2013 Portfolio Status Report of the Energy Efficiency and Peak Demand Response Programs

VOLUME III

APPENDICES K - P

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Self Direct Program:
Program Year 2013 Evaluation Report

Prepared for:
AEP Ohio

AEP OHIO®
A unit of American Electric Power

May 12, 2014

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Executive Summary

The Self Direct Program allows qualifying business customers to commit their already completed energy efficiency and summer peak demand reduction resources to AEP Ohio. AEP Ohio accepts projects on a case-by-case basis, and each must be approved by the Public Utility Commission of Ohio (PUCO) through a special arrangement.

The goal of the Self Direct Program is to educate business customers on all of AEP Ohio's energy efficiency/peak demand reduction (EE/PDR) business sector programs. The Self Direct Program incentives are a way to 'prime the market' for more energy efficiency projects by providing participants start-up funds for their next project that qualifies for AEP Ohio's Custom or Prescriptive Programs for businesses. The Self Direct Program is marketed, administered, and delivered as a single program by DNV GL Services Inc. (implementation contractor) in coordination with AEP Ohio.

Program Participation

The evaluation team analyzed data extracted from AEP Ohio's tracking system on January 14, 2014. As shown in Table ES-1 the 2013 Self Direct program paid incentives on 128 projects constituting 27,273 MWh of *ex ante* reported annual energy savings. The majority of reported energy savings come from custom[1] (52%), lighting (38%), and variable frequency drive (VFD [7%]) measures, as shown in Figure ES-1.

Table ES-1. 2013 Self Direct Program Projects, Measures, and Reported Savings

Metric	*Ex ante* Reported Value
Number of Projects	128
Annual Energy Savings (MWh)	27,273
Electric Peak Demand Savings (kW)	8,982

Source: Evaluation Analysis of AEP Ohio Tracking Data from January 14, 2014.

[1] The majority of savings from custom measures come from Process Variable Speed Drive's (VSD), Air-Cooled Chillers, HVAC, VFDs for HVAC, and Heat Recovery Systems.

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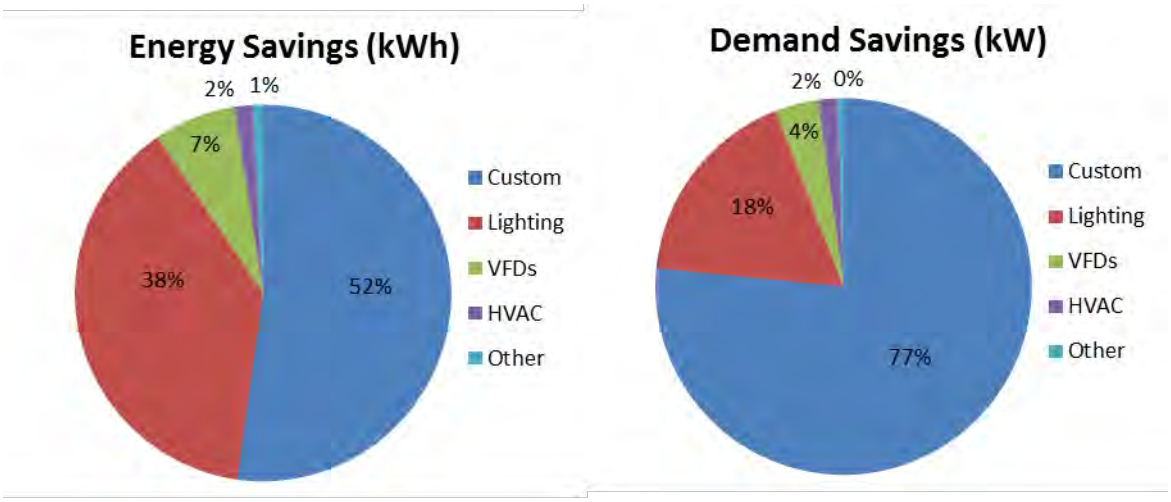
Figure ES-1. Percentage of Savings Installed by Measure Category



Source: Evaluation Analysis of AEP Ohio Tracking Data from January 14, 2014.

Data Collection Activities

Table ES-2 provides a summary of 2013 data collection activities for the Self Direct Program impact and process evaluations.

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Table ES-2. Data Collection Activities for 2013 Self Direct Evaluation

Evaluation Effort	Data Collection	Targeted Population	Sampling Unit	Sample Design	Sample Size	Timing
Impact and Process	Collection of Program Tracking Data	Self Direct projects filed with the PUCO in 2013	Project	NA	NA	Jan 2013 to December 2013
Process	In-depth Interviews	AEP Ohio program Staff	Contact from AEP Ohio	NA	1	November, 2014
		Self Direct program implementation staff	Contact from the implementation contractor	NA	1	
Process	CATI Surveys	Self Direct program participants	Unique contact from tracking database	Census	51	March 2014 to April 2014
Impact	Project Technical Reviews	Self Direct projects filed with the PUCO in 2012	Project	Random sampling using stratified ratio estimation	30	October 2013 to April 2014
Impact	On-site Measurement & Verification	Projects with Industrial Lighting measures, or in Large/Medium strata	Project	Random subset of technical review sample	23	January 2014 to April 2014

Source: Evaluation Activities Conducted From Jan 2013 Through April 2014.

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Key Evaluation Findings and Recommendations

Key Impact Findings and Recommendations

As shown in Table ES-3, the impact evaluation verified 96 percent of the reported energy savings and 107 percent of the reported demand savings. The relative precision at the two-tailed 90 percent confidence interval was ± 9.1 percent for energy and ± 6.8 percent for demand.

Table ES-3. 2013 Program Goals, *Ex Post* Savings and Realization Rates

Metric	2013 Program Goals	*Ex Ante* (a)	*Ex Post* (b)	Realization Rate RR = (b)/(a)	Overall Relative Precision at 90% Confidence	Percent of Goal
Annual Energy Savings (MWh)	20,000	27,273	26,304	0.96	9.1%	132%
Coincident Peak Reduction (MW)	2.5	9.0	9.7	1.07	6.8%	392%

Source: AEP Ohio VOLUME 1: 2012 TO 2014 Energy efficiency/Peak Demand Reduction (EE/PDR) Action Plan, November 29, 2011; Evaluation Data Collection and Analysis as described in Section 2.

Other key impact evaluation findings include:

1. Projects involving large-scale municipal lighting installations (e.g. traffic lights and street lights) tend to be difficult to document and verify, because municipalities cover large areas and tend to install fixtures gradually. Navigant evaluated a large traffic light project as part of the 2013 Self Direct sample, and due to limited documentation, had difficulty obtaining the necessary information to verify the installations.

   Impact Recommendation #1: Navigant recommends that the implementation contractor provide ample documentation of where municipal lighting measures are installed to enable onsite verification, particularly for projects that make up a significant fraction of the program's savings (greater than 5 percent).

2. In 2013, Navigant discovered a greater discrepancy between the *ex ante* savings reported in the database and the *audited* savings, as compared to 2012 where the difference was negligible. The discrepancy was due to an error in the lighting calculation spreadsheet.

   Impact Recommendation #2: Navigant recommends that the implementation contractor reviews its lighting analysis template for prescriptive measures to ensure that the savings are being calculated as intended based on what is stated in the implementation contractor's Workpapers.

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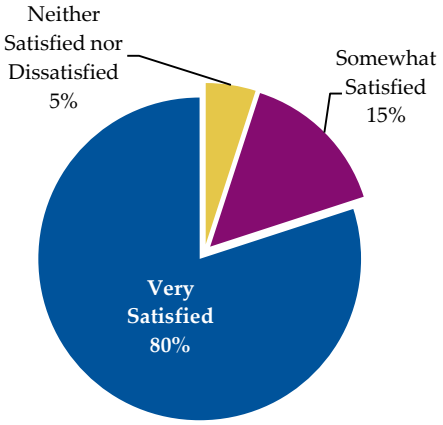
3. Navigant adjusted the deemed savings inputs for 38 percent of the measures and 15 percent of the reported energy savings from the Self Direct program. The categories of adjustment included operating hours, coincidence factors, HVAC interactive effects, T12 baselines, HP/RW fixture wattage, and lighting controls. These adjustments led to a 0.04 percent decrease in energy savings and a 0.20 percent decrease in demand savings.[2]

   Impact Recommendation #3: Navigant recommends that the implementation contractor apply Navigant's adjusted per-unit savings values to Self Direct Program measures in future years.

Key Process Findings and Recommendations

Overall, 95% of the twenty program participants in our sample are *very or somewhat satisfied* with the Self Direct Program. None of the program participants reported any level of dissatisfaction with the program as shown in ES-1.

Figure ES-1. Overall Satisfaction with the Self Direct Program



Source: 2013 AEP Ohio Self Direct Survey, N=20.

Other key process evaluation findings include:

1. As previously recommended, AEP Ohio emailed all customers eligible for the Self Direct Program in 2013 to inform them of their other program choices. Despite this targeted effort, when asked why they chose to participate in the Self Direct Program, customers indicated that:

   a. Self Direct Program incentives were higher than other AEP Ohio business sector programs, or that the Self Direct Program offered rebates for equipment not available through the other programs (however, this is not actually the case).

[2] A more detailed description of the entire Deemed Savings Review methodology and findings is provided in the Prescriptive Program evaluation report.

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b. This was the only program they knew about (suggesting messaging and marketing of AEP Ohio's business sector programs needs to be improved).

c. That they did not qualify for the Prescriptive Program (and it sounded like they think they never would).

Process Recommendation #1: Customers who participate in the Self Direct Program should be more consistently informed by AEP Ohio, the implementation contractor, or the Solution Provider on how they can participate in the Custom or Prescriptive programs in the future. Only 15 percent of the respondents reported an answer that might be considered logical given the (lack of) Self Direct marketing activities (i.e., they participated in the Self Direct Program because the timing of their participation prevented them from participating in these other programs).

. AEP Ohio should consider delivering a quarterly or even monthly series of email or direct mail communications to customers to remind them of their potential program choices. Solution Providers and AEP account representatives should also be reminded that customers in the Self Direct Program should always be educated about the other programs.

2. Customers suggested that the wording of the application could be improved and that the application could be simplified.

   Process Recommendation #2: Retooling the program application for the web site is an opportunity for AEP Ohio to simplify the wording.

3. The on-line application is expected to further increase satisfaction with the application process for those who are willing to use it.

   Process Recommendation #3: While AEP Ohio has made progress toward the on-line application, it was not implemented in 2013. Consider selecting three to five Solution Providers and customers with varied levels of experience with the program to 'test' the online application process before it is offered to all Solution Providers and customers. This may have been implemented in 2013.

4. Staff changes within the implementer took a toll on processing resources for complicated projects in 2013. Some customers still indicate frustration with the length of time needed for processing projects.

   Process Recommendation #4: The program is running quite smoothly overall except for a few temporary issues with engineering resources in 2013 that should be solved in 2014. AEP Ohio and the implementation contractor should develop a more efficient process for reviewing complicated Self Direct Program applications in 2014. The Navigant Team suggests that the implementation contractor conduct a succession planning exercise for their senior engineering staff in Ohio to prevent such a situation in the future.

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1. Introduction

This evaluation report chapter covers the Self Direct Program element of the AEP Ohio business energy efficiency and peak demand reduction programs.

1.1 Program Description

The Self Direct Program allows qualifying business customers to commit their already completed energy efficiency and summer peak demand reduction resources to AEP Ohio. AEP Ohio accepts projects on a case-by-case basis, and each must be approved by the Public Utility Commission of Ohio through a special arrangement. Eligibility for business customers is determined by meeting one of two criteria:

- The customer has energy consumption greater than 700,000 kWh per year from AEP Ohio, or
- The customer is part of a national account involving multiple facilities in one or more states.

Submitted projects must have an installation date within three years of the date of acceptance into the program. Each project is required to produce verifiable and persistent energy savings (kWh) and/or peak demand reduction (kW) for at least five years from the date of installation. Projects are also required to have a payback period between one and seven years without the incentive applied, and pass cost-effectiveness tests determined by AEP Ohio.

The goal of the Self Direct Program is to educate business customers on all of AEP Ohio business sector programs. The Self Direct incentives are a way to 'prime the market' for more energy efficiency projects by providing participants start-up funds for their next project that qualifies for AEP Ohio's Custom or Prescriptive Programs.

The Self Direct Program is marketed, administered, and delivered as a single program by AEP Ohio. The program is managed by an implementation contractor, DNV GL Services Inc., in coordination with AEP Ohio.

1.2 Self Direct Program 2013 Participation Summary

The evaluation team analyzed data extracted from AEP Ohio's tracking system on January 14, 2014. As shown in Table 1-1, the 2013 Self Direct Program paid incentives on 128 projects constituting 27,273 MWh of *ex ante* reported annual energy savings. The majority of reported energy savings come from custom[3] (52%), lighting (38%), and variable frequency drive (VFD [7%]) measures, as shown in Figure 1-1.

[3] The majority of savings from custom measures come from Process Variable Speed Drives (VSD), Air-Cooled Chillers, HVAC, VFDs for HVAC, and Heat Recovery Systems.

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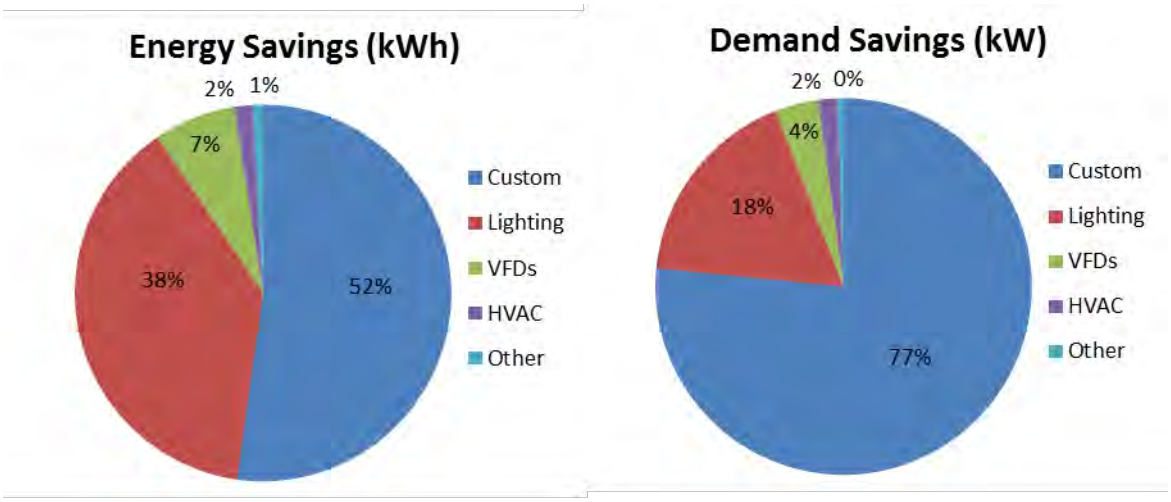
Table 1-1. 2013 Self Direct Program Projects, Measures and Reported Savings

Metric	*Ex ante* Reported Value
Number of Projects	128
Number of Measures	302
Annual Energy Savings (MWh)	27,273
Electric Peak Demand Savings (kW)	8,982

Source: Evaluation Analysis of 2013 AEP Ohio Tracking Data.

Figure 1-1. Percentage of Savings Installed by Measure Category



Source: Evaluation Analysis of 2013 AEP Ohio Tracking Data.

1.3 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 algorithms specified in the workpapers and the inputs provided in the data extract from AEP Ohio. Audited savings should equal *ex ante* savings if 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 site visits for a sample of projects.

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2. Methodology

The evaluation team conducted impact and process evaluation activities for the Self Direct Program following the methodologies outlined below.

2.1 Impact Evaluation Methodology

2.1.1 Overview of Impact Evaluation Approach

The purpose of the impact evaluation is to determine 2013 evaluation-verified (*ex post*) annual energy and peak demand savings. The evaluation followed the same multi-step approach as was implemented for the Prescriptive Program evaluation.

1. **Tracking System Review**. The evaluation team reviewed the data tracking system to summarize program participation, and to identify the sectors and measures contributing the majority of savings.

2. **Deemed Savings Review**. The evaluation team applied findings from the Deemed Savings Review conducted for the Prescriptive Program to the Self Direct Program as appropriate.

3. **Sample Design**. The team designed and selected a stratified, random sample of participants to verify program-level impacts with 10% relative precision at the 90% confidence interval.

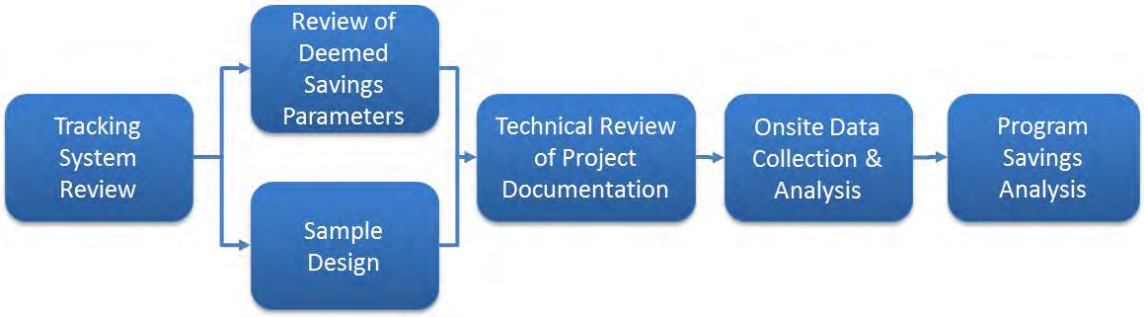
4. **Technical Review of Project Documentation**. Navigant engineers reviewed project-specific documentation for the sampled projects and adjusted the savings as appropriate.

5. **Onsite Data Collection and Analysis**. The evaluation team conducted onsite data collection and analysis at a subset of sampled data points to collect more robust data for targeted measures and sectors.

6. **Program Savings Analysis**. The evaluation team combined the results from the evaluation tasks described above to determine program-level energy and demand impacts.

Figure 2-1 illustrates the impact evaluation task flow.

Figure 2-1. Impact Evaluation Task Flow



2.1.2 Tracking System Review

In the first step of the impact evaluation, Navigant reviewed the data tracking system provided by AEP Ohio. The evaluation team identified key tracking fields, including project number, participant name and contact information, project status, building type, measure type, and savings. Next, the team summarized the tracking system data to identify the sectors and measures contributing the majority of savings. The high-savings sectors, projects, and measures were targeted during the sample design.

2.1.3 Deemed Savings Review

Navigant applied the results of the Prescriptive deemed savings review to the prescriptive measures within the Self Direct Program. The custom measures within the Self Direct Program were evaluated on a project- and measure-specific basis.

This section provides an overview of the deemed savings review methodology. A more detailed version of the methodology can be found in the Program Year 2013 Evaluation Report for the Prescriptive Program.

The review of deemed savings parameters included four essential parts:

1. Assessment of measures for review.
2. Assessment of key changes between the implementation contractor's 2012 Workpapers and 2013 Workpapers.
3. Recalculation of *ex ante* savings for reviewed measures.
4. Review of the lighting HVAC interactive effects.

The following sections provide an overview of the Deemed Savings Review task.

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2.1.3.1 Assessment of Measures for Review

In the first part, Navigant used the output from the Tracking System Review task to determine the measures to be included in the deemed savings review. Since lighting measures make up the majority of prescriptive measures found in the Prescriptive and Self Direct programs, Navigant restricted the list to lighting only, which was also Navigant's focus for the deemed savings review in 2012 due to a similar trend in savings.

2.1.3.2 Assessment of Key Changes between the implementation contractor's 2012 Workpapers and 2013 Workpapers

Navigant compared the deemed savings values for lighting measures in the the implementation contractor 2012 Workpapers and 2013 Appendix to determine key changes between the workpapers. Based on Navigant's review, there were no major changes to the deemed savings values for lighting measures in 2013, with the exception of the HVAC interactive effects. As a result, Navigant's recommendations in the 2012 Deemed Savings Review still apply, with the exception of lighting HVAC interactive effects. Navigant's primary recommendations from the 2012 Deemed Savings Review were to update the wattages for T12 baseline measures, adjust the wattages for high performance and reduced wattage measures, update the deemed savings for occupancy sensors, and update the hours of use and coincidence factors from DEER 2008 to DEER 2011.

2.1.3.3 Recalculation of ex ante *Savings*

In the final part of the Deemed Savings Review, Navigant recalculated the *ex ante* savings for the measures included in the review twice—once using the algorithms and inputs specified by the implementation contractor's Workpapers, and once using Navigant's engineering adjusted savings from the Deemed Savings Review. This exercise resulted in two databases of savings:

1. **"*Audited Savings*" database**: savings for the majority of measures recalculated using the implementation contractor's Workpapers inputs and assumptions.

2. **Navigant's "*Engineering Adjusted Savings*" database**: savings for the majority of measures recalculated using Navigant's improved inputs from the Deemed Savings Review.

The engineering adjusted savings database was used as the basis of comparison for the verified savings from the sampled projects. A more detailed description of the program savings analysis, including the use of the audited savings database and the engineering adjusted savings database, is provided in Section 3.2.3 and Section 3.2.4.

2.1.3.4 Review of the Lighting HVAC Interactive Effects

The primary change that the implementation contractor made to lighting measures between the the implementation contractor's 2012 Workpapers and the 2013 Workpapers was to the HVAC interactive

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effects.[4] In the 2012 Workpapers, the HVAC interactive effects came from DEER 2008, and in the 2013 Workpapers the values come from the Illinois Technical Reference Manual (Illinois TRM). Since the HVAC interactive effects impact 89 percent of the measures in the tracking database, Navigant conducted a thorough analysis to determine how the HVAC interactive effects in the Illinois TRM were calculated. Navigant's review of the HVAC interactive effects consisted of three parts:

1. Determine how the HVAC interactive effects in the Illinois TRM were calculated and what methodology was used.

2. Execute the same methodology to determine if Navigant could obtain the values used in the Illinois TRM.

3. Provide recommendations to AEP Ohio and the implementation contractor based on recalculating the HVAC interactive effects.

2.1.4 Impact Evaluation Sample Design

In addition to the adjustment of the *ex ante* savings, the evaluation team sampled a portion of projects from the *ex ante* database to verify savings using more robust methods, including a technical review of project documentation (described in the Executive Summary) and onsite data collection and analysis (described in Section 2.1.6). The sample design used stratified ratio estimation to reduce the number of sample points required to meet the precision targets, thus providing accurate results at reduced overall cost.

The sample frame for the 2013 evaluation included only those projects reported as filed with the PUCO from January 11, 2013 through December 31, 2013. The sample sizes within each stratum were calculated to provide 10 percent relative precision at the two-tailed 90 percent confidence interval (90/10) for Self Direct Program annual energy (kWh) and peak demand (kW) savings.[5] Table 2-1 shows the strata definitions, the number of projects within each stratum, and the calculated sample sizes.

[4] It is important to note that the source of the lighting hours of use and coincidence factors did not change between the the implementation contractor 2012 Workpapers and the 2013 Workpapers, which is why Navigant's recommendations in the 2012 Deemed Savings Review still apply in 2013. The values used in the implementation contractor's Workpapers come from DEER 2008 and Navigant recommends that the implementation contractor update these values with the more current DEER 2012 values.

[5] The Navigant team analyzed sample results from the 2012 evaluation to determine an appropriate starting point for the coefficient of variation (CV) on the *ratio* of verified to *ex ante* savings. The final CV used in the sample design was 0.40 for both energy and demand.

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Table 2-1. Strata Definitions and Sample Sizes

Stratum Number	Stratum Name	Lower kWh Threshold	Lower kW Threshold	Sample Frame Projects	Sample Size
1	Large	1,000,000	100	6	6
2	Small	7,500	1.5	120	11
			Total	**126**	**17**

Source: Evaluation Analysis of 2013 AEP Ohio Tracking Data.

Finally, Navigant selected the samples within each stratum randomly. Once the sample points were selected, the sample was compared to the sample frame in a few key categories[6] to ensure that the sample was sufficiently representative of the sample frame. If a selected sample was found to be misrepresentative of the population, the entire sample was discarded and a new one was randomly selected. Table 2-2 shows the final sample reported savings that were evaluated as a percentage of the sample frame.

Table 2-2. Strata Definitions and Sample Sizes

Stratum Number	Stratum Name	MWh Savings			kW Savings		
		Sample Frame (SF)	Sample	% of SF	Sample Frame (SF)	Sample	% of SF
1	Large	13,946	13,946	100%	1,423	1,423	100%
2	Small	12,848	2,743	21%	1,396	387	28%
Total or Overall Value		**26,794**	**16,689**	**62%**	**2,819**	**1,810**	**66%**

Note: Total may not sum to due to rounding.
Source: Evaluation Analysis of 2013 AEP Ohio Tracking Data.

2.1.5 Technical Review of Project Documentation

Navigant requested the project-specific documentation for each of the 17 sampled projects from the implementation contractor, and conducted a detailed technical review of each. The assessment included a review of the *ex ante* database, the recalculated savings in the audited and engineering-adjusted savings databases (if applicable), customer applications, invoices, and equipment specifications. Navigant made adjustments to project-specific savings wherever project documentation clearly showed different values from the database, or where obvious calculation mistakes were present. Custom measures were given extra attention to ensure the appropriate methods were used to evaluate the savings. Navigant also used the adjusted inputs from the Deemed Savings Review task in the project-specific analysis for prescriptive measures.

[6] The categories included Building Type, Measure Category, and broad geographic area.

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2.1.6 Onsite Data Collection and Analysis

Navigant conducted onsite data collection and analysis for a subset of projects selected from the technical review sample. The team developed project-specific M&V (measurement and verification) plans 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:

- Visual verification of measure installation and operation
- Verification of reported measure quantities
- Verification of measure nameplate data, including manufacturer and model number, capacity (watts, Btu/h, tons, etc.), and efficiency
- Verification of measure operating characteristics, including the schedule of operation, annual operating hours, and loading
- Verification of the appropriate baseline technology

2.1.7 Program Savings Analysis

In the final step of the impact evaluation, Navigant combined the outputs from all the previous steps to determine program-level verified energy and demand savings. More specifically, the team calculated the ratios between the project-specific verified savings for the sampled projects to the *adjusted savings* from Navigant's adjusted savings database. This critical step serves to improve the overall precision of the sample results by *first* improving the denominator (i.e., savings against which we compare sample results) used in the ratio estimation technique.[7]

Navigant then extrapolated the sample results to the population of program participants using the adjusted savings database. The extrapolation procedure followed the structure specified in the sample design, and it used stratified ratio estimation to determine program-level verified (i.e.; realized) savings. Finally, the team compared the program-level realized savings to the *ex ante* program savings to determine the Self Direct Program realization rate. Figure 2-2 shows the program savings analysis process in graphical form.

[7] The project-specific ratios between sample-verified and *adjusted* savings will be better (i.e., closer to 1.0) than the ratios between sample-verified and *ex ante* savings. This improved and tighter distribution of sample ratios results in better precision when extrapolated to the population of program participants.

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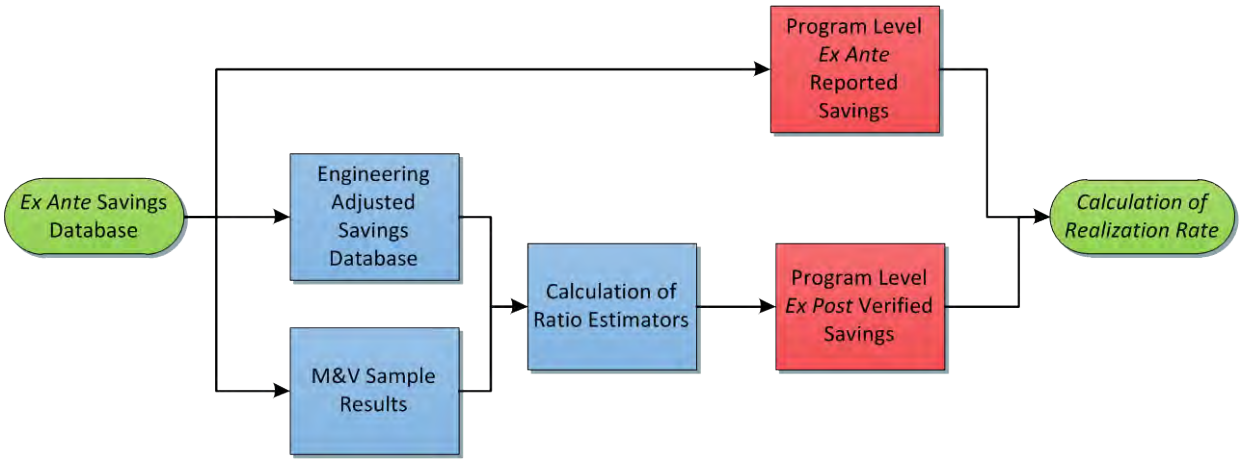
Figure 2-2. Program Savings Analysis Process



2.2 *Process Evaluation Methodology*

2.2.1 Overview of Process Evaluation Approach

The purpose of the process evaluation is to assess the effect of the structure and implementation of the program on its performance and on customer satisfaction. The evaluation team's process efforts provide insights and recommendations to support the continued success of the Self Direct Program.

Central to the process evaluation for the Self Direct Program were interviews with AEP Ohio program managers and with staff of the implementation contractor, 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. In addition, the evaluation team conducted a computer-assisted telephone interview (CATI) with participating customers to better understand customer satisfaction and perceptions related to the program.

2.2.2 Interview and Survey Design

The evaluation team used a senior staff member to conduct in-depth qualitative interviews. Senior staff were flexible in their approach to the discussion, allowing the respondent to talk about his/her experience or perspective while still shaping the discussion toward the most important, relevant and necessary information. The team conducted the interviews by telephone in order to complete the interviews quickly and to be flexible to the respondents' schedule.

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 evaluation team took detailed notes during each in-depth interview and/or taped the discussion to ensure thorough documentation.

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2.2.3 Program and Implementer Staff Interviews

Navigant conducted an interview with the AEP Ohio Self Direct Program Coordinator and with the the implementation contractor Operations Manager. This interview was completed in November 2013. The interview with the AEP Ohio Program staff focused on program processes, the goals of the program, how the program was implemented and the perceived effectiveness of the program. Interviews with the implementer were covered all of the Business programs and did not focus on one specific program.

2.2.4 CATI Telephone Survey of Program Participants

A computer-assisted telephone interview survey targeted a population of 51 unique customer contact names drawn from the Self Direct Program tracking system extract. Because of the small number of possible respondents, the evaluation team targeted a census for completion.[8] The survey ultimately finished with 20 completed interviews from the Self Direct Program participants, representing a response rate of 39 percent. All CATI interviews were completed in March or early April 2014.

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 Section 5.2 Appendix B.

2.3 Summary of Data Collection Activities

Table 2-3 provides a summary of 2013 data collection activities for the Self Direct Program impact and process evaluations.

[8] Since the team was targeting a census of participants for survey completion, no sample design was required.

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Table 2-3. Data Collection Activities for 2013 Self Direct Evaluation

Evaluation Effort	Data Collection	Targeted Population	Sampling Unit	Sample Design	Sample Size	Timing
Impact and Process	Collection of Program Tracking Data	Self Direct projects filed with the PUCO in 2013	Project	NA	NA	Jan 2013 to Dec 2013
Process	In-depth Interviews	AEP Ohio program Staff	Contact from AEP Ohio	NA	1	November, 2013
		Self Direct program implementation staff	Contact from the implementation contractor	NA	1	
Process	CATI Surveys	Self Direct program participants	Unique contact from tracking database	Census	51	March 2014 to April 2014
Impact	Project Technical Reviews	Self Direct projects filed with the PUCO in 2013	Project	Random sampling using stratified ratio estimation	17	November 2013 to March 2014
Impact	On-site Verification	Projects in Large strata	Project	Random subset of technical review sample	6	January 2014 to March 2014

Source: Evaluation Activities Conducted From Jan 2013 Through April 2014.

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3. Impact Evaluation Results

The results of the impact evaluation are presented in the following parts:

1. Findings from the Deemed Savings Review.
2. Findings from the Technical Review and Onsite Data Collection.
3. Program Savings Analysis.
4. Cost effectiveness

Section 3.1 through Section 3.4 explains each part in more detail.

3.1 Savings Summary

As shown in Table 3-1, the impact evaluation verified 96 percent of the reported energy savings and 107 percent of the reported demand savings. The relative precision at the two-tailed 90 percent confidence interval was ± 9.1 percent for energy and ± 6.8 percent for demand.

Table 3-1. 2013 *Ex Post* Savings and Realization Rates

Metric	Energy Savings (MWh)	Demand Savings (kW)
Ex ante Reported Savings	27,273	8,982
Ex post Savings	26,304	9,651
Realization Rate	0.96	1.07
Relative Precision @ 90% CI	9.1%	6.8%

Source: Evaluation Data Collection and Analysis as Described in Section 2.

3.2 Findings from Deemed Savings Review

The review of deemed savings parameters for the Self Direct Program included three major outputs:

1. Adjusted Per-Unit Savings Values for the Reviewed Measures
2. Audited savings
3. Engineering Adjustment Savings

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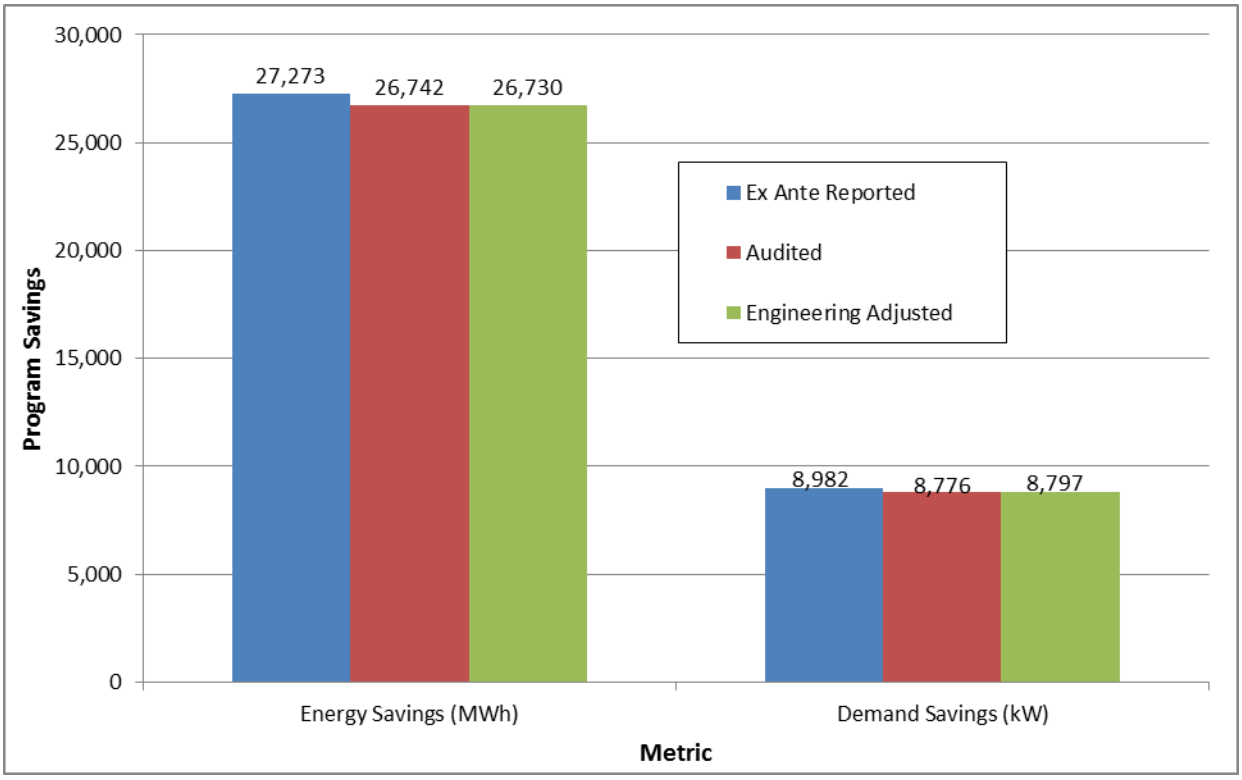
The following sections provide an overview of the key findings from this task.[9] These findings apply to *prescriptive lighting measures* within the Self Direct program. Custom measures were wholly evaluated during the Technical Review and Onsite Data Collection tasks.

Figure 3-1 shows a summary comparison of the *ex ante* reported, the *audited* savings, and Navigant's *engineering adjusted* savings through the Deemed Savings Review at the program level. Overall, Navigant's adjustments from the Deemed Savings Review served to decrease the energy savings by less than one percent and increase the demand savings by less than one percent.

Figure 3-1. Comparison of *Ex Ante* Reported, Audited and Navigant's Engineering Adjusted Savings



Source: Evaluation Data Collection and Analysis as described in Section 2.

See Appendix A.2 for more detail about the deemed savings review findings.

3.3 Findings from Technical Review and Onsite Data Collection

Navigant conducted a technical review of project documentation for a total of 17 projects selected from the sample. The evaluation team completed onsite verification visits for the six projects in the large

[9] For more information about the Deemed Savings Review, refer to the 2013 Evaluation Report for the Prescriptive Program.

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stratum. The sampled projects included both prescriptive and custom measures. The custom measures included installations of energy management systems, process VFDs, refrigeration compressors, and process motors. The results are discussed in more detail in Appendix A.

3.4 Program Savings Analysis

Navigant combined the results of the Deemed Savings Review with the results of the Technical Review and Onsite Data Collection for the sampled projects to determine program-level verified energy and demand savings. In the first step, Navigant extrapolated the sample results to the population of program participants using the *engineering adjusted savings* database to determine the *ex post* savings via ratio estimation.

In this analysis, the ratio estimator is not the same as the realization rate. The realization rate provides the ratio between the *ex post* savings and the *ex ante* savings. Navigant's analysis includes an interim step, in which the *ex post* savings for the sample are first compared to the adjusted savings. This crucial step yields improved relative precision over that achieved using the *ex ante* savings database.[10]

Table 3-2 shows the ratio estimators and relative precision at the two-tailed 90 percent confidence interval for energy and demand savings. Overall, the relative precision on the sample results was ± 7.8 percent for energy and ± 13.6 percent for demand.

Table 3-2. Energy and Demand Ratio Estimators and Relative Precision

Stratum Number	Stratum Name	Energy Savings Statistics		Demand Savings Statistics	
		Ratio Estimator	Relative Precision @ 90% Conf. Int.	Ratio Estimator	Relative Precision @ 90% Conf. Int.
1	Large	1.01	4.4%	1.12	6.1%
2	Small	0.95	20.3%	0.96	37.6%
Overall Value		**0.98**	**9.1%**	**1.10**	**6.8%**

Source: Evaluation Analysis of Tracking Data and Sample Results

[10] For more discussion, see Section 2.1.7.

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As shown in Table 3-3, the impact evaluation verified 96 percent of the reported energy savings and 107 percent of the reported demand savings. The relative precision at the two-tailed 90 percent confidence interval is the same as that on the ratio estimator: ± 7.8 percent for energy and ± 13.6 percent for demand.

Table 3-3. *Ex Post* Savings and Realization Rates

Metric	Energy Savings (MWh)	Demand Savings (kW)
Ex ante Savings [A]	27,273	8,982
Engineering Adjusted Savings [B]	26,730	8,797
Ratio Estimator [RE]	0.98	1.10
Ex post Savings [C = B * RE]	26,304	9,651
Realization Rate [RR = C / A]	0.96	1.07
Relative Precision @ 90% Conf. Int.	9.1%	6.8%

Source: Evaluation Analysis of Tracking Data and Sample Results.

AEP Ohio achieved 132 percent and 392 percent of the 2013 program goals for energy savings and demand demand reduction, respectively, as shown in Table 3-4.

Table 3-4. 2013 Program Goals, *Ex Post* Savings and Realization Rates

Metric	2013 Program Goals	Ex-ante (a)	Ex-post (b)	Realization Rate RR = (b)/(a)	Overall Relative Precision at 90% Confidence	Percent of Goal
Annual Energy Savings (MWh)	20,000	27,273	26,304	0.96	9.1%	132%
Coincident Peak Reduction (MW)	2.5	9.0	9.7	1.07	6.8%	392%

Source: AEP Ohio VOLUME 1: 2012 TO 2014 Energy efficiency/Peak Demand Reduction (EE/PDR) Action Plan, November 29, 2011; Evaluation Data Collection and Analysis as described in Appendix A.

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3.5 Cost-Effectiveness Review

This section addresses the cost effectiveness of the Self Direct Program. Cost effectiveness is assessed through the use of the Total Resource Cost (TRC) test. Table 3-4 summarizes the unique inputs used in the TRC test.

Table 3-5. Inputs to Cost-Effectiveness Model for Self Direct Program

Item	Value
Average Measure Life	10
Projects	128
Annual Energy Savings (MWh)	26,304
Coincident Peak Savings (kW)	9,651
Third Party Implementation Costs	577,960
Utility Administration Costs	$209,085
Utility Incentive Costs	$1,220,192
Participant Contribution to Incremental Measure Costs	$6,805,111

Based on these inputs, the TRC ratio is 2.1. Therefore, the program does pass the TRC test. Table 3-5 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 Self Direct Program

Test Results for Self Direct	Ratio
Total Resource Cost	2.1
Participant Cost Test	3.5
Ratepayer Impact Measure	0.6
Utility Cost Test	7.8

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

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4. Process Evaluation Results

The evaluation team engaged 20 program participants to explore the issues that were foremost in their minds regarding the Self Direct Program. Program managers for both AEP Ohio and the implementation contractor provided their input for the evaluation.

4.1 Findings from the Interviews of Program Staff

4.1.1 Roles of AEP Ohio and Implementation Contractor

AEP Ohio retained the implementation contractor as its program administrator, responsible for day-to-day operations for most of the Business Programs. AEP Ohio's Prescriptive, Custom, New Construction and Self Direct Program Coordinators reported to an overall Business Program Manager. AEP Ohio staff persons support outreach and marketing, planning, evaluation, and reporting. For the 2013 Self Direct evaluation, Navigant staff interviewed the Self Direct Program Coordinator and members of the implementation contractor operations staff.

the implementation contractor is responsible for program implementation on a day-to-day basis. the implementation contractor collects the applications, tracks the data, prepares the documents for filing with the commission, and provides the engineering staff for Self Direct projects with custom measures. The implementer provides the first level of application review and processing, and calculates the appropriate Self Direct incentive. the implementation contractor conducts a peer engineering review of more complex projects.

AEP Ohio reviews the applications a second time and hands all submission of Self Direct projects to the PUCO. Once the PUCO approves the application, AEP Ohio releases the project for payment and the implementation contractor mails the incentive check.

The implementation contractor provides the project and measure-tracking system, conducts pre- and post-installation metering and inspections, as appropriate, and issues checks after the project is approved. The implementation contractor handles customer communication regarding application processing and approvals, working with AEP Ohio Customer Service Representatives as needed.

4.1.2 Communication

Both the implementation contractor personnel and AEP Ohio personnel agreed that they work collaboratively on the Self Direct Program. The implementation contractor and AEP Ohio program coordinators may discuss details of the program numerous times a day. Team meetings are held weekly to coordinate program issues. The implementer participates in AEP Ohio's quarterly seminars for customers and/or Solution Providers.

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4.1.3 Marketing Strategy

Implementation contractor personnel, AEP Ohio program coordinators, and Customer Service personnel share responsibility for promoting the Self Direct Program. The implementation contractor and AEP Ohio partner to present informational presentations at trade shows/expos/seminars, and to community groups such as the Chamber of Commerce and the Ohio Manufacturers Association, along with the other Business Programs in the portfolio. The Self Direct Program has no explicit budget for marketing.

While AEP Ohio and the implementation contractor continued to meet with customers as requested, the Self Direct Program was not the major focus of 2013 marketing efforts because of the launch of the Retro-Commissioning Program and the re-launch of the Business Express Program. The Self Direct Program attracted similar numbers of customers as in 2012. The fact sheet and the application represent the full suite of collateral materials that are available. AEP Ohio encourages Solution Providers to use the program as a tool to help customers fund future projects. No marketing changes are planned for 2014 for the Self Direct Program.

4.1.4 Changes in Marketing Segmentation

While no changes were made to efforts underway to market the Self Direct Program, no new marketing segmentation strategies were implemented in 2013.

4.1.5 Improving the Application

Currently, customers can complete the application online using a fillable PDF that they sign electronically. AEP Ohio is working on improving the business sector web site, including developing a fully on-line application. The structure will be more segment-based rather than program-based in an attempt to simplify the process for customers.

4.1.6 Customer Satisfaction

Customers have generally been giving positive feedback about the Self Direct program to AEP Ohio. Customer complaints about the rebate are few.

4.1.7 Changes to the Program in 2013

AEP Ohio and the implementation contractor did not implement any changes to the Self Direct Program in 2013..

4.1.8 Program Challenges

Program personnel indicated several challenges with the Self Direct Program:

1. The structure of the program is a disadvantage, since all projects and payments must be approved by the PUCO, a process which takes up to 60 days.

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2. The Self Direct Program is not marketed independently and no marketing dollars are spent on it separately from other programs. The program is used to 'prime the pump' by providing funds for current program participation.

3. Additional challenges include lack of awareness of the program and the amount of time it takes to fill out the application.

4.2 Findings from the Participant Surveys

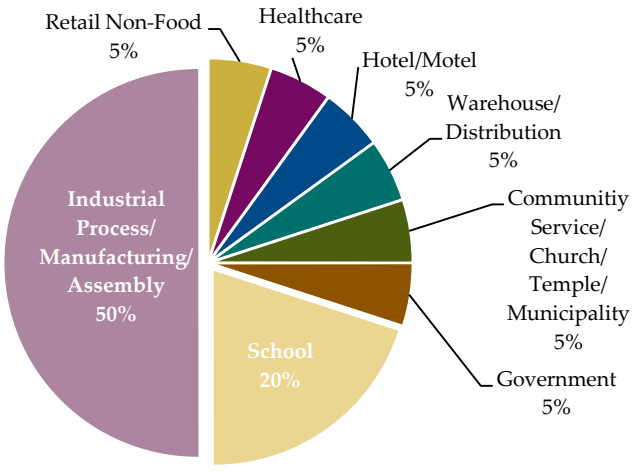
This section presents Navigant's detailed findings from the Self Direct program participant surveys.

4.2.1 Profile of Participating Survey Respondents

The telephone survey effort began with 51 unique contact names, and the evaluation team was able to complete surveys with 20 program participants, a response rate of 39 percent, slightly higher than the 33 percent response rate achieved last year. The team could not make contact with the remaining potential respondents either because of repeated calls with no answer, an answering machine, or a person who screened incoming phone calls.

As shown in *Figure 4-1. Profile of Survey Respondents*, 50 percent of the survey respondents are engaged in some type of manufacturing or industrial process. Schools make up the second largest share (20%), and the remaining survey respondents come from a variety of sectors.

Figure 4-1. Profile of Survey Respondents



Source: 2013 AEP Ohio Self Direct Survey, N=20.

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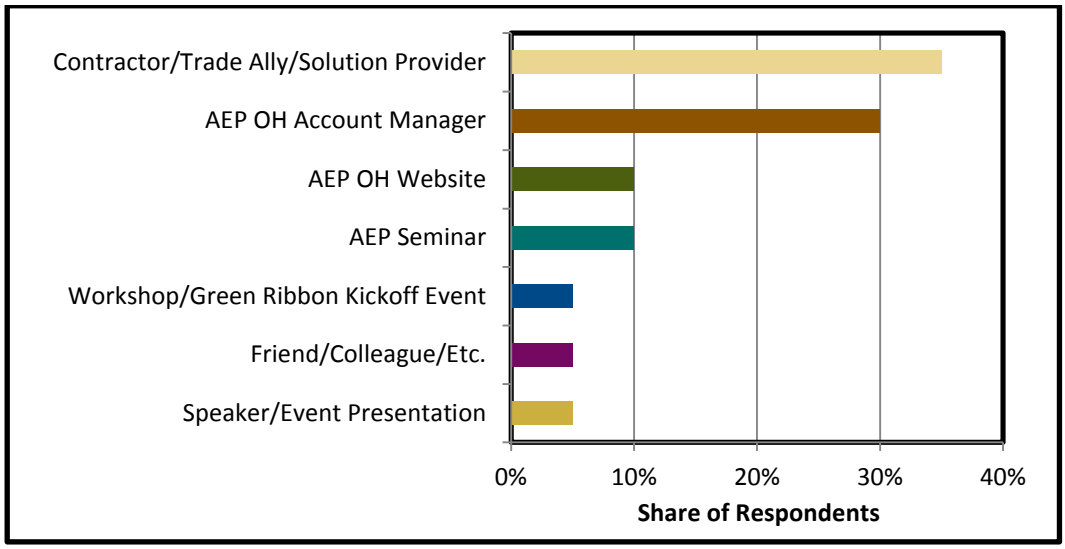
4.2.2 Learning About The Program

As seen in Figure 4-2, survey respondents first heard about the program primarily through a contractor (35%) or their AEP Ohio account manager (30%).

Figure 4-2. First Source of Program Information



Source: 2013 AEP Ohio Self Direct Survey, N=20.

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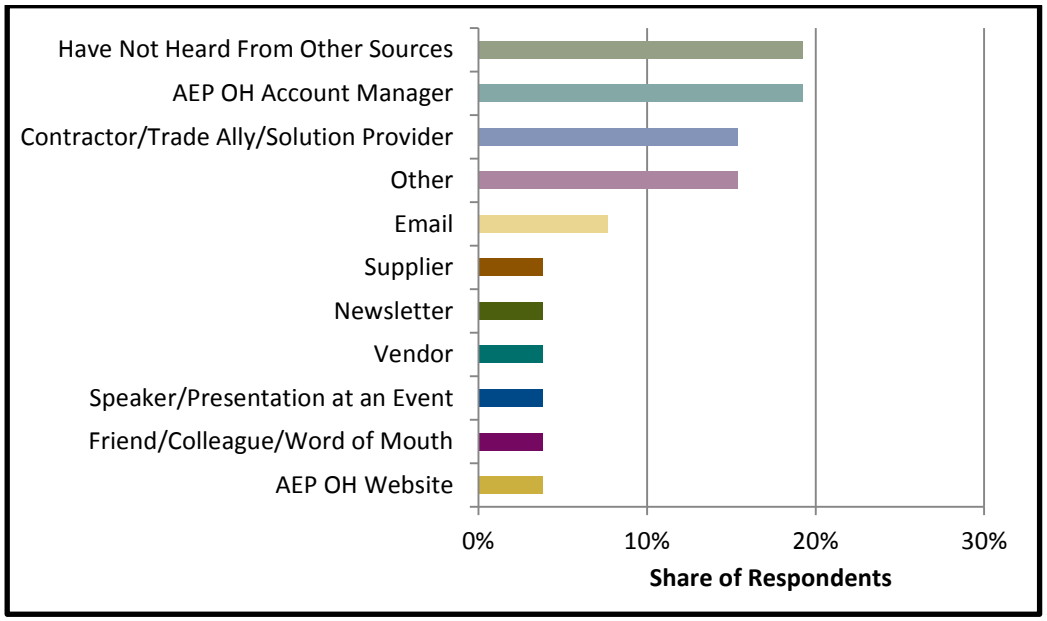
Survey respondents were then asked about sources of information for the program after they first became aware of it. As shown in Figure 4-3, no single source represented more than one-quarter of the responses. Most frequently cited secondary responses included: None (have not heard from other sources, 19%), AEP Ohio Account Manager (19%), or contractors/other trade ally/solution provider (15%).

Figure 4-3. Secondary Sources of Information about the Self Direct Program



Source: 2013 AEP Ohio Self Direct Survey, N=20. Multiple Responses Accepted.

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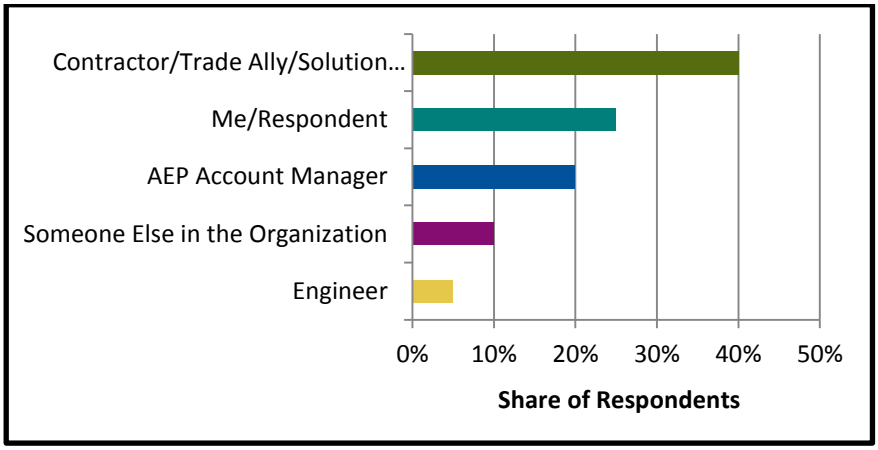
4.2.3 Identifying the Program Opportunity

As seen in Figure 4-4, contractors/other trade allies (40%) were the most commonly cited parties for identifying the opportunity to participate, with respondents themselves (25%) and AEP Ohio account managers (20%) following respectively.

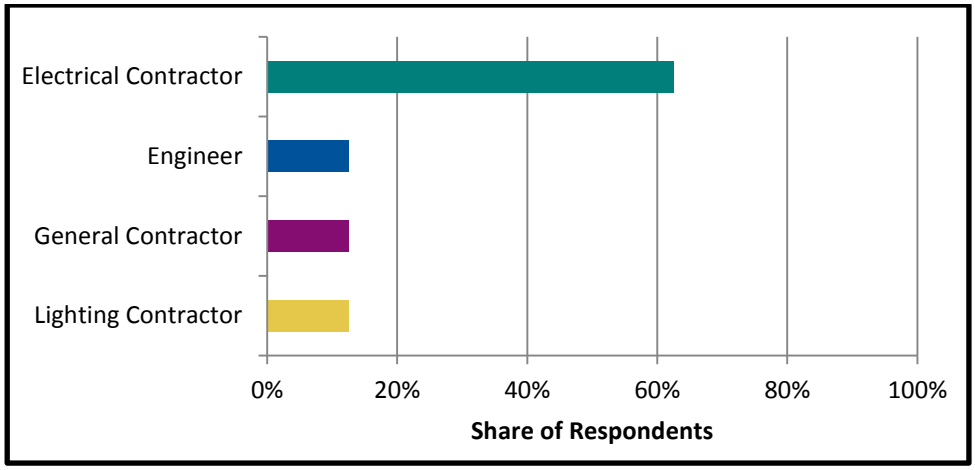
Figure 4-4. Person Responsible for Identifying Program Opportunity



Source: 2013 AEP Ohio Self Direct Survey, N=20.

As shown in Figure 4-5, electrical contractors were the most frequently cited contractor type to provide program information (63%). Engineers, general contractors, and lighting contractors all represented 13 percent shares.

Figure 4-5. Most Frequently Cited Solution Providers Providing Program Information



Source: 2013 AEP Ohio Self Direct Survey, N=20.

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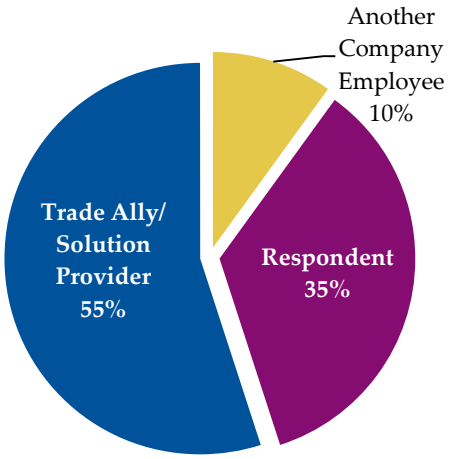
4.2.4 Application Process

As seen in Figure 4-6, more than half of the survey respondents indicated the program application was completed by a trade ally/solution provider (55%). Thirty-five percent indicated that they filled out the program application personally, and 10 percent reported that it was completed by another company employee.

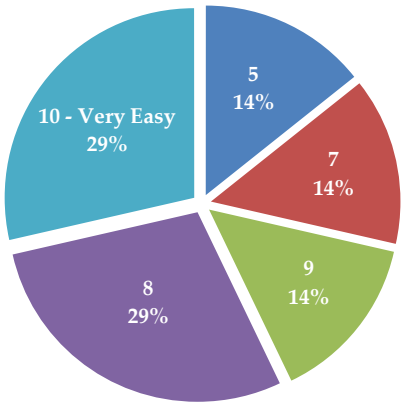
Figure 4-6. Who Completed the Program Application?



Source: 2013 AEP Ohio Self Direct Survey, N=20.

Respondents who completed the application were asked to rate the application process on a 0 to 10 point scale, where 0 represents 'very difficult' and 10 represents 'very easy'. Eighty-six percent of respondents were satisfied with the process (defined as 7 or greater on the 10-point scale), and no respondents scored the difficulty of the application process below a five.

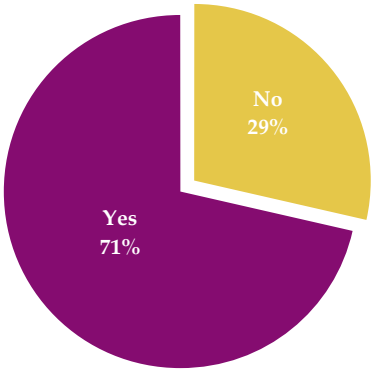
Figure 4-7. Self Direct Application Process Rating (10='Very Easy', 0='Very Difficult')



Source: 2013 AEP Ohio Self Direct Survey, N=7 .

As shown in Figure 4-8, 71 percent of respondents found that the paperwork requirements were clear for participation in the Self Direct Program.

Figure 4-8. Clarity Regarding Required Paperwork Submission



Source: 2013 AEP Ohio Self Direct Survey, N=7.

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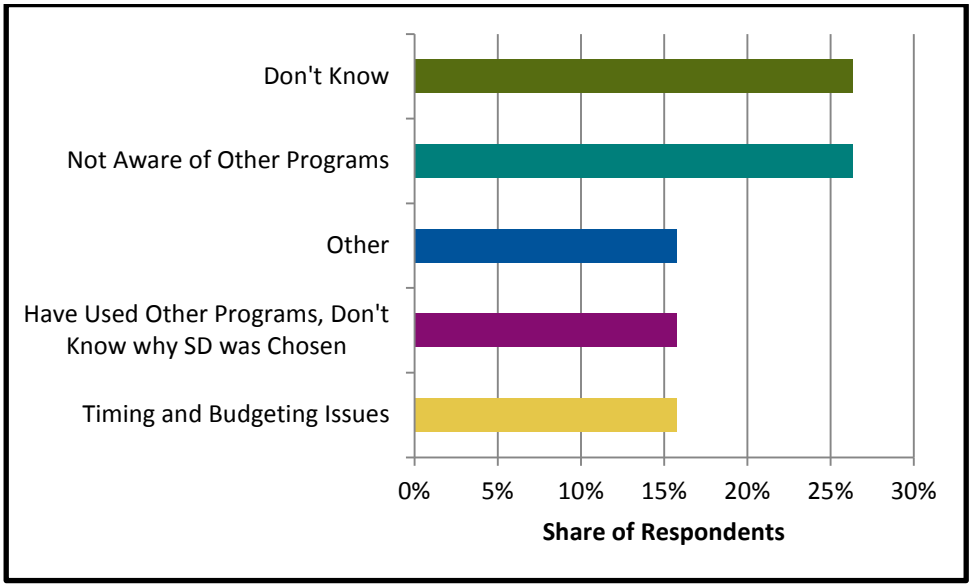
4.2.5 Reasons for Selecting Self Direct Over Other Programs

Respondents provided a number of reasons for choosing the Self Direct Program (where they receive only 75 percent of the rebate) over the Prescriptive or Custom Programs. As shown in Figure 4-9, customers either typically don't know (26%), are not aware of other programs (26%), or other (16%). Of the five survey respondents who said they were not aware of other AEP Ohio Programs, two were informed of the opportunity by an AEP Ohio representative (manager), two were informed by a Solution Provider, and one found out about the program from attending a presentation by AEP Ohio. These findings appear to indicate a basic lack of knowledge among about one-fourth of participants with respect to how the Self Direct Program differs from other program offerings, and what other offerings may be available to them.

Figure 4-9. Reasons for Choosing the Self Direct Program over Other Programs

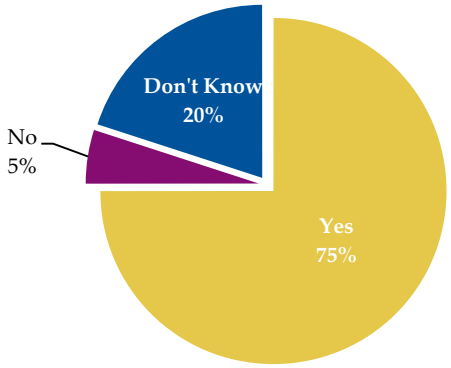


Source: 2013 AEP Ohio Self Direct Survey, N=19.

When asked about satisfaction with the level of incentives offered through the Self Direct Program, 100 percent of survey respondents reported they were satisfied (N=20), with the option of a 'Yes' or 'No' response. When contrasted with findings from Figure 4-9, this finding may suggest that program participants are not investigating other opportunities due to satisfaction with the incentives already offered by the Self Direct Program. Furthermore, 95 percent of respondents (N=20) indicated they intended to participate in the Self Direct Program in the future.

As shown in Figure 4-10, 75 percent of respondents indicated they will use the incentive to fund other energy efficiency projects.

Figure 4-10. Will the Incentive be used to Conduct Future EE Projects?

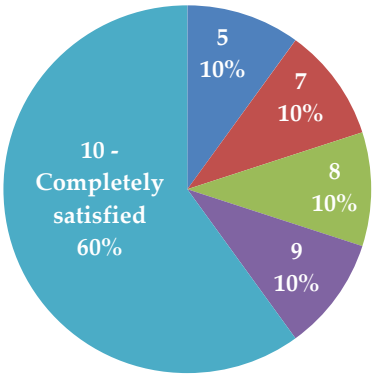


Source: 2013 AEP Ohio Self Direct Survey, N=20

4.2.6 Communications

Figure 4-11 shows that 60 percent of survey respondents were 'completely satisfied' with their communications with AEP Ohio. All respondents reported a score of five or greater, indicating mean satisfaction was overall positive. A number of comments indicated staff were 'responsive'.

Figure 4-11. Customer Satisfaction Regarding Communications with AEP Ohio and Program Personnel (10='Completely Satisfied', 0='Not at all Satisfied')



Source: 2013 AEP Ohio Self Direct Survey, N=20.

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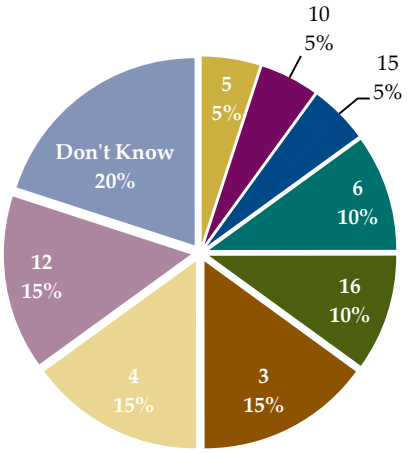
As shown in Figure 4-12, the length of time to receive an incentive after application submission was variable. About two –thirds of respondents received the inventive in 12 weeks or less (65%).

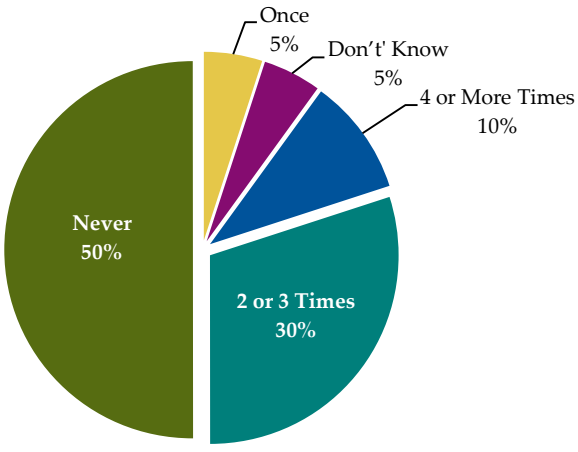
Figure 4-12. After Application Submission, How Many Weeks to Receive Incentive?



Source: 2013 AEP Ohio Self Direct Survey, N=20.

As shown in Figure 4-13, 50 percent of respondents never contacted AEP Ohio or the implementation contractor outside of the application submission. Only five percent contacted the program once, 30 percent contacted the program two to three times, with smaller shares reporting contacting the program four or more times.

Figure 4-13. How Often Did You Contact AEP Ohio or Implementation Contractor Other than for Application Submission?



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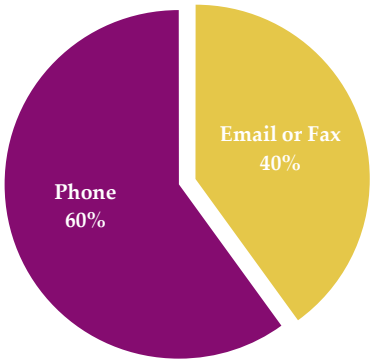
Source: 2013 AEP Ohio Self Direct Survey, N=20.

As shown in Figure 4-14, 60 percent of respondents reported the phone was the primary method of contacting AEP Ohio or program staff, while 40 percent reported the primary method was either email or fax.

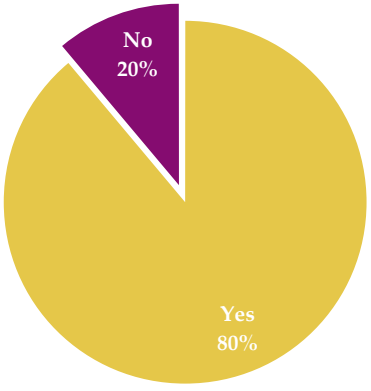
Figure 4-14. Primary Method of Contacting AEP Ohio or Implementation Contractor



Source: 2013 AEP Ohio Self Direct Survey, N=20

As shown in Figure 4-15, 80 percent of respondents were informed and aware that the final payment required the approval of the PUCO.

Figure 4-15. Was the Customer Informed Incentive Payment Required the Approval of PUCO?



Source: 2013 AEP Ohio Self Direct Survey, N=20.

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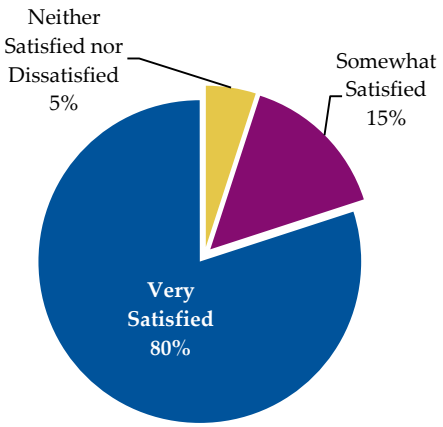
4.2.7 Satisfaction with the Self Direct Program

Respondents were asked to rate the Self Direct Program on a 1-5 point satisfaction/dissatisfaction scale. As shown in Figure 4-16, overall satisfaction with the Self Direct Program was high, with 80 percent of respondents reporting they were *very satisfied*15 percent reporting they were *somewhat satisfied*. No respondents reported they were either *somewhat dissatisfied* or *very dissatisfied*.

Figure 4-16. Overall Satisfaction with the Self Direct Program



Source: 2013 AEP Ohio Self Direct Survey, N=20.

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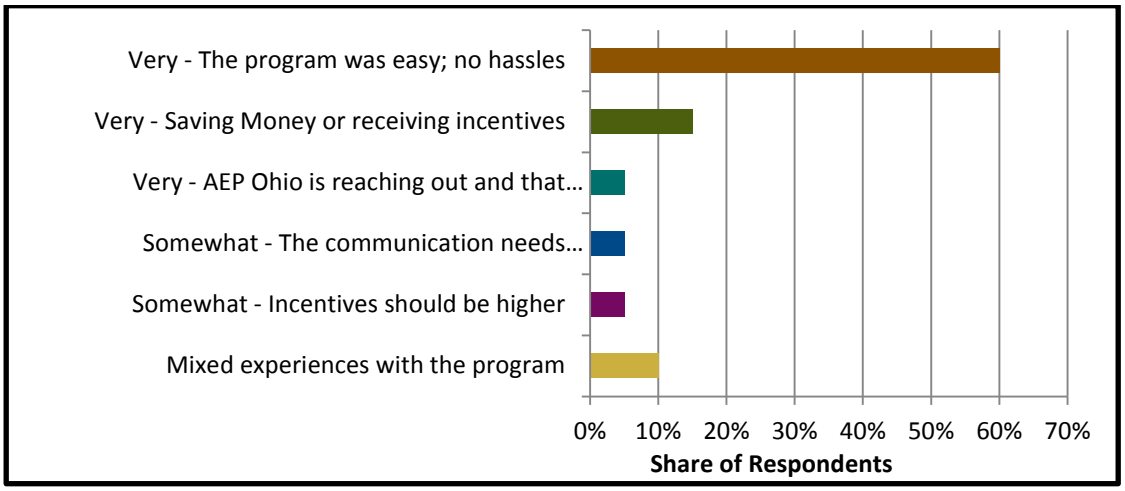
As detailed in Figure 4-17, in addition to 80 percent reporting they were *very satisfied* with the Self Direct program, 60 percent indicated that program participation was 'easy with no hassles', and 15 percent that they were *very satisfied* as a result of saving money or receiving incentives. Twenty percent of respondents were either *somewhat satisfied* or had 'mixed' experiences with the program, with five percent reporting incentives should be higher and that communication needs improving.

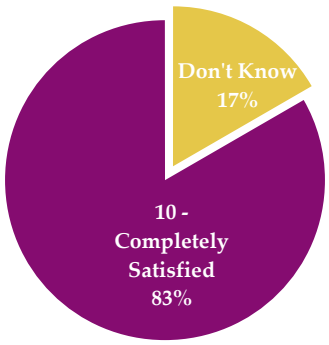
Figure 4-17. Reported Satisfaction with the Self Direct Program



Source: 2013 AEP Ohio Self Direct Survey, N=20.

As shown in Figure 4-18, 83 percent of respondents indicated they were *completely satisfied* with the post-installation inspection. When asked why they chose that rating many responded that the inspectors were thorough and efficient.

Figure 4-18. Satisfaction with the Post-Installation Inspection



Source: 2013 AEP Ohio Self Direct Survey, N=6.

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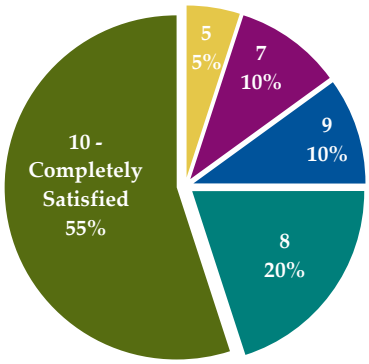
As shown in Figure 4-19, 55 percent of customers reported they were 'completely satisfied' with the length of time it took to receive the incentive payment and 95 percent of respondents reported a rating of 7 or higher on a 10 point scale, indicating overall satisfaction ('satisfied' is defined as a 7 or higher).

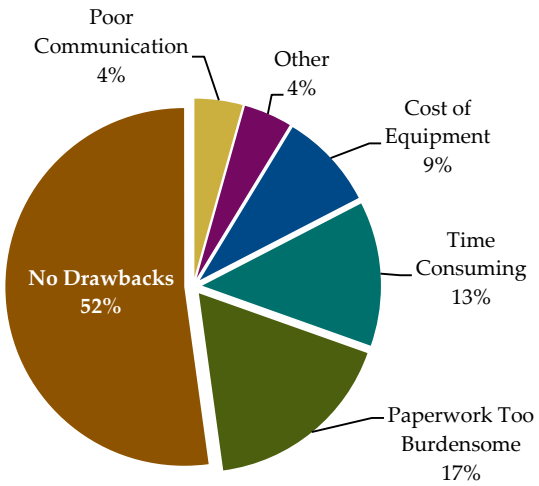
Figure 4-19. Satisfaction with time to Receive Incentive Payment (10='Completely Satisfied', 0='Not at all Satisfied')



Source: 2013 AEP Ohio Self Direct Survey, N=20.

As shown in Figure 4-20, 52 percent of respondents reported there were *no drawbacks* to participation in the Self Direct Program. The primary reported drawbacks included that the paperwork was burdensome (17%) and that participation in the program was time-consuming (13%).

Figure 4-20. Reported Drawbacks to Participation in the Program



Source: 2013 AEP Ohio Self Direct Survey, N=20. Multiple responses accepted.

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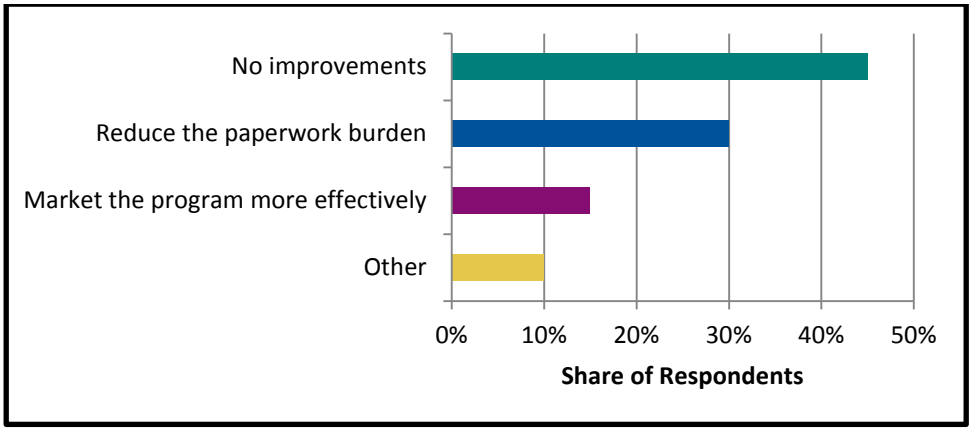
Figure 4-21 reflects the high satisfaction levels shown in Figure 4-17, with 45 percent reporting *no improvements* to the program are necessary. Thirty percent of respondents indicated the paperwork burden could be reduced and 15 percent that the program could be more effectively marketed.

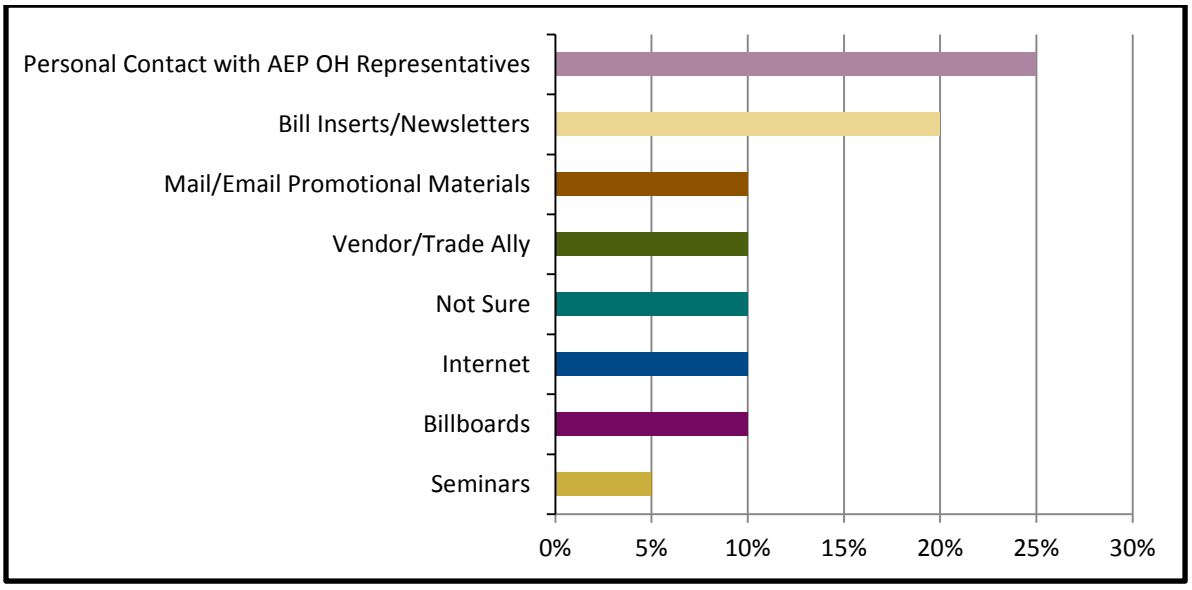
Figure 4-21. Ways to Improve the Self Direct Program



Source: 2013 AEP Ohio Self Direct Survey, N=20.

Figure 4-22 reflects respondents' opinions on how AEP Ohio can best reach out to inform more customers about energy efficiency programs. Personal contact with an AEP Ohio representative (25%) and bill inserts/newsletters (20%) were the most common responses, and a series of other responses were reported by 10 percent or fewer survey respondents.

Figure 4-22. How Should AEP Ohio Reach Customers about these Programs?



Source: 2013 AEP Ohio Self Direct Survey, N=20.

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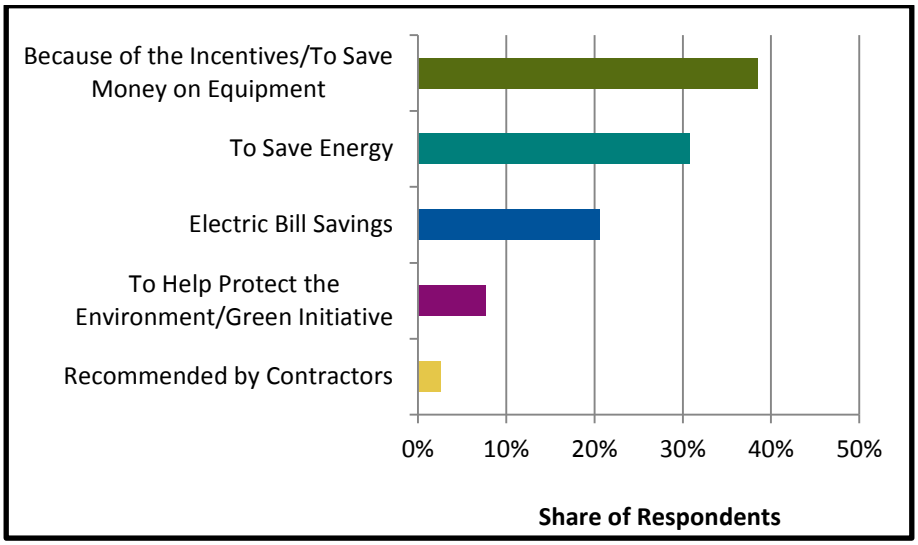
4.2.8 Reasons for Participating in the Program

The Self Direct Program pays incentives for projects that have already been completed by the customer. The most cited reason for participation was the program incentive, reported by 38 percent of the respondents (see Figure 4-23). Other reasons included energy savings (31%) and bill savings (21%).

Figure 4-23. Reasons for Participation



Source: 2013 AEP Ohio Self Direct Survey, N=20. Multiple Responses Accepted.

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5. Key Findings and Recommendations

This section presents the key findings and recommendations from the 2013 Self Direct program impact and process evaluations.

5.1 Key Impact Findings and Recommendations

1. The 2013 realization rate (defined as *ex post* savings / *ex ante* savings) for the Self Direct Program was 0.96 for energy savings and 1.07 for demand savings. The relative precision at the two-tailed 90 percent confidence interval was ± 9.1 percent for energy and ± 6.8 percent for demand. Overall, the implementation contractor is doing a good job estimating the savings resulting from the Self Direct Program.

2. Custom and lighting measures provided the majority of *ex ante* energy savings for the program (52 percent and 38 percent, respectively).

3. Projects involving large-scale municipal lighting installations (e.g. traffic lights and street lights) tend to be difficult to document and verify, because municipalities cover large areas and tend to install fixtures gradually. Navigant evaluated a large traffic light project as part of the 2013 Self Direct sample, and due to limited documentation, had difficulty obtaining the necessary information to verify the installations.

   Impact Recommendation #1: Navigant recommends that the implementation contractor provide ample documentation of where municipal lighting measures are installed to enable onsite verification, particularly for projects that make up a significant fraction of the program's savings (greater than 5 percent).

4. In 2013, Navigant discovered a greater discrepancy between the *ex ante* savings reported in the database and the *audited* savings, as compared to 2012 where the difference was negligible. The discrepancy was due to an error in the lighting calculation spreadsheet.

   Impact Recommendation #2: Navigant recommends that the implementation contractor reviews its lighting analysis template for prescriptive measures to ensure that the savings are being calculated as intended based on what is stated in the implementation contractor's Workpapers.

5. Navigant adjusted the deemed savings inputs for 38 percent of the measures and 15 percent of the reported energy savings from the Self Direct program. The categories of adjustment included operating hours, coincidence factors, HVAC interactive effects, T12 baselines, HP/RW fixture

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wattage, and lighting controls. These adjustments led to a 0.04 percent decrease in energy savings and a 0.20 percent decrease in demand savings.[11]

Impact Recommendation #3: Navigant recommends that the implementation contractor apply Navigant's adjusted per-unit savings values to Self Direct Program measures in future years.

5.2 Key Process Findings and Recommendations

1. Overall, 95% of the twenty program participants in our sample are *very or somewhat* satisfied with the Self Direct Program. None of the program participants reported any level or dissatisfaction with the program.

2. The program is exceeding its kWh goals and 75% of the customers surveyed are using the incentive to fund other energy efficiency projects, thereby helping AEP Ohio achieve one of its qualitative program goals.

3. As previously recommended, AEP Ohio emailed all customers eligible for the Self Direct Program in 2013 to inform them of their other program choices. Despite this targeted effort, when asked why they chose to participate in the Self Direct Program, customers indicated that:

    a. Self Direct Program incentives were higher than other AEP Ohio business sector programs, or that the Self Direct Program offered rebates for equipment not available through the other programs (however, this is not actually the case).

    b. This was the only program they knew about (suggesting messaging and marketing of AEP Ohio's business sector programs needs to be improved).

    c. That they did not qualify for the Prescriptive Program (and it sounded like they think they never would).

Process Recommendation #1: Customers who participate in the Self Direct Program should be more consistently informed by AEP Ohio, the implementation contractor, or the Solution Provider on how they can participate in the Custom or Prescriptive programs in the future. Only 15 percent of the respondents reported an answer that might be considered logical given the (lack of) Self Direct marketing activities (i.e., they participated in the Self Direct Program because the timing of their participation prevented them from participating in these other programs).

AEP Ohio should consider delivering a quarterly or even monthly series of email or direct mail communications to customers to remind them of their potential program choices. Solution Providers and AEP account representatives should also be reminded that customers in the Self Direct Program should always be educated about the other programs.

[11] A more detailed description of the entire Deemed Savings Review methodology and findings is provided in the Prescriptive Program evaluation report.

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4. Customers suggested that the wording of the application could be improved and that the application could be simplified.

   Process Recommendation #2: Retooling the program application for the web site is an opportunity for AEP Ohio to simplify the wording.

5. The on-line application is expected to further increase satisfaction with the application process for those who are willing to use it.

   Process Recommendation #3: While AEP Ohio has made progress toward the on-line application, it was not implemented in 2013. Consider selecting three to five Solution Providers and customers with varied levels of experience with the program to 'test' the online application process before it is offered to all Solution Providers and customers. This may have been implemented in 2013.

6. Staff changes within the implementer took a toll on processing resources for complicated projects in 2013. Some customers still indicate frustration with the length of time needed for processing projects.

   Process Recommendation #4: The program is running quite smoothly overall except for a few temporary issues with engineering resources in 2013 that should be solved in 2014. AEP Ohio and the implementation contractor should develop a more efficient process for reviewing complicated Self Direct Program applications in 2014. The Navigant Team suggests that the implementation contractor conduct a succession planning exercise for their senior engineering staff in Ohio to prevent such a situation in the future.

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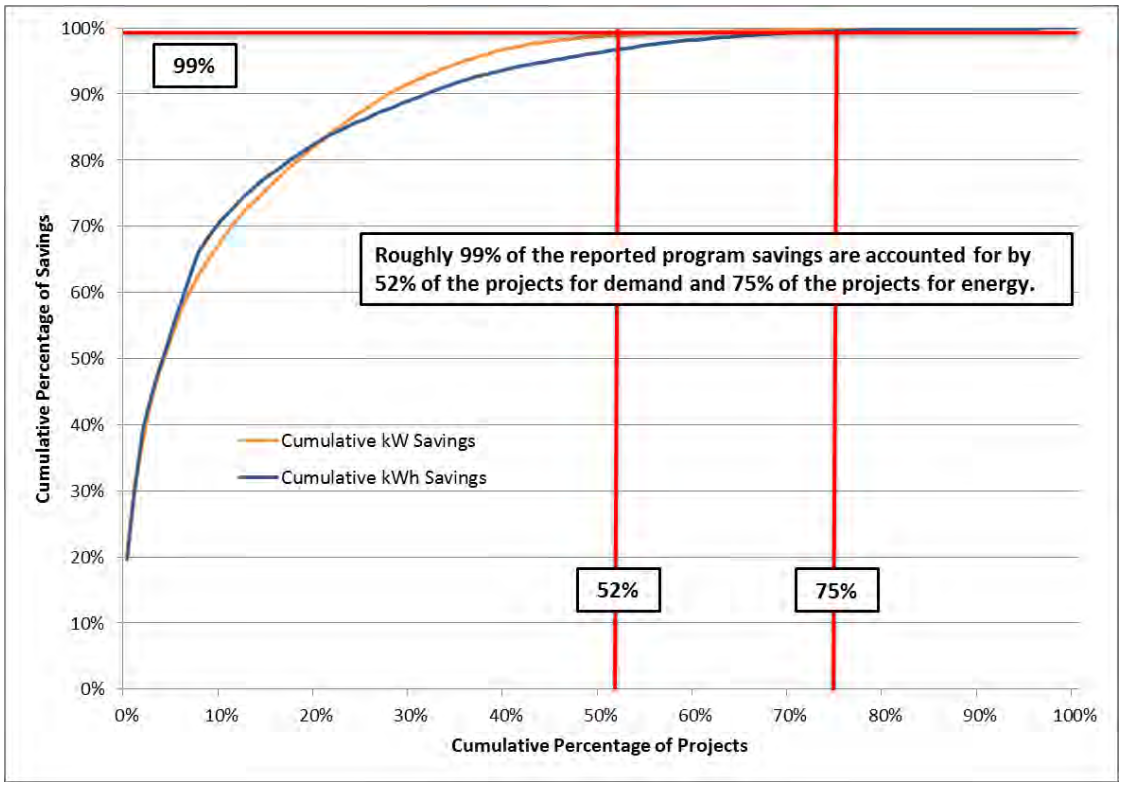
Appendix A. Impact Evaluation

A.1 Impact Evaluation Sample Design

The savings summaries from the Tracking System Review task revealed that the top 75 percent of projects (based on individual project energy savings) accounted for 99.7 percent of the energy savings, while the top 52 percent of projects (based on individual project demand savings) account for 98.7 percent of the demand savings.

Figure A-1. Cumulative Percentage of Savings vs. Cumulative Percentage of Projects

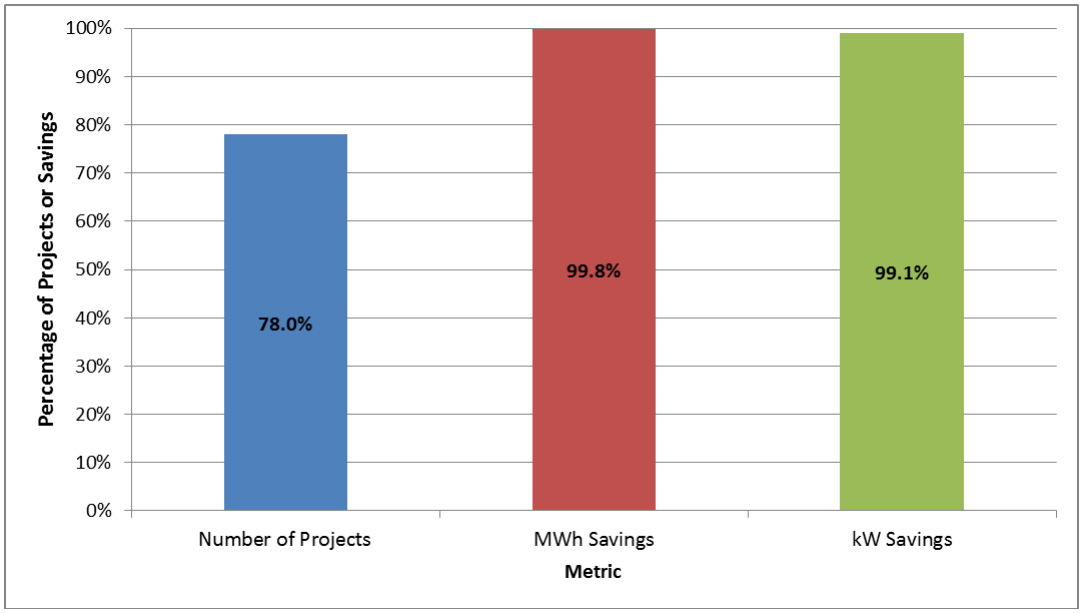


Source: Evaluation Analysis of 2013 AEP Ohio Tracking Data

The evaluation team subsequently set review thresholds of 7,500 kWh per project and 1.5 kW per project. If a project met neither criterion, it was removed from the sample frame. This key step increases the sampling efficiency, since the cost of evaluating very small savings projects exceeds the value of the

information gleaned from them. As shown in Figure A-2, this task resulted in a final sample frame representing more than 99 percent of the savings with just 78 percent of the projects.[12]

Figure A-2. Percentage of the Population Reported Projects and Savings in Sample Frame



Source: Evaluation Analysis of 2013 AEP Ohio Tracking Data

Navigant defined the sample strata by the magnitude of reported savings. Stratifying by project size reduces the overall number of required samples by taking advantage of the concentrations of savings when relatively few projects contribute to a large fraction of total impacts.

A.2 Deemed Savings Review

This section provides more detail on the findings of the Deemed Savings Review discussed in Section 3.2.

Adjustments to Per-Unit Savings Values

As part of the 2012 Deemed Savings Review, Navigant reviewed 32 of the 49 deemed lighting measures in the implementation contractor's Workpapers which, in 2013, make up 15 percent of the reported energy savings and 8 percent of the demand savings. In addition to adjusting the lighting coincidence factors and hours of use, Navigant also made a few measure-specific adjustments as follows:

[12] The percentage of projects meeting either the kWh or kW criteria (78%) is greater than the percentage of projects meeting just the kWh or just the kW criteria (75% and 52%, respectively).

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1. **T12 Baseline**: adjustments to baseline wattage assumption for measures with a T12 lamp/ballast baseline

2. **HP/RW**: adjustments to the energy efficient wattage assumption for the high performance and reduced wattage T8 measures

3. **Controls**: adjustments to lighting controls savings factors

4. **Other**: minor adjustments to other measures with a smaller overall impact

In addition, for 2013, Navigant conducted a critical review of the HVAC interactive effects used by the implementation contractor. Additional information can be found in Navigant's 2012 Deemed Savings Review[13] and in the 2013 Prescriptive Program Evaluation Report.

Calculation of the Audited Savings

As described in Section 2.1.3 , Navigant recalculated the *ex ante* savings for 38 percent (125 of 302 measures) of the reported Self Direct measure installations using the implementation contractor's Workpapers inputs (the "Audited " savings).[14] For the remaining 62 percent of records that could not easily be recalculated, Navigant used the *ex ante* reported savings as a proxy for the *audited* savings value. The resulting audited savings were 1.9 percent lower than the reported energy savings and 2.3 percent lower than the reported demand savings. This error can be attributed to a mistake in the spreadsheet calculator that the implementation contractor uses to determine lighting savings.[15]

Figure A-1 and Figure A-2 provide a comparison of the database (*ex ante*) savings and the audited savings. The black line signifies when the database value equals the audited savings value, i.e., when the deemed savings values in the implementation contractor's Workpapers align with what is in the database. The data points above the line signify when the implementation contractor under-reported on the savings and the data points below the line signify when the implementation contractor over-reported on the savings.

As seen in Figure A-1, the implementation contractor slightly over-reported on the energy savings. The error affects all building types, but affected the Industrial/Manufacturing and Miscellaneous building types the most. Approximately 12 percent of the measures in the database had a percent difference of 10 percent or greater between what was recalculated and what was originally reported[16]. The most common

[13] AEP12- Deemed Savings Review_061313.docx.

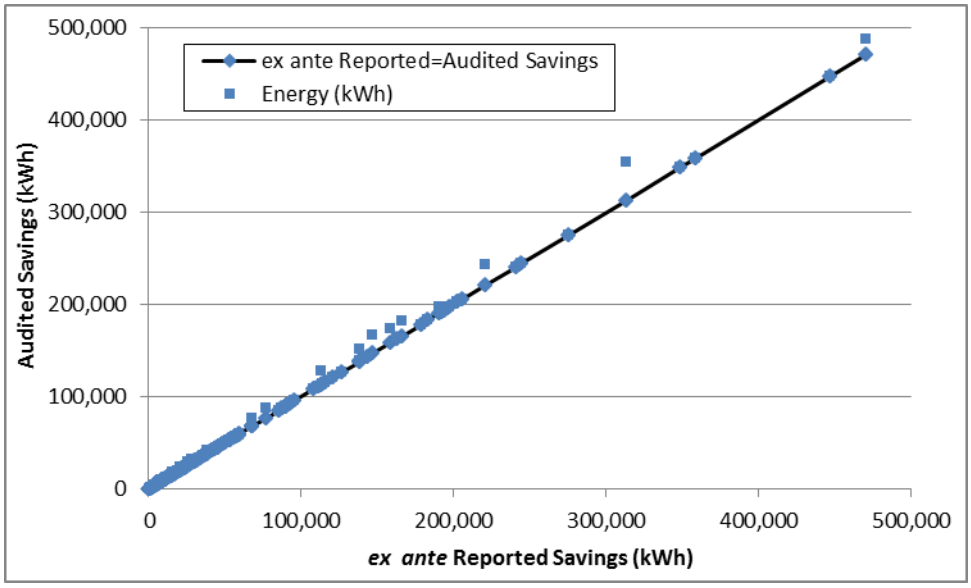
[14] the implementation contractor's methodology for determining savings from lighting measures is to multiply the per-unit savings value from Workpapers by the operating hours and energy HVAC interactive effects (for energy), or the coincidence factor and demand HVAC interactive effects (for demand). The operating hours, coincidence factors, and HVAC interactive effects are all indexed by building type and measure category (CFL, non-CFL, and exit sign). Navigant leveraged this well-documented design to recalculate savings using the same method.

[15] Please refer to the 2013 Prescriptive Program Evaluation Report for more information.

[16] This includes both lighting and non-lighting measures.

measure that was under-reported by more than 10 percent was Interior New T8/T5 Fluorescent Fixtures. Approximately 30 percent of the lighting measures that Navigant recalculated had a percent difference greater than 10 percent from the reported energy savings in the database[17].

Figure A-1. Comparison of *Ex Ante* Reported (x-axis) and Audited (y-axis) Energy Savings



Source: Navigant's 2013 Deemed Savings Review.

[17] This percentage is only based on the 5,357 lighting measures that Navigant recalculated.

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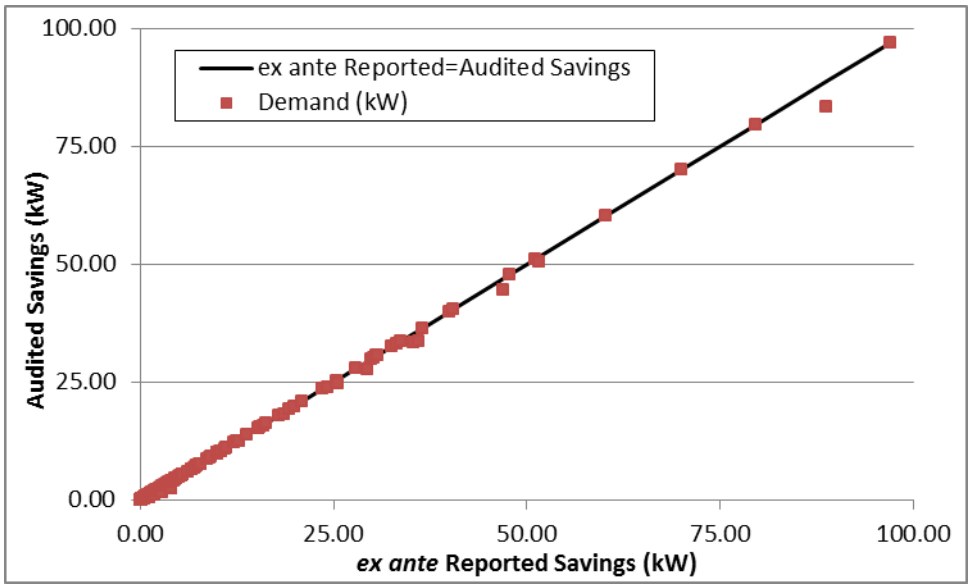
As seen in Figure A-2, the implementation contractor slightly over-reported on demand savings, however a majority of the audited savings were equal to the database savings.

Figure A-2. Comparison of *Ex Ante* Reported (x-axis) and Audited (y-axis) Demand Savings



Source: Navigant's 2013 Deemed Savings Review.

Calculation of Navigant's Engineering Adjusted Savings

Navigant also recalculated the *ex ante* savings using Navigant's *engineering adjusted* per-unit savings values as previously described. This exercise was completed on the exact same set of measures (38 percent of the total) as the *audited* savings calculations, and the remaining 62 percent of measures used the *ex ante* reported values as a proxy for the adjusted savings values.

Figure A-3 and Figure A-4 show a comparison between the *ex ante* reported savings (x-axis) and engineering adjusted savings (y-axis) for energy and demand. The data points below the line mean that Navigant's engineering adjustments resulted in a decrease in the savings, and the data points above the line resulted in an increase in the savings.

As seen in Figure A-3, Navigant's engineering adjusted savings were approximately equal to the reported savings. The data points above the line are New T8/T5 Fluorescent Fixtures with the building type "Industrial Manufacturing." The percent difference is primarily due to the database issue discussed above.

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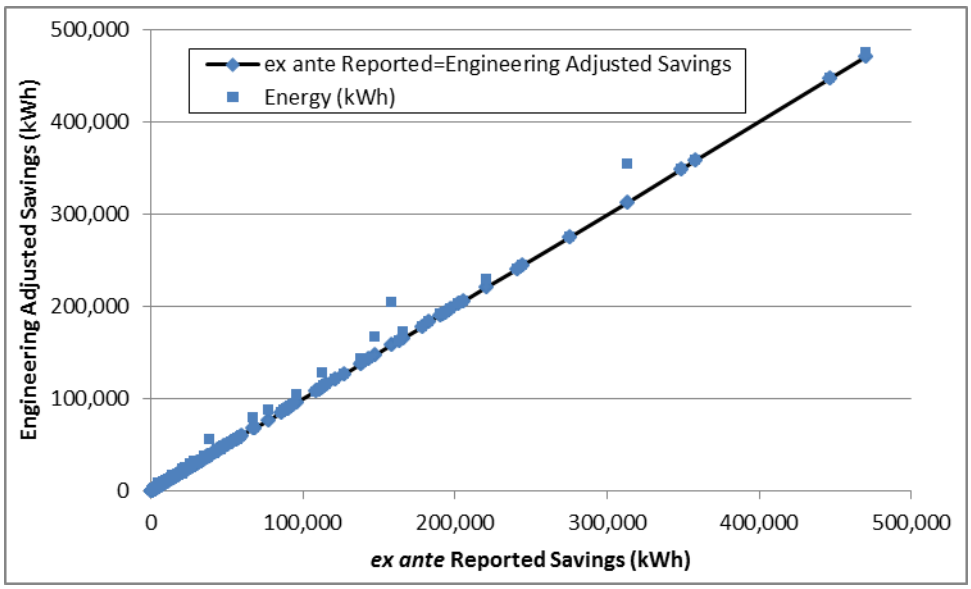
Figure A-3. Comparison of *Ex Ante* Reported (x-axis) and Engineering Adjusted (y-axis) Energy Savings



Source: Navigant's 2013 Deemed Savings Review.

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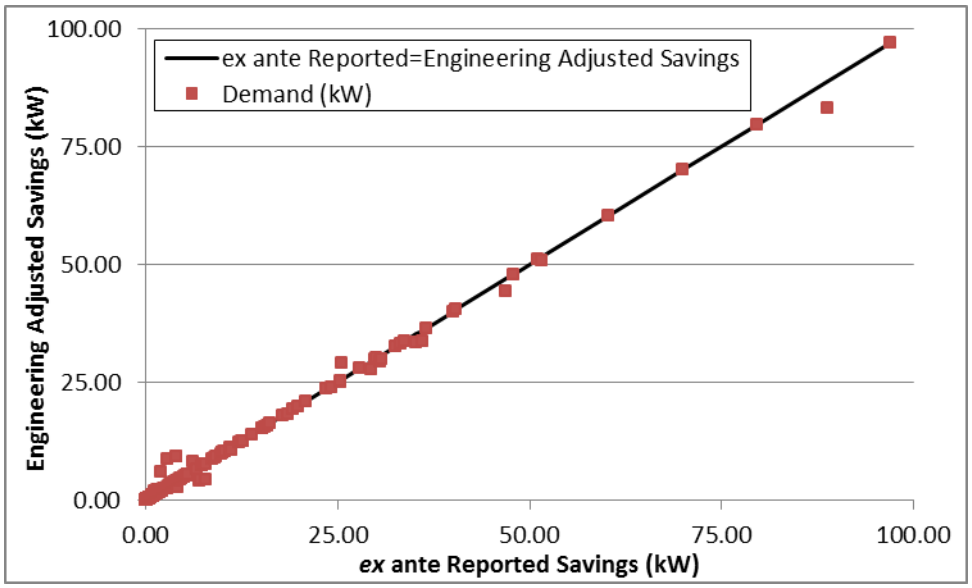
As seen in Figure A-4, Navigant's engineering adjusted savings resulted in a minimal increase in the demand savings as compared to those reported in the database. The primary driver for this trend is Interior Occupancy Sensors, which is the small cluster of data points at the bottom left of the following figure.

Figure A-4. Comparison of *Ex Ante* Reported (x-axis) and Engineering Adjusted (y-axis) Demand Savings



Source: Navigant's 2013 Deemed Savings Review.

Findings from Deemed Savings Review

Illinois TRM Approach for Calculating HVAC Interactive Effects

The energy and demand HVAC interactive effects in the Illinois TRM are based on the following algorithm:

Equation 5-1: Standard Equation Used in Illinois TRM to Calculate HVAC Interactive Effects

$$Interactive\ Effect = \frac{Building\ Usage_{Prototype} - Building\ Usage_{LPD\ Measure}}{Lighting\ Usage_{Prototype} - Lighting\ Usage_{LPD}}$$

For each building type in the Illinois TRM there are two models: the prototype (baseline) and the LPD Measure (efficient case), which assumes a 20 percent reduction in lighting power density from the baseline case. Each of the models are then run with the five Illinois weather zones and the energy and demand interactive effects are calculated for each of the weather zones using the equation above. In order to calculate the overall interactive effect for each building type, a simple average of the five weather zones is used, with the exception of when there are faulty outputs from the models and those

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values are thrown out. In multiple instances, the outputs from eQUEST resulted in HVAC interactive effects with negative values or values less than one and therefore were left out of the simple average.

The energy interactive effects are calculated using the hourly output file from eQUEST, which lists the hourly energy usage for each end use for the entire year. The building usage is based off of a sum of the "Total End-Use" energy for the entire year and the lighting usage is based off of the sum of the "Lighting End-Use" energy for the entire year. The demand interactive effects are based off of the "Report: PS-E Energy End-Use Summary for all Electric Meters" from eQUEST. The building usage and the light usage are based off of the day with the maximum kW, which doesn't necessarily fall during the peak demand period.

Concerns in Using Illinois TRM

Navigant reviewed both the building models and the assumptions used to generate the Illinois TRM HVAC interactive effects, as well as the implementation contractor's application of those values. In general, the HVAC interactive effects developed for the Illinois TRM and applied to the 2013 the implementation contractor's Workpapers are consistent with standard practice, with a few exceptions as follows.

1. The Illinois TRM modeled all building types (except for hotel/motel guest rooms) with gas heat; therefore the HVAC interactive effect only recognizes the cooling season savings and not the heating season penalty. For systems with electric heat this penalty should be taken into consideration. Version 3.0 of the Illinois TRM takes into account these penalties.

2. The HVAC interactive effects for the building types in the Illinois TRM are a simple average of the outputs from the five weather zones in Illinois. However, some of the models had erroneous outputs and thus were not included. For example, the eQUEST model for the Illinois TRM building type High School had negative energy HVAC interactive effects for four of the five weather zones, so the value in the TRM is based off of one weather zone.

3. The mapping of the eQUEST model building types to the building types in the Illinois TRM and the implementation contractor's Workpapers are not always an accurate approximation. For example, the Grocery building type in the Illinois TRM is based off of the outputs from the Convenience Store eQUEST model.

4. The demand HVAC interactive effect in Table 3 of the 2013 the implementation contractor Workpapers for "Education—Secondary School" is based off of the Illinois TRM building type "High School/Middle School," which has a likely erroneous demand HVAC interactive effect value of 0.74. Per the mapping in Workpapers, the building type "Education—Secondary School" is averaged with "Education – Primary School" for the building type "School" and it is likely an underestimation of the savings.

5. The demand HVAC interactive effects in the Illinois TRM are based on the day during the year with the maximum demand usage, which is not consistent with the AEP Ohio peak demand period.

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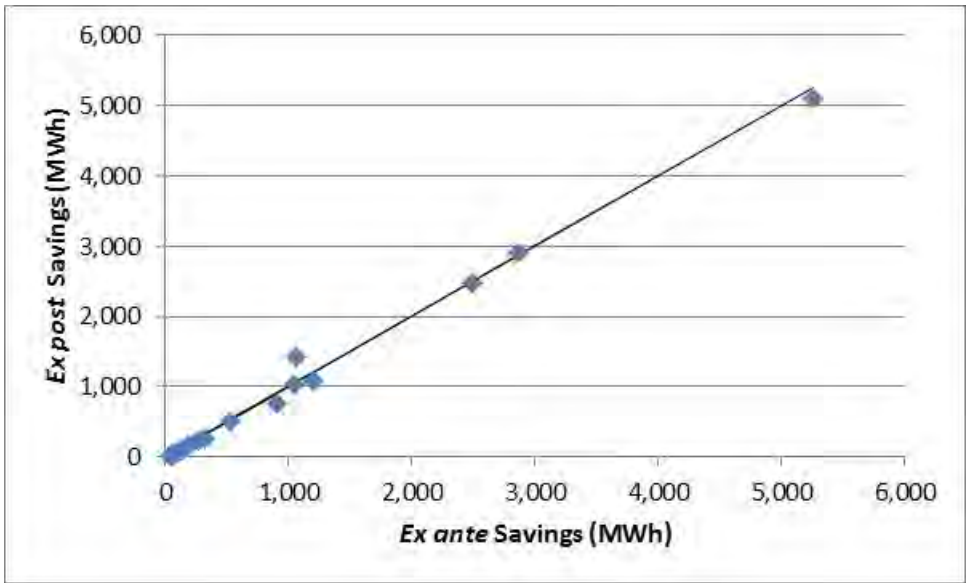
A.3 Findings from Technical Review and Onsite Data Collection

Figure A-5 and Figure A-6 show the *ex ante* and *ex post* verified savings of each sampled project for energy and demand savings, respectively. The data points above the diagonal line represent projects with realization rates greater than one, while data points below the line represent those with realization rates less than one. The results of the technical review and onsite verification visits show that the *ex post* verified savings were in line with the *ex ante* savings, aside from two outliers in Figure A-6.

Figure A-5. Comparison of *Ex Ante* and *Ex Post* Energy Savings



Source: Navigant Analysis

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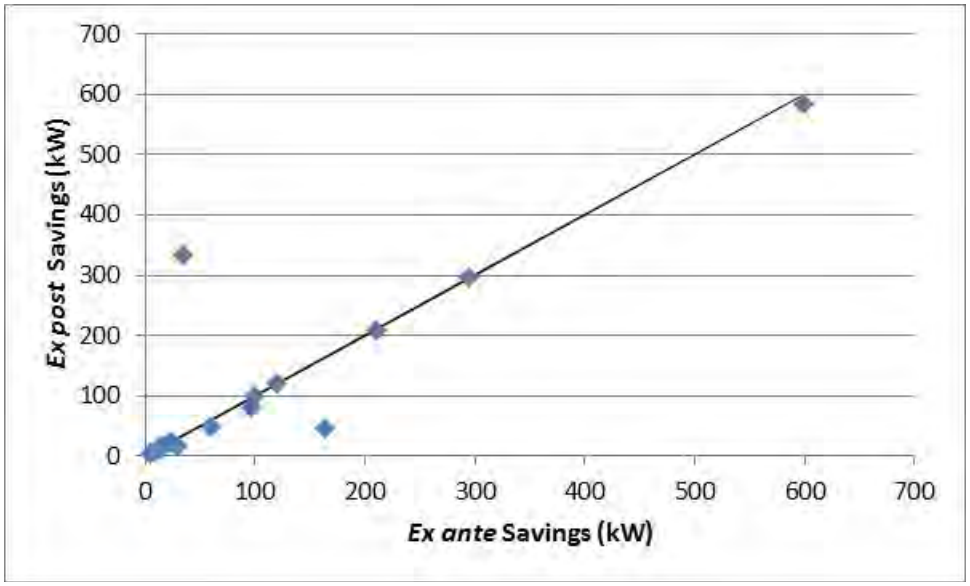
Figure A-6. Comparison of *Ex Ante* and *Ex Post* Demand Savings



Source: Navigant Analysis

Figure A-7 shows the relative impact of various discrepancies on the overall savings estimates. Positive changes represent an increase in verified savings compared to the *ex ante* savings, while negative changes represent a decrease. The discrepancy categories are defined as follows:

- **Fixture Quantity** – A change in the fixture quantity, resulting in a change in the ΔWatts
- **Updating Workpapers** – An update from the savings calculation methods from the 2012 Workpapers to those from the the implementation contractor 2013 Workpapers
- **Fixture Type** – A change in the fixture wattage of one or more fixture types, resulting in a change in the ΔWatts
- **HOU (Reported)** – A change in the annual operating hours based on the customer interview for onsite verification visits
- **Building Type** – A change in the building type used to describe the site, resulting in different annual operating hours, coincidence factor, and HVAC interaction factors
- **Custom** – A change made to a custom project that does not fall into any of the above categories

There were minor impacts on the energy realization rate from changes to fixture quantity, customer-reported hours of use, building type, and custom measure assumptions. The primary impacts on realization rate for demand are the Fixture Quantity and Custom categories. The Custom category is driven primarily by one large project that involved the installation of VFDs on two large motors. The demand savings were recalculated to more closely reflect the way AEP Ohio calculates peak demand usage, leading to a large increase in kW savings. Rather than using the maximum kW value over a three year period of data, Navigant calculated the average kW in the AEP Ohio peak period.

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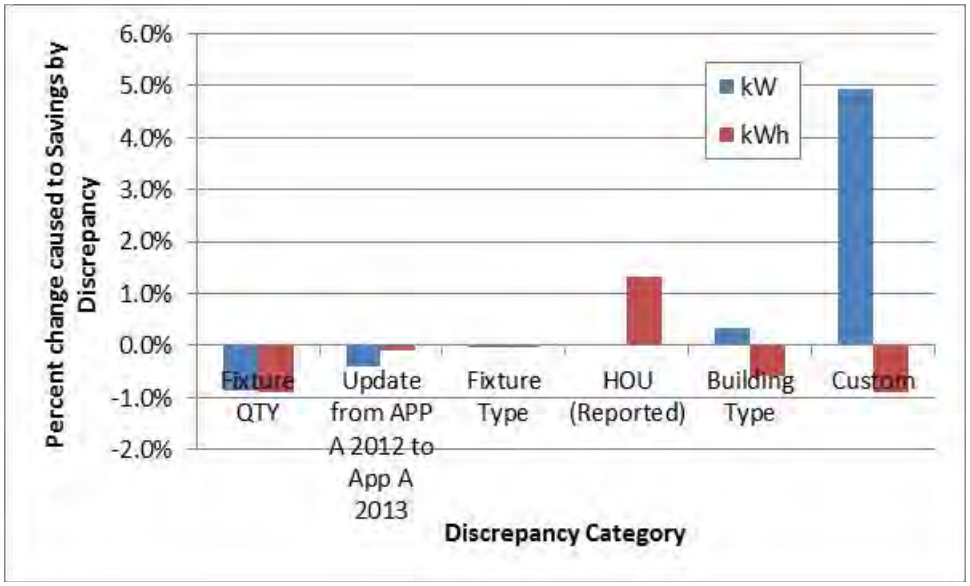
Figure A-7. Relative Impact of Different Drivers on Self Direct Project Realization Savings



Source: Navigant Analysis

A.4 Program Savings Analysis

As shown in Figure A-8, the impact evaluation verified 96 percent of the reported energy savings and 107 percent of the reported demand savings.

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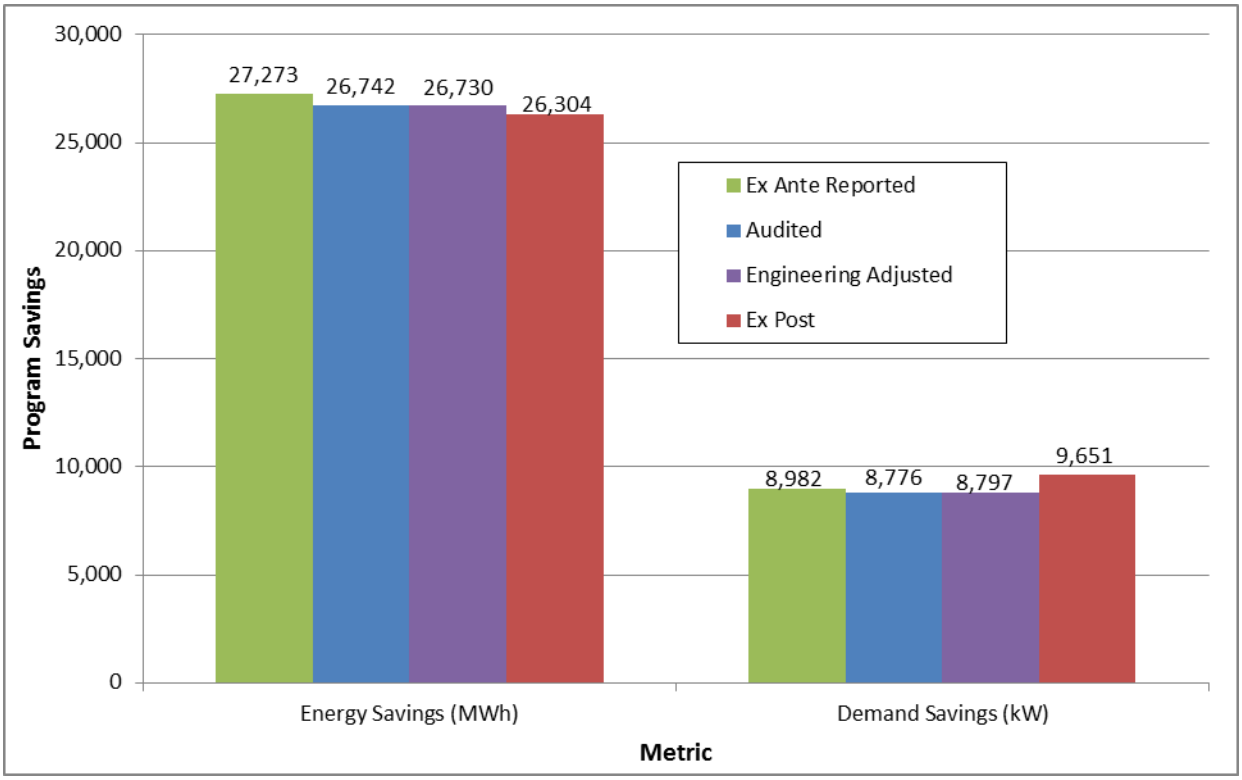
Figure A-8. Comparison of *Ex Ante* to *Ex Post* Savings



Source: Evaluation Analysis of Tracking Data and Sample Results

Figure A-9 shows the relative effect of each impact evaluation task on the overall *ex post* savings analysis. The greatest impacts came as a result of the *verified* savings calculations, which decrease the *ex ante* energy savings by -0.5 percent and increased the *ex ante* demand savings by 9.8 percent.[18]

[18] The impact on the audited savings arose from an error in the lighting calculation spreadsheet. See Section 3.2.3 for a more detailed explanation.

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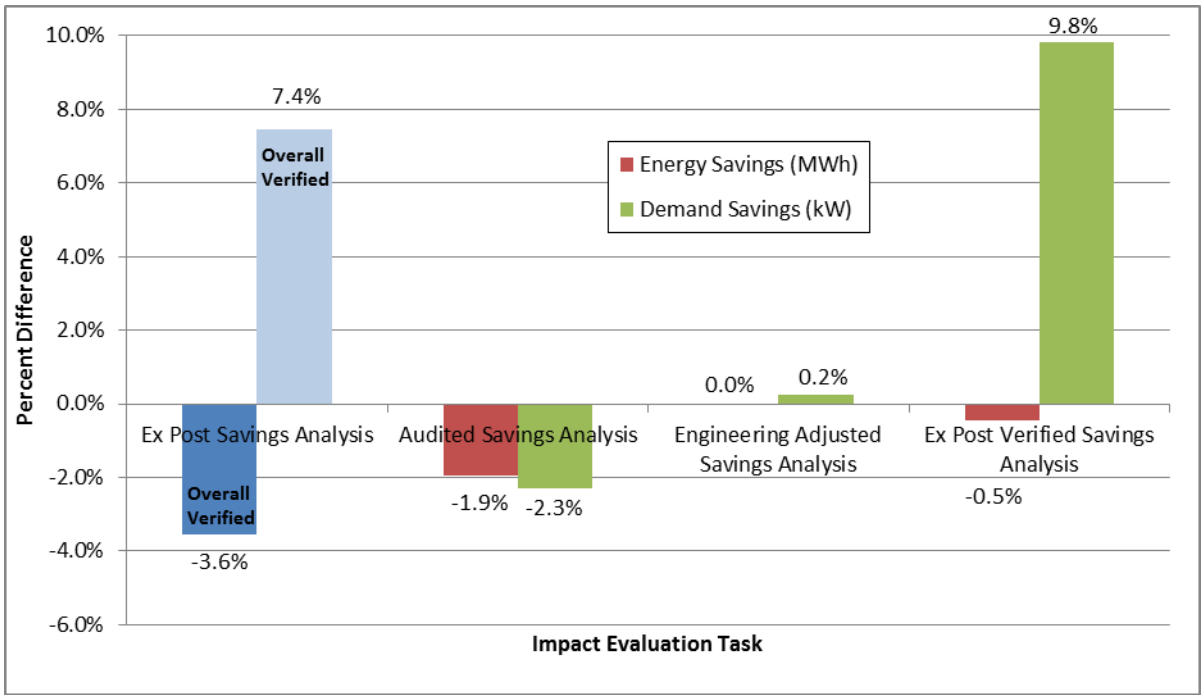
Figure A-9. Relative Effect of Each Impact Evaluation Task[1]



Source: Evaluation Analysis of Tracking Data and Sample Results.

[1] The component parts representing each impact evaluation task will not be strictly additive to the overall impact, since each task builds upon the output of the previous task.

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Appendix B. Participant Telephone Survey Instrument

AEP Ohio Evaluation for the Self Direct Program

Customer Participant Survey

February 13, 2014

INTRODUCTION. Hello, this is <INTERVIEWER NAME> calling from Blackstone Group on behalf of AEP Ohio. This is not a sales call. May I please speak with <APPLICATIONCONTACTNAME>?

[IF NEEDED]: My understanding is that <APPLICATIONCONTACTNAME> is responsible for making energy-related decisions for your firm at <SERVICE ADDRESS> and was listed as the primary contact when <ORGANIZATION NAME> participated in AEP Ohio's Self Direct 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 <ORGANIZATIONNAME>'S PARTICIPATION IN AEP OHIO'S SELF DIRECT PROGRAM? [REPEAT INTRODUCTION WITH NEW CONTACT]

2. NO, THIS PERSON IS NOT AVAILABLE RIGHT NOW [ASK WHEN AVAILABLE OR LEAVE MESSAGE. SCHEDULE CALL BACK]

3. YES – SKIP TO Q2

97 NO, OTHER REASON (THANK & TERMINATE)
98. DON'T KNOW (THANK & TERMINATE)
99. REFUSED (THANK & TERMINATE)

Q2. Hello, my name is <INTERVIEWER NAME> calling from Blackstone Group on behalf of AEP Ohio. We're calling to do a follow-up survey about your firm's participation in the Self Direct program. Do you recall participating in the Self Direct Program on or about <ACTUALPROJECTCOMPLETIONDATE>?

1 YES → CONTINUE TO Q3

2 NO → [DESCRIBE PROGRAM = *the self direct program provides rebates for energy efficient projects completed within the previous three years and ask if they were involved.* IF STILL NO RECALL → MAY I SPEAK WITH SOMEONE WHO IS LIKELY TO BE RESPONSIBLE FOR FACILITY IMPROVEMENTS?] [REPEAT INTRODUCTION WITH NEW CONTACT]

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3 THERE IS NO ONE HERE WITH INFORMATION ON THAT ADDRESS/WRONG ADDRESS – (THANK & TERMINATE)

[IF NEEDED] Blackstone Group is an independent consulting firm hired by AEP Ohio to learn about customer experiences with its Self Direct program 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 Self Direct program 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.

Q3. 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.

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

Now I'd like to ask you some questions about the project you submitted.

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Introduction

Q4. How did you <u>first</u> hear about the financial incentives available through the Self Direct program? (SINGLE PUNCH) (DO NOT READ LIST)

1. AEP OHIO ACCOUNT MANAGER
2. AEP OHIO WEBSITE
3. WORKSHOP/GREEN RIBBON KICKOFF EVENT
4. CONTRACTOR/TRADE ALLY/SOLUTION PROVIDER
5. EMAIL
6. FRIEND/COLLEAGUE/WORD OF MOUTH
7. BILL INSERT
8. WEBINAR
9. SPEAKER/PRESENTATION AT AN EVENT
10. NEWSLETTER
11. VENDOR
14. SUPPLIER
17. SALES REPRESENTATIVE
00. OTHER, SPECIFY_____
98. DON'T KNOW
99. REFUSED

5. *<u>After the first time</u>*, from what other sources have you heard about the program? (MULTIPLE RESPONSES ACCEPTED) (DO NOT READ LIST)

1. AEP OHIO ACCOUNT MANAGER
2. AEP OHIO WEBSITE
3. WORKSHOP/GREEN RIBBON KICKOFF EVENT
4. CONTRACTOR/TRADE ALLY/SOLUTION PROVIDER
5. EMAIL
6. FRIEND/COLLEAGUE/WORD OF MOUTH
7. BILL INSERT
8. WEBINAR
9. SPEAKER/PRESENTATION AT AN EVENT
10. NEWSLETTER
11. VENDOR
14. SUPPLIER
17. SALES REPRESENTATIVE
18. HAVEN'T HEARD FROM ANY OTHER SOURCES (MAKE EXCLUSIVE)
00. OTHER, SPECIFY_____
98. DON'T KNOW
99. REFUSED

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Role of Solution Provider

6. Who identified the opportunity for receiving an incentive through the AEP Ohio Self Direct Program in 2013? [DO NOT READ; SINGLE RESPONSE]

1. ME/RESPONDENT
2. CONTRACTOR/TRADE ALLY/SOLUTION PROVIDER
3. ENGINEER
4. ARCHITECT
5. MANUFACTURER
6. DISTRIBUTOR
7. AEP ACCOUNT MANAGER
8. OWNER/DEVELOPER
9. PROJECT MANAGER
97. OTHER, SPECIFY_____
98. DON'T KNOW
99. REFUSED

Ask Q7 and Q8 if Q6 = 2; OTHERWISE SKIP TO Q9

7. What type of solution provider or contractor told you about the program? [DO NOT READ; SINGLE RESPONSE]

1. LIGHTING CONTRACTOR
2. HVAC CONTRACTOR
3. ELECTRICAL CONTRACTOR
4. GENERAL CONTRACTOR
5. ENGINEER
6. ARCHITECT
97. OTHER, SPECIFY_____
98. DON'T KNOW
99. REFUSED

8. What role did the solution provider or contractor play in your decision to participate in the program?

OPEN ENDED RESPONSE_____
98. DON'T KNOW
99. REFUSED

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Participation in the Self Direct Program

9. What were the primary reasons your company participated in the AEP Ohio Self Direct Program?

[DO NOT READ; ACCEPT MULTIPLE ANSWERS] (SP TEAM: ALPHABETIZE LIST)

1. BECAUSE OF THE INCENTIVES/TO SAVE MONEY ON EQUIPMENT PURCHASE
2. TO SAVE ENERGY
3. TO SAVE MONEY ON ELECTRIC BILLS
4. BECAUSE THE PROGRAM WAS SPONSORED BY A UTILITY
5. TO HELP PROTECT THE ENVIRONMENT
6. PREVIOUS EXPERIENCE WITH OTHER UTILITY PROGRAMS
7. RECOMMENDED BY UTILITY ACCOUNT REPS
8. RECOMMENDED BY CONTRACTORS
9. PRIOR PARTICIPATION IN SIMILAR PROGRAMS
97. OTHER, SPECIFY_____
98. DON'T KNOW
99. REFUSED

10. Did you participate in the Self Direct Program in 2009, 2010, 2011 or 2012? (ACCEPT MULTIPLE RESPONSES)

1. 2009
2. 2010
3. 2011
4. 2012
98. DON'T KNOW
99. REFUSED

The Application

11. Who was primarily responsible for preparing the incentive application (including the required supporting documentation)? (DO NOT READ, SINGE PUNCH)

1. RESPONDENT
2. TRADE ALLY/SOLUTION PROVIDER
3. ANOTHER COMPANY EMPLOYEE
4. OTHER_____
98. DON'T KNOW
99. REFUSED

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(ASK Q12 AND Q13 IF Q11=1)

12. How would you rate the process for completing the Self Direct application? Please use a scale of 0 to 10 where 0 is "very difficult" and 10 is "very easy".
00. VERY DIFFICULT
01.
02.
03.
04.
05.
06.
07.
08.
09.
10. VERY EASY
98. DON'T KNOW
99. REFUSED

13. Was it clear to you what paperwork you needed to submit to qualify for the Self Direct Program?

1 YES
2 NO
98 DON'T KNOW
99 REFUSED

ASK Q14 IF Q13 = 2

14. What was unclear to you?

00. (OPEN END)
98 DON'T KNOW
99 REFUSED

15. Did your organization experience a delay of at least a week in preparing the Self Direct incentive application?

1 YES
2 NO
98 DON'T KNOW
99 REFUSED

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16. Were you informed that final payment required approval by the Public Utility Commission of Ohio before you received your incentive payment?

1 YES
2 NO
98 DON'T KNOW
99 REFUSED

17. Do you plan to participate in the AEP Ohio Self Direct program in the future?

1 YES
2 NO
98 DON'T KNOW
99 REFUSED

(If Q17 = 1, ASK Q18, ELSE SKIP TO Q19)

18. Why do you choose to participate in the Self Direct Program and accept a lower incentive rather than if you had participated in the Prescriptive or Custom Programs?

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

READ DESCRIPTION IF NEEDED: 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, often requiring unique design and technology solutions for each participant.

00. (OPEN END)
98 DON'T KNOW
99 REFUSED

NAVIGANT

The Incentive Level

19. Are you satisfied with the level of incentives offered through the Self Direct program?

1 YES
2 NO
98 DON'T KNOW
99 REFUSED

20. Will the incentive you received be used to conduct future energy efficiency projects?

1 YES
2 NO
98 DON'T KNOW
99 REFUSED

(ASK Q21 IF Q20=2)
21. Why not?

00. (OPEN END)
98 DON'T KNOW
99 REFUSED

Program Improvements

B1a What do you see as the main benefits to participating in the Business Self Direct Program? [DO NOT READ, MULTIPLE RESPONSE, UP TO 3] (ALPHABETIZE LIST)

1. ENERGY SAVINGS
2. GOOD FOR THE ENVIRONMENT
3. LOWER MAINTENANCE COSTS
4. BETTER QUALITY/NEW EQUIPMENT
5. REBATE/INCENTIVE
7. IMPROVED SAFETY/MORALE
8. SET EXAMPLE/INDUSTRY LEADER
9. ABLE TO MAKE IMPROVEMENTS SOONER
10. SAVES MONEY ON UTILITY BILL
00. OTHER, SPECIFY [OPEN END]
98. DON'T KNOW
99. REFUSED

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B1b What do you see as the drawbacks to participating in the program? [MULTIPLE RESPONSE, UP TO 3] (DO NOT READ LIST) (ALPHABETIZE LIST)

1. PAPERWORK TOO BURDENSOME
2. INCENTIVES NOT HIGH ENOUGH/NOT WORTH THE EFFORT
3. PROGRAM IS TOO COMPLICATED
4. COST OF EQUIPMENT
5. NO DRAWBACKS
6. POOR COMMUNICATION
7. TIME CONSUMING
8. UNDERFUNDED/RAN OUT OF MONEY
00. OTHER, SPECIFY [OPEN END]
98. DON'T KNOW
99. REFUSED

22. How do you think the program can be improved?

00. (OPEN END)

98 DON'T KNOW

99 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 Self Direct program.

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]

E1a. [ASK IF E1<4)What would have made you more satisfied?

RECORD VERBATIM
1. NOTHING
2. DON'T KNOW
3. REFUSED

(ASK IF E1>=4)

E1b. Why did you give that rating?

00. RECORD VERBATIM

98. DON'T KNOW

99. REFUSED

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E 2. How satisfied were you with the amount of the incentive? (READ IF NECESSARY: 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]

E 3. How satisfied were you with the energy efficient equipment offered by the program? (READ IF NECESSARY: 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]

E3a. [ASK IF E3<4] What would have made you more satisfied with the energy efficient equipment?

RECORD VERBATIM
7. NOTHING
8. DON'T KNOW
9. REFUSED

E3b. (ASK IF E3>=4) Why did you give that rating?

RECORD VERBATIM
8. DON'T KNOW
9. REFUSED

E 4. In the course of participating in the AEP Ohio program, other than sending in the incentive application, how often did you contact AEP Ohio or program staff with questions? (DON'T READ)

1	Never	**E7**
2	Once	**continue**
3	2 or 3 times	**continue**
4	Four times or more	**continue**
98	DON'T KNOW	**continue**
99	REFUSED	**continue**

E 5. How did you contact them? [CHECK ALL THAT APPLY; AFTER EACH RESPONSE, ASK: Were there any other ways you contacted them?]

1	PHONE	**continue**
2	EMAIL OR FAX	**continue**
3	LETTER	**continue**
4	IN PERSON	**continue**
97	OTHER [OPEN END]_____	**continue**
98	DON'T KNOW	**continue**
99	REFUSED	**continue**

E 6. Overall how satisfied were you with your communications with AEP Ohio and program staff? 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]

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E6a. [ASK IF E6<4] What would have made you more satisfied?

OPEN END_____

7. NOTHING
8. DON'T KNOW
9. REFUSED

(ASK IF E6>=4)

E6b. Why did you give that rating?
OPEN END_____
8. DON'T KNOW
9. REFUSED

E 7. From the time you submitted the application, about how many weeks did it take to receive your incentive? [INSERT NUMERIC OPEN END 0-200, 98 DON'T KNOW, 99 REFUSED]

E 8. How satisfied were you with how long it took to receive the 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]

(ASK IF E8<4)
E8a. What would have made you more satisfied?

OPEN END_____
7. NOTHING
8. DON'T KNOW
9. REFUSED

ASK IF E8>=4

E8b. Why did you give that rating?
OPEN END_____
8. DON'T KNOW
9. REFUSED

E 9. Did AEP Ohio or its contractors conduct a post-installation inspection of the equipment you installed through the incentive program?

1	Yes	**continue**
2	No	
8	DON'T KNOW	
9	REFUSED	

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E 10. How satisfied were you 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]

E10a. [ASK IF E10<4] What would have made you more satisfied with the post-installation inspection?

RECORD VERBATIM
7. NOTHING
8. DON'T KNOW
9. REFUSED

ASK IF E10>=4

E10b. Why did you give that rating?
OPEN END_____
8. DON'T KNOW
9. REFUSED

E 11. Have you noticed lower electricity bills since you installed your new energy efficient equipment?

1	YES	**Continue**
2	NO	**E13.**
8	DON'T KNOW	**E13**
9	REFUSED	**E13**

E 12. Would you say your bill savings are…[READ LIST]

1	About what you expected	**continue**
2	More than you expected	**Continue**
3	Less than you expected	**Continue**
8	DON'T KNOW	**Continue**
9	REFUSED	**Continue**

E 13. If you were rating your overall satisfaction with the AEP Ohio Self Direct Program, would you say you were Very Satisfied, Somewhat Satisfied, Neither Satisfied nor Dissatisfied, Somewhat Dissatisfied or Very Dissatisfied?

1	VERY SATISFIED	**Continue**
2	SOMEWHAT SATISFIED	**Continue**
3	NEITHER SATISFIED NOR DISSATISFIED	**Continue**
4	SOMEWHAT DISSATISFIED	**Continue**
5	VERY DISSATISFIED	**Continue**
8	DON'T KNOW	**E15**
9	REFUSED	**E15**

E 14. Why do you give the Program that rating?
RECORD VERBATIM
8. DON'T KNOW
9. REFUSED

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E 15. If you were rating your overall satisfaction with the AEP Ohio, would you say you were Very Satisfied, Somewhat Satisfied, Neither Satisfied nor Dissatisfied, Somewhat Dissatisfied or Very Dissatisfied?

1	VERY SATISFIED	**Continue**
2	SOMEWHAT SATISFIED	**Continue**
3	NEITHER SATISFIED NOR DISSATISFIED	**Continue**
4	SOMEWHAT DISSATISFIED	**Continue**
5	VERY DISSATISFIED	**Continue**
8	DON'T KNOW	**B1a**
9	REFUSED	**B1a**

E 16. Why do you give AEP Ohio that rating?
RECORD VERBATIM
8. DON'T KNOW
9. REFUSED

23. AEP Ohio wishes to inform more customers about energy efficiency programs. How do you suggest that AEP Ohio reach customers like yourself about these programs?

[OPEN ENDED]
98. DON'T KNOW
99. REFUSED

Customer Background

We are almost finished. I'd just like to get some general background information about <COMPANY> and your responsibilities there. (DO NOT READ, SINGLE PUNCH)

24. What is your title at your company?

1 FACILITIES MANAGER
2 BUILDING MANAGER
3 ENERGY MANAGER
4 OTHER FACILITIES MANAGEMENT/MAINTENANCE POSITION
5 CHIEF FINANCIAL OFFICER
6 OTHER FINANCIAL/ADMINISTRATIVE POSITION
7 PROPRIETOR/OWNER
8 PRESIDENT/CEO
00 (OTHER (SPECIFY) ___
98 DON'T KNOW
99 REFUSED

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25. What is <ORGANIZATIONNAME>'s primary business activity at this particular facility at (<SERVICE ADDRESS>)? [RECORD ONE] (DO NOT READ LIST) (SP TEAM: ALPHABETIZE LIST)

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 DON'T KNOW
99 REFUSED

26. About how many full-time employees work at this location? (RANGE 0-5000)

&EMP # OF EMPLOYEES
98 DON'T KNOW
99 REFUSED

27. Does <ORGANIZATIONNAME> own or lease this facility?

1 OWN
2 LEASE
98 DON'T KNOW
99 REFUSED

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(ASK IF Q27=2 ASK Q28)

28. Do you pay the electric bill?

1 YES
2 NO
98 DON'T KNOW
99 REFUSED

29. Is the company headquarters in Ohio or elsewhere?

1 HQ IN OHIO
2 HQ ELSEWHERE, OUTSIDE OF OH
98 DON'T KNOW
99 REFUSED

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

RECORD VERBATIM ANSWER_____

98 DON'T KNOW
99 REFUSED

Those are all the questions I have for you today. Thank you so much for your time. Your insights are extremely valuable to AEP Ohio.

APPENDIX L

NAVIGANT

NON-RESIDENTIAL NEW CONSTRUCTION PROGRAM

Program Year 2013 Evaluation Report

Prepared for:
AEP OHIO

AEP OHIO®
A unit of American Electric Power

May 9, 2014

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Executive Summary

AEP Ohio's Non-Residential New Construction (NRNC) Program provides support for customers building a new facility or undertaking a major renovation to incorporate higher levels of energy efficiency in their building design. The program is divided into three approaches, 1) Prescriptive, 2) Custom, and 3) Whole Building, which are intended to meet the needs of buildings of varying size and complexity. The Prescriptive and Custom approaches in the NRNC Program are similar to AEP Ohio's Prescriptive and Custom Programs, with the exception that lighting energy savings are calculated based on Lighting Power Density (LPD) calculations relative to LPD allowances in the Ohio Energy Code. The Whole Building approach is a comprehensive approach utilizing building energy modeling simulations for customers with larger or more complex buildings that want to maximize the energy efficiency of their new building. The program is delivered by DNV GL (formerly KEMA), an implementation contractor, on behalf of AEP Ohio. 2013 represents the third year of program operation.

Program Participation

The 2013 program year represents the third year of operation for the New Construction Program for which Navigant has conducted an evaluation. One hundred and ninety six (196) projects were completed in 2013 at 163 different premises and involved 171 different buildings[1]. The floor area for buildings where it was reported totaled 10.9 million square feet of new and renovated buildings. Estimating the total floor area for all participants resulted in 13.6 million square feet of new and renovated buildings[2]. This represents more than double the level of activity in 2012, when 94 projects were completed at 68 buildings.

As shown in Table ES-1, the vast majority of the projects completed in 2013 applied under the Prescriptive option; though three projects were a combination of Prescriptive and Custom savings. The number of Whole Building projects increased to 25 in 2013 from 17 in 2012; however Whole Building projects represent a smaller proportion of total projects than in the prior year (13% in 2013 compared to 18% in 2012).

Table ES-1 Activity by Program Option

Option and Number of Buildings	Number of Projects	Percent of Total Projects	Estimated Floor Area (sq. ft.)	Incentives	*Ex Ante* Savings (kWh/year)
Prescriptive Only	168	85.7%	10,734,294	$2,025,390	20,530,155
Prescriptive/Custom Combination	3	1.5%	852,888	$132,492	1,834,551
Whole Building	25	12.8%	2,058,506	$582,960	5,409,232

Figure ES-1 illustrates the reported energy savings within each building type. Manufacturing facilities and warehouses together represented over half of the energy savings reported for 2013, while the

[1] Some premises represented an entire campus with multiple buildings.
[2] Estimated floor areas were reported for 130 of the 171 buildings that completed projects in 2013. Where the data was missing, Navigant approximated the floor areas based on the energy savings of the building.

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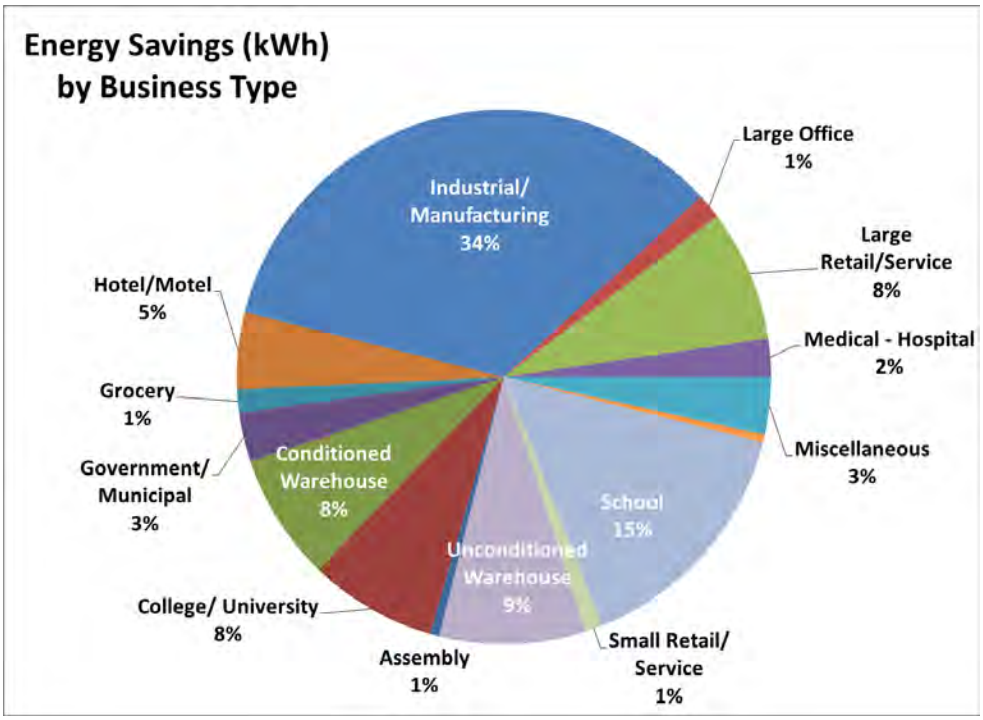
educational sector (schools, colleges and universities) represented almost another quarter (23%) of reported savings. 20,824 MWh/year (75% of total) were for projects in new buildings, while 6,950 MWh/year (25%) were for projects involving energy efficiency improvements as part of major renovations.

Figure ES-1 Energy Savings by Type of Business



NOTE – Business types recorded as "Assembly" and "Assembly /Meeting Place" have been combined for reporting purposes.

Data Collection Activities

Overall 140 unique organizations were involved in New Construction projects under the program in 2013. Of these, 123 unique participant contacts had provided e-mail contact information. All 123 participants were sent an on-line survey to request their input regarding the program; 18 of these e-mail addresses were found to be undeliverable. Fifty-two participants responded to the survey and 47 fully completed the on-line survey questions. Based on a population of 140 unique organizations participating in the 2013 program year, a sample of 46 participants was required to provide a confidence level of 90% with a +/-10%[3] margin of error.

As part of the impact study, 63 percent of the claimed *ex ante* energy savings underwent an engineering review of the project files. Forty-two percent of the *ex ante* savings were subject to a telephone review

[3] This assumes a 'normal' or non-skewed response distribution.

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and 26 percent underwent an on-site review. Table ES-2 provides a profile of the impact measurement and verification (M&V) sample stratification and the level of review within each stratum.

Table ES-2 Impact Sampling Strata and Achieved Sampling

Stratum by Approach and Energy Savings	Number of Buildings	Strata weight by Energy	Number of Desk Reviews	Number of Telephone Reviews	Number of On-site Reviews
Large (> 1 GWh)	7	35.2%	7	5	4
Medium (> 200 MWh, < 1GWh)	27	34.1%	17	6	2
Small (> 40 MWh, < 200MWh)	71	26.8%	12	6	2
Very Small (< 40 MWh)	66	3.9%	3	2	0
Total	171	100%	39	19	8
Percent of *Ex Ante* Savings			62.6%	37.2%	25.6%

Key Evaluation Findings and Recommendations

The results of the evaluation and recommendations resulting from Navigant's review are presented in the following sections.

Key Impact Findings and Recommendations

As summarized in Table ES-3, the verified energy savings exceeded the 2013 targets of 10 GWh and 1.23 MW coincident demand reduction. Realization rates for energy continued to be strong in 2013, however some savings calculation discrepancies were found in individual projects. Realization rates on coincident demand reduction are low in 2013, but improved from 2012 where the demand realization rate equaled 0.56. Low demand realization in 2013 was driven by prescriptive lighting, where reported savings did not include a coincidence factor and no consideration was taken for baseline light reduction controls.

Table ES-3 Impact Savings, Realization Rate and Sample Precision

Metric	*2013 Program Goals*	*Ex Ante (a)*	*Ex Post (b)*	Realization Rate RR = (b) / (a)	Overall Relative Precision at 90% Confidence	Percent of Goal
Annual Energy Savings (MWh)	10,000	27,774	27,186	0.98	6.7%	272%
Coincident Peak Reduction (MW)	1.23	6.32	4.92	0.78	9.9%	400%

Other key impact findings and recommendations include:

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1. For the third year, Navigant notes that *ex ante* demand savings for prescriptive lighting did not include a coincidence factor. This resulted in reporting the building peak demand reduction, not the demand reduction coincident with AEP Ohio's peak.

    » **Impact Recommendation #1a:** Ensure that the *ex ante* demand reduction is the demand reduction that is coincident with the AEP Ohio peak.

    » **Impact Recommendation #1b:** There should be three fields in the tracking database regarding demand reduction. One for the building demand reduction, one coincident with the AEP Ohio peak, and one coincident with the PJM peak.

2. *Ex ante* baseline did not account for the baseline requirement of light reduction controls, resulting of an overstatement of the energy savings. Additionally, the as-built building documentation did not specify the level of light reduction controls installed in the buildings.

    » **Impact Recommendation #2a:** Baseline lighting power should be reduced by the baseline requirement for light reduction controls. Navigant recommends using a baseline condition for spaces requiring light reduction with manual dimming. Navigant further recommends that lighting power be reduced by a factor of 10% in the spaces with this requirement.

    » **Impact Recommendation #2b:** Specify that DNV GL calculate the difference in energy savings between the baseline and the as-built lighting controls which may include occupancy sensors.

    » **Impact Recommendation #2c:** Clearly state whether manual light reduction controls are employed in the as-built building and whether or not a fixture has occupancy control.

3. On-site visits and detailed review of project files revealed several errors in the *ex ante* savings calculation including: 1) the use of outdated drawings and specifications, 2) inaccurate light fixture counts, 3) exterior lights being counted as interior lights, 4) inaccurate motor size on VFDs, 5) the mischaracterization of warehouses as manufacturing spaces, and 6) calculating interactive effects on unconditioned spaces.

    » **Impact Recommendation #3a:** Before incentives are paid, obtain the final "as-built" drawing and specifications to facilitate updating savings calculations to reflect the as-built drawings.

    » **Impact Recommendation #3b:** Verify as-built motor sizes either through invoices or site visits.

    » **Impact Recommendation #3c:** The amount of time interacting with design teams during and outside of site visits is not sufficient to eradicate errors. Increase interaction both ways so that a better understanding of the building is achieved. More interaction would

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also present opportunities to increase building efficiency through having more opportunities to actively suggest improvements.

» **Impact Recommendation #3d:** Consider doing a final walk through of all completed buildings to verify installation details.

» **Impact Recommendation #3e:** If a site visit is not performed, meetings with the design team should include discussions about space type, e.g. warehouse versus manufacturing, and specifics such as space conditioning details for the interactive effects.

4. Savings are frequently underestimated due to issues such as capping savings once incentives are capped, not calculating savings from occupancy sensors, or ignoring the savings from exterior lighting.

» **Impact Recommendation: #4a** Account for all LPD savings, even when it exceeds 50 percent better than baseline LPD.

» **Impact Recommendation #4b:** Review building details during the design phase and ensure all systems eligible for program participation are included.

5. On Whole Building projects, by reviewing the hourly model output during the coincident period, it was determined that the coincidence of demand reduction was frequently not calculated. This is the most accurate way of determining coincident demand reduction. When available, simulation models should be used for this purpose.

» **Impact Recommendation #5a:** Obtain energy models and run with the coincident peak period. Check that demand savings equals the reported coincident demand reduction.

Key Process Findings and Recommendations

AEP Ohio and DNV GL continue to make improvements to the program as they gain experience and the program becomes more established. The program has had increased success in achieving earlier involvement in building projects as market awareness increases. Several changes to the program were made in the 2013 program year, including but not limited to:

- Increased use was made of "Dodge" data, which provides reporting on new construction activity. To some extent, this data has been used to identify potential projects that could be approached as potential program participants; however, the main use of this information has been as a source of market intelligence to support discussions with Solutions Providers.
- AEP Ohio changed the program requirements to require participants using the Whole Building option provide executable versions of their building simulation models. This change resulted in a more robust review and has changed the nature of the building review process.
- For projects participating in the Whole Building option, an increased emphasis was placed on identifying energy efficiency opportunities for equipment treated as plug loads and exterior

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lighting. Program staff are now working to identify opportunities for end uses such as kitchen equipment which are not specifically addressed in the building energy modeling. The new process is now obtaining better information on exterior lighting and identifying some efficiency improvements.

Participants continued to show a high level of satisfaction with the program. Table ES-4 shows satisfaction overall and by category on a scale of 0-10. Responses received from Solution Providers (SPs) who had been involved in the program indicated a high level of satisfaction with the program, both from the perspective of the Solution Providers and indirectly from their clients.

Table ES-4 Respondent Satisfaction with the Program

Category	Rating (47 respondents)
Time required to participate	8.1
Level of Documentation	7.4
Overall Satisfaction	8.7

Note – 10 represents very satisfied.

Key Process 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. The current application process indicates that a "*Pre-Approval Application*" should be submitted "before construction begins" and that "*Final Application and complete documentation must be received of substantial completion*" (or installation of the customer's revenue meter)[4]. Experience indicates that trying to add energy efficiency design elements after the design has been completed often leads to conflicts with budgets and timelines. We also note that projects pursuing LEED certification are currently required to complete their LEED submission prior to applying for the AEP Ohio program[5].
    - » **Process Recommendation #1a:** AEP Ohio should review the eligibility requirements for the program, and specifically for the Whole Building and Custom options, and consider requiring projects to apply in the design stage, when the program can best influence the energy efficiency of the building design.
    - » **Process Recommendation #1b:** AEP Ohio should work with Solution Providers and participants in LEED-oriented projects to become involved in the AEP Ohio program before submitting their LEED proposal. Program staff should develop strategies and initiatives to encourage a greater emphasis on energy efficiency in LEED projects.

[4] Page 36 of the AEP Ohio NRNC application form.
[5] The "Whole Building" application (Page 36 of the application form) indicates that projects pursuing LEED are required to submit their final template and supporting documentation as part of their application to the AEP Ohio NRNC program.

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- » **Process Recommendation #1c:** As part of the review process, program staff should offer technical advice where appropriate to improve the energy efficiency of building designs.

2. The program application requires that the incentive not exceed 50 percent of the project cost. Project cost is defined as the material cost of installed equipment.
   - » **Process Recommendation #2**: Consider amending incentive requirements to not exceed the incremental cost of efficiency upgrades or 50 percent of the project cost, whichever is less.
3. Prescriptive projects tend towards interior lighting power density only savings and are not reaching the potential of the Prescriptive approach. Exterior lighting, lighting controls, HVAC and refrigeration are common measure categories that should have better representation in the Prescriptive approach.
   - » **Process Recommendation #3a:** Navigant recommends improving the comprehensiveness of each project through a combination of project reviews during design, education of Solution Providers, incentive adjustments, and rewards to Solution Providers. For example, the interior lighting incentive could be lowered, while raising the incentive for lighting controls or HVAC.
4. The program is now obtaining executable building energy models for all Whole Building projects as recommended in last year's evaluation. Feedback from both Solution Providers and DNV GL indicates that this move has led to a more robust review process and DNV GL has begun to make changes to reflect this new process.
   - » **Process Recommendation #4a:** Modify the review process for any projects in which building energy modeling has been completed to include an early meeting with the design team to review the modeling approach, any assumptions used, and any questions that the reviewers may have regarding the project.
   - » **Process Recommendation #4b:** As part of discussions with project design teams, it is recommended that information be gathered on the model versions being used for designs. Design teams should be encouraged to obtain current versions of modeling software.

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1 Introduction and Purpose of Study

1.1 Program Overview

AEP Ohio's Non-Residential New Construction (NRNC) Program provides support for customers building a new facility or undertaking a major renovation to incorporate higher levels of energy efficiency in their building design. The program is divided into three approaches, 1) Prescriptive, 2) Custom, and 3) Whole Building, which are intended to meet the needs of buildings of varying size and complexity. The Prescriptive and Custom approaches in the NRNC Program are similar to AEP Ohio's Prescriptive and Custom Programs, with the exception that lighting energy savings are calculated based on Lighting Power Density calculations relative to allowances in the Ohio Energy Code. The Whole Building approach is a comprehensive approach utilizing building energy modeling simulations for customers with larger or more complex buildings that want to maximize the energy efficiency of their new building. The program is delivered by DNV GL (formerly KEMA), an implementation contractor, on behalf of AEP Ohio. The 2013 program year represents the third year of operation for this program.

1.2 Evaluation Objectives

This report presents the findings from the impact and process evaluations of the AEP Ohio Non-Residential New Construction Program (NRNC) for 2013. The objectives of the evaluation were to: (1) quantify energy and summer peak demand savings impacts at the meter from the program during 2013; (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 3.3 (Process Findings).

1.3 Evaluation Methods

Program impacts for the NRNC Program for this report 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, inspection of the building energy models and/or site verification of the installed components of the energy efficiency measures designed for the subject buildings. Summer coincident peak savings are 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, DNV GL (the program implementer) and a group of Solution Providers involved in whole building projects. An on-line survey was used to solicit input from program participants who were willing to answer the survey.

A program logic model was not developed by AEP Ohio or DNV GL during the development of the Non-Residential New Construction Program. Consequently, Navigant interviewed staff from AEP Ohio

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and DNV GL, reviewed program materials and reviewed strategy documents to gain an understanding of program logic, expected inputs, outputs and outcomes for the program.

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 2013	Process Evaluation
Secondary Literature Review	Publicly-available evaluations of other utility non-residential new construction programs; reports of construction practices in absence of utility programs	Impact and Process Evaluation
In-depth Telephone Interviews	AEP Ohio Program staff	Process Evaluation
	DNV GL staff	Process Evaluation
On-Line Surveys	Program Participants	Impact and Process Evaluation
Trade Ally Interviews	Solution Providers involved in NRNC projects.	Process Evaluation
Project File Review	Sample of completed projects	Impact and Process Evaluation
Telephone Verification	Where project files were incomplete	Impact and Process Evaluation
On-site Verification	Where uncertainties in the savings calculation existed	Impact and Process Evaluation
Tracking Data Review	All program participants	Impact and Process Evaluation

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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. This is 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 2013 program year; (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. To meet these objectives, the evaluation team undertook the following activities.

1. **Evaluation Questions.** Established key evaluation questions as part of developing the 2013 Evaluation Plan with AEP Ohio staff.

2. **Tracking Data Review.** Reviewed the program tracking data collected by DNV GL and provided to the evaluation team by AEP Ohio.

3. **Review of Marketing Activities.** Reviewed the overall marketing activities and approach as implemented by DNV GL.

4. **Review of Participation**. Reviewed program participation by building type, program approach, 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, 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 engineering calculations and building model simulations. Telephone verifications were conducted if clarifications from the project files were needed to complete the analysis. Telephone verifications included clarifications of the project scope, determination of incremental cost, quantifying operation hours, requests for missing files or drawings, and any other clarification needed to accurately determine the impact of the project. Where uncertainties still existed in the savings calculations, on-site visits were conducted. On-site visits included verification of equipment specifications and quantities, collection of energy management system data, as well as metering were required.

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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 Ohio and DNV GL and with Solutions Providers, a review of program tracking data, and feedback received from the participant survey.

2.2 *Key Evaluation Questions*

Navigant worked with AEP Ohio to identify a number of key evaluation questions regarding the 2013 NRNC program. 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

2013 Non Residential New Construction Program Research Questions **The evaluation will seek to answer the following key research questions.**	**AEP/ KEMA**	**Participants**	**Trade Allies**	**Research & Analysis**
Evaluation Review				
1. Review progress on implementing recommendations / issues identified in the 2012 evaluation.	√			√
2. Compare 2013 findings with findings from prior year evaluations.				√
3. Have changes made to the 2013 program been effective in increasing satisfaction and/or participation?	√	√		√
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 (*ex post*) savings divided by program-reported (*ex ante*) 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				
1. Is the marketing effort sufficient to meet current and future program participation goals?	√	√	√	√
2. What type of support is DNV GL providing to the building design and construction community? Is it sufficient? Are the incentive levels motivating increased participation?	√		√	
3. How thoroughly does DNV GL cover the AEP Ohio service territory? Is there a more effective means of identifying projects within the AEP Ohio service territory?	√			√

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2013 Non Residential New Construction Program Research Questions **The evaluation will seek to answer the following key research questions.**	AEP/ KEMA	Participants	Trade Allies	Research & Analysis
4. 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?	√	√	√	√
5. Is program outreach effectively increasing awareness of the program opportunities? 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?	√	√	√	
6. How did customers become aware of the program? What marketing strategies could be used to boost program awareness?	√	√		
7. For participants who are committed to LEED, has the program been effective in increasing the level of energy efficiency in their building design? How can the program encourage greater energy efficiency within this group of participants? Have program participants decided to pursue LEED certification after committing to program participation?	√	√	√	
Program Characteristics and Barriers				
8. How do participants perceive the program tracks available to them? Are participants knowledgeable about the available program tracks?		√		
a) Is there enough flexibility in the various tracks to meet their needs? Do needs vary by sector or design method employed?		√		
b) Are expectations and requirements clearly explained?		√		
c) Is the incentive structure for the Whole Building Track sufficient?		√	√	
d) Are new construction projects in the Prescriptive Track achieving comprehensive savings? Are they receiving the support they need?	√	√	√	√
e) Is the Custom Track process clear	√	√	√	
f) Are the incentive levels for the Custom Track reasonable?	√	√	√	
9. How do participants perceive the incentives and costs related to this program?	√	√		

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2013 Non Residential New Construction Program Research Questions **The evaluation will seek to answer the following key research questions.**	AEP/ KEMA	Participants	Trade Allies	Research & Analysis
a) Do participants and trade allies6 perceive the incentives between the different tracks to be fair and equitable?		√		
b) Are building owners satisfied with the program incentives?	√	√		
c) Are the design teams satisfied with the program incentives?			√	
d) Would a reallocation of budget between incentive spending and marketing spending increase program participation and savings?	√			√
e) Should the budget allocation between incentives for building owners and incentives for design teams be adjusted to meet participation and savings goals?	√	√	√	√
f) Are there particular program characteristics that could be changed to improve customer satisfaction while maintaining program effectiveness?	√	√	√	
10. 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, ownership or design approach?	√	√	√	
11. Do building tenants in the AEP Ohio service territory place a value on energy efficiency? Does this result in an increase perceived or real value and greater demand for buildings achieving a higher level of energy efficiency?	√	√	√	
12. 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				
13. Have any changes been introduced to the program since the last evaluation? If so, how, why, and what has been the impact of the change on program performance?	√			
14. Are the program processes effective for motivating participation and smoothly providing incentives to participants? Navigant will review:				
a) Program tracking and data management.				√
b) Required forms.		√		√
c) Impact to timeline.		√	√	√
d) Ease of use.		√		√

[6] Trade allies include Solutions Providers involved in the Prescriptive program track and design teams involved in Custom and Whole Building Program tracks.

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2013 Non Residential New Construction Program Research Questions **The evaluation will seek to answer the following key research questions.**	AEP/ KEMA	Participants	Trade Allies	Research & Analysis
e) Internal program communications.				√
f) Program staffing.				√
15. Does the program tracking system provide adequate information for program evaluation?				√
16. Are Solution Providers[7] satisfied with the Program? Are there barriers to participation for Solution Providers? What is the relationship between Solution Providers and the design community? Are there barriers for the design community that complicates their participation? Is the design community knowledgeable about the benefits of energy efficient designs?	√			√
17. What are the verification procedures carried out by the implementation contractor for the program? Have these been implemented in a manner consistent with the program design? Do these procedures present their own implementation barrier?	√	√	√	
18. What are the opportunities for program improvement?	√	√	√	
Community Impact				
19. Do customers use commitment to energy efficiency in their collateral materials, or local/national advertising to distinguish their brand from their competition? Would collateral material from AEP Ohio that could be posted on-site to communicate their program participation be useful to customers?	√	√		
20. Has the program helped customers and contractors in other ways such as increasing knowledge of energy efficiency opportunities?		√	√	
21. Does AEP Ohio/KEMA 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?	√	√		
22. Does AEP Ohio/KEMA publically recognize design teams achieving excellence in their designs (e.g. best designs over 70,000 SF)?	√		√	
23. Has the program directly stimulated job growth among Solution Providers participating in the program?	√		√	√

[7] Solutions Providers would include all trade allies involved in the program, such as architects, engineers, or building energy system modelers.

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2.3 Tracking Data Review

Program tracking data is critical for determining the impacts of the new construction program. A copy of the program tracking data collected by DNV GL was provided by AEP Ohio to the evaluation team.

- 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.

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 requested from AEP Ohio and DNV GL. Information on marketing, communications and outreach efforts was also obtained from both AEP Ohio and DNV GL.

2.5 Review of Participation

The evaluation team used the program tracking data to analyze participation by a number of key factors including building type, completion date, program approach (Whole Building, Prescriptive and Custom), 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 3.

2.6 Primary Data Collection

Primary data collection included in-depth interviews with program actors and 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, DNV GL, and Solution Providers involved in the program. On-line surveys were used to obtain input from participating customers to better understand customer satisfaction and perceptions related to the Non-Residential New Construction Program. The interviews and surveys were informed by the review of relevant program tracking databases, documents, and other materials to understand how the program worked and how it has been marketed for 2013.

Discussion guides were developed allowing a structured but open-ended interview and provided to AEP Ohio for review. A free-flowing discussion resulted between interviewer and respondent and real time interviewing flexibility was achieved. Staff experienced in new building programs and program evaluations were used to perform the interviews. Interviews were conducted by telephone in order to provide flexibility to the respondents' schedules.

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The participant surveys were developed with a combination of closed and open-ended questions allowing for quantitative analysis and qualitative evaluation of the program. The survey was conducted through an on-line survey using *Survey Analytics* software.

2.6.1 Population and Sampling for Process Study

As discussed, a total of 196 projects in 171 unique buildings were completed during 2013. These projects involved 140 unique organizations of which 123 unique participant contacts had provided e-mail contact information. These 123 participants were sent an on-line survey to request their input regarding the program; 18 of these e-mail addresses were found to be undeliverable.

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, each unique participant might represent multiple projects. Forty-nine participants responded to the survey. Of these 4 did not respond to all of the questions. The 49 responses represents a 35 percent response rate from these selected 'unique' participants and 47 percent of those who actually received the survey. This exceeds the sample size of 46 required to provide a +/-10% margin of error at a confidence level of 90%[8] .

2.7 Methods Used to Analyze Impact Data

Completed projects were divided into four 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 as-built assumptions. Energy modeled projects were reviewed for model inputs on the baseline and as-built models. Where the project files were incomplete telephone verifications were conducted. Telephone verification consisted of a conversation with the site representative most intimate with the project details. The site representative would be asked about the project scope and missing information would be requested. Additionally, 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 for 2013 was chosen to achieve a 90/10 level of confidence and relative precision for the engineering review. The program was evaluated at the building[9] level and divided into four strata based on *ex ante* energy savings. Buildings were randomly selected from each stratum. There were some buildings that had multiple projects within the program year. Since these buildings underwent one efficiency effort for the building, but were divided by milestones or components of the building, Navigant decided to evaluate at the building level rather than at the project level.

[8] Number of target completes were calculated using the Raosoft web tool at: http://www.raosoft.com/samplesize.html.
[9] In most cases a building is the same as a premise, with the exception of premises that represent a campus of buildings.

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Projects were sorted from largest to smallest kWh 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 39 buildings to be selected for application documentation and engineering review. In the end, Navigant sampled 63 percent of the reported program MWh savings. Table 2-1 provides a profile of the impact measurement and verification (M&V) 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, telephone or on-site level review.

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

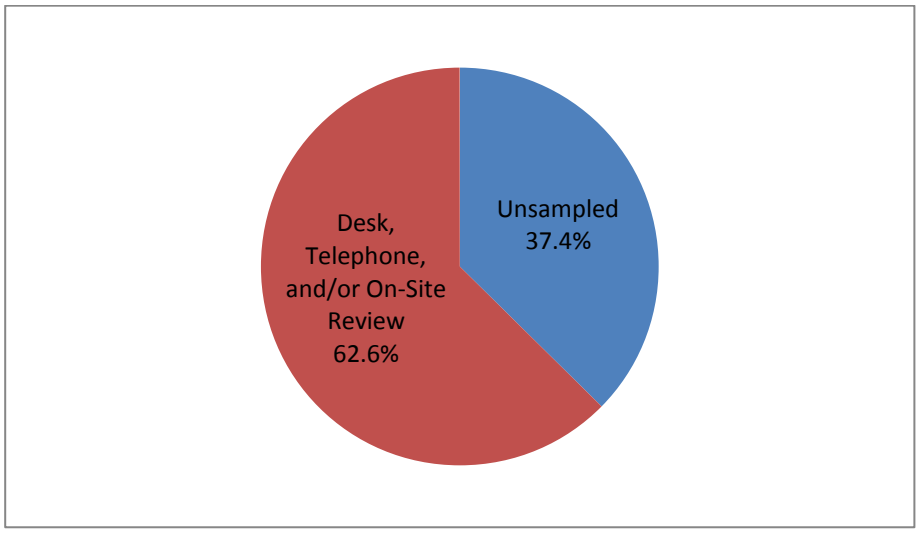

Table 2-1. Impact Sampling Strata and Achieved Sampling

Stratum by Approach and Energy Savings	Number of Buildings	Strata weight by Energy	Number of Desk Reviews	Number of Telephone Reviews	Number of On-site Reviews
Large (> 1 GWh)	7	35.2%	7	5	4
Medium (> 200 MWh, < 1GWh)	27	34.1%	17	6	2
Small (> 40 MWh, < 200MWh)	71	26.8%	12	6	2
Very Small (< 40 MWh)	66	3.9%	3	2	0
Total	171	100%	39	19	8
Percent of *Ex Ante* Savings			62.6%	37.2%	25.6%

2.7.2 *Ex Post* Energy Savings Calculation

Energy savings calculations were conducted in accordance with DNV GL's Appendix A AEP Ohio Prescriptive Measures Protocols, the 2010 Draft Ohio Technical Reference Manuals (Draft TRM), other published methodologies such as regional TRM's and accepted engineering approaches as appropriate. Energy modeled buildings were evaluated in accordance to ASHRAE 90.1 – Appendix G. The baseline was determined using the appropriate energy code for the building as reported by DNV GL project files.

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Since the Ohio energy code changed in November of 2011, if Navigant could not determine the appropriate energy code to apply, we assumed the building to be subject to IECC 2009 or ASHRAE 90.1-2007. Lighting was analyzed via lighting power density calculations using the building area method. Standard approaches were taken with HVAC, shell, appliances, and other equipment. When executable building energy models were available, the models were analyzed for run hours during the actual peak period to determine coincident peak demand reduction.

2.7.3 Realization Rates Calculation Method

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

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

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:

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

2.8 Methods Used to Analyze Process Data

Fifty-two participants responded to the survey and 47 fully completed the on-line survey questions. Based on a population of 140 unique organizations participating in the 2013 program year, a sample of 46 participants was required to provide a confidence level of 90% with a +/-10%[10] margin of error.

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 of this report. 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 completed in 2013.

As Figure 2-3 and Figure 2-4 illustrate, the sample population matches reasonably to the distribution of projects by business type, though there are some differences. The survey responses under-represent schools and warehousing while over-representing colleges and universities compared to the population of projects. No responses were received from government or municipal projects which represented 7 percent of projects. The "other" (or miscellaneous) category was also over-represented in the survey results indicating that respondents did not feel that their business matched any of the categories listed.

[10] This assumes a 'normal' or non-skewed response distribution.

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Figure 2-3 Program Participation by Business Type

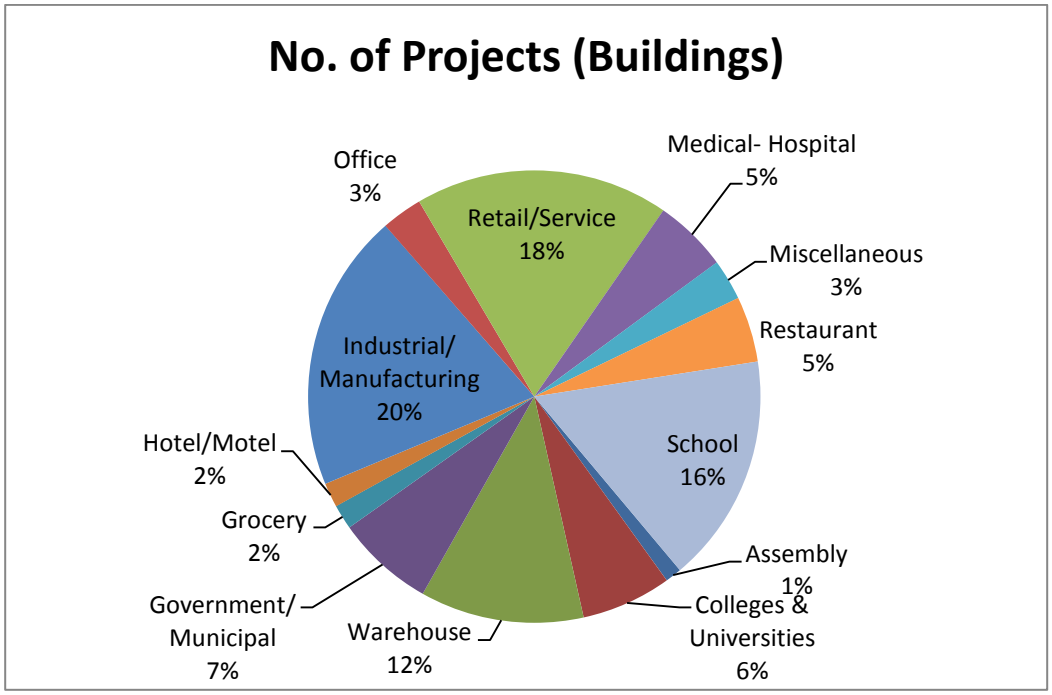
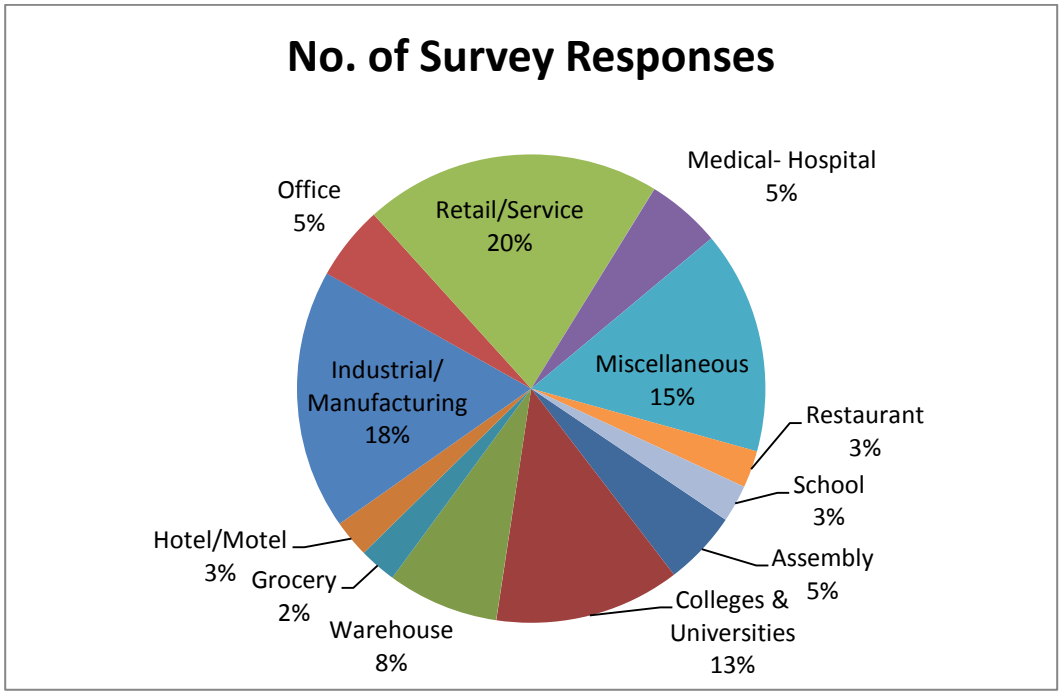


Figure 2-4 Survey Respondents by Business Type



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3 Detailed Evaluation Findings

3.1 Program Activity

The 2013 program year represents the third year of operation for the New Construction program and in which Navigant has evaluated its operation. One hundred and ninety six (196) projects were completed in 2013 at 163 different premises and involved 171 different buildings. The projects involved over 13 million square feet of new and renovated buildings[11]. A number of participants in the program were involved in multiple projects, with 71 of the projects being completed by 25 organizations. This represents more than double the level of activity in 2013, when 94 projects were completed at 68 buildings.

Total energy savings reported for the program amounted to 27,774 MWh, while the reported demand reduction totaled 6.3 MW (see Table 3-1). This is almost triple the target of 10,000 MWh set for 2013. Over $3.4 million in incentives were paid out to program participants, for an average contribution of $19,892 per building.

Table 3-1. Program Summary

	2013 Program	2012 Program
Total Project Cost	$11,740,689	$6,640,814
Floor Area (reported sq. ft.)	10,877,861	6,300,275
Floor Area (estimated. sq. ft.)^	13,645,690	Not Calculated
Amount of Incentives	$2,740,843	$1,715,596
Ex Ante Energy Savings Reported to Program (MWh)	27,774	19,305
Ex Ante Demand Savings Reported to Program (MW)	6.3	5.31

^ *Floor area –for unique buildings in each year.*

Projects were distributed across a variety of business types; though schools continued to represent a significant share of buildings involved (16%) while manufacturing facilities represented 20 percent of buildings in which projects were completed in 2013. Table 3-2 below shows the number of buildings, estimated Floor Area, incentives and savings by sector, based on information reported in the tracking database.

[11] Estimated floor areas were only reported for 130 of the 171 buildings that completed projects in 2013. Navigant approximated the floor areas where the data was missing based on the energy savings of the building.

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Table 3-2. Activity by Business Type

New Construction Program (2013 Budget Year)				
Business Type	No. of Buildings	Estimated Floor Area (sq. ft.)	Incentives	*Ex Ante* Savings (kWh/year)
Assembly	2	244,665	$34,653	154,294
College/University	11	564,411	$346,990	2,147,260
Conditioned Warehouse	8	1,224,292	$200,009	2,139,466
Government/Municipal	12	410,424	$87,768	827,557
Grocery	3	41,740	$28,174	387,500
Hotel/Motel	3	449,782	$121,565	1,292,381
Industrial/Manufacturing	34	3,183,344	$741,850	9,529,692
Large Office	3	269,360	$36,449	416,501
Large Retail/Service	16	672,861	$214,571	2,213,165
Medical- Hospital	9	549,441	$52,904	643,320
Miscellaneous	5	1,221,902	$60,370	962,136
Restaurant	8	44,940	$17,755	131,014
School	28	1,950,883	$492,668	4,171,867
Small Office	2	8,281	$2,520	20,542
Small Retail/Service	15	171,222	$28,649	282,673
Unconditioned Warehouse	12	2,638,134	$273,948	2,454,529
Total	171	13,645,689	$2,740,843	27,773,899

Note: Totals may not sum due to rounding.

As shown in Table 3-3, the vast majority of the 196 projects completed in the 2013 program year applied under the Prescriptive option; though three projects were a combination of Prescriptive and Custom savings. The number of whole building projects increased to 25 in 2013 from 17 in 2012; however Whole Building projects represent a smaller proportion of total projects than in the prior year (13% compared to 18% in 2012). In terms of energy savings, projects completed under the Whole Building option represented fewer than 20% of total program savings, compared to 49% of program savings in 2012. This high reliance on Prescriptive savings leads to the assumption that the program is not sufficiently investigating comprehensive efficiency measures beyond the standard measures.

Table 3-3. Activity by Program Option

Option and Number of Buildings	Number of Projects	Percent of Total Projects	Estimated Floor Area (sq. ft.)	Incentives	*Ex Ante* Savings (kWh/year)
Prescriptive Only	168	85.7%	10,734,294	$2,025,390	20,530,155
Prescriptive/Custom Combination	3	1.5%	852,888	$132,492	1,834,551
Whole Building	25	12.8%	2,058,506	$582,960	5,409,232

As shown in Table 3-4, of the 171 participating buildings, 113 (66% of total) were for projects in new buildings while 58 (34%) were for projects involving energy efficiency improvements as part of major renovations.

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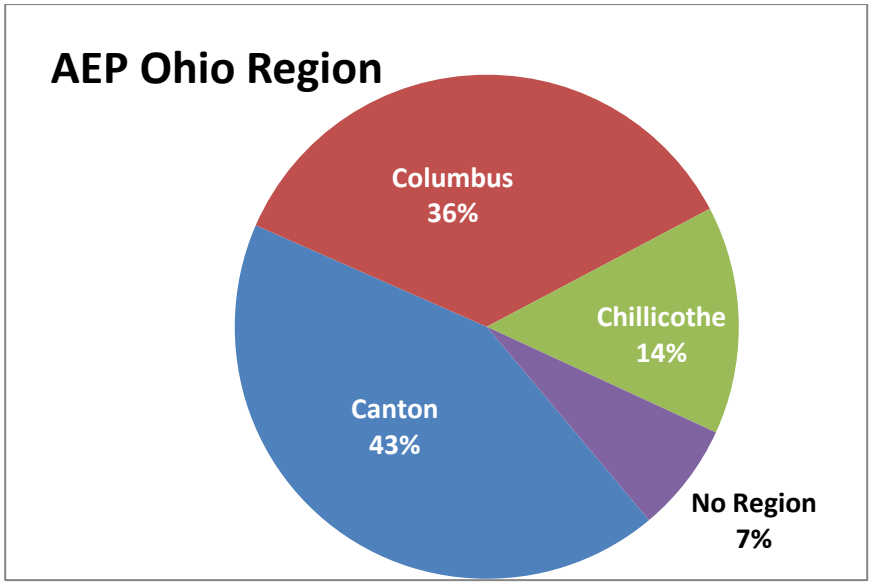
Table 3-4. Activity by Type of Construction Project

New Construction Program (2013 Budget Year)		
Construction Type	Number of Buildings	Estimated Floor Area (sq. ft.)
New Construction	113	9,033,908
Major Renovation	58	4,611,781
Total	171	13,645,689

The average building size for buildings that reported their floor area in 2013 was 81,820 square feet. This is significantly larger than the average size of projects in 2012 (53,000 sq. ft.). Analysis of the reported floor area by program option indicated that buildings with a custom calculation were on average over three times the size of all other building categories. Whole building projects were not substantially different in size from the overall program building size average.

The project tracking base records the AEP Ohio region in which each project occurred. Participating buildings were primarily concentrated in the Columbus and Canton regions (Figure 3-1) with most of the balance (14%) in the Chillicothe region. No region was recorded for 7 percent of the buildings. The service addresses recorded for the buildings indicate that applications were received for projects in 73 different Ohio communities; indicating a reasonable coverage of the AEP Ohio territory.

Figure 3-1. Participating Building Locations (AEP Ohio Regions)



In terms of the number of buildings by business type (Figure 3-2), manufacturing facilities and warehouses together represented over half of the energy savings reported for the 2013 program year while large retail/service, the educational sector (schools, colleges and universities) represented almost another quarter (23%) of reported savings.

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In terms of energy savings (Figure 3-3), manufacturing facilities, schools, and large retail/service together represented over 50 percent of the types reported for the 2013.

Figure 3-2. Number of Buildings by Business Type

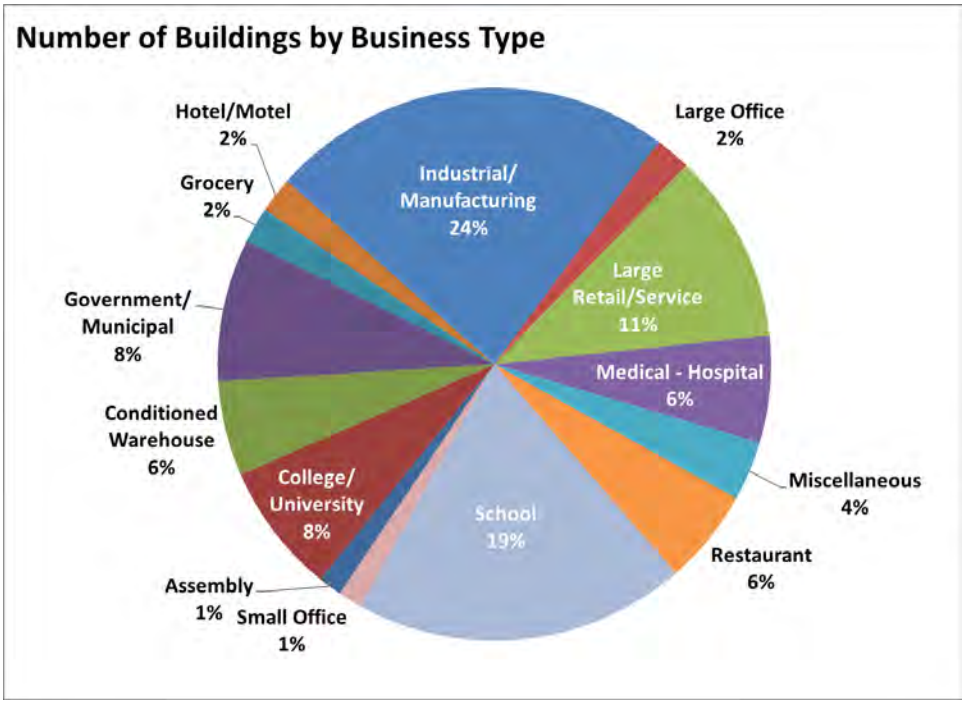
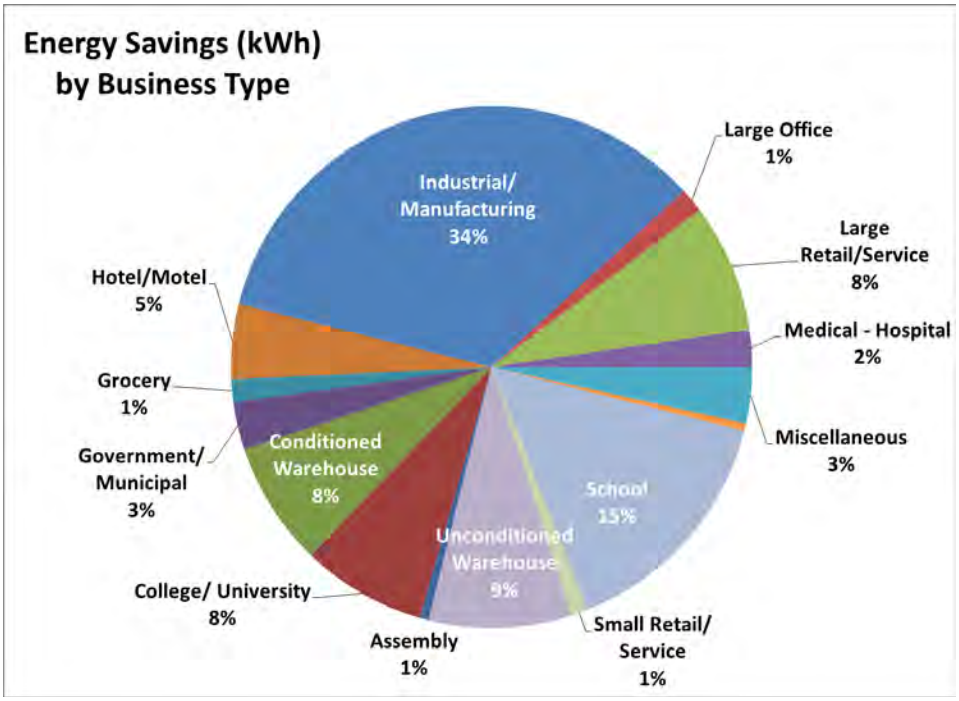


Figure 3-3. Energy Savings by Type of Business



NOTE – Business types recorded as "Assembly" and "Assembly /Meeting Place" have been combined for reporting purposes.

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Table 3-5 Floor Area by Program Option

Program Option	Average Floor Area Reported (sq. ft.)
All NRNC Buildings	78,423
Whole Building Buildings	88,162
Prescriptive Only Buildings	72,529
Prescriptive/Custom Combination Buildings	284,296

The range of prescriptive measures covered in the program was expanded slightly in 2013 to include outdoor lighting. The breakdown of energy savings by measure category is shown in Table 3-6. As in past years, the majority of the energy savings reported from Prescriptive measures related to lighting efficiency (71%), followed by variable frequency drives for HVAC equipment (17%) and other HVAC-related measures (6%) and refrigeration (5%). None of the other measure categories accounted for more than 1 percent of energy savings. This represents a slightly more diverse mix of measures compared to 2012 (see Figure 3-4) but still indicates that projects using the Prescriptive approach are not approaching the efficiency opportunities holistically. The evaluation team believes that additional savings opportunities are available that are still not being effectively pursued. Mature programs following best practices typically achieve 40% to 50% savings through non-lighting measures.

Table 3-6 Prescriptive Measure *Ex Ante* Savings

Prescriptive Savings by Measure Type		
Measure Category	*Ex Ante* Energy Savings (kWh)	% of Total
Lighting	15,148,460	71%
HVAC	1,374,214	6%
HVAC VFD^	3,523,542	17%
Ice Making	5,176	0%
Refrigeration	981,257	5%
Motors	16,659	0%
Miscellaneous (compressed air)	236,101	1%
Total	21,285,410	100%

^ *Variable Frequency Drives*

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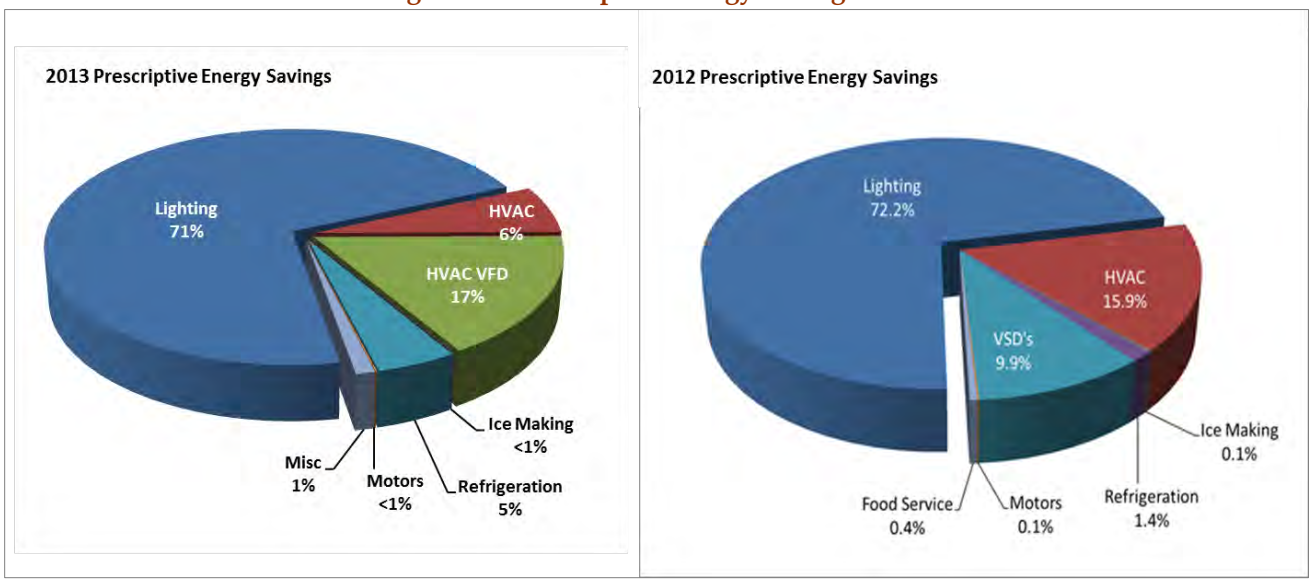
Figure 3-4. Prescriptive Energy Savings



Lighting measures completed under the program were divided into three broad categories; with Lighting Power Density (LPD) further sub-divided according to the type of space, as shown in Table 3-7. Lighting Power Density reductions accounted for 98.9 percent of reported energy savings, while interior daylighting sensor controls accounted for 0.02 percent and interior occupancy sensors comprised 1.1 percent. This is an indication that Solution Providers have not adopted lighting controls sufficiently and the program is not addressing all the savings opportunities.

Table 3-7 Lighting Measures by Category

Lighting Prescriptive Measures	Number of Projects	Calculated Incentives ($)	*Ex Ante* Energy Savings (kWh)	*Ex Ante* Demand Savings (kW)	*Percent of Ex Ante Lighting Energy Savings*
Interior Controls	5	12,079	168,322	114	1.1%
Interior Daylight Sensor Controls	1	224	2,377	1	0.0%
LPD	18	175,151	1,466,453	441	9.7%
Interior LPD	102	1,138,229	11,236,125	2,751	74.2%
Garage LPD	2	29,410	644,079	74	4.3%
Exterior LPD	41	151,731	1,631,104	-	10.8%
Total	169	1,506,823	15,148,460	3,380	100.0%

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3.3 *Impact Findings*

This section includes a summary and discussion of the evaluation-calculated energy and demand savings for the 2013 Non-Residential New Construction Program. Annual electricity savings were calculated using the data collected through document reviews and field visits for the sample of sites.

3.3.1 Summary of Impact Findings

The *ex post* energy and summer coincident demand savings for 2013 are 27,186 MWh/year and 4.92 MW respectively. This is a considerable increase over the 2012 savings of 20,406 MWh/year and 2.98 MW, and exceeded the 2013 goal of 10,000 MWh and 1.23 MW coincident demand reduction. The realization rate for energy continues to be very close to 1, while the demand realization rate improved to 0.78 as compared to 0.56 in 2012. These results are shown in Table 3-8 and exhibit strong growth in the program performance.

Table 3-8. Impact Savings, Realization Rate and Precision of Sample

Metric	*2013 Program Goals*	*Ex Ante (a)*	*Ex Post (b)*	Realization Rate RR = (b) / (a)	Overall Relative Precision at 90% Confidence	Percent of Goal
Annual Energy Savings (MWh)	10,000	27,774	27,186	0.98	6.7%	272%
Coincident Peak Reduction (MW)	1.23	6.32	4.92	0.78	9.9%	400%

3.3.2 Driving Factors of Realization Rate

Data analysis revealed that certain factors are driving the realization rate between claimed savings and verified savings. Energy savings and demand savings will be discussed individually.

3.3.2.1 Energy Considerations

Figure 3-5 is a graphical representation of the building 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 buildings with energy realization rates above one, while those points below and to the right are building with realization rates less than one. Significant outliers are labeled with their respective project numbers.

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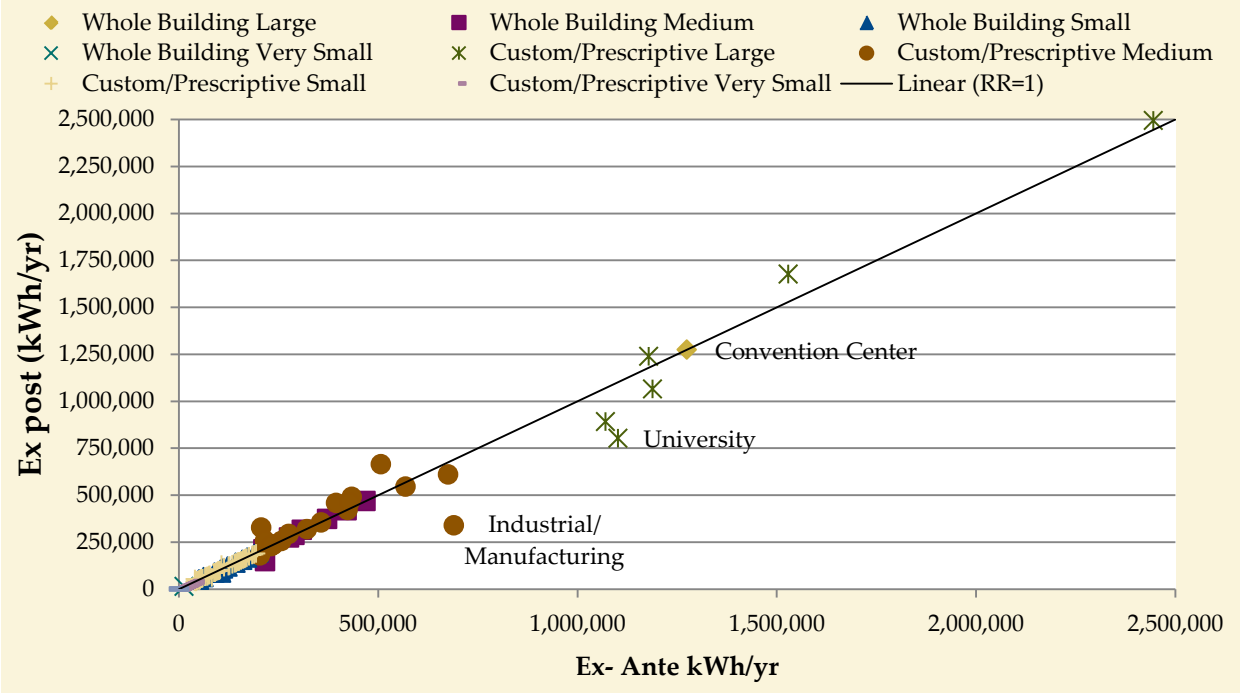
Figure 3-5. *Ex Ante* vs. *Ex Post* Energy Savings



Analyzing these data, key results are:

1. Each building in the large stratum was analyzed and its accurate realization rate helps drive the overall program realization rate of 0.98.
2. One building in the large stratum had a lower realization rate primarily due to the *ex ante* savings using an old version of DNV GL's Appendix A.
3. The one energy modeled building in the large stratum did not have the executable model. DNV GL took a conservative approach to the savings. Navigant agrees this approach is appropriate due to the lack of information absent the model.
4. The building with the lowest realization rate was an industrial/manufacturing building. Most of the *ex ante* savings are from lighting. The on-site visit found significantly lower lighting operational hours than the *ex ante* deemed operating hours.

Organizing the data by the size of the energy savings claim, seven buildings accounted for over 35 percent of the overall program energy savings claim. These buildings had a realization rate of 0.96, and significantly contributed to the overall program realization rate accuracy.

Of the seven largest energy claims, the building with the lowest realization rate, 0.73, was a central chiller plant at a university. Eighty-four percent of the *ex ante* energy savings at the building are from chillers, with the remainder of the savings coming from variable frequency drives (VFD) and interior lighting. DNV GL's Chiller and VFD calculations differed from its Appendix A. There were two projects at the building, and it appears that one project was based on an earlier version of DNV GL's Appendix A, instead of the 2013 version, which has lower deemed savings. The second project at the building used the 2013 Appendix A calculation, however the calculations used deemed savings for water-cooled, centrifugal chillers in the 300-599 ton range, instead of >= 600 ton for three of the 2500 ton chillers. For

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lighting, the verified annual hours were based on the site visit reported hours that are lower than the deemed hours in DNV GL's Appendix A. Navigant also applied a 10 percent reduction to the allowed/installed lighting fixtures based on manual dimming requirements per IECC 2009.

The largest energy savings claim on a modeled building was a convention center. The primary savings for this building is due to HVAC efficient chiller and ventilation fan savings. The *ex ante* whole building energy models were not available for evaluation as these projects were completed prior to DNV GL changing the requirement for executable energy models. DNV GL took a conservative approach, reducing the savings for typical occupancy outside the model. Navigant's believes that the reduction likely overly penalizes the savings. However, without an executable model and the lack of file documentation on the detailed occupancy schedules, Navigant allowed the 35% savings deduction from DNV GL without further adjustment. In the absence of whole building energy models, the implementation contractor should request and review the following information at a minimum, which may not normally be provided in LEED documentation:

- 8760 hourly baseline and efficient whole building kW outputs
- Detailed hourly equipment schedule multipliers on a weekly and seasonal basis
- Detailed hourly occupancy schedule multipliers on a weekly and seasonal basis
- Chiller equipment part load curves, baseline and efficient case
- Minimum realized modeled equipment turndown for variable speed equipment, baseline and efficient
- Modeled seasonal heat wheel effectiveness, if applicable

The building with the lowest energy realization rate, 0.49, was an industrial/manufacturing building with a savings claim falling in the medium sized stratum. There were five projects in this building. Eight-three percent of the building energy savings are from lighting, while most of the remaining savings are HVAC VFD savings. For the interior lighting projects, the annual hours verified during the site visits were lower than the deemed hours for Warehouse/Workshop in DNV GL's Appendix A. Navigant applied a 10 percent reduction to the allowed/installed lighting fixtures based on manual dimming requirements per IECC 2009. Some adjustments were made to installed fixture counts and wattages based on the site visits. For the exterior LPD project, the realization rate was above one since verified fixture types had a lower wattage that reported. The *ex ante* HVAC calculations in one project were based on DNV GL's 2012 deemed savings calculator instead of 2013, which has lower deemed savings. The 2013 version of DNV GL's Appendix A does not include bonus factors for the Variable Refrigerant Flow, Multi-split AC/HP measure. However, the 2012 version did have bonus factors for energy and demand savings.

3.3.2.2 Demand Considerations

Figure 3-6 groups the impact results by program approach. While each program approach has a demand realization rate around 0.8, the Prescriptive grouping has the lowest realization rate, 0.77. Further inspection of the Prescriptive projects reveals two systematic errors in the analysis; *ex ante* savings is not coincident with the AEP Ohio peak, and baselines are not adjusted to account for code required light reduction controls.

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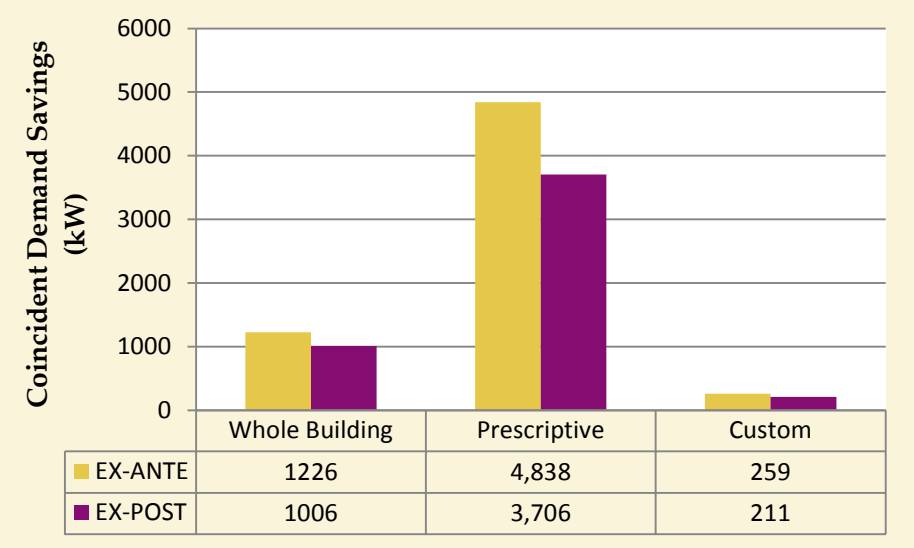
Figure 3-6. Summer Coincident Demand Reduction by Program Approach



Regarding coincident demand reduction, the tracking data has two fields for demand savings, 'SumOfkwdemandreduction' and 'CoincidenceKW'. The CoincidenceKW field was not complete for all projects and represents PJM demand reduction. This field is not used. SumOfkwdemandreduction is used as the *ex ante* savings, but inspection of the prescriptive projects sampled shows that these savings were the building maximum demand reduction, not the reduction coincident with the AEP Ohio peak, i.e. no coincidence factor is applied to the prescriptive demand reduction.

For baseline lighting controls, the *ex ante* calculations did not account for baseline code requirements of light reduction controls. Navigant took exception to the 2010 Draft Ohio TRM that states manual light reduction control accounts for a 30 percent energy reduction[12]. A more modest reduction is usually taken and Navigant applied a 10 percent reduction referencing the Efficiency Vermont TRM User's Manual number 2010-67a. Systematically the lighting power density allowances were overstated since the calculation assumed zero control.

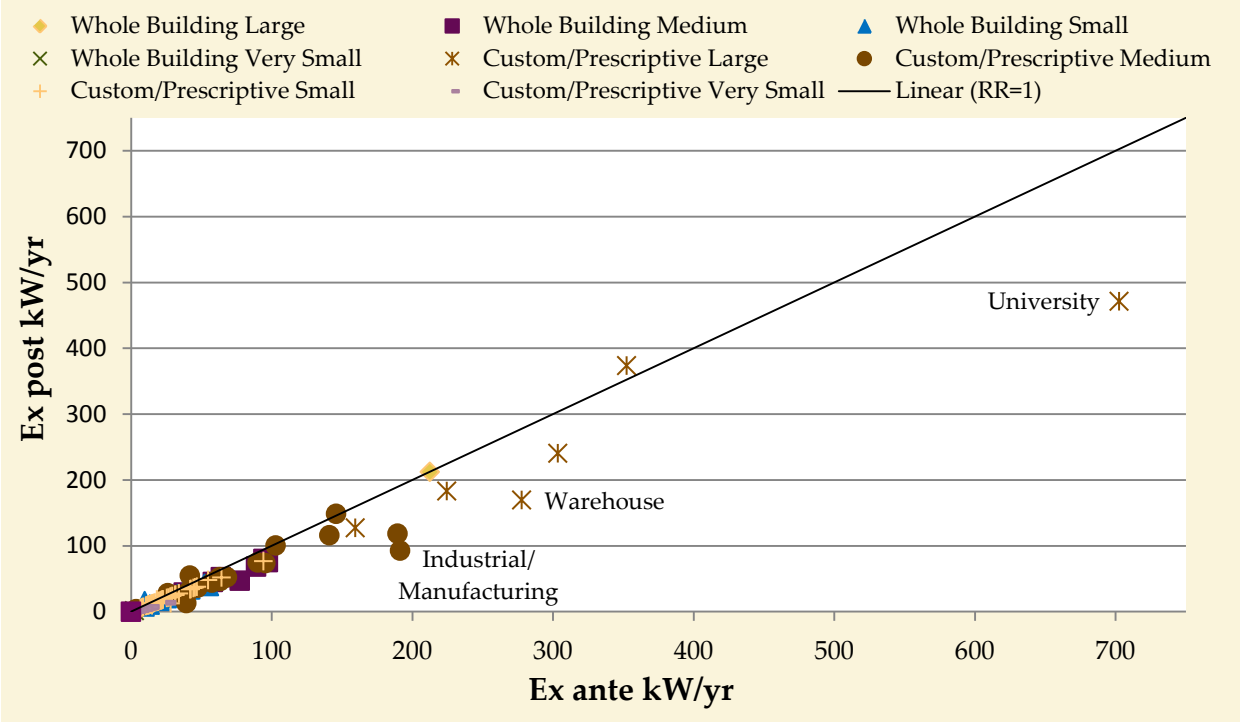
While Navigant accepted the DNV GL Appendix A demand interactive effects for "Education – Secondary School", a value of 0.74, the interactive effect appears to be in error since a summer coincident demand factor by definition would have to be above 1.0. All other building types listed in Appendix A have an interactive effect above 1.0 including primary schools. Further investigation will take place in the 2014 impact evaluation. Navigant believes this value should be more in line with other building type interactive effects, all of which are above 1.0 in Appendix A.

Beyond the systematic errors, there are individual buildings that had a significant impact on the demand realization rate. Figure 3-7 illustrates the relationship of *ex ante* demand reduction relative to the ideal

[12] 30% reduction for manual light reduction is excessively high for a manual control. Most references take a more modest savings for manually dimming lighting equipment. One example is the Vermont TRM which lists a 10% reduction for manual dimming. Vermont Energy Investment Corporation wrote both the 2010 Draft Ohio TRM and the Vermont TRM.

realization rate of one for the sampled buildings. As before, the buildings are categorized by the magnitude of energy savings rather than demand reduction for consistency with the prior section.

Figure 3-7 *Ex Ante* vs. *Ex Post* Summer Coincident Demand Reduction



The University and the Industrial/Manufacturing buildings are the same buildings already discussed in section 3.2.2.1. The same factors that drove a low realization rate for energy on those projects also drove a low realization rate on coincident demand reduction. Please refer to section 3.2.2.1 for more details.

Another building with a reduced demand realization rate is a lighting project in an unconditioned warehouse with a small conditioned office space. The low realization rate for demand, 0.61, is primarily due to warehouses having a coincidence factor of 0.70 that was not applied to the savings calculation, and the baseline not accounting for light reduction controls. Additionally the installed fixture counts were found to be different from the *ex ante* calculation.

3.3.3 Other Issues found in *Ex Ante* Savings

There were several projects where old versions of DNV GL's Appendix A or DNV GL's savings calculator were used for projects completing in 2013. This report previously mentions a university building that uses the 2012 version of the savings calculator. This error was also found on two other projects.

When calculating lighting power density (LPD) savings, proper characterization of the building type is critical for determining savings. Some warehouses are being characterized as manufacturing which

incorrectly inflates savings. One project incorrectly treated a 3-shift manufacturing site with an attached unconditioned warehouse entirely as a 1-shift manufacturing site. A second project is a warehouse that was characterized as a manufacturing building. A third project was a warehouse characterized as a manufacturing space, but this project also used a preliminary lighting plan. Navigant visited this site and found the installed fixtures to be entirely different. There were also exterior lights that were incorrectly characterized as interior lights.

LPD incentives are capped at a 50 percent reduction from the baseline code. DNV GL therefore does not claim savings on projects beyond 50 percent savings. Even though incentives are capped, the lighting system is being incentivized and therefore the savings should not be capped. For example, a project that achieved 65 percent reduction of the code allowances should claim the full 65 percent savings, even if the incentive is based on 50 percent.

Several lighting projects were found to have different fixture counts than the *ex ante* calculation. One project had discrepancies in the lighting fixture types.

Variable Frequency Drive (VFD) savings is linearly dependent on the motor horsepower. Some projects did not have the correct motor power which led to errors.

Whole Building projects have the ability to more accurately calculate demand reduction coincident with the AEP Ohio peak. Rather than using a deemed coincident factor, best practice is to use the model hourly analysis during the AEP Ohio peak period.

Several miscellaneous errors were noted. Examples include:

- Using a deemed chiller savings coefficient from the wrong chiller size range
- Using a deemed savings intended for unitary or split AC's on a mini-split. Mini-splits should have a separate deemed savings
- Claiming savings on two cycling air dryers when only one was installed and one 40 HP motor with claimed savings was not installed
- Claiming a cooling bonus, but was found to be an unconditioned space
- Not account for savings from installed occupancy sensors

3.3.4 Incremental Cost Analysis

The project incremental cost is an important parameter in the benefit/cost analysis. The incremental cost is defined as the difference between the as-built building with all the efficiency features and the code minimally compliant building. In the tracking data the field 'ProjectTotalCost' was used as the *ex ante* incremental cost, however it is apparent that the costs being reported did not follow a consistent methodology. Navigant reviewed the project files and corrected project incremental cost and Figure 3-8 shows the results. While most projects reported true incremental project costs, eight of the projects appeared to have reported the entire cost of constructing the building.

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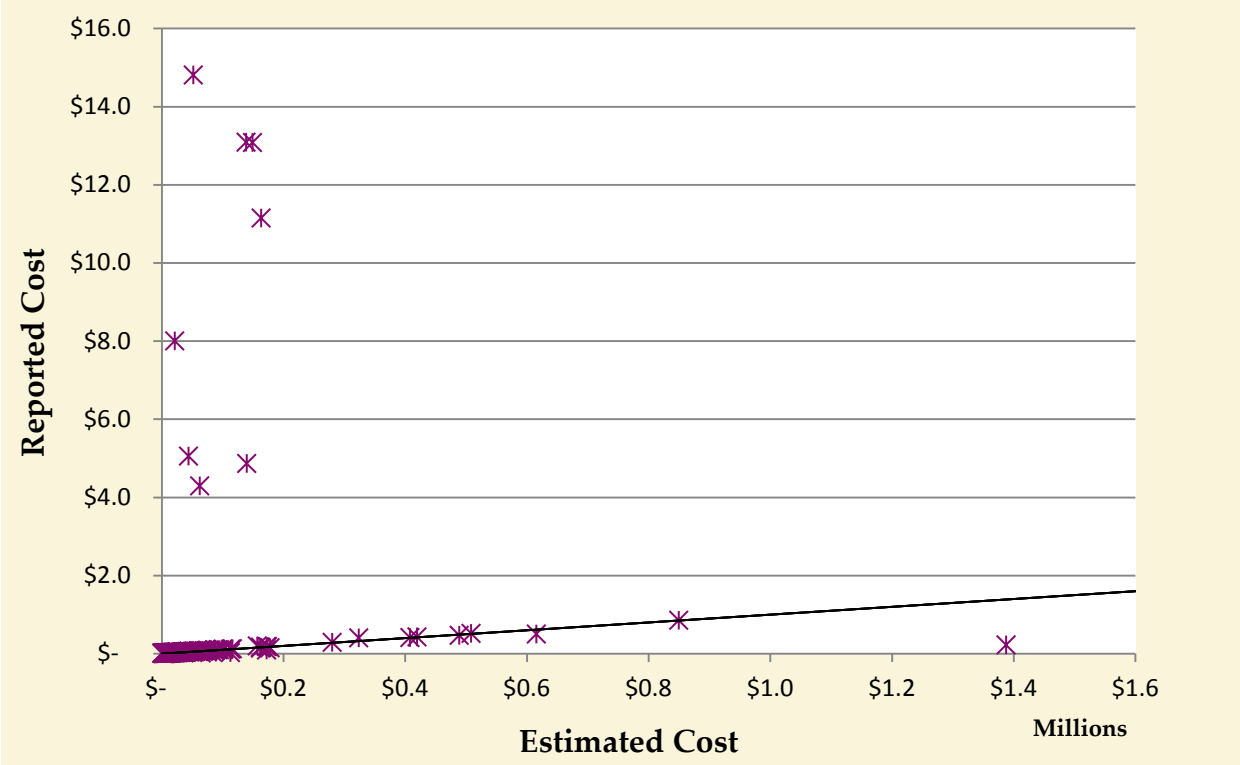
Figure 3-8 *Ex Ante* vs. *Ex Post* Project Incremental Cost



3.4 Process Findings

AEP Ohio and DNV GL continue to make improvements to the program as they gain experience and the program becomes more established. Feedback from program participants and Solution Providers indicates a high level of satisfaction both with program design and program processes. The program has had some success in achieving earlier involvement in building projects as market awareness increases. Several changes to the program were made in the 2013 program year:

- Increased use was made of "Dodge" data, which provides reporting on new construction activity. To some extent this data has been used to identify potential projects that could be approached as potential program participants, however, the main use of this information has been as a source of market intelligence to support discussions with Solutions Providers.
- Some improvements were made to the application form, to simplify the form by providing separate applications for specific categories of measures and make the process clearer by providing a requirements checklist.
- AEP Ohio changed the program requirements to require that participants using the Whole Building option provide executable versions of their building simulation models. This change resulted in a more robust review and has changed the nature of the building review process.
- For projects participating in the Whole Building option, an increased emphasis was placed on identifying energy efficiency opportunities for equipment treated as plug loads and exterior lighting. Program staff are now working to identify opportunities for end uses such as kitchen

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equipment, which are not specifically addressed in the building energy modeling. In past years, the application didn't request information on exterior lighting. Similarly, the new process is now obtaining better information on exterior lighting and identifying some efficiency improvements. Some additional Prescriptive items identified for inclusion in the 2014 program were also encouraged in the latter part of the 2013 program year.

- Outreach efforts were focusses on strengthening and deepening ties with Solutions Providers. Program staff have started to work to meet with Solution Providers on a regular basis and follow up on the status of projects. This effort has resulted in more projects being submitted per Solution Provider firm.
- Additional processes were developed to improve communications with participants and Solutions Providers around issues such as missing application information or conveying the incentive payment.

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

3.4.1 Participant Satisfaction

Participants continued to show a high level of satisfaction with the program. On a scale of 0-10, they gave the program an average overall score of 8.7. Table 3-9 shows satisfaction overall and by category. Participants also indicated that they were satisfied regarding the level of documentation required and the time required to complete the application process.

Table 3-9. Respondent Satisfaction with the Program

Category	Rating (47 respondents)
Time required to participate	8.1
Level of Documentation	7.4
Overall Satisfaction	8.7

Note – 10 represents very satisfied.

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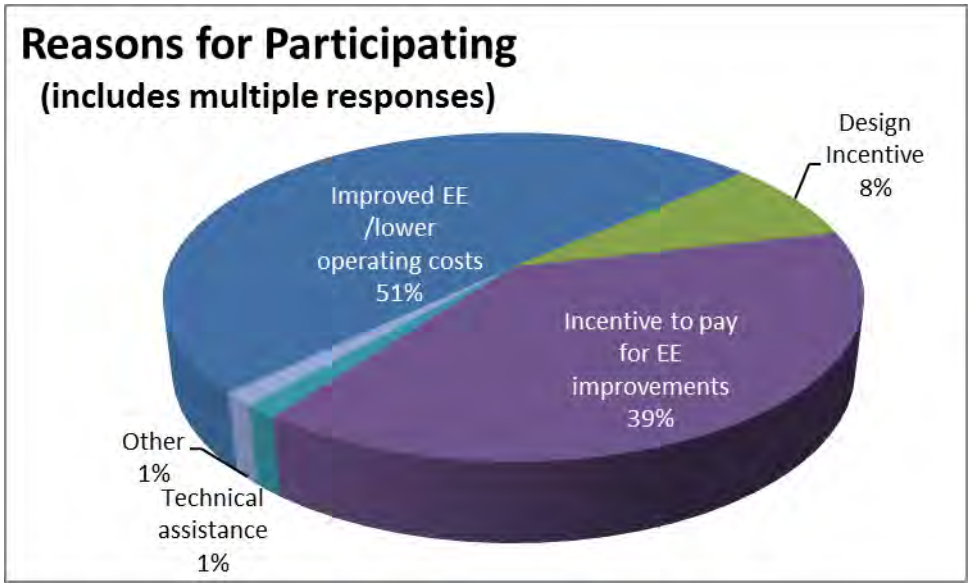
Responses received from Solution Providers who had been involved in the program indicated a high level of satisfaction with the program, both from the perspective of the Solution Providers and indirectly from their clients. One Solution Provider indicated that his firm was a "huge supporter" of the program and recommended it to all of their clients. Solution Providers which have worked with other New Construction programs, within Ohio and in other states, commented that the AEP Ohio program was "by far the easiest" to participate in and that it was "one of the best in the market". Comments with regards to the incentives available under the program indicated that they were worthwhile and that the design incentive makes it easier to do an efficient building project in AEP Ohio's territory than in other parts of Ohio. Solution Providers commented that outreach for the program was very strong and participation in the program was described as a "no brainer" for anyone developing an efficient building project.

3.4.2 Participant Motivations

Not surprisingly, the main reasons provided for participating in the program related to energy efficiency and lower operating costs, followed by the provision of incentives to pay for energy efficiency improvements. As shown in Figure 3-9, incentives were the main motivator for 47 percent of participants. Eight percent of participants referenced the design incentive as a key reason for participation.

Figure 3-9 Reasons for Participating in the AEP Ohio New Construction Program



Feedback from Solution Providers indicate that for clients who have decided to include energy efficiency in their design beyond code requirements, there is no reason to not participate in the program. Some Solution Providers indicated that most of their projects now participate in the AEP Ohio program.

The majority (77%) of respondents to the survey indicated that they were building facilities that they would operate. Ten percent of participants indicated that they were building the project to lease, and two percent indicated that they were building to sell. While information is not available for the proportion of all new buildings in AEP Ohio's territory that are built to own, lease, rent or sell, the

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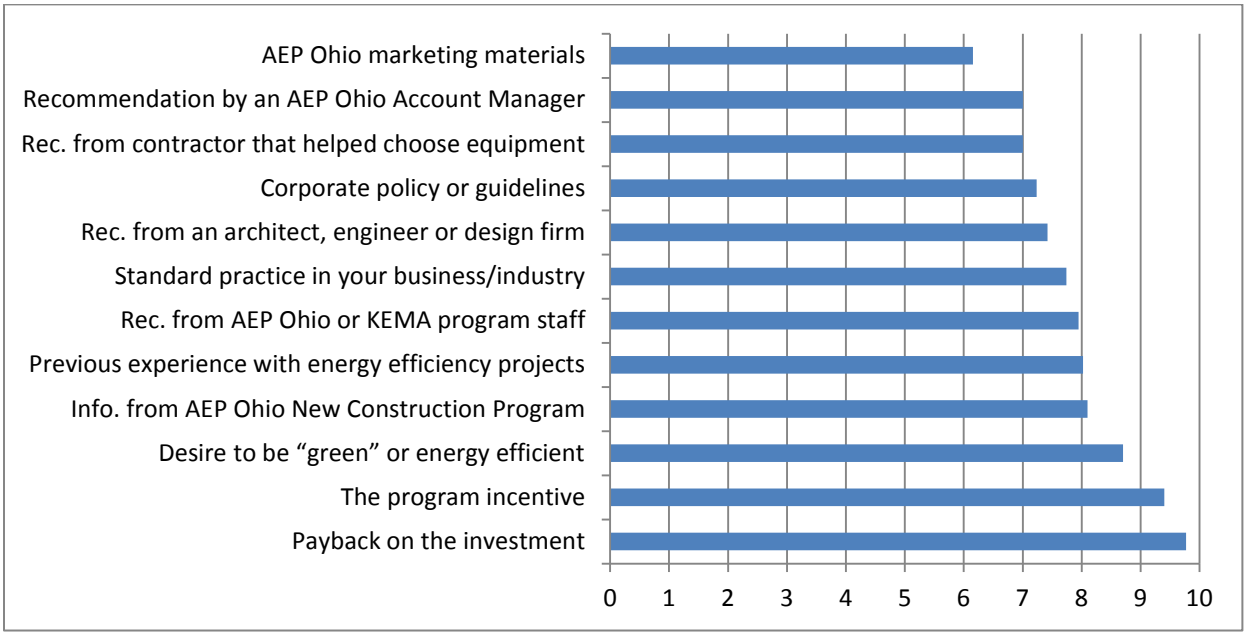
evaluation team believes that these results imply that the adoption of higher levels of energy efficiency has primarily occurred among the portion of the market which is building facilities that will be owner-occupied and will therefore benefit from lower operating costs.

As in past years, feedback from the Solution Providers indicated that many of the projects which participated in the Whole Building approach had already made a commitment to pursuing the LEED process. Solution Providers reported that the application process for the AEP Ohio program aligns well with the LEED process so that the AEP Ohio program doesn't require significant additional work beyond completing the application.

Participants were asked to rate the importance of different information sources on their decision to incorporate a higher level of energy efficiency in their building project (Figure 3-10) on a scale of 1 to 10, where 10 indicated the factor was "extremely important". Most participants indicated that a number of different factors influenced their decision; however, the payback on the investment (9.8) and the availability of the program incentive (9.4) were rated as the most significant factors. The desire to be "green" or energy efficient was also given a high rating (8.7).

It is evident from the responses that a number of factors influence decision makers considering the level of energy efficiency to incorporate into new construction programs. This reinforces the need for a multi-pronged strategy to provide information, outreach and support in this market.

Figure 3-10. Factors Influencing Energy Decisions



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3.4.3 Marketing Efforts and Program Awareness

AEP Ohio and DNV GL continued to be proactive in identifying and reaching out to key market segments and market actors to build awareness of the Non Residential New Construction Program and recruit projects.

- In 2013, increased use was made of "Dodge" data, which provides reporting on new construction activity. This information has primarily been used to provide market intelligence to program staff in reaching out to Solution Providers and in some cases, in identifying potential new Solution Providers.
- DNV GL has developed new processes to increase communications with both applicants and Solution Providers to reinforce the value of the program and identify new opportunities. For example, the check conveyance process has been improved to specifically identify that the monies being provided are a result of participation in the New Construction Program and to inform the Solution Provider that the incentive has been provided. A new step has also been added to communicate with participants to ask if they are involved in any other new construction projects which might be eligible for the program.
- As in past years, DNV GL and AEP Ohio staff held meetings with Solution Providers and attended other outreach events. In the last year, DNV GL also used these meetings to provide awards to Solution Providers which have been active in the program. This recognition helped to reinforce the importance of the role played by Solution Providers and to highlight the value the program delivered to both Solution Providers and their clients.

Several of the design firms interviewed as part of the review mentioned meeting with DNV GL staff or attending sessions offered by DNV GL to provide an overview of the program. Solution Providers reported that they found these sessions informative and helpful in better understanding how to access the program to assist their clients. Some of the Solution Providers also mentioned the level of activity they had achieved in the past year (a take away from the meeting with AEP Ohio and DNV GL) and that they were working to obtain broader involvement across their firm. One Solution Providers complimented AEP Ohio on its outreach efforts, indicating that the outreach effort was very robust and that one of AEP Ohio's strength was that they always reach out to their Solution Provider and listen to their input.

Two of the design firms mentioned the benefits to their business as a result of participating in the program. Specifically, the design incentive was mentioned as being sufficient to pay for the modeling and design effort and that the modeling is very helpful in demonstrating the benefits of energy efficiency improvements.

In 2013, most participants indicated that they had learned of the program through AEP Ohio staff (42%) while 6 percent indicated they had learned of the program through KEMA (DNV GL) staff. Eight percent reported learning of the program through the internet or AEP Ohio web site and six percent through a workshop. If contacts through industry or trade association and trade publications are included, this implies that more than three-quarters of participants in 2013 learned of the program through outreach activities by AEP Ohio and DNV GL.

Fifteen percent of participants indicated that they had learned of the program through their architect or engineer. This is an increase over past years and indicates a positive increase in involvement by design

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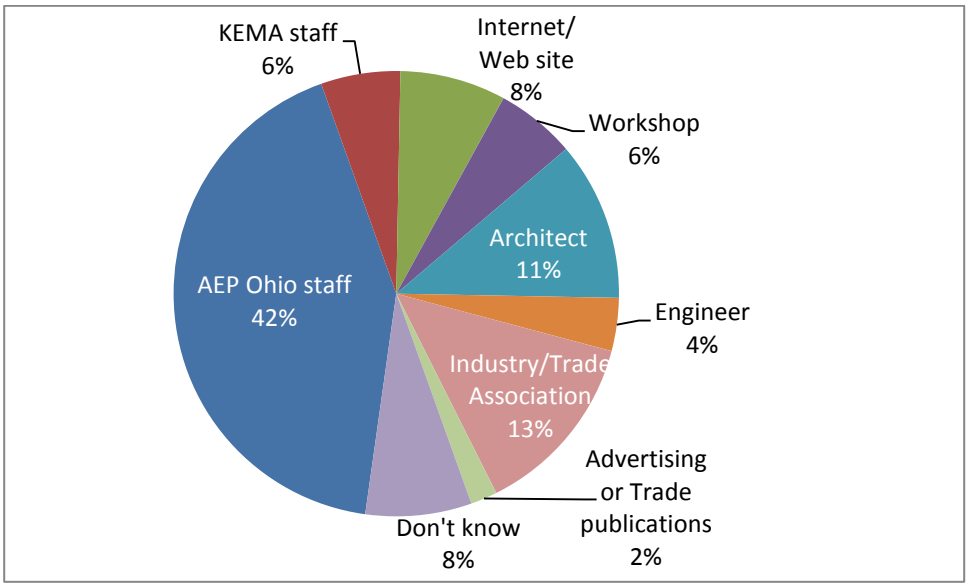
teams in communicating the program's availability to their clients. Figure 3-11 shows the information sources as cited by participants.

Figure 3-11. Participant Information Sources



Navigant notes that the AEP Ohio web page for Builders and Contractors, which provides application forms for new service connections (https://www.aepohio.com/builders/Default.aspx) has been changed to include a link to the New Construction Program as recommended in the 2012 evaluation.

Awareness of the New Construction program appears to be increasing across the Ohio market. Feedback from Solution Providers indicates that a growing number of clients now ask about the program. At the same time, outreach to the design community is building awareness and acceptance of the program among Solutions Providers. Continued efforts to strengthen and deepen relationships with Solution Providers should ensure increased and earlier program participation.

3.4.4 Program Requirements

The program application form requires that the incentive not exceed 50 percent of the project cost, but does not define how project cost is determined. Discussions with AEP Ohio staff reveal that project cost is the entire cost of the materials installed as part of the project. In some cases this has included non-energy costs, i.e., the entire cost of building construction. Navigant believes that the cost that should be considered should only address the incremental cost of efficiency measures installed.

Unlike retrofit programs, new construction is always a comparison between buying minimally code compliant materials and more efficient materials. As such, the proper cost decision a design team or building owner is facing is the incremental cost of upgrading to more efficient equipment. By limiting the incentive to the incremental cost of efficiency, the participant can make informed decisions relative to the direct efficiency investment. Additionally AEP Ohio would be protected from over-incenting measures that are relatively inexpensive to the participant.

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Since AEP Ohio's program is predominantly prescriptive in nature, deemed incremental costs can be used for Prescriptive measures. By using deemed incremental costs, the process would remain quick and efficient. Whole Building projects usually have components that are prescriptive, and the prescriptive costs can be applied to those components. Only Custom measures need be carefully calculated for incremental cost, however, the custom incremental costs are already required for accurate benefit/cost analysis.

3.4.5 Barriers to Participation

As discussed in section 3.2.2, the majority of participants in the 2013 New Construction program were organizations that were building an owner-occupied facility. Discussions with Solution Providers indicated that split incentives[13] continue to be a significant barrier to the adoption of higher efficiency in new construction. Some sectors, such as warehousing, have reportedly completely embraced energy efficiency in new construction projects. Other sectors, such as educational and government facilities, are often mandated to build to a specified level of efficiency above that required by the Ohio Building Code. According to Solution Providers, the market for office space and common areas for malls are starting to show a greater demand for efficiency; though this is less evident in smaller urban markets. Demand for energy efficiency is reported to be quite low in the retail market; where lease terms are often quite short. As demand for more efficient space and lower operating costs grows from tenants, it can help drive decisions by project developers. Some Solution Providers indicated that this is beginning to happen with respect to warehouse space, and that across markets, the availability of incentives has helped to overcome some of the barriers related to initial costs.

The survey of program participants indicated that potential lessees and buyers place a relatively high value on energy efficiency in their market, as shown in Figure 3-12. Increased demand for energy efficiency by potential building occupants has helped to drive a trend to more efficient buildings in other markets. The indication that potential buyers place a slightly higher emphasis on energy efficiency than potential lessees is consistent with the expected interests of owner-operators compared to building tenants.

[13] "Split incentives" occur when the organization building a new facility is not the organization that will be operating the facility and paying the energy bills. As a result, the organization building the facility has limited or no incentive to spend often limited capital to improve energy efficiency.

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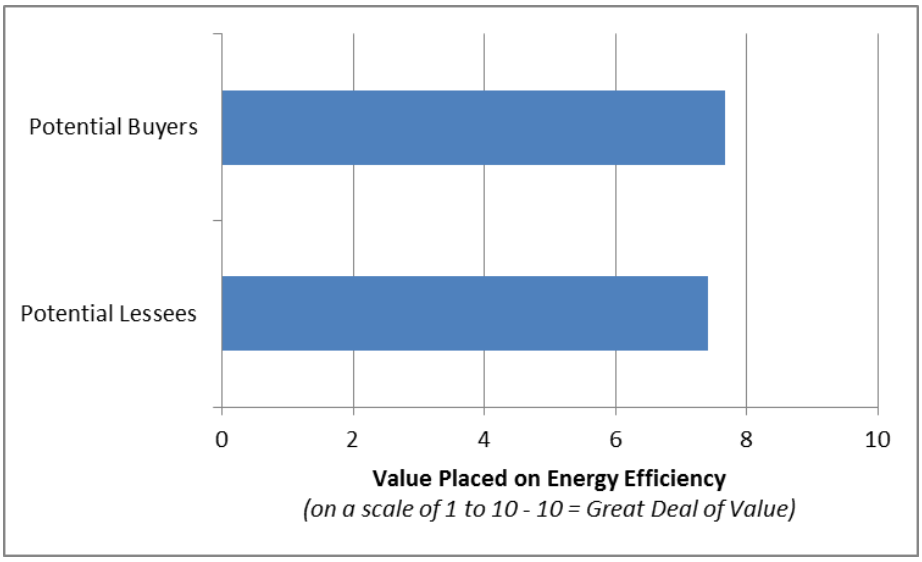
Figure 3-12. Importance of Energy Efficiency in Market



The survey also queried the barriers to increasing energy efficiency in the design of new buildings, as shown in Figure 3-13. The majority of responses focused on the additional capital cost of including higher levels of energy efficiency and the payback or return on energy efficiency improvements. Other factors, such as uncertainty about the performance of efficiency upgrades, potential additional time required to include a more efficient design, or split incentives between the builder and the ultimate occupant of the space, were given relatively lower importance. This may, in part, reflect the nature of the respondents, given that the majority of participants (77%) indicated that they were building the facility that they would then operate (owner-occupied).

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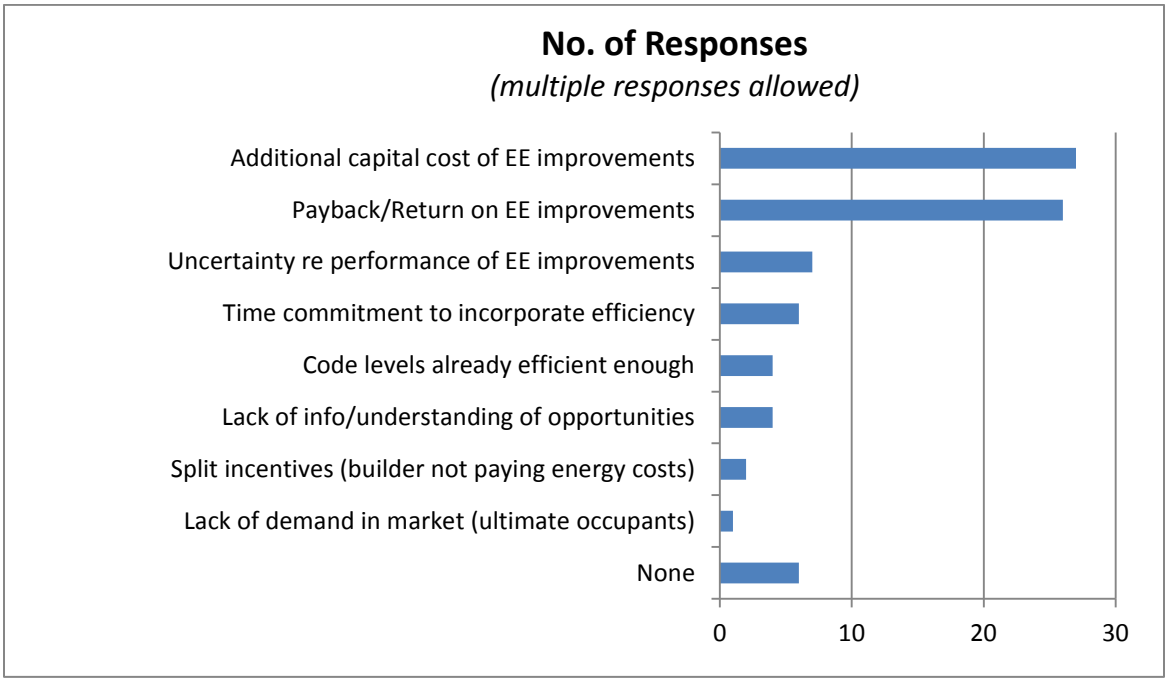
Figure 3-13 Barriers to Increased Energy Efficiency



3.4.6 Customer Enrollment Process

Navigant reviewed the customer enrollment process, including the application forms, processes followed by DNV GL in reviewing and approving applications, the time required for review and approval of applications, and the approval review processes. We found no significant issues with respect to the enrollment and approval process and believe changes made to the application process, including simplifying the process and adding a requirements checklist, are helping to improve the process for participants. Participants reported that they found it relatively easy to find information regarding the program (rated as 7.8 out of 10, where 10 represented very easy.

Feedback from Solution Providers and participants indicated there were no significant barriers to program participation once a decision had been taken to achieve higher efficiency in a project. When asked about the ease or difficulty of the application process, respondents rated the ease of use at 7.9 out of 10, where 10 represented very easy to complete.

Solutions Providers reported that they generally provide significant support to applicants in completing the application process, often helping to complete the application form and supporting the collection of required documentation. Some indicated that DNV GL is now providing some increased support in this area as well.

Fourteen percent of participants who had participated in the Prescriptive option indicated that they had considered participating in the Whole Building option. Those who chose the Prescriptive program option indicated that their decision was based on the application process being simpler (50%) or their project not being large enough to pursue the Whole Building option (17%). Two other applicants

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indicated that they felt that the Whole Building option was too complex and bureaucratic or required too much time and expense for their project.

The only area of uncertainty noted with regards to the application process concerned the demand reduction reporting requirement. It was noted that some applicants had been confused about what demand reduction to report. Navigant notes that the "Whole Building Performance Summary" now specifies that the executable model submitted with the application must model the "as-designed and the as-built building models including both AEP and PJM peak values".

3.4.7 Incentive Payment Process

Funds for each program year are reserved on a project-by-project basis as applications are received. Applications are then monitored as they proceed through the application steps to verify that they are progressing as expected. If projects are delayed, particularly between program years, monies reserved for a particular project may be freed up.

A review of payments indicates that there was often a significant period between the date on which the building was completed ("Actual Project Completion Date) and the date on which the incentive check was mailed (average 202 days). This may not be indicative, however, in that in many cases the application was submitted after the completion date. On average 114 days elapsed between the date on which a completed application was received ("Completed Final Received") and the date on which the check was mailed.

No significant concerns were expressed by Solution Providers regarding the incentive payment process, though one Solution Provider commented that it can be an issue. That particular Solution Provider indicated that it generally takes about four months to work through a prescriptive project and that it then takes a further two months before the incentive is received. As mentioned earlier, DNV GL has changed the process around the conveyance of the incentive check to more clearly identify that the payment is being made as part of the incentive program and to add additional follow up communications with the customer.

3.4.8 Actions absent the Program

Projects participating in the New Construction Program have generally been designed to include energy efficiency that exceeds requirements in the Ohio Building Code. As is past years, most of the projects proceed with little or no change in efficiency from the levels proposed when these are submitted. In most instances, an initial or revised 'as-built' modeling of the project is accepted from the applicant, with DNV KEMA's role to verify the level of savings attained. Feedback from Solution Providers reinforced that this is perceived to be the "normal" course, while DNV GL sometimes offers suggestions for improvement, in most instances the discussion centers around verification rather than opportunities for further improvements. One Solution Provider indicated that they would not expect DNV GL to provide technical advice given that they consider themselves to be the experts on sustainable design.

Interviews with program staff, on the other hand, indicate that in some instances, DNV GL staff have been able to recommend improvements for projects, particularly under the Whole Building Approach. In general, the ability to influence the design of a new building increases with earlier involvement in the

project. Program staff indicated where they were able to influence some improvement in building efficiency, in cases where they became involved at the pre-design stage.

As discussed in section 3.2.2, many of the projects that participated in the New Construction Program also pursued LEED certification. In most instances (66%) the decision to pursue LEED certification preceded the decision to participate in the AEP Ohio program, however, in 2013, 16 percent of respondents indicated that they had decided to pursue LEED certification after applying to the AEP Ohio program.

Given the motivation of obtaining a certain level of LEED certification, there is an opportunity for the New Construction Program to increase the emphasis placed on energy efficiency within the overall objective of LEED certification. While some Solution Providers reported that the level of energy efficiency included in their building project was essentially unchanged by the availability of the program, others indicated that the availability of the program incentives increased the level of energy efficiency included in some of their projects. The ability to influence the level of efficiency was greatest in projects which became involved in the New Construction Program early in the project process. Solution Providers indicated that the level of energy efficiency was improved in approximately 25 to 35 percent of projects. DNV GL also noted that they had seen some new projects being submitted that incorporated design concepts that they had recommended in past projects to the same Solution Provider or developer.

The survey indicated that some participants have changed their policies or processed for other new construction projects or purchase decisions. The most common change is to include energy modeling of new construction projects (14 responses). A number of participants also reported that they have changed their purchasing practices to specify certain types of equipment or efficiency levels (13) or to specify a payback level when purchasing new energy consuming equipment (6). Seven respondents indicated that they now require new buildings to meet a specific code or standard (such as LEED). Figure 3-14 presents responses about action taken as a result program participation.

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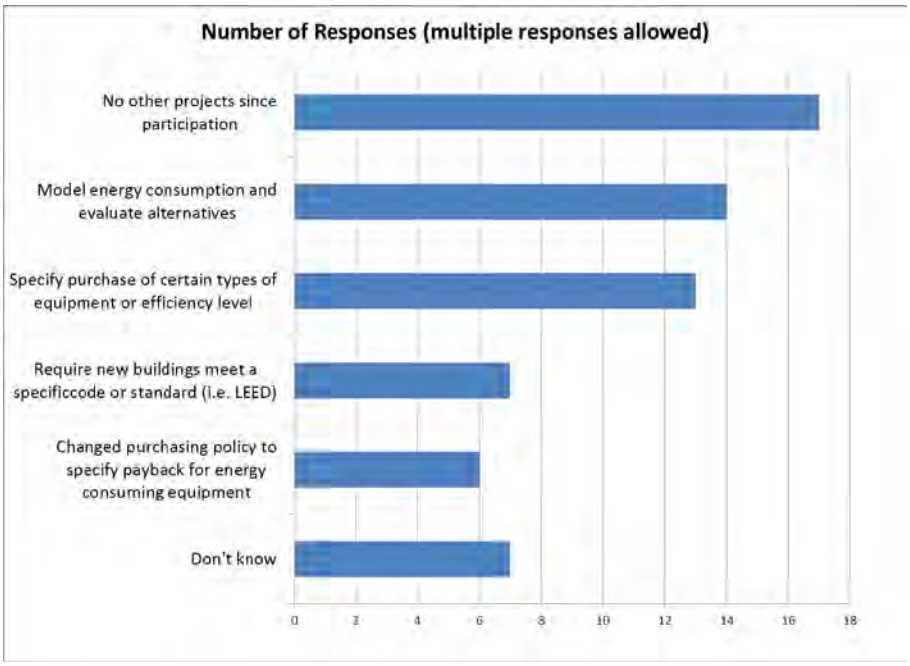
Figure 3-14. Actions Taken as a Result of Participation in NRNC



3.4.9 Program Tracking Data Review

The program tracking database is used to record all of the information from program applications and to track the progress of applications through the process. While the evaluation team noted in other sections that some fields were not fully populated for all applications, our overall assessment is that the tracking database is reasonable and accurately reflects the status of program applications.

As in past years, Navigant offers some suggestions for improving the usability of the tracking database and making the data clearer for those reviewing the data:

1. Several acronyms and abbreviations are used in the tracking database that may be unclear to someone unfamiliar with the system or new staff assigned to work on the tracking data by the program administrator. We recommend 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. If different spreadsheets are used for different program approaches, explanations of how these spreadsheets differ and where to locate other tracking data should be included.

2. Some information appears to be tracking the same information, for example: business type and business segment or District and Region. We recommend reviewing the need for multiple, similar fields and the elimination of duplicate information.

3. Some fields in the tracking database were not completed for all applicants. Some of this information, such as building floor area, is useful in evaluating the program and comparing program results. We recommend that a check be added as part of the administrative review of

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applications to ensure that complete information on the project has been received and entered into the database.

4. As indicated in our prior evaluation, there is no clear means of identifying which projects are enrolled in the Prescriptive approach or the Custom approach. This process is complicated by the fact that incentives may be accessed through more than one program option under the same project number in some cases. While it is possible to parse out the information on different programs, this could be made easier by adding three columns to the tracking spreadsheet that specifically identify whether each of the program approaches was used for that particular project number.

3.4.10 Verification and Due Diligence

There are two levels of due diligence carried out as part of the program. The first is the administrative element, ensuring that information submitted to the program is processed accurately and recorded in the project tracking database as previously discussed. The second process is the engineering review of applications to ensure that the savings for a project are calculated correctly and result in the appropriate level of incentive for the customer.

In terms of information tracking, all projects are subject to an administrative review after the application has been received and entered into the program tracking database. This administrative review is then confirmed through a management review before information is provided to AEP Ohio. AEP Ohio then reviews all program application data provided by DNV GL and approves program incentives.

The engineering review process differs depending on the type of project (Prescriptive, Custom or Whole Building) and the level of verification carried out differs depending on the type and size of the project. All projects are reviewed by a technical reviewer and most projects also go through a peer review process. Projects that involve incentives over $25,000 are also reviewed by AEP Ohio staff. Projects may also be subject to a site visit for verification. The proportion of projects subject to a site visit is based on the level of incentive payment, with a higher sampling rate applied to projects with a higher level of incentive.

Reviews for the Prescriptive and Custom Approach program are relatively simple. Staff reviews the application and supporting documentation to determine compliance with program rules and determines the level of incentives. For the Custom Approach, engineering calculations are also reviewed.

Building energy modeling remains an important component of new construction program, with 27 percent of participants in the survey indicating that they had completed building energy simulation modeling. While modeling is always required for projects participating in the Whole Building option, some other projects also complete modeling. Although there is no direct evidence that the program has increased the prevalence of modeling in the market, comments from Solutions Providers indicate that those who have used modeling have found it to be very beneficial in demonstrating the value of including energy efficiency investments in their projects.

In past years, applicants using the Whole Building approach submitted model inputs and outputs. In 2013, the process was changed to require applicants to provide executable versions of their models.

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While this change occurred after some of the 2013 projects had been submitted, most applicants cooperated in providing executable versions of their models for review.

Program staff are now able to review the model, project documentation and drawings to determine whether the energy simulation model properly represents the building design. DNV GL reviewers work with the modelers representing the applicant to ensure that the model accurately reflects expected energy use, which is then used to determine the level of incentives available under the program. Given that modeling results can be subject to assumptions made in the modeling process and even to the version of model used, these executable files are important parts of the review process.

The change to obtain an executable version of the model is important and has resulted in a number of changes in the review process. Both program staff and design team members commented that the ability to execute the model has made for a more focused and robust review. Since both parties are now able to see the same results it has led to greater discussion of how systems are represented in the model. In most cases where some modification to the model is required, changes are made by the applicant's design team; however, modifications are occasionally done by the DNV GL review team for convenience. Where such changes are made, these are clearly identified and the design team is advised of the change.

DNV GL indicated that it is also working to change the review process as a result of having access to the executable models. DNV GL has found that the process can be made more effective by identifying any questions regarding the application and model and arranging a meeting with the design team early in the process. Clarifying any assumptions included in the modeling and understanding the process used by the modelers up-front, has been found to reduce the amount of back-and-forth that occurred between the design and review teams in past. DNV GL believes that this has helped to speed up the review process and improve the experience for the applicant's design team. DNV GL noted that the time required to review and evaluate the application may take longer in some instances now that they are completing a more detailed review and that the review of the executables has also required some adjustments to the mix of experience required for their reviewers.

No significant dispute was reported to have occurred during the 2013 program year. While it is not uncommon for the evaluation to determine a level of savings that differs from the applicant's initial estimate, these differences have generally been resolved without issue. In most instances, program staff and Solution Providers indicated that differences arose from legitimate differences in engineering opinion on how to estimate savings or represent an efficiency change in the building energy model.

Navigant also notes that AEP Ohio and DNV GL do not have a formal Dispute Resolution process in place for the program. We recommend that consideration be given to developing a formal process to provide a framework in case such disputes arise in future.

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3.5 *Cost Effectiveness Review*

This section addresses the cost effectiveness of the Efficient Products Program. Cost effectiveness is assessed through the use of the Total Resource Cost (TRC) test. Table 3-11 summarizes the unique inputs used in the TRC test.

Table 3-10 Inputs to Cost-Effectiveness Model for AEP Ohio NRNC Program

Item	
Measure Life	13.1
Projects	196
Ex Post Annual Energy Savings (MWh)	27,186
Ex Post Coincident Peak Savings (MW)	4.92
Third Party Implementation Costs	$961,816
Utility Administration Costs	$458,428
Utility Incentive Costs	$2,981,225
Participant Cost	$6,810,331

Based on these inputs, the TRC ratio is Therefore, the program passes the TRC test. Table 3-12 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 3-11 Cost Effectiveness Results for the Non Residential New Construction Program

Test Results for NRNC	Benefit/Cost Ratio
Total Resource Cost	2.0
Participant Cost Test	3.7
Ratepayer Impact Measure	0.6
Utility Cost Test	3.8

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

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4 Key Findings and Recommendations

This section presents the key findings and recommendations from the 2013 Non-Residential New Construction program impact and process evaluations.

4.1 Key Impact Findings and Recommendations

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

1. Several prescriptive projects that completed in 2013 but started in a prior year were using old version of Appendix A and the DNV GL deemed savings calculator, which had different deemed coefficients.

    - **Impact Recommendation #1:** The review process should include a check to make sure all calculations have been updated to the current deemed factors.

2. *Ex ante* demand savings for prescriptive lighting did not include a coincidence factor. This resulted in reporting the building peak demand reduction, not the demand reduction coincident with AEP Ohio's peak.

    - **Impact Recommendation #2a:** Ensure that the *ex ante* demand reduction is the demand reduction that is coincident with the AEP Ohio peak.

    - **Impact Recommendation #2b:** There should be three fields in the tracking database regarding demand reduction. One for the building demand reduction, one coincident with the AEP Ohio peak, and one coincident with the PJM peak.

3. *Ex ante* baseline did not account for the baseline requirement of light reduction controls, resulting of an overstatement of the energy savings. Additionally, the as-built building documentation did not specify the level of light reduction controls installed in the buildings.

    - **Impact Recommendation #3a:** Baseline lighting power should be reduced by the baseline requirement for light reduction controls. Navigant recommends the baseline condition for spaces requiring light reduction with manual dimming. Navigant further recommends that lighting power be reduced by a factor of 10 percent in the spaces with this requirement.

    - **Impact Recommendation #3b:** Specify that DNV GL calculate the difference in energy savings between the baseline and the as-built lighting controls which may include occupancy sensors.

    - **Impact Recommendation #3c:** Clearly state whether manual light reduction controls are employed in the as-built building and whether or not a fixture has occupancy control. Claim

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savings when lighting control system exceeds energy code requirements as would be the case when occupancy sensors are present, 30 percent reduction, as opposed to the baseline manual dimming, 10 percent reduction. Note: to count as manual light reduction the controls must reduce light in a reasonably uniform pattern. Switching by alternating rows of lights is considered reasonably uniform, however left half of room versus right half of room does not qualify as reasonably uniform.

4. On-site visits and detailed review of project files revealed several errors in the *ex ante* savings calculation including: the use of outdated drawings and specifications, inaccurate light fixture counts, exterior lights being counted as interior lights, inaccurate motor size on VFD's, the mischaracterization of warehouses as manufacturing spaces, and calculating interactive effects on unconditioned spaces.

    » **Impact Recommendation #4a:** Before incentives are paid, obtain the final "as-built" drawing and specifications to facilitate updating savings calculations to reflect the as-built drawings.

    » **Impact Recommendation #4b:** Verify as-built motor sizes either through invoices or site visits.

    » **Impact Recommendation #4c:** The amount of time interacting with design teams during and outside of site visits is not sufficient to eradicate errors. Increase interaction both ways so that a better understanding of the building is achieved. More interaction would also present opportunities to increase building efficiency through having more opportunities to actively suggest improvements.

    » **Impact Recommendation #4d:** Consider doing a final walk through of all completed buildings to verify installation details.

    » **Impact Recommendation #4e:** If a site visit is not performed, meetings with the design teams should include discussions about space type, e.g. warehouse versus manufacturing, and specifics such as space conditioning details for the interactive effects.

5. Savings is frequently underestimated due to issues such as: capping savings once incentives are capped, not calculating savings from occupancy sensors, ignoring the savings from exterior lighting.

    » **Impact Recommendation #5a:** Account for all LPD savings, even when it exceeds 50 percent better than baseline LPD.

    » **Impact Recommendation #5b:** Review building details during the design phase and ensure all systems eligible for program participation are included.

6. On Whole Building projects, by reviewing the hourly model output during the coincident period, it was determined that the coincidence of demand reduction was frequently not calculated. This is the most accurate way of determining coincident demand reduction. When available, simulation models should be used for this purpose.

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» **Impact Recommendation #6:** Obtain energy models and run with the coincident peak period. Check that demand savings equals the reported coincident demand reduction.

7. *Ex ante* savings for mini-splits are being calculated with larger split system deemed factors. Mini-splits typically behave differently than larger systems and should have their own deemed factor.

» **Impact Recommendation #7:** Add a mini-split deemed savings calculation on the next update of Appendix A

8. The secondary school interactive effect factor for demand appears to be incorrect.

» **Impact Recommendation #8:** Investing the validity of the secondary school interactive demand factor and update DNV GL's Appendix A.

9. The *ex ante* project cost is not being determined with a consistent methodology. This is a critical factor in the cost/benefit analysis.

» **Impact Recommendation #9a:** Apply a consistent methodology to the calculation of project cost. Check for outliers in the cost data.

» **Impact Recommendation #9b:** Incremental cost over baseline is the critical number to determine. At minimum track the incremental cost.

» **Impact Recommendation #9c:** For custom measures, clearly define the baseline as well as the associated baseline cost.

4.2 Key Process 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. Program staff have made progress in achieving earlier involvement in new construction projects. Evidence indicates that early involvement increases the opportunity to encourage high levels of energy efficiency in the project design and is important for the NRNC Program to be effective. Navigant congratulates AEP Ohio in its success in this effort, and encourages continued effort.

   The current application process indicates that a "*Pre-Approval Application*" should be submitted "before construction begins" and that "*Final Application and complete documentation must be received of substantial completion*" (or installation of the customer's revenue meter)[14]. Experience indicates that trying to add energy efficiency design elements after the design has been completed often leads to conflicts with budgets and timelines. Other leading programs

[14] Page 36 of the AEP Ohio NRNC application form.

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encourage early involvement or limit eligibility to projects which are still at a point where the program can influence the design.

- The California Savings by Design initiative, limits eligibility to projects which are "*At a point where design changes are feasible, preferably in the conceptual or schematic design phase.*"[15]

- Energy Trust of Oregon encourages potential applicants to contact the program as early as possible in the design and development phase in order to maximize their opportunities[16].
- NYSERDA recommends that applications be submitted in the early schematic design phase or sooner. Program information warns that if an application is submitted in the design development phase it may be limited to only pre-qualified program measures[17].
- The ComEd/Nicor Smart Ideas New Construction program[18] requires that "*Applications must be submitted early in design to qualify for the program (design development or earlier). Projects in construction will not qualify*".

The evaluation team also notes that projects pursuing LEED certification are currently required to complete their LEED submission prior to applying for the AEP Ohio program[19]. These projects represent a unique opportunity in that the decision to pursue LEED already implies a commitment to higher levels of energy efficiency. Earlier involvement in these projects could provide increase the opportunity to influence the design and increase the emphasis on energy efficiency compared to other LEED design elements.

» **Process Recommendation #1a:** Encourage project applicants to use the design process and modeling to test the value of alternative building system improvements. This encouragement can take the form of DNV GL recommending specific improvements during the design stage (best practice), assisting design teams in assessing the net cost (with incentives) of efficiency upgrades, and general education on the benefits of energy efficiency relative to the small incremental cost.

» **Process Recommendation #1b:** AEP Ohio should review the eligibility requirements for the program, and specifically for the Whole Building and Custom options, and consider requiring projects to apply in the design stage, when the program can best influence the energy efficiency of the building design.

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[15] Savings By Design Online Program Handbook, Section 1-3, General Requirements and Eligibility, http://www.savingsbydesign.com/book/savings-design-online-program-handbook#booknode-441

[16] Energy Trust of Oregon, New Commercial Buildings, Opportunities for commercial construction projects, http://energytrust.org/trade-ally/programs/new-commercial-buildings/

[17] NYSERDA web site, New Construction Program Frequently Asked Questions, http://www.nyserda.ny.gov/Energy-Efficiency-and-Renewable-Programs/Commercial-and-Industrial/CI-Programs/New-Construction-Program/NCP-FAQs.aspx#Eligibility

[18] https://www.comed.com/Documents/business-savings/NC_Overview.pdf

[19] The "Whole Building" application (Page 36 of the application form) indicates that projects pursuing LEED are required to submit their final template and supporting documentation as part of their application to the AEP Ohio NRNC program.

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- » **Process Recommendation #1c:** AEP Ohio should work with Solution Providers and participants in LEED-oriented projects to become involved in the AEP Ohio program before submitting their LEED proposal. Program staff should develop strategies and initiatives to encourage a greater emphasis on energy efficiency in LEED projects.
- » **Process Recommendation #1d:** As part of the review process, program staff should offer technical advice where appropriate to improve the energy efficiency of building designs. Recognizing that many of the design firms are well informed and experienced in efficient design, it is recommended that consideration be given to the provision of support for projects to take an "integrated design" approach to new construction. For example, the ***Savings by Design*** program, offered by utilities in California, offers Design Assistance free-of-charge to building owners and design teams, to support integration of innovative design and technology in new construction. AEP Ohio should consider the possibility of re-allocating some of incentive budget to support increased use of an "integrated design" process.

2. The program has been successful in building market awareness of the program and has developed strong relationships with some Solution Providers or Design Teams. In discussions with program staff and Solution Providers, it was noted that while the program may have a strong relationship with one Partner or group within a design firm, there may be very little involvement by others within the same firm. Program staff indicated that they are working to take a more systematic approach to Solutions Providers to strengthen and deepen existing relationships. Navigant endorses this approach.

   Over the past year, program staff have worked to enhance communications processes with participants and Solution Providers and to work to identify opportunities for new projects with past participants. Navigant supports these efforts and encourages the use of awards and publicity for Solutions Providers who have been active in the program.

   - » **Process Recommendation #2a:** Increase outreach and education efforts aimed at broadening involvement by other members of firms with which the program has established strong working relationships.
   - » **Process Recommendation #2b:** Continue to work to expand and improve communications with participants to raise the profile of the program incentives and benefits and to identify future opportunities. As part of this effort, consideration should be given to documenting the benefits of the program, from both the participant and Solution Provider perspective, through case studies of effective and efficient design.
   - » **Process Recommendation #2c**: Program staff should record the names and companies attending outreach events so that Solutions Providers who have attended events but not participated in the program could be interviewed for future evaluations.

3. The program application requires that the incentive not exceed 50 percent of the project cost. Project cost is defined as the material cost of installed equipment.

   - » **Process Recommendation #4**: Consider amending incentive requirements to not exceed the incremental cost of efficiency upgrades or 50 percent of the project cost, whichever is less.

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4. Program staff at AEP Ohio and DNV GL indicated that they have started to explore opportunities for loads which are not specifically modeled within projects pursuing the Whole Building Option (i.e. plug loads and other equipment). Navigant supports this move to encourage greater use of efficient equipment within these projects and suggests that program staff also look for opportunities for custom projects associated with projects using both the prescriptive and whole buildings options.

5. Prescriptive projects tend towards interior lighting power density only savings and are not reaching the potential of the prescriptive approach. Exterior lighting, lighting controls, HVAC and refrigeration are common measure categories that should have better representation in the prescriptive approach.

    » **Process Recommendation #6:** Navigant recommends improving the comprehensiveness of each project through a combination of project reviews during design, education of Solution Providers, incentive adjustments, and rewards to Solution Providers. For example, the interior lighting incentive could be lowered, while raising the incentive for lighting controls or HVAC.

6. The program is now obtaining executable building energy models for all Whole Building projects as recommended in last year's evaluation. This presents a significant change to the verification process. Feedback from both Solution Providers and DNV GL indicates that this move has led to a more robust review process and DNV GL has begun to make changes to reflect this new process.

    » **Process Recommendation #7a:** Modify the review process for any projects in which building energy modeling has been completed to include an early meeting with the design team to review the modeling approach, any assumptions used, and any questions that the reviewers may have regarding the project. While ideally these meetings would be held in person, teleconferencing and web-conferencing can be used where that is more convenient. Early feedback indicates that this will provide a more efficient process and an improved experience for the design team and program participant.
    » **Process Recommendation #7b:** As part of discussions with project design teams, it is recommended that information be gathered on the model versions being used for designs. Design teams should be encouraged to obtain current versions of modeling software.

7. Continue to educate and advocate with Solution Providers and participants for comprehensive designs that leverages lighting controls, HVAC, thermal shell, commercial kitchen, and other equipment efficiency opportunities.

8. AEP Ohio indicated that it does not have a formal Dispute Resolution process in place for the program. While no significant dispute was reported to have occurred during the 2013 program year, best practice would be to have a process in place before it is required.

    » **Process Recommendation #9:** That a formal dispute resolution process be developed to provide a framework in case such disputes arise in future

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4.3 Key Tracking System and Project File Findings and Recommendations

With respect to the Project Tracking Database and Project Files, Navigant offers the following observations and recommendations for improved clarity and tracking:

1. A number of acronyms and abbreviations are used in the tracking database that may be unclear to someone unfamiliar with the system or new staff assigned to work on the tracking data by the program administrator.
    - » **Project Recommendation #1:** Consider 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. If different spreadsheets are used for different program approaches, explanations of how these spreadsheets differ and where to locate other tracking data should be included.
2. Some information appears to be tracking the same information, for example: business type and business segment or District and Region.
    - » **Project Recommendation #2:** Review the need for multiple, similar fields and eliminate those fields which duplicate information. This issue may addressed by the prior recommendation to add documentation of the fields used. If there is a reason why these fields are required and in some way represent different information then an explanation of the data should be provided in a folder documenting the database.
3. In reviewing the tracking database Navigant found that some fields were not completed for all applicants. Some of this information, such as building floor area, is useful in evaluating the program and comparing program results.
    - » **Project Recommendation #3:** That a check be added as part of the administrative review of applications to ensure that complete information on the project has been received and entered into the database.
4. New Construction project files can be considerable and complex with several design modifications over time. Without intimate knowledge of the project the details can be confusing and there exists uncertainty as to which document is the current revision.
    - » **Project Recommendation #4a:** It is suggested that all project files include an overview or summary sheet that briefly states what happened over the course of the design and construction of the building, which may span multiple years.
    - » **Project Recommendation #4b:** All project files should include a general drawing that lets the reviewer know the size, configuration and use of the buildings.

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Appendix A Participant Survey Instruments: 2013 AEP Ohio Non-Residential New Construction Program Participant Survey

Survey: Energy - AEP Non-Residential - 03/14

2013 AEP OHIO NON-RESIDENTIAL NEW CONSTRUCTION PROGRAM
Participant Survey

Awareness and Motivation

1. How did you learn of the AEP Ohio New Construction program?

- ☐ AEP Ohio staff
- ☐ KEMA staff
- ☐ Internet/Web site*
- ☐ Workshop
- ☐ Architect*
- ☐ Engineer*
- ☐ Energy Modeler*
- ☐ Industry/Trade Association*
- ☐ Advertising/Trade publications
- ☐ Don't know

*** Please specify the name:**

2. What were the main reasons your company decided to participate in the program? (select all that apply)

- ☐ Improved energy efficiency/lower operating costs
- ☐ Design/Modeling Assistance
- ☐ Design Incentive
- ☐ Incentive to pay for EE improvements
- ☐ Technical assistance
- ☐ Don't know
- ☐ Other, please specify:

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3. Which of the following best describes your purpose in building this project?

- ○ To operate my business
- ○ To sell
- ○ To lease (retaining ownership)
- ○ To rent (retaining ownership
- ○ Other, please specify:

3a. Using a scale of 0-10 where 0 represents little value and 10 represents a great deal of value:

	0 - Little value	1	2	3	4	5	6	7	8	9	10 - A great deal of value	Don't know
How much value do you feel is placed on energy efficiency by potential lessees in your market.	○	○	○	○	○	○	○	○	○	○	○	○
How much value do you feel is placed on energy efficiency by potential buyers in your market.	○	○	○	○	○	○	○	○	○	○	○	○

Please only answer question 4 and 4a if you received an incentive under the Prescriptive option in the program.

4. Did you consider participation in the whole building stream?

- ○ Yes
- ○ No

4a. Why did you choose the Prescriptive Stream?

- ○ Simpler to apply.
- ○ Project not large enough to pursue whole building approach.
- ○ Time considerations
- ○ Other, please specify:

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5. Were you pursuing LEED certification for this project prior to applying to the AEP Ohio program?

- ○ Yes
- ○ No
- ○ Don't know

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5a. Did you decide to pursue LEED after applying to the AEP Ohio program?

- ○ Yes
- ○ No
- ○ Don't know

5b. Did you change your initial design intended to meet LEED requirements to increase the amount of electrical energy savings?

- ○ Yes
- ○ No
- ○ Don't know

Experience with the Program

6a. 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?

0 - Very difficult	1	2	3	4	5	6	7	8	9	10 - Very easy	Don't know
○	○	○	○	○	○	○	○	○	○	○	○

6b. Did you use the on-line application form?

- ○ Yes
- ○ No
- ○ Don't know

6c. Using that same scale of 0-10 where 0 represents very difficult and 10 represents very easy - how easy or difficult did you find the application process?

0 - Very difficult	1	2	3	4	5	6	7	8	9	10 - Very easy	Don't know
○	○	○	○	○	○	○	○	○	○	○	○

---

7. Using a scale of 0-10 where 0 represents very unsatisfied and 10 represents very satisfied – how would you rate your satisfaction with the following:

	0 - Very unsatisfied	1	2	3	4	5	6	7	8	9	10 - Very satisfied	N/A
The level of documentation required	○	○	○	○	○	○	○	○	○	○	○	○

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Time required to participate in the program	○	○	○	○	○	○	○	○	○	○	○	○
The program overall	○	○	○	○	○	○	○	○	○	○	○	○

8a. Can you offer any suggestions as to how the program application process could be improved?

8b. Do you have any suggestions on how the overall program could be improved?

9. Please rate the importance of each of the following in your decision to proceed with the energy efficient project at this time using a scale where 0 means not at all important and 10 means extremely important. .

	0 - Not at all important	1	2	3	4	5	6	7	8	9	10 - Extremely important	N/A
Recommendation from an architect, engineer or design firm	○	○	○	○	○	○	○	○	○	○	○	○
Recommendation from a vendor or contractor that helped you choose the equipment	○	○	○	○	○	○	○	○	○	○	○	○
Information from AEP Ohio Business New Construction Program	○	○	○	○	○	○	○	○	○	○	○	○
Recommendation from an AEP Ohio or KEMA program staff person	○	○	○	○	○	○	○	○	○	○	○	○
Previous experience with energy efficiency projects	○	○	○	○	○	○	○	○	○	○	○	○
AEP Ohio marketing materials	○	○	○	○	○	○	○	○	○	○	○	○
The program incentive	○	○	○	○	○	○	○	○	○	○	○	○
Recommendation by an account manager of AEP Ohio	○	○	○	○	○	○	○	○	○	○	○	○
Standard practice in your business/industry	○	○	○	○	○	○	○	○	○	○	○	○
Corporate policy or guidelines	○	○	○	○	○	○	○	○	○	○	○	○
Payback on the investment	○	○	○	○	○	○	○	○	○	○	○	○
Desire to be "green" or energy efficient	○	○	○	○	○	○	○	○	○	○	○	○

10. Are there specific things that your company does differently in other new construction projects now because of your participation in the program?

☐ Specify purchase of certain types of equipment or levels of efficiency

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- ☐ Require new buildings meet a specified code or standard (such as LEED)
- ☐ Changed purchasing policy to specify a level of payback for energy consuming equipment
- ☐ Model energy consumption and evaluate alternatives
- ☐ No other projects since participation
- ☐ Don't know
- ☐ Other, please specify:

---

11. What do you see as the main barriers to increasing the level of energy efficiency in the design of your new building projects?

- ☐ Additional capital cost of energy efficiency improvements
- ☐ Payback/Return on additional energy efficiency improvements
- ☐ Split incentives (different firm paying to build building than firm that pays for energy costs)
- ☐ Uncertainty about performance of efficiency improvements
- ☐ Lack of demand in market (from ultimate users of space)
- ☐ Lack of understanding/information on opportunities
- ☐ Code levels already efficient enough
- ☐ Additional time commitment required to incorporate efficiency
- ☐ None
- ☐ Don't know
- ☐ Other, please specify:

---

12. AEP Ohio wishes to reach more customers about their energy efficiency programs. How do you suggest that AEP Ohio reach customers like yourself? (If you don't know, please type "don't know" below.)

Modeling

---

13. Did you complete a building energy simulation (modeling) for the project?

- ○ Yes

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○ No

Q14. Using a scale of 1-10 where 1 represents little value and 10 represents a great deal of value – how much value do you feel energy modeling added to your project?

1 - Little value	2	3	4	5	6	7	8	9	10 - Great deal of value	Don't know
○	○	○	○	○	○	○	○	○	○	○

Background About Your Firm

B1. What is your job title or role?

○ Facilities Manager
○ Building Manager
○ Energy Manager
○ Other facilities management/maintenance position
○ Chief Financial Officer
○ Other financial/administrative position
○ Proprietor/Owner
○ President/CEO
○ Don't know
○ Refuse to anser
○ Other, please specify:

B2. Approximately how many new building projects has your firm completed in Ohio in the last 5 years?

○ Don't know
○ Refuse to answer

B3. What is the principal business activity / (type of business [COMPANY] conducted at the building for which the incentive was provided?

○ Office
○ Community Service/ Religious/Municipality

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- ○ Retail (non-food)
- ○ College/university
- ○ School
- ○ Grocery store
- ○ Convenience store
- ○ Restaurant
- ○ Health care/hospital
- ○ Hotel or motel
- ○ Warehouse
- ○ Personal Service
- ○ Industrial Electronic & Machinery
- ○ Mining, Metals, Stone, Glass, Concrete
- ○ Petroleum, Plastic, Rubber and Chemicals
- ○ Other Industrial
- ○ Agricultural
- ○ Condo Association/Apartment Management
- ○ Don't know
- ○ Refuse to answer
- ○ Don't Know
- ○ Other, please specify:

B5. What is the total square footage of the portion of the facility that the business conducts at this location? Your best estimate will be fine.

- ○ Don't know
- ○ Refuse to answer

Thank you very much for taking the time to participate.

We appreciate your assistance.

POWERED BY SURVEY ANALYTICS

APPENDIX M

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EXPRESS PROGRAM FOR SMALL BUSINESS CUSTOMERS:

Program Year 2013 Evaluation Report

Presented to
AEP Ohio

AEP OHIO®
A unit of American Electric Power

May 13, 2014

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Executive Summary

This document summarizes findings and results from the evaluation of the Express Program for Small Business Customers (Express Program) implemented by AEP Ohio for the program year, January 1, 2013 through December 31, 2013[1].

The Express Program currently provides a one-stop, turn-key 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.

Program Participation

The 2013 Express Program paid incentives on 930 projects constituting 10,490 MWh of *ex-ante* reported annual energy savings and 2,756 kW of peak demand savings as shown in Table ES-1. All of the savings are from lighting measures, with T8 retrofits representing the majority of installed measures, as shown in Figure ES-1.

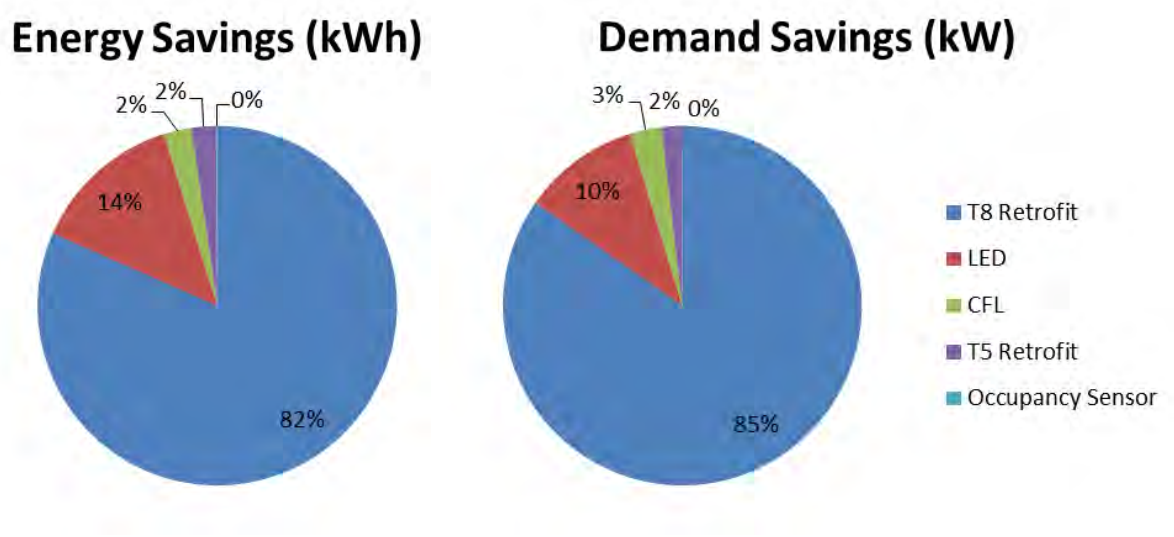
Table ES-1. Express Program *Ex Ante* Projects, Measures and Savings

Metric	Reported Value
Number of Projects	930
Number of Measures	40,842
Annual Energy Savings (MWh)	10,490
Electric Peak Demand Savings (kW)	2,756

Source: Evaluation analysis of 2013 AEP Ohio tracking data

[1] Program Year 2013 began January 1, 2013 and ended December 31, 2013.

Figure ES-1. Percentage of Measures Installed by Measure Category



Source: Evaluation analysis of 2013 AEP Ohio tracking data

Data Collection Activities

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

Table ES-2. Data Collection Activities for 2013 Express Evaluation

Evaluation Effort	Data Collection	Targeted Population	Sampling Unit	Sample Design	Sample Size	Timing
Impact and Process	Collection of Program Tracking Data	Express projects paid in 2013	Project / Measure	NA	NA	Jan 2013 to Dec 2013
Process	In-depth Interviews	AEP Ohio Program Staff	Contact from AEP Ohio	NA	1	October, 2014
Process	In-depth Interviews	Express Program Implementation Staff	Contact from the implementer	NA	3	October, 2014 to November 2014
Process	In-depth Interviews	Express Installation Contractors	Contact from Installation Contractors	NA	5	February, 2014 to March 2014
Process	CATI Surveys	Express Program Participants	Unique contact from tracking database	Random	216	March 2014 to April 2014
Impact	Billing Data	Express projects paid in 2013 and pipeline customers	Census	AEP Ohio Customer Information System	929	February 2014 to April 2014
Impact	On-site Verification	Express projects paid in 2013	Project	Random stratified by install quarter	20	March 2014 to April 2014

Source: Evaluation activities conducted from May 2013 through April 2014.

Key Impact Findings and Recommendations

The 2013 program realization rate (defined as verified *ex post* savings/*ex-ante* reported savings) is 58 percent for energy savings, and 97percent for demand reduction. The relative precision at a 90 percent confidence level for the 2013 Express Program projects in the sample is ± 20 percent for the energy realization rate and better than ± 10 percent for the demand realization rate. The precision 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. The impact results for the 2013 Express Program are shown in Table ES-2.

Table ES-3. Savings Estimates for 2013 Express Program

	2013 Program Goals	Ex-Ante Savings (a)	Audited Savings (b)	Realization Rate RR = (b) / (a)	Percent of Goal
Energy Savings (MWh)	10,552	10,490	6,062	0.58	57%
Demand Savings (kW)	1,759	2,756	2,662	0.97	151%

Key impact findings and recommendations include:

1. The Express Program for Small Business Customers 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.

   Impact Recommendation #1: Continue to target difficult to reach customers for 2014 and beyond.

2. Only lighting measures were installed in 2013. No HVAC or refrigeration measures were installed.

   Impact Recommendation #2: Expand and market the program to include additional measures. Work with the implementation contractor to recruit participants who install measures other than lighting (refrigeration and/or HVAC) so that the full benefits of the program can be realized.

3. Program tracking information is very good. Description of algorithms and program documentation is also thorough and complete. The evaluation team's review of savings calculations found no errors in algorithms and all relevant fields sufficiently populated, with the exception of "FacilityTypeCd".

   Impact Recommendation #3: The "FacilityTypeCd" field is used only to advise initial hours of use, but does not represent the actual customer facility type. An example is the "Bakery" designation, which covers auto repair, fast food, small office and other

building types. For consistency and clarity the appropriate type of building should be presented to better categorize firmographic information.

4. The realization rate (defined as verified *ex post* savings divided by *ex-ante* reported savings) is 58 percent for energy savings, and 97percent for demand reduction. The reasons for low realization stem from the parameter estimates and are several and compounding.

   Impact Recommendation #4a: Assess estimated hours of use as accurately as possible by fixture. It appears that the implementation contractor is already doing a better job after launching the program, but success in future years requires accurate hour estimates.

   Impact Recommendation #4b: HVAC interactive effects are applied at the project level, regardless of location within a facility. The implementation contractor should ensure that the location data that shows exterior and garage fixtures in particular should not accrue additional energy savings due to improper application of HVAC interactive effects.

   Impact Recommendation #4c: Ensure existing fixture wattages for common fixtures accurately represent the technologies that are replaced.

   Impact Recommendation #4d: Ensure specified equipment is installed and recorded in the tracking data, including low wattage lamps rather than regular wattage lamps when specified.

   Impact Recommendation #4e: Burned-out lamps in existing systems may have been underestimated. Provide a consistent approach to recording burnouts, including differentiating entire fixtures and individual lamps.

   Impact Recommendation #4d: Coincidence factors should be updated to the values used in the Prescriptive Program evaluation for consistency across business sector programs.

Key Process Findings and Recommendations

1. The turn key Business Express Program as implemented by the implementer got off to a 'rough start' as one installation contractor described it. The most serious problems concerned the lack of knowledge on the part of the auditors. Most of the auditors did not have a background in lighting and the learning curve was quite steep, and, for providers, quite slow. The situation has improved and mistakes are much less frequent than earlier in the year. One partial solution was that the implementer has a crew that makes a second visit when necessary to correct problems, relieving that burden from the installation contractor.

   Process Recommendation: #1 The situation with lighting raises some concern about plans to expand the measures beyond lighting to HVACs, VFDs and other more

complicated measures. The easy task will be to find contractors who can install the equipment. The more difficult task would seem to be finding auditors that can provide credible estimates of energy savings for the types of measures.

2. Contractors raised concerns about the lack of work early in 2014 and the slow payments from the implementer in late 2013 and early 2014. For smaller installation contractors who may be dedicating most of their resources to this program, these two issues can be threatening to the viability of the firm.

   Process Recommendation #2a: The lack of work in 2014 may be an aberration due to slow markets and the need for all to take a break about the business of the first year. However, the logic for stopping the flow of projects through the pipeline for the Business Express Program is unclear.[2] If a six week break is needed for processing projects, the implementer should be fully prepared to begin marketing the program at the beginning of the year.

   Process Recommendation #2b: The implementer should take extra steps to remind contractors that invoices are not paid for sixty days. This should also be carefully explained to the contractor before they sign the contract. Small contractors may have the most trouble with meeting payroll when the Express Program accounts for a significant proportion of their workload. Also, the implementer and AEP Ohio should process the Business Express Program contractor payments in a timely manner to ensure a steady stream of payments to contractors given the contractual limitations.

3. Customers were most likely to report dissatisfaction with the Express Business Program because of low savings levels after installation of the energy saving equipment.

   Process Recommendation #3: This issue is generally tied to inaccurate hours of use of inaccurate specifications of the removed equipment. An automatic flag is attached if project savings exceeds 30 percent of usage. More aggressive monitoring may be warranted.

4. AEP Ohio is getting feedback from the implementer that it would like to expand eligibility to 300,000 kWh. The implementer thinks there is a gap between the Prescriptive and the Express Program for that size customer.

   Process Recommendation #4: AEP Ohio should analyze the Prescriptive Program participation data to see if customers in the size range participate in the Prescriptive Program in expected numbers and then make the decision to expand the eligibility or not.

[2] It is possible that severe winter weather could have influenced the lack of work during this time period.

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Section 1. Introduction

This section provides an overview of the Express Program itself, Navigant's objectives for this evaluation and a review of customer participation metrics.

1.1 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 objectively analyze the energy and demand savings (impacts) claimed by the program and to review program processes to ensure that the program is reaching the intended audience with quality and consistently delivered service.

1.2 Program Description

The implementation of the Business Express Program was awarded to a different implementer in 2012. The current 2013 evaluation is effectively the first evaluation of the reconstituted Business Express Program.

The Express Program provides one-stop turn-key services to small businesses (defined as customers with less than 200,000 kWh consumption per year) for lighting upgrades. The program targets customers that typically do not participate in other 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 has higher equipment incentives than other business offerings.

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.

A new implementation contractor, Lime Energy Services Company, was selected to deliver the Express program for 2013. With this change also came a new program model that focuses on an integrated delivery of audit services, measure installation and application handling. The savings algorithms have changed from a prescriptive deemed savings approach in prior years to a more custom approach, taking into account fixture-specific parameters relevant for lighting equipment such as hours of use.

1.3 Key Program Elements

The following provides a summary of critical program elements:

- **Customer Eligibility.** 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. In addition to the annual consumption restriction, participants must be AEP Ohio customers and cannot be mercantile or managed national account

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customers. These other criteria presume that these other customer groups have adequate access to capital and energy efficiency expertise and support at the corporate level.

» **Equipment Eligibility**. Approved equipment includes indoor and outdoor lighting retrofits, occupancy sensors. To date, however, only lighting measures have been completed through the program. 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.

» **Project Proposal.** The implementation assessor, a member of Lime Energy's staff, conducts an assessment of a facility to identify energy-saving opportunities and provides a detailed project proposal that includes the equipment and labor description, expected savings, project costs, the incentive amount and the customer's share of the project cost. The proposal step constitutes a pre-inspection.

» **Equipment Installation.** Implementation staff specifies the project equipment from the proposal and sends the equipment request to an expeditor who gathers the needed equipment from the warehouse and places it on a pallet. The assigned sub-contractor picks up the equipment and performs the physical installation. To allow the implementer to maintain consistency between projects and ensure energy savings, the number of contractors has been reduced.

» **Post-installation Inspection**. Post-installation inspections are conducted for a sample of sites. Post-installation inspections are conducted to assure quality and to verify energy savings and as a feedback for quality improvements.

» **Incentive Limits.** Project incentives cannot exceed 80 percent of the total project cost.

» **Incentive Payment.** AEP Ohio directly pays the implementation contractor the incentive amount and the customer receives an invoice for their portion of the project cost directly from the implementation contractor. Twelve month interest-free financing is available to certain customers, although there is a discount of 6 percent applied for customers for paying in full upon project completion.

1.4 Implementation Strategy

In 2013, the program was marketed to small businesses by the implementer's phone bank that make appointments for program auditors to visit the customer to conduct the free energy assessment. Program auditors also market the program directly to customers in assigned geographic territories. They are able to target certain customer types such as auto

repair or small grocery stores. Word of mouth is becoming another important way for customers to find out about the program.

1.5 Program Participation

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 inTable 1-1, the 2013 Express Program paid incentives on 930 projects and 40,842 measures constituting 10,490 MWh and 2,756 kW of *ex ante* reported annual energy and peak demand savings, respectively. All of the savings are from lighting measures, with T8 retrofits representing the majority of installed measures.

Table 1-1. Express Program *Ex Ante* Projects, Measures and Savings

Metric	Reported Value
Number of Projects	930
Number of Measures	40,842
Annual Energy Savings (MWh)	10,490
Electric Peak Demand Savings (kW)	2,756

Source: Evaluation analysis of 2013 AEP Ohio tracking data

Linear fluorescent T8 retrofits continue to be the single largest contributor of savings, similar to previous years, as well as other business programs offered by AEP Ohio. The breakdown is shown in Figure 1-2. Contributions from LEDs are 14 percent of energy savings and 10 percent of demand savings.

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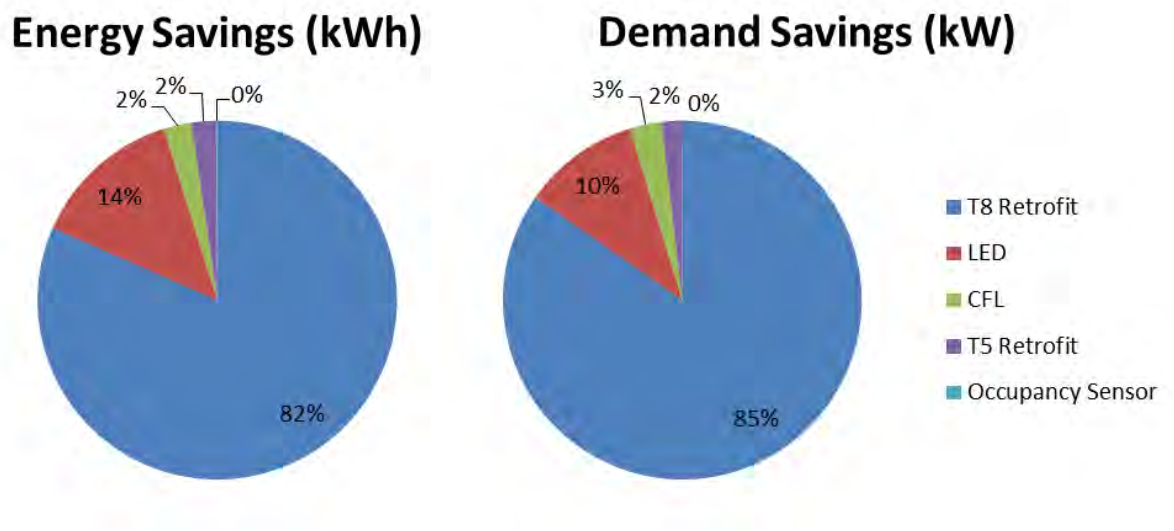
Figure 1-1. Measures Installed by Measure Category



Source: Evaluation analysis of 2013 AEP Ohio tracking data

Installation location data, as shown in Figure 1-2, indicates that 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 T8 lighting retrofits and LED exit signs and interior LEDs also a significant portion of savings. A closer look at the garage lighting contribution indicates that this measure code may have been inconsistently applied based on the "Location" field in the data, however. This is explored later in the report.

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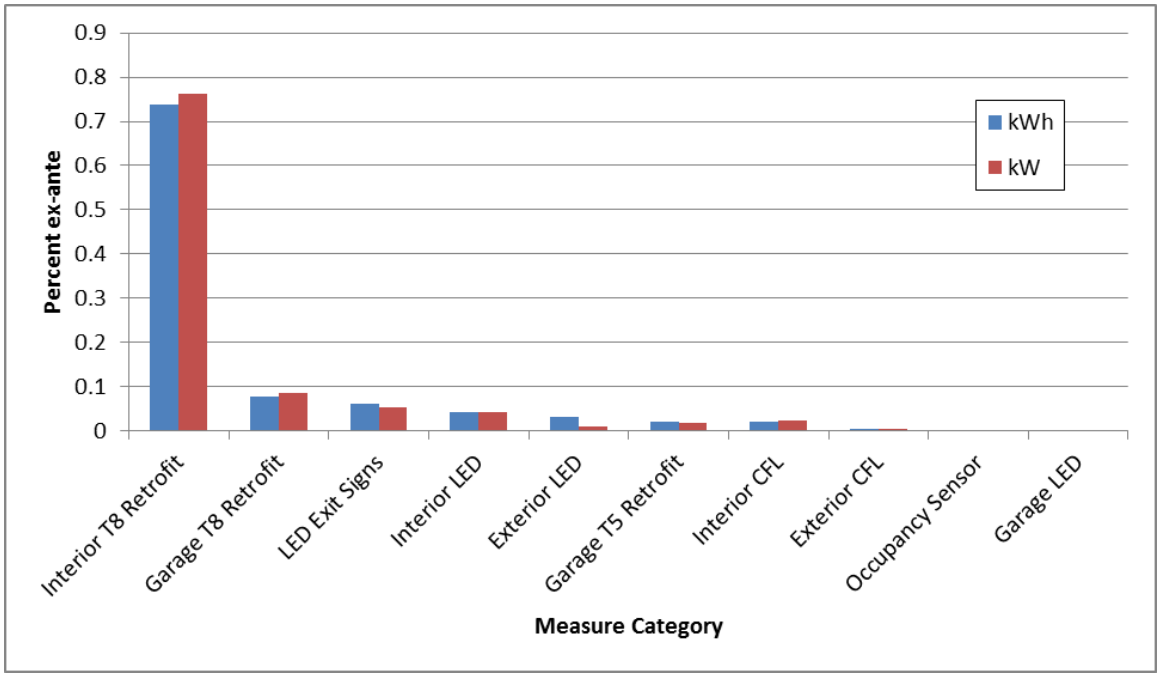
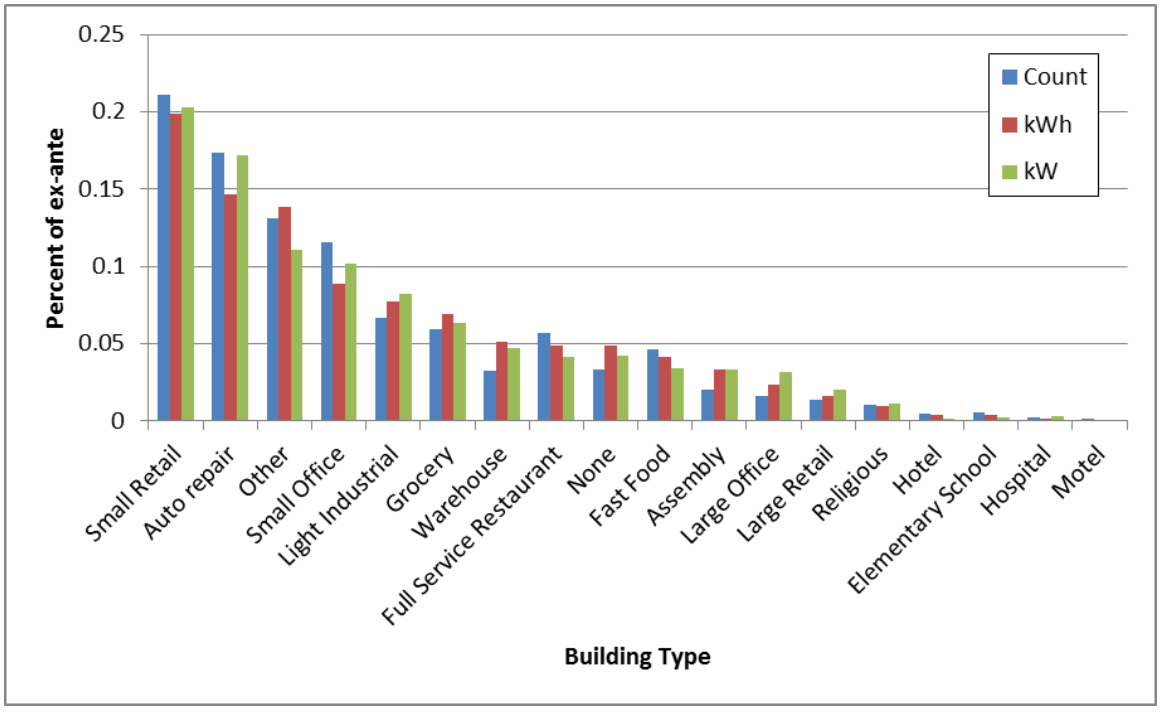
Figure 1-2. Measures Installed by Location and Measure Category



The small retail and auto repair segments have a majority of the proposals and energy savings, as shown in Figure 1-3. In general, energy and demand savings are roughly proportional to the number of proposals generated for each market segment.

Figure 1-3. Measures Installed by Building Type



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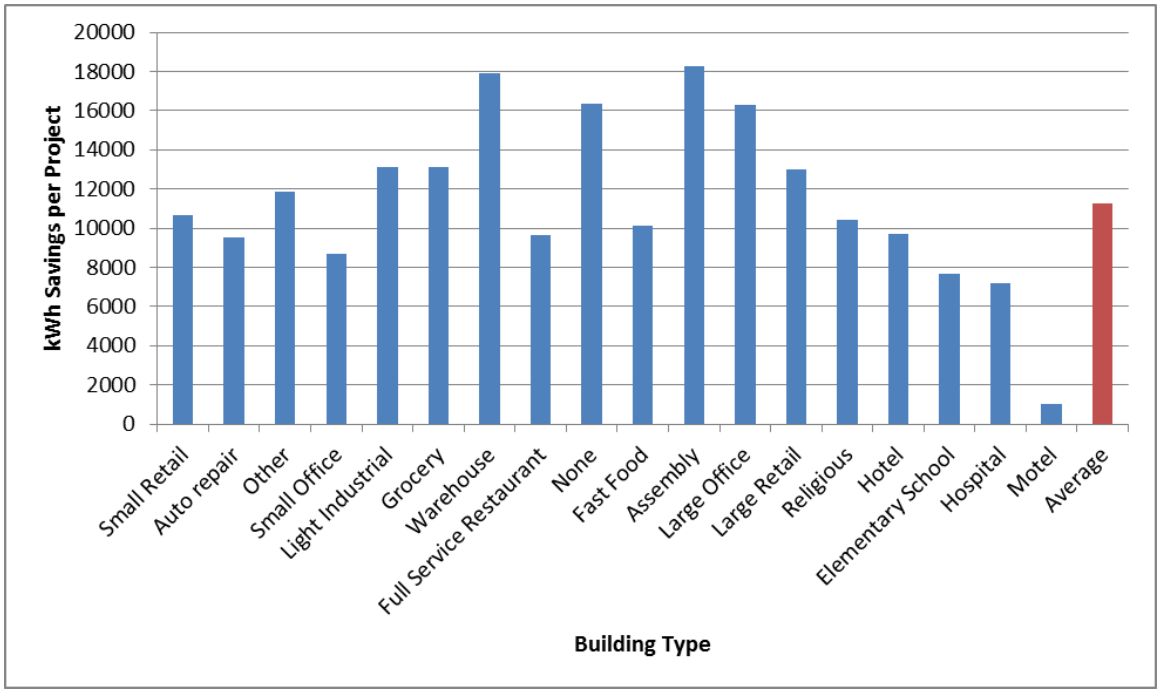
Looking further into the building type, as expected the warehouse and assembly have the largest energy savings per site, although savings per site are relatively consistent across all building types, as shown in Figure 1-4. Overall, the average *ex ante* savings per project is 11,280 kWh, down from 16,264 kWh in 2012. For comparison, the average energy use per project is 58,879 kWh, down from 65,900 kWh in 2012.[3]

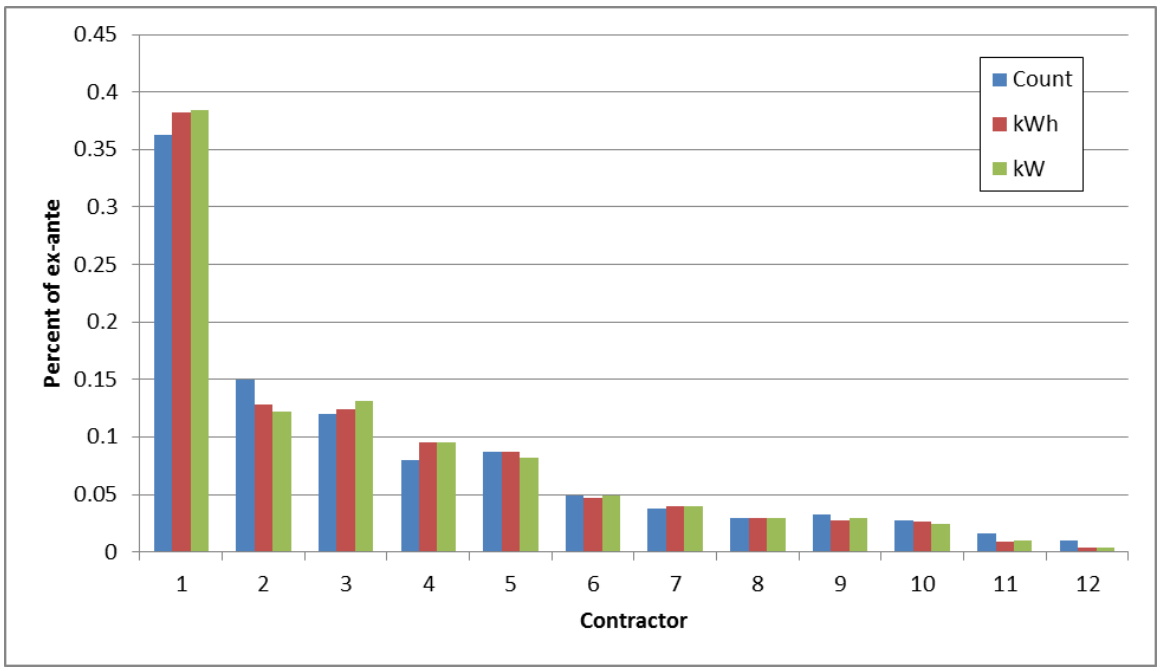
Figure 1-4. Average Savings per Project by Building Type



[3] Express Program for Small Business; Program Year 2012 Evaluation Report

For 2013, 12 contractors performed equipment installations on behalf of the implementation contractor. One particular contractor installed almost 40 percent of the total measures, as shown in Figure 1-5.

Figure 1-5. Percent Savings by Unique Contractor



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Section 2. Methodology

The evaluation team conducted impact and process evaluation activities for the Express Program following the methodologies outlined below.

2.1 Impact Evaluation Methodology

Savings verification was conducted by multiple methods, with a separate methodology used for energy savings and peak demand savings.

2.1.1 Audited Savings 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.

2.1.2 Engineering Adjusted Savings Review

This review is designed to identify potential parameter adjustments to *ex ante* reported savings for measures where the evaluation team recommends an alternative default value for a specific measure. Updated parameters are consistent with the values used for the Prescriptive Program evaluation to provide consistency across the business portfolio. This review serves as the basis for calculating peak demand savings and also provides insight for any discrepancies found in the billing analysis.

2.1.3 Billing Analysis

A billing analysis of 2013 participants and pipeline participants serves as the basis for determining program energy savings. 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 pipeline participants as a comparison group accounts for other exogenous effects such as macro-economic trends. Pre-

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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.[4] Note that 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.

2.1.4 Sample On-site Verification

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. Navigant 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.

2.1.5 Task Flow Schematic

The task flow for these activities is shown in Figure 2-1 below for both energy and demand. Note that verified savings from the sample sites is used to inform the drivers of the realizations, but are not actually a part of the calculation.

[4] 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.

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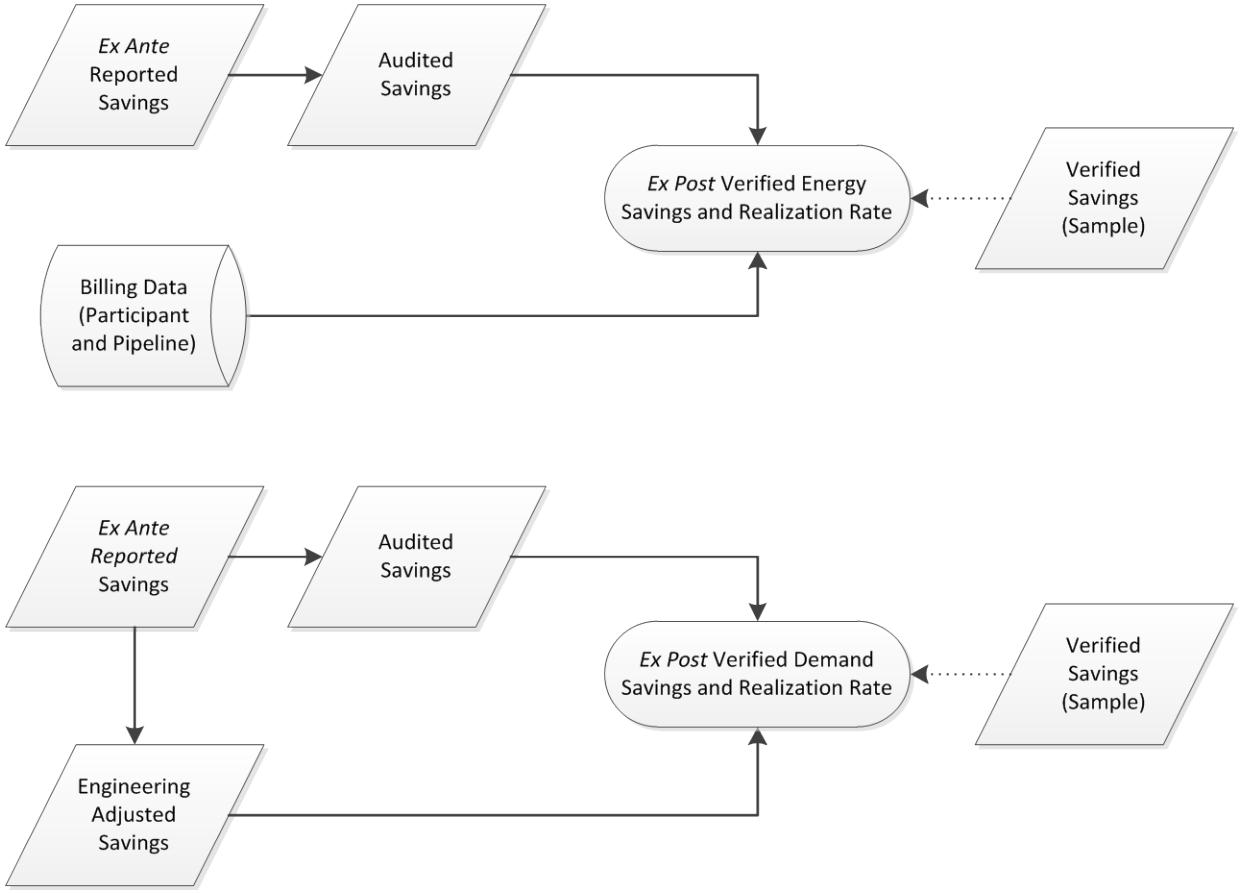
Figure 2-1. Energy and Demand Impact Evaluation Task Flow



2.2 *Process Evaluation Methodology*

The process evaluation was conducted by multiple methods as well, covering all relevant stages of program implementation.

2.2.1 Overview of Process Evaluation Approach

The purpose of the process evaluation is to assess the effect of the structure and implementation of the program on its performance and on customer satisfaction. The evaluation team's process efforts provide insights and recommendations to support the continued success of the Business Express Program.

Central to the process evaluation for the Business Express 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. In addition, the evaluation team conducted a computer-assisted telephone interview (CATI) survey with

participating customers to better understand customer satisfaction and perceptions related to the program.

2.2.2 Interview and Survey Design

The evaluation team used a senior staff member to conduct in-depth qualitative interviews. Senior staff were flexible in their approach to the discussion, allowing the respondent to talk about his/her experience or perspective while still shaping the discussion toward the most important, relevant and necessary information. The team conducted the interviews by telephone in order to complete the interviews quickly and to be flexible to the respondents' schedule.

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 evaluation team took detailed notes during each in-depth interview and/or taped the discussion to ensure thorough documentation.

2.2.3 Program and Implementer Staff Interviews

Several in-depth staff interviews were conducted as part of this evaluation. Two of these interviews were conducted with the Business Express Program Coordinator. Two interviews were conducted with employees of the implementation contractor. These interviews were completed in October and November 2013. The interviews with the AEP Program employees focused on program processes, the goals of the program, how the program was implemented and the perceived effectiveness of the program. The interviews with the implementator 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 B: Program Staff and Implementer Interview Guide.

In addition, installation contractors were interviewed in February and March to better understand their role and perspective on the program. The interview guide used for these interviews is included in Appendix B: Contractor Interview Guide.

2.2.4 CATI Telephone Survey of Program Participants

A CATI survey targeted a population of 762 unique customer contact names drawn from the Express Program January 30, 2014 tracking system extract. The survey finished with 216 completed interviews from the Business 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 2014.

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: Participant Telephone Survey.

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2.3 *Data Sources*

The data for evaluation of the Express Program was gathered through a number of sources. The evaluation team conducted in-depth telephone interviews with the AEP Ohio Program Coordinator, reviewed tracking system data and performed onsite verifications. Finally, the team performed a billing analysis of participants to determine *ex post* energy savings. Table 2-1 provides a summary of these data collection activities, including the targeted population, the sample frame, and the timeframe in which the data collection occurred.

Table 2-1. Data Collection Activities for 2013 Evaluation

Evaluation Effort	Data Collection	Targeted Population	Sampling Unit	Sample Design	Sample Size	Timing
Impact and Process	Collection of Program Tracking Data	Express projects paid in 2013	Project / Measure	NA	NA	Jan 2013 to April 2014
Process	In-depth Interviews	AEP Ohio Program Staff	Contact from AEP Ohio	NA	1	October, 2014
Process	In-depth Interviews	Express Program Implementation Staff	Contact from Implementer	NA	3	October, 2014 to November 2014
Process	In-depth Interviews	Express Installation Contractors	Contact from Installation Contractors	NA	5	February, 2014 to March 2014
Process	CATI Surveys	Express Program Participants	Unique contact from tracking database	Random	216	March 2014 to April 2014
Impact	Billing Data	Express projects paid in 2013 and pipeline customers	Census	AEP Ohio Customer Information System	929	February 2014 to April 2014
Impact	On-site Verification	Express projects paid in 2013	Project	Random stratified by install quarter	20	March 2014 to April 2014

Source: Evaluation activities conducted from May 2013 through April 2014.

2.3.1 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 pipe-delimited text file. The most current tracking data used for this evaluation was extracted April 24th, 2014, with several earlier files used for preliminary analysis.

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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.

2.3.2 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.

2.3.3 Billing Data

The evaluation team utilized monthly billing data for the regression analysis, provided by AEP Ohio staff. The data included monthly billing data spanning January 2012 through April 2014 for 2013 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. The regression model includes billing data from 2013 and 2014.

2.4 Sampling Plan

2.4.1 Impact Sample

The Impact evaluation of program energy savings was based on a billing analysis of an attempted census of 2013 participants and an attempted census of pipeline participants for 2014, to-date, as a comparison group. Individual projects were dropped from the analysis due to insufficient data. Please see Appendix A for details. The attempted census achieves our 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 these 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 that the project was completed based on feedback from the Express program manager and implementation contractor and weighted by savings. On-site tasks only included verification of retrofit equipment and hours of operation based on facility hours.

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2.4.2 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 762 unique customer contact names with paid projects for the 2013 Business Express Program.[5] 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 of 0.5. The sample design showed 270 samples required to meet 95/5.

[5] This analysis was conducted on a data extract from January 30, 2014.

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Section 3. Impact Evaluation Results

This section presents the results of the impact evaluation of the Express program, including energy and demand impacts.

3.1 Savings Summary

As shown in Figure 3-1, the impact evaluation verified 58 percent of the *ex ante* reported energy savings and 97 percent of the *ex ante* reported demand savings.

Table 3-1. 2013 *Ex Post* Savings and Realization Rates

Metric	Energy Savings (MWh)	Demand Savings (kW)
Ex ante Reported Savings	10,490	2,756
Ex post Verified Savings	6,062	2,662
Realization Rate	0.58	0.97

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

3.2 Findings from the Audited Savings Review

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. The team found no technical errors in this review.

3.3 Findings from the Engineering Adjusted Savings Review

The evaluation team reviewed tracking data further to verify methodologies and equations for estimating savings. In 2013 the Express Program only installed lighting-related measures including linear fluorescent (T5 and T8) retrofits, LED lamps, LED exit signs, CFLs and occupancy sensors. The basis for AEP Ohio's *ex ante* reported savings are thus driven by the formulae outlined in the following sections.

3.3.1 Program Impact Parameter Estimates

Energy and demand savings are calculated per measure with the following equations:

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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:

kW.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 impact 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 when our internal estimates did not agree with recorded project values, the team found that the discrepancy frequently resulted in over-estimated savings.

3.3.2 Lighting Power

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

The tracking data contained a high level field detailing the type of baseline fixture. These values typically correspond to several variations of lamp and ballast combinations. A sensitivity analysis using a weighted average of fixture wattages for the high and low assumptions from the technical reference spreadsheet were compared to the reported baseline wattages. Possible values range from as much as 31 percent lower to 9 percent higher than reported, as shown below in Figure 3-2.

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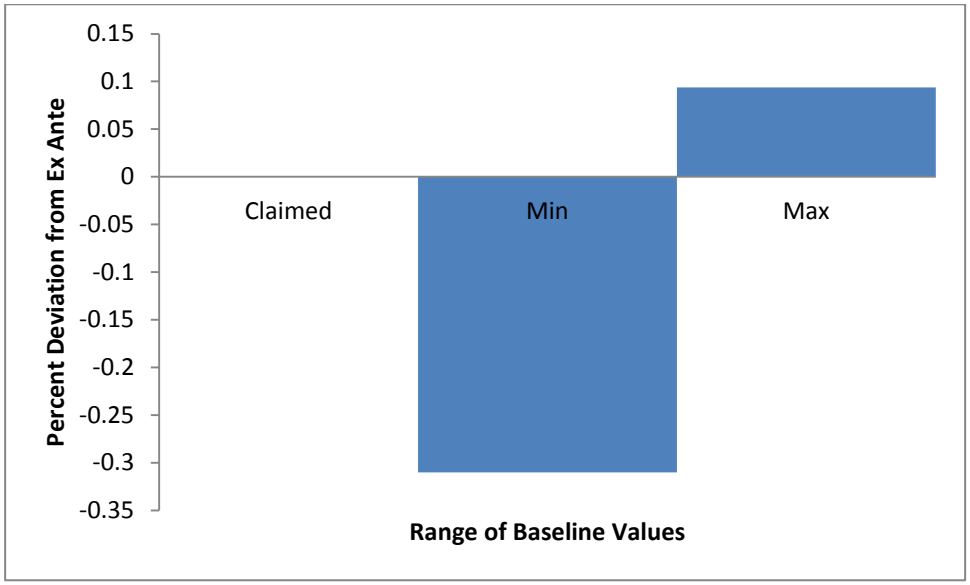
Figure 3-1. Weighted Range of Possible Baseline Wattages



It is difficult to argue that the implementation contractor is overestimating baseline wattages from the documentation provided, but it is clear that the potential exists. Proper identification of baseline fixture and ballast type is critical to making accurate savings estimates, and it is likely that this may play some role in the realization rate reduction.

3.3.3 Hours of Operation

The 2011 and 2012 Express Program Evaluation Reports[6,7] identified over-estimated hours of operation as a key driver of over-estimated reported program savings. The new for 2013 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 that 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

[6]Express Program for Small Business; Program Year 2011 Evaluation Report
[7]Express Program for Small Business; Program Year 2012 Evaluation Report

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hours of use. It's not clear how the hours of use are calculated, however. Because hours of use are a significant driver of energy savings, this parameter is likely partially responsible for the reduction in realization rate and should be documented more thoroughly in the future

3.3.4 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. While the evaluation team found the deemed values reasonable, a single interactive effect is applied to all fixtures for a project rather than on a fixture by fixture basis. From the location description data, it appears that exterior lights, garage lights and other lights in places that are likely unconditioned are credited with additional savings due to interactive effects and contribute to the reduction in realization rate. The evaluation team zeroed out the interactive effects for fixture labeled as exterior or garage.

3.3.5 Coincidence Factors

The coincidence factor is used to calculate the percentage of time during the peak period that the efficient measure operates. The evaluation team found that the coincidence factors that AEP Ohio used to calculate demand savings were taken from the Prescriptive program documentation for consistency of approach across the business programs. In an effort to maintain a consistent evaluation approach the evaluation team recommends adjusting the coincidence factors to those used by the Prescriptive evaluation team, which are taken from DEER 2011[8] and mapped to the Ohio building types.

3.3.6 As-Found Lamp Burn-Out

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

[8] Database for Energy Efficiency Resources; California Energy Commission and California Public Utilities Commission (CPUC) 2011

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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. During rollout of the program this process was not handled consistently, however, and a flat burnout rate of 0.95 was applied to some measures. As with other parameters, there is not sufficient evidence to counter the detailed tracking data, but the potential for overestimating savings does exist.

3.4 Findings from the Billing Analysis

The evaluation team conducted a regression analysis using monthly billing data from premises tied to 2,132 projects: 929 completed 2013 projects and 1,203 pipeline projects. One additional project came through post-analysis and was thus excluded from the regression, but because this site represents less than 0.03 percent of ex ante savings the evaluation team opted to simply apply the realization rate to the one additional site.

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. 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 interacted with the program participation flag. For a detailed description of the regression model and results see Appendix A.

The evaluation team estimates a realization rate of 57.8 percent. That is, verified savings are equal to 57.8 percent of ex-ante savings reported in the tracking database. This corresponds to average annual program savings of 6,523 kWh per project, representing a 10.1 percent reduction in energy usage due to the Express Program. The 90 percent confidence interval around this estimate is 5,108 kWh to 7,938 kWh per premise, with a relative precision of 22 percent. Note that the precision reflects uncertainty in the regression model parameter estimates, while the confidence and precision targets are aimed at reducing sampling error. [9] 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. The uncertainty in the regression model is driven by variability in the data and the lack of post-period bills. At the time of this evaluation more than half of the 2013 participants had fewer than eight bills in the post-period.

[9] Additional sources of uncertainty are typically not quantified when using methods other than regression analysis.

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Total 2013 program savings are calculated as the average program savings times 929 ,the number of projects included in the regression analysis, for total of 6,060 MWh. Applying the realization rate of 57.8 percent outlined above to the one additional site that came through post-analysis yields a final ex post savings estimate of 6,062 MWh . Total 2013 savings from the Express Program are thus estimated at 6,062 MWh.

3.5 Findings from Sample On-site Verification

Navigant conducted onsite verification visits for a total of 20 selected projects throughout the service territory. As discussed, the sample was stratified by project completion quarter and *ex ante* energy savings. 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 164 measures 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 for the first year of the Express program under the new implementation contractor. Key findings include the following.

- **Hours of use.** 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 92.6 percent of reported hours for the sample. Perhaps most interestingly, when looking at the verified hours by the quarter in which the project was completed, there is a positive trend indicating that the implementation contractor has improved throughout the year, as shown in Figure 3-3 below.

- **Incorrect lamp wattages recorded.** For one site, 52 total T8 fixtures were found with 32W lamps rather than 28W lamps as indicated in the tracking data. It is unclear how systemic an issue this is, but nonetheless this is an additional contributor to a reduced realization rate.

- **Additional equipment installed.** One customer indicated that they now have additional lights in their facility, but the tracking data does not indicate any non-retrofit fixtures. It is unclear whether the additional lights are program-related at all, but the potential exists for performing additional installs within the program.

- **Equipment issues**. Several customers reported equipment issues. One customer indicated that 4 out of 32 T8 fixtures were not functioning, in addition to one LED exit sign. Another customer indicated that one fixture remains on at all times and they are unable to switch it off, despite several follow up visits by the installation contractor.

- **Perceived Savings**. Two customers reported that their bills have increased since participating in the program. It's possible that these customers are mistaken, not

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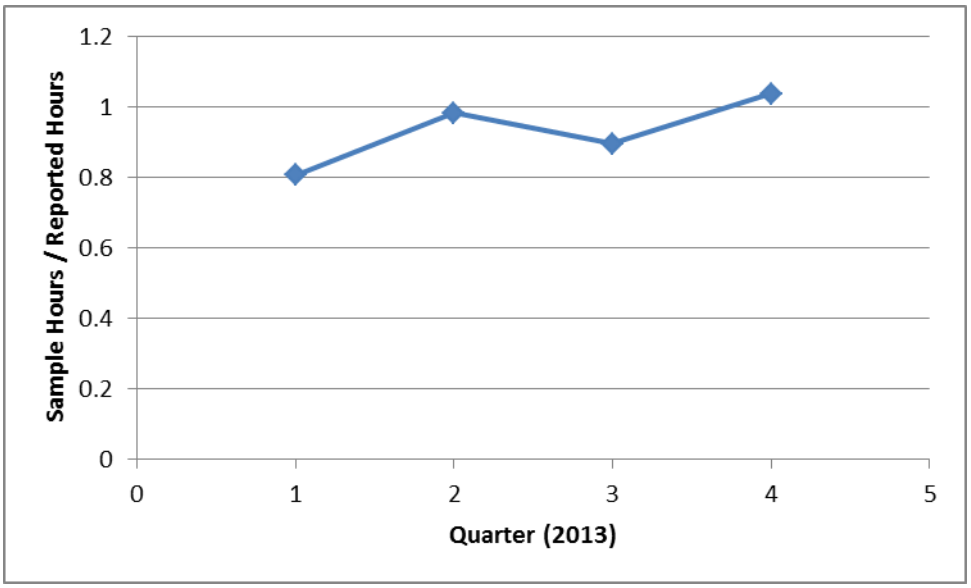
examining equal billing periods or not accounting for changes in non-lighting energy use.

Figure 3-2. Sample Hours vs Reported Hours by Quarter



3.6 Discussion of Impact Results

3.6.1 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 2013 Express Program, shown in Table 4-1. No further adjustments were made to verified kWh savings.

Table 3-2. Savings Estimates for 2013 Express Program

	2013 Program Goals	*Ex Ante Reported* Savings (a)	Verified *Ex Post* Savings (b)	Realization Rate RR = (b) / (a)	Percent of Goal
Energy Savings (MWh)	10,552	10,490	6,062	0.58	57%
Demand Savings (kW)	1,759	2,756	2,658	0.97	151%

The realization rate for energy is striking and deserves further consideration. While much improved from previous years, the potential to over-estimate *ex ante* savings persists. 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 will be between 9 percent and 16 percent versus the prior year's

consumption, if *all* lighting is retrofit. Factoring in interactive effects would increase this 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 annual consumption is about 58,879 kWh and the average *ex ante* savings among the projects is 11,280 kWh or 19 percent, roughly one and a quarter to one and a half times expectations. Furthermore, not all lighting systems were replaced. Therefore, the full lighting savings *potential* was not captured.

The evaluation team concludes that the *ex ante* estimates for the AEP Express Program continue to be high, although performance is vastly improved compared to the previous program from 2011 and 2012. Navigant's further research shows that the billing analysis is consistent with performance of similar programs.

3.6.2 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 identified the baseline fixture wattage, the coincidence factor and the demand interactive effect as potential sources of error in the demand calculation. Of the parameters, the evaluation team applied coincident factors consistent with the Prescriptive evaluation recommended values. In addition, the interactive effects were zeroed out for exterior and garage locations, resulting in a realization rate of 97 percent.

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Section 4. Process Evaluation Results

There are many topics to explore during a process evaluation. The primary path the evaluation team used to explore the program was through in-depth interviews five installation contractor who installed the equipment and program management staff, as well as the review of program materials. In addition, our data collection partner surveyed 216 program participants. The findings from all Program Managers and the Installation contractors are summarized below, followed by the findings from the customer survey.

4.1 Program Administration

The AEP Ohio goal for the Business Express in 2013 was 10.6 GWh of energy savings. The program achieved 6.1 GWh or 58 percent of goal. It is not unusual for first year programs to come close to goal but to find it difficult to achieve goal.

According to the Program Manager, a goal of the Express Program is to create jobs and to serve the small business segment of commercial accounts. The program is designed to concentrate on the 'mom and pop' organizations, not the national accounts.

4.2 Program Implementation

At the first visit from the auditor, customers are given a proposal that includes a list of recommendations, estimates of energy savings, the project cost and the estimated payback period. This also counts as the pre-inspection. Customers receive a post-installation inspection phone call to assure quality and to verify energy savings. They are offered no-interest 12 month financing or a 6 percent reduction in the customer's cost of the project if paid in full upon completion of project. Program auditors can track the progress of the project on-line as each step is logged into an on-line tracking system.

Once the customer signs the proposal, the equipment request is sent to a warehouse where all the needed parts are aggregated and palletized. Express Program installation contractors are assigned a customer, pick up the required pallet from the warehouse and install the equipment with little or no business disruption. AEP Ohio pays the implementer directly for the rebate, the implementer pays the installation contractors, and the customer is billed by the implementer for their portion of the program cost. 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.

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4.3 Program Delivery Mechanisms-the Installation Contractor Perspective

The contractors reported that the program had a 'rough start'. According to the contractors, the program auditors did not have enough knowledge to specify the jobs completely. Installation contractors believe that the auditors that sell the jobs have zero electrical experience and they don't know what they are looking at. They miss the need for extra equipment such as lifts, they miss-count the lights and order retrofit kits that don't match the lighting. Another issue for installation contractors was the lack of understanding for the cost of safely accessing lighting in areas with obstacles.

One installation contractor said they stayed away from small projects where there was no cushion for extra work. As least one provider has an agreement that if they find something the auditor missed, the costs are added to the customer charges. Another provider skips over those lights. One provider thinks that the implementer sells the projects cheap to encourage customers to participate and that the program auditors are paid on a commission, "So they want to sell the job with zero regard to the installers that get paid a fixed amount." Many of these issues required the installation contractor to return to the job site. Recently, the implementer hired their own crew to return to the site and make corrections.

To help all the players, the customer, the auditor and the installation contractor communicate with each other, the implementer added software called 'Base Camp'. All of the players are encouraged to use this format to communicate on-site issues to each other and to track projects.

Another issue mentioned by the installation contractor is that the implementer is often late with their payments to the contractors. One provider said: "The accounts payable people don't answer our phone calls or respond to phone calls." However, the implementer pointed out that they do not pay invoices for 60 days. If the contractors are more comfortable with customers with a shorter payment policy, they may view the payments as 'late'. Another installation contractor said, "It is like pulling teeth to get extra money to do extra work." And that it frequently turns into a 'he said, she said' situation.

On contractor experienced an issue regarding the timing of the installations. Some customers wouldn't get in until ten AM. The installation contractor's crews start work at seven AM. They would scramble to find the crews something to do for those few hours because the customers would not agree to come in early. Another problem was the customers don't want to move anything themselves and they also don't want the installation contractors to touch their 'stuff'. It is sometimes a difficult situation for the installation contractor as these situations raise their costs when their payment for the job is fixed.

Much of this has improved significantly since the start of the program. The implementer is investing a significant amount of time and training to continue educating the auditors to

identify issues in the field. The implementer is aware that mistakes in the field can be costly. They will continue with education and training to eliminate assessment issues.

4.4 Installation Contractor Training

Business Express providers were taught the procedures for delivering the program. They were trained to complete the paperwork and the procedures for closing out the project. AEP Ohio gave them a flow chart and a Power Point presentation. The installation contractors think that most of the training has been straightforward.

4.5 Advantages to the Program

Positive aspects of the Express Program according to the installation contractor are:

- The implementer has been easy to work with as the program improved across the board.
- Contractors can get more work done for a cheaper price.
- There are no problems with customers because they know the installation contractor is coming.
- There are no disconnects between what the customer thinks they are going to get and what the installation contractor installs.
- The installation contractor is able to work (tangentially) with AEP Ohio.
- The Express Program has less paperwork than other programs.
- The Express Program makes it easier to see the customer.
- Without the rebate, the project would not sell. Without the free money, these customers would not implement energy efficient projects.
- Installation contractors are able to make money without having to provide the materials.

4.6 Disadvantages to the Program

4.6.1 Barriers to the Program – Identified by Program Management

According to the program coordinator, the main barrier to installation contractor participation was lack of program knowledge and understanding. Not all contractors will be attracted to the Business Express Program.

According to staff, barriers to the program can also include:

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- Lack of capital
- Lack of understanding about energy efficiency technologies
- General malaise or disbelief that customers can save that much money.

4.6.2 Program Barriers – Identified by Contractors

Contractors were asked about barriers that AEP could help with and those that AEP can't control. Some of the barriers that AEP could help with are:

- The kWh maximum to participate in the program limits the number of customers who qualify for the program
- One disadvantage to the program is the need to return to the site. Getting back and forth can be a hassle when the job site is miles away. The need for this has been reduced by the addition of the implementer's crew, the distributor that aggregates the product onto pallets, and the positive learning curve of the auditors.
- The only disadvantage not previously mentioned is the lack of work in the winter months. The contractors did not expect the extreme drop-off in participation.

AEP Ohio could not help resolve other barriers for customers such as:

- Future business concerns
- Fear of change
- Unwillingness to adapt to new equipment
- Customers waiting for LEDs to become more affordable so they only have to change their lighting once.

4.7 Success and the Future of These Efforts

The installation contractors reported that the Express Program has been successful for them. They replaced a huge number of T12s fixtures for small customers. The recycling program was very efficient. Word of mouth on the positive aspects of the program has grown as more customers have participated in the program. They are hoping 2014 will also be a successful year.

The only program weakness that is still in play according to the installation contractors is that the payments have been slow to arrive.

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4.8 Express Program Eligibility Changes for 2013

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 October 2011, AEP Ohio increased the limit to 200,000 kWh per year. At first, to exclude large, mercantile customers from the program, AEP Ohio required that a participating customer have only one account. This requirement has since been expanded to a maximum of six accounts in one customer's name, as long as each account has less than 200,000 kWh annual usage. Alternatively, the customer may have more than one account (i.e. meter) on a site. These basic changes significantly increased the number of customers who qualified for the program. AEP Ohio is getting feedback from the implementer that they would like to expand eligibility to 300,000 kWh. The implementer thinks there is a gap between the Prescriptive and the Express Program for that size customer.

4.9 Survey Results

In the next sections, we present the results from the survey of 218 program participants. The survey was fielded in March and April, 2014 and asked about topics such as sources of information, satisfaction with the program and with attributes of the program, satisfaction with AEP Ohio, type of measure installed, program benefits, program drawbacks, and improvements to the Program.

4.9.1 Source of Program Information

Half of the program participants in the survey (50 percent) first heard about the program from an AEP mailer. The next most mentioned source of information about the program (49 percent) was from a speaker at an event. About a third (32 percent) of survey respondents first found out about the program from an AEP Ohio Express Program auditor. Survey respondents also heard about the program from their AEP Ohio account executive (25 percent) or from a supplier or contractor (20 percent). Fewer program participants heard about the Express Program from a friend or colleague (12 percent) or from an in-person visit (10 percent). These results are presented in Figure 4-1.

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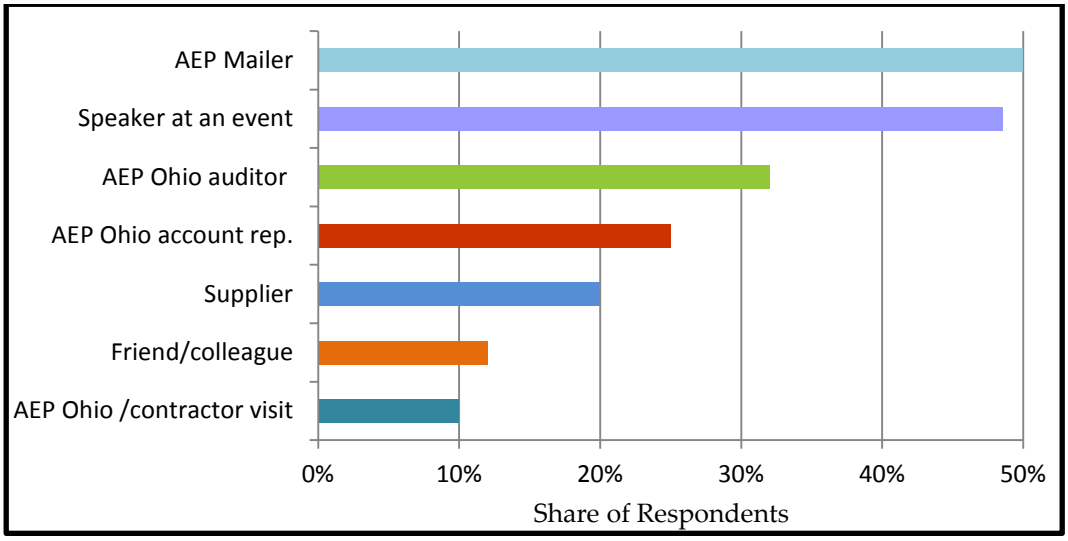
Figure 4-1. 2013 Where Customers First Heard about the Program

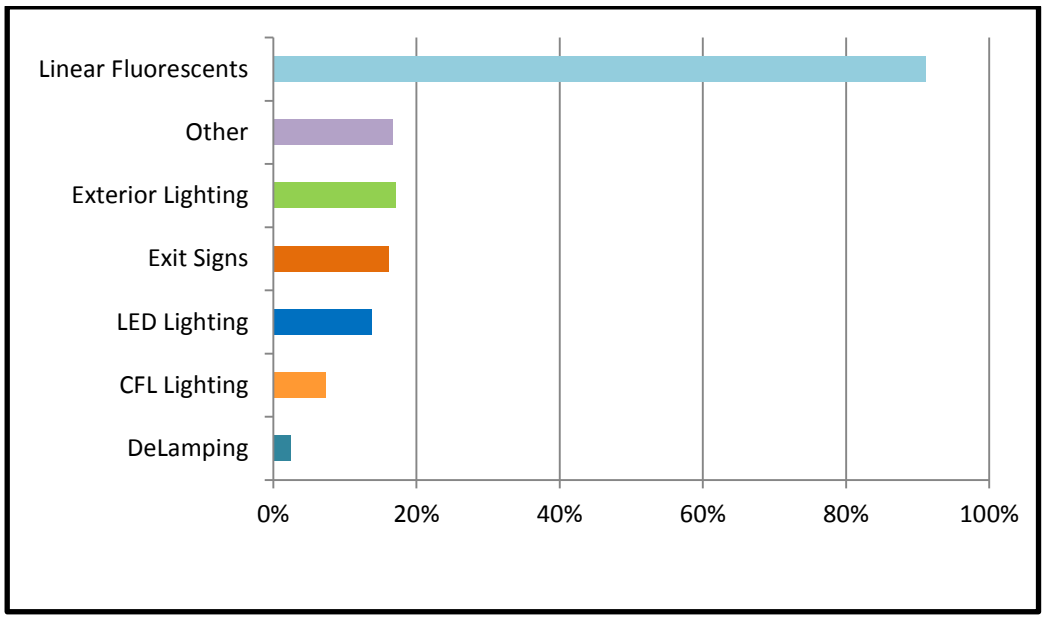


2013 Business Express Survey Data n=218

4.9.2 Types of Measures Installed

In the 2013 survey of customers shown in Figure 4.2, 91 percent of program participants reported installing linear fluorescent lamps. Fewer than 20 percent of program participants installed other types of lighting, including exterior lighting (17 percent), exit lights (16 percent), LED lighting (14 percent) and CFLs (7 percent). Only 2 percent of the survey respondents reported de-lamping.

Figure 4-2. 2013 Types of Measures Installed



2013 Business Express Survey Data n=218, multiple responses accepted

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4.9.3 Role of the Contractor

Under the new implementer, the installation contractor's role is limited to picking up the equipment from the warehouse and installing it according to the contract as developed by the program assessor. Ninety-five percent of the time this system worked as intended. However, in some cases, the customer requested changes to the contract or the equipment could not be installed at the site. In those cases, the amount of the invoice was different than the amount in the proposal.

Most installation contractors appear to have installed the equipment in a professional and courteous manner. Survey respondents reported that:

- 91 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
- 84 percent would recommend their installation contractor to others and 13 percent would not

According to customers, over 50 percent of the installation contractors had to return to the customers' place of business to complete the installation.

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

- Unprofessional behavior (5)
- A series of small transgressions that created a story of woe (5)
- They left a mess (4)
- The job is still not completed (4)
- Scheduling problems (4)
- Poor work quality (2)

4.9.4 Satisfaction with AEP Ohio, the Business Express Program and the Program Measures

As shown in Figure 4-3, overall, over 90 percent of survey respondents were 'very or somewhat satisfied' with AEP Ohio, the Business Express Program, and the measures offered by the program. Over 60 percent of survey respondents were 'very satisfied' with AEP Ohio (67 percent), the Business Express Program (63 percent) and the program measures (62 percent).

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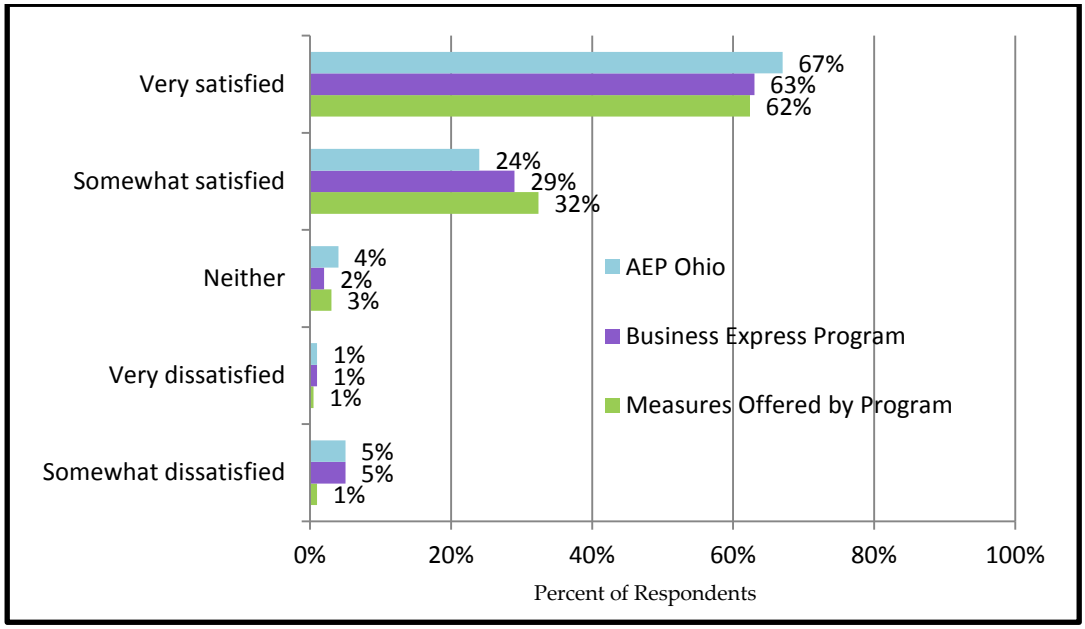
Figure 4-3. 2013 Customer Satisfaction and the Reasons for Providing the Rating



2013 Business Express Survey Data n=218

4.9.5 Customer Satisfaction with AEP Ohio and the Reasons for the Rating

After survey respondents were asked to rate AEP Ohio on a scale from one to five where five was 'very satisfied', four was 'somewhat satisfied', three was 'neither, two was 'somewhat dissatisfied, and one was 'very dissatisfied', they were asked to explain why they rated the program the way they did. The results are shown in Figure 4-4. Almost 40 percent of the participants were 'very satisfied' because contractors were reliable and the lighting products were excellent. The other major reasons for a high level of satisfaction with AEP Ohio was that the utility provides value and good services (26 percent) and that they provide reliable power (5 percent).

The main reason for being 'somewhat satisfied' with AEP Ohio was that there were issues with the program delivery. 7 percent of respondents were in this category. Survey respondents who reported that bills were too high either rated their satisfaction with AEP Ohio as 'somewhat satisfied' or 'somewhat dissatisfied'.

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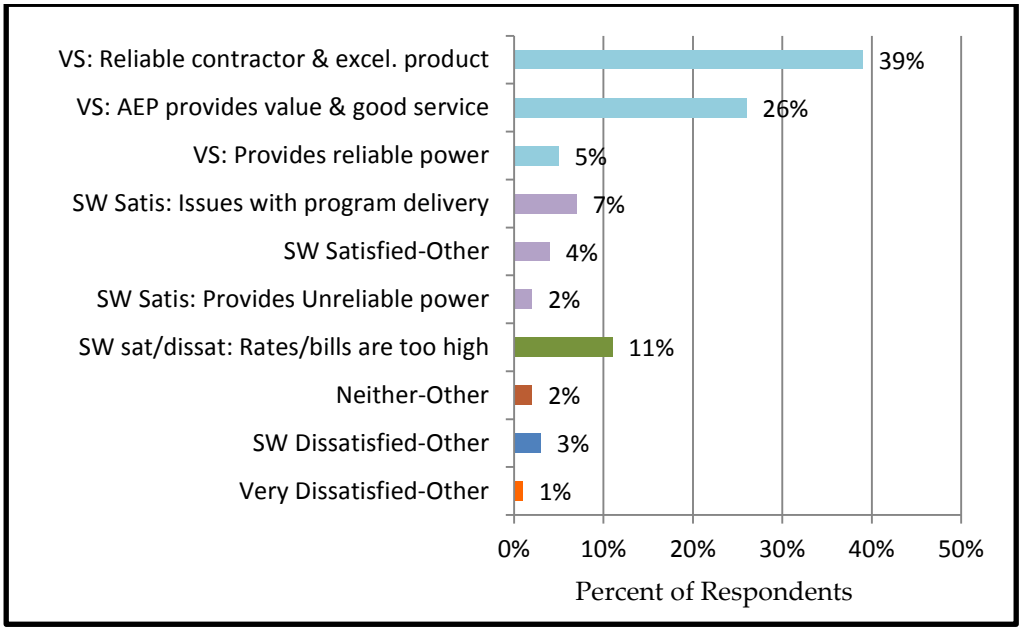
Figure 4-4. 2013 Customer Satisfaction and the Reasons for the Rating



2013 Business Express Survey Data n=218

4.9.6 Customer Satisfaction with the Program and the Reasons for the Rating

After survey respondents were asked to rate the program on a scale from one to five where five was 'very satisfied', four was 'somewhat satisfied', three was 'neither, two was 'somewhat dissatisfied, and one was 'very dissatisfied', they were asked to explain why they rated the program the way they did. The results are shown in Figure 4-5. 63 percent of the respondents were 'very satisfied' with the program. Almost half of the participants were 'very satisfied' because the program worked as promised (49 percent). The other major reason for a high level of program satisfaction was the reduced energy use or better quality lighting (11 percent). Almost 30 percent of the program participants were 'somewhat satisfied' with the program. Some of them had small issues (8 percent) or problems with the program (5 percent) or they reported the savings were not up to their expectations (4 percent). These were the same reasons provided by customers who said they were dissatisfied with the program.

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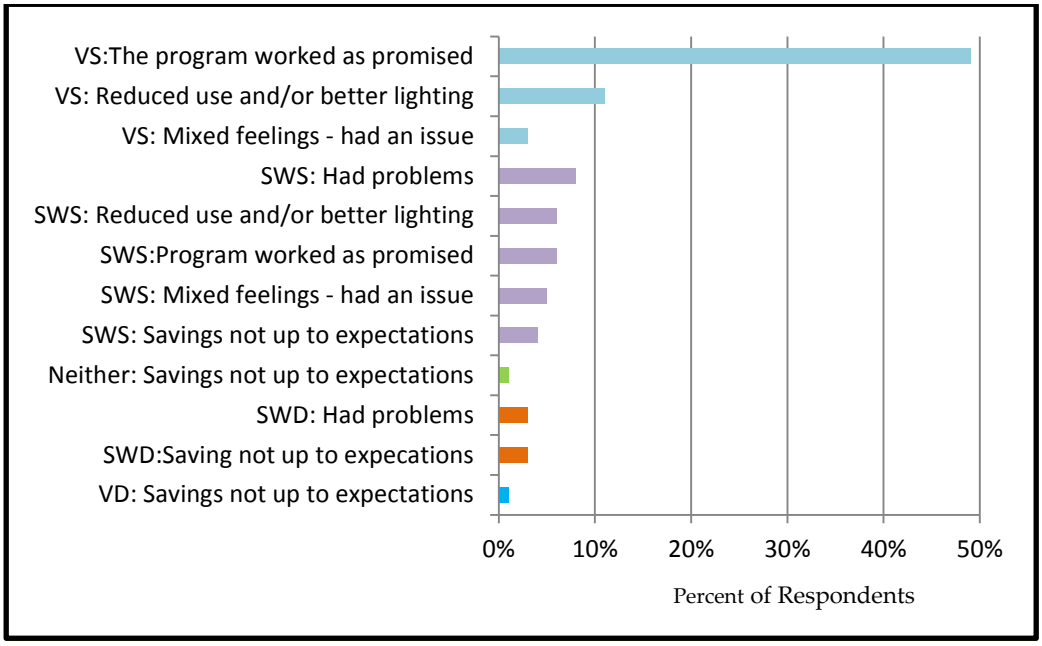
Figure 4-5. 2013 Customer Satisfaction and the Reasons for Providing the Rating



2013 Business Express Survey Data n=218

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 4.6. They were most satisfied with the presentations given by AEP Ohio, by the efficiency level of the program measures, and by the energy assessment performed by the auditor. From 85 percent to 90 percent of customers were satisfied with these attributes of the program. Customers were slightly less satisfied with AEP's ability to deliver the program (81 percent), the expertise of the installation contractor (81 percent) and the reduced cost to the customer (77 percent).

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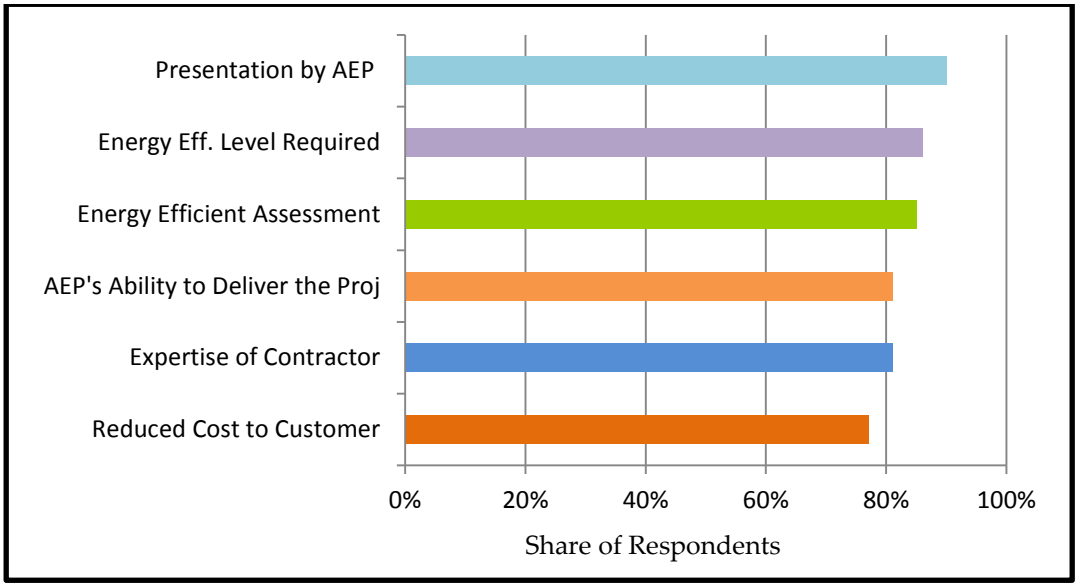
Figure 4-6. 2013 Customer Satisfaction with the Attributes of the Program

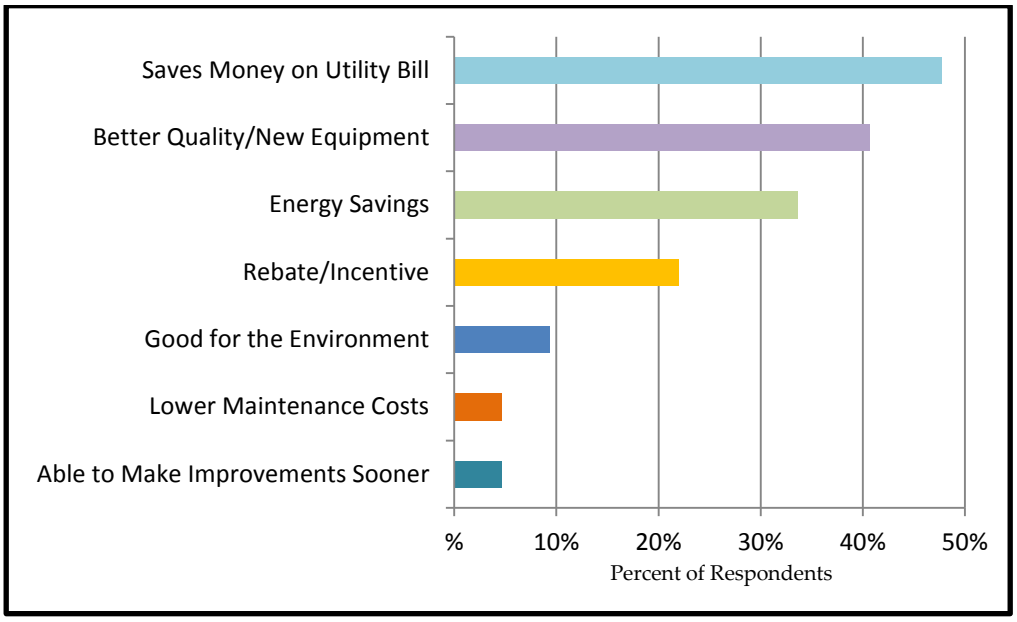


2013 Business Express Survey Data n=218

4.9.7 Program Benefits

Program participants mentioned the three most important program benefits to the Express Program were saving money on the utility bill (48 percent), better quality lighting (41 percent), and energy savings (31 percent) as shown in Figure 4-7).

Figure 4-7. 2013 Business Express Program Benefits



2013 Business Express Survey Data n=218; multiple responses accepted.

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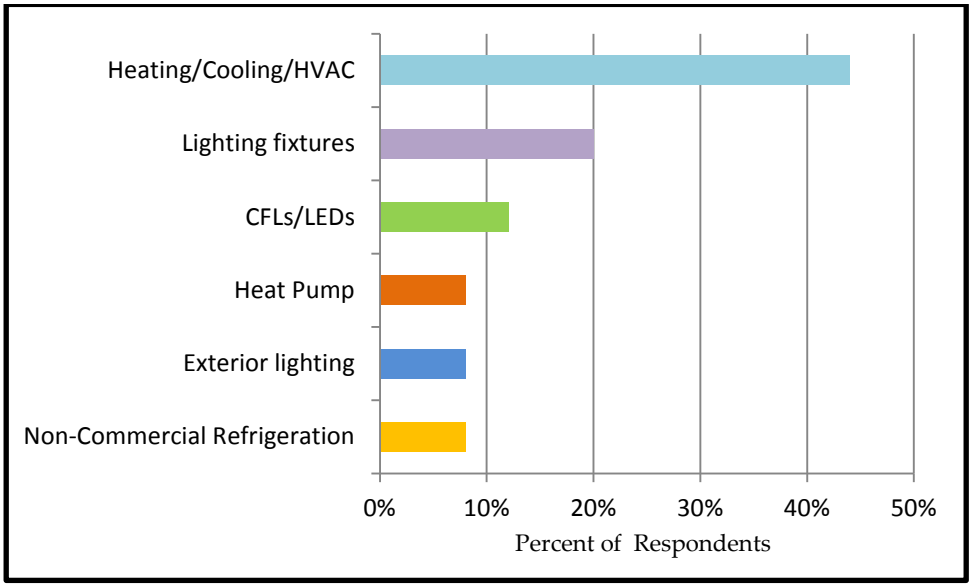
4.9.8 Influence of Express Program on Future Program Participation

Over 75 percent of program participants plan to participate in other AEP Ohio programs in the future (78 percent). 7 percent said they do no plan to participate again and 15 percent do not know what their future plans are.

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 Business 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, twelve percent of the survey respondents installed additional energy-efficient equipment in their facility or facilities.

Almost half, 44 percent, of the extra equipment installed outside the program was heating, cooling or ventilation equipment. Another 20 percent of the respondents installed lighting fixtures and 12 percent installed CFLs or LED lights as shown in Figure 4-8.

Figure 4-8. 2013 Equipment Installed Outside the Program



2013 Business Express Survey Data n=218;

The most mentioned reason for not applying for a rebate for and energy efficient measure was that the respondent did not think they could apply for a rebate (65 percent) or they did not think the equipment qualified (19 percent). Most of this equipment (93 percent) was not recommended by the Express Program assessment. Only 23 percent said the program was significant (rating of 8, 9, 10) in their decision to install the equipment.

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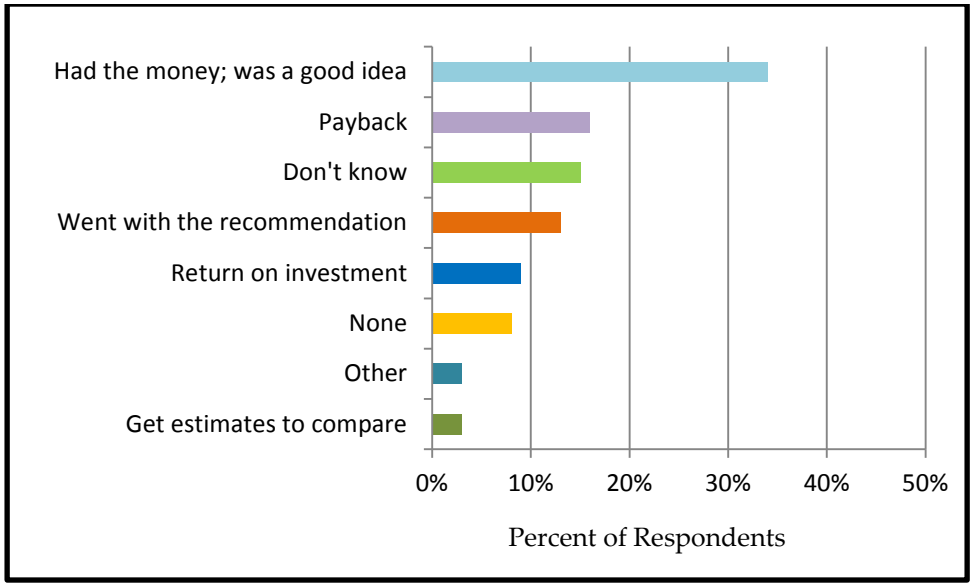
Table 4-1. 2013 Equipment Installed Outside the Program

Reason for Not Participating in an AEP Program	Percent
Didn't know that I could	66 percent
Didn't qualify for the program	19 percent
Not in the proposal	8 percent
Business is too big for program	4 percent
Wasn't that expensive	4 percent

4.9.9 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. About one-third of these smaller customers said they did not use any criteria; if they had the money and it was a good idea then the purchased the equipment. Only 16 percent said they used payback calculations, 9 percent said they used return on investment or they bid the project out and compare the estimates (3 percent). Other customers did not know if any calculations were made (15 percent), went with the recommendation with any financial calculations (13 percent) or did not use any calculations when making these decisions (8 percent). These results are presented in Figure 4-9.

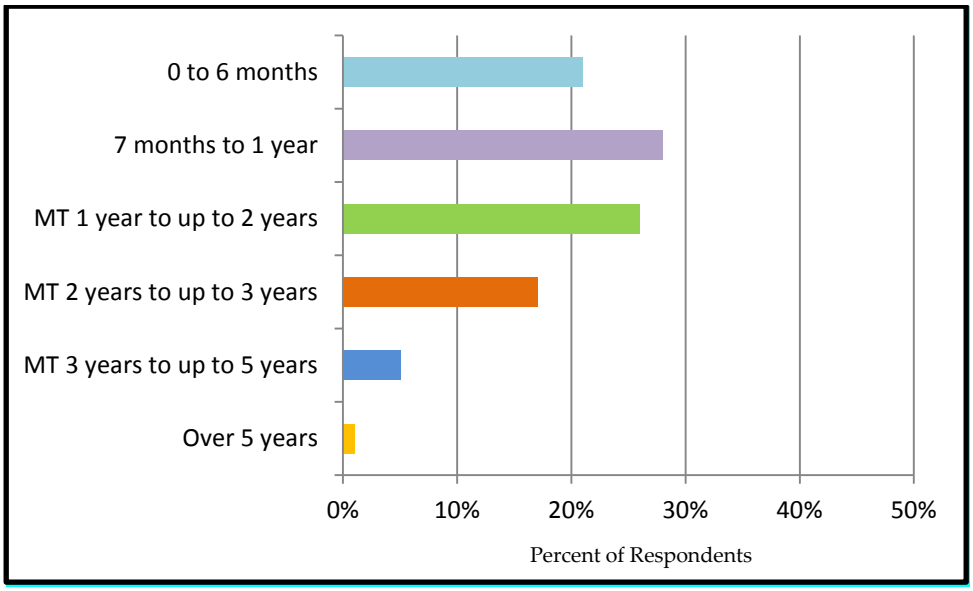
Figure 4-9. 2013 Financial Calculation Used



2013 Business Express Survey Data; Participants n=213.

Customers were asked about the length of time they would need for payback even if they did not say they used payback. They were most likely to report they used seven months to one year (28 percent) but were almost as likely to use 1 year to 2 years. Overall, three-fourths of customers reported using a payback of two years or less. These results are presented in Table 4-10.

Figure 4-10. 2013 Payback Criteria



2013 Business Express Survey Data; Participants n=178

4.9.10 Program Drawback and Barriers

The program implementers see out-of-pocket expenses that are not in the budget as one of the program drawbacks. Also, customers are unaware of the new regulations concerning T12s.

Survey respondents were also asked to list the drawbacks of the program. 71 percent of them could not think of any drawbacks of the Express Program. The most mentioned drawback by program participants was the cost of the equipment (6 percent), the install wait (5 percent), and dealing with the installation contractor or the implementer (5 percent). About 2 percent of the program participants said the incentive did not justify the effort the program took, that there were no bill savings, that the survey was inconvenient, and that the program was too time-consuming. These results are presented in Figure 4-11.

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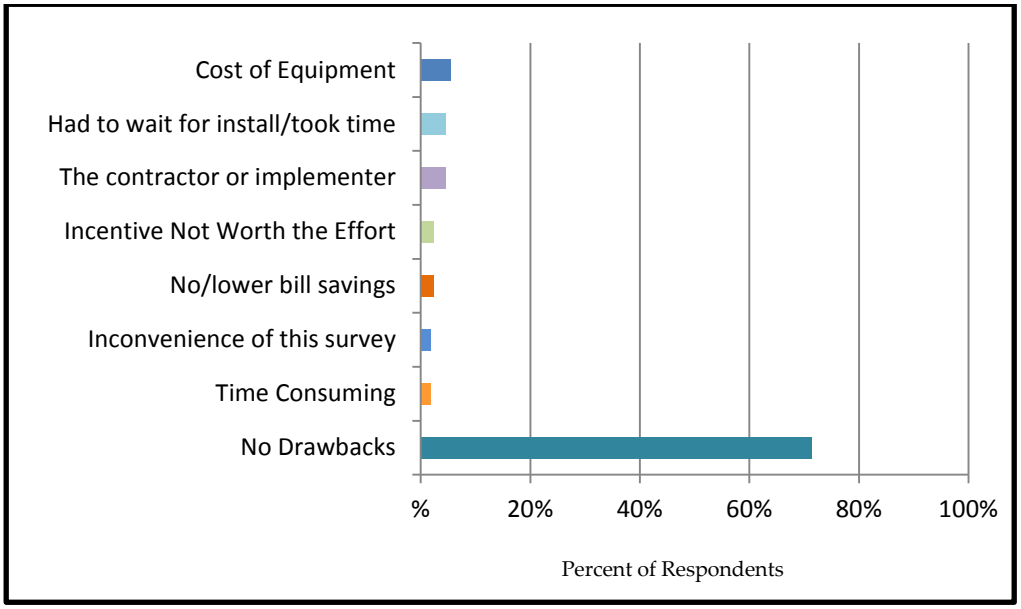
Figure 4-11. 2013 Business Express Program Drawbacks

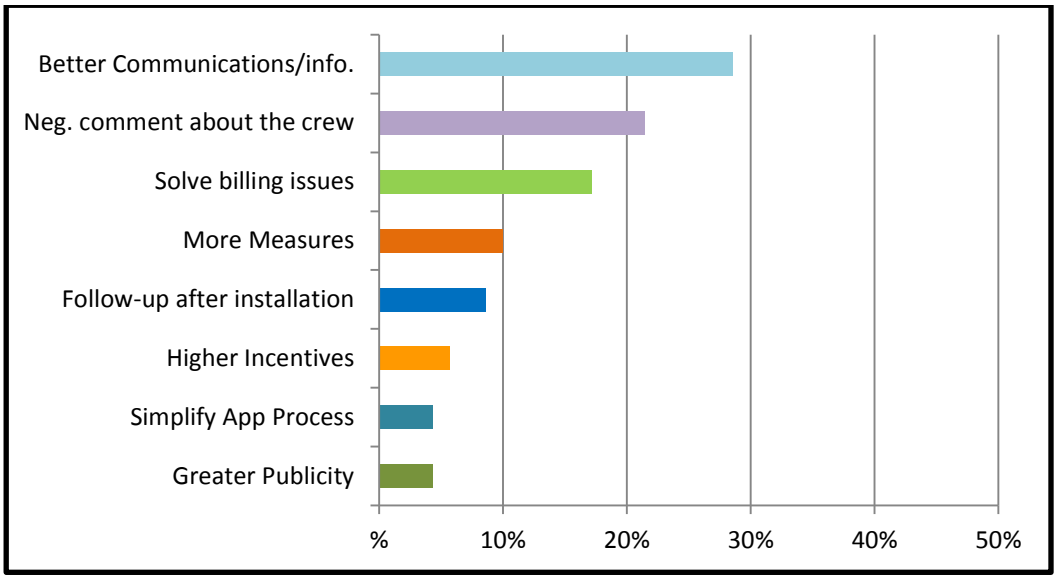


2013 Business Express Survey Data n=218;

4.9.11 Program Improvement Ideas

As shown in Figure 4-12, customers offered few ideas for improving the program. 68 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, followed by solving billing issues (17 percent) and adding more measures (10 percent).

Figure 4-12. Suggestions for Program Improvement



2013 Business Express Survey Data n=218

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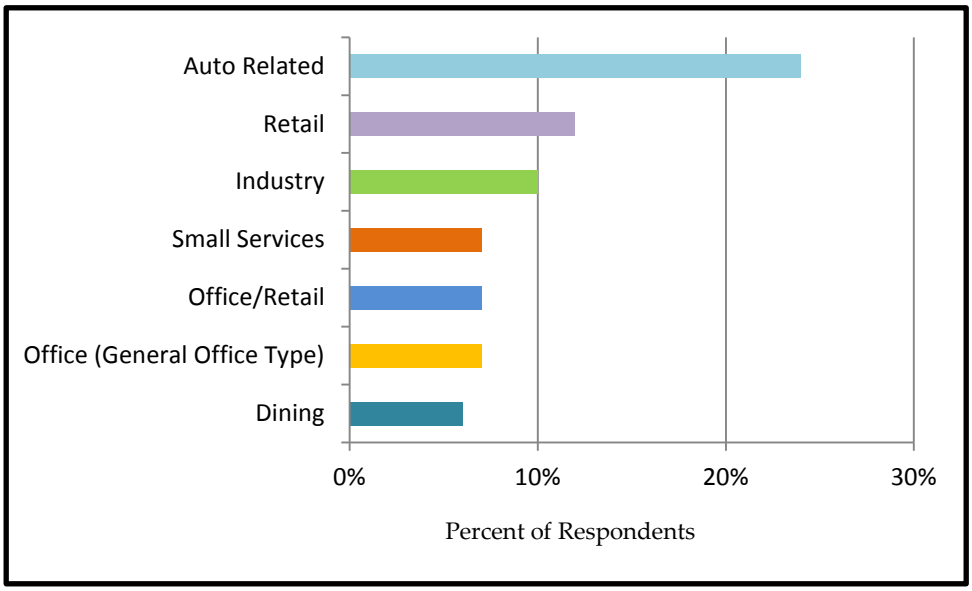
4.9.12 Firmographics

The largest percentage of customers in our sample were from auto related firms (24 percent), followed by retail (12 percent) and industry (10 percent). Seven percent of the respondents reported they were in the small services, office/retail, or office sector, while 6 percent were in the dining sector. Only those sectors representing 5 percent or more of the sample are shown in Figure 4-13.

Figure 4-13. 2013 Customer Sectors



2013 Business Express Survey Data; Participants n=216

The majority of business types for our participant sample of Express customers were owners of the firm in the sample (54 percent). 17 percent reported their title as a member of upper management and 13 percent said they were in a financial or administrative position.

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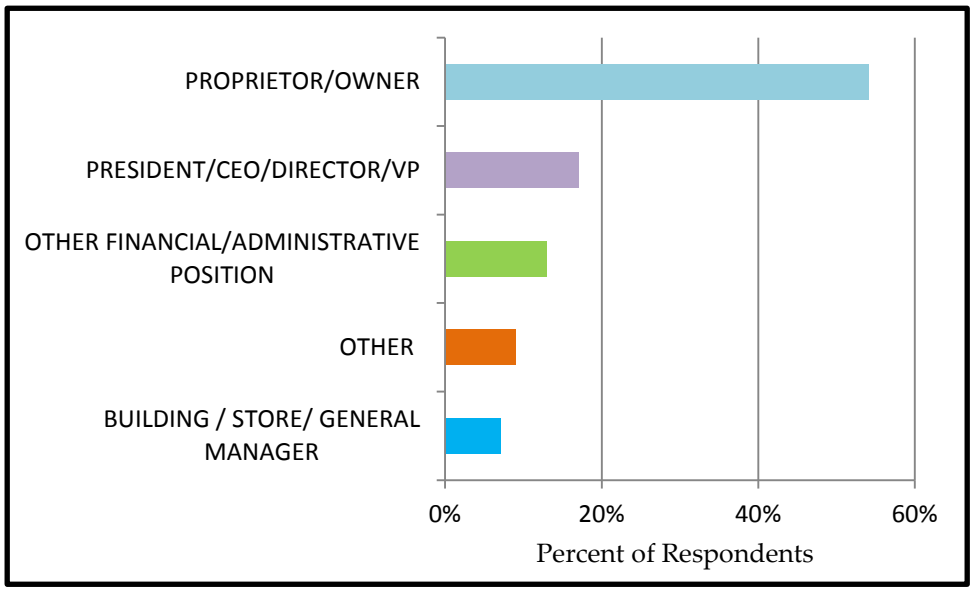
Figure 4-14. 2013 Title of Respondent



2013 Business Express Survey Data; Participants n=216

The square footage for the buildings ranged from 200 square feet to 200,000 square feet with an average of size of almost 8,000 square feet. The building ages ranged from less than a year to 150 years old with an average age of about 41 years. 57 percent of the participating businesses reported fewer than five employees and 41 percent reported from 5 to 25 employees.

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Section 5. Conclusions and Recommendations

This final section outlines the evaluation team's conclusions and recommendations for program improvement.

5.1 Impacts Conclusions and Recommendations

The Express Program was refreshed for 2013 with a new program implementer. For what is essentially a first year program, the revised program made some important improvements over the previous program. 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.

1. The Express Program for Small Business Customers 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.

   Impact Recommendation #1: Continue to target difficult to reach customers for 2014 and beyond.

2. Only lighting measures were installed in 2013. No HVAC or refrigeration measures were installed.

   Impact Recommendation #2: Expand and market program to include additional measures. Work with the implementation contractor to recruit participants who install measures other than lighting (refrigeration and/or HVAC) so that the full benefits of the program can be realized.

3. Program tracking information is very good. Description of algorithms and program documentation is also thorough and complete. The evaluation team's review of savings calculations found no errors in algorithms and all relevant fields sufficiently populated, with the exception of "FacilityTypeCd".

   Impact Recommendation #3: The "FacilityTypeCd" field is used only to advise initial hours of use, but does not represent the actual customer facility type. An example is the "Bakery" designation, which covers auto repair, fast food, small office and other BuildingTypes. For consistency and clarity the appropriate type of building should be presented to better categorize firmographic information.

4. The realization rate (defined as verified *ex post* savings divided by *ex-ante* reported savings) is 58 percent for energy savings, and 97 percent for demand reduction. There are several reasons for the low realization rate, which stem from the parameter estimates and have a compounding effect.

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Impact Recommendation #4a: Assess estimated hours of use as accurately as possible by fixture. It appears that the implementation contractor is already doing a better job after launching the program, but success in future years requires accurate hour estimate.

Impact Recommendation #4b: HVAC interactive effects are applied at the project level, regardless of location within a facility. The implementation contractor should ensure that the location data that shows exterior and garage fixtures especially do not accrue additional energy savings due to improper application of HVAC interactive effects.

Impact Recommendation #4c: Ensure existing fixture wattage for common fixtures accurately represent the technologies that are replaced.

Impact Recommendation #4d: Ensure specified equipment is installed and recorded in the tracking data, including low wattage lamps rather than regular wattage lamps when specified.

Impact Recommendation #4e: Burned-out lamps in existing systems may have been underestimated. Provide a consistent approach to recording burnouts.

Impact Recommendation #4f: Coincident factors should be updated to the values used in the Prescriptive evaluation for consistency across business programs.

5. Often a single customer facility may cover multiple premises and meters. While it appears that any issues regarding multiple premises and meters were correctly accounted for by AEP Ohio and the implementation contractor, this is of critical importance when completing a project.

   Recommendation #5: Continue to carefully match meters and customers correctly to ensure that there are no potential issues when performing a billing analysis.

5.2 Process Conclusions and Recommendations

1. The turn key Business Express Program as implemented by the implementer got off to a 'rough start' as one Installation contractor described it. The most serious problems concerned the lack of knowledge on the part of the auditors. Most of the auditors did not have a background in lighting and the learning curve was quite steep, and, for providers, quite slow. The situation has improved and mistakes are much less frequent than earlier in the year. One partial solution was that Lime Energy has a crew that makes a second visit when necessary to correct problems, relieving that burden from the installation contractor.

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Recommendation #1: The situation with lighting raises some concern about plans to expand the measures beyond lighting to HVACs, VSDs and other more complex measures. The easy task will be to find installation contractors who can install the equipment. The more difficult task would seem to be finding auditors that can provide credible estimates of energy savings for the types of measures.

2. Contractors raised concerns about the lack of work early in 2014 and the slow payments from the implementer in late 2013 and early 2014. For smaller installation contractors who may be dedicating most of their resources to this program, these two issues can be threatening to the viability of the firm.

   Recommendation #2a: The lack of work in 2014 may be an aberration due to slow markets and the need for all to take a break about the busyness of the first year. However, the logic for stopping the flow of projects through the pipeline for the Business Express Program is unclear.[10] If a six week break is needed for processing projects, the implementer should be fully prepared to begin marketing the program at the beginning of the year.

   Recommendation #2b: The implementer should take extra steps to remind contractors that invoices are not paid for sixty days. This should also be carefully explained to the before they sign the contract. Small contractors may have the most trouble with meeting payroll when the Express Program accounts for a significant proportion of their workload. Also, the implementer and AEP Ohio should process the Business Express Program contractor payments in a timely monthly to ensure a steady stream of payments to contractors given the contractual limitations.

3. Customers were most likely to report dissatisfaction with the Express Business Program because of low savings levels after installation of the energy saving equipment.

   Recommendation #3: This issue is generally tied to inaccurate hours of use of inaccurate specifications of the removed equipment. An automatic flag is attached if project savings exceeds 30 percent of usage. More aggressive monitoring may be warranted.

4. Customers were more likely to say that more communication was needed for the program to run more smoothly.

[10] It is possible that severe winter weather could have influenced the lack of work during this time period.

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Recommendation #4: Communications between AEP Ohio and the implementer appear to be working efficiently. Customers, however, said they are not receiving communications are frequently as they would like.

5. AEP Ohio is getting feedback from the implementer that they would like to expand eligibility to 300,000 kWh. The implementer thinks there is a gap between the Prescriptive and the Express Program for that size customer.

   Recommendation #5: AEP Ohio should analyze the Prescriptive Program participation data to see if customers in the size range participate in the Prescriptive Program in expected numbers and then make the decision to expand the eligibility or not.

5.3 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 5-1 summarizes the unique inputs used in the TRC test.

Table 5-1. Inputs to Cost-Effectiveness Model for Express Program

Item	
Average Measure Life	11
Units	930
Annual Energy Savings (MWh)	6,062
Coincident Peak Savings (kW)	2,662
Third Party Implementation Costs	307,567
Utility Administration Costs	339,761
Utility Incentive Costs	2,489,462
Participant Contribution to Incremental Measure Costs	4,019,633

Based on these inputs, the TRC ratio is 0.9. Therefore; the program does not pass the TRC test. Table 5-2 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 5-2. Cost Effectiveness Results for the Express Program for Small Business

Test Results	
Total Resource Cost	0.9
Participant Cost Test	1.9
Ratepayer Impact Measure	0.5
Utility Cost Test	1.3

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.

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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 2013 tracking database included 929 completed projects, 126 completed pipeline projects, 46 pending projects, and 1,031 projected projects, for a total of 2,132 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 a single project.[11]

1. Navigant excluded projects from the analysis if any of the following criteria were met:
2. Projects with negative usage values in at least one bill (2 projects)
3. Projects with both completed and pipeline work (16 projects)
4. 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:
5. The account number differed from the account number at the time of participation, indicating the tenant had changed
6. The observation occurred during the period that the work was being done (between the *workbegindate* and *workcompletedate*)
7. The observation corresponded to a bill cycle that ended prior to 2013
8. The billing record was a duplicate
9. The bill period was less than 20 or greater than 75 days in length

[11] 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.

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10. The billing usage was determined to be an outlier, defined as greater than 10 times the median usage or less than one-tenth the median usage[12]

11. Observations for pipeline projects after the project work began

12. The regression analysis included usage data from 1,884 projects.

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 interacted seasonal binary variables with the post-installation variable. Seasonal binary variables allow energy usage and program savings to vary by season. 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. The regression equation is given by:

Equation 1

$$ADU_{it} = \alpha_i + \sum_{s=2}^{6} \beta_s * SeasonYear_{st} + \sum_{j=1}^{4} \gamma_s * Season_{jt} * Post_{it} + \epsilon_{it}$$

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*

[12] The median usage is 125.3 kWh per day. Observations with daily usage greater than 1,253 kWh per day or less than 12.53 kWh per day were excluded from the regression analysis (8004 observations).

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$SeasonYear_{st}$ = A binary variable taking a value of 1 if period t is in season-year s. The five seasons include spring 2013 through spring 2014. Winter 2013 is the baseline season because it is the first complete season of the analysis period.

$Season_{jt}$ = A binary variable taking a value of 1 if period t is in season j. The four seasons include winter, spring, summer, and fall. The winter and spring seasons include data from both 2013 and 2014.[13]

$Post_{it}$ = 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

The parameters on the seasonal variables capture the change in energy consumption for the premises that have not yet entered the program. The parameters on the interactions between the seasonal variables and the post variable capture the *incremental* seasonal change in energy consumption for the participants that have entered the program. Said differently, the parameters on the interaction terms capture the difference in energy consumption between premises that have entered the program and those that have not yet entered the program. This difference is the direct impact of the Express Program and is captured by the γ_s parameters.

Annual savings are calculated as the average of the seasonal savings. The realization rate is calculated as the ratio of the annual savings estimate from the regression model to the average *ex post* reported savings estimate for participants included in the regression model.[14]

[13] The winter and spring post interaction terms include data from the 2013 and 2014 seasons to increase the number of observations in the post period for each season. Very few projects were completed in the first few months of 2013, and so we use the observations from the same season in 2014 to help estimate the seasonal savings.

[14] This step is necessary because the average ex-ante savings for premises included in the regression analysis differs from the average ex-ante savings for all 2013 participating premises. The difference results from premises and observations being excluded from the regression model due to missing or incorrect data.

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The realization rate is then multiplied by the average *ex post* savings estimates for all 2013 participants to obtain the verified average savings estimate for the Express program.

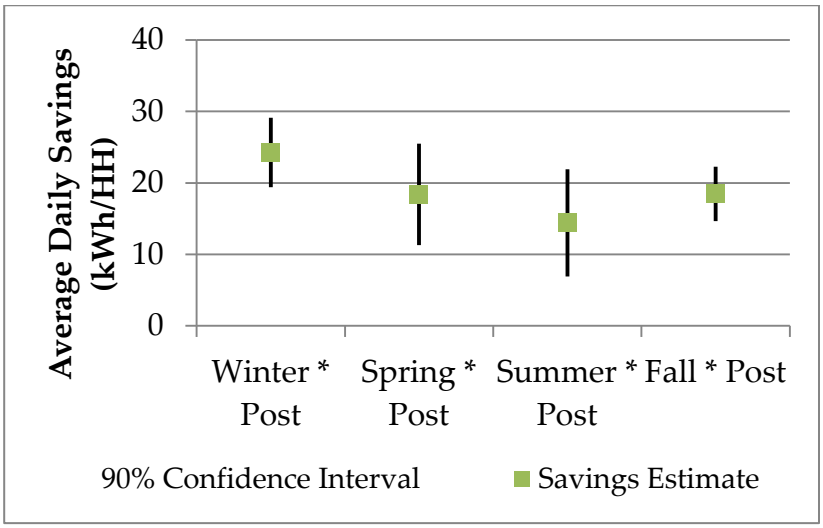
Parameter estimates are given in Table 6-1and shown in Figure 6-1. As expected, the parameters for variables involving post are negative: usage decreases after program measures have been installed. T-statistics greater than 1.64 indicate that the parameter is statistically significantly different from zero at the 90 percent confidence level. Note that all parameters involving post are statistically significant.

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

Variable	Coefficient	Standard Error	T-Statistic
Winter * Post	-24.256	2.956	-8.21
Spring * Post	-18.375	4.323	-4.25
Summer * Post	-14.402	4.556	-3.16
Fall * Post	-18.455	2.324	-7.94
Spring 2013	2.738	1.367	2.00
Summer 2013	35.940	2.301	15.62
Fall 2013	-1.377	1.531	-0.90
Winter 2014	7.205	1.631	4.42
Fall 2014	-20.408	3.321	-6.15

Source: Navigant analysis
*Note: Winter*Post and Spring*Post include data from 2013 and 2014.*

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



Source: Navigant analysis

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Appendix B: Customer CATI Interview Instrument, Program Manager Guide, and Contractor Guide

2013 AEP OHIO BUSINESS PROGRAMS –EXPRESS PROGRAM PARTICIPANT SURVEY

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 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 2013 did <C**ustomerName**> 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 <**MeasDesc 1**>, <**MeasDesc 2**> and <**MeasDesc 3**> at <C**ustomerName**>. **(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

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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) (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

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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).**

S4a Was the proposal clear about the scope of work to be performed?

1 YES
2 NO
8 DON'T KNOW
9 REFUSED

[ASK S4b IF S4a=2]

S4b Why not? **(DO NOT READ)**

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

S5 Was the proposal clear about your share of the project's final cost?

1 YES
2 NO
8 DON'T KNOW
9 REFUSED

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S3 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 for the work?

1 YES
2 NO
8 DON'T KNOW
9 REFUSED

INTRODUCTION TO CONTRACTOR WORK

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

1 YES
2 NO
8 DON'T KNOW
9 REFUSED

S6a2 Did the contractor bring the correct materials to complete 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

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

1 YES
2 NO
8 DON'T KNOW
9 REFUSED

[ASK S6b IF S6a=2]

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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).

LOAN MODULE

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

1 YES
2 NO
8 DON'T KNOW
9 REFUSED

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

MEASURE MODULE

The following questions are about the <**MeasDesc 1**> you installed through the Express Install Program.

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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 or 2013, DK, REF]**

L1 Please briefly describe what 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

NAVIGANT

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 Exterior
2 Less Than 25 percent
3 25 percent To Less Than 50 percent
4 50 percent To Less Than 100 percent
5 All Interior Lights (100 percent)
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 percent
3 25 percent To Less Than 50 percent
4 50 percent To Less Than 100 percent
5 All Interior Lights (100 percent)
8 Don't Know
9 Refused

PAYBACK BATTERY

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

N8 What financial calculations does **<CustomerName>** make before proceeding with installation of equipment like this?

00 [RECORD VERBATIM]
98 DON'T KNOW
99 REFUSED

N9 What is the payback cut-off point you use in months or years, 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

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5 more than 3 years to up to 5 years
6 Over 5 years
8 DON'T KNOW
9 REFUSED

SPILLOVER 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
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

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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 = 98, 99]

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

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

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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 to the business owner? 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**

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(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 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

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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
6 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**

NAVIGANT

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**>, **<Customer City>.**

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

1 PROPRIETOR/OWNER

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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 should be 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

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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)**

9999998 DON'T KNOW
9999999 REFUSED

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 .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)

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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.

NAVIGANT

2013 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.

5.3.1 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.

5.3.2 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.]*

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3. What are the formal and informal communication channels between AEP Ohio and Lime Energy ? 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 Contractors for the Business Express Program? May I review a copy of this document?

5.3.3 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?

5.3.4 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 Contractors Is it sufficient? Do they need more training?

11. What is the feedback on the training they receive now?

12. How thoroughly do contractors 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 or customers effectively increasing awareness of the program opportunities?

    a. What is the format of the outreach? Does it differ for each?

    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?

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5.3.5 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 participation in the program, and how can these be addressed by the program? Are there plans to expand participation in 2014?

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?

5.3.6 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? Lime Energy

27. Who initiates the program participation?

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

28. Are the program processes effective for smoothly providing incentives to customers and motivating the to participate?
    a. Program tracking and data management

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b. Training for on-line data system – feedback?

c. Internal program communications

d. 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?

5.3.7 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.

NAVIGANT

Contractor Interview Guide

February 27, 2014

Name of Interviewee: _____ Date: _____

Title: _____ Company: _____
Phone number:_____

5.3.8 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 Express Program for Small Business Customers. We're currently in the process of conducting interviews with sub-contractors to improve our understanding of the Express Program.

At this time we are interested in asking some questions of the person most experienced with the delivery and installation of equipment under the Express Program for Small Business Customers. [CONFIRM THAT THIS IS THE PERSON MOST KNOWLEDGEABLE AT THEIR BUSINESS OR GET ALTERNATE NAME].
The questions will only take about half an hour. Information you provide will be kept anonymous in our reports. General observations and findings will appear in our final report, but they will not be attributed to any named person or company. Is this a good time to talk? [IF NOT, SCHEDULE A CALL BACK.]

5.3.9 Background

1. Can you briefly describe the company you work for and the type of business it conducts? What are your job responsibilities at your company? How long have you been in this position?

2. Which other AEP Ohio Programs has your organization participated in during 2013? How did you become interested in the Express Program?

3. About how many Express Program projects did your install in 2013?

4. About how much of your organization's resources were used by the Business Express Program in 2013?

5.3.10 Participation

5. What are the main benefits to your firm? What are the drawbacks to your firm?

6. In your opinion, has the Express Program increased your business?

7. What kind of training was provided to become an Express Program Sub-Contractor?

8. What is expected of contractors for the Express Program? Did you participate in the Express Program in 2011 or 2012?

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13.

9. How many of your projects have been inspected by the implementer or AEP Ohio? Have you been asked to return to any job sites to install material missing from the original pallet?

10. How satisfied are you with your experiences with the current Express Program?

11. Is it clear what the implementer expects from you?

12. Is the job inventory supplied to you by the implementer correct? If not, what do you do? How long do these issues take to be resolved? How are they resolved?

13. Do you receive payments on time?

5.3.11 Success and the Future of These Efforts

14. In your opinion, how successful is the Express Program? Why? What are the strengths? What are the weaknesses?

5.3.12 Other

15. 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

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Retro-Commissioning Program: Program Year 2013 Evaluation Report

Presented to
AEP Ohio

AEP OHIO®
A unit of American Electric Power

May 13, 2014

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Executive Summary

This document presents a summary of the findings and results from the evaluation of the 2013 Retro-Commissioning (RCx) Program implemented by AEP Ohio for the program year January 1, 2013 through December 31, 2013.[1] The RCx Program completed its inaugural year in 2013, and this is the first evaluation of the program.

Retro-Commissioning 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 retro-commissioning process in order to facilitate implementation of projects that yield savings with low costs of documentation and investigation.

Program Participation

AEP Ohio Retro-Commissioning Program is two-tiered, based on facility floor area[2] and on-peak demand. Retro-Commissioning Lite is offered to facilities between 100,000 and 150,000 square feet and on-peak demand between 125 kW and 499 kW. RCx Comprehensive is offered to facilities larger than 150,000 square feet and on-peak demand of 500 kW and above. In 2013 the RCx Program had 19 participants, of which seven were RCx Comprehensive. Implemented measures were mostly improved equipment scheduling. Table ES-1 provides a summary of 2013 Retro-Commissioning Program reported results.

Table ES-1. 2013 Retro-Commissioning Program Projects, Measures, and Reported Savings

Metric	RCx Comprehensive	RCx Lite	Program Reported
Number of RCx Lite Projects	7	12	19
Number of Measures	16	35	51
Annual Energy Savings (MWh)	2,532	2,205	4,737
Peak Demand Savings (kW)	0.44	0	0.44

Source: Evaluation analysis of AEP Ohio tracking data from January 16, 2014

Among the 19 projects submitted, there were nine unique customers. Several school districts submitted multiple projects for different schools in respective districts. Six different Retro-commissioning Service Providers (RSPs) conducted studies through the program in 2013.

[1] Program Year 2013 participation is based on incentive payments mailed to participants dated between January 1, 2013 and December 31, 2013.
[2] Size-based tiers are guidelines. AEP Ohio may assign projects to either program track based on project particulars. Furthermore, several schools between 50,000 and 100,000 square feet participated in the program in 2013 due to aggregated size in a school district.

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Data Collection Activities

Table ES-2 provides a summary of 2013 data collection activities for the Retro-Commissioning Program impact and process evaluations.

Table ES-2. Data Collection Activities for 2013 Retro-Commissioning Program Evaluation

Data Collection	Targeted Population	Sample Frame	Sample Design	Sample Size	Timing
Tracking Data Analysis	RCx Program projects approved for payment for 2013	AEP Ohio Tracking Database	-	All	May 2013 to April 2014
In-depth Interviews	AEP Ohio Program Staff	Contact from AEP Ohio	RCx Program Manager	1	October 2013 to November 2013
	RCx Program Implementers	Contact from AEP Ohio	Program Implementation Staff	3	
	RCx Program Participants	Tracking Database	Census of RCx Program Participants	9/6 completed	February 2014 to March 2014
	RCx Providers	Tracking Database	Census of RCx Providers	6	
Application File Review	Tracking Database	Stratified Random Sample by Project-Level kWh	Stratified Random Sample by Project-Level kWh	11	December 2013 to April 2014
Supplemental Site Data Verification	Application File Review Sample	Application File Review Sample	Key issue sites	4	March 2014 to April 2014

Source: Evaluation activities conducted from July 2013 through April 2014.

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Key Evaluation Findings and Recommendations

Key Impact Findings and Recommendations

The impact results for the 2013 Retro-Commissioning Program are shown in Table ES-3.

Table ES-3. Savings Estimates for the 2013 Retro-Commissioning Program

	2013 Program Goals[1]	*Ex Ante*[2] Savings (a)	Audited Savings (b)	Realization Rate RR = (b) / (a)	Percent of Goal
Energy Savings (MWh)	5,552	4,737	3,840	81%	69%
Demand Savings (MW)	1.14	0.44	0.44	100%	38%

Sources:
[1]AEP Ohio Volume 1: 2012 TO 2014 Energy Efficiency/Peak Demand Reduction (EE/PDR) Action Plan, November 29, 2011. [2]Evaluation analysis of AEP Ohio tracking data from January 16, 2014.

Table ES-4. Savings Estimates for the 2013 Retro-Commissioning Program

Metric	Energy Savings (MWh)	Demand Savings (MW)
Ex Ante Reported Savings	4,737	0.44
Ex Post Verified Savings	3,840	0.44
Realization Rate	**0.81**	**1.00**
Relative Precision @ 90% CI	9.5%	NA[3]

1. **Finding:** The 2013 *ex post* savings fell short of goals. The number of projects fell short of anticipated participation, 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: Continue program outreach to school districts and other multi-site entities to maintain participation levels. Attempt to recruit more RCx Comprehensive participants. Encourage more thorough and complete inspections and analysis to identify available savings.

2. **Finding:** The tracking database content is lagging the program. Completed measures were not entered into the database and in some cases inaccurate savings values were entered. Many useful data fields are not being populated.

[3] The sample was based on energy savings and the sampled sites do not support a precision estimate for demand savings.

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Impact Recommendation #2: Place higher priority in keeping tracking systems current and accurate. Implement cross-checks between project-level aggregation and measure-level detail. Delete database fields that will not be used, or back populate those fields to increase their usefulness.

3. **Finding:** 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 completed.

   Impact Recommendation #3: Require an accurately completed project workbook be completed before a project incentive is paid. This information should include:

   1) Billing history to calibrate and validate savings estimates. Multi-year analysis would benefit the program.
   2) Include an equipment schedule with nameplate information and design parameters to validate estimates.
   3) Enable more active calculation space on each "Opportunity" tab so that *full* measure calculations can be presented and archived in one location.
   4) 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 calculations did not demonstrate review by the implementation contractor or knowledgeable subject-matter expert. As a result multiple errors were made in inputs, calculation scope and retro-commissioning concepts.

   Impact Recommendation #4: Require engineering review of all calculations, including:

   1) Establish and enforce default values when assumptions must be made.
   2) 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.
   3) Include secondary savings effects as practicable. For example, include ventilation heating and cooling savings in addition to fan motor savings when fans schedules are adjusted.
   4) Generate a list of typical retro-commissioning measures with brief narratives to describe primary and secondary energy benefits.

Process Evaluation Findings and Recommendations

Program Participant Findings and Recommendations

1. **Finding:** Program participants confirmed the pivotal role of RSPs in the customers' decisions to participate in the program and in their level of success in the program. The RCx Program was successful in educating some customers about the value of retro-commissioning. Retro-commissioning Service Providers explained the customers' options, completed the program paperwork and, in most cases, implemented the RCx project. Program participants rated the process of participating in the RCx program as easy because of the RSPs.

   Process Recommendation #1: The success of the program rests squarely on the ability of the implementer and AEP Ohio to continue to recruit RSPs that can deliver the benefits of RCx to customers.

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2. **Finding:** One customer suggested that AEP Ohio allow grouping smaller sites together to reach to eligibility criteria. This customer has over 50 scattered sites and was willing to volunteer for a pilot program that would aggregate the smaller buildings.

   Process Recommendation #2: Navigant is doubtful that this idea would work for this customer and this program. However, it does bring up an idea that might apply to other customers in one-off situations. With a program like RCx, it might be productive to stretch the program requirements for customers whose characteristics are close to meeting the requirements or for customers in unique situations.

Solution Provider Findings and Recommendations

3. **Finding:** Currently, the market for the RCx Program is limited by two factors. First, the number of firms within the service area that provide RCx services may not be limited to the six currently enrolled, but it is expected to be a small number. Second, RCx providers do not market RCx as a stand-alone product. Retro-commissioning Service Providers would not take it 'to the street', but prefer to market it to current clients who may have some interest in the program. RSPs view the RCx Program as a bonus they add to the other services offered to their customers.

   Process Recommendation #3a: AEP Ohio should verify that all of the qualified regional RCx providers are participating in the program and recruit those currently not enrolled.

   Process Recommendation #3b: The current program does not seem designed to encourage RSPs to market the program beyond their current customers. AEP Ohio might need to train RSPs to market the program and/or change the program incentive structure to widen the market for the program.

4. **Finding:** RSPs point out the financial commitment to implement measures with short payback is unknown before the detailed RCx study is conducted.

   Process Recommendation #4: Some method is needed to approximate the implementation costs at the start of the RCx process. Perhaps AEP Ohio could develop a benchmark of financial commitments based on completed projects to-date and searchable by size or type of facility. Alternatively, customers could choose instead to commit to spend a maximum amount on implementation based on facility area rather than implementing all measures with simple payback less than two years. This alternative would put a cap value on the perceived risk.

Implementer and AEP Ohio Findings and Recommendations

5. **Finding:** The RSP is paid by the customer after the customer receives the incentive based on the savings from the changes to the control systems and any other program measures implemented. This design protects AEP Ohio from the risk associated with the RCx Program, but provides the solution provider with no motivation for marketing the program beyond their current customer list.

   Process Recommendation #5: AEP Ohio and the implementation contractor should conduct focus groups with RSPs to determine if program changes acceptable to AEP Ohio would increase program participation.

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Section 1. Introduction

This evaluation report chapter covers the Retro-Commissioning (RCx) Program element of the AEP Ohio energy efficiency and peak demand reduction (EE/PDR) programs. 2013 is the first year retro-commissioning has been offered by AEP Ohio as a component of its portfolio of Business Programs. This report is the first evaluation of the AEP Ohio RCx Program.

1.1 Program Description

AEP Ohio launched the Retro-Commissioning (RCx) Program in 2013. The RCx Program offers incentives to non-residential, non-industrial customers who conduct retro-commissioning studies at their site and implement identified measures. The incentives are designed to defray the cost of the study. Retro-commissioning 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. The RCx Program aims to streamline the typical retro-commissioning process in order to facilitate implementation of projects that yield savings with low costs of documentation and investigation.

The AEP Ohio RCx Program is two-tiered, based on facility floor area and minimum peak demands[4]. RCx Lite is offered to facilities with a minimum peak demand of 125 kW, and that are between 100,000 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 CLEAResult, Inc. (implementation contractor) in coordination with AEP Ohio. Program services are delivered by AEP Ohio-approved Retro-commissioning Service Providers (RSPs).

1.2 Key Program Elements

The goals of the 2013 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 provides a summary of critical program elements.

Performance Incentive. RCx Program incentives 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. Incentive Parameters

Program Track	Study Incentive	Additional Incentives
RCx Lite	$5,000	NA
RCx Comprehensive	$0.10/sqft	$0.05/kWh saved (longer payback)

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

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Incentive Limits. Project incentives cannot exceed $0.13/kWh saved in the first year or $600,000 per customer per year.

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 retro-commissioning study conducted by an approved AEP Ohio RSP.

Implement Measures. Once the RCx study is complete the customer has 180 days to implement recommended measures. All measures with a payback of less than two years must be implemented to qualify for incentives. All measures are subject to verification.

Final Applications. Final applications must be submitted within 60 days of 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 within six weeks.

Measures and Incentives for 2013

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 Retro-Commissioning Program address many building systems, but typically they focus on the Heating, Ventilation and Air Conditioning (HVAC) equipment.

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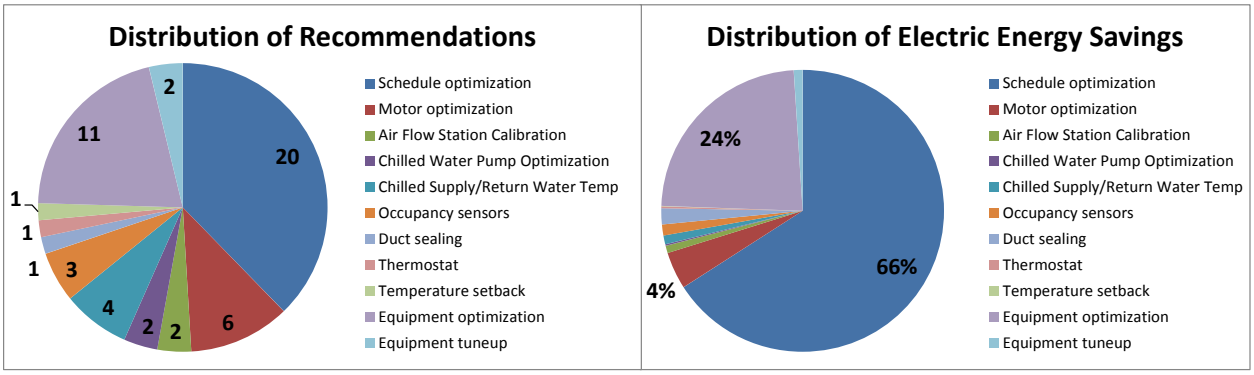
Figure 1-1 shows program energy savings by type.

Figure 1-1. 2013 Retro-Commissioning Program Measures by Type



Scheduling Equipment (mostly air handlers) comprises more than one-third of the recommendations and almost two-thirds of the program savings. Equipment optimization (mostly economizer-related) is the other major measure type, with a significant contribution from motor optimization. Other systems were addressed by the program, but to a much lesser degree.

Solution Provider Participation

AEP Ohio and the implementation contractor recruited a Retro-commissioning Service Provider (RSP) network of approved RSP contractors. The RSPs have been trained on the program processes and have demonstrated their retro-commissioning capabilities. Six different service providers completed projects through the program. Service providers with multiple projects often submitted projects for multiple schools within school districts.

Table 1-2. 2013 Retro-Commissioning Service Providers

Service Provider	RCx Comprehensive	RCx Lite	Program Reported
A	2	6	8
B	1	4	5
C	0	2	2
D	2	0	2
E	1	0	1
F	1	0	1
Total	**7**	**12**	**19**

Source: Evaluation analysis of AEP Ohio tracking data from January 16, 2014

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2013 Retro-Commissioning Program Participation Summary

The evaluation team analyzed data delivered by AEP Ohio on January 16, 2014. As shown in Table 1-3, the 2013 Retro-Commissioning Program paid incentives on 19 projects constituting 4,737 MWh of *ex ante* reported annual energy savings.

Table 1-3. 2013 Retro-Commissioning Program Projects, Measures, and *Ex Ante* Savings

Metric	RCx Comprehensive	RCx Lite	Program Reported
Number of RCx Lite Project	7	12	19
Number of Measures	16	35	51
Annual Energy Savings (MWh)	2,532	2,205	4,737
Peak Demand Savings (kW)	0	0.44	0.44

Source: Evaluation analysis of AEP Ohio tracking data from January 16, 2014

Table 1-4 and Figure 1-2 provide a profile of 2013 RCx Program participation at the market segment level. Among 2013 RCx Program participants there were five participating school districts which submitted a combined fifteen projects of the nineteen submitted. The other four projects were large commercial office buildings (three) and other (one).

Table 1-4. 2013 Retro-Commissioning Program Participation by Business Type

Business Type	Project Count		*Ex ante* Reported Savings, MWh		*Ex ante* Reported Savings, kW	
Large Office Building	3	16%	700	15%	0	0%
Schools (K-12)	15	79%	3,524	74%	436.7	100%
Other	1	5%	513	11%	0	0%
Total	**19**	**100%**	**4,737**	**100%**	**436.7**	**100%**

Source: Evaluation analysis of tracking data from AEP Ohio database exports from January 16, 2014.

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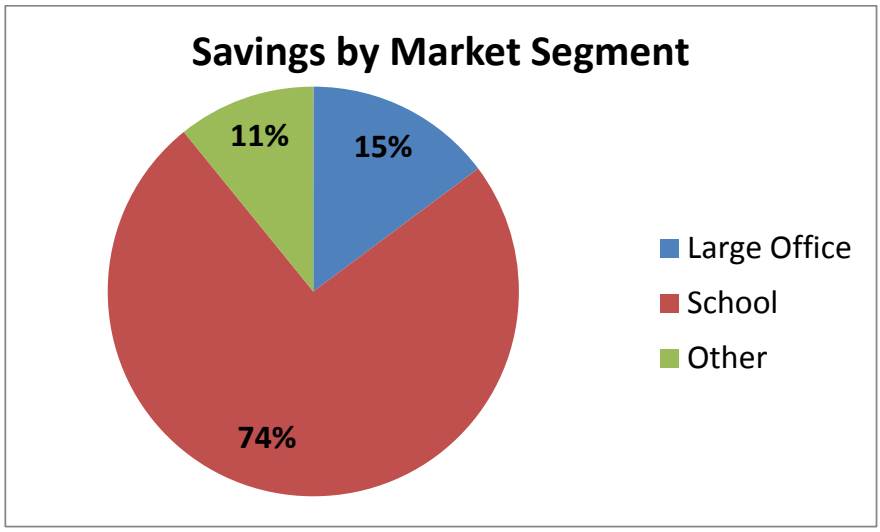
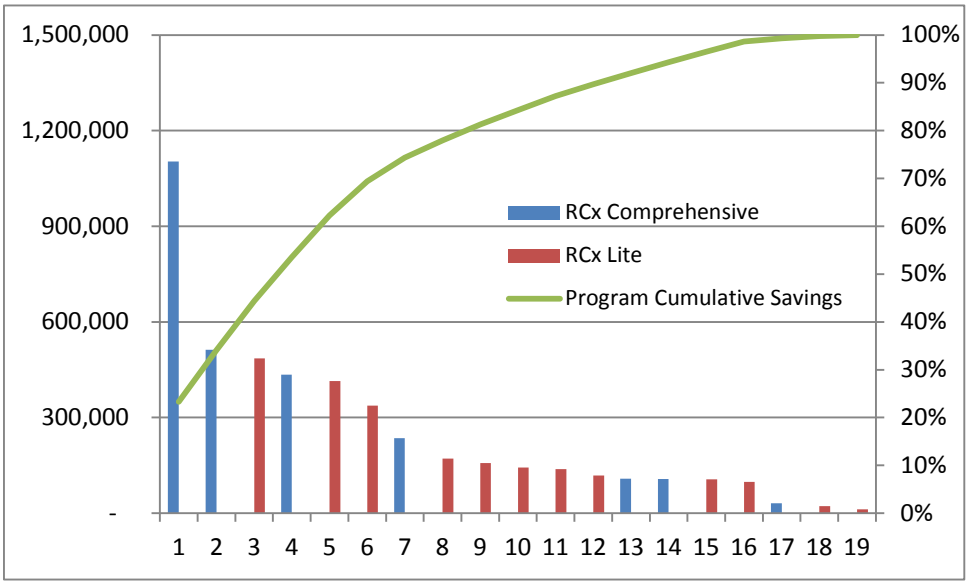
Figure 1-2. 2013 Retro-Commissioning Program *Ex Ante* MWh Savings by Business Type



Source: Evaluation analysis of tracking data from AEP Ohio database exports from January 16, 2014.

Figure 1-3 shows that only four projects (twenty percent) account for 54 percent of program savings, and seven projects account for 74 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 1-3. 2013 Distribution of Savings by Project



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Section 2. Methodology

For Retro-Commissioning Program participants, Navigant conducted impact and process evaluation activities following the methodologies outlined below.

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 RCx Program tracking system. Savings verification is conducted through a multi-step approach:

- **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. Evaluation adjustments identified through the Tracking System Savings review would have been made to all measures in the population where the adjustment was found to be applicable.
- **Default Measure Savings Assessment**, to identify potential adjustments to *ex ante* reported savings for RCx measures where Navigant recommends an alternative default value for a specific measure or input to savings calculation.
- **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. Sampling is discussed in Section 2.3.

Reported savings for retro-commissioning measures are based on project-specific calculations submitted by the customer and RSPs with project applications and verified by the implementation contractor.

Documentation Technical Review

Navigant conducted application Documentation and Technical Review on a sample of projects randomly selected from the customer participant population according to the sampling protocol discussed in Section 2.3. 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. When possible, measure quantities were verified by comparing them to invoices from contractors. If a post-inspection was carried out, measure quantities and specifications from the inspection were assumed to be correct. Where it was not possible to verify measure quantities from independent documents, it was assumed that the implementer quantities were correct.

For each measure in the sampled project, 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* or default measure savings assumptions.

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

- Hours of use
- Inaccurate engineering estimates and calculation methods
- Adding secondary effects
- Equipment specifications
- Additional post-installation data
- Other changes

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

Supplemental Site Data Collection

For the RCx Program evaluation plan, AEP Ohio projected 35 completed projects for RCx Lite and RCx Comprehensive, combined. From among those Navigant planned a technical review of 29 projects with nine on-site verification visits from among the review sites. Due to lower actual participation, Navigant determined a sample of 11 sites was adequate. Navigant worked to schedule on-sites with several participants, but determined that remote verification was effective and required less coordination to get permission to enter student-occupied schools. Thus, we remotely verified schedules and set points via live demonstrations of controls and data for four sites. After additional data was collected, Navigant developed annual energy and demand impacts based on the verified data, supplemental information from on-site personnel and application information.

Verification Results

The evaluation results were reviewed at the project-level by an experienced engineer familiar with the evaluation. Using project *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.

2.1.2 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 satisfaction. The evaluation team's process efforts provide insights and recommendations to support the continued success of the Retro-Commissioning Program.

Central to the process evaluation for the Retro-Commissioning 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 program plans. In addition, the evaluation team conducted in-depth interviews with participating customers and Retro-commissioning service providers to better understand customer satisfaction and perceptions related to the program.

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

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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 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.

2.2 *Data Sources*

The data collected for evaluation of the 2013 RCx Program was gathered during a number of activities including:

- In-depth telephone interviews with AEP Ohio program coordinators and the implementation contractor
- In-depth telephone interviews with participating customers
- Tracking system data review
- Documentation technical review of a sample of projects
- On-site measurement and verification at customer sites for a subset of projects sampled from the application documentation technical review

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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 2013 Evaluation

Data Collection	Targeted Population	Sample Frame	Sample Design	Sample Size	Timing
Tracking Data Analysis	RCx Program projects approved for payment for 2013	AEP Ohio Tracking Database	-	All	May 2013 to April 2014
In-depth Interviews	AEP Ohio Program Staff	Contact from AEP Ohio	RCx Program Manager	1	October 2013 to November 2013
	RCx Program Implementers	Contact from AEP Ohio	Program Implementation Staff	3	
	RCx Program Participants	Tracking Database	Census of RCx Program Participants	9	February 2014 to March 2014
	RCx Providers	Tracking Database	Census of RCx Providers	6	
Application File Review	Tracking Database	Stratified Random Sample by Project-Level kWh	Stratified Random Sample by Project-Level kWh	11	December 2013 to April 2014
Supplemental Site Data Verification	Application File Review Sample	Application File Review Sample	Key issue sites	4	March 2014 to April 2014

Tracking Data

In mid-January 2014, 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. Program samples for the Computer-Assisted Telephone Interview (CATI) participating customer phone sample were drawn from the same January 2014 extract.

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.

- Project data do not appear to be complete for all of the projects submitted in the 2013 program year.

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- Project-level savings does not always equal the sum of measure-level savings.
- Measure-level savings does not always agree with calculations submitted in the project workbooks and supplemental documents.
- Measure-level key parameter data fields are not populated. These data are not critical, but they would help verify savings estimates.
- There is no record of technical review by the implementation contractor, though there are records for on-site verification for all projects.

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

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 the implementation contractor (calculation spreadsheets and verification photos and site reports). Also included were outputs and input summaries for projects that were estimated with hourly simulations. This documentation was delivered through Navigant's secure file transfer site. Navigant also reviewed program materials developed by the implementation contractor and AEP Ohio.

Program and Implementer Manager Interviews

Two in-depth interviews with key program representatives were conducted as part of this evaluation. The AEP Ohio Retro-Commissioning Program Manager was interviewed solely about the Retro-Commissioning Program. The AEP Ohio Manager, Business Programs, and members of the implementation contractor staff were interviewed for the Retro-Commissioning Program. The interviews were completed over the phone in October or November 2013. 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. The discussion guides used to interview the Program Managers is included in Appendix A.

Program Participant Telephone Interviews

Data were collected to support the process evaluation (such as questions concerning program design and implementation, program marketing and awareness, and customer satisfaction) and business demographics for the process component of the evaluation. In-depth telephone interviews were conducted with a census of 2013 RCx Program participants. This survey focused on the program process evaluation. The discussion guide used to interview program participants is included in Appendix A.

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 for AEP Ohio. The program-level *ex ante* reported savings data were analyzed by program track and project size to inform sample design. After analysis, the sample design selected for the Retro-Commissioning Program evaluation was stratified by project size. Project size is defined as the sum of all *ex ante* installed kWh within an individual project, as defined by unique project IDs assigned by AEP Ohio.

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Projects were sorted from largest to smallest kWh 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. Stratum 1 consists of projects with the largest reported energy savings, Stratum 2 of medium-sized projects, and Stratum 3 with the smallest projects. This approach resulted in a total sample of 11 projects to be selected for application documentation and engineering review. In the end, Navigant sampled 76 percent of the reported program MWh savings. Table 2-2 provides a profile of the impact measurement and verification (M&V) sample in comparison with the populations within each stratum.

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

	Population Summary		Sample		
Sampling Strata	Number of Projects (N)	*Ex ante* Savings MWh	N	*Ex ante* MWh	Sampled % of Population
Stratum 1 large	1	1,103	1	1,103	100%
Stratum 2 medium	6	2,420	5	2,005	83%
Stratum 3 small	12	1,214	5	493	41%
Total or Overall	**19**	**4,737**	**11**	**3,601**	**76%**

Source: Evaluation analysis of program tracking data

2.3.2 Process Samples

The participant survey targeted a population of nine unique customer contact names with paid projects in the 2013 RCx Program, drawn from the January 16, 2014 tracking system extract. Several school districts submitted projects for multiple locations and listed a single contact person for all projects. These duplicates were removed from the call list. Navigant attempted to survey a census of participants and service providers and successfully completed interviews with six of the program participants and the six RSPs.

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Section 3. Detailed Evaluation Findings

This section presents the results of the impact and process evaluations of the 2013 Retro-Commissioning Program.

3.1 Impact Results

3.1.1 Findings from the Impact Verification Task

Navigant estimated *ex post* program impacts based on application documentation review, supplemental verification data, and conversations with operation staff, following the methodology outlined in Section 3. Observations from the verification experience were that the implementation contractor and AEP Ohio have a quality control approach that needs some improvements to prevent inaccuracies and ensure that energy savings are fully realized. Application processing appears to be fair and timely, and ensures that rebate payments are appropriate. One customer incentive payment was delayed in order to acquire additional post-installation data.

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2013 Evaluation observations and recommendations are provided in Table 3-1.

Table 3-1. 2013 Impact Observations and Recommendations

2013 Issue/Observation	2013 Recommendation
When *ex ante* 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.
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 finally rules of thumb. Add more conservative adjustments as less-specific inputs are used.
Several RSPs use rules-of-thumb or other sources that are un-documented and might mis-represent savings.	Generate a list of typical retro-commissioning measures and document the required data acquisition and analysis approach. Require engineering review of all calculations by the implementation contractor.
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.

3.1.2 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 savings for the population.[5] 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[6]. The standard error was used to estimate the error bound around the estimate of *ex post* energy savings and demand reduction.

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

[6] The Zone 1 Non-Lighting 1 stratum had only three projects, and only one of these was sampled. Rather than calculate a realization rate for this stratum separately, the evaluation team combined Zone 1 Non-Lighting projects into one stratum for the statistical extrapolation.

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The realization rate (defined as *ex post* savings divided by *ex ante* reported savings) is 81 percent for energy savings, and 100 percent for demand reduction. Lower realization rates are a result of flawed analysis and calculations and inconsistent inputs. The electric demand realization rate is based on a single site that claimed peak demand savings.

The relative precision at a 90% confidence level for the 2013 Retro-Commissioning Program projects in the sample is ± 9.5% for the energy realization rate and precision for the demand realization rate cannot be estimated from the sample[7].

3.1.3 Program Impact Results

Based on the impact parameter estimates described in the previous section, Navigant estimated the *ex post* program impacts resulting from the 2013 Retro-Commissioning Program, as shown in Table 3-2. No further adjustments were made to *ex post* savings.

Table 3-2. Savings Estimates for 2013 Retro-Commissioning Program

	Ex Ante Savings (a)	Audited Savings (b)	Realization Rate RR = (b) / (a)
Energy Savings (MWh)	4,737	3,840	81%
Demand Savings (MW)	0.43	0.43	100%

The Retro-Commissioning Program fell short of its 2013 goals of 5,552 MWh energy savings and 1.14 MW demand savings. Lower than anticipated participation in the Retro-Commissioning Program is the largest factor in goals attainment. A projected 35 projects in August resulted in only 19 projects by year's end. Slow implementation of measures is a hallmark of retro-commissioning programs elsewhere.

[7] The sample was designed for energy savings and the selected sites do not support an precision estimate for demand savings.

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Table 3-3 provides participation counts and *ex ante* savings estimates at the measure level. Due to the diverse measure types installed through the RCx Program, it is not practical to provide results by individual measure, so results were aggregated to measure end-use level. The verification sample was not designed based on end-use; therefore, Navigant does not report *ex post* savings at the measure end-use level.

Table 3-3. 2013 RCx Program Participation and Savings by Measure End-Use

Measure End-Use	Measure Count	*Ex Ante* Reported Savings	
		MWh	MW
HVAC	42	4,475	0.44
Lighting	3	59	0
Motors	6	203	0
Total	**51**	**4,737**	**0.44**

Source: Program tracking database, January 16, 2014. Measure counts are greater than program participants (19) because participants can install more than one measure of the same or different end-use for each application.

3.1.4 Cost-effectiveness review

This section addresses the cost effectiveness of the 2013 Retro-commissioning 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 3-4. Inputs to Cost-Effectiveness Model for AEP Ohio Custom Program

Item	2013
Measure Life	5
Participants	19
Ex Post Annual Energy Savings (MWh)	3,840
Ex Post Coincident Peak Savings (MW)	0.43
Third Party Implementation Costs	499,578
Utility Administration Costs	126,037
Utility Incentive Costs	187,838
Participant Contribution to Incremental Measure Costs	121,916

Based on these inputs, the TRC ratio is 1.3 and the program passes the TRC test for the program in its entirety. Table 3-6. Cost-Effectiveness Results for Custom Program 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.

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Table 3-5. Cost-Effectiveness Results for Custom Program

Test Results for Custom Program	2013
Total Resource Cost	1.3
Participant Cost Test	12.7
Ratepayer Impact Measure	0.4
Utility Cost Test	1.2

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

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3.2 *Process Evaluation Results*

3.2.1 *AEP Ohio Business Retro-Commissioning Program Evaluation-Program Participants*

Customer Background

The Navigant team interviewed six of nine 2013 program participants for the RCx Program Evaluation. Program participants reported their facilities included two office complexes, three schools, and a museum.

The titles of the participants interviewed were:

- Operations director
- Facility manager (2)
- Internal architect
- Vice president of building operations
- Building, grounds and transportation supervisor

The six customers in our study reported the number of full-time employees ranging from 120 to 1,000. Four of the customers reported employee estimates between 120 and 180. The other two reported 900 and 1,000 employees at the one location.

Four of the customers in our study own their facilities and two lease them. Five of the six study respondents have their company headquarters in Ohio.

One-half of the customers first learned about the Retro-Commissioning Program from their RSP. The other sources of information were the AEP Ohio account representative, a presentation by AEP Ohio and the superintendent of schools. All of the program participants were pleased that AEP Ohio was helping customers with their conservation efforts and assisting with rebates.

Role of Program Players

Retro-commissioning Service Providers played a pivotal role in educating customers about the value of Retro-commissioning, explaining their options, completing the program paperwork and, in most cases, finishing the RCx project, according to program participants. Most of the program participants were not aware of RCx and how much savings it could achieve. However, one customer was using RCx to help his organization earn their LEED certification.

Program participants rated the process of participating in the RCx program as easy. Most of the changes were programming changes to the control system and did not demand action on the part of the customer. In addition, the program RSPs completed the paperwork for them.

Most program participants did not proactively seek additional information about the Retro-Commissioning Program. At least one of them visited the program web site, but most did not. They could not imagine how the process could have been any easier for them with the RSP using their expertise to identify the savings opportunities.

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Satisfaction with the Program

All of the participants were very satisfied with the program. Participants reported satisfaction with the depth of the investigation and that the analysis was appropriate for their organization.

Four of the respondents discussed the recommendations they received for additional equipment retrofits from the RCx program. Customers realized they could not achieve more savings until they upgraded their equipment. One said: "it was the best we can do until we get new boiler or new chiller on line and then we will have more savings." Or, "when we get a new control system, we will get more savings." Customers plan to make equipment changes as their budgets permit. Another customer noted they will be making changes to its preventive maintenance schedules and will be paying more attention to detail.

Satisfaction with Program Incentives

All of the program participants Navigant interviewed had received their incentives and were pleased with them. The participant working for LEED certification used the program to launch a sustainability project. RCx program participants were pleased that the incentives were delivered to them in two to four months.

Satisfaction with Program Communications

All of the customers rated their satisfaction with communications between themselves and their RCx service provider as very high. One participant said: "They are very good at keeping us informed as to what was going on and what step we were on." Program participants also reported excellent communication experiences with AEP Ohio and/or the implementer when they verified control system schedule changes.

The RSPs suggested that all of the participants make changes to their building automation controls. A few customers were advised to make equipment changes over the next few years. A couple of other customers already had long term plans to change out older equipment, such as control systems and chillers, as their budgets permitted. One customer implemented the RCx changes in one part of the facility and made plans to make similar changes in the second half of the facility next year.

Program Benefits

Customers reported that the major benefits to the RCx program were:

- A noticeable difference in electric and gas usage
- The rebate
- Staff training; increased knowledge about retro-commissioning and sustainability
- Increased staff awareness of the need to monitor changes to the control system
- Promoting a relationship with AEP Ohio staff
- Helped the customer pursue LEED certification
- Reduced energy and costs in a 24-hour work environment
- Reduced wear and tear on equipment and reduced maintenance costs

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Program Drawbacks

A few program participants noted that the cost of the program was a drawback even though they knew they would make it back over time. The others did not report any drawbacks to the program.

Program Improvements

Program participants offered up two program modifications for AEP Ohio to consider. First, the program should be marketed more effectively by AEP Ohio. One customer pointed out that he had not received an email message about the program and that the program was not featured on the web site.

The second idea was to pilot grouping smaller sites together to reach to eligibility guidelines. This customer has over 50 scattered sites and is willing to volunteer for a pilot program that would aggregate the smaller buildings.

Awareness of Other EE Programs

The program participants were all aware of the Prescriptive, Self-Direct and Custom Programs. A few were also currently participating in other programs or had participated in the past.

3.2.2 Retro-Commissioning Service Providers

A small number of Retro-commissioning Service Providers with proven experience in the field were selected to market and deliver the program. AEP Ohio staff provided specific training on how to work within this program. The half-day training explained the program, how it was structured, the incentive structure, how AEP Ohio wanted to gain customers and how the Retro-commissioning Solution Provider (RSP) fit into the program. RSPs were provided software developed by the implementer and a computer tablet enabling then to receive customers' usage history for a year after the contract with the customer was signed. The RSPs use the software to screen customers and share with AEP Ohio and the implementer which customers are interested in the program.

Firmographics of the Retro-Commissioning Providers

The Navigant Team interviewed all six of the RSPs who participated in the RCx Program. All of the respondents were members of upper management such as the company President, the owner of the company or a Manager. Staff estimates ranged from one employee to 1,000 employees.

While the six firms all provide retro-commissioning services, they differed in other ways:

- A design and engineering firm with over 100 employees
- A large, national company that designs, builds and maintains HVAC systems.
- A single person consulting and commissioning firm who specializes in problem buildings
- A small firm with about a dozen engineers who act as staff engineers for their clients but who do not install any equipment or make any changes to the control system
- A company that provides building maintenance, performance engineering, retro-commissioning and commissioning for commercial buildings
- A company with over fifty employees that provides quality engineering, controls, design/build services and retro-commissioning services

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The six firms also differed by the sector they served:

- Commercial buildings
- Government buildings and schools
- Any non-residential building
- School and colleges
- Mostly industrial
- Utility measurement & verification

Program Implementer

According to RSPs, the implementation contractor does a good job of communicating the program and keeping RSPs up-to-date and engaged in the program. All of the RSPs know whom to contact with program questions. Most of their questions are about qualifying customers for the program. The implementer collaborated closely with RSPs and sent out the incentive checks quickly.

Retro-commissioning Solution Providers were asked to rate the implementation staff on a scale from one to five where one meant 'very unsatisfactory ' and five meant 'very satisfactory'. All of the ratings of the implementation staff were a five on the one to five scale.

RSP Training

The RSPs received training on how the program works and what AEP Ohio expected from the them. The training taught RSPs what the expectations were and how to program works. One RSP said that it was beneficial to understand what the utility was trying to accomplish with the program.

The trainings and monthly webinars kept the RSPs informed and encouraged them to participate in the program. AEP Ohio hosted regular meetings and AEP Ohio or implementer personnel were available to help the RSP when they find program opportunities. The implementer was praised by RSPs for helping to clarify the sometimes confusing application processes.

Marketing and Promoting the Program

RSPs are targeting their own customers to find those whose needs fit the program. A few have used or plan to use existing marketing materials in the near future. None of the providers in this study have plans to take the program beyond the customers they are communicating with for other sales or service purposes. For instance, one provider said: "We are actively talking to people about our programs so we are getting to people on a regular basis and we need to see if the opportunity is there before we see if it (RCx) is applicable or not." One RSP promoted Energy Star or LEED Certification and packaged the retro-commissioning process into the improvement process. Another said that it is about finding opportunities to match the program. In their view, the best marketing tool is sitting down with the customer to discover their needs.

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Solution Providers and Quality Control

According to the RSPs, quality control procedures included review of the savings calculations and some indication of how the system was changed by the program implementation. One provider said he sends the implementer screen shots to provide verification of how the system was changed. Another said they submit calculations that are reviewed before the implementer signs off on the check. One RSP said: "It is not like they just sign off and people get a check. Things have to be proved and recalculated." The RSP said that the implementer was very efficient at communicating with them about the program and staying engaged with the projects. The implementer has been diligent in providing the resources to verify that changes, and, in one case, to walk through the changes to observe how the equipment worked at different control settings.

Program Benefits

Retro-commissioning solution providers were asked: What are the benefits to your company of participating in the AEP Ohio Program? They said:

- We want to provide added services for existing and new customers.
- Our goal is to save customers money on their utility bill and deliver rebates
- We like the ability to tell an existing client that there is an opportunity for them to save money
- The program is a great marketing tool
- We are always looking for ways to reduce energy consumption for our customers

Only one RSP said that the program was not a huge benefit to his company.

RSP's Evaluation of the Program - Strengths

The RSPs enumerated a few strengths of the RCx Program:

- Having AEP Ohio behind it, promoting it and recognizing its value
- The application process itself and having the implementer there to help
- The application seemed pretty straight forward
- "Overall, it is a great program and great service to the customers. AEP Ohio has chosen a great company to manage the process for them."
- "We can sell it."

Most of the RSPs reported that the program was successful or that it would be successful as customers enter the pipeline. One pointed out the program "captures a realm of the market that was being ignored". The dissenting RSP said that the program could be successful, but not as it is currently defined.

RSP's Evaluation of the Program - Weaknesses

RSPs mentioned program weaknesses as well. One weakness that was mentioned was that some smaller customers would like to access the program but do not qualify. Also, because the incentive is capped by

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the size of the building, a very large building will receive a larger rebate for achieving the same level of savings as a small building[8].

Issues with Customer Participation

The RSPs reported that they all had a few customers that would choose RCx without the program, especially if the customer had already committed to LEED. LEED building managers are in a continuous improvement mode to achieve LEED status. At least one RSP has tried to sell RCx changes in conjunction with its audit services. At issue is how much energy the RCx changes will save. One RSP claimed that if a customer has an inefficient system, he may save fifty percent, while for the next customer, who is efficiently using their equipment already, the savings may be only two to three percent. Some problems may be due to features of the control system that have been turned off or over-ridden.

RSPs said they are trying to educate building managers in a new way of acting and running the building because they may have been trained to operate the building inefficiently. The RSPs train the customers by reviewing the report and talking them through it. RSPs want customers to continue to realize the savings they have achieved.

According to RSPs, there are a number of reasons that customers might reject the program:

- The up-front cost of the rebate does not cover the up-front fee of the RSP
- Customer's lack of understanding about the benefits of the program
- Customers do not perceive a problem with their equipment
- They may have other initiatives that take priority over RCx
- Companies may not want to make a change

Customers only understand the program participation process if the solution provider explains it. Once they understand it, they rarely turn it down.

Low Program Participation

Participation in the RCx Program was lower than the program goal in 2013. The six RSPs in our study completed from one to three projects each in 2013; however, most of them knew of customers who were planning to participate in 2014 or who were considering the program for 2014.

One RSP reported the program increased his business. The others reported that the program 'was a bonus', an add-on, or had the potential to increase business, but had not. One RSP said that his customers see the rebate programs and the RCx Program as one 'pile' and "if there could be collaboration between the programs, we could pull more clients in." For instance, if "RCx were partnered with the audit program [sic], RSPs could get compensated for the audit/assessment… because in many ways they are dependent on each other." He said that "RCx often falls by the wayside when other programs have upfront rebates to start working as opposed to [the customer] pay[ing] up front and wait[ing] until the end to see what happens." He is not sure that he can sell it as a stand-alone RCx Program.

[8] This issue was addressed by a program change for 2014 where both large and small customer incentives are paid on a square foot basis.

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Suggested Program Improvements

Next, RSPs were asked how they thought the program could be improved. The most common response was that the RSP could not think of any ways to improve the program. Two of the RSPs said they would have told the implementer right away had they thought of something. Another said that he was happy because his customers were happy.

One RSP reported that the program was difficult for them to implement because it not a good fit with the firm's current business model. This RPS would prefer to get funding for the study and then to hand it to another provider to implement.

3.2.3 The Retro-Commissioning Program Evaluation: AEP Ohio and Implementer Program Managers

The implementer contractor manages the day-to-day program delivery issues with the RSPs and customers. The implementer sells the Program to the RSPs and the RSPs sell the program to the customer. The program was designed to be driven by the RCx market and not by incentives. In this design, the most important driver of the program is the RSPs. The second uncommon feature of the AEP Ohio RCx program is that AEP Ohio only pays an incentive after the customer has implemented measures with a payback of two years or less. No incentive is paid at the beginning of the assessment stage of the process. AEP Ohio designed the program to use market forces to drive the success of the program. The implementer is required to pre-qualify the RSPs to confirm they are all able to conduct retro-commissioning.

Relationship with Retro-Commissioning Solution Providers

AEP Ohio and the implementer have had a few issues with RSPs. The goal was out of reach in 2013 because the projects were not getting finalized. Some RSPs requested to be on the list but were unable to complete any program qualifying projects or the projects appeared without going through the pre-application process. AEP Ohio does not encourage solution providers to cut corners on the pre-application process because the pre-application prevents the RSPs from over-promising or under-delivering on the project.

The implementer held bi-monthly meetings with RSPs to keep them updated on the changes and to answer questions. Also, they send out a weekly newsletter. The Program Manager calls them semi-regularly depending on how active the RSPs has been in the RCx Program and if they have projects in the pipeline.

The Role of AEP Ohio Account Representatives

The AEP Ohio account representatives were not informed about the Retro-Commissioning Program early in the year. There was an instance where an account representative told a customer not to participate in the program. That is when the implementer realized the account representatives lacked knowledge of the program and the concept of RCx. The implementer regretted that they did not ask the account representatives to be more engaged at the beginning of the program. However, account representatives are now very much part of the marketing strategy. The account managers use their relationships to reassure the customer that the RCx Program is legitimate and they help the RSPs with access to targeted customers.

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Program Goals

According to the Program Manager, the main goal of the RCx program is "to serve the customer …by helping them realize energy savings thru low cost, no cost types of measures." A large amount of what is accomplished through the RCx Program is on the Operations & Maintenance side of the business where budgets are small. The program was designed to help customers maximize the use of their dollars and save money.

The program experienced a slower ramp up than expected and meeting the goal was challenging. Most of the RSPs have only finished a couple of projects; in total, only nine customers participated in the program in 2013. The program fell short of energy savings and participation goals for the program year.

Prospects for the 2014 program year, however, are much higher. There were projects in the pipeline that seem to signal increased participation as more providers ramp up their involvement in the program and get the word out to more of their customers.

The implementation contractor marketed selectively to those RSPs that were most active in the program. They mainly marketed to RSPs who can explain the program to customers. Many customers don't understand the concept of retro-commissioning and need the one-on-one discussion to understand the program. However, AEP Ohio is mailing information to building owners and managers who might be expected to be more knowledgeable about RCx. The plan is that customers will reach out to the RSPs. They expect more diversity in the participating segments in 2014, but in 2013 more than 70 percent of the participants and energy savings were generated from K-12 schools.

Selling Retro-Commissioning

One opinion voiced by a Program Manager was that AEP Ohio needs to do a better job of marketing the RCx Program even though current marketing activities in 2013 included webinars, trade events, peer meetings, engineering association meetings and building association meetings. According to the Program Manager, these activities have helped build the credibility of the program but customers are not going to RSPs and asking for the program.

It is best to market to the facilities people because they speak the language of RCx. Trying to market the program to an executive or manager is very difficult. To attract the right person, AEP Ohio and implementer staff attended trade shows where they can explain the program in detail. One Program Manager had this to say about selling the Retro-Commissioning Program:

> "'Retro-commissioning' – everyone in a technical capacity like building managers, engineers, and maintenance managers, they all understand what it is and that it is important. It is not hard to sell the concept of RCx. It is harder to sell the concept of having someone come and do the retro-commissioning. Because it is not capital intensive. It is all the operating and maintenance stuff. It comes out of O&M budget, which are never as big as it should be… Barriers get in the way based on budgets. The CFO might not understand it needs to be done."

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How Retro-Commissioning Service Providers Are Marketing the Program

Retro-commissioning Service Providers have the most influence on which customers participate in the RCx program. The RSPs are selling the RCx Program exclusively to their existing customers. Currently, customers are not going to trade allies and requesting the RCx program.

According to the implementer, AEP Ohio designed this program to be a market driven program, but there is not a huge market for it, especially for existing buildings. Retro-commissioning has taken hold in other areas of the country, such as Chicago, Minneapolis or on the coasts, much more than in Ohio. However, a number of the smaller RSP's have been doing RCx as a side benefit for their customers. Some of the market barriers include education about what RCx is and education about how much a customer can the save.

The implementation contractor has been hearing feedback from the RSPs about the program and reported that RSPs liked that the program was available, but thought the paperwork was burdensome.

Target Marketing

According to the implementation contractor, RSPs targeted hotels, fitness centers, universities, hospitals and schools. Most of the participation in the first year was schools. A few hospitals are in the pipeline, but their projects won't be finished until 2014. Hospitals are more difficult to include in the RCx program because it takes more time to evaluate the hospital than an elementary school. Some projects take longer because the RSPs must work around certain requirements – for instance, in the hospital some operating rooms have to remain a certain temperature for safety reasons. The implementer plans to achieve more diversity in the segments next year by targeting hotels and larger fitness centers.

Customers completed a few projects that the implementer staff plans to develop into case studies. They are developing a school case study and a large non-profit case study and are searching for a commercial project to add to the mix.

Marketing the Program on the AEP Ohio Web Site

The AEP Ohio web site plays a role in the marketing process. Customers can find a complete list of Registered RSPs, a fact sheet, quick start guide, FAQs and an 888- number on the web site. They can also access a quick synopsis of the program and the steps they need to take to get started with the program.

3.2.4 Customer Satisfaction with the RCx Program

Program Strengths

According to the implementer, one of the RCx program strengths was that it provides a focus on operations in addition to the usual focus on capital improvements. As customers reach for deeper energy savings and sustainability commitments, changing out lights and equipment will not be enough. The RCx program helps make sure building managers are educated on how best to operate their buildings and teaches them what good operations and maintenance (O&M) practices are to make sure that every piece of equipment is operating as efficiently as possible.

Other strengths of the AEP Program, according to the implementer, include (1) that the program delivery was well organized, (2) that the implementer had an excellent site engineer, and (3) that the client was willing to be collaborative.

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Program Weaknesses

The program manager identified a few program weaknesses:

1. The market for RCx may not respond how and when AEP Ohio wants it to or expects it to respond. That is a big weakness.

2. The direct payment to customers created a timing problem for RSPs. The customers pay the RSP directly and will be billed by their RSP in advance of receiving the program incentive. The customer may or may not pay the RSP before they receive the rebate, which may take months to arrive.

Program Barriers

Lack of awareness and customer knowledge about RCx are the two biggest barriers, according to the Program Manager. Customers are more familiar with the concepts of the other programs. RCx as a program concept is not intuitive. With RCX, the participant doesn't know the incentive before they engage the study. RCX is much more behavioral and subjective.

The difficulty with the current program design is that customers do not get an incentive until after the process changes are made or the equipment is installed. The RSPs may have a long wait for any payment from the customer. One of the program course corrections made mid-year was to pay a performance reward, basically a bonus, to the RSPs. RSPs receive a bonus of 0.005 cents per kWh if they submit the final application within 30 days of project completion. While RSPs still don't receive the bonus until the project is implemented, it is a direct payment that has helped motivate a core group of RSPs to become engaged with the program.

Quality Assurance and Quality Control Procedures

The Implementation Contractor outlined the quality assurance steps:

- RSPs enroll the customer in the program through the pre-approval process and engineering personnel review the application. The pre-approval engineering review determines that the proposed changes qualify for the program.
- Next, the RSP completes the work and submits a final application. Engineering staff conducts a review of the implemented changes.
- The implementation contractor may visit the site to verify the changes as defined in the final application.
- Finally, utility personnel conduct a final review and approve the payment of the incentive.

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Section 4. Evaluation Findings and Recommendations

Following are impact and process evaluation findings and recommendations.

4.1 Impact Evaluation Findings and Recommendations

1. **Finding:** The 2013 *ex post* savings fell short of goals. The number of projects fell short of anticipated participation, and the savings per project was lower. Some projects did not have the depth of analysis required to identify more savings. Some accrued savings was not accounted for using the estimating methods of some service providers.

   Impact Recommendation #1: Continue program outreach to school districts and other multi-site entities to maintain participation levels. Attempt to recruit more RCx Comprehensive participants. Encourage more thorough and complete inspections and analysis to identify available savings.

2. **Finding:** The tracking database content is lagging the program. Competed measures were not entered into the database and in some cases inaccurate savings values were entered. Many useful data fields are not being populated.

   Impact Recommendation #2: Place higher priority in keeping tracking systems current and accurate. Implement cross-checks between project-level aggregation and measure-level detail. Delete database fields that will not be used, or back populate those fields to increase their usefulness.

3. **Finding:** 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 completed.

   Impact Recommendation #3: Require an accurately completed project workbook be completed before a project incentive is paid. This information should include:

   1) Billing history to calibrate and validate savings estimates. Multi-year analysis would benefit the program.
   2) Equipment schedules with nameplate information and design parameters to validate estimates.
   3) Enable more active calculation space on each "Opportunity" tab so that *full* measure calculations can be presented and archived in one location.
   4) 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 calculations did not demonstrate review by the implementation contractor or knowledgeable subject-matter expert. As a result multiple errors were made in inputs, calculation scope and retro-commissioning concepts.

   Impact Recommendation #4: Require engineering review of all calculations, including:

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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 ventilation heating and cooling savings in addition to fan motor savings when fans schedules are adjusted.
d. Generate a list of typical retro-commissioning measures with brief narratives to describe primary and secondary energy benefits.

4.2 Process Evaluation Findings and Recommendations

4.2.1 Program Participant Findings and Recommendations

1. **Finding:** Program participants confirmed the pivotal role of the RSP in the customers' decisions to participate in the program and in their level of success in the program. The RCx Program was successful in educating some customers about the value of retro-commissioning. Retro-commissioning Service Providers explained the customers' options, completed the program paperwork and, in most cases, implemented the RCx project. Program participants rated the process of participating in the RCx program as easy because of the RSPs.

   Process Recommendation #1: The success of the program rests squarely on the ability of the implementer and AEP Ohio to continue to recruit RSPs that can deliver the benefits of RCx to customers.

2. **Finding:** One customer suggested that AEP Ohio allow grouping smaller sites together to reach to eligibility criteria. This customer has over 50 scattered sites and was willing to volunteer for a pilot program that would aggregate the smaller buildings.

   Process Recommendation #2: Navigant is doubtful that this idea would work for this customer and this program. However, it does bring up an idea that might apply to other customers in one-off situations. With a program like RCx, it might be productive to stretch the program requirements for customers whose characteristics are close to meeting the requirements or for customers in unique situations.

4.2.2 Solution Provider Findings and Recommendations

3. **Finding:** Currently, the market for the RCx Program is limited by two factors. First, the number of firms within the service area that provide RCx services may not be limited to the six currently enrolled, but it is expected to be a small number. Second, RCx providers do not market RCx as a stand-alone product. Retro-commissioning Service Providers would not take it 'to the street', but prefer to market it to current clients who may have some interest in the program. RSPs view the RCx Program as a bonus they add to the other services offered to their customers.

   Process Recommendation #3a: AEP Ohio should verify that all of the qualified regional RCx providers are participating in the program and recruit those currently not enrolled.

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Process Recommendation #3b: The current program does not seem designed to encourage RSPs to market the program beyond their current customers. AEP Ohio might need to train RSPs to market the program and/or change the program incentive structure to widen the market for the program.

4. **Finding:** RSPs point out the size of the incentive is unknown before the detailed and expensive RCx study is conducted.

   Process Recommendation #4: Some method is needed to approximate the incentive at the start of the RCx process. AEP Ohio could develop a check list of customer's characteristics that would qualitatively indicate if a customer was a candidate for an RCx study. For instance, a customer with a recent RCx study, with a new control system that turns all systems off at night, and/or with new energy efficient HVAC and lighting systems may not be a good candidate for the RCx program.

4.2.3 Implementer and AEP Ohio Findings and Recommendations

5. **Finding:** The RSP is paid by the customer after the customer receives the incentive based on the savings from the changes to the control systems and any other program measures implemented. This design protects AEP Ohio from the risk associated with the RCx Program, but provides the solution provider with no motivation for marketing the program beyond their current customer list.

   Process Recommendation #5: AEP Ohio and the implementation contractor should conduct focus groups with RSPs to determine if program changes acceptable to AEP Ohio would increase program participation.

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Appendix A: Survey Instruments

AEP Ohio Evaluation for the Retro Commissioning Program

Customer Participant In-Depth Interview Guide

March 10, 2014

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 <SERVimplementation contractorE ADDRESS> and was listed as the primary contact when <Company> participated in AEP OHIO Ohio's Retro Commissioning 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 Retro Commissioning 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 Retro Commissioning program. Do you recall participating in the Retro Commissioning on or about <PROGRAM DATE>?

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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 Retro-commissioning and Retro-Commissioning 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 Retro-commissioning and Retro-Commissioning 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 Retro-Commissioning / Retro-commissioning Lite] aspect of the program. Throughout our conversation I will refer to the program simple as the Retro-Commissioning program. [If necessary: Retro-Commissioning Lite is more appropriate for small commercial/institutional buildings]

4. Do you remember how you first learned about the Retro Commissioning program? Explain.

a. Since then, have you heard about the program from other sources? Who? IF THEY SAY SERVimplementation contractorE PROVIDER: What type of service provider/contractor told you about the program?

5. What were the circumstances surrounding your decision to participate? What Retro Commissioning 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?

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[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 you visit the AEP web site to gather information about the program? 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. How could these issues be improved in the future?

14. What suggestions did you receive from the service provider to improve your control sequences as

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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 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 Retro Commissioning Program?

a. Did the Retro-commissioning 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 Retro Commissioning 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 Retro Commissioning 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?

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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 PARTimplementation contractorIPATED IN AEP OHIO BUSINESS PRESCRIPTIVE PROGRAM OR CUSTOM PROGRAM AND DID NOT MENTION THE PROGRAMS ABOVE IN Q19.

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?

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23. What is <COMPANY>'s primary business activity at this particular facility (<SERVimplementation contractorE 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?

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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.

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Solution Provider In-depth Interview Guide

AEP-Ohio Business Retro-Commissioning

Solution Provider Interview Guide

February 4, 2014

N=5

Name of Interviewee: _____ Date: _____

Title: _____ _____ Company: _____

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 Retro-Commissioning Program. We're currently in the process of conducting interviews with providers of Retro-Commissioning services to improve our understanding of AEP-Ohio's programs.

Our records show you have been approved as an RCx Solution Provider and completed as least one RCx project during 2013. At this time we are interested in asking some questions of the person most experienced your firm's participation in the RCx program. [CONFIRM THAT THIS IS THE PERSON MOST KNOWLEDGEABLE AT THEIR BUSINESS OR GET ALTERNATE NAME].
The questions will only take about half an hour. Information you provide will be kept anonymous in our reports. General observations and findings will appear in our final report, but they will not be attributed to any named person or company. Is this a good time to talk? [IF NOT, SCHEDULE A CALL BACK.]

Background

Another avenue for AEP customers to get incentives and they do.

1. Can you briefly describe the company you work for and the type of business it conducts? Who are your primary business customers? Your company sells the service. What type of services do you provide to your clients? Do you partner with another company to implement the changes your engineers identify?

2. Can you briefly summarize your roles and responsibilities at your company? For how long have you carried these out?

Solution Provider Participation

3. What are the main benefits to your firm of participating in the program?

4. About how many RCx projects was your company involved with in 2013? Is there a reason you have not been involved with more projects? In your opinion, has the RCx Program increased your business?

5. Can you describe the application process for solution provider registration? *[Probe for qualifications or training requirements.*

6. What kind of training was provided as part of the registration process? Was the training useful?

7. What is expected of RCx solution providers? Do you know of any quality control procedures in place? Does a representative from AEP Ohio visit the client to review the RCx project?

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Marketing and Promotion to Customers

8. How does your company become involved with projects associated with the program? Do you actively promote participation or do customers bring projects they want to submit to the RCx Program?

9. I understand that the RCx Program is marketing by the Solution Providers. Has your company promoted the program through its own marketing collateral or have you used the pieces developed by AEP Ohio? Who, outside of your company has been influential in getting customers to participate?

10. What kind of support, if any, does AEP Ohio provide to you for marketing the program to your customers? Do you distribute utility-produced marketing materials? Have you requested any other types of support/collateral, etc. ?

11. Do you think AEP Ohio's level of marketing and promotion of the RCx Program has been appropriate so far? Do you think promotional efforts are successful? Do you think they reach the right audience? If AEP is missing areas of opportunity, what are those areas?

12. Do you have suggested changes to AEP Ohio's marketing efforts for next year? If so, please describe these changes

Customer Participation

13. What needs do customers have for participating in the program? Have your customers participated in the RCx Lite Program or the RCx Custom Program or both? Do you prefer one over the other? They have been very open minded.

14. Do customers understand the participation process? How do you get program information to them? What improvements can you made in this process?

15. What is the review time between completing the pre-approval application and letter of approval from AEP Ohio? Is the average amount of review time acceptable? Does it stall the momentum of the project?

16. What are the reasons that customers might not participate in this program? Do customers complain about any particular aspects of the program? Do customers cancel their participation or drop out of this program? If so, why?

Quality Assurance and Quality Control

17. Have you had to answer questions or provide additional information for any of the RCx projects?

Program Implementer

18. Do you know whom to contact for help with this program?

19. How closely do you work with implementer staff during a project?

20. How would you rate your interactions with implementation staff on a scale from 1 to 5 where 5 is very satisfactory and 1 is very unsatisfactory?

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Program Adjustments and Enhancements

21. What type of information could the implementer provide you to increase your familiarity and understanding of the program?

22. What could be modified to make the program work better (e.g., incentive levels, eligible equipment, etc)? If so, what would you recommend? Why do you think this change is needed?

23. Would more training be useful? What kind of training would be useful?

Success and the Future of These Efforts

24. In your opinion, how successful is the program? Why? Has your total business increased because of the RCx Program?

25. What are the strengths? What are the weaknesses? Do you feel that some customers (Lite or Custom) would be choosing your retro-commissioning services without the incentives of the RCx Program? [Please explain.]

26. What about training for customers themselves.

Other

27. 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.

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AEP Ohio and Implementer Interview Guide

2013 AEP-Ohio Evaluation for Retro Commissioning Program

Program Staff and Implementer In-Depth Interview Guide

October 2, 2013

Name of Interviewee: _____ Date: _____

Title: _____ Company: _____

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 Retro Commissioning 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 Retro Commissioning 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 (CLEAResult) improve this situation?**

Overall Goals and Objectives

5. **What are the quantitative goals of the program for this first 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?**

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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. **Please describe the program marketing campaign for the RCX program.**

9. **Do you think the level of marketing and promotion of the RCX program contributed to the program meeting its goals?**

10. **Do you think these materials have been successful in 2013? Are there any plans to expand the marketing effort for this program next year?**

11. **What has been most influential in getting customers to participate? What else has been influential?**

12. **Who has been most influential in getting customers to participate? Who else has been influential?**

13. **Do you have a written marketing plan? Can you provide me with copies of your latest marketing plan and all marketing collateral used?**

14. **Who developed the presentations and collateral materials for the 2013 program?**

15. **Are there any plans to develop case studies from the experiences of customers during this first program year?**

16. **During this first year, was there a need to market to solution providers? How many RCX solution providers were approved as solution providers? Are there plans to add more solution providers to the list in the future?**

17. **Did AEP Ohio and/or CLEAResult provide specific training for RCX solution providers?**

18. **Do you anticipate making any significant changes to the marketing efforts for Program Year 2014?**

    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)

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Communicating the Program to Participants

19. **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?**

20. **What improvements have been made, if any, during 2013 to improve program communication to participant processes? What do you think still needs to be changed going forward?**

The Web Site

21. **What role does the Web site play?**

22. **Are customers able to quickly find a RCX solution provider in their region from information available on the web site?**

23. **Is the online application successful for the RCX program? Do solution providers use the online application?**

24. **What still needs improving on the web site, in your opinion? Any other improvements in the marketing of the program you are considering?**

Solution Providers

25. **How successful are solution providers in recruiting customers for the programs they are involved in?**

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

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

28. **Did the expectations of solution providers' change in 2013? If so, please describe.**

Program Participation

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

29. **How active are account managers in selling the RCX program?**

30. **Is their activity helpful and adequate? In what way can account managers improve the program experience?**

31. **How active are CLEAResult staff in selling the RCX Program?**

Barriers to Program Participation

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32. **What do you think are the greatest barriers to customer participation in the RCX Program?**

33. **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

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

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

Rebates/Incentives

36. **Are program participants satisfied with the current rebate amounts and incentive limit caps for the RCX program?**

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

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Program Adjustments and Enhancements

38. **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.**

39. **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?**

40. **Why do you think this change is needed?**

Success and the Future of These Efforts

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

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

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

44. **How could the program be improved?**

Other
Program Managers Only

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

46. **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.

EXTRA

A common thing on the customer side is that many schools and government systems have an energy management system and rely on the service contractor to manage it. These organizations do not utilize the service contracts or monitor their systems properly, so their system settings are incorrect. When the RSPs advise them to take certain steps and ask the service contractor to do their job, they understand that they can realize a large amount of savings.

APPENDIX O

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DATA CENTER PROGRAM:

Program Year 2013 Evaluation Report

Prepared for:
AEP Ohio

AEP OHIO®
A unit of American Electric Power

May 12, 2014

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Executive Summary

AEP Ohio's Data Center (DC) program provides support for customers who want to achieve higher levels of energy efficiency in their 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[1]. The program is delivered by Willdan, an implementation contractor, on behalf of AEP Ohio.

Program Participation

The 2013 program year represents the first year of operation for the Data Center Program. During the first year of the program's operation in 2013, 17 projects were completed by 14 different companies at 15 unique premises. The projects involved the implementation of 23 different measures. Three of the customers who participated in the program completed multiple projects. Table ES-1 summarizes the key program indicators.

Table ES-1. Program Summary

	Total	Average per Reporting Project
Total Project Cost	$10,559,772	$641,085
Reported Floor Area (estimated. sq. ft.)[2]	404,146	36,741
Amount of Incentives	$863,735	$50,808
Energy Savings Reported to Program (MWh)	10,898	641
Demand Savings Reported to Program (MW)	1.51	0.0888

Total energy savings reported for the program amounted to 10,898 MWh, while the reported demand reduction totaled 1.5 MW (see Table ES-1). This roughly doubles the program goals of 5,984 MWh and 0.743 MW set for the 2013 program year.

[1] Note that the eligibility criterion was relaxed in the 2013 program year due to the program being available for only part of the year.
[2] Of the 15 unique premises, 11 had a value for the estimated square feet. Therefore, these numbers excluded the four premises without an estimated floor area.

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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 Sector

Calculated Values from Tracking Database					
Sector	No. of Projects	Incentives	*Ex ante* Energy Savings (kWh)	*Ex ante* Demand Savings (kW)	$/MWh
Industrial/Manufacturing	1	$4,855	60,681	7	$80.0
School	2	$13,487	245,880	40	$54.8
Government/Municipal	1	$2,159	33,187	4	$65.1
Data Center	10	$724,635	9,076,203	1,310	$79.8
Large Office	2	$94,364	1,179,548	114	$80.0
Large Retail/Service	1	$24,235	302,938	35	$80.0
Total	**17**	**$863,735**	**10,898,437**	**1,510**	$79.3

Data Collection Activities

Primary data collection included in-depth interviews with program actors 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 Willdan. 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 2013.

As part of the impact study, 92 percent of the claimed *ex ante* energy savings underwent an engineering review of the project files. Sixty-five percent of the *ex ante* savings were subject to an on-site review.

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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 (> 1 GWh)	4	80.1%	4	3
Medium (> 100 MWh, < 1GWh)	8	17.7%	4	3
Small (< 100 MWh)	5	2.2%	1	0
Total	17	100%	9	6
Percent of *Ex Ante* Savings			91.8%	64.7%

Key Evaluation Findings and Recommendations

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

Key Impact Findings and Recommendations

As summarized in Table ES-4, the *ex post* energy and summer coincident demand savings for 2013 are 9,796 MWh/year and 1.36 MW respectively. This is a strong result for a first year program, and exceeded the 2013 goal of 5,984 MWh and 0.743 MW coincident demand reduction. The realization rates for both energy and demand are both nearly 0.9, which is reasonable for a first year program.

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

Metric	*2013 Program Goals*	*Ex Ante (a)*	*Ex Post (b)*	Realization Rate RR = (b) / (a)	Overall Relative Precision at 90% Confidence	Percent of Goal
Annual Energy Savings (MWh)	5,984	10,898	9,796	0.899	18.4%	164%
Coincident Peak Reduction (MW)	0.743	1.51	1.36	0.901	14.1%	183%

Other key impact findings and recommendations include:

1. Project files did not consistently establish whether the project is considered a retrofit or a Replace on Burnout (ROB) scenario. Some Uninterruptible Power Supply (UPS) projects determined cost based on ROB, but calculated energy savings based on retrofit criteria.

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Key Impact Recommendation #1a: Consistently discuss whether the project should be considered a retrofit or a ROB scenario. Replace on Burnout projects 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.

Key Impact Recommendation #1b: Verify the determination of retrofit or ROB by looking at project economics from the participant's perspective. If the payback period exceeds the lifetime of the measure, the true motivation of the project is likely a non-energy factor and the project is likely a ROB.

Key Impact Recommendation #1c: Consistently match the approach to determining incremental cost and project savings. If a project is a retrofit, then the cost is the full cost of the project and the proper baseline is the existing equipment. If the project is a ROB, the incremental cost would be the difference between the installed cost and the cost to install new baseline equipment. Replace on Burnout energy savings would be relative to the efficiency of new equipment meeting energy code or industry standard.

2. Some projects, in particular UPS projects, did not provide details or a referenced document regarding how baseline efficiencies were determined.

   Key Impact Recommendation #2a: Navigant agrees to Willdan's approach of using existing equipment as the baseline for retrofit projects. Willdan adequately attempted to retrieve baseline metered data where possible and necessary. Navigant suggests continuing this current practice.

   Key Impact Recommendation #2b: Regarding ROB projects or retrofit projects without metered baseline performance, Navigant suggests following the California Energy Efficiency Baselines for Data Centers[3] or other credible industry documents to establish the baseline criteria.

3. One project involving UPS optimization relied on metered data, comparing pre-retrofit data to post-retrofit data. The project file showed that 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.

[3] 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

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Key Impact Recommendation #3a: 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.

Key Impact Recommendation #3b: On projects where the energy savings is flat over the course of the year, the magnitude of the energy savings and the demand savings should be relative to the 8760 hours in a year. Navigant suggests that a quality control check be put in place to see that energy and demand are offset by approximately 8760 hours when savings is flat or nearly flat.

4. Willdan used a credible and conservative approach when determining savings from large server projects; however savings accuracy would be improved if following the National Renewable Energy Laboratory's (NREL) Uniform Methods Project's approach for virtualized servers[4].

   Key Impact Recommendation #4a: Large server project savings should be calculated using the difference between baseline and installed utilization, server idle power and server full-load power.

   Key Impact Recommendation #4b: Supporting documentation for large server virtualization projects should detail:

   - A list of servers to be removed including make, model and quantity
   - The host virtualization servers including make, model and quantity
   - The UPS Systems, including the UPS systems being removed (make, model, size), changes to the UPS after virtualization, UPS systems purchased (make, model, size), and USP location
   - Costs of the virtualization software and costs of new hardware including host server, data storage, UPS, switches, etc.
   - Room conditioning details sufficient to determine interactive cooling effects
   - Disposal receipt or photo of decommissioned servers
   - Screen shot of the virtualized environment showing the number of virtual servers
   - UPS kVA reading both before and after the project retrofit

   Key Impact Recommendation #4c: Incentives should be withheld on large server projects until sufficient data has been received to verify the project level savings.

   Key Impact Recommendation #4d: The participant should be notified that independent third-party verification will likely be required. Much of the same information will likely be needed to be collected by the third-party verification agent.

[4] NREL's Uniform Methods Project is still in draft form. Navigant is one of the reviewers for the Uniform Methods Project.

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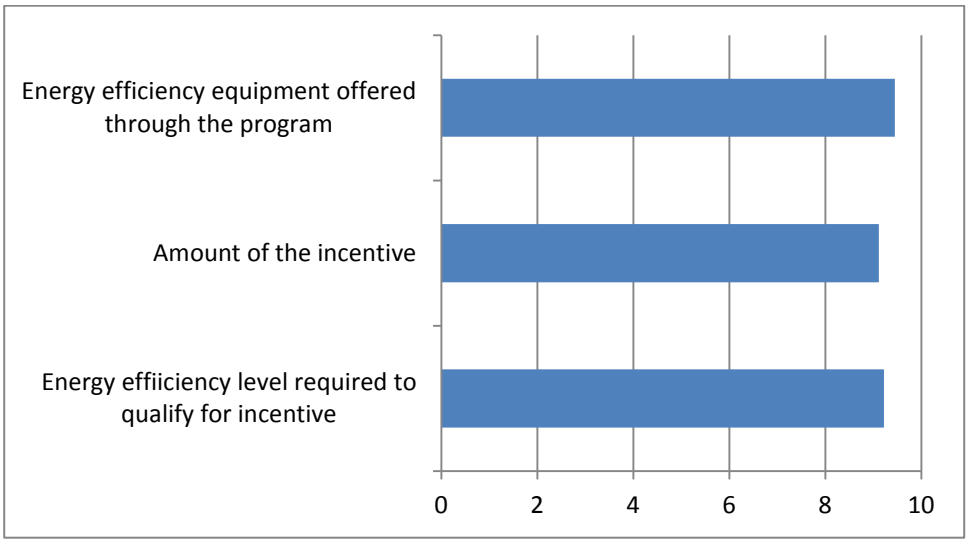
Key Process Findings and Recommendations

Participants 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 respondents indicated that they were very satisfied with the efficiency level required to qualify for the program (9.2), the level of efficiency equipment made available through the program (9.4), and the amount of the incentive (9.1), as shown in Figure ES-1.

Figure ES-1. Level of satisfaction



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. Participants indicated that 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 participants indicated that the energy efficiency project implemented had resulted in improved reliability and up-time performance.

   Key Process Recommendation #1: Given the very high priority that data center operators place on these issues, it is recommended that consideration be given to developing case studies or testimonials on the non-energy benefits of energy efficiency projects to use in program communications.

2. Solutions Providers were found to play a smaller role in the Data Center Program than is the case for some other programs. Despite these limitations, Solution Providers could 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.

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Key Process Recommendation #2: AEP Ohio and Willdan should work to establish a network of Solution Providers who can provide market intelligence and act as lead generators for the program. Such an effort might include provision of an incentive for participating Solution Providers.

3. In reviewing the information available regarding the program on AEP Ohio's web site, Navigant noted that AEP's Economic and Business Development division offers a "***Qualified Data Center Site Program***" that helps companies seeking a site for a new Data Center. Program staff indicated that they are aware of this program and share information on any potential projects which might qualify under the AEP Ohio Data Center program; however, Navigant understands that this is an informal process.

   Key Process Recommendation #3: A formal reporting process should be developed to ensure that this internal AEP Ohio coordination continues in the future. None of the 2013 program participants indicated that it had participated in the AEP Qualified Data Center Site Program.

4. The program application requires that the incentive not exceed 50 percent of the project cost. Project cost is defined as the material cost of installed equipment.

   Key Process Recommendation #4: Consider amending 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.

5. Navigant notes that 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 that a formal dispute mechanism be developed before any issues arise.

   Key Process Recommendation #5: That a formal dispute resolution process is developed to provide a framework in case such a dispute arises in future.

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1 Introduction and Purpose of Study

1.1 Program Overview

AEP Ohio's AEP Data Center (DC) program provides support for customers who want to achieve higher levels of energy efficiency in their 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[5]. The program is delivered by Willdan, an implementation contractor, on behalf of AEP Ohio.

A target of 5,984 MWh in energy savings and 0.743 MW peak demand reduction was set for the 2013 program year. A secondary goal was to ensure that 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.

1.2 Evaluation Objectives

This report presents the findings from the impact and process evaluations of the AEP Data Center (DC) program for 2013. The objectives of the evaluation were to: (1) quantify energy and summer peak demand savings impacts at the meter as a result of the 2013 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 3.3 (Process Findings).

1.3 Evaluation Methods

For this report, program impacts for the Data Center Program 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.

[5] Note that the eligibility criterion was relaxed in the 2013 program year due to the program being available for only part of the year.

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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 Willdan (the program implementer) as well as an on-line survey of all program participants.

A program logic model was not developed by AEP Ohio or Willdan during the development of the Data Center Program. Consequently, Navigant interviewed staff from AEP Ohio and Willdan, and other available support materials to gain an understanding of program logic, expected inputs, outputs and outcomes for the program.

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 2013	Process Evaluation
Secondary Literature Review	Publicly-available evaluations of other utility Data Centre programs and available reports on Data Center Energy Management	Impact and Process Evaluation
In-depth Telephone Interviews	AEP Ohio Program staff	Process Evaluation
	Willdan staff	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

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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. This is 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 2013; (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. To meet these objectives, the evaluation team undertook the following activities.

1. **Evaluation Questions.** Established key evaluation questions as part of developing the 2013 evaluation plan with AEP Ohio staff.
2. **Tracking Data Review.** Reviewed the program tracking data collected by Willdan and provided to the evaluation team by AEP Ohio.
3. **Review of Marketing Activities.** Reviewed the overall marketing activities and approach as implemented by Willdan and AEP Ohio.
4. **Review of Participation**. Reviewed program participation by business type, 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, on-line surveys of program participants, 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 cost, 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 were 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 Ohio and Willdan, program tracking data, and participant survey data.

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2.2 *Key Evaluation Questions*

Navigant worked with AEP Ohio to identify a number of key evaluation questions regarding the Data Center program. 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

2013 Data Center Program Research Questions **The evaluation will seek to answer the following key research questions.**	**AEP/ Willdan**	**Participants**	**Solution Providers**	**Research & Analysis**
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 (*ex post*) savings divided by program-reported (*ex ante*) 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 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 Willdan 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 Willdan cover the AEP Ohio service territory? Is there a more effective means of identifying projects within the AEP Ohio service territory?	√			√
10. Is program outreach effectively increasing awareness of the program opportunities?	√	√	√	
a) What types of outreach activities are used?	√			

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2013 Data Center Program Research Questions **The evaluation will seek to answer the following key research questions.**	**AEP/ Willdan**	**Participants**	**Solution Providers**	**Research & Analysis**
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, ownership or design approach?	√	√	√	
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. Are the program processes effective for motivating participation and smoothly providing incentives to participants? Navigant will review:				
a) Program tracking and data management.				√
b) Required forms.		√		√
c) Impact to timeline.		√	√	√
d) Ease of use.		√		√
e) Internal program communications.				√
f) Program staffing.				√
18. Does the program tracking system provide adequate information for program evaluation?				√

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2013 Data Center Program Research Questions **The evaluation will seek to answer the following key research questions.**	AEP/ Willdan	Participants	Solution Providers	Research & Analysis
19. What verification procedures are carried out by the implementation contractor for the program? Have these been implemented in a manner consistent with the program design? Do these procedures present their own implementation barrier?	√	√	√	
20. What are the opportunities for program improvement?	√	√	√	√
Community Impact				
21. 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?	√	√	√	
22. Does AEP Ohio/Willdan 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?	√	√		
23. Has AEP Ohio/Willdan documented any case studies that can be used to demonstrate the benefits of the program?				
24. Has the program had any impact on employment in the region?	√		√	√

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 Willdan was provided by AEP Ohio to the evaluation team.

- 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.

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 Willdan. Information on marketing, communications and outreach efforts was also obtained from both AEP Ohio and Willdan.

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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 3.

2.6 *Primary Data Collection*

Primary data collection included in-depth interviews with program actors 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 Willdan. 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 2013.

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 evaluations were 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 four Solution Providers. None of the Solution Providers were available to participate.

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 17 projects by 14 different companies at 15 unique premises were completed in the programs first year of operation in 2013. All 14 unique participant contacts were solicited for response. To avoid potential issues with spam filters, individual e-mails were sent to each unique participant contact. One of the participant e-mail addresses was found to no longer be active. 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.

Thirteen participants responded to the survey, though only nine of these completed all questions. The nine completed surveys represent a 64 percent response rate and provide a confidence interval of approximately 85% confidence with a margin of error of +/- 15%[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 for 2013 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 and divided into three strata based on ex ante energy savings. Projects were randomly selected from each stratum. 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 nine projects to be selected for application documentation and engineering review. In the end, Navigant sampled 92 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, telephone or on-site level review.

[6] Assuming a normal, un-skewed response distribution.

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

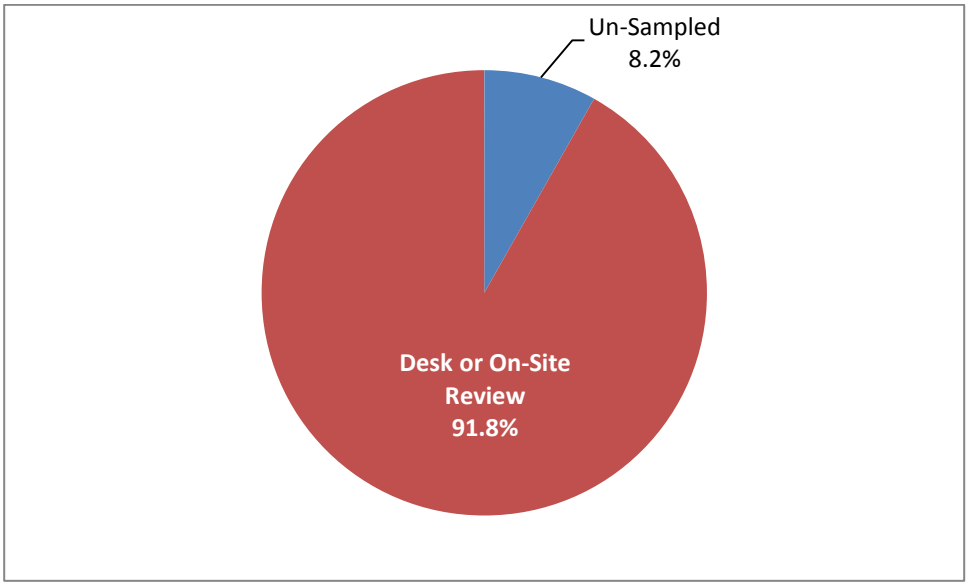

Table 2-1. Impact Sampling Strata and Achieved Sampling

Stratum by Approach and Energy Savings	Number of Projects	Strata weight by Energy	Number of Desk Reviews	Number of On-site Reviews
Large (> 1 GWh)	4	80.1%	4	3
Medium (> 100 MWh, < 1GWh)	8	17.7%	4	3
Small (< 100 MWh)	5	2.2%	1	0
Total	17	100%	9	6
Percent of *Ex Ante* Savings			91.8%	64.7%

2.7.2 *Ex Post* Energy Savings Calculation

Energy savings calculations were conducted in accordance with the 2010 Draft Ohio Technical Reference Manuals (Draft Ohio TRM), other published methodologies such as regional TRM's and accepted engineering approaches as appropriate. The baseline was 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

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2.7.3 Realization Rates Calculation Method

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

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

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:

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

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 2013. Figure 2-3 and Figure 2-4 compare the sample population with the survey responses. The comparison is complicated by the fact that the business type was recorded as "Data Center" for 59 percent of program participants in the tracking database. It appears that the survey responses over-represent the education sector, and hospitals or medical facilities, however, some of these may have been recorded as Data Centers in the tracking database.

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Figure 2-3. Program Participation by Business Type

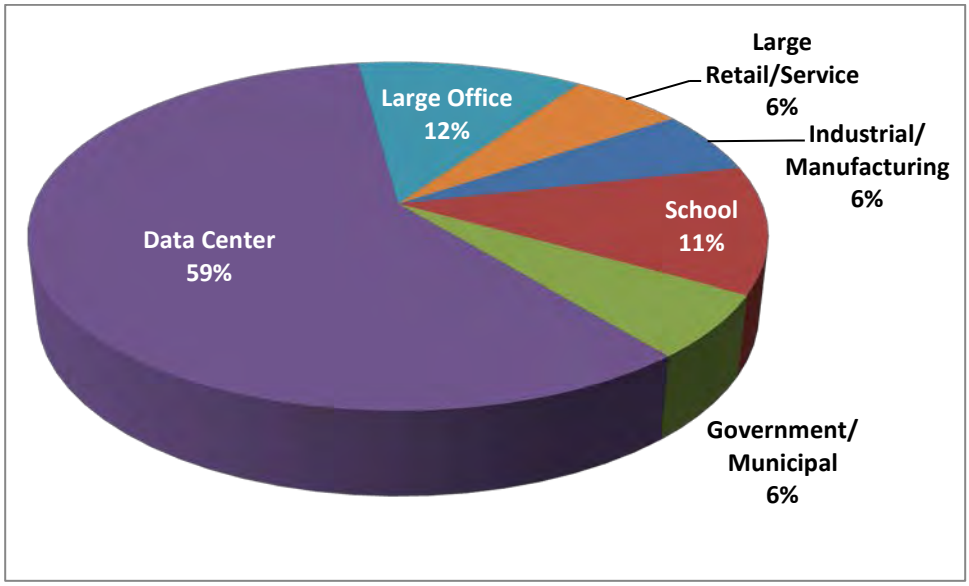
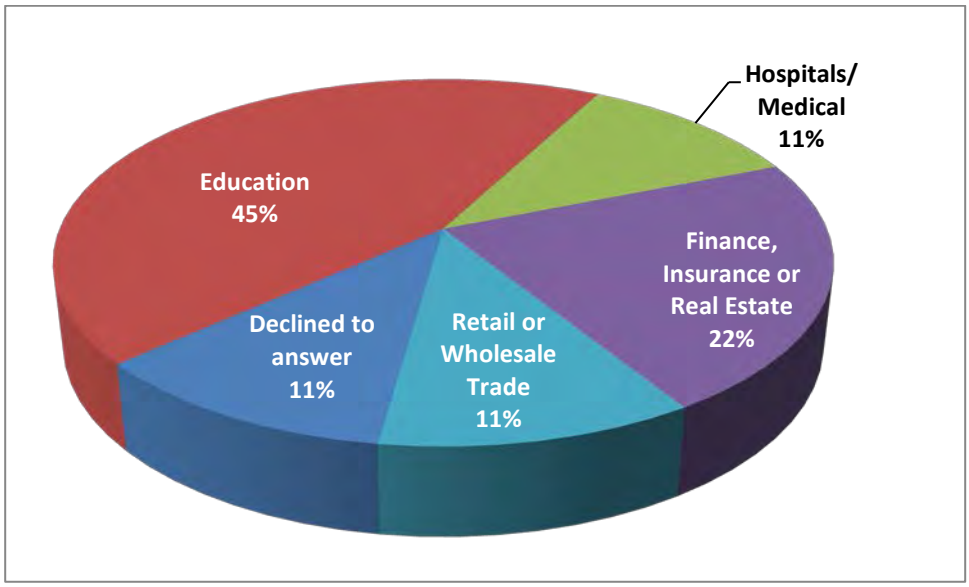


Figure 2-4. Survey Respondents by Business Type



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3 Detailed Evaluation Findings

3.1 *Program Activity*

The 2013 program year represents the first year of operation for the Data Center program. During the first year of the program's operation in 2013, 17 projects were completed by 14 different companies at 15 unique premises. The projects involved the implementation of different types of measures. Three of the customers who participated in the program completed multiple projects. Table 3-1 summarizes the key program indicators. Total energy savings reported for the program amounted to 10,898 MWh while the reported demand reduction totaled 1.5 MW. This roughly doubles the program goals of 5,984 MWh and 0.743 set for the 2013 program year.

Table 3-1. Program Summary

	Total	Average per Project
Total Project Cost	$10,559,772	$641,085
Reported Floor Area (estimated. sq. ft.)[8]	404,146	36,741
Amount of Incentives	$863,735	$50,808
Energy Savings Reported to Program (MWh)	10,898	641
Demand Savings Reported to Program (MW)	1.51	0.0888

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 Savings by Sector

Calculated Values from Tracking Database					
Sector	No. of Projects	Incentives	*Ex ante* Energy Savings (kWh)	*Ex ante* Demand Savings (kW)	$/MWh
Industrial/Manufacturing	1	$4,855	60,681	7	$80.0
School	2	$13,487	245,880	40	$54.8
Government/Municipal	1	$2,159	33,187	4	$65.1
Data Center	10	$724,635	9,076,203	1,310	$79.8
Large Office	2	$94,364	1,179,548	114	$80.0
Large Retail/Service	1	$24,235	302,938	35	$80.0
Total	17	$863,735	10,898,437	1,510	$79.3

[8] Of the 15 unique premises, 11 had a value for the estimated square feet. Therefore, these numbers excluded the four premises without an estimated floor area.

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For almost 60 percent of the projects, the business type was recorded as "Data Center" with no indication of the economic sector or sectors served. Other characteristics of the participants included:

- Over 80 percent of the businesses that participated in projects indicated that they operated 24/7, while just 18 percent indicated 8 hours per day and 5 days per week operations.
- Eleven of the 17 projects completed in the first year of the programs operation were submitted after the date of completion indicated on the application. One project didn't indicate a project submission date and one project showed that the application was submitted on the completion date.
- Only three projects provided information on the level of Power Usage Effectiveness or PUE; used to measure energy efficiency in Data Centers[9]. The average PUE for those that provided the information was 1.8.

The application form for the program asked participants to indicate how they had learned of the program, with the results presented in Figure 3-1. Seventy percent indicated that they had initially heard of the program through AEP Ohio Account Representatives, while 18 percent had learned of the program from their Solutions Provider. The tracking database also recorded that a Solutions Provider was involved in implementing the efficiency project in just over one-third of the projects completed during the year.

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

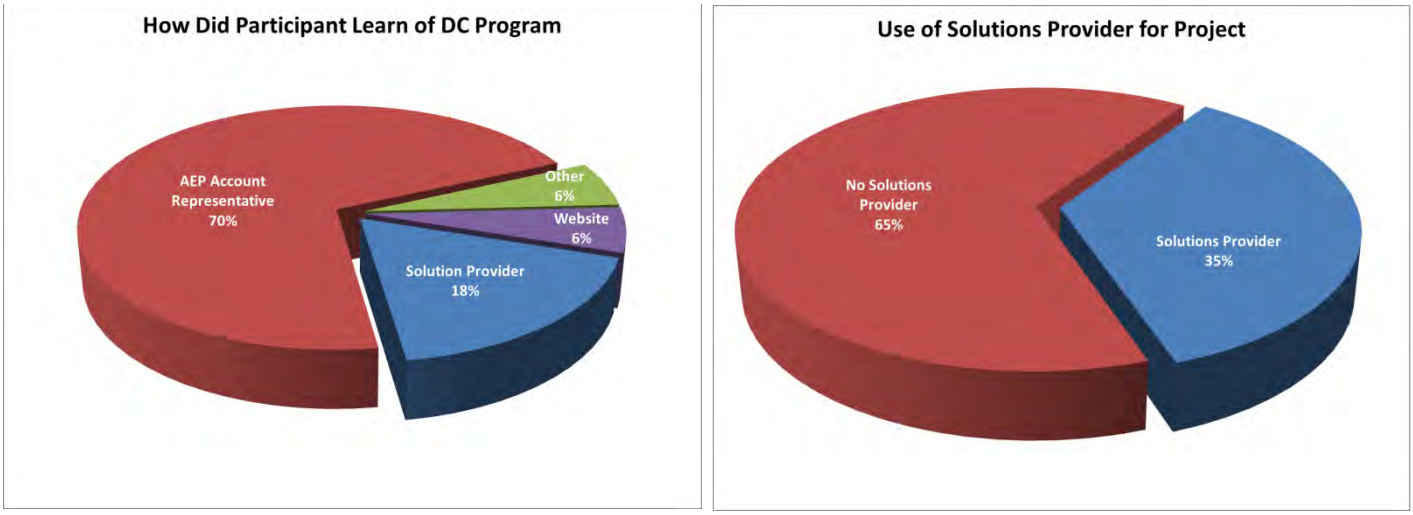

Figure 3-2 compares the distribution of the number of 2013 Data Center projects and the distribution of *ex ante* savings by business type. As the chart shows, almost 60 percent of the projects and over 80

[9] 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.

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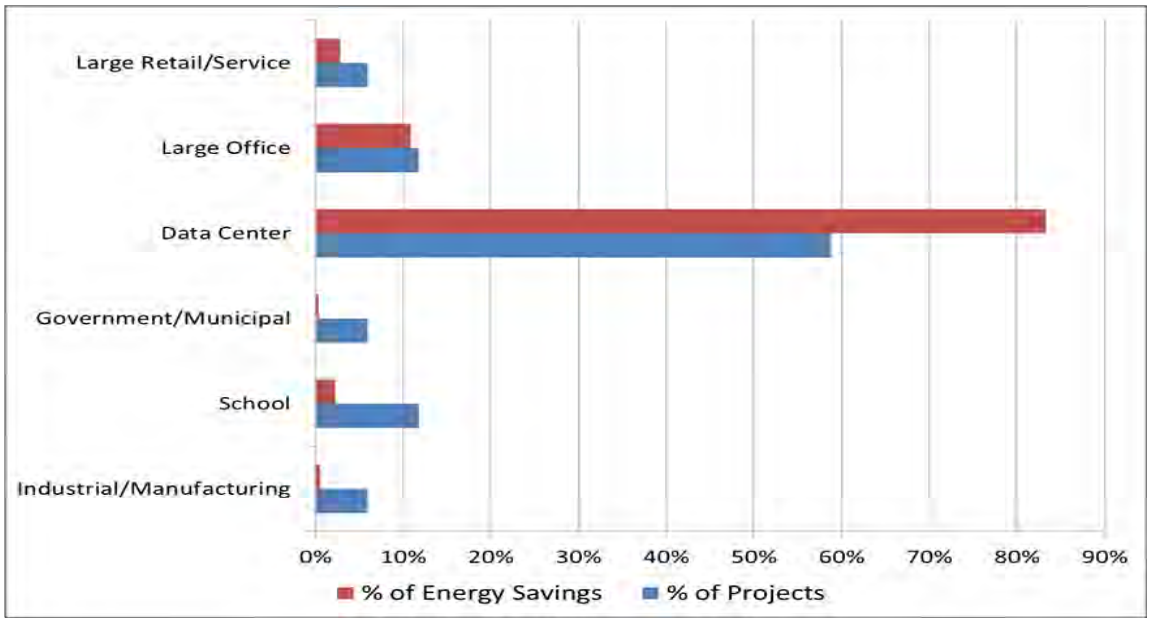
percent of the *ex- ante* savings came from projects identified as Data Centers. The tracking database did not provide a breakdown of which economic sectors these data centers represented.

Figure 3-2. Projects by Business Type



Measures completed under the program were divided into seven sub-categories, as shown in Table 3-3 and Figure 3-3. The largest share of savings came from three server virtualization projects (38%), while two categories, hardware, server, uninterruptible power supply (UPS) and other equipment upgrades or optimization accounted for 39 percent of savings. Just over one-fifth of program savings (22%) came from projects which improved the efficiency of data center heating and cooling (water cooled chillers, split AC and heat pumps, VFDs on HVAC equipment or expansion of existing HVAC systems).

Table 3-3. Measures by Category

Measure Description	No. of Projects	Savings (kWh)	Savings (kW)
Performance resource optimization, equipment, uninterruptible power source	7	1,426,703	166
IT equipment virtualization	3	4,128,338	440
HVAC equipment - variable frequency drive	4	884,276	101
IT hardware or server	2	2,876,740	391
HVAC equipment -unitary and split AC & heat pump	5	792,209	85
HVAC equipment -water-cooled chillers	1	744,682	322
Ductwork expansion	1	45,959	5
Total		*10,898,907*[10]	*1,510*

[10] There was a small discrepancy of an extra 470 kWh being reported in the measures database that was not present in the project database.

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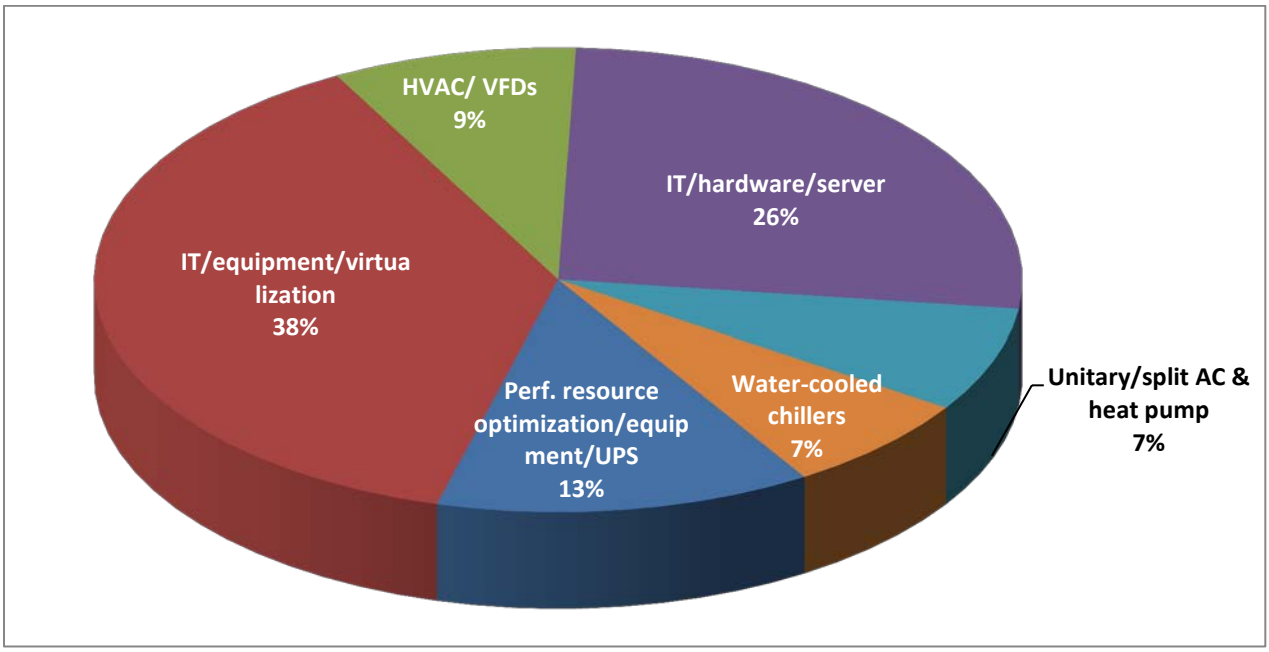
Figure 3-3. Measures Implemented in Data Center Program



3.2 *Impact Findings*

This section includes a summary and discussion of the evaluation-calculated energy and demand savings for the 2013 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 Willdan. Data center projects are complex, and clear and concise documentation is necessary for effective evaluation. Navigant appreciates the level of detail provided, however the project files would be improved if all projects were to include project lifetime. 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 2013 are 9,796 MWh/year and 1.36 MW respectively. This is a strong result for a first year program, and exceeded the 2013 goal of 5,984 MWh and 0.743 MW coincident demand reduction. The realization rate for both energy and demand is nearly 0.9, which is reasonable for a first year program. These results are shown in Table 3-5. Precision was worse than 10% due to some medium to small projects having low realization rates.

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

Metric	*2013 Program Goals*	*Ex Ante (a)*	*Ex Post (b)*	Realization Rate RR = (b) / (a)	Overall Relative Precision at 90% Confidence	Percent of Goal
Annual Energy Savings (MWh)	5,984	10,898	9,796	0.899	18.4%	164%
Coincident Peak Reduction (MW)	0.743	1.51	1.36	0.901	14.1%	183%

3.2.2 Driving Factors of Realization Rate

Data analysis revealed that 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.

Nine projects were sampled as part of the impact study. Close inspection revealed that two of the projects were server or server virtualization projects; three projects were primarily new Uninterruptible Power Supply (UPS) projects, one of which had a pump VFD component; three projects involved new Computer Room Air Conditioners (CRACs) or new Computer Room Air Handlers (CRAHs); and one was primarily a chiller optimization project with a UPS component.

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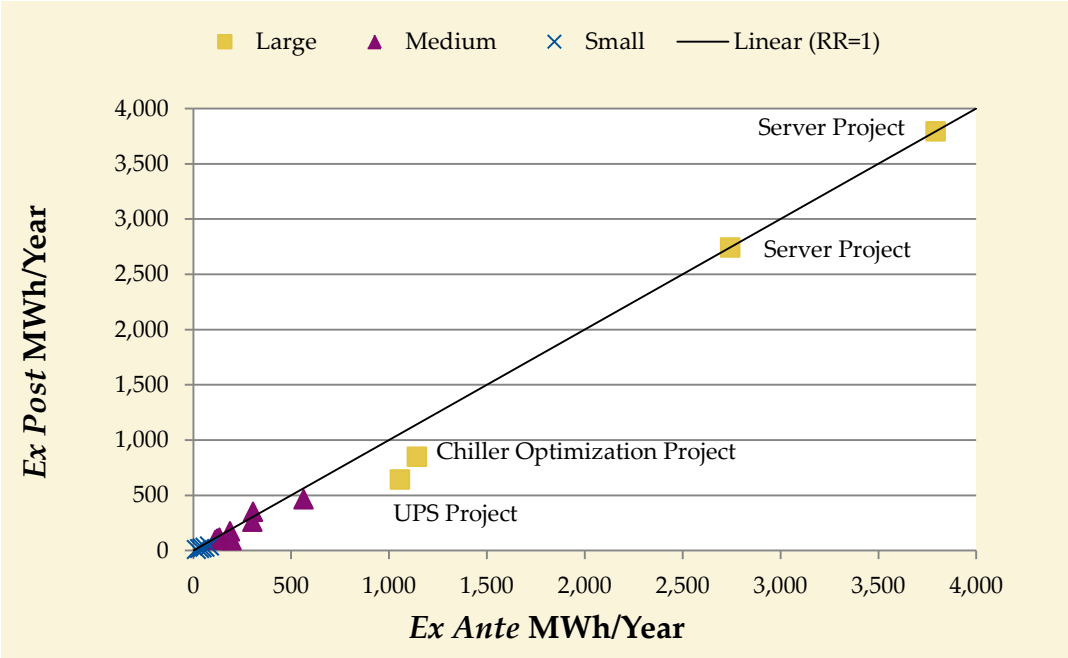
Figure 3-4 is a graphical representation of the project level *ex ante* versus *ex post* energy savings grouped by sample strata and program approach. The diagonal line represents the goal of a realization rate of one. Points above and to the left of the RR=1 line represent projects with energy realization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



All UPS projects, as well as the one highlighted in Figure 3-4, had reduced savings due to the baseline being increased. Navigant suggests using the California Energy Efficiency Baselines for Data Centers[11] as the basis for UPS baseline. Additionally, in some of the UPS projects it was not clear if the project was claimed to be a retrofit or a Replace on Burnout (ROB) project. In one case, the incremental cost was presented as the difference between a new baseline UPS and the installed UPS, suggesting an ROB project, while at the same time claiming savings relative to the old UPS, suggesting retrofit. All projects should be clear whether the project is retrofit, ROB, or early replacement. Navigant allowed one UPS project to be treated as a retrofit, but disagreed with the 83 percent that was assumed for the baseline. Navigant used a value of 85 percent[12] for this project.

[11] 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

[12] See figure 10.02 of the California "Data Center Best Practices Guide" found at: http://www.pge.com/includes/docs/pdfs/mybusiness/energysavingsrebates/incentivesbyindustry/DataCenters_BestPractices.pdf

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The Chiller Optimization project also included some new UPS equipment and a UPS optimization. The chiller portion of the project included comprehensive metering, allowing for a realization rate of 1.0 on the chiller energy savings. The chiller demand savings had a small correction as the project file appeared to use the PJM peak rather than the Ohio peak as defined in the Draft Ohio TRM. The project level realization rate is below one due to significant reductions in the UPS portion of the project, particularly the UPS optimization. The project file calculation did not adjust for the computing load difference between the baseline metering and the post-retrofit metering. Interestingly, the demand calculation did account for the computing load difference.

The server projects had a realization rate near 1.0 for both energy and demand. Server project savings can vary significantly depending on loading and server selection. Ideally, for large projects such as these, robust baseline and retrofitted meter logging should be conducted, including baseline and efficient utilization, server idle power and server full load power. Unfortunately, all of these values were not available for these projects. Willdan took an acceptably conservative approach to these projects based on some metered data as well as an industry published server power consumption database. In the future, Navigant recommends using the National Renewable Energy Laboratory's (NREL) Unified Methods Project's approach for virtualized servers[13], which is:

$$kW_{baseline} = \sum_{1}^{n} (kW_{sa,idle} + U_{sa} * (kW_{sa,full\ load} - kW_{sa,idle})$$

$$kW_{w\ Virt} = \sum_{1}^{m} (kW_{vh,idle} + U_{vh} * (kW_{vh,full\ load} - kW_{vh,idle})$$

$$〚\ 〚Annual\ Energy\ Savings〛\_Virt = (kW〛\_baseline - \ 〚kW〛\_(w\ Virt)\ ) * 8760$$

Where,

$kW_{baseline}$	= total power draw in kilowatts of all single application servers without virtualization during server refresh
sa	= single application servers, numbered 1 to n
$kW_{sa,idle}$	= power draw in kilowatts of a single application server at idle
$kW_{sa,\ full\ load}$	= power draw in kilowatts of a single application server at full load
U_{sa}	= utilization of single application server

[13] NREL's Uniform Methods Project is still in draft form. Navigant is one of the reviewers for the Uniform Methods Project.

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$kW_{w\ virt}$	= total power draw in kilowatts of all virtual hosts (this value can be obtained using the above calculation or through metering the power of the installed virtual host)
vh	= virtual host servers, numbered 1 to m
$kW_{vh,\ idle}$	= power draw in kilowatts of a virtual host server at idle
$kW_{vh,\ full\ load}$	= power draw in kilowatts of a virtual host server at full load
U_{vh}	= virtual host server utilization

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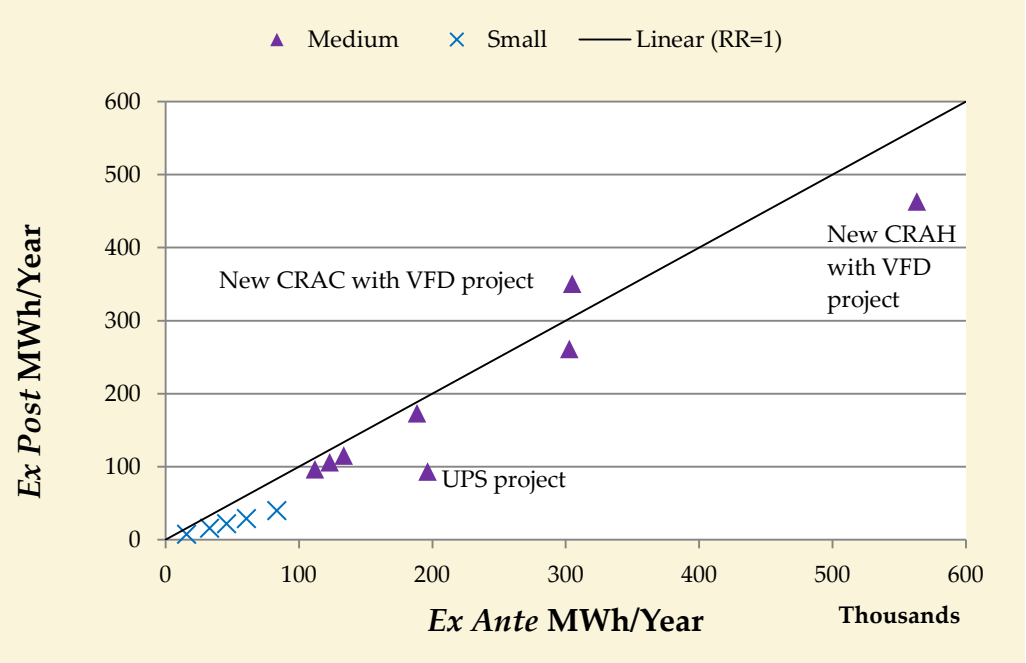
Figure 3-5 shows presents the same information as in Figure 3-4, but with the large projects removed so that details results can be demonstrated for medium and small projects. The three projects sampled that involved either CRAH's or CRAC's all had VFD's on the fans. These projects had realization rates above or below 1.0 largely due to Navigant's metering providing different results than the original project files. Navigant agreed with Willdan's approach where mechanical efficiency of these units should be determined by ASHRAE 90.1 – 2010 even though Ohio is following the 2007 version of ASHRAE 90.1. The 2007 version does not provide baselines for data centers. However, since Ohio's current energy code does not address data centers, Navigant will not follow the 2010 requirement for economizers on larger CRAC and CRAH units.[14] The CRAC project, for instance, was large enough to require an economizer if Ohio was following ASHRAE 90.1 – 2010.

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



[14] Most of AEP's Ohio's service territory is in zone 5a, which requires economizers on units above 135,000 Btu/hour

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3.3 Process Findings

The process review found that the program has been successful in meeting its participation and energy savings goals in its first year of operation. The program processes appear to be reasonable and the program is well accepted by participants. The program has also been successful in meeting the ancillary goal of making the program available to data centers of different sizes. As a new program, some processes can be refined and improved, and there appears to be room for further expansion. Several 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). Only respondent rated the process as difficult (1 out of 10); commenting that: "*There is no way a normal individual company can interpret the form and execute. You have to use a 3rd party company as I did to not only find out about it, but submit the form. The rest is easy from my or the customer standpoint".*
- Completing the application process was also rated as quite easy (8.5 out of 10), with four respondents indicating it was very easy (10 out of 10) and only one respondent indicating that it was difficult (1 out of 10). The one respondent who found the process difficult indicated that the process was made easier by using a third party to help them complete the process (comment above).

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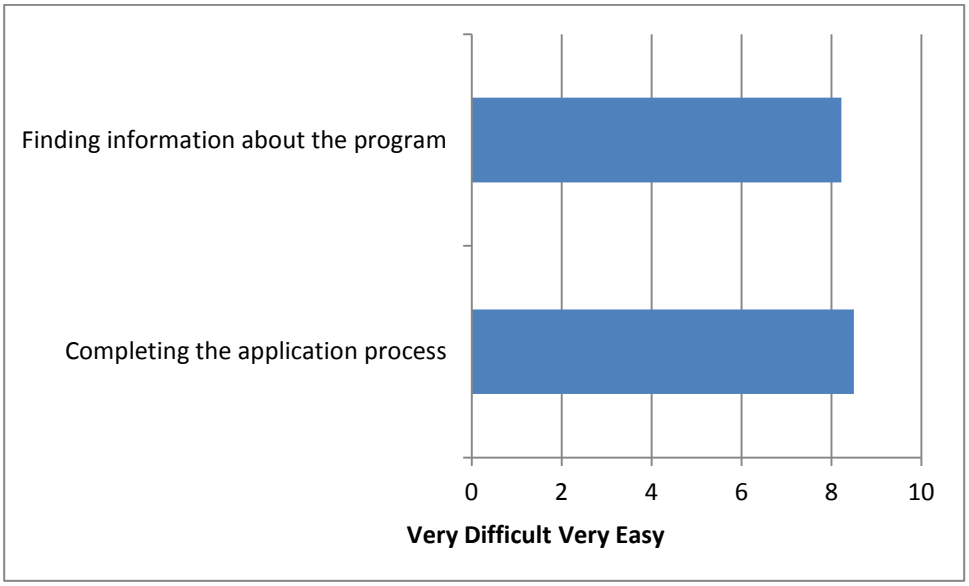
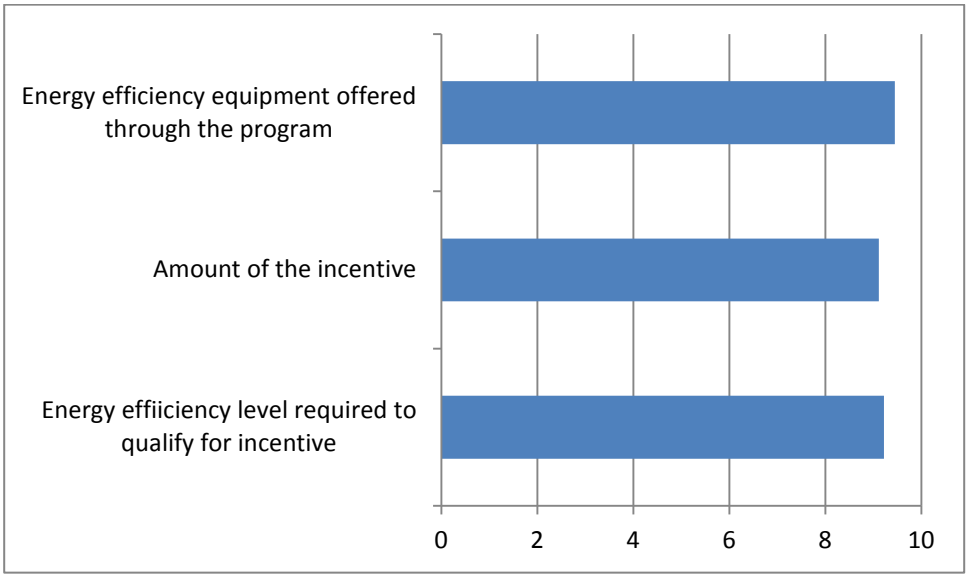
Figure 3-6. Ease of use of the program



Participants were also questioned about their level of satisfaction with the efficiency requirements and incentive levels offered through the program. Respondents indicated that they were very satisfied with the efficiency level required to qualify for the program (9.2), the level of efficiency equipment made available through the program (9.4), and the amount of the incentive (9.1). No suggestions were offered on how the program could be changed to make participants more satisfied.

Figure 3-7. Level of satisfaction



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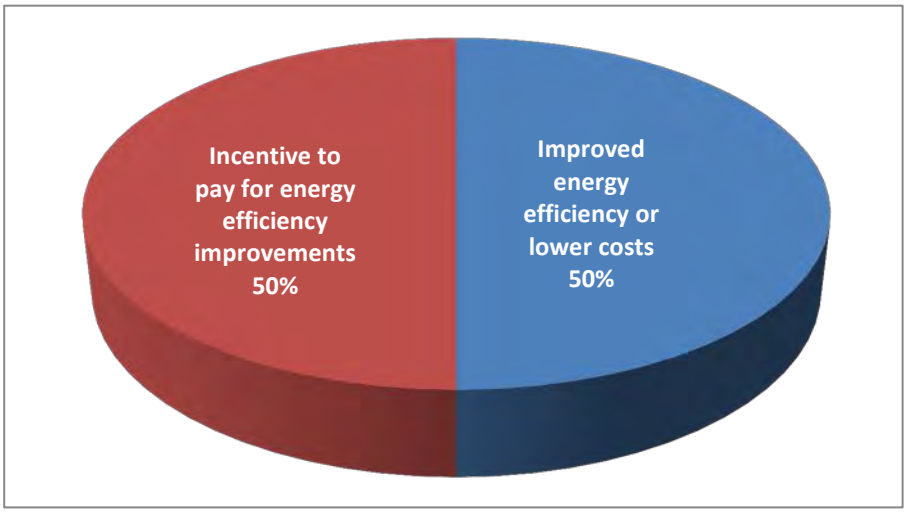
3.3.2 Participant Motivations

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 evenly between "improved energy efficiency and lower operating costs", and the availability of the "incentive to pay for energy efficiency improvements". None of the respondents indicated that the availability of technical assistance 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 that there were any other, non-energy benefits associated with the energy efficiency project that was implemented (Figure 3-9). A number of co-benefits were identified, including lower maintenance costs (8 occurrences), increased information technology (IT) capacity (6) and improved up-time, cost savings for ancillary equipment, and a reduced carbon footprint (7 occurrences each).

Willdan mentioned that it has found a number of non-energy benefits that have accrued as a result of efficiency projects, including reduced space requirements for equipment. Willdan indicated that many data center operators, in particular enterprise data centers, are under pressure to find energy efficiency opportunities and reduce their carbon footprint. While projects are generally approved based on their economics, considerations such as reduced carbon footprint are a factor for some players in the market.

Participants were also asked if they had any concerns that the measures implemented to improve energy efficiency might have an effect on other areas of performance. The only area of concern, reported by four of the respondents, was that they had some concern about the project affecting reliability and up-time. It is noteworthy that "lack of understanding" about the benefits of the program to up-time was mentioned as a barrier to participation (discussed below).

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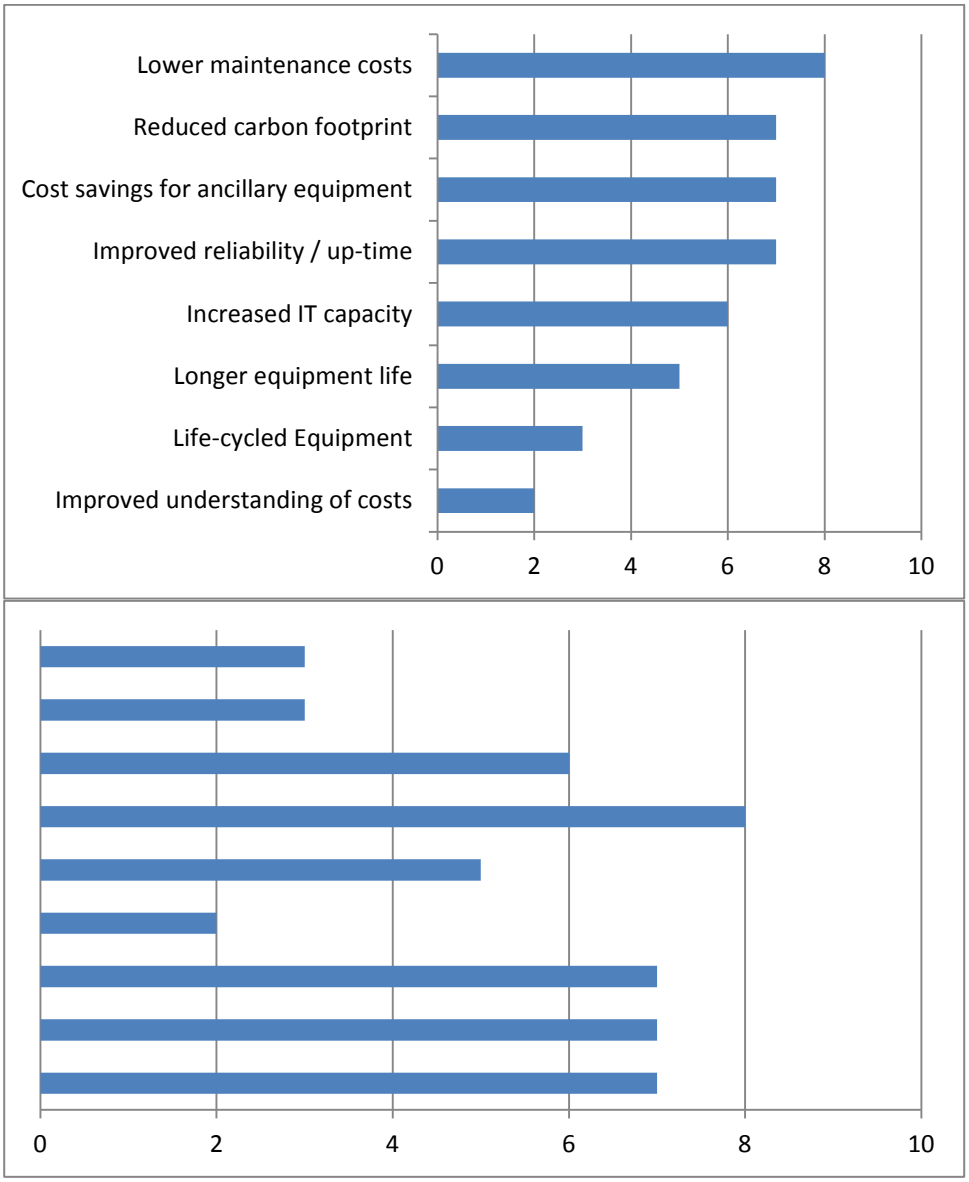
Figure 3-9. Did the efficiency measure you implemented provide any non-energy benefits?



Note: Multiple responses allowed.

3.3.3 Marketing Efforts and Program Awareness

Both AEP Ohio and Willdan staff stressed the importance of having a specific program to reach out to Data Centers, noting that this is a unique market segment with very particular needs. As a result, it was felt that successfully accessing this market required a specific marketing approach and program staff who could "talk the talk" with IT professionals.

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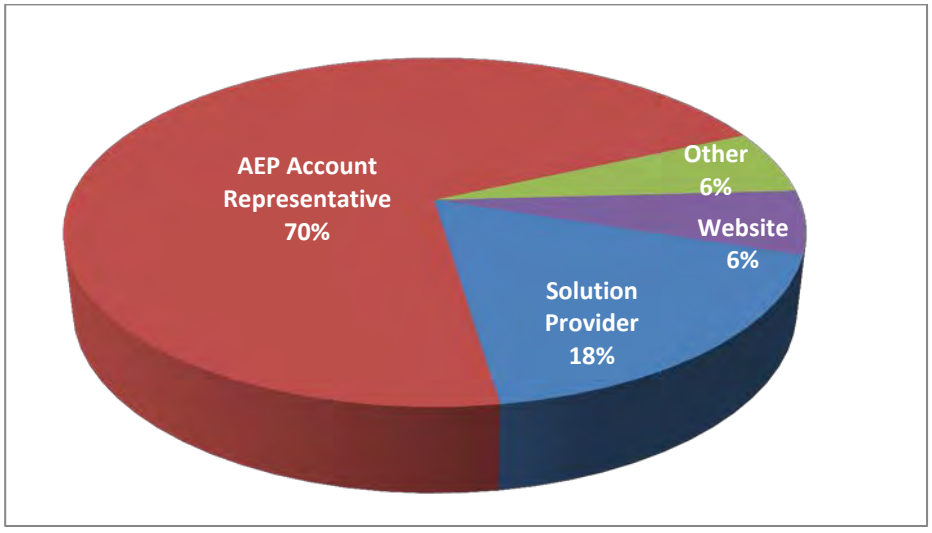
Building market awareness of any new initiative is always a challenge. In the case of the Data Center Program, both AEP Ohio and Willdan indicated that they had leveraged existing relationships with clients believed to have a data center in order to identify potential participants. Program staff and AEP Ohio Account Representatives also reached out to key market segments, using targeted brochures and other efforts to build awareness of the Data Center Program and recruit projects. Willdan staff indicated that they had participated in some outreach events, including the Columbus hospital show, AEP Ohio energy efficiency forums, and a few forums specific to Data Centers.

As indicated in Figure 3-10, information collected during the application process shows that 70 percent of the projects completed in 2013 indicated that they had heard about the program from their AEP Ohio Account Representatives, while 18 percent indicated they heard of the program from a Solutions Provider and nine percent from the AEP Ohio web site, as shown in Figure 3-11. By contrast, over half (55%) of the survey respondents indicated that they initially heard of the program from AEP Ohio or Willdan staff, while a further 27 percent heard of the program through outreach activities (workshops, seminars or the program web site). These differences may reflect differences between the total population and the sample of those who responded, or may reflect different information from the survey respondents and those who originally completed the application form.

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



**Survey question asked "How did you learn of the AEP Oho Data Center program?*

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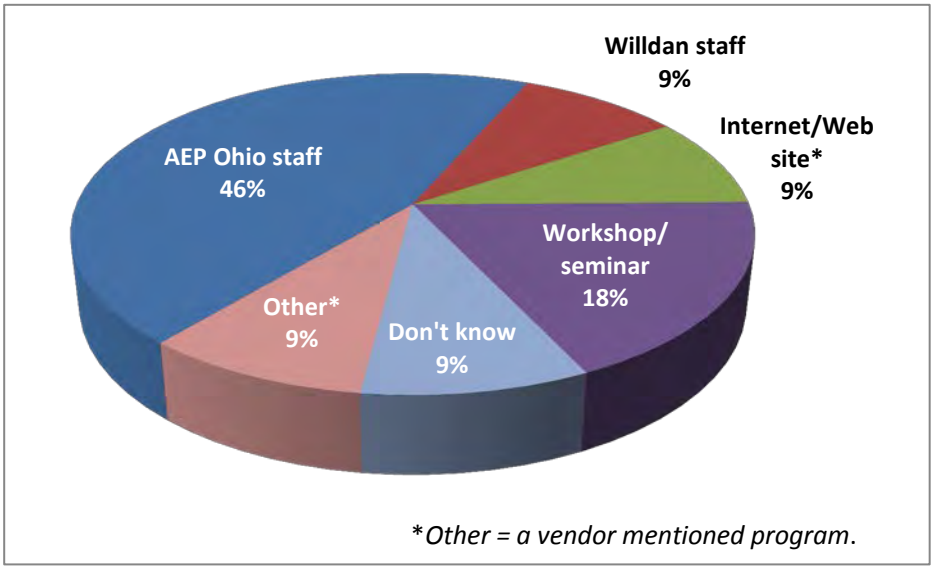
Figure 3-11. How did Participants Learn of Program (per Tracking Database)



In reviewing information available regarding the program on the web site, Navigant noted that AEP's Economic and Business Development division offers a "***Qualified Data Center Site Program***" 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*"[15]. Data Center Program staff indicated that they are aware of this program and share information on any potential ***Qualified Data Center Site Program*** projects which might qualify under the AEP Ohio Data Center Program. Navigant understands that this relationship is currently informal based on staff location and therefore recommends that a formal process be developed to ensure that this coordination continue in future. AEP Ohio can determine whether this process should link to the Non-Residential New Construction Program or the Data Center Program. None of the 2013 program participants indicated that it had participated in the AEP Qualified Data Center Site Program; though we note that they would only have been interested in the program had they been siting a new facility..

As indicated previously, Solutions Providers have not played a major role in projects to-date. While there are a small number of Solution Providers who provide comprehensive management of data center efficiency projects, the nature of many of the energy efficiency upgrades is such that Solutions Providers may only be peripherally involved, or may only be involved in one aspect of a larger project. Despite these limitations, Solution Providers could 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. Program management indicated that they intend to work to expand the involvement of Solution Providers in the program as it continues to develop. Navigant recommends that

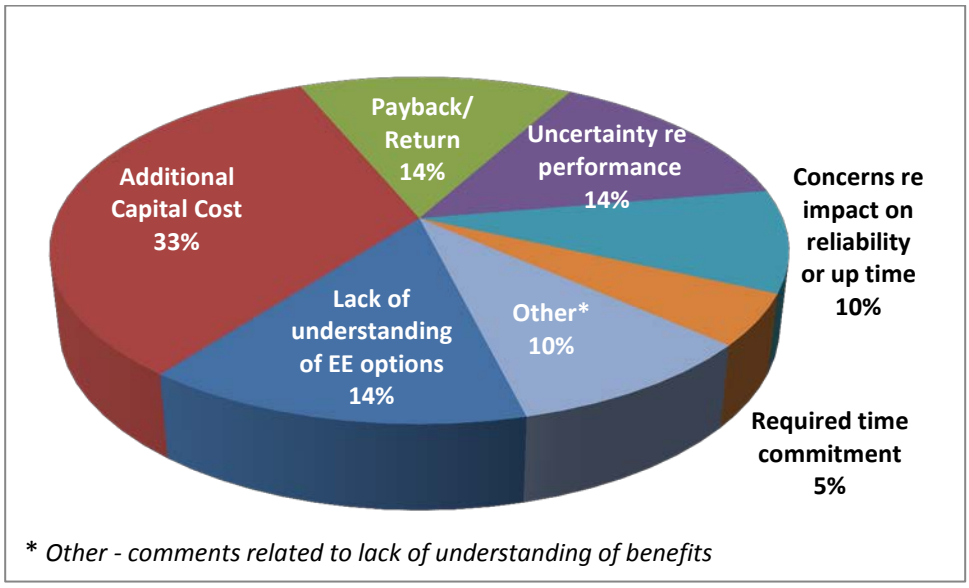
[15] http://www.aepdatacenters.com/

AEP Ohio and Willdan work to establish a network of Solution Providers that can provide market intelligence and act as lead generators for the program. Such an effort might include provision of an incentive for participating Solution Providers.

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 and return) and uncertainty over the value and performance of energy efficiency upgrades (uncertainty regarding the performance of the measures and lack of understanding of available energy efficiency options). Concerns over the potential impact of the energy efficiency upgrade on reliability and up-time were also indicated by 10 percent of respondents Figure 3-12. While the program incentives are designed to change the financial calculus, this indicates that there is also an opportunity to overcome information barriers through outreach, education and communications.

Figure 3-12. Barriers to increasing EE of Data Centers



Comments from Willdan and AEP Ohio indicate that 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. Willdan believes that its reputation within the industry has helped in overcoming this barrier and stressed that it will be important to work with Solutions Providers who have an established reputation with the Data Center market.

Feedback from Willdan, AEP Ohio and participants indicated no significant barriers to program participation for those who have made a decision to improve the energy efficiency of their Data Center. The dominant concerns expressed around implementing energy efficiency upgrades concerned any possible impact on reliability and up time.

While the overall rating of the application process was very positive, some concerns were expressed that the application form was difficult for an average customer to complete without assistance. One participant also commented that he had experienced some challenges in explaining how they were intending to reduce energy use through the implementation of the project.

All of the respondents indicated that they felt that 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. Fifty-six percent indicated that they could have achieved more if they had access to additional incentives.

3.3.5 Customer Enrollment Process

Navigant reviewed the customer enrollment process, including the application forms, processes followed by Willdan in reviewing and approving applications, time required for review and approval of applications, and approval review processes. Navigant notes that the listing of the "*Steps for Submitting Your Application*" and the "*Check list*" included in the application form are helpful in ensuring that all of the required elements are included in applications.

An early copy of the application form included some elements that were not relevant to the Data Center program, including references to "*Incentive Tiering*" and "*Custom Projects".* It appears that the initial form was based on an application for another program and these references were inadvertently left in the form. The form has since been revised to correct these issues, however, no revision date was found on the printed versions of the application form. Navigant recommends that a revision date be maintained on the application form so that any such issues can be identified in future.

While participants rated the participation process as quite easy (see section 3.1.1) some participant comments indicate that there is potential for making the form and the process clearer (see section 3.3.4). Comments from program staff also highlighted that some of the projects completed under this program are relatively complex and may take an extended period of over a year to complete. This has led to some challenges in obtaining required documentation for some applicants. While this is not unexpected given that this was a new program, it is recommended that program management consider how to highlight documentation requirements in program material and processes to support the collection of documentation as projects proceed.

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

3.3.6 Incentive Payment Process

Incentive payments amounts are based on energy savings estimates developed by Willdan and are approved by AEP Ohio. A review of the tracking database indicates that most of the applications (11 of 15) were submitted after the project was completed. The average elapsed time from the date of the application to the date on which the incentive was paid was 115 days. Navigant recommends that the tracking database be modified to include a column to record when all information required for approval

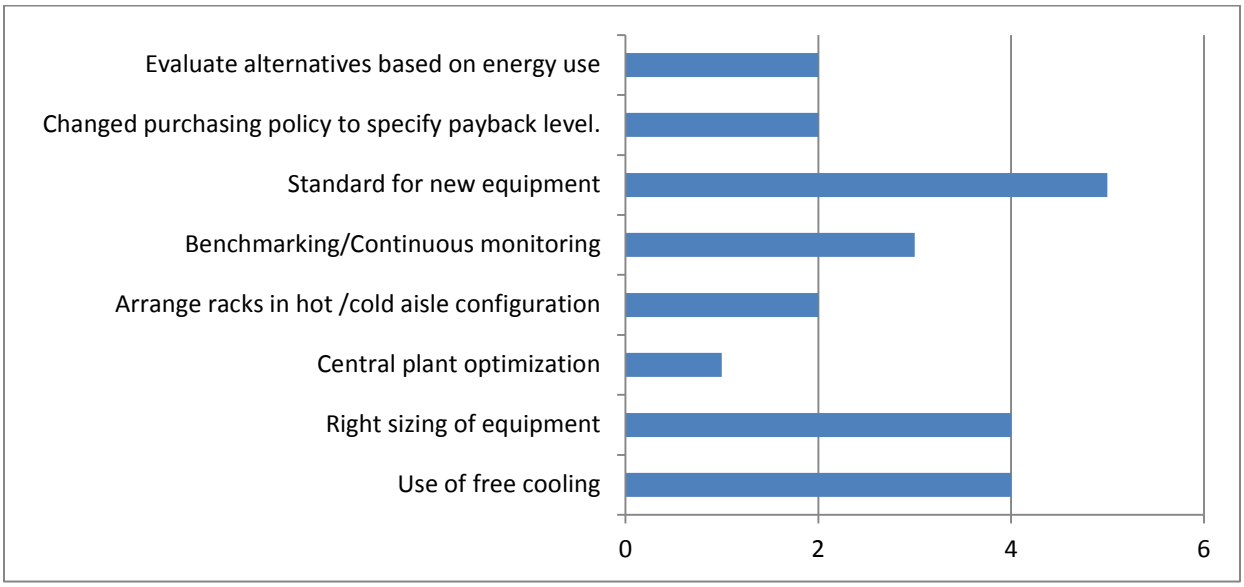
of the project incentive was received. This would enable tracking of the time required to process incentive payments. No comments were received from participants with regards to the time required to obtain incentives under the program.

3.3.7 Changes as a Result of Participation

Willdan reports that it is beginning to see 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 at other data centers that they operate as a result of what they had learned from the project completed under the AEP Ohio Data Center Program, results shown in Figure 3-13. More than half of the respondents indicated that they had made changes in other data centers as a result of what they had learned from their participation in the AEP Ohio program.

Figure 3-13. Changes Made as a Result of Participation in Data Center Program



Question – Are there specific things that the company does differently in other Data Center projects because of participation in the program?

3.3.8 Program Tracking Data Review

Program tracking data is maintained by Willdan and shared with AEP Ohio via a SharePoint site. Navigant reviewed the tracking data and found that 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, a number of project numbers use "Data Center" as the business type. Given that all eligible applications are for a data center, this designation provides very little information on the nature of the business involved. It is recommended that to the extent possible the economic sectors these data centers represented be recorded.

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- A number of fields were found to have incomplete information (i.e. building square footage, pre and post kW, etc.). It is recommended that the administrative review include a requirement to obtain this information or note why it could not be obtained). In some instances, it is not clear if a blank field indicates that information has not yet been entered or if it is missing. In these instances, Navigant recommends that if the field does not apply, that "n.a." or some other code be used to indicate if the field does not apply. 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 is 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.
    - Three fields for demand reduction are recommended to be tracked. One field would be the demand reduction based on the project peak demand reduction, one field for the demand reduction coincident with the Ohio peak period, and one coincident with the PJM 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 that such a field be added.
- A number of acronyms and abbreviations are used in the tracking database that 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 containing an explanation of column headers, any acronyms used as field values, and any protocols with respect to how the data is reported.

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 that information submitted to the program is processed and recorded in the project tracking database. Application forms are reviewed to ensure that these are eligible, that the form is complete and that all required documentation has been provided. Program management reported that 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 Willdan.

All applications are subject to an engineering review to ensure that the savings for the project are calculated correctly and result in the appropriate level of incentive for the customer. The program implementer develops an M&V plan for each project to determine how energy savings will be measured

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or estimated. The baseline used in estimating 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. Willdan stressed that it works to ensure that 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 that it is in touch with projects on a monthly basis.

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. Willdan reports that post installation metering is carried out for about one-half of the projects.

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

Willdan 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 that relate to the energy efficiency program, with obvious implications for verifications efforts. The second challenge related to the program goal of including a variety of customers and therefore project sizes. This concern has led Willdan to streamline its verification process so that it could evaluate a small initiative at the same cost per kW as a large project.

Navigant notes that 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 that a formal dispute mechanism be developed before such issues arise.

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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 3-9 summarizes the unique inputs used in the TRC test.

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

Item	
Measure Life	6.4
Projects	17
Ex Post Annual Energy Savings (MWh)	9,796
Ex Post Coincident Peak Savings (kW)	1,360
Third Party Implementation Costs	782,057
Utility Administration Costs	186,534
Utility Incentive Costs	$864,230
Participant Cost	$3,626,708

Based on these inputs, the TRC ratio is 0.9. 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 NRNC	Benefit/Cost Ratio
Total Resource Cost	0.9
Participant Cost Test	1.9
Ratepayer Impact Measure	0.5
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.

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4 Key Findings and Recommendations

This section presents the key findings and recommendations from the 2013 Data Center program impact and process evaluations.

4.1 Key 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. Project files did not consistently provide details on how lifetime and incremental cost were determined, or in a few cases the parameter vales were not provided at all.

   Impact Recommendation #1a: Consistently list the incremental cost of efficiency as well as the project lifetime or lifetime energy savings. 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.

   Impact Recommendation #1b: Provide details on how lifetime and incremental cost of efficiency is determined including references and supporting documentation.

2. Project files did not consistently establish whether the project is considered a retrofit or a Replace on Burnout (ROB) scenario. Some UPS projects determined cost based on ROB, but calculated energy savings based on retrofit criteria.

   Impact Recommendation #2a: Consistently discuss whether the project should be considered a retrofit or a ROB scenario. ROB projects 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.

   Impact Recommendation #2b: Verify the determination of retrofit or ROB by looking at project economics from the participant's perspective. If the payback period exceeds the lifetime of the measure, the true motivation of the project is likely a non-energy factor and the project is likely an ROB.

   Impact Recommendation #2c: Consistently match the approach to determining incremental cost and project savings. If a project is a retrofit, then the cost is the full cost of the project and the proper baseline is the existing equipment. If the project is an ROB, the incremental cost would be the difference between the installed cost and the cost to install new baseline equipment. ROB

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energy savings would be relative to the efficiency of new equipment meeting energy code or industry standard.

3. Some projects, in particular UPS projects, did not provide details or a referenced document regarding how baseline efficiencies were determined.

   Impact Recommendation #3a: Navigant agrees to Willdan's approach of using existing equipment as the baseline for retrofitted projects. Willdan adequately attempted to retrieve baseline metered data where possible and necessary. Navigant suggests continuing the current practice.

   Impact Recommendation #3b: Regarding ROB projects or retrofit projects without metered baseline performance, Navigant suggests following the California Energy Efficiency Baselines for Data Centers[16] or other credible industry documents to establish the baseline criteria.

4. Regarding the baseline mechanical efficiency of air conditioners and condensing units serving data centers, Willdan referenced the ASHRAE 90.1 – 2010 baseline.

   Impact Recommendation #4a: Navigant agrees with the approach Willdan has taken using ASHRAE 90.1 – 2010 as the basis for baseline mechanical efficiency and suggests continuing the current practice.

   Impact Recommendation #4b: Since the Ohio energy code is based on ASHRAE 90.1 – 2007, Navigant suggests that the baseline configuration is no economizer on air conditioning systems. Should the energy code be updated to reflect ASHRAE 90.1 – 2010, then the baseline would follow the ASHRAE guideline where economizers are included in the baseline of larger air conditioning systems.

5. One project involving a CRAC system did not have flat savings over the year. When calculating the coincident demand reduction, Willdan calculated and reported the demand reduction coincident with the PJM peak, but not coincident with the Ohio peak.

   Impact Recommendation #5: While the PJM peak is an important parameter to calculate and record, the reported demand reduction for the program should be relative to the Ohio peak as defined in the Draft Ohio TRM.

6. One project involving UPS optimization relied on metered data, comparing pre-retrofit data to post-retrofit data. The project file showed that output power was reduced in the post-retrofit data, yet the energy saving calculation merely showed the difference in input power. The

[16] 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

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demand savings calculation adjusted the difference in input power relative to the difference in the output power.

Impact Recommendation #6a: 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.

Impact Recommendation #6b: On projects where the energy savings is flat over the course of the year, the magnitude of the energy savings and the demand savings should be relative to the 8760 hours in a year. Navigant suggests that a quality control check be put in place to see that energy and demand are offset by approximately 8760 hours when savings is flat or nearly flat.

7. Willdan used a credible and conservative approach when determining savings from large server projects; however savings accuracy would be improved if following the National Renewable Energy Laboratory's (NREL) Unified Methods Project's approach for virtualized servers[17].

   Impact Recommendation #7a: Large server project savings should be calculated using the difference between baseline and installed utilization, server idle power and server full-load power.

   Impact Recommendation #7b: Supporting documentation for large server virtualization projects should detail:

   - A list of servers to be removed including make, model and quantity
   - The host virtualization servers including make, model and quantity
   - The UPS Systems including the UPS systems being removed (make, model, size), changes to the UPS after virtualization, UPS systems purchased (make, model, size), and USP location
   - Costs of the virtualization software and costs of new hardware including host server, data storage, UPS, switches, etc.
   - Room conditioning details sufficient to determine interactive cooling effects
   - Disposal receipt or photo of decommissioned servers
   - Screen shot of the virtualized environment showing the number of virtual servers
   - UPS kVA reading both before and after the project retrofit

   Impact Recommendation #7c: Incentives should be withheld on large server projects until sufficient data has been received to verify the project level savings.

   Impact Recommendation #7d: The participant should be notified that independent third party verification will likely be required. Much of the same information will likely be needed to be collected by the third party verification agent.

[17] NREL's Uniform Methods Project is still in draft form. Navigant is one of the reviewers for the Uniform Methods Project.

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4.2 Key Tracking System Findings and Recommendations

Program tracking data is maintained by Willdan and shared with AEP Ohio via a SharePoint site. Navigant reviewed the tracking data and found that 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 that all eligible applications are for a Data Center this provides very little information on the nature of the business involved. It is recommended that to the extent possible the economic sectors these data centers represented be recorded.
- A number of fields were found to have incomplete information (i.e. building square footage, pre and post kW, etc.). It is recommended that the administrative review include a requirement to obtain this information or note why it could not be obtained). In some instances it is not clear if a blank field indicates that information has not yet been entered or if it is missing (i.e. Post Inspection Date). In these instances, Navigant recommends that if the field does not apply, that "n.a." be entered. 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.
    - Three fields for demand reduction are recommended to be tracked. One field would be the demand reduction based on the project peak demand reduction, one field for the demand reduction coincident with the Ohio peak period, and one coincident with the PJM 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 that such a field be added.
- A number of acronyms and abbreviations are used in the tracking database that 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.

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4.3 Key Process 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. Participants indicated that 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 participants indicated that the energy efficiency project that they had implemented had resulted in improved reliability and up-time performance.

   Process Recommendation #1: Given the very high priority that data center operators place on this issue, it is recommended that consideration be given to developing case studies or testimonials on the non-energy benefits of energy efficiency projects that can be used in program communications.

2. Solutions Providers were found to play a smaller role in the Data Center Program than is the case for some other programs. Despite these limitations, Solution Providers could 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: AEP Ohio and Willdan should work to establish a network of Solution Providers who can provide market intelligence and act as lead generators for the program. Such an effort might include provision of an incentive for participating Solution Providers.

3. In reviewing information available regarding the program on AEP Ohio's web site, Navigant noted that AEP's Economic and Business Development division offers a "***Qualified Data Center Site Program***" that helps companies seeking a site for a new Data Center. Program staff indicated that they are aware of this program and share information on any potential projects which might qualify under the AEP Ohio Data Center program; however, Navigant understand that this is an informal process.

   Process Recommendation #3: A formal reporting process should be developed to ensure that this internal AEP Ohio coordination continues in future. None of the 2013 program participants indicated that it had participated in the AEP Qualified Data Center Site Program.

4. In reviewing program material for the Data Center program, Navigant found a number of changes had been made to the program application form. While we support the improvements that were made, we note that there is currently no information on the form to indicate when it was revised. This could cause an issue if an applicant was relying on information on a form printed prior to a revision being made.

   Process Recommendation #4: That a revision date is maintained on the application form so that in future it will be possible to identify when the form has been changed.

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5. The program application requires that the incentive not exceed 50 percent of the project cost. Project cost is defined as the material cost of installed equipment.

   Process Recommendation #5: Consider amending 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.

6. Most participants rated the participation process as quite easy; however, some participant comments indicate that there is potential for improvements in the form and the process. In addition, comments from program staff highlighted that the complexity and extended period of time required to complete some projects has led to some challenges in obtaining required documentation for some applicants.

   Process Recommendation #6a: Review the program application form to determine if there are opportunities to simplify or clarify the form. Ideally, obtain feedback from Solutions Providers or past participants on specific elements of the form that can be improved.

   Process Recommendation #6b: Program staff should consider how to highlight documentation requirements in program material and processes to support the collection of documentation as projects proceed.

7. 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 that there is some room to further improve communications.

   Process Recommendation #7: That program staff 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 that customers understand that 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.

8. Navigant notes that 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 that a formal dispute mechanism be developed before such issues arise.

   Process Recommendation #8: That a formal dispute resolution process is developed to provide a framework in case such disputes arise in future.

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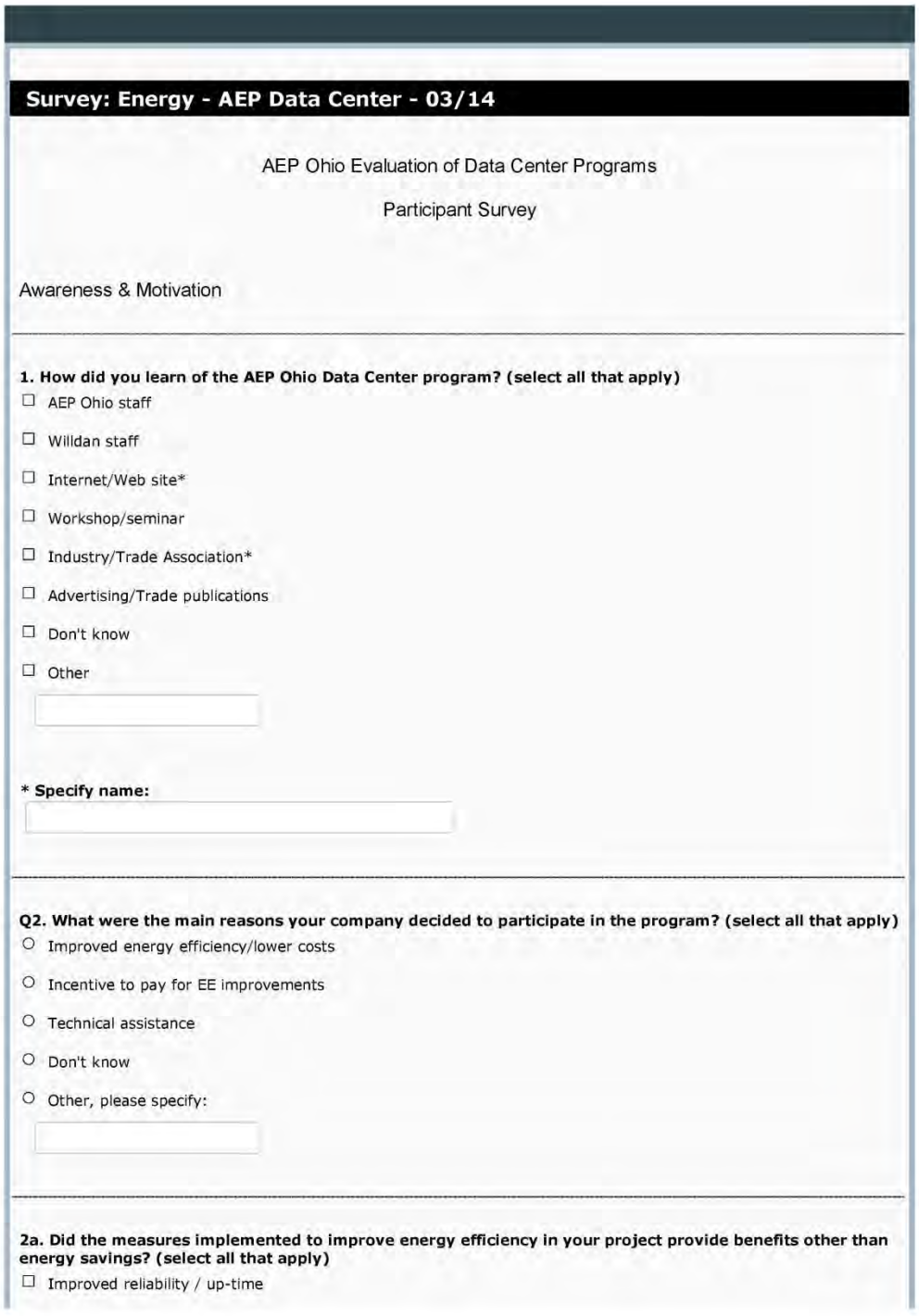
Appendix A: Participant Survey Instrument



Survey: Energy - AEP Data Center - 03/14

AEP Ohio Evaluation of Data Center Programs

Participant Survey

Awareness & Motivation

---

1. How did you learn of the AEP Ohio Data Center program? (select all that apply)

- ☐ AEP Ohio staff
- ☐ Willdan staff
- ☐ Internet/Web site*
- ☐ Workshop/seminar
- ☐ Industry/Trade Association*
- ☐ Advertising/Trade publications
- ☐ Don't know
- ☐ Other

*** Specify name:**

Q2. What were the main reasons your company decided to participate in the program? (select all that apply)

- ○ Improved energy efficiency/lower costs
- ○ Incentive to pay for EE improvements
- ○ Technical assistance
- ○ Don't know
- ○ Other, please specify:

2a. Did the measures implemented to improve energy efficiency in your project provide benefits other than energy savings? (select all that apply)

- ☐ Improved reliability / up-time

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- ☐ Cost savings for ancillary equipment
- ☐ Reduced carbon footprint
- ☐ Improved understanding of costs
- ☐ Longer equipment life
- ☐ Lower maintenance costs
- ☐ Increased IT capacity
- ☐ New Construction/Major Renovation
- ☐ Life-cycled Equipment

2b. Did you have any concerns about measures implemented to improve energy efficiency in your project impacting other areas of performance?

- ☐ Reliability / Up-time
- ☐ Equipment life

Experience with Program

Q3 a. Using a scale of 0-10 where 0 represents very easy and 10 represents very difficult – how would you rate the ease of finding information about the program?

0 - Very difficult	1	2	3	4	5	6	7	8	9	10 - Very easy
○	○	○	○	○	○	○	○	○	○	○

Q3 b. Using that same scale, how easy or difficult did you find the application process?

0 - Very difficult	1	2	3	4	5	6	7	8	9	10 - Very easy
○	○	○	○	○	○	○	○	○	○	○

Q4. Using a scale of 0-10 where 0 represents very unsatisfied and 10 represents very satisfied – how would you rate your satisfaction or dissatisfied with the following?

0 - Very Unsatisfied	1	2	3	4	5	6	7	8	9	10 - Very Satisfied
○	○	○	○	○	○	○	○	○	○	○

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Q4 a) If you responded to a) or b) with a rating of less than 5, please indicate the reason for your dissatisfaction:

The level of documentation required?

rating

Reason for dissatisfaction:

The program overall?

rating

Reason for dissatisfaction:

Q5. What specific things does your company do differently in other Data Center projects because of your participation in the program?

- ☐ Use of free cooling
- ☐ Right sizing of equipment
- ☐ Central plant optimization
- ☐ Use of liquid cooling for racks and computers
- ☐ Arrange racks in hot aisle/cold aisle configuration
- ☐ Benchmarking/Continuous monitoring
- ☐ Require new equipment to meet a specified standard
- ☐ Changed purchasing policy to specify a level of payback for energy consuming equipment.
- ☐ Adopted design concepts applied in project completed under AEP Ohio program
- ☐ Model or estimate energy consumption and evaluate alternatives
- ☐ No changes
- ☐ Don't know
- ☐ Other

Q6. Can you offer any suggestions as to how the program application process could be improved?

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Q6a. Do you have any other suggestions on how the overall program could be improved?

Q7. What do you see as the main barriers to increasing the level of energy efficiency in Data Centers?

- ☐ Lack of understanding/information on energy efficiency options
- ☐ Additional Capital Cost of energy efficiency improvements
- ☐ Payback/Return on additional energy efficiency improvements
- ☐ Uncertainty about performance of efficiency improvements
- ☐ Concerns regarding the impact on reliability /up time or other aspects of performance
- ☐ Additional time commitment required to incorporate efficiency
- ☐ Split incentives (different firm paying to build building than firm that pays for energy costs)
- ☐ None
- ☐ Don't know
- ☐ Other, please specify:

Q8. Were the incentives offered under the program sufficient to make the project financially attractive?

- ○ Yes
- ○ No

Q9. Could you have achieved further energy savings if additional incentives had been available?

- ○ Yes
- ○ No

Q10. If this project involved a new Data Center, did your firm use the AEP Qualified Data Center Site program?
(*The Qualified Data Center Site Program is an AEP Economic and Business Development program that helps companies seeking a Data Center site by providing information on development-ready sites that have passed a rigorous independent qualification process*).

- ○ Yes
- ○ No

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Satisfaction with the Program

E1. How satisfied were you with the energy efficiency level 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"?

0 - Not at all Satisfied	1	2	3	4	5	6	7	8	9	10 - Completely Satisfied
○	○	○	○	○	○	○	○	○	○	○

E2. What would have made you more satisfied?

○ Nothing

○ Don't know

E2a. Why did you give that rating?

○ Don't know

E3. How satisfied were you with the amount of the incentive using a scale from 0 to 10, where 0 is "not at all satisfied" and 10 is "completely satisfied"?)

0 - Not at all satisfied	1	2	3	4	5	6	7	8	9	10 - Completely Satisfied
○	○	○	○	○	○	○	○	○	○	○

E4. How satisfied were you with the energy efficient equipment offered by the program using a scale from 0 to 10, where 0 is "not at all satisfied" and 10 is "completely satisfied"?)

0 - Not at all satisfied	1	2	3	4	5	6	7	8	9	10 - Completely Satisfied
○	○	○	○	○	○	○	○	○	○	○

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E5. What would have made you more satisfied with the energy efficient equipment?

○ Nothing

○ Don't know

E5a. Why did you give that rating?

○ Don't know

E6. In the course of participating in the AEP Ohio Data Center program, and other than sending in the incentive application, how often did you contact AEP Ohio or program staff with questions?

☐ Never

☐ Once

☐ 2 or 3 times

☐ Four times or more

☐ Don't know

Background About Your Firm

B1. What is your job title or role?

○ Chief Information Officer

○ Other IT management position

○ Facilities Manager

○ Energy Manager

○ Other facilities management/maintenance position

○ Chief Financial Officer

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- ○ Other financial/administrative position
- ○ President/CEO
- ○ Don't know
- ○ Refuse to answer
- ○ Other, please specify:

B2. Approximately how many data centers does your firm operate? How many are in AEP Ohio's service territory?

B3. What is the principal business activity / (type of business [COMPANY] of your firm?

- ○ Finance, Insurance or Real Estate
- ○ Retail or Wholesale Trade
- ○ Education
- ○ Hospitals/Medical
- ○ Accommodation or Food Service
- ○ Manufacturing
- ○ Non-manufacturing industry
- ○ Government
- ○ Communication, Transportation or Utilities
- ○ Other Services
- ○ Don't Know
- ○ Decline to answer
- ○ Other, please specify:

B4. What is the total square footage of the data center at this location? Your best estimate will be fine.

total sq.ft.

- ○ Don't know
- ○ Decline to answer

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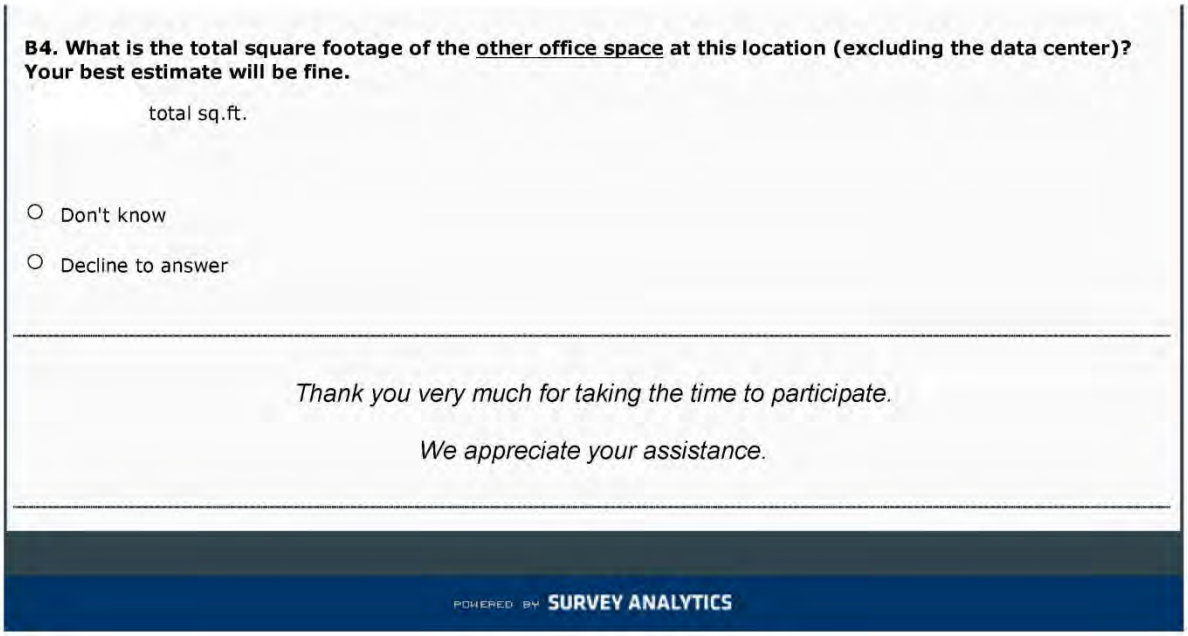

B4. What is the total square footage of the other office space at this location (excluding the data center)? Your best estimate will be fine.

total sq.ft.

○ Don't know

○ Decline to answer

Thank you very much for taking the time to participate.

We appreciate your assistance.

POWERED BY SURVEY ANALYTICS

APPENDIX P

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TRANSMISSION AND DISTRIBUTION AND INTERNAL SYSTEM EFFICIENCY IMPROVEMENTS PROGRAM

Program Year 2013 Evaluation Report

Prepared for:
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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 2013 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 Draft Ohio TRM evaluation protocols[1] 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 2010, accessed at: http://amppartners.org/pdf/TRM_Appendix_E_2011.pdf .

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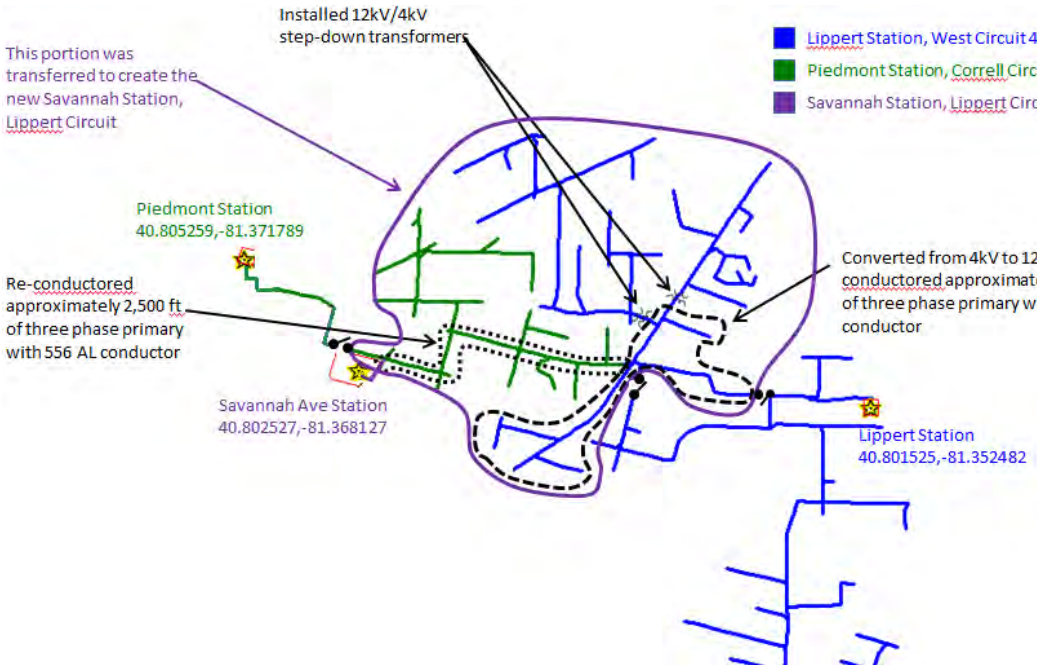
2 Methodology

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 1.

Figure 1. Example Project Diagram: Savannah Station, Lippert Circuit – Reconfigure & Reconductor



In this example, several sections of the Leppert circuit were reconductored and transferred to a new circuit, resulting in net peak loss savings of 25 kW. Per Navigant's request, AEP Ohio provided CYMDist

[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.

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.

$$\textit{Energy Loss Savings} = \textit{Peak Loss Savings} * (C_1 * LF + C_2 * LF^2) * 8760$$

Where LF is the feeder load factor, and C1 and C2 are coefficients derived using methods outlined in published industry literature. C_1 and C_2 for AEP Ohio are 0.1 and 0.9, respectively.[3]

The loss factor for the above 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.

[3] System Load Factor 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.

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3 Detailed Findings

Table 1 summarizes the peak demand and energy reductions for AEP Ohio.[4] Results are presented separately for distribution and transmission assets. 2013 reported loss savings are higher for transmission facilities. Table 3 (Appendix) presents reported demand and energy loss savings for specific T&D projects that AEP Ohio placed in service during 2013.

Table 1. Peak Demand and Energy Reductions

	Number of Projects	Peak (kW)	Energy (MWh)
Distribution	28	881	2,990,809
Transmission	48	10,100	35,924,000
TOTAL	76	10,981	38,914,809

3.1 Distribution Loss Savings

Navigant's review confirmed that AEP Ohio's composite peak demand savings of approximately 0.9 MW for distribution is reasonable and consistent with the level of savings associated with the 28 projects summarized above and listed individually in Table 3. 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. We note the amount of savings is approximately one-half of those reported in 2012. For most AEP Ohio distribution projects, loss savings are less than one percent of peak feeder load, in some cases, quite small. Nonetheless, these modest reductions are reasonable given the scope of each upgrade, and confirm that AEP Ohio exercised care to not overstate savings. 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.

3.2 Transmission Loss Savings

The magnitude of total loss savings (10.1 MW at peak) associated with transmission level is based on the combined savings associated with 48 projects or line segments that resulted in loss savings. Table 3 lists specific transmission projects and upgrades placed into service in 2013. Similar to 2012, transmission losses are well above distribution level savings. Notably, both the number of transmission projects and total savings is approximately twice the values reported in 2012. The higher level of transmission savings

[4] 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.

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(compared to distribution) 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 our 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.[5] 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.

[5] 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.

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Appendix A

Table 2 lists the T&D project types from the Draft Ohio TRM. Note that some project categories used in prior years did not apply in 2013 as no projects were undertaken; for example, no voltage conversion projects were completed in 2013. One new category, Capacitors & Power Factor Protocol, has been added since completion and reporting of 2012 program results.

Table 2. 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 3 lists the project name, scope, whether the project was either Transmission (T) or Distribution (D), the type of project in terms of the Draft Ohio TRM designations, and the peak demand reduction (kW) and the annualized loss reduction (kWh).

Table 3. AEP Ohio T&D Projects

Project	Scope	TRM Project Type	Peak Reduction (kW)	Annualized Loss Reduction (kWh)	Transmission or Distribution
OP – Decliff Station, West Circuit	Reconductoring	2	76.4	299,814	D
OP – Fremont Station, Industrial Park #2 Circuit	Reconductoring	2	33.8	132,471	D
OP – West End Station, East Circuit	Capacitors	8	1.0	3,844	D
OP – Berwick Station, West Circuit	Reconductoring	2	3.6	14,161	D
OP – Bucyrus Center Station, South Circuit	Reconductoring	2	3.6	14,122	D
OP – North Bucyrus Station, North Circuit	Reconductoring	2	0.4	1,569	D
OP – East Bucyrus Station, West Circuit	Reconductoring	2	0.4	1,687	D

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Project	Scope	TRM Project Type	Peak Reduction (kW)	Annualized Loss Reduction (kWh)	Transmission or Distribution
OP –Stadium Park Station, South Circuit	Reconductoring & Regulation	2, 6	18.9	74,336	D
OP – Walnut Creek Station, Walnut Creek	Reconductoring	2	17.7	69,589	D
OP – Reedurban Station, Raff Road Circuit	Reconductoring	2	16.6	65,157	D
OP – Savannah Station, Lippert Circuit	Reconductoring & Regulation	2, 6	25.3	99,206	D
OP – Savannah Station, Peidmont Circuit	Reconductoring & Reconfiguration	2, 6	43.2	169,423	D
OP – Gambier Station, Radio Hill Circuit	Reconductoring	2	80.3	314,917	D
OP – Pittsburgh Ave Station, Green Valley Circuit	Reconductoring	2	91.0	356,968	D
OP –Newark Station, Seroco Circuit	Reconductoring	2	2.0	7,845	D
OP –Sharon Valley Station, Sharon Valley	Reconductoring	2	0.6	2,197	D
CSP –Elk Station, Handen Dundas Circuit	Reconductoring	2	2.1	6,258	D
CSP –Lick Station, Northwest Circuit	Reconductoring	2	145.2	424,490	D
CSP –Rio Station, Porter Circuit	Reconductoring	2	11.3	33,071	D
CSP –Coolville Station, South Circuit	Reconductoring	2	50.8	148,427	D
CSP –Trimble Station, Murray City Circuit	Reconductoring	2	47.0	137,403	D
CSP –Kimberly Station, Chauncey Circuit	Reconductoring	2	48.4	141,584	D
CSP –Trimble Station, Glouster Circuit	Reconductoring & Reconfiguration	2, 6	36.2	105,823	D
CSP – Circleville Station, Thompson Circuit	Reconductoring	2	0.1	322	D
CSP –Circleville Station, Northeast Circuit	Load Balancing	6	6.1	17,808	D
CSP –Highland Station, North Hill Circuit	Reconductoring	2	42.9	125,414	D

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Project	Scope	TRM Project Type	Peak Reduction (kW)	Annualized Loss Reduction (kWh)	Transmission or Distribution
CSP –McDermott Station, McDermott Circuit	Multi-Phasing	6	8.3	24,328	D
CSP –Center St Station, State Route 93 Circuit	Reconductoring	2	67.9	198,575	D
Carrollton - Carroll Co-op 69kV Line, Petersburg: CONSTRUCT 69 KV LINE	Reconductoring	2	Included Below	Included Below	T
THORNVILLE - NEW LEXINGTON (Newark) 69KV: REBUILD 5.9 MI.	Reconductoring	2	Included Below	Included Below	T
Kalida - Auglaize 69 kV Line: Rebuild 23.7 Miles, Continental to Auglaize	Reconductoring	2	Included Below	Included Below	T
SUGARCREEK - RAY 34.5kV: REBUILD 5.7 MI. formerly SUGARCREEK - BALTIC 34.5kV	Reconductoring	2	Included Below	Included Below	T
Kalida - Auglaize 69kV Line: Retire & Remove	Reconductoring	2	Included Below	Included Below	T
North Newark - South Granville: reconductor 69kv line	Reconductoring	2	Included Below	Included Below	T
PAULDING - MARK CENTER 69KV: ROW FOR REBUILD 11.9 MI.	Reconductoring	2	Included Below	Included Below	T
Carroll Co-op 69kV Extension, Atwood: Build 69kV line extension to Atwood	Reconductoring	2	Included Below	Included Below	T
Desert Road - Petersburg 69kV line section Rebuild & Reconductor	Reconductoring	2	Included Below	Included Below	T
MT VERNON-HOWARD 69Kv REBUILD ACADEMIA-E FREDERICKSTOWN SW Str 96-155	Reconductoring	2	Included Below	Included Below	T
West Bellaire - Brues 138kV - String second W. Bellaire - Brues 138kV circuit on	Reconductoring	2	Included Below	Included Below	T
Miller - Jewett 69kV Line:Rebuild Miller-Jewett Section	Reconductoring	2	Included Below	Included Below	T
Crimm Road 69kV Extension: Tap line to provide service for M3	Reconductoring	2	Included Below	Included Below	T

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Project	Scope	TRM Project Type	Peak Reduction (kW)	Annualized Loss Reduction (kWh)	Transmission or Distribution
South Canton-Star 345kV Circuit: Reconductor entrance span on subject circuit	Reconductoring	2	Included Below	Included Below	T
Steamtown 138kV Loop - Service to Markwest Seneca	Reconductoring	2	Included Below	Included Below	T
Blackhawk 69kV Extn.: Create 69kV temporary loop to feed Markwest	Reconductoring	2	Included Below	Included Below	T
Cornerstone (Transco): Rebuild station on new site	Reconfiguration	6	Included Below	Included Below	T
Cornerstone: Purchase site for new station	Reconfiguration	6	Included Below	Included Below	T
Central Portsmouth: Inst 69 kV CBs for converted circuits	Reconfiguration	6	Included Below	Included Below	T
Millbrook Park: Transco Create 69 kV terminals for converted ckt Phase 1	Reconfiguration	6	Included Below	Included Below	T
Ruhlman: Convert to 69 kV-OP Work	Reconductoring	2	Included Below	Included Below	T
Millbrook-Offnere 69 kV Line: Reterminate at Cornerstone & Millbrook Park	Reconfiguration	6	Included Below	Included Below	T
Ruhlman-Cornerstone Circuit: Reterminate at Ruhlman	Reconfiguration	6	Included Below	Included Below	T
Waller-Central Portsmouth Line: install ADSS	Reconfiguration	6	Included Below	Included Below	T
Millbrook Park-Ruhlman Circuit: Reterminate	Reconfiguration	6	Included Below	Included Below	T
Ironton-Portsmouth 69 kV Line Entrnace span at Millbrook Park	Reconductoring	2	Included Below	Included Below	T
Millbrook Park-Ashley 69 kV Tie Line - Reterminate at MP	Reconfiguration	6	Included Below	Included Below	T
Tenth and Offnere Street: Retire/remove station	Reconfiguration	6	Included Below	Included Below	T

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Project	Scope	TRM Project Type	Peak Reduction (kW)	Annualized Loss Reduction (kWh)	Transmission or Distribution
Cornerstone - Distr Line work to tie into the new station	Reconfiguration	6	Included Below	Included Below	T
CORNERSTONE: STATION - REBUILD STATION ON NEW SITE	Reconfiguration	6	Included Below	Included Below	T
MILLBROOK PARK: CREATE 69 KV TERMINALS FOR Ruhlman	Reconfiguration	6	Included Below	Included Below	T
Central Portsmouth: Inst 69 kV CB for Ruhlman (Transco work)	Reconfiguration	6	Included Below	Included Below	T
Central Portsmouth: Phase 2 removal & install CB A and B	Reconfiguration	6	Included Below	Included Below	T
Millbrook Park: Phase 1 removal work	Reconfiguration	6	Included Below	Included Below	T
Millbrook Park: Phase 2 removal work & CB rehab	Reconfiguration	6	Included Below	Included Below	T
Scioto Trail (OP):	Reconfiguration	6	Included Below	Included Below	T
Remove Millbrook Park-New Boston Coke 34.5 kV line	Reconductoring	2	Included Below	Included Below	T
Ruhlman: Transco- Construct 69 kV through path with 69 kV breakers	Reconductoring	2	Included Below	Included Below	T
Millbrook Park-New Boston Coke 34.5 kV line Remove	Reconfiguration	6	Included Below	Included Below	T
Scioto Trail: Retirement and Removal	Reconfiguration	6	Included Below	Included Below	T
Millbrook Park: Haverhill & Bus Diff Relaying	Reconfiguration	6	Included Below	Included Below	T
Ruhlman :D Line work	Reconfiguration	6	Included Below	Included Below	T
Scioto Trail: D Line work	Reconfiguration	6	Included Below	Included Below	T
North Portsmouth: Station Protection Upgrades	Reconfiguration	6	Included Below	Included Below	T
North Portsmouth: Station Protection Upgrades	Reconfiguration	6	Included Below	Included Below	T
CORRIDOR: T1 REPL W/ 675 MVA	Reconductoring	2	Included Below	Included Below	T

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Project	Scope	TRM Project Type	Peak Reduction (kW)	Annualized Loss Reduction (kWh)	Transmission or Distribution
BEATTY ROAD: T3 REPL W/ 675 MVA & Replace Overdutied 138kV CBs	Reconductoring & Reconfiguration	2, 6	Included Below	Included Below	T
S BLOOMINGVILLE SW-ROSS 138kV 20.9MI OHTRANSCO	Reconductoring	2	10,100	35,924,000	T

Summary: Application (Part 3 of 3) electronically filed by Mr. Steven T Nourse on behalf of Ohio Power Company