

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

VOLUME III

APPENDICES M - R



A unit of American Electric Power

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APPENDIX M



EXPRESS PROGRAM FOR SMALL BUSINESS CUSTOMERS

2014 Evaluation Report

Prepared for:
AEP Ohio



May 13, 2015

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Executive Summary

This report presents the results and findings from the evaluation of the 2014 AEP Ohio Express Program for Small Business Customers (Express 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 Express Program currently provides a one-stop, turnkey service to small businesses for energy efficient lighting, HVAC and refrigeration equipment upgrades. Savings estimates are based on prescriptive formulas for simplicity and auditability, while tailoring key parameters such as hours of use on a fixture-by-fixture basis. The implementation contractor served as the contact point for the program to simplify the participation process for small businesses with limited resources and energy efficiency expertise. In 2014, the AEP Ohio Express Program completed a total of 567 projects, as shown in Table ES-1.

Table ES-1. Express Program Projects and Reported Savings

Metric	Reported Value
Number of Projects	567
Annual Energy Savings (MWh)	7,224
Electric Peak Demand Savings (kW)	1,774

ES.2 Key Impact Findings

Table ES-2 shows the *ex ante* savings claimed by the program, the *ex post* verified savings, and the 2014 realization rates. The realization rate for 2014 was 0.73 for energy and 0.90 for demand. To estimate the *ex post* energy savings, the evaluation team independently used a fixed effects regression model based on participants' pre- and post-retrofit energy consumption data. The evaluation team applied engineering based adjustments to estimate *ex post* demand savings. In 2014, the program achieved 47 percent of the energy savings goal and achieved 87 percent of the peak demand goal.

Table ES-2. Program Savings and Realization Rate for 2014

	2014 Program Goals (a)	<i>Ex Ante</i> Savings (b)	<i>Ex Post</i> Savings (c)	Realization Rate RR = (c) / (b)	Percent of Goal = (c) / (a)
Energy Savings (MWh)	11,063	7,224	5,253	73%	47%
Demand Savings (kW)	1,844	1,774	1,605	90%	87%



ES.3 Conclusions from Program Year 2014

The 2014 Express Program evaluation resulted in eight primary conclusions:

1. **Overall, the Express Program is running smoothly.** The Express Program has many positive attributes and remains an important component of business sector customer offerings. Hard-to-reach customers are the primary participants in the program, and customers continue to be highly satisfied with both the program and AEP Ohio. From conversations with AEP Ohio program staff and the implementation contractor, a culture of continuous improvement has been fostered, and a willingness to improve quality control is evident. The Express Program has successfully added refrigeration measures as a program offering.
2. **Program tracking data continues to be very good.** Description of algorithms and program documentation is thorough and complete. The evaluation team's review of savings calculations found no errors in algorithms and all relevant fields sufficiently populated. However, the evaluator did not address whether the tracking system is adequate for regulatory prudence reviews or corporate requirements.
3. **The realization rate (defined as verified *ex post* savings divided by *ex ante* reported savings) is 73 percent for energy savings, and 90 percent for demand savings.** There are myriad drivers of the realization rate, which stem from the parameter estimates to contractor installation issues, which create a compounding effect.
4. **Auditor training increased in 2014.** The implementation contractor hired and trained more knowledgeable Energy Advisors. As the first contact with the customer and as the person who determines what will be implemented, the Energy Advisor is important to the success of the program. It is in the customer's best interest that the Express Program provides a thorough analysis of lighting options, especially with the newer technologies available. Efforts to better estimate hours of use and ensuring that fixtures were installed onsite have improved from 2013 significantly.
5. **Some customers were likely to report dissatisfaction with the Express Program because of low savings levels after installation of the energy saving equipment, or from poor contractor program delivery.** The proportion of program participants who reported these issues was comparatively small. Another issue reported by a few customers was that their business was disrupted during project installation.
6. **Customers reported that personal contact is the most common way to first hear about the program,** including visits from AEP Ohio, the implementation contractor staff, or word of mouth. Sixty-nine percent of customers heard about the program from a personal contact.
7. **Return visits to finish installation were common.** According to customers, 59 percent of the installation contractors needed more than one day's work to complete the installation. Over one-third of the contractors (38%) had to return because of not having all the materials to complete the job, or the job was too much work to finish in one day (35%). Survey respondents reported that 17



percent of contractors returned after the equipment was initially installed to correct work that needed to be redone. Ten percent of respondents said the contractor had to return because of special circumstances, such as the presence of children in a day care center.

8. **Customers are installing additional equipment outside of the program.** Thirteen percent of the survey respondents installed additional energy-efficient equipment in their facility after participating in the program. Thirty-one percent of the extra equipment installed outside of the program was lighting fixtures, 13 percent commercial refrigeration, and 25 percent other types of equipment. These customers did not attempt to further participate in the Express Program because they did not know they could, and because they believed the equipment did not qualify for the program.

ES.4 Recommendations from Program Year 2014

The 2014 evaluation resulted in eight main recommendations:

1. **Build additional expertise in refrigeration retrofits projects and expand the program to include additional measures.** This includes a wider variety of lighting and refrigeration measures, and also potentially heating, ventilation and air conditioning (HVAC), variable frequency drives (VFDs), and other complex measures, so that comprehensive energy savings can be realized for small business customers. It is important to educate auditors and staff so that they can provide credible estimates of energy savings and coordinate installation contractors for these measures.
2. **Explore additional LED measures,** such as linear LEDs, that can be used in lieu of more traditional T8 lamps and ballasts for T12 retrofits projects. There is additional energy and demand savings beyond T8s, and Navigant found that customers are responding well to these new products. It is important to ensure contractors are trained and knowledgeable in the installation procedures for these products.
3. **Refine auditor processes to ensure consistent and accurate impact parameter estimates.** This includes estimating hours of use as accurately as possible, capturing HVAC system type for interactive effects, ensuring baseline fixtures match deemed wattages, and capturing existing burnouts. Lighting and refrigeration parameters should mirror the values used in the Prescriptive Program, which are the results of years of research on similar measures, rather than the New York Technical Reference Manual values, where appropriate. Baseline wattage for T12 fixtures should be explored further.
4. **Improve performance of installation contractors who are not prepared, trained, and performing quality work,** and identify and provide feedback to the contractors who are not living up to their contractual obligations and representing AEP Ohio in a professional manner. Although program participants were generally pleased with their contractors for making an appointment and having the correct materials to complete the installation, one concern is the 17 percent of contractors who had to return to the job site to correct work. Of the contractors that had to return to the customers' facilities, 38 percent did not have all the materials they needed to complete the job, pointing to problems with the aggregator whose job is to guarantee that all the needed materials are on the



pallet for every job. The implementation contractor should identify and not retain those contractors who are not meeting customer needs.

5. **Explore the installation contractor's role in the program further.** Navigant recommends installation contractors are included in the evaluation of the Express Program in 2015 to further understand potential barriers. Explore the reason for the delay between measure installation and project completion and potential solutions.
6. **Manage customer expectations for energy savings.** The implementation contractor should create a process and/or collateral materials to explain to customers when the report is generated that their situation may not result in large amounts of energy, or by proxy cost savings.
7. **Create additional marketing opportunities.** Most customers reported they first heard about the program via some type of personal contact. The implementation contractor should encourage, and possibly reward, personal recommendations and should make sure every contact contains program information. The implementation contractor and AEP Ohio should leverage this marketing channel to focus on other marketing channels to ensure the program meets goals.



1 Introduction

This section provides an overview of the Express Program element of AEP Ohio's Business Energy Efficiency and Peak Demand Reduction (EE/PDR) portfolio, Navigant's objectives for this evaluation and a review of customer participation metrics. In addition, this section describes minor differences in how the 2014 program was implemented in comparison to the 2013 program. The last part of this section describes the objectives of this evaluation.

1.1 Program Description

The Express Program provides turnkey energy audits free of charge with higher percentage incentives than the Prescriptive Program, energy efficiency measure installation, and payment services to small businesses and was originally restricted to customers with annual usage of less than 200,000 kWh. In 2014, AEP Ohio added customers with a maximum of 100 kW billing demand, regardless of kWh usage. Between 2,000 and 3,000 more customers are able to potentially participate in the Express Program as a result of that change.

The Express Program achieves the majority of energy savings from lighting retrofit measures, including T8, T5, LED, and lighting control measures, as well as refrigeration measures, such as ECM motors and LED case lighting. The program targets customers that typically do not participate in other business program offerings due to various market barriers, including lack of capital, inadequate energy expertise, or insufficient personnel to explore energy efficiency options. To address market barriers, the Express Program provides a free audit and higher equipment incentives than other business offerings, and provides a suite of services to streamline the customer experience.

The Express Program is marketed, administered, and delivered as a single program by AEP Ohio. The program is managed by an implementation contractor in coordination with AEP Ohio. The program is marketed to small businesses by the implementer's phone bank which makes the appointment for a program auditor to visit the customer to conduct the free energy assessment. Program auditors also market the program directly to customers in assigned geographic territories, and are able to target certain customer types, such as auto repair shops or small grocery stores. The auditors are also employees of the implementation contractor and therefore do not have a vested interest in the installation of any given measure.

The program model focuses on an integrated delivery of audit services, measure installation and application handling. The savings algorithms differ slightly from the large business Prescriptive Program's deemed savings approach by applying a more custom approach, which takes into account fixture-specific parameters relevant for lighting equipment, such as hours of use.

1.2 Evaluation Overview

This evaluation report covers the Express Program for Small Business Customers element of the AEP Ohio's business Energy Efficiency and Peak Demand Reduction (EE/PDR) portfolio. The goals of this program evaluation are to analyze the energy and demand savings (impacts) claimed by the program, and to review program processes to ensure the program is reaching the intended audience with quality and consistently delivered service.



1.3 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 changes related to program eligibility and measure offerings for 2014.

1.3.1 Customer Eligibility.

As in 2013, AEP Ohio business customers with annual energy consumption below 200,000 kWh and less than seven accounts in that business name can participate in the Express Program. For 2014, customers with peak billing demands up to 100 kW demand also are eligible to participate regardless of annual energy use. In addition to the annual consumption restriction, participants must be AEP Ohio customers and cannot be mercantile or managed national account customers. These other criteria presume these other customer groups have adequate access to capital, as well as energy efficiency expertise and support at the corporate level.

1.3.2 Measure Offerings

Approved equipment includes indoor and outdoor lighting retrofits, lighting controls, refrigeration, and HVAC measures. For 2014, however, program results included only lighting and refrigeration measures. Projects must result in a reduction of energy usage at the project level, which allows the implementation contractor flexibility to bundle less efficient measures with more efficient measures to increase sales and reach more customers.

1.4 Evaluation Objectives

The three major objectives of this evaluation were to: (1) quantify energy and peak demand savings impacts in 2014, (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:

1.4.1 Impact Questions

1. Were the energy savings for the program achieved as reported?
2. What were the realization rates? (Defined as evaluation-verified (*ex post*) savings divided by program-reported *ex ante* savings.)
3. What are the benefits, costs and cost effectiveness of this program?

1.4.2 Process Questions

Marketing and Participation

4. What customer market segments participate in the program?
5. Is outreach to customers effectively increasing awareness of the program opportunities?
6. What is the format of the outreach?



7. Are the messages within the outreach clear and actionable?

Program Characteristics and Barriers

8. How do participants perceive the incentives and costs related to this program?
9. Are customers satisfied with the program discounts?
10. Are there particular program characteristics that could be changed or emphasized to improve customer satisfaction while maintaining program effectiveness?

Administration and Delivery

11. How effective are the following processes?
 - a. Overall project completion, from initial contact to issuing the incentive payment
 - b. Incentive payment process, from project completion to issuing the incentive payment.
 - c. Program tracking and data management
 - d. Internal communications flow
 - e. Program staffing
12. What is the time from initial contact to final project completion for 2014? Are the following program delivery processes effective and are incentives provided to customers efficiently?
 - a. Program tracking and data management
 - b. Internal program communications
 - c. Program staffing
13. How many customers are taking advantage of the loan option provided by the implementation contractor? Does the loan option appear to increase participation levels? Are customers, the IC and AEP Ohio satisfied with this offering?
14. What are the verification procedures for the program? Do these procedures present their own participation barriers?
15. What are the opportunities for program improvement?

1.5 Savings Terminology

This section defines the terminology used to describe the savings values at each stage of the evaluation:

- » *Ex ante* savings – Savings reported by AEP Ohio
- » *Audited* savings – Savings recalculated by Navigant using the inputs specified in the data extract from AEP Ohio. Audited savings should equal *ex ante* savings where the algorithms were applied correctly by the implementation contractor.
- » *Engineering adjusted* savings – Savings recalculated by Navigant using the Navigant-adjusted algorithms and inputs where applicable, based on the results of the deemed savings review.



- » *Ex post* savings – final verified savings taking into account findings from all steps, including the technical review of project files and results of the billing analysis.



2 Methodology

This section describes the methodology used to conduct the impact and process evaluations, including a discussion of data sources and sampling. Table 2-1 summarizes the various activities undertaken for the audited impact and process evaluations. Impact verification was conducted using two methods, with a separate methodology used for energy savings and peak demand savings. The process evaluation was conducted by multiple methods as well, covering all relevant stages of program implementation.

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

Data Collection Type	Targeted Population	Supported Evaluation Activities
Tracking Data Review	All projects paid in 2014	Impact and Process Evaluation
Deemed Savings Review	All measures included in 2014 projects	Impact Evaluation
On-Site Data Collection and Analysis	Sample of completed 2014 projects	Impact and Process Evaluation
Billing Analysis	All projects paid in 2014 and pipeline customers	Impact Evaluation
In-depth Telephone Interviews	Program staff and implementer	Process Evaluation
Telephone survey	Program participants	Process Evaluation

2.1 Data Sources

The data for evaluation of the Express Program was gathered through a variety of sources. The evaluation team conducted a survey of program participants, in-depth telephone interviews with the AEP Ohio Program Coordinator and the program implementer, reviewed tracking system data and performed onsite verifications. Finally, the team performed a billing analysis of participants to determine *ex post* energy savings.

2.1.1 Tracking Data

The Express Program evaluation team was able to extract key program participation data from the program-tracking database, which was provided by AEP Ohio as a comma separated text file. The most current tracking data used for this evaluation was extracted April 10, 2015, with several earlier files used for preliminary analysis.

The database consists of a measure level dataset with measure level impacts, application submittal and status data, and AEP Ohio recalculated energy and demand savings values, which represent the *ex ante* savings. The evaluation team found the data and tracking system complete, organized and containing all relevant information, however, the evaluator did not address whether the tracking system is adequate for regulatory prudence reviews or corporate requirements.



2.1.2 Program Documentation

The evaluation team also reviewed program materials developed by the contractor and AEP Ohio, including the AEP Ohio and the implementation contractor technical reference spreadsheets documenting savings algorithms and program materials available from the program website.

2.1.3 Billing Data

For the regression analysis, the evaluation team utilized monthly billing data provided by AEP Ohio staff. The data included monthly billing data spanning January 2013 through March 2015 for 2014 participants and pipeline customers. Key data fields included the premise number (used to merge the billing and tracking data), bill account number, dates of bill period, read code, and usage amount.

2.2 Tracking Data Review

This review is designed to identify potential adjustments to *ex ante* reported savings for measures due to outliers, missing information, or tracking system data entry or calculation errors. The evaluation team identified key tracking fields, including project number, participant name and contact information, project status, building type, measure type, and *ex ante* savings. Next, the team summarized the tracking system data to identify the sectors and measures contributing the majority of savings. However, the evaluator did not address whether the tracking system is adequate for regulatory prudence reviews or corporate requirements.

2.3 Deemed Savings Review

This review is designed to identify potential parameter adjustments to *ex ante* reported savings for measures if the evaluation team recommends an alternative default value for a specific measure. Updated parameters are expected to be consistent with those used for estimating energy and demand savings for similar measures in other business program offerings to provide consistency across the business sector portfolio. The deemed savings review serves as the basis for calculating peak demand savings and also provides insight for any discrepancies found in the billing analysis.

2.4 On-Site Data Collection and Analysis

On-site visits are designed to verify measure installations operating characteristics for projects throughout the service territory and advise recommendation and findings from other components of the evaluation. The Navigant team conducted onsite data collection and analysis for a subset of projects selected from the technical review sample. A project-specific M&V plan was developed for each sampled project. These plans detailed the reported measures and operating characteristics, as well as the data collection plan for the project. The M&V plans all followed a common template, but the data collection tasks within each were custom-designed to target any key uncertainties in the reported savings analysis. The default onsite M&V tasks included a visual verification of measure installation and operation, reported measure quantities, measure nameplate data, verification of measure operating characteristics, including the schedule of operation, and HVAC system type.



2.5 *Billing Analysis*

A billing analysis of 2014 participants and pipeline participants serves as the basis for determining program energy savings. The variation-in-adoption (VIA) model takes advantage of the differential timing of program enrollment to identify program savings. The model essentially takes the perspective that the best comparison group for participants consists of those customers that enroll in the program in a later period. Use of pipeline participants as a comparison group accounts for other exogenous effects, such as macro-economic trends. Pre- and post-installation periods are determined on a project-by-project basis. Use of fixed effects accounts for project-specific characteristics that do not change over time, such as square footage of the premise.¹ Program savings are estimated through the use of a statistically adjusted engineering (SAE) model, which incorporates the *ex ante* claimed savings for each project in the regression. Because the billing analysis does not take into account time of day savings, the demand savings are verified by use of the engineering adjusted savings.

2.6 *In-depth Telephone Interviews*

Several in-depth staff interviews were conducted as part of this evaluation as shown in Table 2-2. An interview was conducted with the Express Program Coordinator and with implementation staff. These interviews were completed in March and April, 2015. The interviews with the AEP Program staff focused on program processes, the goals of the program, how the program was implemented, and the perceived effectiveness of the program. The interviews with implementation staff explored the implementation of the program in more detail and also covered areas of data tracking and quality assurance. The interview guide used for these interviews is included in Appendix C: Program Staff and Implementer Interview Guide.

¹ The fixed effects account for the variation in energy usage *across* projects, while the remaining variables in the regression analysis account for the variation in energy usage *within* each project. The regression model explicitly accounts for seasonal variation in energy usage (which includes weather effects) and participation in the Express 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 Coordinator	1	March 2015
	Implementer Contractor	Contacts from AEP Ohio	Program Development Director Midwest Regional Manager	1	April 2015

2.7 Telephone Survey

A CATI survey targeted a population of 423 unique customer contact names drawn from the Express Program February 15, 2015 tracking system extract. The survey finished with 120 completed interviews from the Express Program participants. This survey focused on questions to estimate the program impacts and to support the process evaluation. All CATI interviews were completed in March or early April 2015. The evaluation team collected data to support the process evaluation, including questions concerning program design and implementation, program marketing and awareness, customer satisfaction, and business demographics. The survey instrument used for the participant surveys is included in Appendix B.

2.8 Sampling Plan

The sample frames to support the process and impact activities are summarized in Table 2-3 and detailed in the following subsections.

Table 2-3. Summary of Sample Frames

Sample Use	Sample Frame	Size
Billing Analysis	Program participants	Census
Onsite Verification Visits	Program participants	20 (17 lighting, 3 refrigeration)
Participant Surveys	Unique customer contacts	120

2.8.1 Impact Sample

The Impact evaluation of program energy savings was based on a billing analysis of an attempted census of 2014 participants and pipeline participants for 2015 to-date, as a comparison group. Appendix A includes additional details on the methodology. The attempted census achieves the impact goal of a relative precision of ± 10 percent at a 90 percent level of confidence.



Other impact questions were researched with less rigor since those data were only used to provide context for the billing analysis, as well as the *ex ante* savings and incentive calculations. The evaluation team reviewed measure inputs and savings to verify equations used to calculate savings and incentives and to verify the application of valid fixture power, hours of use, and HVAC interaction factors. The evaluation team also performed site visits for 20 sites to verify equipment installation. These sites were selected from the tracking database randomly throughout the AEP Ohio service territory, stratified by the quarter in the year the project was completed based on feedback from the Express Program Coordinator and implementation contractor, and weighted by savings. Onsite tasks only included verification of retrofit equipment and hours of operation based on facility hours.

2.8.2 Process Sample

The process evaluation sample was based on the primary tracking database. Measures were rolled up to projects, and then rolled up again by customer contacts representing discrete sample points. The largest site and measures for each contact were provided as data to the survey house for customer phone surveys.

The sampling approach for the participant surveys followed a random sample design. Navigant's analysis of the program database showed a population of 461 unique customer contact names with paid projects for the 2014 Express Program.² The targeted number of completes was calculated to support the analysis of survey responses that are statistically valid at a 95 percent confidence interval with a relative precision of 5 percent (95/5), assuming a coefficient of variance (CV) of 0.5. The sample design showed 220 samples required to meet 95/5. The data collection firm was successful in collecting 120 completed surveys.

2.9 Ex Post Savings Evaluation Methods

The methodology for estimating *ex post* verified savings differs for energy savings and demand reductions. For energy savings, the billing analysis provides a robust estimate of realized savings, but because the billing data is only collected at monthly intervals it is not possible to derive a demand estimation. Therefore, for demand reductions, the evaluation team reviewed the tracking data and performed an engineering review of the deemed savings estimates, which were informed by the limited onsite verification visits.

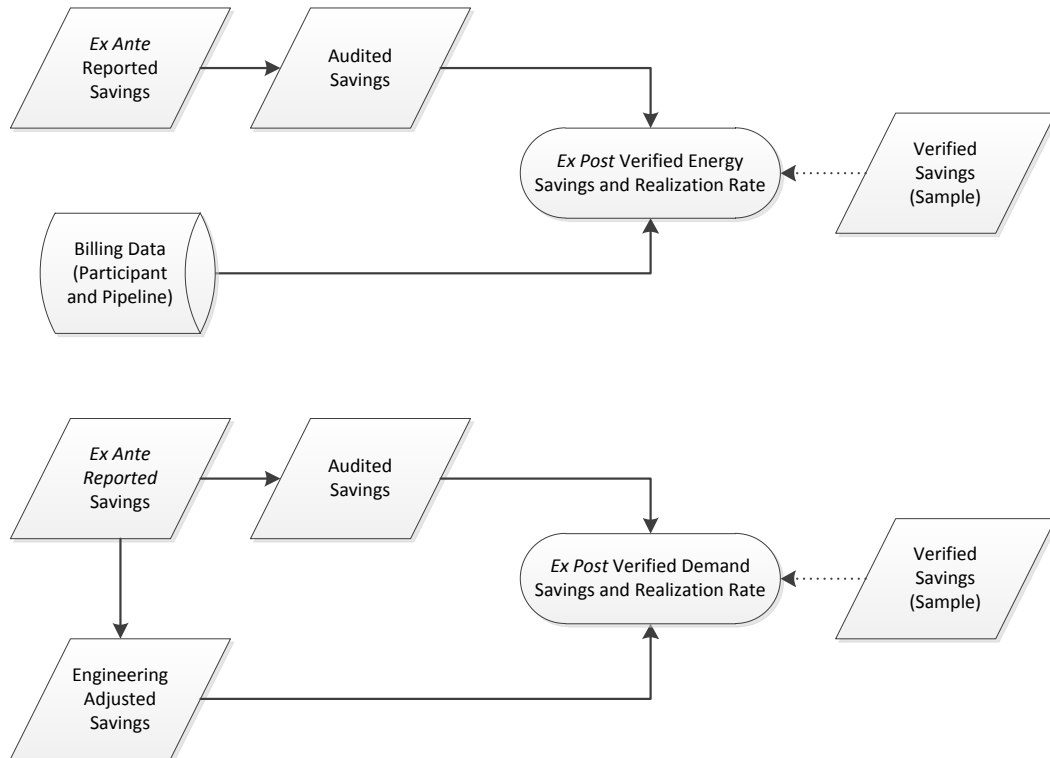
2.9.1 Task Flow Schematic

The task flow for these activities is shown in Figure 2-1 for both energy and demand. Verified savings from the sample sites is used to inform the drivers of the realization rates, but are not actually a part of the calculations that determine *ex post* verified savings.

² This analysis was conducted on a data extract from January 30, 2014.



Figure 2-1. Energy and Demand Impact Evaluation Task Flow





3 Evaluation Findings

This section presents the detailed findings from the 2014 Express Program evaluation related to (1) program activity, (2) audited impact findings, (3) process evaluation findings, and (4) cost effectiveness review.

3.1 Program Activity

The evaluation team extracted key program participation data from AEP Ohio's Express Program database. The database includes a single flat data file with both project and measure level data, including application submittal and status data, customer and contractor contact information, and both implementation contractor and AEP Ohio calculated energy and demand savings values. Project data is linked by a unique proposal number to measure-level information.

As shown in Table 3-1, in 2014, the Express Program paid incentives on a total of 567 projects, encompassing 26,072 installed measures and 7.2 GWh of *ex ante* reported annual energy savings. This is a decrease from participation in 2013, where the Express Program completed 930 projects³.

Table 3-1. Express Program Year 2014 Activity

Metric	Reported Value
Number of Projects	567
Number of Measures Installed	26,072
Annual Energy Savings (MWh)	7,224
Electric Peak Demand Savings (kW)	1,774

Source: Evaluation analysis of 2013 AEP Ohio tracking data

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 Express Program.

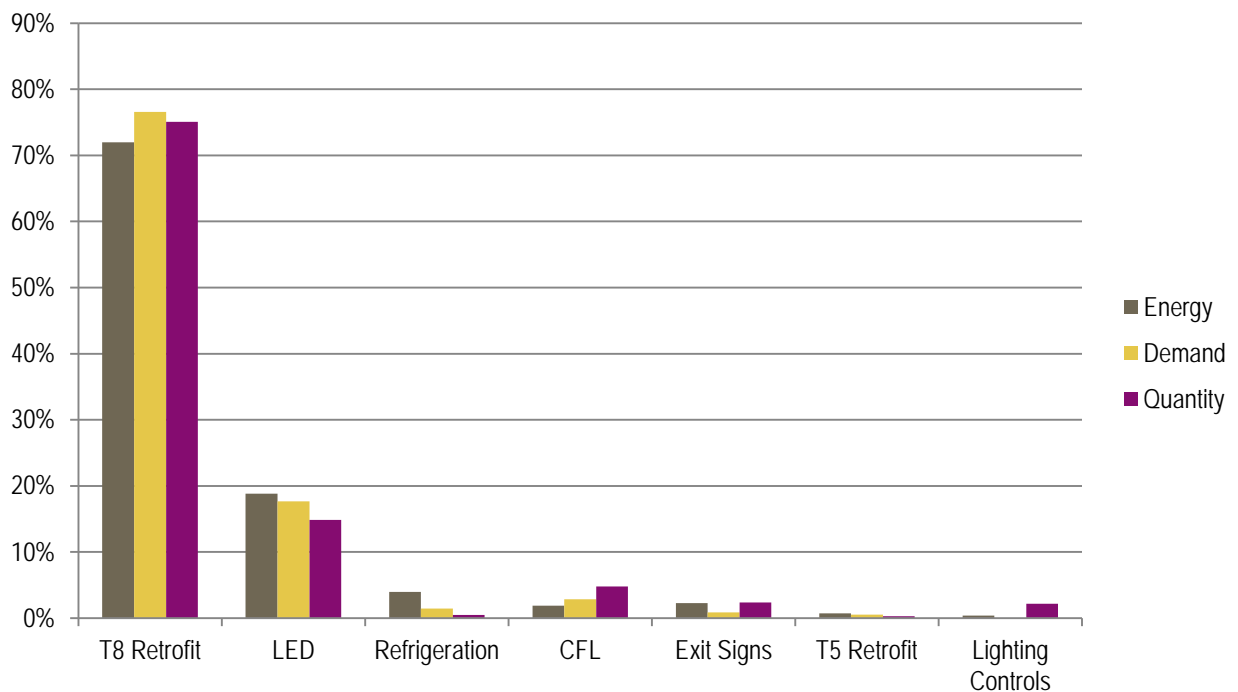
1. Linear fluorescent retrofits (T8) continue to dominate reported energy savings and demand reductions.
2. The majority (80%) of lighting measures are installed indoors, with the remainder split between garage lighting and exterior lighting.
3. Projects encompass a wide variety of small business facility types, with small retail, grocery, and small office representing the top three.
4. Average *ex ante* energy savings per project have risen slightly from 58,879 kWh in 2013 to 65,898 kWh, while average savings per site has risen slightly from 19.1 percent to 19.3 percent as well.
5. A single contractor was responsible for almost half of the total project installations in 2014.

³ Express Program for Small Business; Program Year 2013 Evaluation Report



Linear fluorescent T8 retrofits continue to be the single largest contributor of *ex ante* reported energy and demand savings, similar to previous years, as well as other business programs offered by AEP Ohio. The breakdown is shown in Figure 3-1. Contributions from LEDs are 19 percent of energy savings and 18 percent of demand reductions, compared to 14 percent energy savings and 10 percent demand reductions from 2013.

Figure 3-1. Measures Installed and Reported Savings by Measure Category

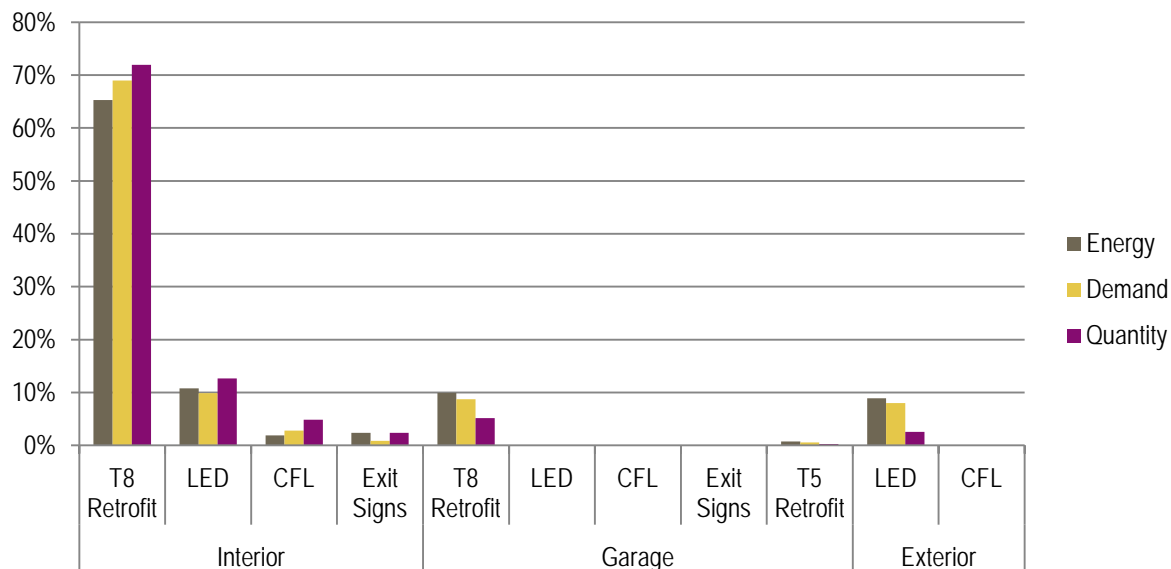


Source: Evaluation analysis of 2014 AEP Ohio tracking data

Installation location data, shown in Figure 3-2, indicates the majority of measures are installed indoors as expected, with garage and exterior lighting also contributing to overall savings. The T8 retrofits are the main driver of program energy and demand savings, with garage and exterior LEDs also contributing a significant portion of savings. A closer look at the garage lighting contribution indicates this code is applied to a variety of space types without HVAC systems, such as warehouse or truck bay.

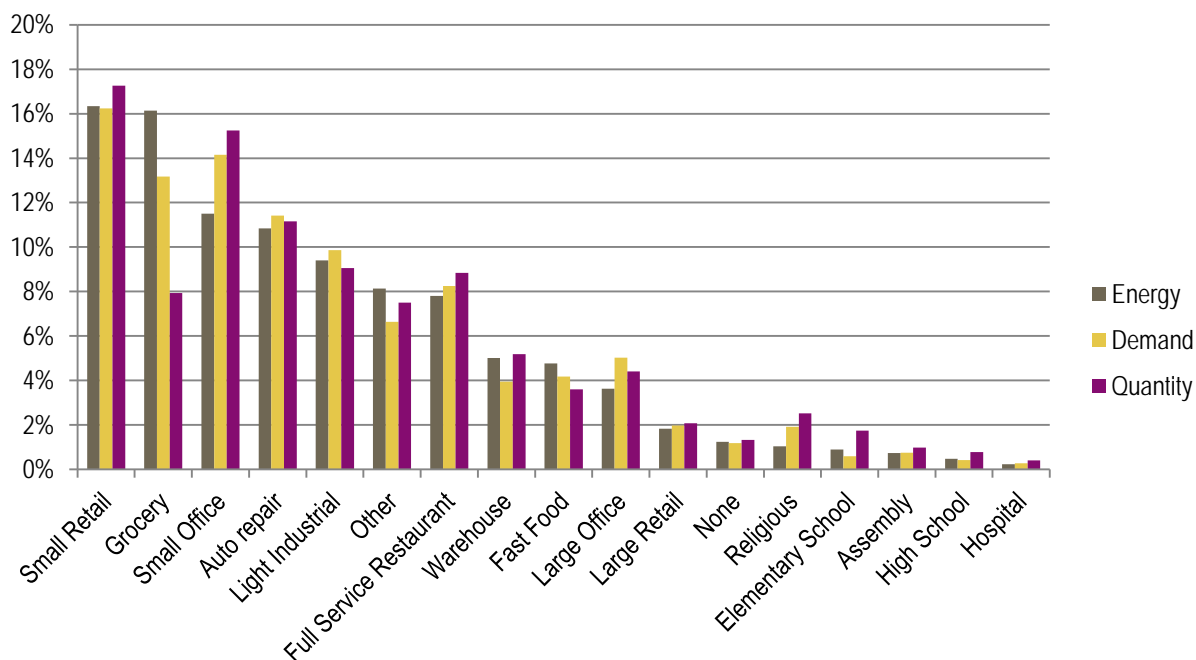


Figure 3-2. Lighting Measures Installed by Location and Measure Category



The small retail, grocery and small office facility types generate the most proposals and energy savings, as shown in Figure 3-3. In general, energy and demand savings are roughly proportional to the number of proposals generated for each facility type.

Figure 3-3. Measures Installed by Facility Type

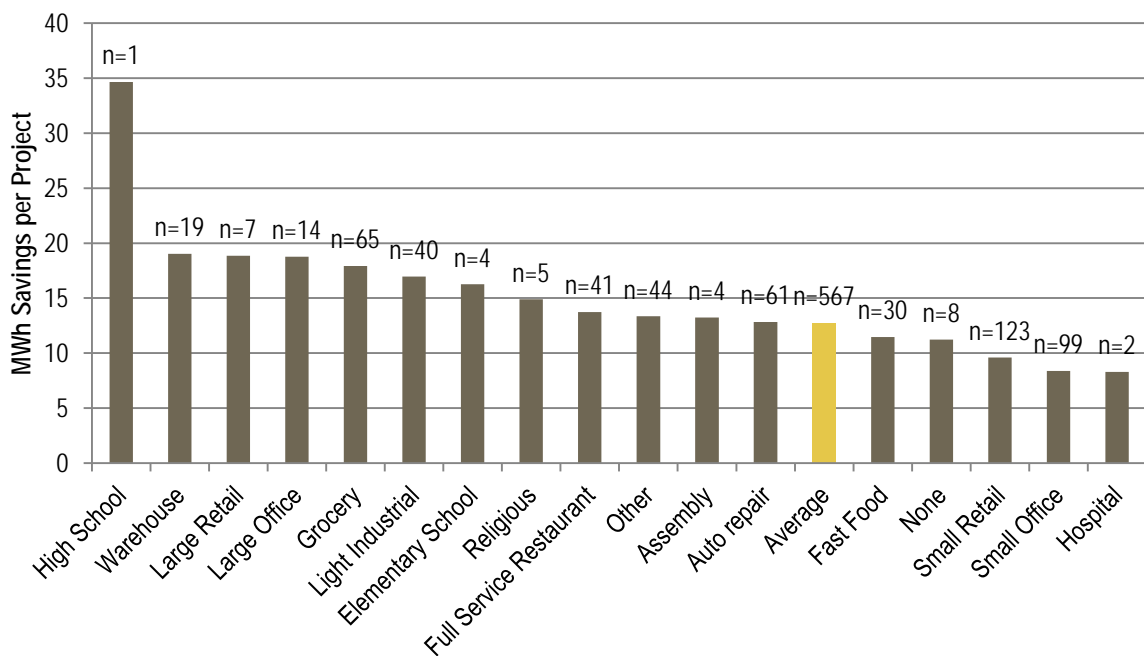




Looking further into the building type, high school has the largest *ex ante* energy savings per site, although average savings per site are relatively consistent across all other building types, as shown in Figure 3-4. It is important to note that high school encompasses only a single project. Overall, the average *ex ante* savings per project is 12,741 kWh, up slightly from 11,280 kWh in 2013.

For comparison, the average energy use per project is 65,898 kWh, up from 58,879 kWh in 2013⁴. The average *ex ante* energy savings as a percent of total site energy consumption is 19.3 percent of energy consumption, almost identical to the 19.1 percent from 2013.

Figure 3-4. Average Savings per Project by Building Type

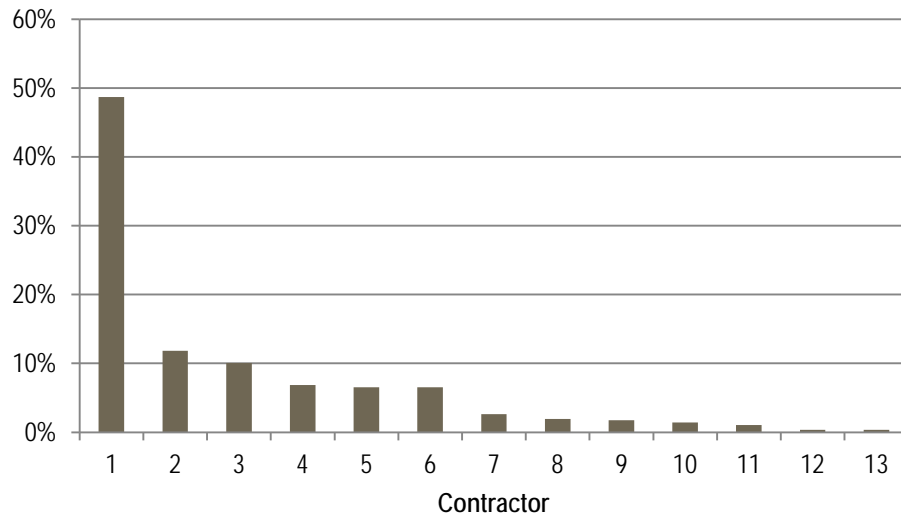


⁴ Express Program for Small Business; Program Year 3 Evaluation Reports



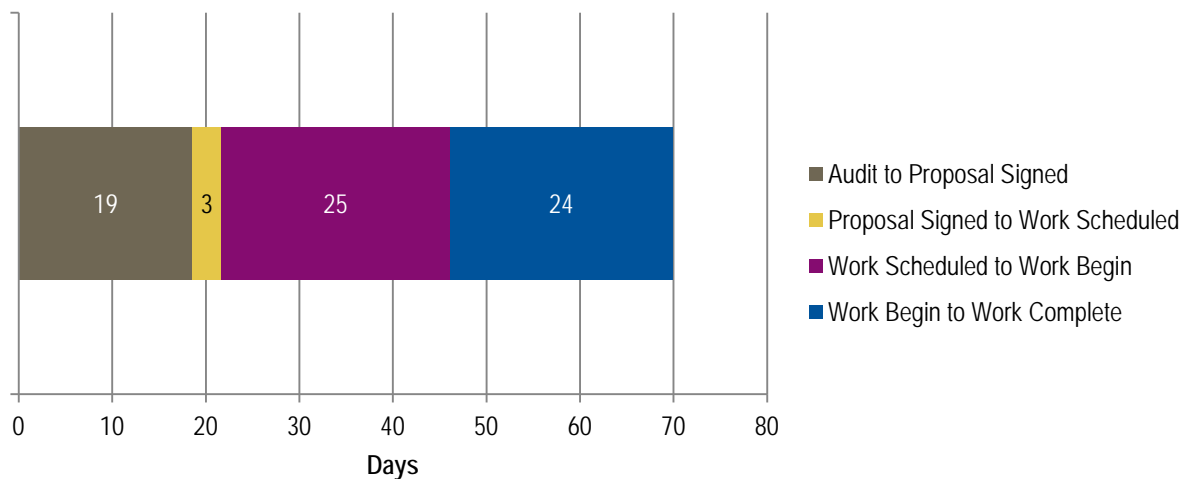
For 2014, 13 contractors performed equipment installations on behalf of the implementation contractor. One particular contractor completed almost 50 percent of the total projects, as shown in Figure 3-5. In 2013, the largest contractor completed almost 40 percent of projects, indicating potential consolidation, or simply a particular installation contractor targeting the Express Program.

Figure 3-5. Percent of Projects Completed by Unique Contractor



The average total length of a project from the audit to the customer invoice is unknown because the tracking data does not include the date that the customer received a final invoice for work performed. The process from audit to work complete takes on average 71 days and covers four key milestones as shown in Figure 3-6. Note that the proposal is generated during the time of the audit and presented to the customer.

Figure 3-6. Duration of Key Project Milestones





3.2 Impact Evaluation Findings

As shown in Table 3-2 the impact evaluation verified 73 percent of the *ex ante* reported energy savings and 90 percent of the *ex ante* reported demand savings. The evaluation team performed a billing analysis to inform the *ex post* energy savings, and applied engineering based adjustments to the AEP Ohio tracking data to inform the *ex post* demand savings.

Table 3-2. 2014 Ex Post Savings and Realization Rates

Metric	Energy Savings (MWh)	Demand Savings (kW)
<i>Ex Ante</i> Reported Savings	7,224	1,774
<i>Ex Post</i> Verified Savings	5,253	1,605
Realization Rate	73%	90%

Source: Evaluation data collection and analysis as described in Section 3

The 2014 program realization rate (defined as verified *ex post* savings/*ex-ante* reported savings) is 73 percent for energy savings, and 90 percent for demand reduction. The relative precision is ± 18 percent on the energy realization rate and better than ± 10 percent for the demand realization rate at the 90 percent confidence level, two-sided. The energy precision value reflects uncertainty in the regression model parameter estimates. Because the regression model includes all participants with viable data, the sampling error is virtually zero, and so the savings estimates satisfy the 90 percent confidence and 10 percent precision targets.

3.2.1 Findings from the Audited Savings Review

This section provides a detailed description of impact findings for the 2014 Express Program, including verified energy and demand savings and realization rates. The evaluation team reviewed tracking data and recalculated the energy and demand savings values according to the methodologies outlined in the technical documentation and from conversations with AEP Ohio staff. All relevant parameters, including pre- and post-quantities, pre- and post-wattages, HVAC interactive effects, coincidence factors and burnout quantities were either available directly in the tracking data or in lookup tables provided by AEP Ohio staff.

Observations from this review were that project-tracking systems are well organized and contain sufficient documentation. Contact information for both the customer and contractor is clearly presented, existing equipment and retrofits are adequately described to estimate savings, and proposed equipment descriptions are thorough and consistent.

As a result of the Audited Savings Review, the evaluation team updated the energy and demand savings associated with exterior lighting measures to remove the contribution from HVAC interactive effects. This results in minor adjustments to both the energy and demand saving and results in an audited realization rate of 99% for both energy and demand savings.

From the location description data, it appears that some lights flagged as interior lights may be located in places that are unconditioned. These lights are credited with additional savings due to interactive effects, and contribute to the reduction in realization rate found in the billing analysis. It was unclear



whether the location code was more accurate than the measure code itself. Therefore, the evaluation team opted not to apply this adjustment to the population of affected measures.

3.2.2 Findings from the Engineering Adjusted Savings Review

The evaluation team reviewed all measures further to verify methodologies, equations, and parameters for estimating energy and demand savings. In 2014, the Express Program installed lighting measures including linear fluorescent (T5 and T8) retrofits, LED lamps, LED exit signs, and CFLs lighting controls, as well as refrigeration retrofit measures. The basis for AEP Ohio's *ex ante* reported savings are driven by the formulae outlined in the following sections.

3.2.2.1 Lighting Parameter Estimates

Energy and demand savings for lighting measures are calculated per measure from the following equations⁵:

Equation 1. Energy Savings

$$kWh.savings = [kW.base * (QTY.base - QTY.burnout) - kW.eff * QTY.eff] * Hours * HVAC.kWh$$

Equation 2. Demand Savings

$$kW.savings = [kW.base * (QTY.base - QTY.burnout) - kW.eff * QTY.eff] * CF * HVAC.kW$$

Where:

kWh.savings = energy savings (kWh)
kW.savings = demand savings (kW)
kW.base = connected kW of baseline equipment
kW.eff = connected kW of efficient equipment
QTY.base = quantity of baseline equipment
QTY.eff = quantity of efficient equipment
Hours = estimated annual hours of use
HVAC.kWh = energy interactive effect
HVAC.kW = demand interactive effect
CF = coincidence factor

The evaluation team reviewed the lighting parameters to determine whether these were reasonable and acceptable or required revision.

The evaluation team reviewed inputs for fixture power, hours of operation, HVAC interactive effects, and coincidence factors. Individually, the team judged that most of these parameters are reasonable but should be revisited to ensure that they both represent the climate and building characteristics of the AEP Ohio service territory and align with other business program assumptions where relevant.

⁵ Refrigeration measure savings algorithms taken from New York Standard Approach for Estimating Energy Savings from Energy Efficiency Programs – Residential, Multi-Family, and Commercial/Industrial Measures Version 2, December 10, 2014.

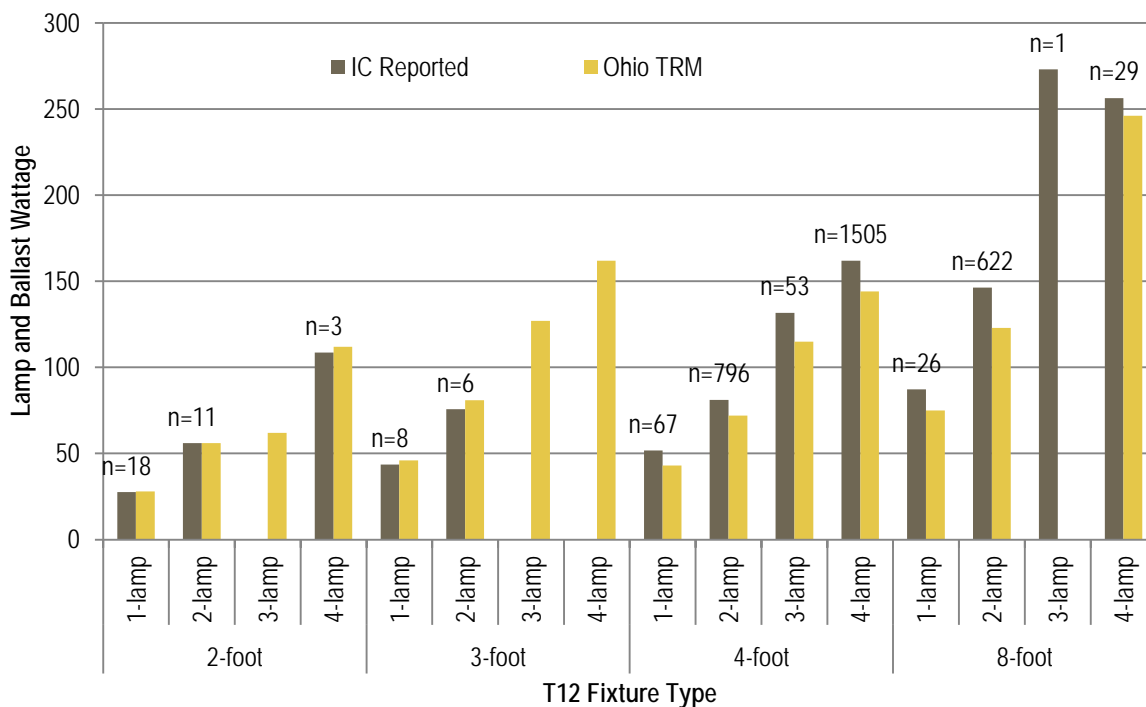


3.2.2.2 Lighting Power

In general, the evaluation team agreed with estimated fixture power listed in the technical reference spreadsheets. The team acknowledges the custom approach taken by the implementation contractor to identify the specific wattage of the baseline fixture has the potential to yield accurate estimates, but in practice, the auditors must take care to ensure that the correct ballast efficiency is chosen.

The tracking data contains a high-level field detailing the type of baseline fixture. These values typically correspond to several variations of lamp and ballast combinations. A comparison using a weighted average of fixture wattages found in the tracking data and the fixture wattages from the Draft Ohio TRM⁶ shows the AEP Ohio reported fixture wattages are typically higher, as shown in Figure 3-7. For example, looking at the popular 4-foot 4-lamp T12, the average wattage in the tracking data is 162, while the Draft TRM value is 144. All of the popular 4-foot T12 lamp wattages in the Draft Ohio TRM are lower than the average wattages for equivalent fixtures found in the tracking data. For 2-foot and 3-foot lamps, values are comparable, with the Draft TRM values actually slightly lower in some cases, but note that these lamps are significantly less common than 4-foot lamps,

Figure 3-7. Weighted Comparison of T12 Baseline Wattages



⁶ Table 8: Baseline and Efficient Fixture Wattages, page 173, State of Ohio Energy Efficiency Technical Reference Manual, August 6, 2010



While the evaluation team did not determine that the implementation contractor is overestimating baseline wattages from the documentation provided, the potential exists. Proper identification of baseline fixture and ballast type is critical to making accurate savings estimates, and as shown in the onsite findings in Section 3.2.4, it is likely that these issues play a role in the realization rate reduction.

3.2.2.3 Hours of Operation

Prior Express Program Evaluation Reports^{7,8} identified over-estimated hours of operation as a key driver of over-estimated reported program savings. The 2013 and 2014 program methodology attempts to remedy some of the issues by collecting customer reported annual hours of operation on a per-fixture basis. This custom approach allows the implementation contractor to provide savings estimates with a greater degree of certainty than is possible with a strict deemed approach based on facility type.

One caveat is the implementation contractor auditor must take care to accurately characterize hours of use for each fixture. A review of the data indicates that certain fixtures in spaces less frequented, such as private offices, storerooms, closets, etc. are reported with low hours of use, while spaces such as lobbies, main offices, etc. are reported with high hours of use, as expected. Compared to 2013, the increased realization rate, as well as the onsite findings discussed in Section 3.2.4, indicates the auditors in 2014 more accurately estimated hours of use.

3.2.2.4 HVAC Interactive Effects

Savings from more efficient lighting in conditioned spaces includes HVAC interaction effects, depending on the type of heating and/or air-conditioning equipment used. The tracking data includes thorough HVAC information to advise this parameter. The evaluation team found the deemed values reasonable, although these are based on the NY TRM and climate data from Poughkeepsie NY, rather than Ohio. The evaluation team used these values for 2014 because these take into account the HVAC system type found onsite, rather than making weighted assumptions on system type for a building type.

3.2.2.5 Coincidence Factors

The coincidence factor is used to calculate the percentage of time during the peak period the efficient measure operates. The evaluation team found the coincidence factors AEP Ohio used to calculate demand savings were consistent with other business program offerings for consistency of approach across the business programs. However, the values used were drawn from the PJM peak period recommended deemed values, rather than the AEP Ohio peak period deemed values. In addition to this adjustment, the evaluation team applied the coincidence factors associated with exterior fixtures (0.00) and garage fixtures (1.00) which resulted in an adjustment of 0.92 due to this effect.

⁷Express Program for Small Business; Program Year 2012 Evaluation Report.

⁸Express Program for Small Business; Program Year 2013 Evaluation Report.



3.2.2.6 *As-Found Lamp Burn-Outs*

As-found lamp-burn-out is also a potential source for savings over-estimates. Existing power and energy depends on the number of lamps burning at the time of the contractor's survey. Because lamps are most often replaced when a sufficient number have failed to affect illumination or aesthetics, some burned-out lamps are expected in the baseline case in most businesses. New equipment presumably does not burn out within the first year, with most replacements having a rated lamp life of 8,000 hours for CFLs, 18,000 hours for linear fluorescent lamps, and 50,000+ hours for LED exit signs. The implementation contractor accounts for burn-outs by taking note of the quantity of burnouts during the assessment and subtracting these from the baseline quantity, and in some cases applying a ratio of burnouts. The variety of quantities within the burnout data indicates the implementation contractor is attempting to characterize this effect, and the evaluation team believes this is not a large contributor to the realization rate.

3.2.2.7 *Refrigeration Measure Assumptions*

Refrigeration measures, new for 2014, account for 4 percent and 1.4 percent of *ex ante* reported energy savings and demand savings, respectively. The evaluation team found the refrigeration assumptions based on the NY TRM appropriate, but notes that similar measures are offered through other AEP Ohio business program offerings. The evaluation team was unable to directly compare per unit savings between the methodologies employed in the Express Program compared to the methodology used in the Prescriptive Program due to differences in reported parameters.

3.2.3 Findings from the Billing Analysis

The evaluation team conducted a regression analysis using monthly billing data from premises tied to 1,048 projects: 567 completed 2014 projects and 481 pipeline projects. The regression model takes advantage of the differential timing of program enrollment to identify program savings. The VIA model essentially takes the perspective that the best comparison group for participants are customers that enroll in the program in a later period. Pre- and post-installation periods are determined on a project-by-project basis. Use of fixed effects accounts for customer-specific characteristics that do not change over time, such as square footage of the premise. The regression accounts for seasonality of savings due to HVAC interaction effects via the inclusion of seasonal binary variables. Program savings are estimated through the use of a statistically-adjusted engineering (SAE) model, which incorporates the *ex ante* claimed savings for each project into the regression. This helps to account for the variation in project size in the regression model. For a detailed description of the regression model and results, see Appendix A.

The evaluation team estimates a realization rate of 0.73. That is, verified savings are equal to 73 percent of *ex ante* savings reported in the tracking database. This corresponds to average annual program savings of 9,265 kWh per project, representing a 10.3 percent reduction in energy usage due to the Express Program. The 90 percent confidence interval around this estimate is 8,526 kWh to 10,003 kWh per premise, with a standard error of 0.08 for the realization rate. The uncertainty in the regression model is driven by variability in the data and the lack of a sufficient number of post-period bills for a large number of projects. At the time of this evaluation, 51 percent of the 2014 participants had six or fewer bills in the post-period. Total 2014 program savings are calculated from the energy realization rate times the total claimed savings for the Express Program in 2014, for a total of 5,253 MWh.



3.2.4 Findings from On-site Verification

Navigant conducted onsite verification visits for a total of 20 randomly-selected projects throughout the service territory. As discussed, the sample was stratified to ensure some refrigeration sites were visited. Because this process was designed to inform rather than serve as the basis for the impact evaluation, it is not necessary to obtain 90/10 confidence and precision for the sample.

Of the 20 sites, a total of 114 measure records representing 558 individual fixtures were verified. The evaluation team attempted to verify the parameters related to impact calculations onsite and assess any trends that may provide insight into other activities, as well as a due diligence activity. The energy realization rate for the sample is 0.82, while the demand realization rate is 0.79 for the sample of sites visited. Key findings include the following.

- » **Hours of use are improved from 2013.** The evaluation team verified reported hours of use-based on data provided by the customer during the visit. Overall, the evaluation team verified hours at 96.1 percent of reported hours for the sample, up from 92.6 percent in 2013. This indicates that the auditing team is more accurately characterizing hours of use in 2014.
- » **Lamp wattages recorded are improved from 2013.** The evaluation team found no inconsistencies between the lamp wattages found onsite and the wattages recorded in the tracking database.
- » **Baseline wattages for T12 fixtures may overestimate wattage.** This issue results in an increased wattage differential between the efficient fixtures and baseline fixtures, which results in savings overestimates. While it was not possible to manually verify the baseline fixture specifications, reducing baseline fixture wattages to those found in the Draft Ohio TRM resulted in a decrease in the energy realization rate of 19 percent and a decrease in the demand realization rate of 21 percent for the limited sample. The evaluation team suspects that this is a driver of the realization rate.
- » **Overall, customers are satisfied with retrofit equipment, but some equipment issues exist** One customer indicated the new lights do not produce adequate light, while another indicated due to improper installation, several fixtures were not functional and required follow-up visits.

3.2.5 Discussion of Impact Evaluation Results

3.2.5.1 Energy Savings

Based on the billing analysis described in the previous section, the evaluation team estimated the verified program energy and demand impacts resulting from the 2014 Express Program, as shown in Table 3-3. No further adjustments were made to verified kWh savings.

Table 3-3. Savings Estimates for 2014 Express Program

2014 Program Goals (a)	Ex Ante Savings (b)	Ex Post Savings (c)	Realization Rate RR = (c) / (b)	Percent of Goal = (c) / (a)
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Energy Savings (MWh)	11,063	7,224	5,253	73%	47%
Demand Savings (kW)	1,844	1,774	1,605	90%	87%

The realization rate for energy is significantly higher than in 2013 (0.58) and indicates the AEP Ohio and implementation contractor staff have improved processes to better estimate energy savings impacts. While much improved from previous years, the potential to over-estimate *ex ante* savings still exists. Navigant's preliminary analysis assumed that lighting comprises about 30-40 percent of electricity consumption (in a natural gas heated facility) and the predominant retrofits for linear fluorescent systems typically save 30-40 percent of lighting energy. Combined, *ex ante* expected savings are expected to fall between 9 percent and 16 percent versus the prior year's consumption, if *all* lighting is retrofitted and customer usage habits remain the same. Factoring in interactive effects would increase this amount to between 10 to 18 percent. Billing analysis is most effective when savings is greater than 5 percent of the total to differentiate the savings from background noise in the data.

For the Express Program, the average energy use per project is 65,898 kWh and the average *ex ante* savings per project is 12,741 kWh, or 19.3 percent of energy consumption. Furthermore, not all lighting systems were replaced, either by customer request or if existing fixtures were already energy efficient.

The evaluation team concludes that the *ex ante* estimates for the AEP Express Program continue to be high, although performance is significantly improved compared to the program from 2013. Navigant's further research shows the billing analysis is consistent with performance of similar programs.

3.2.5.2 Demand Savings

Because the billing analysis does not estimate electric demand savings, the engineering adjusted savings review serves as the basis for demand savings. As noted earlier, the evaluation team reviewed the tracking data and deemed savings assumptions and determined them to be reasonable, resulting in a realization rate of 0.90 due to adjustments to exterior lighting HVAC interactive effects, and exterior and garage coincidence factors.



3.3 Process Evaluation Findings

This section provides a detailed description of process findings for the 2014 Express Program based on interviews with program staff and the participant survey.

3.3.1 Program Administration

According to the Program Coordinator, the goals of the Express Program are and to serve the small business segment of business accounts and to create jobs within the local communities. The program is designed to concentrate on the 'mom and pop' organizations, not the national accounts. The implementer's primary goal in 2014 was to realize a high realization rate in energy savings.

3.3.2 Program Implementation

Customers are contacted either by phone or in person by the implementer's call center or by an Energy Advisor. An appointment is scheduled to conduct the walk-through audit or it is sometimes performed on the spot when the contact is in person. At the conclusion of the first visit from the Energy Advisors, customers are given a proposal that includes a list of recommendations, estimates of energy savings, the project cost, and the estimated payback period. This proposal also counts as the project pre-inspection. After the project is completed, customers receive a post-installation inspection phone call to assure quality and to verify energy savings.

Other features of the program include the offer of a no-interest 12 month loan or a 6 percent reduction in the project cost if paid in full. Incentives cover between 0 percent to 80 percent of the project cost, depending on the equipment type, building construction, customer operation, the age of existing equipment, location and other specific conditions.

The system the implementation contractor will be soon employ uses the load factor and monthly use to flag customers whose projected program savings is too high, given the customer's current actual usage. An error message is triggered and the Energy Advisor rewrites or rejects the proposal.

A change in implementer management meant increased opportunities for Energy Advisor training. For instance, lighting experts taught the Energy Advisors how to recognize different lighting opportunities. The implementer hired Energy Advisors that were more knowledgeable about energy efficiency and assigned them to concentrate on delivering the program. In the third quarter, the Implementer added refrigeration measures. More training for Energy Advisors on refrigeration savings probably will be needed.

The call center increased out-bound calling efforts and sent out more marketing letters. The call center has also developed marketing collateral that speaks to certain market segments with first person accounts or aggregate estimates of what others in the segment have saved through the Express Program.

3.3.3 Barriers to the Program

According to the Program Coordinator, there are few barriers for the customer. The implementation contractor does all the paperwork. The customer only needs to agree to the project, signs the



approval letter and pays its portion of the project. The contractor submits the documents after the equipment is installed. The implementation contractor processes the paperwork to invoice AEP Ohio and also offers financing. Although there are few barriers, some customers choose not to approve the project even with a positive cash flow, better lighting, and no out of pocket expense.

3.3.4 Eligibility Changes for 2014

The program has been modified from the original program plan. When AEP Ohio first planned the Express Program, it set the maximum yearly usage at 100,000 kWh. However, early experience showed that the 100,000 kWh per year criteria excluded too many customers. In 2011, AEP Ohio increased the limit to 200,000 kWh per year. At first, AEP Ohio required that a participating customer have only one account. This requirement has since been expanded to a maximum of six non-franchise accounts in one customer's name, as long as each account has less than 200,000 kWh annual usage. In 2014, AEP Ohio added customers with 100 kW usage or less, regardless of kWh energy usage. About 2,000 to 3,000 more potential customers were able to participate in the Express Program based on that change.

3.3.5 Survey Results

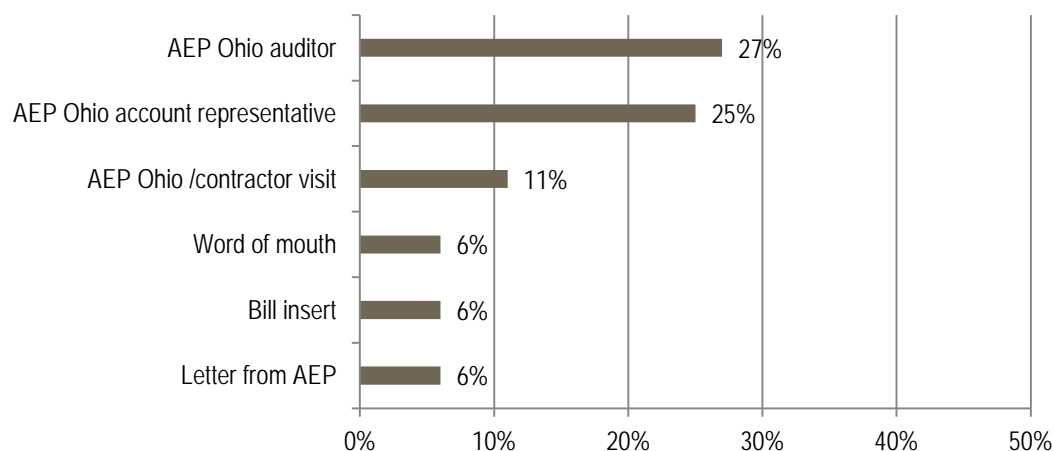
The next sections present the results from the survey of 120 program participants. The survey was fielded in March and April, 2015 and asked about topics such as sources of information, program satisfaction, program attributes, satisfaction with AEP Ohio, type of measure installed, program benefits, program drawbacks, and program improvements.

3.3.5.1 Source of Program Information

Twenty-seven percent of survey respondents first heard about the program from an AEP Ohio Express Energy Advisor. Survey respondents also heard about the program from their AEP Ohio account executive (25%) or from an AEP Ohio representative or contractor visit (11%). Few program participants heard about the Express Program by word of mouth from a friend or colleague (6%), from a bill insert (6%) or letter from AEP Ohio (6%). These results are presented in Figure 3-8.



Figure 3-8. 2014 Where Customers First Heard about the Program



2014 Business Express Survey Data n=120

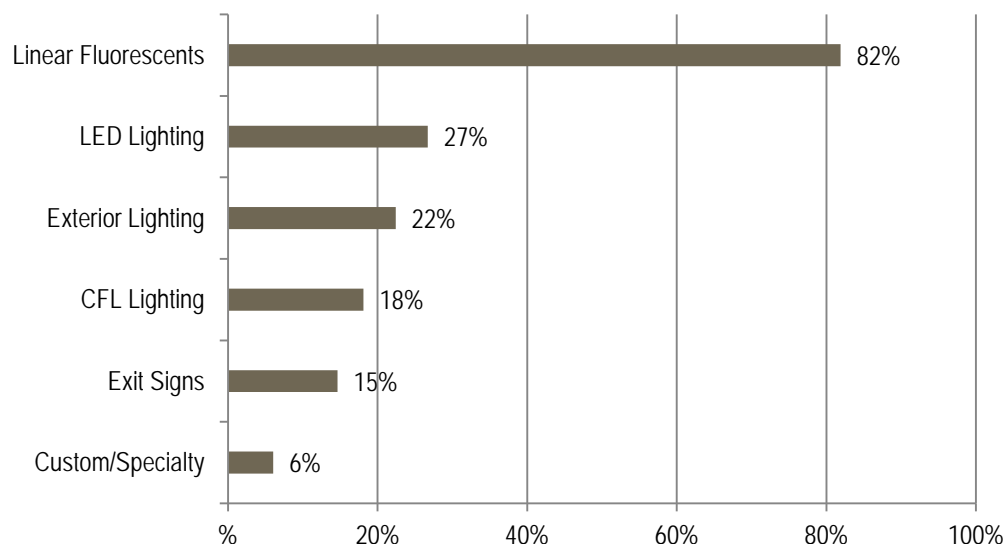
3.3.5.2 *Types of Measures Installed*

In the 2014 survey of customers, shown in Figure 3-9, 82 percent of program participants reported installing linear fluorescent lamps. Fewer than 30 percent of program participants installed LED bulbs (27%), exterior lighting (22%), CFL lighting (18%), or exit signs (15%). Six percent of the survey respondents reported installing custom or specialty lighting through the Express Program.

The proportion of CFL and LED lighting increased two, to two and a half times from 2013 to 2014, respectively. Respondents were slightly more likely to install exit lighting in 2014 and were about 10 percentage points less likely to install linear fluorescent lighting.



Figure 3-9. 2014 Types of Measures Installed



2014 AEP Ohio Business Express Survey Data n=120, multiple responses accepted

3.3.5.3 *Role of the Installation Contractor*

Currently, the installation contractor's role in the program is limited to picking up the equipment from the warehouse and installing it according to the contract, as developed by the Energy Advisor. Ninety-four percent of the time, this system worked as intended. However, in 6 percent of cases, the invoice was less because the contractor could not install all the lighting in the proposal, or the Energy Advisor or the contractor made an error in the contract. In those cases, the amount of the invoice was different, generally less, than the amount in the proposal.

Most installation contractors appear to have installed the equipment professionally. Survey respondents reported that:

- » 98 percent of the installation contractors made an appointment
- » 80 percent of the installation contractors had the correct materials to complete the installation at the first visit
- » 92 percent would recommend the installation contractor to others while 7 percent would not

Customers' reasons for their unwillingness to recommend the contractor to others included:

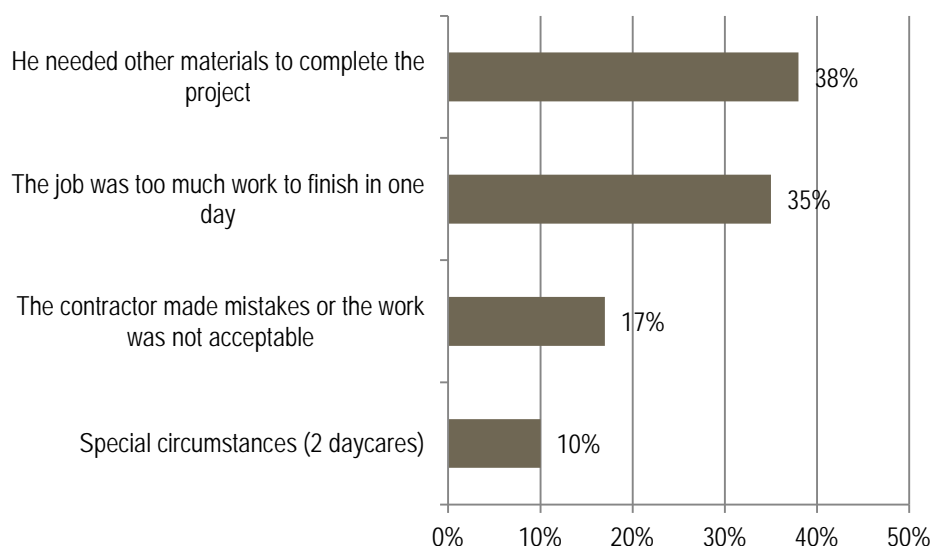
- » They were not knowledgeable (3)
- » Their work was of poor quality (5)
- » They did not show up when scheduled (2)



- » They left a mess (1)
- » The equipment was defective (2)

According to customers, 59 percent of the installation contractors had to return to the customers' place of business to complete the installation. As shown in Figure 3-10, over one-third of the contractors (38%) had to return because of not have all the materials to complete the job or the job was too much work to finish in one day (35%). Survey respondents reported that 17 percent of contractors returned to complete work that needed to be redone. And ten percent said the contractor had to return because of special circumstances, such as the presence of children in a day care center.

Figure 3-10. Reasons the Installation Contractor Had to Return



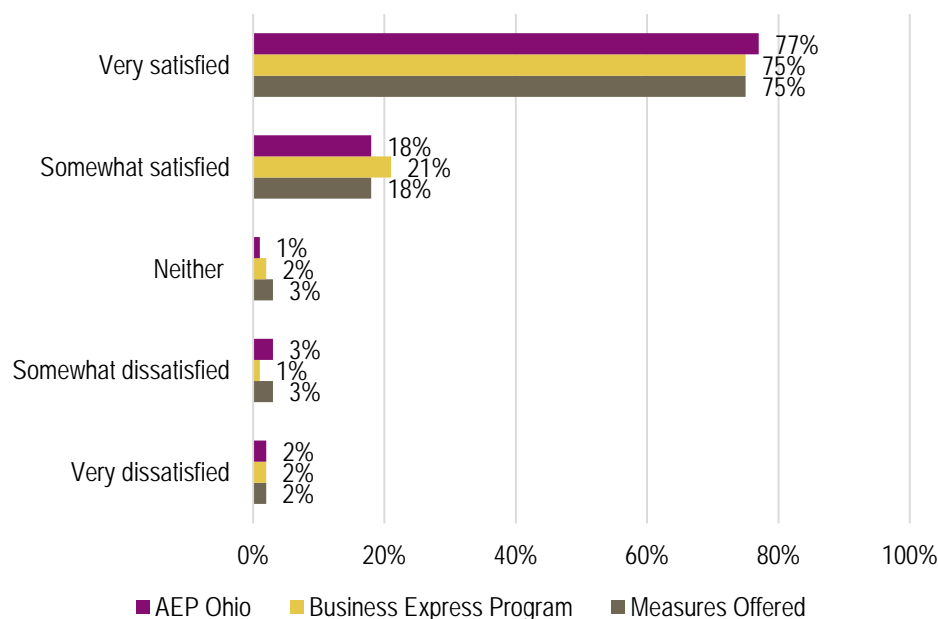
2014 AEP Ohio Business Express Survey Data n= 50
(Only 50 respondents answered this question because it was added mid-way through the data collection process)

3.3.5.4 *Satisfaction with AEP Ohio, the Business Express Program and the Program Measures*

As shown in Figure 3-11, no differences are found between satisfaction with AEP Ohio, the Business Express Program and the program measures. Overall, over 90 percent of survey respondents are 'very or somewhat satisfied' with AEP Ohio, the Business Express Program and the measures offered by the program. And over 70 percent of survey respondents were 'very satisfied' with AEP Ohio (77%), the Business Express Program (75%) and the program measures (75%).



Figure 3-11. 2014 Customer Satisfaction with AEP Ohio, the Business Express Program and the Measures Offered

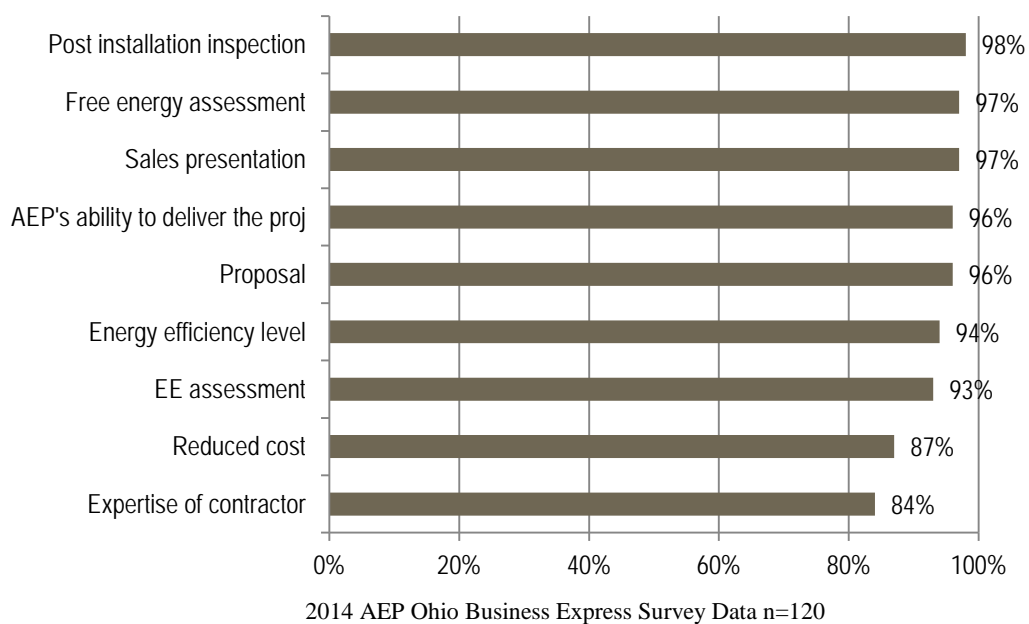


2014 AEP Ohio Business Express Survey Data n=120

In the next set of questions, survey respondents were asked if they were satisfied with the attributes of the program and its delivery. Customers were satisfied with all aspects of the program, as shown in Figure 3-12. Customers were most satisfied with the post installation inspections (98%), the free energy assessment (97%), the sales presentation (97%), and by AEP Ohio's ability to deliver the project (96%). Also receiving high marks were the proposal (96%) and the energy efficiency level of equipment installed (94%). Reduced costs and the expertise of the installation contractor received slightly lower satisfaction scores (87% and 84%, respectively).



Figure 3-12. 2014 Customer Satisfaction with the Attributes of the Program

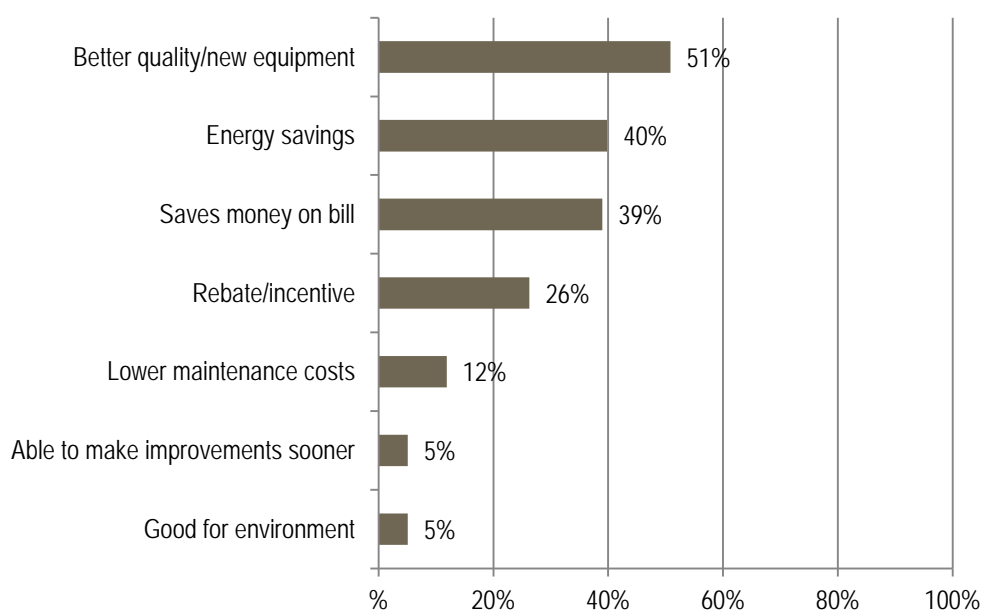




3.3.5.5 Program Benefits

Program participants mentioned the three most important program benefits to the Express Program were 1) receiving better quality or new equipment (51%), 2) energy savings (40%) and 3) bill savings (39%), as shown in Figure 3-13. In addition, 26 percent thought the rebate was an important program benefit.

Figure 3-13. 2014 Express Program Benefits (Multiple Responses)



2014 Business Express Survey Data Multiple Responses Accepted n=120

3.3.5.6 Influence of Express Program on Future Program Participation

Over 70 percent of program participants plan to participate in other AEP Ohio programs in the future (71%). Seven percent of participants said they do not plan to participate again, while 12 percent do not know of their future plans.

3.3.5.7 Equipment Installed Outside the Program

The program helps small business customers move toward future program participation through education and a positive, low effort experience with an energy efficiency program. However, one of the major barriers to program participation for the small customer is cash flow. The Express Program reduced the investment dollars for the current project, but does not place any extra dollars in the hands of the customer to facilitate the next energy efficient project. However, some customers were inspired to install more additional equipment. Thirteen percent of the survey respondents installed additional energy-efficient equipment in their facility after their program participation. Thirty-one percent of the



extra equipment installed outside the program was lighting fixtures, 13 percent commercial refrigeration and 25 percent of other types of equipment as shown in Table 3-4. One survey respondent installed each of the following: HVAC equipment, non-commercial refrigerator, LED lighting, an oven, and a boiler.

Table 3-4. Equipment Installed Outside the Program

Equipment	Frequency	Percentage
Lighting Fixtures	5	31%
Other	4	25%
Commercial refrigeration	2	13%
Cooling	1	6%
Non-commercial refrigeration	1	6%
LED Lighting	1	6%
Oven	1	6%
Boiler	1	6%
Total	16	100%

2014 Business Express Survey Data n=16

As shown in Table 3-5, the most mentioned reason for not applying for a rebate for an energy-efficiency measure was the respondent did not know it could apply for a rebate (43%), or they did not think the equipment qualified (28%).

Most of this equipment (88%) was not recommended by the Express Program assessment. One-third (5 respondents) said the program was significant (rating of 8, 9 or 10) in their decision to install the equipment.

Table 3-5. 2014 Equipment Installed Outside the Program

Reason for Not Participating in an AEP Program	Percent
Didn't know that I could	43%
Didn't qualify for the program	28%
Bought equipment before the Program	7%
Other	4%
Total	100%

2014 Business Express Survey Data n=14

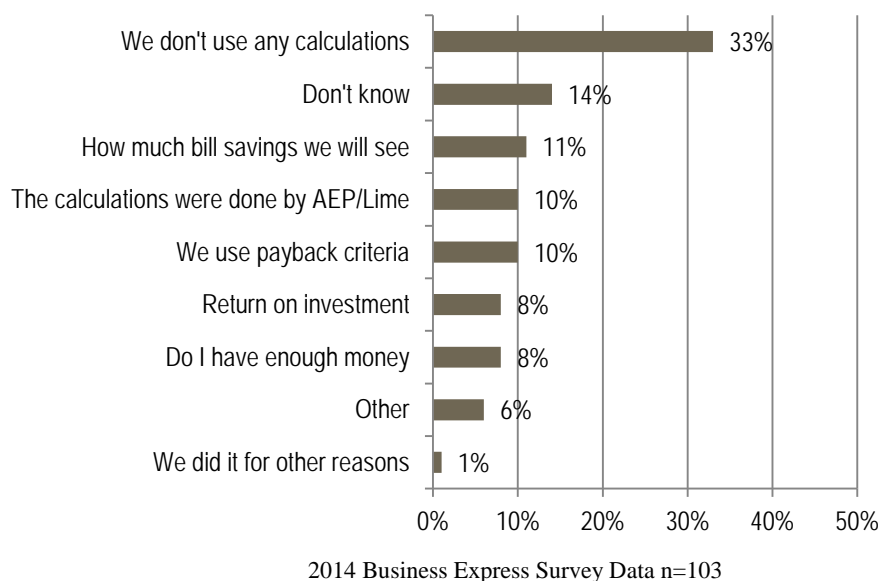
3.3.5.8 Financial Criteria and the Influence on Program Participation

Survey respondents were asked a series of questions about the financial criteria their organization uses in making decisions to install equipment like the program measures. One-third of these smaller customers said they did not use any calculations (33%). Fourteen percent reported they did not know what calculations were made, and eleven percent used estimated bill savings as a decision criteria. Ten



percent said they used payback calculations, eight percent said they used return on investment or made the decision based on whether they had the money. These results are presented in Figure 3-14.

Figure 3-14. 2013 Financial Calculation Used



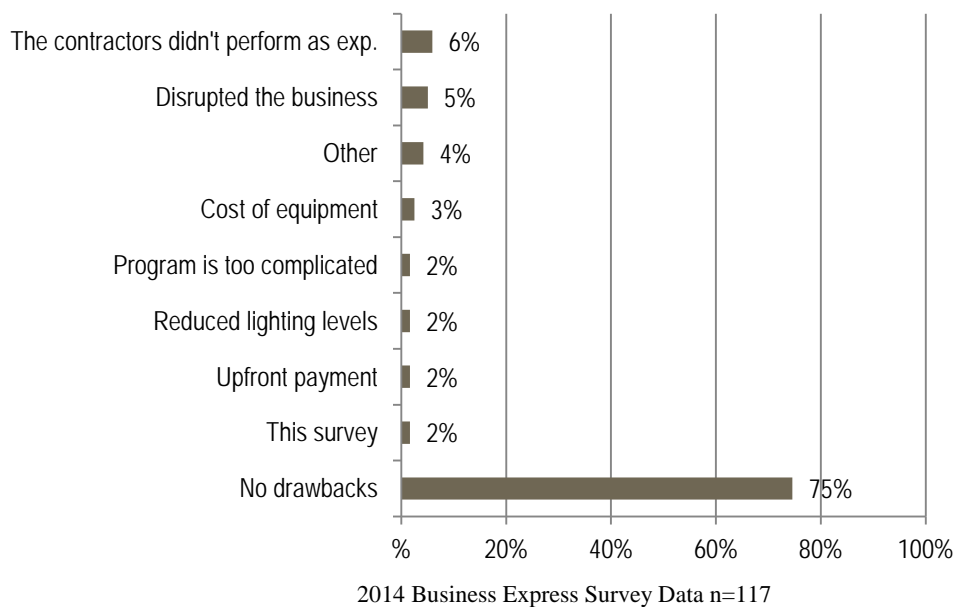
Thirty-one percent of program participants took advantage of the free financing option. Of those who accepted the loan option, two-thirds would not have participated in the Express Program without the loan. In addition, 11 percent of those who did not choose the loan option said they would not have participated in the Express Program without the possibility of a loan.

3.3.5.9 Program Drawback and Barriers

Survey respondents were asked to list the drawbacks of the program. Seventy-five percent of them could not think of any program drawbacks. Six percent of respondents mentioned their contractors did not perform as expected, five percent said the program disrupted the business, four percent gave other reasons, and three percent said the upfront cost of the equipment was a program barrier. Two percent mentioned the participant survey was a program drawback. These results are presented in Figure 3-15.



Figure 3-15. 2014 Business Express Program Drawbacks

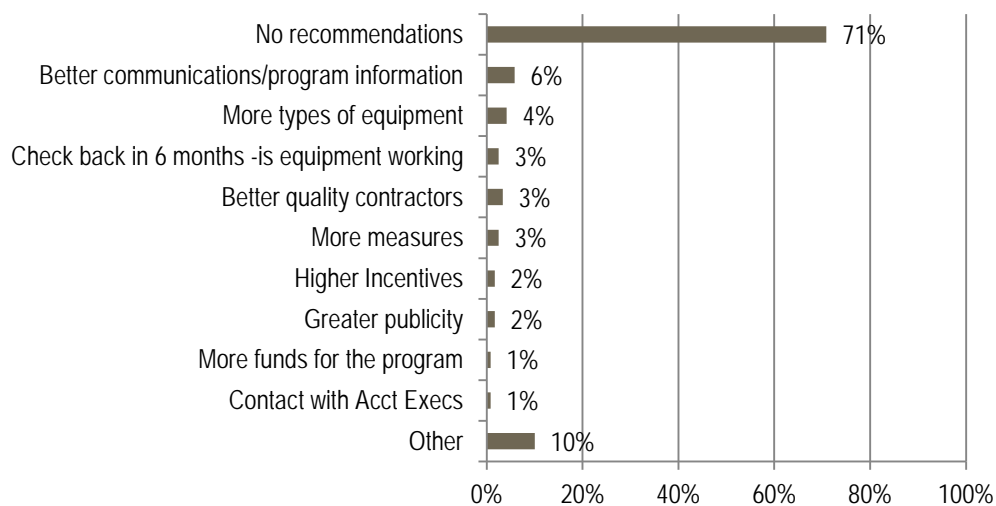




3.3.5.10 Program Improvement Ideas

As shown in Figure 3-16, customers offered ideas for improving the program. Seventy-one percent of program participants were not able to offer any ideas for improving the program. Of those who answered the question, better communications and information was the top rated idea (6 percent), followed by more type of equipment (4 percent) and a six-month call-back to verify the equipment is working (3 percent).

Figure 3-16. 2014 Business Express Program Improvements



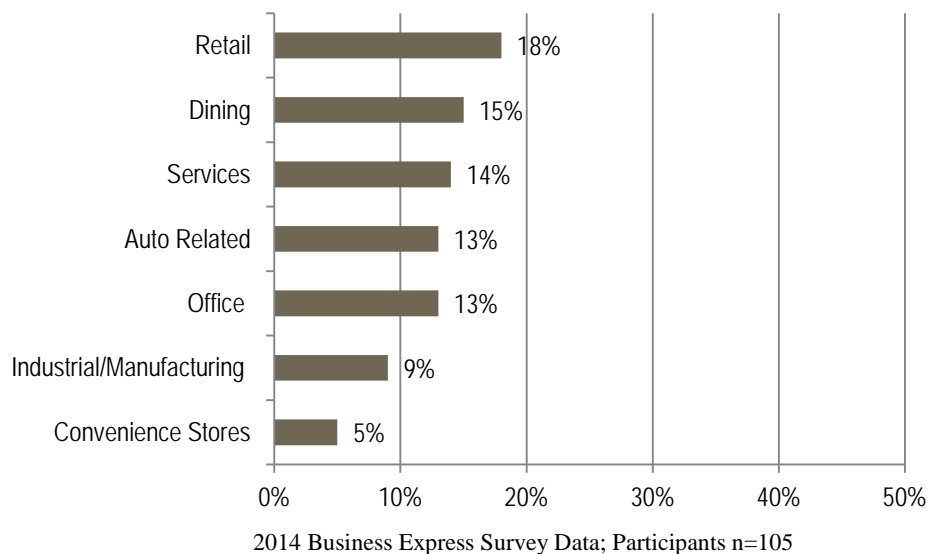
2014 Business Express Survey Data n=120

3.3.5.11 Firmographics

The largest percentage of customers in the sample were from retail firms (18%), followed by dining (15%), services (14%), auto related organizations (13%), and offices (13%). Nine percent of the respondents reported they were in the industrial sector, while five percent were convenience stores. Only those sectors representing five percent or more of the sample are shown in Figure 3-17, excluding 13 percent of the respondents.

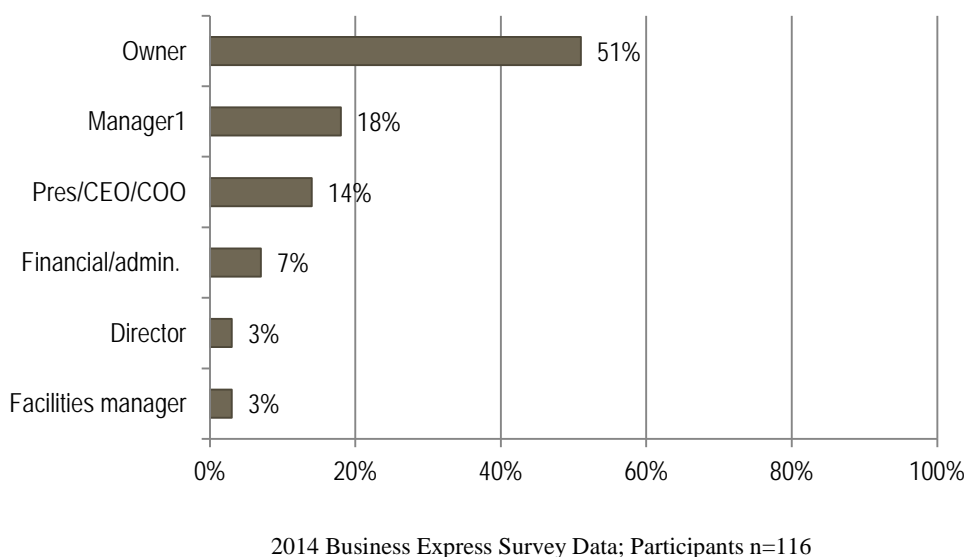


Figure 3-17. 2014 Customer Sectors



The majority of business types for the participant sample of Express customers were owners of the firm (51%). Eighteen percent reported their title as Manager, while 14 percent said they were the President, CEO, or COO. The respondents to the survey were clearly a decision maker within their organization as shown in Figure 3-18.

Figure 3-18. 2014 Title of Respondent





The square footage for the buildings ranged from 100 square feet to 100,000 square feet with an average of size of almost 8,300 square feet. The building ages ranged from three years old to 150 years old, with an average age of about 49 years.

Fifty-nine percent of the participating businesses reported fewer than five employees while 27 percent reported from 5 to 25 employees. Four percent reported from 25 to 40 employees; no customers in our sample reported more than 40 employees.



3.4 Cost Effectiveness Review

This section addresses the cost effectiveness of the Express Program for Small Business Customers. Cost effectiveness is assessed through the use of the Total Resource Cost (TRC) test. Table 3-6 summarizes the unique inputs used in the TRC test.

Table 3-6. Inputs to Cost-Effectiveness Model for Express Program

Item	
Average Measure Life	15
Projects	567
Annual Energy Savings (kWh)	5,252,989
Coincident Peak Savings (kW)	1,605
Third Party Implementation Costs	175,565
Utility Administration Costs	200,251
Utility Incentive Costs	1,580,085
Participant Contribution to Incremental Measure Costs	2,912,075

Based on these inputs, the TRC ratio is 1.4. Therefore; the program passes the TRC test. Table 3-7 summarizes the results of the cost-effectiveness tests. Results are presented for the Total Resource Cost test, the Ratepayer Impact Measure Test, and the Utility Cost Test.

Table 3-7. Cost Effectiveness Results for the Express Program for Small Business

Test Results	
Total Resource Cost	1.4
Participant Cost Test	2.5
Ratepayer Impact Measure	0.6
Utility Cost Test	2.3

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 from Program Year 2014

The 2014 Express Program evaluation resulted in eight primary conclusions:

1. **Overall, the Express Program is running smoothly.** The Express Program has many positive attributes and remains an important component of business sector customer offerings. Hard-to-reach customers are the primary participants in the program, and customers continue to be highly satisfied with both the program and AEP Ohio. From conversations with AEP Ohio program staff and the implementation contractor, a culture of continuous improvement has been fostered, and a willingness to improve quality control is evident. The Express Program has successfully added refrigeration measures as a program offering.
2. **Program tracking data continues to be very good.** Description of algorithms and program documentation is thorough and complete. The evaluation team's review of savings calculations found no errors in algorithms and all relevant fields sufficiently populated. However, the evaluator did not address whether the tracking system is adequate for regulatory prudency reviews or corporate requirements.
3. **The realization rate (defined as verified *ex post* savings divided by *ex ante* reported savings) is 73 percent for energy savings, and 90 percent for demand savings.** There are myriad drivers of the realization rate, which stem from the parameter estimates to contractor installation issues, which create a compounding effect.
4. **Auditor training increased in 2014.** The implementation contractor hired and trained more knowledgeable Energy Advisors. As the first contact with the customer and the person who determines what will be implemented, the Energy Advisor is important to the success of the program. It is in the customer's best interest that the Express Program provides a thorough analysis of lighting options, especially with the newer technologies available. Efforts to better estimate hours of use and ensure that fixtures installed onsite have improved from 2013 significantly.
5. **Some customers were likely to report dissatisfaction with the Express Program because of low savings levels after installation of the energy saving equipment, or from poor contractor program delivery.** The proportion of program participants who reported these issues was comparatively small. Another issue reported by a few customers was that their business was disrupted during project installation.
6. **Customers reported that personal contact is the most common way to first hear about the program,** including visits from AEP Ohio, the implementation contractor staff, or word of mouth. Sixty-nine percent of customers heard about the program from a personal contact.



7. **Return visits to finish installation were common.** According to customers, 59 percent of the installation contractors needed more than one day's work to complete the installation. Over one-third of the contractors (38%) had to return because of not having all the materials to complete the job, or the job was too much work to finish in one day (35%). Survey respondents reported that 17 percent of contractors returned after the equipment was initially installed to correct work that needed to be redone. Ten percent of respondents said the contractor had to return because of special circumstances, such as the presence of children in a day care center.
8. **Customers are installing additional equipment outside of the program.** Thirteen percent of the survey respondents installed additional energy-efficient equipment in their facility after participating in the program. Thirty-one percent of the extra equipment installed outside of the program was lighting fixtures, 13 percent commercial refrigeration, and 25 percent other types of equipment. These customers did not attempt to further participate in the Express Program because they did not know they could, and because they believed the equipment did not qualify for the program.

4.2 Recommendations for Program Improvements

The 2014 evaluation resulted in eight main recommendations:

1. **Build additional expertise in refrigeration retrofits projects and expand the program to include additional measures.** This includes a wider variety of lighting and refrigeration measures, and also potentially heating, ventilation and air conditioning (HVAC), variable frequency drives (VFDs), and other complex measures, so that comprehensive energy savings can be realized for small business customers. It is important to educate auditors and staff so that they can provide credible estimates of energy savings and coordinate installation contractors for these measures.
2. **Explore additional LED measures,** such as linear LEDs, that can be used in lieu of more traditional T8 lamps and ballasts for T12 retrofits projects. There is additional energy and demand savings beyond T8s, and Navigant found that customers are responding well to these new products. It is important to ensure contractors are trained and knowledgeable in the installation procedures for these products.
3. **Refine auditor processes to ensure consistent and accurate impact parameter estimates.** This includes estimating hours of use as accurately as possible, capturing HVAC system type for interactive effects, ensuring baseline fixtures match deemed wattages, and capturing existing burnouts. Lighting and refrigeration parameters should mirror the values used in the Prescriptive Program, which are the results of years of research on similar measures, rather than the New York Technical Reference Manual values, where appropriate. Baseline wattage for T12 fixtures should be explored further.
4. **Improve performance of installation contractors who are not prepared, trained, and performing quality work,** and identify and provide feedback to the contractors who are not living up to their contractual obligations and representing AEP Ohio in a professional manner. Although program participants were generally pleased with their contractors for making an appointment and having



the correct materials to complete the installation, one concern is the 17 percent of contractors who had to return to the job site to correct work. Of the contractors that had to return to the customers' facilities, 38 percent did not have all the materials they needed to complete the job, pointing to problems with the aggregator whose job is to guarantee that all the needed materials are on the pallet for every job. The implementation contractor should identify and not retain those contractors who are not meeting customer needs

5. **Explore the installation contractor's role in the program further.** Navigant recommends installation contractors are included in the evaluation of the Express Program in 2015 to further understand potential barriers. Explore the reason for the delay between measure installation and project completion and potential solutions.
6. **Manage customer expectations for energy savings.** The implementation contractor should create a process and/or collateral materials to explain to customers when the report is generated that their situation may not result in large amounts of energy, or by proxy cost savings.
7. **Create additional marketing opportunities.** Most customers reported they first heard about the program via some type of personal contact. The implementation contractor should encourage, and possibly reward, personal recommendations and should make sure every contact contains program information. The implementation contractor and AEP Ohio should leverage this marketing channel to focus on other marketing channels to ensure the program meets goals.



Appendix A Fixed Effect Regression Model

This Appendix provides a detailed description of the fixed effects regression model used to develop savings from the billing data.

A.1 Data Cleaning

The 2014 tracking database included 567 completed projects, 133 completed pipeline projects, 103 pending projects, and 245 projected projects, for a total of 1,048 projects. Multiple projects tied to a single premise were combined for the purpose of the regression analysis. Usage data for bill accounts that were active at the time of participation were combined for all premises tied to a single project.⁹

Navigant excluded projects from the analysis if any of the following criteria were met:

1. Projects with negative usage values in at least one bill (3 projects)
2. Projects with both completed and pipeline work (13 projects)
3. Navigant combined estimated bills (those with read codes equal to E, EF, ET, H, HF, J, M, MF, and SR) with the following bill with an actual reading. Navigant excluded observations from the analysis if any of the following criteria were met:
 4. The account number differed from the account number at the time of participation, indicating the tenant had changed
 5. The observation occurred during the period that the work was being done (between the *workbegindate* and *workcompletedate*)
 6. The observation corresponded to a bill cycle that ended prior to 2013
 7. The billing record was a duplicate
 8. The bill period was less than 20 or greater than 75 days in length
 9. The billing usage was determined to be an outlier, defined as greater than 100 times the median usage or less than one-hundredth the median usage
10. Observations for pipeline projects after the project work began
11. The regression analysis included usage data from 779 projects

⁹ Usage data was combined by the month and year of the bill read date, due to differences in billing cycles for multiple accounts tied to a single project.



A.2 Regression Analysis

Navigant estimated a fixed effects regression model in which pipeline participants and participants that enter the program later in the year serve as controls for participants that enter earlier in the year. The regression model takes advantage of the differential timing of program enrollment to identify program savings. The model essentially takes the perspective that the best comparison group for participants consists of those customers that enroll in the program in a later period. Use of fixed effects accounts for customer-specific characteristics that do not change over time, such as square footage of the premise.

The evaluation team expects slight seasonal variation of savings due to the interaction effects between lighting and the HVAC system. To account for the seasonality of savings, Navigant included seasonal binary variables. Seasonal binary variables allow energy usage to vary by season without impacting the overall savings estimate. These variables are sufficiently flexible to capture the effects of changes in weather and other factors that change by season, such as extended business hours during a holiday season. Program savings are estimated through the use of a statistically adjusted engineering (SAE) model, which incorporates the ex ante claimed savings for each project into the regression. Formally, the regression equation is given by:

Equation 1

$$ADU_{it} = \alpha_i + \beta_s * SeasonYear_{st} + \gamma_s * ClaimedSavings_i * Post_{it} + \epsilon_{it}$$

Where i indicates the premise, t indicates the bill period, s indicates the season-year, j indicates the season, and

ADU_{it}	= Average daily usage (kWh) for premise i in period t
α_i	= The constant term ("fixed effect") for premise i
$SeasonYear_{st}$	= A series of binary variables taking a value of 1 if period t is in season-years. The eight seasons include spring 2013 through winter 2015. Winter 2013 is the baseline season because it is the first complete season of the analysis period.
$ClaimedSavings_i$	= A variable indicating the claimed savings for premise i as a result of participating in the program. This value has been converted to an average daily savings for analysis purposes.
$Post_{it}$	= A binary variable taking a value of 1 if the measure has been installed at premise i prior to period t .
ϵ_{it}	= The model error for participant i in period t . Standard errors are clustered to account for heteroskedasticity and autocorrelation at the participant level.
β_s, γ_s	= Model parameters

Seasons are defined by the following cut-off dates:

Winter	January 1 – March 31
Spring	April 1 – June 30
Summer	July 1 – September 30
Fall	October 31 – December 31



Annual savings for each project are calculated as the estimated realization rate times the annual claimed savings for each project in the Express Program. The estimated realization rate is an output of the regression model, and is denoted as γ_s in the preceding equation.

Parameter estimates are given in Table A-1. As expected, the parameters for variables involving post are negative: usage decreases after program measures have been installed. T-statistics greater than 1.64 indicate that the parameter is statistically significantly different from zero at the 90 percent confidence level. In particular, note that the post savings parameter, representing the estimated realization rate, is statistically significant.

Table A-1. Regression Model Parameter Estimates, Equation 1

Variable	Coefficient	Standard Error	T-Statistic
Post * Claimed Savings	-0.727	0.080	-9.12
Spring 2013	-3.689	1.671	13.66
Summer 2013	38.839	2.843	-5.59
Fall 2013	-10.403	1.861	-4.85
Winter 2014	-13.359	2.753	-4.68
Spring 2014	-9.161	1.956	10.84
Summer 2015	32.064	2.957	-5.59
Fall 2014	-12.182	2.180	-2.34
Winter 2015	-6.946	2.963	-9.12

Source: Navigant analysis



Appendix B Customer Interview Instrument

2014 AEP OHIO BUSINESS PROGRAMS –EXPRESS PROGRAM PARTICIPANT SURVEY February 2015

INTRODUCTION

Hello, this is _____ from Blackstone Consulting calling on behalf of AEP Ohio. This is not a sales call. May I please speak with <SiteContactNameFirst> <SiteContactNameLast>?

Our records show that <CustomerName> purchased <MeasDesc1-3?>, which was/were installed on or about <WorkCompleteDate>. The cost of the work was reduced by incentives from AEP Ohio to the contractor. We are calling to do a follow-up study about <CustomerName>'s participation in this program, which is called the AEP Ohio Express Program. I was told you are the person most knowledgeable about this project. Is this correct? [IF NOT, ASK TO BE TRANSFERRED TO THE MOST KNOWLEDGABLE PERSON OR RECORD NAME & NUMBER].

This survey will take about 20 minutes. Is now a good time?

- I1 1 YES
- 2 NO, NOW IS NOT A GOOD TIME (SCHEDULE CALL-BACK)
- 3 NO, NOT INTERESTED IN PARTICIPATING (TERMINATE)

SCREENING QUESTIONS

A1 Just to confirm, during 2014 did <CustomerName> install energy efficient equipment through AEP Ohio's Express Program at <CustomerAddr1>, <CustomerCity>, Ohio? (IF NEEDED: This is a program where the program implementer assessed your lighting and other equipment and proposed a scope of work for energy efficient equipment, and later installed this equipment at your business.) Our records show you installed <MeasDesc1>, <MeasDesc2> and <MeasDesc3> at <CustomerName>. (DO NOT READ)

- 1 YES, PARTICIPATED AS DESCRIBED
- 2 YES, PARTICIPATED BUT AT ANOTHER LOCATION
- 3 NO, DID NOT PARTICIPATE IN PROGRAM
- 00 OTHER, SPECIFY
- 98 DON'T KNOW
- 99 REFUSED

[SKIP A2 IF A1=1, 2]

- A2 Is it possible that someone else dealt with the energy-efficient product installation? (DO NOT READ)
- 1 YES, SOMEONE ELSE DEALT WITH IT
 - 2 NO (THANK AND TERMINATE)
 - 00 OTHER, SPECIFY (THANK AND TERMINATE)
 - 98 DON'T KNOW (THANK AND TERMINATE)
 - 99 REFUSED (THANK AND TERMINATE)



[IF A2=1, ask to be transferred to that person and/or get contact name and phone number. If not available, thank and terminate. If available, go back to A1]

Before we begin, I want to emphasize that this survey will only be about the <MeasDesc1> you installed through the AEP Ohio Express Install Program at <CustomerAddr1> in <CustomerCity> in 2013.

A3 I'd like to confirm some information. Our records show that you installed <MeasDesc 1>, <MeasDesc 2> and <MeasDesc 3> through the Express Install Program. Is this correct?

- 01 YES (SKIP to S0)
- 02 NO
- 98 DON'T KNOW
- 99 REFUSED

A3_1 Is it possible that someone else dealt with the energy-efficient product installation? (DO NOT READ)

- 1 YES, SOMEONE ELSE DEALT WITH IT (ASK FOR TRANSFER AND/OR RECORD CONTACT NAME AND NUMBER AND GO BACK TO A1)
- 2 NO (THANK AND TERMINATE)
- 00 98 DON'T KNOW (THANK AND TERMINATE)
- 99 REFUSED (THANK AND TERMINATE)

HEARD ABOUT PROGRAM

S0 How did you first hear about the Express Install Program? Was it from: (READ LIST UNTIL R CHOOSES AN ANSWER) (SP TEAM: PLEASE PLACE ANSWER CHOICES IN ALPHABETICAL ORDER, ANCHOR "OTHER", "DON'T KNOW" & "REFUSED" AT THE BOTTOM OF THE LIST)

- 1 AEP Ohio auditor (LIME contractor)
- 2 Registered express contractor
- 3 AEP Ohio website
- 4 Workshop/training
- 5 E-mail
- 6 Friend/colleague/word of mouth
- 7 Bill insert
- 8 Speaker/presentation at an event
- 9 Newsletter
- 10 Vendor
- 11 AEP Ohio /contractor visit
- 12 Supplier
- 13 AEP Ohio account representative
- 97 Other, specify (record open end)
- 98 Don't know
- 99 Refused

CONTRACTOR AND PROPOSAL MODULE



S1 How would you rate your satisfaction with the energy efficiency assessment conducted by the contractor at your business site? Please use a scale from 0 to 10, where 0 is “not at all satisfied” and 10 is “completely satisfied”? [SCALE 0-10; 98=Don’t know, 99=Refused] (SP TEAM: PRESENT AS GRID).

S2 How would you rate your satisfaction with the proposal prepared for you by the Express Program? Please use a scale from 0 to 10, where 0 is “not at all satisfied” and 10 is “completely satisfied”? [SCALE 0-10; 98=Don’t know, 99=Refused] (SP TEAM: PRESENT AS GRID).

S3a Was the proposal clear about the scope of work to be performed?

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

[ASK S3b IF S4a=2]

S3b Why not? (DO NOT READ)

- 1. TOO MUCH DETAIL (EXPLAIN, RECORD OPEN END ____)
- 2. TOO LITTLE DETAIL (EXPLAIN, RECORD OPEN END ____)
- 3. COSTS UNCLEAR
- 4. RESPONSIBILITIES NOT CLEAR
- 00. OTHER, SPECIFY (RECORD OPEN END ____)
- 98. DON'T KNOW
- 99. REFUSED

S4 Was the proposal clear about your share of the project’s final cost?

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

S5 How would you rate AEP Ohio’s ability to deliver the proposed project? Please use a scale from 0 to 10, where 0 is “not at all able to implement” and 10 is “completely able to implement”? [SCALE 0-10; 98=Don’t know, 99=Refused] (SP TEAM: PRESENT AS GRID).

S6 Was the amount in the proposal the same amount on the invoice?

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

S6a. Why did the invoice and the proposal differ?

INTRODUCTION TO CONTRACTOR WORK



S6a1 Program schedulers arranged for a contractor to install your energy efficient equipment. Did the contractor who installed your equipment make an appointment?

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

S6a2 Did the contractor bring the correct materials for the project?

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

S6a3 Did the contractor need to return to your business to complete the installation?

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

IF YES ASK:

S6a4: Why did the contractor need to return to your business?

- 1 The job was too much work to finish in one day
- 2 He needed other materials to complete the project
- 3 He was slow
- 4 Other (specify _____)
- 8 DON'T KNOW
- 9 REFUSED

S6a Would you recommend the contractor who installed your equipment to others?

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

[ASK S6b IF S6a=2]

S6b Why not? (DO NOT READ LIST)

- 1 THE COMPANY IS TOO SMALL
- 2 NOT KNOWLEDGEABLE
- 3 POOR WORK QUALITY
- 4 POOR TIMELINESS/DIDN'T SHOW UP WHEN SCHEDULED



- 5 POOR EQUIPMENT SELECTION
- 6 SCHEDULING PROBLEMS
- 7 LEFT A MESS
- 00 OTHER, SPECIFY (RECORD OPEN END_____)
- 98 DON'T KNOW
- 99 REFUSED

B3 Was a post-installation inspection performed by AEP Ohio?

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

B4 **(ASK IF B3 = 1)** How would you rate your satisfaction with the post-installation inspection? Please use a scale from 0 to 10, where 0 is “not at all satisfied” and 10 is “completely satisfied”? [SCALE 0-10; 98=DON'T KNOW, 99=REFUSED] (SP TEAM: PRESENT AS GRID).

MEASURE MODULES

The following questions are about the **<MeasDesc1>** you installed through the Express Install Program.

IF MEASDESC_1 = “REFRIGERATION” GOTO REFRIGERATION MODULE – R0.

L0 When did you implement or install this project (IF NECESSARY, PROBE FOR BEST GUESS)

- a Month [Dropdown. Precodes for Jan through Dec., DK, REF]
- b Year [Dropdown. Precodes for 2011, 2012, 2013, 2014, DK, REF]

L1 Please briefly describe what lighting was installed through the Express Program. (IF NEEDED: WHAT TYPES OF LIGHTING WERE INSTALLED?) **[SELECT ALL THAT APPLY.] (DO NOT READ LIST) (SP TEAM: PLEASE PLACE ANSWER CHOICES IN ALPHABETICAL ORDER, ANCHOR “OTHER”, “DON'T KNOW” & “REFUSED” AT THE BOTTOM OF THE LIST)**

- 1 LINEAR FLUORESCENTS
- 2 CFL LIGHTING
- 3 LED LIGHTING
- 4 HID LIGHTING
- 5 EXTERIOR LIGHTING
- 6 CUSTOM DISPLAY OR SPECIALTY LIGHTING
- 7 LIGHTING CONTROLS (INTERIOR OR EXTERIOR)?
- 8 EXIT SIGNS
- 9 DELAMPING
- 10 OTHER, SPECIFY (____ RECORD OPEN END)
- 98 DON'T KNOW
- 99 REFUSED

L2 Was the new lighting equipment installed in an air conditioned or cooled space? (DO NOT READ)



- 1 YES
- 2 NO
- 3 SOME OF THE LIGHTING WAS AND SOME WASN'T
- 8 DON'T KNOW
- 9 REFUSED

LIGHTING CONTROLS

[ASK IF L1 = 7; ELSE GOTO NEXT SECTION]

L3 **Before** Lighting Controls were installed, about how many hours per day were the lights in operation? **[NUMERIC OPEN END; 0 TO 24; 98=Don't know, 99=Refused]** INTERVIEWER NOTE: **[IF THE RESPONDENT INDICATES THE NUMBER OF HOURS DIFFERED BY DAY, ASK FOR AN AVERAGE]**

- 1 ____ RECORD RESPONSE
- 98 DON'T KNOW
- 99 REFUSED

L4 **After** controls were installed, about how many hours per day were the lights in operation? **[NUMERIC OPEN END; 0 TO 24; 98=Don't know, 99=Refused]** INTERVIEWER NOTE: **[IF THE RESPONDENT INDICATES THE NUMBER OF HOURS DIFFERED BY DAY, ASK FOR AN AVERAGE]**

- 1 ____ RECORD RESPONSE
- 98 DON'T KNOW
- 99 REFUSED

L4a What percentage of **outdoor** lights received new controls? Would you say: (READ LIST)

- 1 None – Controls Are All Interior
- 2 Less than 25%
- 3 25% to Less Than 50%
- 4 50% to Less Than 100%
- 5 All Interior Lights (100%)
- 8 Don't Know
- 9 Refused

L4b What percentage of **interior** lights received new controls? Would you say: (READ LIST)

- 1 None – Controls Are All Exterior
- 2 Less than 25%
- 3 25% to Less Than 50%
- 4 50% to Less Than 100%
- 5 All Interior Lights (100%)
- 8 Don't Know
- 9 Refused

LOAN MODULE



LL1 Express Program participants were offered a 12 month interest-free financing option. Did you choose this program option?

- 1 YES
- 2 NO GO TO L0
- 8 DON'T KNOW GO TO L0
- 9 REFUSED GO TO L0

[ASK IF LL1 = 1]

LL2 Would you have decided to participate in the program if the interest free loan was not offered as part of the Express Program?

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

REFRIGERATION MODULE

[ASK IF MEASDESC1, 2 or 3 = 'REFRIGERATION' ELSE SKIP TO NEXT MEASURE MODULE OR GOTO N8]

Measure Loop

[Loop 1: ASK IF MEASDESC=?. Loop 2: ASK IF MEASDESC2=?. Loop 3: ASK IF MEASDESC3=?.]

[For Loop 2, replace "1" at the end of read-ins with "2"; for Loop 3, replace "1" with "3".]

The following questions are about the refrigeration equipment installed through the Business Express Program.

R0 When did you install the refrigeration equipment? (IF NECESSARY, PROBE FOR BEST GUESS)
A MONTH [PRECODES FOR JAN THROUGH DEC.]
B YEAR [PRECODES FOR 2010, 2011, 2012, 2013, 2014]

REMOVED EQUIPMENT

R1 What type of refrigeration equipment was replaced when you installed the new equipment through the Business Express Program? (DO NOT READ) (SP TEAM: ALPHEBATIZE LIST)

- 1 OLD STRIP CURTAINS
- 2 OLDER ANTI-SWEAT HEAT CONTROLLERS
- 3 STANDARD EFFICIENCY EVAPORATOR FAN MOTORS
- 4 OLDER ICE MAKER
- 5 OLDER CONTROLS
- 6 OLDER COMPRESSOR
- 7 OLDER CONDENSER
- 8 OLDER DISPLAY CASES OR WALK-IN EVAPORATOR
- 9 CASE LIGHTING UPGRADE
- 10 SAME EQUIPMENT, JUST NEWER
- 00 OTHER, SPECIFY [OPEN END]



96 NONE - NOT A REPLACEMENT [END OF MEASURE LOOP; GO TO NEXT MEASURE OR PY3 NET-TO-GROSS MODULE]

98 DON'T KNOW

99 REFUSED

R2 Approximately how old was the refrigeration equipment that was replaced by the new refrigeration equipment? Was it...

1 Less than 5 years old

2 Between 5 and 10 years old

3 10 to 20 years old

4 more than 20 years old

98 DON'T KNOW

99 REFUSED

[END OF REFRIGERATION MEASURE LOOP; GO TO N8]

PAYBACK BATTERY

I'd like to find out more about the payback criteria <CustomerName> uses for its investments.

N8 What financial calculations does **your organization** make before proceeding with installation of energy efficient equipment like this?

00 [RECORD VERBATIM]

98 DON'T KNOW

99 REFUSED



N9 What is the payback cut-off point you use, before deciding to proceed with such an investment? Would you say...?

- 1 0 to 6 months
- 2 7 months to 1 year
- 3 more than 1 year to up to 2 years
- 4 more than 2 years to up to 3 years
- 5 more than 3 years to up to 5 years
- 6 Over 5 years
- 8 DON'T KNOW
- 9 REFUSED

SPILOVER MODULE

Thank you for discussing the new **<MeasDesc1>** that you installed. Next, I would like to discuss any energy efficient equipment you might have installed outside of the program.

SP1 Since your participation in the Small Business Express Program, did you implement any additional energy efficiency measures at this facility or at your other facilities within AEP Ohio's service territory that did not receive incentives through any utility or government program?

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

[ASK SP2-SP5h IF SP1=1, ELSE SKIP TO S1a (Participation Process and Program Satisfaction Module)]

SP2 What was the additional measure that you implemented? (IF RESPONSE IS GENERAL, E.G., "LIGHTING EQUIPMENT", PROBE FOR SPECIFIC MEASURE. PROBE FROM LIST, IF NECESSARY.) (DO NOT READ UNLESS NECESSARY) **INTERVIEWER NOTE:** [IF MORE THAN ONE PROJECT ASK RESPONDENT TO THINK ABOUT THE MEASURE THAT COSTS THE MOST]

- 1 LIGHTING FIXTURES
- 2 LIGHTING CONTROLS
- 3 COOLING
- 4 NON-COMMERCIAL REFRIGERATION
- 5 OFFICE EQUIPMENT
- 6 COMMERCIAL REFRIGERATION
- 00 OTHER, SPECIFY _____
- 8 DON'T KNOW
- 9 REFUSED

SP5 I have a few questions about the additional measure that you installed. (If needed, read back measure: **<SP2 RESPONSE>**) [OPEN END]

- a. Why did you not receive an incentive for this equipment?
(RECORD VERBATIM)
- 8 DON'T KNOW



- 9 REFUSED
- b. Why did you not install this equipment through the Small Business Express Program?
(RECORD VERBATIM)
- 8 DON'T KNOW
- 9 REFUSED
- c. Please describe the size, type, and other attributes of this equipment.
(RECORD VERBATIM)
- 8 DON'T KNOW
- 9 REFUSED
- d. Please describe the efficiency of this equipment.
(RECORD VERBATIM)
- 8 DON'T KNOW
- 9 REFUSED
- e. How many did you install?
(RECORD VERBATIM)
- 8 DON'T KNOW
- 9 REFUSED

SP5f. Was this equipment specifically recommended by the Small Business Express Program Assessment?

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

SP5g. How significant was your experience in the Small Business Express Program in your decision to install this equipment, using a scale of 0 to 10, where 0 is not at all significant and 10 is extremely significant? **[SCALE 0-10; 98=Don't Know; 99=Refused] (SP TEAM: PRESENT AS GRID).**

[SKIP SP5h IF SP5g < 5 or = 98, 99]

SP5h. Why do you give it this rating? [OPEN END]

- 1 ____ (RECORD VERBATIM)
- 8 DON'T KNOW
- 9 REFUSED

STATE-WIDE EVALUATOR NON-RESIDENTIAL PARTICIPATION PROCESS AND PROGRAM SATISFACTION MODULE

I'd now like to ask you a few more general questions about your participation in the Express Install program.
[PLEASE RANDOMIZE S1A-S1D]

S1a. How satisfied were you with the reduced cost? Please use a scale from 0 to 10, where 0 is "not at all satisfied" and 10 is "completely satisfied"? **[SCALE 0-10; 98=DON'T KNOW, 99=REFUSED] (SP TEAM: PRESENT AS GRID).**



S1b. How satisfied were you with the expertise of the contractor? Please use a scale from 0 to 10, where 0 is “not at all satisfied” and 10 is “completely satisfied”? [SCALE 0-10; 98=DON’T KNOW, 99=REFUSED] (SP TEAM: PRESENT AS GRID).

S1c. How satisfied were you with the Sales presentation by the AEP Ohio representative? Please use a scale from 0 to 10, where 0 is “not at all satisfied” and 10 is “completely satisfied”? [SCALE 0-10; 98=DON’T KNOW, 99=REFUSED] (SP TEAM: PRESENT AS GRID).

S1d. How satisfied were you with the free energy assessment? Please use a scale from 0 to 10, where 0 is “not at all satisfied” and 10 is “completely satisfied”? [SCALE 0-10; 98=DON’T KNOW, 99=REFUSED] (SP TEAM: PRESENT AS GRID).

E 1. How satisfied were you with the energy efficiency level required to qualify for an incentive? Please use a scale from 0 to 10, where 0 is “not at all satisfied” and 10 is “completely satisfied”? [SCALE 0-10; 98=DON’T KNOW, 99=REFUSED] (SP TEAM: PRESENT AS GRID).

E 2. (ask only if E1 = 7 or lower) What would have made you more satisfied?

RECORD VERBATIM

98 DON’T KNOW

99 REFUSED

E 3. How satisfied were you with the measures offered by the program? Would you say you were Very Satisfied, Somewhat Satisfied, Neither Satisfied nor Dissatisfied, Somewhat Dissatisfied or Very Dissatisfied?

1	Very satisfied	SKIP TO E5
2	Somewhat satisfied	SKIP TO E5
3	Neither satisfied nor dissatisfied	
4	Somewhat dissatisfied	
5	Very dissatisfied	
88	DON’T KNOW	SKIP TO E5
99	REFUSED	SKIP TO E5

(ASK E4 IF E3 is equal to 3, 4 or 5; else SKIP to E5)

E 4. What would have made you more satisfied with the measures?

RECORD VERBATIM

98 DON’T KNOW

99 REFUSED

E 5. Have you noticed lower electricity bills since you installed your new (lighting?) measure?



1	YES	
2	NO	SKIP to E 7.
88	DON'T KNOW	
99	REFUSED	

E 6. Would you say your bill savings are...[READ LIST]

1	About what you expected
2	More than you expected
3	Less than you expected
88	DON'T KNOW
99	REFUSED

E 7. If you were rating your overall satisfaction with the AEP Business Express Program, would you say you were Very Satisfied, Somewhat Satisfied, Neither Satisfied nor Dissatisfied, Somewhat Dissatisfied or Very Dissatisfied?

1	Very satisfied	
2	Somewhat satisfied	
3	Neither satisfied nor dissatisfied	
4	Somewhat dissatisfied	
5	Very dissatisfied	
88	DON'T KNOW	SKIP TO BB1a
99	REFUSED	SKIP TO BB1a

E 8. Why do you give it that rating?

RECORD VERBATIM

98 DON'T KNOW
99 REFUSED

BENEFITS AND BARRIERS

BB1a What do you see as the main benefits to participating in the Express Program? [MULTIPLE RESPONSE, UP TO 3] (DO NOT READ) (SP TEAM: PLEASE PLACE ANSWER CHOICES IN ALPHABETICAL ORDER, ANCHOR "OTHER", "DON'T KNOW" & "REFUSED" AT THE BOTTOM OF THE LIST)

- 1 ENERGY SAVINGS
- 2 GOOD FOR THE ENVIRONMENT
- 3 LOWER MAINTENANCE COSTS
- 4 BETTER QUALITY/NEW EQUIPMENT
- 5 REBATE/INCENTIVE
- 6 IMPROVED SAFETY/MORALE
- 7 SET EXAMPLE/INDUSTRY LEADER
- 8 ABLE TO MAKE IMPROVEMENTS SOONER
- 9 SAVES MONEY ON UTILITY BILL



- 00 OTHER, SPECIFY
- 98 DON'T KNOW
- 99 REFUSED

BB1b What do you see as the drawbacks to participating in the program? [MULTIPLE RESPONSE, UP TO 3] (DO NOT READ)

INTERVIEWER NOTE: [IF THE RESPONDENT SAYS NO DRAWBACKS CONTINUE WITH THE NEXT QUESTION]

- 1 NO DRAWBACKS (**SKIP TO NEXT QUESTION R1**)
- 2 INCENTIVES NOT HIGH ENOUGH/NOT WORTH THE EFFORT
- 3 PROGRAM IS TOO COMPLICATED
- 4 COST OF EQUIPMENT
- POOR COMMUNICATION
- 7 TIME CONSUMING
- 00 OTHER, SPECIFY
- 98 DON'T KNOW
- 99 REFUSED

FEEDBACK AND RECOMMENDATIONS

R1 Do you plan to participate in other AEP Ohio programs in the future?

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

E23 Do you have any suggestions on how the Express Program could be improved? [MULTIPLE RESPONSE, UP TO 4] (DO NOT READ) (**SP TEAM: PLEASE PLACE ANSWER CHOICES IN ALPHABETICAL ORDER, ANCHOR "OTHER", "NO RECOMMENDATIONS", "DON'T KNOW" & "REFUSED" AT THE BOTTOM OF THE LIST**)

- 1 HIGHER INCENTIVES
- 2 MORE MEASURES
- 3 GREATER PUBLICITY
- 4 BETTER COMMUNICATION/IMPROVE PROGRAM INFORMATION
- 5 CONTACT/INFORMATION FROM ACCOUNT EXECUTIVES
- 6 LONGER TIME PERIOD TO COMPLETE PROJECT
- 7 BETTER REVIEW OF APPLICATIONS
- 8 SIMPLIFY APPLICATION PROCESS
- 9 ELECTRONIC APPLICATIONS
- 10 MORE FUNDS FOR THE PROGRAM
- 00 OTHER, SPECIFY (RECORD OPEN END)
- 96 NO RECOMMENDATIONS (**SP TEAM: PLEASE MAKE EXCLUSIVE**)
- 98 DON'T KNOW (**SP TEAM: PLEASE MAKE EXCLUSIVE**)
- 99 REFUSED (**SP TEAM: PLEASE MAKE EXCLUSIVE**)



E21 Finally, if you were rating your overall satisfaction with AEP Ohio, would you say you were Very Satisfied, Somewhat Satisfied, Neither Satisfied nor Dissatisfied, Somewhat Dissatisfied or Very Dissatisfied?

1	Very satisfied	
2	Somewhat satisfied	
3	Neither satisfied nor dissatisfied	
4	Somewhat dissatisfied	
5	Very dissatisfied	
88	DON'T KNOW	SKIP TO B 1
99	REFUSED	SKIP TO B 1

E22. Why do you give it that rating?
RECORD VERBATIM
98 DON'T KNOW
99 REFUSED

FIRMOGRAPHICS

Finally, I'd like to ask you few general questions about your company, specifically the facility at **<CustomerAddr1>**, **<CustomerCity>**.

B1 What is your job title or role? (DO NOT READ)

- 1 PROPRIETOR/OWNER
- 2 PRESIDENT/CEO
- 3 FACILITIES MANAGER
- 4 BUILDING / STORE MANAGER
- 5 ENERGY MANAGER
- 6 FACILITIES MANAGEMENT/MAINTENANCE POSITION
- 7 CHIEF FINANCIAL OFFICER
- 8 OTHER FINANCIAL/ADMINISTRATIVE POSITION
- 9 SALES STAFF
- 10 LESSOR
- 00 OTHER (SPECIFY)
- 88 DON'T KNOW
- 99 REFUSED

B2 Our records describe the facility at **<CustomerAddr1>** where **<CustomerName>** participated in the AEP Ohio Express Install Program as a **<FacilityTypeCd>**. Is this correct? (DO NOT READ)

- 1 YES **SKIP to B3AA**
- 2 NO
- 88 DON'T KNOW **SKIP to B3AA**
- 99 REFUSED **SKIP to B3AA**

B3A What is the principal activity or type of business that **<CustomerName>** conducts at this location? [IF NEEDED:] This may not be the main activity of your organization, but is the main activity that occurs at this location. For example, is it an office, a warehouse, a store?



[DO NOT READ LIST. RECORD ONE RESPONSE.] (SP TEAM: PLACE CHOICE 13 "OTHER INDUSTRIAL" IMMEDIATELY AFTER CHOICE 12. ANCHOR "MISCELLANEOUS", "DON'T KNOW" & "REFUSED" AT THE BOTTOM OF THE LIST)

- 1 OFFICE
- 2 RETAIL (NON-FOOD)
- 3 SCHOOL
- 4 GROCERY STORE
- 5 CONVENIENCE STORE
- 6 RESTAURANT
- 7 HEALTH CARE/HOSPITAL
- 8 HOTEL OR MOTEL
- 9 WAREHOUSE
- 10 PERSONAL SERVICE
- 11 COMMUNITY SERVICE/ CHURCH/ TEMPLE/MUNICIPALITY
- 12 INDUSTRIAL ELECTRONIC & MACHINERY
- 13 OTHER INDUSTRIAL
- 14 AGRICULTURAL
- 15 CONDO ASSOCIATION/APARTMENT MANAGEMENT
- 77 MISCELLANEOUS [RECORD VERBATIM]
- 88 DON'T KNOW
- 99 REFUSED

B3AA Does your organization own or lease the space at <CustomerAddr1>?

- 1 OWN
- 2 LEASE
- 3 OWN PART AND LEASE PART
- 98 DON'T KNOW
- 99 REFUSED

B4 What is the total square footage of the portion of the facility that you occupy at this location? Your best estimate will be fine.

RECORD RESPONSE (RANGE 1 TO 100,000)

9999998DON'T KNOW
9999999REFUSED

B5 How old is this facility? [NUMERIC OPEN END, 0 TO 150; 998=DON'T KNOW, 999=REFUSED]

RECORD RESPONSE IN YEARS (RANGE 0 TO 150)

INTERVIEWER NOTE: [PLEASE ASK THE AGE OF THE LARGEST USED SPACE] (IF ANYTHING LESS THAN A YEAR, TYPE IN 0.5)

- 998 DON'T KNOW
- 999 REFUSED



[ASK B6 IF B5=998]

- B6 Do you know the approximate age of the building? Would you say it is...? (READ LIST)
- 1 Less than 2 years
 - 2 2 to 4 years
 - 3 5 to 9 years
 - 4 10 to 19 years
 - 5 20 to 29 years
 - 6 30 or more years
 - 8 DON'T KNOW
 - 9 REFUSED
- B7 Which of the following best describes the facility? This facility is... (READ LIST)
- 1 <CustomerName>'s only location
 - 2 One of several locations owned by <CustomerName>
 - 3 The headquarters location of <CustomerName> with several locations
 - 8 DON'T KNOW
 - 9 REFUSED
- B8 About how many full-time employees work at the facility at <CustomerAddr1>? (READ LIST)
- 1 Less than 5
 - 2 6 to 25
 - 3 26 to 40
 - 4 Over 40
 - 88 DON'T KNOW
 - 99 REFUSED

Thank you for your participation in this survey. AEP will use this feedback to serve you better.



Appendix C Program Manager Guide

2014 AEP-Ohio Evaluation for the Business Express Program Program Staff and Implementer In-Depth Interview Guide

Respondent name:	
Respondent phone number:	
Respondent title:	
Respondent type: (circle one:)	
Date:	

[Note to Reviewer] The Interview Guide is a tool to guide process evaluation interviews with utility staff and implementation contractors. The guide helps to ensure the interviews include questions concerning the most important issues being investigated in this study. Follow-up questions are a normal part of these types of interviews. Therefore, there will be sets of questions that will be more fully explored with some individuals than with others. The depth of the exploration with any particular respondent will be guided by the role that individual played in the program's design and operation, i.e., where they have significant experiences for meaningful responses. The interviews will be audio taped and transcribed.

Introduction

Hi, may I please speak with [NAME]?

My name is ____ and I'm calling from Navigant Consulting, we are part of the team hired to conduct an evaluation of AEP Ohio's Business Express Program. We're conducting interviews with program managers and key staff in order to improve our understanding of AEP-Ohio's programs. At this time we are interested in asking you some questions about the Business Express program. The questions will only take about a half hour. Is this a good time to talk? [IF NOT, SCHEDULE A CALL BACK.]

Ok, great. If you don't mind, I would like to do a voice recording our conversation to speed up the note taking. Is that OK? I'm going to switch you to speaker phone. I am in an enclosed, private office.

Roles and Responsibilities

1. Briefly summarize your role in the Business Express Program. What are your main responsibilities?



2. Please explain who is involved in the program implementation, and what their roles are? *[Probe for all significant actors with responsibility in program delivery including implementer, the Registered Express Contractors and installation contractors.]*
3. What are the formal and informal communication channels between AEP Ohio and KEMA? Do you feel information is shared in a timely manner on this program?
4. Are there any documents that outline the roles and responsibilities of program staff and the Registered Express Contractors (RECs) for the Business Express Program? May I review a copy of this document?

Overall Goals and Objectives

5. What is the first year goal for the Business Express Program? Participation? Savings?
6. Outside of the quantitative goals (e.g., \$, \$/kWh, savings and participation rates), in your own words, what are the key objectives of this program?
7. According to these metrics, did the program meet the 2011 goals? Why or why not?

Marketing and Participation

8. Could you briefly describe the process for participation in the program from the customer perspective?
9. Is the marketing effort sufficient to meet current and future program participation goals?
10. What type of support is the program providing to program partners, the Registered Express Contractors (RECs)?

Is it sufficient? Do they need more training?

11. What is the feedback on the training they receive now?
12. How thoroughly do RECs cover the AEP Ohio service territory?
13. What customer market segments participate in the program?
14. Do you collect data on customer market segments on the application? Why not?
15. How many customers agree, on average, to the walk through audit?
16. How many customers agree to implement the energy saving equipment?
17. Is the program outreach to RECs or customers effectively increasing awareness of the program opportunities?
 - a. What is the format of the outreach? Does it differ for each REC?
 - b. How often does the outreach occur?
 - c. Are the messages within the outreach clear and actionable?



18. Are you considering using social media or Internet advertising to market this program?

Program Characteristics and Barriers

19. Overall, do you have a sense of how satisfied program participants are with various aspects of the program?

20. How do participants perceive the incentives and costs related to this program?

- a. Are customers satisfied with the program incentives to sustain participation goals?
- b. Should the budget allocation between incentive spending and marketing spending be adjusted to meet participation and savings goals?
- c. Are there particular program characteristics that could be changed to improve customer satisfaction while maintaining program effectiveness?

21. What are key barriers to participation in the program for eligible customers who do not participate, and how can these be addressed by the program?

22. What are key barriers to REC participation in the program, and how can these be addressed by the program? Are there plans to expand REC participation in 2012?

23. Are drop-outs an issue? When do participants drop out? What causes participants to drop out of the program? Do you consider a customer that does not implement the proposed EE equipment a partial dropout?

Administration and Delivery

24. Has the program, as implemented, changed from the original plan?

If so, how, why, and was this an advantageous change?

25. Approximately what percent of all projects are pre-inspected and post-inspected?

Who determines if a project requires inspection? How?

26. Who conducts pre and post inspections and how are they documented?

Have these been implemented in a manner consistent with program design?

Do these procedures present their own implementation barrier? (KEMA?)

27. Who initiates the program participation?

Does the customer approach the REC or does the REC approach the customer?

28. Are the program processes effective for smoothly providing incentives to customers and motivating the RECs to participate?

Program tracking and data management

Training for on-line data system – feedback?



Internal program communications

Program staffing

29. What determines how much of the project cost is incented?

Does the customer get an estimate of how much his share will be before he decides to participate in the program?

Program Improvement

30. What are the opportunities for program improvement?

31. Do you have any other comments or suggestions for us?

Thank you very much for taking the time in assisting us with this evaluation. Your contribution is a very important part of the process.

We might follow-up with you by phone later, if additional questions arise.

APPENDIX N



RETROCOMMISSIONING PROGRAM

2014 Evaluation Report

Prepared for:
AEP Ohio



May 9, 2015

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Executive Summary

This document presents a summary of the findings and results from the evaluation of the 2014 Retrocommissioning (RCx) Program implemented by AEP Ohio for the program year January 1, 2014 through December 31, 2014.¹ This report is the second annual evaluation of the program. Following 2014, AEP Ohio has decided to change implementation contractors. Therefore, observations with respect to program operations can be considered “lessons learned” or “problems to avoid” for the new 2015 program implementation contractor.

ES.1 Program Summary

Retrocommissioning helps commercial and institutional customers improve the performance and reduce energy consumption of their facilities through the systematic evaluation of *existing* building systems. AEP Ohio offers incentives to defray the cost of the study if measures with a payback period of 24 months or less are implemented. These low- and no-cost measures improve system operations, reduce energy use and demand, and, in many cases, improve occupant comfort. The RCx Program aims to streamline the typical retrocommissioning process in order to facilitate implementation of projects that yield savings with low costs of documentation and investigation.

ES.2 Program Participation

The AEP Ohio Retrocommissioning Program is two-tiered, based on facility floor area² and on-peak demand. Retrocommissioning Lite is offered to facilities between 50,000 and 150,000 square feet and minimum peak demand greater than 125 kW. Retrocommissioning Comprehensive is offered to facilities larger than 150,000 square feet and minimum peak demand of 500 kW. In 2014, the RCx Program had 27 projects, of which eleven were RCx Comprehensive. Implemented measures were mostly improved equipment scheduling. Table ES-1 provides a summary of 2014 Retrocommissioning Program reported results.

Table ES-1. 2014 Retrocommissioning Program Projects, Measures, and Ex Ante Savings

Metric	RCx Comprehensive	RCx Lite	Ex Ante Reported
Number of RCx Projects	11	16	27
Number of Measures	31	20	51
Annual Energy Savings (MWh)	3,225	1,292	4,517
Peak Demand Savings (kW)	189.6	145.0	334.6

Source: Evaluation analysis of AEP Ohio tracking data from February 11, 2015

¹ 2014 participation is based on incentive payments mailed to participants dated between January 1, 2014 and December 31, 2014.

² Size-based tiers are guidelines. AEP Ohio may assign projects to either program track based on project particulars.



Among the 27 projects submitted, there were fourteen unique customers. Several school districts submitted multiple projects for different schools in respective districts. Nine different Retrocommissioning Service Providers (RSPs) conducted studies through the program in 2014.

ES.3 Data Collection Activities

Table ES-2 provides a summary of data collection activities for the 2014 Retrocommissioning Program impact and process evaluations.

Table ES-2. Data Collection Activities for 2014 Retrocommissioning Program Evaluation

Data Collection	Targeted Population	Sample Frame	Sample Design	Sample Size	Timing
Tracking Data Analysis	Retrocommissioning Program projects approved for payment for 2014	AEP Ohio Tracking Database	-	All	November 2014 to April 2015
In-depth Interviews	AEP Ohio Program Staff	Contact from AEP Ohio	Business Programs Manager and Retrocommissioning Program Manager	2	January 2015 to March 2015
In Depth Interviews	Retrocommissioning Program Participants (n=14)	Tracking Database	Sample of Retrocommissioning Program Participants	6	March 2015 to April 2015
Application File Review	2014 Retrocommissioning Program Participants	Census by Track	Stratified Random Sample by Track & Project-Level kWh	24	February 2015 to April 2015
Follow-up / On-site Verification	Application File Review Sample	Application File Review Sample	Key issue sites	6	February 2015 to March 2015

Source: Evaluation activities conducted from October 2014 through April 2015.

ES.4 Key Evaluation Findings and Recommendations

Key Impact Findings and Recommendations

The impact results for the 2014 Retrocommissioning Program are shown in Table ES-2, including: the *ex ante* savings claimed by the program, the evaluated savings, and the 2014 realization rates. The realization rates for 2014 were 64% for energy and 70% for demand savings. In 2014, the program achieved 2,908 MWh *ex post* energy savings and 0.235 MW peak demand savings. Reasons for adjustments to savings estimates were varied.

- Inadequate documentation of the baselines
- Flawed engineering analysis or verification steps
- Unreasonable assumptions



- Mis-calibrated energy simulations of proposed savings
- Adjustments to set points and schedules based on on-site or follow-up evaluation research

The impact results for the 2014 Retrocommissioning Program are shown in Table ES-3.

Table ES-3. Savings Estimates for the 2014 Retrocommissioning Program

	2014 Program Goals ¹ (a)	<i>Ex Ante</i> ² Savings (b)	Evaluated Savings (c)	Realization Rate RR = (c) / (b)	Percent of Goal = (c) / (a)
Energy Savings (MWh)	7,305	4,517	2,908	64%	40%
Demand Savings (MW)	1.495	0.335	0.235	70%	16%

Sources: ¹AEP Ohio Volume 1: 2012 TO 2015 Energy Efficiency/Peak Demand Reduction (EE/PDR) Action Plan, November 29, 2011. ²Evaluation analysis of AEP Ohio tracking data from February 11, 2015.

The 2014 Retrocommissioning Program impact evaluation resulted in several findings and recommendations. Most findings are repeated from the 2013 program evaluation, as these were not addressed by the implementation contractor.

1. **Finding:** The 2014 *ex post* savings fell short of goals. The number of projects fell short of anticipated participation (50), and the savings per project was lower. Some projects did not have the depth of analysis required to identify more savings. Some accrued savings were not accounted for using the estimating methods of some service providers.

Impact Recommendation #1: Expand program outreach to school districts, colleges, and other multi-site entities to increase participation levels.

Impact Recommendation #2: Recruit more RCx Comprehensive participants through trade organizations, such as the Building Owners and Managers Association (BOMA) or the Ohio Hospital Association (OHA). Even large industrial customers frequently have significant office space that may qualify for retrocommissioning services.

Impact Recommendation #3: Encourage more thorough and complete inspections and analysis to identify more available savings.

2. **Finding:** The tracking database content is lagging the program. Retrocommissioning is a process that unfolds over a period of time. Energy efficiency measures are added, modified and deleted through this process. Tracking measures, investigation, and savings calculations can be difficult.

Impact Recommendation #4: Place higher priority on keeping tracking systems current and accurate. Delete database fields that will not be used, or back populate those fields to increase their usefulness.

Impact Recommendation #5: Add measure numbers to each measure in each project. If measures are added and/or dropped from the project, maintain base numbering so that it is possible to track the evolution of the project and savings calculations.

3. **Finding:** The streamlined deliverable format (spreadsheet workbook) is laudable, but as implemented, it is inadequate for managing the projects or for evaluation purposes. In all cases, the workbook was not thoroughly completed.



Impact Recommendation #6: Require an accurate and complete project workbook before a project incentive is paid. This information should include:

- a. Billing history to calibrate and validate savings estimates. Multi-year analysis would benefit the program.
 - b. Include an equipment schedule with nameplate information and design parameters to validate estimates.
 - c. Enable more active calculation space on each “Opportunity” tab so that *full* measure calculations can be presented and archived in one location; or allow references to supplemental live calculation spreadsheets that can be validated in the evaluation.
 - d. Link all measure savings to a summary page and also auto-generate a page to facilitate error-free uploads to the tracking database.
4. **Finding:** Most engineering analysis calculations did not demonstrate review by the implementation contractor or a knowledgeable subject-matter expert. As a result, multiple errors were made in inputs, calculation scope, and retrocommissioning concepts.

Impact Recommendation #7: Require engineering review of all calculations, including:

- a. Establish and enforce default values when assumptions must be made.
 - b. Establish priority preference of data sources – measured/trended data, design parameters, equipment nameplate and finally rules of thumb. Add more conservative adjustments as less-specific inputs are used.
 - c. Include secondary savings effects as practicable. For example, include heating, ventilation and cooling savings, in addition to fan motor savings, when fans schedules are adjusted.
 - d. Establish “reasonableness” checks on savings estimates, as compared to apportioned actual energy consumption.
 - e. Generate a list of typical retrocommissioning measures with brief standard narratives to describe primary and secondary energy benefits.
5. **Finding:** Many projects involved installation of new controls. These are not typical retrocommissioning measures. It appears that some program service providers are not following retrocommissioning processes to “improve the operation of existing equipment”, but rather to collect an incentive while marketing and selling controls equipment they distribute or represent.

Impact Recommendation #8: Require projects to have a functioning and capable energy management system as a program prerequisite.

Impact Recommendation #9: Look into channeling EMS projects into more appropriate programs, such as the Custom Program or Prescriptive Program.

6. **Finding:** Impact metrics are lower than anticipated. The average *ex post* savings per square foot is about 0.6 kWh per square foot, which is less than industry benchmarks of 1-2 kWh per square foot. Because the cost of retrocommissioning will likely inhibit future investigations initiated by the customer, it is best to seize the opportunity of the program to maximize savings identification.

Impact Recommendation #10: Introduce tools to the RSPs to facilitate more thorough investigations at lower cost. Examples would be standard calculation templates to reduce engineering costs and enable more resources for investigation of measures.



Process Evaluation Findings and Recommendations

1. **Finding:** Registered RSPs are the logical agents to market the RCx Program to customers due to their specialized expertise, customer contacts and their understanding of the retrocommissioning process. The success of the program rested entirely on the RSPs ability and desire to sell this program to their customers. The revitalized program will provide the RSPs with more reasons to market the program as they will not need customers to contract for an engineering study with uncertain outcomes.

Process Recommendation #1: Develop stronger relationships with RSPs, offer them extra training in the program - especially on unfamiliar technology - and teach them how the program will benefit their organization.

2. **Finding:** The three program participants interviewed were mostly satisfied with the program incentive. One customer said the incentive was lower than they would have liked because of the square footage. He only received \$5,000 because of the size of his building. As the Program Manager pointed out, the two-tiered rebate system based on square footage was not always appropriate.

Process Recommendation #2: Change the two tiered incentive structure to provide better and more proportionate incentives for energy and demand savings. By changing the implementation contractor, there is an opportunity to change the direction of the program.

3. **Finding.** The program is focused on short-term savings when improvements to long-term participant engagement and RSP investigative depth can be improved in the context of retrocommissioning.

Process Recommendation #3: Consider additional training for participants and Service Providers.

Section 1. Introduction

This evaluation report chapter covers the Retrocommissioning (RCx) Program element of the AEP Ohio energy efficiency and peak demand reduction (EE/PDR) programs. The RCx program was launched in 2013. This report is the second annual evaluation of the program. Following the 2014 program year, AEP Ohio has decided to change implementation contractors.

1.1 *Program Description*

AEP launched the Retrocommissioning (RCx) Program in 2013. The RCx Program offers incentives to non-residential, non-industrial customers who conduct retrocommissioning studies at their site and implement identified energy efficiency measures. The incentives are designed to defray the cost of the study.

Retrocommissioning is a process that helps commercial and institutional customers improve the performance and reduce energy consumption of their facilities through the systematic evaluation of *existing* building systems. Low- and no-cost measures are identified and implemented to improve system operations, reduce energy use and demand, and, in many cases, improve occupant comfort. Examples include set point or schedule changes that can be managed from a Building Automation System. The RCx Program aims to streamline the typical retrocommissioning process in order to facilitate the implementation of projects that yield savings with low documentation and investigation costs.

The AEP Ohio RCx Program is two-tiered, based on facility floor area and minimum peak demands³. RCx Lite is offered to facilities with a minimum peak demand of 125 kW and between 100,000 square feet, and 150,000 square feet with peak demand between 125 kW and 499 kW. RCx Comprehensive is offered to facilities with a minimum peak demand of 500 kW and that are larger than 150,000 square feet. The program is managed by a third-party implementation contractor in coordination with AEP Ohio. Program services are delivered by registered Retrocommissioning Service Providers (RSPs) who have been vetted by AEP Ohio and the implementation contractor.

1.2 *Key Program Elements*

The goals of the 2014 RCx Program are to contribute to the MWh targets in AEP Ohio's EE/PDR Plan at or below the program budget, improve customer satisfaction with the program, increase outreach to customers, and internally involve more customer service staff in promoting the program to assigned customers. The program is designed to appeal to diverse commercial and institutional customers. The following sections provide a summary of key program elements.

³ Size-based tiers are guidelines. AEP Ohio may assign projects to either program track based on project particulars.



1.2.1 Performance Incentive

RCx Program incentives in 2014 are based on the type of project completed. To be eligible for Implementation Incentives, RCx Lite and RCx Comprehensive participants must implement *all* identified measures with paybacks of less than two years. Additional incentives may be available for RCx Comprehensive participants who implement measures with paybacks of greater than two years. Table 1-1 lists the incentives available.

Table 1-1. Incentive Parameters

Program Track	Implementation Incentive		Incentive Limits
	≤ 2 year Payback	> 2 year Payback	
RCx Lite	\$5,000	NA	\$0.13/kWh saved \$600,000/customer/year
RCx Comprehensive	\$0.10/ square foot	\$0.05/kWh saved	

1.2.2 Participation Milestones

Participation in the program is designed to streamline the retrocommissioning process, yet ensure adequate savings are implemented within each project. To achieve these competing goals, the program has defined milestones for each project.

Pre-Screening. Pre-Screening is required for all RCx projects to ensure adequate savings potential and customer willingness to implement measures as required by the program.

RCx Study. Customer must have a retrocommissioning study conducted by an approved AEP Ohio RSP.

Implement Measures. Once the RCx study is complete, the customer implements recommended measures. In order to qualify for incentives, all measures with a payback of less than two years must be implemented. All measures are subject to verification.

Final Applications. Final applications must be submitted following project completion and include the appropriate back-up documentation to verify the project is complete. The implementation contractor reviews final applications for eligibility and completeness.

Incentive Payment. Once the program accepts a project for payment, incentives are processed and delivered.

1.2.3 Measures and Incentives for 2014

Eligible measures run the gamut of building operations and energy use, though in most cases capital intensive items are proscribed or are channeled to other AEP Ohio EE/PDR programs. Improved equipment scheduling to better match operation and occupancy, set-point optimization, improved controls, and deferred repairs qualify as eligible measures through the RCx Program. Measures submitted through the Retrocommissioning Program address many building systems, but typically these focus on the Heating, Ventilation and Air Conditioning (HVAC) equipment.



1.2.4 Solution Provider Participation

AEP Ohio and the implementation contractor recruited and approved a network of Retrocommissioning Service Providers (RSPs) for the program. The fourteen registered RSPs have been trained on the program processes and have demonstrated their retrocommissioning capabilities. Nine different RSPs completed projects through the program in 2014, as shown in Table 1-2. Service providers with multiple projects often submitted projects for multiple schools within school districts.

Table 1-2. 2014 Retrocommissioning Service Providers

Service Provider	RCx Comprehensive	RCx Lite	Program Reported
A	1	-	1
B	5	10	15
C	1	-	1
D	-	1	1
E	1	2	3
F	2	-	2
G	-	2	2
H	1	-	1
I	-	1	1
Total	11	16	27

Source: Evaluation analysis of AEP Ohio tracking data from February 11, 2015

1.3 Evaluation Overview

The three major objectives of the evaluation are to: (1) quantify energy savings and summer peak demand reduction from the 2014 Retrocommissioning Program; (2) determine key process-related program strengths and weaknesses and identify ways in which the program can be improved; and (3) provide data to determine program cost effectiveness. The evaluation sought to answer the following research questions.

1.3.1 Impact Questions

1. Were the impacts reported by the program achieved?
2. What were the realization rates? (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 this program?

1.3.2 Process Questions

The process evaluation questions for the 2014 Retrocommissioning Program focused on the following key areas:

1. Program design and implementation changes in 2014
2. Changes to customer and RSP program participation between 2013 and 2014
3. Effectiveness of program design and processes
4. Effectiveness of program implementation
5. Effectiveness of program marketing and outreach



6. Barriers to and benefits of participation
7. Participant satisfaction

To answer these questions, the evaluation included four main activities: (1) desk review of project files and savings estimates, (2) post-installation follow-up or on-site inspections for impact evaluation, (3) in-depth interviews with program coordinators and (4) in-depth interviews with program participants for the process evaluation of the Retrocommissioning Program.

Section 2. Methodology

This section describes the methodology used to conduct the impact and process evaluations for the Retrocommissioning Program. Table 2-1 summarizes the various activities undertaken for the impact and process evaluation. The evaluation team reviewed program tracking data, which summarizes information on projects implemented through the Retrocommissioning Program, however, the evaluator did not address whether the tracking system is adequate for regulatory prudence reviews or corporate requirements.

Navigant reviewed program documents and the technical documents for sampled projects. The impact evaluation also conducted follow-up with participant personnel, either in person or via telephone to confirm project parameters and final operations. Primary process evaluation data collection efforts included in-depth telephone interviews with program staff at AEP Ohio and program participants. Interviews with the implementation contractor and service providers were not conducted, as the program delivery and processes will be overhauled for 2015 and subsequent years.

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
Application Technical Review	Sampled projects	Impact Evaluation
Follow-up / On-site verification	Selected projects from the Sample	Impact Evaluation
In-depth Telephone Interviews	Program staff	Process Evaluation
Telephone Interviews	Program participants	Process Evaluation

2.1 Tracking Data Review

The impact evaluation includes reviews of the tracking data to identify potential adjustments to *ex ante* reported savings for measures due to outliers, missing information, or tracking system data entry or calculation errors, however, the evaluator did not address whether the tracking system is adequate for regulatory prudence reviews or corporate requirements. The assessment of the tracking data and program activity is discussed in Section 3.2.1. 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 Retrocommissioning Program website
- 2012-2014 Energy Efficiency/Peak Demand Reduction Action Plan



2.2 *Project Documentation and Technical Review*

Navigant conducted project documentation and technical review on a sample of projects randomly selected according to protocol from the customer participant population. For each selected project, Navigant performed an in-depth review of project documentation to assess the engineering methods, parameters and assumptions used to generate the *ex ante* reported savings and estimated incentives.

For each measure in the sampled projects, Navigant estimated *ex post* savings based on the review of project documentation and engineering analysis. *Ex post* adjustments to *ex ante* savings were based on building-specific information, invoices, additional billing history, specifications sheets and other documentation to the extent it was judged more representative of the project than *ex ante* inputs or default measure savings assumptions. If a post-inspection or follow-up call was made, measure data from the follow-up were used.

Reasons for changes to *ex ante* reported savings could include the following:

- Hours of use
- Unreasonable engineering assumptions, such as assumed 100% motor loading.
- Inaccurate engineering estimates and calculation methods
- Adding secondary effects, such as ventilation savings when fans are turned off, or reduced cooling load from fan motor heat when static pressure is reduced
- Equipment specifications
- Additional post-installation data
- Other changes

Engineering-based energy and demand reduction algorithms were used to compute *ex post* savings.

2.3 *On-site and Follow-up Data Collection*

For the RCx Program evaluation plan, AEP Ohio projected 23 completed projects for RCx Lite and RCx Comprehensive, combined. From among those, Navigant planned a technical review of 20 projects with five on-site verification visits. Actual participation totaled 27 sites, and Navigant sampled of 24 sites for the impact evaluation. Navigant worked to schedule on-sites with several participants, but determined that for several sites, remote verification was effective and required less coordination. Thus, Navigant collected on-site data from two sites and remotely verified schedules and set points via live demonstrations of controls and data for four additional sites. After additional data was collected, Navigant developed annual energy and demand savings impacts based on the verified data, supplemental information from on-site personnel and application information.

2.4 *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 Business Programs and Marketing Manager	2	March, 2015
In-depth Telephone Interviews	Program Participants	2014 Program Participants (n=14)	Sample of six participants	3	March/April 2015

2.5 *Participant Survey*

The evaluation team conducted in-depth surveys with three participating customers to better understand customer satisfaction and perceptions related to the program and retrocommissioning. The evaluation team used senior staff members to conduct in-depth qualitative interviews. Interview guides were developed to be open-ended and allow for a free-flowing discussion between interviewer and respondent, and real time interviewing flexibility. The team developed guides which highlighted key issues, to delve deeply into pertinent issues based on the respondents' knowledge of and experience with the program.

The evaluation team took detailed notes during each in-depth interview and/or taped the discussion to ensure thorough documentation. For any quantitative questions, interviewers are trained to record and summarize responses to allow the evaluators to draw conclusions in the analysis.

2.6 *Data Sources Summary*

The data collected for evaluation of the 2014 Retrocommissioning Program was gathered during a number of activities including:

- In-depth telephone interviews with AEP Ohio program managers
- In depth telephone interviews with participating customers
- Tracking system data review
- Documentation technical review of a sample of projects
- Follow-up and on-site measurement and verification at customer sites for a subset of projects sampled from the project documentation technical review



Table 2-3 provides a summary of these data collection activities including the targeted population, the sample frame, and the time frame in which data collection occurred.

Table 2-3. Data Collection Activities for 2014 Evaluation

Data Collection	Targeted Population	Sample Frame	Sample Design	Sample Size	Timing
Tracking Data Analysis	Retrocommissioning Program projects approved for payment for 2014	AEP Ohio Tracking Database	-	All	November 2014 to April 2015
In-depth Interviews	AEP Ohio Program Staff	Contact from AEP Ohio	Business Programs Manager and Retrocommissioning Program Manager	2	January 2015 to March 2015
In Depth Interviews	Retrocommissioning Program Participants (n=13)	Tracking Database	Sample of Retrocommissioning Program Participants	3 sampled participants	March 2015 to April 2015
Application File Review	2014 Retrocommissioning Program Participants	Census by Track	Stratified Random Sample by Track & Project-Level kWh	24	February 2015 to April 2015
Follow-up / On-site Verification	Application File Review Sample	Application File Review Sample	Key issue sites	6	February 2015 to March 2015

2.7 Sampling Plan

Sampling for the impact and process evaluations followed different criteria.

2.7.1 Impact Sample

Navigant conducted the sample design and selection process to target a relative precision of $\pm 10\%$ or better at a 90% level of confidence for each program track – RCx Comprehensive and RCx Lite. The program-level *ex ante* reported savings data were analyzed by program track and project size to inform sample design. After analysis, the impact sample design was stratified by program track only.

This approach resulted in a total sample of 24 projects selected for application documentation and engineering review. Upon selection, Navigant sampled 92 percent of the reported program MWh savings.



Table 2-4 provides a profile of the impact measurement and verification (M&V) sample in comparison with the populations within each stratum. The estimated relative precision of this sample at 90% confidence is ± 6.6 percent for the program.

Table 2-4. Profile of the Retrocommissioning Impact M&V Sample by Track & Strata

Sampling Strata	Population Summary		Sample		
	Number of Projects (N)	Ex Ante Savings (MWh)	N	Ex Ante Savings (MWh)	Sampled Percent of Population
Comprehensive Strata 1	11	3,225	10	3,016	94%
Lite Strata 2	16	1,292	14	1,133	88%
Total or Overall Value	27	4,517	24	4,149	92%

Source: Evaluation analysis of program tracking data

2.7.2 Process Sample

The participant survey targeted a population of six unique customer contact names with paid projects in the 2014 RCx Program, drawn from the February 11, 2014 tracking system extract. Navigant attempted to survey six RCx Program participants from the 14 program participants, but successfully completed interviews with only three of them. The sample was chosen to ensure the inclusion of non-schools, to include both Lite and Comprehensive projects and to include small to large projects. The sample of six program participants included two elementary school systems, a university, a science park, an office campus and a manufacturing facility.

Section 3. Detailed Evaluation Findings

This section presents the detailed findings from the 2014 RCx Program evaluation related to (1) program activity, (2) impact findings, (3) process evaluation findings, and (4) cost effectiveness review.

3.1 2014 Retrocommissioning Program Participation Summary

The evaluation team analyzed data delivered by AEP Ohio on February 11, 2015. As shown in Table 3-1, the 2014 Retrocommissioning Program paid incentives on 27 projects constituting 4,517 MWh of *ex ante* reported annual energy savings. As expected the RCx Lite projects claim less savings on average than RCx Comprehensive projects. The structure of the RCx Lite deliverable is very streamlined to reduce the engineering cost of retrocommissioning. An un-intended result of streamlining is reduced documentation and measures are not itemized meaningfully. Overall, disaggregation of savings by measure is inconsistent between the two program tracks.

Table 3-1. 2014 Retrocommissioning Program Projects, Measures, and Ex Ante Savings

Metric	RCx Comprehensive	RCx Lite	Ex Ante Reported
Number of Projects	11	16	27
Number of Measures	31	20	51
Annual Energy Savings (MWh)	3,225	1,292	4,517
Peak Demand Savings (kW)	189.6	145.0	334.6

Source: Evaluation analysis of AEP Ohio tracking data from February 11, 2015



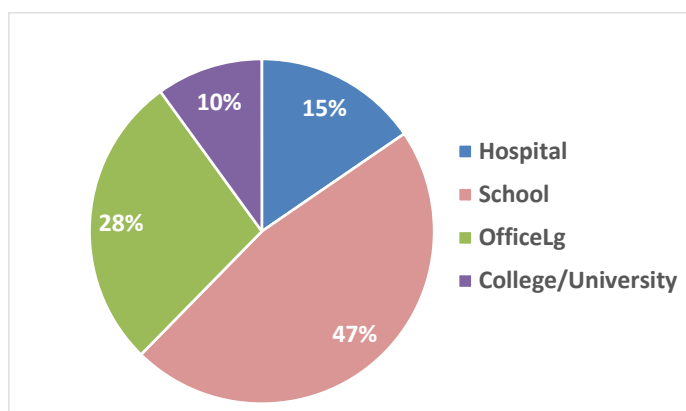
Table 3-2 and Figure 3-1 provide a profile of 2014 RCx Program participation at the market segment level. Among 2014 RCx Program participants, there were five participating school districts which submitted a combined eighteen projects of the 27 submitted. The RCx Lite track was comprised of thirteen schools, two smaller university buildings, and a small office building.

Table 3-2. 2014 Retrocommissioning Program Participation by Business Type

Business Type	Project Count		Ex ante Reported Savings (MWh)		Ex ante Reported Savings (kW)	
Hospital	1	4%	697	15%	173.4	52%
Schools (K-12)	18	67%	2,119	47%	138.0	41%
Office Building	5	19%	1,249	28%	23.2	7%
College / University	3	11%	451	10%	0.0	0%
Total	27	100%	4,517	100%	334.6	100%

Source: Evaluation analysis of tracking data from AEP Ohio database exports from February 11, 2015.

Figure 3-1. 2014 Retrocommissioning Program Ex Ante MWh Savings by Market Segment



Source: Evaluation analysis of tracking data from AEP Ohio database exports from February 11, 2015.



Figure 3-2 shows that only five projects (twenty percent) account for 52 percent of program savings, and eleven projects account for 75 percent of program savings. While RCx Lite participants tend to have less identified savings, several sites had savings comparable to the RCx Comprehensive participants.

Figure 3-2. 2014 Distribution of Savings by Project

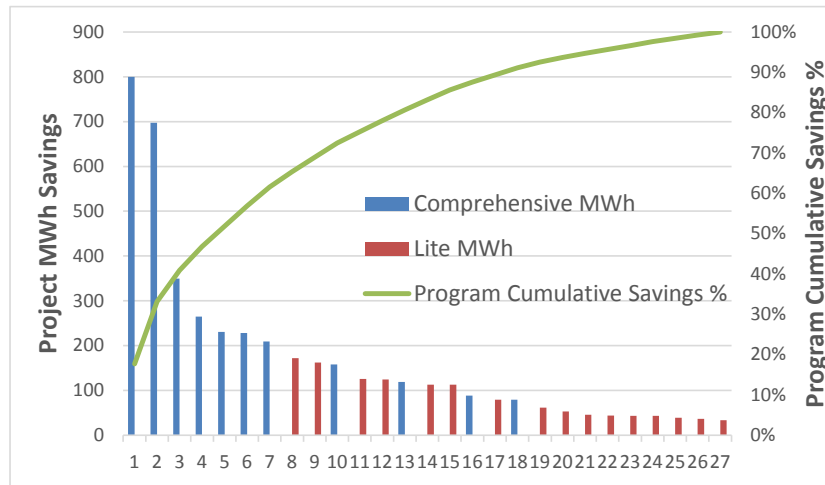
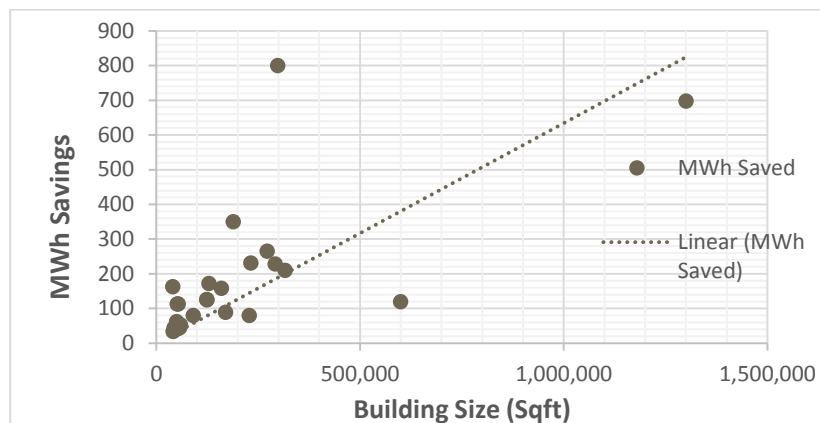


Figure 3-3 plots *ex ante* MWh savings against building size. The figure shows that most participants were smaller than 300,000 ft² and a very rough estimate of savings on the linear trend line⁴ is 0.6 kWh/ft². One building considerably above the trend line (higher savings) is a large government office building. Similarly, the building most noticeably below the trend line is also an office building. All buildings smaller than 150,000 ft² participated in the RCx Lite track. Conversely, all larger buildings were part of the RCx Comprehensive track.

Figure 3-3. Savings and Building Area (ft²)



⁴ The displayed trend line is forced through the origin (0 ft², 0 MWh) and the average savings is 0.6 kWh/ft². If the trend is not forced through the origin the *ex ante* savings estimate is 74,000 kWh, plus 0.5 kWh/ft².



3.2 *Impact Evaluation Results*

This section presents the results of the impact evaluation of the 2014 Retrocommissioning Program.

3.2.1 *Tracking System and Program Documentation Review*

Tracking system

In late-January 2015, the RCx Program evaluation team received project-level and measure-level tracking data exports from the AEP Ohio tracking database. AEP Ohio provided data in Excel spreadsheet format.

The database extract spreadsheet includes a project level dataset with project total impacts, application submittal and status data, and internal approval information. Project data was linked by a unique project number to measure-level records. Each project could have one or more linked measures of the same or different end-uses.

For the most part Navigant found the data tracking system adequate, but there were significant deficiencies in some cases. However, the evaluator did not address whether the tracking system is adequate for regulatory prudence reviews or corporate requirements.

- Measure-level savings do not always agree with calculations submitted in the project workbooks and supplemental documents
- Measure numbers are not always consistent and linking tracked savings to documentation for measures is not always clear
- Measure-level key parameter data fields are not populated. These data are not critical, but they would help verify savings estimates
- Measure descriptions are often too generic to be useful for analysis of measure types and systems affected
- There is no record of measure-level technical review by the implementation contractor, though there are records for on-site verification for all projects

Navigant conducted the sample design for file review using database exports from the tracking system.

3.2.2 *Project and Program Documentation*

To support the engineering review, AEP Ohio provided project documentation in electronic format for each project. Documentation included scans of invoices, measure specification sheets and the application and files for the calculation spreadsheets (or scans) and any text describing the project and verification reports). In general, Navigant found the project documentation lacking:

- Measure descriptions were often missing or incomplete. Lists of affected equipment were missing.
- If hourly simulations were used to estimate savings, the executable models were not included.
- Adequate documentation of the baseline condition was frequently missing.
- Adequate documentation of the actual post-installation condition was often missing.
- The measure verification by the implementation contractor was cursory and inadequately documented.
- The project workbooks were often incomplete in at least one aspect: equipment lists, billing history, completed measures, abandoned measures, savings calculations.



Incentive calculations appear to be accurate according to the calculation rubric (Section 1.1.1).

3.2.3 Findings from the Impact Verification Task

Navigant estimated *ex post* program impacts based on application documentation review, supplemental verification data, and conversations with operations staff, following the methodology outlined in Section 2. In general, Navigant concludes that the implementation contractor and AEP Ohio quality control approach needs significant improvements to prevent inaccuracies and ensure that energy savings are fully realized.

Notably, though, application processing appears to be fair and timely, and ensures that rebate payments are appropriate. Navigant found that recommendations from the 2013 impact evaluation have been not yet been addressed (Table 3-3). All 2013 recommendations are pending corrective action at the time of this 2014 evaluation.

Table 3-3. 2013 Impact Observations and Recommendations and 2014 Status

2013 Issue/Observation	2013 Recommendation	2014 Status
When <i>ex ante</i> savings estimates are made using simulation software, Navigant was unable to validate the simulation because the documentation was inadequate to re-run the simulation.	Require all files necessary to re-run simulations are included in the project documentation to assist the evaluation process. Require electronic versions of spreadsheets used for estimates are submitted in all other cases.	Pending corrective action
Different RSPs use different input assumptions for savings estimates. The program should aim for consistency among RSPs.	Define and enforce the use of default assumptions when measured data are not available. Encourage the use of actual measured data and/or trend data to ensure valid savings estimates. Establish priority preference of data sources – measured/trended data, design parameters, equipment nameplate, program assumptions and rules of thumb. Add more conservative adjustments as less-specific inputs are used.	Pending corrective action
Several RSPs use rules-of-thumb or other sources that are un-documented and might mis-represent savings.	Generate a list of typical retrocommissioning measures and document the required data acquisition and analysis approach. Require engineering review of all calculations by the implementation contractor.	Pending corrective action
The streamlined deliverable format (spreadsheet workbook) is laudable, but as implemented, it is inadequate for managing the projects or for evaluation purposes. Frequently the workbook is not fully completed.	Require project workbooks are complete with historical billing records, equipment schedules and savings calculations. Link all measure savings to a summary page and also auto-generate a page to facilitate error-free uploads to the tracking database.	Pending corrective action

3.2.4 Program Impact Parameter Estimates

The statistical method of separate ratio estimation was used for combining individual realization rates from the sample projects into an estimate of *ex post* energy and demand savings for the population.⁵ In the case of a separate ratio estimator, a separate energy and demand savings realization rate is calculated for each stratum and then combined – weighted by savings in each stratum. These steps are matched to the stratified random sampling method that was used to create the sample for the program. The standard error was used to estimate the error bound around the estimate of *ex post* energy savings and demand reduction.

The realization rate (defined as *ex post* savings divided by *ex ante* reported savings) is 64.4 percent for energy savings, and 70.2 percent for demand reduction. The reasons for changes to the savings estimates were many, including: errors in engineering methods, un-reasonable assumptions, changes to set points or schedules and mis-calibrated energy simulations.

3.2.5 Program Impact Results

Based on the impact parameter estimates described in the previous section, Navigant estimated the *ex post* program impacts resulting from the 2014 Retrocommissioning Program, as shown in Table 3-4. No further adjustments were made to evaluated savings. Project-level evaluated savings and realization rates are included in Appendix A.

Table 3-4. Savings Estimates for 2014 Retrocommissioning Program

	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)	7,305	4,517	2,908	64%	40%
Demand Savings (MW)	1.495	0.335	0.235	70%	16%

Sources: AEP Ohio Volume 1: 2012 TO 2014 Energy Efficiency/Peak Demand Reduction (EE/PDR) Action Plan, November 29, 2011. Evaluation analysis of AEP Ohio tracking data from February 11, 2015.

The Retrocommissioning Program fell short of its 2014 goals of 7,305 MWh energy savings and 1.495 MW of demand savings. Goals non-attainment is attributed to fewer projects and less saving per project than planned.

⁵ A full discussion of separate ratio estimation can be found in Sampling: Design and Analysis, Lohr, 2010 2nd Edition, pp. 144-145.



3.3 *Process Findings*

AEP Ohio's 2014 Retrocommissioning Program offers incentives designed to fund retrocommissioning studies that identify no-cost and low-cost energy efficiency measures using existing equipment, provided the participant implements all measures with a payback of two years or less

The process evaluation of the AEP Ohio Retrocommissioning Program focuses on the following researchable questions:

- Effectiveness of program implementation
- Effectiveness of program design and processes
- Customer experience and satisfaction with the program
- Opportunities for program improvement

The full list of research questions can be found in the 2014 Retrocommissioning Program Evaluation Plan. The evaluation team conducted in-depth interviews with three participants to explore issues that were foremost in importance with respect to the Retrocommissioning Program.

3.3.1 *Program Participant Source of Information*

In 2014, AEP Ohio relied on the implementer to recruit RCx service providers (RSPs) to deliver the program to the customers. They identified the RSPs and explained the program. A few RSPs tried the program immediately. The RSPs were to conduct the study, identify the two-year payback projects and present them to the customer. After the study was conducted and the energy and demand savings identified and installed, AEP Ohio would pay an incentive. This sequence allowed AEP Ohio to not pay incentives for the engineering, if there was no energy and demand savings.

However, the Program Coordinator explained that the customers were also reluctant to spend the money for the engineering project upfront, if the project savings and payback were not there. The customer could receive an incentive of ten cents a square foot. The Lite Projects were capped at \$5,000 while the average engineering study could cost more; thus, customers were committing to costs without an assured payback.

In addition, the RSPs were not committed to the program as some thought it was easier to do the projects outside of the Retrocommissioning Program or, possibly, use the Prescriptive or Custom Program instead. Few projects were begun in 2014 as most of these were spillover projects from 2013. AEP Ohio concluded the 2013-2014 program design was not successful. Program changes were implemented for 2015.

The three customers interviewed were all in the market to improve the energy efficiency of their campus buildings. They were in the market to upgrade their control systems and improve their older equipment and building shells. Most of the buildings had never been re-commissioned.



3.3.2 Marketing and Outreach Practices

Retrocommissioning Service Providers were the chosen method of marketing and delivering the program. They are a specialized type of engineering company that maximizes the effectiveness of control systems. The success of the program rested entirely on the RSPs ability and desire to sell this program to their customers. These engineering companies tend to have regional or national experience and may have rejected the program design because they did not directly receive the incentives for study. The incentive was calculated based on the size of the building. AEP Ohio found that this type of incentive did not fairly reward all customers.

3.3.3 Program Incentives

The three interviewed program participants were mostly satisfied with the program incentive. One customer said the incentive was lower than they would have liked because of the square footage. He only received \$5,000. Another customer split the incentive with the RSP.

3.3.4 Participant Satisfaction

Two of the three program participants were very satisfied with the program. One reported that he was glad that it was continuing and he thought that paying incentives for the study at the beginning of the process would get rid of one of the 'roadblocks' to participation. Another program participant said that he was neutral toward the program because he was not convinced the savings would be significant. His organization was planning to participate with a second building. Possibly, with more evidence the customer will change his mind about the potential savings of retrocommissioning.

All of the customers in our sample were very familiar with the other AEP Ohio programs. They have participated in the Prescriptive and Custom Programs and are familiar with those processes. One program participant said that while the program can always been streamlined, his role the last few years has been to make sure the contractor has completed the application correctly, signing it and collecting the checks.

One participant, the one not happy with the program, said the program should:

- Apply to smaller buildings
- Have a different incentive schedule
- Be more prescriptive

He also said that "One of the challenges is that to base it (the incentive) on savings, requires a lot of engineering calculations which eats up the incentive."

The 2015 Retrocommissioning Program design will address most of this customer's objections.

3.3.5 Benefits of the Program

Program benefits are readily apparent to participants. One customer reported the following.

- We save money
- We are able to make buildings more comfortable
- We have simplified the scheduling with our software



3.3.6 Program Limitations

The biggest participation barrier for customers is the cost of the engineering study. The customers do not want to pay for an engineering study without proof of savings - likewise for AEP Ohio. In addition, there was an apparent lack of commitment from RSPs. In 2014, the Retrocommissioning Program had no new projects in the queue. The RSPs found it easier to do projects without the program.

One customer said their goal was to “receive more in rebates than we spent.” He figures that they broke even or spent more than they received because they asked their RSP to return to the site to verify the equipment was working properly. He mentioned a post-implementation survey as a second drawback of the program.

3.4 Cost Effectiveness Review

This section addresses the cost effectiveness of the 2014 Retrocommissioning Program. Cost effectiveness is assessed through the use of the Total Resource Cost (TRC) test. Table 3-5 summarizes the unique inputs used in the TRC test.

Table 3-5. Inputs to Cost-Effectiveness Model for AEP Ohio Retrocommissioning Program

Item	2014
Measure Life	5
Participants	27
Ex Post Annual Energy Savings (kWh)	2,908,000
Ex Post Coincident Peak Savings (kW)	235
Third Party Implementation Costs	247,875
Utility Administration Costs	140,293
Utility Incentive Costs	353,951
Participant Contribution to Incremental Measure Costs	0

The cost effectiveness analysis is based on evaluation *ex post* impacts. The data for “Participant Contribution to Incremental Measure Costs” were taken from the tracking system based on participant supplied project costs.

Based on these inputs, the TRC ratio is 1.0 and the program passes the TRC test for the program in its entirety. Table 3-6 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 3-6. Cost-Effectiveness Results for Retrocommissioning Program

Test Results for Retrocommissioning Program	2014
Total Resource Cost	1.0
Participant Cost Test	N/A
Ratepayer Impact Measure	0.4
Utility Cost Test	1.0



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.

Section 4. Conclusions and Recommendations

4.1 Impact Evaluation Findings and Recommendations

The impact results for the 2014 Retrocommissioning Program are shown in Table 4-1, which shows the *ex ante* savings claimed by the program, the evaluated savings, and the 2014 realization rates. The realization rate for 2014 was 0.644 for energy and 0.702 for demand savings. In 2014, the program achieved 2,908 MWh energy savings and 0.235 MW peak demand savings. Reasons for adjustments to *ex ante* savings estimates were varied.

- Inadequate documentation of the baselines
- Poor engineering analysis or verification steps
- Unreasonable assumptions
- Mis-calibrated energy simulations of proposed savings and
- Adjustments to setpoints and schedules based on on-site or follow-up evaluation research

Table 4-1. Program Savings and Realization Rate for 2014

	2014 Program Goals (a)	Ex Ante Savings (b)	Evaluated Savings (c)	Realization Rate RR = (c) / (b)	Percent of Goals = (c) / (a)
Energy Savings (MWh)	7,305	4,517	2,908	64%	40%
Demand Savings (MW)	1.495	0.335	0.235	70%	16%

Sources: ¹AEP Ohio Volume 1: 2012 TO 2014 Energy Efficiency/Peak Demand Reduction (EE/PDR) Action Plan, November 29, 2011. ²Evaluation analysis of AEP Ohio tracking data from February 11, 2015.

The 2014 Retrocommissioning Program impact evaluation resulted in several findings and recommendations:

1. **Finding:** The 2014 *ex post* savings fell short of goals. The number of projects fell short of anticipated participation (50), and the savings per project was lower. Some projects did not have the depth of analysis required to identify more savings. Some accrued savings were not accounted for using the estimating methods of some service providers.

Impact Recommendation #1: Expand program outreach to school districts, colleges, and other multi-site entities to increase participation levels.

Impact Recommendation #2: Recruit more RCx Comprehensive participants through trade organizations, such as the Building Owners and Managers Association (BOMA) or the Ohio Hospital Association (OHA). Even large industrial customers frequently have significant office space that may qualify for retrocommissioning services.

Impact Recommendation #3: Encourage more thorough and complete inspections and analysis to identify more available savings.

2. **Finding:** The tracking database content is lagging the program. Retrocommissioning is a process that unfolds over a period of time. Energy efficiency measures are added, modified and deleted through this process. Tracking measures, investigation, and savings calculations can be difficult.



Impact Recommendation #4: Place higher priority on keeping tracking systems current and accurate. Delete database fields that will not be used, or back populate those fields to increase their usefulness.

Impact Recommendation #5: Add measure numbers to each measure in each project. If measures are added and/or dropped from the project, maintain base numbering so that it is possible to track the evolution of the project and savings calculations.

3. **Finding:** The streamlined deliverable format (spreadsheet workbook) is laudable, but as implemented, it is inadequate for managing the projects or for evaluation purposes. In all cases, the workbook was not thoroughly completed.

Impact Recommendation #6: Require an accurate and complete project workbook before a project incentive is paid. This information should include:

- a. Billing history to calibrate and validate savings estimates. Multi-year analysis would benefit the program.
 - b. Include an equipment schedule with nameplate information and design parameters to validate estimates.
 - c. Enable more active calculation space on each “Opportunity” tab so that *full* measure calculations can be presented and archived in one location; or allow references to supplemental live calculation spreadsheets that can be validated in the evaluation.
 - d. Link all measure savings to a summary page and also auto-generate a page to facilitate error-free uploads to the tracking database.
4. **Finding:** Most engineering analysis calculations did not demonstrate review by the implementation contractor or a knowledgeable subject-matter expert. As a result, multiple errors were made in inputs, calculation scope, and retrocommissioning concepts.

Impact Recommendation #7: Require engineering review of all calculations, including:

- a. Establish and enforce default values when assumptions must be made.
 - b. Establish priority preference of data sources – measured/trended data, design parameters, equipment nameplate and finally rules of thumb. Add more conservative adjustments as less-specific inputs are used.
 - c. Include secondary savings effects as practicable. For example, include heating, ventilation and cooling savings, in addition to fan motor savings, when fans schedules are adjusted.
 - d. Establish “reasonableness” checks on savings estimates, as compared to apportioned actual energy consumption.
 - e. Generate a list of typical retrocommissioning measures with brief standard narratives to describe primary and secondary energy benefits.
5. **Finding:** Many projects involved installation of new controls. These are not typical retrocommissioning measures. It appears that some program service providers are not following retrocommissioning processes to “improve the operation of existing equipment”, but rather to collect an incentive while marketing and selling controls equipment they distribute or represent.

Impact Recommendation #8: Require projects to have a functioning and capable energy management system as a program prerequisite.



Impact Recommendation #9: Look into channeling EMS projects into more appropriate programs, such as the Custom Program or Prescriptive Program.

6. **Finding:** Impact metrics are lower than anticipated. The average *ex post* savings per square foot is about 0.6 kWh per square foot, which is less than industry benchmarks of 1-2 kWh per square foot. Because the cost of retrocommissioning will likely inhibit future investigations initiated by the customer, it is best to seize the opportunity of the program to maximize savings identification.

Impact Recommendation #10: Introduce tools to the RSPs to facilitate more thorough investigations at lower cost. Examples would be standard calculation templates to reduce engineering costs and enable more resources for investigation of measures.

4.2 *Process Evaluation Findings and Recommendations*

1. **Finding:** Registered RSPs are the logical agents to market the RCx Program to customers due to their specialized expertise, customer contacts and their understanding of the retrocommissioning process. The success of the program rested entirely on the RSPs ability and desire to sell this program to their customers. The revitalized program will provide the RSPs with more reasons to market the program as they will not need customers to contract for an engineering study with uncertain outcomes.

Process Recommendation #1: Develop stronger relationships with RSPs, offer them extra training in the program - especially on unfamiliar technology - and teach them how the program will benefit their organization.

2. **Finding:** The three program participants interviewed were mostly satisfied with the program incentive. One customer said the incentive was lower than they would have liked because of the square footage. He only received \$5,000 because of the size of his building. As the Program Coordinator pointed out, the two-tiered rebate system based on square footage was not always appropriate.

Process Recommendation #2: Change the two tiered incentive structure to provide better and more proportionate incentives for energy and demand savings. By changing the implementation contractor, there is an opportunity to change the direction of the program.

3. **Finding.** The program is focused on short-term savings when improvements to long-term participant engagement and RSP investigative depth can be improved in the context of retrocommissioning.

Process Recommendation #3: Consider additional training for participants and Service Providers, such as MEEA's Building Operator Certification (BOC) for program participants.



Appendix A. Sampled Project Summary

This appendix provides project-level evaluated savings and realization rates for project sampled for the impact evaluation. For projects with realization rates more than +/-10% from 100% Navigant provides brief reasons for our ex post changes. Reasons for changes were not systematic in any way and reflect one-off changes or interpretation of the data and project context.

Table A-1. Project Evaluated Savings and Realization Rates

Project	Ex Ante		Evaluated		Realization Rate	
	MWh	kW	MWh	kW	MWh	kW
Medical - Hospital 1	697,090	173.40	554,884	64.94	80%	37%
OfficeLg 2	119,271	16.21	119,271	9.30	100%	57%
College/University 2	62,088	-	29,304	-	47%	-
OfficeLg 4	79,420	-	18,987	0.00	24%	-
School 14	36,900	0	24,493	-	66%	-
School 4	157,988	-	115,016	0.00	73%	-
School 2	230,909	-	147,399	0.00	64%	-
School 10	52,953	0	35,326	-	67%	-
School 11	44,295	0	19,868	-	45%	-
School 12	43,398	0	16,562	-	38%	-
School 7	124,762	-	58,833	-	47%	-
School 13	43,243	0	11,749	-	27%	-
School 15	33,435	0	18,548	-	55%	-
School 3	228,121	-	73,340	0.00	32%	-
School 6	125,648	-	47,568	-	38%	-
School 9	79,491	-	33,542	-	42%	-
OfficeLg 1	799,629	0	499,320	130.77	62%	-
College/University 3	39,467	0	20,263	-	51%	-
College/University 1	349,873	-	169,151	0.00	48%	-
School 5	172,030	138.18	139,253	22.90	81%	17%
School 1	265,000	-	202,453	0.00	76%	-
OfficeLg 5	162,702	7.00	162,702	7.00	100%	100%
School 8	113,035	-	67,747	0.00	60%	-
OfficeLg 3	88,402	-	88,402	0.00	100%	-



Project ID	Dominant Reasons for <i>ex post</i> Adjustments
OfficeLg 1	Estimates do not include secondary effects. <i>Ex ante</i> chiller efficiency revised based on on-site observation. Flawed assumptions including motor loading and affinity law exponents. <i>Ex ante</i> estimates not supported by site-specific data.
Medical - Hospital 1	Static pressure reduction modified based on on-site inspection. Assumed parameters not reasonable without supporting data – 90% fan static efficiency, 100% motor loading
College/University 1	Assumed parameters not reasonable without supporting data –100% motor loading, affinity law exponents. Ventilation savings not included.
School 1	Revised calculations based on design parameters and observed fan speeds rather than assumed motor loading and flawed use of affinity laws.
School 2	<i>Ex ante</i> estimates assume 100% motor loading, 100% motor efficiency and 100% outdoor air.
School 3	<i>Ex ante</i> estimates assume 100% motor loading, 100% motor efficiency and 100% outdoor air.
School 5	<i>Ex ante</i> estimates assume 100% motor loading, 100% motor efficiency and 100% outdoor air. Pump hours adjusted to ex post findings
School 4	<i>Ex ante</i> estimates assume 100% motor loading, 100% motor efficiency and 100% outdoor air.
School 6	<i>Ex ante</i> estimates assume 100% motor loading, 100% motor efficiency and 100% outdoor air.
School 7	<i>Ex ante</i> estimates assume 100% motor loading, 100% motor efficiency and 100% outdoor air.
OfficeLg 2	Reduced demand savings due to impacts occurring off-peak
School 8	Revised calculations based on design parameters and observed fan speeds rather than assumed motor loading and flawed use of affinity laws.
School 9	<i>Ex ante</i> estimates assume 100% motor loading, 100% motor efficiency and 100% outdoor air.
OfficeLg 4	Re-estimated with an 8 degree setback affecting ventilation air only. Internal loads are not changed by the measure.
College/University 2	Hours of operation changed based on ex post inspection
School 10	<i>Ex ante</i> estimates assume 100% motor loading, 100% motor efficiency and 100% outdoor air.
School 11	<i>Ex ante</i> estimates assume 100% motor loading, 100% motor efficiency and 100% outdoor air.
School 12	<i>Ex ante</i> estimates assume 100% motor loading, 100% motor efficiency and 100% outdoor air.
School 13	<i>Ex ante</i> estimates assume 100% motor loading, 100% motor efficiency and 100% outdoor air.
College/University 3	Hours of operation changed based on ex post inspection
School 14	<i>Ex ante</i> estimates assume 100% motor loading, 100% motor efficiency and 100% outdoor air.
School 15	<i>Ex ante</i> estimates assume 100% motor loading, 100% motor efficiency and 100% outdoor air.



Appendix B. In Depth Interview Instruments

AEP Ohio Evaluation for the Retrocommissioning Program

Customer Participant In-Depth Interview Guide

January 27, 2015

Name of Interviewee: _____ Date: _____
Title: _____ Company: _____
Interviewer: _____ Project Number: _____

The interviews will be audio taped and transcribed.

Identify Appropriate Respondent

1. Hello, this is <INTERVIEWER NAME> calling from Navigant Consulting on behalf of AEP Ohio. This is not a sales call. May I please speak with <CONTACT> ?

[IF NEEDED]: my understanding is that <CONTACT> is responsible for making energy-related decisions for your firm at <SERVICE ADDRESS> and was listed as the primary contact when <Company> participated in AEP OHIO Ohio's Retrocommissioning Program. May I please speak with him/her?

1 No, this person no longer works here → Is there someone else that is involved with facility improvements or building operations that might be familiar with <company>'s participation in AEP OHIO Ohio's Retrocommissioning program? [Repeat introduction with new contact]

2 No, this person is not available right now [Ask when available or leave message.] CALL BACK LATER

3 Yes – SKIP to Q2

97 No, other reason (THANK & TERMINATE)

2. Hello, my name is <INTERVIEWER NAME> calling from Navigant Consulting on behalf of AEP Ohio. We're calling to do a follow-up survey about your firm's participation in the Retrocommissioning program. Do you recall participating in the Retrocommissioning on or about <PROGRAM DATE>?

1 Yes → continue to Q3



2 No → [Describe program and ask if they were involved. If still no recall → Can I speak with someone who is likely to be responsible for facility improvements?]

3 There is no one here with information on that address/wrong address – THANK & TERMINATE

[IF NEEDED] Navigant is an independent consulting firm hired by AEP Ohio to learn about customer experiences with its Comprehensive Retrocommissioning and Retrocommissioning Lite programs and to help AEP Ohio improve its programs for the future.

[IF NEEDED] This is a very important fact-finding survey with companies that have recently participated in an energy efficiency program sponsored by AEP Ohio. We are NOT interested in selling anything, and we are primarily interested in gaining your feedback on the Comprehensive Retrocommissioning and Retrocommissioning Lite programs to help AEP Ohio improve the services it provides to its customers in the future. Your responses will not be connected with your firm in any way and will be summarized with responses we get from other businesses that we talk with.

3. Great. Are you the person responsible or were you involved with your company's decision to participate in the program, or were you the main point of contact with AEP Ohio?

1 Yes → Great. We would like to ask you some questions about this program, which should only take about 15 to 20 minutes. Is now a good time, or is there a time we can call you back tomorrow?

2 No → Ask for contact name and repeat introduction in Q2.

Now I'd like to ask you about the project you submitted. Our records show that you participated in the [Comprehensive Retrocommissioning / Retrocommissioning Lite] aspect of the program. Throughout our conversation I will refer to the program simple as the Retrocommissioning program. [If necessary: Retrocommissioning Lite is more appropriate for small commercial/institutional buildings]

4. Do you remember how you first learned about the Retrocommissioning program? Explain.
- a. Since then, have you heard about the program from other sources? Who? IF THEY SAY SERVICE PROVIDER: What type of service provider/contractor told you about the program?
5. What were the circumstances surrounding your decision to participate? What Retrocommissioning Projects has your organization conducted in the past 5 years?
- a. What role did the service provider play in your decision to participate in the program?



[PROBES: Who was first involved in the decision to move forward with this project and submit an application?]

6. Can you spend just a few minutes and describe the process that you went through to participate in the program? Was this process difficult? What made the process difficult for you?
7. Who was primarily responsible for preparing the paperwork for the program? Was it someone within your organization or one of the RCx service providers?
 - a. Did you consult any resources such as the AEP Ohio website, program materials, the spreadsheet calculator, or an account representative about the program?
 - b. If respondent visited the AEP Ohio website, what task was accomplished there?
 - c. Could the participation process be made easier for you? If so, how?

Incentives

8. Have you received your incentive from participating in the program? Were you satisfied with the amount of the incentive? Why not?
9. IF YES: How long did it take to receive your incentive? Was that a reasonable amount of time? If not, what held up payment of the incentive?

Communications

10. Did you receive any materials describing the RCx program and its benefits? Did your account rep talk to you about the program?
11. How would you describe communications between your organization and your RCx service provider during your program participation?
12. Did you have any contact with the program implementer or with AEP Ohio about the Program? How would you describe communications between your organization and the program implementer (CLEAResult) (or your organization and AEP Ohio) during your program participation?
13. Were there any issues with the program implementer? If so, please describe.
14. What suggestions did you receive from the service provider to improve your control sequences as part of the RCx program? Did you receive any suggestions to replace equipment or did you replace equipment as part of the RCx program?
15. Has a representative from the program (if asked say Clearesult or AEP Ohio) visited our facility to



verify the details of your program participation? How did that process work? Were you satisfied with this process? If not, what could be improved?

Program Improvements

16. What are the main benefits to your firm of participating in the program? Are there any drawbacks to participating in the RCx program?
17. Overall, how satisfied are you with the Retrocommissioning Program?
 - a. Did the Retrocommissioning service and scope of work meet your expectations? Was the depth of investigation and analysis appropriate to your needs?
 - b. Did some aspects of your building operations receive too much attention? Did some areas receive too little attention?
 - c. Did you receive recommendations for additional equipment retrofit or replacement to save energy? If yes, please describe.
 - d. Are you likely to act on recommendations for additional equipment retrofit or replacement to save energy? Which ones? How soon?
18. How do you think the program can be improved?

PROBES: Are there elements in the program that should be modified to make the Retrocommissioning program work better? If so, what would you recommend? Why do you think this change is needed?

Awareness of Other EE Programs

19. Aside from the Retrocommissioning Program that we have been discussing today, are you aware of other AEP Ohio programs or resources that are designed to promote energy efficiency for businesses like yours?
20. What types of programs or resources can you recall?

PROBES: Do you know what organization/company administers that program? After each response prompt with "Can you recall any others?"

Have you participated in any of these programs? Which ones?

21. IF CUSTOMER HAS NOT PARTICIPATED IN AEP OHIO BUSINESS PRESCRIPTIVE PROGRAM



OR CUSTOM PROGRAM:

- a. Are you aware of AEP Ohio's Business Prescriptive Rebate Program? [PROBE – describe program if necessary.] Description of program:

AEP Ohio's Prescriptive Incentive Program offers businesses set financial incentives for the implementation of energy-efficient improvements and technologies that reduce energy consumption.

- b. Are you aware of AEP Ohio's Business Custom Rebate Program? [PROBE – describe program if necessary.] Description of program:

The Custom Program is designed to address any cost-effective electricity saving measure not addressed or offered yet through other AEP Ohio programs, including prescriptive incentives. Projects in the Custom Program are more complex and address a system or process most often requiring unique design and technology solutions for each participant, so specific savings and incentives are determined when the project is specified.

Customer Background

We are almost finished. I'd just like to get some general background information about <COMPANY> and your responsibilities there.

22. Can you briefly summarize your role at your company? What are your main responsibilities?
23. What is <COMPANY>'s primary business activity at this particular facility (<SERVICE ADDRESS>)? [RECORD ONE]

- 1 Office
- 2 Retail (non-food)
- 3 College/University
- 4 School
- 5 Grocery Store
- 6 Restaurant
- 7 Health Care
- 8 Hospital
- 9 Hotel or Motel
- 10 Warehouse/Distribution
- 11 Construction
- 12 Community Service/Church/Temple/ Municipality
- 13 Industrial Process/ Manufacturing/ Assembly – type?
- 14 Condo Assoc./Apartment Mgmt.
- 15 Other (Please specify) _____
- 98 Refused
- 99 Don't Know

24. About how many full-time employees work at this location?



&EMP # of employees

98 Refused

99 Don't Know

25. Does <COMPANY> own or lease this facility?

1 Own

2 Lease

98 Refused

99 Don't Know

IF THE COMPANY LEASES THE FACILITY:

26. Do your pay the electric bill?

27. Is the company headquarters in Ohio or elsewhere?

1 HQ in Ohio

2 HQ elsewhere, outside of OH

98 Refused

99 Don't Know

28. Do you have any other comments or suggestions for us?

That's all of the questions I have for you today. Thank you so much for your time, your insights are extremely valuable to AEP Ohio. Have a great day!

Thank you very much for taking the time in assisting us with this evaluation. Your contribution is a very important part of the process.



2014 AEP-Ohio Evaluation for Retrocommissioning Program

AEP Program Staff In-Depth Interview Guide

December, 2014

Name of Interviewee: _____ Date: _____

Title: _____ Company: AEP Ohio _____

Introduction

Hi, may I please speak with [NAME]?

My name is ____ and I'm calling from Navigant Consulting, we are part of the team hired to conduct an evaluation of AEP-Ohio's Business Energy Efficiency programs. We're conducting interviews with program managers and key staff in order to improve our understanding of AEP-Ohio's programs. At this time we are interested in asking you some questions about the Retrocommissioning Custom program. The questions will only take about an hour. Is this a good time to talk? [IF NOT, SCHEDULE A CALL BACK.]

[READ FOR IMPLEMENTER ONLY] Ok, great. I would like to talk to you about your involvement in the retro commissioning program.

Roles and Protocols

1. **Can you briefly summarize your role and responsibilities in the Retrocommissioning program?**
2. **Has your role changed during the first year of the program? How?**
3. **Please describe the formal and informal communication channels between AEP and CLEAResult?**
4. **Do you feel information has been shared in a timely manner during? If not, how can AEP Ohio improve this situation?**

Overall Goals and Objectives

5. **What are the quantitative goals of the program for this year? (e.g., \$, \$/kWh, savings and participation rates)**
6. **Outside of the quantitative goals (e.g., \$, \$/kWh, savings and participation rates), what are the key goals and objectives of the RCX program?**



Program Theory

7. What are the:
 - a. Market barriers addressed by the RCX program
 - b. Program intervention strategies to address these barriers
 - c. Program delivery steps? (We are looking for cause-effect relationships between proposed intervention and actions taken for all steps in the chain of program delivery steps.)

Marketing and Promotion

8. Do you think these materials have been successful in 2014? Are there any plans to expand the marketing effort for this program next year?
9. What has been most influential in getting customers to participate? What else has been influential?
10. Are there any plans to develop case studies from the experiences of customers during this 2014 program year?
11. Did AEP Ohio and/or CLEAResult provide specific training for RCX solution providers?
12. Do you anticipate making any significant changes to the marketing efforts for Program Year 2015?

If so, please describe these changes. Do you have documentation of these changes? If so, can you provide copies to me? (May be too early)
13. What do customers do if they have questions about the participation process? About how many customers contact CLEAResult or the Call Center about the RCX Program?
14. What improvements have been made, if any, during 2014 to improve program communication to participants? What do you think still needs to be changed going forward?



The Web Site

15. What role does the Web site play?
16. Are customers able to quickly find a RCX solution provider in their region from information available on the web site?
17. Any other improvements in the marketing of the program you are considering?

Solution Providers

18. How successful are solution providers in recruiting customers for the RCX PROGRAM?

Do you have a sense of solution providers' overall satisfaction with their participation in this program this year?

19. Are solution providers meeting your expectations for the RCX Program?

Program Participation

We are also trying to learn of any process related issues that may arise from the current design of the program.

20. How active are account managers in selling the RCX program?
21. Is their activity helpful and adequate? In what way can account managers improve the program experience?
22. How active are CLEAResult staff in selling the RCX Program?

Barriers to Program Participation

23. What do you think are the greatest barriers to customer participation in the RCX Program?
24. Do you have a sense of how satisfied customers are with various aspects of the program (e.g., ease of application, verification process, amount of incentive, the timing of incentive payments)?

Quality Assurance and Quality Control - Program Managers Only

25. What kind of quality assurance and quality control procedures are in place to evaluate project completion? Do all projects receive pre and post inspections?



26. In your opinion, what can be done to improve the QA/QC process?

Rebates/Incentives

27. How do solution providers perceive the incentive levels for the RCX program? Does this differ for the two types of participants?

Program Adjustments and Enhancements

28. Are there any changes planned for the program offerings in the 2014 Program Year (e.g., program offerings, marketing approach, targets, incentive levels, etc.)? If so, please describe these additions or deletions.

29. Are there any other elements in design, structure, and/or operation that should be modified to make the program(s) work better? If so, what would you recommend?

Success and the Future of These Efforts

30. In your opinion, how successful was the RCX program during the first year?

31. What are the strengths? What are the weaknesses? Do you feel that free-ridership is a major concern for the program(s)? [Please explain.]

32. Do you think the current economic conditions are positively or negatively affecting the program? If so, how?

33. How could the program be improved?

Other

Program Managers Only

34. Who should we interview at CLEAResult? Are there any additional people with key roles that we should talk to at AEP?

35. Do you have any other comments or suggestions for us?

Thank you very much for taking the time in assisting us with this evaluation. Your contribution is a very important part of the process.



We might follow-up with you by phone later, if additional questions arise.

APPENDIX O



DATA CENTER PROGRAM

2014 Evaluation Report

Prepared for:

AEP Ohio



A unit of American Electric Power

May 11, 2015

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Executive Summary

AEP Ohio's AEP Data Center Program provides support for customers who want to achieve higher levels of energy efficiency in data centers. The program is designed to reward customers for energy improvements by providing an incentive based on a facility's annual energy savings. Any business which is a customer of AEP Ohio and operates a data center is eligible to apply for assistance under the program. Applications for an incentive under the program must be submitted within six months of the completion of the project. The program is delivered by an implementation contractor on behalf of AEP Ohio.

The program goal for 2014 was set as 7,979 MWh in energy savings and 0.99 MW in peak demand savings. A secondary goal was to ensure the program was made available to customers of all sizes, therefore, program staff sought to have a range of project sizes included in the program. Total *ex post* energy savings reported for the 2014 program amounted to 11,895 MWh, exceeding the target for the year. Total *ex post* demand savings reported for the 2014 program amounted to 1.36 MW, exceeding the target for the year.

ES.1 Program Participation

The Data Center Program entered its second year of operation in 2014. The number of projects completed in year two more than doubled to 36; from 17 projects in the first year of operation. As in the first year, several projects were completed for the same companies. Overall 23 unique customers were involved in completing projects in 2014. The projects involved the implementation of 53 different measures. Six of the customers who participated in the program in 2014 completed multiple projects. Table ES-1 summarizes the key program indicators. Total energy savings reported for the program amounted to 13,571 MWh. Demand reductions reported under the program totaled 1.55 MW.

Table ES-1. Program Summary

	2014 Total	Average per Project
Total Project Cost	\$8,343,820	\$231,773
Reported Floor Area (sq ft)	511,027	14,195
Amount of Incentives	\$1,083,131	\$30,087
<i>Ex Ante</i> Energy Savings (MWh)	13,571	376,987
<i>Ex Ante</i> Demand Savings (MW)	1.55	0.043

Table ES-2 shows the number of projects, incentives and savings by sector, based on information reported in the tracking database.

**Table ES-2. Summary of Savings by Economic Sector**

Economic Sector ¹	No. of Projects	Floor Area	Ex Ante Energy Savings (kWh)	Ex Ante Demand Savings (kW)	Incentive \$ per kWh
School	2	1,207	35,608	4	\$0.0800
Colocation Data Center	3	55,000	916,241	132	\$0.0772
Aviation	1	Not Reported	31,093	4	\$0.0800
Large Office	2	1,600	116,151	13	\$0.0653
Industrial/Manufacturing	6	58,340	4,648,497	544	\$0.0800
Large Retail/Service	4	40,500	1,353,677	154	\$0.0800
Medical/Hospital	2	12,200	314,910	36	\$0.0800
Government/Municipal	3	9,760	289,139	34	\$0.0800
Small Office	1	500	21,328	2	\$0.0800
FIRE ²	4	330,000	5,647,966	620	\$0.0800
Telecommunications	8	1,920	196,912	13	\$0.0800
Total	36	511,027	13,571,522	1,556	\$0.0797

The application form for the program asks participants to indicate how they learned of the program. The tracking database shows 83 percent of participants indicated they had initially heard of the program through an AEP Ohio Account Representative, while 17 percent learned of the program from their contractor or Solution Provider. The tracking database also recorded whether a Solution Provider was involved in implementing the efficiency project. Overall, the database shows seven different Solution Providers were involved in 16 projects completed during the year. This amount is a significant increase over the levels reported in the first year of the program and speaks to the success of outreach efforts by program staff to obtain greater involvement by Solution Providers.

ES.2 Data Collection Activities

Primary data collection included in-depth interviews with program managers, implementation staff and trade allies (Solution Providers), surveys of program participants and review of program tracking data. Marketing activities, application forms and other program inputs were also analyzed.

In-depth qualitative interviews were completed with AEP Ohio and the implementation contractor staff. On-line surveys were conducted with participating customers to gather information on customer satisfaction and perceptions related to the Data Center Program. The interviews and surveys were informed by prior review of relevant program tracking databases, documents, and other materials to understand how the program worked and how it has been marketed for 2014.

¹ Economic sector was determined by Navigant as a way to determine the penetration of the program into various sectors. Economic sector was not defined or tracked by the implementation contractor.

² FIRE is the Finance, Insurance and Real Estate sectors.



Solutions Providers involved in the Data Center projects were also approached to obtain their input on the program. Requests for an interview and a follow up e-mail were sent to all of the Solution Providers involved in projects in the 2014 program year. As part of the Evaluation Plan Navigant planned to interview up to two Solutions Providers and was able to complete interviews with two of the seven Solution Providers.

Twelve participants responded to the survey of the 23 unique participants, with eleven completing all questions. The eleven completed surveys represent a 48 percent response rate and provide a confidence interval of approximately 85% confidence with a margin of error of +/- 15%³.

As part of the impact study, 82 percent of the claimed *ex ante* energy savings underwent an engineering review of the project files. Sixty-eight percent of the *ex ante* savings were subject to an on-site review.

Table ES-3 provides a profile of the impact measurement and verification (M&V) sample stratification and the level of review within each stratum.

Table ES-3. Impact Sampling Strata and Achieved Sampling

Stratum by Approach and Energy Savings	Number of Projects	Strata weight by Energy	Number of Desk Reviews	Number of On-site Reviews
Large (> 750 MWh)	5	70.15%	5	4
Medium (> 75 MWh, < 750 MWh)	14	26.36%	7	1
Small (< 75 MWh)	17	3.49%	2	0
Total	36	100%	14	5
Percent of <i>Ex Ante</i> Savings			81.76%	67.43%

ES.3 Key Evaluation Findings and Recommendations

The following sections summarize the findings of Navigant's evaluation and recommendations to further improve the Data Center Program.

ES.3.1 Key Impact Findings and Recommendations

The *ex post* energy and summer coincident demand savings for 2014 are 11,895 MWh and 1.36 MW, respectively. The realization rate (RR) for both energy and demand is approximately 0.88. These results are shown in Table ES-4. Precision was strong in 2014, with both energy and demand precision well below the target 10%.

³ Assuming a normal, un-skewed response distribution, 12 responses would be required to provide an 85% level of confidence with a margin of error of +/- 15%.

**Table ES-4. Impact Savings, Realization Rate and Precision of Sample**

Metric	2014 Program Goals (a)	<i>Ex Ante</i> (b)	<i>Ex Post</i> (c)	Realization Rate RR = (c) / (b)	Overall Relative Precision at 90% Confidence	Percent of Goal = (c) / (a)
(Annual Energy Savings (MWh)	7,979	13,572	11,895	88%	5.39%	149%
Coincident Peak Reduction (MW)	0.99	1.56	1.36	87%	6.36%	137%

Other key impact findings and recommendations include:

1. Project lifetime and the incremental cost of efficiency are important parameters in calculating the benefit/cost analysis, as well as establishing the validity of chosen project baseline. The implementation contractor has begun tracking lifetimes and incremental costs, but some improvements are possible.

Impact Recommendation #1a: Lifetimes should be tracked at the measure level, and a lifetime savings in kWh should be calculated at the project level.

Impact Recommendation #1b: Navigant, AEP Ohio and the implementation contractor should hold a meeting to agree on predetermined lifetimes for common data center measures. These should include, IT servers and storage devices, new UPS, Desktop virtualization, HVAC optimizations, and hot aisle containment.

2. Project files did not clearly establish whether a project or its measures are considered retrofits or Replace on Burnout (ROB) scenarios. Projects where existing equipment has remaining useful life should be considered a retrofit, where savings is relative to the existing equipment. When existing equipment has reached the end of its useful life, the measure should be considered a ROB. Savings for ROB measures should ignore the existing equipment and be relative to the difference in energy from a new, low-cost option to the as-installed equipment. ROB projects also need to subtract the cost of the baseline equipment from the total project cost to determine the incremental cost of efficiency.

Impact Recommendation #2: Consistently label each measure as a retrofit, a ROB, or a new construction scenario. Provide a discussion in the project files of why the measure was classified as such. Replace on Burnout measures are sometimes referred to as a market opportunity because a market motivation beyond saving energy is driving the replacement or expansion of existing equipment, i.e. a new piece of equipment is being purchased regardless of whether energy is being saved. The question should be asked regarding the true motivation of the equipment replacement.



3. The primary reason realization rates were below 1.0 in 2014 was the baseline analysis on projects involving Computer Room Air Handlers (CRAHs) with variable Electrically Commutated (EC) fans. While the implementation contractor properly calculated the fan motor size per ASHRAE Standard 90.1, no load factor was applied to the motors. Additionally, savings were claimed for interactive effects that would have been present in both the baseline and efficient cases.

Impact Recommendation #3a: When calculating power for a motor based on nameplate information or energy code values, a load factor needs to be applied. Fan motors should receive a 75 percent load factor and pumps an 80 percent load factor.

Impact Recommendation #3b: For market opportunities such as ROB, new construction or new applications, include a quality control to check if savings would also be present in the baseline case.

ES.3.2 Key Process Findings and Recommendations

The process review found the program has been successful in meeting its participation and energy savings goals in its second year of operation. The program processes appear to be reasonable, easy for customers to access, and well accepted by participants. Participants report being well supported by program staff in accessing the program and completing required application information. The program has been successful in broadening the range of participating customers and in meeting the ancillary goal of making the program available to data centers of different sizes. In the second year of operation, program staff have refined and improved some program processes and been successful in increasing involvement by Solution Providers. There still appears to be room for further expansion of the program

Participants who responded to the survey indicated a high level of satisfaction with the program. On a scale of 0-10, where 10 indicated a high level of satisfaction, participants rated all elements of the program as 8 or higher.

- Participants ranked the ease of finding information regarding the program at 8.2 out of 10 (where 10 indicated it was “very easy” to find information).
- Completing the application process was also rated as quite easy (8.5 out of 10), with only one respondent indicating it was difficult (1 out of 10).
- Providing the information required as part of the application process was also rated as relatively easy (8.9 out of 10 where 10 represents very easy).

Participants were also questioned about their level of satisfaction with the incentive levels offered through the program and with the program as a whole. Respondents indicated a high level of satisfaction with incentives offered under the program, with 81 percent indicating the level of incentives offered was sufficient to make the project financially attractive. Overall satisfaction with the level of efficiency and with the program as a whole was quite high, at 9.6 out of 10.

The following process recommendations are offered to help improve program effectiveness and efficiency, as well as to further improve participants’ experience with the program.



1. Twenty-nine of the 36 projects completed in 2014 were submitted after the date of completion indicated on the application, though 12 of these projects were submitted within one week of the completion date. The information for seven of the projects indicates the project was submitted more than six months after the completion date shown. The eligibility criteria for the program indicate applications must be submitted within six months of project completion.

Process Recommendation #1a: Navigant recommends AEP Ohio review the eligibility of the projects entered into the database with an application date more than six months after the completion date to determine whether this is a data entry issue or if these projects should not have been deemed to be eligible. Projects over six months old could be moved to the Self Direct program if the customer is mercantile. Based on that review, Navigant recommends the processes ensuring eligibility requirements are met also be reviewed.

Process Recommendation #1b: To encourage early involvement in the program, Navigant recommends participants be required to submit a pre-application prior to project completion in order to be eligible for the program. This approach would also allow the implementation contractor an opportunity to review the efficiency project and suggest enhancements or additions to the project, thus maximizing savings.

2. Both the survey responses and the information recorded in the tracking database reinforce the fact that communications regarding the program have focused largely on personal sales and direct contact. While this direct sales approach has been successful, and information on the program is available on the AEP Ohio website, there is clearly an opportunity to do more to communicate the benefits of the program and promote opportunities for improved energy efficiency in Data Centers.

Process Recommendation #2: Navigant recommends direct sales efforts be supplemented with a broader outreach and communications campaign, to build awareness of both the program and of opportunities to reduce energy use in Data Center operations. This effort could link to other information sources, such as the federal Office of Energy Efficiency & Renewable Energy Data Center Energy Efficiency program⁴.

3. Participants indicated reliability and up-time were a significant concern to their operations. Some participants also indicated that concerns over energy efficiency projects impacting performance could be a barrier to action. On the other hand, seven of the eleven participants who responded to the survey indicated the energy efficiency project implemented resulted in improved reliability and up-time performance.

Process Recommendation #3a: Given the very high priority data center operators place on reliability and performance, Navigant recommends AEP Ohio and the implementation contractor consider documenting some program success stories in case studies to communicate the benefits of energy efficiency and the value delivered through the program. AEP Ohio has now posted some case

⁴ <http://energy.gov/eere/femp/data-center-energy-efficiency>



studies on the program website. Case studies could also address key concerns and motivators for Data Center and Facility Managers who might consider such initiatives.

The high level of concern over data center security and reliability can also result in concerns over access to equipment for verification purposes. Additionally, some participants do not comprehend the difference between implementation contractor inspections compared to verification for evaluation purposes. To avoid misunderstanding, Navigant recommends the requirement to allow project verification be clearly communicated, and the purpose of the evaluation impact verification be defined.

Process recommendation #3b: Develop processes and protocols for all evaluators to follow when attempting to gain access to large data center customers that retain highly sensitive information. The process should include a contact plan that is individually considered for each customer and a 30 day timeframe for the customer to conduct due diligence in approving the visitor to enter the premise.

Process recommendation #3c: Navigant recommends the requirement to participate in project verification be communicated at multiple touch points, including in the program application; in communications from the implementer during the implementation process, particularly for large projects; at the time of the final inspection and in conveying the incentive check.

Process recommendation #3d: Amend the language in the application form to define evaluation verification, and differentiate that activity from implementation contractor inspections. Represent this distinction whenever evaluation verification is mentioned verbally or in writing.



1 Introduction and Purpose of Study

1.1 Program Overview

AEP Ohio's Data Center Program provides support for customers to achieve higher levels of energy efficiency in data centers. The program is designed to reward customers for energy improvements by providing an incentive based on a facility's annual energy savings. Any business which is a customer of AEP Ohio and operates a data center is eligible to apply for assistance under the program. Applications for an incentive under the program must be submitted within six months of the completion of the program. The program is delivered by an implementation contractor on behalf of AEP Ohio.

The program target for 2014 was set as 7,979 MWh in energy savings. A secondary goal was to ensure the program was made available to customers of all sizes, therefore, program staff sought to have a range of project sizes included in the program. Total energy savings reported for the 2014 program amounted to 13,571 MWh, exceeding the target for the year. Total peak demand savings reported for the 2014 program amounted to 0.99 MW, exceeding the target for the year.

1.2 Evaluation Objectives

This report presents the findings from the impact and process evaluations of the AEP Ohio Data Center Program for 2014. The objectives of the evaluation were to: (1) quantify energy and summer peak demand savings impacts at the meter as a result of the 2014 program; (2) determine key process-related program strengths and weaknesses and identify ways in which the program can be improved and; (3) determine program cost-effectiveness. Specific process evaluation questions are summarized in Section 0 (Process Findings).

1.3 Evaluation Methods

Program impacts were evaluated in terms of energy and demand savings. A portion of the completed project population was sampled with the intention of achieving 90% confidence and a 10% precision on both the program energy and demand savings.

The *ex post* energy and demand savings of the sampled projects were determined by engineering review of the project files, engineering review of the *ex ante* savings analysis, and/or site verification of the installed components of the energy efficiency measures included in the project. Summer coincident peak savings is determined by engineering analysis of the savings potential during the peak period, or by adjusting demand savings with a published coincidence factor for summer peak demand.

Data collection activities are summarized in Table 1-1. Primary data collection efforts included in-depth telephone interviews with program staff at AEP Ohio and the implementation contractor (the program implementer), as well as an on-line survey of all program participants.



Navigant interviewed staff from AEP Ohio and the implementation contractor, and other available support materials to gain an understanding of program logic, expected inputs, outputs and outcomes.

Table 1-1. Summary of Data Collection Activities

Data Collection Type	Targeted Population	Supported Evaluation Activities
Review of Program Documentation	Program documentation and marketing materials new for 2014	Process Evaluation
Secondary Literature Review	Publicly-available evaluations of other utility Data Center programs and available reports on Data Center Energy Management	Impact and Process Evaluation
In-depth Telephone Interviews	AEP Ohio Program staff	Process Evaluation
	The implementation contractor staff	Process Evaluation
	Solution Providers	Process Evaluation
On-line Surveys	Program Participants	Impact and Process Evaluation
Project File Review	Sample of completed projects	Impact and Process Evaluation
On-site Verification	Sample of completed projects	Impact and Process Evaluation
Tracking Data Review	All program participants	Impact and Process Evaluation

2 Methodology

This section describes the methodology used to conduct the process and impact evaluations. A high-level overview of the steps taken to collect and analyze the data for this evaluation is described in Section 2.1. These steps are followed by a discussion of the research questions that guided the evaluation and the tasks completed as part of the process evaluation, including the review of tracking data, the marketing activities and participation. Finally, the methods used for primary data collection tasks and in analyzing the impact and process data are discussed.

2.1 Overview of Approach

This evaluation was driven by three overarching objectives: (1) quantify energy and summer coincident demand savings impacts from the program during 2014; (2) determine key process-related program strengths and weaknesses and identify ways in which the program can be further improved and; (3) determine program cost-effectiveness. To meet these objectives, the evaluation team undertook the following activities.

1. **Evaluation Questions.** Established evaluation questions as part of developing the 2014 evaluation plan with AEP Ohio staff.
2. **Tracking Data Review.** Reviewed the program tracking data collected by the implementation contractor and provided to the evaluation team by AEP Ohio.⁵
3. **Review of Marketing Activities.** Reviewed the overall marketing activities and approach as implemented by the implementation contractor and AEP Ohio.
4. **Review of Participation.** Reviewed program participation by economic sector, size of customer and data center, completion date, and geographic location.
5. **Primary Data Collection.** Performed primary data collection, including: in-depth interviews with program staff, the implementation team, and Solution Providers involved with the program, on-line surveys of program participants, a file review for a subset of randomly selected projects, and on-site verification for a subset of the projects selected as part of the file review.
6. **Methods Used to Analyze Impact Data.** Quantified energy and coincident peak demand reduction savings by reviewing project files. File reviews included verifying baseline selection, determination of incremental costs, quantifying operation hours, reviewing all inputs and assumptions, and engineering algorithms selected. Where uncertainties still existed in the savings calculations, on-site visits were conducted. On-site visits included clarifications of the project scope; requests for missing supporting documentation, verification of equipment specifications and quantities, and collection of energy management system data, as well as metering where required.
7. **Methods Used to Analyze Process Data.** Assessed the effectiveness of the program processes by analyzing program documents, the results of in-depth interviews with program staff at AEP

⁵ The evaluator did not address whether the tracking system is adequate for regulatory prudence reviews or corporate requirements.



Ohio and the implementation contractor as well as Solution Providers, program tracking data review, and participant survey data analysis.

2.2 Key Evaluation Questions

Navigant worked with AEP Ohio to identify a number of evaluation questions regarding the Data Center Program. As the program completes its second year some of the questions focused on how the program has changed since its first year of operation. Figure 2-1 lists the research questions to be addressed in the evaluation and the information sources used to identify each question.

Figure 2-1. Evaluation Questions

2014 Data Center Program - Research Questions	AEP/ IC	Participants	Solution Providers	Research & Analysis
The evaluation seeks to answer the following key research questions				
Impact Questions				
1. Were the impacts reported by the program achieved? If not, why not?	√			√
2. What were the realization rates and what were primary factors driving the realization rates? (Defined as evaluation-verified (<i>ex post</i>) savings divided by program-reported (<i>ex ante</i>) savings.)				√
3. What were the quantifiable benefits and cost of the program? How cost effective was the program in achieving its goals.				√
Process Questions				
Marketing and Participation				
4. What are the key interests and motivations for potential and actual participants? Does the program address any of these motivations beyond the financial incentives offered?	√	√	√	
5. What customer market segments or types of projects participate in the program? What are the key motivations and barriers relevant to specific segments or project types? How can barriers be overcome? Can communications more effectively target key motivations?	√	√		
6. How was the program marketed to the target audience? Are marketing and communications efforts sufficient to meet current and future program participation goals?	√			
7. What type of support is the implementation contractor providing to the program participants? Is this level of support sufficient to attain targeted levels of participation?	√		√	
8. Are the incentive levels offered as part of the program sufficient to motivate participation?	√	√	√	
9. How thoroughly does the implementation contractor cover the AEP Ohio service territory? Are there more effective means of identifying projects within the AEP Ohio service territory?	√			√
10. Is program outreach effectively increasing awareness of the program opportunities?	√	√	√	



2014 Data Center Program - Research Questions				
The evaluation seeks to answer the following key research questions				
	AEP/ IC	Participants	Solution Providers	Research & Analysis
a) What types of outreach activities are used?	√			
b) How often does the outreach occur?	√			
c) Are the messages within the outreach clear and actionable?		√	√	
d) Are the messages addressing key motivations and barriers?	√	√	√	
11. How did customers become aware of the program? What marketing strategies could be used to boost program awareness?	√	√		
Program Characteristics and Barriers				
12. How did participants learn of the program?		√		
13. How do participants perceive the program?		√		
14. How do participants perceive the incentives and costs related to the program?		√		
a) Do participants and Solutions Providers understand eligibility rules and the incentives available?		√	√	
b) Would reallocation of budget between incentive spending and marketing and outreach spending increase program participation and program savings?	√	√	√	
c) Are there particular program characteristics that could be changed to improve customer satisfaction or participation while maintaining program effectiveness?	√	√	√	
15. What are the key barriers to participation in the program for eligible customers who do not participate, and how can these be addressed by the program? Do these barriers vary by sector or participant characteristics?	√	√	√	
16. How many participants applying to the program drop out before completion of their project? Where this occurs, what causes participants to drop out of the program?	√	√	√	
Administration and Delivery				
17. Has the program, as implemented, changed from 2013? If so, how, why, and was this an advantageous change? Were any new measures added or modified?	√	√	√	
18. Do the program processes effectively provide incentives to customers and motivate the Solution Providers to participate? Has the program made progress in reducing the project approval and review time for more complex projects? Navigant will review:				
a) Program tracking and data management.				√
b) Required forms.		√		√
c) Impact to timeline.		√	√	√
d) Ease of use.		√		√
e) Internal program communications.				√



2014 Data Center Program - Research Questions				
The evaluation seeks to answer the following key research questions				
	AEP/ IC	Participants	Solution Providers	Research & Analysis
f) Program staffing.				✓
19. Does the program tracking system provide adequate information for program evaluation?				✓
20. What verification processes have been used by the implementation contractor for the program? How has the implementation contractor verified eligibility? How are energy and demand savings verified? Have these processes been implemented in a manner consistent with the program design? Do these procedures present their own implementation barrier?	✓	✓	✓	
21. What are the opportunities for program improvement?	✓	✓	✓	✓
Community Impact				
22. Has the program resulted in ancillary benefits (such as improved reliability or performance) or helped customers and Solutions Providers in other ways, such as increasing knowledge of energy efficiency opportunities?	✓	✓	✓	
23. Does AEP Ohio/ implementation contractor award customers with completed energy efficient projects with any acknowledgment (certificate, plaque, occupant communications, etc.) that can be used to publicize their achievements within their organization or community?	✓	✓		
24. Has AEP Ohio/ implementation contractor documented any case studies that can be used to demonstrate the benefits of the program?	✓			

2.3 Tracking Data Review

Program tracking data is critical for determining the impacts of the Data Center Program. A copy of the program tracking data collected by the implementation contractor was provided by AEP Ohio to the evaluation team. The tracking data was dated December 31, 2014.

- The evaluation team reviewed all of the fields recorded on the application forms and cross checked the collected data fields against the fields recorded in the tracking database to identify data fields essential for consideration in the impact and process evaluations.
- Key data fields in the database were reviewed to identify missing, incomplete, or inconsistent data.
- The data collected was also reviewed to identify any additional information that would be helpful in evaluating program performance, however, the evaluator did not address whether the tracking system is adequate for regulatory prudence reviews or corporate requirements.



2.4 Review of Marketing Activities

Marketing collateral, application forms and other materials available from the AEP Ohio web site were reviewed and additional marketing material was discussed with AEP Ohio and the implementation contractor. Information on marketing, communications and outreach efforts was also requested from both AEP Ohio and the implementation contractor.

2.5 Review of Participation

The evaluation team used the program tracking data to analyze participation by a number of key factors, including type of business, completion date, data center/customer size and geographic location. The analysis focused on metrics such as number of participants and impact results. The results of this analysis are presented, in part, in the discussion of program activity in Section 0.

2.6 Primary Data Collection

Primary data collection included in-depth interviews with program managers, implementation staff and trade allies (Solution Providers), surveys of program participants, and review of program tracking data. Marketing activities, application forms, and other program inputs were also analyzed.

In-depth qualitative interviews were completed with AEP Ohio and the implementation contractor. On-line surveys were conducted with participating customers to better understand customer satisfaction and perceptions related to the Data Center Program. The interviews and surveys were informed by prior review of relevant program tracking databases, documents, and other materials to understand how the program worked and how it has been marketed for 2014.

Discussion guides were developed to allow a structured but open-ended interview. A free-flowing discussion resulted between interviewer and respondent and real time interviewing flexibility was achieved. Staff experienced in program evaluation was used to perform the interviews. Interviews were conducted by telephone in order to provide flexibility to the respondents' schedules.

Solutions Providers involved in the Data Center projects were also approached to obtain their input on the program. Requests for an interview and a follow up e-mail were sent to all of the Solution Providers involved in projects in the 2014 program year. As part of the Evaluation Plan. Navigant was able to complete interviews with two of the seven Solution Providers

The on-line participant surveys were developed with a combination of short answer questions and open-ended discussions allowing for quantitative analysis and qualitative evaluation of the program. The survey was conducted using *Survey Analytics* survey software. On-line surveys were chosen to provide flexibility to the respondents' schedules, allowing respondents to complete the survey at a time of their choosing, and over time, if convenient.

2.6.1 Population and Sampling for Process Study

As discussed in section 3.1, a total of 36 projects by 23 different companies were completed during 2014. All 23 unique participant contacts were contacted by e-mail with a request to participate. After the on-line survey was sent out, two reminders were issued to participants, as well as one personalized e-mail requesting participants to respond to the survey.



The survey was directed to the decision maker who was recorded as being the applicant responsible for each project and is therefore assumed to be the most knowledgeable about the customer's decision to participate, and resulting interaction with the program. Some participants had multiple projects and/or premises. Survey data was analyzed to determine the number and proportion of responses to each question or possible response. Verbatim responses were also reviewed to obtain an overall sense of participant perceptions of the program and to identify feedback or suggestions that were not anticipated in closed questions. The survey instrument is included in Appendix A.

2.6.2 Sampling Error / Expected Precision

In selecting the sample for the participant survey, participants with multiple projects were only added to the sample once. As a result, a few unique participants might represent multiple projects.

Twelve participants responded to the survey of the 23 unique participants, with eleven completing all questions. The eleven completed surveys represent a 48 percent response rate and provide a confidence interval of 85% confidence with a margin of error of +/- 17%⁶.

2.7 Methods Used to Analyze Impact Data

Completed projects were divided into three strata based on *ex ante* energy savings. A random sample was selected from each stratum to be analyzed. Desk reviews were conducted on all sampled projects which included engineering calculations of energy savings claims and verification of baseline and retrofit assumptions. If uncertainties in the savings calculation existed, an on-site verification was conducted. Site visits inspected equipment specifications and quantity, verified hours of operation, collection of energy management system data and/or metering where required, and answered any outstanding questions. Results of the verification reviews were statistically applied to the entire population to determine *ex post* savings.

2.7.1 Impact Sample of Project Files

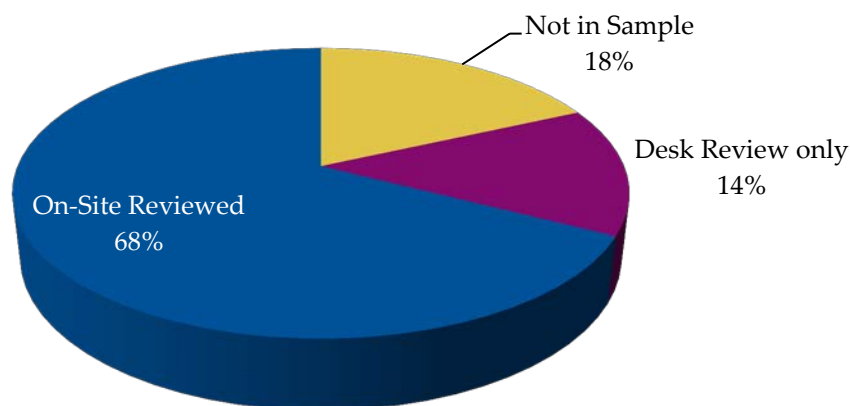
The impact sample was chosen to achieve a 90/10 level of confidence and relative precision for the engineering review. The program was evaluated at the project level. The selected projects were sorted from largest to smallest energy savings and placed into strata, attempting to achieve a relatively even distribution of cumulative standard deviation in energy savings between strata and minimize overall sample size. This approach resulted in a total sample of fourteen projects to be selected for application documentation and engineering review. In the end, Navigant sampled 82 percent of the reported program energy savings.

Table 2-1 provides a profile of the impact measurement and verification sample in comparison with the populations within each stratum. Figure 2-2 illustrates the total *ex ante* energy savings claim and the proportion of which went through desk or on-site level review.

⁶ Assuming a normal, un-skewed response distribution, 11 responses provide an 85% level of confidence with a margin of error of +/- 17%.

**Table 2-1. Impact Sampling Strata and Achieved Sampling**

Stratum by Energy Savings	Number of Projects	Strata weight by Energy	Number of Desk Reviews	Number of On-site Reviews
Large (> 750 MWh)	5	70.15%	5	4
Medium (> 75 MWh, < 750 MWh)	14	26.36%	7	1
Small (< 75 MWh)	17	3.49%	2	0
Total	36	100%	14	5
Percent of <i>Ex Ante</i> Savings			81.76%	67.43%

Figure 2-2. Impact Sampling as a Percent of *Ex Ante* kWh Savings

2.7.2 *Ex Post* Energy Savings Calculation

Energy savings calculations were conducted using standard engineering practices to determine custom savings in data centers. Where possible, lifetimes were applied to the data center program measures that are consistent with lifetimes applied to other AEP Ohio business programs. Retrofit applications used a baseline of the existing equipment, while for Replace on Burnout, ROB, project baselines were determined using the “California Energy Efficiency Baselines for Data Centers, Statewide Customized New Construction and Customized Retrofit Incentive Programs, Revision 1”⁷ and the appropriate energy code, where applicable.

⁷ The California Energy Efficiency Baselines for Data Centers can be found at: http://www.pge.com/includes/docs/pdfs/mybusiness/energysavingsrebates/incentivesbyindustry/hightech/data_center_baseline.pdf



2.7.3 Realization Rates Calculation Method

Realization rates for each stratum were calculated with the following equation:

$$RR = \frac{\sum_{\text{sampled}} E_{\text{ex-post}}}{\sum_{\text{sampled}} E_{\text{ex-ante}}}$$

Where:

E = the energy savings or demand reduction for each project in the stratum

Realization rates in each stratum were applied to the project population of that stratum with the following equation:

$$E_{i,\text{ex-post}} = RR_{\text{stratum}} * E_{i,\text{ex-ante}}$$

2.8 Methods Used to Analyze Process Data

In addition to estimating the level of confidence associated with the survey results, Navigant compared the characteristics of the respondents with the demographics of the population of projects in 2014. Figure 2-3 and Figure 2-4 compare the sample population with the survey responses. The comparison is complicated by the fact the business type was recorded as “Data Center” for 44 percent of program participants in the tracking database; however Navigant reclassified these participants based on company research. While the telecommunications sector was specified for 22 percent of the projects, these were multiple small projects all conducted by the same participant who declined the survey. Government/Municipal, as well as Large Office sectors, also failed to respond to the survey. Overall, the survey respondents represent a diversity of program participants and capture all of the major participant sectors.

Figure 2-3. 2014 Program Participation by Economic Sector

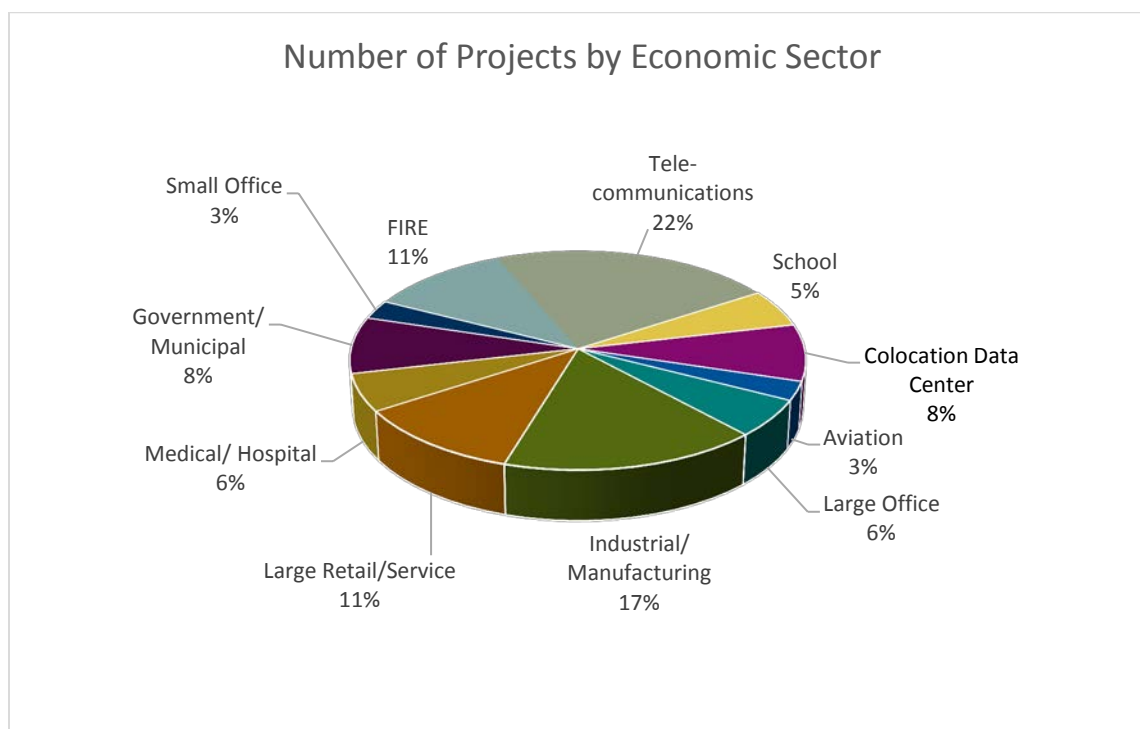
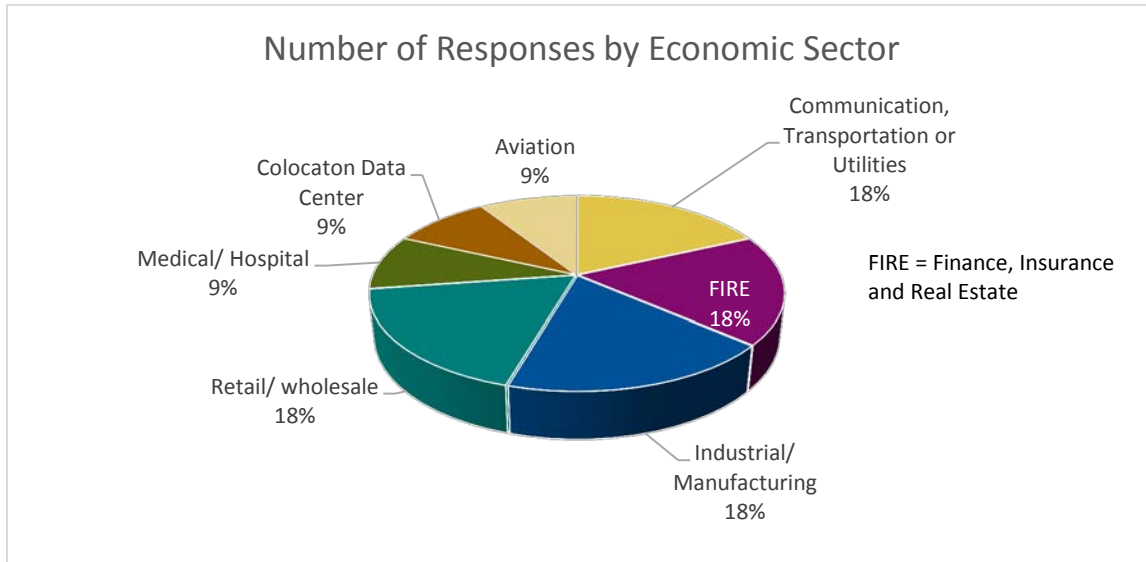




Figure 2-4. 2014 Survey Respondents by Economic Sector





3 Detailed Evaluation Findings

3.1 Program Activity

The Data Center Program entered its second year of operation in 2014. The number of projects completed in year two more than doubled to 36 from 17 projects in the first year of operation. As in the first year, several projects were completed for the same companies. Overall, 23 unique customers were involved in completing projects in 2014. The projects involved the implementation of 53 different measures. Six of the customers who participated in the program in 2014 completed multiple projects. Table 3-1 summarizes the key program indicators. Total *ex ante* energy savings reported for the program amounted to 13,571 MWh. Demand reductions reported under the program totaled 1.55 MW.

Table 3-1. Ex-Ante Program Summary

	2014 Total	Average per Project
Total Project Cost	\$8,343,820	\$231,773
Reported Floor Area	511,027	14,195
Amount of Incentives	\$1,083,131	\$30,087
<i>Ex Ante</i> Energy Savings (MWh)	13,571	376,987
<i>Ex Ante</i> Demand Savings (MW)	1.55	0.043



Table 3-2 shows the number of projects, incentives and savings by sector, based on information reported in the tracking database.

Table 3-2. Summary of Ex-Ante Savings by Economic Sector

Economic Sector ⁸	No. of Projects	Floor Area	Ex Ante Energy Savings (kWh)	Ex Ante Demand Savings (kW)	Incentive \$ per kWh
School	2	1,207	35,608	4	\$0.0800
Colocation Data Center	3	55,000	916,241	132	\$0.0772
Aviation	1	Not Reported	31,093	4	\$0.0800
Large Office	2	1,600	116,151	13	\$0.0653
Industrial/Manufacturing	6	58,340	4,648,497	544	\$0.0800
Large Retail/Service	4	40,500	1,353,677	154	\$0.0800
Medical/Hospital	2	12,200	314,910	36	\$0.0800
Government/Municipal	3	9,760	289,139	34	\$0.0800
Small Office	1	500	21,328	2	\$0.0800
FIRE ⁹	4	330,000	5,647,966	620	\$0.0800
Telecommunications	8	1,920	196,912	13	\$0.0800
Total	36	511,027	13,571,522	1,556	\$0.0797

For 44 percent of the projects, the business type in the tracking database was recorded as “Data Center” with no indication of the economic sector or sectors served. Navigant reviewed these projects to identify the economic sector for the purposes of this review, and recommends program staff identify the type of business for each project and record this information in the database. Table 3-2 and later figures present the distribution by economic sector based on Navigant’s interpretation of economic sector.

- Ninety-four percent of the businesses participating in projects indicated the data center operated 24/7, while just six percent indicated eight hours per day and five days per week or a similar schedule.
- According to the information in the database, 29 of the 36 projects completed in 2014 were submitted after the date of completion indicated on the application, though 12 of these projects were submitted within one week of the completion date. The results from the survey of program participants indicate almost two-thirds of participants report their first contact with the program occurred before the project was initiated. Navigant assumes many participants were working with the program without formally applying.
- The information for seven of the projects indicates the project was submitted more than six months after the completion date shown. The eligibility criteria for the program indicate applications must be submitted within six months of project completion. Navigant recommends AEP Ohio review the eligibility of these projects to determine whether this is a data entry issue

⁸ Economic sector was determined by Navigant as a way to determine the penetration of the program into various sectors. Economic sector was not defined or tracked by the implementation contractor.

⁹ FIRE is the Finance, Insurance and Real Estate sectors.



or if these projects should not have been deemed to be eligible. Based on that review, we recommend the processes ensuring eligibility requirements be reviewed.

- Only four projects provided information on the level of Power Usage Effectiveness or PUE; used to measure energy efficiency in Data Centers¹⁰. The average PUE for these projects was 1.98.

The application form for the program asks participants to indicate how they had learned of the program. As shown in Figure 3-1, the tracking database shows 83 percent of participants indicated they initially heard of the program through an AEP Ohio Account Representative, while 17 percent learned of the program from their contractor or Solution Provider (Solution Provider). In terms of *ex ante* energy savings, projects in which the participant indicated they had learned of the program from an AEP Ohio Account Representative accounted for 97 percent of program savings. A comparison of participants with program results for 2013 indicates five of the participants in the 2014 program also had completed project in 2013. The tracking database also recorded whether a Solution Provider was involved in implementing the efficiency project. Overall, the database shows seven different Solution Providers were involved with 16 projects completed during the year. This amount is a significant increase over the levels reported in the first year of the program and speaks to the success of outreach efforts by program staff to obtain greater involvement by Solution Providers.

Figure 3-1. Program Awareness and Involvement of Solutions Providers

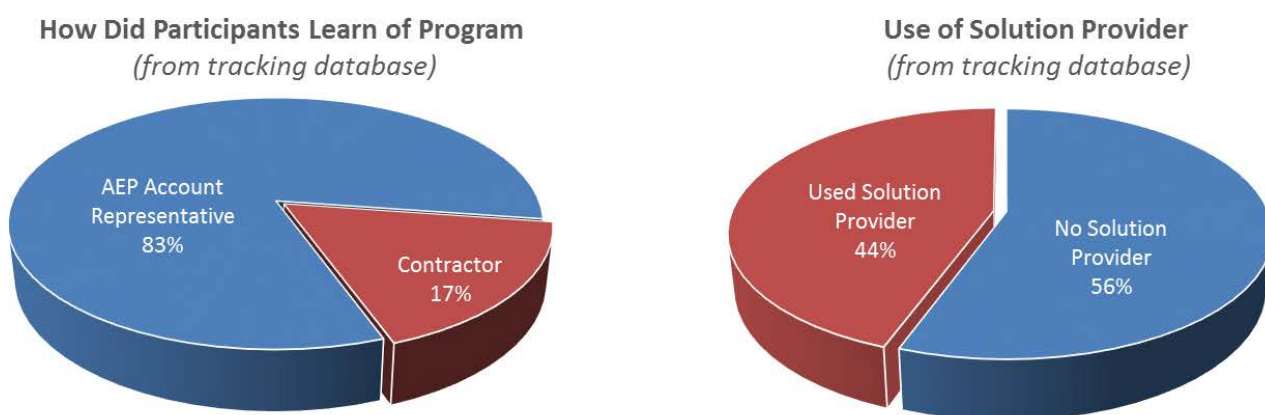


Figure 3-2 compares the distribution of the number of Data Center projects in 2014 to the distribution of *ex ante* savings by economic sector. As the chart shows, the largest number of projects came from telecommunications (22%), however these projects were originally one project later divided into eight projects. After telecommunications, industrial/manufacturing (17%) has the next largest number of projects. The majority of *ex ante* savings on the other hand came from the FIRE¹¹ (41.6%) and industrial/manufacturing (34.3%) sectors.

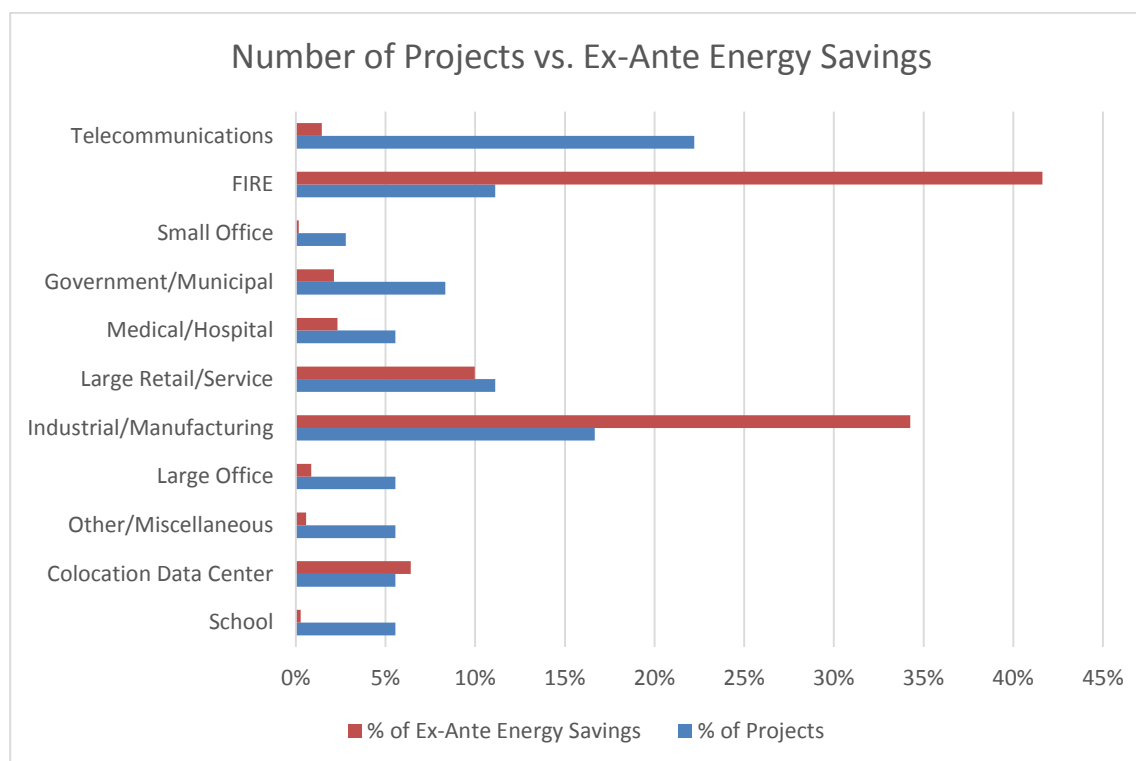
¹⁰ PUE is calculated by dividing the amount of electrical energy entering a data center by the energy used to run the computer infrastructure in the data center.

¹¹ Finance, Insurance and Real Estate sectors.



Navigant notes the distribution of projects shows a broader coverage of economic sectors than was reported in the first year of the program. It is recommended more information be obtained about the type of business associated with the projects reported as Data Centers.

Figure 3-2. Projects by Economic Sector



Measures completed under the program were divided into two broad categories, measures related to Heating, Ventilation and Cooling (HVAC) or IT Equipment Upgrades (IT). Overall, HVAC measures accounted for about 40% of program savings, with the balance of savings derived from IT equipment improvements¹². Within each category, measures were further subdivided into the different sub-categories shown in Table 3-3. A graphical breakdown of measures is provided in Figure 3-3. The largest share of savings came from server virtualization projects (31%). Two categories, HVAC/CRAH and Mainframe Refresh projects contributed 21% and 17% of program savings respectively and HVAC Optimization contributed 9%. The balance of program savings was attributed to a range of measure types, most of which individually contributed less than 4% each.

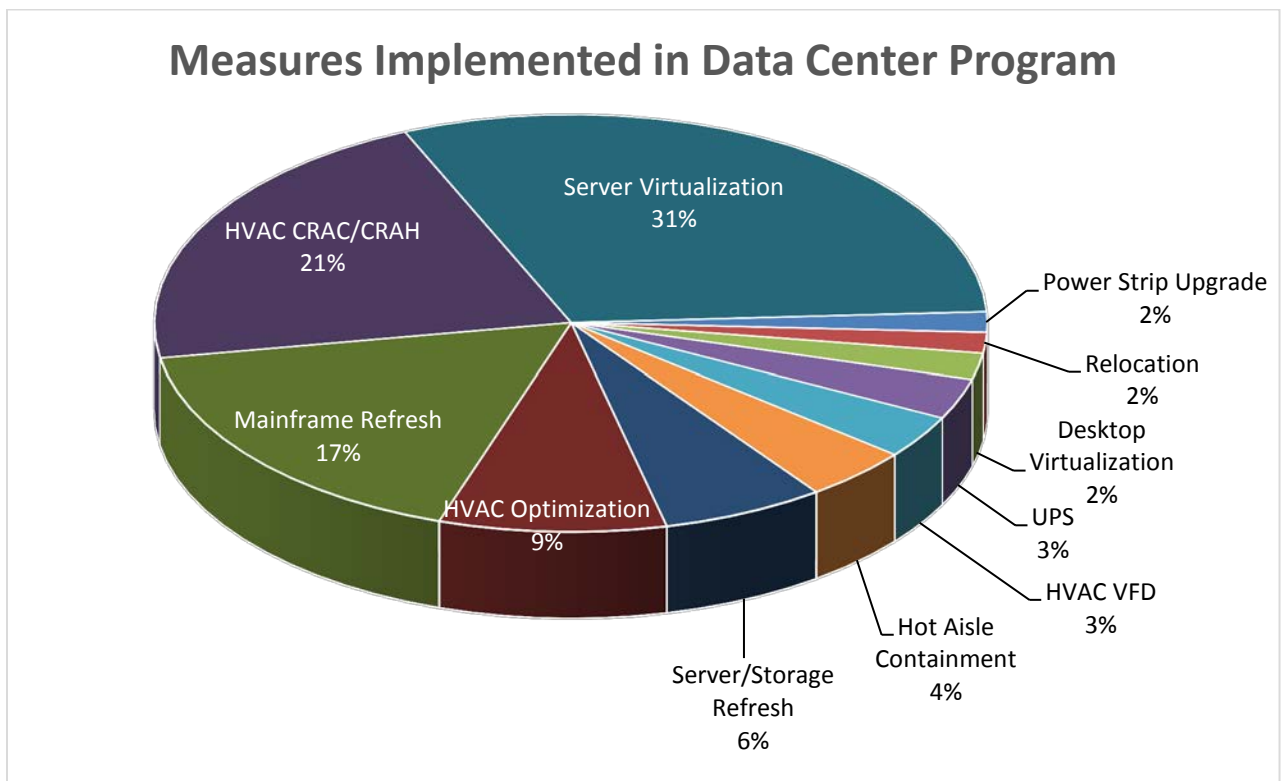
¹² Note each IT equipment improvement also had interactive HVAC savings. When factoring this into the analysis, over half of the savings in the program is HVAC savings.



Table 3-3. Measures by Category

Measure Types	No. of Measures	Ex Ante Savings		Measure
		kWh	kW	Cost
Desktop Virtualization	1	276,291	31.5	\$65,782
Hot Isle Containment	1	562,956	91.7	\$177,796
HVAC CRAC/CRAH	16	2,874,311	318.7	\$739,243
HVAC Optimization	9	1,193,855	114.3	\$535,404
HVAC VFD	2	452,612	51.7	\$66,015
Mainframe Refresh	2	2,329,338	266.9	\$585,345
Power Strip Upgrade	1	214,822	24.5	\$70,920
Relocation	2	216,476	24.7	\$151,542
Server Virtualization	5	4,166,818	475.6	\$1,317,177
Server/Storage Refresh	5	858,022	108.2	\$279,321
UPS	9	426,021	48.5	\$239,720
Total -	53	13,571,522	1,556.3	\$4,228,266

Figure 3-3. Measures Implemented in Data Center Program by Energy Savings (kWh)





3.2 Impact Evaluation Findings

This section includes a summary and discussion of the evaluation-calculated energy and demand savings for the 2014 Data Center Program. Annual electricity savings were calculated using the data collected through document reviews and field visits for the sample of sites.

With few exceptions, the project details and savings calculation approach was well documented by the implementation contractor, and per Navigant's recommendation the implementation contractor started documenting project lifetime in the middle of 2014. Data center projects are complex, and clear and concise documentation is necessary for effective evaluation. Navigant appreciates the level of detail provided. The project files would be improved if all projects clearly stated the condition of the existing equipment, and if they are analyzing the project as a retrofit or a Replace on Burnout (ROB). Additionally, more detail on the basis for incremental project cost would improve the project files.

3.2.1 Summary of Impact Findings

The *ex post* energy and summer coincident demand savings for 2014 are 11,895 MWh/year and 1.36 MW respectively. In the second year of the program, the implementation contractor was able to meet targets without the first year benefit of previously-completed projects. The realization rate for both energy and demand is approximately 0.88, which is slightly lower than the 2013 result of a 0.90 realization rate. These results are shown in Table 3-4. Precision was strong in 2014, with both energy and demand precision well below the target 10%.

Table 3-4. Impact Savings, Realization Rate and Precision of Sample

Metric	2014 Program Goals (a)	<i>Ex Ante</i> (b)	<i>Ex Post</i> (c)	Realization Rate RR = (c) / (b)	Overall Relative Precision at 90% Confidence	Percent of Goal = (c) / (a)
(Annual Energy Savings (MWh))	7,979	13,572	11,895	88%	5.39%	149%
Coincident Peak Reduction (MW)	0.99	1.56	1.36	87%	6.36%	137%

3.2.2 Driving Factors of Realization Rate

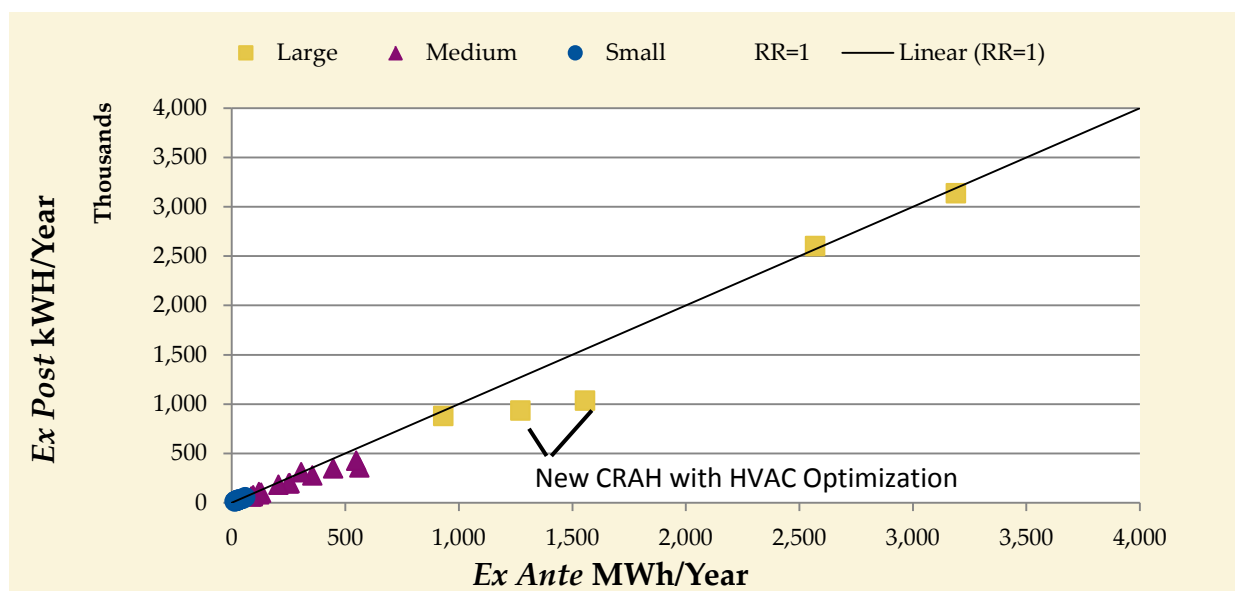
Data analysis revealed certain factors are driving the realization rate between claimed savings and verified savings. Energy savings and demand savings will be discussed simultaneously since most measures have a flat savings profile regardless of time or season.

Fourteen projects were sampled as part of the impact study. Four of the sampled projects were primarily virtualization projects; two of the projects were IT refresh projects, on servers, storage devices or mainframes; three projects were new Uninterruptible Power Supply (UPS) projects; two projects involved new Computer Room Air Handlers (CRAHs), both with HVAC optimizations; one sampled project was new Variable Frequency Drives (VFDs) on CRAHs; one project was hot-aisle containment; and one project was a relocation to a colocation data center with more efficient facilities.



Figure 3-4 is a graphical representation of the project level *ex ante* versus *ex post* energy savings grouped by sample strata and program approach. The diagonal line represents the goal of a realization rate of one. Points above and to the left of the RR=1 line represent projects with energy realization rates above one, while those points below and to the right are projects with realization rates less than one.

Figure 3-4. *Ex Ante* vs. *Ex Post* Energy Savings



The two projects primarily driving the program RR below one are both at the same facility and both primarily regarding the addition of new CRAHs. The project with 1,272 MWh *ex ante* savings was for nine new CRAHs with electrically commutated (EC) fans. These CRAHs were added to larger rooms with other CRAHs in the space. The project also included controls to shut off existing air handling units in another area and a VFD pump optimization. Primarily, Navigant found the *ex ante* savings on the new CRAHs to be overstated. The implementation contractor compared the installed CRAHs to ASHRAE Standard 90.1, which allows for constant value CRAHs. While Navigant agrees with the use of ASHRAE 90.1 and the calculation used to size the fan motors, the implementation contractor assumed the baseline fans would be running at 100 percent. Typically constant value fans run at a load factor of 70 to 80 percent. Navigant applied a load factor of 80 percent to all baseline fan motors, reducing the savings. Further, the implementation contractor calculated saving due to rebalancing the existing CRAHs after the addition of the new CRAHs. While metering clearly shows the existing CRAHs are now drawing less power, this same effect would have taken place had the addition of ASHRAE Standard 90.1 baseline CRAHs taken place. Essentially this savings is double-counted in the implementation contractor's calculation.

The second project with 1,556 MWh *ex ante* savings was for twelve CRAHs with EC fans. The project also involved improvements to the data center roof, resulting in a lower HVAC load. This project suffered from the same issues as the first, with no load factor on the baseline fans and double-counting savings due to rebalancing existing CRAHs. Realization rates for these two projects are 73 percent on the first and 66 percent on the second.



Figure 3-5. *Ex Ante* vs. *Ex Post* Energy Savings without the Large Stratum

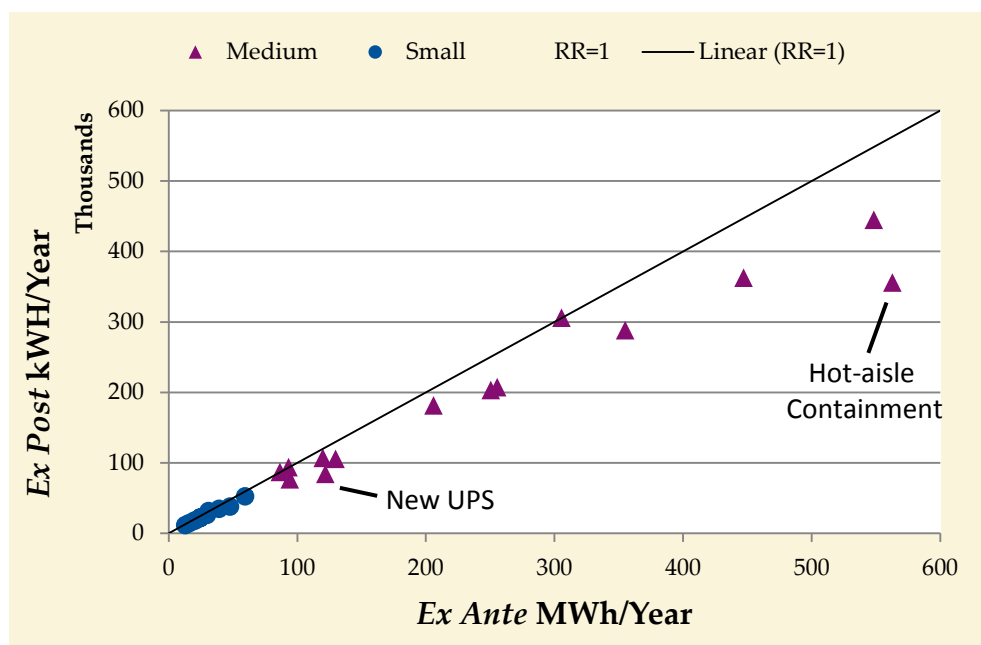


Figure 3-5 presents the same information as in Figure 3-4, but with the large projects removed so detailed results can be demonstrated for medium and small projects. The hot-aisle containment project involved adding hot-aisle to constant volume 30-ton computer room air conditioners (CRACs). The implementation contractor calculated the difference in CRAC energy from pre and post retrofit spot measurements taken a year apart. These readings were taken on days where the daily high and low were within three degrees of each other, but the project files do not indicate the outside temperature at the time of the reading. Both were warm days with 84°F for the pre reading and 87°F for the post reading. The *ex ante* savings is based on four CRACs being turned off as a result of the hot-aisle containment project. Navigant did an on-site of the project and obtained trend data for an unseasonably cold week of March, where daily highs ranged from 36-66°F. Unfortunately, the observed number of CRAC units during the time periods was only one to two more CRACs turned off relative to the baseline. Further, Navigant captured outside air dependence that, if fully adjusted, would show more energy use than the baseline case. Meanwhile, IT loading had not significantly changed from the implementation contractor's readings. Essentially, the data was pointing towards no savings, but hot-aisle containment was confirmed, and is a proven method of reducing data center HVAC energy. The main issue in the implementation contractor analysis was a lack of robust baseline data, which is essential for properly calculating hot-aisle containment savings. Rather than zeroing the project savings, Navigant employed a conservative savings estimate based on hot-aisle containment experience.

The new Uninterruptible Power Supply (UPS) project consolidated four existing UPSs into a single 225 kVA UPS. The *ex ante* savings for this project used a baseline UPS output higher than the post retrofit UPS output. This overstates the savings, as server load had decreased in the post retrofit case. Navigant calibrated so baseline UPS output equals retrofitted UPS output, resulting in a 69 percent realization rate.



In addition to the previously mentioned projects, adjustments to *ex ante* savings were found in smaller projects with less of an effect on the program level realization rate. These included two other UPS projects; one which should have used a Replace on Burnout (ROB) baseline rather than the existing equipment, and one where Navigant found the UPS to be operating at a lower output load, causing the efficiency to be lower than the *ex ante* efficiency. There was also a relocation project where the implementation contractor applied 8760 hours to HVAC and lighting measures had less than 8760 hours of savings.

The implementation contractor started including project lifetimes and incremental project costs in the middle of 2014, per Navigant's suggestion in the 2013 evaluation report. While Navigant is encouraged lifetimes and incremental cost are being reported, some improvements can be made. The tracking data does not currently include a field for lifetime savings. One lifetime is reported for each project that appears to be based on the largest measure in the project, rather than calculating lifetime at the measure level. There is not a mutually agreed upon referenced document for measure lifetimes, therefore the implementation contractor and Navigant are using different measure lifetimes. For instance the implementation contractor is using a five year lifetime for servers, storage and mainframes; while Navigant's experience interviewing data centers indicate four years for servers and storage devices is a typical lifetime. Based on a recent IBM mainframe lifecycle study¹³, mainframes are typically offered for 4.4 years and maintained for another 6.2 years. For the average user purchasing mid-offering, they would have 8.4 years left of support. As not everyone would run a mainframe to the end of its supported lifetime, Navigant suggests using a 6 year lifetime for mainframes.

Treatment of incremental costs has improved, but further improvements are still desirable. The incremental project cost is also not included in the tracking data. The project files should include a short statement indicating whether the implementation contractor is treating the project as a retrofit of existing equipment with significant remaining useful life, or treating the project as a Replace on Burnout (ROB) where the existing equipment is near end of life. The project files are not consistently detailed on how the incremental cost has been calculated, especially with respect to how baseline costs were calculated on ROB projects. Lastly, many projects did not include tax in the incremental cost.

¹³ "IBM Mainframe Life Cycle HistoryV1.5b", D. Clarke, August 7, 2014. Available at http://www-304.ibm.com/partnerworld/wps/servlet/ContentHandler/techline/TD105503_migrated



3.3 Process Evaluation Findings

The process review found the program has been successful in meeting its participation and energy savings goals in its second year of operation. The program processes appear to be reasonable, easy for customers to access and well accepted by participants. The program has been successful in broadening the range of customers participating in the program and in meeting the ancillary goal of making the program available to data centers of different sizes. In the second year of operation, program staff have refined and improved some program processes and been successful in increasing involvement by Solution Providers. There still appears to be room for further expansion of the program. A number of recommendations for continued program improvement are found in each of the following subsections.

The remainder of this section presents these findings in more detail. The section begins by discussing participant satisfaction with various aspects of the program. This is followed by a discussion of the effectiveness of various aspects of the program processes, beginning with marketing, and continuing through the incentive payments:

- » Participant Motivations
- » Marketing Efforts and Program Awareness
- » Customer Enrollment Process
- » Incentive Payment Process

Following this, the following aspects of the program processes are examined in further detail:

- » Customer Behavior in the Absence of the Program
- » Review of Program Tracking Data
- » Verification and Due Diligence

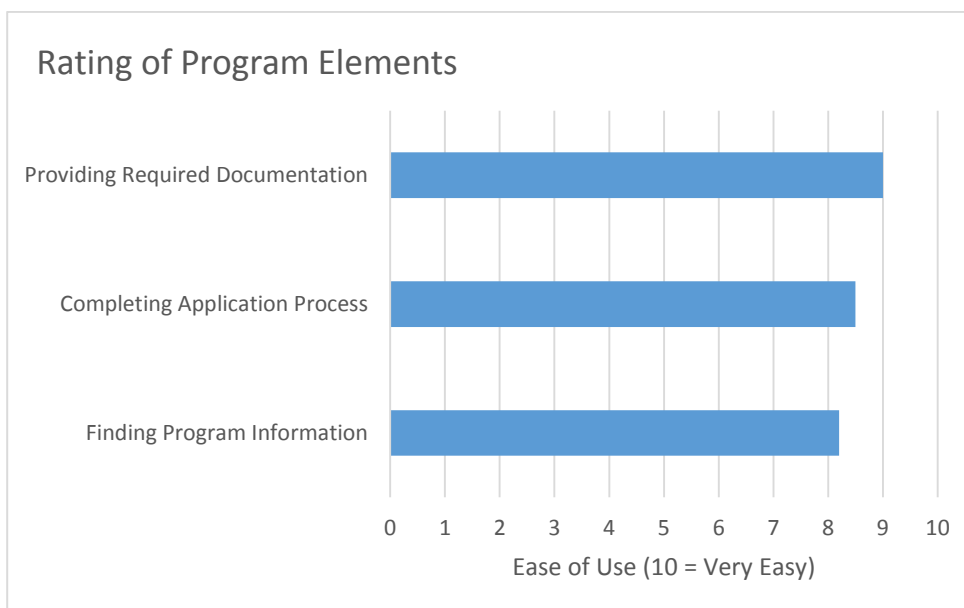
3.3.1 Participant Satisfaction

Participants who responded to the survey indicated a high level of satisfaction with the program. On a scale of 0-10, where 10 indicated a high level of satisfaction, participants rated all elements of the program as 8 or higher. Survey results are presented in Figure 3-6 and Figure 3-7. Participants ranked the ease of finding information regarding the program at 8.2 out of 10 (where 10 indicated it was “very easy” to find information).

- Completing the application process was also rated as quite easy (8.5 out of 10), with only one respondent indicating it was difficult (1 out of 10).
- Providing the information required as part of the application process was also rated as relatively easy (8.9 out of 10 where 10 represents very easy).

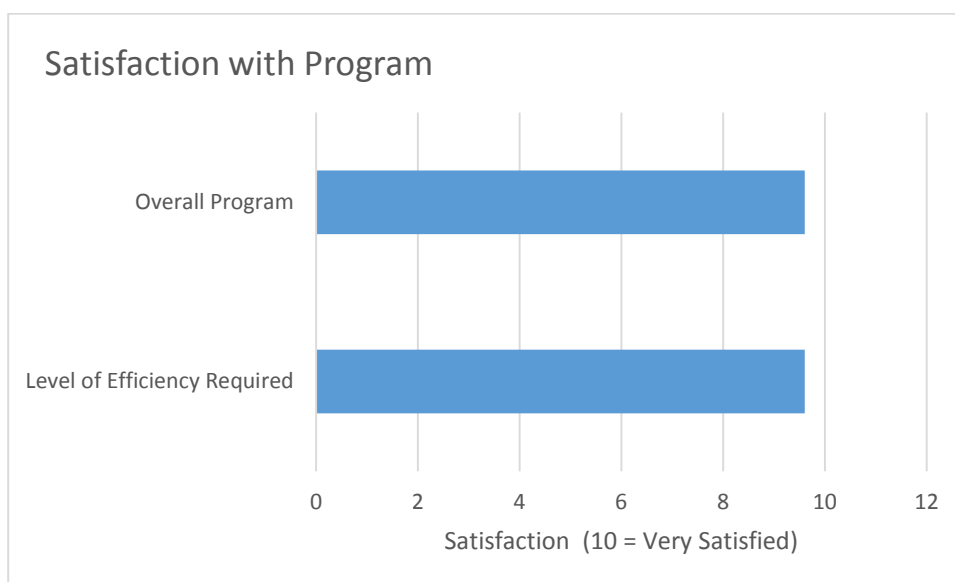


Figure 3-6. Ease of use of the program



Participants were also questioned about their level of satisfaction with the incentive levels offered through the program and with the program as a whole. Respondents indicated a high level of satisfaction with incentives offered under the program, with 81 percent indicating the level of incentives offered was sufficient to make their project financially attractive. Overall satisfaction with the level of efficiency and with the program as a whole were both quite high, at 9.6 out of 10.

Figure 3-7. Level of satisfaction

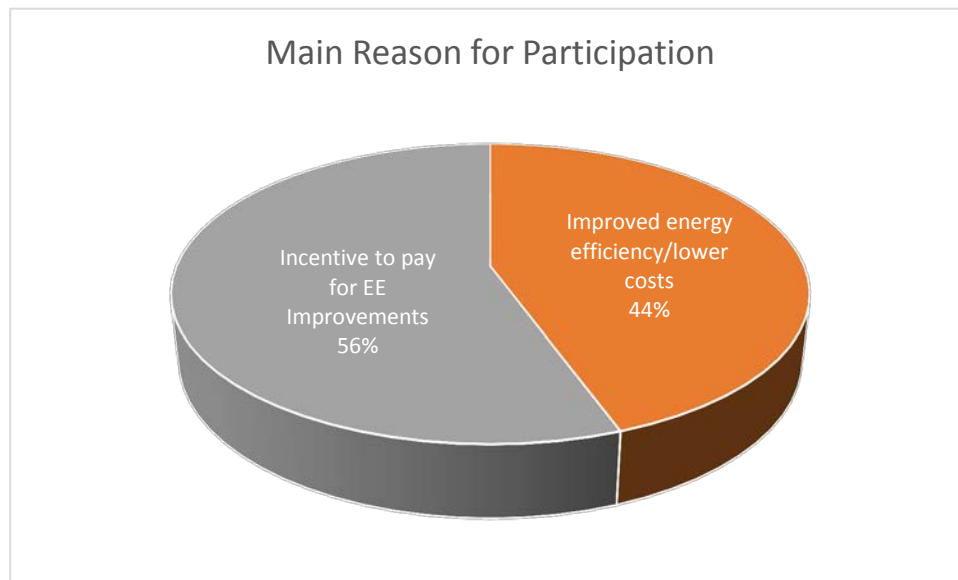




3.3.2 Participant Motivations

Program participants were asked to identify the main reason they decided to participate in the AEP Ohio Data Center Program. As Figure 3-8 illustrates, the responses were split between two key motivations; “improved energy efficiency and lower operating costs”, and the availability of the “incentive to pay for energy efficiency improvements”. These results are very similar to those found in the first year of the program. None of the respondents indicated the availability of technical assistance or other program elements played a significant role in their decision.

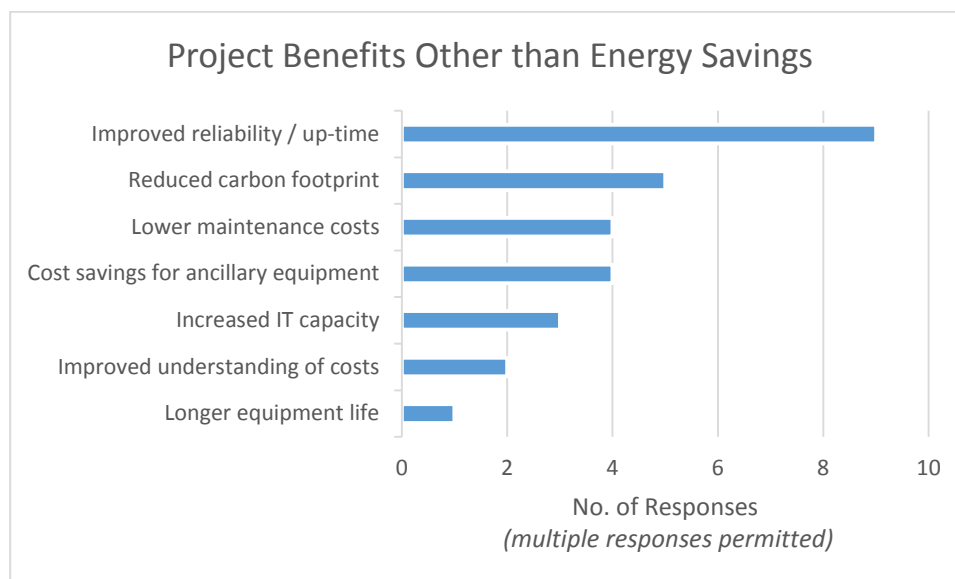
Figure 3-8. Reasons for Participating in the AEP Ohio Data Center Program





The survey also asked if the participant felt there were any other, non-energy benefits associated with the energy efficiency project implemented, results are in Figure 3-9. A number of co-benefits were identified, with improved reliability and up time being the most commonly mentioned benefit (9 of 11). Other benefits mentioned included reduced carbon footprint (5), lower maintenance costs and cost savings for ancillary equipment (4 each), as well as increased information technology (IT) capacity, improved understanding of costs, and longer equipment life.

Figure 3-9. Did the efficiency measure you implemented provide any non-energy benefits?



Note: Multiple responses allowed.

Solution Providers interviewed about the program indicated cost management was a common concern, reflected in part through a concern over managing energy costs. One Solution Provider who reported his firm was involved in 20 to 30 Data Center programs each year estimated reliability and first cost were each primary concerns for about one-third of his clients, and energy efficiency was the main concern for only about 20 percent of clients. Solution Providers indicated key concerns differ by type of client, with reliability being the key concern for finance and large retail clients, while first cost is a higher priority for industrial or general office clients. For finance and large retail clients, downtime is viewed as translating directly into revenue loss. Feedback from Solution Providers also pointed out the non-energy benefits of the program tend to be greatest for existing facilities which participate in the program. Those facilities which are upgrading existing equipment tend to enjoy benefits related to increased reliability and productivity relative to their old equipment.

3.3.3 Marketing Efforts and Program Awareness

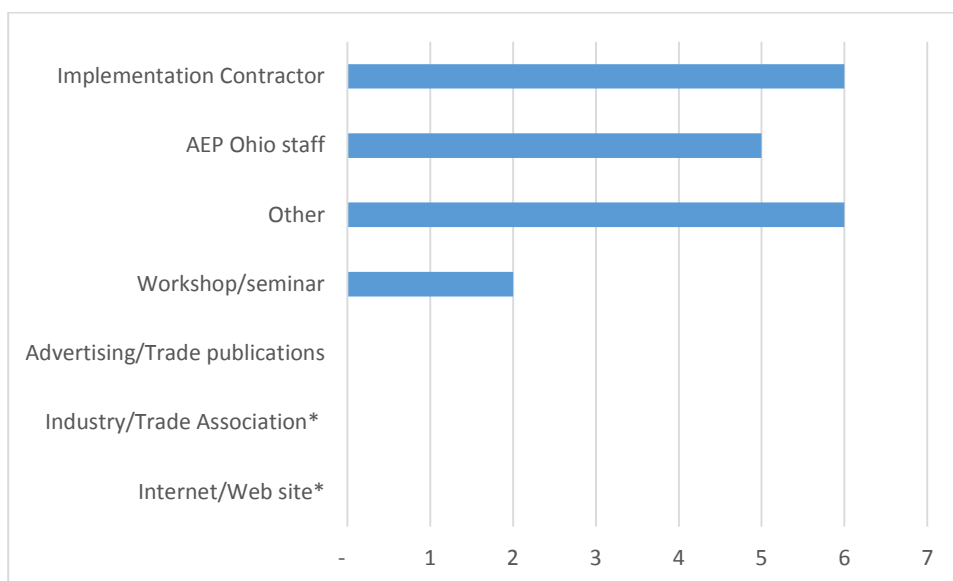
In discussing the program, AEP Ohio and the implementation contractor staff stressed the importance of having a specific program to reach out to Data Centers. This segment has been identified as a unique market segment with very particular needs. As a result, it was felt successfully accessing this market required a specific marketing approach and program staff who could “talk the talk” with IT professionals.



During the second year of the program's operation, program staff report they worked to reach out to the sector, both to build awareness of the program and to encourage participation by Solutions Providers. Outreach was largely limited to direct contact activities, conducted by both AEP Account Representatives and the implementation contractor staff, and included cold calls to customers known to have data centers, meetings with Solution Providers, and some targeted outreach to segments identified as having potential, such as schools and hospitals. The implementation contractor also indicated they did an e-mail blitz to potential participants to communicate the availability of the program and generate leads. Program staff noted the outreach process is complicated somewhat by the fact some companies use a third party to administer their Data Center. This means, in some instances, the organization responsible for the Data Center at a customer site is not actually an AEP Ohio customer.

Feedback from Solution Providers and in the participant survey reinforces the program's outreach strategy has been successful in increasing awareness and acceptance of the program. The Solution Providers interviewed had each enrolled at least one project in the program and indicated an interest in learning more about the program and increasing their involvement. Solution Providers also indicated some of their clients were already aware of the program when contacted by the Solution Provider.

Figure 3-10. How did Participants Learn of Program (per Survey)



**Survey question asked "How did you learn of the AEP Ohio Data Center Program?
Multiple Responses Permitted.*

As was shown earlier in Figure 2-4, information in the tracking database indicates 83 percent of participants reported they had learned of the program through an AEP Ohio Account Representative. Figure 3-10 illustrates how participants learned of the program according to the survey. Responses to the survey show most customers learned of the program through the implementation contractor or AEP Ohio staff, two reported learning of the program through a workshop or seminar, and six mentioned they had learned of the program through some other means. Both the survey responses and the information recorded in the tracking database reinforce that communications regarding the program has



focused largely on personal sales and direct contact. While this direct sales approach has been successful, Navigant recommends it be supplemented with a broader outreach and communications campaign, to build awareness of both the program and of opportunities to reduce energy use in Data Center operations.

As noted in last year's evaluation, AEP Ohio's Economic and Business Development division offers a "**Qualified Data Center Site Program**" (QDC Solution Provider) that helps companies seeking a site for a new Data Center by providing information on development-ready sites "*that have passed a rigorous independent qualification process*"¹⁴. Data Center Program staff continue to liaison with the **QDC Solution Provider** to identify projects which might qualify under the AEP Ohio Data Center Program and that a couple of new construction projects had come in through the **QDC Solution Provider** . One of the 2014 program participants indicated it had participated with the QDC Solution Provider¹⁵.

Solutions Providers played a much larger role in the program in its second year of operation. In the evaluation, it was expected going forward, the main role for Solution Providers would be in communicating the availability of the program to their clients operating data centers and in making program staff aware of potential data center efficiency projects. In 2014, Solution Providers have played those roles; providing market intelligence and leads for the program, but have also been involved in developing and bringing projects into the program as it continues to develop. Navigant recommends AEP Ohio and the implementation contractor continue this work of establishing a network of Solution Providers for the program.

3.3.4 Barriers to Participation

The main barriers to increasing energy efficiency in data centers reported by participants related to financial issues (capital cost), followed by uncertainty regarding the performance of the measures and a lack of understanding of available energy efficiency options. Just fewer than 40% (4 of 11 responses) mentioned concerns over the time commitment required, uncertainty about measure performance, and payback or return on investment. While the program incentives are designed to change the financial calculus, these results also indicate the program can contribute to overcoming barriers through provision of information on efficiency opportunities, performance and reliability benefits and the time required to participate in the program.

Participants were also asked if they had any concerns prior to undertaking the project that the measures implemented to improve energy efficiency might have an effect on other areas of performance. Only one respondent indicated they had some concerns about the project's impact on reliability. Three mentioned they had other areas of concern prior to participation.

Comments from the implementation contractor, AEP Ohio and Solution Providers all indicate the data center sector is very risk averse with respect to reliability and up-time performance. As a result, there is some need to build trust within the sector that energy efficiency projects will not threaten these key performance objectives. Navigant recommends AEP Ohio and the implementation contractor consider documenting some program success stories in case studies to communicate the benefits of energy

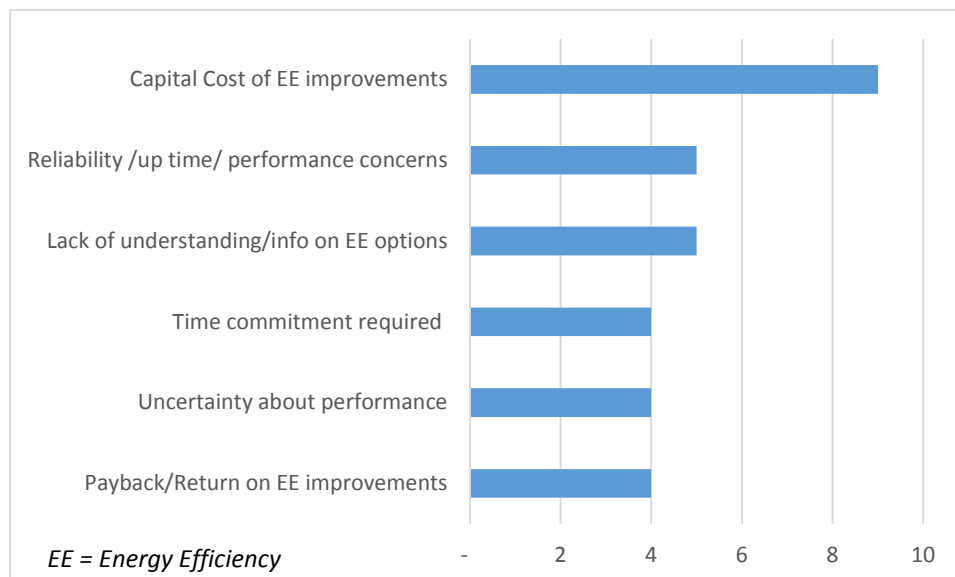
¹⁴ <http://www.aepdatacenters.com/>

¹⁵ Note only new facilities would be eligible for the QDC Solution Provider.



efficiency, the value delivered through the program and address some of the key concerns and motivators for Data Center and Facility Managers who might consider such initiatives.

Figure 3-11. Barriers to increasing Energy Efficiency of Data Centers



* Survey question asked "What do you see as the main barriers to increasing the level of energy efficiency in Data Centers?"

Graph Shows Number of Responses to Survey Question, Multiple Responses Permitted.

Overall customer satisfaction with different elements of the application process and the program generally was found to be quite positive. No significant concerns were expressed with regards to the level of documentation required or problems in obtaining the type of information required for the application. Program staff and Solution Providers, however, mentioned some issues have arisen with concerns over security and access to facilities for measurement and evaluation purposes. Some concerns have been expressed over possible risks to reliability that could arise when installing measurement equipment. While we understand these issues have been resolved to-date, we suggest the AEP Ohio and the implementation contractor ensure the requirement to allow access to the site for evaluation purposes be clearly communicated when initially discussing the project and setting out the M&V plan.

Feedback from Solution Providers involved in the program reinforced that the incremental capital costs of energy efficiency measures are a key barrier but also indicated lack of knowledge and awareness of opportunities to reduce energy use are a key barrier for many customers. This again speaks to the opportunity for the program to encourage increased efficiency through expanded communication and education efforts.

3.3.5 Customer Enrollment Process

Navigant reviewed the customer enrollment process, including the application forms, processes followed by the implementation contractor in reviewing and approving applications, time required for review and approval of applications, and approval review processes. Navigant notes the listing of the



"Steps for Submitting Your Application" and the *"Check list"* included in the application form are helpful in ensuring all of the required elements are included in applications.

Navigant found no significant issues with respect to the enrollment and approval process. In part this reflects the fact that program staff has provided considerable support to participants in completing program applications and supporting documentation.

Participants rated the process as quite easy (see section 3.1.1) and both Solution Providers and customers commented on the high level of support provided by the implementation contractor staff. The comment below is typical of the positive comments about the level of support from the implementation contractor that were received in the survey:

"My last energy rebate was a lot easier due to [the implementation contractor] – they keep me on the right track of what information they needed and helped the process to move along".

Some participants also offered comments on how to improve the process. Most related to communications and included suggestions to set up regular weekly touch points to improve communications and keep the project moving along, and to have a single point of contact during the process (customer indicated they had to talk to two to three people/groups to get started). One participant mentioned the initial paperwork seemed a little redundant and confusing, but complemented the person supporting them with helping them to sort out and complete the paperwork.

3.3.6 Incentive Payment Process

Incentive payments amounts are based on energy savings estimates developed by the implementation contractor and are approved by AEP Ohio. A review of the tracking database indicates the average elapsed time from the date of the application to the date on which the incentive was paid was 137 days. The elapsed time from the date on which the project passed final inspection (*PostInspectionPassed*) to the time when the incentive was paid (*IncentivePaidDate*) was 145 days. For eight of the projects, the time delay was over 200 days. Ten other projects were paid in 63 days or less. For three of the projects that were paid an incentive, there is no record of when the project passed post inspection. The time delay between the post inspection and approval and issuing the incentive seems quite long, however, there is no indication in the tracking database of when the program received all of the information required to pay the incentive. Navigant recommends a column be added to the database to record that information so the time required to issue the incentive can be properly tracked and monitored. No comments were received from participants with regards to the time required to obtain incentives under the program.

3.3.7 Changes as a Result of Participation

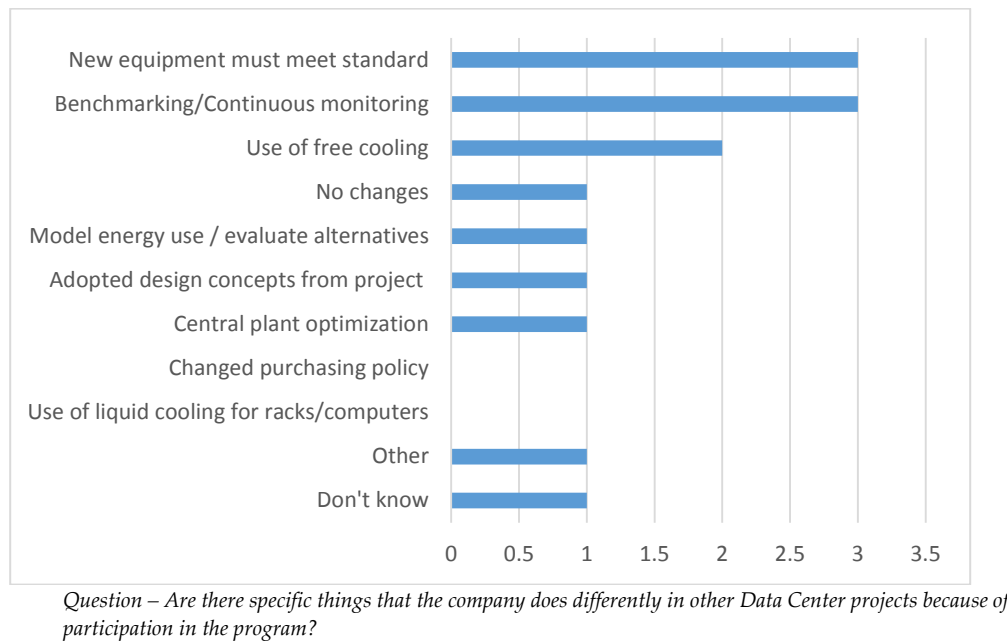
In the second year of operation, program staff succeeded in obtaining earlier involvement in projects. While it is not always clear based on the data in the program tracking database, 64% of participants responding to the survey indicated their first contact with the program occurred before their energy efficiency project was initiated. This early involvement provides a greater opportunity for program staff (the implementation contractor) to influence the project and encourage the inclusion of other energy efficiency measures.



Navigant did not complete a detailed survey to determine the extent to which measures undertaken as part of the program could be attributed specifically to the program. Feedback from program staff indicates some firms which have completed projects under the program come back with additional projects now that they know of the incentive program.

As part of the survey, participants were asked if they had made any changes in the way they operate other data centers as a result of what they had learned from the project completed under the AEP Ohio Data Center Program. As shown in Figure 3-12, respondents indicated they have made a variety of changes in other data centers as a result of what they had learned from their participation in the AEP Ohio program. The most common changes include requiring new equipment to meet a specified standard in terms of energy consumption and use of benchmarking or continuous monitoring.

Figure 3-12. Changes Made as a Result of Participation in Data Center Program



All of the respondents indicated they felt the incentives offered under the program were sufficient to make the project financially attractive. Participants were also asked whether they could have achieved further energy savings had additional incentives been available. Only three of 11 respondents (28%) indicated they could have achieved more if additional incentives had been available.

3.3.8 Program Tracking Data Review

Program tracking data is maintained by the implementation contractor and shared with AEP Ohio via a SharePoint site. Navigant reviewed the tracking data and found it to be reasonably comprehensive and complete, however, the evaluator did not address whether the tracking system is adequate for regulatory prudence reviews or corporate requirements.

The following recommendations are offered to further improve the value of the tracking data:



- In the Projects folder, a number of project numbers use “Data Center” as the business type. Given all eligible applications are for a data center, this designation provides very little information on the nature of the business involved. It is recommended, to the extent possible, the economic sectors these data centers represented be recorded.
- A number of fields were found to be incomplete (i.e. building area was missing for 10 projects, application date was missing for 1 project, pre and post kW were missing for many projects, PUE was completed for only 4 projects, etc.). It is recommended the administrative review include a requirement to obtain this information or note why it could not be obtained). Currently it is not clear if a blank field indicates information was not required, has not yet been entered or if it is missing on the actual application. To improve clarity, Navigant recommends, if the field does not apply, a code be used to explicitly indicate that. This designation will help make it clear where follow-up may be required to complete a task (i.e. an inspection) or obtain data (i.e. if the inspection has been completed but not recorded).
- Adding or modifying a few tracked fields would enhance the evaluation process:
 - Navigant recommends data center floor space be tracked rather than building area.
 - Lifetime energy savings and the incremental cost of efficiency are needed for benefit/cost analysis. Lifetime energy is the product of each measure’s first year energy savings multiplied by the measure’s lifetime, summed over all measures. Incremental cost is defined as the project cost minus the baseline cost of all efficiency measures.
 - It is recommended three fields be tracked for demand reduction: 1) demand reduction based on the project peak demand reduction, 2) demand reduction coincident with the Ohio peak period, and 3) demand coincident with the PJM system peak.
 - As mentioned, the tracking data does not include a field to indicate when all of the information required to approve the application was received. This could be the date on which the final application was approved or when the final inspection was completed. It is recommended such a field be added.
- A number of acronyms and abbreviations are used in the tracking database without explanation. Navigant recommends adding a folder to the worksheet which documents the database and provides an explanation of column headers, acronyms, and any protocols with respect to how the data is reported.

Navigant also asked program staff about other metrics used to monitor the program. The implementation contractor reported it also tracks measures such as engineering review time, accuracy of data entry and customer satisfaction.

3.3.9 Verification and Due Diligence

Navigant reviewed verification, due diligence and quality control issues with respect to both program data and the engineering review of energy savings carried out as part of the program. Administrative procedures are in place to ensure information submitted to the program is processed and recorded in the project tracking database. Application forms are reviewed to ensure these are eligible, the form is complete and all required documentation has been provided. Program management reported all projects are subject to an administrative review after being entered into the program tracking database before



being uploaded to a SharePoint site for review by AEP Ohio. AEP Ohio then reviews all program application data provided by the implementation contractor.

All applications are subject to an engineering review to ensure the savings for the project are calculated correctly and result in the appropriate level of incentive for the customer. The program implementer develops a measurement and verification (M&V) plan for each project to determine how energy savings will be measured or estimated. The baseline used in estimating the potential incentive is determined by equipment age and whether it is being replaced at end-of-life. In most instances, a site inspection is carried out as part of this process. The implementation contractor stressed it works to ensure its process for estimating energy savings is transparent and that it maintains communications with the customer throughout the process, using in-person meeting, phone and e-mail contact to ensure the implementer is in touch with projects on a monthly basis. Feedback from Solution Providers and the participant survey support this claim, with 50 percent of survey respondents indicating they had been in contact with program staff two or three times, and 40 percent indicating more than four times.

The engineering review process differs depending on the type and size of the project. The nature of the projects is quite varied and results in different verification requirements. Depending on the nature of the efficiency measure, verification may be based on engineering calculations and equipment specifications, use of metering data available within the data center, or the installation of metering by the program administrator. The implementation contractor reports post installation metering is carried out for about half of the projects.

The engineering analyses typically rely on custom spreadsheets developed by the implementation contractor, modified as required for the AEP Ohio program. Modeling is generally done within these spreadsheets rather than using building simulation models. The implementation contractor expressed some concerns with how effectively building simulation models handle HVAC systems for data centers.

The implementation contractor noted a couple of challenges involving savings verification. One is that many of the data centers involved in the program are constantly in a state of flux. Projects such as server virtualization may take place over an extended period of time. This issue makes it particularly challenging to isolate and identify those aspects of the data centers' operation related to the energy efficiency program, with obvious implications for verifications efforts. The second challenge relates to the program goal of including a variety of customers, and therefore project sizes. This concern has led the implementation contractor to streamline its verification process so it could evaluate a small initiative at the same cost per kWh as a large project. To make programs cost effective from an administrative perspective, it is common for implementation contractors to take this streamlined approach with smaller projects. While Navigant supports this approach, as the evaluation contractor. Navigant will sample the smaller project strata so that a program level savings can be achieved within the required confidence and precision.

Navigant notes AEP Ohio does not have a formal Dispute Resolution process in place for the program. While there have not been any significant disputes regarding the process to-date, it is recommended a formal dispute mechanism be developed before such issues arise.



3.4 Cost Effectiveness Review

This section addresses the cost effectiveness of the Data Center Program. Cost effectiveness is assessed through the use of the Total Resource Cost (TRC) test. Table 3-5 summarizes the unique inputs used in the TRC test.

Table 3-5. Inputs to Cost-Effectiveness Model for AEP Ohio Data Center Program

Item	
Measure Life	7
Projects	36
<i>Ex post</i> Annual Energy Savings (kWh)	11,894,798
<i>Ex post</i> Coincident Peak Savings (kW)	1,349
Third Party Implementation Costs	720,080
Utility Administration Costs	192,419
Utility Incentive Costs	1,083,131
Participant Cost	4,228,266

Based on these inputs, the TRC ratio is 0.8. Therefore, the program does not pass the TRC test. Table 3-6 summarizes the results of the cost-effectiveness tests. Results are presented for the Total Resource Cost test, the Ratepayer Impact Measure Test, and the Utility Cost Test.

Table 3-6. Cost Effectiveness Results for the Data Center Program

Test Results for Data Center	Benefit/Cost Ratio
Total Resource Cost	0.8
Participant Cost Test	1.7
Ratepayer Impact Measure	0.5
Utility Cost Test	2.1

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 Key Findings and Recommendations

This section presents the key findings and recommendations from the 2014 Data Center Program impact and process evaluations.

4.1 *Key Evaluation Impact Findings and Recommendations*

These recommendations are specific to increasing realization rate and streamlining the impact verification.

1. Project lifetime and the incremental cost of efficiency are important parameters in calculating the benefit/cost analysis, as well as establishing the validity of chosen project baseline. The implementation contractor has begun tracking lifetimes and incremental costs, but some improvements are possible.

Impact Recommendation #1a: Lifetimes should be calculated at the measure level and a lifetime savings in kWh should be calculated at the project level.

Impact Recommendation #1b: Navigant, AEP Ohio and the implementation contractor should hold a meeting to agree on predetermined lifetimes for common datacenter measures. These should include: IT servers and storage devices, new UPS, Desktop virtualization, HVAC optimizations, and hot aisle containment.

Impact Recommendation #1c: Continue to improve on providing details on how lifetime and incremental cost of efficiency is determined. Include references and supporting documentation.

2. Project files did not clearly establish whether a project or its measures are considered retrofits or Replace on Burnout (ROB) scenarios. Projects where existing equipment has remaining useful life should be considered a retrofit, where savings is relative to the existing equipment. When existing equipment has reached the end of its useful life, the measure should be considered a ROB. Savings for ROB measures should ignore the existing equipment and be relative to the difference in energy from a new, low-cost option to the as-installed equipment. Replace on Burnout projects also need to subtract the cost of the baseline equipment from the total project cost to determine the incremental cost of efficiency.

Impact Recommendation #2: Consistently label each measure as a retrofit, a ROB or a new construction scenario. Provide a discussion in the project files of why the measure was classified as such. Replace on Burnout measures are sometimes referred to as a market opportunity because a market motivation beyond saving energy is driving the replacement or expansion of existing equipment, i.e. a new piece of equipment is being purchased regardless of whether energy is being saved. The question should be asked regarding the true motivation of the equipment replacement.

3. One project involving UPS optimization relied on metered data, comparing pre-retrofit data to post-retrofit data. The project file showed output power was reduced in the post-retrofit data,



yet the energy saving calculation merely showed the difference in input power. The demand savings calculation adjusted the difference in input power relative to the difference in the output power.

Impact Recommendation #3: When comparing baseline metering to post-retrofit metering, the data needs to be normalized to any outside changes in load or equipment changes beyond the scope of the project.

4. The primary reason realization rates were below one in 2014 was the baseline analysis on projects involving CRAHs with variable electrically commutated fans. While the implementation contractor properly calculated the fan motor size per ASHRAE Standard 90.1, no load factor was applied to the motors. Additionally, savings was claimed for interactive effects that would have been present in both the baseline and efficient cases.

Impact Recommendation #4a: When calculating power for a motor based on nameplate information or energy code values, a load factor needs to be applied. Fan motors should receive a 75 percent load factor and pumps an 80 percent load factor.

Impact Recommendation #4b: For market opportunities such as ROB, new construction or new applications, include a quality control to check if savings would also be present in the baseline case.

5. Data center projects frequently involve complex savings calculations that are further complicated by a variety of constantly changing variables. One example is hot-aisle containment where savings results vary significantly depending on baseline conditions. Precise calculations are difficult without robust trending data immediately before and just after the retrofit. Navigant found one example of a hot-aisle containment project where the baseline data was not available and the implementation contractor calculated savings based on snapshots a year apart.

Impact Recommendation #5a: Attempt to engage with each project as early as possible in the planning phase, allowing the implementation contractor the opportunity to collect all the necessary baseline data. Additionally, the implementation contractor would be able to review the project and suggest enhancements to maximize savings.

Impact Recommendation #5b: The implementation contractor should make every effort to obtain baseline and post-retrofit data as chronologically close to each other as possible.

Impact Recommendation #5c: For projects with highly unpredictable savings, when baseline data is not available or the project size does not justify metering, a very conservative safety factor should be applied to savings estimates. In the example of the hot-aisle containment project, Navigant would have recommended a 35 percent safety factor.

6. Navigant found one example on a relocation project where the implementation contractor initially correctly calculated annual savings for lighting and HVAC that had full load operational hours of less than 8760. However, the final number reported was the demand savings multiplied by 8760, overstating the annual savings.



Impact Recommendation #6: When calculating annual savings the implementation contractor should check if all savings are truly flat for the entire 8760 hours in a year.

4.2 *Key Tracking System Findings and Recommendations*

Program tracking data is maintained by the implementation contractor and shared with AEP Ohio via a SharePoint site. Navigant reviewed the tracking data and found it to be reasonably comprehensive and complete. The following recommendations are offered to further improve the value of the tracking data:

- In the “Projects” folder of the spreadsheet, a number of project numbers use “Data Center” as the business type. Given all eligible applications are for a Data Center, this designation provides very little information on the nature of the business involved. It is recommended, to the extent possible, the economic sectors these data centers represent be recorded.
- A number of fields were found to be incomplete (i.e. building area was missing for 10 projects, application date was missing for one project, pre and post kW were missing for many projects, PUE was completed for only four projects, etc.). It is recommended the administrative review include a requirement to obtain this information or note why it could not be obtained.
- Currently, it is not clear if a blank field indicates information was not required, has not yet been entered, or if it is missing on the actual application. To improved clarity, Navigant recommends if the field does not apply, a code be used to explicitly indicate that. This designation will help make it clear where follow-up may be required to complete a task (i.e. an inspection) or obtain data (i.e. if the inspection has been completed but not recorded).
- The addition or modification of a few tracked fields would enhance the evaluation process.
 - Data center floor space is recommended to be tracked rather than building area.
 - Lifetime energy savings and the incremental cost of efficiency are needed for benefit/cost analysis. Lifetime energy is the product each measure’s first year energy savings multiplied by the measure’s lifetime, summed over all measures. Incremental cost is defined as the project cost minus the baseline cost of all efficiency measures.
 - It is recommended three fields be tracked for demand reduction: 1) demand reduction based on the project peak demand reduction, 2) demand reduction coincident with the Ohio peak period, and 3) demand coincident with the PJM system peak.
 - The tracking data does not appear to include a field to indicate when all of the information required to approve the application was received. This could be the date on which the final application was approved or when the final inspection was completed. It is recommended such a field be added.
- A number of acronyms and abbreviations that are used in the tracking database may be unclear to someone unfamiliar with the system or new staff assigned to work on the tracking data by the program administrator. Navigant recommends adding a folder documenting the database, with an explanation of column headers, any acronyms used as field values, and any protocols with respect to how the data is reported.



4.3 Key Process Evaluation Findings and Recommendations

The following process recommendations are offered to help improve program effectiveness and efficiency and further improve participant's experience of the program.

1. Twenty-nine of the 36 projects completed in 2014 were submitted after the date of completion indicated on the application, though 12 of these projects were submitted within one week of the completion date. The information for seven of the projects indicates the project was submitted more than six months after the completion date shown. The eligibility criteria for the program indicate applications must be submitted within six months of project completion.

Process Recommendation #1a: Navigant recommends AEP Ohio review the eligibility of the projects entered into the database with an applications date more than six months after the completion date to determine whether this is a data entry issue or if these projects should not have been deemed to be eligible. Projects over six months old could be moved to the Self Direct program if the customer is mercantile. Based on that review, Navigant recommends the processes around ensuring this eligibility requirement is met also be reviewed.

Process Recommendation #1b: Navigant recommends to encourage early involvement in the program that participants are required to submit a pre-application prior to project completion in order to be eligible for the program. This would also allow the implementation contractor an opportunity to review the efficiency project and suggest enhancements or additions to the project, thus maximizing savings.

2. Solutions Providers were found to play a more significant role in the Data Center Program in its second year of operation. AEP Ohio and the implementation contractor are to be commended for their efforts to increase Solution Provider involvement in the program. As mentioned in last year's evaluation, Solution Providers can play an important role in communicating the availability of the program to their clients' operating data centers and in making program staff aware of potential data center efficiency projects.

Process Recommendation #2: Navigant recommends AEP Ohio and the implementation contractor expand this work of establishing a network of Solution Providers for the program.

3. Both the survey responses and the information recorded in the tracking database reinforce the fact that communications regarding the program has focused largely on personal sales and direct contact. While this direct sales approach has been successful and information on the program is available on the AEP Ohio website, there is clearly an opportunity to do more to communicate the benefits of the program and opportunities for improved energy efficiency in Data Centers.

Process Recommendation #3: Navigant recommends direct sales efforts be supplemented with a broader outreach and communications campaign, to build awareness of both the program and of opportunities to reduce energy use in Data Center operations. This effort could link to other



information sources such as the federal Office of Energy Efficiency & Renewable Energy Data Center Energy Efficiency program¹⁶.

4. Participants indicated reliability and up-time were a significant concern to their operations. Some participants also indicated concerns over energy efficiency projects impacting performance could be a barrier to action. On the other hand, seven of the eleven participants who responded to the survey indicated the energy efficiency project they implemented had resulted in improved reliability and up-time performance.

Process Recommendation #4a: Given the very high priority data center operators place on reliability and performance, Navigant recommends AEP Ohio and the implementation contractor consider documenting some program success stories in case studies to communicate the benefits of energy efficiency and the value delivered through the program. Such case studies could also address some of the key concerns and motivators for Data Center and Facility Managers who might consider such initiatives.

The high level of concern over security and reliability can also result in concerns over access to equipment for verification purposes. Additionally, some participants do not comprehend the difference between implementation contractor inspections and Navigant's evaluation verification. To avoid misunderstanding, Navigant recommends the requirement to allow project verification be clearly communicated and the purpose of the impact evaluation verification be defined.

Process recommendation #4b: Develop processes and protocols for all evaluators to follow when attempting to gain access to large data center customers that retain highly sensitive information. The process should include a contact plan that is individually considered for each customer and a 30 day timeframe for the customer to conduct due diligence in approving the visitor to enter the premise.

Process recommendation #4c: Navigant recommends the requirement to participate in project verification be communicated at multiple touch points, including in the program application; in communications from the implementation contractor during the process, particularly for large projects; at the time of the final inspection and in conveying the incentive check.

Process recommendation #4d: Amend the language in the application form to define evaluation verification and differentiate this from implementation contractor inspections. Continue this distinction whenever verification is mentioned verbally or in writing.

5. The program application requires the incentive not exceed 50 percent of the project cost¹⁷. Project cost is defined as the material cost of installed equipment.

Process Recommendation #5: Amend incentive requirements to not exceed the incremental cost of efficiency upgrades (retrofit minus baseline cost), or 50 percent of the project cost, whichever is less.

¹⁶ <http://energy.gov/eere/femp/data-center-energy-efficiency>

¹⁷ Page 6 of the application states: "AEP Ohio will pay the lesser of 1) the calculated incentive as approved by AEP Ohio or 2) 50% of the total project cost (not including internal labor)".



6. Overall, feedback regarding program outreach was quite positive and the program was successful in meeting its targets for its first year. As a new program, however, Navigant expects there is some room to further improve communications.

Process Recommendation #6: Program staff should consult with other programs to leverage their experience in improving communications around each of the “touch points” with participants. For example, the Non Residential New Construction Program has enhanced communications around the conveyance of the incentive check to ensure customers understand the check represents support for an energy efficiency project, and to follow-up to determine if the customer is involved in any other potential projects.

7. Navigant notes AEP Ohio does not have a formal Dispute Resolution process in place for the program. While there have not been any significant disputes regarding the process to-date, it is recommended a formal dispute mechanism be developed before such issues arise.

Process Recommendation #7: Develop a formal dispute resolution process to provide a framework in case such disputes arise in future.



Appendix A Participant Survey Instrument

Note – Actual survey was delivered in on-line format through Survey Analytics software. As a result some questions were presented on conditional basis, depending on answers to prior questions.

AEP Ohio Data Center Programs Evaluation PARTICIPANT SURVEY On-Line Survey Form

a) Introduction

Navigant is completing an independent evaluation of AEP Ohio's energy efficiency program for Data Centers. As a participant in that program we are asking for your assistance in completing a short on-line survey. The survey will ask you some questions about your experience with the program to help us better understand how effective the program has been and how it might be improved in future years.

The survey should take about 15 minutes to complete.

Some background about the survey

- **Confidentiality.** Navigant is an independent evaluation firm retained to evaluate AEP Ohio programs. Your contact information or response to this survey will not be used for any other purpose and results will only be presented in aggregate. Our objective is simply to understand what factors were important to your company's decision to improve energy efficiency and apply to this program.
- **If you are not the right person** – Please let us know who would be the appropriate person to contact – or forward the invitation to complete the survey to the appropriate person in your organization.
- **Security.** Your responses will not affect your ability to participate in the program in the future.
- **Contact.** If you would like to talk with someone about this survey from our client, AEP Ohio, the contact is:



- **AEP Ohio – Linda Ecker** – available by phone (614) 883-7881 or e-mail lkeckerr@aep.com

b) Awareness & Motivation

Q1: How did you first learn of the AEP Ohio Data Center program?

- a) AEP Ohio staff
- b) Willdan staff
- c) Internet/Web site, [Specify] _____
- d) Workshop/seminar
- e) Industry/Trade Association (specify association)
- f) Advertising/Trade publications
- g) DON'T KNOW
- h) OTHER, Solution Provider (PLEASE SPECIFY) _____
- i) *Refused to answer*

Q2. What were the main reasons your company decided to participate in the program?
(select all that apply)

- a) Improved energy efficiency/lower costs
- b) Incentive to pay for efficiency improvements
- c) Technical assistance
- d) DON'T KNOW
- e) OTHER (Solution Provider PLEASE SPECIFY) _____

Q2a) Did the project you carried out provide benefits other than energy savings? (Select all that apply).

- a) Improved reliability/ up-time
- b) Cost savings for ancillary equipment
- c) Reduced carbon footprint
- d) Improved understanding of costs
- e) Longer equipment life
- f) Lower maintenance costs



- g) Increased IT capacity
- h) Other – please specify: _____
- i) No non-energy saving benefits

Q2b) Did you have any concerns in implementing the program about the project potentially impacting other areas of performance? (i.e. reliability of equipment, etc.). (Please select all that apply).

- a) Reliability/ up-time
- b) Equipment life
- c) Other – please specify: _____

c) Experience with Program

The following questions ask about your experience with the program.

Q3 a. Using a scale of 0-10 where 0 represents very difficult and 10 represents very easy – how would you rate the ease of finding information about the program?

Very Difficult											Very Easy
0	1	2	3	4	5	6	7	8	9	10	

IF Q3a < 5, then ask Q3ai)

Q3ai) Please describe what you found difficult. _____

Q3 b. Using that same scale, how easy or difficult did you find the application process?

Very Difficult											Very Easy
0	1	2	3	4	5	6	7	8	9	10	

IF Q3b < 5, then ask Q3bi)

Q3bi) Please describe what you found difficult. _____

Q3c. Providing the level of documentation required?

Very Difficult											Very Easy
0	1	2	3	4	5	6	7	8	9	10	



IF Q3c < 5, then ask Q3ci)

Q3ci) Please describe what you found difficult. _____

Q4a). Were the incentives offered under the program sufficient to make the project financially attractive?

- a) Yes
- b) No
- c) Don't know

Q4b) Could you have achieved further energy savings if additional incentives had been available?

- a) Yes
- b) No
- c) Don't know

Q5. If this project involved a new Data Center, did your firm use the AEP Qualified Data Center Site program?

- a) Yes
- b) No
- c) Don't know

d) Experience with Program

Q6. How satisfied were you with the level of energy efficiency required to qualify for an incentive using a scale from 0 to 10, where 0 is "not at all satisfied" and 10 is "completely satisfied"?

Q7 Overall, how satisfied were you with the program - using a scale of 0-10; where 0 represents not at all satisfied and 10 represents very satisfied?

Not at all											Very
Satisfied											Satisfied
0	1	2	3	4	5	6	7	8	9	10	

IF Q6 < 5, then ask Q6i)

Q7i) Please describe why you were dissatisfied. _____



Q8. Are there specific things that your company does differently in other Data Center projects now because of your participation in the program? (Please select all that apply).

- a) Use of free cooling
- b) Right sizing of equipment
- c) Use of liquid cooling for racks and computers
- d) Arrange racks in hot aisle/cold aisle configuration
- e) Benchmarking/Continuous monitoring
- f) Changed purchasing policy to specify a specific code, standard, efficiency level or level of payback for energy-consuming equipment
- g) Adopted design concepts applied in project completed under AEP Ohio program
- h) Model or estimate energy consumption and evaluate alternatives
- i) Haven't made any changes based on participation in program.
- j) Don't know
- k) OTHER[specify] _____

Q9. Can you offer any suggestions as to how the program application process could be improved?

Q9a. Do you have any other suggestions on how the overall program could be improved?

Q10. What do you see as the main barriers to increasing the level of energy efficiency in Data Centers? (Please select all that apply).

- a) Lack of understanding/information on energy efficiency options.
- b) Additional Capital Cost of energy efficiency improvements.
- c) Payback/Return on additional energy efficiency improvements.
- d) Uncertainty about performance of efficiency improvements.
- e) Concerns regarding the impact on reliability /up time or other aspects of performance.
- f) Additional time commitment required to incorporate efficiency.



- g) Split incentives (different firm paying for equipment than firm that pays for energy costs).
 - h) Don't feel there are any barriers.
 - i) Don't know.
 - j) OTHER[specify] _____
- Q10a) Did your first contact with the AEP Ohio Data Center program occur before or after your organization initiated the energy efficiency project.
- a) Contact with Data Center program occurred before project was initiated.
 - b) Contact with Data Center program occurred after project was initiated.
 - c) Don't know.
- Q10b) In the course of participating in the AEP Ohio Data Center program, and other than sending in the incentive application, how often were you in contact with AEP Ohio or program staff with questions?
- a) Never
 - b) Once
 - c) 2 or 3 times
 - d) Four times or more
 - e) Don't know

Background About Your Firm

This final section includes a few general questions about your company, specifically at the facility which participated in the AEP Ohio Data Center program.

B1. What is your job title or role?

- a) Chief Information Officer
- b) Other IT management position
- c) Facilities Manager
- d) Energy Manager
- e) Other Facilities Management/Maintenance position
- f) Chief Financial Officer
- g) Other financial/Administrative position
- h) President/CEO



- i) Owner
- j) Other (Specify) _____

B2a) Approximately how many data centers does your firm operate?

- a) Number _____
- b) Don't know

B2b) How many are in AEP Ohio's service territory.

- a) Number _____
- b) Don't know

B3. What is the principal business activity / type of business of your firm? Please indicate the main business activity of your organization, not simply the business activity that occurs at this location.

- a) Finance, Insurance or Real Estate
- b) Retail or Wholesale Trade
- c) Education
- d) Hospitals/Medical
- e) Accommodation or Food Service
- f) Manufacturing
- g) Non-manufacturing industry
- h) Government
- i) Communication, Transportation or Utilities
- j) Other Services
- k) Don't Know
- l) Decline to answer
- m) Other, please specify: _____

B4. What is the total square footage of the data center at this location? Your best estimate will be fine.

a) Square Feet	
b) Don't Know	



c) Decline to answer	
----------------------	--

B5. What is the total square footage of the other office space at this location (excluding the data center)? Your best estimate will be fine.

a) Square Feet	
b) Don't Know	
c) Decline to answer	

*On behalf of AEP Ohio, thank you very much for taking the time to participate.
We appreciate your assistance.*

APPENDIX P



Continuous Energy Improvement Program

2014 Evaluation Report

Prepared for:
AEP Ohio



A unit of American Electric Power

May 11, 2015

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Executive Summary

This report presents the results of the evaluation of the 2014 AEP Ohio Continuous Energy Improvement 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 Continuous Energy Improvement Program provides large industrial customers with the training to view the energy consumption of their facilities in a holistic manner and help identify no/low cost opportunities to reduce consumption. The training is designed help participants apply principles and practices of continuous improvement to implement strategic energy management that may help reduce their energy bill by five to fifteen percent with little or no financial investment. Results from the program showed around three percent savings of total site usage during the 12 month training period with the most successful site showing eleven percent savings. Energy and demand savings will continue to be monitored for two more years.

Table ES-1 provides a summary of 2014 Continuous Efficiency Improvement reported results. Details on the program goals and relative success are shown in Table ES-3.

Table ES-1. 2014 Continuous Efficiency Improvement Projects and Ex Ante Savings

Metric	Ex Ante Value
Number of Projects	49
Energy Savings (MWh)	40,223
Peak Demand Savings (kW)	1,673

Source: Evaluation analysis of AEP Ohio tracking data from 2014.

ES.2 Data Collection Activities

The CEI program obtains savings through behavioral-low cost and no cost based changes. For this reason, Navigant did not complete onsite visits as a part of the data collection activities for this program. Instead, Navigant performed phone verification with participating customers, AEP Ohio staff and the program implementation contractor. These phone interviews focused on process activities performed as a part of the CEI Program and feedback regarding these activities. Navigant also collected information regarding production changes or other major changes in operation at the facilities. Table ES-2 provides a summary of 2014 data collection activities for the CEI Program impact and process evaluations.

**Table ES-2. Data Collection Activities for 2014 CEI Evaluation**

Data Collection	Targeted Population	Sample Frame	Sample Design	Sample Size	Timing
Tracking Data Analysis	CEI Program projects approved for payment for 2014	AEP Ohio Tracking Database	-	All	Feb 2015 to March 2015
In-depth Interviews	AEP Ohio Program Staff	Contact from AEP Ohio	Business Programs Manager and CEI Program Manager	3	March 2015
	CEI Program Implementers	Contact from AEP Ohio	Triple Point Implementation Staff	2	
Facility Interviews	CEI Program Participants	Tracking Database	10% Precision and 90% Confidence	N=50 Targeted = 15 Completed = 18	Feb 2015 to March 2015
Application File Review	Tracking Database	Stratified Random Sample by Site-Level kWh	Stratified Random Sample by Site-Level kWh	18	March 2015 to April 2015

Source: Evaluation activities conducted from July 2014 through April 2014

ES.3 Key Impact Findings

The program exceeded the 2014 kWh goals. The tracking data showed an average savings of three percent of total site energy usage during the 12 month training period. This is less than the five to fifteen percent that the program documentation estimates, but Navigant expects this savings to increase into years 2 and 3 as measures were being implemented throughout the 12 month training period. The most that a site saved in the 12 month training period was eleven percent.

The program did not achieve its demand savings goals Early in this program, the implementation contractor did not understand that demand savings had to be calculated and reported to the PUCO. When the lack of demand savings in reporting was brought to their attention, the program implementation contractor then began calculating demand when:

- Equipment was taken off line and not brought back into service, and/or
- Equipment was changed to permanently require less kW to operate



The implementation contractor only accounted for demand savings in specific cases, but AEP Ohio is working to expand these demand calculations moving forward. Table ES-3 and Table ES-4 show the impact results for the 2014 Continuous Energy Improvement Program.

Table ES-3. Savings Estimates for the 2014 Continuous Energy Improvement Program

	Program Goals ¹ (a)	Ex Ante Savings (b)	Ex Post Savings ² (c)	Realization Rate RR = (c) / (b)	Percent of Goal = (c / (a))
Energy Savings (MWh)	20,000	40,222	39,298	0.98	196%
Demand Savings (MW)	2.5	1.67	1.63	0.98	67%

Sources: ¹AEP Ohio Volume 1: 2012 TO 2014 Energy Efficiency/Peak Demand Reduction (EE/PDR) Action Plan, November 29, 2011. ²Evaluation analysis of AEP Ohio tracking data from January 17, 2014.

Table ES-4. Savings Estimates for the 2014 CEI Program

Metric	Energy Savings (MWh)	Demand Savings (MW)
Ex Ante Reported Savings	40,223	1.67
Ex Post Verified Savings	39,298	1.63
Realization Rate	0.98	0.98
Relative Precision @ 90% CI	13%	13%

ES.4 Conclusions from 2014

- The CEI program achieved savings at some of AEP Ohio's largest and most energy aware customers.** This supports the concept that large industrial sites can implement a significant number of no/low cost energy efficiency measures. Having an Energy Expert as a resource for commercial and industrial customers helps these sectors recognize and implement otherwise ignored energy efficiency opportunities.
- Customers reported high satisfaction with the program.** The satisfaction of this program was high regardless of the amount of savings a customer implemented. Customers were very pleased with the training workshops and interaction with the implementation contractor. Customers were especially appreciative of the site level attention received from the implementation contractor, including the walk-through assessments and expert advice on their processes. Additionally, the program has generated compelling goodwill for AEP Ohio.



3. **The program realized 98 percent of *ex ante* savings while achieving twice its energy goal for 2014.** While AEP Ohio was able to achieve the overall program goal, each site saved an average of three percent of total site usage over the 12 month training period compared to the initial estimate of five to fifteen percent. Navigant expects that this savings will be higher during years 2 and 3 as measure were being implemented throughout the first 12 months.
4. **The implementation contractor maintains quality and accurate data in the tracking system.** Navigant did not identify any serious deficiencies, errors or patterns of missing data. The tracking system is adequate for planning all aspects of evaluation, however, the evaluator did not address whether the tracking system is adequate for regulatory prudence reviews or corporate requirements.
5. **AEP Ohio's personalized one on one marketing approach has worked well.**
6. **Building an Energy Team with an Executive Sponsor at the customer location has been critical in the success of changing the organizations' culture.** An energy team of five to eight employees at each location is established with an Executive Sponsor supporting the teams' efforts. The Executive Sponsor is an executive level employee that can directly influence the energy culture of all departments within the organization.

ES.5 Recommendations for Program Improvements

1. **AEP Ohio should provide two tiers of training based on each participating company's levels of expertise.** Some customers felt the level of training was too basic for their needs and explained things they were already aware of, while others commented they learned many concepts they had not previously considered.
2. **AEP Ohio should provide training or on-call assistance for customers looking to expand their equipment purchases.** Training on smart purchasing and process integration may result in long-term savings after the program is completed. When customers purchase new equipment for their facilities, they reported needing training on how to adjust the equipment to maximize production while minimizing energy usage.
3. **Moving forward into years two and three, the implementer should adjust the energy model to match one-year post conditions.** When Navigant analyzed sites with variations of production that were +/- 10%, the site-level realization rates ranged from 0.39 to 1.56. In order to calculate more accurate savings, the implementer could make model adjustments after the first year post assessment is completed by choosing one-year pre data that most closely matches current operation. If production or other variables did not change +/- 10% this change would not be required.
4. **AEP Ohio should offer participants a follow-up meeting three to six months after the final workshop.** Customers also mentioned that there was value in meeting with peers that were facing similar challenges in implementing energy efficient projects. Several customers mentioned they would like to have a follow up meeting with these peers after the first twelve months of training is complete. The Energy Champions were interested in the additional measures that other companies implemented and ideas on how others are keeping energy reduction as a continuous goal in their respective companies.



5. **The implementer should provide demand savings for the program beyond the restrictions put into place for the 2014 program.** The program has both savings and demand goals but the implementer only reported demand savings when equipment was permanently removed or permanently upgraded to use less energy. Navigant recognizes that the energy model used to calculate the kWh savings may not be sufficient to calculate demand savings. This is due to data restrictions regarding the variables such as production, which are not often reported hourly. AEP Ohio and the implementer should work closely together to determine how the demand savings should be calculated and reported.



1 Introduction

This section provides a description of the AEP Ohio Continuous Energy Improvement (CEI) Program, as well as a brief discussion of the underlying program theory and logic. The last part of this section describes the objectives of this evaluation.

1.1 Program Description

The program is designed to help participants apply principles and practices of continuous improvement to implement strategic energy management that may help reduce their energy bill by five to fifteen percent with little or no financial investment. AEP Ohio's CEI program provides the tools, coaching, structure, and resources necessary to achieve energy savings by engaging employees through operations and maintenance changes.

The Continuous Energy Improvement (CEI) program design was for large industrial customers that consume more than 10 GWh annually. After the first cohort was completed in 2013, AEP Ohio expanded the scope of the program to include clients that use three GWh or more for cohorts 2 through 4. Results from the program showed around three percent savings on average, with the most successful site showing eleven percent savings.

CEI program features include:

- Coaching assistance, tools, and templates to help meet plant and corporate cost savings targets
- Custom statistical models for each customer to help measure and manage energy intensity
- Improved company image to customers, community, and employees
- Reduced maintenance cost, increased quality and productivity, and improved safety
- An Energy Coach and technical resources to help customers identify and implement energy saving opportunities
- A structured support group of local companies that share best practices and provide team support, encouragement, and accountability
- An annual incentive of \$0.02 per kWh saved over the course of three years

The AEP Ohio Business Sector Programs, including the Continuous Efficiency Improvement Program, are marketed, administered, and delivered as an integrated program by AEP Ohio. An implementation contractor, in coordination with AEP Ohio staff, manages the CEI program.

1.2 Evaluation Objectives

This report presents the findings from the impact and process evaluations of the AEP CEI 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 key research questions. Section 3 presents detailed results regarding these questions.



Impact Questions

1. What are the actual achieved energy and demand savings in this program?
2. What were the realization rates for the projects? [Defined as evaluation-verified (*ex post*) savings divided by program-reported (*ex ante*) savings].
3. Did the program reach its 20 GWh goal in the first year?
4. What are the benefits, costs, and cost effectiveness of this program?

Process Questions

Marketing and Participation

1. What motivates customers to participate in the program?
2. How are sites recruited/marketed to
 - a. Criteria for recruiting?
 - b. How are they chosen and targeted?
 - c. Who is excluded or included?
 - d. Is the majority of the participation from internal recruiting or outside interest?
3. Is participation sufficient to meet current and future program goals?
4. Are other industrial sites performing CEI-type programs?
5. Is the program outreach to customers effective in marketing the program?
 - a. What is the format of the outreach?
 - b. How often does the outreach occur?
 - c. Are the messages within the outreach clear and actionable?

Program Characteristics and Barriers

6. Is the number of workshops conducted sufficient?
7. How well received is the workshop content? Should it be revised?
8. What measures were installed at these sites as a result of the CEI program?



9. What actions were undertaken at these sites as a result of the CEI program?
10. How does the energy model adjust to major changes?
 - a. Are these changes logged and are old versions available?
 - b. Is the model checked for accuracy and reasonability throughout the process, and by whom?
11. What is the satisfaction of the participants?
 - a. Are customers satisfied with the program incentives?
 - b. Should the budget allocation between incentive spending and marketing spending be adjusted to meet participation and savings goals?
 - c. Are there particular program characteristics that could be changed to improve customer satisfaction while maintaining program effectiveness?
 - d. Are customers aware of the possible technical firms with whom they can partner (such as ESCOs, engineering consulting firms)?
12. Of the customers that were recruited:
 - a. Did any of the sites not have the proper data available to participate?
 - b. Did any of the sites not have the proper technical expertise to participate?
 - i. Why did they not seek this kind of training elsewhere? Were they unaware of the benefits of this kind of training?
 - c. Were they aware of any other CEI type programs in other jurisdictions?



2. Methodology

For CEI Program participants, Navigant conducted impact and process evaluation activities using the following methodologies.

2.1 Analytical Methods

2.1.1 Impact Evaluation Methods

The objective of this element of the impact evaluation is to verify or adjust the *ex ante* reported savings in the CEI Program tracking system. Navigant used a multi-step approach to verify these savings:

- **Tracking System Savings Review**, to identify potential adjustments to *ex ante* reported savings for measures due to outliers, missing information, or tracking system data entry or calculation errors. Navigant adjusted all measures in the population identified through the Tracking System Savings Review where the adjustment was found to be applicable.
- **Application Documentation Technical Review**, to identify potential adjustments to *ex ante* reported savings for measures based on review of documentation, assumptions, and engineering analysis for a sample of projects. Section 2.3 discusses sampling.
- **Data collection through phone interviews with the Energy Champion**, to account for any major changes that made at the facility during or after the program. The Energy Champion was the onsite contact identified by the CEI program to lead activities and attend the training.
- **Other Adjustments to Savings**. Other adjustments to savings could include statistical or baseline adjustments to *ex ante* savings.

Reported savings for the CEI Program are from project-specific calculations submitted by the CEI program implementation contractor. The implementer bases its calculations on energy models that are created from pre-project data and collected post-project energy usage. Typically, these models use two years of energy usage data, along with production, weather data, or other factors that could affect site energy usage. The model is then compared to site usage after the CEI program has begun. The difference in energy usage is claimed as savings.

2.1.2 Documentation and Technical Review

Navigant conducted file reviews for a sample of CEI projects in order to calculate the realization rate of this program with 10% precision and 90% confidence. The projects were stratified by total site usage and the number of required sites were identified for each size category. Based on these goals Navigant performed phone interviews asking key impact questions for each site. Details of this process are provided in Section 2.3.1.

For each selected project, Navigant's in-depth review of project documentation included assessing the engineering methods, parameters and assumptions used to generate the *ex ante* reported savings. For each sampled CEI site, Navigant estimated *ex post* savings based on the review of project documentation



and engineering analysis. Navigant made *ex post* adjustments to *ex ante* savings based on building-specific information, additional billing history, and major changes reported during the Energy Champion interviews.

Reasons for changes to *ex ante* reported savings could include the following:

- Change in production from the pre and post period
- Change in operating hours from the pre and post period
- Change in employees from the pre and post period
- Misalignment of reported energy usage and provided billing data

Navigant used engineering-based energy algorithms to compute *ex post* savings.

2.1.3 Verification Results

After Navigant developed the *ex post* impacts for each project in the sample, an experienced engineer familiar with the evaluation reviewed the results at the project level. Using *ex post* savings results, Navigant estimated an *ex post* realization rate (which is the ratio of the *ex post* savings to *ex ante* reported savings) for each stratum. The stratum-level realization rates were then applied to the population of *ex ante* reported savings by strata. The result is an *ex post* estimate of savings for the program.

2.1.4 Process Evaluation Methods

The purpose of the process evaluation is to assess the effect of the program structure and program implementation on program performance and customer's satisfaction. The evaluation team's review of the CEI process provides insights and recommendations to support the continued success of the Program.

Navigant's approach to the process evaluation for the CEI Program included interviews with AEP Ohio program managers and with staff of the implementation contractor, as well as a review of relevant program tracking databases, documents, and other materials, to understand how the program has evolved from the previous year. In addition, the evaluation team conducted interviews with the Energy Champion at each facility to understand customers' satisfaction and perceptions related to the program.

Navigant developed interview guides to be open-ended and allow for a free-flowing discussion between interviewer and respondent, and real time interviewing flexibility. The interview guides highlighted key issues, but did not require being read verbatim to offer the interviewer flexibility to delve deeply into pertinent issues based on the respondents' knowledge of and experience with the program.

The evaluation team took detailed notes during each in-depth interview. For quantitative questions, trained interviewers record and summarize responses to allow the evaluators to draw conclusions in the analysis.

2.2 Data Sources

The 2014 CEI Program evaluator used several methods to collect data for evaluation including:



- » In-depth telephone interviews with the AEP Ohio program coordinator and the implementation contractor
- » Interviews with participating customers
- » Tracking system data review
- » Technical review of the Documentation for a sample of projects

Table 2-1 provides a summary of these data collection activities, including the targeted population, the sample frame, and the period in which data collection occurred.

Table 2-1. Data Collection Activities for 2014 Evaluation

Data Collection	Targeted Population	Sample Frame	Sample Design	Sample Size	Timing
Tracking Data Analysis	CEI Program projects approved for payment for 2014	AEP Ohio Tracking Database	-	All	Feb 2015 to March 2015
In-depth Interviews	AEP Ohio Program Staff	Contact from AEP Ohio	Business Programs Manager and CEI Program Manager	3	March 2015
	CEI Program Implementers	Contact from AEP Ohio	Triple Point Implementation Staff	2	
Facility Interviews	CEI Program Participants	Contact from AEP Ohio	10% Precision and 90% Confidence	N=50 Targeted = 15 Completed = 18	Feb 2015 to March 2015
Application File Review	Tracking Database	Stratified Random Sample by Site-Level kWh	Stratified Random Sample by Site-Level kWh	18	March 2015 to April 2015

2.2.1 Tracking Data

The CEI Program evaluation team was able to extract key program participation data from AEP Ohio's tracking database, which was provided in Excel spreadsheet format. The database extract spreadsheet includes a project level dataset with project total impacts, application submittal and status data, and internal approval information. Savings calculations were on a site-by-site basis although the technical documentation provided by the implementer sometimes grouped sites together when these were under the same company.



In general, the implementation contractor maintains quality and accurate data in the tracking system. Navigant did not identify any serious deficiencies, errors or patterns of missing data. The tracking system is adequate for planning all aspects of evaluation, however, the evaluator did not address whether the tracking system is adequate for regulatory prudence reviews or corporate requirements.

2.2.2 Project and Program Documentation

To support Navigant's engineering review, the program implementer provided project documentation in electronic format for each project. Documentation included detailed project reports and calculation spreadsheets.

2.2.3 Program and Implementer Staff Interviews

Navigant conducted five in-depth interviews with key program representatives as part of this evaluation. Navigant interviewed the AEP Ohio Business Programs Manager about the CEI Program, the AEP Ohio Program Coordinator, and employees of the implementation contractor by telephone in March 2015. To understand the goals of the program, the interviews focused on the program processes, the program implementation, the perceived effectiveness of the program, and plans for improving the program.

2.2.4 Program Participant Telephone Interview

The process evaluation collected information regarding program design and implementation, program marketing and awareness, and customers' satisfaction and business demographics for the process component of the evaluation. Telephone surveys were complete in February and March 2015. These interviews focused on estimating the program impacts and supporting the process evaluation. Appendix A includes the questionnaire used for the survey.

2.3 Sampling Plan

2.3.1 Impact Sample

The sample design and selection process was conducted to target a relative precision of 10% or better at a 90% level of confidence. The sample design selected for the CEI Program evaluation was stratified by site size. Site size is defined as the kWh energy usage for each individual site.

Projects were sorted from largest to smallest kWh usage and placed into strata. Stratum 1 equates to projects with the largest energy usage (greater than 50 GWh), Stratum 2 to medium-sized sites, and Stratum 3 to the smallest projects (less than 20 GWh). This approach resulted in a total sample of 18 projects for application documentation and engineering review. Navigant sampled 54 percent of the reported program energy savings. Table 2-2 provides a profile of the impact measurement and verification (M&V) sample compared with the populations within each stratum.



Table 2-2. Profile of the Impact M&V Sample by Strata

Sampling Strata	Population Summary		n	Sample	
	Number of Projects (N)	Ex Ante Savings, MWh		Ex Ante MWh	Sampled Percent of Population
Strata 1 large	6	21,322	5	13,161	83%
Strata 2 medium	15	13,030	5	7,281	33%
Strata 3 small	28	4,945	8	1,376	28%
Total or Overall Value	49		18		36%

Source: Evaluation analysis of program tracking data

2.3.2 Process Sample

The Energy Champion interviews targeted a population of 18 unique customer sites with paid projects in the 2014 CEI Program, drawn from the tracking system extract. Several companies listed a single contact for multiple sites; this contact's feedback was used to represent all sites under this contacts control.



3. Detailed Evaluation Findings

This section presents the detailed findings from the 2014 CEI evaluation related to (1) program activity, (2) *ex post* impact findings, (3) process evaluation findings, and (4) cost effectiveness review.

3.1 Program Activity

Table 3-1 provides a summary of 2014 Continuous Efficiency Improvement reported results.

Table 3-1. 2014 Continuous Efficiency Improvement Projects, and Ex Ante Savings

Metric	Ex Ante Value
Number of Projects	49
Energy Savings (MWh)	40,223
Peak Demand Savings (MW)	1.673

Source: Evaluation analysis of AEP Ohio tracking data from 2014

The implementer provided training to small groups called cohorts. Each cohort consisted of a group of customer facilities that participated in the CEI program. Each cohort started at a different time and performed training over a twelve-month timeframe. AEP Ohio calculated the saving for the 2014 CEI program by taking the cumulative sum of savings for one year after each cohort training began. This means that cohort 1 savings is calculated from Jan-13 to Dec-13 and Cohort 4 savings is calculated from Oct-13 to Sep-14, as shown in Table 3-2. These sites will continue to receive incentives for three years at 2 cents per kWh per year. AEP structured the incentives in this way to help encourage persistence of the activities completed by this program.

Table 3-2. CEI 2014 Program Details

Cohort	Start Date	Number of Sites	Site Usage (GWh)	Demand Savings (MW)	First Year Savings (GWh)
Cohort 1	Jan-13	19	473	0.8	21.1
Cohort 2	May-13	7	227	0.1	7.1
Cohort 3	Sep-13	12	152	0.2	4.1
Cohort 4	Oct-13	11	516	0.6	8.0

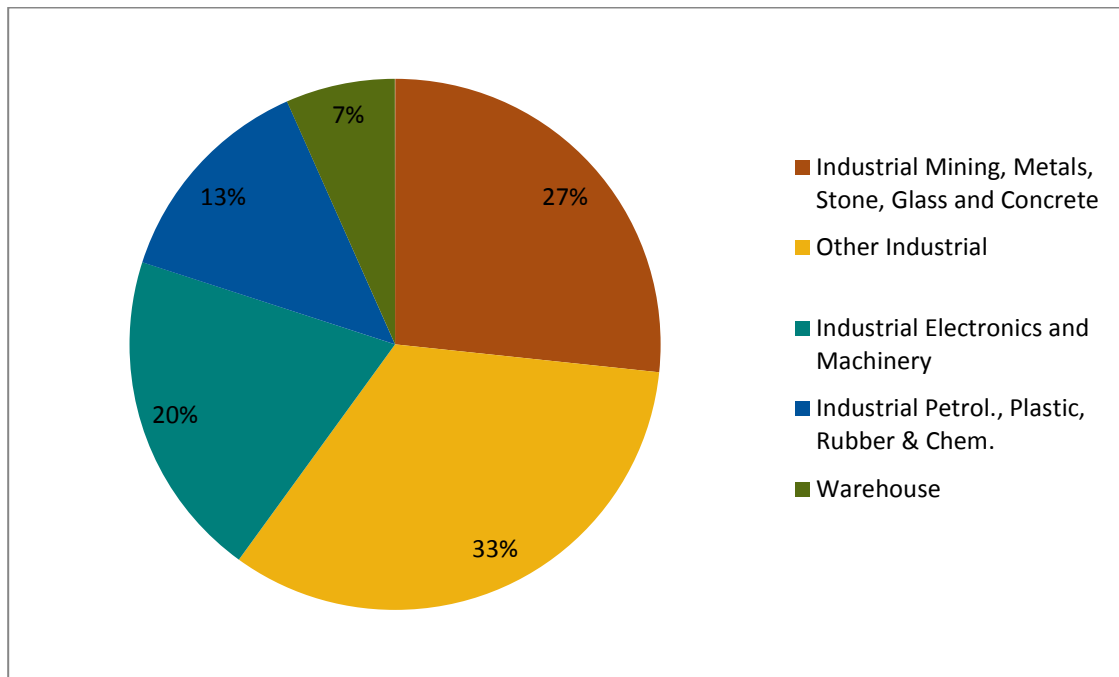


Ninety percent of the interviewed participants in the 2014 sample had more than one facility participate in the CEI Program. Only two of the participants in the sample had one facility in the program. The average age of the facilities is 49 years old, with a range of 24 to 120 years. The average facility size is about 882,000 square feet.

Another demographic is the number of employees per facility. Over 45 percent of respondents reported a workforce of 500 employees or less, between 500 and 1,000 employees (20%), with 33 percent employing over 1,000 employees.

Customers in the survey were involved in a broad range of activities, as shown in Figure 3-1. The top four sectors in the sample were all from the industrial sector, including Industrial (Other) at 33 percent of the sample, Industrial (Mining, Metals, Stone, Glass, Concrete) at 26 percent of the sample, Industrial (Electronic and Machines) at 20 percent of the sample, and Industrial (Petroleum, Plastic, Rubber and Chemicals) at 13 percent of the sample. The remaining site was a large warehouse.

Figure 3-1. CEI Participants Business Sectors





3.2 Impact Evaluation Findings

This section presents the results of the impact and process evaluations of the 2014 CEI Program.

3.2.1 Findings from the Impact Verification Task

Navigant estimated *ex post* program impacts based on billing data and model inputs provided by the CEI Program, such as production and temperature information. Navigant observed that the implementation team and AEP Ohio have a quality control approach that:

1. Appears sufficient to prevent inaccuracies
2. Ensures that energy savings are realized
3. Processes applications in a fair and timely manner
4. Ensures that rebate payments are appropriate

See Table 3-3 for more impact observations and recommendations.

Table 3-3. 2014 Impact Observations and Recommendations

2014 Issue/Observation	2014 Recommendation
Large production, or other key dependent variable, changes in year 1 and year 2 of “pre” data	Create models for each pre year and use the model that most closely represents post production. Choose either the model that most closely represents typical production, or chose a model after post information is collected.
Difficulty with aligning billing data with CEI data	Clearly identify all electric meters associated with the project. Some sites may have multiple meters.

3.2.2 Program Impact Parameter Estimates

This evaluation combined individual realization rates from the sample projects into an estimate of *ex post* energy savings. Navigant applied the sample information to the population using the statistical method of separate ratio estimation.¹ In the case of a separate ratio estimator, a separate energy savings realization rate is calculated for each stratum and then combined. These steps are matched to the stratified random sampling method that was used to create the sample for the program. Navigant used the standard error to estimate the error bound around the estimate of *ex post* energy savings.

The realization rate (defined as *ex post* savings divided by *ex ante* reported savings) is 98 percent. The project-level energy realization rates across strata ranged from 0.39 to 1.56. The variation in realization rates was due to major independent variables changing from the pre and post model. Nine of the sixteen sites showed production changes of at least +/- 10% from the pre activities and post activities. When

¹ A full discussion of separate ratio estimation can be found in Sampling: Design and Analysis, Lohr, 2010 2nd Edition, pp. 144-145.



creating the *ex post* model, Navigant chose pre data that most closely matched the production of the post period.

Moving forward into years two and three, the implementer should adjust the energy model to match one-year post conditions. The implementer should choose the pre data year that has independent variables that most closely represent the post operation. If these variables did not change +/- 10% this change would not be required.

3.2.3 Program Impact Results

Based on the impact parameter estimates described in the previous section, Navigant estimated the *ex post* program impacts resulting from the 2014 CEI Program, as shown in Table 3-4. Navigant made no further adjustments to *ex post* savings.

Table 3-4. Savings Estimates for 2014 CEI Program

Program	Ex-ante Reported Savings		Annual Ex post Savings	
	MWh	MW	MWh	MW
Total	40,223	1.67	39,298	1.63

The CEI Program exceeded its 2014 goals of 20 GWh energy savings, but fell short of the demand savings goal. At first, the program implementer did not realize that though they were not being measured on demand, they were obligated to calculate it for reporting purposes and only calculated demand savings for removed equipment, or modified equipment that permanently required less demand to operate. Tables 3-5 and 3-6 show a summary of the impact results.

Table 3-5. Savings Estimates for the 2014 Continuous Energy Improvement Program

	Program Goals ¹	Ex Ante Savings	Ex Post Savings ²	Realization Rate	Percent of Goal
	(a)	(b)	(c)	RR = (c) / (b)	= (c / (a))
Energy Savings (MWh)	20,000	40,222	39,298	0.98	196%
Demand Savings (MW)	2.5	1.67	1.63	0.98	67%

Sources: ¹AEP Ohio Volume 1: 2012 TO 2014 Energy Efficiency/Peak Demand Reduction (EE/PDR) Action Plan, November 29, 2011. ²Evaluation analysis of AEP Ohio tracking data from January 17, 2014.


Table 3-6. Savings Estimates for the 2014 CEI Program

Metric	Energy Savings (MWh)	Demand Savings (MW)
<i>Ex Ante</i> Reported Savings	40,223	1.67
<i>Ex Post</i> Verified Savings	39,298	1.63
Realization Rate	0.98	0.98
Relative Precision @ 90% CI	13%	13%

Table 3-7 shows the site level results for the impact evaluation work. Although there was a large variation of savings at the site level, the overall program resulted in a realization rate near 1.0 overall. The program initially estimated savings, as a percentage of total site usage, would range from five to fifteen percent. Based on the *ex ante* and *ex post* savings, the CEI program achieved an average of three percent savings of total site usage over the 12 month training period with a maximum of eleven percent and a minimum of no savings.

Table 3-7. Site level Realization Rate

Site #	<i>Ex Ante</i> (kWh)	<i>Ex Post</i> (KWh)	Site Level Realization Rate	Total Site Usage Savings
01.01A	166,195	166,195	100%	3%
01.01B	-	-	-	-
01.01C	16,027	16,027	100%	0%
01.01D	-	-	-	-
04.01	4,454,436	4,454,436	100%	3%
01.02	156,033	61,126	39%	1%
01.03	2,710,126	2,293,389	85%	11%
01.04	503,392	249,922	50%	2%
04.02	703,708	743,971	106%	0%
02.01A	850,134	470,656	55%	2%
02.01B	326,656	392,974	120%	4%
04.03	208,506	202,144	97%	1%
01.05	1,690,589	1,803,742	107%	6%
02.02	1,537,440	2,404,547	156%	7%
02.02	3,194,699	3,194,627	100%	3%
04.04	-	-	-	-
01.06	4,808,966	4,808,966	100%	5%
01.07	493,090	493,090	100%	2%
Total	21,819,997	21,755,813	-	-



Source: Navigant impact evaluation and Program Tracking database.



3.3 Process Evaluation Findings

AEP Ohio's CEI Program is a low-cost/no cost based program rather than a traditional rebated program. Table 3.9 outlines the steps taken to implement this program.

Table 3-8. Process Steps for the Continuous Energy Improvement Program

Step	Responsible Party		
	AEP Ohio	Implementer	Participant
1) Participant identification	•		
2) Participant recruitment	•	•	
3) Training sessions/workshops		•	•
4) Establish an Energy Team			•
5) Establish an energy intensity baseline and maintain a tracking system for energy savings		•	•
6) Walk-through assessment of participant energy management practices		•	•
7) Establish an Energy Policy and reduction goals			•
8) Develop a regression model reflecting participants baseline energy consumption (referred to as the "Energy Model")		•	
9) Develop employee engagement plan			•
10) Implement cost-effective energy efficiency and projects			•
11) Record energy consumption changes in the Energy Model		•	•
12) Produce year end energy consumption reports per participant		•	
13) Approve Annual Energy Model reports on participants energy consumption	•		

While most of AEP Ohio's programs address the energy efficiency of a specific end use, AEP Ohio's Continuous Energy Improvement program addresses *how* a customer uses its electricity and identifies ways to change the customer's operating and maintenance procedures. AEP Ohio offered an annual incentive of \$0.02/kWh saved for the first three years of savings. AEP Ohio implemented the CEI Program in 2013 with the training of cohort one; cohorts two to four were trained from 2013 into 2014. These four groups included some of AEP Ohio's largest energy consumers; collectively they used 1,342



GWh annually. The facilities realized the benefits of the training and the resulting improvements in 2013 and 2014. The original goal for cohorts one through four was 20 GWh energy savings. AEP Ohio far exceeded this goal by achieving 40 GWh of energy reduction from operating and maintenance changes in customer's use of electricity.

These changes included turning off equipment when not in use, changing production schedules, and developing internal energy conservation programs with the focus of involving employees in energy savings activities. While all of the participants formed Energy Teams to work on identified ways to reduce consumption, four companies took it a step further and formed company-wide initiatives to identify ways to reduce energy on an ongoing basis. These companies encouraged employee involvement by giving small incentives, such as LED lamps or vending machine gift cards, to employees who identified ways to reduce the facilities energy use.

Navigant conducted fifteen Energy Champion interviews, two implementer interviews and three program manager interviews in the evaluation of AEP Ohio's CEI Program. These interviews provided insight regarding the delivery and implementation of the program from these three different perspectives, as discussed in sections 3.3.1 through section 3.3.5.

The process evaluation of AEP Ohio's CEI Program focuses on two researchable topics:

- Marketing and Participation
- Program Characteristics and Barriers

3.3.1 Marketing and Participation

Site Recruitment

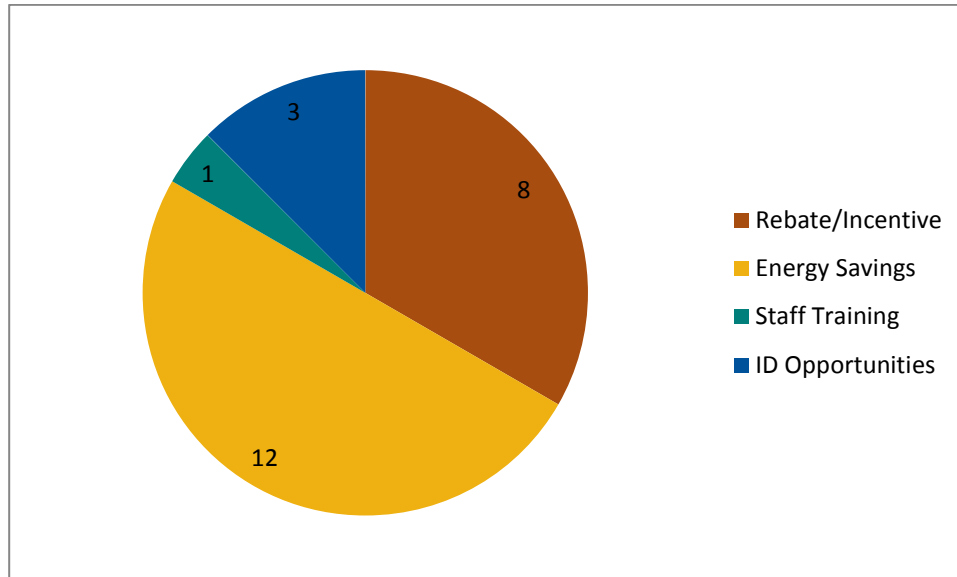
In 2013, AEP Ohio developed a list of customers with a minimum consumption of 10 to 20 GWh of electricity per year. These customers tend to be the most knowledgeable about how to maximize their energy usage. AEP Ohio Customer Service Engineers reviewed this list, identifying the customers having the resources of staff and time to participate in the CEI Program, and met personally with these customers to solicit participation in the program. The strong relationship between AEP Ohio Customer Service Engineers and the large customers, coupled with the one-on-one invitation to participate in the program worked well. AEP Ohio's Customer Service Engineers recruited approximately 95 to 97 percent of customers in the first four cohorts by meeting with them personally.

3.3.2 Site Participant Motivation

Figure 3-2 reflects the participant's main reasons for signing up for the program. Twelve of fifteen interviewed customers felt the potential of undertaking no/low cost energy measures to reduce electricity consumption/bills was one of the main reasons to participate. Eight of the customers indicated the annual incentive of \$0.02 per kWh saved over a three-year period was one of the main reasons to participate.



Figure 3-2. CEI Participant Reasons



Many of these customers have been making energy efficiency improvements periodically. Even with their internal expertise, these participants felt that having an outside expert review their facilities and make recommendations at no cost was a valued opportunity. At first, one customer was doubtful of the benefits of the program but was very satisfied in the end:

“We wanted to get an additional set of eyes looking at how we did things. We originally were very skeptical of the benefits of this program, as we had been trying to identify and make energy efficiency improvements for five years and thought we had captured all of the low hanging fruit. So when AEP Ohio suggested a program that would identify low or no cost measures we were skeptical; however the program did identify a lot of measures we could make.”

3.3.3 Marketing and Outreach

AEP Ohio does not market this program in the traditional sense, such as via newspaper/TV ads, trade ally affiliation, or brochures. For this program’s customer base, AEP Ohio representatives performed one-on-one meetings with potential CEI Program participants to explain the programs benefits and encourage participation.

3.3.4 Program Characteristics and Barriers

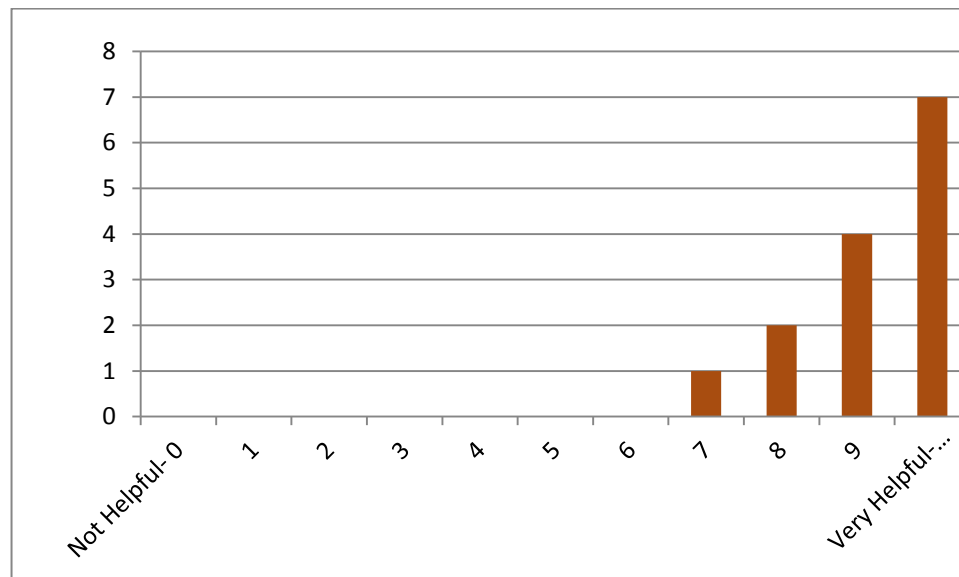
3.3.4.1 Assessment of Training Workshops

The cohort Training Workshop is a critical component of the CEI Program. In 2013/2014, these workshops consisted of twelve customer meetings: five meetings were with the full cohort group and about seven meetings were with a customer either face-to-face or over the phone. The purpose of these meetings was to influence how customer’s view energy usage. Specifically, instead of focusing on how individual pieces of equipment use energy, these meeting focus on how the whole facility uses energy.



The customers surveyed reported that the full group meetings were extremely informative and valuable to their respective organizations. Presentations by subject matter experts on how to improve the efficiency of installed equipment, such as compressed air, motors and lighting, were mentioned by the participants as one of the larger benefits of the workshops. In some instances, the implementation contractor brought these experts on the walk-through assessment of the participant's facilities to consult on how to implement improvements. Customers appreciated the expert feedback, in addition to the walk-through assessment, as it provided them with an objective viewpoint as to how their facilities could reduce their energy consumption. Customers felt that a monthly meeting was reasonably spaced as it allowed them to try to incorporate the lessons learned into their facilities in-between sessions. Figure 3-3 presents results from a participant survey regarding the workshop conducted.

Figure 3-3. How satisfied were you with the content of these workshops? (n=14)



3.3.4.2 Program Influence

Participants identified three major components of the training they felt benefited them the most:

- The formation of Energy Teams at their respective facilities, and having energy reduction become a company value
- The inclusion of key decision makers on the Energy team. These members included people who were responsible for either the financial decisions or the operational decisions.
- Working with other companies and discussing what actions each were taking to improve facility energy efficiency was very beneficial to participants
- The energy model each was given to help track their energy usage and identify any abnormalities



Part of the process to help the on-site Energy Teams get started was an energy assessment conducted by the program implementer at each facility. Many assessments included all members of the Energy Team including the Energy Sponsor and other decision makers. Having the key decision makers informed of the benefits of the change helped in justifying the facility change. The program implementation contractor would have a meeting to discuss the nine most common energy wasters and then walk through the facility and yellow tag areas identified as having potential savings to pursue further. These areas would become part of the Energy Teams' plans for improvements.

The efficiency improvements made by the customer sites ranged from simple to complex:

- Turn off equipment when not in use
- Raise the set point of the air conditioning by a couple of degrees
- Delamp every other light in their hallways with little to no impact on light quality
- Change the scheduling of production - when running overtime jobs, identify other jobs that can be run at the same time
- Identify and seal leaks in the compressed air system; adjust the system pressure to meet, but not exceed production needs. One facility saved \$50,000 a year just by making compressed air changes.
- Develop a company value of continually being aware of energy usage and identify ways to minimize usage
- Implemented an Energy Management Code on their production lines calibrating all of their operators
- Also implemented a reuse chilled water upgrade
- Improved compressed air system by making changes to the piping and centrally controlling the system

The majority of customers who participated in these workshops implemented operational and maintenance changes. The customers who were not as successful attributed it to lack of support from management, or significant and continual changes in staffing.

Customers also mentioned that there was value in meeting with peers that were facing similar challenges in implementing energy efficient projects. Several customers mentioned that they would like to have a follow up meeting with these peers after the first twelve months of training is complete. The Energy Champions were interested in the additional measures that other companies implemented and ideas on how others are keeping energy reduction as a continuous goal in their respective companies. AEP should offer participants a follow-up meeting three to six months after the final workshop.

3.3.4.3 Regression Model

The implementation contractor provided the Energy Model to every facility. AEP Ohio, the implementer and the customer all use this regression model to estimate site energy. The model utilized a variety of inputs including weather and production. The implementation contractor goes through a series of steps while developing the model.



- The implementation contractor builds an energy model prototype for each customer and the model is tested for the first month. AEP Ohio and the customer review the results of the model to verify the resulting numbers are accurate.
- The implementer makes any necessary changes before turning the final version over to the customer and AEP Ohio.
- At the end of the first year, the implementer reviews the model again and provides explanations for any variations throughout the year.

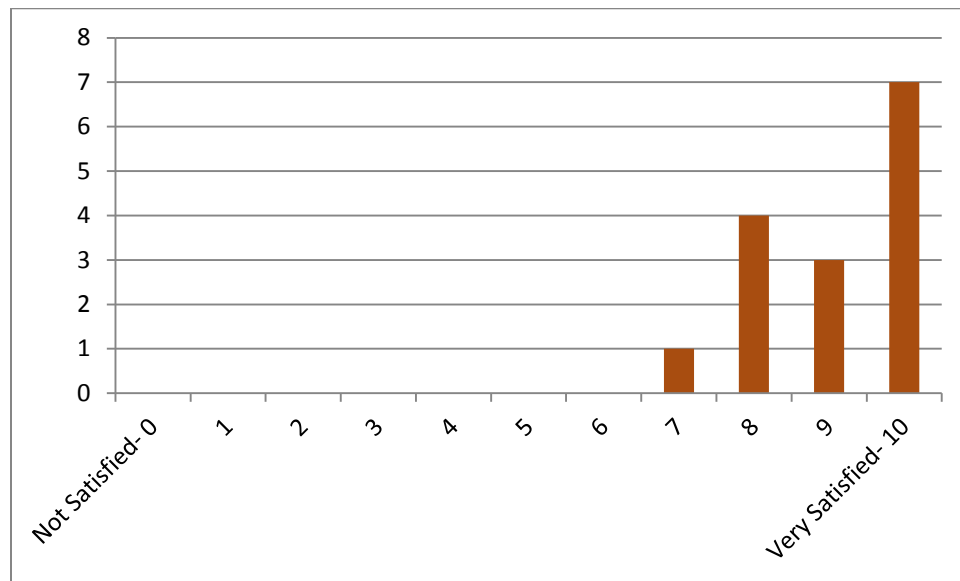
A model can go through multiple revisions before it is ready for tracking energy savings. Having this energy model allowed sites to predict their usage given a set of changes. Many of the customers commented on how powerful this tool was and how it benefited them as they were considering making facility upgrades.

The Implementer develops the model to be flexible in its use and allows for changes. When the customer uploads the model, the implementer will reach out and discuss any variations caused by new equipment or operational changes. The model tracks the cumulative sum of energy efficient activities. The difference is calculated by using predicted energy usage, based on previous years of energy use data, and what the site is currently using, and accumulates the energy savings on a monthly basis. If the model is updated, archived older versions are available for reference purposes.

3.3.5 Participant Satisfaction

As shown in Figure 3-4 the overall response from participants was very positive. They were amazed at the savings they could achieve by making a minimal investment in both time and money. They felt the workshop presentations provided valuable information they could apply to their own facilities.

Figure 3-4. Customer Overall Satisfaction (n=15)





When asked what major benefits have you received from the workshops, participants responded:

- I thought the presentation on motors and pumps was excellent. Triple Point Energy was very knowledgeable.
- Personally, the workshops at the other companies were the most beneficial. Touring other companies and seeing their processes was really beneficial for me; I saw how others were using/addressing the compressed air and saw some potential for us.”
- There were many beneficial aspects of the workshops:
 - a. The workshops were very well structured, and the information enlightening.
 - b. There was a speaker regarding compressors and loss of air during loading that made my company think of how they were using their compressors and the potential for energy savings in regards to air-compressors.
 - c. Working with the other companies was extremely helpful, visiting the different companies and seeing the programs they have put in place, discuss the issues each other are having and “brainstorm” solutions. I still calls some of them to network and discuss different ideas.

While participants were pleased with the program, they did have thoughts on how the program can be improved:

- Provide two tiers of training based on participating company’s levels of expertise
- Continue and expand the technical training, it was very helpful



3.4 Cost Effectiveness Review

This section addresses the cost effectiveness of the 2014 CEI Program. The Total Resource Cost (TRC) test is used to assess the Cost Effectiveness of the program. Table 3-9 summarizes the unique inputs used in the TRC test.

Table 3-9. Inputs to Cost-Effectiveness Model for AEP Ohio CEI Program

Item	2014
Measure Life	5
Participants	49
<i>Ex Post</i> Annual Energy Savings (kWh)	39,298,617
<i>Ex Post</i> Coincident Peak Savings (kW)	1,673
Third Party Implementation Costs	3,048,677
Utility Administration Costs	450,173
Utility Incentive Costs	849,678
Incremental Measure Costs	0

The basis of the evaluation *ex post* impacts is the cost effectiveness analysis. The implementation contractor did not supply any data for “Participant Contribution to Incremental Measure Costs”. The implementation Incentives for years two and three are projected and included in the cost-effectiveness analysis.

Based on these inputs, the TRC ratio is 2.7 and the program passes the TRC test for the program in its entirety. Table 3-10 summarizes the results of the cost effectiveness tests. The stated results are for the Total Resource Cost test, the Participant test, the Ratepayer Impact Measure test, and the Utility Cost test.

Table 3-10. Cost-Effectiveness Results for CEI Program

Test Results for CEI Program	2014
Total Resource Cost	2.7
Participant Cost Test	N/A
Ratepayer Impact Measure	0.5
Utility Cost Test	1.6

At this time, the calculation of the TRC does not include the reduction of greenhouse gas emissions. These additional benefits would increase the given TRC benefit/cost ratio.



4 Evaluation Findings and Recommendations

4.1 Conclusions from Program Year 2014

- 1 **The CEI program achieved savings at some of AEP Ohio's largest and most energy aware customers.** This supports the concept that large industrial sites can implement a significant number of no/low cost energy efficiency measures. Having an Energy Expert as a resource for commercial and industrial customers helps these sectors recognize and implement otherwise ignored energy efficiency opportunities.
- 2 **Customers reported high satisfaction with the program.** The satisfaction of this program was high regardless of the amount of savings a customer implemented. Customers were very pleased with the training workshops and interaction with the implementation contractor. Customers were especially appreciative of the site level attention received from the implementation contractor, including the walk-through assessments and expert advice on their processes. Additionally, the program has generated compelling goodwill for AEP Ohio.
- 3 **The program realized 98 percent of *ex ante* savings while achieving twice its energy goal for 2014.** While AEP Ohio was able to achieve the overall program goal, each site saved an average of three percent of total site usage over the 12 month training period compared to the initial estimate of five to fifteen percent. Navigant expects that this savings will be higher during years 2 and 3 as measure were being implemented throughout the first 12 months.
- 4 **The implementation contractor maintains quality and accurate data in the tracking system.** Navigant did not identify any serious deficiencies, errors or patterns of missing data. The tracking system is adequate for planning all aspects of evaluation, however, the evaluator did not address whether the tracking system is adequate for regulatory or corporate requirements.
- 5 **AEP Ohio's personalized one on one marketing approach has worked well.**
- 6 **Building an Energy Team with an Executive Sponsor at the customer location has been critical in the success of changing the organizations' culture.** An energy team of 5-8 employees at each location is established with an Executive Sponsor supporting the teams' efforts. The Executive Sponsor is an executive level employee that can directly influence the energy culture of all departments within the organization.

4.2 Recommendations for Program Improvements

1. **AEP Ohio should provide two tiers of training based on each participating company's levels of expertise.** Some customers felt the level of training was too basic for their needs and explained things they were already aware of, while others commented they learned many concepts they had not previously considered.
2. **AEP Ohio should provide training or on-call assistance for customers looking to expand their equipment purchases.** Training on smart purchasing and process integration may result in long-term savings after the program is completed. When customers purchase new equipment for their



facilities, they reported needing training on how to adjust the equipment to maximize production while minimizing energy usage.

3. **Moving forward into years two and three, the implementer should adjust the energy model to match one-year post conditions.** When Navigant analyzed sites with variations of production that were +/- 10%, the site-level realization rates ranged from 0.39 to 1.56. In order to calculate more accurate savings, the implementer could make model adjustments after the first year post assessment is completed by choosing one-year pre data that most closely matches current operation. If production or other variables did not change +/- 10% this change would not be required.
4. **AEP Ohio should offer participants a follow-up meeting three to six months after the final workshop.** Customers also mentioned that there was value in meeting with peers that were facing similar challenges in implementing energy efficient projects. Several customers mentioned they would like to have a follow up meeting with these peers after the first twelve months of training is complete. Energy Champions were interested in the additional measures that other companies implemented and ideas on how others are keeping energy reduction as a continuous goal in their respective companies.
5. **The implementer should provide demand savings for the program beyond the restrictions put into place for the 2014 program.** The program has both savings and demand goals but the implementer only reported demand savings when equipment was permanently removed or permanently upgraded to use less energy. Navigant recognizes that the energy model used to calculate the kWh savings may not be sufficient to calculate demand savings. This is due to data restrictions regarding the variables such as production, which are not often reported hourly. AEP Ohio and the implementer should work closely together to determine how the demand savings should be calculated and reported.



Appendix A. Participant, Staff, and Solution Provider Interview Guides

AEP Ohio CEI Program: AEP Ohio Program Manager Interview Guide

Introduction

This guide is to be used to interview AEP Ohio staff for the Continuous Energy Improvement (CEI) Program during the 2014 program year. These questions will not necessarily be asked verbatim, but rather serve as a roadmap during conversation.

Research Questions or Objectives

Confirm program processes (e.g., program delivery, program processes and marketing efforts) for 2014

Identify current program successes and challenges

Identify opportunities for program improvement

Interview Instructions

Prior to interview, request the following program documents:

- Any new marketing materials

- Most recent status reports regarding progress toward goals

Interview

Section A: Introduction

We are interested in asking you some questions about the program so that we can understand the new program elements and get a sense of program successes and challenges, from your perspective.

Before we get started, can you take a moment and explain your role and scope of responsibilities with respect to AEP Ohio's CEI Program? How long have you held this position?

Section B: Program Goals/Status

1. What are the program goals for program year 2014 (i.e., goals from the 2013-2014 Plan)?
2. How is the program doing in terms of meeting these goals?



- A. Are there goals that program staff use that are different from those outlined by the Plan?
- B. Are there any other quantitative goals that AEP Ohio keeps track of, including non-energy goals (e.g., recycling)?
- 3. Is participation sufficient to meet current and future program goals?
- 4. Tell me about the best project in your program this past year

Section C: Marketing and Outreach Activities

- 1. Is AEP Ohio involved in how sites are chosen for your program?
 - A. What are the criteria for recruiting?
 - B. How are sites chosen and targeted? (What messages about the program are customers most responsive to in your recruiting?)
 - C. Who is excluded or included (for the first 4 cohorts)?
 - D. Is the majority of the participation from internal recruiting or outside interest?
- 2. Of the customers that were recruited:
 - A. Did any of the sites not have the proper data available to participate?
 - B. Did any of the sites not have the proper technical expertise to participate?
 - C. Why did they not seek this kind of training elsewhere? Were they unaware of the benefits of this kind of training?
- 3. Are other industrial sites (of your participants) performing CEI-type programs?
- 4. How are you planning to recruit moving forward?

Section D: Program Tracking and Reporting

- 1. How does the implementer communicate savings to you?
- 2. How does the implementer report changes to the model to you?



- a. Are you getting the data you need in a useable and timely format? (for both you and for compliance Prudency and Verification reviews)
3. Is there anything you would like to see change about the data transfer process between you and the CEI implementer? If so, what?
4. How were the written reports delivered to you?
 - a. Did you have any issues with these reports including timing, ability to review, or the information that was provided to both you and the customer?

Section E: Program Strengths and Areas for Improvement

1. What unexpected things happened that impacted the program's operation or reaching goals?
2. What are things that you would like to change about this program moving forward?
 - a. What impediments are there to you making changes?
 - b. What could the implementer change?
3. In regard to the cohort meetings/training:
 - a. Did you attend these meetings? (how many per month)
 - b. Did customer account reps attend?
 - c. How satisfied are you with the frequency of these workshops?
 - d. How satisfied are you with the content of these workshops?
 - e. Many of the sites mentioned that they might like a check-up meeting (3-6 months after the last meeting). What do you think about adding some meetings after the first 12 month period?
 - f. In your opinion, what can AEP Ohio do to improve these workshops?

Section F: Closing

1. Do you have any other comments, concerns or suggestions about the program that we didn't discuss that you would like to make sure I know about?

Thank you very much for taking the time in assisting us with this evaluation. If I come up with any additional questions that come from this interview do you mind if I send you an email or give you a quick call?



AEP Ohio CEI Program: Implementation Staff Interview Guide

This guide is to be used to interview implementation staff for the AEP Ohio Continuous Energy Improvement (CEI) Program during the 2014 program year. These questions will not necessarily be asked verbatim, but rather serve as a roadmap during conversation.

Research Questions or Objectives

- Confirm program processes (e.g., program delivery, program processes and marketing efforts) for 2014
- Identify current program successes and challenges
- Identify opportunities for program improvement

Interview Instructions

Prior to interview, request the following program documents:

- Copies of marketing plans
- Marketing activities tracking sheet
- Any new marketing materials
- Documentation of goals (units, energy savings, non-energy savings) for each product type
- Most recent status reports regarding progress toward goals

Interview

Section A: Introduction

[If needed:] First we would like to give you some background about who we are and why we want to talk with you today.

We are interested in asking you some questions about this program so that we can understand the new program elements and get a sense of program successes and challenges, from your perspective.

Before we get started, can you take a moment and explain your role and scope of responsibilities with respect to AEP Ohio's CEI Program?

Section B: Program Design

Next, we would like to discuss a little more about how the program is currently structured.



1. Besides the monthly training, how did you provide support to your facilities?
2. Beside the energy coach, what staff do you provide to support these sites? What support do they provide?
3. What do you feel could be changed to the program design, either by you or AEP Ohio?
4. In regard to the cohort meetings/training:
 - a. Did you attend these meetings? (how many per month)
 - b. How satisfied are you with the frequency of these workshops?
 - c. How satisfied are you with the content of these workshops? Do you feel that you were limited by what you could present and do you plan to make changes moving forward?
 - d. Many of the sites mentioned that they might like a check-up meeting (3-6 months after the last meeting). What do you think about adding some meetings after the first 12 month period?
5. How does the energy model adjust to major changes (production, operating hours and employee count for example)?
 - a. Are these changes logged and are old versions available?
 - b. Is the model checked for accuracy and reasonability throughout the process, and by whom?
 - c. How do you account for (savings in) large financial projects that are completed at the site during this measure period?
 - d. What difficulties did you run into while developing this model? Did you have reasons that this model took a while to develop or did you lack data you needed to develop it?
6. How are the clients using the energy Model?
 - a. Can the client use it internally to help cost justify projects?
 - b. What level of accuracy can they rely on?
 - c. Are there any constraints within the model that would limit how long the model could be used by the clients?



7. How did you report the results to the client and AEP Ohio?
 - a. Did you have any issues with these reports including timing, or the information that you had to provide to both AEP Ohio and the customer?

Section C: Marketing and Outreach Activities

1. Are you involved in how sites are chosen for your program?
 - E. What are the criteria for recruiting?
 - F. How are they chosen and targeted? If needed: What's the relationship between you and AEP Ohio in recruiting and choosing sites?
 - G. Who is excluded or included?
 - H. Is the majority of the participation from internal recruiting or outside interest?
 - I. A couple of the customers interviewed mentioned that the others in their cohort group were at vastly different levels of knowledge on Energy Efficiency as well as manufacturing issues/needs. How are the cohort groups formed?
2. Of the customers that were recruited:
 - D. Did any of the sites not have the proper data available to participate?
 - E. Did any of the sites not have the proper technical expertise to participate?
3. Are you aware of other CEI-type programs in the AEP Ohio area?

Section D: Improvement on Training Workshops

1. Do you feel that the training workshops could be improved and how?
2. Do you feel that the number of workshops conducted is sufficient, would you like to increase or decrease the number of workshops?
3. Do you think doing a follow up / check in training would be valuable?



How should a follow up process work?
What goals or metrics should be included?

- a. How often would you do this kind of checkup after the first year?

Section E: Closing

1. Do you have any other comments, concerns or suggestions about the program that we didn't discuss that you would like to make sure I know about?
2. Was there any team formation that worked better for companies?

Thank you very much for taking the time in assisting us with this evaluation. If I come up with any additional questions that come from this interview, do you mind if I send you an email or give you a quick call?



AEP Ohio CEI Program: Energy Champion Interview Guide

Introduction

This guide is to be used to interview Energy Champions for the Continuous Energy Improvement (CEI) Program during the 2014 program year. These questions will not necessarily be asked verbatim, but rather serve as a roadmap during conversation.

Research Questions or Objectives

- Confirm program processes (e.g., program delivery, program processes and marketing efforts) for 2014
- Identify current program successes and challenges
- Identify opportunities for program improvement

Interview Instructions

Prior to interview, request the following program documents:

- Copies of marketing plans
- Marketing activities tracking sheet
- Any new marketing materials
- Documentation of goals (units, energy savings, non-energy savings) for each product type
- Most recent status reports regarding progress toward goals
- Program application
- Program policies and procedures

Interview

Section A: Introduction

We are interested in asking you some questions about the program so that we can document your understanding of the new program elements and get a sense of program successes and challenges, from your perspective.

1. Before we get started I have a couple general questions, can you take a moment and explain your job title or role?
2. About how many fulltime equivalent employees work at the facility?



1	Less than 10	
2	11 to 25	
3	26 to 40	
4	41 to 75	
5	76 to 100	
6	More than 100	
88	Refused	
99	Don't Know	

3. What is the total square footage of the portion of the facility that you occupy at this location?
Your best estimate will be fine.
4. What is the age of the site (XXX)?
5. What principal activity type of your facility? What do you manufacturer?

1	Office	
2	Retail (non-food)	
3	College/university	
4	School	
5	Grocery store	
6	Convenience store	
7	Restaurant	
8	Health care/hospital	
9	Hotel or motel	
10	Warehouse	
11	Personal Service	
12	Community Service/ Church/ Temple/Municipality	
13	Industrial Electronic & Machinery	
14	Industrial Mining, Metals, Stone, Glass, Concrete	
15	Industrial Petroleum, Plastic, Rubber and Chemicals	
16	Other Industrial	
17	Agricultural	
18	Condo Association/Apartment Management	
77	Miscellaneous [RECORD VERBATIM]	
88	Refused	
99	Don't Know	

6. Is this Site (XXX) the headquarters, one of several locations or the only site for your company?
Has the program been implemented at your other sites, or will they be participating in the future?

How many of these sites are in the AEP Ohio Territory?



Section B: Program structure

1. How was the “energy champion”, “energy team” and “Executive sponsor” chosen for your facility?
1. Who was your “energy coach”?
2. What are the main goals that your facility originally chose to participate in the CEI program?
(guide if need to fit in bins below)

1	Rebate/ Incentive	
2	Lower Utility Bill	
3	Help to justify Investment	
4	Able to Make improvements Sooner	
5	Energy Savings	
6	Training for you Staff	
7	ID Opportunities	
8	Other	

2. In regard to your interaction with Triple Point Energy:
 - a. Besides the monthly training, how did Triple Point Energy provide support to your facility? Hamster wheel, meters, send resources, exercise, future thinking
 - b. On a scale of 1-10, where 1 is not at all helpful and 10 is very helpful, how helpful were these activities in helping your facility to achieve your primary goal?-10
 - c. What do you think Triple Point Energy could do to be more helpful? (maybe make more specific)

Section C: Facility’s Goals/Program Status

1. How did you originally find out about this program?
2. Before participating in the CEI program, had you sought any similar training elsewhere?

Section D: Changes to Program Processes

1. What behavioral changes has your facility undertaken as a result of the CEI Program?
2. What financial measures have you installed at your facility during your participation in the CEI program?
 - a. In what ways did the CEI program influence your facility’s decision to install these measures?
 - b. Did you explore other AEP Ohio business energy efficiency programs when installing these measures?
3. Since you began participating in this program, has your facility had any significant change in hours of operation?



- a. In Did the CEI program influence these changes in operating hours?
4. Since you began participating in this program, has your facility had any significant change in the number of employees?
5. Since you began participating in this program, has your facility had any significant change in production?
 - a. Did the CEI program influence these changes in production?
6. Has your facility installed any measures through programs other than the CEI Program?

Section E: Training Workshops

1. How frequently do you attend the CEI Program training workshops?
2. How many people from your organization regularly attend the CEI Program training workshops?
3. On a scale of 1-10, where 1 is not at all satisfied and 10 is very satisfied, how satisfied are you with the frequency of these workshops?
 - a. [If <6] What are the reasons that you are less than satisfied with the frequency of these workshops?
4. On a scale of 1-10, where 1 is not at all satisfied and 10 is very satisfied, how satisfied are you with the content of these workshops?
 - a. [If <6] What are the reasons that you are less than satisfied with the content of these workshops?
5. In particular, what major benefits have you gotten from the workshops?
6. In your opinion, what can AEP Ohio do to improve these workshops?

Section F: Marketing and Outreach Activities

1. What marketing or informational materials have you received about this program?
2. On a scale of 1-10, where 1 is not at all helpful and 10 is very helpful, how helpful have these materials been in helping you to understand the program objectives and processes?
 - a. [IF <6] What are the reasons that you found these materials to be unhelpful in understanding the program objectives and processes?

Section H: Participant Satisfaction

1. On a scale of 1-10, where 1 is not at all satisfied and 10 is very satisfied, how satisfied are you with the program, overall?
 - a. [IF <6] What are the reasons that you are less than satisfied with the program, overall?
2. Is there anything AEP Ohio could do to increase your satisfaction with the program, overall?



Section I: Closing

1. Do you have any other comments, concerns or suggestions about the program that we didn't discuss that you would like to make sure I know about?

Thank you very much for taking the time in assisting us with this evaluation. If I come up with any additional questions that come from this interview do you mind if I send you an email or give you a quick call?

APPENDIX Q



Bid to Win Program 2014 Evaluation Report

Presented to
AEP Ohio



May 11, 2015

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Executive Summary

This document presents a summary of the findings and results from the evaluation of the 2014 Bid to Win Program implemented by AEP Ohio for the program year January 1, 2014 through December 31, 2014.¹ The Bid to Win Program served customers in AEP Ohio's business sector by offering a reverse bid process, where the bidding starts at an established bid ceiling price and pre-qualified participants bid down the price, or incentive per kilowatt-hour (kWh), to a level at which they will complete energy efficiency projects to generate electric savings. Winning participants were then responsible for installing new equipment and measures based on the kWh energy savings consistent with their bids. The program sought to influence business customers to move forward with large projects that were not well served through other business programs that have maximum incentive caps.

Program Participation

In 2014, four qualified participants with winning bids identified several projects in 2014, one of which completed and was paid incentives under the program in 2014. Table ES-1 provides a summary of 2014 Bid to Win Program reported results.

Table ES-1. 2013 Bid to Win Program Projects, Measures, and Ex Ante Savings

Metric	Ex Ante Value
Number of Projects	1
Number of Measures ²	8
Annual Energy Savings (MWh)	3,351
Electric Peak Demand Savings (kW)	404.03

Source: AEP Ohio performance report dated December 31, 2014 (AEP Ohio EE-PDR 2014 Performance Report 12-31-2014 Final.xlsx)

The program's energy savings were achieved by installing variable speed drives on high horsepower industrial fans and pumps which previously used inlet guide vanes for speed control, or which ran continuously at full speed.

The reported *ex ante* energy savings split by end-use was 60 percent for industrial process fans and 40 percent for industrial process pumps. The Navigant *ex post* evaluated energy savings analysis determined the split by end-use was 51 percent for industrial process fans and 49 percent for industrial process pumps.

¹ The program initiated a pilot launch with its first Bid Process on October 25, 2013, with a subsequent Bid Process on January 21, 2014.

² Eight different pieces of equipment received variable speed drives under the program.

Data Collection Activities

Table ES-2 provides a summary of 2014 data collection activities for the Bid to Win Program impact and process evaluations.

Table ES-2. Data Collection Activities for 2014 Bid to Win Program Evaluation

Evaluation Effort	Data Collection	Targeted Population	Sampling Unit	Sample Design	Sample Size	Timing
Impact and Process	Collection of Program Data	Bid to Win projects paid in 2014	Project	census	1	October 2013 to December 2014
Process	In-depth Interviews	AEP Ohio program Staff	Contacts from AEP Ohio	NA	3	August 2014 to September 2014
		Bid to Win Program implementation staff	Contact from implementer	NA	3	
Impact	Project Technical Reviews	Bid to Win projects paid in 2014	Project	census	1	September 2014 to April 2015
	On-site Verification	Census of Technical Review Projects	Project	census	1	September 2014 to April 2015

Source: Evaluation activities conducted from July 2014 through April 2015

Key Evaluation Findings and Recommendations**Impact Evaluation Findings and Recommendations**

The impact results for the 2014 Bid to Win Program are shown in Table ES-3 and Table ES-4.

Table ES-3. Savings Estimates for the 2014 Bid to Win Program

	2014 Program Goals ¹ (a)	Ex Ante Savings ² (b)	Ex Post Savings ³ (c)	Realization Rate RR = (c) / (b)	Percent of Goal = (c) / (a)
Energy Savings (MWh)	20,000	3,350.9	5,131.8	1.5	26%
Demand Savings (kW)	2,460	404	554	1.4	23%

Sources: ¹ VOLUME 1: 2012 TO 2014 ENERGY EFFICIENCY/ PEAK DEMAND REDUCTION (EE/PDR) ACTION PLAN November 29, 2011. ²AEP Ohio performance report dated December 31, 2014 (AEP Ohio EE-PDR 2014 Performance Report 12-31-2014 Final.xlsx) ³Navigant evaluated savings.

Table ES-4. Savings Estimates for the 2014 Bid to Win Program

Metric	Energy Savings (MWh)	Demand Savings (kW)
<i>Ex Ante</i> Reported Savings	3,350.9	404
<i>Ex Post</i> Verified Savings	5,131.8	554
Realization Rate³	1.5	1.4

1. **Finding #1:** The program achieved the following successes:
 - a. The project exceeded the required three GWh first year savings
 - b. The project life exceeded the minimum 10 year requirement
 - c. The Program Operations Manual was current, relevant, and being followed
 - d. The appropriate eligibility requirements were properly adhered to
 - e. Applications were appropriately completed and backed with supporting documentation
 - f. AEP Ohio has an internal quality control approach sufficient to identify most inaccuracies
2. **Finding #2:** The program had the following areas for improvement:
 - a. *Ex ante* savings verification by the project implementer did not meet the requirements of the International Performance Measurement and Verification Protocol (IPMVP)⁴ for baseline specification and energy savings estimation (see Table ES-5).
 - b. The implementer utilized assumed values rather than measured values for key variables in the savings calculations, such as power factor, without verifying the accuracy of the values.
 - c. Spot checks of equipment kW by the implementer to verify calculated implementer kW derived from facility amperage data were not reported in the project file. Spot checks would not have added substantial cost to the implementer's verification process. Spot checks typically reveal discrepancies between measured kW values and calculated kW values, such as those used by the implementer to estimate *ex ante* savings.

³ The Bid to Win Program was evaluated using a census sample of a single project. As such, the realization rate calculated for a single project does not have a statistical uncertainty (such as 90/10) associated with it. The relative engineering uncertainty on the evaluated savings for the first year savings of the single project is $\pm 10\%$ for MWh and $\pm 3\%$ for MW.

The Navigant evaluated savings were calculated based on sub-hourly amperage data provided by the facility manager from their Building Management System (EMS), calibrated for accuracy by Navigant using Navigant spot checks and nearly three weeks of Navigant metered power data concurrent with EMS efficient case trending. Baseline and efficient EMS data was available for nearly one year pre and post.

⁴ Detailed project findings were provided separately to AEP Ohio by Navigant.

- d. The implementer did not calibrate the facility amperage to actual true power measurements. The implementer's metering approach therefore introduced substantial uncertainty into the savings estimate, since the facility amperage was metered using the existing facility Energy Management System (EMS) on the load side of the VFDs, where the voltage and power frequency are highly variable.

Impact Recommendation #1: To ensure realization rates closer to 1.00 for high impact projects, the implementer conducting the *ex ante* savings verification should follow the basic requirements of the IPMVP.

Table ES-5. IPMVP⁵ Options Summary for AEP Ohio Bid to Win Program

IPMVP Option	Summary Description	Navigant Evaluation Notes
Option A	Key Parameter Measurement	The implementer utilized this method, taking advantage of amperage trends available from the facility EMS, however did not justify the estimated parameters as required
Option B	All Parameter Measurement	Navigant utilized three weeks of on site power measurements to calibrate annual facility amperage available from the implementer and participant
Option C	Whole Facility (Utility Billing Data Analysis)	Navigant determined that the savings were not large enough relative to facility usage to evaluate savings using this method
Option D	Calibrated Simulation	Not used

⁵ International Performance Measurement and Verification Protocol, Concepts and Options for Determining Energy and Water Savings Volume 1, EVO 10000 – 1:2012.

Process Evaluation Findings and Recommendations

Satisfaction with the Bid to Win Program

1. **Finding:** Based on AEP Ohio Bid to Win program staff and implementer interviews, customers and Solution Providers appear to be satisfied with the Bid to Win Program. Program staff reported that repeat bid process participation among pre-qualified bidders was common.

Process Recommendation #1: Although based solely on program staff observations, these results suggest the program delivery and contact worked well in 2014. Program staff reported a program focus on continuous improvement to help resolve issues impacting participant satisfaction with program processes, facilitating customer transition into the 2015 version of the program.

Program Growth

2. **Finding:** Solution Providers and some customers appeared to be comfortable with program processes, including bid process participation and project development and implementation. Program staff indicated that Solution Providers have a greater understanding of how to navigate the program than customers due to their past experience with AEP Ohio programs and energy efficiency expertise.

Process Recommendation #2: To support greater customer and Solution Provider participation, in addition to the taped trainings already provided by AEP Ohio via the AEP Ohio website, the program could have expanded its outreach bid process by producing short, instructional videos that could be made available through outlets like YouTube for customers and Solution Providers to learn about the program.

Program Processes

3. **Finding:** As projects neared completion, participants were required to submit a Project Completion Form, including documentation like itemized and paid invoices, proof of purchase receipts, and engineering calculations, to confirm the project has been completed in accordance with program requirements, that all project costs were eligible, and an appropriate incentive had been requested by the program participant. Following the submission of the Project Completion Form and supporting documentation, the program implementer performs a final technical review, as defined by quality assurance/quality control (QA/QC) procedures to verify energy savings achieved through the project. In addition to the final technical review, all projects were subject to an on-site visit to ensure quality and verification of measure installation either prior to or after receiving an incentive award.

Process Recommendation #3: Formalizing the documentation and verification process could have eased and speed the project completion process for customers and Solution Providers. Navigant recommends establishing a checklist of concrete documentation requirements to confirm project completion, in addition to completing on-site visits to ensure quality and verify measure installation *prior* to the receipt of incentive awards.

Section 1. Introduction

This evaluation report chapter covers the Bid to Win Program element of the AEP Ohio energy efficiency and peak demand reduction (EE/PDR) programs.

1.1 Program Description

The Bid to Win Program serves customers in AEP Ohio's commercial and industrial sector by offering a reverse bid process, or Bid Processes, where the bidding starts at an established bid ceiling price and pre-qualified participants bid down the price, or incentive per kilowatt hour (kWh), to a level at which they will complete energy efficiency projects to generate electric savings. Winning participants were then responsible for installing new equipment and measures based on the kWh energy savings consistent with their bids. The program seeks to influence business customers to move forward with large projects that were not well served through other business programs.

The Bid to Win Program is an AEP Ohio Business Sector Program, marketed, administered, and delivered as an integrated program by AEP Ohio. The program is managed by an implementation contractor in coordination with AEP Ohio. The implementation contractor may, in turn, coordinate with a Solution Provider contracted to the end use customer, or with the end use customer itself.

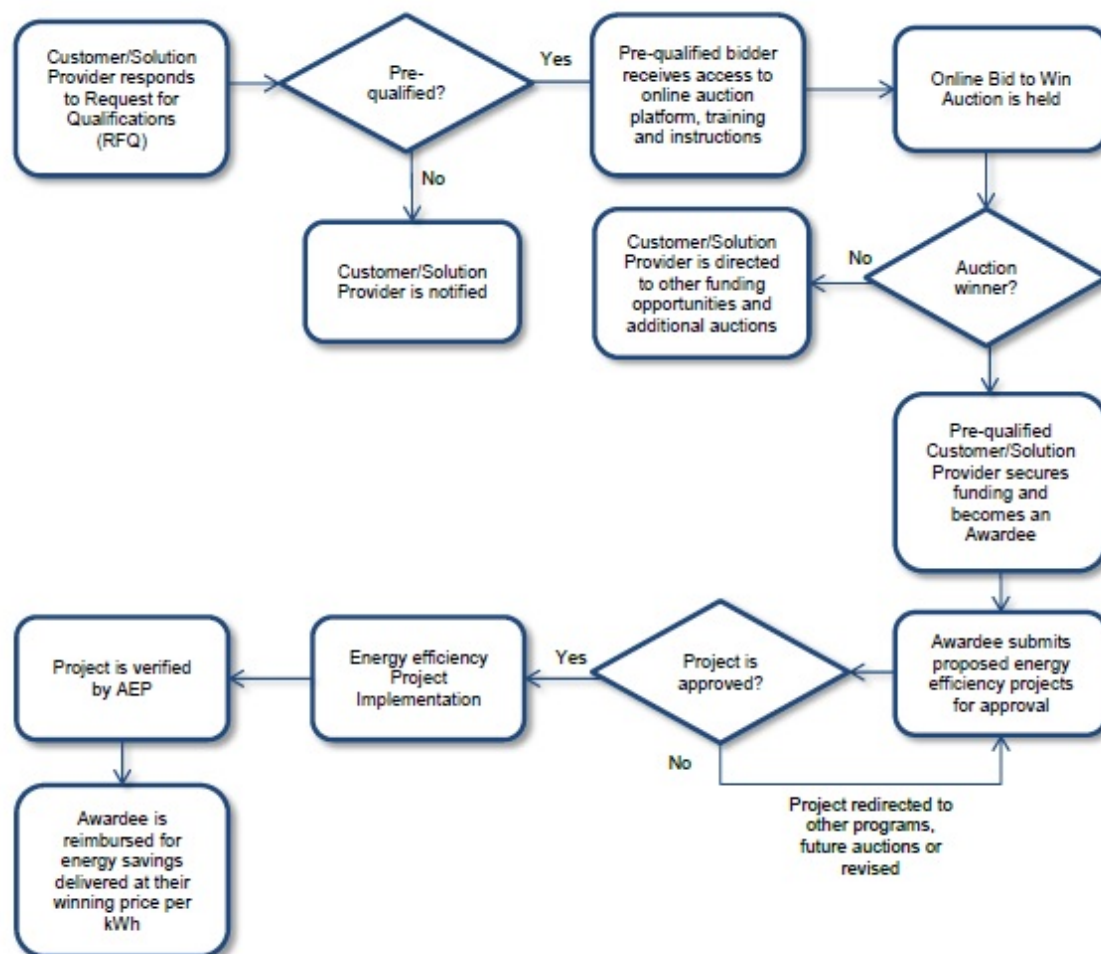
1.2 Key Program Elements

The 2014 Bid to Win Program sought to achieve the following quantitative and qualitative goals:

- Achieve 20,000 MWh in annual energy savings
- Achieve 2,460 kW of demand savings
- Achieve an average expected useful life (EUL) of 10 years for installed measures
- Achieve the market incentive price per 10-year lifecycle kWh saved
- Produce long-term, cost effective energy savings with high verified and attribution values in the commercial and industrial sectors
- Inform AEP Ohio on what future incentive rates should be
- Provide customers with large projects who would have reached the incentive cap under the AEP Ohio Prescriptive and Custom Program a pathway to achieving energy savings while still receiving financial incentives
- Achieve a high level of customer satisfaction
- Support the development of a highly educated customer and service provider base

Figure 1-1 presents the process map for the Bid to Win Program and the following provides a summary of critical program elements.

Figure 1-1. Bid to Win Program Process Map



Source: AEP Ohio Bid to Win Program Operations Manual, August 2, 2013.

Incentive Structure. Incentives provided through the Bid to Win Program were based on the outcomes of reverse bidding processes. All reverse bid processes began with a predetermined starting cost per kWh bid amount and bid decrement limitations, with the lowest bidder in each bid process becoming the “Awardee” tasked with implementing energy efficiency projects that achieve energy savings equivalent to their winning bid. In all 2014 program bid processes, the bid ceiling prices were set at \$0.08/kWh, which was the Custom Program incentive amount in 2014, with minimum bid decrements of \$0.001/kWh. Table 1-1 provides examples of potential bids, awards, and expected energy savings.

Table 1-1. Example Incentive Structure for Bid to Win Program

Bid Example	Bid Block Amount	Bid Amount (\$/kWh saved)	Required Amount of Energy Savings
1	\$350,000	\$0.05	7,000,000 kWh
2	\$350,000	\$0.06	5,833,000 kWh
3	\$350,000	\$0.08	4,375,000 kWh

Source: AEP Ohio Bid to Win Program Operations Manual, August 2, 2013. AEP Ohio Bid to Win Program Request for Qualifications, October 28, 2013.

Incentive Limits. Pre-qualified bidders were eligible for awards up to \$1 million in incentive funding for their energy efficiency project. If projects were expected to generate enough energy savings to warrant a higher award, incentives over \$1 million could be offered with approval from AEP Ohio. Additionally, projects that deliver within 90 to 110 percent of estimated energy savings will also receive an incentive bonus of \$0.005/kWh from AEP Ohio.

Bidder Pre-Qualification. To participate in Bid to Win bid processes, Solution Providers and customers were required to complete and submit a Request for Qualifications (RFQ), which allowed the applicant to verify financial viability, show past experience in implementing energy efficiency projects, demonstrate ability to implement energy efficiency projects within the program requirements, and determine eligibility of proposed energy efficiency projects and implementation strategy. Customers and Solution Providers were also required to document proper licensing, bonding, and insurance. The program implementer reviewed the RFQ and supplied documentation and either issued an approval letter to the customer or Solution Provider, or notified the applicant that it was deemed unqualified to participate in the program. Bid process dates and details were provided to pre-qualified bidders and also posted on the program website.

Live Bid Process. Following the pre-qualification stage, customers and Solution Providers were provided with instructions on how to participate in the live bid process. The bid process included providing the bidder with access to the online bid process platform and training on use of the bid process platform and bidding process. Additionally, a mock bid process allowed bidders an opportunity to practice the bidding process. During live bid process, bidders logged into the bid process platform and actively submitted bid prices to compete for energy efficiency incentives. Throughout the bid process, bidders could view the bids of other participants and use this information to inform decisions on how to continue bidding in the bid process. Competition in the bid process space was encouraged and leveraged to drive down the cost of energy efficiency. The participant placing the lowest incentive per kWh bid price became the bid process winner and Awardee. The bidders did not know who they were bidding against; it was a blind auction.

Awardee Notification. After winning a bid process, Awardees received an award letter, an Incentive Agreement that outlined the final incentive amount provided to the Awardee upon achieving the required energy savings, and a Welcome Packet, including program guidelines, customer service standards, sample invoice forms, and marketing guidelines. Awardees were also provided with support from a Program Advisor to serve as a primary point of contact

throughout the duration of the project and conduct monthly status calls with to keep the project on track. Awardees also were offered opportunities to participate in additional trainings to aid participants in understanding the program processes, workflows, requirements, and terms and conditions.

Identification and Implementation of Projects. Program participants came into the bidding process with plans already in place for an energy efficiency project or they identified projects following the bid process after they have become a winning bidder. In order to qualify for program incentives, projects submitted must be pre-approved by AEP Ohio and meet the following requirements:

- » Be completed by a AEP Ohio customer
- » Consist of facility retrofits that result in reduced energy consumption
- » Have a minimum payback of one year
- » Have a minimum, aggregate expected first year savings of three GWh
- » Have an average effective useful life (EUL) of ten years
- » Be completed within six months or no later than December 31, 2014, unless given special approval from the Public Utilities Commission of Ohio (PUCO)

Final Applications. The program implementer conducted a review of the Project Completion Form, including documentation (e.g., itemized and paid invoices, proof of purchase receipts, and engineering calculations), to confirm the project had been completed in accordance with program requirements, that all project costs were eligible, and an appropriate incentive amount had been requested by the program participant.

Final Technical Review. After submission of the Project Completion Form and supporting documentation, the program implementer performed a final technical review, as defined by quality assurance/quality control (QA/QC) procedures to verify energy savings achieved through the project. In addition to the final technical review, all projects were subject to an on-site visit to ensure quality and verification of measure installation either prior to, or after receiving, an incentive award.

Incentive Payment. Following the final technical review, the program implementer submitted a payment request to AEP Ohio at which point the request was processed. AEP Ohio then issued the incentive check to the Awardee.

Measures and Incentives for 2014

Eligible equipment included all energy efficient measures, or bundles of measures, that reduce energy consumption and meet the terms and conditions of the program, which required Awardees to complete projects achieving at least three GWh in energy savings, and have an average EUL for the measure, or bundle of measures, of ten years.

Ineligible projects included:

- those at facilities not served by AEP Ohio
- those completed outside of the program period unless granted approved by the PUCO
- include purchased or installed equipment prior to the Awardee receiving program funding
- involve replacing existing equipment with old or used equipment

- involve fuel switching
- involve removal or termination of existing process
- include renewable technologies

Solution Provider Participation

Within the Bid to Win Program, Solution Providers act as bidders and also supported AEP Ohio customers participating in the program. Solution Providers also worked with multiple customers; however, a Solution Provider could not receive multiple awards through the Bid to Win bid process.

Marketing the Bid to Win Program was heavily targeted at existing Solution Providers and contractors working within AEP Ohio's territory. In this respect, the Bid to Win Program leveraged AEP Ohio's Solution Provider network of contractors, which is a network of contractors that have been trained on the program, have applied to market the program, and were listed on the AEP Ohio website as a registered contractor for AEP Ohio business sector programs.

2014 Bid to Win Program Participation Summary

The evaluation team analyzed data delivered by AEP Ohio on September 19, 2014. As shown in Table 1-2, the 2014 Bid to Win Program paid incentives on one project constituting 3,351 MWh of *ex ante* reported annual energy savings.

Table 1-2. 2014 Bid to Win Program Projects, Measures, and Ex Ante Savings

Metric	Ex Ante Value
Number of Projects	1
Number of Measures	8
Annual Energy Savings (MWh)	3,351
Electric Peak Demand Savings (kW)	404

Source: AEP Ohio performance report dated December 31, 2014 (AEP Ohio EE-PDR 2014 Performance Report 12-31-2014 Final.xlsx)

The program energy savings was achieved by installing variable speed drives on high horsepower industrial fans and pumps which previously used inlet guide vanes for speed control, or which ran continuously at full speed.

The reported *ex ante* energy savings split by end-use was 60 percent for industrial process fans and 40 percent for industrial process pumps. The Navigant *ex post* evaluated energy savings analysis determined the split by end-use was 51 percent for industrial process fans and 49 percent for industrial process pumps.

Section 2. Methodology

For Bid to Win Program participants, Navigant conducted impact and process evaluation activities using the following methodologies.

2.1 Analytical Methods

Impact Evaluation Methods

The objective of this element of the impact evaluation is to verify or adjust the *ex ante* reported savings. Savings verification is conducted through a multi-step approach:

- **Documentation Technical Review**, to identify potential adjustments to *ex ante* reported savings for measures based on review of documentation, assumptions, and engineering analysis for a sample of projects.
- **Other Adjustments to Savings: On Site Data Collection**. Other adjustments utilized by Navigant to calculate the *ex post* savings included Navigant calibration of facility-provided EMS data based on Navigant onsite data collection.

Reported savings for custom measures are based on project-specific calculations submitted by customers with project applications and verified by the implementer, or custom calculations based on measured data and pre-installation and/or post-installation inspections performed by the implementer.

Documentation Technical Review

Navigant conducted application Documentation and Technical Review to assess the engineering methods, parameters and assumptions used to generate the *ex ante* reported savings. Navigant performed a check of annual billing data to confirm whether the magnitude of the reported project savings was large enough relative to the annual usage for billing data, or interval data, to be utilized to calculate *ex post* savings (IPMVP Option C). Navigant determined that Option C could not be utilized for the project since the savings were too small relative to the total usage on the utility meter, therefore Option B, submetering, was used instead.

Navigant estimated *ex post* savings based on the review of project documentation, Navigant's efficient case on site data collection per IPMVP Option B, and engineering analysis. *Ex post* adjustments to *ex ante* savings were based on project-specific information gathered independently by Navigant, with assistance from AEP Ohio and the customer.

Reasons for changes to *ex ante* reported savings typically include the following:

- Hours of use
- Coincidence factor
- Baseline equipment demand
- Post retrofit equipment demand
- Additional post-installation data
- Other changes, such as analysis methodology

Navigant used engineering-based energy and demand reduction algorithms to compute *ex post* savings. Navigant *ex post* savings was calculated using a pre-post sub-metered data approach per Option B of the IPMVP.

On-site Data Collection

A Navigant subcontractor conducted two on-site inspections at the customer site, and installed short-term power meters on each piece of equipment, resulting in a high degree of confidence appropriate for validation of the demand resource.

A site-specific measurement and verification (M&V) approach and detailed field forms were developed for on-site data collection based on the IPMVP. On-site sources included interviews completed at the time of the on-site visit, visual inspection of the systems, and equipment and spot measurements.

After all of the field data was collected, annual energy and demand impacts were developed based on the on-site data, amperage monitoring data provided by the customer, and Navigant calibration true root mean square (RMS) power data logged onsite.

Verification Results

Once the *ex post* impacts were developed for each project in the sample, the results were reviewed at the project-level by an experienced engineer familiar with the evaluation. Using *ex post* savings results, Navigant estimated an *ex post* realization rate.

Process Evaluation Methods

The purpose of the process evaluation was to assess the effect of the program structure and program implementation on program performance and customer satisfaction. The evaluation team's process efforts provide insights and recommendations to support AEP Ohio in its development of alternative finance programs.

Central to the process evaluation for the Bid to Win Program were interviews with AEP Ohio program managers and with staff of the implementation contractor, as well as review of relevant program tracking databases, documents, and other materials, to understand how the program has evolved from the previous year. The evaluation team used senior staff members to conduct in-depth qualitative interviews. Interview guides were developed to be open-ended and allow for a free-flowing discussion between interviewer and respondent, and real time interviewing flexibility. The team developed guides which highlighted key issues, but did not require being read verbatim to offer the interviewer flexibility to delve deeply into pertinent issues based on the respondents' knowledge of and experience with the program.

The evaluation team took detailed notes during each in-depth interview and/or recorded the discussion to ensure thorough documentation. For any quantitative questions, interviewers are trained to record and summarize responses to allow the evaluators to draw conclusions in the analysis.

2.2 Data Sources

The data collected for evaluation of the 2014 Bid to Win Program was gathered during a number of activities including:

- In-depth telephone interviews with AEP Ohio program coordinators and the implementation contractor
- Tracking data review
- Documentation technical review of a census sample of projects
- On-site measurement and verification at the customer site

Table 2-1 provides a summary of these data collection activities including the targeted population, the sample frame, and the time frame in which data collection occurred.

Table 2-1. Data Collection Activities for 2014 Evaluation

Data Collection	Targeted Population	Sample Frame	Sample Design	Sample Size	Timing
Tracking Data Analysis	Bid to Win projects paid in 2014	Census of one project	-	All (one project)	October 2013 to December 2014
In-depth Interviews	AEP Ohio Program Staff	Contacts from AEP Ohio	Business Programs Manager and Bid to Win Program Manager and Staff	3	August 2014 to September 2014
	Bid to Win Program Implementers	Contact from AEP Ohio	CB&I Program Implementation Staff	3	
Application File Review	Bid to Win projects paid in 2014	Census of one project	Census	All (one project)	March 2015 to April 2015
On-site Verification	Bid to Win projects paid in 2014	Census of one project	Key issue sites	All (one project)	March 2015 to April 2015

Tracking Data

The Bid to Win Program evaluation team was able to extract key program participation data from AEP Ohio's documentation provided for the single project, as well as the AEP Ohio EE/PDR 2014 Performance Report dated December 31, 2014.

Project and Program Documentation

To support the engineering review, AEP Ohio provided project documentation in electronic format for each sampled project. Documentation included materials from the applicant (invoices, measure specification sheets, vendor proposals) and implementation contractor (calculation spreadsheets and verification photos and site reports). This documentation was provided by uploading to a secure file transfer site. Navigant also reviewed program materials developed by the implementer and from the AEP Ohio program website.

Program and Implementer Staff Interviews

Navigant conducted four in-depth interviews with six key program representatives as part of this evaluation. The AEP Ohio Bid to Win Program Coordinator was interviewed solely about the Bid to Win Program. Navigant also interviewed the Bid to Win Program Coordinator and the Research and Development Coordinator in order to understand the history of the program as it evolved from a pilot into a program. Follow-up interviews were conducted with the Bid to Win Program Coordinator and the Research and Development Coordinator to help refine understanding of program developments and goals. An interview was also conducted with the three implementation contractor staff members. The telephone interviews were completed between August and September 2014. The interviews focused on program processes to better understand the goals of the program, how the program was implemented, the perceived effectiveness of the program, and future plans for improving the program. See Appendix A, B, and C for program staff and implementer interview guides.

2.3 Sampling Plan

Impact Sample

Due to the small number of projects that participated in the Bid to Win Program, Navigant employed a census sample as part of the program evaluation. The one project completed in 2014 under the October 25, 2013 and January 21, 2014 bid processes was evaluated.

Table 2-2. Impact Evaluation Sample*

Utility-Year-Program	Documentation Review Sample	On-Site Visits**
AEP Ohio 2014 Bid to Win, Bid Process 1 and 2	1	2

* Based on a census sample of Bid Process 1 and Bid Process 2 projects only.

**A Navigant subcontractor performed two site visits including short term datalogger installation and retrieval, and true RMS demand spot checks of equipment as directed by Navigant.

Section 3. Detailed Evaluation Findings

This section presents the detailed results of the impact and process evaluations of the 2014 Bid to Win Program.

3.1 Impact Evaluation Results

Findings from the Impact Verification Task

Navigant estimated *ex post* program impacts based on application documentation review and on-site verification following the methodology outlined in Section 3.

Navigant found the following:

- The Program Operations Manual was current, relevant, and being followed
- The appropriate eligibility requirements were properly adhered to
- Applications were appropriately completed and backed with supporting documentation
- AEP Ohio has an internal quality control approach sufficient to identify most inaccuracies
- The project implementer underestimated attribution of savings to program activity.

Program Impact Parameter Estimates

The realization rate (defined as *ex post* savings divided by *ex ante* reported savings) is 153 percent for energy savings, and 137 percent for demand reduction, based on the population of a single project. The primary reason for the discrepancy between *ex ante* and *ex post* savings were incorrect metering approach and power factor assumptions by the implementation contractor.

Program Impact Results

As described in the previous section, Navigant estimated the *ex post* program impacts resulting from the 2014 Bid to Win Program, as shown in Table 3-1.

Table 3-1. Savings Estimates for 2014 Bid to Win Program

Program	Ex Ante Reported Savings		Ex Post Savings	
	MWh	kW	MWh	kW
Total (one project)	3,351	404	5,132	554

3.2 Process Evaluation Results

AEP Ohio's 2014 Bid to Win Program is a reverse bid process for financial incentives program where customers and Solution Providers can become pre-qualified to participate in live, online bid process and bid to sell their energy efficiency services at an incentive price per kWh.

Navigant's process evaluation of the AEP Ohio Bid to Win Program focuses on the following researchable questions:

- Effectiveness of program implementation
- Effectiveness of program design and processes
- Customer and program partner experience
- Opportunities for program improvement

The full list of research questions can be found in the 2014 Bid to Win Program Evaluation Plan. Sections below cover the following subjects: Marketing and Outreach Practices, Program Goals, Program Process, Participant Satisfaction and Experience, Portfolio Strengths, and Program Weaknesses.

3.2.1 Program Implementation

Marketing and Outreach Practices

In 2014, AEP Ohio introduced a number of methods to market the Bid to Win Program to both customers and Solution Providers working in the business sector. Program marketing targeted several types of potential bidders and market partners to drive interest in the program, as shown in Table 3-2.

Table 3-2. Customer and Solution Provider Types Targeted by the Bid to Win Program

Targeted Sectors	Targeted Bidders	Key Market Delivery Partners
Commercial Customers	Energy Service Companies (ESCOs)	Customer Associations
Industrial Customers	Installation Contractors	Trade Associations
	Engineering and Consulting Firms	Manufacturers and Retailers
	Eligible Customers	AEP Account Managers

Source: AEP Ohio Bid to Win Program Operations Manual, August 2, 2013.

The Bid to Win Program was marketed through the following four primary channels:

1. **AEP Ohio leveraged its own Business program managers**, outreach professionals, account representatives, and staff to market the Bid to Win Program to identify and target potential bidders.
2. **AEP Ohio targeted existing AEP Ohio Solution Providers** and large energy use customers through e-mail blasts, website content, fact sheets, direct-mail, cold calls, and a program education PowerPoint slide deck. AEP Ohio also established direct contact with Solution Providers, who were identified through participation rankings based on the energy savings achieved over the past twelve months, the *Industrial Energy Users of Ohio* and the *Ohio Manufacturers' Association*, and recommendations from the Custom and Prescriptive Program implementer.

3. **AEP Ohio conducted customized customer outreach** through phone calls and face-to-face interaction with customers identified based on existing customer accounts and previous involvement with Solution Providers who historically had implemented projects over 3GWh.
4. **AEP Ohio announced the program's RFQ** through the Association of Energy Services Professionals (AESP) website, the Solution Provider newsletter and other energy industry websites.

3.2.2 Program Design and Processes

Program Goals

The goal of the Bid to Win Program as communicated through interviews with program staff and in program documents and collateral was to enable the implementation of large scale projects at the lowest possible cost. The program sought to produce long-term, cost effective energy savings in the business sector, in addition to providing customers with incentive dollars to support energy savings projects otherwise unavailable through other AEP Ohio program offerings.

Program Process

The Bid to Win program served customers in AEP Ohio's commercial and industrial sector by offering reverse bidding events, where the bidding started at an established bid ceiling price and participants bid down the price, or incentive per kWh, to complete energy efficiency projects to generate electric savings. In this case, the lowest bidder became the Awardee and then must complete a project to achieve energy savings equivalent to their winning bid.

Projects were required to provide energy savings of three GWh or more, have a minimum one year payback, have an average expected useful life (EUL) of ten years for the measure or bundle of measures implemented through the project, and be able to complete the project by December 31, 2014⁶.

Prior to participating in the bidding process, customers and Solution Providers interested in the program were required to complete and submit a Request for Qualifications (RFQ) along with supporting documentation in order to establish experience with energy efficiency projects, sufficient capital to complete large scale projects, and availability of potential projects. Once approved, customers and Solution Providers were offered training on how to use the online bid process platform and an opportunity to participate in a mock bid process to prepare for the live bid process.

Bid events took place over the course of an hour with extensions applied if bids were placed in the last minute of the bid process⁷. Events were held October 25, 2013 and January 21, 2014 producing eight Awardees.

⁶ Awardees could be granted special approval from the PUCO to complete their projects in 2015.

⁷ This approach was adopted after a technical issue kept a bid process participant from being able to place bids during an bid process event and when a number of bidders waiting until the end of a bid process to place bids creating a 60 second delay in bid postings, which caused AEP Ohio to opt to re-run the event with buy-in from the bid process participants.

The average winning bid across participating bidders was approximately \$0.06 per kWh. At the time of the Navigant 2014 evaluation of the Bid to Win Program, one project had been completed. All other projects have either been delayed or have been dropped by the bidder.

Participant Satisfaction and Experience

Program staff indicated that both customers and Solution Providers were satisfied with the Bid to Win Program with many returning to participate in additional bid processes. Interviewees acknowledged that the program appeared to be easier for Solution Providers than customers to navigate as a result of their past experiences working with AEP Ohio and their knowledge and expertise regarding energy efficiency project work. Program staff also noted that the program was structured to offer customers and Solution Providers options to complete work within the Bid to Win Program or through other AEP Ohio programs, which was viewed as both a benefit of the program and a boon to participant satisfaction.

Portfolio Strengths

Program staff indicated that a primary strength of the Bid to Win Program has been that it provides both customers and Solution Providers with access to financial incentives to support energy saving projects that previously did not exist through AEP Ohio, allowing participants to identify and complete projects that may not have been completed at all. Program staff also stated that participant satisfaction with the program was strong because even if a bid process bidder was unable to win the bid process, the company was offered opportunities to move projects into the Custom Program to generate energy savings and receive an incentive from AEP Ohio.

Program Weaknesses

Program staff pointed to a number of factors that limited participation in the Bid to Win Program including:

- » Delayed marketing of the program
- » Timing of the December RFQ and January 2014 bid process
- » Customer reluctance to participate in the program due to fears about meeting Awardee participation requirements
- » Technological barriers related to the functioning of the bid process website
- » Solution Provider ability to complete large energy saving projects in specified program timeline

2014 Program Changes

In 2015, AEP Ohio replaced the Bid to Win Program with the Bid4efficiency Program. Program staff reported leveraging learnings from across the implementation process of the Bid to Win Program to inform the development and design of the Bid4efficiency program. For details on the differences between the Bid to Win and Bid4efficiency programs, please see the Navigant “AEP Ohio Bid Program Early Results Memo” dated August 29, 2014.

3.3 Cost Effectiveness Review

This section addresses the cost effectiveness of the 2014 Bid to Win Program. Cost effectiveness is assessed through the use of the Total Resource Cost (TRC) test. Table 3-3 summarizes the unique inputs used in the TRC test.

Table 3-3. Inputs to Cost-Effectiveness Model for AEP Ohio Bid to Win Program

Item	2014
Measure Life*	15
Participants	1
Ex Post Annual Energy Savings (kWh)	5,131,784
Ex Post Coincident Peak Savings (kW)	554
Third Party Implementation Costs (\$)	421,656
Utility Administration Costs (\$)	51,294
Utility Incentive Costs (\$)	180,949
Incremental Measure Costs (\$)	169,671

* Source: Measure life source is the DEER Database 2006-2007, "DEER EUL_Summary_10-1-08.xls"

Based on these inputs, the TRC ratio is 5.3 and the program passes the TRC test for the program in its entirety.

Table 3-4 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 3-4. Cost-Effectiveness Results for Bid to Win Program

Test Results for Bid to Win Program	2014
Total Resource Cost	5.3
Participant Cost Test	22.7
Ratepayer Impact Measure	0.8
Utility Cost Test	5.2

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.

Section 4. Evaluation Findings and Recommendations

4.1 Impact Evaluation Findings and Recommendations

Table 4-1. Savings Estimates for the 2014 Bid to Win Program

Metric	Energy Savings (MWh)	Demand Savings (kW)
Goal Savings (project level ⁸)	3,000	N/A
<i>Ex Ante</i> Reported Savings	3,351	404
<i>Ex Post</i> Verified Savings	5,132	554
Realization Rate⁹	1.5	1.4

1. **Finding #1:** The program achieved the following successes:
 - a. The project exceeded the required three GWh first year savings
 - b. The project life exceeded the minimum 10 year requirement
 - c. The Program Operations Manual was current, relevant, and being followed
 - d. The appropriate eligibility requirements were properly adhered to
 - e. Applications were appropriately completed and backed with supporting documentation
 - f. AEP Ohio has an internal quality control approach sufficient to identify most inaccuracies
2. **Finding #2:** The program had the following areas for improvement:
 - a. *Ex ante* savings verification by the project implementer did not meet the requirements of the International Performance Measurement and Verification Protocol (IPMVP)¹⁰ for baseline specification and energy savings estimation (see Table ES-5).

⁸ The original EE/PDR program level goals are as reported in Table ES-3. The project level Goal Savings shown in Table 4-1 are the threshold per project goal per the AEP Ohio program design.

⁹ The Bid to Win Program was evaluated using a census sample of a single project. As such, the realization rate calculated for a single project does not have a statistical uncertainty (such as 90/10) associated with it. The relative engineering uncertainty on the evaluated savings for the first year savings of the single project is $\pm 10\%$ for MWh and $\pm 3\%$ for MW.

Navigant's evaluated savings were calculated based on sub-hourly amperage data provided by the facility manager from the Building Management System (EMS), calibrated for accuracy by Navigant using Navigant spot checks and nearly three weeks of Navigant metered power data concurrent with EMS efficient case trending. Baseline and efficient EMS data were available for nearly one full year pre and post.

¹⁰ Detailed project findings were provided separately to AEP Ohio by Navigant.

- b. The implementer utilized assumed values rather than measured values for key variables in the savings calculations, such as power factor, without verifying the accuracy of the values.
- c. Spot checks of equipment kW by the implementer to verify calculated implementer kW derived from facility amperage data were not reported in the project file. Spot checks would not have added substantial cost to the implementer's verification process. Spot checks typically reveal discrepancies between measured kW values and calculated kW values, such as those used by the implementer to estimate *ex ante* savings.
- d. The implementer did not calibrate the facility amperage to actual true power measurements. The implementer's metering approach therefore introduced substantial uncertainty into the savings estimate, since the facility amperage was metered using the existing facility Energy Management System (EMS) on the load side of the VFDs, where the voltage and power frequency are highly variable.

Impact Recommendation #1: To ensure realization rates closer to 1.00 for high impact projects, the implementer conducting the *ex ante* savings verification should follow the basic requirements of the IPMVP.

Table 4-2. IPMVP¹¹ Options Summary for AEP Ohio Bid to Win Program

IPMVP Option	Summary Description	Navigant Evaluation Notes
Option A	Key Parameter Measurement	The implementer utilized this method, taking advantage of amperage trends available from the facility EMS, however did not justify the estimated parameters as required
Option B	All Parameter Measurement	Navigant utilized three weeks of on site power measurements to calibrate annual facility amperage available from the implementer and participant
Option C	Whole Facility (Utility Billing Data Analysis)	Navigant determined that the savings were not large enough relative to facility usage to evaluate savings using this method

¹¹ International Performance Measurement and Verification Protocol, Concepts and Options for Determining Energy and Water Savings Volume 1, EVO 10000 – 1:2012.

IPMVP Option	Summary Description	Navigant Evaluation Notes
Option D	Calibrated Simulation	Not used

4.2 Process Evaluation Findings and Recommendations

Process Evaluation Findings and Recommendations

Satisfaction with the Bid to Win Program

- Finding:** Based on AEP Ohio Bid to Win program staff and implementer interviews, customers and Solution Providers appear to be satisfied with the Bid to Win Program. Program staff reported that repeat bid process participation among pre-qualified bidders was common.

Process Recommendation #1: Although based solely on program staff observations, these results suggest the program delivery and contact worked well in 2014. Program staff reported a program focus on continuous improvement to help resolve issues impacting participant satisfaction with program processes, facilitating customer transition into the 2015 version of the program.

Program Growth

- Finding:** Solution Providers and some customers appeared to be comfortable with program processes, including bid process participation and project development and implementation. Program staff indicated that Solution Providers have a greater understanding of how to navigate the program than customers due to their past experience with AEP Ohio programs and energy efficiency expertise.

Process Recommendation #2: To support greater customer and Solution Provider participation, in addition to the taped trainings already provided by AEP Ohio via the AEP Ohio website, the program could have expanded its outreach bid process by producing short, instructional videos that could be hosted on the AEP Ohio website and made available through outlets like YouTube for customers and Solution Providers to learn about the program.

Program Processes

- Finding:** As projects near completion, participants were required to submit a Project Completion Form, including documentation like itemized and paid invoices, proof of purchase receipts, and engineering calculations, to confirm the project has been completed in accordance with program requirements, that all project costs were eligible, and an appropriate incentive has been requested by the program participant. Following the

submission of the Project Completion Form and supporting documentation, the program implementer performs a final technical review, as defined by quality assurance/quality control (QA/QC) procedures to verify energy savings achieved through the project. In addition to the final technical review, all projects were subject to an on-site visit to ensure quality and verification of measure installation either prior to or after receiving an incentive award.

Process Recommendation #3: Formalizing the documentation and verification process could have eased and speed the project completion process for customers and Solution Providers. Navigant recommends establishing a checklist of concrete documentation requirements to confirm project completion, in addition to completing on-site visits to ensure quality and verify measure installation *prior* to the receipt of incentive awards.

Appendix A. Program Staff In-depth Interview Guide

AEP-Ohio Evaluation for Bid to Win Program AEP Program Staff In-Depth Interview Guide July 2014

Name of Interviewee: _____ Date: _____

Title: _____ Company: _____

[Note to Reviewer] This interview guide is a tool to guide process evaluation interviews with utility staff involved in the day-to-day operations of AEP Ohio's Bid to Win Program. The guide helps to ensure the interviews include questions concerning the most important issues being investigated in this study. Follow-up questions are a normal part of these types of interviews. Therefore, there will be sets of questions that will be more fully explored with some individuals than with others. The depth of the exploration with any particular respondent will be guided by the role that individual played in the program's design and operation, i.e., where they have significant experiences for meaningful responses.

The purpose of this interview guide is to drive the Evaluation Team's discussion with program staff regarding the development, operation, and goals of AEP Ohio's Bid to Win program. This interview will be conducted via telephone with program staff and will be recorded and transcribed as needed for the purposes of this evaluation.

Topic Area	Topic Objective
Roles and Protocols	Understand internal staff structure and identify key staff
Program Goals, Objectives, and Structure	Understand the program goals, detailed objectives and operational structure; identify details about program for incorporation into the program theory and logic model
Interview Wrap-up	Miscellaneous and wrap-up questions

Roles and Protocols

1. Can you briefly summarize your role and responsibilities in the Bid to Win program?
[Probe for main responsibilities, length of time with program, percent of time dedicated to program, and whether role in program has changed or evolved over time.]
2. Who are the key staff involved in the program's implementation?
[Probe for understanding of each person's role and how implementer activities are different or separate from program staff activities and what activities people engage in on a day-to-day basis.]
3. Please describe the formal and informal communication channels between AEP and Chicago Bridge & Iron Company (CB&I)? What was the transition process like for the change from Shaw to CB&I? Were there any delays or setbacks related to this shift?

Program Goals, Objectives, and Structure

4. Why did AEP Ohio create this program?
5. What are the overall goals of the program?
[Probe on the quantitative goals of the program (i.e., number of participants/bidders, savings achieved)]
6. Is the program on track to meet the kWh or participation goals? Are other bid process scheduled for 2014? Are there any plans in place for future bid process?

Program Theory

7. Briefly describe the program processes/delivery steps.
8. What market barriers does the program address? What program intervention strategies are designed to address these barriers?
9. What specific actions are you hoping to encourage with the program? What do you want participants to do when they win a bid? What do you want participants to do when they lose a bid?
10. Were there any external factors beyond your control that affected the program or the program's expected results?

Marketing and Promotion

11. Do you have a written marketing plan for the Bid to Win Program?
12. Please describe the program marketing campaign for the Bid to Win program.
[Probe on differences in marketing efforts between customers and Solution Providers.]
13. Do you think these actions/materials have been successful so far? Do you think the level of marketing and promotion of the Bid to Win program attracted enough participants to the program?
14. What has been most influential in getting customers to participate? What else has been influential?

15. Was the marketing effort for Bid to Win sufficient to meet program participation goals?
[Probe on potential changes to program marketing for 2015]
16. Are there any plans to develop case studies from the experiences of customers during this first program year?

Communicating the Program to Participants

17. What type of support is the program providing to program partners? Is it sufficient?
18. Is program outreach to customers effectively increasing awareness of program opportunities? What is the format of outreach? How often does outreach occur? Are outreach messages clear and actionable?
19. Can you describe the role of account managers in the Bid to Win program? What kinds of support do they offer to program participants? How frequently are they in contact with program participants?
20. What do customers do if they have questions about the participation process? Do you think they know who to call for more information?
21. What improvements have been made, if any, to improve program communication to participant processes? What do you think still needs to be changed going forward?

Program Participation

22. Can you describe each element of the program process (i.e., pre-qualification, bidder training, bid process participation, project proposal and approval, project implementation, verification, and reimbursement)?
[Probe: Does the process run smoothly? Have there been any incidences where participants have been pre-qualified, but maybe shouldn't have been? Have potential participants in past rounds attempted to get pre-qualified again in later rounds? Is this encouraged? Why or why not? What do participants think of the process? How involved is AEP Ohio in the verification process?]
23. Can you talk about the bidder training class? What went into it and how was it received by bidders? How can the course be improved?
24. What do participants think of the bidding process? What types of strategies do winning customers apply to win? Is there enough competition in the bidding process?
25. Are winning participants satisfied with the program incentive structure?
26. What types of projects were proposed by winning bidders? As we understand it, there is one project that is now complete and four more in progress. Are these projects on track? Can you describe the process for tracking projects? Has there been frequent communication between program participants and Energy Advisors? Has the program been able to identify and troubleshoot implementation problems early and often? Why or why not?

27. Do customers and solution providers understand the goals of the program (i.e., large capital investment projects vs. smaller aggregated projects?) Do they understand the differences between Bid to Win and other AEP Ohio custom programs?
28. Do non-winning participants return to re-bid in future cycles? Do you have any sense of the types of projects non-winning participants might have submitted?
29. What is the role of the solution provider with customers? How many Solution Providers were involved with the program? Did they plan a pivotal role in the customers' decision to participate in the Bid to Win program? Should we interview a few solution providers about their view of the program?
30. Did any Solution Providers aggregate projects to qualify for the program? Were they successful bidders?
31. Are there particular program characteristics that could be changed to improve customer satisfaction while maintaining program effectiveness?

Barriers to Program Participation

32. What do you think are the greatest barriers to customer participation in the Bid to Win Program?
[Probe on project types, ability to understand reverse bid process process]
33. Do you have a sense of how satisfied customers are with various aspects of the program (e.g., ease of pre-qualification, verification process, bidding process, amount of incentive, the timing of incentive payments, implementation process)? Do they perceive the bidding process as fair?

Data Tracking/Quality Assurance and Quality Control

34. What types of data do you actively monitor to assess how the program is going? Is there anything you specifically look for as an indication that things are going well or need improvement? How often do you review the data?
35. What kind of quality assurance and quality control procedures are in place to evaluate project completion? Is metering used to estimate savings? Do all projects receive pre and post inspections? Who conducts these inspections? Do these inspections determine if the project met the bid savings amount (i.e., if the bidder receives the last incentive payment)?
36. In your opinion, what can be done to improve the QA/QC process?

Program Adjustments and Enhancements

37. Are there any other elements in design, structure, and/or operation that should be modified to make the program work better? If so, what would you recommend?
38. Why do you think this change is needed?

Success and the Future of These Efforts

39. In your opinion, how successful was the Bid to Win program during the first year?
40. What are the strengths? What are the weaknesses? [Please explain.]
41. How could the program be improved?
[Probe: We understand that the program has gone through some significant revamping over the course of its development. Can you describe what steps have been taken and how this will impact future developments?]

Interview Wrap-up

42. Is there anything else important about the Bid to Win program that we have not yet covered? Is there anyone else you would recommend that we speak with about this program?
43. What questions are most important for you to answer through our evaluation?
44. Do you have any other comments or suggestions for us?

Thank you very much for taking the time in assisting us with this evaluation. Do you mind if we follow-up with you by phone later, if additional questions arise?

Appendix B. Program Staff Follow-up In-depth Interview Guide

AEP-Ohio Evaluation for Bid to Win Program AEP Program Staff Follow-up Interview Guide September 2014

Program and Early Feedback Memo Questions

1. Based on feedback from AEP Ohio, we're planning to focus our interviews with the eight participants who were successful bidders. Could you tell us a bit about the near participants, those who participated in the bid process, but did not win? Do you know if any of these participants continued on with their projects through another AEP Ohio program? How about those who were pre-qualified, but did not place bids during the bid process? Did they pursue projects and incentives? Do you perceive any barriers for those "drop-out" participants that would have limited their ability to bid?
2. Can you tell us a bit more about how bidding worked for Bid to Win? How long did the bid process periods run for?
3. We understand that there were a few hiccups in the first and second bid process and since that time changes have been made to Bid4efficiency to address those issues. Can you tell us about those incidents and the actions taken to avoid those issues going forward?

Web Usability Questions

We'd like to ask you a few questions about Bid4efficiency to help us develop our plans for the web usability study. We understand that the bid process will open on October 1st and run through October 22nd. During this period of time, there are two separate approaches we can apply to get feedback on the bid process website and its functions. To help us decide which method to approach...

1. With the RFQ process closed for the October bid process, can you give us a description of the types of Solution Providers and customers planning to participate in Bid4efficiency?
[Probe: Ask about measure/equipment interests. Are there any current participants who participated in Bid to Win?]

2. What are you hoping to see come out of the web usability study? What is most important for you to have answered through this study?

Thank you very much for taking the time in assisting us with this evaluation. Do you mind if we follow-up with you by phone later, if additional questions arise?

Appendix C. Implementation Staff In-depth Interview Guide

AEP-Ohio Evaluation for Bid to Win Program Implementation Staff In-Depth Interview Guide September 2014

Name of Interviewee: _____ Date: _____

Title: _____ Company: _____

[Note to Reviewer] This interview guide is a tool to guide process evaluation interviews with implementation staff involved in the day-to-day operations of AEP Ohio's Bid to Win Program. The guide helps to ensure the interviews include questions concerning the most important issues being investigated in this study. Follow-up questions are a normal part of these types of interviews. Therefore, there will be sets of questions that will be more fully explored with some individuals than with others. The depth of the exploration with any particular respondent will be guided by the role that individual played in the program's design and operation, i.e., where they have significant experiences for meaningful responses.

The purpose of this interview guide is to drive the Evaluation Team's discussion with implementation staff regarding the development, operation, and goals of AEP Ohio's Bid to Win program. This interview will be conducted via telephone with program staff and will be recorded and transcribed as needed for the purposes of this evaluation.

Topic Area	Topic Objective
Roles and Protocols	Understand internal staff structure and identify key staff
Program Goals, Objectives, and Structure	Understand the program goals, detailed objectives and operational structure; identify details about program for incorporation into the program theory and logic model
Interview Wrap-up	Miscellaneous and wrap-up questions

Roles and Protocols

1. Please briefly summarize your role and responsibilities in the Bid to Win program.
[Probe for main responsibilities, length of time with program, and whether role in program has changed or evolved over time.]
2. Who are the key staff involved in the program's implementation?
[Probe for understanding of each person's role and what activities people engage in on a day-to-day basis.]
3. Do you rely on any additional Solution Providers or subcontractors to assist with measure implementation?

Program Goals, Objectives, and Structure

4. What are the overall goals of the program?

[Probe on the quantitative goals of the program (i.e., number of participants/bidders, savings achieved)]

5. Is the program on track to meet the kWh or participation goals? Are other bids scheduled for 2014? Are there any plans in place for future bids?

Program Theory

6. Can you describe each element of the program process (i.e., pre-qualification, bidder training, bid participation, project proposal and approval, project implementation, verification, and reimbursement)?

[Probe: Does the process run smoothly? Have there been any incidences where participants have been pre-qualified, but maybe should not have been? What do participants think of the process? How involved is AEP Ohio in the verification process?]

7. Were there any external factors beyond your control that affected the program or the program's expected results?

Marketing and Promotion

8. Please describe the program marketing campaign for the Bid to Win program.

[Probe on differences in marketing efforts between customers and Solution Providers.]

9. Do you think these actions/materials have been successful so far? Do you think the level of marketing and promotion of the Bid to Win program attracted enough participants to the program?

[Probe on potential changes to program marketing for 2015]

10. What has been most influential in getting customers to participate? What else has been influential?

Communicating the Program to Participants

11. What type of support is the program providing to program participants? Is it sufficient?

12. Is program outreach to customers effectively increasing awareness of program opportunities? What is the format of outreach? How often does outreach occur? Are outreach messages clear and actionable?

13. What do customers do if they have questions about the participation process? Do you think they know who to call for more information?

14. What improvements have been made, if any, to improve program communication to participant processes? What do you think still needs to be changed going forward?

Program Participation

15. What do participants think of the bidding process? Is there enough competition in the bidding process? What types of strategies do winning customers apply to win?

16. What types of projects were proposed by winning bidders? As Navigant understands it, there is one project that is now complete and two more in progress, completing in 2015. Are these projects on

track for completion in 2015? Please describe the process for tracking project milestones. Has there been frequent communication between program participants and Solution Providers? Has the program been able to identify and troubleshoot implementation problems early and often? Why or why not?

17. Do customers and Solution Providers understand the goals of the program (i.e., large capital investment projects vs. smaller aggregated projects?) Do they understand the differences between Bid to Win and other AEP Ohio programs, such as the Custom Program?
18. Are there particular program characteristics that could be changed to improve customer satisfaction while maintaining program effectiveness?

Barriers to Program Participation

19. What do you think are the greatest barriers to customer participation in the Bid to Win Program?
[Probe on project types, ability to understand reverse bid process, perception of incentive amount relative to other AEP Ohio programs.]
20. Do you have a sense of how satisfied customers are with various aspects of the program (e.g., ease of pre-qualification, verification process, bidding process, amount of incentive, the timing of incentive payments, implementation process)? Do they perceive the bidding process as fair?

Data Tracking/Quality Assurance and Quality Control

21. What types of data do you actively monitor to assess how the program is going? Is there anything you specifically look for as an indication that things are going well or need improvement? How often do you review the data?
22. What kind of quality assurance and quality control procedures are in place to evaluate project completion? Is metering used to estimate savings? Do all projects receive pre and post inspections? Who conducts these inspections? Do these inspections determine if the project met the bid savings amount (i.e., if the bidder receives the last incentive payment)?

Program Adjustments and Enhancements

23. Are there any other elements in design, structure, and/or operation that should be modified to make the program work better? If so, what would you recommend? Why do you think this change is needed?

Success and the Future of These Efforts

24. In your opinion, how successful was the Bid to Win program during the first year? How could the program be improved?
[Probe: We understand that the program has gone through some significant revamping over the course of its development. Can you describe what steps have been taken and how this will impact future developments?]

Interview Wrap-up

25. Is there anything else important about the Bid to Win program that we have not yet covered? Is there anyone else you would recommend that we speak with about this program?

{Mention who else we are planning on speaking with}

26. What questions are most important for you to answer through our evaluation?

Thank you very much for taking the time in assisting us with this evaluation. Do you mind if we follow-up with you by phone later, if additional questions arise?

APPENDIX R



TRANSMISSION AND DISTRIBUTION AND INTERNAL SYSTEM EFFICIENCY IMPROVEMENTS PROGRAM

2014 Evaluation Report

Prepared for:
AEP Ohio



April 23, 2015

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1. Program Description

AEP Ohio's Transmission and Distribution and Internal System Efficiency Improvements Program (load loss reduction program) is targeted to transmission and distribution (T&D) facilities that are candidates for efficiency improvements, typically in concert with other benefits, such as increased capacity or reliability performance. For most of these projects, T&D savings are achieved when lines and equipment are replaced with similar facilities that produce lower line and equipment losses. For example, replacing smaller, high resistance wire with larger wire that has lower resistance is commonly referred to as reconductoring. Physical losses accrue in the form of heat losses. When heating losses are high due to loading equipment above normal ratings for extended periods of time, equipment can be damaged or experience premature loss of life.

Loss reduction also is achieved when new lines are added and existing lines reconfigured, lines are converted to operate at a higher voltage (resulting in lower current needed to supply the same amount of load); feeder power factor is improved; and low loss devices are installed, such as highly-efficient transformers. T&D efficiency benefits accrue via lower peak demand and reduced energy losses. Because losses are proportional to the square of the load served, the percent reduction in peak demand losses are higher than the percent reduction in energy losses.

AEP Ohio's T&D loss reduction program for projects placed in service during 2014 focuses on several of the following measures listed (not all are necessarily implemented in any given year). The methodology AEP Ohio employed to derive demand and energy loss savings is presented in the sections that follow. Table 3 lists the Ohio TRM evaluation protocols¹ that AEP Ohio applies to each of the categories.

- » Line reconductoring (distribution, subtransmission and transmission)
- » New substations and circuits (distribution, subtransmission and transmission)
- » Voltage conversion
- » Power factor improvement (via capacitor banks, regulators & load-tap changers)
- » Feeder reconfiguration
- » Load transfers and phase balancing

The items previously listed commonly are referred to as loss reduction programs, and include both load and no load losses. Some electrical equipment, such as transformers, produces load and no-load losses. Load losses are those that vary as the amount of current increases or decreases. No-load losses are those that are independent of load, and occur during all hours the device is in service. No-load losses typically occur only on equipment that requires inductive current (magnetizing current) to operate, such as transformers and motors. Loss reduction programs sometimes may include the replacement of equipment with high no-load losses with devices with lower no-load losses. The load reduction savings AEP Ohio has estimated for the aforementioned programs do not appear to include any projects focusing mostly on reduction of no-load losses, which is common among utilities.

¹ *State of Ohio Energy Efficiency Technical Reference Manual*. Prepared for the Public Utilities Commission of Ohio by Vermont Energy Investment Corporation, August 6, 2010.





2. Methodology

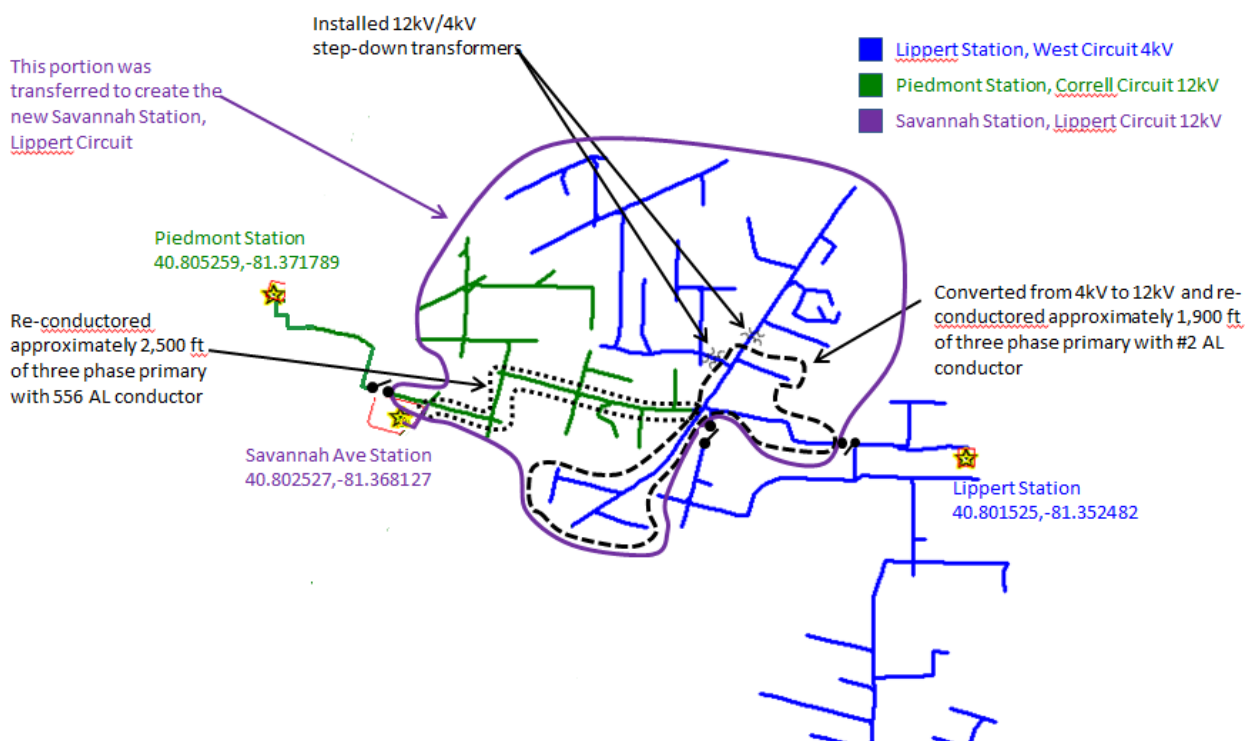
AEP Ohio estimated load loss reduction amounts using tools and methods that are commonly employed to accurately predict peak and energy savings. These include use of a comprehensive and detailed distribution feeder load flow simulation model (CYMDist) and network transmission load flow models (PSS/E) to estimate loss savings at the time of the feeder peak. The CYMDist and PSS/E models are commonly used by power industry professionals and each employs a level of rigor that is sufficient to accurately predict losses for transmission and distribution facilities.² The accuracy of the model results is highly dependent on model inputs and assumptions. AEP Ohio provided Navigant distribution model loss output tables and electrical diagrams that illustrate the upgrades and changes made for each feeder, with before and after loss summaries, thereby ensuring loss estimates are based on net loss savings. A typical line segment of a representative feeder (Savannah, Lippert Circuit and Reconductoring project) targeted for loss savings is illustrated in Figure 2-1.³

² The loss reduction projects cited by AEP Ohio include distribution lines, typically 15 kV class and below. They also include higher rated distribution and transmission lines rated 23 kV, 34.5 kV, 69 kV, 138 kV and 345 kV. Lines rated 34.5 kV, 69 kV and 138 kV often operate radially, but may be configured in a network arrangement, particularly 138 kV. Lines rated 345 kV are almost always operated in a network configuration.

³ The Savannah/Lippert project is a continuation of work initiated in 2013 and carried over to 2014. Most energy savings from the project were achieved and reported in 2014. The diagram also appeared in the 2013 T&D and Internal System Efficiency Improvements Program Evaluation Report.



Figure 2-1. Example Project Diagram: Savannah Station, Lippert Circuit – Reconfigure & Reconductor



In this example, several sections of the Lippert circuit were reconducted and transferred to a new circuit, resulting in net peak loss savings of 25 kW. Per Navigant's request, AEP Ohio provided CYMDist load flow electric one-line diagrams and loss savings results for representative feeders that Navigant selected.

Peak demand losses are derived by conducting load flow studies with and without the upgrade, with the difference in losses between the two cases equal to the net loss savings. AEP Ohio provided copies of model output and feeder maps that confirm AEP Ohio's distribution planning personnel included a high level of detail in the CYMDist feeder model for each of the loss reduction programs previously listed. The peak load loss savings AEP Ohio derived for each of the projects listed are consistent with the percent savings Navigant has determined in its own studies of similar upgrades for utility distribution systems, as well as results we have reviewed from projects developed by other utilities.

To derive energy loss savings, AEP Ohio employs the following formula, which Navigant supports as a reasonable and accurate approach. This equation has been vetted and accepted within the utility industry for decades.

$$\text{Energy Loss Savings} = \text{Peak Loss Savings} * (C_1 * LF + C_2 * LF^2) * 8760$$



Where LF is the feeder load factor, and C1 and C2 are coefficients derived using methods outlined in published industry literature. C1 and C2 for AEP Ohio are 0.1 and 0.9, respectively.⁴

The loss factor for the preceding formula typically is between 0.30 and 0.50. The results of AEP Ohio's loss reduction program are presented in subsequent sections of this report.

⁴ The Energy Loss Savings formula and values used by AEP Ohio were obtained from internal reports titled "2006 Analysis of System Losses" for the Columbus Southern Power Company and Ohio Power Company, revised 09/30/2009. These reports compiled the results of system loss investigations conducted during 2006 and published in 2007 by Management Applications Consulting, Inc. for The Columbus Southern Power Company. These studies also included derivation of the C1 and C2 coefficients. The load factors for Ohio Power and Columbus Southern Power Company for 2014 are 65.2% and 55.6%, respectively; obtained from the 2011 Analysis of System Losses for each company and subsequently updated in 2013.



3. Detailed Findings

Table 3-1 summarizes the peak demand and energy reductions for AEP Ohio.⁵ Results are presented separately for distribution and transmission assets. 2014 reported loss savings are higher for transmission facilities. Table A- 2 (Appendix) presents reported demand and energy loss savings for specific T&D projects that AEP Ohio placed in service during 2014.

Table 3-1. Peak Demand and Energy Reductions

	Number of Projects	Peak (kW)	Energy (kWh)
Distribution	27	2,979	9,442,249
Transmission	19	8,000	28,985,000
TOTAL	46	10,979	38,427,249

3.1 Distribution Loss Savings

Navigant's review confirmed that AEP Ohio's composite peak demand savings of approximately three MW for distribution is reasonable and consistent with the level of savings associated with the 27 projects summarized above and listed individually in Table 3 (Appendix). This conclusion is supported by the type of projects included in the AEP Ohio loss reduction program and the methods AEP Ohio employed to derive these savings. Navigant notes the amount of savings increased three-fold of those reported in 2013, a substantial increase. Similar increases were achieved for energy savings. Much of the increase is driven by four major voltage conversions, reconductoring and reconfiguration projects that each achieved over 300 kW in peak demand reduction. The average savings per project also has increased from 2013, while the total number of projects decreased from 28 to 27. Nonetheless, for some AEP Ohio distribution projects, loss savings are less than one percent of peak feeder load; in some cases, quite small.

Navigant's review confirms the peak demand and energy reductions are reasonable given the scope of each upgrade. Further, similar to most electric utilities, most distribution projects are implemented to address capacity shortages or improve reliability or operating flexibility, with loss reduction as an ancillary benefit - major upgrades typically are not justified on loss reduction benefits alone. For example, several projects are line reconductoring; that is, replacing smaller wire with larger wire. However, the amount of wire replaced typically is a relatively small percent of the total miles of conductor on the feeder, which accounts for the relatively small amount of loss savings as a function of total feeder load. However, because distribution feeder losses typically are less than five percent of total feeder demand, the reduction that AEP Ohio cites represents significant savings

⁵ In prior years' reports, results were presented separately for Ohio Power Company and Columbus Southern Power. Following the merger of these two companies, results are reported on a consolidated basis.



3.2 Transmission Loss Savings

The magnitude of total loss savings (8.0 MW at peak) associated with transmission level is based on the combined savings associated with 19 projects or line segments that resulted in loss savings. Table 3 (Appendix) lists specific transmission projects and upgrades placed into service in 2014. Similar to 2013, transmission losses are well above distribution level savings. Notably, the number of transmission projects is lower than 2013 (48); however, total savings is only about 20 percent below the values reported in 2013, indicating the average savings per project has increased substantially. The increased average savings per project is due to several major transmission expansion and rebuild projects, which include new or upgraded 345kV and 765kV facilities, in addition to lower voltage transmission upgrades. Similar to prior years, the magnitude of transmission savings is greater than distribution. This finding is not unusual, as major transmission upgrades often result in substantial line loss savings, as the amount of power delivered per line mile is much higher than distribution lines. Navigant views AEP Ohio's transmission peak loss savings as consistent with the level of loss reduction achieved by other utilities that have implemented upgrades comparable with those listed in Table 3. Similar to distribution, transmission upgrades usually are implemented to improve performance and increase capacity transfer capability, with loss reduction as an added benefit.

Navigant's conclusions are supported by the review of AEP Ohio's project details and the analysis AEP Ohio prepared for each project, each of which confirms that the level of rigor applied to transmission level projects also is consistent with methods employed by electric utilities and transmission system operators. Further, the analysis AEP Ohio used to derive transmission energy savings is consistent with methods used by many electric utilities. Most important, AEP Ohio transmission planning reports that it performed detailed network load flow studies to estimate transmission loss savings.⁶ Based on the amount of transmission network load and types of upgrades outlined in Table 3, Navigant concludes that AEP Ohio's reported peak and energy loss savings is reasonable and accurate.

⁶ The loss savings for transmission projects were derived on a composite basis for AEP Ohio, as it was necessary to conduct network load flow studies with all upgrades and modifications in service; that is, the transmission projects are not mutually exclusive in terms of their combined impact on the transmission network, as the resultant line loadings will vary as the network is changed. Thus, the loss savings associated with each project, if modeled individually, are not additive.



Appendix A.

Table A- 1 lists the T&D project types from the Ohio TRM. Note that some project categories used in prior years did not apply in 2014 as no projects were undertaken; for example, no mass plant retrofit or large customer connection projects were completed in 2014.

Table A- 1. T&D Project Types

Ohio TRM T&D Project Types
1. Mass Plant Replacement and Expansion Analysis Protocol
2. Conductor Analysis Protocol
3. Large Customer Connection Analysis Protocol
4. Mass Plant Retrofit Analysis Protocol
5. Substation Transformer Analysis Protocol
6. System Reconfiguration Analysis Protocol
7. Voltage Conversion Analysis Protocol
8. Capacitors & Power Factor Protocol

Table A- 2 lists the project name, scope, whether the project was either Transmission (T) or Distribution (D), the type of project in terms of the Ohio TRM designations, the peak demand reduction (kW) and the annualized loss reduction (kWh).

Table A- 2. AEP Ohio T&D Projects

Project	Scope	TRM Project Type	Peak Reduction (kW)	Annualized Loss Reduction (kWh)	Transmission or Distribution (T or D)
1. Scio/Tri-City 12kV - 3.5 mi of 3-1CU recond w/ 3-4/0 AA	Reconductoring	2	18.9	74,257	D
2. Dresden Ave, East Liverpool - reconductoring (St Clair, Hospital)	Reconductoring	2	1.3	4,943	D
3. Stone St, Commercial - 4kV to 12kV conversion	Reconfiguration & Voltage Conversion	6, 7	355.1	1,393,078	D
4. Mungen, Cygnet - recond #6 Cu to #2AA	Reconductoring	2	2.6	10,317	D
5. East Canton / West Recond 3800' With 1/0 AA	Reconductoring	2	19.4	76,101	D
6. Billiar / Mt Eaton recond 12,400' with 1/0 AA	Reconductoring	2	23.1	90,576	D



Project	Scope	TRM Project Type	Peak Reduction (kW)	Annualized Loss Reduction (kWh)	Transmission or Distribution (T or D)
7. Savannah / Lippert - Convert and transfer remaining customers from Lippert Road Station.	Reconfiguration & Voltage Conversion	6, 7	24.2	94,734	D
8. Berlin / Berlin & Berlin / Bunker Hill. PPR relocation & reconductor. Circuit re-configuration and small wire replacement.	Reconductoring & Reconfiguration	2, 6	59.5	233,402	D
9. Cridersville North Reconductor	Reconductoring	2	105.3	413,181	D
10. Richey Rd Reconductor (N. Zanesville, East)	Reconductoring	2	91.2	357,910	D
11. South Granville, Rural - reconductoring	Reconductoring	2	11.9	46,680	D
12. Etna, 12KV Circuit - reconductoring	Reconductoring	2	19.7	77,199	D
13. Elk 228-01 Reconductor pole# 1993344422650 to 2007001422591 from #2AS to 4/0AA	Reconductoring	2	2.1	6,258	D
14. Camp Sherman VA Hospital - reconductor	Reconductoring	2	112.9	330,013	D
15. Highland, Hillsboro Rocky Fork (SR 247) - reconductor	Reconductoring	2	0.0	58	D
16. Highland, Hobart (SR 50) - reconductor	Reconductoring	2	12.7	37,077	D
17. Vigo, Richmondale - reconductor	Reconductoring	2	37.9	110,969	D
18. Waverly, Lake White-Hospital - reconductor	Reconductoring & Reconfiguration	2, 6	38.5	112,431	D
19. Seaman, Winchester - reconductor	Reconductoring	2	181.5	530,839	D
20. Seaman, Cherry Fork - reconductor	Reconductoring	2	179.7	525,546	D
21. Circleville, General Electric - reconductor	Reconductoring	2	4.2	12,398	D
22. Bentonville Rebuild	Reconductoring & Reconfiguration	2, 6	390.9	1,143,084	D



Project	Scope	TRM Project Type	Peak Reduction (kW)	Annualized Loss Reduction (kWh)	Transmission or Distribution (T or D)
23. Croton Egg Farm - reconductor	Reconductoring	2	468.4	1,369,643	D
24. SR 7 - reconductoring Step 2 (Coolville, South)	Reconductoring	2	33.9	99,010	D
25. Laurel Cliff Tie - reconfiguration (Meigs, Pomeroy)	Reconductoring & Reconfiguration	2, 6	558.0	1,631,495	D
26. Lincoln Hill - 4-12kV conversion (Meigs, Middleport)	Reconfiguration & Voltage Conversion	6, 7	3.3	9,620	D
27. Plains Tie - reconfiguration (Poston, Southeast)	Reconfiguration	6	222.8	651,428	D
28. Build a new 21.7 mile 138 kV circuit from Gahanna station to West Millersport station with conductor sizes ranging from 1272 ACSR/PE 54/19 to 2303.5 ACAR 54/37.	Expansion	1	inc	inc	T
29. Replaced the Crooksville 138/69 kV 90 MVA transformer to a 130 MVA transformer.	Substation Transformer	5	inc	inc	T
30. Replace Marysville 3000A 765/345 kV transformer with a new 2250 MVA 765/345 kV transformer	Substation Transformer	5	inc	inc	T
31. Build a new 138kV single circuit line from Melmore-Tiffin Center Station, 12.59 miles, ACSR-795 conductor	Expansion	1	inc	inc	T
32. Replace existing Fostoria Central TRF with a new lower impedance 345/138 kV, 450 MVA unit	Reconductoring	2	inc	inc	T
33. Install a new 345-138kV 450 MVA transformer #3 at Canton Central substation; also at Canton Central, replace existing 345-138kV 200 MVA transformers #1 & #2 with a new 450 MVA transformer #1	Expansion and Substation Transformer	1, 6	inc	inc	T



Project	Scope	TRM Project Type	Peak Reduction (kW)	Annualized Loss Reduction (kWh)	Transmission or Distribution (T or D)
34. Convert the Pekin-Bane 23kV circuit to 69kV operation. Re-insulate 10.1 miles of transmission line between Pekin & Bane stations for 69kV, keeping the existing conductor. Retire the Pekin 69-23kV transformer.	Voltage Conversion	7	inc	inc	T
35. Rebuild and reductor 3.9 mile East Liverpool-South Calcutta 69kV line section. Replace 3/0 copper conductor with 1233.6 ACSS/TW Yukon.	Reconductoring	2	inc	inc	T
36. Rebuild and reductor 10 mile East Sparta-Sunnyside 23kV circuit to 69kV standards (continue to operate at 23kV). Replace a mix of smaller conductors with 1033.5 ACSR 54/7 Curlew.	Reconductoring	2	inc	inc	T
37. Reductor 13 miles 345 kV line on existing towers between Kammer and West Bellaire with 1851 ACCR/TW.	Reconductoring	2	inc	inc	T
38. Build a new 21.7 mile 138 kV circuit from Gahanna station to West Millersport station with conductor sizes ranging from 1272 ACSR/PE 54/19 to 2303.5 ACAR 54/37.	Expansion	1	inc	inc	T
39. Build 7 miles of 138 kV line from Elk to Bolins with the conductor 1233.6 ACSR/TW Yukon.	Expansion	1	inc	inc	T
40. New Vassell 765/345 kV 2250 MVA transformer. Tap existing Kammer - Maliszewski 765 kV circuit to bring into the new Vassell Station	Expansion	1	inc	inc	T
41. New Vassell 345/138 kV 675 MVA transformer	Expansion	1	inc	inc	T



Project	Scope	TRM Project Type	Peak Reduction (kW)	Annualized Loss Reduction (kWh)	Transmission or Distribution (T or D)
42. String new Vassell - Corridor 345 kV 8.2 mile circuit with 954 ACSR conductor. Tap existing Corridor - Hyatt 345 kV circuit to bring into the new Vassell Station	Reconductoring & Reconfiguration	2, 6	inc	inc	T
43. Construct new Vassell - Delaware 138 kV 16.4 mile circuit with portions of 1272 ACSR and 1590 ACSR conductor	Expansion	1	inc	inc	T
44. Build new Jug - Kirk 12.3 mile 138 kV circuit with dual 954 ACSR conductor	Expansion	1	inc	inc	T
45. Rebuild the 4 miles Bexley - Groves 138 kV circuit replacing 636 ACSR with 1926.9 ACSR/TW conductor	Reconductoring	2	inc	inc	T
46. Rebuild the 19.1 miles Bixby - West Lancaster 138 kV circuit replacing numerous old conductors with 1033.5 ACSR conductor	Reconductoring	2	8,000.0	28,985,000	T

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Summary: Report -2014 Portfolio Status Report (Part 3 of 3) electronically filed by Mr. Steven T Nourse on behalf of Ohio Power Company