2017 Mercantile Customer Program Evaluation Report

Prepared for the FirstEnergy Ohio Companies:

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

Prepared by:

ADM Associates, Inc.
3239 Ramos Circle
Sacramento, CA95827
916.363.8383

Table of Contents

List of Figures

List of Tables

1. Executive Summary

The Ohio operating companies, The Cleveland Electric Illuminating Company (“CEI”), Ohio Edison Company (“OE”), and The Toledo Edison Company (“TE”) (collectively “Companies”), continued the Mercantile Customer Program during 2017. This report presents the results of the impact and process evaluations of the Mercantile Customer Program activity occurring during 2017.

The main features of the approach used for the evaluation are as follows:

- Data for the study were collected through review of program materials, on-site inspections, end-use metering, and interviews with the Companies’ staff members, participating customers, and contractors. Based on data provided by the Companies, a sample design was developed for on-site data collection. Samples were drawn that provide savings estimates for each program providing energy savings estimation with ±10% statistical precision at the 90% confidence level.
- Table *1.1* shows the sample size employed for this study.
- Site visits were utilized to collect data for savings impact calculations, to verify measure installation, and to determine measure operating parameters. Facility staff were interviewed to determine the operating hours of installed systems and to locate any additional benefits or shortcomings with the installed systems. For some of these sites, energy efficient equipment was monitored to obtain accurate information on equipment operating characteristics. Site visits occurred for 20 out of the 24 projects in the ADM sample.

Table 1.1 Sample Sizes for Data Collection Efforts

Type of Data Collected	Sample Size
On-Site Measurement and Verification	24

The ADM sample of 24 projects accounts for 55% of the reported annual energy savings. Ex-post gross savings were estimated using proven techniques, including industry standard engineering calculations and verification of computer simulations developed to determine energy savings.

The realized energy savings of the 2017 Mercantile Customer Program from the three service territories are summarized in

Table *1.2*. For the entire program, the ex-post gross energy savings totaled 44,655,636 kWh. The gross realization rate for program kWh savings is 101%.

Table 1.2 Summary of kWh Savings

Operating Company	Rate Code	Ex Ante kWh Savings	Ex-Post kWh Savings	Realization Rate
CEI	CE-GS	6,657,162	6,196,452	93%
	CE-GT	3,604,278	3,571,355	99%
Total		**10,261,440**	**9,767,807**	**95%**
OE	OE-GP	4,969,255	5,026,064	101%
	OE-GS	10,088,635	10,277,811	102%
	OE-GT	9,814,761	10,645,900	108%
Total		**24,872,651**	**25,949,774**	**104%**
TE	TE-GP	2,907,916	2,766,099	95%
	TE-GS	2,415,077	2,480,902	103%
	TE-GT	3,635,229	3,691,054	102%
Total		**8,958,222**	**8,938,055**	**100%**
Grand Total		**44,092,313**	**44,655,636**	**101%**

The ex-post gross peak kW reductions of the 2017 Mercantile Customer Program from the three service territories are summarized in Table 1.3. The ex-post gross peak demand savings for the program are 5,336 kW. The gross realization rate for program peak kW savings is 120%.

Table 1.3 Summary of Peak kW Savings

Operating Company	Rate Code	Ex Ante kW Savings	Ex-Post kW Savings	Realization Rate
CEI	CE-GS	958	1,156	121%
	CE-GT	379	348	92%
Total		**1,337**	**1,504**	**113%**
OE	OE-GP	306	451	148%
	OE-GS	667	977	147%
	OE-GT	1,405	1,332	95%
Total		**2,378**	**2,761**	**116%**
TE	TE-GP	386	572	148%
	TE-GS	68	109	160%
	TE-GT	293	391	133%
Total		**747**	**1,071**	**143%**
Grand Total		**4,462**	**5,336**	**120%**

2. Introduction and Purpose of Study

This report presents the results of the impact and process evaluations of the Mercantile Customer Program for activity during the 2017 program year.

2.1 Overview of Evaluation Approach

The overall objective of the impact evaluation of the Mercantile Customer Program is to verify the gross energy savings and peak demand (kW) reduction resulting from participation in the program during the 2017 program year.

Per the Companies' interpretation of Ohio RC §4928.662, for all measure types listed in the Ohio TRM[1]; all installation rates, deemed savings, and hours of use were calculated per the Ohio TRM ("Deemed"). In addition, ADM calculated gross savings for measures in the program with "as found" baseline conditions, hours of use, and installation rates. The values reported for both ex ante and ex post energy savings (kWh) and peak demand reduction (kW) represent the higher calculated value obtained from both methodologies.

The approach for the impact evaluation had the following main features.

- Available documentation (e.g., audit reports, savings calculation work papers, etc.) was reviewed for a sample of projects, with attention given to the calculation procedures and documentation for savings estimates.
- On-site data collection was conducted for a sample of projects to provide the information needed for estimating savings and demand reductions. Monitoring was also conducted at some sites to obtain more accurate information on the hours of operation for lighting.

Gross savings were estimated using proven techniques:

- Analysis of lighting savings was accomplished using ADM's custom-designed lighting evaluation model with system parameters (fixture wattage, operating characteristics, etc.) based on information on operating parameters collected on-site and, if appropriate, industry standards as well as inputs for the OH TRM.
- For custom measures or relatively more complex measures, ADM estimated savings using IPMVP[2] Option C: Whole Facility analysis methodology.

[1] Ohio Independent Evaluator 2010 Evaluation Plan, Prepared for Public Utilities Commission of Ohio, December 6, 2010

[2] International Performance, Measurement, and Verification Protocol. "Concepts and Options for Determining Energy and Water Savings", Volume 1. January 2012.

3. Description of Program

Since 2009, the Companies have implemented the Mercantile Customer Program in Ohio. On July 17, 2013, the Public Utilities Commission of Ohio ordered that the Mercantile Pilot Program be permanently adopted, explaining that the Pilot for mercantile customers has fulfilled its goal of developing a simplified application filing and approval process.

To be eligible to participate in the Mercantile Customer Program, a customer had to be a "Mercantile customer" as defined in R.C. § 4928.01 (A) (19). According to this definition, a mercantile customer is a commercial or industrial customer who meets either of two criteria:

- Consumes more than 700,000 kWh per year; or
- Is part of a national account involving multiple facilities in one or more states.

The Mercantile Customer Program is targeted at mercantile customers that have implemented projects in the last 3 calendar years that resulted in energy efficiency and/or peak demand reductions.

Under Rule 4901:1-39-05(G), Ohio Administrative Code (O.A.C.), a mercantile customer is permitted to file with the Public Utilities Commission of Ohio (PUCO), either individually or jointly with an electric utility, an application to commit the customer's existing demand reduction, demand response, and energy efficiency programs for integration with the electric utility's programs.

For the 2017 program year, mercantile customers who participated in the program chose between two types of incentives:

- An exemption from the Demand Side Energy efficiency (DSE2) Rider for a specified period, or
- A cash rebate option.

To be eligible for either of these incentive options, a customer was required to provide sufficient data to illustrate that the customer installed self-directed energy efficiency and/or demand reduction technologies that produced energy savings and/or peak demand savings.

Calculations for exemption from the DSE2 rider are made on a site-by-site basis, where a site is defined as a location with one or more facilities located on one or more parcels of land, provided that the parcels are contiguous (e.g., a plant, hospital complex, or university located on one or more contiguous parcels of land would qualify as a site). This is the Companies' definition and is not determined by Commission rules.

Although all accounts related to a given site were eligible for an exemption, the exemption was applied only to those accounts identified by a customer on the Joint

Application it files with the Company to the PUCO. Aggregate savings from projects on the site were compared to the aggregate baseline of all accounts included in the application to determine if the site met the eligibility requirement.

Several criteria were used to determine energy efficiency project incentive levels under the Mercantile Customer Program.

- Regardless of whether a customer replaces equipment before its end of life or upon equipment failure, efficiency savings were eligible for counting against the FE Ohio Company targets as measured against the as-found equipment. However, in the case of replacement on failure, for the purposes of calculating savings that are eligible for an incentive, the energy savings calculation must use the standard as the baseline, not the as-found condition.
- If a customer replaced equipment at end of life with standard equipment, projects were not eligible for an incentive; however, utilities may count the savings as compared to as-found towards compliance goals, and the customer is eligible for a Commitment Payment.[3]
- Behavioral modifications or operational improvements could have qualified for incentives, but only if an investment was made on the customer's part and if the savings are measurable and verifiable. If there was no investment, the customer was not eligible for an incentive; however, utilities may verify savings towards compliance goals, regardless of customer incentive level. Even though a customer may not receive an incentive for a behavioral modification, they may receive instead a commitment payment so that utilities may commit those savings towards compliance. Additionally, for behavioral modifications, applicants are required to file annual applications.

Ex-ante energy savings are calculated using methodologies outlined in the Ohio Technical Reference Manual (TRM) or using industry standard engineering calculations.

The ex-ante gross savings by each utility are shown in

[3] The commitment payment is not an incentive but rather intended to offset the administrative costs of filing an applications. Case No. 10-834-EL-POR, September 15, 2010 Entry.

Table 3.1. There were 123 dockets in the program which were expected to provide savings of 44,092,313 kWh.

Table 3.1 Ex-Ante Annual Energy Savings

Operating Company	Ex-Ante kWh Savings
CEI	10,261,440
OE	24,872,651
TE	8,958,222
Total Companies	**44,092,313**

Error! Not a valid bookmark self-reference. shows the program's ex-post kWh savings by date of the application filed. A significant portion of savings was filed in the last 4 months of the program year.

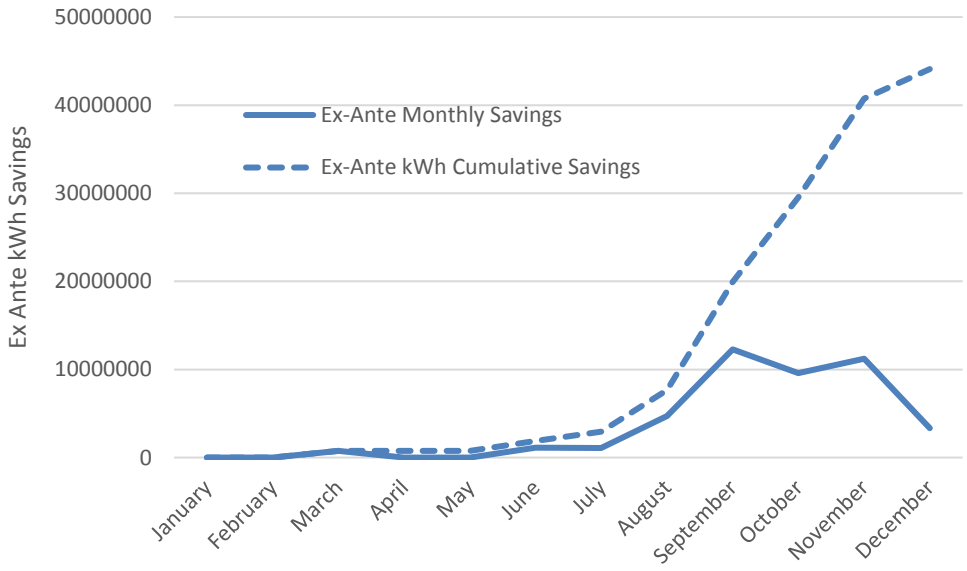

Figure 3-1 Realized Savings by Regulatory Reporting Date

4. Methodology

ADM's evaluation of the 2017 Mercantile Customer Program consisted of both an impact evaluation and a process evaluation. The impact methodology is described in section 4.1 and the process evaluation is described in section 4.4.2 of this chapter.

4.1 Impact Evaluation Methodology

The methodology used for estimating gross savings is described in this section.

4.1.1 Sampling Plan

Data used to estimate the gross savings achieved through the Mercantile Customer Program were collected for samples of applications filed during the 2017 program year. Data provided by the Companies program staff showed that during 2017, there were 123 dockets associated with the program, which were expected to provide savings of 44,092,313 kWh annually.

The completed dockets for PY2017 represented a wide range of measures and energy savings values. Of the 123 dockets, 100 have ex-ante annual savings of less than 500,000 kWh. To represent the population of dockets, ADM selected a sample with a sufficient number of projects to estimate the total achieved savings with 10% precision at 90% confidence. Projects were categorized by measure (lighting and non-lighting) as well as ex-ante annual energy savings kWh. The boundaries of each stratum are developed through an R programming language package which is based on the Bethel-Chromy algorithm to ensure precision is met.[4] The resulting sample consisted of 3 categories, or strata, for non-lighting dockets, and 4 strata for lighting dockets for the sample, the ex-post gross kWh precision is ±9.68%.

Sampling for the collection of program M&V data accounted for the M&V effort occurring in real time during program implementation. Completed projects accumulate over time as the program is implemented, and sample selection was thus spread over the entire program year. ADM used a near real-time process whereby a portion of the sample was selected periodically as project applications in the program were completed. The timing of sample selection was contingent upon the timing of the completion of projects during the program year.

[4] https://cran.r-project.org/web/packages/SamplingStrata/index.html

Table 4.1 presents the number of projects and ex-ante energy savings of the sampled projects by stratum.

Table 4.1 Population Statistics Used for Sample Design

Stratum Name	Ex-Ante kWh Savings	Strata Boundaries (kWh)	Population of Projects	Design Sample Size
Non-Lighting 1	3,149,990	<819,540	18	4
Non-Lighting 2	12,014,968	819,541 - 3,404,051	7	4
Non-Lighting 3	6,189,232	3,404,052 - 6,189,232	1	1
Lighting 1	3,787,916	<162,978	60	4
Lighting 2	6,441,434	162,979 - 469,063	23	4
Lighting 3	7,856,239	469,064 - 1,024,904	11	5
Lighting 4	4,652,534	1,029,905 - 2,069,180	3	2
Total	**44,092,313**		**123**	**24**

As shown in Table 4.2, the sample projects account for approximately 55% of the ex-ante kWh savings.

Table 4.2 Ex-Ante kWh Savings for Sampled Projects by Stratum

Stratum Name	Ex-Ante kWh Savings (population)	Ex-Ante kWh Savings (Sample)	Percent of Ex-Ante kWh in Sample
Non-Lighting 1	3,149,990	1,355,071	43%
Non-Lighting 2	12,014,968	7,635,318	64%
Non-Lighting 3	6,189,232	6,189,232	100%
Lighting 1	3,787,916	363,386	10%
Lighting 2	6,441,434	1,118,200	17%
Lighting 3	7,856,239	3,922,288	50%
Lighting 4	4,652,534	3,463,002	74%
Total	**44,092,313**	**24,046,497**	**55%**

As shown in Table 4.3, the sample projects account for approximately 49% of the ex-ante peak kW savings.

Table 4.3 Ex-ante Peak Demand kW Savings for Sampled Projects by Stratum

Stratum Name	Ex-Ante Peak kW (population)	Ex-Ante Peak kW (Sample)	Percent of Ex-Ante kWh in Sample
Non-Lighting 1	149	0*	0%
Non-Lighting 2	1,016	784	77%
Non-Lighting 3	914	914	100%
Lighting 1	310	28	9%
Lighting 2	1095	166	15%
Lighting 3	764	78	10%
Lighting 4	214	214	100%
Total	**4,462**	**2,184**	**49%**

*The 3 projects chosen for this stratum did not report peak kW reduction

4.1.2 Review of Documentation

After the sample of projects was selected, the Companies' program staff provided documentation pertaining to those projects. The first step in the evaluation effort was to review this documentation and other program materials that were relevant to the evaluation effort.

For each project, the available documentation (e.g., audit reports, savings calculation work papers, etc.) for each rebated measure was reviewed, with attention given to the calculation procedures and documentation for savings estimates. Documentation that was reviewed for all projects selected for the sample included program forms, databases, reports, billing system data, weather data, and any other potentially useful data. Each application was reviewed to determine whether the following types of information had been provided:

- Documentation for the equipment changed, including (1) descriptions, (2) schematics, (3) performance data, and (4) other supporting information
- Documentation for the new equipment installed, including (1) descriptions, (2) schematics, (3) performance data, and (4) other supporting information
- Information about the savings calculation methodology, including (1) what methodology was used, (2) specifications of assumptions and sources for these specifications, and (3) correctness of calculations

If there was uncertainty regarding a project or apparently incomplete project documentation, ADM staff contacted the Company program staff to seek further information to ensure the development of an appropriate project-specific M&V plan.

4.1.3 On-Site Data Collection Procedures

On-site visits were completed to collect data that were used in calculating savings impacts. The visits to the sites of the sampled projects collected primary data on the facilities participating in the program.

When projects were selected for the M&V sample, ADM notified the Companies by providing the Companies' Energy Efficiency and Demand Response EM&V staff with a list of projects for which ADM planned to schedule M&V activities. This list includes the company name, the PUCO docket, the site address or other premise identification, and the respective contact information for the customer representative ADM intended to contact to schedule an appointment.

Typically, notification was provided at least two weeks prior to ADM contacting customers to provide ample time to schedule M&V visits.

During the on-site visits, the ADM field staff accomplished three major tasks:

- First, they verified the implementation status of all measures for which customers received incentives. ADM verified that the energy efficiency measures were indeed installed, that they were installed correctly and that they still function properly.
- Second, ADM collected the physical data needed to analyze the energy savings that have been realized from the installed improvements and measures. Data are collected using a form that was prepared specifically for the project in question after an in-house review of the project file.
- Third, ADM interviewed the contact personnel at the facility to obtain additional information on the installed system to complement the data collected from other sources.

At some sites, monitoring was conducted to gather more information on the operating hours of the installed measures. Monitoring was conducted at sites where it was judged that the monitored data would be useful for further refinement and higher accuracy of savings calculations. Monitoring was not considered necessary for sites where project documentation allowed for sufficiently detailed calculations.

4.1.4 Procedures for Estimating Savings from Measures Installed through the Mercantile Customer Program

ADM used a specific set of methods to determine gross savings for projects that depend on the type of measure being analyzed. These measure types and the typical methods are summarized in Table 4.4.

Table 4.4 Typical Methods to Determine Savings for Custom Measures

Type of Measure	Method to Determine Savings
Compressed Air Systems	Engineering analysis, with monitored data on load factor and schedule of operation
Lighting	Custom-designed lighting evaluation model, which uses data on wattages before and after installation of measures and hours-of-use data from field monitoring.
HVAC (including packaged units, chillers, cooling towers, controls/EMS)	eQuest model using DOE-2 as its analytical engine for estimating HVAC loads and calibrated with site-level billing data to establish a benchmark.
Motors and VFDs	Measurements of power and run-time obtained through monitoring
Refrigeration	Simulations with eQuest engineering analysis model, with monitored data
Process Improvements	Engineering analysis, with monitored data on load factor and schedule of operation

The activities specified produced two estimates of gross savings for each sample project: an ex-ante gross savings estimate (as provided by the customer) and the ex-post gross savings estimates developed through the M&V procedures employed by ADM. ADM developed estimates of program-level gross savings by applying a ratio estimation procedure in which achieved savings rates estimated for the sample projects were applied to the program-level ex-ante savings.

Throughout PY2017, ADM reviewed the ex-ante savings calculations of dockets that exceed 1,000,000 kWh. These reviews led to changes in docket savings values which helped mitigate evaluation risk.

Energy and demand savings realization rates[5] were calculated for each project for which on-site data collection and engineering analysis/building simulations were conducted. Sites with relatively high or low realization rates were further analyzed to determine the reasons for the discrepancy between ex-ante and ex-post energy savings.

The basic procedures used for estimating savings from various measure types can be reviewed in Appendix B.

4.2 Process Evaluation Methodology

The following section provides a description of the PY2017 Mercantile Program Process Evaluation The section includes the process evaluation objectives and methods.

[5]The savings realization rate for a project is calculated as the ratio of the achieved savings for the project (ex-post) (as measured and verified through the M&V effort) to the expected savings (ex ante) (as determined through the project application procedure and recorded in the tracking system for the program).

4.2.1 Process Evaluation Objectives

The process evaluation was designed to research and document the program delivery mechanisms, and collective experiences of program participants, partners, and staff. ADM uses such information to assess if implementation strategies and/or program design could better serve business customers. Table 4-5 provides a summary of the research questions and corresponding data collection activities.

Table 4-5 Research Questions

Researchable Questions	Activity to Support the Question
Were there any significant program design changes? If so, what influenced the change(s) how did the change(s) impact the program?	■ Program staff interviews ■ Administrator interviews
Is the program being administered effectively in terms of program oversight, communication, staffing, training and/or reporting?	■ Program staff interviews ■ Administrator interviews
Is the program being implemented effectively in terms of the participation processes, application tools and marketing and outreach? Could improvements be made to better reach the intended market?	■ Program staff interviews ■ Administrator interviews ■ Participant Survey
What influenced 2017 participants to enroll in the Program over other qualifying Programs offered by the Companies?	■ Participant survey ■ Administrator interviews
Were the program participants and administrators satisfied with their experiences?	■ Administrator interviews ■ Participant survey

4.2.2 Process Evaluation Methods

To address these researchable issues, ADM reviewed program documentation, administered participant surveys, and completed in-depth interviews with program staff and administrators. ADM began the process evaluation in August of 2017 with the development of data collection instruments and a review of program documentation. Data collection and analysis occurred September 2017 through January 2018.

- **Program Documentation Review:** Program materials are an important data source for the process evaluation. We began by requesting all available documentation from program staff. This list included any operating or process manuals, marketing materials, and current versions of the applications.
- **Program Staff In-Depth Interviews:** ADM researchers conducted in-depth interviews with four key program staff at the Companies, two were corporate

program managers and two were regional account representatives. The objective of these interviews was to gather information about program design and implementation strategies to elicit feedback regarding program successes and opportunities for improvements.

- **Administrator In-Depth Interviews:** ADM conducted in-depth interviews with three of the five industry organizations that serve as program administrators. The interviews addressed issues related to program design, communication, and opportunities for improvements.
- **Participant Survey:** ADM administered online surveys to program participants. In total, 21 customers completed the survey. Survey topics covered program awareness, decision making, the participation process including communication with program staff, and satisfaction.

5. Detailed Evaluation Findings

This chapter reports ADM's impact evaluation findings for the 2017 Mercantile Customer Program.

5.1 Impact Evaluation Findings

This section provides the results of ex-post gross savings for the Mercantile Customer Program during the 2017 Program year.

5.1.1 Ex-Post Gross kWh Savings

The ex-post kWh savings of the 2017 Mercantile Customer Program are summarized by sampling stratum in Table 5.1. Overall, the ex-post gross savings were equal to 101% of the ex-ante savings.

Table 5.1 Ex-ante and Gross Ex-Post kWh Savings by Sample Stratum

Stratum Name	Ex-Ante kWh Savings	Ex-Post kWh Savings	Realization Rate
Non-Lighting 1	3,149,990	3,155,681	100%
Non-Lighting 2	12,014,968	12,087,639	101%
Non-Lighting 3	6,189,232	6,983,336	113%
Lighting 1	3,787,916	3,957,983	104%
Lighting 2	6,441,434	5,418,153	84%
Lighting 3	7,856,239	8,472,569	108%
Lighting 4	4,652,534	4,580,275	98%
Total	**44,092,313**	**44,655,636**	**101%**

Error! Not a valid bookmark self-reference. shows the ex-ante and ex-post energy savings by project within the ADM sample. These projects represent a precision of +/- 9.68% at a 90% confidence interval.

Table 5.2 Ex-Ante and Ex-Post Realized kWh Savings for Sample Population

Docket Number	Ex-Ante kWh Savings	Ex-Post kWh Savings	Realization Rate
17-0242	80,075	84,625	106%
17-0427	155,419	346,989	223%
17-0428	785,214	656,465	84%
17-0432	277,569	304,373	110%
17-0453	6,189,232	6,983,336	113%
17-0466	343,939	278,432	81%
17-0529	1,024,904	1,030,383	101%
17-0532	778,839	855,986	110%
17-0533	2,069,180	2,190,729	106%
17-0535	802,043	1,155,885	144%
17-0787	1,393,822	1,218,489	87%
17-0989	531,288	531,288	100%
17-1146	17,635	15,990	91%
17-1609	259,755	256,565	99%
17-1640	1,087,464	1,297,913	119%
17-1716	819,540	640,004	78%
17-1743	50,427	44,367	88%
17-1489	230,617	234,504	102%
17-1787	283,889	164,836	58%
17-0433	102,543	66,153	65%
17-1453	215,249	235,698	110%
17-0593	3,404,051	3,404,051	100%
17-1610	1,580,791	1,580,792	100%
17-0786	1,563,012	1,398,743	89%
Total	**24,046,497**	**24,976,596**	**104%**

5.1.2 Ex-Post Gross Peak kW Savings

The ex-post gross peak kW reductions of the 2017 Mercantile Customer Program are shown in

Table 5.3 by sampling stratum. The ex-post gross peak demand savings for the program is equal to 120% of ex-ante savings.

Table 5.3 Ex-ante and Gross Realized Peak kW Savings

Stratum Name	Ex-Ante kW Savings	Ex-Post kW Savings	Realization Rate
Non-Lighting 1	149	225	151%
Non-Lighting 2	1,016	984	97%
Non-Lighting 3	914	831	91%
Lighting 1	310	582	188%
Lighting 2	1,095	794	73%
Lighting 3	764	1,666	218%
Lighting 4	214	253	118%
Total	**4,462**	**5,336**	**120%**

The ex-post gross peak kW reductions by docket within the ADM sample are shown in

Table 5.4. These dockets represent a peak kW precision of +/- 25.71%.

Table 5.4 Ex-Ante and Ex-Post Realized kW Savings

Docket Number	Ex-Ante kW Savings	Ex-Post kW Savings	Realization Rate
17-0242	0	18	NA
17-0427	0	1	NA
17-0428	6	6	99%
17-0432	0	1	NA
17-0453	914	831	91%
17-0466	78	54	70%
17-0529	20	17	85%
17-0532	4	3	84%
17-0533	1	3	253%
17-0535	48	144	300%
17-0787	213	250	118%
17-0989	0	0	NA
17-1146	3	3	92%
17-1609	25	25	99%
17-1640	182	182	100%
17-1716	0	73	NA
17-1743	0	0	NA
17-1489	15	14	95%
17-1787	48	23	47%
17-0433	0	1	NA
17-1453	25	30	120%
17-0593	356	332	93%
17-1610	218	218	100%
17-0786	28	28	100%
Total	**2,184**	**2,257**	**103%**

Some of the randomly chosen dockets for the ADM sample presented no peak demand reduction while ADM found that there is a peak demand reduction. This was the case for an entire stratum.

5.1.3 Discussion of Ex-Post Savings Analysis

The docket level realization rates were reviewed to assess whether there were factors that were causing systematic differences in the realization rates. An analysis was

conducted to determine whether realization rates for projects differed systematically by ex-ante kWh savings. The analysis showed that there was not a meaningful correlation.

Sample project realization rates and ex-ante kWh savings are plotted in

Figure 5-1. There is not a strong association between realization rates and ex-ante kWh savings.

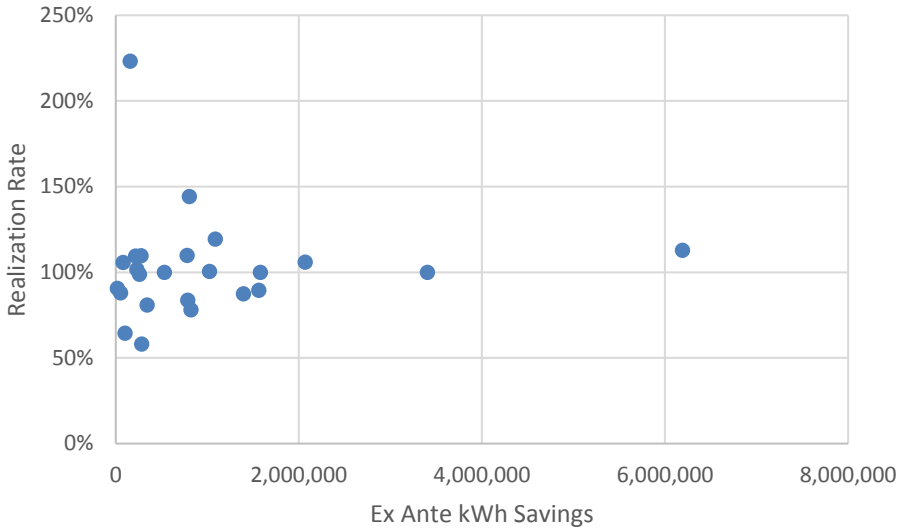

Figure 5-1 Sample Project Realization Rate versus ex-ante kWh Savings

Case-by-case examination showed that project-specific factors were more likely to cause realized kWh savings to differ from ex-ante savings. Project-specific factors include the type of measure implemented, building type, facility operating schedule, and other parameters that may affect energy efficiency measure savings. Of the projects in the ADM sample, 6 utilized deemed inputs, 3 utilized a combination of deemed and as-found inputs depending on the measures in the docket and 15 used as-found inputs. The high number of as-found inputs being used in the analyses is mostly due to the nature of the projects that fall into the mercantile program. A number of these analyses utilized billing regression analysis which allows the analysis to be based on a holistic approach when multiple energy efficiency measures have been implemented.

Project-specific factors that had an influence on realization rate include the following:

- Different savings calculation method. The retro-commissioning projects are treated as billing regression analyses. It is not always feasible for an ex-ante approach to be a billing regression analysis as post-installation billing data may not be available.
- Lighting hours of use were found to be different during the verification site visit.

- Lighting fixture quantities were found to be different during the verification site visit.
- Reconfiguration of air compressor system compared to ex-ante calculations.
- Ex-ante deemed values pulled from PA TRM as opposed to Ohio TRM
- A longer time interval of power monitoring data and or trend data available for ex-post calculations which affected savings.

Overall, the major differences in docket level realization rates are due to the nature of ex-post calculations having the benefit of collecting more post-installation data. By providing pre-construction reviews of above-threshold projects, many discrepancies were rectified prior to the filing of dockets. Pre-construction reviews were conducted on dockets that exceeded 1,000,000 kWh of annual energy savings. During PY2017, pre-construction reviews were conducted on 26 dockets. Of these dockets, 12 were filed under PY2017. This practice helps mitigate evaluation risk and ADM recommends its continuation, not only for above threshold projects, but any projects where the savings algorithms should be reviewed.

5.1.4 Discussion of Ex-Post Peak Reduction

For custom calculations, there were instances where ex-ante peak demand reduction (kW) was not provided. It is unclear if it was not provided due to no anticipated peak reduction or due to the calculation not completed.

Another reason for the difference in peak demand reduction is due to a different method of calculation in the ex-post algorithms for as-found lighting projects and custom projects. For as-found lighting calculations, ADM develops an hourly energy reduction based on each hour of the 2018 calendar year (8760 curve). This allows the calculation to pull out the average kW reduction during the peak demand window. Custom ex-post calculations which involve simulations also pull hourly values for peak demand reduction.

5.2 Process Evaluation Findings

The following section summarizes program level conclusions from the PY2017 process evaluation.

5.2.1 Program Design

- The rebate option was reinstated in 2017. Customers could still apply for the rider exemption during 2015 and 2016, but the rebate was not available.

- The Companies' program staff discussed changes that have occurred since the rebate option was last available in 2014. In 2017 the program removed the annual $500,000 rebate cap per customer per operating company; the rebate is still capped at 50% of the total project cost or $250,000 per project, whichever is lowest. Note that beginning in 2017, the $250,000 cap does not apply to combined heat and power projects.
- All administrators interviewed[6] believed the program covers the appropriate measure types, considering almost any equipment type that can demonstrate energy savings is accepted. Administrators described the application materials as lengthy but appropriate for program participation. Two administrators expressed dissatisfaction with the length of time it takes to receive approval and rebates. They acknowledged that the PUCO's role contributes to the additional layer of oversight; however, customers do not understand the process and therefore administrators spend a significant amount of time following up with program staff and communicating with customers about the status or rebates.

5.2.2 Program Administration

- During the program year, there was an initial influx of projects which was to be expected from rebates being suspended in 2015-2016. Then from June through September, the program offered a bonus that doubled the available rebate. Program staff said the program launch was smooth since the program had been operating in 2016; the only change was the reinstatement of the rebate option. From a program operations perspective not much changed in 2017.
- Administrators indicated that the 2017 program year was mostly smooth, with only a few slowdowns in the early months of the program. They attributed the early roadblocks to learning curves that had to be overcome by new staff and a higher volume of applications. Overall, the administrators noted that the program requirements and participation process were unchanged; therefore, the 2017 program year was successful from their perspective.
- Administrators indicated that communication with program staff is sufficient for supporting their efforts with application submission and approval. There is, however, a need for more advanced notice regarding program happenings, including start and stop dates for the program year and bonus incentive periods. They emphasized that customer outreach does not happen immediately after they

[6] ADM spoke with representatives from the Council for Smaller Enterprises (COSE), County Commissioners Association of Ohio (CCAO), and the Industrial Energy Users (IEU).

are notified of program details; it takes time to ramp up efforts and generate interest among their customers/members.

5.2.3 Program Implementation

- The AEG system has automation features and allows for customers or administrators to upload their application and supporting documentation as it becomes available. System limitations include limits on file size and access issues with customers' corporate firewalls. The AEG system allows for customers to submit documentation without the review of a customer service representative. The regional account representatives believe that having the support of either program staff or an administrator is imperative. The regional account representatives also noted that with reinstatement of rebates they conducted meetings with administrators early in the year to walk them through the application submission process.
- The program is primarily marketed through the Companies regional customer account representatives, program administrators, and on the program website[7]. Program staff also noted that the C&I Energy Solutions implementation contractor, Sodexo has provided referrals when they encounter customers with past projects that could qualify for the rebates through the Mercantile Customer Program. There was a consensus that developing projects for mercantile customers is heavily dependent on relationships and very little mass marketing is done to inform customers about the rebate/exemption options offered through the Mercantile Customer Program.
- Administrators do not actively market the Mercantile Customer Program, rather when they encounter a customer with a qualifying project they inform them of the rebate options. They noted that medium-sized business customers that are just over the 700,000-kWh annual threshold may be less aware of the program than others that have higher usage or have participated in the past. Administrators noted that contractor referrals were an effective means by which customers were made aware of the program.
- Two administrator interviewees stated that they saw an increase in program applications due to the reinstatement of the rebate option, however, another administrator noted that many of their members opted out[8] and therefore they saw a decline in applications overall. Administrators felt that as businesses continue to

[7] www.energysaveohio.com

[8] Beginning January 1, 2017, a customer (as defined in R.C. § 4928.6610) of an electric distribution utility may opt out of the opportunity and ability to obtain direct benefits from the utility's portfolio plan as described in R.C. § 4928.6611.

opt out of the Companies' energy efficiency programs and the backlog of projects are submitted, there may be challenges in identifying good projects for the Mercantile Customer Program.

5.2.4 Program Influence

- In summary, customers are learning about the program through their utility representatives and in 2017 they participated in the Mercantile Customer Program over other incentive programs offered by the Companies because the equipment was either already installed or other incentives were not available.
- Most participants were aware of the bonus incentive prior to starting the project application; they reported they probably would have still completed the project application without the bonus incentive. However, the bonus incentive did affect the timing of the project application submission, in that it encouraged some customers (44%) to complete their application earlier than they otherwise would have.
- Just over half of the survey respondents reported that they have plans to install high-efficiency equipment in the next two years, with most projects being lighting.

5.2.5 Satisfaction

- Survey respondents reported high levels of satisfaction with the Mercantile Customer Program. There were slightly lower satisfaction ratings related to the application process including the amount of time it took for application approval and the steps to submit a complete application.
- All three administrators we spoke with were satisfied with the Mercantile Customer Program. They believe the strengths are knowledgeable and dedicated staff and the program design that allows for customers to recover a portion of dollars already spent. They were also pleased with the bonus incentive period but would have preferred more notice, as it takes time to create awareness of bonuses. Sources of dissatisfaction were the ambiguity that exists regarding program year-end dates and the processing time from when the project goes from the PUCO back to the Companies for payment.

6. Conclusion

Table 6.1 summarizes the ex-post gross savings for each program. The Mercantile Program achieved an overall annual energy savings realization rate of 101%.

Table 6.1 Summary of kWh Savings

Operating Company	Rate Code	Ex-Ante kWh Savings	Ex-Post kWh Savings	Realization Rate
CEI	CE-GS	6,657,162	6,196,452	93%
	CE-GT	3,604,278	3,571,355	99%
Total		**10,261,440**	**9,767,807**	**95%**
OE	OE-GP	4,969,255	5,026,064	101%
	OE-GS	10,088,635	10,277,811	102%
	OE-GT	9,814,761	10,645,900	108%
Total		**24,872,651**	**25,949,774**	**104%**
TE	TE-GP	2,907,916	2,766,099	95%
	TE-GS	2,415,077	2,480,902	103%
	TE-GT	3,635,229	3,691,053	102%
Total		**8,958,222**	**8,938,055**	**100%**
Grand Total		**44,092,313**	**44,655,636**	**101%**

6.1 Recommendations

ADM offers the following recommendations for continued improvement of the Mercantile Customer Program.

- Increase cross-program marketing for the Mercantile Customer Program. Program allies are one of the primary marketing channels for the C&I Energy Solutions Program. The Companies should include information regarding the Mercantile Customer Program in their future training and information sharing sessions.
- Develop targeted marketing strategies for mercantile customers that meet the following criteria:
    - Medium-size customers whose usage exceed the minimum kWh threshold but may not receive support from the Companies account representatives.
    - Sector-specific marketing through administrators, aimed at customers such as schools that may not have as strong relationships with the Companies account representatives.
- Increase communication to program participants and administrators regarding the status of rebates checks. Status notifications and more frequent in-person check delivery are means by which the program could enhance relationships among

business customers and grow program exposure. The program does currently do some in-person check delivery; the recommendation comes from positive feedback regarding instances in 2017 when staff delivered checks.

Appendix A: Evaluation Savings Tables

This appendix contains annualized ex-post kWh savings, ex-post peak demand reductions, and ex-post lifetime savings for the Mercantile Customer Program.

Table A-1 Summary of kWh Savings

Operating Company	Ex-Ante kWh Savings	Ex-Post kWh Savings	Realization Rate
CEI	10,261,440	9,767,807	95%
OE	24,872,651	25,949,774	104%
TE	8,958,222	8,939,055	100%.
Total Companies	**44,092,313**	**44,655,636**	**101%**

Table A-2 Summary of Peak kW Savings

Operating Company	Ex-Ante Peak kW Savings	Ex-Post Peak kW Savings	Realization Rate
CEI	1,337	1,504	113%
OE	2,378	2,761	116%
TE	747	1,071	143%
Total Companies	**4,462**	**5,336**	**120%**

Table A-3 Summary of ex-post Lifetime kWh Savings

Operating Company	Lifetime Ex-Post kWh Savings
CEI	77,977,002
OE	385,772,217
TE	107,487,204
Total Companies	**573,236,422**

Appendix B: Savings Calculation Methodologies

Plan for Analyzing Savings from Lighting Measures: Lighting measures examined include retrofits of existing fixtures, lamps and/or ballasts with energy efficient fixtures, lamps and/or ballasts. These types of measures reduce demand, while not affecting operating hours. Any proposed lighting control strategies are examined that might include the addition of energy conserving control technologies such as motion sensors or daylighting controls. These measures typically involve a reduction in hours of operation and/or lower current passing through the fixtures.

Analyzing the savings from such lighting measures requires data for retrofitted fixtures on (1) wattages before and after retrofit and (2) hours of operation before and after the retrofit. Fixture wattages are taken from a table of standard wattages, with corrections made for non-operating fixtures. Hours of operation are determined from metered data collected after measure installation for a sample of fixtures.

To determine baseline and post-retrofit demand values for the lighting efficiency measures, ADM uses in-house data on standard wattages of lighting fixtures and ballasts to determine demand values for lighting fixtures. These data provide information on wattages for the common lamp and ballast combinations.

As noted, ADM collects data with which to determine average operating hours for retrofitted fixtures by using Time-of-Use (TOU) data loggers to monitor a sample of “last points of control” for unique usage areas in the sites where lighting efficiency measures have been installed. Usage areas are defined to be those areas within a facility that are expected to have comparable average operating hours. For industrial customers, expected usage areas include fabrication areas, clean rooms, office space, hallways/stairways, and storage areas. Typical usage areas are designated in the forms used for data collection.

ADM uses per-fixture baseline demand, retrofit demand, and appropriate post-retrofit operating hours to calculate peak demand savings and annual energy savings for sampled fixtures of each usage type.

The on-off profile and the fixture wattages are used to calculate post-retrofit kWh usage. Peak fixture demand is calculated by dividing the total fixture kWh usage during the Companies’ peak period by the number of hours in the peak period.

Peak period demand savings are calculated as the difference between peak period baseline demand and post-installation peak period demand of the affected lighting equipment, per the following formula:

$$\text{Peak Demand Savings} = kW_{\text{Before}} - KW_{\text{After}}$$

The baseline and post-installation average demands are calculated by dividing the total kWh usage during the Peak Period by the number of hours in the Peak Period.

ADM calculates annual energy savings for each sampled fixture per the following formula:

$$\text{Annual Energy Savings} = kWh_{Before} - kWh_{After}$$

The values for insertion in this formula are determined through the following steps:

1) Results from the monitored sample are used to calculate the average operating hours of the metered lights in each costing period for every unique building type/usage area.
2) These average operating hours are then applied to the baseline and post-installation average demand for each usage area to calculate the respective energy usage and peak period demand for each usage area.
3) The annual baseline energy usage is the sum of the baseline kWh consumption in all the usage areas. The post-retrofit energy usage is calculated similarly. The energy savings are calculated as the difference between baseline and post-installation energy usage.
4) Savings from lighting measures in conditioned spaces are factored by region-specific and building type-specific heating cooling interaction factors, allowing for the calculation of total savings attributable to lighting measures, inclusive of impacts on HVAC operation.

Plan for Analyzing Savings from HVAC Measures: Savings estimates for HVAC measures installed at a facility are derived by using the energy use estimates developed through DOE-2 simulations and engineering calculations. Each simulation produces estimates of HVAC energy and demand usage to be expected under different assumptions about equipment and/or construction conditions. There may be cases in which DOE-2 simulation is inappropriate because data are not available to properly calibrate a simulation model, and engineering analysis provides more accurate M&V results.

For the analysis of HVAC measures, the data collected through on-site visits and monitoring are utilized. Using these data, ADM prepares estimates of the energy savings for the energy efficient equipment and measures installed in each of the participant facilities. Engineering staff develops independent estimates of the savings through engineering calculations or through simulations with energy analysis models. By using energy simulations for the analysis, the energy use associated with the end use affected by the measure(s) being analyzed can be quantified. With these quantities in hand, it is a simple matter to determine what the energy use would have been without the measure(s).

Before making the analytical runs for each site with sampled project HVAC measures, engineering staff prepares a model calibration run. This is a base case simulation to ensure that the energy use estimates from the simulations have been reconciled against actual data on the building's energy use. This run is based on the information collected in an on-site visit pertaining to types of equipment, their efficiencies and capacities, and their operating profiles. Current operating schedules are used for this simulation, as are local

(TMY) weather data covering the study period. The model calibration run is made using actual weather data for a time corresponding to the available billing data for the site.

The goal of the model calibration effort is to have the results of the DOE-2 simulation come within approximately 10% of the patterns and magnitude of the energy use observed in the billing data history. In some cases, it may not be possible to achieve this calibration goal because of idiosyncrasies of facilities (e.g., multiple buildings, discontinuous occupancy patterns, etc.).

Once the analysis model has been calibrated for a facility, ADM performs three steps in calculating estimates of energy savings for HVAC measures installed or to be installed at the facility.

- First, an analysis of energy use at a facility under the assumption that the energy efficiency measures are not installed is performed.
- Second, energy use at the facility with all conditions the same but with the energy efficiency measures now installed is analyzed.
- Third, the results of the analyses from the preceding steps are compared to determine the energy savings attributable to the energy efficiency measure.

Plan for Analyzing Savings from Motors: Estimates of the energy savings from use of high-efficiency motors on HVAC and non-HVAC applications are derived through an "after-only" analysis. With this method, energy use is measured only for the high-efficiency motor and only after it has been installed. The data thus collected is then used in estimating what energy use would have been for the motor application *if the high-efficiency motor had not been installed.* In effect, the after-only analysis is a reversal of the usual design calculation used to estimate the savings that would result from installing a high-efficiency motor. That is, at the design stage, the question addressed is how energy use change for an application would if a high-efficiency motor is installed, whereas the after-only analysis addresses what the level of energy use would have been had the high-efficiency motor not been installed.

For the “after only” analysis, it is not possible to use a comparison of direct measurements to determine savings, since measured data are collected only for the high-efficiency motor. However, savings attributable to the installation of the high-efficiency motor can be estimated using information on the efficiencies of the high-efficiency motor and on the motor, it replaced. Demand and energy savings can be calculated as follows:

$$\text{Peak Demand Savings} = kW_{peak} \times (1/Eff_{old} - 1/Eff_{new})$$

where kW_{peak} = Volts x $Amps_{peak}$ x Power Factor, and $Amps_{peak}$ is the interval with the maximum recorded Amps during the monitoring period

$$\text{Energy Savings} = kW_{ave} \times (1/Eff_{old} - 1/Eff_{new}) \times \text{Hours of use}$$

where kW_{ave} = Volts x $Amps_{ave}$ x Power Factor and $Amps_{ave}$ is the average measured Amps for the duration of the monitored period.

$$\text{Annual Energy Savings} = kW_{ave} \times (1/Eff_{old} - 1/Eff_{new}) \times (\text{days of operation per year} / \text{days metered}) \times \text{Annual Adjustment Factor}$$

where kW_{ave} = Volts x $Amps_{ave}$ x Power Factor for the monitoring period, $Amps_{ave}$ is the average measured Amps for the duration of the monitored period, and use factor is determined from interviews with site personnel.

Annual Adjustment Factor is 1 if the monitoring period is typical for the yearly operation, less than 1 if the monitoring period is expected to be higher use than typical for the rest of the year, and more than 1 if the monitoring period is expected to be lower than typical for the rest of the year.[9]

The information on motor efficiencies needed for the calculation of savings is obtained from different sources.

Data on the efficiencies of high-efficiency motors installed under the program should be available from program records.

Care must be taken using nameplate efficiency ratings of replaced motors unless the company maintains good documentation of their equipment. If a motor has been rewound it may not operate as originally rated. However, if the efficiencies of the old motors are not directly available, the efficiency values can be imputed by using published data on average efficiency values for motors of given horsepower. Based on rules established under the Commission's Mercantile Pilot Program, Docket No. 10-834-EL-EEC, utilities may count equipment of failure to as-found conditions.

Because most motors monitored run only under full load conditions, some adjustments must be made from the "industry averages" of full load efficiencies. Motor efficiency curves of typical real motors that have the same full load efficiencies are used for determining part load efficiencies.

Like motor efficiency, the power factor varies with motor loading. Motor power factor curves of typical real motors that have the same full load power factor are used for determining part load power factor.

Another factor to consider in demand and energy savings comparisons of motor change-out programs is the rotor slip. Full load RPM ratings of motors vary. For centrifugal loads, such as fans and pumps, the power supplied is dependent on the speed of the driven equipment. The power is theoretically proportional to the cube of the speed, but in practice acts more like the square of the speed. In general, high-efficiency motors have slightly

[9] Current year weather data were compared with the *Typical Meteorological Year* from the National Oceanic & Atmospheric Administration (NOAA)

higher full load RPM ratings (lower slip) than standard motors. Where nameplate ratings of full load RPM are available for replaced motors, a derating factor can be applied.[10]

The data needed to carry out these plans for determining savings are collected from several sources.

- The first source of data is the information from each project's documentation. This information is expected to include aggregate energy used at a site, disaggregated energy usage data for certain targeted processes (if available), before (actual) and after (projected) data on production, scrap, and other key performance indicators, and final reports (which include process improvement recommendations, analyses, conclusions, performance targets, etc.).
- The second source of data is the energy use data that the Companies collect for these customers.
- The third source is information collected through on-site inspections of the facilities. ADM staff collects the data during on-site visits using a form that is comprehensive in addressing a facility's characteristics, its modes and schedules of operation, and its electrical and mechanical systems. The form also addresses various energy efficiency measures, including high-efficiency lighting (both lamps and ballasts), lighting occupancy sensors, lighting dimmers and controls, air conditioning, high-efficiency motors, etc.
- The fourth source of data, selected end-use equipment is monitored to develop information on operating schedules and power draws.

Plan for Analyzing Savings from VFDs: A variable-frequency drive (VFD) is an electronic device that controls the speed of a motor by varying the magnitude of the voltage, current, or frequency of the electric power supplied to the motor. The factors that make a motor load a suitable application for a VFD are (1) variable speed requirements and (2) high annual operating hours. The interplay of these two factors can be summarized by information on the motor's duty cycle, which essentially shows the percentage of time during the year that the motor operates at different speeds. The duty cycle should show good variability in speed requirements, with the motor operating at reduced speed a high percentage of the time.

Potential energy savings from the use of VFDs are usually most significant with variable-torque loads, which have been estimated to account for 50% to 60% of total motor energy use in the non-residential sectors. Energy saving VFDs may be found on fans, centrifugal pumps, centrifugal blowers, and other centrifugal loads, most usually where the duty cycle of the process provided a wide range of speeds of operation.

[10]As an example, take the case where a new motor has a full load RPM rating of 1770 and the old motor had a full load RPM rating of 1760. The derating factor would be:

Derating factor = $(RPM_{old})^2 / (RPM_{new})^2 = 1760^2 / 1770^2 = 0.989$

ADM's approach to determining savings from installation of VFDs involves (1) making one-time measurements of voltage, current, and power factor of the VFD/motor and (2) conducting continuous measurements of amperage over a period to obtain the data needed to develop VFD load profiles and calculate demand and energy savings. VFDs are generally used in applications where motor loading changes as motor speed changes. Consequently, the true power drawn by a VFD is recorded to develop VFD load shapes. One-time measurements of power are made for different percent speed settings. Power and percent speed or frequency (depending on VFD display options) are recorded for as wide a range of speeds as the customer allows the process to be controlled; field staff attempt to obtain readings from 40 to 100% speed in 10 to 15% increments.

Plan for Analyzing Savings from Compressed Air Measures: Measures to improve the efficiency of a compressed air system include the reduction of air leaks, resizing of compressors, installing more efficient compressors, improved controls, or a complete system redesign. Savings from such measures are evaluated through engineering analysis of compressor performance curves, supported by data collected through short-term metering.

ADM field staff obtains nameplate information for the pre-retrofit equipment either from the project file or during the on-site survey. Performance curve data are obtained from manufacturers. Engineering staff then conduct an engineering analysis of the performance characteristics of the pre-retrofit equipment. During the on-site survey, field staff inspects the as-built system equipment, takes pressure and load readings, and interview the system operator to identify seasonal variations in load. Potential interactions with other compressors are assessed and it is verified that the rebated compressor is being operated as intended.

When appropriate, short-term measurements are performed to reduce the uncertainty in defining the load on the as-built system. These measurements may be taken either with a multi-channel logger, which can record true power for several compressors, with current loggers, which can provide average amperage values, or with motor loggers to record operating hours. The appropriate metering equipment is selected by considering variability in load and the cost of conducting the monitoring.

Plan for Analyzing Savings from Refrigeration and Process Improvements: Analysis of savings from refrigeration and process improvements is inherently project-specific. Because of the specificity of processes, analyzing the processes through simulations is generally not feasible. Rather, reliance is made on engineering analysis of the process affected by the improvements. Major factors in ADM's engineering analysis of process savings are operating schedules and load factors. Information on these factors is developed through short-term monitoring of the affected equipment, be it pumps, heaters, compressors, etc. The monitoring is done after the process change, and the data gathered on operating hours and load factors are used in the engineering analysis to define "before" conditions for the analysis of savings.

Plan for Analyzing Savings from Whole Facility Energy and Water Process Improvements: In cases where a measure's impact may be "visible in the bills", ADM investigates using an IPMVP[11] Option C: Whole Facility analysis methodology. The general format used is a monthly pre/post-implementation billing data regression, which compares site-specific weather data and/or other impactful variables (e.g. production data) against monthly billing data to determine how energy consumption of the facility varies with these variables and the implemented measure. To perform the billing regression, several pieces of information are usually ascertained:

- Details about the electric metering arrangement at a facility, to determine which meter(s) are impacted by the measure, and other loads involved.
- Time affected by measure implementation.
- Whether or not any other energy projects or changes to facility operation affecting energy usage were implemented in or around the timeframe of the rebated measure. If so, adjustments may be made, or in some cases, the regression is not feasible.

[11] International Performance, Measurement, and Verification Protocol. "Concepts and Options for Determining Energy and Water Savings", Volume 1. January 2012.