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Industrial Systems Study Program
PY6 Evaluation Report

Final

Energy Efficiency / Demand Response Plan:
Plan Year 6
(6/1/2013-5/31/2014)

Presented to
Commonwealth Edison Company

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E. Executive Summary

This report presents a summary of the findings and results from the Impact Evaluation of the Commonwealth Edison Company's (ComEd) program year (PY6)[1] Industrial System program. The Industrial Systems Study Program, started in PY4 with Compressed Air Systems, and has expanded over the past three years to include process cooling and industrial refrigeration systems. The Industrial Systems Program offers a combination of technical assistance and financial incentives. Technical assistance includes an industrial systems study which assesses the performance of the facility's industrial compressed air, process cooling, and refrigeration systems to ensure efficient, economical operation. The study examines the systems' operating characteristics to help identify cost-effective energy saving measures, using a combination of capital investment and low or no cost measures.

E.1. Program Savings

Table E-1 summarizes the electricity savings from the Industrial Systems Program.

Table E-1. PY6 Total Program Electric Savings

Savings Category	Energy Savings (MWh)	Peak Demand Savings (MW)
Ex Ante Gross Savings	25,393	3.30
Verified Gross Savings	24,121	3.63
Verified Net Savings	17,902	3.01

Source: ComEd tracking data and Navigant team analysis.

Based on the gross impact sample size of 9 projects in PY6, the evaluation results yielded an energy gross realization rate of 0.95 and a peak demand gross realization rate of 1.10. The relative precision for the gross impact results at a one-tailed 90% confidence level is ± 2% for the energy realization rate and ±12% for the peak demand realization rate. For PY6, the evaluation verified net-to-gross ratio (NTGR) is 0.74 for energy savings and 0.83 for peak demand savings, and is based on a NTG analysis on an attempted census of projects completed in PY6. The relative precision for the evaluation verified net-to-gross ratio (NTGR) for energy savings at a one-tailed 90% confidence level is ±2%.

E.2. Participant Information

In total, 24 projects were completed in PY6. The table below presents the number of projects completed in PY6, along with the ex-ante gross kWh claimed and the ex-ante gross kW claimed for each sampling strata.

[1] The PY6 program year began June 1, 2013 and ended May 31, 2014.

Table E-2. PY6 Industrial Program Participation

Sampling Strata	Ex-ante kWh Impact Claimed	Ex-ante kW Impact Claimed	Completed Projects
1	10,441,820	966	2
2	8,063,426	1,113	6
3	6,887,612	1,221	16
TOTAL	25,392,858	3,300	24

Source: Evaluation Team analysis

E.3. Results Summary

The following table summarizes the key metrics from PY6.

Table E-3. PY6 Results Summary

Participation	Units	PY6
Net Savings	MWh	17,902
Net Demand Reduction	MW	3.01
Gross Savings	MWh	24,121
Gross Demand Reduction	MW	3.63
Program Realization Rate	#	0.95
Program Demand Realization Rate	#	1.10
Program NTG Ratio †	#	0.74
Program Demand NTG Ratio †	#	0.83
Compressed Air Projects Completed	#	16
Refrigeration Projects Completed	#	2
Process Cooling Projects Completed	#	5
Process Heating Projects Completes	#	1
Total Projects Completed	#	24

Source: ComEd tracking data and Navigant team analysis.
† A retrospective value. Source: ComEd PY5-PY6 Proposal Comparisons with SAG.xls, which is to be found on the IL SAG web site here: http://ilsag.info/net-to-gross-framework.html

E.4. Key Findings and Recommendations

The PY6 Industrial Systems program performed strongly, with a verified gross realization rate for energy of 0.95, and for demand of 1.10. The PY6 gross energy realization rate of 0.95 is greater than the PY5 0.88 realization rate. The PY6 energy realization rate results were adversely affected by a reduction in realized savings for project #17239. Due to this project, the measure operating conditions changed (centrifugal compressor was used as the base-loaded compressor instead of screw compressor) after the

ex-ante M&V analysis was completed. As a result, the evaluation team adjusted the calculation model to account for the representative operating conditions, which resulted in lower realized savings.

Overall, the program team did a good job of ensuring all the implemented measures were installed and operating as planned. The program team continues to collect site specific pre- and post-metered data for all projects which resulted in accurate estimation of savings. Additionally, the impact results make it evident that ComEd has followed the evaluation team's recommendations from previous years regarding carrying out data collection activities, normalizing models and implementing best practices for developing savings calculations, which are key to program's solid performance in PY6.

The following provides insight into key program findings and recommendations.[2]

Improvements to Demand Savings Calculations

Finding 1. Out of the nine projects sampled by the evaluation team, five projects reported average demand savings in the tracking data instead of PJM peak demand savings[3]. For four out of the five projects, peak demand savings were included in the calculations, but were not reported.

Recommendation 1. The program should ensure that they are both calculating and reporting savings for the PJM peak demand period and non-coincident demand in the tracking data.

Measurement and Estimation of Power Factor

Finding 2. There were some instances where the reported power factor was found to be significantly higher than the typical values for compressors and pump motors.

Recommendation 2. Power factor values used in savings calculations should be confirmed to fall within the typical range for industrial system equipment (compressor and pump motors). For power factor measurements that exceed typical or nameplate values, multiple spot measurements should be taken to confirm accuracy of the measurements. If an atypical power factor is still determined to be correct after due diligence is performed, sufficient documentation should be provided to support the out of range values. In the absence of metered data, motor or pump nameplate rated power factor, a typical value of 0.80 should be used for motor applications.

Data Collection Activities

Finding 3. Three of the seven compressed air system audits used ultrasonic leak detectors to identify leaks and estimate their leak rates. Using a leak detector to estimate leak rates may not be totally accurate because dB readings depend on several factors, including leak geometry that may not be captured. However, the dB readings do provide a level of objectivity that judging by feel doesn't. Additionally, the ultrasonic leak detector is likely to provide a more thorough check of the system as it is not affected by background noise and may be easier to use in tight spots than going by feel. Project #17236 did not use a detector and the average leak rate seemed fairly high, but the total volume of leaks detected for this

[2] Numbered findings and recommendations in this section are the same as those found in the Findings and Recommendations section of the evaluation report for ease of reference between each section.

[3] PJM defines the coincident summer peak period as the months of June through August, 1PM to 5PM Central Time on non-holiday weekdays.

project was only about 5% of the system average CFM. This total leak volume seems low relative to other typical systems.

Recommendation 3. Ultrasonic leak detectors should be used to identify and classify leaks for Compressed Air projects that involve a leak repair aspect to the project.

1 Introduction

1.1 Program Description

The ComEd Smart Ideas for Your Business program provides incentives for business customers who upgrade their facilities with energy efficient equipment. This incentive program is available to all eligible, nonpublic, commercial and industrial customers in ComEd's service territory. ComEd's Smart Ideas for Your Business suite of energy efficiency programs includes an Industrial Systems program. This program offers comprehensive studies of compressed air systems, industrial refrigeration systems, or process cooling systems.

The Industrial Systems Study portion of ComEd's Smart Ideas for Your Business program included only the compressed air system study in PY4. In PY5, the Industrial Systems Study program was expanded to include the study of process cooling systems and industrial refrigeration systems, which continued through PY6.

The Industrial Program offers a combination of technical assistance and financial incentives. Technical assistance includes an industrial systems study which assesses the performance of the facility's industrial compressed air system, process cooling system and refrigeration system to ensure efficient, economical operation. This service examines the system's operating characteristics to help identify energy saving measures, using a combination of capital investments and low or no cost measures. In addition to the study, ComEd provides a one-time incentive to cover the costs of the equipment and installation of the Implementation Bundle, which includes compressed air leak repair, installation of no-loss condensate drains, installations of high-efficiency air nozzles, and optimization of compressor operation controls. In addition to this, other measures not part of the Implementation Bundle may be eligible for a one-time incentive of $0.07 per annual kWh saved after proper implementation of recommendations identified through the Industrial Systems Program. Recommendations from the study are not eligible for any other ComEd incentive. Eligible annual kWh savings are determined through measurement and verification activities. The total incentive cannot exceed 100% of the total implementation costs and 100% of the total incremental costs for improvements recommended in the study.

1.2 Evaluation Objectives

The Evaluation Team identified the following key researchable questions for EPY6:

1.2.1 Impact Objectives

1. Estimate the gross impacts from the program.
2. Identify opportunities for improvement to program impact calculations and estimates.
3. Estimate the net impacts from the program.
4. Provide up-front evaluation input for large or complex projects before each application is finalized and paid by the program.

1.2.2 Process Objectives

The evaluation team did not conduct a process evaluation in PY6 and placed priority on the net and gross impact evaluation efforts in order to maximize the evaluation budget. Additionally, the evaluation team conducted process evaluations for PY4 and PY5 and did not see any significant procedural changes in PY6.

2 Evaluation Approach

Program Year 6 represents the second full year of implementation for the Industrial Program. For the PY6 evaluation, gross impact results were developed based on detailed M&V analysis for three projects and thorough desk reviews for another six projects. The evaluation team calculated the PY6 NTGR based on NTG research completed for an attempted census of PY6 projects. The verified gross savings estimates were multiplied by the researched NTGR to calculate the verified net energy and peak demand savings.

2.1 Overview of Data Collection Activities

The core data collection activities included on-site audits and desk reviews in support of gross impact analysis, and telephone surveys in support of NTG analysis. The full set of data collection activities is shown in the Table 2-1.

Table 2-1. Primary Data Collection Activities

What	Who	Target Completes	Completes Achieved	When	Comments
Onsite M&V Audit	Participants	3	3	May – November 2014	Sampled projects from Stratum 1 and 2
Desk Reviews	Participants	7	6	August – November 2014	Sampled projects from Stratum 2 and 3. Reviews include engineer conducted telephone interviews
Telephone Survey	Participants	Census (24 participants)	17	September – November 2014	Data collection supporting NTG research analysis.
Telephone Survey	Technical Service Providers	Census (18 TSPs)	16	September – November 2014	Data collection supporting NTG research analysis.

2.2 Verified Savings Parameters

The following table, Table 2-2, presents the parameters that were used in the verified gross and net savings calculations and indicates which were examined through evaluation activities and which were deemed.

Table 2-2. Verified Savings Parameter Data Sources

Input Parameters	Data Source	Deemed † or Evaluated?
Gross Energy Savings Realization Rate	PY6 Analysis	Evaluated
Gross Peak Demand Savings Realization Rate	PY6 Analysis	Evaluated
kWh Net-to-Gross Ratio (NTGR)	PY6 Analysis	Evaluated
kW Net-to-Gross Ratio (NTGR)	PY6 Analysis	Evaluated
Net Energy Savings	PY6 Analysis	Evaluated
Net Peak Demand Savings	PY6 Analysis	Evaluated

† Source: ComEd PY5-PY6 Proposal Comparisons with SAG.xls, which is to be found on the IL SAG web site here: http://ilsag.info/net-to-gross-framework.html

2.2.1 Verified Gross Program Savings Analysis Approach

The objective of the gross program savings evaluation is to verify the veracity and accuracy of the PY6 ex ante gross savings estimates in the Industrial Systems program tracking system. The PY6 evaluation activities included on-site M&V analysis for three projects and desk reviews for six projects. The savings reported for the completed PY6 projects were evaluated using the methods outlined directly below.

On-site data collection included verification of measure installation, functioning system and planned system operation, and specific details of any variation between the ex ante and ex post verifications. On-site audits also entailed collection of customer-stored data to support downstream M&V calculations. Measurement data obtained from the sites, including spot measurements, run-time hour data logging, and post-installation interval metering, were used to calibrate the site-specific analyses. Customer-supplied data from energy management systems (EMS) or supervisory control and data acquisition (SCADA) systems were also obtained when available.

Desk reviews involved a review of project documentation provided by the program, an engineering review of the algorithms and an audit of ex ante calculation models used by the program to estimate energy and peak demand savings. The engineering audit of program calculations determined if the inputs for the program calculations were reasonable and acceptable or if they needed any revisions based on evaluation findings. In addition to the desk reviews, the evaluation team completed telephone interviews with the site contacts for each site and the information collected during these interviews was used to verify the savings estimates. The site contacts were also requested to provide post-installation operating data electronically. The information collected was used to inform evaluation savings calculations.

Engineering calculations were performed to derive evaluated gross kWh and KW savings. These calculations started with an engineering audit of the algorithms used by the program to calculate energy savings and the inputs that feed into those algorithms. The engineering review also included a preliminary judgment to identify those assumptions with higher uncertainty or potential to influence the program savings estimate. The data collected was to verify and/or update the assumptions that feed into engineering algorithms of measure level savings. Data obtained from the sampled sites served to verify measure installation, determine installed measure characteristics, assess operating hours and relevant modes of operation, identify the characteristics of the replaced equipment, support the selection of

baseline conditions and perform ex-post savings calculations. The peak kW savings calculation methodology was consistent with PJM requirements[4] for each project. The final step involved discussion of project-level results with the implementation teams and ComEd's program staff to ensure that both the evaluation team and the implementation teams are in agreement about their understanding of the project scope and details.

A verified gross realization rate was then estimated for the sampled sites, weighted by sampling stratum, and applied to the entire population of projects. The result is a verified gross savings estimate for the Industrial Systems Program. Additional details on the sampling approaches that are described in greater detail in Section 2.3 below.

2.2.2 Verified Net Program Savings Analysis Approach

The primary objective of the net savings analysis was to determine the program's net effect on customers' electricity usage. After gross program impacts have been assessed, net program impacts are derived by estimating a NTGR that quantifies the percentage of the gross program impacts that can reliably be attributed to the program. A customer self-report method, based on data gathered during participant phone surveys, was used to estimate the NTGR for this evaluation.

Verified net energy and coincident peak demand savings were calculated by multiplying the verified gross savings estimates by the calculated NTGR. In PY6, the NTGR values used to calculate the verified net savings were based on the NTG research conducted for an attempted census of completed projects. This NTGR method was approved at the Illinois Stakeholders Advisory Group (SAG) and documented.[5]

NTG research methods in PY6 consisted of participant and technical service provider survey data collection and analysis. Research for both groups used a self-report survey-based method in which participants and technical service providers were asked a series of questions designed to assess the influence of program and non-program factors on their decisions to implement and offer energy efficient industrial systems measures, respectively. The participant survey instrument researched the participants' awareness of the installed measures prior to their participation in the program, and their previous use of those measures outside the program.

For PY6, the net program impacts were quantified solely on the estimated level of free-ridership. Information regarding participant spillover was also collected, but ultimately did not support a finding of any spillover.

The determination of free ridership requires estimating what would have happened in the absence of the program. Responses from the survey are used to calculate a Program Components score, a Program Influence score and a No-Program score for each project covered through the survey. These three scores can take values of 0 to 10 where a lower score indicates a higher level of free-ridership. The calculation then averages those three scores to come up with a project- or measure-level net-to-gross ratio.

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[4] PJM defines the coincident summer peak period as 1:00-5:00 PM Central Prevailing Time on non-holiday weekdays, during the months of June through August.

[5] Source: ComEd PY5-PY6 Proposal Comparisons with SAG.xls, which is to be found on the IL SAG web site here: http://ilsag.info/net-to-gross-framework.html

Further details on the scoring approach used to calculate free-ridership from data collected through participant telephone surveys are provided in the Appendix, in Table 6-1.

Once free-ridership has been estimated, the project or measure level Net-to-Gross Ratio (NTGR) is calculated as 1 – Free-ridership Rate.

Technical Service Provider (TSP) interviews and project summaries provided by program staff were also used to provide context.

2.3 *Sampling*

2.3.1 Profile of Population

ComEd's Frontier tracking extract dated November 30, 2014 contains data for all the completed projects in PY6. A total of 24 projects were completed in PY6. Of these 24 projects, one company was responsible for completing three projects; one compressed air, one process cooling, and one process heating. One additional project was considered a "split project", meaning part of the project was finished in PY6 and the rest of the project will be claimed in PY7. Table 2-3 presents information for each of three strata developed for sampling within the Industrial Program. The number of projects is presented by strata, along with ex-ante gross kWh claimed and ex-ante gross kW claimed.

Table 2-3. PY6 Industrial Program Participation by Sampling Strata

Sampling Strata	Ex-ante kWh Impact Claimed	Ex-ante kW Impact Claimed	Completed Projects
1	10,441,820	966	2
2	8,063,426	1,113	6
3	6,887,612	1,221	16
TOTAL	25,392,858	3,300	24

Source: Evaluation Team analysis based on ComEd tracking database, November 30, 2014.

2.3.2 Gross Impact (M&V) Sample

Consistent with the evaluation plan, a stratified random sampling approach was used to select the gross impact sample of 10 projects. Projects were sorted and placed in three strata using ex-ante savings kWh.

Table 2-4 provides a profile of the gross impact sample in comparison with the program population. The original sample consisted of 10 applications, responsible for 18.8 million kWh and represented 74% of the program population's ex-ante impact claim. However, during the evaluation phase, it was determined that one facility from the sample was closed. The evaluation team decided to remove this site from the sample as facility closure is treated as a persistence issue and should not be factored into the calculation of first year savings. Removing this site from the sample resulted in nine applications (reduced from 10). The three strata accounted for more than 18 million kWh of ex-ante impact claim and represented 71% of the program population's ex-ante energy impacts. The ex-ante based kWh sample weights for the three strata are shown below.

Table 2-4. PY6 Gross Impact Sample by Strata

Sampling Strata	Population Summary			Gross Impact Sample		
	Number of Tracking Records (N)	Ex Ante kWh Impact Claimed	kWh Weights	Number of Tracking Records (n)	Ex Ante kWh	Sampled % of Population kWh
1	2	10,441,820	0.41	2	10,441,820	100%
2	6	8,063,426	0.32	4	5,818,498	72%
3	16	6,887,612	0.27	3	1,741,806	25%
TOTAL	24	25,392,858	-	9	18,002,124	71%

Source: Evaluation Team analysis

2.3.3 Net Impact Sample

Per the evaluation plan, the target for the participant and technical service providers' surveys were census attempts for the Industrial Systems program in PY6. Data from these surveys were in support of the Net-to-Gross component of the evaluation.

Profile of the Net Impact Sample

Table 2-5 summarizes the participating customer telephone interviews completed in support of the PY6 NTG research efforts. The completed interviews represent 21.4 million kWh or 84% of the ex ante impact claim for the total program population.

Per the evaluation plan, the sampling approach for the participant survey conducted in support of the net-to-gross component of the impact evaluation was a census attempt. Out of the 24 participants in PY6, telephone surveys were conducted with 17 participants. The remaining 7 participants were not interviewed for a variety of reasons: being unable to reach anyone willing to complete a survey after multiple attempts at three of the businesses, one was a shut-down facility, two were multiple projects completed by one participant (we completed an interview for one of the projects), and one was a split project that will be interviewed as part of the PY7 evaluation.

Table 2-5. PY6 Net Impact Sample by Strata

Sampling Strata	Population Summary			Completed Interviews		
	Number of Tracking Records (N)	Ex Ante kWh Impact Claimed	kWh Weights	Number of Tracking Records (n)	Ex Ante kWh	Sampled % of Population kWh
1	2	10,441,820	0.41	2	10,441,820	100%
2	6	8,063,426	0.32	4	5,818,498	72%
3	16	6,887,612	0.27	11	5,177,620	75%
TOTAL	24	25,392,858	-	17	21,437,938	84%

Source: Evaluation Team analysis

A census attempt was made in interviewing the Technical Service Providers (TSPs) associated with PY6 Industrial Systems projects. Of the 18 unique PY6 TSPs the evaluation team was able to complete interviews with 16 of them.

3 Gross Impact Evaluation

The evaluation team reviewed ComEd's tracking data extract to determine reported PY6 ex ante gross savings. The verified gross program impacts for the evaluation of the Industrial System program were developed based on the on-site M&V analysis for three sites and engineering desk reviews for seven projects.

3.1 Tracking System Review

ComEd provided the evaluation team with direct access to their on-line tracking system and data for evaluation purposes. The on-line system was easy to work with and provided viewing access to the project tracking data plus downloading rights to project documentation in electronic format for each project. This documentation was complete and greatly facilitated the evaluation efforts.

Key findings include:

1. In addition to projects belonging to the Industrial Systems program, the tracking database extract included projects from other programs. In many cases it was not immediately apparent how a given project/record was aligned with a specific program.
2. Tracking data does not report their project by the three project end-use types; Compressed Air, Process Cooling, and Industrial Refrigeration. ComEd should include a field in the tracking database, similar to the one used in the Frontier database, to identify the program name and end use types for all projects so that the evaluation team and the program staff can clearly identify the projects from the Industrial Systems program vs. projects from other programs.

3.2 Gross Program Impact Parameter Estimates

Gross program impacts for this evaluation of the Industrial Systems Study Program were developed based on the on-site visits including detailed M&V analysis for three projects and thorough engineering desk reviews supported with telephone interviews for six projects. The verified gross impact results for PY6 are shown in Table 3-1 below.

Table 3-1. Verified Gross Savings Parameters

Input Parameters	Value	Deemed or Evaluated?
Energy Savings Realization Rate	0.95	Evaluated
Peak Demand Savings Realization Rate	1.10	Evaluated

Source: Evaluation Team analysis

There are two basic statistical methods for combining individual gross realization rates from the sample projects into an estimate of verified gross kWh savings for the population when stratified random sampling is used. These two methods are called "separate" and "combined" ratio estimation.[6] In the case of a separate ratio estimator, a separate gross kWh savings realization rate is calculated for each stratum

[6] A full discussion and comparison of separate vs. combined ratio estimation can be found in Sampling Techniques, Cochran, 1977, pp. 164-169.

and then combined. In the case of a combined ratio estimator, a single gross kWh savings realization rate is calculated directly without first calculating separate gross realization rates by stratum.

The evaluation team used the separate ratio estimation technique to estimate verified gross impacts for the Industrial System Study program. The separate ratio estimation technique follows the steps outlined in the California Evaluation Framework[7] which identified best practices in program evaluation. These steps are matched to the stratified random sampling method that was used to create the sample for the program. The standard error was used to estimate the error bound around the estimate of verified gross impacts.

3.3 *Verified Gross Program Impact Results*

Based on the gross impact sample size of nine projects in PY6, the evaluation results yielded energy gross realization rate of 0.95 and demand gross realization rate of 1.10, as indicated in Table 3-1. The resulting total program verified gross savings is 24,128,906 kWh and 3,621 kW as shown in Table 3-2.

Table 3-2. Gross Parameters and Savings Estimates

Sampling Strata	Ex Ante kWh	Evaluation Verified kWh	kWh RR	Ex Ante kW	Evaluation Verified kW	kW RR
1	10,441,820	10,405,628	1.00	966	1,059	1.10
2	8,063,426	7,125,231	0.88	1,113	1,003	0.90
3	6,887,612	6,590,348	0.96	1,221	1,566	1.28
TOTAL	25,392,858	24,121,207	0.95	3,300	3,628	1.10

Source: Evaluation Team analysis

The PY6 gross energy realization rate of 0.95 is higher than the 0.88 realization rate in PY5. The PY6 energy realization rate results were adversely affected due to reduction in realized savings for a single project: Project #17239. For this project, the measure operating conditions changed (centrifugal compressor was used as the base-loaded compressor instead of screw compressor) after the ex-ante M&V analysis was completed. As a result, the evaluation team adjusted the calculation model to account for the representative operating conditions, which resulted in lower realized savings.

The two stratum 1 projects account for 58% of the sampled savings participated in detailed M&V onsite evaluations. The stratum 1 large projects realization rate of 1.0 reveal that the calculation methods used for both of these projects were consistent and accurate. The results of these stratum 1 projects were significant in driving the program realization rate higher.

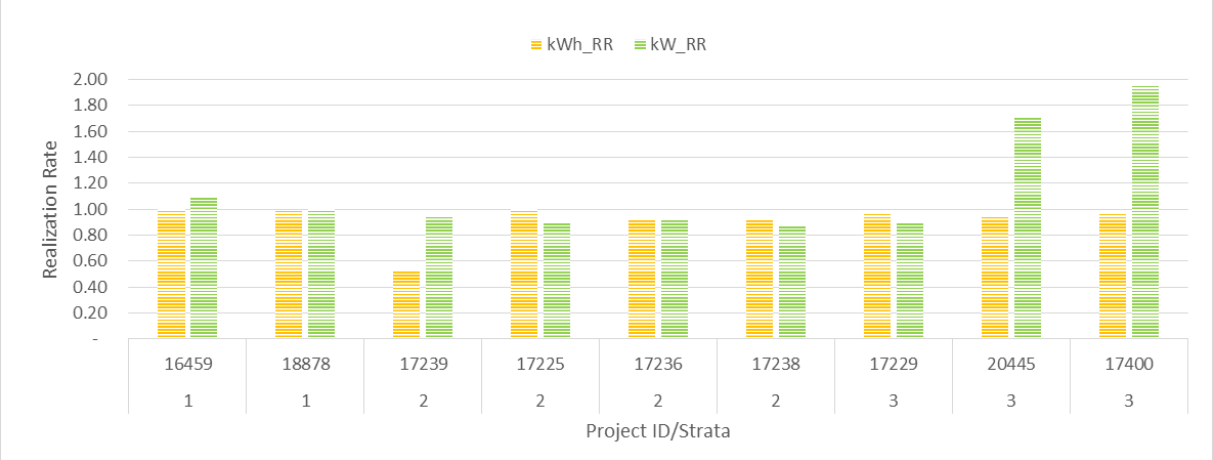
Strata 2 projects' energy and demand realization rates of 0.88 and 0.90, respectively, were lower than stratum 1 realization rates. The lower realization rate for this stratum was primarily due to the project #17239. As discussed previously, the change in operating conditions (i.e., shift in base load compressor used by the facility) resulted in a significant reduction of savings.

[7] Tec Market Works, "The California Evaluation Framework," Prepared for the California Energy Commission, June 2004. Available at http://www.calmac.org

Stratum 3 projects had a large discrepancy between energy and demand realization rates of 0.96 and 1.28, respectively. One common factor between the three projects was related to the PJM peak demand versus annual average demand savings. All three Strata 3 sites reported annual average peak demand savings instead of PJM peak demand savings. For two out of the three sites, the *ex-ante* PJM peak demand savings were calculated, but not reported, and incorporating these results in a drop in an un-weighted demand savings realization rate of six percent. The other largest factor in the discrepancy between energy and demand realization rates for Strata 3 comes down to a single project: Project #20445, which showed a difference between energy and demand realization rates of over 75%. There were several project-specific issues surrounding this project that are briefly explained at the end of this section.

Figure 3-1 below shows a comparison of the energy and demand realization rates for every site, broken down by strata. The PY6 energy savings realization rate results ranged from 0.52 to 1.00 which shows a large variation in realization rates across projects. For five out of the nine projects, the gross energy realization rate was greater than program mean realization rate (0.95) and for the remaining four projects the gross energy realization rate was less than program mean realization rate.

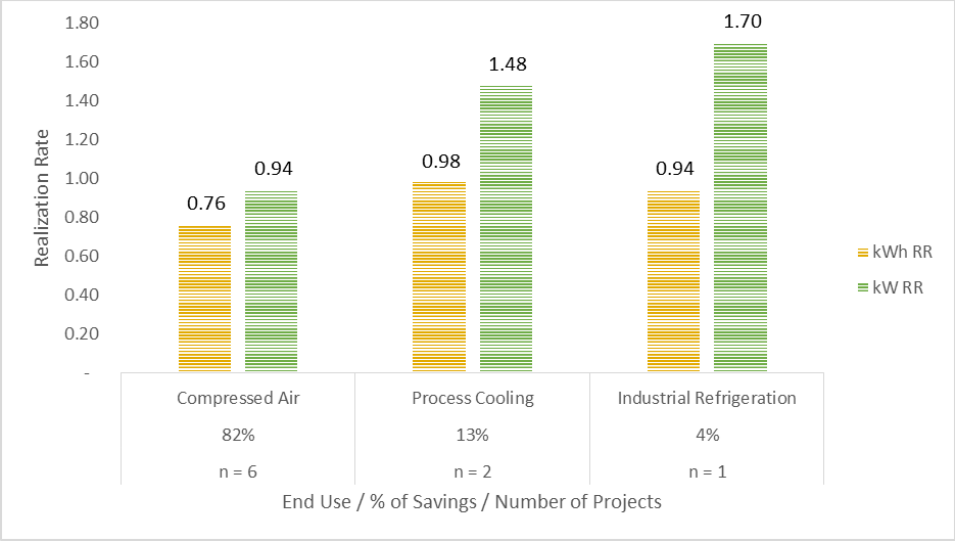
Figure 3-1. Energy and Demand Realization Rates by Project ID and Strata



Source: Evaluation Team analysis

Although the Industrial Systems program provides incentives for energy efficiency in process cooling systems, industrial refrigeration systems, and compressed air systems, the largest portion of the sample energy savings came from compressed air projects (82%), followed by process cooling (13%), and finally industrial refrigeration (4%), as seen below in Figure 3-2. The energy savings realization rate was below 1.00 for all end-uses. The process cooling and industrial refrigeration end-uses showed demand realization rates of much higher than 1.0. The two Strata 3 sites that were process cooling or industrial refrigeration end-uses were found to have reported the average annual demand savings, rather than the peak demand savings.

Figure 3-2. Un-weighted Energy and Demand Realization Rates by End-Use



Source: Evaluation Team analysis

The results of each project are summarized in Table 3-3. Some key observations from the site specific evaluation results include the following:

- Project #17239: The *ex-ante* post-retrofit compressor setup for this site had an existing 300HP screw compressor as the base-loaded compressor, with the new 100HP compressor acting as the trim compressor. A third, existing 350HP centrifugal compressor was left in place, as backup. During the *ex-post* verification, it was confirmed that the 350HP centrifugal compressor was actually used as the base-loaded compressor with the 300HP screw compressor used as backup, as the system average CFM demand was higher during the *ex-post* evaluation.
- Project #17238: The savings at this site were attributed to repairing leaks in the compressed air system, instead of purchasing a new compressor. The savings gap between *ex-ante* and *ex-post* results for this site were a result of the difference in vacuum power claimed. The *ex-ante* calculations used the power from the existing pumps to calculator the savings, while the *ex-post* results assumed the specific power of a new pump, as that is what would have been installed in the absence of the leak repairs being performed.
- Project #20445: The first change in calculations made by the evaluation team was a review of power factors. While some power factors were reported to be measured, others did not state their source, so the *ex-post* calculations adjusted the unsourced PF's to average of the measured PF's at the site... The *ex-ante* calculations also did not take into account motor efficiency in their compressor power (kW) usage. Finally, the *ex-ante* calculations reported an average demand, rather than a peak demand.
- Project #17400: A power factor discrepancy was the reason for the majority of the savings discrepancy for the energy calculations. The demand calculations however, reported the average demand savings instead of the peak demand savings in their *ex-ante* calculations. Additionally, *ex-ante* peak savings are based on the monthly maximum temperature with a 5% safety factor applied.
- Project #17223: This facility was closed in September, 2014. Evaluation team conducted a basic desk review and found no issues with the savings calculations (resulting in a RR of 1.0). Since facility closure is treated as a persistence issue, this site was removed from the sample.

Table 3-3. Gross Impact Realization Rate Results for the Selected Industrial Systems Study Sample

Sampled Application ID	Sample-Based Ex-ante Impact Claimed		Sampling Strata	Ex Ante-Based Gross Impact Weights by Strata	Sample-Based Evaluation Verified Gross Impact		Application -Specific Evaluation Verified Gross Realization Rate		Sample-Based Evaluation Verified Gross Realization Rate	
	kWh	kW		kWh	kWh	kW	kWh	kW	kWh	kW
16459	8,375,422	956	1	0.80	8,375,422	1048.70	1.00	1.10	1.00	1.10
18878	2,066,398	10	1	0.20	2,030,206	10.00	0.98	1.00		
17239	819,375	76	2	0.14	427,155	71.40	0.52	0.94	0.88	0.90
17225	1,593,004	196	2	0.27	1,593,004	176.30	1.00	0.90		
17236	1,745,728	199	2	0.30	1,608,498	184.30	0.92	0.92		
17238	1,660,391	254	2	0.29	1,512,848	220.80	0.91	0.87		
17229	652,912	78	3	0.37	630,550	69.90	0.97	0.90	0.96	1.28
20445	766,245	35	3	0.44	721,360	59.50	0.94	1.70		
17400	322,649	22	3	0.19	314,721	43.43	0.98	1.96		
TOTAL	18,002,124	1,825	-	NA	17,213,764	1,884	NA	NA	0.95	1.10

Source: Evaluation Team analysis

The relative precision for the gross impact results at one-tailed 90% confidence level is ±2% for the kWh realization rate and ±13% for the kW realization rate. The evaluation kWh realization rate of precision of ±2% achieved in this evaluation is better than the evaluation targeted kWh realization rate precision of ±10% at one-tailed 90% confidence level which set forth in the PY6 Industrial Systems Program Evaluation Plan. The results by stratum are summarized in Table 3-4 and Table 3-5 below. For stratum 3 the relative precision for gross demand realization rate is low due to the high variability of site level gross realization rates.

Table 3-4. Gross kWh Realization Rates and Relative Precision at 90% Confidence Level

Sampling Strata	Relative Precision ± %	Low	Mean	High
1	0%	1.00	1.00	1.00
2	6%	0.83	0.88	0.94
3	1%	0.95	0.96	0.97
TOTAL	2%	0.93	0.95	0.97

Source: Evaluation Team analysis

Table 3-5. Gross kW Realization Rates and Relative Precision at 90% Confidence Level

Sampling Strata	Relative Precision ± %	Low	Mean	High
1	0%	1.10	1.10	1.10
2	1%	0.89	0.90	0.91
3	29%	0.91	1.28	1.66
TOTAL	13%	0.96	1.10	1.24

Source: Evaluation Team analysis

The evaluation team has provided ComEd with site-specific M&V reports for each verified project. These site-specific impact evaluation reports summarize the ex-ante savings in the final application submitted, the ex post M&V plan, the data collected at the site, and all of the calculations and parameters used to estimate savings.

Overall, the program team did a good job of ensuring all the implemented measures were installed and operating as planned. The program team continues to collect site specific pre- and post-metered data for all projects which resulted in accurate estimation of savings. Additionally, the impact results make it evident that ComEd has followed the evaluation team's recommendations from previous years regarding data collection activities, normalizing models and best practices for developing savings calculations which are key to program's solid performance in PY6.

4 Net Impact Evaluation

The SAG has determined that the NTGR for this program should be based on primary research during the current program year and applied retrospectively to determine verified net savings.[8]

As described in Section 2.2.2, free-ridership was estimated using a self-report method that relies on data obtained from participating customer and participating technical service provider surveys. A project and/or measure-specific Net-to-Gross ratio (NTGR) was calculated for each site. The PY6 project-specific and stratum level NTGRs are shown in Table 4-1.

Table 4-1. PY6 NTGR Results for the Industrial Systems Study Sample

Project ID*	Sampling Strata	Project Specific Energy NTGR	Sample-Based Research Findings kWh NTGR	Sample-Based Research Findings kW NTGR
PY6 – 01**	1	0.83	0.72	0.82
PY6 – 02**	1	0.29		
PY6 – 03**	2	0.88	0.76	0.76
PY6 – 04**	2	0.78		
PY6 – 05**	2	0.68		
PY6 – 06**	2	0.76		
PY6 – 07**	3	0.82	0.75	0.90
PY6 – 08**	3	0.58		
PY6 – 09**	3	0.78		
PY6 – 10	3	0.89		
PY6 – 11	3	0.90		
PY6 – 12	3	0.67		
PY6 – 13	3	0.83		
PY6 – 14	3	0.43		
PY6 – 15	3	***		
PY6 – 16	3	0.97		
PY6 – 17	3	0.67		
Total	N/A	N/A	0.74	0.83

Source: Evaluation Team analysis

* Actual Project IDs are not provided to protect customer confidentiality.

**Overlaps with gross impact sample.

***NTG score removed because of inconsistent answers.

A ratio estimation technique was used to estimate the program-level NTGR, based on the steps outlined in the California Evaluation Framework. The standard error was used to estimate the error bound around the estimate of the verified evaluation NTGR. The program level kWh and kW NTGR, along with confidence intervals and precision estimates, are shown in Table 4-2 (kWh impacts) and in Table 4-3 (kW impacts).

[8] Source: ComEd PY5-PY6 Proposal Comparisons with SAG.xls, which is to be found on the IL SAG web site here: http://ilsag.info/net-to-gross-framework.html

Spillover was also researched in this evaluation and the magnitude was found to be quite small as discussed below in the spillover section. *Therefore, a quantification of spillover was not included in the calculation of NTGR for PY6.*

Table 4-2. kWh NTGR and Relative Precision at 90% Confidence Level

Sampling Strata	Relative Precision ± %	Low NTGR	Mean NTGR	High NTGR
1	0%	0.72	0.72	0.72
2	3%	0.74	0.76	0.79
3	5%	0.71	0.75	0.79
TOTAL	2%	0.73	0.74	0.76

Source: Evaluation Team analysis

Table 4-3. kW NTGR and Relative Precision at 90% Confidence Level

Sampling Strata	Relative Precision ± %	Low NTGR	Mean NTGR	High NTGR
1	0%	0.82	0.82	0.82
2	3%	0.74	0.76	0.78
3	4%	0.86	0.90	0.94
TOTAL	2%	0.81	0.83	0.85

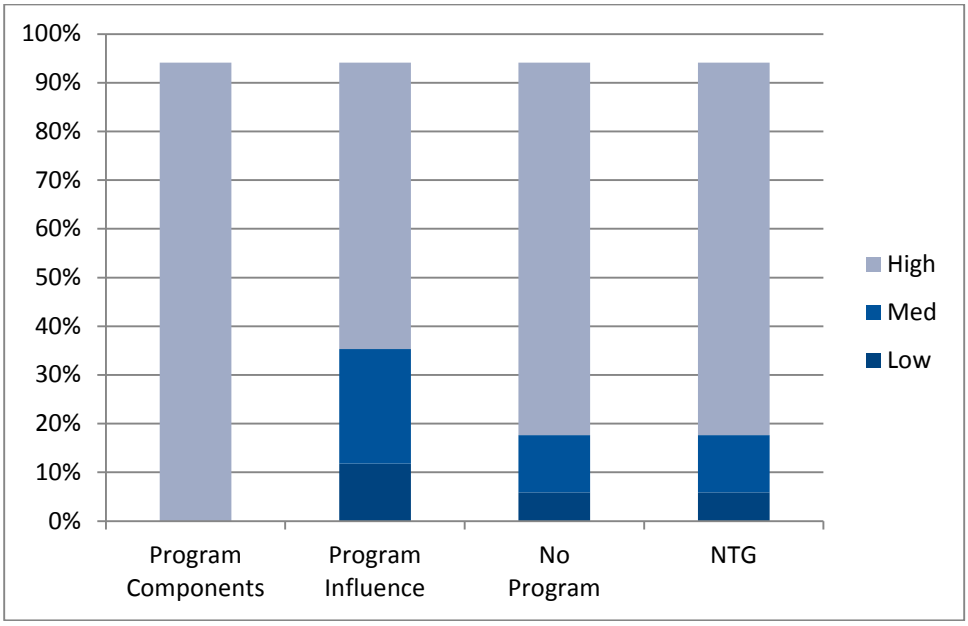
Source: Evaluation Team analysis

Observations regarding PY6 NTGR findings. Overall, the program influence has improved in PY6 based on the Evaluation Research Findings kWh NTGR of 0.74, compared to the PY5 kWh NTGR of 0.68. The energy NTGR scores for the three sampling strata are 0.72 for stratum 1 (large sized projects), 0.76 for stratum 2 (medium sized projects), and 0.75 for stratum 3 (small sized projects).

Significant free-ridership (at or above 40%) was found in three out of 17 evaluated projects, of which one project had a resulting NTGR below 0.30. One project had received incentives from both ComEd and North Shore Gas Company, based on the electricity and natural gas savings impacts, respectively. Since the majority of the savings were therm-based, the incentive from North Shore Gas accounted for 71% of the total received, while ComEd's portion accounted for 29%. Prior to pro-ration based on each firm's shares of incentive funding, the initial NTGR was set to 1.0. A multiplier of 0.29 was then applied based on ComEd's contribution. This "sharing savings" approach is also used in Wisconsin in cases where project incentives are co-funded by more than one source. Two other projects with substantial free-ridership had low No-Program[9] scores revealing that absent the program, the customer would have been very likely to install the same measures at the same time on their own.

As shown in Figure 4-1, relatively high and relatively low NTG scores in the sample were not directly affected to the same extent by the Program Influence and Program Components[10] score. That is, the correlation between the Program Influence and Program Components scores and resulting NTGR was not as significant as was the correlation with the No-Program score and the resulting NTGR.

Figure 4-1. NTG Component Scores



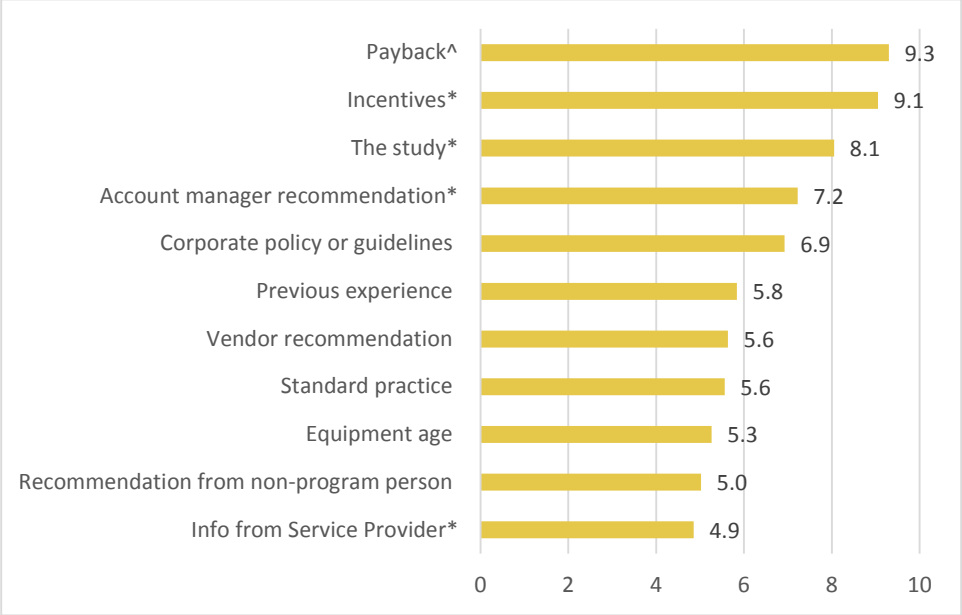
Source: Evaluation Team analysis

Figure 4-1 provides a breakdown of each of the three scores used to calculate the NTGR based on the distribution of values reported for each project. Overall free-ridership in the Industrial Systems Program is relatively low. In cases with partial free-ridership, a number of different reasons existed. Three customers reported that one of the measures they installed would have been installed at the same time in the absence of the program, resulting in a low No-Program score. Further, when PY6 participants were asked to divide 10 points between the importance of the Program versus the most important of the non-program factors in their decision to implement the measure, three out of 17 participants rated the non-program factors higher than the program factors, resulting in a low Program Influence score.

Further, Figure 4-2 presents the average scores for each Program Components score element in the telephone survey. Most of the program elements were rated high, while non-program elements were rated lower. The payback and program incentives were rated highest on average (9.3 and 9.1, respectively), followed by technical assistance provided by the ComEd sponsored study (8.1) and recommendation from an account manager (7.2). In contrast, the only program element that rated somewhat low was the information provided by the Service Provider, at an average of 4.9.

[10] A Program Components score reflects the importance of various program-related and non-program elements in the customer's decision and timing of the decision in selecting specific program measures.

Figure 4-2. Average Ratings of Program Component Elements



Source: Evaluation Team analysis

* Program related elements

^ Payback can be a program or a non-program related element depending on whether the incentive helped the participant meet their payback requirements or not.

4.1 Spillover

Spillover effects were also investigated in the PY6 evaluation based on responses to a battery of spillover questions in the telephone survey. The evidence of spillover for the program is presented in Table 4-4 below. These results ultimately did not support any quantification of spillover savings.

Table 4-4. Evidence of Spillover in PY6

Spillover Question	Evidence of Spillover
Since your participation in the ComEd program, did you implement any additional energy efficiency measures at this facility that did NOT receive incentives through any utility or government program?	Of the 17 surveyed customers that responded to this question, 3 said "Yes" (18%). These 3 respondents implemented a total of 3 energy efficiency measures.
What type of energy efficiency measure was installed without an incentive?	(1) Compressed air project that did not qualify (1) Cooling towers to reduce load on chillers (1) Additional vacuums with controls
On a scale of 0 to 10, where 0 means "not at all significant" and 10 means "extremely significant," how significant was your experience in the ComEd program in your decision to implement this energy efficiency measures?	For the 3 implemented measures: (2) Rating between 0 and 3 (1) Rating between 4 and 6 (0) Rating between 7 and 10

Source: Evaluation Team analysis

These findings suggest that there are no spillover effects for PY6. While participating customers are installing other energy efficiency improvements outside of the program, they attribute little to no influence to the program in their decision to install these additional measures. The evaluation team will collect spillover data in this same manner in the PY7 evaluation. The decision to conduct additional evaluation activities to quantify spillover in PY7 will be examined as part of the evaluation planning effort.

4.2 Evaluation Research Findings Net Program Impact Results

Net program impacts were derived by multiplying the evaluation research findings gross program savings by the evaluation research findings NTGR. The evaluation calculated verified net savings is shown in Table 4-5 below.

Table 4-5. PY6 Verified Net Impact Savings Estimates

Savings Source	Sample Size	Energy Savings (MWh)	Significance 90/10	Coincident Peak Demand Savings (MW)	Significance 90/10
Ex Ante PY6 Gross Savings	24	25,393	Yes	3.30	Yes
Realization Rate	9	0.95	Yes	1.10	Yes
Verified Gross Savings	24	24,121	Yes	3.63	Yes
Free Ridership	17	0.26	Yes	0.17	Yes
Spillover	17	0.00	Yes	0.00	Yes
NTG	17	0.74	Yes	0.83	Yes
Verified Net Savings	24	17,902	Yes	3.01	Yes

Source: Evaluation Team analysis

Table 4-6 and Table 4-7 provide the strata-level evaluation verified net impact results for the PY6 program. Strata-level NTG ratios are weighted by ex-ante savings to calculate program-level NTG ratios for kWh and kW. This weighting scheme is consistent with the sampling method used. Since the NTGR results are weighted by ex-ante savings, the strata level net kWh results do not add up to the total program net kWh results. The strata-level net kWh will only add up to the total if they are weighted by ex-post gross, but this would be inconsistent with the sampling method used.

Table 4-6. Program-Level Evaluation Verified Net kWh Impacts

Sampling Strata	Ex Ante Gross kWh	Research Findings Gross kWh	Research Findings kWh RR	Research Findings Net kWh	Research Findings NTGR
1	10,441,820	10,405,628	1.00	-*	0.72
2	8,063,426	7,125,231	0.88	-*	0.76
3	6,887,612	6,590,348	0.96	-*	0.75
TOTAL	25,392,858	24,121,207	0.95	17,902,035	0.74

* The stratum level Ex Post Net kWh results are not applicable due to different sampled populations between gross and net.
Source: Evaluation Team analysis

Table 4-7. Program-Level Evaluation Verified Net kW Impacts

Sampling Strata	Ex Ante Gross kW	Research Findings Gross kW	Research Findings kW RR	Research Findings Net kW	Research Findings NTGR
1	966	1,059	1.10	-*	0.82
2	1,113	1,003	0.90	-*	0.76
3	1,221	1,566	1.28	-*	0.90
TOTAL	3,300	3,628	1.10	3,009	0.83

* The stratum level Ex Post Net kWh results are not applicable due to different sampled populations between gross and net.
Source: Evaluation Team analysis

5 Findings and Recommendations

Based on the gross impact sample size of nine projects in PY6, the PY6 Industrial Systems program performed strongly, with a verified gross realization rate for energy of 0.95, and for demand of 1.10. The PY6 gross energy realization rate of 0.95 is higher than the PY5 0.88 realization rate. The PY6 energy realization rate results were adversely affected by a reduction in realized savings due to project, #17239. Project #17239 measure operating conditions changed (centrifugal compressor was used as the base-loaded compressor instead of screw compressor) after the ex-ante M&V analysis was completed. As a result, the evaluation team adjusted the calculation model to account for the representative operating conditions, which resulted in lower realized savings.

Overall, the program team did a good job of ensuring all the implemented measures were installed and operating as planned. The program team continues to collect site specific pre- and post-metered data for all projects which resulted in accurate estimation of savings. Additionally, the impact results make it evident that ComEd has followed the evaluation team's recommendations from previous years regarding data collection activities, normalizing models and best practices for developing savings calculations, which is main driver for the improved and solid program performance in PY6.

Key evaluation findings and recommendations include the following:

Improvements to Demand Savings Calculations

Finding 1. Out of the nine projects sampled by the evaluation team, five projects reported average demand savings in the tracking data instead of PJM peak demand savings[11]. For four out of the five projects, peak demand savings were included in the calculations, but were not reported.

Recommendation 1. The program should ensure that they are both calculating and reporting savings for the PJM peak demand period and non-coincident demand in the tracking data.

Measurement and Estimation of Power Factor

Finding 2.

There were some instances where the reported power factor was found to be significantly higher than the typical values for compressors and pump motors.

Recommendation 2. Power factor values used in savings calculations should be confirmed to fall within the typical range for industrial system equipment (compressor and pump motors). For power factor measurements that exceed typical or nameplate values, multiple spot measurements should be taken to confirm accuracy of the measurements. If an atypical power factor is still determined to be correct after due diligence is performed, sufficient documentation should be provided to support the out of range values. In the absence of metered data, motor or pump nameplate rated power factor, a typical value of 0.80 should be used for motor applications.

[11] PJM defines the coincident summer peak period as the months of June through August, 1PM to 5PM Central Time on non-holiday weekdays.

Data Collection Activities

Finding 3. Three of the seven compressed air system audits used ultrasonic leak detectors to identify leaks and estimate their leak rates. Using a leak detector to estimate leak rates may not be totally accurate because dB readings depend on several factors, including leak geometry that may not be captured. However, the dB readings do provide a level of objectivity that judging by feel doesn't. Additionally, the ultrasonic leak detector is likely to provide a more thorough check of the system as it is not affected by background noise and may be easier to use in tight spots than going by feel.

Recommendation 3. Ultrasonic leak detectors should be used to identify and classify leaks for Compressed Air projects that involve a leak repair aspect to the project.

6 Appendix

6.1 Net-to-Gross Scoring Algorithm

Table 6-1. Basic Net-to-Gross Scoring Algorithm for the PY6 Industrial Systems Program

Scoring Element	Calculation
Program Components score. The maximum score (on a scale of 0 to 10 where 0 equals not at all influential and 10 equals very influential) among the self-reported influence level the program had for: A. Availability of the program incentive B. Technical assistance from utility or program staff C. Recommendation from utility or program staff D. Information from utility or program marketing materials E. Endorsement or recommendation by a utility account rep F. Recommendation from vendor or Technical Service Provider[12]	Maximum of A, B, C, D, E and F
Program Influence score. "If you were given a TOTAL of 10 points that reflect the importance in your decision to implement the <ENDUSE>, and you had to divide those 10 points between: 1) the program and 2) other factors, how many points would you give to the importance of the PROGRAM?"	Points awarded to the program Divide by 2 if the customer learned about the program AFTER deciding to implement the measure that was installed
No-Program score. "Using a likelihood scale from 0 to 10, where 0 is "Not at all likely" and 10 is "Extremely likely", if the utility program had not been available, what is the likelihood that you would have installed exactly the same equipment?" Adjustments to the "likelihood score" are made for timing: "Without the program, when do you think you would have installed this equipment?" Free-ridership diminishes as the timing of the installation without the program moves further into the future.	Interpolate between No Program Likelihood Score and 10 where "At the same time" or within 6 months equals No Program score, and 48 months later equals 10 (no free-ridership)
Project-level Free-ridership (ranges from 0.00 to 1.00)	1 – Sum of scores (Program Components, Program Influence, No-Program)/30
PY6 Project level Net-to-Gross Ratio (ranges from 0.00 to 1.00)	1 – Project level Free-ridership
Apply score to other end-uses within the same project?	If yes, assign score to other end-uses of the same project
Apply score to other projects of the same end-use?	If yes, assign score to same end-use of the additional projects

[12] Only applicable for sites that indicated a vendor influence score greater than maximum of the other program element scores or those sites that had a study performed by a Technical Service Provider.

6.2 *Survey Instruments*

6.2.1 Participant Telephone Survey

COMED SMART IDEAS FOR YOUR BUSINESS PROGRAM
PARTICIPANT SURVEY – INDUSTRIAL SYSTEMS PROJECTS
PY6 Draft

Contact Name:
Business Name:
Address:
Phone:
Email:

Variables used in this survey:
CONTACTNAME
COMPANY
PROJECT_TYPE (compressed air, process cooling, or refrigeration)
MONTH/YEAR
ADDRESS
SERVICE_PROVIDER
NO_OF_MEASURES
MEASURE1
MEASURE2
MEASURE3
MEASURE4
MEASURE5
MEASURES_NOT_INSTALLED
NUM_PROJECTS

Introduction
Hello, this is _____ from Itron calling on behalf of ComEd regarding your company's participation in the Industrial Systems program. May I please speak with [**CONTACTNAME**]?

Our records show that [**COMPANY**] completed a <**PROJECT_TYPE**> project in ComEd's Smart Ideas for Your Business Industrial Systems Program, and we are calling to conduct a follow-up study about your firm's participation in this program. Our records indicate that you're the person most knowledgeable and the most involved with the decision to participate in the program. Is this correct? [IF NOT, ASK TO BE TRANSFERRED TO THE DECISION MAKER OR SOMEONE FAMILIAR WITH THE BASIS FOR THE DECISION TO PARTICIPATE OR RECORD NAME & NUMBER.]

[IF NEITHER DECISION MAKER OR SOMEONE FAMILIAR WITH THE BASIS FOR THE DECISION TO PARTICIPATE, IS AVAILABLE TERMINATE AND CALL REFERRAL]
(IF NEEDED: Is it possible that someone else dealt with the <**PROJECT_TYPE**> project?)

This survey will take about 20 minutes. Is now a good time? [If no, schedule call-back]

Participation Verification

A1 First, according to our records, you participated in ComEd's Smart Ideas for Your Business Industrial Systems Program between <**MONTH/YEAR**>. [*IF NEEDED: the ComEd Smart Ideas for Your Business Industrial Systems Program promotes energy efficiency improvements to industrial facilities with a primary focus on Compressed Air, Industrial Refrigeration, and Process Cooling system improvements. The program offers technical assessments to help identify applicable measures and analyze the energy and cost savings of the recommended measures. The program also offers cash incentives to help cover a portion of the cost of making the recommended energy efficiency improvements to the energy using equipment.]*
Do you recall participating in the ComEd Smart Ideas for Your Business Industrial Systems Program between <**MONTH/YEAR**>?

1. Yes
2. No Thank & terminate
88. Refused Thank & terminate
99. Don't know Thank & terminate

A2 Next, I'd like to confirm the following information regarding your participation in the Industrial Systems Program. I understand that you participated at <**ADDRESS**>. The Industrial Systems study was completed in <**MONTH/YEAR**> by <**SERVICEPROVIDER**> and you implemented <**NO OF MEASURES**> measure(s), including <**MEASURE1**>, <**MEASURE2**>, <**MEASURE3**>.) Does that sound right?

1. Yes
2. No Thank & terminate
88. Refused Thank & terminate
99. Don't know Thank & terminate

Project Background

B1. Before I ask you specific questions about your decision, please tell me in your own words why you decided to look into making changes to improve the energy efficiency of the <**PROJECT_TYPE**> equipment at this facility? Were there any other reasons?

77. RECORD VERBATIM
88. Refused
99. Don't know

N1b Where did the idea to look into making changes to improve the energy efficiency of the <**PROJECT_TYPE**> come from? [IF NEEDED: Did your company develop the idea, was it suggested by a vendor or consultant or the program Service Provider, was it the result of an audit, was it part of a larger expansion or remodeling effort?]

77. RECORD VERBATIM
88. Refused
99. Don't know

S1. How did you first hear about the Industrial Systems Program? **[DO NOT READ]**

1. Service provider
2. ComEd program representative
3. ComEd Account manager
4. ComEd Website
5. Friend/colleague/word of mouth
6. Contractor
77. Other [RECORD VERBATIM]

88. Refused
99. Don't know

S2. How long ago or when was this?
1. RECORD VERBATIM
88. Refused
99. Don't know

B2a. Before learning about the ComEd Industrial Systems Program, had you ever made any other changes to improve the energy efficiency of your <**PROJECT_TYPE**> equipment at this facility or any of your other facilities?
1. Yes, at this facility
2. Yes, at another facility [skip the next two questions, go to B5]
3. No [skip the next two questions, go to B5]
88. Refused [skip the next two questions, go to B5]
99. Don't know [skip the next two questions, go to B5]

[ASK IF B2a=1]
B2aa. Specifically, what did you have done at this facility?
77. RECORD VERBATIM
88. Refused
99. Don't know

[ASK IF B2a=1]
B2b. Did you receive an incentive or another form of financial support for this previous <**PROJECT_TYPE**> project?
1. Yes
2. No
88. Refused
99. Don't know

B5. My next questions are about your awareness of the energy saving opportunities identified through your Industrial Systems study PRIOR to conducting it. Would you say you were aware of all, some, or none of the opportunities before the study? [if needed read: <**MEASURE1** through **MEASUREx**>]
1. All [skip the next question]
2. Some
3. None [skip the next three questions]
88. Refused [skip the next three questions]
99. Don't know [skip the next three questions]

[ASK IF B5=2]
B6. Which of the following energy saving opportunities were you previously aware of? Were you aware of the opportunities with your… (1=Yes, 2=No, 88=Refused, 99=Don't know)
a. **MEASURE1**
b. **MEASURE2** [ASK IF MEASURE2 ne ""]
c. **MEASURE3** [ASK IF MEASURE3 ne ""]
d. **MEASURE4** [ASK IF MEASURE4 ne ""]
e. **MEASURE5** [ASK IF MEASURE5 ne ""]

[ASK IF B5=1,2]

B2bb. What were the main factors that kept you from making the specific changes identified through the Industrial Systems Program Study PRIOR to your participation in the program?
77. [RECORD VERBATIM]
88. Refused
99. Don't know

[ASK IF B5=1,2]
B2cc Did the information you received through the program influence you to make any additional improvements or upgrades to the improvements you already had in mind?
1. Yes
2. No
88. Refused
99. Don't know

[ASK IF B2cc=1]
B2dd Please explain what you were planning on doing before the program and how the program influenced you to make additional improvements or upgrades?
77. [RECORD VERBATIM]
88. Refused
99. Don't know

[ASK IF **MEASURES_NOT_INSTALLED** not blank]
B8c. Our records show that your company did not install all of the measures recommended in the Industrial Systems study. What were the reasons why your company didn't implement the following measures: <**MEASURES_NOT_INSTALLED**>?
77. [RECORD VERBATIM]
88. Refused
99. Don't know

[ASK IF **NUM_PROJECTS**>1]
B7. Our records indicate that your company completed <**NUM_PROJECTS**> projects through the program. Was your decision to participate in the program the same for each project?
1. Yes
2. No
77. Some decisions were the same (RECORD VERBATIM)
88. Refused
99. Don't know

Decision Influences (*USED IN NTG CALCULATOR*)

BEGIN LOOP FOR MEASURE1-MEASURE3

N1. When did you first learn about ComEd's Industrial Systems Program, was it BEFORE or AFTER you first began to THINK about implementing <**MEASUREx**>?
1. Before [skip the next question, go to N3]
2. After
88. Refused
99. Don't know

[ASK IF N1=2, 88, 99]
N2. Did you learn about ComEd's Program and the availability of technical assistance and incentives for energy efficiency improvements BEFORE or AFTER you DECIDED to implement <**MEASUREx**>?

1. Before
2. After
88. Refused
99. Don't know

[IF N2 = 2 THEN ASK, ELSE SKIP TO N3.]

N2a. How did you first learn about <**MEASUREx**>? [IF NEEDED: Were you working with another contractor?]
77. Record VERBATIM
88. Refused
99. Don't know

N2b. Did you delay your project in order to receive the study/incentive through the Program?
1. Yes
2. No
88. Refused
99. Don't know

[IF N2b = 1 THEN ASK, ELSE SKIP TO N3.]

N2bb. How long did you delay your project to receive the study/incentive?
77. Record VERBATIM
88. Refused
99. Don't know

N2c. Why did you decide to participate in the Smart Ideas for your Business Program AFTER you had decided to implement <**MEASUREx**>?
77. Record VERBATIM
88. Refused
99. Don't know

N3. Now I'm going to ask you to rate the importance of several factors that might have influenced your decision to implement <**MEASUREx**>. On a scale from 0 to 10, where 0 means 'not at all important' and 10 means 'extremely important', how important were the following in your decision to implement <**MEASUREx**>.
[FOR N3a-m, RECORD 0 to 10; 96=Not Applicable; 88=Refused; 99=Don't know][If needed: How important in your DECISION to conduct the study and commit the funding to implement <**MEASUREx**> was…]

[ROTATE N3a-N3m]

N3a. The age or condition of all or part of the <**PROJECT_TYPE**> equipment
N3b. The availability of cash incentives for <**MEASUREx**>
N3c. The comprehensive study funded by the Smart Ideas Program
N3e. Previous experience with this type of project
N3f. The recommendation from your ComEd Account Manager
N3h. The information from the Industrial Systems Program Representative (Service Provider)
N3i. Recommendation from an expert not affiliated with the program
N3j. Standard practice in your business/industry
N3l. Corporate policy or guidelines
N3m.Payback on the investment with the incentives

N3n. Were there any other factors that we haven't discussed that were influential in your decision to implement <**MEASUREx**>? If so, what were they? [If needed: Are these other factors program related?]
77. Yes [RECORD VERBATIM]

96. Nothing else influential [skip the next question, go to N41]
88. Refused [skip the next question, go to N41]
99. Don't know [skip the next question, go to N41]

[ASK IF N3n=77]
N3nn. Using the same 0 to 10 scale, how would you rate the influence of this factor?
#. RECORD 0 to 10
96. Not Applicable
88. Refused
99. Don't Know

[READ IF (N3a, N3b, N3c, N3e, N3f, N3h, N3i, N3j, N3l, N3m, OR N3n)=8,9,10]
You just told me that the following factors were important:
[READ IN ONLY ITEMS WHERE THEY GAVE A RATING OF 8 or higher]
PROGRAM RELATED:
N3b. The availability of cash incentives for <**MEASUREx**>
N3c. The comprehensive study funded by the Smart Ideas Program
N3f. The recommendation from your ComEd Account Manager
N3h. The information from the Industrial Systems Program Representative (Service Provider)
OTHER FACTORS:
N3a. The age or condition of all or part of the <**PROJECT_TYPE**> equipment
N3e. Previous experience with this type of project
N3i. Recommendation from an expert not affiliated with the program
N3j. Standard practice in your business/industry
N3l. Corporate policy or guidelines
N3m. Payback on the investment with the incentives
N3n. Other factor

N41. If you were given a TOTAL of 10 points that reflect the importance in your decision to implement <**MEASUREx**>, and you had to divide those 10 points between: 1) the program and 2) other factors, how many points would you give to the importance of the PROGRAM? [IF NEEDED: Program factors include the cash incentives, the fully funded study, recommendations by ComEd staff or Service Provider.] Points given to program:
#. RECORD 0 to 10
88. Refused
99. Don't Know

[CALCULATE VARIABLE "OTHERPTS" AS: 10 MINUS N41 RESPONSE; IF N41=88, 99, SET OTHERPTS=BLANK]

N42. And how many points would you give to other factors? [IF NEEDED: Other factors include the age or condition of the old equipment, previous experience, recommendations from people unrelated to the program, standard practice, corporate policy.] [The response should be <**OTHERPTS**> because both numbers should equal 10.]
#. RECORD 0 to 10
88. Refused
99. Don't Know

PAYBACK BATTERY

N10a. Did the cash incentive, including the avoided cost of the assessment, move <**MEASUREx**> within an acceptable payback cutoff point?

1. Yes
2. No
88. Refused
99. Don't know

CONSISTENCY CHECK ON PROGRAM IMPORTANCE SCORE

[ASK IF (N41>=7 AND ALL OF (N3b, N3c, N3f, AND N3h)=0,1,2,3), ELSE SKIP TO N4e]

N4 You just gave <**N41 RESPONSE**> points to the importance of the program, I would interpret that to mean that the program was quite important to your decision to install this equipment. Earlier, when I asked about the importance of individual elements of the program I recorded some answers that would imply that they were not that important to you. Just to make sure I have recorded this properly, I have a couple questions to ask you.

N4a When asked about THE AVAILABILITY OF THE CASH INCENTIVE, you gave a rating of ...<**N3B RESPONSE**> ... out of ten, indicating that the cash incentive was not that important to you. Can you tell me why the cash incentive was not that important?
77. Record VERBATIM
88. Refused
99. Don't know

N4b When I asked you about THE COMPREHENSIVE STUDY, you gave a rating of ...<**N3C RESPONSE**> ... out of ten, indicating that the study was not that important to you. Can you tell me why the study was not that important?
77. Record VERBATIM
88. Refused
99. Don't know

N4c When I asked you about THE RECOMMENDATION FROM YOUR COMED ACCOUNT MANAGER, you gave a rating of ...<**N3F RESPONSE**> ... out of ten, indicating that the recommendation was not that important to you. Can you tell me why the recommendation was not that important?
77. Record VERBATIM
88. Refused
99. Don't know

N4d When asked about THE INFORMATION from the INDUSTRIAL SYSTEMS PROGRAM REP, you gave a rating of ...<**N3H RESPONSE**> ... out of ten, indicating that this information from the program rep was not that important to you. Can you tell me why this information was not that important?
77. Record VERBATIM
88. Refused
99. Don't know

[ASK IF N41<=3 AND ANY ONE OF (N3b, N3c, N3f, OR N3h =8,9,10) ELSE SKIP TO N9a]

N4e You just gave <**N41 RESPONSE**> points to the importance of the program. I would interpret that to mean that the program was not very important to your decision to make energy efficiency improvements to the <**PROJECT_TYPE**>. Earlier, when I asked about the importance of individual elements of the program I recorded some answers that would imply that they were very important to you. Just to make sure I understand, would you explain why you scored the importance of the program a <**N41 RESPONSE**> in your decision to make energy efficiency improvements to the <**PROJECT_TYPE**>?

Actions Without the Program

ASK FOR MEASURE1, SKIP to N12 FOR MEASURE2 and MEASURE3

N9a. Now we would like you to think about the action you would have taken if the Program had not been available. If you had not received the ComEd comprehensive study, would you have undertaken a study on your own?

1. Yes
2. No
88. Refused
99. Don't know

N12. Now thinking about <**MEASUREx**> and its efficiency. Using a likelihood scale from 0 to 10, where 0 is "Not at all likely" and 10 is "Extremely likely", if the ComEd Industrial Systems program had NOT been available, what is the likelihood that you would have performed/installed the exact same measure?

#. RECORD 0 to 10
88. Refused
99. Don't know

N13. Without the program, when do you think you would have implemented <**MEASUREx**>? Would you say…

1. At the same time [skip the next two questions, go to B1a]
2. Earlier [skip the next two questions, go to B1a]
3. Later
4. Never [skip the next two questions, go to B1a]
88. Refused [skip the next two questions, go to B1a]
99. Don't know [skip the next two questions, go to B1a]

[ASK IF N13=3]

N13a. How much later would you have implemented <**MEASUREx**>? Would you say…

1. 1 to 3 months later [skip the next question, go to B1a]
2. 4 to 6 months later [skip the next question, go to B1a]
3. 7 to 12 months later [skip the next question, go to B1a]
4. 13 to 24 months later [skip the next question, go to B1a]
5. More than 2 years later
88. Refused [skip the next question, go to B1a]
99. Don't know [skip the next question, go to B1a]

[ASK IF N13a=5]

N13b. Why do you think it would have been 2 or more years later?

77. RECORD VERBATIM
88. Refused
99. Don't know

ASK FOR MEASURE1, SKIP to CH1 AFTER MEASURE3

B1a Thinking about all of the questions we just discussed, would you say the decision making process was the same for <**MEASURE2**> and <**MEASURE3**>, or was each measure part of a separate decision?

1 Same decision making process for all
2 Different decision making process
77 Other, specify
88 Refused
99 Don't know

END NTG LOOP

If B1A=1 THEN MOVE ON TO CH1, ELSE BEGIN NTG LOOP FOR THE NEXT MEASURE

Spillover and Channeling

CH1. Since your participation in the Industrial Systems program, have you installed any additional energy efficient equipment at this facility?

1. Yes
2. No
88. Refused
99. Don't know

[ASK IF CH1=1(yes), ELSE SKIP TO S1]

CH2. What type of energy efficient equipment did you install?

77. RECORD VERBATIM
88. Refused [skip the next three questions, go to S1]
99. Don't know [skip the next three questions, go to S1]

CH2a. Did you receive an incentive from any utility or government program for this measure?

1. Yes
2. No
88. Refused
99. Don't know

CH3. On a scale of 0 to 10, where 0 means "no influence" and 10 means "greatly influenced," how much influence did your participation in the Industrial Systems Program have on your decision to install additional energy efficiency measures?

#. SCALE 0-10
88. Refused
99. Don't know

[ASK IF CH3=8,9 or 10; ELSE SKIP TO S1]

CH4. How did the Industrial Systems Program influence your decision to install additional energy efficiency measures?

77. RECORD VERBATIM
88. Refused
99. Don't Know

Those are all of the questions I have. Thank you very much for your participation!

6.2.2 Technical Service Providers Telephone Survey

Vendor NTG Survey Instrument – for ComEd Custom Programs – Industrial Systems version – PY6

Introduction

AA1. Hello, this is _____ from Itron calling on behalf of ComEd. THIS IS NOT A SALES CALL. I am calling about your firm's recent involvement in conducting a technical assessment study sponsored by ComEd for ... <%CUSTOMER>... through the ComEd Smart Ideas for Your Business Program on approximately ... <%STUDY_DATE>._____Our records indicate that ...<%CONTACT>... would be the person most knowledgeable about this. Is he/she available?

1	Yes	AA5
2	No	AA2
88	Refused	Thank and Terminate
99	Don't know	Thank and Terminate

AA2. Who would be the person most knowledgeable about your firm's involvement in conducting a technical assessment study sponsored by ComEd for ...<%CUSTOMER>... through the ComEd Smart Ideas for Your Business Program on approximately...<%STUDY_DATE>?

1	Record name	AA3
88	Refused	Thank and Terminate
99	Don't know	Thank and Terminate

AA3. May I speak with him/her?

1	Yes	AA4
2	No (not available right now)	SCHEDULE APPOINTMENT

AA4. Hello, this is _____ from Itron calling on behalf of ComEd. THIS IS NOT A SALES CALL. I was told that you are the person most knowledgeable about your firm's involvement in conducting a technical assessment study sponsored by ComEd for ...<%CUSTOMER>... through the ComEd Smart Ideas for Your Business Program on approximately...<%STUDY_DATE>. Is this correct?

1	Yes	A1
2	No, there is someone else (RECORD NAME AND ASK TO BE TRANSFERRED)	AA5
3	No and I don't know who to refer you to	Thank and Terminate
88	Refused	Thank and Terminate
99	Don't know	Thank and Terminate

AA5. Am I speaking with …<%BETTER_CONTACT> ...the representative of your company that worked with ...<%CUSTOMER>... during the time that your firm conducted a technical assessment study sponsored by ComEd? This study was conducted on approximately... <%STUDY_DATE>.

1	Yes	A1
2	Yes, but we need to make an appointment.	Reschedule appt.
3	No but I will give you to the correct person.	AA4
88	Refused	Thank and Terminate

99	Don't know	Thank and Terminate

Before we start, I would like to inform you that for quality control purposes, this call may be monitored by my supervisor. For the sake of expediency, we will be recording this interview.

A1. Our records indicate that your firm conducted a technical assessment study sponsored by ComEd in which you recommended that <%CUSTOMER> install <%MEASURE1-%MEASURE3>. Is this correct?

1	Yes	A2
2	No	Thank and Terminate
88	Refused	Thank and Terminate
99	Don't know	Thank and Terminate

[DO NOT READ: The following question will determine if we ask about influences on their recommendations. Please be sure to be thorough with this question. If they truly only installed this equipment, then a "No" is fine]

LOOP/ASK FOR EACH MEASURE (1-3)

A2. As <%CUSTOMER>'s vendor, did you recommend the installation of this <%MEASUREx>?

1	Yes	A3
2	No	A3
88	Refused	A3
99	Don't know	A3

A3. Can you please explain what was your firm's involvement with ...<%CUSTOMER>'s ... implementation of <%MEASUREx>? [IF NEEDED: were they just an order taker, were they just equipment suppliers, or were they instrumental in what equipment was selected?.....if they were instrumental, then you need to go back and correct the answer to the previous question.]

77	RECORD VERBATIM	A3a
88	Refused	Thank and Terminate
99	Don't know	Thank and Terminate

A3a Does your company currently stock and sell <%MEASUREx>s?

1	Yes	V2
2	No	V2
88	Refused	V2
99	Don't know	V2

[READ] For the sake of expediency, during the balance of the interview, we will be referring to the ComEd Smart Ideas for Your Business Program as the PROGRAM and we will be referring to the installation of ... <%MEASUREx> as the MEASURE. I will repeat this from time to time during the interview as your organization may have installed more than one measure through more than one program.

I am going to ask you to rate the importance of the ComEd Smart Ideas for Your Business in influencing your decision to recommend this <%MEASUREx> to ...<%CUSTOMER>.. Think of the degree of importance as being shown on a scale with equally spaced units from 0 to 10, where 0 means not at all

important and 10 means very important, so that an importance rating of 8 shows twice as much influence as a rating of 4.

V2. Using this 0 to 10 scale where 0 is NOT AT ALL IMPORTANT and 10 is EXTREMELY IMPORTANT, how important was the ComEd Smart Ideas for Your Business Program, including incentives as well as program services and information, in influencing your decision to recommend that ...<%CUSTOMER>... install the energy efficiency <%MEASUREx> at this time?

#	Record 0 to 10 score (_____)		V3
88	Refused	V3	
99	Don't know		V3

V3. And using a 0 to 10 likelihood scale where 0 is NOT AT ALL LIKELY and 10 is EXTREMELY LIKELY, if the ComEd Smart Ideas for Your Business Program, including incentives as well as program services and information, had not been available, what is the likelihood that you would have recommended this specific <%MEASUREx> to ...<%CUSTOMER>?

#	Record 0 to 10 score (_____)		V4
88	Refused	V4	
99	Don't know		V4

V4. Approximately, in what percent of technical assessment studies did you recommend this <%MEASUREx> before you learned about the ComEd Smart Ideas for Your Business Program?

%	Record PERCENTAGE		V5
88	Refused	V5	
99	Don't know		V5

V5. And approximately in what percent of technical assessment studies do you recommend this <%MEASUREx> now that you have worked with the ComEd Smart Ideas for Your Business Program?

%	Record PERCENTAGE		V6a
88	Refused	V6a	
99	Don't know		V6a

V6a. In what other ways has the ComEd Smart Ideas for Your Business Program influenced your recommendation that a customer install <%MEASUREx>?

1	Record FIRST mention		V6aa
2	Record SECOND mention		V6aa
3	Record THIRD mention		V6aa
4	No other way		V7b
88	Refused	V7b	
99	Don't know		V7b

IF V6a=1 THEN ASK, ELSE V6ab

V6aa. Using a 0 to 10 scale, how important was <%FIRST_MENTION_IN_V6A > in your recommendation that a customer install <%MEASUREx>?

#	Record 0 to 10 score (_____)		V6a
88	Refused	V6a	

99	Don't know	V6a

IF V6a=2 THEN ASK, ELSE V6ac
V6ab. Using a 0 to 10 scale, how important was <%SECOND_MENTION_IN_V6A > in your recommendation that a customer install <%MEASUREx>?

#	Record 0 to 10 score (_____)	V6ac
88	Refused	V6ac
99	Don't know	V6ac

IF V6a=3 THEN ASK, ELSE V7b
V6ac. Using a 0 to 10 scale, how important was <%THIRD_MENTION_IN_V6A > in your recommendation that a customer install <%MEASUREx>?

#	Record 0 to 10 score (_____)	V7b
88	Refused	V7b
99	Don't know	V7b

V7b. And how important was the information provided by the ComEd website in your recommendation that a customer install this MEASURE?

#	Record 0 to 10 score (_____)	V7c
88	Refused	V7c
99	Don't know	V7c

V7c. And how important was your firm's past participation in an incentive or study-based program sponsored by ComEd in your recommendation that a customer install this MEASURE?

#	Record 0 to 10 score (_____)	V8
88	Refused	V8
99	Don't know	V8

IF VENDOR ALSO STOCKS AND SELLS PROGRAM QUALIFYING <%MEASURE> (if A3a=1) THEN ASK V8. ELSE SKIP TO V15.
V8. Approximately, what percentage of your sales over the last 12 months of <%MEASUREx>s installed in ComEd's service territory are energy efficient models, that qualify for incentives from the program?

%	Record PERCENTAGE	V9
88	Refused	V9
99	Don't know	V9

V9. In what percent of sales situations do you encourage your customers in ComEd's service territory to purchase program qualifying <%MEASUREx>s?

%	Record PERCENTAGE	V9a
88	Refused	V10
99	Don't know	V10

IF V9 < 100% THEN ASK. ELSE SKIP TO V10.
V9a. In what sales situations do you NOT encourage your customers to purchase program qualifying <%MEASUREx>s? And why is that?

77	RECORD VERBATIM	V10
88	Refused	V10
99	Don't know	V10

V10. Of those installations of <%MEASUREx>s in ComEd's service territory that qualify for incentives, approximately what percentage do not receive the incentive?

%	Record PERCENTAGE	V11
88	Refused	V12
99	Don't know	V12

IF V10 > 0%

V11. Why do you think they do not receive the incentive?

77	RECORD VERBATIM	V12
88	Refused	V12
99	Don't know	V12

V12. Do you also recommend <%MEASUREx>s in areas where customers do not have access to incentives for energy efficient models?

1	Yes	V13
2	No	V14
88	Refused	V14
99	Don't know	V14

V13. About what percent of your sales of program-qualifying <%MEASUREx>s are represented by these areas where incentives are not offered?

%	Record PERCENTAGE	V14
88	Refused	V14
99	Don't know	V14

V14. Have you changed your stocking practices of <%MEASUREx>s as a result of ComEd's Program? [IF NEEDED: BY STOCKING PRACTICES, I MEAN THE TYPES OF EQUIPMENT YOU SUPPLY AND SELL IN COMED'S SERVICE TERRITORY.]

1	Yes	V15
2	No	V15
88	Refused	V15
99	Don't know	V15

IF V12=1

V15. Do you promote energy efficient equipment, such as <%MEASUREx>, equally in areas with and without incentives??

1	Yes	V16
2	No	V16
88	Refused	V16
99	Don't know	V16

V16. Do you know of any other vendors that worked with <%CUSTOMER> during their implementation and/or installation of <%MEASUREx>? For example engineers or designers?

1	Yes	V16a
2	No	V17
88	Refused	V17
99	Don't know	V17

V16a. Do you have their business name?

77	RECORD Business name and contact's name and phone number(s)	V17
88	Refused	V17
99	Don't know	V17

END LOOP – MEASURE 1-3

PROCESS MODULE

V17 And finally, for verification purposes only, may I please have your first name?

77	RECORD VERBATIM	END

END Those are all the questions I have for you today. Thank you very much for your time.

END OF SURVEY