfolio energy goal and 20 percent of the consumer portfolio demand goal. The program did not meet its energy consumption and demand goals in 2014. Overall residential portfolio management considerations resulted in a reduced emphasis on this program later in the year.

1.1.1 2014 Program Differences Compared to 2013

The core program processes and basic program theory of the 2014 program did not change from 2013. However, there were a number of small changes related to program implementation and marketing for 2014.

Program Implementation

For most of the year, the incentive amount for customers was $50. The incentive was increased to $60 in July and August, the highest enrollment period of the year. In 2013, the $60 incentive was offered from October to December.

The program offered a refer-a-friend incentive from March to June, offering $25 for each friend referred. The program manager described this effort as being somewhat successful, but it was discontinued in lieu of more effective marketing channels that would provide a greater volume of leads. The incentives provided to retailers in 2013 were not offered in 2014.

Program staff described an increase in the percentage of appliance pickups coming from retail partnerships. At the time of the interview, program staff reported this percentage to be 5.3 percent, approximately double the percentage from 2013 (the tracking data was very similar, around 5.5 percent from retailers). This percentage has typically been lower in previous years.

Marketing

In 2014, AEP Ohio continued targeted print, digital, and broadcast advertising campaigns. AEP Ohio used behaviorally-, geographically-, and demographically-targeted banners on popular websites and geographically- and demographically-targeted audio and banner advertisements on internet radio. AEP Ohio also placed advertisements on local news websites and broadcast television and cable in major metropolitan areas. Radio advertisements were used exclusively in the Columbus area. Based on a mid-year report on the program's marketing,[3] the cable television advertising and local newspaper print advertisements were scaled back in favor of increased broadcast television advertisements.

AEP Ohio also sent out bill inserts and "eBlasts" (emails) on roughly a quarterly basis, as well as a bill message at the beginning of the year. The targeted mailings and raffle promotions in 2013 were not continued in 2014.

[3] *2014 Midyear Evaluation of Marketing Plan*. June 26, 2014.

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1.1.2 Program Theory

The basic program theory of the 2014 program is unchanged compared to the 2013 program theory. As part of the 2011 evaluation, the evaluation team constructed a detailed logic model to thoroughly capture the program theory of the Appliance Recycling Program. Because the program theory for the 2014 program is unchanged from that in the 2011 program, a detailed program theory description and logic model are not contained in this current report. The reader is instead referred to the 2011 evaluation report.[4]

1.2 *Evaluation Objectives*

This report presents the findings from the impact and process evaluations of the AEP Ohio Appliance Recycling Program for 2014. The objectives of the evaluation were to: (1) quantify energy and peak demand savings impacts in 2014 for these products, (2) determine key process-related program strengths and weaknesses, and (3) provide recommendations to improve the program. The evaluation sought to answer the following research questions

Impact Questions

1. How many appliances were collected through the program, by type (refrigerator or freezer), configuration (e.g., upright vs. chest), and pickup mechanism (i.e., home pickup vs. retail partnership)?
2. Did AEP Ohio appropriately calculate the Ohio TRM annual energy (kWh) and summer peak demand (kW) impacts for the program?
3. What were the realization rates? (Defined as evaluation-verified (*ex post*) savings divided by program-reported (*ex ante*) savings.)
4. What is the cost effectiveness of this program?

Process Questions

1. How do participants become aware of the program?
2. Are participants satisfied with various aspects of the program (i.e., enrollment, appliance pickup, incentive payment)? If not, why not?
3. Do participants report that their appliances were in working condition prior to being picked up by the program?
4. Are partnering retail sales associates satisfied with the program? What has been their experience with the program thus far? Are there any retailer-side challenges that may contribute to low customer enrollment through this channel?
5. What are the enrollment and promotional practices of successful retail partnerships in other utility jurisdictions? How do these differ from those of AEP Ohio retail partners?
6. How many customers enroll in the program but then cancel? How many who cancel do not re-enroll in the program within the calendar year?

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[4] *Program Year 2011 Evaluation Report: Appliance Recycling Program.* Navigant Consulting and Energy Market Innovations, Inc. May 8, 2012.

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7. Has the program as implemented changed from 2013? If so, how, why, and was this an advantageous change?
8. What are the current program challenges and how are these being addressed?
9. What are the opportunities for program improvement?

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2 Methodology

This section describes the methodology used to conduct the impact and process evaluations. Table 2-1 summarizes the various activities undertaken for the impact and process evaluation. The evaluation team analyzed new program documentation for 2014 (the 2014 marketing plan and report) and reviewed program tracking data[5], which contains information on all of the refrigerators and freezers recycled through the Appliance Recycling Program. The evaluation team also conducted in-depth research of peer utility appliance recycling programs with retail partnerships, to better understand other programs' successes and challenges with this outreach approach. This review included both primary data collection (e.g., interviews) and a secondary data review (e.g., published reports).

Primary data collection efforts included in-depth telephone interviews with program staff at AEP Ohio and the program implementer. In order to understand customer experiences with the program, the evaluation team conducted a telephone survey with customers who had a refrigerator or freezer recycled through the program in 2014.

Table 2-1. Summary of Data Review and Data Collection Activities

Data Collection Type	Targeted Population	Supported Evaluation Activities
Tracking Data Review	All program participants	Impact and Process Evaluation
Program Documentation Review	Any new program documentation	Process Evaluation
Review of Successful Retailer Partnerships (Secondary Literature Review and Interviews)	Any new published studies relevant to the evaluation of appliance recycling, feedback from peer utility program managers, implementers, and/or evaluation staff	Process Evaluation
In-depth Telephone Interviews	Program staff and implementer	Process Evaluation
Telephone survey	Program participants	Process Evaluation

2.1 *Tracking Data Review*

The program tracking data are critical for determining the impacts of the Appliance Recycling Program, as it indicates the number of appliances and many characteristics of the appliances collected through the program. Thus, reviewing the tracking system is important for calculating program impacts and for

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[5] The evaluator did not address whether the tracking system is adequate for regulatory prudency reviews or corporate requirements.

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assessing the effectiveness of program processes, however, the evaluator did not address whether the tracking system is adequate for regulatory prudency reviews or corporate requirements.

The tracking data collected were provided by AEP Ohio for the evaluation team to review. First, the evaluation team determined key data fields essential for consideration in the impact and process evaluations. Next, the team examined frequency distributions for each of the key fields, identifying missing, incomplete, or inconsistent data. Finally, the team formulated assumptions that are used in subsequent analyses to account for missing, incomplete, or inconsistent data. The result was a more complete and accurate evaluation and assessment of the impacts of the Appliance Recycling Program, however, the evaluator did not address whether the tracking system is adequate for regulatory prudency reviews or corporate requirements.

The tracking review included several assessments of the data. The evaluation team assessed key appliance characteristics of appliances recycled through the program, including appliance age, size, and configuration. Project data including complete dates and project IDs were analyzed to determine how many customers recycled more than one appliance through the program.

In addition to records on completed projects, the evaluation team reviewed appointment cancellation data, which contains all of the customers who signed up for the Appliance Recycling Program and then cancelled or changed their pickup appointment at least once. The evaluation team reviewed these data to determine how many of the program projects were cancelled or rescheduled. To determine how many cancellations represent true dropouts and how many go on to eventually participate in the program, the evaluation team compared the cancellation data with the program tracking data.

The assessment of the tracking data and program activity is discussed in Section 3.3.7. The assessment of the cancellation data is discussed in Section 3.3.5.

2.2 *Program Documentation Review*

For the 2014 program, the evaluation team reviewed the following documents to understand the details of the 2014 program and to inform customer surveys.

- AEP Ohio Appliance Recycling Program website
- AEP Ohio 2014 Marketing Plan and Report
- 2012-2014 Energy Efficiency/Peak Demand Reduction Action Plan

2.3 *Review of Successful Retailer Partnerships*

In order to capture the current state of successful appliance recycling program retailer partnerships, the evaluation team conducted a literature review of peer utility program evaluations to find the best practices utilized in these successful partnerships. The evaluation team also reached out to staff in other jurisdictions to solicit feedback on successful retail partnerships, including implementers, utility staff, and evaluators. This effort resulted in two completed interviews: one with a utility program manager and one with an evaluator. The combined efforts of the literature review and interviews with staff in other

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jurisdictions highlighted other programs' successes and challenges in working with retailers to promote their appliance recycling programs. The findings resulting from this research are found in Section 3.3.4.

2.4 Interviews with Participating Retail Sales Associates

In order to gather more detailed information on the partnerships with retailers and any barriers that may exist to in-store enrollment, the evaluation team attempted to complete in-depth interviews with sales associates at the newer participating retailer's store locations. Despite multiple attempts over several weeks, the evaluation team was unable to complete any interviews with retail staff. The corporate contact at this retailer declined to provide sales associate contact information due to a lack of permission from management.

2.5 In-depth Program Staff Interviews

In order to answer the key process evaluation research questions, the evaluation team conducted several in-depth interviews, as summarized in Table 2-2. The purpose of these interviews was to understand changes in program implementation, collect feedback on research priorities, and understand stakeholders' experiences with the program.

Table 2-2. Summary of In-depth Interviews

Data Collection Type	Targeted Population	Sample Frame	Sample Target	Sample Size	Timing
In-depth Telephone Interviews	AEP Ohio Program Staff	Contacts from AEP Ohio	Program Manager Consumer Programs and Marketing Manager	2	November 2014
	Implementation Contractor Program Staff	Contacts from AEP Ohio	Program Development Director Midwest Regional Manager	2	November 2014

2.6 Participant Survey

The evaluation team also conducted a telephone survey with program participants. The data from this survey were used to address process evaluation research questions.

To ensure that surveys were conducted with a representative sample of participants, the survey sample was stratified by appliance type: refrigerator or freezer. Within each stratum, surveys were completed with a random sample of participants. The evaluation team constructed the sample design before the final end-of-year program data were available. The evaluation team estimated target sample sizes needed to estimate results at a 95 percent level of confidence +/- 5 percent relative precision (95/5) at the program level, while simultaneously attaining 90/10 for both customers recycling refrigerators and customers recycling freezers.

In order to derive target sample sizes, the evaluation team started by assuming an estimated total of 20,000 recycled units for the year, which was based on the yearly unit goals for the implementer. Based

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on this information, to attain 95/5 at the program level the evaluation team computed a minimum sample size of 377 completed participant surveys. In order to attain at least 90/10 at the appliance level, the evaluation team allocated 70 target completes to customers recycling freezers and 307 target completes to customers recycling refrigerators.

Table 2-3 shows the actual population of appliances collected in 2014 through the program, the number of participant surveys completed, and the resulting sampling error. It should be noted that respondents in the participant survey were asked to confirm the type of appliance that they had had picked up. While surveys were completed with respondents recycling 70 freezers and 307 refrigerators according to the program tracking data, due to corrections made by respondents during the survey, the breakdown of total survey completions was actually 315 refrigerators and 62 freezers. At the program level, sampling efforts resulted in +/- 5.0 percent precision at a 95 percent level of confidence. For refrigerators, +/- 5.5 percent precision was attained and for freezers +/- 12.3 percent precision was attained at the 95 percent level of confidence.

Table 2-3. 2014 Participant Survey Completions and Population-Level Sampling Error

Appliances Collected	2014 Population Size	Survey Target Completions	Survey Completions (with corrected appliance type during survey)	Sampling Error
Refrigerators	14,460	307	315	5.5%[(a)]
Freezers	3,274	70	62	12.3% [(b)]
Total	17,734	377	377	5.0%

a. At 90% confidence, sampling error = 4.6%.
b. At 90% confidence, sampling error = 10.3%

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In order to secure the 377 survey completions, the evaluation team attempted to contact 2,115 AEP Ohio customers who participated in the program. Table 2-4 highlights the call disposition from those attempted contacts. In total, 18 percent of all customers contacted ultimately participated in the survey.

Table 2-4. Participant Survey Sample Disposition

Contact Disposition	Customers	Percent
Completions	377	18%
Left voicemail	717	34%
Unable to reach (e.g., no answer, busy, answering machine)	478	23%
Refusal	352	17%
Non-specific callback/Appointment scheduled	69	3%
Telephone number issue	43	2%
Screened ineligible	21	1%
Non-residence number	20	< 1%
Add to do not call list	15	< 1%
Not available permanently	10	< 1%
Language barrier	7	< 1%
Number changed	5	< 1%
Quota met	1	< 1%
Total Participants Attempted to Contact	2,115	100%

2.7 *Ex Post Savings Evaluation Methods*

Program savings were calculated using the AEP Ohio program tracking data and the Ohio TRM. The program tracking data were used to verify appliance counts by type. The evaluation team determined *ex post* savings values by applying the deemed values for refrigerator and freezer "Early Retirement" (recycling) from the Ohio TRM to these appliance counts.[6] Deemed per-unit values for refrigerator and freezer savings are summarized in Table 2-5.

Table 2-5. Deemed Per-Unit Savings Values from Ohio TRM

Appliance Type	Deemed Per-Unit Energy Savings (kWh)	Deemed Per-Unit Demand Savings (kW)
Refrigerator	1,376.15	0.22
Freezer	1,244.40	0.20

[6] Refrigerator and/or Freezer Retirement (Early Retirement), Ohio TRM, 2010. pp. 23-24.

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Total energy and demand savings were calculated as the sum of per-unit savings for all units listed in the program tracking data. The *ex post* savings findings are discussed in Section 3.1.

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3 Detailed Evaluation Findings

This section presents the detailed findings from the 2014 Appliance Recycling Program evaluation related to (1) program activity, (2) *ex post* impact findings, (3) process evaluation findings, and (4) cost effectiveness review.

3.1 *Program Activity*

As shown in Table 3-1, in 2014, the AEP Ohio Appliance Recycling Program collected a total of 17,734 appliances.

Table 3-1. Appliance Recycling Program Year 2014 Activity

Appliance	Number of Units	Percent of Total Appliances
Refrigerators	14,460	81.5%
Freezers	3,274	18.5%
Total	17,734	100.0%

The following key findings and figures provide a summary of program activity and a detailed description of the appliances collected through the 2014 AEP Ohio Appliance Recycling Program.

- **The average age of recycled appliances was lower than the average age in previous years, at 16.7 years for refrigerators and the 19.9 years for freezers.** This finding follows a trend dating back to the 2011 evaluation. This decrease in appliance age over time may be a reflection of the program having already targeted older appliances. Importantly, the average refrigerator age has declined to less than 20 years, meaning the units were manufactured after the 1993 major change in refrigerator Federal Standards. This result may represent a significant "tipping point" in refrigerator age, which may impact unit savings, although currently the Ohio TRM does not vary depending on appliance age. The middle 50 percent of the appliances were between 10 and 24 years old. The oldest appliance was an 83-year-old refrigerator. Figure 3-1 shows a histogram of recycled appliance age.
- **The majority (94%) of participants recycled a single unit.** The other 6 percent recycled two units. This percentage did not change from the 2013.
- **The majority of refrigerators (75%) and all freezers were secondary units according to the tracking system. However,** the participant survey found the opposite: a majority of respondents who recycled a refrigerator reported that it was primary (61 percent).
- **The majority of recycled refrigerators (64%) were top freezer refrigerators.** Other types included side-by-side (28%), single door (4%), and bottom freezer (4%) refrigerators.
- **The majority of recycled freezers (68%) were upright freezers.** The other 32 percent of freezers were chest freezers.
- **The most appliances were recycled in August 2014**, with 575 freezers and 2,097 refrigerators picked up that month. Figure 3-2 shows refrigerators and freezers recycled by month.

- **The average size of refrigerators recycled through the program was 18.8 ft³. The average size of freezers was 16.2 ft³.** Both appliance types ranged from 10 ft³ to 30 ft³. The average sizes have remained relatively unchanged from the previous two years. Appliance size is presented in Figure 3-3.

Figure 3-1. Program Appliances Recycled by Age (in years)

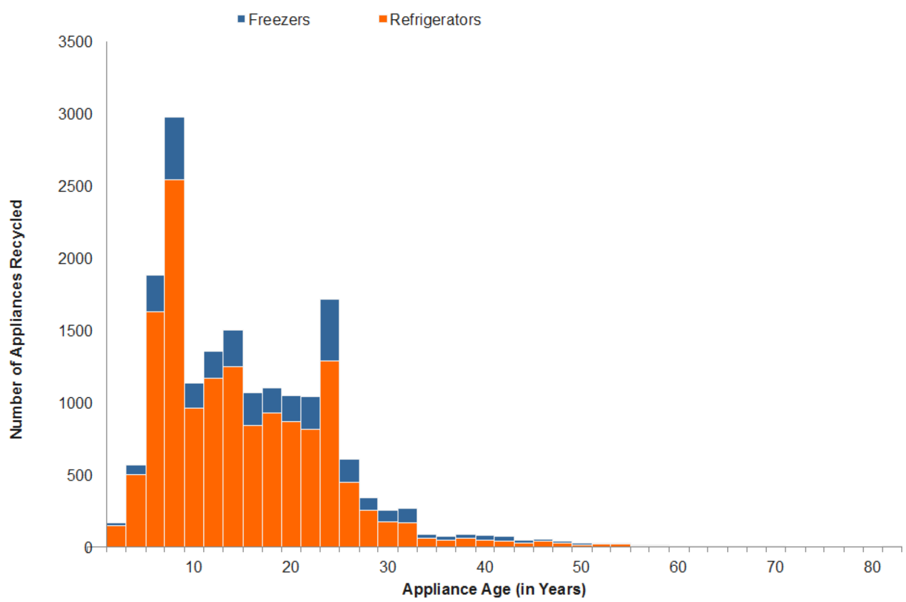

Figure 3-2. Program Appliances Recycled by Month

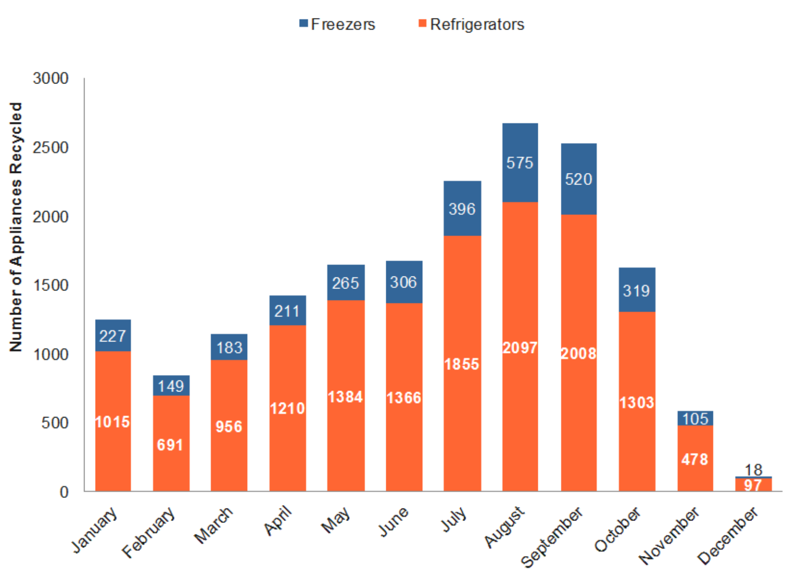

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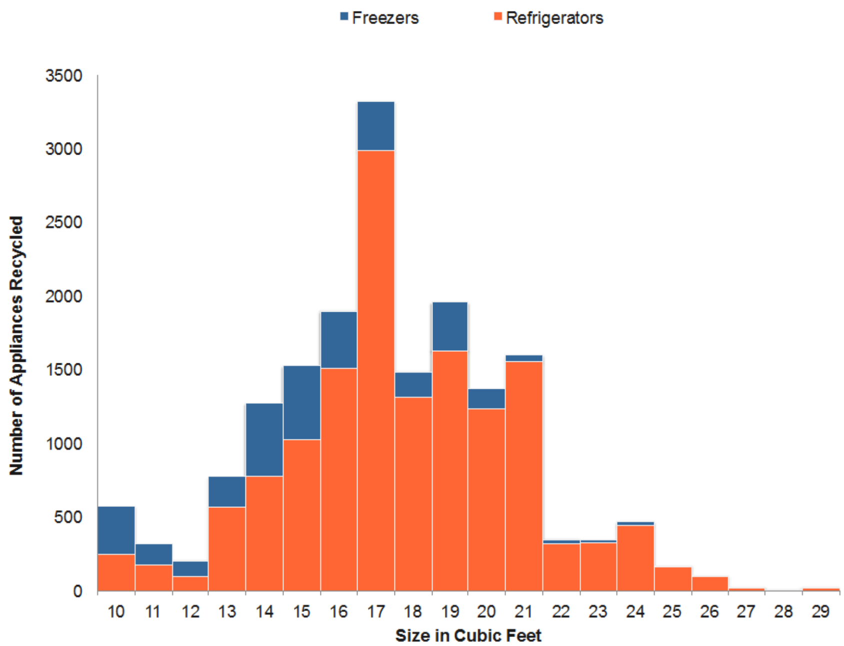
Figure 3-3. Program Appliances Recycled by Size (in ft³)



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3.2 *Impact Evaluation Findings*

This section provides a detailed description of impact findings for the 2014 Appliance Recycling Program, including total energy and demand savings and realization rates for refrigerators and freezers. The evaluation team reviewed the AEP Ohio tracking data to inform the *ex post* savings evaluation. This tracking data consisted of three data files, all of which were reviewed for completeness (additional information on 2014 program activity is detailed in Section 3.3.7). The evaluation team used the Units file to calculate *ex post* savings.

The 2014 Appliance Rebate Program energy savings totaled 23,973 MWh. Refrigerators accounted for 83 percent of those savings. The evaluation team verified the *ex ante* energy savings using the previously methodology described and the Ohio TRM deemed per-unit savings values. All energy realization rates were 1.00. Table 3-2 shows the deemed per-unit values, unit counts, total energy savings, realization rates, and percentage of savings for refrigerators, freezers, and the overall program.

Table 3-2. *Ex Ante* and *Ex Post* Energy Savings and Realization Rates

Appliance	Count	Per-Unit Energy Savings (kWh)	Total *Ex Ante* Energy Savings (MWh)	Total *Ex Post* Energy Savings (MWh)	Percent of Energy Savings	Realization Rate
Refrigerators	14,460	1,376.15	19,899.13	19,899.13	83.0%	1.00
Freezers	3,274	1,244.40	4,074.17	4,074.17	17.0%	1.00
Total	17,734		23,973.30	23,973.30	100.0%	1.00

The 2014 Appliance Rebate Program demand savings totaled 3.83 MW. Refrigerators accounted for 83 percent of those savings. The evaluation team verified the *ex ante* demand savings using the methodology described above and the Ohio TRM deemed per-unit savings values. All demand realization rates were 1.00. Table 3-3 shows the deemed per-unit values, unit counts, total demand savings, realization rates, and percentage of savings for refrigerators, freezers, and the overall program.

Table 3-3. *Ex Ante* and *Ex Post* Demand Savings and Realization Rates

Appliance	Count	Per-Unit Demand Savings (kW)	Total *Ex Ante* Demand Savings (MW)	Total *Ex Post* Demand Savings (MW)	Percent Of Demand Savings	Realization Rate
Refrigerators	14,460	0.22	3.18	3.18	83.0%	1.00
Freezers	3,274	0.20	0.65	0.65	17.0%	1.00
Total	17,734		3.84	3.83	100.0%	1.00

Note: Totals may not sum due to rounding.

In 2014, the program achieved 83 percent of the 29 GWh energy savings goal and achieved 66 percent of the peak demand goal of 5.8 MW.

3.3 Process Evaluation Findings

This section provides a detailed description of process findings for the 2014 Appliance Recycling Program. Data collection activities that informed the process evaluation included:

- Interviews with program and implementation staff
- Tracking data and cancellation data review
- Secondary research and interviews with peer utility programs
- Primary research with participating customers

Overall, process evaluation data collection efforts indicate that the Appliance Recycling Program is running smoothly. On the whole, the overall program structure and program processes have remained relatively unchanged from 2013.

Participant awareness comes mostly from bill inserts, word of mouth, appliance retailers, and TV advertisements. There has been a consistent increase in awareness from retailer sources—including sales associates and store postings—since 2011. Thirty-four percent of survey respondents reported learning about the program from an in-store sales associate, either from Appliance Recycling partnered retailers or cross-promotion from Efficient Products partnered retailers. Additionally, the percentage of customers who heard about the program from an Appliance Recycling partnered retailer increased considerably from 2013 to 2014.

The evaluation team also researched peer utility programs offering retailer partnerships for appliance recycling programs to determine program successes and challenges. While other programs tended to have higher retailer enrollment/pickup rates, most had a similar structure and design to AEP Ohio's. However, the hallmark of one particularly successful retail partnership was the maintenance of a highly engaged and well-trained retailer network. According to that utility's program manager, this result was achieved by designating outreach staff dedicated to visiting retailers, engaging them, and training retail staff on a regular basis.

Participants continue to be highly satisfied with the program and all of its components (e.g., enrollment experience, rebate amount, collection team, and time to receive rebate). Participants also report high levels of satisfaction with AEP Ohio as a service provider, with 85 percent reporting being at least "somewhat satisfied." In terms of motivations to participate, the incentive amount and convenience of the pickup are the main drivers to participation reported by survey respondents, which is consistent with last year's evaluation findings.

Of all the customers who signed up for the program, 21 percent canceled an appointment at some point, but 88 percent ultimately participated. In other words, 12 percent of customers who signed up for the program dropped out at some point and did not complete the program. The dropout rate is very similar to 2013's dropout rate, and lower than in previous years.

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The current challenges mentioned by program staff included the evolving population of recycled appliances and uncertainty surrounding the remaining supply. Recycled appliances are getting younger, and should the Ohio TRM be updated to reflect this, the deemed savings values will likely decrease. This could make it more challenging for the program to meet cost-effectiveness and energy savings goals.

Key findings from the process evaluation of the 2014 Appliance Recycling Program follow and include the following topics:

- Marketing and program awareness
- Participant experiences, including: characteristics of recycled appliances; motivations for program participation; enrollment experience; experience scheduling a pickup; appliance collection process; rebate timing and amount; communication with AEP Ohio and program staff; and perceived energy savings
- Overall satisfaction
- Participant demographics
- Successful peer utility retail partnership programs
- Cancelled appointments
- Current program challenges
- Tracking data review

3.3.1 Marketing and Program Awareness

In 2014, AEP Ohio continued to target print, digital, and broadcast advertising campaigns. AEP Ohio used behaviorally-, geographically-, and demographically-targeted banners on popular websites and geographically- and demographically-targeted audio and banner advertisements on internet radio. AEP Ohio also placed advertisements on local news websites and broadcast television and cable in major metropolitan areas. Radio advertisements were used exclusively in the Columbus area. Based on the 2014 marketing mid-year report,[7] the cable television advertising and local newspaper print advertisements were scaled back in favor of increased broadcast television advertisements.

AEP Ohio also sent out bill inserts and "eBlasts" (emails) on roughly a quarterly basis, as well as a bill message at the beginning of the year. According to the mid-year program analysis, bill inserts are generally the primary response driver for recycling programs across the country, although the AEP Ohio program is notable for its success in driving participation through other means.[6] The targeted mailings and raffle promotions in 2013 were not continued in 2014.

[7] *2014 Midyear Evaluation of Marketing Plan.* June 26, 2014.

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Source of awareness was gathered in the program tracking data and asked during surveys with participants, as shown in Table 3-4. Both data sources contained similar responses, with respondents most frequently mentioning bill inserts, followed by word-of-mouth, as their primary source of awareness. Retailers, either via a sales associate or a posting in store, were the third most common method of awareness for participants, indicating that retailers are effectively educating customers on the program.

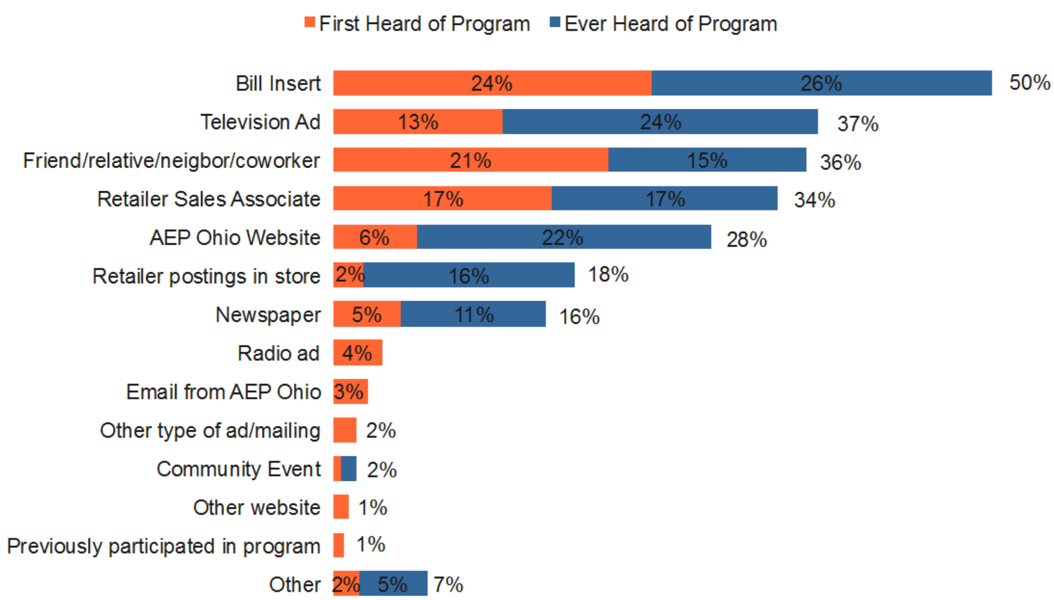
Table 3-4. Primary Program Awareness from Tracking Data and Survey

Source of Awareness	Tracking Data Frequency	Tracking Data Percent	Survey Frequency	Survey Percent
Utility bill insert	4,715	28.1%	84	24.2%
Friend/neighbor/coworker	2,812	16.8%	72	20.7%
Sales associate for appliance retailer/posting at retailer	2,541	15.2%	66	19.0%
Television	1,917	11.4%	45	13.0%
AEP Ohio website	1,051	6.3%	22	6.3%
Newspaper	526	3.1%	18	5.2%
Radio	630	3.8%	13	3.7%
Email from AEP Ohio	1,207	7.2%	9	2.6%
Other type of ad/mailing	-	-	6	1.7%
Other website	-	-	4	1.2%
Previously participated in program	-	-	3	0.8%
Community event	76	0.5%	2	0.5%
Other not mentioned above	1289	7.6%	3	0.8%
Total	16,764	100%	347	100%

Note. Results are not shown for thirty respondents who reported "Don't know" to this question in the participant survey. Total sums to less than 100 percent due to rounding.

In addition to being asked how they first became aware of the Appliance Recycling Program, respondents were also prompted to answer whether they had heard of the program any other way. Figure 3-4 shows the detail of how respondents initially became aware of the program, as well as whether they heard of the program through any other sources. The evaluation team's findings confirm the scaling back of cable TV and newspaper ads reported in the 2014 mid-year marketing report with fewer respondents in 2014 than in 2013 hearing about the program through newspaper and television. In 2013 almost a quarter (24%) of respondents reported hearing about the program in a newspaper: this rate dropped to 16 percent in 2014. Likewise, while 48 percent of respondents reported hearing about the program via television in 2013, only 37 percent reported the same in 2014. The percentage of respondents who reported hearing about the program from a retailer sales associate increased slightly in 2014, to 34 percent from 32 percent in 2013.

Figure 3-4. Where Survey Respondents Heard of the Appliance Recycling Program



Of those respondents whose primary source of awareness was from a retailer, only about half (48%) reporting hearing about the program from a partnered retailer. The remainder heard of the program from other retailers and other local appliance retailers, all of which work with the Efficient Products Program.

3.3.2 Program Participation

In this section, the evaluation team describes the key findings related to Appliance Recycling Program participation. These findings include characteristics of the recycled appliance; motivation for program participation; detailed findings regarding respondents' experiences enrolling in the program via website, retailer, and telephone enrollment channels; their experience with the pick-up; communications with program staff; and rebate timing and amount.

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Characteristics of Appliances Disposed Through the Program

The evaluation team examined several characteristics of the appliances recycled through the program, both from the program tracking data and the participant survey data. According the tracking data, one quarter of refrigerator participants recycled a primary refrigerator in 2014. However, surveyed respondents reported considerably different breakouts; 61 percent stated they recycled a primary refrigerator while 39 percent recycled a secondary (or other non-primary) refrigerator. According to the implementation contractor, appliance pick-up staff currently collect this information at the time of pick-up, and staff are instructed to gather historical use information from the participant (i.e., whether the appliance was used as primary or secondary for the past 12 months), which is in turn documented in the tracking data. The questions asked of survey respondents are documented in the appendix to this report.

While the methodologies for data collection were slightly different between the tracking data and participant survey, it does not entirely explain the differences between the survey and tracking data. The 2011 evaluation documented some inconsistencies in how the data collection protocols are implemented during the pick-up, with one staff noting they used the location of the appliance to determine whether it was primary or secondary and only asked the customer if necessary. If these inconsistencies have continued, this may be one possible reason for the differing findings. However, given the fact that the surveys can be completed several months to a year after the appliance has been picked up, it is also possible that recall bias during the participant surveys may be affecting customers' recollection of the type of appliance recycled, although this is less likely. Sampling error, which can exist whenever a sample is compared to a population, could also be contributing to this difference; this would mean that a higher than normal proportion of participants who recycled a primary refrigerator may have been sampled than would normally be expected from random selection.

Overall, most of the respondents who recycled their appliance through AEP Ohio's Appliance Recycling Program were disposing of an appliance that was still in good condition and effectively cooled its contents. As shown in Table 3-5, more than half of the respondents (61%) reported that the appliance they had recycled was working and in good condition. Nearly a quarter of respondents (23%) stated that their recycled appliance still effectively cooled its contents but needed minor repairs, while 11 percent reported that their appliance partially cooled contents but had other major issues. Few respondents recycled appliances that were non-functioning; 5 percent of respondents reported their appliance did not cool contents effectively but did turn on, while less than 1 percent respondents reported that their appliance did not turn on at all.

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Table 3-5. Condition of Appliance Disposed Through the Program

Condition of Appliance	Refrigerator		Freezer		Total	
	Frequency	Percent	Frequency	Percent	Frequency	Percent
Effectively cooled contents and was in good condition	174	58.4%	44	72.1%	218	60.7%
Effectively cooled contents but needed minor repairs	72	24.2%	10	16.4%	82	22.8%
Partially cooled contents but had bigger problems	35	11.7%	6	9.8%	41	11.4%
Did not cool contents effectively but did turn on	16	5.4%	1	1.6%	17	4.7%
Did not turn on	1	0.3%	0	0.0%	1	0.3%
Total	298	100.0%	61	100.0%	359	100.00%

Note. Results are not shown for the four respondents who reported "Don't know" to the question.
Totals may not sum to 100 percent due to rounding.

Motivations for Program Participation

Respondents were asked to describe their motivations for recycling their appliance through the Appliance Recycling Program. Overall, the cash incentive emerged as the most frequently noted motivation across the board. When asked to give their primary motivation for participating in the program, nearly half of participants (47%) named the cash incentive. The convenience of the home pickup came next, at 20 percent of respondents, followed by the fact that the appliance was recycled at 16 percent. Table 3-6 details all respondents' primary motivations to participate.

Table 3-6. Primary Motivations for Participating in AEP Ohio Appliance Recycling Program Over Alternative Disposal Options

Primary Motivation	Frequency	Percent
The cash incentive	176	47.3%
Convenience of home pickup	74	19.9%
Appliance was recycled	60	16.1%
Free pick up	37	9.9%
Did not know of any other way	9	2.4%
Other	5	1%
Recommendation from friend/family	4	1.1%
Needed to get rid of old fridge	4	1.1%
The incentive as well as the convenience	3	0.8%
Total	372	100%

Note: Totals may not sum to 100 percent due to rounding.

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Respondents were also asked if they had had any secondary reasons for participating. Almost half (47%) said they did not have any secondary reasons for participation. An additional 27 percent mentioned the cash incentive, 12 percent mentioned the fact that the appliance was being recycled, and 11 percent mentioned the convenience of the home pickup as secondary motivations to their participation in the program.

To further gauge the impact of the rebate on customers decision to participate in the program, respondents were specifically asked to rate how much the rebate motivated them to participate in the program, on a 1 to 5 scale where 1 means "not at all" and 5 means "very much." Most respondents found the rebate to be highly motivating, with slightly more than three-quarters (77%) rating it a 4 or 5. Sixteen percent rated it a 3, and 6 percent rated it a 1 or 2. The average rating was 4.3.

Enrollment Experience

As part of the participant survey, respondents were asked to explain how they enrolled in the program and what their enrollment experience was like. By and large, participants reported few issues enrolling and were highly satisfied with all aspects.

Participants have several enrollment options available to them, they can: (1) call the customer service phone number, (2) sign up via the AEP Ohio website, or (3) enroll at a participating retailer. When asked how they enrolled in the program, more than half of the respondents reported enrolling by telephone (57%) as shown in Table 3-7. The second most frequent source of program application was online, with a third (33%) of respondents using the website. Eight percent reported enrolling in the program via a retail store, with few respondents (2%) enrolling via the mail.

Table 3-7. Respondent-Reported Method of Program Enrollment

Source of Participant Application	Frequency	Percent
Telephone	179	56.5%
Online	105	33.1%
In-store	26	8.2%
Mail	7	2.2%
Total	317	100.0%

Note. Results are not shown for the twenty respondents who reported "Don't know" to this question.

The evaluation team also examined the program tracking data to assess the how many customers enrolled via the different routes throughout the year. Interestingly, the 8 percent of respondents who reported enrolling in the program in-store is considerably higher than what is documented in the tracking data (1%). Customers who do not enroll in the program in-store still have the option of having their retailer pick up their old appliance, as they can telephone the program's call center to request a retailer pick-up. Respondents were also asked who picked up their appliance – the retailer during a delivery of a new appliance, or the utility. Thirteen percent reported having their appliance picked up by

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a retailer. However, in the tracking data, 5.5 percent were documented as having their appliance picked up by a retailer.

Respondents were asked several questions to further explore their enrollment experience, with questions tailored to the method through which they signed up. Overall, participants reported smooth enrollment processes across all methods. Respondents who signed up via the website reported few issues finding the sign-up screen on the website; 99 percent said it was easy with only one respondent having trouble. Respondents who signed up through a retailer were asked a similar question; whether it was easy for them to sign up for the program in the store. All respondents who signed up via a retailer (100%) said that they found it easy to sign up in-store.

Finally, respondents who signed up via the phone were asked to rate how polite and courteous their representative was, on a scale from 1 to 5 where 1 means “not at all polite or courteous” and 5 means “very polite and courteous.” Nearly all respondents rated their representative a 4 or 5 on the above scale (99%), with an average rating of 4.8.

Most respondents reported being satisfied with their enrollment experience overall, regardless of how they had enrolled in the program. At least three-quarters of respondents from each enrollment channel reported being very satisfied, and overall, 98 percent of respondents were very or somewhat satisfied with the enrollment process. Figure 3-5details customer satisfaction with each enrollment channel. Respondents who enrolled via the program website were the most likely to report being “very satisfied” (91%), followed by those who enrolled by telephone (86%) and in-store (77%). Nearly all of the respondents (6 out of 8) who did not report being either somewhat or very satisfied had enrolled via telephone. Among the 2 percent of respondents who were neutral or not satisfied with their enrollment experience, concerns included:[8]

- Being frustrated with the amount of time spent on the phone in order to get their pickup scheduled (enrolled via telephone, n = 3)
- Being unable to use the preferred method of enrollment, the website, and having to call the program to enroll (enrolled via telephone, n = 1)
- Being upset about speaking with a rude customer service representative (enrolled via telephone, n = 1)

[8] Three of the respondents who reported not being satisfied said that they “didn’t know” why they had given their satisfaction rating.

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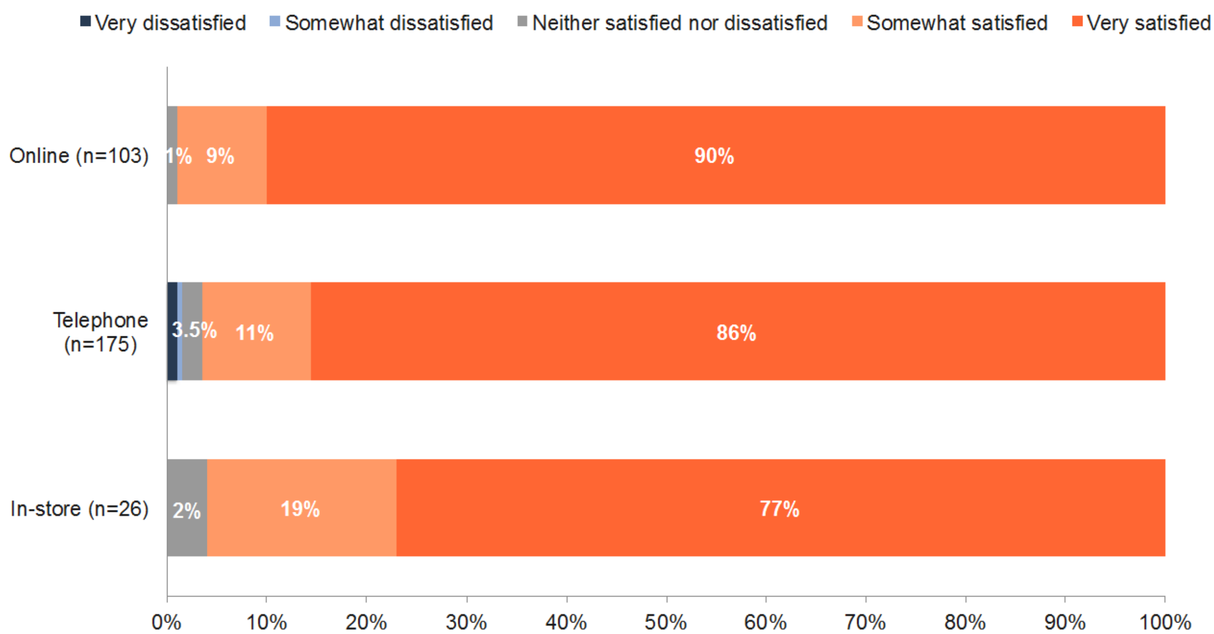
Figure 3-5. Reported Satisfaction with Enrollment Experience



Note. Results are not shown for the four respondents who reported "Don't know" to this question, the seven respondents who reported they signed up via the mail, the twenty-eight respondents who reported a different member of their household enrolled in the program, or the twelve respondents who did not remember how they enrolled in the program.

By and large, respondents had all of their questions answered during the enrollment process. Only four respondents reported having unanswered questions while signing up to participate in the program. The types of unanswered questions included:

- Being unable to find an answer online, and calling AEP Ohio (enrolled via website, n = 1)
- Being unclear on the pickup process (enrolled via website, n = 1)
- The sales associate they enrolled with did not have in-depth knowledge about the program, and that they had to seek other sources of information to answer their questions (enrolled via retailer, n = 2)

Experience Scheduling a Pickup

Respondents were asked about their experience scheduling to have their appliance picked up, as summarized by Table 3-8. Nearly three-quarters (73%) of respondents reported being very satisfied with the amount of time it took between scheduling their appliance pickup and when it was actually picked up by the appliance collection team. A smaller amount of respondents (16%) reported being somewhat satisfied and less than a tenth of respondents (8%) reported being neither satisfied nor dissatisfied. Nearly all respondents (99%) were able to schedule a pickup at time that was convenient for them, and most said their pick-up occurred between 1 and 2 weeks after they called to schedule it (62%). Fifteen percent said it took longer than 3 weeks.

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Table 3-8. Satisfaction with Time it Took Between Scheduling and Pickup

Satisfaction Rating	Frequency	Percent
Very satisfied	272	73.3%
Somewhat satisfied	58	15.6%
Neither satisfied nor dissatisfied	31	8.4%
Somewhat dissatisfied	7	1.9%
Very dissatisfied	3	0.8%
Total	371	100.0%

Note. Results are not shown for the six respondents who reported "Don't know" to this question.

Of the respondents who were neutral or not satisfied with the time it took between scheduling and pickup, most were frustrated by waiting too long to have their appliance picked up. In particular, these respondents noted that once they had made the decision to participate in the program it was frustrating to have to "work around" a non-operational appliance taking up room in their home. Following is the breakdown of reasons for customers' lack of satisfaction:

- Being frustrated with waiting too long for their appliance to be picked up (n=28, 90%)
- Being "misinformed" by a retailer about who would be picking up the appliance (n=1)
- Being inconvenienced by AEP Ohio rescheduling the pickup time (n=1)
- Being inconvenienced by the pickup team requiring respondent to plug appliance in to see if it worked (n=1)

Appliance Collection Process

Generally, respondents were very satisfied with the performance of the appliance collection team, as shown in Table 3-9. A majority of respondents (99%) reported being very satisfied or somewhat satisfied with the appliance collection team. Two of the respondents who did not report being satisfied with the appliance collection team said that the collection team was rude, while one respondent reported that the collection team had scratched their floor when removing their appliance.[9]

[9] One respondent said it did not know why it gave that rating, and another did not give a clear reason why it was not fully satisfied with the appliance collection team.

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Table 3-9. Satisfaction with Appliance Collection Team

Satisfaction Rating	Frequency	Percent
Very satisfied	343	94.0%
Somewhat satisfied	17	4.7%
Neither satisfied nor dissatisfied	4	1.1%
Somewhat dissatisfied	0	0.0%
Very dissatisfied	1	0.3%
Total	365	100.0%

Note. Respondents who reported "Don't know" to this question, the 6 respondents who were not home for the pickup, or for the 1 respondent who refused to answer.
Totals may not sum to 100% due to rounding.

Most respondents reported receiving a call in advance that the appliance pick-up team would be coming (97%). Additionally, nearly all respondents (99%) said that the appliance pick-up team arrived during the scheduled appointment window.

Rebate Timing and Amount

Respondents were asked to report their recollection of the amount of the rebate they received for recycling their appliance through the program. Most said either $50 (67%) or $60 (28%), although a few respondents gave other incentive amounts ranging from $20 to $150. Respondents who reported receiving $60 most frequently participated in the summer months (88% of those who received $60 reported participating in July, August, or September), which generally aligns with when the rebate change occurred. A small number of respondents (10%) reported receiving $60 in January of 2014, although this could be overflow from the $60 incentive that was offered in the fourth quarter of 2013.

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As shown in Table 3-10, most respondents reported being either very satisfied (76%) or somewhat satisfied (22%) with the amount of the incentive they received for recycling their appliance. A slightly higher percentage of respondents who received $60 reported being very satisfied with their rebate amount compared to those who received $50 (81% and 75% respectively), but this difference was not statistically significant. In total, eight respondents reported being neutral or not satisfied with the payment amount. When asked what incentive they would prefer, these respondents reported they would have preferred:[10]

- $100 (n = 4)
- $80 (n = 1)
- $300 (n = 1)

Table 3-10. Satisfaction with the Payment Amount

Satisfaction Rating	Frequency	Percent
Very satisfied	281	76.2%
Somewhat satisfied	80	21.7%
Neither satisfied nor dissatisfied	4	1.1%
Somewhat dissatisfied	2	0.5%
Very dissatisfied	2	0.5%
Total	369	100.0%

Note. Results are not shown for the five respondents who reported "Don't know" to this question and the three respondents who refused to answer.
Totals may not sum to 100% due to rounding.

[10] One respondent said it did not know, and one said he/she would be satisfied with the payment amount if he/she didn't have to move their appliance. This is likely because the respondent had purchased a new refrigerator, and needed to move the old one to another place in their home before it was picked up.

For the most part, respondents were less satisfied with the time it took to receive their rebate than the amount of the rebate. Whereas only 2 percent respondents reported that they were neutral or not satisfied with the payment amount, 12 percent respondents reported being either neutral or dissatisfied with the time it took to receive the rebate, as shown in Table 3-11.

Table 3-11. Satisfaction with the Time to Receive Rebate

Satisfaction Rating	Frequency	Percent
Very satisfied	167	62.1%
Somewhat satisfied	70	26.0%
Neither satisfied nor dissatisfied	26	9.7%
Somewhat dissatisfied	1	0.4%
Very dissatisfied	5	1.9%
Total	269	100.0%

Note. Results are not shown for the five respondents who reported "Don't know" to this question. This question was not asked of the 101 respondents who reported that they did not know how long it took them to receive their rebate.
Totals may not sum to 100% due to rounding.

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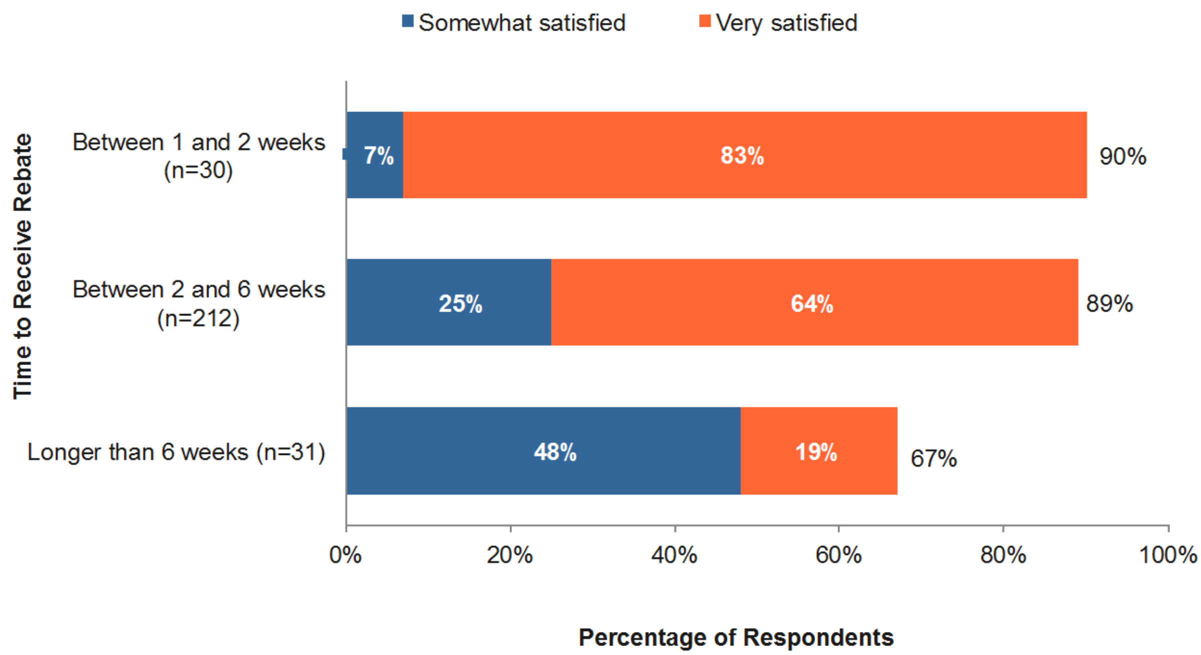
Respondents were asked to clarify how long it took them to receive their rebate. As demonstrated in Figure 3-6, the longer a respondent reported it took to receive their rebate, the less likely it was to report being very satisfied or somewhat satisfied with this aspect of the program. While overall satisfaction levels did not change much for respondents who waited between 1 and 6 weeks for their rebate, satisfaction levels dropped sharply for respondents who had to wait longer than 6 weeks.

Figure 3-6. Percentage of Respondents at Least Somewhat Satisfied with Self-Reported Time to Receive Rebate



Note. The one respondent who reported 1 week or less is not included in the figure.

Interactions with AEP Ohio Staff

When asked if they had contacted AEP Ohio with questions, slightly less than one-fifth (19%) of respondents had. Most had only contacted AEP Ohio once (81%), although 16 percent contacted AEP Ohio two or three times and 3 percent contacted them four or more times. It should be noted that it is unclear whether participants actually spoke with AEP Ohio or are referring to speaking with staff at the implementation contractor call center. Participants who call the program number likely do not realize they are speaking with a subcontractor and assume they are speaking with AEP Ohio directly.

As shown in Table 3-12, most of the respondents who reported communicating with AEP Ohio during the appliance recycling process reported that they were very satisfied (82%) with their communication. Almost a tenth of respondents (8%) reported being somewhat satisfied, while another 8 percent did not report being satisfied when they communicated with AEP Ohio. Of the respondents who were neutral or not satisfied, the types of problems reported included:[11]

- Not receiving either their rebate or a returned call from AEP Ohio (n = 2)
- Speaking with a rude customer service representative they spoke with was rude (n = 1)
- Experiencing a lack of communication between AEP Ohio and the pickup company (n = 1)
- Having to reschedule their original pickup time (n = 1)

Table 3-12. Satisfaction with Communication

Satisfaction Rating	Frequency	Percent
Very satisfied	56	82.4%
Somewhat satisfied	6	8.8%
Neither satisfied nor dissatisfied	3	4.4%
Somewhat dissatisfied	2	2.9%
Very dissatisfied	1	1.5%
Total	68	100.0%

Note. Results are not shown for the one respondent who reported "Don't know" to this question.

Perceived Energy Savings

Slightly more than one-third (36%) of respondents stated that they had noticed energy savings on their bill. Those who recycled a freezer (37%) were equally likely to notice savings as those who recycled a primary refrigerator (35%) or secondary refrigerator (37%).

[11] When the respondents were asked why they provided low satisfaction ratings, one reported that they "didn't know" why they had provided that rating.

As shown in Table 3-13, the majority of the respondents who noticed energy savings were satisfied with the amount of energy savings they saw in their utility bills. Few respondents, only 4 percent, reported not being satisfied with the amount of energy savings they noticed on their bill.

Table 3-13. Satisfaction with Energy Savings

Satisfaction Rating	Frequency	Percent
Very satisfied	74	67.9%
Somewhat satisfied	31	28.4%
Neither satisfied nor dissatisfied	3	2.8%
Somewhat dissatisfied	1	0.9%
Very dissatisfied	0	0.0%
Total	**109**	**100.0%**

Note. The 198 respondents who did not notice energy savings were not asked this question; one respondent reported "Don't know" to this question and is not included in this table.

3.3.3 Overall Satisfaction

Overall, participants are very satisfied with their experience with the Appliance Recycling program. Nearly all respondents (98%) were very or somewhat satisfied with their experience with the program. Regardless of their satisfaction rating, all respondents were asked if they had any suggestions for program improvement. Most said they did not (80%). Of the remaining customers, the most frequent suggestions for improvement included:

- Providing a bigger rebate (n = 11)
- A faster pickup of the appliance (n = 9), faster turnaround on the rebate (n = 6), or both (n = 3)
- More advertising to spread awareness of the program (n=8)

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When asked about their overall level of satisfaction with AEP Ohio as their utility, the majority of respondents reported that they were either very satisfied (57%) or somewhat satisfied (28%), as summarized by Table 3-14. Out of the respondents who did not report being satisfied with AEP Ohio, most reported being neither satisfied nor dissatisfied (11%) rather than somewhat dissatisfied (3%) or very dissatisfied (0.5%).

Table 3-14. Satisfaction with AEP Ohio

Satisfaction Rating	Frequency	Percent
Very satisfied	215	57.0%
Somewhat satisfied	107	28.4%
Neither satisfied nor dissatisfied	41	10.9%
Somewhat dissatisfied	12	3.2%
Very dissatisfied	2	0.5%
Total	377	100.0%

Respondents were asked whether their participation in the Appliance Recycling program changed their opinion about AEP Ohio in general, as summarized by Table 3-15. Just more than half of respondents (53%) reported that it had made them feel more favorable toward AEP Ohio. Meanwhile, most of the remaining respondents (47%) reported that the program had not affected their opinion of AEP Ohio. Very few of the respondents (0.5%) reported that the program had made them feel less favorably towards AEP Ohio.

Table 3-15. Effect of Program Participation on Favorability Toward AEP Ohio

Response	Frequency	Percent
More favorable toward AEP Ohio	195	53.0%
Less favorable toward AEP Ohio	2	0.5%
No difference	171	46.5%
Total	377	100.0%

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3.3.4 Successful Peer Utility Retail Partnership Programs

Through conducting secondary research into appliance recycling programs with retailer partnerships, the evaluation team identified six similar programs, and was able to interview one peer utility program manager and one program evaluator to further probe on insights learned from retail partnerships. Key program characteristics are detailed in Table 3-16.

Table 3-16. Appliance Recycling Programs with Retail Partnerships

Utility	Partners/Implementers	Retailer Enrollment/ Pickup Rate	Customer Incentive	Source of information
SMUD	Partner: Best Buy and Sears. Implementer: JACO and ICF	~40%	$50	Interview with SMUD PM; SMUD website
Southern California Edison (SCE) and Pacific Gas & Electric (PG&E)	Partner: Sears; Implementers: JACO, ARCA, and Enerpath	7% for SCE 16% from PG&E	$50	Publically available evaluation report [(a)]
Puget Sound Energy	Partner: Sears and Lowe's and other local retailers; Implementer: JACO	N/A (new partnerships at time of report)	$25 pre-paid Visa card	Publically available evaluation report [(b)]
Energy Trust of Oregon	Partner: Sears; Implementer: PECI and JACO	9%	$30	Publically available evaluation report [(c)]
ComEd	Partner: One local retailer and four national; Implementer: JACO	N/A	$35	Publically available evaluation report [(d)]
Consumers Energy	Partner: Sears, ABC Warehouse; Implementer: JACO	7%	$50	Interview with program evaluator, EPA presentation, [(e)] Consumers Energy website

a. http://www.calmac.org/publications/SCE_PGE_ARP_Final_Report_Vol.1_09-18-13.pdf; http://www.calmac.org/publications/build10sceretailerfinal1004.pdf
b. http://rtf.nwcouncil.org/subcommittees/fridgerecycle/meetings/PSE%20Ref%20Impact%20Final_WithERR.pdf
c. http://energytrust.org/library/reports/1001_FridgeRecycling_Eval.pdf
d. http://ilsagfiles.org/SAG_files/Evaluation_Documents/ComEd/ComEd%20EPY5%20Evaluation%20Reports/ComEd _FFRR_EMV_Report_PY5_2014-04-15_Final.pdf
e. http://www2.epa.gov/sites/production/files/2014-04/documents/rad_utility-retailer_webinar_26_march_2014_final_508.pdf

Overall, most of the retail partnerships examined through the secondary research were similar in terms of design and marketing to AEP's Ohio's partnerships through the Appliance Recycling Program. The evaluation team was able to conduct an interview with one program staff member and one evaluator representing a successful appliance recycling program retailer partnership, from the Sacramento Municipal Utility District (SMUD) and from Consumers Energy.

One element common to most of the researched programs is retail partnerships with Sears. As of 2010, Sears was the number one retailer of home appliances in the U.S. (according to a 2010 article in This Week

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In Consumer Electronics cited by the Innovologie evaluation of Southern California Edison). AEP Ohio's retailer pickup rate, according to program tracking data, was slightly lower at 5.5 percent than other programs; however, this is a considerable increase from previous years.

AEP Ohio's marketing approach is also relatively similar to other programs with retailer partnerships. As noted in the programs' evaluation report, Southern California Electric (SCE) and Pacific Gas and Electric (PG&E) leveraged their relationships with appliance retailers by providing them with customer-facing marketing materials to distribute; this included appliance clings, pamphlets, point of purchase displays, and posters. The SCE/PG&E evaluation report noted that their retailer marketing and outreach has been an effective outreach mechanism, even though retailers are not incented for providing outreach for the program. In fact, for the 2010-2012 program cycle for PG&E, customer marketing via retailers was the only marketing conducted due to a non-existent marketing budget on the utility side. The Energy Trust of Oregon also offered point-of purchase marketing materials to partnered retailers, along with some training and support documents.

SMUD's marketing efforts through channels like radio and television commercials, email blasts, point-of-purchase materials, and bill inserts are not appreciably different from AEP Ohio's marketing efforts. However, the respondent from SMUD estimated that 40 percent of the appliances recycled through the program came through the retailer enrollment channel, which is considerably higher than other researched programs. While the same contractor implements the program, SMUD also utilizes another subcontractor to provide outreach to retailers and train employees on the Appliance Recycling program. These subcontractors are local to the SMUD territory area, and therefore able to make frequent visits to local retailers. The respondent from SMUD attributed much of the success of the program to both the strong training offered to sales associates, and the success of the marketing materials produced in-house by SMUD.

The program manager at SMUD noted that considerable effort is expended on training sales associates in how to sell and enroll customers in the program. The implementation contractor representative for the program was located in California and was able to frequently visit retail locations and engage sales associates. The respondent from SMUD also noted that the time it took for retail associates to sign up customers was approximately 5 minutes; given that most retail sales associates are paid on commission, limiting the amount of time needed by retail associates to sign up customers may also help encourage enrollment via that channel. AEP Ohio's implementer noted that it takes a retail associate anywhere from 2 to 10 minutes to sign a customer up in store.

While enrollments have historically been low, customer awareness of the program via retailers is higher for AEP Ohio's program than for other researched programs. Interestingly, despite leveraging retailers for marketing purposes, program awareness via retailers for SCE/PG&E was lower (between 17-24%) than for AEP Ohio's customers who reported hearing about the program from a retailer (34%; see Section 3.3.1), although the California utilities' enrollment/pick-up rates are higher. The same was true for the Energy Trust of Oregon, with 26 percent of respondents hearing about the program from retailers. This indicates that while retailers in general are doing a relatively good job educating customers about the AEP Ohio program, the barrier for retailers may be actually signing customers up for the program on-site.

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3.3.5 Cancelled Appointments

As shown in Table 3-17, the overall dropout rate for the 2013 program year was 12 percent, which is very similar to the dropout rate in 2013 (11%). Of all the customers who enrolled in the program at some point, 88 percent eventually participated in the program. This table shows that there were 3,907 customers who cancelled an appointment with the Appliance Recycling Program at some point. Of these, 44 percent (*n* = 1,715) eventually participated in the program, while the remaining 56 percent (*n* = 2,192) ultimately did not participate in the program. Most of those who cancelled only did so once (88%). These findings are nearly identical to the cancellation rates from the 2013 analysis.

Table 3-17. Participation and Dropout After Initial Enrollment in the Program

Behavior After Initial Enrollment	Number of Customers	Percent of Customers
Kept Original Appointment and Never Cancelled	14,703	79.0%
Cancelled At Least Once And Eventually Participated	1,715	9.2%
Cancelled At Least Once And Never Participated (e.g., “Near-Participants” or “Dropouts”)	2,192	11.8%
Total Number of Customers Who Initially Enrolled in the Program	18,610	100.0%

Note. Customers that had valid data populated in the “ClientCoPremiseID” field were included in this analysis (necessary in order to match cancellation data to tracking data).

3.3.6 Current Program Challenges

Interviews with program staff identified two key challenges facing the program: (1) declining energy savings per unit as unit age decreases over time, and (2) uncertainty over remaining supply. While the program currently uses the deemed savings value determined in the Ohio TRM, this estimate is now several years old and likely overstated given the trend towards a younger population of recycled appliances. Should the Ohio TRM be updated to more closely align with the current population of recycled appliances, the deemed savings available for each appliance will drop, which may make it more difficult for the program to maintain cost effectiveness and meet energy savings goals.

From a long-term perspective, average unit age will decline as customers recycle newer appliances, which have lower consumption than older appliances and therefore lower energy savings when recycled. There is also uncertainty as to the remaining number of recyclable appliances, which may necessitate higher incentives. Program staff noted that they are currently taking steps to address these challenges, including considering varying the incentive based on the age of the appliance, and focusing marketing to target older units.

The program has continued to explore additional retail partnerships, although AEP Ohio described difficulty enrolling any additional retailers. The program did substantially increase pick-ups from retail in-store sources, however, approximately doubling in percentage from 2013. This increase came despite the fact that incentives provided to sales associates in 2013 were not offered again in 2014. One program manager thought the challenge of generating significant retail leads is related to the time constraints of

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sales associates, who are paid by commission and do not want to spend extra time signing up customers for the program.

3.3.7 Tracking Data Review

The evaluation team reviewed the program tracking data to identify characteristics of appliances recycled in 2014 and inform the process and impact evaluation. After review, minor adjustments were made to these data:

- The vintage of one refrigerator was not reported in the data. As this field was used for the impact savings market research, the evaluation team assumed an average vintage (1997) for this appliance.

3.4 *Cost Effectiveness Review*

This section addresses the cost effectiveness of the Appliance Recycling Program. Cost effectiveness is assessed through the use of the Total Resource Cost (TRC) test. Table 3-18 summarizes the unique inputs used in the TRC test. Based on these inputs, the TRC ratio is 2.9. Therefore, the program passes the TRC test.

Table 3-18. Inputs to Cost-Effectiveness Model for Appliance Recycling Program

Item	Value
Average Measure Life	8
Units	17,734
Annual Energy Savings (kWh)	23,973,295
Coincident Peak Savings (kW)	3,836
Third Party Implementation Costs	$830,469
Utility Administration Costs	$59,059
Utility Incentive Costs	$2,135,963
Participant Contribution to Incremental Measure Costs	0

Table 3-19 summarizes the results of the cost-effectiveness tests. Results are presented for the Total Resource Cost test, the Participant test, the Ratepayer Impact Measure Test, and the Utility Cost Test.

Table 3-19. Cost Effectiveness Results for the Appliance Recycling Program

Test Results for Appliance Recycling	Value
Total Resource Cost	2.9
Participant Cost Test	N/A
Ratepayer Impact Measure	0.4
Utility Cost Test	2.9

At this time, additional benefits related to reduction of greenhouse gas emissions have not been quantified in the calculation of the TRC. These additional benefits would increase the given TRC benefit/cost ratio.

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4 Conclusions and Recommendations

4.1 Conclusions from Program Year 2014

The 2014 Appliance Recycling Program evaluation resulted in five primary conclusions:

1. ***Ex post* savings matched program *ex ante* values based on the Ohio TRM.** No issues surfaced in the review of savings calculations, which resulted in a realization rate of 1.00 for both energy and demand savings.

2. **The average age of recycled refrigerators (16.7 years) and freezers (19.9 years) continues to decrease.** The population of appliances currently being recycled is moving farther from the Ohio TRM assumptions, which assume the average age of recycled appliances is greater than 20 years.

3. **Overall, the Appliance Recycling Program is running very smoothly.** The program has not undertaken any significant changes since 2013, and customers continue to be highly satisfied.

4. **The program tracking data and the participant survey data do not align for the primary vs. secondary parameter.** While the data collection protocols used during the appliance pick-up appear to be sound (staff are directed to gather historical appliance use to determine whether it was primary or secondary), the participant survey found more than double the percentage of primary recycled refrigerators than is currently documented in the tracking database. One quarter of 2014 refrigerators were marked as primary in the tracking data, while 61 percent of participant survey respondents said the recycled refrigerator was their primary unit. While the evaluation team did not speak directly with pick-up staff for the 2014 evaluation, one possible reason for this may be inconsistent application of the data collection protocols by appliance pick-up staff while on-site.

5. **In spite of some remaining challenges with the retail partnerships, pickups via retailers increased considerably in 2014.** While in-store enrollments continue to represent a small portion of total enrollments (~1%), pickups via retailers increased to nearly 6 percent in 2014, according to program tracking data.[12] Additionally, more than a third of survey respondents had heard of the program at a retailer, and half of those heard from partnered retailers. This indicates that retailers are doing a good job educating customers on the program, even if retailers are not enrolling customers in-store.

[12] Participants have two enrollment options to have their appliance picked up by a retailer: in-store enrollment or enrolling for retailer pickup via the implementation contractor's call center.

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4.2 *Recommendations for Program Improvements*

The 2014 evaluation resulted in three main recommendations:

1. **Identify reasons preventing retail associates from effectively enrolling customers in-store.** As identified in the secondary research with peer utility programs, retailers can be an effective outreach arm and sign-up method; however, in-store enrollment for the AEP Ohio program is low. Outreach to retailers from AEP Ohio program staff may shed some light on why few participants are enrolled in-store, despite an increase in the number of pickups from retailers.

2. **Ensure pick-up staff are consistently following data collection protocols when identifying whether a refrigerator is primary or secondary.** While the evaluation team did not interview pick-up staff in 2014, in the 2011 Appliance Recycling Program Evaluation Report it was identified that pick-up staff did not always consistently ask these questions of participants. However, while the survey questions are relatively similar to the questions asked by the program pick-up staff, future evaluations should more closely aligning the questions asked in surveys to the data collection protocols used on-site, to limit any difference in data collection methods that could be affecting these numbers. The consistency with which pickup staff gather this information should also be reviewed.

3. **Given the trend towards a younger population of appliances being recycled, develop a mitigation strategy should the Ohio TRM be updated in the future.** While this is not currently an issue for the program, should the TRM be updated to be more in-line with the observed program population (younger appliances, which provide lower energy savings), the program may need to adapt its approach in order to maintain cost effectiveness and meet energy savings goals. Examples of marketing strategies include specifically target older appliances, or offering higher incentives to collect more appliances.

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Appendix A Survey Instruments

Appendix A contains the survey instrument used to collect data for the participant survey, as well as findings from the general population survey conducted for the Efficient Products program that relate to the Appliance Recycling program.

A.1 Survey Instrument

A0. Is your electric company AEP Ohio or another company? **[DO NOT READ LIST]**
1. AEP Ohio
2. Ohio Power (OP)
3. Columbus Southern Power (CSP)
97. Another company (Specify)
98. Don't Know
99. Refused **[TERMINATE]**

A1. Our records show that you had had a refrigerator or freezer picked up for recycling through AEP's appliance recycling program. Is this correct?
1. Yes
2. No **[RECORD VERBATIM, TERMINATE]**
8. Don't Know **[TERMINATE]**
9. Refused **[TERMINATE]**

A2. Was the appliance that was picked up a refrigerator or a freezer?
1. Refrigerator or combination refrigerator/freezer
2. Freezer only
8. Don't Know **[TERMINATE]**
9. Refused **[TERMINATE]**

A3. Was the **[IF A2=1 "refrigerator", IF A2=2 "freezer"]** that was picked up used at your primary residence?
1. Yes
2. No **[RECORD VERBATIM; TERMINATE]**
8. Don't Know **[TERMINATE]**
9. Refused **[TERMINATE]**

A4 Was your appliance picked up by a retailer during delivery of a new **[IF A2=1 "refrigerator", IF A2=2 "freezer"]**?
1. Yes **[CONFIRM PICK-UP BY RETAILER PARTNER]**
2. No **[CONFIRM PICK-UP BY AEP'S APPLIANCE REYCLING CONTRACTOR]**
97. Other (SPECIFY)
8. Don't know

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9. Refused

[IF A2=1]

A5. Was the refrigerator that was picked up the only refrigerator in the home?
1. Yes **[SKIP TO B1]**
2. No
8. Don't Know
9. Refused

A6. **[IF A2=1]** Was the appliance that was picked up the *primary* refrigerator in the home?
[IF NEEDED:] The primary refrigerator is the one used most frequently by the household, and typically located in the kitchen. Would you describe the refrigerator that was picked up as the *primary* refrigerator?
1. Yes **[SKIP TO B1]**
2. No
8. Don't Know
9. Refused

A7. **[IF A2=1]** In what location did the refrigerator operate before it was removed by AEP Ohio?
[CLARIFICATION: If they moved the refrigerator while they waited to have it picked up, we are interested in where it was located before they decided to have it removed, not where it was located while they were waiting for it be picked up.]
[DO NOT READ LIST; RECORD ONLY ONE RESPONSE]
1. Kitchen
2. Garage
3. Porch/Patio
4. Basement
77. Other **[SPECIFY]**
8. Don't Know
9. Refused

A8. What was the condition of the **[IF A2=1 "refrigerator", IF A2=2 "freezer"]**? Would you say …
[READ RESPONSE LIST; RECORD ONLY ONE RESPONSE]
1. It effectively cooled its contents and was in good physical condition,
2. It effectively cooled its contents but needed minor repairs like a door seal or handle,
3. It partially cooled its contents but had some bigger problems, or
4. It did not cool its contents effectively, but it did turn on
5. It did not turn on
8. Don't know **[DO NOT READ]**
9. Refused **[DO NOT READ]**

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Section B: Process Questions

B1. Next I have some questions about your experiences with the AEP Ohio Appliance Recycling Program.

How did you first learn about the Appliance Recycling Program? **[DO NOT READ LIST; RECORD ONLY ONE RESPONSE]**
1. Bill insert
2. TV ad
3. Friend/relative/neighbor
4. AEP Ohio website
5. Newspaper
6. Community event
7. From a store sales associate where you bought a new appliance, e.g. Sears **[SPECIFY RETAILER]**
8. Store Postings advertising the Appliance Recycling Program **[SPECIFY RETAILER]**
97. Other **[SPECIFY]**
98. Don't know
99. Refused

IF B1=98,99 SKIP TO B3

B2. Since you first learned about the program, please indicate if you have heard about the program from any of the following sources. **[READ RESPONSE LIST; DO NOT READ RESPONSE SELECTED IN B1 ALLOW FOR MULTIPLE RESPONSES]**

		Yes	No	Don't know	Refused
B2a.	Bill insert	1	2	-8	-9
B2b.	TV ad	1	2	-8	-9
B2c.	Friend/relative/neighbor	1	2	-8	-9
B2d.	AEP Ohio website	1	2	-8	-9
B2e.	Newspaper	1	2	-8	-9
B2f.	Community event	1	2	-8	-9
B2g.	From a store sales associate where you bought a new appliance **[SPECIFY RETAILER]**	1	2	-8	-9
B2h.	Store Postings advertising the Appliance Recycling Program **[SPECIFY RETAILER]**	1	2	-8	-9
B2i.	Any other way? **[SPECIFY]**	1	2	-8	-9

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B3. There are a number of ways you could have disposed of your appliance(s). What is the MAIN reason you chose the AEP Ohio Appliance Recycling Program instead of some other way? **[DO NOT READ RESPONSE LIST]**
1. The cash incentive
2. The convenience of the home pick-up/Don't have to take it someplace myself
3. Pick up was free
4. Appliance was recycled/Was disposed of in a way that was good for environment
5. Was recommended by friend/family
6. Was recommended by retailer
7. Did not know of any other way/No other option
97. Other (Specify)
98. Don't know
99. Refused

B4. Were there any other reasons? **[DO NOT READ RESPONSE LIST; DO NOT SHOW ANSWER SELECTED IN B3; ALLOW FOR MULTIPLE RESPONSES]**
1. The cash incentive/incentive check
2. The convenience of the home pick-up/Don't have to take it someplace myself
3. Pick up was free
4. Appliance was recycled/Was disposed of in a way that was good for environment
5. Was recommended by friend/family
6. Was recommended by retailer
7. Did not know of any other way/No other option
97. Other (Specify)
96. No other reason
98. Don't know
99. Refused

B4b. On a scale of 1 to 5, where 1 is "not at all" and 5 is "very much", how much did the rebate motivate you to participate in the Appliance Recycling program?
1. 1 (Not at all)
2. 2
3. 3
4. 4
5. 5 (Very much)
8. Don't know
9. Refused

B5. Are you the one that signed up for the program, or did someone else in your household sign up?
1. I signed up
2. Someone else signed up **[SKIP TO F3]**
8. Don't know **[SKIP TO F3]**
9. Refused **[SKIP TO F3]**

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B6. Did you sign up on the phone, online, or in-store? **[NOTE: IF AN "OTHER" TYPE RESPONSE CAN BE PLACED INTO EITHER 1 OR 2, DO SO AND PROCEED ACCORDINGLY]**
1. Telephone **[SKIP TO D1]**
2. Online
3. In-store **[SKIP TO E1]**
97. Other **[SPECIFY; SKIP TO F1]**
98. Don't know **[SKIP TO F1]**
99. Refused **[SKIP TO F1]**

Section C: Online Sign-up Battery

[IF B6=2]

C1. Was it easy to find the sign up screen on the website?
1. Yes
2. No
8. Don't know
9. Refused

C2. Did the website answer all your questions about the program?
1. Yes
2. No **[PROBE AND CLARIFY: Which questions did you have that were unanswered?]**
3. Not applicable
8. Don't know
9. Refused

C3. Did you receive confirmation that your sign up had been successful?
1. Yes
2. No
3. Not applicable
8. Don't know
9. Refused

[SKIP TO F1]

Section D: Phone Sign-up Battery

[IF B6=1]

D1. On a scale of 1 to 5, where 1 is "not at all" and 5 is "very much", how would you rate the phone representative in terms of being polite and courteous?
1. 1 (Not at all polite/courteous)
2. 2

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3. 3
4. 4
5. 5 (Very polite/courteous)
8. Don't know
9. Refused

D2. Did the representative answer all your questions about the program?
1. Yes **[SKIP TO F1]**
2. No **[PROBE AND CLARIFY: Which questions did you have that were unanswered? SKIP TO F1]**
6. Not applicable
8. Don't know
9. Refused

[SKIP TO F1]

Section E: In-store Sign-up Battery

[IF B6=3]
E1. Was it easy to sign up in the store while ordering your appliance?
1. Yes
2. No
8. Don't know
9. Refused

E2. Did the sales staff answer all your questions about the program?
1. Yes
2. No **[PROBE AND CLARIFY: Which questions did you have that were unanswered?]**
6. Not applicable
8. Don't know
9. Refused

Section F: Participant Satisfaction

F1. On a scale of 1 to 5, where 1 is "very dissatisfied" and 5 is "very satisfied," how satisfied were you with the sign-up experience?
5. Very satisfied) **[SKIP TO F3]**
4. Somewhat satisfied **[SKIP TO F3]**
3. Neither satisfied nor dissatisfied
2. Somewhat satisfied
1. Very dissatisfied
8. Don't Know **[SKIP TO F3]**
9. Refused **[SKIP TO F3]**

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F2. **[ASK IF F1 < 4]** Why did you rate it that way? **[PROBE TO CLARIFY]**
1. (Enter Verbatim Response)
8. Don't know
9. Refused

F3. Were you able to schedule a pick-up date and time that was convenient for you?
1. Yes
2. No
8. Don't know
9. Refused

F4. How much time passed between when you scheduled the appointment and when your appliance(s) was/were picked up? **[NOTE TO INTERVIEWER: IF RESPONDENT SAYS "ABOUT A WEEK", RECORD AS 1 WEEK, ETC.]**
(Numeric open end) **[ENTER DAYS OR WEEKS]**
98. Don't know
99. Refused

F5. On a scale of 1 to 5 were 1 is "very dissatisfied" and 5 is "very satisfied," how satisfied are you with the time it took between when you scheduled the appliance pickup and when it was actually picked up?
5. Very satisfied **[SKIP TO F6]**
4. Somewhat satisfied **[SKIP TO F6]**
3. Neither satisfied nor dissatisfied
2. Somewhat dissatisfied
1. Very dissatisfied
8. Don't Know **[SKIP TO F6]**
9. Refused **[SKIP TO F6]**

F5b. **[ASK IF F5 < 4]** Why did you rate it that way?
1. (Enter verbatim response)
8. Don't know
9. Refused

F6. Just before the pick-up took place, did you or anyone in your household receive a call in advance to confirm the appointment or to let you know the collection team was coming?
1. Yes
2. No
6. Not applicable
8. Don't know
9. Refused

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F7. Did the collection team arrive during the scheduled appointment window?
1. Yes
2. No
6. Not applicable
8. Don't know
9. Refused

F8. On a scale of 1 to 5 were 1 is "very dissatisfied" and 5 is "very satisfied," how satisfied were you with the collection team who picked up your appliance(s)?
5. Very satisfied **[SKIP TO F10]**
4. Somewhat satisfied **[SKIP TO F10]**
3. Neither satisfied nor dissatisfied
2. Somewhat dissatisfied
1. Very dissatisfied
6. (Wasn't at home) **[SKIP TO F10]**
98. Don't Know **[SKIP TO F10]**
99. Refused **[SKIP TO F10]**

F9. **[ASK IF F8 < 4]** Why did you rate it that way?
[RECORD OPEN END]
8. Don't know
9. Refused

F10. How much was the payment that AEP Ohio offered for recycling your appliance? If you recycled more than one appliance, we are interested in knowing the amount of the payment you received (or will receive) for the single appliance we've been discussing today. **[DO NOT READ RESPONSE LIST.]**
1. $35
2. $50
97. Other (Specify)
98. Don't know
99. Refused

F11. How satisfied were you with the payment amount? Would you say you were: **[READ LIST]**
5. Very satisfied **[SKIP TO F12]**
4. Somewhat satisfied **[SKIP TO F12]**
3. Neither satisfied nor dissatisfied
2. Somewhat dissatisfied
1. Very dissatisfied
8. Don't Know **[SKIP TO F12]**
9. Refused **[SKIP TO F12]**

F11b. **[ASK IF F11 < 4]** What size payment would you have been satisfied with? **[PROBE TO CLARIFY]**

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\## **[OPEN-ENDED – $0 - $100, code in $5 increments]**
97. Other (Specify)
98. Don't Know
99. Refused

F12. From the time you had your appliance picked up, about how many weeks did it take to receive your rebate? **[DO NOT READ RESPONSE LIST]**
1. 1 week or less
2. More than one week to 2 weeks
3. More than 2 weeks to 3 weeks
4. More than 3 weeks to 4 weeks
5. More than 4 weeks to 5 weeks
6. More than 5 weeks to 6 weeks
7. More than 6 weeks to 7 weeks
8. Longer than 7 weeks (Specify)
9. Have not received my check yet (Specify how long they have been waiting) **[SKIP TO F15a]**
98. Don't Know **[SKIP TO F15A]**
99. Refused **[SKIP TO F15A]**

F13. How satisfied were you with how long it took to receive the payment? Would you say you were: **[READ LIST]**
5. Very satisfied **[SKIP TO F15A]**
4. Somewhat satisfied **[SKIP TO F15A]**
3. Neither satisfied nor dissatisfied
2. Somewhat dissatisfied
1. Very dissatisfied
8. Don't Know **[SKIP TO F15A]**
9. Refused **[SKIP TO F15A]**

F14. **[ASK IF F13 < 4]** What amount of time would be reasonable to receive the payment? **[PROBE TO CLARIFY; RECORD OPEN END DAYS AND WEEKS]**
98. Don't Know
99. Refused

F15a. In the course of participating in the AEP Ohio program, how often did you contact AEP Ohio or program staff with questions? **[CLARIFY IF NEEDED: THIS WOULD HAVE BEEN <u>AFTER</u> THE INITIAL SCHEDULING CALL]**
6. Never **[SKIP TO F16A]**
2. Once
3. 2 or 3 times
4. 4 times or more
8. Don't Know **[SKIP TO F16A]**
9. Refused **[SKIP TO F16A]**

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F15b. How did you contact them? **[ALLOW MULTIPLE RESPONSES]**
1. Phone
2. Email of fax
3. Letter
4. In person
8. Don't Know
9. Refused

F15c. And how satisfied are you with your communications with AEP Ohio and program staff? Would you say you were: **[READ LIST]**
5. Very satisfied **[SKIP TO F16A]**
4. Somewhat satisfied **[SKIP TO F16A]**
3. Neither satisfied nor dissatisfied
2. Somewhat dissatisfied
1. Very dissatisfied
8. Don't Know **[SKIP TO F16A]**
9. Refused **[SKIP TO F16A]**

F15d. **[ASK IF ~~G28c~~ Q15C< 4]** Why did you rate it that way?
97. (Enter verbatim response)
98. Don't Know
99. Refused

F16a. Have you noticed any savings on your electric bill since removing your old **[IF STRATA 1 OR 3: refrigerator / IF STRATA 2: freezer]**?
1. Yes
2. No **[SKIP TO F17]**
8. Don't Know **[SKIP TO F17]**
9. Refused **[SKIP TO F17]**

F16b. How satisfied are you with any savings you noticed on your electric bill since removing your old **[IF STRATA 1 OR 3: refrigerator / IF STRATA 2: freezer]**? Would you say you were: **[READ LIST]**
5. Very satisfied
4. Somewhat satisfied
3. Neither satisfied nor dissatisfied
2. Somewhat dissatisfied
1. Very dissatisfied
8. Don't Know
9. Refused

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F17. If you were rating your overall satisfaction with the AEP Ohio Appliance Recycling Program, would you say you were: **[READ LIST]**
5. Very satisfied
4. Somewhat satisfied
3. Neither satisfied nor dissatisfied
2. Somewhat dissatisfied
1. Very dissatisfied
8. Don't Know **[SKIP TO F18]**
9. Refused **[SKIP TO F18]**

F17b. Why do you give it that rating?
97. (Enter verbatim response)
98. Don't Know
99. Refused

F18. Do you have any suggestions to improve the program?
97. (Enter verbatim response)
98. Don't Know
99. Refused

F19a. Based on your overall experience with AEP Ohio's service, how satisfied are you with having them as your electric company? Would you say you are: **[READ LIST]**
5. Very satisfied
4. Somewhat satisfied
3. Neither satisfied nor dissatisfied
2. Somewhat dissatisfied
1. Very dissatisfied

F19b. **[ASK IF F19a < 4]** Why did you rate it that way? **[PROBE FOR CLARITY AND SPECIFICITY IF NEEDED:** ***Was there something in particular you had in mind when you chose a rating of [RATING]?*****]**
97. (Record verbatim response)
98. Don't Know
99. Refused

F20. Would you say participating in this program has made you feel more favorable, less favorable, or no different about AEP Ohio?
1. More favorable about AEP Ohio
2. Less favorable about AEP Ohio
3. No different about AEP Ohio
8. Don't Know
9. Refused

F21. For how many years have you been an AEP Ohio customer at any location?

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(NUMERIC OPEN END)
00. Less than one year
98. Don't Know
99. Refused

Section G: Demographics

G1. ***I have just a few questions left for background purposes only.***

Which of the following best describes your home/residence? **[READ LIST]**
1. Single-family home, detached construction (Not a duplex, townhome, or apartment; attached garage is OK)
2. Factory manufactured/modular (Single family home),
3. Mobile home (Single family),
4. Row house
5. Two or Three family attached residence
6. Apartment (4 + families)
7. Condominium
97. Other (Specify)
98. Refused
99. Don't Know

G1b. Do you own or rent this residence?
1. Own **[SKIP TO G3]**
2. Rent
8. Don't Know **[SKIP TO G3]**
9. Refused **[SKIP TO G3]**

G2. Do you pay your own electric bill or is it included in your rent?
1. Pay bill
2. Included in Rent
8. Don't Know **[DO NOT READ]**
9. Refused **[DO NOT READ]**

G3. Approximately when was your home constructed? [**DO NOT READ]**
1. Before 1960
2. 1960-1969
3. 1970-1979
4. 1980-1989
5. 1990-1999
6. 2000-2005
7. 2006 or later
98. Don't Know
99. Refused

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G4. Approximately how many square feet is your residence? RANGE – 1 to 50,000
(Numeric open end)
99998. Don't Know
99999. Refused

G5a. **[ASK IF G1=1]** How many square feet is the <u>above-ground</u> living space [IF NECESSARY: This excludes basements]? RANGE – 1 to 50,000
(Numeric open end) **[SKIP TO G6A]**
99998. Don't Know
99999. Refused **[SKIP TO G6A]**

G5b. **[IF G5A=99998]** Would you estimate the <u>above-ground</u> living space is about: **[READ LIST]**
1. Less than 1,000 sqft
2. Between 1,001 and 2,000 sqft
3. Between 2,001 and 3,000 sqft
4. Between 3,001 and 4,000 sqft
5. Between 4,001 and 5,000 sqft
6. Greater than 5,000 sqft
7. Other (SPECIFY)
98. Don't Know
99. Refused

G6a. **[ASK IF G1=1]** Does your home have a basement?
1. Yes
2. No
97. Other (SPECIFY)
98. Don't Know
99. Refused

G6b. **[ASK IF G6A=1]** How many square-feet is your basement? [IF NEEDED] Would you estimate that it is about: **[READ LIST]**
1. Less than 1,000 sqft
2. Between 1,001 and 2,000 sqft
3. Between 2,001 and 3,000 sqft
4. Between 3,001 and 4,000 sqft
5. Between 4,001 and 5,000 sqft
6. Greater than 5,000 sqft
97. Other (SPECIFY)
98. Don't Know
99. Refused

END. Those are all the questions I have. Thank you so much for your participation!

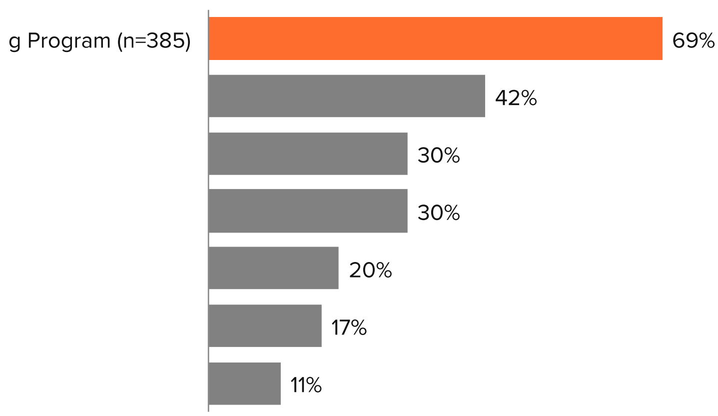
A.2 General Population Survey Findings

A general population survey was conducted as part of the Efficient Products Program evaluation, and the survey included some questions about awareness and participation in the Appliance Recycling Program. Following are the Appliance Recycling Program findings stemming from this survey.

General Population Awareness of Program Incentives

Respondents to the residential general population survey were asked to report their awareness of residential incentives available to AEP Ohio customers. Every respondent was asked about their awareness of the Appliance Recycling Program to assess the effectiveness of AEP Ohio's targeted marketing efforts. In addition, respondents were asked about their awareness of two of the remaining six programs. Figure A-1 shows customer awareness of each of the residential efficiency programs. Customers were most aware of the Appliance Recycling Program, with more than two-thirds of the customers responding that they were either "somewhat familiar" or "very familiar" with the program.

Figure A-1. General Population Awareness of Rebate Programs



Note. Percentages include customers who were "somewhat familiar" or "very familiar" with each program. Each customer was asked about the Appliance Recycling Program, and then was randomly assigned questions about two of the remaining six programs.

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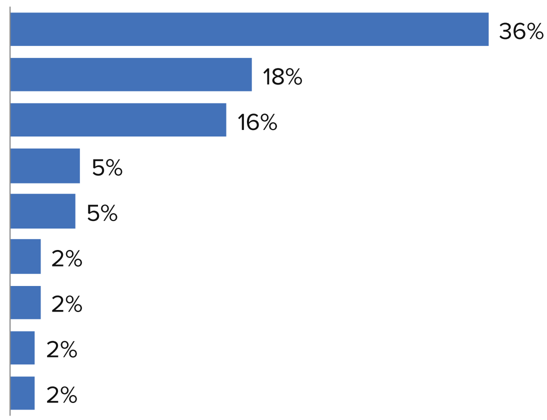
Customers who had heard of the Appliance Recycling Program were then asked how they first heard of the program. Responses to this question are shown in Figure A-2. Customers most frequently heard of the program through bill inserts. Customers also cited word of mouth and television advertisements as the main sources of awareness.

Figure A-2. General Population Awareness Method for Appliance Recycling Program (n = 265).

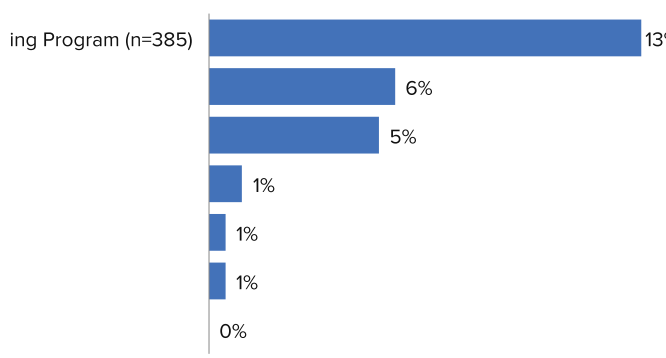


Note. This graph only contains the top nine responses.

General Population Participation in Rebate Programs

Respondents to the residential general population survey were also asked about their participation in any of AEP Ohio's residential energy efficiency programs. The responses for this question are presented in Figure A-3. The Appliance Recycling Program had the highest percent of respondents who had participated in the program. The next highest participation rates were for the In-home Energy Program and the appliance rebates component of the Efficient Products Program.

Figure A-3. General Population Participation in Rebate Programs



Note. Customers were only asked this question if they reported that they were aware of the program. Customers who had not heard of the program were counted as non-participants.

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Participants who had not participated in an AEP Ohio energy efficiency program were asked about their interest in participating in these programs. Of those who had heard of the programs but had not participated, the following percent of customers were interested in participating:

- 65% - Efficient Products appliance rebates (out of 48)
- 57% - Appliance Recycling Program (out of 214)
- 56% - ENERGY STAR New Homes Program (out of 32)
- 37% - In-home Energy Program (out of 70)

Customers who were aware of the programs but had not participated in them were also asked about the reasons they decided not to participate. Most commonly, customers had not participated in the Appliance Recycling Program because they were not disposing of appliances. These responses included that their existing equipment still works (32%), they don't need the program equipment (21%), or that they don't have an extra appliance to recycle (20%). Another 10 percent of customers had not participated because they rent their apartment and their landlord takes care of the appliances.

APPENDIX D

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e^3*smart*^{SM} Program

2014 Evaluation Report

Prepared for:
AEP Ohio

AEP OHIO®
A unit of American Electric Power

May 2, 2015

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Table of Contents

Executive Summary 1

ES.1 Program Summary 1
ES.2 Key Impact Evaluation Findings and Recommendations 2
ES.3 Key Process Evaluation Findings and Recommendations 3

1. Program Description 5

1.1. Program Overview and Description 5
1.2. Evaluation Objectives 6

2. Evaluation Methods 7

2.1 Overview of Approach 7
2.2 Tracking System Review 8
2.3 Engineering Algorithm Review 8
2.4 Ex Post Savings Evaluation Methods 8
2.5 Teacher Interviews 9
2.6 Program Material Review 9

3. Program Level Results 10

3.1 Impact Evaluation Results 10
3.1.1 Program Impact Results 10
3.1.2 Measure Installation Rates 12
3.1.3 Tracking System Review 13
3.1.4 *Ex Post* Savings Evaluation (Algorithm Review) 13
3.1.5 Compact Fluorescent Lamps 14
3.1.6 Energy and Demand Savings Calculations for Low-Flow Showerheads 16
3.1.7 Energy and Demand Savings Calculations for Faucet Aerators 16
3.1.8 Weather Stripping 18
3.1.9 Door Sweep 21
3.1.10 Lower Hot Water Heater Temperature 23
3.2 Process Evaluation Results 25
3.2.1 Survey Installation Return Rates 25
3.2.2 Participant Satisfaction 27
3.2.3 Educational Impact and Raising Energy Efficiency Awareness 27
3.2.4 Community Outreach 27
3.2.5 Program Marketing and Channeling to Other Programs 28
3.2.6 Teacher Stipend 28
3.3 Cost-Effectiveness Review 29

4. Conclusions and Recommendations 30

4.1 Key Evaluation Impact Findings and Recommendations 30
4.2 Key Process Evaluation Findings and Recommendations 31

Appendix A. 2013–2014 School Year Online Student Survey 33

Appendix B. Appendix B. *e³smart℠* Teacher Evaluation Form... 36

Appendix C. *e³smart* Lesson Plan Alignment with Teaching Standards....................... 38

Appendix D. Media Outreach Press Release and Superintendent Letter...................... 42

D.1 Press Release for AEP Ohio e3smart℠ Program—For Use by Teachers in AEP Ohio Schools... 42
43
D.2 Superintendent Congratulation Letter.. 43

Appendix E. Information in the Energy Efficiency Kits about AEP Ohio's Energy Efficiency/Peak Demand Reduction (EE/PDR) Programs... 44

List of Tables

Table ES-1. 2013-2014 Overall Evaluation Results 2
Table 2-1. Summary of Data Collection Activities 8
Table 3-1. Energy Savings Estimates 11
Table 3-2. Demand Savings Estimates 12
Table 3-3. *Ex Post* Number of Measures Installed, 2013–2014 School Year 13
Table 3-4. Key Parameters for CFLs 14
Table 3-5. Draft 2010 Ohio TRM-Specified Values for the Delta Watts Multiplier for CFLs 15
Table 3-6. CFL Algorithm Review Findings 15
Table 3-7. Key Parameters for Low-Flow Showerheads 16
Table 3-8. Low-Flow Showerhead Algorithm Review Findings 16
Table 3-9. Key Parameters for Faucet Aerators 17
Table 3-10. Bathroom Aerator Algorithm Review Findings 17
Table 3-11. Kitchen Aerator Algorithm Review Findings 18
Table 3-12. Key Parameters for Weather Stripping Energy Savings 19
Table 3-13. Key Parameters for Weather Stripping Demand Savings 20
Table 3-14. Total Savings for Weather Stripping 20
Table 3-15. Key Parameters for Door Sweep Energy Savings 22
Table 3-16. Key Parameters for Door Sweep Demand Savings 23
Table 3-17. Total Savings for Door Sweep 23
Table 3-18. Key Parameters for Lower Hot Water Heater Temperature Savings 23
Table 3-19. Total Savings for Lower Hot Water Heater Temperature 24
Table 3-20. Teacher Survey: Comparison of Teachers with Low and High Student Installation Return Rates 26
Table 3-21. Mean Satisfaction Scores, Implementation Contractor Survey 27
Table 3-22. Inputs to Cost-Effectiveness Model for *e3smart* Energy Program 29
Table 3-23. Cost Effectiveness Results for the *e3smart* Program 29
Table 4-1. 2013-2014 Overall Evaluation Results 30

List of Equations

Equation 3-1. Engineering Calculation for Energy Savings for CFLs 14
Equation 3-2. Engineering Calculation for Demand Savings for CFLs 14
Equation 3-3. Draft 2010 Ohio TRM-Specified Energy Savings for CFLs 15
Equation 3-4. Draft 2010 Ohio TRM-Specified Demand Savings for CFLs 15
Equation 3-5. Draft 2010 Ohio TRM-Specified Energy Savings for Low-Flow Showerheads 16
Equation 3-6. Draft 2010 Ohio TRM-Specified Demand Savings for Low-Flow Showerhead 16
Equation 3-7. Draft 2010 Ohio TRM-Specified Energy Savings for Faucet Aerators 17
Equation 3-8. Draft 2010 Ohio TRM-Specified Demand Savings for Faucet Aerators 17
Equation 3-9. *Ex Post* Energy Savings for Weather Stripping 18
Equation 3-10. *Ex Post* Demand Savings for Weather Stripping 19
Equation 3-11. *Ex Post* Energy Savings for Door Sweeps 21
Equation 3-12. *Ex Post* Demand Savings for Door Sweeps 22
Equation 3-13. *Ex Post* Energy Savings for Lowering Hot Water Heater Temperature 23
Equation 3-14. *Ex Post* Demand Savings for Lowering Hot Water Heater Temperature 23

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Executive Summary

This report presents the results of an evaluation of AEP Ohio's *e³smart*[SM] Program for the 2013-2014 school year. This section provides a high-level description of the program, key impact findings, and conclusions and recommendations stemming from these findings. Detailed methodology and findings are described in the body of the report.

ES.1 Program Summary

The primary goal of the *e³smart*[SM] Program is to educate teachers, students, and the community about household steps that lead to greater energy efficiency. This program intends to influence students (Grades 4–12) about energy efficient choices early on so that they will be more cognizant of and receptive to energy efficiency choices throughout their lives.

The program achieves energy savings from the measures included in Energy Efficiency Kits (kits) that are provided free of charge through the program. The kits include low-cost energy efficiency measures for students to install in their homes. Students bring the kits home, and with the help of a parent or guardian, install the measures appropriate for the household. Each student is asked to complete a survey reporting the measures installed and replaced. AEP Ohio contracted with an implementation contractor to administer the program.

The program creates a curriculum for teachers that focuses on energy sources, transformation of energy, and energy uses. These lessons were created to teach the fundamentals of energy and energy efficiency, as well as to instruct students on how to properly install the measures included in the kit. Annually, the implementation contractor examines their lesson plans to meet the State of Ohio teaching requirements. Additionally, the implementation contractor trains teachers at a one-day professional development workshop. During the professional development workshop, teachers are taught the key points of the different lessons.

The 2013–2014 school year Energy Efficiency Kits contained the following energy efficiency measures:

- Two 23 W Bright White Compact Fluorescent Lamps (CFLs)
- Two 13 W Soft White CFLs
- Earth Massage Showerhead (1.5 GMP – Gallons Per Minute)
- Light Emitting Diode (LED) Nightlight
- Kitchen Faucet Aerator (1.5 GPM)
- Bathroom Faucet Aerator (1.0 GPM)
- Closed Cell Foam Weather-Strip (17" roll)
- Self-Adhesive Door Sweep
- Hot Water Temperature Gauge Card

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- Small Roll of Teflon Tape
- Flow Meter Bag
- Furnace Filter Alert Whistle
- Refrigerator/Freezer Thermometer
- Marketing material for AEP Ohio's other Energy Efficiency/Peak Demand Reduction Programs

ES.2 Key Impact Evaluation Findings and Recommendations

The Energy Efficiency Kits were distributed to 25,600 students, faculty, staff, and community members (students) during the 2013–2014 school year. The program had 375 participating teachers from 269 different schools.

Table ES-1 shows the 2013–2014 program goals, *ex ante* savings claimed by the program, *ex post* savings, and the realization rates. The *ex post* energy and demand savings for the 2013–2014 school year were 4,875 MWh and 0.57 MW, respectively. To estimate the *ex post* savings, the evaluation team independently applied the methods and assumptions outlined in the Draft 2010 State of Ohio Technical Reference Manual (Draft 2010 Ohio TRM). Several measures, however, were not in the Draft 2010 Ohio TRM. In these cases the evaluation team applied the most appropriate engineering estimates. Due to changes in the savings estimates, the program did not meet its energy saving goals for the 2013–2014 school year.

AEP Ohio calculated the *ex ante* savings from the 19,104 submitted participant surveys. As not all students completed a survey, the evaluation team calculated the installation rate from the participant survey and applied this rate to the total program population of 25,600 participants. AEP Ohio used 50 percent of the average savings per kit, based on the tracking system data, and applied that value to the unreturned kit savings.

Table ES-1. 2013-2014 Overall Evaluation Results

	2014 Program Goals (a)	*Ex ante*[1] Savings (b)	*Ex Post* Savings (c)	Realization Rate RR = (c) / (b)	Percent of Goal = (c) / (a)
Energy Savings (MWh)	6,500	4,338	4,875	1.12	75%
Demand Savings (MW)	1.428	0.52	0.57	1.10	40%

1. The parent/student online survey was returned by 75 percent of the participant population. The evaluation team conducted interviews with teachers to explore if the population of students that did not turn in their surveys was less likely to install the measures than the students who turned in their surveys. The evaluation team also concluded that the majority of surveys are not being entered into the tracking system due to class scheduling conflicts and computer lab issues, which are preventing students from entering their information.

Impact Recommendation #1: Apply the installation rates gathered from the online surveys to the entire population of students receiving a kit to estimate *ex post* savings.

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2. Savings goals were not met in the 2013–2014 school year, mainly because saving values changed for CFLs, and hot water measures were removed from savings when the survey respondent reported it had a natural gas hot water heater. The most significant CFL estimate change occurred when 100 watt and 75 watt incandescent lamps were replaced with CFLs. The Energy Independence and Security Act of 2007 (EISA) states that the replacement value for 100 watt incandescent lamps should be 72 watts rather than 100 watts and the 75 watt incandescent lamps should be 52 watts rather than 75 watts. The hot water heater temperature *ex ante* and *ex post* savings differ due to the *ex post* values using updated saving estimates from the Pennsylvania TRM.

Impact Recommendation #2: Reevaluate the saving goals for the *e³smart*SM Program to reflect the more accurate saving estimates.

3. Hot water heater temperature setback is not addressed in the Draft 2010 Ohio TRM. The savings from this behavior change action are well-established. AEP Ohio's estimate for hot water heater temperature setback should be updated.

Impact Recommendation #3: Adjust the hot water heater temperature setback estimates based on data from the Pennsylvania TRM, until the measure is included in the Draft 2010 Ohio TRM.

ES.3 Key Process Evaluation Findings and Recommendations

The process evaluation objectives were to develop an understanding of the final program design and implementation strategies, document program processes and tracking efforts, and identify and recommend potential program improvements. The data collection approach for the process evaluation included in-depth interviews with AEP Ohio program staff, program implementers, and teachers.

1. The implementation contractor changed the stipend level for returning teachers whose class returned 75 percent or higher of their student installation surveys. The stipend was increased from $100 to $200.

Process Recommendation #1: Monitor the teachers' acceptance of this change and explore what teachers are doing with the stipend. For example, in past evaluations teachers spent the stipend on creative class room activities. Such activities could be an additional component of the teacher's outreach to the local media.

2. The *e³smart*SM database has a separate column for each possible replaced lamp, which makes analysis cumbersome. There also are several other entry fields that could be updated to improve transparency and database analysis.

Process Recommendation #2: AEP Ohio and the implementation contractor should coordinate on restructuring the data the implementer provides so that it is easier to analyze, and also better flow into AEP Ohio's new database.

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3. **Community Outreach.** In the 2013–2014 school year, the program reached over 25,000 participants. Beyond the student and family engagement, the curriculum includes ways that a class can reach out to the local media that will fulfill required state educational standards. For the 2014-2015 school year, the implementation contractor created a new press release, in addition to a letter sent to the school's Superintendent congratulating them on their school's participation in the e³smartSM program.

Process Recommendation #3: Continue to encourage teachers to share their positive experiences through media outreach as an opportunity for AEP Ohio to use this program as an opportunity positive customer experience.

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1. Program Description

This section provides an overview of the AEP Ohio *e³smart*SM Program, beginning with a brief description, followed by a summary of various aspects of the implementation strategy.

1.1. *Program Overview and Description*

The *e³smart*SM Program has multiple goals. One goal is to educate teachers, students, and the community about household steps that lead to greater awareness and appreciation for energy efficiency. Another goal is to determine the energy and demand savings impacts of the Energy Efficiency Kits (kits that students install in their homes.

The *e³smart*SM Program is designed to teach 4th through 12th grade students and their families the benefits of energy efficiency. Kits containing energy efficiency measures are provided to participating students to install in their homes. AEP Ohio contracted with an implementation contractor to administer this program. The implementation contractor has been implementing energy education programs in schools throughout Ohio for nearly 30 years.

The program begins by developing a curriculum for teachers that focuses on energy sources, how energy is transformed, and energy uses. These lessons were created to teach the fundamentals of energy and energy efficiency, as well as to instruct students on how to properly install the measures included in the kit. Annually, the implementation contractor examines the lesson plans to meet the State of Ohio teaching requirements, in addition to training teachers at a one-day professional development class. The implementation contractor created a detailed curriculum divided into seven lesson plans. Each lesson has a classroom and at home component. Teachers are provided with a stipend once their students return the student installation surveys. Teachers also receive continuing education credits for the professional development training session and a reduced rate for graduate credits at Ashland University.

Each student takes a kit home, and with the help of a parent or guardian, installs the measures appropriate for the home. Each student is instructed to complete an online survey reporting the measures installed. If completing the survey online is not possible, a paper option is available.

The Energy Efficiency Kit contains a combination of the following measures:

- Two 23 W Bright White CFLs
- Two 13 W Soft White CFLs
- Earth Massage Showerhead
- LED Nightlight
- Kitchen and Bathroom Faucet Aerators
- Closed Cell Foam Weather-Strip (17" roll)
- Self-Adhesive Door Sweep

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- Hot Water Temperature Gauge Card
- Small Roll of Teflon Tape
- Flow Meter Bag
- Furnace Filter Alert Whistle
- Refrigerator/Freezer Thermometer
- Energy Use Gauge Thermometer
- U.S. Department of Energy (DOE) Energy Savers Booklet

1.2. Evaluation Objectives

The objectives of the evaluation are to: (1) report energy and peak demand savings estimates from the kits; and (2) assess process performance, satisfaction, program operational conditions, and ways to improve the program. The evaluation seeks to answer the following key research questions.

Impact Questions

1. What is the level of annual energy (kWh) and peak demand (kW) savings induced by the program?
2. What were the program measure realization rates?
3. What are reasonable saving estimates for each of the home energy kit measures?
4. What are the benefits, costs, and cost-effectiveness of this program?

Process Questions
Program Characteristics and Barriers

1. Is the program meeting its participation goals?
2. How have teachers incorporated the program into their lesson plan?

Administration and Delivery

1. Is the program administration functioning as expected?
2. Are there any problems with implementing the program?
3. Are program tracking systems adequate? Do they contain all data required to support program tracking and evaluation?

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2. Evaluation Methods

This section describes the analytic methods and data collection activities implemented as part of the process evaluation of the *e³smart℠* Program, including the data sources and sample designs used as the foundation for the data collection activities and analysis.

2.1 Overview of Approach

To meet the objectives of this evaluation, Navigant undertook the following activities:

1. **Development of Evaluation Questions.** Key evaluation questions were established during the development of the 2013–2014 evaluation plan with AEP Ohio staff and from a review of the key outcomes of the 2012–2013 program evaluation.
2. **Tracking Data Review.** The program tracking data collected by the implementation contractor were reviewed. The implementation contractor conducted a separate participant online survey.
3. **Primary Data Collection.** Three primary data collection efforts were conducted in support of this evaluation: 1) in-depth interviews with program staff, 2) participant installation surveys, and 3) teacher questionaries' and interviews.
4. **Methods Used to Analyze Impact Data.** Reviewed algorithms and tracking system to verify measure eligibility and correct application of energy and demand savings.
5. **Methods Used to Analyze Process Data.** The effectiveness of the program processes was assessed by analyzing program tracking data, in-depth interview data, and participant survey data.

Table 2-1 summarizes data collection activities, along with the details regarding the sampling and timing.

Table 2-1. Summary of Data Collection Activities

Data Collection Type	Targeted Population	Sample Frame	Sample Design	Sample Size	Timing
Tracking Data Analysis (Participant Online Survey)	All Program Participants	Tracking Database	-	19,104	June 2014
In-Depth Telephone Interview	AEP Ohio Program Coordinator	Contact from AEP Ohio	Program Coordinator	1	March 2015
In-Depth Telephone Interview	Implementation Contractor	Contact from Implementation Contractor	Program Implementer	1	March 2015
Teacher Questionnaire	Program Participants	Implementation Contractor Contact List	Targeted Sample of Program Participants	111	August 2014
Teacher Surveys	Program Participants	Implementation Contractor Contact List	Targeted Sample of Program Participants	10	February 2015

2.2 Tracking System Review

Navigant conducted a review of program data in the AEP Ohio *e³smart℠* audit tracking system to assess its accuracy and effectiveness for use in recording, tracking, and reporting the processes and impacts of the program. However, the evaluator did not address whether the tracking system is adequate for regulatory prudency reviews or corporate requirements.

2.3 Engineering Algorithm Review

Navigant conducted a review of measure savings algorithms and underlying assumptions for each measure compared to the Draft 2010 Ohio Technical Reference Manual (Draft 2010 Ohio TRM) algorithms. Navigant also calculated energy and demand savings for each measure in the tracking database to ensure that algorithms were applied correctly.

2.4 Ex Post Savings Evaluation Methods

Program savings were assessed using the program tracking data and the Draft 2010 Ohio TRM. Navigant conducted a review of measure savings recorded in the tracking system to verify that the algorithms matched the TRM and were correctly applied for each project. The evaluation team independently calculated energy savings for each measure in the database using the *ex ante* calculation methods based on the TRM. For measures not included in the TRM, the evaluation team examined AEP Ohio's calculation methods and evaluated them against calculation methods identified from secondary sources (recent TRMs from nearby states). *Ex post* savings estimates were then used to calculate adjusted energy and demand savings for each measure.

2.5 Teacher Interviews

In-depth interviews were conducted with seven participating teachers to engage in conversation with the people that are most intimately involved with the delivery of the *e³smart*[SM] Program. The list of interview candidates was developed based on a review of the teacher survey database. The majority of questions were open ended to facilitate open discussion of the topics.

2.6 Program Material Review

Navigant reviewed all program materials provided to date by AEP Ohio and the implementer. A summary list of program materials reviewed for this report includes:

- Program tracking data
- Program impact algorithms and assumptions
- Program lesson plans and teacher instructions
- Program implementation plans
- Program operation manual

3. Program Level Results

This section presents the AEP Ohio *e³smart* Program impact and process evaluation results.

3.1 Impact Evaluation Results

The Home Energy Efficiency Kits were distributed to 25,600 participants during the 2013–2014 school year through 375 teachers participating from 269 different schools.

3.1.1 Program Impact Results

AEP Ohio and the evaluation team estimated savings based on the participant online survey. Table 3-1 and Table 3-2 present the program saving estimates. The *ex post* saving estimates for the *e³smart*SM Program were developed using the installation rates gathered from the student installation survey. These values were then applied to all the distributed kits. AEP Ohio used 50 percent of the average savings per kit, based on the tracking system data, and applied that value to the unreturned kit savings.

The average per measure *ex ante* CFL savings differs slightly from the average per measure *ex post* CFL savings due to differences in the way the delta watts multiplier was applied. Navigant applied the delta watts multiplier to installed CFLs without a reported replaced incandescent bulb. AEP Ohio assumed if the participant reported installing two CFLs but only gave the value for one of the replaced incandescent bulbs that the participant installed two incandescent bulbs at the same value they reported for the one replaced bulb. The hot water heater temperature setback *ex ante* and *ex post* savings differ due to the *ex post* using an updated saving estimate from the Pennsylvania TRM.

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Table 3-1. Energy Savings Estimates

Measure	*Ex ante* Number of installed measures (a)	Ex Post Number of installed measures (b)	*Ex ante* kWh Savings per measure (c)	Ex Post kWh Savings per measure (d)	*Ex ante* kWh (e) = (a) * (c)	Ex Post kWh (f) = (b) * (d)
23 W CFLs (2 Bulbs)[1]	22,621	30,313	39.62	39.89	896,341	1,209,278
13 W CFLs (2 Bulbs)[2]	17,481	23,425	46.16	42.80	806,868	1,002,652
Kitchen Aerators (1.5 GPM)	2,749	3,684	24.50	24.50	67,351	90,252
Bathroom Aerators (1.0 GPM)	2,820	3,779	42.00	42.00	118,440	158,714
LED Nightlight	5,494	7,362	20.59	20.59	113,121	151,587
Lower Hot Water Heater Temperature	1,711	1,853	132.00	151.30	225,852	280,400
Earth Massage Showerhead	3,455	4,630	237.01	237.01	818,870	1,097,313
Weather Stripping	7,547	10,113	11.10	11.10	83,772	112,257
Door Sweep	8,192	10,978	70.42	70.42	576,881	773,042
Outboard Non-Response Adjustment[3]	6,496	N/A	97.04	N/A	630,336	N/A
Total					4,337,831	4,875,493

[1] The savings per measure for 23 W CFLs is a weighted average of the reported replaced wattage bulbs.
[2] The savings per measure for 13 W CFLs is a weighted average of the reported replaced wattage bulbs.
[3] AEP Ohio applied 50% of per kit saving from the tracking data to kits without returned surveys.
* Note: The numbers in this table are the actual numbers from the evaluation analysis. Totals may not sum due to rounding.

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Table 3-2. Demand Savings Estimates

Measure	*Ex ante* Number of installed measures (a)	Ex Post Number of installed measures (b)	*Ex ante* kW Savings per measure (c)	Ex Post kW Savings per measure (d)	*Ex ante* kW (e) = (a) * (c)	Ex Post kW (f) = (b) * (d)
23 W CFLs (2 Bulbs)[1]	22,621	30,313	0.005	0.005	107	145
13 W CFLs (2 Bulbs)[2]	17,481	23,425	0.006	0.005	96	120
Kitchen Aerators (1.5 GPM)	2,749	3,684	0.003	0.003	8	11
Bathroom Aerators (1.0 GPM)	2,820	3,779	0.005	0.005	15	20
LED Nightlight	5,494	7,362	0.000	0.000	0	0
Lower Hot Water Heater Temperature	1,711	1,853	0.000	0.013	0	23
Earth Massage Showerhead	3,455	4,630	0.030	0.030	105	140
Weather Stripping	7,547	10,113	0.001	0.001	10	14
Door Sweep	8,192	10,978	0.012	0.009	100	96
Outboard Non-Response Adjustment[3]	6,496		0.012	0.009	75	N/A
Total					517	569

[1] The savings per measure for 23 W CFLs is a weighted average of the reported replaced wattage bulbs.
[2] The savings per measure for 13 W CFLs is a weighted average of the reported replaced wattage bulbs.
[3] AEP Ohio applied 50% of per kit saving from the tracking data to kits without returned surveys.
* Note: The numbers in this table are the actual numbers from the evaluation analysis. Totals may not sum due to rounding.

3.1.2 Measure Installation Rates

The evaluation team calculated installation rates for each measure using data from the parent/student online surveys. The online survey was offered to every student who received a kit. Of the 25,600 kits distributed, 19,104 surveys were returned, a 75 percent return rate.

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Table 3-3 presents the evaluation team's calculation of *ex post* measures installed. The evaluation team applied the parent/student online survey installation rate to the total possible measures installed based on the number of kits distributed. The *e³smart*[SM] Program is unique in that it gives away measures without the participant asking for these measures. A program with this level of installation uncertainty will have lower installation rates than other energy efficiency programs.

Table 3-3. *Ex Post* Number of Measures Installed, 2013–2014 School Year

Measure	*Installation Rate based on returned surveys
23 W CFLs (2 Bulbs)	59%
13 W CFLs (2 Bulbs)	46%
Kitchen Aerator (1.5 GPM)	32%
Bathroom Aerator (1.0 GPM)	33%
LED Nightlight	29%
Lower Hot Water Heater Temperature	72%
Earth Massage Showerhead	40%
Weather stripping	40%
Door Sweep	43%

*The hot water installation rates are based on the survey installation rates before the hot water heater fuel adjustment.

3.1.3 Tracking System Review

Navigant conducted a review of the program data in the AEP Ohio *e³smart* Program tracking system to verify its accuracy and effectiveness for use in recording, tracking, and reporting the processes and impacts of the program. The implementation contractor tracking data extract contained separate databases for parent/student online surveys and teacher surveys. The parent/student survey dataset contained 70 data fields and over 19,000 records. The tracking system was well-organized and accurate. The evaluator did not address whether the tracking system is adequate for regulatory prudency reviews or corporate requirements.

3.1.4 *Ex Post* Savings Evaluation (Algorithm Review)

Navigant conducted a review of measure savings recorded in the tracking system to verify that the algorithms matched the Draft 2010 Ohio TRM and were correctly applied for each measure. The evaluation team independently calculated energy savings for each measure in the database using the *ex ante* calculation methods based on the Draft 2010 Ohio TRM.

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3.1.5 Compact Fluorescent Lamps

Navigant used a combination of the Draft 2010 Ohio TRM-specified deemed values, program gathered values of delta watts, and installation rates from the team's evaluation to determine measure savings.

For 23 Watt CFLs, the parent/student survey recorded 22,621 installed lamps. Of those 22,621 installed lamps, 19,885 reported the wattage of the incandescent replaced. For 13 Watt CFLs, the parent/student survey recorded 18,602 installed lamps. Of those 17,481 installed lamps, 15,400 reported the wattage of the incandescent replaced. For the CFLs with no reported replaced lamp wattage, the evaluation team used the Draft 2010 Ohio TRM delta watts multiplier. The difference in the *ex ante* and *ex post* CFL counts are due to the evaluation team applying the participant survey installation rate to the entire program participant population, while AEP Ohio used 50 percent of the average savings per kit, based on the tracking system data, and applied that value to the unreturned kit savings. Also, AEP Ohio assumed if the participant reported installing two CFLs but only gave the value for one of the replaced incandescent bulbs, that the participant installed two incandescent bulbs at the same value they reported for the one replaced bulb.

Equation 3-1 and Equation 3-2 present the equations used to calculate the CFL savings when the wattage of the replaced bulb was reported in the tracking system. The in-service rates are already applied to the measure count. Table 3-5 lists the key parameters used in the equations.

Equation 3-1. Engineering Calculation for Energy Savings for CFLs

$$\text{Annual kWh Savings} = (\text{Replaced Bulb Watts} - \text{CFL Watts}) / 1000 * \text{HOURs} * \text{WHF}$$

Equation 3-2. Engineering Calculation for Demand Savings for CFLs

$$\text{Summer Coincident Peak kW Savings} = ((\text{Replaced Bulb Watts} - \text{CFL Watts})/1000) * \text{WHF}_d * \text{CF}$$

Table 3-4. Key Parameters for CFLs

Parameter Description	Parameter	Value	Source
Average Hours of Use per Year	HOURs	1040	Draft 2010 Ohio TRM
Waste Heat Factor for Energy	WHFe	1.07	Draft 2010 Ohio TRM
Waste Heat Factor for Demand	WHFd	1.21	Draft 2010 Ohio TRM
Summer Peak Coincidence Factor	CF	0.11	Draft 2010 Ohio TRM
Change in CFL Watts	Delta Watts	Varies by size	Evaluation
Installation Rate 23 W CFLs	IR	59%	Participant Survey
Installation Rate13 W CFLs	IR	46%	Participant Survey

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If the tracking data did not include the wattage of the bulb replaced, then the Draft 2010 Ohio TRM specifies deemed values for CFLs based on CFL wattages and delta watts multipliers (see Table 3-6), which capture the differences in wattages between various types of CFLs and the incandescent equivalent.
Equation 3-3 and Equation 3-4 show those calculations. Table 3-6 presents the savings results.

Equation 3-3. Draft 2010 Ohio TRM-Specified Energy Savings for CFLs

*Annual kWh Savings = (CFLWatts * Delta Watts Multiplier) * HOURs * WHF$_E$ / 1000*

Equation 3-4. Draft 2010 Ohio TRM-Specified Demand Savings for CFLs

*Summer Coincident Peak kW Savings = (CFLWatts * Delta Watts Multiplier) * WHFd * CF / 1000*

Table 3-5. Draft 2010 Ohio TRM-Specified Values for the Delta Watts Multiplier for CFLs

	Delta Watts Multiplier			
CFL Wattage	2009–2011	2012	2013	2014 and Beyond
15 or less	3.25	3.25	3.25	2.05
16–20	3.25	3.25	2.00	2.00
21 or greater	3.25	2.06	2.06	2.06

Source: State of Ohio Energy Efficiency Technical Reference Manual, 2010

Table 3-6. CFL Algorithm Review Findings

Measure Type	*Ex ante* per-unit kWh Savings (a)	*Ex ante* per-unit kW Savings (b)	Ex Post per-unit kWh Savings (c)	Ex Post per-unit kW Savings (d)	kWh Realization Rate (e) = (c) / (a)	kW Realization Rate (f) = (d) / (b)
23 W CFL	39.62	0.005	39.89	0.005	101%	104%
13 W CFL	46.16	0.006	42.80	0.005	93%	93%

*Note: The *ex ante* and *ex post* per-unit savings are weighted averages. The savings values varied based on the bulb replaced.

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3.1.6 Energy and Demand Savings Calculations for Low-Flow Showerheads

The Draft 2010 Ohio TRM specifies a formula and deemed values for low-flow showerheads. Equation 3-5 and Equation 3-6 present the formulas for energy and demand savings for low-flow showerheads. AEP Ohio and the evaluation team used these formulas for calculating savings. Table 3-8 lists the key parameters used in the equations. Table 3-9 presents the saving results.

Equation 3-5. Draft 2010 Ohio TRM-Specified Energy Savings for Low-Flow Showerheads

*Annual kWh savings per low-flow Showerhead = (GPMbase – GPMlow) * kWh/GPMreduced*

Equation 3-6. Draft 2010 Ohio TRM-Specified Demand Savings for Low-Flow Showerhead

*Annual kW savings per low-flow showerhead = kWh savings /Hours * CF*

Table 3-7. Key Parameters for Low-Flow Showerheads

Parameter Description	Parameter	Ohio TRM Value
Gallons Per Minute of Baseline Showerhead	GPMbase	2.87
Gallons Per Minute of Low-Flow Showerhead	GPMlow	1.5 program specified
Assumed kWh Savings per GPM Reduction	kWh/GPMreduced	173 kWh[1]
Hours of Use per Year	Hours	29
Summer Peak Coincidence Factor	CF	0.0037

[1]VEIC Response 11/15/2010

Table 3-8. Low-Flow Showerhead Algorithm Review Findings

Low-Flow Showerheads	*Ex ante* Savings (a)	Ex Post Savings (b)	Realization Rate (c) = (b) / (a)
Energy (kWh)	237.01	237.01	100%
Demand (kW)	0.03	0.03	100%

3.1.7 Energy and Demand Savings Calculations for Faucet Aerators

The Draft 2010 Ohio TRM specifies deemed values for faucet aerators. The energy savings kit includes two faucet aerators, one for kitchen faucets that have a GPM rating of 1.5 and the other for bathroom faucets that have a GPM rating of 1.0.

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The equations used to calculate energy and demand savings are specified in Equation 3-7 and Equation 3-8. Table 3-10 lists the key parameters used in the equations. Table 3-11 and table 3-12 present the savings results.

Equation 3-7. Draft 2010 Ohio TRM-Specified Energy Savings for Faucet Aerators

*Annual kWh savings = ((GPMbase – GPMlow) / GPMbase) * (# people * gals/day * days/year * DR) / F/home) * 8.3 * (Tft - Tmains) / 1,000,000)) / DHW Recovery Efficiency / 0.003412*

Equation 3-8. Draft 2010 Ohio TRM-Specified Demand Savings for Faucet Aerators

*Annual kW Savings = kWh savings/ hours * CF*

Table 3-9. Key Parameters for Faucet Aerators

Parameter Description	Parameter	Ohio TRM Value
Gallons Per Minute of Baseline Faucet	GPMbase	2.2
Gallons Per Minute of Low-Flow Faucet	GPMlow	1.5 GPM for kitchen faucet aerators 1.0 GPM for bathroom faucet aerators Program specified
Average Number of People per Household	# people	2.46
Average Gallons per Day Used by all Faucets in Home	gals/day	10.9
Days Faucet Used per Year	days/y	365
Percentage of Water Flowing Down Drain	DR	50%
Average Number of Faucets in the Home	F/home	3.5
Constant to Convert Gallons to Pounds		8.3
Assumed Temperature of Water Used by Faucet	Tft	80
Assumed Temperature of Water Entering House	Tmains	57.8
Recovery Efficiency of Electric Hot Water Heater	DHW Recovery Efficiency	0.98
Constant to Converts MMBtu to kWh		0.003412
Average Number of Hours per Year Spent Using Faucet	Hours	21
Summer Peak Coincidence Factor	CF	0.00262

Table 3-10. Bathroom Aerator Algorithm Review Findings

Bathroom Aerator (1.0 GPM)	*Ex ante* Savings (a)	Ex Post Savings (b)	Realization Rate (c) = (b) / (a)
Energy (kWh)	42.0	42.0	100%
Demand (kW)	0.005	0.005	100%

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Table 3-11. Kitchen Aerator Algorithm Review Findings

Bathroom Aerator (1.0 GPM)	*Ex ante* Savings (a)	Ex Post Savings (b)	Realization Rate (c) = (b) / (a)
Energy (kWh)	24.5	24.5	100%
Demand (kW)	0.003	0.003	100%

3.1.8 Weather Stripping

Weather stripping is not included in the Draft 2010 Ohio TRM. The evaluation team used parameters from the Draft 2010 Ohio TRM, the Department of Energy, and the Iowa Energy Center to construct the *ex post* estimate of energy and demand savings for the measure. Table 3-15 shows a summary of the total *ex ante* and *ex post* savings for the measure.

Equation 3-9 and Equation 3-10 present the energy and demand savings for weather stripping. Table 3-13 and Table 3-14 list the key parameters used in the equations.

Equation 3-9. *Ex Post* Energy Savings for Weather Stripping

*Annual kWh savings per foot of weather stripping = (Maximum savings potential from weatherization) * (Fraction of air leaks through windows, ceiling, walls, and floors) * (Fraction of heat transfer due to air leakage [versus conductive heat transfer]) * (Percentage of total leakage area covered per foot of weather stripping)*

Maximum savings potential from weatherization = (Average annual usage Maximum energy savings potential from weatherization measures)*

*Average annual usage = All Electric Residences Average Annual Usage * Percentage of homes that are all electric + Non-All Electric Residences Average Annual Usage * (1- Percentage of homes that are all electric)*

Percentage of total leakage area covered per foot of weather stripping = Area covered per foot of weather stripping / Average leakage area per house

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Table 3-12. Key Parameters for Weather Stripping Energy Savings

Parameter Description	*Ex Post* Value
All Electric Residences Average Annual Usage	15,202[1]
Percentage of Homes that Are All Electric	19.27%[3]
Non-All Electric Residences Average Annual Usage	10,469[3]
Maximum Energy Savings Potential from Weatherization Measures	35%[2]
Fraction of Air Leaks through Windows, Ceiling, Walls, and Floors	41%[3]
Fraction of Heat Transfer due to Air Leakage	60%[4]
Area Covered per Foot of Weather Stripping	12 * Average width of leakage area
Average Width of Leakage Area	0.25[5]
Average Leakage Area per House	374.4 square inches[6]

Equation 3-10. *Ex Post* Demand Savings for Weather Stripping

*Annual kW savings per foot of weather stripping = Cooling savings per foot of weather stripping / Full Load Cooling Hours * Percent runtime during peak period * Summer peak coincidence factor*

*Cooling savings per foot of weather stripping = kWh savings * Percent of HVAC kWh expenditure on cooling*

[1]http://www.puco.ohio.gov/puco/assets/File/EE%20ramp%20up%20page/AEPOHIO%20All%20Electric%20Homes%20J_Williams%207_26_12.ppt
[2] http://energy.gov/articles/weatherized-homes-saving-money-families-across-us.
[3] Navigant engineering estimate.
[4] Navigant engineering estimate.
[5] Navigant engineering estimate.
[6] Krarti, Moncef. *Energy audit of building systems: an engineering approach*. 2nd ed. CRC Press 2011.

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Table 3-13. Key Parameters for Weather Stripping Demand Savings

Parameter Description	*Ex Post* Value
Percent of HVAC kWh Expenditure on Cooling	50%[7]
Full Load Cooling Hour	503.1[8]
Percent Runtime During Peak Period	25%[9]
Summer Peak Coincidence Factor	35%[10]
Fraction of Air Leaks through Windows, Ceiling, Walls, and Floors	0.5[11]
Fraction of Heat Transfer due to Air Leakage	60%[12]
Area Covered per Foot of Weather Stripping	12 * Average width of leakage area
Average Width of Leakage Area	0.25[13]
Average Leakage Area per House	374.4 square inches[14]

Table 3-14. Total Savings for Weather Stripping

Measure	*Ex ante* Savings (a)	Ex Post Savings (b)	Realization Rate (c) = (b) / (a)
Energy (kWh)	11.1	11.1	100%
Demand (kW)	0.001	0.001	100%

[7] Navigant engineering estimate.
[8] Draft Ohio TRM, average of all locations.
[9] Navigant engineering estimate.
[10] http://energy.gov/articles/weatherized-homes-saving-money-families-across-us.
[11] Draft Ohio TRM.
[12] Navigant engineering estimate.
[13] Navigant engineering estimate.
[14] Krarti, Moncef. *Energy audit of building systems: an engineering approach*. 2nd ed. CRC Press 2011.

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3.1.9 Door Sweep

Door sweeps are not included in the Draft 2010 Ohio TRM. The evaluation team reviewed other sources of information to construct a reasonable *ex post* estimate of energy and demand savings for the measure. Table 3-18 shows a summary of the total *ex ante* and *ex post* savings for the measure, followed by detail on the adjustments made. AEP Ohio applied an errant demand savings value resulting in the difference between the *ex ante* and *ex post* values.

Equation 3-11 and Equation 3-12 present the energy and demand savings for door sweeps. Table 3-16 and Table 3-17 list the key parameters used in the equations.

Equation 3-11. *Ex Post* Energy Savings for Door Sweeps

*Annual kWh savings per door sweep = Maximum savings potential from weatherization * Fraction of air leaks through doors * Fraction of heat transfer due to air leakage (versus conductive heat transfer) * Door sweep savings per door / Average number of doors*

Maximum savings potential from weatherization = (Average annual usage Maximum energy savings potential from weatherization measures)*

*Average annual usage = All Electric Residences Average Annual Usage * Percentage of homes that are all electric + Non-All Electric Residences Average Annual Usage * (1- Percentage of homes that are all electric)*

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Table 3-15. Key Parameters for Door Sweep Energy Savings

Parameter Description	*Ex Post* Value
All Electric Residences Average Annual Usage	15,202[15]
Percentage of Homes that Are All Electric	19.27%[16]
Non-All Electric Residences Average Annual Usage	10,469[17]
Maximum Energy Savings Potential from Weatherization Measures	35%[18]
Fraction of Air Leaks through Doors	11%[19]
Fraction of Heat Transfer due to Air Leakage	60%[20]
Door Sweep Savings per Door	75[21]
Average Number of Doors	2.8[22]
Average Leakage Area per House	374.4 square inches[23]

Equation 3-12. *Ex Post* Demand Savings for Door Sweeps

*Annual kW savings per door sweep = Maximum cooling savings per door sweep / Full Load Cooling Hours * Percent runtime during peak period * Summer peak coincidence factor*

*Maximum cooling savings per door sweep = kWh savings per door sweep * Percent of HVAC kWh expenditure on cooling*

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[15] http://www.puco.ohio.gov/puco/assets/File/EE%20ramp%20up%20page/AEPOHIO%20All%20Electric%20Homes%20J_Williams%207_26_12.ppt

[16] http://www.puco.ohio.gov/puco/assets/File/EE%20ramp%20up%20page/AEPOHIO%20All%20Electric%20Homes%20J_Williams%207_26_12.ppt

[17] http://www.puco.ohio.gov/puco/assets/File/EE%20ramp%20up%20page/AEPOHIO%20All%20Electric%20Homes%20J_Williams%207_26_12.ppt

[18] http://energy.gov/articles/weatherized-homes-saving-money-families-across-us

[19] http://www.iowaenergycenter.org/wp-content/uploads/2012/03/HomeSeries1.pdf

[20] Navigant engineering estimate.

[21] Navigant engineering estimate.

[22] AEP Ohio 2013 Existing Residential Baseline Study.

[23] Krarti, Moncef. *Energy audit of building systems: an engineering approach*. 2nd ed. CRC Press 2011.

NAVIGANT

Table 3-16. Key Parameters for Door Sweep Demand Savings

Parameter Description	*Ex Post* Value
Percent of HVAC kWh Expenditure on Cooling	50%[24]
Full Load Cooling Hours	503.1[25]
Percent Runtime during Peak Period	25%[26]
Summer Peak Coincidence Factor	0.5[27]

Table 3-17. Total Savings for Door Sweep

Measure	*Ex ante* Savings (a)	Ex Post Savings (b)	Realization Rate (c) = (b) / (a)
Energy (kWh)	70.42	70.42	100%
Demand (kW)	0.012	0.009	71%

3.1.10 Lower Hot Water Heater Temperature

Lowering the temperature on a hot water heater is not included in the Draft 2010 Ohio TRM. The evaluation team used the Pennsylvania TRM to construct an *ex post* estimate of energy and demand savings for the measure. Table 3-20 shows a summary of the total *ex ante* and *ex post* savings for the measure.

Equation 3-13 and Equation 3-14 present the energy and demand savings for lowering the temperature on a hot water heater. Table 3-19 lists the key parameters used in the equations.

Equation 3-13. *Ex Post* Energy Savings for Lowering Hot Water Heater Temperature

*Annual kWh savings = Surface Area of water heater tank, ft² * (Temperature setpoint of water heater initially - Temperature setpoint water heater after setback) * hours per year (8760) / R value of water heater tank * Thermal efficiency of electric heater element * 3,412 Btu/kWh*

+

Volume of hot water used per day, in gallons days in a year (365) * 1 Btu/◦F lb * (Temperature setpoint of water heater initially - Temperature setpoint water heater after setback) / 3,412 Btu/kWh * Energy Factor of water heater*

Equation 3-14. *Ex Post* Demand Savings for Lowering Hot Water Heater Temperature

*Annual kW savings = Energy to Demand Factor * Annual kWh savings*

Table 3-18. Key Parameters for Lower Hot Water Heater Temperature Savings

[24] Navigant engineering estimate.
[25] Draft Ohio TRM—Average of all locations.
[26] Navigant engineering estimate.
[27] Draft Ohio TRM.

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Parameter Description	*Ex Post* Value
Surface Area of Water Heater Yank, ft^2	24.99 ft^2
Temperature Setpoint of Water Heater Initially	130 ◦F[28]
Temperature Setpoint of Water Heater after Setback	120 ◦F[29]
R Value of Water Heater Tank	8.33[30]
Thermal Efficiency of Electric Heater Element	0.97[31]
Volume of Hot Water Used per Day, in Gallons	7.32 gallons/day[32] [33] [34] [35]
Energy Factor of Water Heater	0.904[36]
Energy To Demand Factor	0.00008294[37]

Table 3-19. Total Savings for Lower Hot Water Heater Temperature

Measure	*Ex ante* Savings (a)	Ex Post Savings (b)	Realization Rate (c) = (b) / (a)
Energy (kWh)	151	132	115%
Demand (kW)	0.013	0	N/A

[28] Pennsylvania Statewide Residential End-Use and Saturation Study, 2012.
[29] Pennsylvania Statewide Residential End-Use and Saturation Study, 2012.
[30] Daily Usage based on AWWA Research Foundation, 1998, Residential End Uses of Water, found in EPA's Water Sense guide: http://www.epa.gov/WaterSense/docs/home_suppstat508.pdf
[31] New York Standard Approach for Estimating Energy Savings from Energy Efficiency Programs. October 15, 2010. Prepared by New York Advisory Contractor Team.
[32] Daily Usage based on AWWA Research Foundation, 1998, Residential End Uses of Water, found in EPA's Water Sense guide: http://www.epa.gov/WaterSense/docs/home_suppstat508.pdf
[33] Average capacity of base (3.19 cu. ft.) and energy efficient (3.64 cu. ft.) clothes washers, Table 2.52, Section 2.26.
[34] Households with Energy Star Clothes Washers 2009 (36%), "Energy Star Product Retrospective: Clothes Washers," 2012. Used to determine current weighted average gallons per load (27.3 gal)
[35] 2007–2011 U.S. Census Data for Pennsylvania (2.47 persons per household average)
[36] Federal Standards are 0.97 -0.00132 x Rated Storage in Gallons. For a 50-gallon tank this is 0.904. "Energy Conservation Program: Energy Conservation Standards for Residential Water Heaters, Direct Heating Equipment, and Pool Heaters" U.S. Department of Energy Docket Number: EE–2006–BT-STD–0129, p. 30
[37] Deemed Savings Estimates for Legacy Air Conditioning and Water Heating Direct Load Control Programs in PJM Region. The report can be accessed online: http://www.pjm.com/~/media/committees-groups/working-groups/lrwg/20070301/20070301-pjm-deemed-savings-report.ashx

3.2 Process Evaluation Results

This section provides the process findings for the 2013–2014 *e³smart*SM Program. Data collection activities that informed the process evaluation included the following:

- Interviews with program and implementation staff
- Parent/student installation surveys
- Teacher surveys
- Teacher questionnaire
- Teacher telephone interviews

The process evaluation data collection efforts indicate that the *e³smart*SM Program is running well. The program structure and program processes have remained relatively unchanged from 2013.

3.2.1 Survey Installation Return Rates

One of the main focuses of this year's process evaluation was to determine if there is any difference in the installation rate for kits that do not have a returned survey. A teacher survey, teacher questionnaire, and in-depth interviews with teachers were conducted to identify why surveys were not returned, and if there would likely be a difference in the installation rate for unreturned surveys.

3.2.1.1 Teacher Survey

The program implementer conducts an annual survey of teachers. The results of teachers with low to no returned student installation surveys were compared to teachers with high student installation survey return rates. Most of the responses of the two groups were similar except for a few categories. The most significant differences (as seen in Table 3-21) are the questions "Support and participation of families" and "Do you believe the unit changed student and/ or family behavior about energy conservation and efficiency?" Teachers with lower student installation return rates indicated less support from families and were less sure that the program changed participant behavior.

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Table 3-20. Teacher Survey: Comparison of Teachers with Low and High Student Installation Return Rates

Question	Teachers with High Student Installation Survey Return Rates	Teachers with Low Student Installation Survey Return Rates
Clarity of instructions (easy to follow)	6.44	6.52
Ease of using activities	6.37	6.38
Acceptability of preparation	6.37	6.24
Age appropriateness of energy content	6.10	5.67
Interest and motivation of students	5.87	5.33
Support and participation of families	4.89	3.76
Academic standards met	5.69	5.85
Ability to positively affect attitudes about energy	5.72	5.43
Your (teacher) overall evaluation of unit	6.29	6.29
Would you conduct the unit again?	Yes 96%	Yes 95%
Do you believe the unit changed student and/ or family behavior about energy conservation and efficiency?	Yes 94%	Yes 81%

*Where 1 was “extremely dissatisfied” and 7 was “extremely satisfied.”

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3.2.2 Participant Satisfaction

Table 3-23 displays the teacher satisfaction ratings for different aspects of the program. The teachers' overall rating was high at 6.29 on a scale of 1 to 7 (where 1 was "extremely dissatisfied" and 7 was "extremely satisfied"). The lowest rating was support and participation from families at 4.81.

Table 3-21. Mean Satisfaction Scores, Implementation Contractor Survey

Program Aspect	Satisfaction Rating* Mean (n=343)
Clarity of instructions (Easy to follow)	6.45
Ease of using activities	6.37
Acceptability of preparation	6.37
Age appropriateness of energy content	6.07
Interest and motivation of students	5.84
Support and participation of families	4.81
Academic standards met	5.70
Ability to positively affect attitudes about energy	5.70
Your (teacher) overall evaluation of unit	6.29

*Where 1 was "extremely dissatisfied" and 7 was "extremely satisfied."

3.2.3 Educational Impact and Raising Energy Efficiency Awareness

Ohio Energy Partnership created a curriculum that focuses on energy sources, transformation of energy, and energy uses. These lessons were created to teach the fundamentals of energy and energy efficiency, as well as instruct students on how to properly install the home energy kit measures. In the 2013–2014 school year, some schools had not transitioned to the new State of Ohio teaching standards. The implementation contractor was using two different lesson plans to meet the needs of the teachers teaching to different State standards. In the 2014–2015 school year, all the schools will be teaching to the same State standards. As such, the implementation contractor will be able to use the same lesson plan for all schools in the 2014–2015 school year. The implementation contractor provides teachers in grades 4th through 12th with a detailed matrix that assists them in identifying the standards met by the *e^{3}smart^{SM}* lesson plan (See Appendix C).

3.2.4 Community Outreach

In the 2013–2014 school year the program reached over 25,000 participants. Beyond student and family engagement, the curriculum includes ways the class can reach out to the local media that incorporates the state educational standards. For the 2014-2015 school year, the implementation contractor created a new press release, in addition to sending a letter to the school's Superintendent congratulating them on their school's participation in the *e^{3}smart^{SM}* Program (See Appendix D).

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3.2.5 Program Marketing and Channeling to Other Programs

The implementation contractor sends teacher applications to every school in the AEP Ohio territory. The application can also be obtained from the implementation contractor's website. The implementation contractor also attends numerous energy conferences in the region to promote the *e³smart*^{SM} Program.

The implementation contractor met the program goal of 24,000 participants. The implementation contractor only allows teachers to continue to participate in the program if they have demonstrated they are committed to the *e³smart*^{SM} Program by achieving a high participant survey submission rate.

The *e³smart*^{SM} Program provides a marketing opportunity for AEP Ohio's other residential energy efficiency programs. The program met this opportunity with materials provided in each kit that contains information about AEP Ohio's energy efficiency/peak demand reduction (EE/PDR) programs and including the URL to AEP Ohio's energy efficiency programs website[38] (See Appendix E).

3.2.6 Teacher Stipend

The implementation contractor has changed the stipend level from $100 to $200 for returning teachers who have 75 percent or more of their class' surveys returned. The implementation contractor was able to do this due to the savings achieved by not needing to provide these teachers with an entirely new lesson plan packet. New teachers continue to receive the $100 stipend for returning 75 percent of the surveys. All teachers who have a 90 percent student installation survey return rate receive a portable phone recharger in addition to their stipend. The implementation contractor realizes that teachers are key to achieving high return rates for student installation surveys and continues to explore new ways to encourage teachers to make returning these surveys a top priority.

[38]. https://www.aepohio.com/save/Default.aspx?ctype=h

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3.3 Cost-Effectiveness Review

This section addresses the cost-effectiveness of the *e³smart* Program. Cost effectiveness is assessed through the use of the Total Resource Cost (TRC) test. Table 3-22 summarizes the unique inputs used in the TRC test.

Table 3-22. Inputs to Cost-Effectiveness Model for *e3smart* Energy Program

Item	Value
Average Measure Life	9
Recipients	25,600
Annual Energy Savings (kWh)	4,875,493
Coincident Peak Savings (kW)	569
Third Party Implementation Costs	250,652
Utility Administration Costs	67,775
Utility Incentive Costs	650,250
Participant Contribution to Incremental Measure Costs	0

Based on these inputs, the TRC ratio is 1.9. Therefore, the program passes the TRC test. Table 3-23 summarizes the results of the cost-effectiveness tests. Results are presented for the Total Resource Cost test, the Participant Cost Test, the Ratepayer Impact Measure Test, and the Utility Cost Test.

Table 3-23. Cost Effectiveness Results for the *e3smart* Program

Test Results	
Total Resource Cost	1.9
Participant Cost Test	0.4
Ratepayer Impact Measure	1.9
Utility Cost Test	2.2

At this time, additional benefits related to reduction of greenhouse gas emissions have not been quantified in the calculation of the TRC. These additional benefits would increase the given TRC benefit/cost ratio.

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4. Conclusions and Recommendations

This section highlights the findings from the impact and process evaluation of the *e³smart*SM Program for the 2013-2014 school year.

4.1 Key Evaluation Impact Findings and Recommendations

The Home Energy Efficiency Kits were distributed to 25,600 students during the 2013–2014 school year. Additional kits were distributed to faculty, staff, and community members but were not included in this report. The program had 375 participating teachers from 269 different schools.

Table 4-1 shows the 2013–2014 program goals, *ex ante* savings claimed by the program, *ex post* savings, and the realization rates. The *ex post* energy and demand savings for the 2013–2014 school year were 4,875 MWh and 0.57 MW, respectively. To estimate the *ex post* savings, the evaluation team independently applied the methods and assumptions outlined in the Draft 2010 State of Ohio Technical Reference Manual (Draft 2010 Ohio TRM). Several measures, however, were not in the Draft Ohio TRM. In these cases the evaluation team applied the most appropriate engineering estimate. Due to changes in the savings estimates, the program did not meet its energy saving goals for the 2013–2014 school year.

AEP Ohio calculated the *ex ante* savings from the 19,104 submitted participant surveys. As not all participants completed a survey, the evaluation team calculated the installation rate from the participant survey and applied this rate to the total program population of 25,600 participants. AEP Ohio used 50 percent of the average savings per kit, based on the tracking system data, and applied that value to the unreturned kit savings.

Table 4-1. 2013-2014 Overall Evaluation Results

	Program Goals (a)	*Ex ante*[1] Savings (b)	Ex Post Savings (c)	Realization Rate RR = (c) / (b)	Percent of Goal = (c) / (a)
Energy Savings (MWh)	6,500	4,338	4,875	1.12	75%
Demand Savings (MW)	1.428	0.52	0.57	1.10	40%

1. The parent/student online survey was returned by 75 percent of the participant population. The evaluation team conducted interviews with teachers to explore if the population of participants that did not turn in their surveys was less likely to install the measures than the students who turned in their surveys. The evaluation team also concluded that the majority of surveys are not being entered into the tracking system due to class scheduling conflicts and computer lab issues, which are preventing students from entering their information.

Impact Recommendation #1: Apply the installation rates gathered from the online surveys to the entire population of students receiving a kit to estimate *ex post* savings.

2. Savings goals were not met in the 2013–2014 school year, mainly because saving values changed for CFLs, and hot water measures were removed from savings when the survey respondent reported it had a natural gas hot water heater. The most significant CFL estimate change occurred when 100

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watt and 75 watt incandescent lamps were replaced with CFLs. The ENERGY INDEPENDENCE AND SECURITY ACT OF 2007 (EISA) states that the replacement value for 100 watt incandescent lamps should be 72 watts rather than 100 watts and the 75 watt incandescent lamps should be 52 watts rather than 75 watts. The hot water heater temperature *ex ante* and *ex post* savings differ due to the *ex post* using an updated saving estimate from the Pennsylvania TRM.

Impact Recommendation #2: Reevaluate the saving goals for the *e³smart*SM Program to reflect the more accurate saving estimates.

3. Hot water heater temperature setback is not addressed in the Draft 2010 Ohio TRM. The savings from this behavior change action are well-established. AEP Ohio's estimate for hot water heater temperature setback should be updated.

Impact Recommendation #3: Adjust the hot water heater temperature setback estimates based on data from the Pennsylvania TRM, until the measure is included in the Draft 2010 Ohio TRM.

4.2 Key Process Evaluation Findings and Recommendations

The process evaluation objectives were to develop an understanding of the final program design and implementation strategies, document program processes and tracking efforts, and identify and recommend potential program improvements. The data collection approach for the process evaluation included in-depth interviews with AEP Ohio program staff, the program administrator, program implementers, and teachers.

1. The implementation contractor changed the stipend level for returning teachers whose class returned 75 percent or higher of their student installation surveys. The stipend was increased from $100 to $200.

Process Recommendation #1: Monitor the teachers' acceptance of this change and explore what teachers are doing with the stipend. For example, in past evaluations teachers spent the stipend on creative class room activities. Such activities could be an additional component of the teacher's outreach to the local media.

2. The *e³smart*SM database has a separate column for each possible replaced lamp, which makes analysis cumbersome. There also are several other entry fields that could be updated to improve transparency and database analysis.

Process Recommendation #2: AEP Ohio and the implementation contractor should coordinate on restructuring the data the implementer provides so that it is easier to analyze, and also better flow into AEP Ohio's new database.

Community Outreach. In the 2013–2014 school year, the program reached over 25,000 participants. Beyond the student and family engagement, the curriculum includes ways that a class can reach out to the local media that will fulfill required state educational standards. For the 2014-2015 school year, the

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implementation contractor created a new press release, in addition to a letter sent to the school's Superintendent congratulating them on their school's participation in the *e^3smart*^{SM} program.

Process Recommendation #3: Continue to encourage teachers to share their positive experiences through media outreach as an opportunity for AEP Ohio to use this program as an opportunity positive customer experience.

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Appendix A. 2013–2014 School Year Online Student Survey

2013–2014 FAMILY INSTALLATION SURVEY
Columbia Gas of Ohio / AEP Ohio

LIGHTING

1) How many of the **23 watt CFLs** did you install?
☐ One ☐ Two ☐ None

2) When installing the **23 watt CFLs**, how many of the following bulbs did you replace?

CFLs	☐ One	☐ Two	☐ None	40w IL	☐ One	☐ Two	☐ None
60w IL	☐ One	☐ Two	☐ None	75w IL	☐ One	☐ Two	☐ None
100w IL	☐ One	☐ Two	☐ None	Other	☐ One	☐ Two	☐ None

3) How many of the **13 watt CFLs** did you install?
☐ One ☐ Two ☐ None

4) When installing the **13 watt CFLs**, how many of the following bulbs did you replace?

CFLs	☐ One	☐ Two	☐ None	40w IL	☐ One	☐ Two	☐ None
60w IL	☐ One	☐ Two	☐ None	75w IL	☐ One	☐ Two	☐ None
100w IL	☐ One	☐ Two	☐ None	Other	☐ One	☐ Two	☐ None

5) Did you install the **LED nightlight**?
☐ Yes ☐ No

If Yes, did you replace an incandescent nightlight?
☐ Yes ☐ No

INSULATION

1) Did you install the **weather stripping** from the energy efficiency items provided?
☐ Yes ☐ No

2) Did you install the **door sweep** from the energy efficiency items provided?
☐ Yes ☐ No

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HVAC

1) What type of **primary heating system** does your home use?

□ Gas furnace □ Electric furnace □ Heat pump □ Baseboard/In-wall unit
□ Other □ Don't Know

2) What type of **primary cooling system** does your home use?

□ Central AC □ Window AC □ Heat pump □ Other □ Don't Know

3) Did you install the **furnace filter whistle**?

□ Yes □ No

4) Did you (or will you) and your family **lower** your thermostat setting for **HEATING**?

□ Yes, we lowered (or will lower) the setting

□ No, our thermostat is already at the recommended setting of 68°F

□ No, other reason

If you answered **YES**, how much did you lower the setting?

□ 1-2° F □ 3-4° F □ 5-6° F □ 7-8° F □ 9° F or more □ Don't Know

6) Did you (or will you) and your family **increase** your thermostat setting for **COOLING**?

□ Yes, we increased (or will increase) the setting

□ No, our thermostat is already at the recommended setting of 78°F

□ No, other reason

If you answered **YES**, how much did you increase the setting?

□ 1-2° F □ 3-4° F □ 5-6° F □ 7-8° F □ 9° F or more □ Don't Know

WATER

1) What type of **water heater** does your home use?
□ Natural Gas □ Electric □ Other □ Don't Know

2) Did you (or will you) and your family change your **thermostat setting for your water heater** to the recommended setting of 120°F?

□ Yes, we lowered (or will lower) the setting

□ No, it was already at the recommended setting

□ No, other reason

If you answered **YES**, how much did you lower the setting?

NAVIGANT

☐ 1-9°F ☐ 10-20°F ☐ 21-29°F ☐ 30-39°F ☐ 40°F or more

3) Did you install the **kitchen faucet aerator**?
☐ Yes ☐ No

4) Did you install the **bathroom faucet aerator**?
☐ Yes ☐ No

5) Did you install the **low-flow showerhead**?
☐ Yes ☐ No

REFRIGERATOR/FREEZER

1) Did you adjust the setting on your **refrigerator** to the recommended setting (34-40°F)?
☐ Yes ☐ No

2) Did you adjust the setting on your **freezer** to the recommended setting (0-5°F)?
☐ Yes ☐ No

CONCLUSION

1) How many people live in your home?

☐ 2 ☐ 3 ☐ 4 ☐ 5 ☐ 6+

2) What type of home do you live in?

☐ Single Family Home ☐ Apartment/Condo/Duplex

3) ***OPTIONAL - Parent/Guardian Permission only:***
Please provide your address and phone number below for possible contact regarding this educational program.

Street: ______________________________ City: ____________________ Zip Code: ________

Phone with Area Code: (___ ___ ___) ___ ___ ___ - ___ ___ ___ ___

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Appendix B. Appendix B. *e³smart*ᔆᴹ Teacher Evaluation Form

e³smart TEACHER EVALUATION FORM

Name_________________________ School________________________

District_____________________

1. Grade Level/Class in which you used the unit_____

2. Number of participating students _____

3. Average pre-poll score_____ Average post-poll score_____

4. Did you use the entire unit?

_____Yes _____No If no, circle which lessons/activities you used.

#1: Intro to E #2: Insulation #3: Heating & Cooling #4: Saving Water #5: Lightbulbs #6: Appliances #7 E Synopsis

5. Circle the lesson(s)/activity(ies) that were most effective.

#1: Intro to E #2: Insulation #3: Heating & Cooling #4: Saving Water #5: Lightbulbs #6: Appliances #7 E Synopsis

6. Please rate the following aspects of the program.

Poor ________________________________ Excellent

a- Clarity of instructions (Easy to follow)	1	2	3	4	5	6	7
b- Ease of using activities	1	2	3	4	5	6	7
c- Acceptability of preparation	1	2	3	4	5	6	7
d- Age appropriateness of energy content	1	2	3	4	5	6	7
e- Interest and motivation of students	1	2	3	4	5	6	7
f- Support and participation of families	1	2	3	4	5	6	7
g- Academic standards met	1	2	3	4	5	6	7
h- Effectiveness of home to school approach	1	2	3	4	5	6	7
i- Ability to positively affect attitudes about energy	1	2	3	4	5	6	7

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including the importance of conservation and efficiency

j- Students' overall evaluation of unit 1 2 3 4 5 6 7

k- Your (teacher) overall evaluation of unit 1 2 3 4 5 6 7

7. How many student kits were you provided? _______

8. How many student kits were given to students? _______

9. How many student kits were completely installed in some other manner? _______

A. school members _____ B. community members _____ C. service projects _____
D. Others _____

Please explain:

10. How many student kits are being stored by you? _______

11. Did you obtain any publicity during the unit? Explain.

12. Would you conduct the unit again? Explain.

13. What recommendations do you have to improve the unit or lessons?

14. What would make the unit more useful to you?

15. Do you believe the unit changed student and/or family attitudes or behavior about energy conservation and energy efficiency? Explain.

16. Any other comments or suggestions.

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Appendix C. *e³smart* Lesson Plan Alignment with Teaching Standards

Energy Efficiency Curriculum Alignment with Ohio's New Learning Standards

OHIO energy PROJECT

Ohio Energy Project manages programs with utility sponsors to offer this free energy saving efficiency education program for teachers, students and families. Your students will become wise consumers of energy, while at the same time helping their families save money by reducing energy waste at home. And, they will advance their science and math skills in an interesting, hands-on environment and meet state teaching requirements. The program aligns to Ohio's New Learning Standards in science and math. For ease of review, we have matched each teaching module in the program to its corresponding standard. A one-day teacher training session will provide grade appropriate curriculum content and lesson plans. If you have any questions, please contact: Debby Yerkes, Executive Director, Ohio Energy Project, 513-688-1717, dyerkes@ohioenergy.org

ENERGY EFFICIENCY EDUCATION OHIO NEW LEARNING STANDARDS SCIENCE / MATH Grades 4 - 12	LESSON 1: INTRO TO ENERGY	LESSON 2: LIGHT BULB OR HEAT BULB	LESSON 3: INSULATION AND AIR LEAKS	LESSON 4: HEATING AND COOLING	LESSON 5: WATER HEATING AND CONSERVATION	LESSON 6: APPLIANCES AND ENERGY	LESSON 7: ENERGY SYNOPSIS	SOURCE PICS & DEFINITIONS	ENERGY ROUND-UP	ENERGY RELAY	SOURCE TEAM MATCH-UP	COAL SEQUENCE	HYDRO SEQUENCE	SMART HOUSE	PLAY IT SMART	TIC TAC ENERGY	ENERGY FACT OR FAKE	TRANSFORMATION EQUATIONS	WHAT AM I?	SAFETY SORT	GAS SEQUENCE
4th Grade																					
Physical Science *Electricity, Heat and Matter*																					
The total amount of matter is conserved when it undergoes a change												X	X								
Energy can be transformed from one form to another or can be transferred from one location to another.		X	X			X						X	X					X			X
Science Inquiry																					
Observe and ask questions about the natural environment																					
Plan and conduct simple investigations	X	X	X	X	X	X	X														
Employ simple equipment and tools to gather data and extend the senses		X	X	X	X	X															
Use appropriate mathematics with data to construct reasonable explanations		X	X	X	X	X															
Communicate about observations, investigations and explanations	X	X	X	X	X	X	X	X	X		X	X	X					X		X	
Review and ask questions about the observations and explanation of others.	X		X		X	X		X	X		X	X	X					X		X	
Math - Operations and Algebraic Thinking																					
Use the four operations with whole numbers to solve problems		X		X	X	X															
Gain familiarity with factors and multiples		X			X	X															
Generate and analyze patterns		X			X	X															
Math - Measurement and Data																					
Solve problems involving measurement and conversion of measurements from larger unit to a smaller unit		X			X	X															
Represent and interpret data		X			X	X															
Math -Mathematical Practices																					
Make sense of problems and persevere in solving them		X			X	X															
Reason abstractly and quantitatively		X			X	X															
Use appropriate tools strategically		X			X	X															
Look for and express regularity in repeated reasoning		X			X	X															

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Energy Efficiency Curriculum Alignment with Ohio's New Learning Standards

ENERGY EFFICIENCY EDUCATION OHIO NEW LEARNING STANDARDS SCIENCE / MATH Grades 4 - 12	LESSON 1: INTRO TO ENERGY	LESSON 2: LIGHT BULB OR HEAT BULB	LESSON 3: INSULATION AND AIR LEAKS	LESSON 4: HEATING AND COOLING	LESSON 5: WATER HEATING AND CONSERVATION	LESSON 6: APPLIANCES AND ENERGY	LESSON 7: ENERGY SYNOPSIS	SOURCE PICS & DEFINITIONS	ENERGY ROUND-UP	ENERGY RELAY	SOURCE TEAM MATCH-UP	COAL SEQUENCE	HYDRO SEQUENCE	SMART HOUSE	PLAY IT SMART	TIC TAC ENERGY	ENERGY FACT OR FAKE	TRANSFORMATION EQUATIONS	WHAT AM I?	SAFETY SORT	GAS SEQUENCE
5th Grade																					
Physical Science ***Light, Sound and Motion***																					
Light and sound are forms of energy that behave in predictable ways		X														X		X			
Science Inquiry																					
Identify questions that can be answered through scientific investigations	X	X	X	X	X	X															
Design and conduct simple investigations		X	X	X	X	X															
Use appropriate mathematics, tools and techniques to gather data and information		X	X	X	X	X															
Analyze and interpret data		X	X	X	X	X															
Develop descriptions, models, explanations and predictions		X	X	X	X	X		X													
Think critically and logically to connect evidence and explanations		X	X	X	X	X															
Recognize and analyze alternative explanations and predictions		X	X	X	X	X															
Communicate scientific procedures and explanations		X	X	X	X	X			X	X	X	X	X					X		X	
Math - Numbers and Operations in Base Ten																					
Understand the place value system		X			X	X															
Perform operations with multi digit whole numbers and with decimals to hundredths		X			X	X															
Math - Measurement and Data																					
Convert like measurement units within a given measurement system		X				X															
Represent and interpret data		X			X	X															
Math -Mathematical Practices																					
Make sense of problems and persevere in solving them		X			X	X															
Use appropriate tools strategically		X			X	X															
Look for and express regularity in repeated reasoning		X			X	X															
6th Grade																					
Physical Science ***Matter and Motion***																					
All matter is made up of small particles called atoms			X					X													
Changes of state are explained by a model of matter composed of atoms and/or molecules that are in motion												X									
There are two categories of energy: kinetic and potential	X	X	X	X		X											X	X			

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Energy Efficiency Curriculum Alignment with Ohio's New Learning Standards

ENERGY EFFICIENCY EDUCATION / OHIO NEW LEARNING STANDARDS SCIENCE / MATH Grades 4 - 12	LESSON 1: INTRO TO ENERGY	LESSON 2: LIGHT BULB OR HEAT BULB	LESSON 3: INSULATION AND AIR LEAKS	LESSON 4: HEATING AND COOLING	LESSON 5: WATER HEATING AND CONSERVATION	LESSON 6: APPLIANCES AND ENERGY	LESSON 7: ENERGY SYNOPSIS	SOURCE PICS & DEFINITIONS	ENERGY ROUND-UP	ENERGY RELAY	SOURCE TEAM MATCH-UP	COAL SEQUENCE	HYDRO SEQUENCE	SMART HOUSE	PLAY IT SMART	TIC TAC ENERGY	ENERGY FACT OR FAKE	TRANSFORMATION EQUATIONS	WHAT AM I?	SAFETY SORT	GAS SEQUENCE
Science Inquiry																					
Identify questions that can be answered through scientific investigations	X	X	X	X	X	X															
Design and conduct simple investigations	X	X	X	X	X	X															
Use appropriate mathematics, tools and techniques to gather data and information		X	X	X	X	X															
Analyze and interpret data		X	X	X	X	X															
Develop descriptions, models, explanations and predictions		X	X	X	X	X															
Think critically and logically to connect evidence and explanations		X	X	X	X	X					X										
Recognize and analyze alternative explanations and predictions		X	X	X	X	X															
Communicate scientific procedures and explanations		X	X	X	X	X												X			
Math - The Number System																					
Compute fluently with multi-digit numbers and find common factors and multiples		X	X	X	X	X															
Represent and interpret data					X	X															
Math -Mathematical Practices																					
Make sense of problems and persevere in solving them		X			X	X															
Use appropriate tools strategically		X			X	X															
Look for and express regularity in repeated reasoning		X			X	X															
Math -Statistics and Probability																					
Develop understanding of statistical variability					X																
7th Grade																					
Earth and Space Science ***Cycles and Patterns of Earth and the Moon***																					
This topic focuses on Earth's hydrologic cycle, patterns that exist in atmospheric and oceanic currents, the relationship between thermal energy and the currents, and the relative position and movement of the Earth, sun and moon.													X	X							
Physical Science ***Conservation of Mass and Energy***																					
This topic focuses on the empirical evidence for the arrangement of atoms on the Periodic Table of Elements, conservation of mass and energy, transformation and transfer of energy												X	X					X			
Science Inquiry																					
Identify questions that can be answered through scientific investigations	X	X	X	X	X	X															
Design and conduct simple investigations	X	X	X	X	X	X															
Use appropriate mathematics, tools and techniques to gather data and information		X	X	X	X	X															
Analyze and interpret data		X	X	X	X	X															
Develop descriptions, models, explanations and predictions		X	X	X	X	X															
Think critically and logically to connect evidence and explanations		X	X	X	X	X				X											
Recognize and analyze alternative explanations and predictions		X	X	X	X	X															
Communicate scientific procedures and explanations		X	X	X	X	X															

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Energy Efficiency Curriculum Alignment with Ohio's New Learning Standards

ENERGY EFFICIENCY EDUCATION OHIO NEW LEARNING STANDARDS SCIENCE / MATH Grades 4 - 12	LESSON 1: INTRO TO ENERGY	LESSON 2: LIGHT BULB OR HEAT BULB	LESSON 3: INSULATION AND AIR LEAKS	LESSON 4: HEATING AND COOLING	LESSON 5: WATER HEATING AND CONSERVATION	LESSON 6: APPLIANCES AND ENERGY	LESSON 7: ENERGY SYNOPSIS	SOURCE PICS & DEFINITIONS	ENERGY ROUND-UP	ENERGY RELAY	SOURCE TEAM MATCH-UP	COAL SEQUENCE	HYDRO SEQUENCE	SMART HOUSE	PLAY IT SMART	TIC TAC ENERGY	ENERGY FACT OR FAKE	TRANSFORMATION EQUATIONS	WHAT AM I?	SAFETY SORT	GAS SEQUENCE
Math -Mathematical Practices																					
Make sense of problems and persevere in solving them		X			X	X															
Use appropriate tools strategically		X			X	X															
Look for and express regularity in repeated reasoning		X			X	X															
8th Grade																					
Physical Science *Forces and Motion*																					
There are different types of potential energy												X	X					X			X
Science Inquiry																					
Identify questions that can be answered through scientific investigations	X	X																			
Design and conduct simple investigations	X	X																			
Use appropriate mathematics, tools and techniques to gather data and information		X																			
Analyze and interpret data		X																			
Develop descriptions, models, explanations and predictions		X																			
Think critically and logically to connect evidence and explanations		X									X										
Recognize and analyze alternative explanations and predictions		X																			
Communicate scientific procedures and explanations		X																X			
Math -Mathematical Practices																					
Make sense of problems and persevere in solving them		X			X	X															
Use appropriate tools strategically		X			X	X															
Look for and express regularity in repeated reasoning		X			X	X															
High School																					
Physical Science																					
Energy and Waves: conservation, transfer and transformation, waves, thermal energy, electricity	X	X	X	X	X	X	X		X	X	X	X	X	X	X	X	X	X	X	X	
Forces and Motion: motion, forces, dynamics												X	X								
Chemistry																					
Structure and properties of matter: atomic structure, phases of matter												X	X								
Environmental Science																					
Earth Systems: hydrosphere, movement of matter and energy	X		X					X	X	X	X	X	X					X			
Earth's Resources: energy resources, air pollution, land use and management, wildlife	X							X	X	X	X	X	X	X	X						X
Global Environmental Problems and Issues: climate change, sustainability, air quality	X	X	X	X	X		X				X			X	X				X		

Energy Efficiency Curriculum Alignment with Ohio's New Learning Standards

ENERGY EFFICIENCY EDUCATION OHIO NEW LEARNING STANDARDS SCIENCE / MATH Grades 4 - 12	LESSON 1: INTRO TO ENERGY	LESSON 2: LIGHT BULB OR HEAT BULB	LESSON 3: INSULATION AND AIR LEAKS	LESSON 4: HEATING AND COOLING	LESSON 5: WATER HEATING AND CONSERVATION	LESSON 6: APPLIANCES AND ENERGY	LESSON 7: ENERGY SYNOPSIS	SOURCE PICS & DEFINITIONS	ENERGY ROUND-UP	ENERGY RELAY	SOURCE TEAM MATCH-UP	COAL SEQUENCE	HYDRO SEQUENCE	SMART HOUSE	PLAY IT SMART	TIC TAC ENERGY	ENERGY FACT OR FAKE	TRANSFORMATION EQUATIONS	WHAT AM I?	SAFETY SORT	GAS SEQUENCE
Physics																					
Forces, momentum and motion: gravitational force and fields, elastic forces, friction force, momentum, impulse and conservation of momentum												X									
Energy: gravitational potential energy, energy in springs, nuclear energy, work and power, conservation of energy												X	X					X			
Waves: wave properties, light phenomena		X														X					
Electricity and magnetism: charging objects, electric fields and electric potential energy, DC circuits, magnetic fields and energy, electromagnetic interactions		X										X	X							X	
Science Inquiry																					
Identify questions and concepts that guide scientific investigations	X	X	X	X	X	X															
Design and conduct simple investigations	X	X	X	X	X	X															
Use technology and mathematics to improve investigations and communications		X	X	X	X	X								X		X					
Formulate and revise explanations and models using logic and evidence (critical thinking)		X	X	X	X	X					X							X		X	
Recognize and analyze explanations and models		X	X	X	X	X		X			X							X			
Communicate and support a scientific argument		X	X	X	X	X					X										

Appendix D. Media Outreach Press Release and Superintendent Letter

D.1 Press Release for AEP Ohio e3smart℠ Program—For Use by Teachers in AEP Ohio Schools

AEP Ohio Provides Energy Efficiency Learning Experiences for Students

Students at _______(school)______ are learning to become wise consumers of energy while at the same time helping their families save money by reducing energy waste at home today. Students in (teacher's name), (grade) class are participating in the e3smart℠ Program which is offered by AEP Ohio, a unit of American Electric Power (NYSE: AEP).

Participating teachers are trained to teach the energy efficiency curriculum which is aligned with Ohio science standards. They also receive instructional supplies to supplement the classroom experience. Students learn about energy forms, sources, transformation, conservation, consumption and efficiency. Along with classroom instruction, the students receive energy saving kits including compact fluorescent light bulbs (CFLs) and light-emitting diodes (LEDs), a low-flow showerhead, faucet aerators and weather stripping to install at home. AEP Ohio has partnered with the Ohio Energy Project to offer the e^{3}smart℠ Program since 2007.

For more information about how your school can participate in e3smart or details about any of AEP Ohio's energy efficiency consumer programs, events and tips, visit AEPOhio.com/WasteLess.

# # #

AEP Ohio provides electricity to nearly 1.5 million customers of major AEP subsidiary Ohio Power Company in Ohio. AEP Ohio is based in Gahanna, Ohio, and is a unit of American Electric Power. News and information about AEP Ohio can be found at aepohio.com.

American Electric Power is one of the largest electric utilities in the United States, delivering electricity to more than 5 million customers in 11 states. AEP ranks among the nation's largest generators of electricity, owning nearly 38,000 megawatts of generating capacity in the U.S. AEP also owns the nation's largest electricity transmission system, a more than 40,000-mile network that includes more 765-kilovolt extra-high voltage transmission lines than all other U.S. transmission systems combined. AEP's transmission system directly or indirectly serves about 10 percent of the electricity demand in the Eastern Interconnection, the interconnected transmission system that covers 38 eastern and central U.S. states and eastern Canada, and approximately 11 percent of the electricity demand in ERCOT, the transmission system that covers much of Texas. AEP's utility units operate as AEP Ohio, AEP Texas, Appalachian Power (in Virginia and West Virginia), AEP Appalachian Power (in Tennessee), Indiana Michigan Power, Kentucky Power, Public Service Company of Oklahoma, and Southwestern Electric Power Company (in Arkansas, Louisiana and east and north Texas). AEP's headquarters are in Columbus, Ohio. News releases and other information about AEP can be found at aep.com.

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AEP Ohio
Fay White
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AEP Ohio
850 Tech Center Drive
Gahanna, Ohio 43230
aepohio.com

AEP OHIO
A unit of American Electric Power

D.2 Superintendent Congratulation Letter

May 12, 2015

Superintendent, Superintendent
School District
Street
City, OH Zip

Dear Superintendent Superintendent,

We would like to commend your outstanding teacher, First Last at School for participating in an award winning energy efficiency education program, e^{3}smart. First is one of 350 teachers throughout AEP Ohio's 61-county service area prepared to teach the e^{3}smart Program. Funded by AEP Ohio and developed by the Ohio Energy Project, this innovative program teaches energy concepts and energy conservation strategies correlated to the National Science Education Content Standards and the Ohio Department of Education Science Standards. In this program, First's students learn about energy at school, and then have the opportunity to apply their knowledge at home with the approval and participation of their parents or guardian.

First attended a day of training to learn about the e^{3}smart program and received over $500 in science equipment and supplies for use in the classroom. In addition, each student participating in e^{3}smart and their families receive an energy conservation kit from AEP Ohio with items valued at approximately $70 to help reduce electricity and fuel use in their homes. Once installed, these energy conservation measures give families the opportunity to see firsthand how low-cost and no-cost measures can lower energy use and reduce energy bills.

The e3smart Program is one of several programs offered by AEP Ohio to help our residential and business customers save money through energy efficiency. Using energy efficiently delays the need for new generation and the future related rate impacts, reduces the environmental impacts of current fossil fuel generation, provides sustainable green jobs in Ohio, and frees up customer resources for other important needs.

We commend First for taking the initiative to bring this opportunity to School students and compliment you and the School District for your hard work, dedication and enthusiasm for energy efficiency education. We hope First Last will have your continued support in offering this program for students during the upcoming 2013-2014 school year.

Sincerely,

Jon Williams Manager Energy Efficiency/Peak Demand Reduction cc: Principal First Last	Deborah Yerkes Deborah Yerkes Executive Director OHIO energy PROJECT

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Appendix E. Information in the Energy Efficiency Kits about AEP Ohio's Energy Efficiency/Peak Demand Reduction (EE/PDR) Programs

Energy Efficiency Programs for Residential Customers in Ohio

APPLIANCE REBATES:

You can save money and energy while protecting the environment through the Appliance Rebate program. Today's appliances can use half of the energy that a 12 year old appliance uses. Any AEP Ohio residential electric customer who purchases an ENERGY STAR® certified appliance between January 1 and December 31, 2014 is eligible for the following rebates:

- ENERGY STAR® certified televisions – **$25**
- ENERGY STAR® certified dehumidifiers – **$25**
- ENERGY STAR® certified clothes washers – **$50**
- ENERGY STAR® certified freezers – **$50**
- ENERGY STAR® certified refrigerators – **$50**
- ENERGY STAR® certified electric heat pump water heaters – **$500**

EFFICIENT LIGHTING:

Get instant, in-store discounts when you purchase ENERGY STAR® certified compact fluorescent light bulbs (CFLs) and ENERGY STAR® certified light emitting diode (LED) bulbs at participating retailers within our Ohio service area. Check website for retailer locations. Receive immediate discounts on CFLs and LEDs in our online **SMART Lighting Store.** You'll find a large selection of energy-efficient lighting and specialty CFLs and LEDs here.

* CFL discounts up to $3 / bulb & LED discounts up to $10 / bulb

APPLIANCE RECYCLING

Get paid to have your old, inefficient refrigerator or freezer picked up and recycled.

- **Get paid** - Receive a $50 incentive check plus FREE, convenient pick up of your old appliance.
- **Save Money and Energy** - Remove an old working refrigerator or freezer and you'll save up to $150 a year in energy costs.
- **Protect the Environment** - 95% of the unit is recycled. Chemicals are properly disposed.
- **Call 1-877-545-4112 or visit AEPOhio.com/WasteLess to schedule your FREE and convenient pickup.**

IN-HOME ENERGY AUDITS:

Want to know where your home is wasting energy? We have three options to help you identify problems and get personalized recommendations that will help you save money and energy.

Energy Assessment

- $25 for a one-hour assessment by a trained assessor.
- Installation of free energy-saving items such as compact fluorescent light (CFL) bulbs and a light emitting diode (LED) night light.
- Installation of a high-efficiency showerhead, faucet aerators, and pipe insulation in homes with electric water heaters.
- Get a prioritized list of suggested measures to reduce energy consumption and information about rebates from AEP Ohio.
- **Call 1-877-856-2454** to schedule your Energy Assessment.

Energy Audit for All-Electric Homes

- $50 for a four-hour audit by a **professional energy auditor**.
- Installation of free energy-saving items such as compact fluorescent light (CFL) bulbs, and light emitting diode (LED) night light.
- Installation of a high-efficiency showerhead, faucet aerators, and pipe insulation for homes with electric water heaters.
- Get a personalized report with suggested energy-saving improvements and information about rebates from AEP Ohio.
- Call 1-877-856-2454 to schedule your Energy Audit.

Online Energy Checkup

- Answer questions online about your home, appliances and energy use.
- Get free, personalized recommendations for saving energy.
- Receive a free energy efficiency kit by mail.

OVER

ENERGY IS PRECIOUS. LET'S NOT WASTE IT. AEP OHIO

0414 Subject to all other program rules and requirements included in the application form. Program terms and conditions subject to change.

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Energy Efficiency Programs for Residential Customers in Ohio

ENERGY STAR® New Home

More Energy Savings and Value Built Right In

A new home is probably the biggest purchase you'll ever make, so you want to get it right. Make the smart choice with an AEP Ohio/ Columbia Gas of Ohio ENERGY STAR® New Home. These homes reduce energy use by as much as 35% or more compared to conventionally built homes – giving you greater savings, comfort and value for years to come. With greater energy savings and value built right in, homeowners can expect a more comfortable and durable home that saves money every year you own it.

EDUCATION FOR KIDS

Students Learn, Families Save

Families with students in schools served by AEP Ohio are learning how to save energy and money at home if their children are participating in e3smart(SM). Now, in its fifth year, this energy efficiency education program is expected to engage up to 32,000 students in grades 5 through 12. The e3smart curriculum as developed by the Ohio Energy Project meets Ohio and National Science Standards and was recognized as an Outstanding Energy Education Project by the Ohio EPA in 2008.

COMMUNITY ASSISTANCE PROGRAM

Customers enrolled in a payment assistance plan (PIPP, HWAP, HEAP) may be eligible to receive free energy efficiency improvements for their home.

Visit AEPOhio.com/WasteLess for more information on energy efficient programs

ENERGY IS PRECIOUS. **LET'S NOT WASTE IT.** AEP OHIO®

APPENDIX E

In-home Energy Program

2014 Evaluation Report

Prepared for:
AEP Ohio

May 7, 2015

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NAVIGANT

Table of Contents

Executive Summary 1

ES.2 Key Impact Evaluation Findings and Recommendations 1
ES.3 Key Process Evaluation Findings and Recommendations 3

1 Program Description 8

1.1 Program Description 8
1.2 Implementation Strategy 9
1.2.1 Program Marketing Strategy 9
1.2.2 Role of AEP Ohio Staff 9
1.2.3 Roles of the Implementation Contractor 9
1.2.4 Measures and Incentives 9
1.3 Program Theory 11
1.4 Evaluation Questions 12
1.4.1 Impact Questions 12
1.4.2 Process Questions 12

2 Evaluation Methods 14

2.1 Overview of Approach 14
2.2 Impact Evaluation Sample 15
2.3 Tracking System Review 16
2.4 Ex Post Savings Evaluation 16
2.5 Adjusted Savings Evaluation 16
2.6 Program Staff Interviews 17
2.7 Process Evaluation Sample 17
2.8 Installation Contractor Interviews 18
2.9 Program Material Review 19

3 Program Level Results 20

3.1 Impact Evaluation Findings 20
3.1.1 Program Activity 20
3.1.2 Measure In-Service Rates 22
3.1.3 Tracking System Review 25
3.1.4 *Ex Ante* Savings Evaluation 27
3.1.5 Adjusted Savings Evaluation 27
3.1.6 Adjusted *Ex Post* Savings 31
3.2 Process Evaluation Findings 32
3.2.1 Participant Satisfaction 32
3.2.2 Marketing and Program Awareness 33

NAVIGANT

3.2.3 Barriers to Participation for Audit Only Participants 33
3.2.4 Application and Payment Processing Time 40
3.2.5 Online Energy Checkup Participant Satisfaction 41
3.2.6 Online Energy Check-up Process 42
3.2.7 Installation Contractor Participation 43
3.2.8 Installation Contractor Satisfaction 44
3.2.9 Audit to Rebate Conversion Rates 46
3.3 Cost-Effectiveness Review 48

4 Conclusions and Recommendations 49

4.1 Key Impact Evaluation Findings and Recommendations 49
4.2 Key Process Evaluation Findings and Recommendations 51

Appendix A Summary of Measure Savings 56

Appendix B Data Collection Instruments 57

NAVIGANT

List of Figures

Figure 3-1. Participant Reasons for Not Installing Energy Kit Measures 25
Figure 3-2. Most Influential Sources of Program Awareness – Participants 33
Figure 3-3. Primary Motivation for Energy Efficiency Improvements – Participants....... 34
Figure 3-4. Most Important Factor in Decision to Make Improvements – Participants....... 35
Figure 3-5. Reasons for Not Installing Recommended Measures – Audit only participants 36
Figure 3-6. Reasons for Not Applying for a Rebate – Audit only participants 37
Figure 3-7. Did Participants Read the Energy Audit Report? 39
Figure 3-8. How Did You Hear About the Program? 42
Figure 3-9. Did Participants Read the Energy Report after Online Checkup? 42
Figure 3-10. Contractor Benefits to Participation 45
Figure 3-11. Factor with Greatest Impact on Contractor Reported Conversion Rates....... 47
Figure 4-1. Summary of Measure Savings....... 56

List of Tables

Table ES-1. 2014 Overall Evaluation Results 1

Table 1-1. AEP Ohio In-home Energy Measure Incentives – January to April 10
Table 1-2. AEP Ohio In-home Energy Measure Incentives – May to December........ 11
Table 2-1. Summary of Data Collection Activities 15
Table 2-2. 2014 Impact Evaluation and Population-Level Sampling Error........ 16
Table 2-3. Data Collection Activities 17
Table 2-4. 2014 Survey Completes and Population-Level Sampling Error........ 18
Table 3-1. Measure Activity Summary – *Ex Ante* 20
Table 3-2. Direct Install (DI) Measure Activity – *Ex Ante*........ 20
Table 3-3. Energy Kit Measure Activity – *Ex Ante* 21
Table 3-4. Retrofit Measure Activity – *Ex Ante* 21
Table 3-5. Number of Audits and Assessments 22
Table 3-6. In-home Energy Program Direct Install Measure In-Service Rates 23
Table 3-7. In-home Energy Program Retrofit Measure In-Service Rates 24
Table 3-8. In-home Energy Program Energy Kit In-Service Rates 24
Table 3-9. Tracking System Review Findings 26
Table 3-10. Tracking System (*Ex Ante*) and Verified (*Ex Post*) Savings Estimates 27
Table 3-11. Total Savings for ECM Motors and Programmable Thermostats 27
Table 3-12. ECM Motor Algorithm Review Findings 28
Table 3-13. Key Impact Parameters for Thermostats 29
Table 3-14. Programmable Thermostat Algorithm Review Findings........ 29
Table 3-15. Tracking System (*Ex Ante*) and Adjusted (*Ex Post*) Savings Estimates 31
Table 3-16. Mean Satisfaction Scores – Participants........ 32
Table 3-17. Satisfaction Ratings – Full and Audit only participants........ 38
Table 3-18. Days for Rebate Processing Time 40
Table 3-19. Mean Online Checkup Satisfaction Scores........ 41
Table 3-20. Mean Contractor Satisfaction Scores........ 44
Table 3-21. Average Conversion Rate by Audit Type 46
Table 3-22. Adjusted Conversion Rates Excluding Installations that Occurred Before Audits........ 46
Table 3-23. Inputs to Cost-Effectiveness Model for In-home Energy Program........ 48
Table 3-24. Cost Effectiveness Results for the In-home Energy Program 48
Table 4-1. 2014 Overall Evaluation Results........ 49

NAVIGANT

Executive Summary

This report describes the results of an evaluation of the 2014 AEP Ohio In-home Energy Program. This Executive Summary provides a high-level description of the program, key impact findings, conclusions, and recommendations stemming from these findings. Detailed methodology and findings are described in the body of the report following the Executive Summary.

ES.1 Program Summary

The purpose of the In-home Energy Program is to provide energy efficiency information and easy-to-install measures to help customers take action to reduce energy use. Energy efficiency products and information are provided to customers at four levels: 1) an *Online Energy Checkup*, 2) an *In-home Energy Assessment,* 3) an *In-home Energy Audit,* and 4) a *Multifamily Direct Install Service*. During an audit or assessment, contractors install compact fluorescent lamps (CFLs), a light emitting diode (LED) night light, and, if using electricity for water heating, low-flow showerheads and low-flow faucet aerators. Customers are eligible for rebates for a list of measures identified during In-home audits or assessments. The program implementation contractor delivers program services on behalf of AEP Ohio and contracts with local installation contractors.

ES.2 Key Impact Evaluation Findings and Recommendations

Navigant used engineering algorithms to verify energy and demand savings for the 2014 In-home Energy Program. The In-home Energy Program reported 10,016 MWh of energy savings and 1.5 MW of demand savings in 2014. The verified (*ex post*) energy and demand savings for 2014 were 8,191 MWh and 1.2 MW. *Ex post* savings fell short of the program energy savings goal of 13,720 MWh, but exceeded the demand savings goal of 0.90 MW, as shown in Table ES-1. The realization rates were 82 percent for MWh and 81 percent for peak kW.

Table ES-1. 2014 Overall Evaluation Results

	2014 Program Goals (a)	*Ex Ante* Savings (b)	*Ex Post* Savings (c)	Realization Rate RR = (c) / (b)	Percent of Goal = (c) / (a)
Energy Savings (MWh)	13,720	10,016	8,191	0.82	60%
Demand Savings (MW)	0.9	1.5	1.2	0.81	137%

[1] Source: 2012-2014 AEP Ohio Energy Efficiency/Peak Demand Reduction Action Plan.

1. **Missed Savings Opportunities.** More than 2,000 MWh of energy savings from over 6,000 measures were removed from the tracking system after submission due to incomplete information. Rebates were paid for some of these measures by the implementation contractor, but AEP Ohio's final quality control processes rejected these because customer information needed for verification was

absent. Many of the non-savings measures were credited back to AEP Ohio or not paid originally. Issues were identified throughout the year with the quality of project data transferred by the implementation contractor to AEP Ohio, requiring frequent and significant revision.

Impact Recommendation #1: Ensure the implementation contractor's data entry system has input validation processes that reject rebate applications filed with missing information that is necessary for verification and savings calculation purposes.

2. **Program Activity.** More than 10,000 audits, assessments and online checkups were conducted by program auditors in 2014, resulting in more than 4,000 retrofits. Multifamily direct install measures accounted for 62 percent of the total *ex ante* program energy saving in 2014, energy kit measures accounted for 16 percent, retrofit measures accounted for 13 percent, and single-family direct install measures accounted for 10 percent of the program's total *ex ante* MWh savings.

3. **Measure In-Service Rates.** The in-service rate for each measure installed through the program was determined through both on-site audits as well as participant telephone surveys. Installation rates for direct install measures ranged from 19 percent (multifamily nightlights) to 91 percent (multifamily CFLs). All retrofit measures were found to have a realization rate of 100 percent. Energy kit measure installation rates ranged from 26 percent for showerheads and aerators to 67 percent for LED nightlights.

4. **LED Nightlight Installation Rates.** The realization rate found for multifamily LED nightlights was lower than for other measures. It is possible that tenants are taking the LED nightlights with them when they move out of the apartment. From data provided by AEP Ohio, Navigant verified that half of the units missing a nightlight did in fact experience turnover in 2014 after the measure installation date.

Impact Recommendation #2: The program should enforce the policy that nightlights should only be installed where these replace an existing nightlight. Nightlights are currently being installed in every unit, regardless of whether an inefficient nightlight existed previously. Enforcing this policy may reduce the incidence of nightlight removal by customers who do not want them.

5. **Energy Kit Installation Rates.** Several energy kit measures were found to have very low installation rates, resulting an overall realization rate of 51 percent for those measures as a whole. These low installation rates have a significant impact on the program's overall realization rate. For instance, if the kit measures all had an installation rate of 100 percent, the program's overall realization rate would increase to 90 percent. The worst installation rates for kit measures were found for the water saving measures (showerheads, aerators and pipe insulation). Most of the participants surveyed who did not install these measures reported that they already had them (51%).

Impact Recommendation #3: Apply an in-service rate adjustment factor to the *ex ante* algorithms for kit measures based on evaluation findings so that *ex ante* savings will more closely align with *ex post* evaluation results and improve the program realization rate.

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6. ***Ex Post* Savings Evaluation.** Navigant conducted a review of measure savings recorded in the tracking system to verify that the energy savings algorithms matched those in the Draft 2010 Draft 2010 Ohio Technical Reference Manual (TRM) and were correctly applied for each project. The evaluation team independently calculated energy savings for each measure in the database using the *ex ante* calculation methods based on the Draft 2010 Ohio TRM. Navigant's algorithm review found that the energy and demand savings algorithms have been constructed and applied properly according to Draft 2010 Ohio TRM specifications.

7. **Adjusted Savings Evaluation.** For high-impact measures (with more than 1% of total program savings) not included in the Draft 2010 Ohio TRM [i.e. electrically-commutating motors (ECM) motors and programmable thermostats], the evaluation team examined AEP Ohio's calculation methods and evaluated these against calculation methods identified from secondary sources (recent TRMs from nearby states).

   The *ex ante* savings calculations for ECM motors use deemed savings based on the home's heating and cooling system type, specified in the 2012 to 2014 AEP Ohio Energy Efficiency/Peak Demand Reduction (EE/PDR) Action Plan. Navigant applied estimates calculated from a more recent study conducted by Advanced Energy. [1] The resulting *ex post* savings for ECM motors was 250 percent of the *ex ante* value. These measures have been removed from the program in 2015, so no further change is recommended.

   The *ex ante* savings calculations for programmable thermostats use deemed savings based on the heating and cooling system type for the home, specified in the AEP Ohio EE/PDR Plan. The evaluation team reviewed recent TRM algorithms for nearby states and applied a more recent algorithm found in the 2014 Pennsylvania TRM that could be modified using Draft 2010 Ohio TRM inputs, resulting in an *ex post* savings of 50 percent of the *ex ante* value.

Impact Recommendation #4: Update the *ex ante* calculations for programmable thermostats based on more recent algorithms and assumptions. Additionally, discontinue rebates for these measures in homes that do not have electric heat, as most savings from these measures occur during the heating season.

ES.3 Key Process Evaluation Findings and Recommendations

The process evaluation component of the In-home Energy Program assessed the effectiveness of the program operations, delivery for the energy audits/assessments, and rebates for retrofit measures. Navigant's process evaluation included in-depth interviews with program staff, participating customers and installation contractors, and a review of program tracking systems, reports and marketing materials. Findings follow along with recommendations.

[1] Murray, Matt, et. al. *Residential HVAC Electronically Commutated Motor Retrofit Report*. February 2012. http://www.advancedenergy.org/_files/pages/Residential-HVAC-Electronically-Commutated-Motor-Retrofit.pdf

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1. **Participants are satisfied with most aspects of the program.** Respondents reported their satisfaction with various elements of the In-home Energy Program was quite high. The average satisfaction reported with the overall program was 8.3 on a scale of 1 to 10 (where 1 was "extremely dissatisfied" and 10 was "extremely satisfied"). Satisfaction with the different aspects of the program did not vary substantially – all aspects scored above 8. The highest ratings were provided for the auditor who assessed the home's performance (9.1), the length of time it took to complete the audit/assessment (8.9) and the time it took to schedule the energy audit (8.9).

2. **Data entry**. Tracking system issues due to installation contractor data entry decreased in 2014 thanks to the new online data entry system (CAKE). Half of the contractors interviewed reported seeing fewer application flaws using the new CAKE online intake tool. Nearly all contractors (8 of 9) reported that the new online system is an improvement over the old paper-based application process. However, some contractors did report that the CAKE system can be time consuming due to some redundancy in the information requested. According to program staff, changes were made to the system mid-year to reduce redundancy of data collected. Despite these improvements to the final data extract provided to Navigant, AEP Ohio's QA/QC process is still finding significant errors, as evidenced by the number of projects negated in the tracking system for non-compliance with program requirements. The data extract provided by the implementation contractor to AEP Ohio contained significant data entry errors or missing data necessitating the removal of substantial savings from the program due to measure ineligibility or inability to confirm customer eligibility.

Process Recommendation #1: Monitor application flaw patterns to optimize data entry. Monitor application flaws occurring through the CAKE system to identify further opportunities to streamline the application process. Eliminate requirements for manual entry of data that is also submitted in supporting documents.

3. **Installation Contractor Satisfaction.** Survey results indicate that contractors are satisfied with the program overall, giving the program a rating of 7.9 out of 10 (compared to 7.3 in 2013). Contractors reported a significant increase in satisfaction with most program elements over 2013. The greatest increase in satisfaction was reported for the process for submitting rebate applications. The only decrease was reported for rebate amounts for HVAC measures (specifically gas measures for which rebates were eliminated in 2014 for cost-effectiveness reasons).

   The most common suggestions on ways to improve the program were more marketing and outreach to customers, and to increase rebate levels. All ten contractors said that additional marketing support from the program would help them sell their services to customers.

Process Recommendation #2: Consider additional marketing support for contractors. Contractors were the largest source of program awareness among customers interviewed. Surveys indicate that marketing efforts focused on supporting contractors' ability to sell energy efficiency retrofits to customers would be well received. Specifically, sales training could satisfy contractors' desire for marketing support, while also helping to improve audit-to-rebate conversion rates. Low audit-to-rebate conversion rates found in this evaluation (19%-30%) indicate that contractors have significant room for improvement in their sales

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practices. Several contractors also mentioned that providing name recognition for "program approved" contractors would be helpful.

Process Recommendation #3: Maintain the website with auditor contact information. The auditor list on the AEP Ohio website was down for revisions when the evaluation team tried to review.

4. **Installation Contractor Participation**. Navigant analyzed participation data for each contractor to identify any trends in participation compared to 2013. More than half of the companies who participated in 2013 and 2014 experienced a significant decrease in participation in 2014. Firms that have experienced growth since last year attributed it to an increase in marketing and customer interest. Those who experienced a decrease attributed it to the elimination of rebates for gas measures (contractors reported that only 38% of the homes they retrofit are electrically heated).

   Navigant observed an increased number of contractors using the online audit for rebate qualification. Of the 86 contractors who had projects where an online checkup was used to qualify customers, 62 of those were HVAC contractors. There is a pool of roughly 50 HVAC contractors whose projects are mostly or exclusively associated with the online checkup. Additionally, almost 75 percent of these projects were installed before the online checkup was conducted. In fact, the majority of new contractors who entered the program in 2014 complete projects in this fashion, mostly for HVAC projects. It appears that contractors are using the program's rebates to sell higher efficiency units, then using the online checkup after the fact to meet program requirements for customer eligibility.

Process Recommendation #4: Sales training targeted to HVAC contractors for selling whole-home performance. As new contractors join the program, to take advantage of HVAC rebates, AEP Ohio should include material in training and/or orientation efforts about identifying and selling whole-house improvements. HVAC contractors relying solely on the online audit are not required to be BPI certified. It is likely that many of these contractors have little knowledge of whole-house retrofits, and how to sell them. Additional training for these contractors could improve the rate of multiple-measure, whole-house retrofits.

5. **Audit-to-Rebate Conversion Rates.** Audit-to-rebate conversion rate is a key indicator of market transformation for home retrofit programs. Navigant was able to calculate conversion rates for the program using tracking data and found that the average conversion rate for the program as a whole was 19 percent in 2014 (adjusted for measures installed before the audit). This adjusted conversion rate is skewed by the Online Checkup (6% conversion rate), which is primarily intended as an educational tool and not necessarily expected to result in retrofit measure installation for every customer. It is more appropriate to focus on the conversion rates associated with audits and assessments (adjusted for audits after installation). These rates are around 30 percent, which are significantly better than the program average rate (19%), but still presents an opportunity for improvement.

   Adjustments made to the conversion rates to account for units installed before the audit complicate the conversion rate metric in ways that may prevent simple benchmarking against other utility programs (which might not have accounted for these adjustments). For many of those Online Checkup participants who received a measure installation before the audit, it is likely that the program rebates (and contractor messaging) did influence them to install higher efficiency measures than they otherwise would have. While the design of an audit/retrofit program traditionally intends that the audit influence customers to make improvements, this program is, in a way, functioning as an HVAC program as well (as noted in Section 3.2.7), which relies on the contractor up-selling high-efficiency units through rebates. For this reason, conventional metrics for evaluating market progress, such as conversion rates, should be viewed carefully for this program.

Process Recommendation #5: Monitor contractor conversion rates and conducting additional targeted outreach and/or training on sales practices among contractors with low rates.

6. **Barriers to Participation.** Participant survey responses indicate that customers are primarily motivated to participate in the program in order to save energy and money. Contrary to initial expectations, up-front cost and lack of capable contractors were not identified as significant barriers to adoption. According to survey response, the information provided (or not provided) in the audit plays a greater role in overcoming barriers to adoption. Rebate recipients reported that their ultimate decision on which measures to install was based on the measures most needed/practical and those that saved the most energy/money, with the auditor's recommendations playing a significant role in both of these decisions.

   Audit only participants (those who did not receive a rebate) reported significantly lower satisfaction with the usefulness of the recommendations they were provided (5.9 compared to 8.1 for rebate participants on a 1-10 scale). A total of 26 percent of customers said that the auditor had no recommendations or that the report did not tell them anything new. These customers wanted to understand why their bills were high and how they were using energy, but felt the audit/assessment was insufficient in providing this information. Many AEP Ohio Customer Services Representatives (CSR's) are using this program as a tool to help resolve high bill complaints. In many cases, the bills and recent rate increases were the focus of these customers and they were not as interested in energy efficiency in general.

   The most common reason cited by audit only participants for not installing measures was that they haven't gotten around to it yet (43%). While many of these participants may eventually follow-through, there may be opportunities for the program to play a role in compelling these participants into action. Audit only participants did not receive rebates through the program, though 58% of them (n=29) indicated that they did install one or more of the auditor's recommendations. This result indicates that the program (through audits) did help even those participants overcome key barriers (i.e. lack of information) to adopting energy efficiency, though not in a way that the program gets credit for because no rebate was given. These findings also indicate that there is a significant number of retrofits occurring as a result of the program that are not receiving rebates (mostly due to customer inaction or measure ineligibility).

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Process Recommendation #6: Provide an additional incentive for rebate applications submitted by contractors, for multiple-measure installations that occur after an audit. Many contractors are reluctant to submit applications on behalf of customers because they do not want to deal with paperwork and are reluctant to adapt to the new online system. Customers are therefore responsible for submitting applications which they often find confusing, resulting in data entry errors and retrofits for which no rebate is received because customers just do not get around to doing this on their own. While requiring contractors to submit paperwork might create an unfavorable barrier to entry for contractors, offering an incentive (or spiff) may help overcome the initial hurdle of adapting to the new system. Additionally, tying the incentive to multiple measure rebates that occur after an audit would help to encourage whole-house retrofits based on audit results. This incentive may be most viable as a promotional offering or temporary offering for new contractors.

Process Recommendation #7: Training and outreach for contractors should emphasize the six-month window for applying for a rebate. The high number of customers (43%) who reported not installing measures or applying for a rebate because they "just haven't gotten around to it yet," might be reduced if (among other things) contractors emphasize the limited application period for applying for rebates in their sales process.

Process Recommendation #8: Emphasize energy and cost savings in messaging. For many/most customers, energy and cost savings are the primary motivators in their decision to participate in the program and implement efficiency improvements. Explore compelling ways to present this information in advertising and audit reports. Additionally, sales training to help contractors find better ways to present this data to customers would be beneficial.

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1 Program Description

This section provides an overview of the AEP Ohio In-home Energy Program. The section begins with a brief program description, followed by a summary of various aspects of the implementation strategy and marketing approach.

1.1 Program Description

The purpose of the In-home Energy Program is to provide energy efficiency information and easy-to-install measures to help customers take action to reduce energy use. Energy efficiency products and information are provided to customers at four levels: 1) an *Online Energy Checkup*, 2) an *In-home Energy Assessment,* 3) an *In-home Energy Audit,* and 4) a Multifamily Direct Install Service. The program implementation contractor delivered program services on behalf of AEP Ohio and contracts with local installation contractors.

The **Online Energy Checkup** is a free web tool that uses actual customer usage history which enables AEP Ohio customers to quickly and easily calculate home energy costs and identify opportunities for savings. The Checkup includes a report with customized energy savings recommendations. Each customer receives a free energy efficiency kit (if it has not already received these items in an In-home assessment or audit). After completing the Checkup, participants are also eligible for rebates for retrofit measures.

The **In-home Energy Assessment** includes a visual inspection of the home and an interview with the homeowner about his or her lifestyle and energy use. The auditor attempts to identify energy-saving opportunities (especially quick to install measures) available in the home and can recommend retrofit measures to reduce energy use. While in the home, the contractor installs up to 12 CFLs, an LED night light, and if electricity is used for water heating, low-flow showerheads and low-flow faucet aerators. There is a $25 fee for the one-hour In-home Energy Assessment, which the customer pays directly to the assessor.

The **In-home Energy Audit** is only available to all-electric customers and targeted high electricity use customers, and is patterned after a Building Performance Institute (BPI) audit. The Audit includes a thorough inspection of the home, an interview with the homeowner, and diagnostic testing for air leakage and combustion safety. The auditor utilizes a computer software program to generate a prioritized list of energy-saving measures that includes the calculated energy savings, estimated installed costs, and simple payback for each measure. While in the home, the contractor installs up to 12 CFLs, an LED night light and, if electricity is used for water heating, low-flow showerheads and low-flow faucet aerators. There is a $50 fee for an In-home Energy Audit.

The **Multifamily Direct Install** component achieves energy savings by installing energy efficiency measures in apartment units at no cost to the tenant or building owner. AEP Ohio's direct installation team conducts a walk-through energy assessment and direct installation of efficient equipment, including

CFLs, showerheads, faucet aerators and LED nightlights. Multifamily units were not eligible for additional equipment rebates in 2014.

1.2 Implementation Strategy

1.2.1 Program Marketing Strategy

The program marketing strategy focuses on residential customers in existing homes and multifamily housing. To maximize savings impacts and the percentage of customers who implement improvements, the program targets promotion to customers with above average consumption.

1.2.2 Role of AEP Ohio Staff

The AEP Ohio staff member most involved in the administration of In-home Energy Program is the Consumer Programs Coordinator. The AEP Ohio Consumer Programs Coordinator is responsible for day-to-day program management responsibilities for the utility, including weekly communication with the program implementer, program tracking and reporting, and assisting with development of program marketing materials. The Coordinator's role did not changed significantly in 2014.

1.2.3 Roles of the Implementation Contractor

The program is delivered and managed primarily by the staff of an implementation contractor. The implementation contractor works on marketing jointly with AEP Ohio and is directly responsible for communicating with customers, scheduling appointments with participants, and coordinating auditors and contractors responsible for assessing participant homes, installing measures, and providing participants with energy surveys that include recommendations for further energy saving actions. The implementation contractor also provides AEP Ohio with reporting, which includes progress toward goals, and participant and measure-level databases. The role of the implementation contractor did not change significantly during 2014.

1.2.4 Measures and Incentives

The In-home Energy Program provides direct installation services for the following measures:

» Compact fluorescent lamps (CFLs)
» Low-flow showerheads for homes with electric water heating
» Faucet aerators (kitchen and bathrooms) for homes with electric water heating
» Pipe insulation, R-4 rated, for homes with electric water heating
» LED nightlight
» Programmable thermostats (removed from direct-install offering mid-year)

In addition to the direct installation service, the program offers two levels of the In-home energy service: an "Assessment" and an "Audit." Both services seek to identify recommendations for equipment upgrades along with rebates for installation of recommended energy efficiency upgrades.

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Customers are eligible for rebates for a list of measures identified during audits or assessments. Table 1-1 shows incentives offered through the In-home Energy Program in 2014 through April and Table 1-2 shows the incentives offered after April. The incentives for Furnace Replacement with Electrically-Commutated Motor were removed from the rebate list in April, 2014. However, incentives continued to be paid on this measure, as well as other measures on the previous rebate schedule, because discontinued forms were still accessible to customers. For cost-effectiveness reasons, incentives for gas-heated homes and performance bonuses were removed concurrently.

Table 1-1. AEP Ohio In-home Energy Measure Incentives – January to April

In-home Energy Rebates	All Electric or Electric Heat Only	Central AC w/Gas or Other
PIN Based CFL Indoor Fixture	$20	same
PIN Based CFL-Outdoor Fixture	$35	same
CFL Torchieres	$20	same
Wall Insulation	$200	$35
Floor Insulation	$150	$25
Air Sealing	$200	$25
Window Film	$0	$45
ENERGY STAR® Window Replacement	$25/window	same
Attic Insulation	$200	$25
Shower Start/Stop	$25	same
Electric Water Heater	$50	same
ENERGY STAR® Ceiling Fan	$20	same
Heat Pump Programmable Thermostat	$50	$25
Programmable Thermostat	$20	same
Duct Sealing	$150	$25
Refrigerant Charge and Air-flow (RCA) Tune Up	$50	same
Furnace Replacement w/ Electrically-Commutated Motor (ECM)	$150	$100
ENERGY STAR® Central Air Conditioning Replacement	$100	same
ENERGY STAR® Air Source Heat Pump Replacement	$350-$700	$100
ENERGY STAR® Ground Source Heat Pump Replacement	$400-$800	$200
Ductless Heat Pump	$350-$800	$100
Complete System Bonus	$150	same
Performance Bonus (Assessment / Audit)	$25 / $50	same

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Table 1-2. AEP Ohio In-home Energy Measure Incentives – May to December

In-home Energy Measure Incentives	All Electric or Electric Heat Only	Central AC w/Gas or Other
Pin-based CFL Indoor Fixture	$20	same
Pin-based CFL-Outdoor Fixture	$35	same
CFL Torchieres	$20	same
Wall Insulation	$250	-
Floor Insulation	$150	-
Air Sealing	$250	-
ENERGY STAR® Window Replacement	$25/window	same
Attic Insulation	$250	-
ENERGY STAR® Ceiling Fan	$20	same
Heat Pump Programmable Thermostat	$50	$25
Programmable Thermostat	$20	same
Duct Sealing	$150	$150
Refrigerant Charge and Air-flow (RCA) Tune Up	$50	same
ENERGY STAR® Central Air Conditioning Replacement	$250	same
ENERGY STAR® Air Source Heat Pump Replacement	$500	same
ENERGY STAR® Ground Source Heat Pump Replacement	$1,500	Same
Ductless Heat Pump	$500	Same
Complete System Bonus	$150	Same
Performance Bonus (Assessment / Audit)	$25 / $50	same

1.3 *Program Theory*

The program theory for the AEP Ohio In-home Energy Program is to produce long-term electric energy savings in the consumer sector by helping customers analyze their energy use and providing incentives for the installation of high-efficiency HVAC, lighting and shell measures. Since the program theory and logic have not changed since 2012, a new logic model was not created for 2014. The reader is instead referred to the 2012 evaluation report[2].

[2] Appendix E Docket 13-1182 AEP Ohio Portfolio Status Report for 2012.

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1.4 Evaluation Questions

The evaluation sought to answer the following research questions. Each of these questions is addressed in the remainder of the evaluation report.

1.4.1 Impact Questions

1. What is the level of annual energy (kWh) and peak demand (kW) savings induced by the program?
2. What were the realization rates for each participation path and for the program as a whole? (Defined as evaluation-verified (*ex post*) savings divided by program-reported (*ex ante*) savings.)
3. What are the benefits and costs, and cost effectiveness of the program?

1.4.2 Process Questions

Marketing and Participation

1. Is the marketing effort sufficient to meet current and future program participation goals?
2. How do participating customers and contractors become aware of the program? What marketing strategies could be used to boost program awareness?
3. Is the program outreach to customers and contractors effective in increasing awareness of the program opportunities?

Program Characteristics and Barriers

1. How do participating customers and contractors perceive the incentives and costs related to the program?
    a. Are customers and contractors sufficiently satisfied with the program incentives to sustain participation goals?
    b. Are there particular program characteristics that could be changed to improve customer and/or contractor satisfaction while maintaining program effectiveness?
2. What are current and past audit-to-rebate conversion rates for the program?
    a. Can we determine conversion rates with program tracking data?
    b. Can we identify contractors with high/low conversion rates to determine why?
    c. Are there certain measures with high/low conversion rates?
3. What are key barriers to participation in the program for eligible customers and contractors who do not participate, and how can these be addressed by the program?
4. Are there significant numbers of retrofits occurring through program contractors that do not participate in the program?
    a. Are these because of program-induced barriers (such as paperwork)?
    b. Do customers complete the rebate form or does the contractor?

Administration and Delivery

1. How has program administration and delivery changed over the course of 2014?

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2. Is program administration being documented and program tracking being conducted in a way that makes the program evaluable?
3. Is the program efficient and well managed? How are problems resolved?
4. Have there been any changes to the verification procedures for the program in 2014?
5. What are the opportunities for program improvement?

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2 Evaluation Methods

This section describes the analytic methods and data collection activities implemented as part of the 2014 impact and process evaluation of the In-home Energy Program, including the data sources and sample designs used as the foundation for the data collection activities and analysis.

2.1 Overview of Approach

To meet the objectives of this evaluation, Navigant undertook the following activities:

1. **Development of Evaluation Questions.** Key evaluation questions were established from the development of the 2014 Evaluation Plan with AEP Ohio staff and a review of the key outcomes of the 2013 Program Evaluation.
2. **Tracking Data Review.** The program tracking data collected by the implementation contractor were reviewed.
3. **Review of New Program Documentation**. Reviewed any program documentation that differed from 2013 (e.g., new marketing materials).
4. **Primary Data Collection.** Four primary data collection efforts were conducted in support of this evaluation: 1) in-depth interviews with program staff, 2) a participant telephone survey, 3) on-site field verification surveys, and 4) installation contractor telephone surveys.
5. **Methods Used to Analyze Impact Data.** Reviewed algorithms and tracking system to verify measure eligibility and correct application of energy and demand savings.
6. **Methods Used to Analyze Process Data.** The effectiveness of the program processes was assessed by analyzing program tracking data, in-depth interview data, and participant survey data.

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Table 2-1 summarizes data collection activities, along with the details regarding the sampling and timing.

Table 2-1. Summary of Data Collection Activities

Data Collection Type	Targeted Population	Sample Frame	Sample Design	Sample Size	Timing
Tracking Data Analysis	All Program Participants	Tracking Database	-	All	March 2015
In-depth Telephone Interview	AEP Ohio Program Coordinator	Contact from AEP Ohio	Program Coordinator	1	February 2015
In-depth Telephone Interview	Implementation Contractor	Contact from Implementation Contractor	Program Implementer	1	February 2015
Computer-Assisted Telephone Interviewing (CATI) Telephone Surveys	Program Participants	Tracking Database	Random Sample of Program Participants	302	February 2015
On-Site Field Surveys	Program Participants	Tracking Database	Random Sample of Program Participants	37	January 2015
Installation Contractor Telephone Surveys	Program Participants	Tracking Database	Random Sample of Program Participants	10	March 2015

2.2 *Impact Evaluation Sample*

Primary data collection activities for the impact evaluation consisted of telephone surveys for single-family participants and onsite surveys for the multi-family participants. The primary purpose of both surveys was to gather data to verify measure installation. It was determined that sufficient data can be collected on single-family installation rates through telephone surveys. However, onsite surveys were conducted for multifamily units because participant data is not collected in the program tracking system that would enable telephone verification.

In order to derive target sample sizes, the evaluation team started by estimating the number of participants for the year, which was based on a mid-year data extract provided by AEP Ohio. Based on this information, to attain +/- 10 percent precision at a 90 percent level of confidence at the program level for the impact sample, a minimum sample size of 299 completed telephone surveys and 36 onsite surveys was determined to be appropriate.

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Table 2-2 shows the actual population of participants in 2014, the number of telephone and on-site surveys completed, and the resulting sampling error. Overall sampling efforts resulted in +/- 8.3 percent precision at a 90 percent level of confidence. Survey participants were drawn from a stratified random sample from the population of program participants in the 2014 tracking database at the site-level.

Table 2-2. 2014 Impact Evaluation and Population-Level Sampling Error

Strata	Survey Method	2014 Strata Population Size (N)	Survey Target Completes	Survey Completes (n)	Sampling Error (95% CI)
Energy Kits	Telephone	3,918	144	146	10.9%
Audit & Direct Install Only	Telephone	6,134	68	70	11.0%
HVAC & Shell	Telephone	3,683	87	88	9.8%
Multifamily Direct Install CFLs	On-Site	7,204	22	22	17.8%
Multifamily Direct Install CFL & DHW	On-Site	4,503	14	15	27.5%
Total		11,707	335	341	8.3%

2.3 *Tracking System Review*

Navigant conducted a review of program data extracted from the AEP Ohio In-home Energy Audit tracking system to assess its accuracy and effectiveness for use in recording, tracking, and reporting the processes and impacts of the program. This data review included an assessment of the rebate processing timeframes, a review of the project data for outliers and missing information.

2.4 *Ex Post Savings Evaluation*

Navigant conducted a review of measure savings algorithms and underlying assumptions for each measure compared to Draft 2010 Ohio TRM algorithms. Navigant also recalculated energy and demand savings for each measure in the tracking database to ensure that algorithms were applied correctly.

2.5 *Adjusted Savings Evaluation*

For high-impact measures (with more than 1% of total program savings) not included in the Draft 2010 Ohio TRM (i.e. ECM motor and programmable thermostat), the evaluation team examined AEP Ohio's calculation methods and evaluated them against calculation methods identified from secondary sources (recent TRMs from nearby states). Adjusted savings estimates for these measures were used to calculate *ex post* energy and demand savings for these measures.

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2.6 *Program Staff Interviews*

In-depth interviews with program staff members were conducted by telephone in February 2015. Each interview lasted between one and two hours and covered program design and implementation, marketing and promotion, and perceived barriers to participation. Table 2-3 provides a summary of the data collection activities conducted to support the process evaluation.

Table 2-3. Data Collection Activities

Data Collection Type	Targeted Population	Sample Frame	Sample Design	Sample Size	Timing
In-Depth Telephone Interviews	AEP Ohio Program Staff	Contacts from AEP Ohio	In-home Energy Program Coordinator	1	February 2015
	Staff of Program Implementer	Contacts from Implementation Contractor	Program Manager	1	February 2015

Interview guides were developed based on the research issues and metrics identified in the background review for the program. The purpose of the guides was to solicit information from those who implement the program. The questions in the guides were primarily focused on these topics:

- Program Contact and Roles
- Program Goals and Objectives
- Program Design and Participation
- Marketing and Outreach
- Program Tracking
- Quality Assurance and Quality Control (QA/QC)
- Staffing and Communication

Separate interviews were conducted with AEP Ohio staff and the implementation contractor to encourage candor and help identify any potential issues regarding the relationships between the two parties. Consistent with standard market research procedure, the confidentiality of each person interviewed was guaranteed, and comments are not attributed to any one individual; rather the evaluation focuses on trends and issues that arose from a variety of perspectives.

2.7 *Process Evaluation Sample*

Primary data collection for the process evaluation focused primarily on a telephone survey of 304 program participants, which was conducted during February 2015.Participant Telephone Survey
A telephone survey of 302 program participants was conducted during February 2015. Two distinct telephone surveys were developed and fielded to assist in the evaluation of the In-home Energy Program. One survey was delivered to participants who received an energy audit/assessment and rebates for retrofit measures. A similar survey was conducted with participants of the Online Energy

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Checkup who received a free energy kit. The surveys were completed by 302 program participants and were designed to serve several purposes:

» To verify and/or update the assumptions that feed into engineering algorithms of measure level savings
» To obtain information on participant satisfaction with the program design and implementation
» To identify any steps in the participation process that customers found difficult or confusing
» To gain insight into customer motivations and the effectiveness of existing and potential communication channels
» To elicit customer suggestions on opportunities for program improvement

In order to derive target sample sizes, the evaluation team started by estimating the number of participants for the year, which was based on a mid-year data extract provided by AEP Ohio. Based on this information, to attain 95/5 statistical confidence and precision at the program level, a minimum sample size of 302 completed participant surveys was determined to be appropriate.

Table 2-4 shows the actual population of energy kit and retrofit rebate recipients in 2014, the number of participant surveys completed, and the resulting sampling error. Overall, at the program level, sampling efforts resulted in +/- 5.2 percent precision at a 95 percent level of confidence.

Table 2-4. 2014 Survey Completes and Population-Level Sampling Error

Strata	2014 Strata Population Size (N)	Survey Target Completes	Survey Completes (n)	Sampling Error (95% CI)
Energy Kits	3,918	145	145	13.0%
Direct Install - No Retrofit	6,134	69	69	11.9%
HVAC & Shell	3,683	88	88	5.1%
Total	13,735	302	302	5.2%

2.8 Installation Contractor Interviews

In-depth interviews were conducted with ten participating contractors to engage in conversation with those firms that are most intimately involved with the delivery of the In-home Energy Program. The final list of interview candidates was developed based on a review of the program database. In designing the interview guide, key objectives were to develop an understanding of contractor perspectives on the market in which the program operates and to gather feedback on the program structure and processes. Interviews were conducted via telephone surveys, with in-depth interview instruments guiding the discussions. The majority of questions were opened ended to facilitate open discussion of the topics, but some information was captured as discrete values to facilitate analysis and comparison.

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2.9 Program Material Review

Navigant has reviewed all program materials provided by AEP Ohio to date and conducted a review of best practices for implementing residential energy audit programs. A summary list of program materials reviewed to date for this report follows.

- » Program tracking data
- » Program impact algorithms and assumptions
- » Program marketing materials/collateral

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3 Program Level Results

This section presents detailed findings of the evaluation of the In-home Energy Program.

3.1 *Impact Evaluation Findings*

3.1.1 Program Activity

Program data from all direct install and retrofit measures installed during 2014 were analyzed to summarize program activity. This section is divided into two sub-sections: 1) direct install, and 2) retrofit. Table 3-1 summarizes program activity across all measure types.

Table 3-1. Measure Activity Summary – *Ex Ante*

Measure	Number of Units	MWh Savings	MW Savings
Direct Install Measures	181,048	7,178	0.87
Energy Kit Measures	66,914	1,555	0.32
Retrofit Measures	4,903	1,283	0.31
Total	252,865	10,016	1.50

Note: Totals may not sum due to rounding.

Table 3-2 shows the distribution of single-family and multifamily direct install measures installed in 2014. CFLs accounted for 77 percent of the direct install measure *ex ante* energy savings, and 63 percent of the total *ex ante* program energy savings.

Table 3-2. Direct Install (DI) Measure Activity – *Ex Ante*

Measure	Number of Units	MWh Savings	MW Savings
Single Family (SF)			
SF DI CFL	20,072	791	0.09
SF DI Pipe Insulation	337	43	0.00
SF DI LED Night Light	2,019	43	0.00
SF DI Faucet Aerator	217	5	0.00
SF DI Shower Heads	345	82	0.01
SF DI Programmable Thermostats	69	10	0.00
Multifamily (MF)			
MF DI CFL	133,473	4,718	0.56
MF DI LED Night Light	11,680	246	0.03
MF DI Shower Heads	4,358	1,033	0.13
MF DI Faucet Aerator	8,478	208	0.03
Direct Install Total	181,048	7,178	0.87

Note: Totals may not sum due to rounding.

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Table 3-3 shows the distribution of energy kit measures sent to customers in 2014. Energy Kit measure savings accounted for approximately 16 percent of total *ex ante* program energy savings in 2014.

Table 3-3. Energy Kit Measure Activity – *Ex Ante*

Measure	Number of Units	MWh Savings	MW Savings
Energy Kit CFLs	21,250	812	0.10
Energy Kit LED Night Light	4,250	90	0.01
Energy Kit Pipe Insulation	1,715	191	0.02
Energy Kit Faucet Aerator	3,430	40	0.01
Energy Kit Shower Heads	1,715	329	0.04
Energy Kit Draft Stoppers	31,896	53	0.07
Energy Kit Weatherstripping	2,658	40	0.07
Energy Kit Total	66,914	1,555	0.32

Note: Totals may not sum due to rounding.

Table 3-4 shows the distribution of retrofit measures installed in 2014. Retrofit measures accounted for only 13 percent of the total *ex ante* program MWh savings, with the majority of those energy savings coming from HVAC measures.

Table 3-4. Retrofit Measure Activity – *Ex Ante*

Measure	Number of Units	MWh Savings	MW Savings
Insulation	524	115	0.00
Air Sealing	288	82	0.00
Windows	97	7	0.00
Duct Sealing	12	9	0.00
Thermostats	1,280	325	0.00
Heat Pumps	419	385	0.08
Central AC Replacement	1017	235	0.20
Furnace with ECM Motor or ECM Motor Replacement	908	102	0.03
Refrigerant Charge and Airflow Tune-up	14	3	0.00
PIN Based CFL Fixture	287	11	0.00
CFL Torchieres	1	0	0.00
Electric DHW Tank Replacement	3	0	0.00
Energy Star Ceiling Fan	53	9	0.00
Retrofit Measure Total	4,903	1,283	0.31

Note: Totals may not sum due to rounding.

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Table 3-5 shows the number of audits, assessments and online audits conducted in 2014. Most participants elected to receive an assessment or an online checkup.

Table 3-5. Number of Audits and Assessments

Audit Type	Number of Customers
In-home Audit	1,215
In-home Assessments	5,042
Online Checkups	4,412
Total	10,669

3.1.2 Measure In-Service Rates

The in-service rate for each measure installed through the program was determined through both on-site audits as well as participant telephone surveys. During the on-site audits, Navigant verified that the number of measures installed in the home matched the number listed in the program database. This information was verified both visually during on-site field visits (for multifamily measures) and through telephone surveys (for single-family measures) to understand any discrepancies between the number of measures reported in the database and the observed number of measures installed. Participants who were surveyed by telephone responded to several questions about the number and types of measures installed through the program. The ratio of the number of measures still installed (as reported or verified) was compared to the number of measures in the program database to determine the installation rate.

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Table 3-6 illustrates that installation rates for direct install measures ranged from 19 percent (multifamily nightlights) to 91 percent (multifamily CFLs).

Table 3-6. In-home Energy Program Direct Install Measure In-Service Rates

DI Measures	Telephone Survey		On Sites		Overall	
	Percent Installed	Number of Respondents	Percent Installed	Number of Respondents	Percent Installed	Number of Respondents
Single Family						
CFLs	80%	87	N/A	N/A	80%	87
Showerheads	79%	94	N/A	N/A	79%	94
Aerators	78%	50	N/A	N/A	78%	50
Pipe Insulation	86%	49	N/A	N/A	86%	49
LED Nightlight	78%	109	N/A	N/A	78%	109
Multifamily						
CFLs	N/A	N/A	91%	37	91%	37
Showerheads	N/A	N/A	90%	37	90%	37
Aerators	N/A	N/A	38%	37	38%	37
LED Nightlight	N/A	N/A	19%	37	19%	37

The realization rate found for multifamily LED nightlights was lower than the other measures, as in 2013 (19%), especially in light of high realization rates found for single-family nightlights (78%). It is believed that some tenants are taking the LED nightlights with them when they move out of the apartment. From data provided by AEP Ohio, Navigant verified that half of the units missing a nightlight did in fact experience turnover in 2014 after the measure installation date. It is possible that the remainder were removed by residents who did not need these or did not like the light.

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Realization rates for retrofit measures were also calculated based on survey data from participants who received an audit, assessment or online audit. Table 3-7 shows installation rates for retrofit measures. All retrofit measures were found to have an installation rate of 100 percent.

Table 3-7. In-home Energy Program Retrofit Measure In-Service Rates

Retrofit Measures	Telephone Survey	
	Percent Installed	Number of Respondents
ECM Motor	100%	50
Central AC Replacement	100%	47
Heat Pump Replacement	100%	53
Insulation	100%	27
Air Sealing	100%	16
Programmable Thermostat	100%	87
Windows	100%	8

Navigant conducted a telephone survey of Online Energy Checkup participants and collected data on installation rates for energy kit measures mailed to participants. Table 3-8 shows installation rates for energy kit measures.

Table 3-8. In-home Energy Program Energy Kit In-Service Rates

Kit Measures	Telephone Survey	
	Percent Installed	Number of Respondents
CFLs	66%	126
LED Nightlight	67%	120
Showerheads	26%	61
Aerators	26%	60
Pipe Insulation	34%	59
Weather Stripping	33%	58
Draft Stoppers	46%	57

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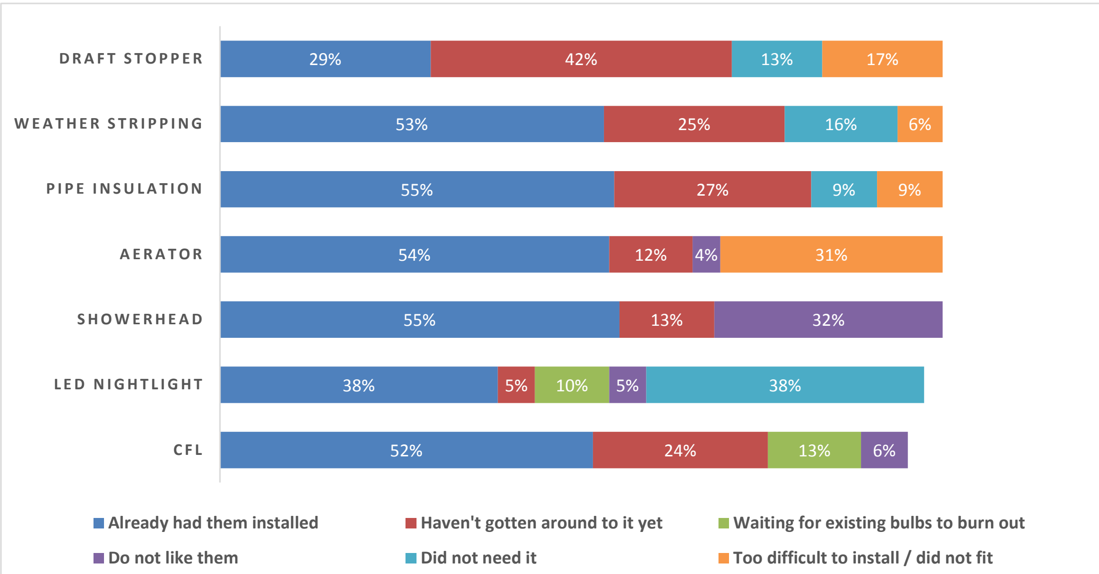
When participants were asked the reason for not installing a particular kit measure, their answers varied depending on the measure, as shown in Figure 3-1. For showerheads, pipe insulation, CFLs and faucet aerators, the most common reason for not installing a measure was already having that measure, or just haven't gotten around to installing it yet. For LED nightlights, the most common reason was that the customers didn't need a nightlight.

Figure 3-1. Participant Reasons for Not Installing Energy Kit Measures



3.1.3 Tracking System Review

Navigant conducted a review of program data in the AEP Ohio In-home Energy Program tracking system to verity its accuracy and effectiveness for use in recording, tracking, and reporting the processes and impacts of the program. This review included an assessment of the rebate processing timeframes and a review of the project data for outliers and missing information.

Two final program tracking databases were provided in support of this evaluation by AEP Ohio in April of 2015. A final summary database was prepared by AEP Ohio, compiling data extracts provided by the implementation contractor. Navigant conducted a review of the tracking data and documented any issues that were discovered.

The tracking data extract contained separate databases for single-family and multifamily measures. The single-family dataset contained 142 data fields and more than 56,000 records. The multifamily dataset contained 131 data fields and more than 44,000 records. Table 3-9 provides a summary of missing data or data entry errors identified during the tracking data review.

Table 3-9. Tracking System Review Findings

Measure	Issue
DHW Direct Install Measures	Navigant found 16 instances where water-saving measures were installed in homes with gas water heaters (compared to 31 in 2013) though no savings were counted.
Central AC Replacement	Several CAC Replacements were ineligible based on SEER level requirements of the existing unit (≤ 13 SEER), according to audit data. However, audit data may not always be reliable as erroneous entries were sometimes found (e.g. 50 SEER).
Air Source Heat Pump	Several heat pumps were ineligible based on SEER level requirements of the existing unit (≥ 13 SEER), according to audit data. Several of these units were less than five years old, possibly indicating replacement on burnout of an existing high-efficiency unit. The existing unit SEER entered with audit data sometimes did not match the SEER listed on the rebate application.
	New system HSPF not recorded for 19 Gas Furnace and CAC to Air Source Heat Pump measures.
Duct Leakage	One duct sealing project did not meet the minimum requirement 20% reduction in leakage.

In addition to the issues identified above, more than 2,000 MWh of energy savings from over 6,000 measures were removed from the tracking system after submission due to incomplete information. Rebates were paid for some of these measures by the implementation contractor but AEP Ohio's final quality control processes rejected these because customer information needed for verification was absent. Many of the non-savings measures were credited back to AEP Ohio or not paid originally. Issues were identified throughout the year with the quality of project data transferred by the implementation contractor to AEP Ohio, requiring frequent and significant revision.

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3.1.4 *Ex Ante* Savings Evaluation

Navigant conducted a review of measure savings recorded in the tracking system to verify that the energy savings algorithms matched those in the Draft 2010 Ohio Technical Reference Manual (TRM) and were correctly applied for each project. The evaluation team independently calculated energy savings for each measure in the database using the *ex ante* calculation methods based on the Draft 2010 Ohio TRM. Navigant's algorithm review found that the energy and demand savings algorithms have been constructed and applied properly. Table 3-10 presents *ex ante* program savings along with Navigant's *ex post* estimates, which include verified measure installation rates. Measure installation rates of less than 100% were primarily responsible for the differences between *ex ante* and *ex post* savings estimates.

Table 3-10. Tracking System (*Ex Ante*) and Verified (*Ex Post*) Savings Estimates

Measure	*Ex Ante* Savings (MWh) (a)	*Ex Ante* Savings (MW) (b)	*Ex Post* Savings (MWh) (c)	*Ex Post* Savings (MW) (d)	Realization Rates energy savings = (c) / (a)	Realization Rates demand savings = (d) / (b)
Energy Kit Measures	1,555	0.32	795	0.15	0.51	0.46
SF Direct Install	973	0.12	775	0.09	0.80	0.80
MF Direct Install	6,205	0.75	5,349	0.65	0.86	0.86
Retrofit Measures	1,283	0.31	1,293	0.31	1.01	1.00
Total Savings / Weighted Average	10,016	1.50	8,211	1.20	0.82	0.80

Note: Totals may not sum due to rounding.

3.1.5 Adjusted Savings Evaluation

For high-impact measures (with more than 1% of total program savings) not included in the Draft 2010 Ohio TRM (i.e. ECM motors and programmable thermostats), the evaluation team examined AEP Ohio's calculation methods and evaluated these against calculation methods identified from secondary sources (recent TRMs from nearby states). *Ex post* savings estimates were used to calculate adjusted energy and demand savings for these measures. Table 3-11 shows a summary of the total *ex ante* and *ex post* savings for each measure. The following sections detail the savings adjustments made to each measure.

Table 3-11. Total Savings for ECM Motors and Programmable Thermostats

Measure	*Ex Ante* Savings (MWh)	*Ex Ante* Savings (MW)	Adjusted *Ex Post* Savings (MWh)	Adjusted *Ex Post* Savings (MW)	Realization Rates energy savings	Realization Rates demand savings
ECM Motor	101.7	0.0	253.5	0.0	2.5	1.7
Programmable Thermostat	334.9	0.0	167.0	0.0	0.5	1.0

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3.1.5.1 ECM Motor

The *ex ante* savings calculations for ECM motors use deemed savings based on the home's heating and cooling system type, cited in the AEP Ohio DSM Plan. The evaluation team reviewed algorithms in recent versions of the Illinois, Massachusetts, and Vermont TRMs, and a recent study conducted by Advanced Energy. Most of these TRM algorithms are based on adaptations of a study conducted by the Energy Center of Wisconsin[3]. Navigant selected the estimates calculated in the Advanced Energy study which were more recent.[4] Table 3-12 shows the *ex ante* savings compared to the *ex post* savings from this study.

Table 3-12. ECM Motor Algorithm Review Findings

Heat Type	*Ex Ante* Savings (kWh/home)	*Ex Ante* Savings (kW/home)	*Ex Post* Savings (kWh/home)	*Ex Post* Savings (kW/home)
Electric Forced-Air Furnace	167.9	0.0497	275.0	0.05
Gas Furnace with Central AC	104.7	0.031	275.0	0.05
Air Source Heat Pump	239.7	0.0473	275.0	0.05

3.1.5.2 Programmable Thermostat

The *ex ante* savings calculations for programmable thermostats use deemed savings based on the heating and cooling system type for the home, cited in the 2012 to 2014 AEP Ohio EE/PDR Action Plan. The evaluation team reviewed recent TRM algorithms for nearby states and applied the following algorithm from the 2014 Pennsylvania TRM. This algorithm was chosen because it relied on assumptions that could be modified and applied to Ohio's climate, using inputs from the Draft 2010 Ohio TRM. Each of the other TRMs reviewed for this analysis (MA, WI, IL, VT, MI, IN) either did not contain thermostat measures, contained an algorithm similar to the one chosen, or relied on either energy modeling or deemed savings that could not be modified for Ohio. Note that the *ex post* savings values have been converted to a unit bases of 1,000 square feet (from tons) for comparison to the *ex ante* savings.

$$\Delta kWh = \Delta kWh_{COOL} + \Delta kWh_{HEAT}$$

$$\Delta kWh_{COOL} = (CAP_{COOL}/1000 \text{ X } (1/(SEER \text{ x } Eff_{duct})) \text{ X } EFLH_{COOL} \text{ X } ESF_{COOL}) / (CFA/1000)$$

$$\Delta kWh_{HEAT} = (CAP_{HEAT}/1000 \text{ X } (1/(HSPF \text{ X } Eff_{duct})) \text{ X } EFLH_{HEAT} \text{ X } ESF_{HEAT}) / (CFA/1000)$$

$$\Delta kW_{peak} = 0$$

[3] Scott Pigg (Energy Center of Wisconsin), *Electricity Use by New Furnaces: A Wisconsin Field Study, Technical Report 230-1*. October 2003, page 20.
[4] Murray, Matt, et. al. *Residential HVAC Electronically Commutated Motor Retrofit Report*. February 2012. http://www.advancedenergy.org/_files/pages/Residential-HVAC-Electronically-Commutated-Motor-Retrofit.pdf

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Where:

CAP_{COOL}	= *Capacity of the air conditioning unit in BTUh, based on nameplate capacity*
CAP_{HEAT}	= *Nominal heating capacity of the electric furnace in BTUh*
Eff_{duct}	= *Duct system efficiency*
SEER	= *Seasonal energy efficiency ratio of the cooling unit*
HSPF	= *Heating seasonal performance factor of the heating unit*
$ESF_{COOL,HEAT}$	= *Energy savings factor for cooling and heating, respectively*
$EFLH_{COOL, HEAT}$	= *Equivalent full load hours for cooling and heating, respectively*

Table 3-13. Key Impact Parameters for Thermostats

Parameter Description	Parameter Value	Source
CAP_{cool}	Actual	Program data gathering. Default 3.25 tons
CAP_{heat}	Actual	Program data gathering. Default 3.25 tons
Eff_{duct}	0.85	Draft 2010 OH TRM
SEER	Actual	Program data gathering. Default 13 SEER
HSPF	Actual	Program data gathering. Default 7.7 HSPF
$EFLH_{heat}$	1272	Draft 2010 OH TRM
$EFLH_{cool}$	552	Draft 2010 OH TRM
CFA	Actual	Program data gathering. Default 2,000 square feet
ESF_{heat}	3.6%	"Programmable Thermostats. Report to KeySpan Energy Delivery on Energy Savings and Cost Effectiveness", GDS Associates, Marietta, GA. 2002. 3.6% factor includes 56% realization rate.
ESF_{cool}	2.0%	DEER 2005 cooling savings for climate zone 16, assumes a variety of thermostat usage patterns.

Table 3-14 shows the *ex ante* savings compared to the *ex post* savings calculated from this method.

Table 3-14. Programmable Thermostat Algorithm Review Findings

Heat Type	*Ex Ante* Savings (kWh/1000 SF)	*Ex Ante* Savings (kW/1000 SF)	*Ex Post* Savings (kWh/1000SF)	*Ex Post* Savings (kW/1000SF)
Electric Forced-Air Furnace	678.2	0.0	352.1	0.0
Gas Furnace with Central AC	50.2	0.0	21.0	0.0
Air Source Heat Pump	276.6	0.0	167.9	0.0

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3.1.6 Adjusted *Ex Post* Savings

Navigant developed independent estimates of *ex post* energy and demand savings for the program by verifying measure savings calculations, adjusting savings calculations for high-impact, non-Draft 2010 Ohio TRM measures and applying realization rates derived from the telephone and field surveys. Table 3-15 presents *ex ante* program savings and Navigant's independent estimates, including adjusted savings values.

Table 3-15. Tracking System (*Ex Ante*) and Adjusted (*Ex Post*) Savings Estimates

Measure	*Ex Ante* Savings (MWh) (a)	*Ex Ante* Savings (MW) (b)	Adjusted *Ex Post* Savings (MWh) (c)	Adjusted *Ex Post* Savings (MW) (d)	Realization Rates: energy savings = (c) / (a)	Realization Rates: demand savings = (d) / (b)
Energy Kit Measures	1,555	0.32	795	0.15	0.51	0.46
SF Direct Install	973	0.12	775	0.09	0.80	0.80
MF Direct Install	6,205	0.75	5,349	0.65	0.86	0.86
Retrofit Measures	1,283	0.31	1,272	0.33	0.99	1.06
Total Savings / Weighted Average	10,016	1.50	8,191	1.22	0.82	0.81

Based on Navigant's engineering review of savings algorithms, which include measure installation rates, the program obtained a kWh realization rate of 82 percent, and 81 percent for kW savings.

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3.2 Process Evaluation Findings

Data sources for the process evaluation included in-depth interviews with program staff and installation contractors, as well as the CATI telephone surveys with a sample of program participants.

3.2.1 Participant Satisfaction

As shown in Table 3-16, respondents reported that satisfaction with various elements of the In-home Energy Program was quite high. The reported average satisfaction with the overall program was 8.3 on a scale of 1 to 10 (where 1 was “extremely dissatisfied” and 10 was “extremely satisfied”). Satisfaction with the different aspects of the program did not vary substantially – all aspects scored above 8. The highest ratings were provided for the auditor who assessed home performance (9.1), the length of time it took to complete the audit/assessment (8.9) and the time it took to schedule the energy audit (8.9). Each of these ratings represents a slight decrease from 2013, when each received a rating of 9.2 or higher on average. This decrease likely reflects the larger pool of “audit only participants” surveyed in 2014 who reported lower satisfaction with the program than “rebate participants”

Table 3-16. Mean Satisfaction Scores – Participants

Program Aspect	Satisfaction Rating, Scale of 1 to 10	
	Mean	N
Energy audit/assessment report	8.2	142
Time it took to schedule the energy audit	8.9	149
Length of time it took to complete the audit/assessment in your home	8.9	155
Energy auditor that assessed your home’s energy performance	9.1	154
Cost of the energy audit/assessment	8.7	151
In-home Energy Program overall	8.3	153
AEP Ohio overall	8.1	154

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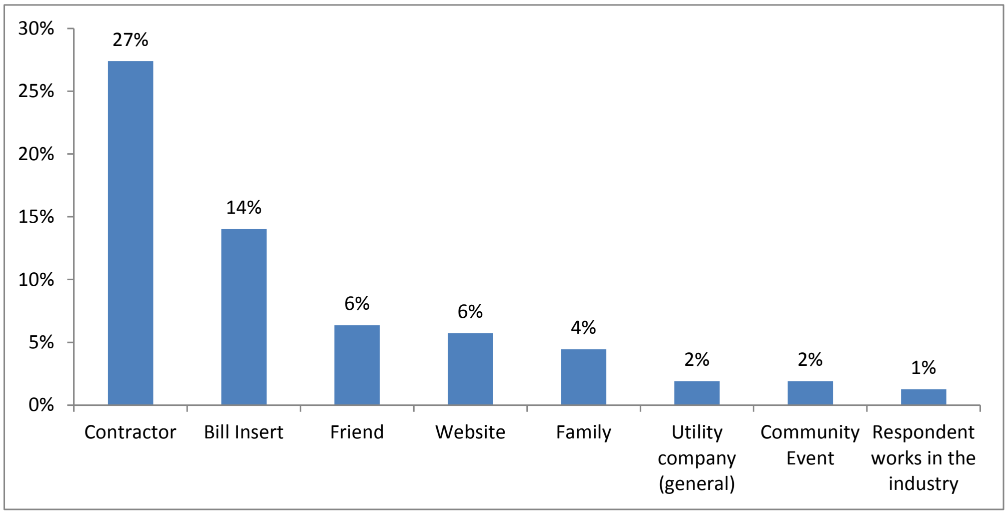
3.2.2 Marketing and Program Awareness

The In-home Energy Program is advertised through a number of marketing channels, including television, newspaper, bill inserts, community outreach events, participating contractors and direct mail to targeted customers. Figure 3-2 shows the most influential sources of program awareness among participant survey respondents (n=157).

Figure 3-2. Most Influential Sources of Program Awareness – Participants



Contractors, bill inserts, family/friends and the AEP Ohio website were the most often cited sources of program knowledge among participants. In total, 27 percent of respondents reported having heard of the program from a contractor, 10 percent recalled hearing about the program from a friend or family, 6 percent from the AEP Ohio website, and 14 percent from a bill insert (n=157). When participants were asked to indicate which source of awareness was most influential in their decision, 29 percent of respondents reported that the contractor was the most influential source of the program.

3.2.3 Barriers to Participation for Audit Only Participants

The key barriers to adoption of energy efficiency improvements in existing homes are commonly cited as 1) lack of actionable information about energy efficiency improvements, 2) the high upfront cost of improvements, and 3) lack of qualified contractors to do the work. The success of the program is dependent on the program's ability to help participants overcome these (and other) barriers by providing information through audits, rebates and a trained contractor network.

Navigant explored the barriers to participation in the In-home Energy Program through specific survey questions targeted to two different participant types, rebate participants and audit only participants. Rebate participants are those who received an audit and a rebate for installing recommended measures. Audit only participants are those who received an audit but did not receive a rebate. Navigant cross-referenced answers given by partial and rebate participants in attempt to identify the key characteristics of each.

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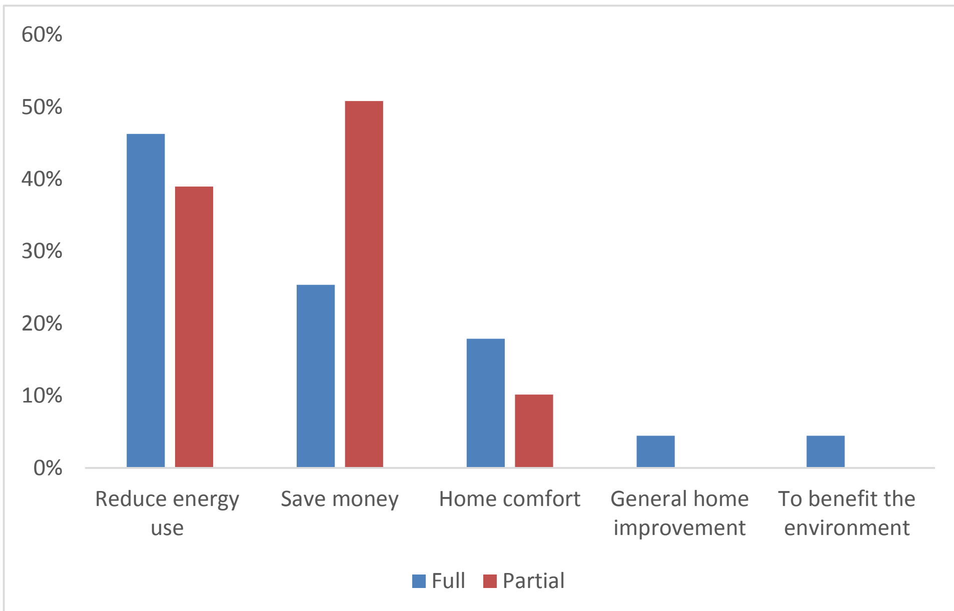
Customer Motivations

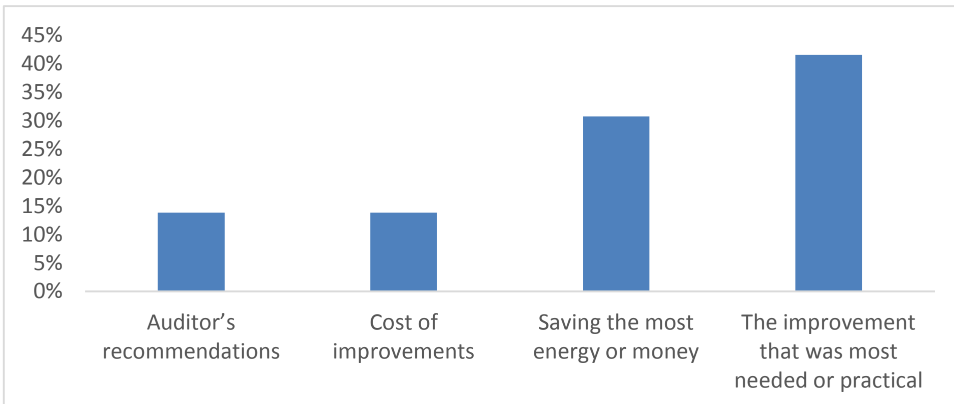
Respondents were asked to report their primary motivation for trying to improve home energy efficiency. Figure 3-3 indicates that audit only participants' (n=59) greatest concern was saving money and reducing energy use. Rebate participants (n=66) had a variety of motivations, the greatest of which was to reduce energy use.

Figure 3-3. Primary Motivation for Energy Efficiency Improvements – Participants



Rebate participants (n=65) were also asked to rate the most important factor in their decision on which improvements to make (Figure 3-4). While a significant portion rated saving energy or money as the highest (31%), 41 percent of participants said that they chose the improvement(s) that were the most needed or practical. This may partially reflect the high numbers of HVAC replace-on-burnout participants who participated in the program primarily to access rebates for high efficiency heating or cooling system replacements.

Figure 3-4. Most Important Factor in Decision to Make Improvements – Participants



Despite the fact that the auditor's recommendations were found to be the least important factor, rebate participants still reported high value for the auditor's recommendations. When asked the importance of the auditor's recommendations on their decision to make improvements, participants reported a rating of 8.2, on a scale of 1-10 (n=66).

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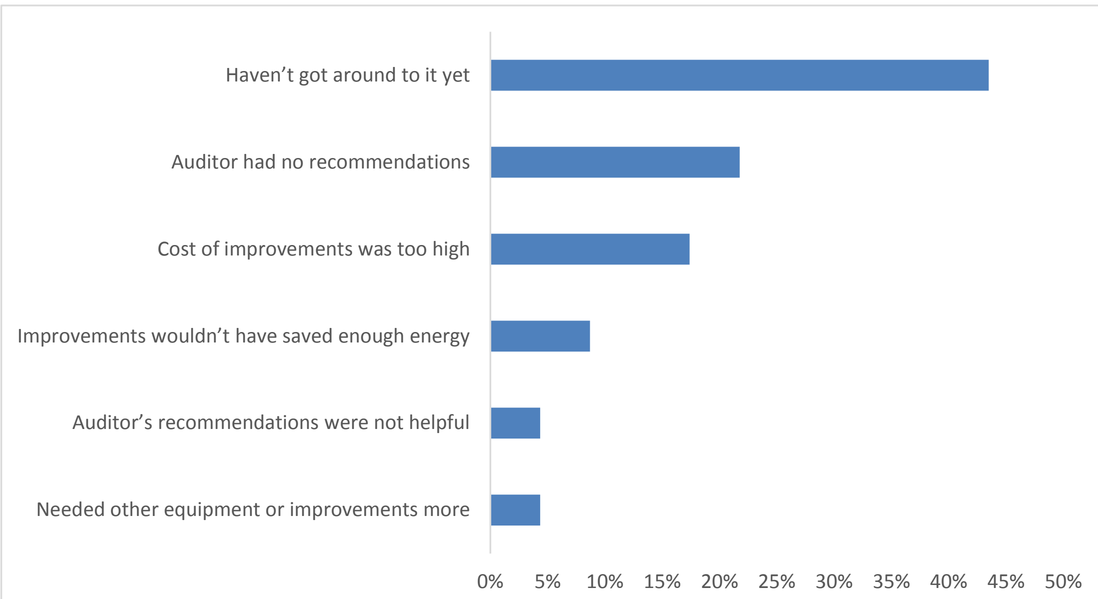
Reasons for Not Installing Recommended Measures

Audit only participants (n=23) were asked the primary reasons they decided not to install any of the contractor's recommendations, presented in Figure 3-5. The most common reason cited for not installing measures was that they haven't gotten around to it yet (43%). A total of 26 percent of customers said that the auditor had no recommendations or that the recommendations weren't helpful. The high cost of improvements was cited by 17 percent, while the difficulty of finding a contractor was not cited by any participants. One participant chose not to install recommended measures because he/she was told by the contractor that the only way he could receive a rebate would be if he used this contractor's company to perform the work.

Figure 3-5. Reasons for Not Installing Recommended Measures – Audit only participants



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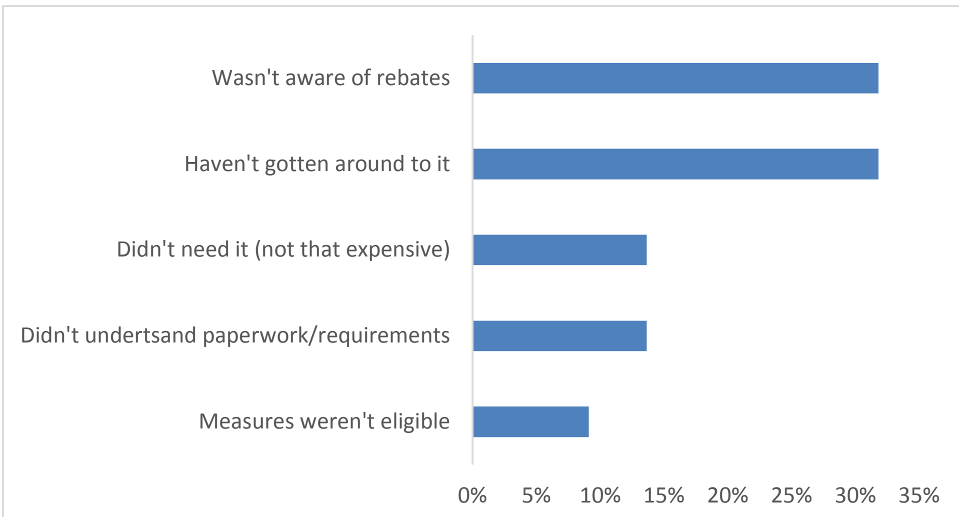
Audit only participants did not receive rebates through the program, though 58% of them (n=29) indicated that they did install one or more of the auditor's recommendations. When asked why they did not apply for a rebate for those measures, 32 percent indicated they weren't aware of rebate opportunities, while another 32 percent reported that they just haven't gotten around to it yet. Many of the latter group are likely to be those participants who are submitting rebate applications well after measures were installed (see Section 3.2.4). These findings indicate that there is a significant number of retrofits occurring as a result of the program that are not receiving rebates (at least during the program year).

Figure 3-6. Reasons for Not Applying for a Rebate – Audit only participants



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Satisfaction with Program Elements

Navigant compared participant satisfaction ratings with various aspects of the program to determine if there are differences in how full and audit only customers perceive the program, presented in Table 3-17. As expected, audit only participants were less satisfied with the program, though they still reported high satisfaction for most program elements. Audit only participants reported the lowest satisfaction with the report received after the audit, and the usefulness of the recommendations they were given.

Table 3-17. Satisfaction Ratings – Full and Audit only participants

Program Aspect	Rebate participants (1 to 10)		Audit only participants (1 to 10)	
	Mean	N	Mean	N
Time it took to schedule the energy audit/assessment	9.1	83	8.6	66
Length of time it took to complete the audit/assessment in your home	9.1	87	8.6	68
Cost of the energy audit/assessment	8.9	85	8.4	66
Energy auditor that assessed your home's energy performance	9.3	85	8.9	69
Report you received that showed your home's energy usage and recommended ways to save energy.	8.5	78	7.9	64
Usefulness of the report recommendations	8.1	65	5.9	59
In-home Energy program overall	8.6	85	8.0	68

Twelve audit only participants reported satisfaction lower than seven for the report they received showing their home's energy usage with recommendations to save. Most of these participants (68%) reported that the report's findings and recommendations were not useful or informative. The remainder either did not understand the auditor's findings/recommendations (17%), did not trust the legitimacy of the auditor's findings/recommendations (17%), or did not receive an audit report (8%). Many of these participants reported that they still don't know why their bills are so high and/or that they wanted more of an explanation of the findings/recommendations. These reports also translated into dissatisfaction with the auditor, who these participants felt, was not thorough enough (in some cases only briefly walking through the house).

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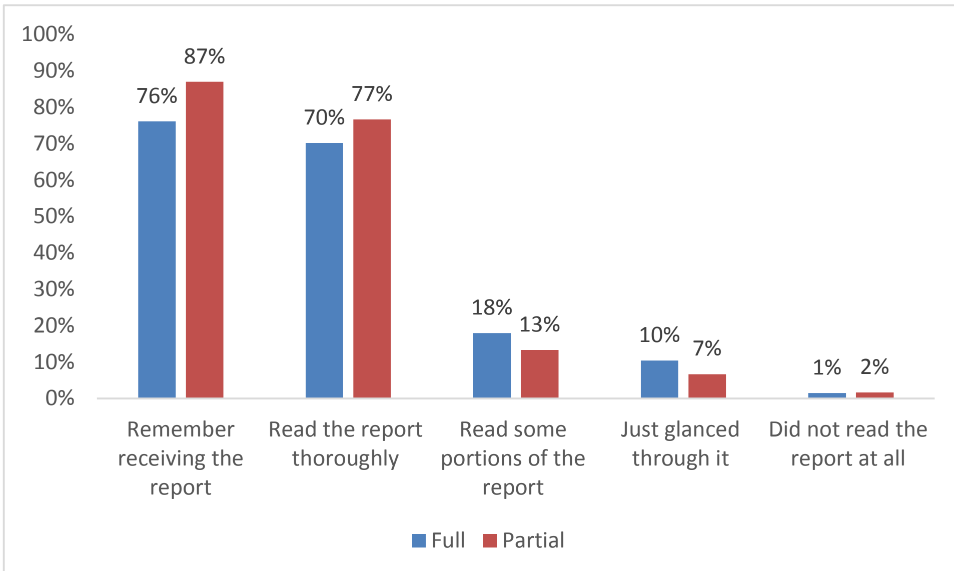
Participants were also asked questions about the degree to which they read the audit report (Figure 3-7). A greater number of audit only participants reported receiving the report and reading it thoroughly.

Figure 3-7. Did Participants Read the Energy Audit Report?



Conclusions

Participant survey responses indicate that customers are primarily motivated to participate in the program in order to save energy and money. Rebate participants, those who received a rebate, reported that their ultimate decision on which measures to install was based largely on which measures were needed most or the most practical. The second most important factor was which measure saved the most energy or money, with the auditor's recommendations playing a significant role in these decisions.

The most common reason cited by audit only participants for not installing measures was that they haven't gotten around to it yet (43%). Many of these participants may eventually install measures, as is indicated by the number of participants each year who apply for a rebate up to a year or more after installing measures. A total of 26 percent of customers said that the auditor had no recommendations or that the recommendations weren't helpful. This may be partially due to the lack of cost-effective opportunities in homes that are already somewhat efficient. The high cost of improvements was cited by 17 percent, while the difficulty of finding a contractor was not cited by any participants.

Audit only participants by definition did not receive rebates through the program, though 58 percent (n=29) indicated that they did install one or more of the auditor's recommendations. This indicates that the program (through audits) did help audit only participants overcome key barriers (i.e. lack of information) to adopting energy efficiency, though not in a way that the program gets credit for because no rebate was given. These findings also indicate that there is a significant number of retrofits occurring as a result of the program that are not receiving rebates (mostly due to customer inaction or measure ineligibility).

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Up-front cost and lack of capable contractors were not reported as significant barriers to adoption, though contractors reported otherwise. According to survey responses, the information provided (or not provided) in the audit plays a greater role in overcoming barriers to adoption. While not every home will have cost-effective retrofit opportunities, it is likely that some opportunities are lost for reasons that could be mitigated. The most significant reasons cited for partial participation in the program is that participants just haven't gotten around to installing recommended improvements or applying for a rebate. While many of these participants may eventually follow-through, there may be opportunities for the program to play a role in compelling these participants into action.

3.2.4 Application and Payment Processing Time

Navigant completed a review of the rebate processing times entered into the rebate tracking dataset. Table 3-18 further breaks down the time period between measure installation to rebate payment for approximately 8,800 rebates. The overall average time from when the application is entered online to rebate payment was 41 days. This average rebate processing time is nine days shorter than 2013 (50 days).

Table 3-18. Days for Rebate Processing Time

Project Type	Days Measure Installed to Application Entered	Application Entered to Invoice	Application Entered to Rebate Paid
Assessment	69	37	41
Online Assessment	47	40	42
Audit	40	37	40
Overall	58	37	41

The maximum duration between measure installation and rebate payment was 902 days. This extreme example was due to the fact that the measure was installed in February 2012, the audit was then conducted in March 2013, and the rebate was paid in September 2014 (against program policies). There were many instances where the audit was conducted after the measure was installed (62 percent of all projects), and several instances where a rebate was paid years after the measure was installed.

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3.2.5 Online Energy Checkup Participant Satisfaction

As shown in Table 3-19, respondents reported that their satisfaction with various elements of the Online Energy Checkup Program was high; the reported average satisfaction with the overall program was 8.2 on a scale of 1 to 10 (where 1 was "extremely dissatisfied" and 10 was "extremely satisfied"). The highest ratings were provided for the ease of using (9.0) and understanding (9.1) the online energy checkup. Lower ratings were provided for the usefulness of the recommendations and information provided in the report (7.5).

Table 3-19. Mean Online Checkup Satisfaction Scores

Program Aspect	Satisfaction Rating (1-10)	
	Mean	N
Overall Online Energy Check program	8.2	123
Usefulness of the recommendations in the report	7.5	136
Energy Savings Kits	8.7	122
Information provided was easy to understand	9.1	122
Information about other sources of energy efficiency information and AEP Ohio energy efficiency programs	7.8	122
I learned something new from the online checkup	7.4	121
Online checkup provided information that I needed in order to take action to save energy and money in my home	7.7	121
Online checkup gave me a better understanding of where I can save energy and money in my home	7.8	121
Time needed to complete the online checkup was reasonable	8.8	121
Online checkup was easy to complete	9.0	122
Communications with program staff	8.7	44

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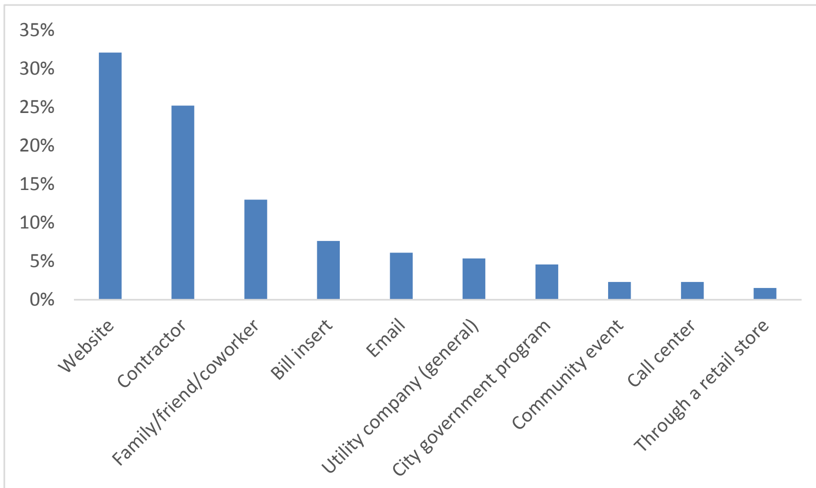
3.2.6 Online Energy Check-up Process

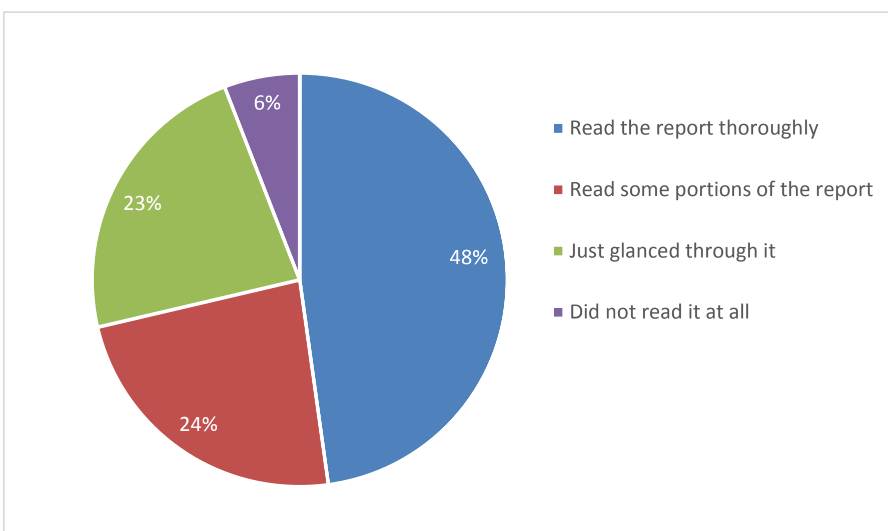
The program website and contractors were the most often cited sources of program knowledge among participants, as shown in Figure 3-8. In total, 32 percent of respondents reported having heard of the program from the website, 25 percent of respondents reported having heard of the program from a contractor, and 13 percent from a family, friend or coworker (n=85).

Figure 3-8. How Did You Hear About the Program?



When asked about the energy report provided following the Online Checkup, the majority of participants (48%) indicated that they had read the report thoroughly. Figure 3-9 illustrates that only 6 percent of participants indicated that they did not read the report at all.

Figure 3-9. Did Participants Read the Energy Report after Online Checkup?



Participants who indicated that they read the report thoroughly were asked how useful the report was on a scale of 1 to 10, where 1 – "not at all useful" and 10 – "very useful." The average rating was 7.5 (n=130, indicating a fairly high level of satisfaction with the report.

Participants were also asked to indicate if they have participated in any other AEP Ohio programs. The survey found that 10 percent of individuals indicated that they had participated in another program, mostly receiving appliance rebates (n=134). Of those individuals, 54 percent indicated that their participation occurred after the Online Energy Checkup Program, indicating that the Online Checkup is successful at channeling some customers to other programs.

3.2.7 Installation Contractor Participation

Navigant analyzed participation data for each contractor to identify any trends in participation compared to 2013. A total of 141 contractors submitted projects to the program in 2014, compared to 79 in 2013, due to an increase in outreach efforts, especially among HVAC contractors. More than half of the companies who participated in both 2013 and 2014 experienced a decrease in participation in 2014. This amounted to a 38 percent decrease in participation among those contractors who participated in 2013.

In 2013, the top ten contractors accounted for 70 percent of the program's savings, while in 2014 the top 10 contractors provided 54 percent of the program's savings. This reflects a growing pool of smaller volume contractors (HVAC) who are contributing larger numbers of projects. For instance, in 2013, 26 contractors submitted more than 100 projects, while in 2014, 34 contractors did.

About 20 percent of contractors surveyed for this evaluation (n=10) reported that their work decreased since last year, whereas 50 percent reported work levels are the same, and 30 percent reported that they have more work with the program compared to 2013. Firms that have experienced growth since last year attributed it to an increase in marketing and customer interest. Those who experienced a decrease attributed it to the elimination of rebates for gas measures, which were removed from the program in 2014 for cost-effectiveness reasons. Contractors reported on average that only 38 percent of the homes that they retrofit are electrically heated.

One of the contractors who contributed the most savings to the program in 2013 actually decided to stop participating temporarily during 2014. When interviewed, this contractor explained that they decided not to participate during part of 2014 due to the suspension of rebates for gas measures and because of the new software program implemented by the implementation contractor (CAKE). They reported being unsure of whether they will participate in the future. The program did work with this contractor to make special allowances to overcome resistance to the new software program.

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Navigant observed an increased number of contractors using the online audit for rebate qualification. Of the 86 contractors who had projects where an online checkup was used to qualify customers, 62 of those were HVAC contractors. There is a pool of roughly 50 HVAC contractors whose projects are mostly or exclusively associated with an online checkup. Additionally, almost 75 percent of these projects were installed before the online checkup was conducted. In fact, the majority of new contractors who entered the program in 2014 complete projects in this fashion, mostly for HVAC projects. It appears that contractors are using the program's rebates to sell higher efficiency units, then using the online checkup after the fact to meet program requirements for customer eligibility. In this way, the In-home Energy program is essentially functioning as a retrofit program and an HVAC program rolled into one.

3.2.8 Installation Contractor Satisfaction

Navigant interviewed ten In-home Energy Program installation contractors to determine their satisfaction with various aspects of the program. Most interview participants were either owners or managers. The top three primary business activities for contractors were conducting energy audits (40%), air sealing and insulation (35%) and HVAC replacement or repair (15%). The contractors interviewed represented roughly 40 percent of the program's total savings in 2014.

In order to develop a more detailed understanding of satisfaction with key program processes, Navigant asked contractors to rate their satisfaction with various program components on a 1-10 scale, where 1 means "very dissatisfied," and 10 means "extremely satisfied." Contractors were generally satisfied with the program overall, and reported a significant increase in satisfaction with most program elements over 2013. The only decrease in satisfaction was reported for rebate amounts for HVAC measures (specifically those gas measures for which rebates were discontinued). The greatest increase was reported for the process for submitting rebate applications. Contractors noted dissatisfaction with the rebate amounts for gas homes and lack of training and marketing support (especially outside of Columbus). However, contractors were clearly pleased with increased rebate levels for non-gas measures, reporting an increase in satisfaction from 5.1 in 2013 to 6.8 in 2014.

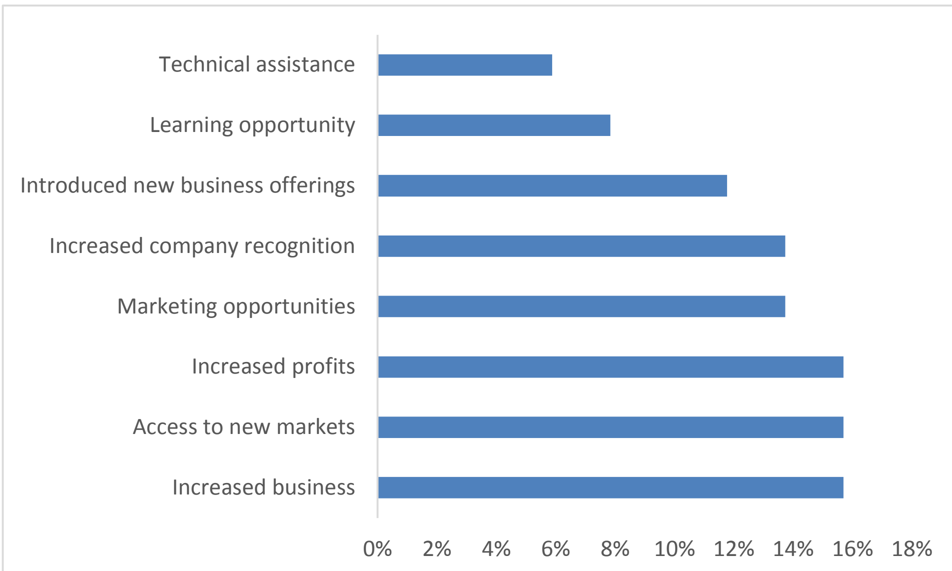
Table 3-20. Mean Contractor Satisfaction Scores

Program Aspect	Satisfaction Rating (1-10)	
	2014	2013
Rebate amounts for shell measures	6.8	5.1
Rebate amounts for HVAC measures	4.9	7.7
Interactions with program staff	7.8	7.4
Training and technical support	6.0	5.4
Level of AEP Ohio marketing/promotion to customers	4.8	4.9
The process for submitting a rebate application	6.9	4.3
The amount of time it takes to receive a rebate	5.0	4.2
The In-home Energy Program in general	7.9	7.3

Half of the contractors interviewed reported seeing fewer application flaws using the new CAKE online intake tool. Nearly all contractors (8 of 9) reported that the new online system is an improvement over the old paper-based application process. Some contractors did report that the CAKE system can be time consuming due to some redundancy in the information requested. According to program staff, changes were made to the system mid-year to reduce redundancy of data collected, which may not be reflected in these comments.

Navigant asked contractors to identify all of the benefits participating in the program provides their company. As seen in Figure 3-10, the top responses were that the program increases business (16%, n=51), access to new markets (16%) and increased profits (16%).

Figure 3-10. Contractor Benefits to Participation



Contractors were also asked to identify drawbacks to participation. The most common drawback was extra administrative burdens (50%, n=10). Specific issues included rebates changing every year, lack of rebates for gas homes, and the expense of conducting assessments which were not profitable. Long wait times to receive rebates dropped off of the (short) list of complaints in 2014. The most common suggestions on ways to improve the program were more marketing and outreach to customers, and to increase rebate levels. All ten contractors said that additional marketing support from the program would help them sell their services to customers. Several contractors mentioned that providing name recognition for "program approved" contractors would be helpful.

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3.2.9 Audit to Rebate Conversion Rates

Audit-to-rebate conversion rate is a key indicator of market transformation for home retrofit programs. Monitoring this metric over time will provide feedback on the success of program activities in overcoming barriers to adoption of energy efficiency. Navigant was able to calculate conversion rates for the program using tracking data as seen in Table 3-21. Auditors submit audit data after each audit/assessment to log direct install measures and receive a rebate for the audit/assessment. The average conversion rate for the program as a whole was 39 percent in 2014. However, when excluding online assessments, the average rate increases to 52 percent. An average conversion rate of 52 percent is high and reflects positively on the program. Navigant also asked contractors to estimate their conversion rates during 2014. Responses ranged from 40 percent to 100 percent with an average of 67 percent. This corresponds with Navigant's average for this group of contractors (69%) based on tracking data.

Table 3-21. Average Conversion Rate by Audit Type

Audit Type	Audits Completed	Retrofits Completed	Conversion Rate
Assessment	4,783	2,556	53%
Audit	1,152	555	48%
Online Checkup	4,410	923	21%
Total	10,345	4,034	39%

According to Navigant's analysis of tracking data, only 17 contractors had conversion rates of less than 50 percent, while 108 contractors had conversion rates of 100 percent. The conversion rate data is skewed, however, by several large contractors with lower rates (~20%), and by the large number of contractors performing audits after measure installation. Audits occurring after the installation should not be factored into the conversion rate, and when these are removed from the analysis, the adjusted conversion rate decreases to 19 percent, as shown in Table 3-22. An average conversion rate of 19 percent is somewhat low and indicates that program activities are not particularly successful at overcoming barriers to adoption of energy efficiency for most participants, especially for Online Checkup participants (6%).

Table 3-22. Adjusted Conversion Rates Excluding Installations that Occurred Before Audits

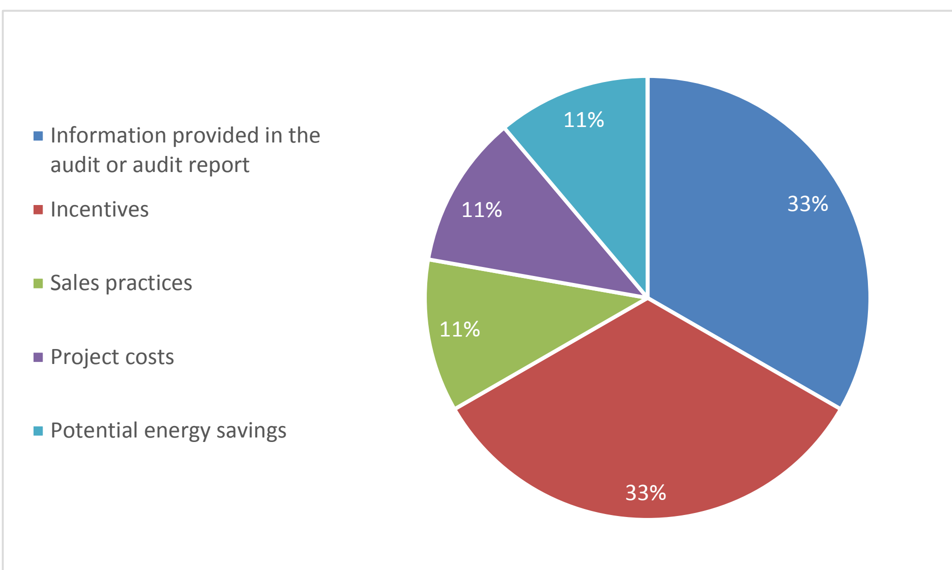
Audit Type	Number Completed	Retrofits Completed	Conversion Rate
Assessment	3,231	1,020	32%
Audit	849	254	30%
Online Checkup	3,662	219	6%
Total	7,742	1,493	19%

However, these conversion rate adjustments complicate the conversion rate metric in ways that prevent simple benchmarking against other utility programs (which might not have accounted for these adjustments). For many of those Online Checkup participants who received a measure installation before the audit, it is likely that the program rebates (and contractor messaging) did influence them to install higher efficiency measures than they otherwise would have. While the design of an audit/retrofit program traditionally intends that the *audit* influence customers to make improvements, this program is, in a way, functioning as an HVAC program as well (as noted in Section 3.2.7), which rely on the contractor up-selling high-efficiency units through rebates. For this reason, conventional metrics for evaluating market progress such as conversion rates, should be viewed carefully for this program.

The adjusted conversion rate for the program as a whole (19%) is skewed by the Online Checkup, which is primarily intended as an educational tool and not necessarily expected to result in retrofit measure installation for every customer. It is more appropriate to focus on the conversion rates associated with audits and assessments (adjusted for audits after installation). As seen in Table 3-22, these rates are around 30 percent, which are significantly better than the overall rate (19%), but still presents an opportunity for improvement.

As shown in Figure 3-11, when contractors were asked what factor has the greatest impact on their conversion rates, an equal portion (33%, n=9) reported incentives and information provided in the audit/report. These two factors are both program components, indicating the importance of the program in influencing energy efficiency improvements. The availability of money (income) was reported by seven of nine contractors as the key difference between customers who install measures versus those who do not. This is a contradiction to reports from the participants themselves indicating information provided during the audit as a more important factor.

Figure 3-11. Factor with Greatest Impact on Contractor Reported Conversion Rates



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3.3 *Cost-Effectiveness Review*

This section addresses the cost effectiveness of the In-home Energy Program. Cost effectiveness is assessed through the use of the Total Resource Cost (TRC) test. Table 3-23 summarizes the unique inputs used in the TRC test.

Table 3-23. Inputs to Cost-Effectiveness Model for In-home Energy Program

Item	Value
Average Measure Life	11
Residences	22,270
Annual Energy Savings (kWh)	8,191,073
Coincident Peak Savings (kW)	1,220
Third Party Implementation Costs	2,458,862
Utility Administration Costs	433,412
Utility Incentive Costs	2,172,015
Participant Contribution to Incremental Measure Costs	2,330,297

Based on these inputs, the TRC ratio is 0.7. Therefore, the program does not pass the TRC test. Table 3-24 summarizes the results of the cost-effectiveness tests. Results are presented for the Total Resource Cost test, the Participant Cost Test, the Ratepayer Impact Measure Test, and the Utility Cost Test.

Table 3-24. Cost Effectiveness Results for the In-home Energy Program

Test Results	
Total Resource Cost	0.7
Participant Cost Test	3.4
Ratepayer Impact Measure	0.3
Utility Cost Test	0.7

At this time, additional benefits related to reduction of greenhouse gas emissions have not been quantified in the calculation of the TRC. These additional benefits would increase the given TRC benefit/cost ratio.

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4 Conclusions and Recommendations

This section highlights the findings from the impact and process evaluation of the In-home Energy Program for 2014.

4.1 *Key Impact Evaluation Findings and Recommendations*

Navigant used engineering algorithms to verify energy and demand savings for the In-home Energy Program. The In-home Energy Program reported 10,016 MWh of energy savings and 1.5 MW of demand savings in 2014. The verified (*ex post*) energy and demand savings for 2014 were 8,191 MWh and 1.2 MW. *Ex post* savings fell short of the program energy savings goals of 13,720 MWh, but exceeded the demand savings goal of 0.90 MW as shown in Table ES-1. The realization rates were 82 percent for MWh and 81 percent for peak kW.

Table 4-1. 2014 Overall Evaluation Results

	2014 Program Goals (a)	*Ex Ante* Savings (b)	*Ex Post* Savings (c)	Realization Rate RR = (c) / (b)	Percent of Goal = (c) / (a)
Energy Savings (MWh)	13,720	10,016	8,191	0.82	60%
Demand Savings (MW)	0.9	1.5	1.2	0.81	137%

[1] Source: 2012-2014 AEP Ohio Energy Efficiency/Peak Demand Reduction Action Plan.

1. **Missed Savings Opportunities** More than 2,000 MWh of energy savings from over 6,000 measures were removed from the tracking system after submission due to incomplete information. Rebates were paid for some these measures by the implementation contractor but AEP Ohio's final quality control processes rejected them because customer information needed for verification was absent. Many of the non-savings measures were credited back to AEP Ohio or not paid originally. Issues were identified throughout the year with the quality of project data transferred by the implementation contractor to AEP Ohio, requiring frequent and significant revision.

Impact Recommendation #1: Ensure the data entry system has input validation processes that reject rebate applications filed with missing information that is necessary for verification and savings calculation purposes.

2. **Program Activity.** More than 10,000 audits, assessments and online checkups were conducted by program auditors in 2014, resulting in more than 4,000 retrofits. Multifamily direct install measures accounted for 62 percent of the total *ex ante* program energy saving in 2014, energy kit measures accounted for 16 percent, retrofit measures accounted for 13 percent, and single-family direct install measures accounted for 10 percent of the program's total *ex ante* MWh savings.

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3. **Measure In-Service Rates.** The in-service rate for each measure installed through the program was determined through both on-site audits as well as participant telephone surveys. Installation rates for direct install measures ranged from 19 percent (multifamily nightlights) to 91 percent (multifamily CFLs). All retrofit measures were found to have a realization rate of 100 percent. Energy kit measure installation rates ranged from 26 percent for showerheads and aerators to 67 percent for LED nightlights.

4. **LED Nightlight Installation Rates.** The realization rate found for multifamily LED nightlights was lower than for other measures. It is possible that tenants are taking the LED nightlights with them when they move out of the apartment. From data provided by AEP Ohio, Navigant verified that half of the units missing a nightlight did in fact experience turnover in 2014 after the measure installation date.

Impact Recommendation #2: Enforce the policy that nightlights should only be installed where these replace an existing nightlight. Nightlights are currently being installed in every unit, regardless of whether an inefficient nightlight existed previously. Enforcing this policy may reduce the incidence of nightlight removal by customers who do not want them.

5. **Energy Kit Installation Rates.** Several energy kit measures were found to have very low installation rates, resulting an overall realization rate of 51 percent for those measures as a whole. These low installation rates have a significant impact on the program's overall realization rate. For instance, if the kit measures all had an installation rate of 100 percent, the program's overall realization rate would increase to 90 percent. The worst installation rates for kit measures were found for the water saving measures (showerheads, aerators and pipe insulation). Most of the participants surveyed who did not install these measures reported that they already had them (51%).

Impact Recommendation #3: Apply an in-service rate adjustment factor to the *ex ante* algorithms for kit measures based on evaluation findings so that *ex ante* savings will more closely align with *ex post* evaluation results and improve the program realization rate.

6. ***Ex Post* Savings Evaluation.** Navigant conducted a review of measure savings recorded in the tracking system to verify that the energy savings algorithms matched those in the Draft 2010 Draft 2010 Ohio Technical Reference Manual (TRM) and were correctly applied for each project. The evaluation team independently calculated energy savings for each measure in the database using the *ex ante* calculation methods based on the Draft 2010 Ohio TRM. Navigant's algorithm review found that the energy and demand savings algorithms have been constructed and applied properly according to Draft 2010 Ohio TRM specifications.

7. **Adjusted Savings Evaluation.** For high-impact measures (with more than 1% of total program savings) not included in the Draft 2010 Ohio TRM [i.e. electrically-commutating motors (ECM) motors and programmable thermostats], the evaluation team examined AEP Ohio's calculation methods and evaluated these against calculation methods identified from secondary sources (recent TRMs from nearby states).

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The *ex ante* savings calculations for ECM motors use deemed savings based on the home's heating and cooling system type, specified in the 2012 to 2014 AEP Ohio Energy Efficiency/Peak Demand Reduction (EE/PDR) Action Plan. Navigant applied estimates calculated from a more recent study conducted by Advanced Energy. [5] The resulting *ex post* savings for ECM motors was 250 percent of the *ex ante* value. These measures have been removed from the program in 2015, so no further change is recommended.

The *ex ante* savings calculations for programmable thermostats use deemed savings based on the heating and cooling system type for the home, specified in the AEP Ohio EE/PDR Plan. The evaluation team reviewed recent TRM algorithms for nearby states and applied a more recent algorithm found in the 2014 Pennsylvania TRM that could be modified using Draft 2010 Ohio TRM inputs, resulting in an *ex post* savings of 50 percent of the *ex ante* value.

Impact Recommendation #4: Update the *ex ante* calculations for programmable thermostats based on more recent algorithms and assumptions. Additionally, discontinue rebates for these measures in homes that do not have electric heat as most savings from these measures occur during the heating season.

4.2 *Key Process Evaluation Findings and Recommendations*

The process evaluation component of the In-home Energy Program assessed the effectiveness of the program operations, delivery for the energy audits/assessments, and rebates for retrofit measures. Navigant's process evaluation included in-depth interviews with program staff, participating customers and installation contractors, and a review of program tracking systems, reports and marketing materials. Findings follow along with recommendations.

1. **Participants are satisfied with most aspects of the program.** Respondents reported their satisfaction with various elements of the In-home Energy Program was quite high. The average satisfaction reported with the overall program was 8.3 on a scale of 1 to 10 (where 1 was "extremely dissatisfied" and 10 was "extremely satisfied"). Satisfaction with the different aspects of the program did not vary substantially – all aspects scored above 8. The highest ratings were provided for the auditor who assessed the home's performance (9.1), the length of time it took to complete the audit/assessment (8.9) and the time it took to schedule the energy audit (8.9).

2. **Data entry**. Tracking system issues due to installation contractor data entry decreased in 2014 thanks to the new online data entry system (CAKE). Half of the contractors interviewed reported seeing fewer application flaws using the new CAKE online intake tool. Nearly all contractors (8 of 9) reported that the new online system is an improvement over the old paper-based application process. However, some contractors did report that the CAKE system can be time consuming due to some redundancy in the information requested. According to program staff, changes were made to the system mid-year to reduce redundancy of data collected. Despite these improvements to the final

[5] Murray, Matt, et. al. *Residential HVAC Electronically Commutated Motor Retrofit Report*. February 2012. http://www.advancedenergy.org/_files/pages/Residential-HVAC-Electronically-Commutated-Motor-Retrofit.pdf

data extract provided to Navigant, AEP Ohio's QA/QC process is still finding significant errors, as evidenced by the number of projects negated in the tracking system for non-compliance with program requirements. The data extract provided by the implementation contractor to AEP Ohio contained significant data entry errors or missing data necessitating the removal of substantial savings from the program due to measure ineligibility or inability to confirm customer eligibility.

Process Recommendation #1: Monitor application flaw patterns to optimize data entry. Monitor application flaws occurring through the CAKE system to identify further opportunities to streamline the application process. Eliminate requirements for manual entry of data that is also submitted in supporting documents.

3. **Installation Contractor Satisfaction.** Survey results indicate that contractors are satisfied with the program overall, giving the program a rating of 7.9 out of 10 (compared to 7.3 in 2013). Contractors reported a significant increase in satisfaction with most program elements over 2013. The greatest increase in satisfaction was reported for the process for submitting rebate applications. The only decrease was reported for rebate amounts for HVAC measures (specifically gas measures for which rebates were eliminated in 2014 for cost-effectiveness reasons).

   The most common suggestions on ways to improve the program were more marketing and outreach to customers, and to increase rebate levels. All ten contractors said that additional marketing support from the program would help them sell their services to customers.

Process Recommendation #2: Develop additional marketing support for contractors. Contractors were the largest source of program awareness among customers interviewed. Surveys indicate that marketing efforts focused on supporting contractors' ability to sell energy efficiency retrofits to customers would be well received. Specifically, sales training could satisfy contractors' desire for marketing support, while also helping to improve audit-to-rebate conversion rates. Low audit-to-rebate conversion rates found in this evaluation (19%-30%) indicate that contractors have significant room for improvement in their sales practices. Several contractors also mentioned that providing name recognition for "program approved" contractors would be helpful.

Process Recommendation #3: Maintain the website with auditor contact information. The auditor list on the AEP Ohio website was down for revisions when the evaluation team tried to review.

4. **Installation Contractor Participation**. Navigant analyzed participation data for each contractor to identify any trends in participation compared to 2013. More than half of the companies who participated in 2013 and 2014 experienced a significant decrease in participation in 2014. Firms that have experienced growth since last year attributed it to an increase in marketing and customer interest. Those who experienced a decrease attributed it to the elimination of rebates for gas measures (contractors reported that only 38% of the homes they retrofit are electrically heated).

   Navigant observed an increased number of contractors using the online audit for rebate qualification. Of the 86 contractors who had projects where an online checkup was used to qualify

NAVIGANT

customers, 62 of those were HVAC contractors. There is a pool of roughly 50 HVAC contractors whose projects are mostly or exclusively associated with the online checkup. Additionally, almost 75 percent of these projects were installed before the online checkup was conducted. In fact, the majority of new contractors who entered the program in 2014 complete projects in this fashion, mostly for HVAC projects. It appears that contractors are using the program's rebates to sell higher efficiency units, then using the online checkup after the fact to meet program requirements for customer eligibility.

Process Recommendation #4: Sales training targeted to HVAC contractors for selling whole-home performance. As new contractors join the program, to take advantage of HVAC rebates, AEP Ohio should include material in training and/or orientation efforts about identifying and selling whole-house improvements. HVAC contractors relying solely on the online audit are not required to be BPI certified. It is likely that many of these contractors have little knowledge of whole-house retrofits, and how to sell them. Additional training for these contractors could improve the rate of multiple-measure, whole-house retrofits.

5. **Audit-to-Rebate Conversion Rates.** Audit-to-rebate conversion rate is a key indicator of market transformation for home retrofit programs. Navigant was able to calculate conversion rates for the program using tracking data and found that the average conversion rate for the program as a whole was 19 percent in 2014 (adjusted for measures installed before the audit). This adjusted conversion rate is skewed by the Online Checkup (6% conversion rate), which is primarily intended as an educational tool and not necessarily expected to result in retrofit measure installation for every customer. It is more appropriate to focus on the conversion rates associated with audits and assessments (adjusted for audits after installation). These rates are around 30 percent, which are significantly better than the program average rate (19%), but still present an opportunity for improvement.

   Adjustments made to the conversion rates to account for units installed before the audit complicate the conversion rate metric in ways that may prevent simple benchmarking against other utility programs (which might not have accounted for these adjustments). For many of those Online Checkup participants who received a measure installation before the audit, it is likely that the program rebates (and contractor messaging) did influence them to install higher efficiency measures than they otherwise would have. While the design of an audit/retrofit program traditionally intends that the audit influence customers to make improvements, this program is, in a way, functioning as an HVAC program as well (as noted in Section 3.2.7), which rely on the contractor up-selling high-efficiency units through rebates. For this reason, conventional metrics for evaluating market progress such as conversion rates, should be viewed carefully for this program.

Process Recommendation #5: Monitor contractor conversion rates and conducting additional targeted outreach and/or training on sales practices among contractors with low rates.

6. **Barriers to Participation.** Participant survey responses indicate that customers are primarily motivated to participate in the program in order to save energy and money. Contrary to initial

NAVIGANT

expectations, up-front cost and lack of capable contractors were not identified as significant barriers to adoption. According to survey response, the information provided (or not provided) in the audit plays a greater role in overcoming barriers to adoption. Rebate participants, those who received a rebate, reported that their ultimate decision on which measures to install was based on the measures most needed/practical and those that saved the most energy/money, with the auditor's recommendations playing a significant role in both of these decisions.

Audit only participants (those who did not receive a rebate) reported significantly lower satisfaction with the usefulness of the recommendations they were provided (5.9 compared to 8.1 for rebate participants on a 1-10 scale). A total of 26 percent of customers said that the auditor had no recommendations or that the report did not tell them anything new. These customers wanted to understand why their bills were high and how they were using energy, but felt the audit/assessment was insufficient in providing this information. Many AEP Ohio Customer Services Representatives (CSR's) are using this program as a tool to help resolve high bill complaints. In many cases, the bills and recent rate increases were the focus of these customers and they were not as interested in energy efficiency in general.

The most common reason cited by audit only participants for not installing measures was that they haven't gotten around to it yet (43%). While many of these participants may eventually follow-through, there may be opportunities for the program to play a role in compelling these participants into action. Audit only participants did not receive rebates through the program, though 58% of them (n=29) indicated that they did install one or more of the auditor's recommendations. This result indicates that the program (through audits) did help even those participants overcome key barriers (i.e. lack of information) to adopting energy efficiency, though not in a way that the program gets credit for because no rebate was given. These findings also indicate that there is a significant number of retrofits occurring as a result of the program that are not receiving rebates (mostly due to customer inaction or measure ineligibility).

Process Recommendation #6: Provide an additional incentive for rebate applications submitted by contractors, for multiple-measure installations that occur after an audit. Many contractors are reluctant to submit applications on behalf of customers because they do not want to deal with paperwork and are reluctant to adapt to the new online system. Customers are therefore responsible for submitting applications which they often find confusing, resulting in data entry errors and retrofits for which no rebate is received because customers just do not get around to doing this on their own. While requiring contractors to submit paperwork might create an unfavorable barrier to entry for contractors, offering an incentive (or spiff) may help overcome the initial hurdle of adapting to the new system. Additionally, tying the incentive to multiple measure rebates that occur after an audit would help to encourage whole-house retrofits based on audit results. This incentive may be most viable as a promotional offering or temporary offering for new contractors.

Process Recommendation #7: Training and outreach for contractors should emphasize the six-month window for applying for a rebate. The high number of customers (43%) who reported not installing measures or applying for a rebate because they "just haven't gotten around to it yet," might be reduced if (among other things) contractors emphasize the limited application period for applying for rebates in their sales process.

Process Recommendation #8: Emphasize energy and cost savings in messaging. For many/most customers, energy and cost savings are the primary motivators in their decision to participate in the program and implement efficiency improvements. Explore compelling ways to present this information in advertising and audit reports. Additionally, sales training to help contractors find better ways to present this data to customers would be beneficial.

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Appendix A Summary of Measure Savings

Figure 4-1. Summary of Measure Savings

Measure Description	Ex-Ante			Ex-Post Verified	
	Quantity	kWh Savings	kW Savings	Verified kWh Savings	Verified kW Savings
MFDI CFL 9W Globe	33,658	887,607	106	807,722	96.6
MFDI CFL 13W	90,204	3,436,046	411	3,126,802	373.9
MFDI CFL 14W R30	9,606	394,058	47	358,593	42.9
MFDI CFL 23W	5	214	0	194	0.0
MFDI LED Night Light	11,680	246,153	28	46,769	5.3
MFDI Shower Heads	4,358	1,032,890	132	929,601	118.9
MFDI Faucet Aerator	8,478	207,711	26	78,930	9.8
Energy Kit CFL 13W	8,500	323,782	38.7	213,696	25.6
Energy Kit CFL 20W	8,500	306,539	36.7	202,316	24.2
Energy Kit CFL 23W	4,250	181,548	21.7	119,821	14.3
Energy Kit LED Night Light	4,250	89,568	10.2	60,010	6.9
Energy Kit Pipe Insulation	1,715	190,703	21.8	64,839	7.4
Energy Kit Faucet Aerator	3,430	40,337	5.0	10,488	1.3
Energy Kit Shower Heads	1,715	329,242	42.1	85,603	11.0
Energy Kit Draft Stoppers	31,896	53,160	66.4	24,454	30.6
Energy Kit Weatherstripping	2,658	39,870	74.4	13,157	24.6
Direct Install Pipe Insulation	337	43,138	4.9	37,099	4.2
Direct Install CFL 13W	14,374	547,534	65.5	438,027	52.4
Direct Install CFL 20W	25	902	0.1	721	0.1
Direct Install CFL 23W	5,673	242,334	29.0	193,867	23.2
Direct Install LED Night Light	2,019	42,550	4.9	33,189	3.8
Direct Install Faucet Aerator	217	5,317	0.7	4,147	0.5
Direct Install Shower Heads	345	81,768	10.5	64,597	8.3
Attic Insulation	416	87,872	3.4	87,872	3.4
Wall Insulation	98	19,244	1.2	19,244	1.2
Floor Insulation	10	7,475	0.2	7,475	0.2
Air Sealing	288	81,637	2.8	81,637	2.8
Windows	9	1,850	0.3	1,850	0.3
Energy Star Window Replacement	88	5,522	0.9	5,522	0.9
Duct Sealing	12	8,642	0.2	8,642	0.2
Heat Pump Thermostat	389	204,652	0.0	114,304	0.0
Direct Install Programmable Thermostat	69	9,785	0.0	4,133	0.0
Programmable Thermostat	891	120,454	0.0	48,562	0.0
Air Source Heat Pump to Energy Star CAC	15	3,173	2.8	3,173	2.8
Ductless Mini Splits (Ductless Heat Pumps)	9	11,079	1.7	11,079	1.7
GS ENERGY STAR Heat Pump	2	9,836	0.9	9,836	0.9
ENERGY STAR Air Source Heat Pump Replacement	64	41,030	7.2	41,030	7.2
ENERGY STAR Heat Pump	342	322,023	65.7	322,023	65.7
Gas Furnace and CAC to AS Heat Pump	2	1,464	1.0	1,464	1.0
Energy Star AC Replacement	1,002	231,859	194.7	231,859	194.7
Furnace with ECM Motor or ECM Motor Replacement	908	101,711	29.0	253,479	48.7
RCA Tune up	14	3,199	0.4	3,199	0.4
PIN Based CFL Fixture (Outdoor)	89	3,393	0.4	3,393	0.4
PIN Based CFL Fixture (Indoor)	198	7,516	0.9	7,516	0.9
CFL Torchieres	1	43	0.0	43	0.0
Electric DHW Tank Replacement	3	309	0.0	309	0.0
Energy Star Ceiling Fan	53	8,851	1.0	8,851	1.0
Total	252,865	10,015,588	1,498	8,191,137	1,220

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Appendix B Data Collection Instruments

The following guides were used to conduct the in-depth surveys.

Title:	**2014 In-home Energy Program Participant Telephone**
Statement of purpose:	These surveys will be used by the evaluation team to determine measure realization rates and to identify key program strengths and weaknesses.
Sample size:	302 energy audit/assessment participants to achieve 95/5 confidence/precision. Online Energy Checkup participants will be surveyed separately.
Survey timeline:	January - February 2015

Key Evaluation Questions	Survey Questions
What were the realization rates for each measure?	CFL1 – R8
How do customers become aware of the program? What marketing strategies could be used to boost program awareness?	P1 - P3
Is the energy audit/assessment providing sufficient information to overcome barriers to implementing energy efficiency improvements (specifically the lack of customer information about EE)?	AR1 – AR5 PP1 - PP8
How do participating customers perceive the incentives and costs related to this program?	R10, PP6, PP7
Are customers satisfied with the program?	R6, P4 – P5

Introduction

Hello, my name is ___________ with The Blackstone Group calling on behalf of AEP Ohio, your electric utility. I'm calling recent participants in AEP Ohio's In-home Energy Program to learn about their experience and satisfaction with the program, all responses will be kept anonymous. This is not a sales call.

May I please speak with [CONTACT NAME]?

[IF NOT AVAILABLE] May I please speak with someone in your household who was involved with your recent decision to purchase energy efficiency measures for your home (IF NEEDED: such as high-efficiency furnace, air sealing, insulation, etc.)? [IF THE DECISION-MAKER IS NO LONGER THERE, THANK AND TERMINATE]

[IF NEEDED] Depending on your responses, this survey will take about 10 minutes to complete.

Screeners

S1. Our records indicate that you received an energy <JOB TYPE>, with information on ways to save energy in your home. Is that correct?

1. YES [SKIP TO CFL1]
2. NO [CONTINUE TO S1A]
98. DON'T KNOW [CONTINUE TO S1A]
99. REFUSED [TERMINATE]

[ASK IF S1=2, 98]

S1A. The energy <JOB TYPE> involved a visit to your home by an energy expert who inspected your home to determine energy savings opportunities. Do you remember this?

1. YES [CONTINUE TO S2]
2. NO [TERMINATE]
98. DON'T KNOW [TERMINATE]
99. REFUSED [TERMINATE]

[ASK IF S1A=1]

S2. Did you participate in the energy <JOB TYPE> process?

1. YES [SKIP TO CFL1]
2. NO [CONTINUE TO S2A]
98. DON'T KNOW [CONTINUE TO S2A]
99. REFUSED [THANK AND TERMINATE]

[ASKIF S2= 2, 98]

S2A. May I speak with someone who followed along the energy <JOB TYPE> process?

1. YES [SKIP CFL1, REINTRODUCE YOURSELF IF NECESARY]
2. NO [THANK AND TERMINATE]
98. DON'T KNOW [THANK AND TERMINATE]
99. REFUSED [THANK AND TERMINATE]

Measure Verification [Measure verification battery is the same for each measure]

CFLs [ASK CFL1 IF QTYCFL>0, IF QTYCFL=0 SKIP TO SHOW1]

CFL1. Our records indicate that the energy auditor gave you some energy efficient light bulbs during the <JOB TYPE>, is this correct?

1. YES [CONTINUE TO CFL1A]
2. NO [SKIP TO CFL1C]
98. DON'T KNOW [SKIP TO CFL1C]
99. REFUSED [SKIP TO SHOW1]

CFL1A. Our records indicate that the auditor gave you [QTYCFL] light bulbs during the <JOB TYPE>, is this correct?

1. YES [SKIP TO CFL2]
2. NO [CONTINUE TO CFL1B]
98. DON'T KNOW [SKIP TO SHOW1]
99. REFUSED [SKIP TO SHOW1]

[ASK IF CFL1A=2]

CFL1B. How many light bulbs did the auditor give you during the <JOB TYPE>?

NAVIGANT

[NUMERIC, 0-50] [IF > 0, SKIP TO CFL2] [IF = 0, SKIP TO CFL1C]
98. DON'T KNOW [CONTINUE TO CFL1C]
99. REFUSED [SKIP TO SHOW1]

CFL1C. Just to confirm, you don't recall the auditor giving you any energy efficient light bulbs during the <JOB TYPE>?

1. YES, HE DID [CONTINUE TO CFL1D]
2. NO, HE DIDN'T [SKIP TO SHOW1]
98. DON'T KNOW [SKIP TO SHOW1]
99. REFUSED [SKIP TO SHOW1]

[ASK IF CFL1C=1]
CFL1D. Do you remember how many light bulbs the auditor gave you?
[NUMERIC, 0-50] [IF > 0, CONTINUE TO CFL2] [IF = 0, SKIP TO SHOW1]
98. DON'T KNOW [SKIP TO SHOW1]
99. REFUSED [SKIP TO SHOW1]

CFL2. How many light bulbs were actually installed during the <JOB TYPE>, as opposed to being left behind for you to install later?
[NUMERIC, 0-50] [IF < QTYCFL, CONTINUE TO CFL2A], [IF = QTYCFL, CONTINUE TO CFL3],
98. DON'T KNOW [CONTINUE TO CFL3]
99. REFUSED [CONTINUE TO SHOW1]

CFL2A. How many of those remaining [INSERT DIFFERENCE BETWEEN QTYCFL AND RESPONSE TO CFL2] that were left behind did you install yourself?
[NUMERIC, 0-50]
98. DON'T KNOW [CONTINUE TO CFL3]
99. REFUSED [CONTINUE TO SHOW1]

[ASK IF CFL2>0]
CFL3. [IF CFL2=1] "Is the light bulb that was installed still in place?"
[IF CFL2>1 or CFL2=98 or 99] "Are all the light bulbs that were installed still in place?"

1. YES [SKIP TO SHOW1]
2. NO [CONTINUE TO CFL4]
98. DON'T KNOW [SKIP TO SHOW1]
99. REFUSED [SKIP TO SHOW1]

[ASK IF CFL3=2]
CFL4. How many of the light bulbs that were installed are still installed?
[NUMERIC, 0-50] [CONTINUE TO CFL5]
98. DON'T KNOW [CONTINUE TO SHOW1]
99. REFUSED [SKIP TO SHOW1]

CFL5. What happened to the light bulb(s) which are no longer installed? [ALLOW MULTIPLE RESPONSES]

1. THROWN AWAY
2. IN STORAGE
3. SOLD OR GIVEN AWAY
4. STOPPED WORKING

97. OTHER [SPECIFY]
98. DON’T KNOW
99. REFUSED

Showerheads [ASK SHOW1 IF QTYSHOW>0, IF QTYSHOW=0 SKIP TO AER1]
SHOW1. Our records indicate that the auditor gave you an energy efficient showerhead during the <JOB TYPE>, is this correct?
1. YES [CONTINUE TO SHOW1A]
2. NO [SKIP TO SHOW1C]
98. DON’T KNOW [SKIP TO SHOW1C]
99. REFUSED [SKIP TO AER1]

SHOW1A. Our records indicate that the auditor gave you [QTYSHOW] showerhead(s) during the <JOB TYPE>, is this correct?
1. YES [SKIP TO SHOW2]
2. NO [CONTINUE TO SHOW1B]
98. DON’T KNOW [SKIP TO AER1]
99. REFUSED [SKIP TO AER1]

[ASK IF SHOW1A=2]
SHOW1B. How many showerheads were you given during the <JOB TYPE>?
[NUMERIC, 0-50] [IF = 0, CONTINUE TO SHOW1C] [IF > 0, SKIP TO SHOW2]
98. DON’T KNOW [CONTINUE TO SHOW1C]
99. REFUSED [CONTINUE TO SHOW1C]

SHOW1C. Just to confirm, you don’t recall the auditor giving you any showerheads during the <JOB TYPE>?
1. YES, HE DID [CONTINUE TO SHOW1D]
2. NO, HE DIDN’T [SKIP TO AER1]
98. DON’T KNOW [SKIP TO AER1]
99. REFUSED [SKIP TO AER1]

SHOW1D. Do you remember how many showerheads the auditor gave you?
[NUMERIC, 0-50] [IF = 0, SKIP TO AER1] [IF >0, CONTINUE TO SHOW2]
98. DON’T KNOW [SKIP TO AER1]
99. REFUSED [SKIP TO AER1]

SHOW2. Was/were the showerhead(s) actually *installed* during the <JOB TYPE> or just left behind?
1. All were installed [CONTINUE TO SHOW3]
2. Some were installed [CONTINUE TO SHOW2A]
3. All were left behind [SKIP TO SHOW2A]
98. DON’T KNOW [CONTINUE TO SHOW3]
99. REFUSED [SKIP TO AER1]

SHOW2A. Did you install the showerheads that the auditor left behind yourself?
1. YES [CONTINUE TO SHOW3]
2. NO [CONTINUE TO SHOW3]
98. DON’T KNOW [CONTINUE TO AER1]

NAVIGANT

99. REFUSED [CONTINUE TO AER1]

SHOW3. [IF QTYSHOW=1] “Is the showerhead that was installed still in place?”
[IF QTYSHOW>1] “Are all the showerheads that were installed still in place?”

1. YES [SKIP TO AER1]
2. NO [CONTINUE TO SHOW4]
98. DON’T KNOW [CONTINUE TO AER1]
99. REFUSED [SKIP TO AER1]

SHOW4. How many of the showerheads are still installed?

[NUMERIC, 0-50] [CONTINUE TO SHOW5]
98. DON’T KNOW [CONTINUE TO AER1]
99. REFUSED [SKIP TO AER1]

SHOW5. What happened to the showerhead(s) which are no longer installed? [ALLOW MULTIPLE RESPONSES]

1. THROWN AWAY
2. IN STORAGE
3. SOLD OR GIVEN AWAY
97. OTHER [SPECIFY]
98. DON’T KNOW
99. REFUSED

AERATORS [SHOW AER1 IF QTYAER>0, IF QTYAER=0 SKIP TO PINS1]
AER1. Our records indicate that the auditor gave you some energy efficient faucet aerator(s) for your kitchen or bathroom sink during the <JOB TYPE>, is this correct?

1. YES [CONTINUE TO AER1A]
2. NO [SKIP TO AER1C]
98. DON’T KNOW [SKIP TO AER1C]
99. REFUSED [SKIP TO PINS1]

AER1A. Our records indicate that the auditor gave you [QTYAER] faucet aerators(s) during the <JOB TYPE>, is this correct?

1. YES [SKIP TO AER2]
2. NO [CONTINUE TO AER1B]
98. DON’T KNOW [SKIP TO PINS1]
99. REFUSED [SKIP TO PINS1]

[ASK IF AER1A=2]
AER1B. How many faucet aerators were you given during the <JOB TYPE>?

[NUMERIC, 0-50] [IF = 0, CONTINUE TO AER1C] [IF > 0, SKIP TO AER2]
98. DON’T KNOW [CONTINUE TO AER1C]
99. REFUSED [SKIP TP PINS1]

AER1C. Just to confirm, you don’t recall the auditor did giving you any faucet aerators that screw onto the faucet in your kitchen or bathroom sink during the <JOB TYPE>?

1. YES, HE DID [CONTINUE TO AER1D]
2. NO, HE DIDN’T [SKIP TO PINS1]

98. DON'T KNOW [SKIP TO PINS1]
99. REFUSED [SKIP TO PINS1]

[ASK IF AER1C=1]
AER1D. Do you remember how many faucet aerators the auditor gave you?
[NUMERIC, 0-50] [IF >0 ASK AER2] [IF = 0, SKIP TO PINS1]
98. DON'T KNOW [CONTINUE TO AER2]
99. REFUSED [CONTINUE TO AER2]

AER2. How many of those faucet aerators were actually *installed* during the <JOB TYPE>, as opposed to just being left behind?
[NUMERIC, 0-50], [IF < QTYAER, CONTINUE TO AER2A] [IF = QTYAER, CONTINUE TO AER3]
98. DON'T KNOW [CONTINUE TO AER3]
99. REFUSED [CONTINUE TO PINS1]

AER2A. Did you install the faucet aerators that the auditor left behind yourself?
1. YES [CONTINUE TO AER3]
2. NO [CONTINUE TO AER3]
98. DON'T KNOW [CONTINUE TO PINS1]
99. REFUSED [CONTINUE TO PINS1]

AER3. [IF AER2=1] "Is the faucet aerator that was installed still in place?"
[IF AER2>1] "Are all the faucet aerators that were installed still in place?"
1. YES [SKIP TO PINS1]
2. NO [CONTINUE TO AER4]
98. DON'T KNOW [SKIP TO PINS1]
99. REFUSED [SKIP TO PINS1]

AER4. How many of the faucet aerators are still installed?
[NUMERIC, 0-50] [CONTINUE TO AER5]
98. DON'T KNOW [CONTINUE TO PINS1]
99. REFUSED [CONTINUE TO PINS1]

AER5. What happened to the faucet aerator(s) which are no longer installed? [ALLOW MULTIPLE RESPONSES]
1. THROWN AWAY
2. IN STORAGE
3. SOLD OR GIVEN AWAY
97. OTHER [SPECIFY]
98. DON'T KNOW
99. REFUSED

Pipe Insulation [SHOW PINS1 IF QTY_PINS>0, IF QTY_PINS=0 SKIP TO LED1]PINS1. Our records indicate that the auditor gave you some foam insulation for your hot water pipes during the <JOB TYPE>, is this correct?

1. YES [SKIP TO PINS2]
2. NO [CONTINUE TO PINS1A]
98. DON'T KNOW [CONTINUE TO PINS1A]
99. REFUSED [SKIP TO LED1]

PINS1A. Just to confirm, you do not recall the auditor giving you any insulation for your water heater pipes during the <JOB TYPE>?

1. YES, HE DID [CONTINUE TO PINS2]
2. NO, HE DIDN'T [SKIP TO LED1]
98. DON'T KNOW [SKIP TO LED1]
99. REFUSED [SKIP TO LED1]

PINS2. Was the pipe insulation actually *installed* during the <JOB TYPE>, as opposed to just being left behind?

1. YES [CONTINUE TO PINS3]
2. NO [SKIP TO PINS2A]
98. DON'T KNOW [SKIP TO PINS2A]
99. REFUSED [SKIP TO LED1]

PINS2A. Did you install the pipe insulation that the auditor left behind yourself?

1. YES [CONTINUE TO PINS3]
2. NO [CONTINUE TO LED1]
98. DON'T KNOW [CONTINUE TO LED1]
99. REFUSED [CONTINUE TO LED1]

PINS3. Is the pipe insulation that was installed still in place?

1. YES [SKIP TO LED1]
2. NO [CONTINUE TO PINS4]
98. DON'T KNOW [SKIP TO LED1]
99. REFUSED {SKIP TO LED1]

PINS4. What happened to the pipe insulation that is no longer installed?

1. IT WAS THROWN AWAY
2. IT'S IN STORAGE
3. IT WAS SOLD OR GIVEN AWAY
97. OTHER [SPECIFY]
98. DON'T KNOW
99. REFUSED

NAVIGANT

LED Nightlight [ASK IF QTY_LED>0, IF QTY_LED=0 SKIP TO PT1]

LED1. Our records indicate that the auditor gave you a LED nightlight during the <JOB TYPE>, is this correct?

1. YES [SKIP TO LED2]
2. NO [CONTINUE TO LED1A]
98. DON'T KNOW [CONTINUE TO LED1A]
99. REFUSED [SKIP TO PT1]

LED1A. Just to confirm, you do not recall the auditor giving you an LED nightlight during the <JOB TYPE>?

1. YES, HE DID [CONTINUE TO LED2]
2. NO, HE DIDN'T [SKIP TO PT1]
98. DON'T KNOW [SKIP TO PT1]
99. REFUSED [SKIP TO PT1]

LED2. Was the nightlight actually *installed* during the <JOB TYPE>, as opposed to just being left behind?

1. YES [CONTINUE TO LED3]
2. NO [CONTINUE TO LED2A]
98. DON'T KNOW [CONTINUE TO LED3]
99. REFUSED [SKIP TO PT1]

LED2A. Did you install the nightlight that the auditor left behind yourself?

1. YES [CONTINUE TO LED3]
2. NO [CONTINUE TO PT1]
98. DON'T KNOW [CONTINUE TO PT1]
99. REFUSED [CONTINUE TO PT1]

LED3. Is the LED Nightlight that was installed still installed?

1. YES [SKIP TO PT1]
2. NO [CONTINUE TO LED4]
98. DON'T KNOW [SKIP TO PT1]
99. REFUSED [SKIP TO PT1]

LED4. What happened to the LED nightlight that is no longer installed? [ALLOW MULTIPLE RESPONSES]

1. IT WAS THROWN AWAY
2. IT'S IN STORAGE
3. IT WAS SOLD OR GIVEN AWAY
97. OTHER [SPECIFY]
98. DON'T KNOW
99. REFUSED

Programmable Setback Thermostat [ASK PT1 IF QTY_PTherm>0, IF QTY_PTherm=0 SKIP TO AR1]

PT1. Our records indicate that a programmable thermostat was installed during the <JOB TYPE>, is this correct?

1. YES [SKIP TO PT1B]
2. NO [CONTINUE TO PT1A]
98. DON'T KNOW [CONTINUE TO PT1A]
99. REFUSED [SKIP TO AR1]

NAVIGANT

PT1A. Just to confirm, you do not recall the auditor giving you a new thermostat during the <JOB TYPE>?

1. YES, HE DID [PT1B]
2. NO, HE DIDN'T [SKIP TO AR1]
98. DON'T KNOW [SKIP TO AR1]
99. REFUSED [SKIP TO AR1]

PT1B. Did the auditor show you how to program the thermostat?

1. YES
2. NO
98. DON'T KNOW
99. REFUSED

PT2. Was the thermostat programmed during the <JOB TYPE>?

1. YES [SKIP TO PT3]
2. NO [CONTINUE TO PT2A]
98. DON'T KNOW [CONTINUE TO PT2A]
99. REFUSED [SKIP TO PT3]

PT2A. Did you program the thermostat yourself?

1. YES
2. NO
98. DON'T KNOW
99. REFUSED

PT3. Is the Programmable Thermostat installed during the <JOB TYPE> still installed?

1. YES [SKIP TO PT4]
2. NO [CONTINUE TO PT3A]
98. DON'T KNOW [SKIP TO AR1]
99. REFUSED [SKIP TO AR1]

PT3A. What happened to the programmable thermostat which is no longer installed? [ALLOW MULTIPLE RESPONSES]

1. THROWN AWAY
2. IN STORAGE
3. SOLD OR GIVEN AWAY
97. OTHER [SPECIFY]
98. DON'T KNOW
99. REFUSED

[IF PT3=1]
PT4. Is the programmable thermostat that was installed during the <JOB TYPE> currently programmed to change the thermostat setting during each day?

1. YES
2. NO
98. DON'T KNOW
99. REFUSED

[IF PT3=2]

NAVIGANT

PT5. Is your current thermostat programmable?

1. YES
2. NO
98. DON'T KNOW
99. REFUSED

[IF PARTICIPANT TYPE = Full, ask questions in this section, OTHERWISE SKIP TO PP1]

[Do not read: Full means they received a retrofit rebate, partial means they received an audit but not a rebate.]

Audit Report

Now I would like you to focus on the Report you received after the <JOB TYPE> that contained recommendations for ways to reduce your energy consumption and your utility bill.

AR1. Do you remember getting the report?

1. YES [CONTINUE TO AR1A]
2. NO [SKIP TO R1]
98. DON'T KNOW [SKIP TO R1]
99. REFUSED [SKIP TO R1]

[ASK IF AR1=1]
AR1A. Would you say that you… [READ LIST]

1. Read the report thoroughly
2. Read some portions of the report
3. Just glanced through it
4. Did not read the report at all
98. DON'T KNOW [SKIP TO R1]
99. REFUSED [SKIP TO R1]

[ASK IF AR1A<5]
AR2. On a scale of 1 to 10 where 1 is "not useful at all" and 10 is "extremely useful", please rate the usefulness of the recommendations contained in the report.

[RECORD, 1-10]

98. DON'T KNOW
99. REFUSED

[ASK IF AR2<7]
AR3. What do you think could be done to make the report more useful?

[RECORD OPEN END RESPONSE]

98. DON'T KNOW
99. REFUSED

AR4. On a scale of 1 to 10 where 1 is "not important" and 10 is "extremely important," how important were the auditor's recommendations on your decision for which improvements to make?

[RECORD RESPONSE 1-10]

98. DON'T KNOW

NAVIGANT

99. REFUSED

AR5. What was your primary goal in trying to improve the energy efficiency of your home? [RECORD ONE ANSWER]

1. Reduce energy costs
2. Save money
3. Make my home more comfortable
4. To improve the market value of my home
5. To make general improvements to my home
6. To benefit the environment
97. Other [SPECIFY]
98. DON'T KNOW
99. REFUSED

AR6. Please rank the following in order of which was most important in your decision of which improvements to make? [RANKING, RANDOMIZE ORDER]

1. Auditor's recommendations
2. Cost of improvements
3. Saving the most energy or money
4. The improvement that was most needed or practical
98. DON'T KNOW
99. REFUSED

Retrofit Measure Verification

Ask Questions below for each retrofit measure installed.

[ASK IF Furnace or Furnace Motor = 1, ELSE SKIP TO R2]
R1. Our records indicate that you installed a new furnace after the energy <JOB TYPE>, is this correct?

1. YES
2. NO
98. DON'T KNOW
99. REFUSED

[ASK IF Central Air Conditioner = 1, ELSE SKIP TO R3]
R2. Our records indicate that you installed a new central air conditioner after the energy <JOB TYPE>, is this correct?

1. YES
2. NO
98. DON'T KNOW
99. REFUSED

NAVIGANT

[ASK IF Heat Pump = 1, ELSE SKIP TO R4]
R3. Our records indicate that you installed a new heat pump after the energy <JOB TYPE>, is this correct?

1. YES
2. NO
98. DON'T KNOW
99. REFUSED

[ASK IF Thermostat = 1, ELSE SKIP TO R5]
R4. Our records indicate that you installed a new programmable thermostat after the energy <JOB TYPE>, is this correct?

1. YES
2. NO
98. DON'T KNOW
99. REFUSED

[ASK IF Attic Insulation = 1, ELSE SKIP TO R6]
R5. Our records indicate that you installed attic insulation after the energy <JOB TYPE>, is this correct?

1. YES
2. NO
98. DON'T KNOW
99. REFUSED

[ASK IF Wall Insulation = 1, ELSE SKIP TO R7]
R6. Our records indicate that you installed wall insulation after the energy <JOB TYPE>, is this correct?

1. YES
2. NO
98. DON'T KNOW
99. REFUSED

[ASK IF Windows = 1, ELSE SKIP TO R8]
R7. Our records indicate that you installed new windows after the energy <JOB TYPE>, is this correct?

1. YES
2. NO
98. DON'T KNOW
99. REFUSED

[ASK IF Air Sealing = 1, ELSE SKIP TO R9]
R8. Our records indicate that you received air sealing after the energy <JOB TYPE>, is this correct?

1. YES
2. NO
98. DON'T KNOW
99. REFUSED

[IF PARTICIPANT TYPE = Partial, ELSE SKIP TO P1]

[Do not read: Audit only participants were interviewed in the past but are broken this out into a separate section this year and added a few new questions pertaining to barriers to installing recommended measures.]

NAVIGANT

Audit only participant Battery

Now I would like you to focus on the Report you received after the <JOB TYPE> that contained recommendations for ways to reduce your energy consumption and your utility bill.

PP1. Do you remember getting the report?

1. YES [CONTINUE TO PP1A]
2. NO [SKIP TO P1]
98. DON'T KNOW [SKIP TO P1]
99. REFUSED [SKIP TO P1]

[IF PP1=1]
PP1A. Would you say that you…. [READ LIST]

1. Read the report thoroughly
2. Read some portions of the report
3. Just glanced through it
4. Did not read the report at all
98. DON'T KNOW [SKIP TO P1]
99. REFUSED [SKIP TO P1]

PP2. On a scale of 1 to 10 where 1 is "not useful at all" and 10 is "extremely useful", please rate the usefulness of the recommendations contained in the report.

[RECORD RESPONSE 1-10]

98. DON'T KNOW
99. REFUSED

[ASK IF PP2<7]
PP3. What do you think could be done to make the report more useful?

[RECORD OPEN END RESPONSE]

98. DON'T KNOW
99. REFUSED

PP3. Did you receive enough information during the audit to be able to make energy efficiency improvements to your home?

1. YES
2. NO
98. DON'T KNOW
99. REFUSED

[ASK IF PP3=2]
PP4. What additional information would have been helpful to you?

[RECORD OPEN END RESPONSE]

98. DON'T KNOW
99. REFUSED

PP5. Did you install any of the energy auditor's recommendations?

NAVIGANT

1. YES [CONTINUE TO PP6]
2. NO [SKIP TO PP7]
98. DON'T KNOW [SKIP TO PP8]
99. REFUSED [SKIP TO PP8]

[ASK IF PP5=1]
PP6. Why did you not apply for a rebate for the energy efficiency improvements you installed? [RECORD OPEN END RESPONSE] [SKIP TO PP8]

98. DON'T KNOW [SKIP TO PP8]
99. REFUSED [SKIP TO PP8]

[ASK IF PP5=2]
PP7. Which of the following describes the main reason you decided not to install any of the auditor's recommendations? [SELECT MULTIPLE]

1. Haven't got around to it yet
2. Auditor's recommendations were not helpful
3. The cost of improvements was too high
4. The improvements wouldn't have saved enough energy
5. Needed other equipment or improvements more
6. Couldn't find a contractor to do the job
97. OTHER [SPECIFY]
98. DON'T KNOW
99. REFUSED

PP8. What was your primary goal in trying to improve the energy efficiency of your home? [SELECT ONE]

1. Reduce energy costs
2. Save money
3. Make my home more comfortable
4. To improve the market value of my home
5. To make general improvements to my home
6. To benefit the environment
97. OTHER [SPECIFY]
98. DON'T KNOW
99. REFUSED

Process Questions
P1. How did you find out about the In-home Energy Program? [DO NOT READ LIST] [SELECT MULTIPLE]

1. BILL INSERT
2. COMMUNITY EVENT/COUNTY/STATE FAIR
3. CONTRACTOR (SUCH AS A PLUMBER, ELECTRICIAN, OR GENERAL CONTRACTOR)
4. EMAIL
5. FAMILY
6. FRIEND
7. RESPONDENT WORKS IN THE INDUSTRY
8. UTILITY COMPANY (GENERAL)
9. WEBSITE
10. YARD SIGNS
97. OTHER [SPECIFY]

NAVIGANT

98. DON'T KNOW
99. REFUSED

[IF P1 HAS MORE THAN ONE ANSWER, ASK P2, OTHERWISE RECORD P2=P1]
P2. Which of these sources of information was most influential in your decision to participate in the program? [SELECT ONE]
[DISPLAY ANSWERS GIVEN IN P1]

P3. How would you suggest AEP Ohio try to reach out to its customers in the future to get them to participate in this program? [DO NOT READ] [ALLOW MULTIPLE RESPONSES]

1. BILL INSERTS
2. FLYERS/ADS/MAILINGS
3. HOMEOWNERS ASSOCIATION
4. NEWSPAPER ADVERTISEMENTS
5. RADIO ADVERTISEMENTS
6. TELEVISION ADVERTISEMENTS
7. PHONE CALLS
8. AEP OHIO WEBSITE
9. INTERNET ADVERTISING – SEARCH ENGINES
10. FACEBOOK, TWITTER, or other social media
97. OTHER [SPECIFY]
98. DON'T KNOW
99. REFUSED

P4. On a scale of 1 to 10, where 1 is extremely dissatisfied and 10 is extremely satisfied, how would you rate your satisfaction with… [SCALE 1-10; 96=not applicable, 98=Don't know, 99=Refused] [SHOW GRID]

P4A. The energy <JOB TYPE> report you received that showed your home's energy usage and recommended ways to save energy.
P4B. The time it took to schedule the energy <JOB TYPE>
P4C. The length of time it took to complete the <JOB TYPE> in your home
P4D. The energy auditor that assessed your home's energy performance
P4E. The cost of the energy <JOB TYPE>
P4F. The In-home Energy program overall
P4G. AEP Ohio overall

[ASK FOR EACH P4A-G<7]
P5A-G. You mentioned you were not satisfied with <P4A-G>. Why did you give this rating?
[RECORD OPEN END RESPONSE]
98. DON'T KNOW
99. REFUSED

Demographics

D1. How many people live in your household year-round?
[NUMERIC, 1-50]
98. DON'T KNOW
99. REFUSED

D2. Do you own or rent your home? [DO NOT READ LIST] [ENTER ONE RESPONSE]

NAVIGANT

1. Own
2. Rent
98. DON'T KNOW
99. REFUSED

D3. How many years have you lived in your current residence?
[NUMERIC, 1-100]
998. DON'T KNOW
999. REFUSED

D4. Is there anything you like to mention about the program that was not captured during the interview here?
[RECORD OPEN END RESPONSE]
96. Nothing
98. Don't Know
99. Refused

Closing

That's all the questions that we have. On behalf of AEP Ohio, I'd like to thank you very much for taking the time to participate in this study.

NAVIGANT

Title: 2014 Online Energy Checkup Participant Telephone Survey

Statement of purpose:	These surveys will be used by the evaluation team to determine measure realization rates and to identify key program strengths and weaknesses.
Sample size:	145 Online Energy Checkup participants to achieve 95/5 confidence/precision.
Survey timeline:	February 2015

Key Evaluation Questions	Survey Questions
What were the realization rates for each measure?	CFL1 – R8
How do customers become aware of the program? What marketing strategies could be used to boost program awareness?	P1 - P3
Is the energy audit/assessment providing sufficient information to overcome barriers to implementing energy efficiency improvements (specifically the lack of customer information about EE)?	OS1-OS8 P4-P6 PP1-PP5
Are customers satisfied with the program?	OS6-OS8

Hello, my name is __________ with the Blackstone Group calling on behalf of AEP Ohio, your electric utility. I'm contacting AEP Ohio customers who recently completed an "Online Energy Checkup" through AEP Ohio's website to learn about their experience and satisfaction with the service. This is not a sales call.

May I please speak with [CONTACT NAME]? [If no CONTACT NAME, "May I please speak with someone in your household who completed the Online Energy Checkup?"]

[IF NOT AVAILABLE] May I please speak with someone in your household who completed the Online Energy Checkup? [IF THE DECISION-MAKER IS NO LONGER THERE, THANK AND TERMINATE]

[IF NEEDED] Depending on your responses, this survey will take about 10-20 minutes to complete.

Screeners

S1. Our records indicate that you completed an Online Energy Checkup on AEP Ohio's website at some point in 2014 and, as part of your participation, AEP Ohio mailed you an energy efficiency kit including products like a low-flow showerhead and LED nightlight. Is that correct?

1. YES [CONTINUE TO OS1]
2. NO [TERMINATE]

98. DON'T KNOW [TERMINATE]
99. REFUSED [TERMINATE]

NAVIGANT

S2. To start, I'd like to ask you a few questions about your experience with the online energy checkup. Do you recall completing the "Online Energy Checkup" interactive tool that helps you evaluate how you use energy in your home and where you can save money?

1. YES [CONTINUE TO OS1]
2. NO [SKIP TO CFL1]
98. DON'T KNOW [SKIP TO CFL1]
99. REFUSED [SKIP TO CFL1]

Online Energy Checkup Information Retention and Satisfaction

OS1. On a scale from 1 to 10 where 1 is "not at all knowledgeable" and 10 is "extremely knowledgeable" how would you rate your knowledge of energy efficiency **before** you participated in the Online Energy Checkup?
[RECORD, 1-10]
98. DON'T KNOW
99. REFUSED

OS2. How much did you learn about energy efficiency from the Online Checkup? Would you say you learned…? (READ LIST)
1. Nothing (SKIP TO OS3)
2. Very Little (SKIP TO OS3)
3. Some, or
4. A lot
98. DON'T KNOW (SKIP TO OS3)
99. REFUSED (SKIP TO OS3)

OS2a. Do you remember anything specific that you found helpful?
[OPEN ENDED]
98. DON'T KNOW
99. REFUSED

OS3. Did the Online Checkup Cause you to purchase any additional measures?
1. YES
2. NO
98. DON'T KNOW
99. REFUSED

[ASK IF OS3=1]
OS3A. What measures did you purchase?
[RECORD OPEN END RESPONSE]
98. DON'T KNOW
99. REFUSED

NAVIGANT

OS4. On a scale of 1to 10, where 1 means "extremely dissatisfied" and 10 means "extremely satisfied", how satisfied were you with the Online Energy Checkup overall?

[RECORD, 1-10]
98. DON'T KNOW
99. REFUSED

[ASK IF OS4 < 6. ELSE SKIP TO OS6.]
OS5. Why did you rate it that way? [OPEN END]

98. DON'T KNOW
99. REFUSED

OS6. From your perspective, what, if anything, could be done to improve the Online Energy Checkup program?

[RECORD OPEN END RESPONSE]
98. DON'T KNOW
99. REFUSED

OS7. On a scale of 1-10 with 1 being "strongly disagree" and 10 being "strongly agree," please indicate how much you agree or disagree with the following statements.

[RECORD, 1-10, SHOW GRID]

A. The information provided was easy to understand
B. The online checkup helped me learn about other sources of energy efficiency information and AEP Ohio energy efficiency programs
C. I learned something new from the online checkup
D. The online checkup provided information that I needed in order to take action to save energy and money in my home
E. The online checkup gave me a better understanding of where I can save energy and money in my home
F. The time needed to complete the online checkup was reasonable
G. The online checkup was easy to complete

OS8. On a scale of 1 to 10, where 1 means "extremely dissatisfied" and 10 means "extremely satisfied", how satisfied were you with the energy savings kit?

[RECORD, 1-10]
98. DON'T KNOW
99. REFUSED

[ASK OS9 IF OS8 <= 5. ELSE SKIP TO CFL1.]
OS9. Why did you rate it that way?

[RECORD OPEN END RESPONSE]
98. DON'T KNOW
99. REFUSED

Measure Verification

[ASK IF CFL=5]
CFL BATTERY

CFL1) The energy savings kit included five energy efficient compact fluorescent light bulbs. How many of those five light bulbs did you install in your home?

1. ONE
2. TWO
3. THREE
4. FOUR
5. FIVE

97. NONE [ASK CFL2 THEN GO TO SKIP BEFORE LED1]
98. DON'T KNOW [SKIP TO LED1]
99. REFUSED [SKIP TO LED1]

[ASK CFL2 IF CFL1<5. ELSE SKIP TO CFL4]

CFL2) What was your reasoning for not installing the energy efficient light bulbs? (DO NOT READ LIST. RECORD ALL THAT APPLY.)

1. ALREADY HAVE EFFICIENT LIGHT BULBS INSTALLED
2. DO NOT LIKE THE LIGHT THAT THE BULBS GIVE OFF
3. THE LIGHT BULB WAS BROKEN
4. THE LIGHT BULB(S) DID NOT WORK
5. HAVEN'T GOTTEN AROUND TO IT YET
97. OTHER (RECORD REASON) [OPEN END]
98. DON'T KNOW [EXCLUSIVE]
99. REFUSED [EXCLUSIVE]

CFL3) What did you do with the light bulb(s) you did not install? (DO NOT READ LIST. RECORD ALL THAT APPLY.)

1. IN STORAGE
2. RECYCLED IT/THEM
3. THREW IT/THEM AWAY IN THE GARBAGE
4. GAVE IT/THEM TO SOMEONE ELSE
97. OTHER (RECORD RESPONSE) [OPEN END]
98. DON'T KNOW [EXCLUSIVE]
99. REFUSED [EXCLUSIVE]

CFL4) How many of the light bulbs that you originally installed are still installed?
[NUMERIC, 0-5]
98. DON'T KNOW
99. REFUSED

NAVIGANT

[ASK IF CFL4 < CFL1. ELSE GO TO CFL6]

CFL5) Why did you remove those [INSERT DIFFERENCE BETWEEN CFL4 and CFL1] light bulbs? (DO NOT READ LIST. RECORD ALL THAT APPLY.)

1. DID NOT LIKE THE LIGHT THE BULB GIVES OFF
2. THE LIGHT BULB WAS BROKEN
3. THE LIGHT BULB DID NOT WORK
4. THE LIGHT BULB STOPPED WORKING ALREADY
5. Light was too dim
6. Bulb took too long to become bright

97. OTHER (RECORD REASON) [OPEN END]
98. DON'T KNOW [EXCLUSIVE]
99. REFUSED [EXCLUSIVE]

CFL6) On a scale of 1 to 10, where 1 means "extremely dissatisfied" and 10 means "extremely satisfied", how satisfied were you with the energy efficient light bulbs?

[RECORD, 1-10]

98. DON'T KNOW

99. REFUSED

[ASK IF LED NIGHTLIGHT=1]

LED NIGHTLIGHT BATTERY

LED1. Did you install the LED nightlight you received in the energy kit?

1. YES [CONTINUE TO LED2]
2. NO [SKIP TO LED3]

98. DON'T KNOW [SKIP TO SH1]
99. REFUSED [SKIP TO SH1]

LED2. Which of the following best describes how you used the LED nightlight that you installed? Did it…? (READ LIST. RECORD ONE RESPONSE.)

1. Replace a regular incandescent nightlight
2. Replace an older efficient nightlight, or
3. Get placed it in a location that didn't previously have a nightlight?
4. Other

98. DON'T KNOW
99. REFUSED

[ASK IF LED1=2, ELSE SKIP TO LED4]

LED3. What was your main reason for not installing the LED nightlight? (DO NOT READ LIST. RECORD ALL THAT APPLY.)

1. WAITING FOR EXISTING NIGHTLIGHT TO BURN OUT
2. HAVEN'T GOTTEN AROUND TO IT YET
3. DO NOT LIKE THE TYPE OF LIGHT IT PROVIDES
4. DO NOT HAVE THE NEED FOR ANOTHER NIGHTLIGHT

97. OTHER (RECORD RESPONSE) [OPEN END]

98. DON'T KNOW [EXCLUSIVE]
99. REFUSED [EXCLUSIVE]

[ASK IF LED2=1, ELSE SKIP TO SH1]
LED4. Is the LED nightlight still installed?
1. YES [SKIP TO LED6]
2. NO [CONTINUE TO LED5]
98. DON'T KNOW [SKIP TO SH1]
99. REFUSED [SKIP TO SH1]

LED5. What was your reasoning for removing the LED nightlight?
1. DO NOT LIKE THE TYPE OF LIGHT IT PROVIDES
2. I DECIDED I DID NOT NEED A NIGHTLIGHT WHERE I PUT IT
3. NOT SATISFIED WITH THE NIGHTLIGHT
4. DID NOT WORK OR BURNED OUT
97. OTHER (RECORD RESPONSE) [OPEN END]
98. DON'T KNOW
99. REFUSED

ASK IF LED1=1
LED6. On a scale of 1 to 10, where 1 means "extremely dissatisfied" and 10 means "extremely satisfied", how satisfied were you with the nightlight?
[RECORD, 1-10]
98. DON'T KNOW
99. REFUSED

[ASK IF SHOWERHEAD=1]
SHOWERHEAD BATTERY
SH1. Did you receive a water-saving showerhead in your energy kit?
1. YES
2. NO [SKIP TO FA1]
98. DON'T KNOW [SKIP TO FA1]
99. REFUSED [SKIP TO FA1]

SH2. Did you install the showerhead you received in the energy kit
1. YES [SKIP TO SH4]
2. NO [CONTINUE TO SH3]
98. DON'T KNOW [SKIP TO FA1]
99. REFUSED [SKIP TO FA1]

SH3. What was your main reason for not installing the showerhead? (DO NOT READ. RECORD ALL THAT APPLY.)
1. ALREADY HAVE AN EFFICIENT SHOWERHEAD INSTALLED
2. I LIKE MY CURRENT SHOWERHEAD THAT IS NOT ENERGY EFFICIENT

NAVIGANT

3. TOO DIFFICULT TO INSTALL
4. WORRIED ABOUT THE POSSIBLE REDUCED PRESSURE OF THE SHOWERHEAD
5. HAVEN'T GOTTEN AROUND TO IT YET
6. DIDN'T LIKE THE APPEARANCE
97. OTHER (RECORD RESPONSE) [OPEN END]
98. DON'T KNOW [EXCLUSIVE]
99. REFUSED [EXCLUSIVE]

[ASK IF SH2=1, ELSE SKIP TO SH6]
SH4. Is the showerhead still installed?
1. YES [SKIP TO SH6]
2. NO [CONTINUE TO SH5]
98. DON'T KNOW [SKIP TO SH6]
99. REFUSED [SKIP TO SH6]

SH5. Why did you remove the showerhead? (DO NOT READ. RECORD ALL THAT APPLY)
1. DID NOT LIKE THE SPRAY
2. DID NOT LIKE THE WATER FLOW (PRESSURE) OF THE SHOWERHEAD
3. Harder to adjust the water temperature
4. IT STOPPED WORKING
97. OTHER (RECORD RESPONSE) [OPEN END]
98. DON'T KNOW [EXCLUSIVE]
99. REFUSED [EXCLUSIVE]

ASK IF SH2=1
SH6. On a scale of 1 to 10, where 1 means "extremely dissatisfied" and 10 means "extremely satisfied," how satisfied were you with the showerhead?
[RECORD, 1-10]
98. DON'T KNOW
99. REFUSED

[ASK IF FAUCET AERATORS=2]
FAUCET AERATORS BATTERY

FA1. Did you receive water-savings faucet aerators in your energy kit?
1. YES [CONTINUE TO FA2]
2. NO [SKIP TO PI1]
98. DON'T KNOW [SKIP TO PI1]
99. REFUSED [SKIP TO PI1]

FA2. Did you install both kitchen and bathroom faucet aerators you received in the energy kit? (DO NOT READ LIST. RECORD ONE RESPONSE.)
1. YES, INSTALLED BOTH [SKIP TO FA5]
2. NO, JUST INSTALLED THE KITCHEN AERATOR [CONTINUE TO FA4]
3. NO, JUST INSTALLED THE BATHROOM AERATOR [CONTINUE TO FA3]

4. NO, DID NOT INSTALL EITHER [CONTINUE TO FA3 AND THEN FA4]
98. DON'T KNOW [SKIP TO PI1]
99. REFUSED [SKIP TO PI1]

FA3. What was your main reason for not installing the kitchen faucet aerator(s)? (DO NOT READ LIST. RECORD ALL THAT APPLY.)
1. ALREADY HAVE (AN) EFFICIENT FAUCET AERATOR(S) INSTALLED
2. DO NOT LIKE THE PRESSURE OF THE FAUCET AERATOR
3. TOO DIFFICULT TO INSTALL
4. HAVEN'T GOTTEN AROUND TO IT YET
5. DIDN'T LIKE THE APPEARANCE
97. OTHER (RECORD REASON) [OPEN END]
98. DON'T KNOW [EXCLUSIVE]
99. REFUSED [EXCLUSIVE]

[ASK IF FA2=2-4)
FA4. What was your main reason for not installing the BATHROOM faucet aerator(s)? (DO NOT READ LIST. RECORD ALL THAT APPLY.)
1. ALREADY HAVE (AN) EFFICIENT FAUCET AERATOR(S) INSTALLED
2. DO NOT LIKE THE PRESSURE OF THE FAUCET AERATOR
3. TOO DIFFICULT TO INSTALL
4. HAVEN'T GOTTEN AROUND TO IT YET
5. DIDN'T LIKE THE APPEARANCE
97. OTHER (RECORD REASON) [OPEN END]
98. DON'T KNOW [EXCLUSIVE]
99. REFUSED [EXCLUSIVE]

[ASK IF FA2=1or 2]
FA5. Is the kitchen faucet aerator still installed?
1. YES
2. NO [SKIP TO FA7]
98. DON'T KNOW [CONTINUE TO FA5]
99. REFUSED [CONTINUE TO FA5]

[ASK IF FA2=1 or 3]
FA6. Is the bathroom faucet aerator still installed?
1. YES
2. NO [SKIP TO FA8]
98. DON'T KNOW [SKIP TO FA9]
99. REFUSED [SKIP TO FA9]

[ASK IF FA5 = 2]
FA7. What was your reasoning for removing the kitchen faucet aerator(s)? (DO NOT READ LIST. RECORD ALL THAT APPLY.)

NAVIGANT

1. I ALREADY HAVE A FAUCET AERATOR
2. DO NOT LIKE THE PRESSURE OF THE FAUCET AERATOR
97. OTHER (RECORD REASON) [OPEN END]
98. DON'T KNOW [EXCLUSIVE]
99. REFUSED [EXCLUSIVE]

[ASK IF FA6 = 2]
FA8. What was your reasoning for removing the bathroom faucet aerator(s)? (DO NOT READ LIST. RECORD ALL THAT APPLY.)

1. I ALREADY HAVE A FAUCET AERATOR
2. DO NOT LIKE THE PRESSURE OF THE FAUCET AERATOR
97. OTHER (RECORD REASON) [OPEN END]
98. DON'T KNOW [EXCLUSIVE]
99. REFUSED [EXCLUSIVE]

[ASK IF FA2<4]
FA9. On a scale of 1 to 10, where 1 means you "extremely dissatisfied" and 10 means you "extremely satisfied", please tell me how satisfied were you with the faucet aerators?

[RECORD, 1-10]
98. DON'T KNOW
99. REFUSED

[ASK IF PIPE INSULATION=1]
WATER HEATER PIPE INSULATION BATTERY

PI1. Did you receive hot water heater pipe insulation in the energy kit?

1. YES [CONTINUE TO PI2]
2. NO [SKIP TO WS1]
98. DON'T KNOW [SKIP TO WS1]
99. REFUSED [SKIP TO WS1]

PI2. Did you install the hot water heater pipe insulation you received in the energy kit?

1. YES [SKIP TO PI4]
2. NO [CONTINUE TO PI3]
98. DON'T KNOW [SKIP TO WS1]
99. REFUSED [SKIP TO WS1]

PI3. Why didn't you install the pipe insulation?

1. ALREADY HAVE PIPE INSULATION INSTALLED
2. TOO DIFFICULT TO INSTALL
3. HAVEN'T GOTTEN AROUND TO IT YET
97. OTHER (RECORD RESPONSE) [OPEN END]
98. DON'T KNOW
99. REFUSED

NAVIGANT

[ASK IF PI2=1, ELSE SKIP TO PI6]
PI4. Is the pipe insulation still installed?
1. YES [SKIP TO PI6]
2. NO [CONTINUE TO PI5]
98. DON'T KNOW [SKIP TO PI6]
99. REFUSED [SKIP TO PI6]

PI5. Why did you remove the pipe insulation? [OPEN END]

ASK IF PI2=1
PI6. On a scale of 1 to 10, where 1 means you "extremely dissatisfied" and 10 means you "extremely satisfied", please tell me how satisfied were you with the pipe insulation?
RECORD, 1-10]
98. DON'T KNOW
99. REFUSED

[ASK IF WEATHERSTRIPPING=1]
WEATHER STRIPPING BATTERY
WS1. Did you receive foam weather stripping in the energy kit?
1. YES [CONTINUE TO WS2]
2. NO [SKIP TO DS1]
98. DON'T KNOW [SKIP TO DS1]
99. REFUSED [SKIP TO DS1]

WS2. Did you install the weather stripping you received in the energy kit?
1. YES [SKIP TO WS4]
2. NO [CONTINUE TO WS3]
98. DON'T KNOW [SKIP TO DS1]
99. REFUSED [SKIP TO DS1]

WS3. Why didn't you install the weather stripping?
1. ALREADY HAVE WEATHER STRIPPING INSTALLED
2. TOO DIFFICULT TO INSTALL
3. HAVEN'T GOTTEN AROUND TO IT YET
97. OTHER (RECORD RESPONSE) [OPEN END]
98. DON'T KNOW
99. REFUSED

[ASK IF WS2=1, ELSE SKIP TO WS6]
WS4. Is the weather stripping still installed?
1. YES [SKIP TO WS6]
2. NO [CONTINUE TO WS5]

NAVIGANT

98. DON'T KNOW [SKIP TO WS6]
99. REFUSED [SKIP TO WS6]

WS5. Why did you remove the weather stripping? [OPEN END]

ASK IF WS2=1
WS6. On a scale of 1 to 10, where 1 means you "extremely dissatisfied" and 10 means you "extremely satisfied", please tell me how satisfied were you with the weather stripping?
[RECORD, 1-10]
98. DON'T KNOW
99. REFUSED

[ASK IF DRAFT STOPPER=1]
DRAFT STOPPER BATTERY
DS1. Did you receive a pack of draft stoppers for your electrical outlets or light switches in the energy kit?
1. YES [CONTINUE TO DS2]
2. NO [SKIP TO R1]
98. DON'T KNOW [SKIP TO R1]
99. REFUSED [SKIP TO R1]

DS2. Did you install the draft stoppers you received in the energy kit?
1. YES [SKIP TO DS4]
2. NO [CONTINUE TO DS3]
98. DON'T KNOW [SKIP TO R1]
99. REFUSED [SKIP TO R1]

DS3. Why didn't you install the draft stoppers?
1. ALREADY HAVE DRAFT STOPPERS INSTALLED
2. TOO DIFFICULT TO INSTALL
3. HAVEN'T GOTTEN AROUND TO IT YET
97. OTHER (RECORD RESPONSE) [OPEN END]
98. DON'T KNOW
99. REFUSED

[ASK IF DS2=1, ELSE SKIP TO DS6]
DS4. Are the draft stoppers still installed?
1. YES [SKIP TO WS6]
2. NO [CONTINUE TO WS5]
98. DON'T KNOW [SKIP TO WS6]
99. REFUSED [SKIP TO WS6]

DS5. Why did you remove the draft stoppers? [OPEN END]

NAVIGANT

ASK IF DS2=1

DS6. On a scale of 1 to 10, where 1 means you "extremely dissatisfied" and 10 means you "extremely satisfied", please tell me how satisfied were you with the draft stoppers?
[RECORD, 1-10]
98. DON'T KNOW
99. REFUSED

Retrofit Measure Verification
Ask Questions below for each retrofit measure installed.
[ASK IF Furnace or Furnace Motor = 1, ELSE SKIP TO R2]
R1. Our records indicate that you installed a new efficient furnace or furnace motor, is this correct?
1. YES
2. NO
98. DON'T KNOW
99. REFUSED

[ASK IF Central Air Conditioner = 1, ELSE SKIP TO R3]
R2. Our records indicate that you installed a new efficient central air conditioner, is this correct?
1. YES
2. NO
98. DON'T KNOW
99. REFUSED

[ASK IF Heat Pump = 1, ELSE SKIP TO R4]
R3. Our records indicate that you installed a new efficient heat pump, is this correct?
1. YES
2. NO
98. DON'T KNOW
99. REFUSED

[ASK IF Thermostat = 1, ELSE SKIP TO R5]
R4. Our records indicate that you installed a new programmable thermostat, is this correct?
1. YES
2. NO
98. DON'T KNOW
99. REFUSED

[ASK IF Attic Insulation = 1, ELSE SKIP TO R6]
R5. Our records indicate that you installed attic insulation, is this correct?
1. YES
2. NO
98. DON'T KNOW

99. REFUSED

[ASK IF Wall Insulation = 1, ELSE SKIP TO R7]
R6. Our records indicate that you installed wall insulation, is this correct?

1. YES
2. NO
98. DON'T KNOW
99. REFUSED

[ASK IF Windows = 1, ELSE SKIP TO R8]
R7. Our records indicate that you installed new windows, is this correct?

1. YES
2. NO
98. DON'T KNOW
99. REFUSED

[ASK IF Air Sealing = 1, ELSE SKIP TO R9]
R8. Our records indicate that you received air sealing, is this correct?

1. YES
2. NO
98. DON'T KNOW
99. REFUSED

Process Questions

P1. How did you find out about the Online Energy Checkup? (DO NOT READ LIST. RECORD ALL THAT APPLY.)

1. BILL INSERT
2. COMMUNITY EVENT/COUNTY/STATE FAIR
3. CONTRACTOR (SUCH AS A PLUMBER, ELECTRICIAN, OR GENERAL CONTRACTOR)
4. EMAIL
5. FAMILY/FRIEND
6. RESPONDENT WORKS IN THE INDUSTRY
7. UTILITY COMPANY (GENERAL)
8. WEBSITE
9. YARD SIGNS
97. OTHER (RECORD RESPONSE.) [OPEN END]
98. DON'T KNOW [EXCLUSIVE]
99. REFUSED [EXCLUSIVE]

[IF P1 HAS MORE THAN ONE ANSWER, ASK P2, OTHERWISE AUTO-FILL.]

NAVIGANT

P2. Which of these sources of information was most influential in your decision to participate in the program? (PROMPT IF NECESSARY. RECORD ONE RESPONSE.) [SHOW ANSWERS GIVEN IN P1. SINGLE PUNCH.]

P3. How would you recommend AEP Ohio reach out to customers in the future to get them to participate in this program? (DO NOT READ. RECORD ALL THAT APPLY.)

1. BILL INSERTS
2. FLYERS/ADS/MAILINGS
3. HOMEOWNERS ASSOCIATION
4. NEWSPAPER ADVERTISEMENTS
5. RADIO ADVERTISEMENTS
6. TELEVISION ADVERTISEMENTS
7. WITH PHONE CALLS

97. OTHER (RECORD RESPONSE) [OPEN END]
98. DON'T KNOW
99. REFUSED

P4. In the course of participating in the AEP Ohio program, how often did you contact AEP Ohio or program staff with questions?

1	Never	P8
2	Once	continue
3	2 or 3 times	continue
4	4 times or more	continue
98	Don't know	continue
99	Refused	continue

P5. How did you contact them? [CHECK ALL THAT APPLY]

1	Phone	**continue**
2	Email or fax	**continue**
3	Letter	**continue**
4	In person	**continue**
98	Don't know	**continue**
99	Refused	**continue**

P6. And how satisfied were you with your communications with AEP Ohio and program staff? Would you say you were Very Satisfied, Somewhat Satisfied, Neither Satisfied nor Dissatisfied, Somewhat Dissatisfied or Very Dissatisfied?

1	Very satisfied	P8
2	Somewhat satisfied	P8
3	Neither satisfied nor dissatisfied	P8
4	Somewhat dissatisfied	continue

NAVIGANT

5	Very dissatisfied	continue
98	Don't know	P8
99	Refused	P8

P7. Why were you dissatisfied?
[OPEN END]
98. DON'T KNOW
99. REFUSED

[ASK IF ANY RETROFIT MEASURE > 0]
P8. Have you noticed any savings on your electric bill since installing your new energy efficient equipment?

1	Yes	continue
2	No	P12
3	Not sure	P12
98	Don't know	P12
99	Refused	P12

[ASK IF P8=1]
P9. How satisfied are you with any savings you noticed on your electric bill since installing your new equipment? Would you say you were Very Satisfied, Somewhat Satisfied, Neither Satisfied nor Dissatisfied, Somewhat Dissatisfied or Very Dissatisfied?

1	Very satisfied	continue
2	Somewhat satisfied	continue
3	Neither satisfied nor dissatisfied	continue
4	Somewhat dissatisfied	continue
5	Very dissatisfied	continue
6	I didn't notice any savings	continue
98	Don't know	continue
99	Refused	continue

[ASK IF P8=1]
P10. How satisfied are you with your new energy efficiency upgrades? Would you say you were Very Satisfied, Somewhat Satisfied, Neither Satisfied nor Dissatisfied, Somewhat Dissatisfied or Very Dissatisfied?

1	Very satisfied	P12
2	Somewhat satisfied	P12
3	Neither satisfied nor dissatisfied	P12
4	Somewhat dissatisfied	continue
5	Very dissatisfied	continue
98	Don't know	P12
99	Refused	P12

NAVIGANT

P11. Why aren't you satisfied?

97	Record verbatim	continue
98	Don't know	continue
99	Refused	continue

P12. Finally, if you were rating your overall satisfaction with the AEP Ohio Online Energy Checkup Program, would you say you were Very Satisfied, Somewhat Satisfied, Neither Satisfied nor Dissatisfied, Somewhat Dissatisfied or Very Dissatisfied?

1	Very satisfied	continue
2	Somewhat satisfied	continue
3	Neither satisfied nor dissatisfied	continue
4	Somewhat dissatisfied	continue
5	Very dissatisfied	continue
98	Don't know	P14
99	Refused	P14

P13. Why do you give it that rating?

97	Record verbatim	continue
98	Don't know	continue
99	Refused	continue

P14. Do you have any suggestions to improve the Online Energy Checkup Program?

1	Yes, record verbatim	Continue
2	No	Continue
98	Don't know	Continue
99	Refused	Continue

P15. What was your primary goal in trying to improve the efficiency of your home? (DO NOT READ LIST. RECORD ONE RESPONSE.)

1. REDUCE ENERGY COSTS
2. MAKE MY HOME MORE COMFORTABLE
3. TO MAKE GENERAL IMPROVEMENTS TO MY HOME
4. TO BENEFIT THE ENVIRONMENT

97. OTHER (RECORD RESPONSE) [OPEN END] ______________________
98. DON'T KNOW [EXCLUSIVE]
99. REFUSED [EXCLUSIVE]

P16. Now I would like you to focus on the Report you received after the online checkup. After receiving the report that contained recommendations for ways to reduce your energy consumption and your utility bill, would you say that you…? (READ LIST. RECORD ONE RESPONSE.)

1. Read the report thoroughly
2. Read some portions of the report

NAVIGANT

3. Just glanced through it, or
4. Did not read the report at all
98. DON'T KNOW
99. REFUSED

[ASK IF P16<5. ELSE SKIP TO PP1]
P17. On a scale of 1 to 10 where 1 is "not useful at all" and 10 is "extremely useful", please rate the usefulness of the recommendations contained in the report.

[RECORD, 1-10]
98. DON'T KNOW
99. REFUSED

AUDIT ONLY PARTICIPANT BATTERY [ASK IF "PARTICIPANT TYPE"=Partial, ELSE SKIP TO OP1]

PP1. Did you receive enough information during the online energy checkup to be able to make energy efficiency improvements to your home?

1. YES [SKIP TO PP3]
2. NO [CONTINUE TO PP2]
98. DON'T KNOW [SKIP TO PP3]
99. REFUSED [SKIP TO PP3]

[ASK IF PP1=2]
PP2. What additional information would have been helpful to you?

[RECORD OPEN END RESPONSE]

98. DON'T KNOW
99. REFUSED

PP3. Did you install any of the online checkup's recommendations?

1. YES [CONTINUE TO PP4]
2. NO [SKIP TO PP5]
98. DON'T KNOW [SKIP TO D1]
99. REFUSED [SKIP TO D1]

[ASK IF PP3=1]
PP4. Why did you not apply for an AEP Ohio rebate for the energy efficiency improvements you installed?

[RECORD OPEN END RESPONSE] [SKIP TO D1]

98. DON'T KNOW [SKIP TO D1]
99. REFUSED [SKIP TO D1]

[ASK IF PP3=2]

NAVIGANT

PP5. Which of the following describes the main reason you decided not to install any of the online checkup's recommendations? [SELECT MULTIPLE]

1. Haven't got around to it yet
2. The recommendations were not helpful
3. The cost of improvements was too high
4. The improvements wouldn't have saved enough energy
5. Needed other equipment or improvements more
6. Couldn't find a contractor to do the job

97. OTHER [SPECIFY]
98. DON'T KNOW
99. REFUSED

OTHER PROGRAMS

OP1. Have you participated in any <u>other</u> AEP Ohio energy efficiency programs in past two years?

1. YES [CONTINUE TO OP2]
2. NO [SKIP TO D1]

98. DON'T KNOW [SKIP TO D1]
99. REFUSED [SKIP TO D1]

OP2. Which other programs have you participated in? [OPEN END]

OP3. Did you participate in this/these programs before or after you completed the Online Energy Checkup?

1. BEFORE THIS ONE
2. AFTER THIS ONE
3. BOTH BEFORE AND AFTER (NOTE TO INTERVIEWER: COULD BE PARTICIPATION IN MULTIPLE PROGRAMS OR PARTICIPATION COULD HAVE TAKEN A LONGER TIME)

98. DON'T KNOW
99. REFUSED

We're just about done. I want to ask you a couple more questions about your household. We don't reveal your individual answers to AEP Ohio or anyone else.

Demographics

Now I'd like to ask you some questions about your home.

D1. How many people live in your household year-round?
[NUMERIC, 1-50]

98. DON'T KNOW
99. REFUSED

D2. How many years have you lived in your current residence?

NAVIGANT

[NUMERIC, 1-100]
98. DON'T KNOW
99. REFUSED

D3. Which of the following best describes your home/residence? READ LIST

1. Single-family home, detached construction [NOT A DUPLEX, TOWNHOME, OR APARTMENT; ATTACHED GARAGE IS OK]
2. Single family home, factory manufactured/modular
3. Single family, mobile home
4. Row House
5. Two or Three family attached residence—traditional structure
6. Apartment (4 + families)---traditional structure
7. Condominium---traditional structure

97. Other (specify)
99 REFUSED
98 DON'T KNOW

D3A. Do you own or rent this residence?
1. Own
2. Rent
99. REFUSED
98. DON'T KNOW

D4. Approximately when was your home constructed? [DO NOT READ]

01	Before 1960
02	1960-1969
03	1970-1979
04	1980-1989
05	1990-1999
06	2000-2005
07	2006 OR LATER
99	Refused
98	Don't know

D5. How many square feet is the above-ground living space (IF NECESSARY, THIS EXCLUDES WALK-OUT BASEMENTS)?
NUMERICAL OPEN END [RANGE 0-99,999]
99. REFUSED
98. DON'T KNOW

D6. [ASK IF D5=98,99] Would you estimate the above-ground living space is about:

1. less than 1,000 sqft
2. 1,001-2,000 sqft

NAVIGANT

3. 2,001-3,000 sqft
4. 3,001-4,000 sqft
5. 4,001-5,000 sqft
6. Greater than 5,000 sqft
99. REFUSED
98. DON'T KNOW

D7. How many square feet of conditioned living space is below- ground (IF NECESSARY, THIS INCLUDES WALK-OUT BASEMENTS)

NUMERICAL OPEN END [RANGE 0-99,999]
99. REFUSED
98. DON'T KNOW

D8. [ASK IF D7=98,99] Would you estimate the below-ground living space is about:

1. less than 1,000 sqft
2. 1,000-2,000 sqft
3. 2,000-3,000 sqft
4. 3,000-4,000 sqft
5. 4,000-5,000 sqft
6. Greater than 5,000 sqft
98 DON'T KNOW
99 REFUSED

D9. Finally, is there anything you like to mention about the program that was not captured during the interview here?

[RECORD OPEN END RESPONSE]
96. Nothing
99. Don't Know

END. That's all the questions that we have. On behalf of AEP Ohio, I'd like to thank you very much for taking the time to participate in this study.

NAVIGANT

Title: 2014 In-home Energy Program Staff In-Depth Interview

Statement of purpose:	This interview guide will be used by the evaluation team to identify key program issues.
Sample size:	2
Survey timeline:	January - February 2015

Key Evaluation Questions	Survey Questions
How has the program changed in 2014?	1-4, 6-8, 9, 13, 18, 20
Is the customer/contractor participation process streamlined to prevent barriers to entry?	9-17, 21
Is the program outreach to customers and contractors effective in increasing awareness of the program opportunities?	18-19
What are the opportunities for program improvement?	5, 7, 10-12, 14-17, 21

Introduction

Thank you for talking with me today about the In-home Energy Program. The goal of this discussion is to talk more fully about the way this program was designed and implemented. All comments will remain confidential.

Program Implementation and Delivery

1. How did the program change in 2014?
2. What were the reasons for those changes?
3. Have changes affected participation rates or customer/contractor satisfaction? Is AEP Ohio doing anything to measure satisfaction changes?
4. How have your roles and responsibilities for the In-home Audit program changed over the past year?
5. Will there be any changes made to the program in the next program year, such as new measures or changes in measure quantities? If so, please describe. What do you expect to accomplish with these changes?
6. Have there been any significant updates to program documents of which we should be aware? If so, may we have a copies of the revised documents?
7. What changes have you made to the program participation process for customers in 2014?
8. Are you satisfied with participation in terms of numbers? In terms of participation/enthusiasm for the program? Where do you see room for improvements?
9. What areas could be refined or enhanced to improve the participation process for customers or contractors?
10. Do you track customer rebate application flaws? If so, can you please send us a report? What are the most common application flaws? What actions are you taking (or have taken) to minimize them?
11. Have there been any changes in the participation process for trade allies in 2014?
12. Were there any changes to the program marketing strategy in 2014?

13. Which outreach mechanisms were most effective at increasing awareness of the program in 2014? What evidence do you have for this?
14. What changes have you made to the data collection and tracking process in 2014?
15. What challenges have there been with the new CAKE rebate processing system? What feedback have you received from contractors?