2022 Indiana Commercial & Industrial Portfolio EM&V Report

Volume I of II

Prepared for:

Indiana Michigan Power

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1. Introduction

Under contract with the Indiana Michigan Power (I&M), ADM Associates, Inc., (ADM) performed evaluation, measurement, and verification (EM&V) activities that confirmed the energy savings (kWh) and demand reduction (kW) realized through the energy efficiency programs that I&M implemented in Indiana during the during January 2022 through December 2022 (PY2022).

This chapter provides a summary of evaluation findings for the C&I program portfolio and presents information regarding the organization of the report.

1.1. Summary of Data Collection

Table 1-1 summarizes the number of verification sites reviewed for the ex post gross analysis.

Table 1-1 Number of Sampled Projects

Program	*Number of Sampled Projects*
Work Prescriptive	23
Work Custom	20
Public Efficient Streetlighting	Census

Surveys were conducted to collect data on the program's impact on participants' decisions to install efficient equipment, as well as their feedback on the program. Table 1-2 summarizes the survey data collection completed for PY2022.

Table 1-2 Summary of Survey Data Collection

Mode	*Time Frame*	*Number of Contacts*	*Number of Completions*
Email	October 2022	131	13
Phone follow up to October email invitation	January 2023	26	3
Email	January 2023	48	1
Total		179	17

1.2. Impact Evaluation Findings

The savings variables presented in this evaluation report are defined in Table 1-3.

Table 1-3 Savings-Related Terminology

Variable	*Definition*
kWh Savings Goal	*kWh Savings Goal* is the energy savings goal cited in the applicable portfolio plan.
Ex Ante Gross kWh Savings	*Ex Ante Gross kWh Savings* are the annual energy savings reported by I&M and are typically obtained from I&M's DSM/EE Program Scorecard documents.

Variable	*Definition*
Gross Audited kWh Savings	*Gross Audited kWh Savings* are determined by reviewing tracking data presenting for any errors and adjusting *Ex Ante Gross kWh Savings* accordingly.
Gross Verified kWh Savings	*Gross Verified kWh Savings* are determined by applying an installation rate to the *Gross Audited kWh Savings*.[1] The installation rate is defined as the ratio of units that were installed (verified) to the number of units reported (claimed).
Ex Post Gross kWh Savings	*Ex Post Gross kWh Savings* are the realized annual gross kWh savings reflecting all adjustments made by ADM, without accounting for free ridership or spillover.
Ex Post Net kWh Savings	*Ex Post Net kWh Savings* are equal to *Ex Post Gross kWh Savings*, adjusted to account for free ridership and spillover.[2]
Ex Post Net Lifetime kWh Savings	*Ex Post Net Lifetime kWh Savings* is the *Ex Post Net kWh Savings* occurring over the course of the applicable measure effective useful life (EUL).
Gross Realization Rate	*Gross Realization Rate* is equal to *Ex Post Gross kWh Savings* divided by *Ex Ante Gross kWh Savings*.
Net-to-Gross Ratio	*Net-to-Gross Ratio* is equal to *Ex Post Net kWh Savings* divided by *Ex Post Gross kWh Savings*.
Free Rider[3]	A *free rider* is a program participant who would have implemented the program measure or practice in the absence of the program. Free riders can be: 1) total, in which the participant's activity would have completely replicated the program measure; 2) partial, in which the participant's activity would have partially replicated the program measure; or 3) deferred, in which the participant's activity would have completely replicated the program measure, but at a future time than the program's timeframe. The free ridership estimate are the savings attributable to free riders.

1 Gross Verified energy impacts will be equal to Gross Audited energy impacts for the Work Prescriptive, Work Custom, and Public Efficient Street Lighting as the in-service rate for these programs is 1.0.

2 ADM conducted a non-participant spillover study in 2021 to estimate non-participant spillover and concluded that there was not any qualifying non-participant spillover. Spillover savings presented in this report reflect participant spillover.

3 Northeast Energy Efficiency Partnerships (NEEP) EMV Glossary version 2.1. https://neep.org/media/4330

Variable	*Definition*
Spillover (Participant and Non-Participant)[4]	*Spillover* effects are reductions in energy consumption and/or demand caused by the presence of an energy efficiency program, beyond the program-related gross savings of the participants and without financial or technical assistance from the program. There can be participant and/or non-participant spillover. *Participant spillover* is the additional energy savings that occur when a program participant independently installs energy efficiency measures or applies energy saving practices after having participated in the efficiency program because of the program's influence. *Non-participant* spillover refers to energy savings that occur when a program non-participant installs energy efficiency measures or applies energy savings practices as a result because of a program's influence.

Based on the definitions presented in Table 1-3, Table 1-4 presents a summary of the components of the impact evaluation that are accounted for in savings variables presented in this report.

Table 1-4 Components of Impact Evaluation Accounted for in Savings Variables

Category	*Tracking Data Review*	*In-Service Rates*	*Ex Post Gross Analysis*	*Net-to-Gross Analysis*
Gross Audited	✓			
Gross Verified	✓	✓		
Ex Post Gross	✓	✓	✓	
Ex Post Net	✓	✓	✓	✓

ADM performed EM&V activities for each of the C&I programs offered by I&M during PY2022. Total C&I portfolio ex post gross energy savings are 40,977,758 kWh, while ex post net energy savings are 36,868,964 kWh, as shown in Table 1-5.

Table 1-5 Summary of Energy Savings – PY2022

Program Name	*Ex Ante Annual kWh Savings*	*Gross Audited kWh Savings*	*Gross Verified kWh Savings*	*Ex Post Annual Gross kWh Savings*	*Gross Realization Rate*	*Ex Post Annual Net kWh Savings*	*Net-to-Gross Ratio*	*Lifetime Net Ex Post kWh Savings*
Work Prescriptive	16,403,055	18,883,903	18,431,394	18,431,394	112%	16,157,685	88%	205,579,377
Work Custom	17,595,760	16,226,554	16,579,879	16,579,879	94%	14,744,794	89%	183,598,535
Public Efficient Street Lighting	5,966,485	5,966,485	5,966,485	5,966,485	100%	5,966,485	100%	113,388,979
C&I Portfolio Totals	39,965,300	41,076,942	40,977,758	40,977,758	103%	36,868,964	90%	502,566,891

Total C&I portfolio ex post gross peak demand savings are 4,847.94 kW, while ex post net peak demand savings are 3,813.59, as shown in Table 1-6.

4 Ibid.

Table 1-6 Summary of Peak Demand Impacts – PY2022

Program Name	*Ex Ante Gross kW Savings*	*Gross Audited kW Savings*	*Gross Verified kW Savings*	*Ex Post Gross kW Savings*	*Gross Realization Rate*	*Ex Post Net kW Savings*	*Net-to-Gross Ratio*
Work Prescriptive	1,814.28	2,163.11	2,034.88	2,034.88	112%	1,701.35	84%
Work Custom	2,803.61	2,704.36	2,813.07	2,813.07	100%	2,112.24	75%
Public Efficient Street Lighting	-	-	-	-	N/A	-	N/A
C&I Portfolio Totals	4,617.89	4,867.47	4,847.94	4,847.94	105%	3,813.59	79%

1.3. Cost Effectiveness Evaluation Findings

ADM performed the following cost effectiveness tests for the programs: Total Resource Cost (TRC) test, Utility Cost Test, Participant Cost Test (PCT), and Ratepayer Impact Measure (RIM) test. A test score above one signifies that, from the perspective of the test, the program benefits were greater than the program costs. Table 1-7 shows the test results for each program.

Table 1-7 Summary of PY2022 Benefit-Cost Ratios

Program	*Program Administrator Cost Test (aka USCRT, or UCT)*	*Total Resource Cost Test*	*Ratepayer Impact Measure*	*Participant Cost Test*
Work Prescriptive	2.73	1.81	0.31	5.95
Work Custom	2.22	2.77	0.31	18.39
Public Efficient Streetlighting	0.99	0.76	0.25	2.39
C&I Portfolio Total	1.90	1.59	0.30	5.39

1.4. Evaluation Findings and Recommendations

1.4.1. Work Custom and Prescriptive

Based on the results of the analysis, ADM identified the following key findings and recommendations I&M could consider as they implement their efficiency programs for commercial and industrial customers.

Collaboration and communication between CLEAResult and I&M staff led the program to identify several key measures and incentives that would appeal to the market and encourage participation in the Work programs that led to the program meeting goals. I&M and CLEAResult staff reported positive communication and collaboration between the two groups that is carrying into 2023. This collaboration led to the encouragement of the market to adopt measure the program had not emphasized in PY2021 such as hotel and cold air weatherization and

compressed air studies. Ultimately, this work led to increased savings for the program and to the program meeting savings goals.

The program increased outreach staffing and focused on large customers that participated in the programs in the past. As of late January 2023, three outreach specialists have regular communications with trade allies and key large customers in their respective territories to drive and support energy saving projects. In addition to working with the large customers and active trade allies in their region, these outreach specialists work with key account managers at the utility, chambers of commerce, and similar entities to alert the commercial and industrial entities in the region to the services and incentives offered by I&M. The program also focused on marketing through monthly newsletters to customers and trade allies, maintaining the program website, conducting paid search, providing online advertising, and providing program collateral at conferences, meetings, and similar functions. I&M has entered into a partnership with Allumia, a third-party provider of Efficiency as a Service. As part of this collaboration, I&M will refer its customers to Allumia, who will cover the initial cost of implementing efficiency improvements. Allumia recoups these costs through the customer's energy savings over time.

- **Recommendation 1:** With the availability of additional outreach resources, the program should also focus on reaching mid-size and large customers that have not participated in the program or have not participated in the last few years while reaping the benefits of outreach to past participants. Findings from the non-participant survey completed in PY2021 found that two-thirds of C&I customers were unaware of I&M incentives, suggesting that there is an opportunity to educate the customer on the incentives I&M offers.

Participant survey findings indicate that contractors are playing important roles in supporting the program. Contractors and vendors were the most common source of program awareness among survey respondents (35% learned of the program from a trade ally, contractor, vendor, or energy consultant) and contractors assisted a majority of participants with the application.

Participants reported a positive experience with the program. Most participants (94%) were satisfied with the program overall and all respondents reported that the application process was somewhat or completely acceptable.

1.5. Organization of Report

ADM prepared two volumes for this report, and they provide information on the impact, process, and cost effectiveness evaluation of the Indiana Michigan Power portfolio of C&I programs implemented in Indiana during the 2022 program year. Volume I is organized as follows:

- Chapter 2: Work Prescriptive
- Chapter 3: Work Custom
- Chapter 4: Public Efficient Streetlighting
- Chapter 5: Cost Effectiveness Evaluation

See report Volume II for chapters that present reports of site-level gross energy impacts, survey instruments and tabulated survey response information.

2. Work Prescriptive

This chapter presents the results of both the impact and process evaluations of the Work Prescriptive Program that Indiana Michigan Power (I&M) offered to its non-residential customers during the period of January 2022 through December 2022.

The objectives of the evaluation were to:

- Establish a pre-approval review procedure;
- Assess gross and net energy (kWh) savings and peak demand (kW) reductions resulting from participation in the program during the program year;
- Document sources of program awareness among participants;
- Assess satisfaction among participating customers; and
- Provide recommendations for program improvement as appropriate.

2.1. Program Description

This program targets non-residential customers eligible for prescriptive measures. These will include commercial, industrial, and institutional customers. For-profit, non-profit, and public agencies (such as schools) are eligible to participate.

Categories of eligible measures for this program include:

- Lighting
- Lighting controls
- HVAC systems
- Variable frequency drives
- Commercial refrigeration equipment
- Commercial kitchen equipment
- Compressed Air – Engineered Nozzle

2.2. Data Collection

2.2.1. Verification of Measures

2.2.1.1. Sampling Plan

ADM selected a sample of all 2022 C&I projects for which ADM performed measurement and verification (M&V) and calculated gross realized kWh savings and kW demand reductions.

ADM used a stratified sampling approach to develop the M&V sample. A stratified sampling approach allowed for a given statistical precision and confidence level target to be met with a smaller sample size than would have been allowed by simple random sampling. Strata boundaries

were based on ex ante kWh energy savings. ADM selected a sample with enough sample units to facilitate estimation of program ex post kWh energy savings with 10% statistical precision at a 90% confidence level.

Completed program projects accumulated over the course of the program year, and sample selection occurred at multiple points in time. The timing of sample selection was contingent upon the timing of the completion of projects during the program year.

The table below shows the number of projects, ex ante gross kWh energy savings, and sampling statistics, by stratum, of the program sample.

Table 2-1 Population Statistics Used for Work Prescriptive Sample Design

Variable	*Stratum 1*	*Stratum 2*	*Stratum 3*	*Stratum 4*	*Stratum 5*	*Totals*
Strata boundaries (kWh)	> 350000	160000 - 350000	65000 - 160000	19000 - 65000	< 19000	
Number of projects	5	27	43	96	98	269
Total Ex Ante Annual kWh	2,043,825	5,879,230	4,364,563	3,251,409	864,244	16,403,270
Average kWh Savings	408,765	217,749	101,501	33,869	8,819	60,978
Std. dev. of kWh savings	40,950	49,302	30,295	13,281	4,941	138,768
Coefficient of variation	0.1	0.23	0.3	0.39	0.56	
Final design sample	1	7	6	5	4	23

2.2.1.2. Verification Data Collection Procedures

ADM used remote verifications to collect project-specific data. ADM staff accomplished three major tasks with these communications:

- First, ADM staff verified the implementation status of all measures for which customers received incentives. They verified the correct installation of the energy efficiency measures and that they still functioned properly.
- Second, ADM staff collected additional data, when necessary, needed to analyze the realized energy savings from the installed improvements and measures. ADM collected data in a form prepared specifically for the project in question after an in-house review of the project file.
- Third, ADM interviewed the contact personnel at a facility to obtain additional information on the installed system to complement the data collected from other sources.

2.2.2. Participant Survey

ADM administered a survey to Work Prescriptive and Work Custom participants to collect data for use in estimating net savings and obtaining feedback about participants' experience with the program. Table 2-2 summarizes the survey data collection efforts. ADM contacted participants by email and a segment of participants with larger projects that did not respond to the October email invitation were contacted by telephone to complete the survey.

Table 2-2 Summary of Work Prescriptive and Work Custom Data Collection

Mode	*Time Frame*	*Number of Contacts*	*Number of Completions*
Email	October 2022	131	13
Phone follow-up to October email invitation	January 2023	26	3
Email	January 2023	48	1
Total		179	17

2.2.3. Staff Interviews

The evaluation team completed staff interviews with the key staff responsible for managing and implementing the Work programs. Specifically, the interviews covered:

- The program approach to outreach and marketing.
- Any recent changes to measure and incentives.
- The launch of new program offerings like the midstream offering and the efficiency as a service element and the associated partnership with Allumia.
- Feedback from participants and trade allies about their satisfaction with the program.
- Key successes and challenges experience in the last year.

The evaluation team completed two interviews, one with the key I&M staff person responsible for the Work programs, and the second with four CLEAResult staff that worked in management, marketing, reporting, and rebate processing (Table 2-3).

Table 2-3 Staff Interview Summary

Interviews	*Title*	*Key Duties*
Interview #1	Programs Coordinator at Indiana Michigan Power	Manage all energy efficiency work for I&M including being the primary point of contact for CLEAResult
Interview #2	Marketing Portfolio Manager	Oversee I&M marketing campaigns and demand generation
	Program Director	Oversee CLEAResult work for I&M Residential and Commercial Programs
	Senior Program Manager	Oversee Work Programs including being the key liaison with I&M staff
	Program Analyst	Reporting, forecasting, and rebate processing

2.3. Estimation of Ex Post Gross Savings

2.3.1. Methodology for Estimating Ex Post Gross Savings

2.3.1.1. Review of Documentation

I&M's program implementation contractor provided documentation for the sampled energy efficiency projects undertaken at customer facilities. ADM's first step in the evaluation effort was

to review this documentation and other program materials that were relevant to the evaluation effort.

For each sampled project, ADM reviewed the available documentation (e.g., audit reports, savings calculation work papers, etc.) for each rebated measure, with attention given to the calculation procedures and documentation for savings estimates. Reviewed documents included program forms, reports, billing system data, weather data, and any other potentially useful data. For each application, ADM determined if the following types of information was available for each application:

- 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.

In addition to the above activities, ADM completed a review of program tracking data. The purpose of the review was to assess the sufficiency of the tracking data for supporting program implementation and evaluation. To this end, ADM reviewed the program data to verify tracking of the following fields, that the fields were populated (i.e., the data were not missing), and that the values were reasonable.

- Unique customer identifier, such as customer account number;
- Customer specific project data such as contact name and information, building type;
- Project milestone dates such as application submission date, application approval, incentive payment (where applicable);
- Measure specific information such as:
  - type of measure;
  - specific measure;
  - ex ante measure kWh energy savings and peak kW reductions;
  - measure attributes necessary to estimate measure savings (where applicable);
  - unique measure identifier (e.g., numeric or alpha-numeric code);
  - unit serial number (where applicable);
  - incremental costs / project costs
- Vendor/Contractor business name, contact name and information (where applicable);
- Incentive amounts; and
- Application status.

ADM provided recommendations, specifically regarding tracking measure level information, to the implementation contractor based on this review.

2.3.1.2. Procedures for Estimating Measure-Level Gross Energy Savings

A breakdown of sampled measures for the Work Prescriptive Program is below in Table 2-4.

Table 2-4 Breakdown of Sampled Prescriptive Measures

Measure Category	*Ex Ante Annual kWh Savings*	*Ex Post Annual Gross kWh Savings*	*Gross Realization Rate*
Air Conditioner	10,929	2,138	20%
Exterior Area Lighting Fixture - HID to LED	300,406	374,314	125%
Heat Pump	11,245	2,396	21%
HID-to-LED Retrofit	7,698	6,828	89%
Interior Area Lighting Fixture - HID to LED	326,367	352,611	108%
LED Exit Sign	6,474	11,867	183%
LED MR16 Replacing Incandescent	4,187	11,238	268%
LED Recessed Light Fixture/Lamps	105,537	135,706	129%
LED Tube Relamp	888,047	1,197,759	135%
Lighting Occupancy Sensor	303,105	270,778	89%
Streetlight Fixture	720,543	767,848	107%
VFD Added to HVAC Fans	67,080	64,386	96%
Total	2,751,620	3,197,869	116%

ADM calculated a kWh energy savings gross realization rate and a peak kW reduction gross realization rate for each site in the M&V sample. Sites with relatively high or low gross realization rates were analyzed to determine the reasons for the discrepancy between ex ante and ex post energy savings. The site-level gross impact analysis results for each M&V sample site are presented in Volume II of the report. These reports outline the data sources and analytical approaches employed in the calculation of measure impacts.

2.3.2. Results of Ex Post Gross Savings Estimations

The kWh gross realization rate is the ratio of sampled measure ex post gross kWh energy savings to sampled measure ex ante kWh energy savings. The kW gross realization rate is the ratio of sampled measure ex post gross kW demand savings to sampled measure ex ante kW demand savings. Since a stratified sampling approach was employed for this program, stratum-level kWh and kW gross realization rates were developed for each sampling stratum.

Program-level gross ex post gross kWh energy savings are calculated as follows:

- The ex-ante kWh energy savings of non-sampled measures are factored by the applicable stratum-level kWh gross realization rates to calculate ex post gross kWh energy savings for non-sampled measures.
- The ex post gross kWh energy savings of all sampled measures and all non-sampled measures are summed.

Program-level gross ex post gross kW demand savings are calculated as follows:

- The ex-ante kW demand savings of non-sampled measures are factored by the applicable stratum-level kW gross realization rates to calculate ex post gross kW savings for non-sampled measures.
- The ex post gross kW demand savings of all sampled measures and all non-sampled measures are summed.

2.3.2.1. Ex Post Gross kWh Savings

Table 2-5 displays the ex ante and ex post gross kWh savings of the Work Prescriptive Program including gross realization rates for sampled projects.

Table 2-5 Work Prescriptive Project-Level Ex Ante and Ex Post kWh Savings

Stratum	*Project Number*	*Measure*	*Ex Ante kWh Savings*	*Gross Ex Post kWh Savings*	*Project Gross Realization Rate*
1	120	LED lighting	377,667	808,050	214%
2	114	LED lighting and occupancy sensor	304,536	39,356	13%
2	103	Streetlighting	253,735	293,247	116%
2	109	LED lighting	214,724	356,414	166%
2	104	Streetlighting	198,396	207,192	104%
2	105	Streetlighting	183,265	190,845	104%
2	121	LED lighting	181,652	277,845	153%
2	110	LED lighting	165,542	151,444	91%
3	115	LED lighting and occupancy sensor	150,349	142,410	95%
3	116	LED lighting, exit signs, and occupancy sensor	133,074	149,814	113%
3	117	LED lighting	93,982	99,395	106%
3	102	Streetlighting	85,147	76,564	90%
3	101	VFD, Heat pump	78,325	66,782	85%
3	100	LED lighting	67,092	82,659	123%
4	122	LED lighting	62,052	33,159	53%
4	106	LED lighting and occupancy sensor	59,085	81,976	139%
4	118	Occupancy sensor	54,900	52,612	96%
4	108	LED lighting	37,485	54,443	145%
4	107	LED lighting	25,384	23,646	93%

Stratum	*Project Number*	*Measure*	*Ex Ante kWh Savings*	*Gross Ex Post kWh Savings*	*Project Gross Realization Rate*
5	119	Air conditioner and LED exit signs	12,589	3,798	30%
5	113	LED lighting and occupancy sensor	5,610	2,831	50%
5	112	LED lighting	5,454	2,718	50%
5	111	LED lighting	1,572	669	43%
All Non-Sample Projects			13,651,435	15,233,525	112%
Total			16,403,055	18,431,394	112%

Fifteen of the 23 sampled prescriptive projects had a realization rate that was lower than 90% or higher than 110%.

- Projects 100, 103, 106, 108, 109, 116, 120 & 121 had high realization rates (123%, 116%, 139%, 145%, 166%, 113%, 214% &153%, respectively). The difference between the ex ante and the ex post savings was due to the ex ante analysis applying a deemed per fixture/lamp kWh savings value that was multiplied by the quantity of measures to estimate the project savings, whereas the ex post analysis used project-specific information (wattages, hours of use for the space, and appropriate heating and cooling interactive factors).
- Projects 111,112, & 113 had low realization rates (43%, 50% & 50%, respectively) for lighting measures. The ex ante deemed savings per unit values may have been derived with hours of use greater than the ex post analysis, which verified 2,500 annual operating hours. The application form for lighting projects also includes a second savings estimate, labeled "Annual kWh Reduction", with a result that was similar to the ex post savings, as hours of use were included in the supplemental calculation.
- In Project 114, there was a double-counting issue with the installed lighting due to the disaggregation of the installed measures into the Prescriptive or Custom programs. The as-built lighting survey was referenced by separate Excel spreadsheet pivot tables. Specifically, when the installed measures were grouped into the Custom program, the ex ante savings were based on the pivot table that referenced the "existing fixture." On the other hand, when the installed measures were grouped into the Prescriptive program, the ex ante savings were based on the pivot table that referenced the unique field for "efficient fixture." The ex post method retained the 1:1 retrofits in the prescriptive savings, and the measures with a quantity changes in the custom savings.
- Project 122 had a low realization rate (53%) for lighting measures. The ex ante deemed savings per unit values may have been derived with hours of use greater than the ex post analysis, which verified 2,340 annual operating hours. A second reason was that the same deemed savings estimate was applied to 105W and 155W efficient lamps, which resulted in realization rates of 87% and 51%, respectively.

Two prescriptive heat pump projects also had low realization rates.

- Projects 101 and 119 had realization rates of 85% and 30%, respectively. Both projects involved heat pump measures, when air conditioning units with a gas heat source were installed. The ex post savings analysis only counted cooling savings from the units. Because both projects were new construction projects, the ex post analysis referenced federal appliance standards for the baseline efficiency.

Table 2-6 presents the ex post annual gross kWh savings for the Work Prescriptive Program from January 2022 through December 2022.

Table 2-6 Ex Post Annual Gross kWh

Ex Ante Gross kWh Savings	*Gross Audited kWh Savings*	*Gross Verified kWh Savings*	*Ex Post Gross kWh Savings*	*Gross Realization Rate*
16,403,055	18,883,903	18,431,394	18,431,394	112%

2.3.2.2. Ex Post Gross kW Reductions

Table 2-7 presents the ex post peak kW reduction for the Work Prescriptive Program from January 2022 through December 2022.

Table 2-7 Ex Post Peak kW Reduction

Ex Ante Gross kW Savings	*Gross Audited kW Savings*	*Gross Verified kW Savings*	*Ex Post Gross kW Savings*	*Gross Realization Rate*
1,814.28	2,163.11	2,034.88	2,034.88	112%

2.4. Estimation of Ex Post Net Savings

2.4.1. Methodology for Estimating Ex Post Net Savings

The net savings analysis was used to determine what part of the gross energy savings achieved by program participants could be attributed to the effects of the program. The net savings attributed to program participants are the gross savings less free ridership, plus spillover.

2.4.1.1. Methodology for Estimating Free Ridership

A survey of program participants that asked them about role of the program in their decision to implement the energy efficiency measures informed the net-to-gross analysis.

ADM considered three factors to determine what percentage of savings may be attributable to free ridership. The three factors are:

- Plans and intentions of firm to install a measure even without support from the program;

- Influence that the program had on the decision to install a measure; and
- A firm's previous experience with a measure installed under the program.

For each of these factors, ADM applied rules to develop binary variables indicating whether a participant's behavior shows free ridership. These rules make use of answers to questions on the decision maker survey questionnaire.

The first factor requires determining if a participant's intention was to install an energy efficiency measure even without the program. The answers to a combination of several questions are used with a set of rules to determine whether a participant's behavior indicates likely free ridership. Two binary variables account for customer plans and intentions: one, based on a more restrictive set of criteria that may describe a high likelihood of free ridership, and a second, based on a less restrictive set of criteria that may describe a relatively lower likelihood of free ridership.

The first, more restrictive criteria indicating customer plans and intentions that likely signify free ridership are as follows:

- The respondent answers "yes" to the following two questions: "Did you have plans to install the measure before participating in the program?" and "Would you completed the [MEASURE] project even if you had not participated in the program?"
- The respondent answers "definitely would have installed" to the following question: "If the financial incentive from the [PROGRAM] had not been available, how likely is it that you would have installed [MEASURE] anyway?"
- The respondent answers "did not affect timing of purchase and installation" to the following question: "How did the availability of information and financial incentives through the [PROGRAM] affect the timing of your purchase and installation of [MEASURE]?"
- The respondent answers "no, the program did not affect level of efficiency that we chose for equipment" in response to the following question: "Did you purchase and install the [MEASURE] earlier than you otherwise would have without the program?"

The second, less restrictive criteria indicating customer plans and intentions that likely signify free ridership are as follows:

The respondent answers "yes" to the following two questions: "Did you have plans to install the [MEASURE] before participating in the program?" and "Would you have completed the [MEASURE] project even if you had not participated in the program?"

- Either the respondent answers "definitely would have installed" or "probably would have installed" to the following question: "If the financial incentive from the [PROGRAM] had not been available, how likely is it that you would have installed [MEASURE] anyway?"
- Either the respondent answers "did not affect timing of purchase and installation" to the question: "Did you purchase and install the [MEASURE] earlier than you otherwise would have without the program?" or the respondent indicates that while program information and financial incentives did affect the timing of equipment purchase and installation, in the

absence of the program they would have purchased and installed the equipment within the next two years.

- The respondent answers "no, the program did not affect level of efficiency that we chose for equipment" in response to the following question: "Did you choose equipment that was more energy efficient than you would have chosen because of the program?"

The second factor requires determining if a customer reports that a recommendation from a Program representative or experience with the program was influential in the decision to install a particular piece of equipment or measure.

The criterion indicating that program influence may signify a lower likelihood of free ridership is that either of the following conditions is true:

- The respondent answers "very important" to the following question: "How important was previous experience with the [Program Name] in making your decision to install [Equipment/Measure]?
- The respondent answers "yes" to the following question: "Did a representative of the [Program Name] recommend that you install [Equipment/Measure]?"

The third factor requires determining if a participant in the program indicates that he or she had previously installed an energy efficiency measure like the one that they installed under the program without an energy efficiency program incentive during the last three years. A participant indicating that he or she had installed a similar measure is considered to have a likelihood of free ridership.

The criteria indicating that previous experience may signify a higher likelihood of free ridership are as follows:

- The respondent answers "yes" to the following question: "Before participating in the [Program Name], had you installed any equipment or measure similar to [Rebated Equipment/Measure] at your facility?"
- The respondent answers "yes, purchased energy efficient equipment but did not apply for financial incentive." To the following question: "Has your organization purchased any energy efficient equipment in the last three years for which you did not apply for a financial incentive through the [Program Name?"

The four sets of rules just described are used to construct four different indicator variables that address free ridership behavior. For each customer, a free ridership value is assigned based on the combination of variables. With the four indicator variables, there are 12 applicable combinations for assigning free ridership scores for each respondent, depending on the combination of answers to the questions creating the indicator variables. Table 2-8 shows these values.

Table 2-8 Free Ridership Scoring

Indicator Variables				*Free Ridership Score*
Had Plans and Intentions to Install Measure without the Program? (Definition 1)	*Had Plans and Intentions to Install Measure without the Program? (Definition 2)*	*The Program had influence on Decision to Install Measure?*	*Had Previous Experience with Measure?*	
Y	Y	Y	Y	100%
Y	Y	N	Y	100%
Y	Y	N	N	100%
Y	Y	Y	N	67%
N	Y	N	Y	67%
N	Y	Y	Y	33%
N	Y	N	N	33%
N	N	N	Y	33%
N	Y	Y	N	0%
N	N	Y	Y	0%
N	N	Y	N	0%
N	N	N	N	0%

The free ridership assessment also included questions on the participants' financial ability to pay for the measures. These questions were used to assess the consistency of the responses to the questions used to score free ridership.

Responses are considered inconsistent if the respondent indicates that they were not financially able to install the equipment, but state that they have plans to install the equipment and would have installed it without the program incentive. There were no cases where respondents reported this and that they could not have afforded the measure without program support.

2.4.1.2. Methodology for Estimating Spillover

Program participants could implement additional energy saving measures without receiving a program incentive because they participated in the program. The energy savings resulting from these additional measures constitute program participant spillover effects.

To assess participant spillover savings, survey respondents are asked whether or not they implemented any additional energy saving measures for which they did not receive a program incentive. Respondents are also asked to provide information on the measures implemented for use in estimating the associated energy savings.

To determine if the savings from the reported measures were attributable to the program, survey respondents were asked questions about the degree to which their experience with the program influenced them to implement the measures and the likelihood of implementing the measures in the absence of the program. Specifically, respondents were asked the following questions:

- SO1: How important was your experience with the [PROGRAM_NAME] in your decision to install this lighting equipment?
- SO2: If you had NOT participated in the [PROGRAM_NAME], how likely is it that your organization would still have installed this lighting equipment?

ADM calculated the spillover score using Equation 2-1.

Equation 2-1

$$Spillover = Average(SO1, 10 - SO2)$$

Savings from measures associated with a spillover score greater than 7 were considered attributable to the program.

All survey response data were systematically reviewed by a researcher who was familiar with the portfolio. As part of this review, the researcher could determine whether the available information justifies modifying the spillover score calculated in accordance with the algorithm outlined below. The spillover score calculated in accordance with the algorithm outlined above could be revised in instances in which there were significant apparent inconsistencies between responses provided by the decision maker or in cases in which the responses were apparently invalidated by other information regarding the measure(s). Additionally, responses may be dropped in cases where respondents do not report sufficient information to estimate the savings associated with the measure implemented.

2.4.2. Results of Ex Post Net Savings Estimation

Because a limited number of responses (n = 17) were obtained from PY2022 participants, ADM used the survey responses for PY2021 and PY2022 and weighted them based on the ex post kWh savings to calculate the average free ridership rate applicable to the aggregate PY2021 and PY2022 ex post savings.

To estimate the free ridership rate applicable to PY2022 survey-nonrespondents, ADM adjusted the combined PY2021/PY2022 free ridership rate. This adjustment involved taking into account the reported free ridership rate from PY2021 and the free ridership rate from PY2022 survey respondents. This adjustment was necessary to develop an estimate of the free ridership applicable to PY2022 non-survey respondents, while ensuring that the weighted average free ridership rate is applied, in the aggregate, to the PY2021 and PY2022 ex post savings.

Table 2-9 summarizes the net ex post kWh savings and the net ex post kW demand reduction of the Work Prescriptive Program.

Table 2-9 Ex Post Net kWh and kW Savings

Category	*kWh*	*kW*
Ex Ante Gross Savings	16,403,055	1,814.28
Gross Audited Savings	18,883,903	2,163.11
Gross Verified Savings	18,431,394	2,034.88
Ex Post Gross Savings	18,431,394	2,034.88
Gross Realization Rate	112%	112%
Ex Post Free Ridership	2,273,709	333.52
Ex Post Non-Participant Spillover	-	-
Ex Post Participant Spillover	-	-
Ex Post Net Savings	16,157,685	1,701.35
Net-to-Gross Ratio	88%	84%
Ex Post Net Lifetime Savings	205,579,377	n/a

2.5. Process Evaluation

ADM completed a process evaluation of the PY2022 program. The following research activities informed the process evaluation.

- Interviews and discussions with program staff.
- Review of program documents and tracking data.
- Interviews with participating program trade allies.
- A survey of program participants.
- A survey of I&M customers that did not participate in the program.

2.5.1. Process Evaluation Findings

ADM interviewed program staff and completed a survey of program participants. The interviews with program staff provided information on how the program was implemented in 2022, changes made since 2021, and key successes and challenges. Surveys provided feedback from customers on their perspective of program processes.

2.5.1.1. Program Team Perspective

2.5.1.1.1. Outreach and Marketing

The Work programs rely on outreach specialists that work directly with customers and trade allies to drive energy saving projects to the program. As of late January 2023, two outreach specialists have regular communications with trade allies and key large customers in their respective territories to drive and support energy saving projects. In addition to working with the large customers and active trade allies in their region, these outreach specialists work with key account managers at the utility, chambers of commerce, and similar entities to alert the commercial and industrial entities in the region to the services and incentives offered by I&M.

The program provides marketing efforts that complement the outreach specialists' efforts. The Work programs generate demand by providing monthly newsletters to customers and trade allies, maintaining the program website, conducting paid search, providing online advertising, and providing program collateral at conferences, meetings, and similar functions. Staff reported they emphasize marketing efforts at times when there are program changes such as when the program provides bonus incentives or is trying to encourage the adoption of specific measures.

The program relies partially on large customers repeatedly using the Work programs for projects so keeping these customers informed of program changes and opportunities is important to continue to gather savings. Staff reported that several large industrial customers in the region got involved with the program by doing a lighting project at one site and then doing follow-up projects at other sites in the region. According to staff, after the program began emphasizing compressed air incentives, several companies have recently begun doing compressed air projects across multiple sites in the region. And, because the compressed air studies and work need to be done annually, these sites will likely need to be reminded of the compressed air opportunities for years to come, thus also providing an opening for the program to promote other savings opportunities.

The program has emphasized reaching large energy users in recent years to concentrate on the large savings opportunities but has recently begun to promote program offerings to smaller users. The program does reach out to chambers of commerce and economic development commissions to promote program offerings to small commercial customers but there has not been a concerted effort to reach these organizations in the same way as the large energy users because of the savings opportunities available at large organizations. However, the program recently brought in an outreach specialist to focus on "mom-and-pop shops" with offerings like exterior lighting incentives, an incentive most likely to appeal to many of these smaller organizations. Additionally, in 2023, there will be an emphasis on rolling out a small business direct install offering that has already attracted interest from trade allies wanting to participate.

In the last year and into 2023, the program has emphasized recruiting compressed air trade allies. Staff reported identifying significant opportunities for energy savings coming from compressed air leak detection in 2021 and early 2022. To gather savings from that work, the program looked to boost their numbers of trade allies doing this type of work in 2022. According to staff, the program was successful in recruiting these allies as they were able to meet energy savings goals in large part due to the uptick in these types of projects in 2022.

2.5.1.1.2. Program Changes to Measures and Incentives

Some trade allies in neighboring utility areas and states have become more active in I&M territory due to a change in incentives. Staff reported that a large trade ally that completes many energy saving projects in a neighboring utility area has begun to work more in I&M territory, in part due to the increase in incentives offered by I&M. Additionally, another trade ally that has been active in Michigan with the program, has recently become more active in Indiana in part because of the increase in incentives offered in Indiana.

2.5.1.1.3. New Work Program Offerings

The energy efficiency as a service program (EESP) element has not seen notable participation in 2022, mostly because of how new the service is. Staff reported that the EESP service, provided through a partnership with Allumia, started in November 2022 and customers are now learning about the service. I&M launched this service to help large energy users find creative ways to finance energy saving capital projects.

2.5.1.1.4. Feedback from the Market

Trade allies and participants tell program staff they are largely satisfied with the services offered. According to staff, trade allies and participants report that the participation process is relatively easy and when they have questions they know they can work with an outreach specialist that will assist them. As discussed in Section 2.2.2, survey responses collected for the evaluation effort indicate a high rate of program satisfaction.

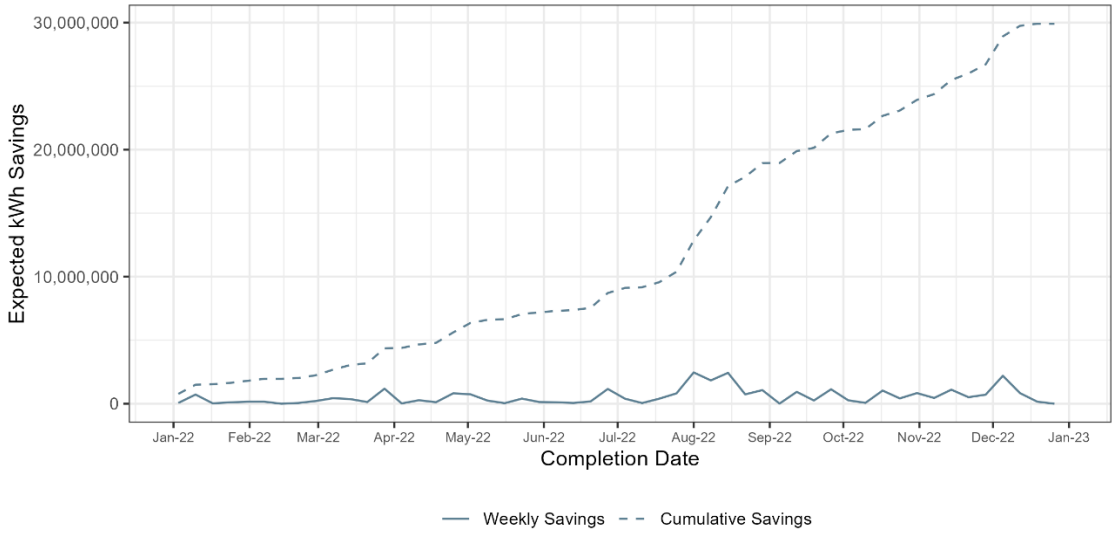
Participants reported to staff that they appreciate the non-energy benefits of their project. Specifically, participants told staff they appreciate the safety improvements provided by their new lighting and the reduced maintenance costs associated with upgraded equipment.

2.5.1.1.5. Successes and Challenges in 2022

Staff noted these successes in 2022:

- **Communication and collaboration between the implementation staff and the I&M staff was effective in 2023.** Specifically, when problems, issues, or opportunities arose throughout the year, each party made the other aware of the issue and they worked collaboratively to address it. For example, the teams started seeing savings coming in from the compressed air projects and they are now working together on building upon those opportunities by looking into the possibility and cost effectiveness of offering compressor upgrades.
- **CLEAResult reviewed the list of available incentives in the first half of 2022 looking for opportunities to encourage the adoption of certain measures in the market.** Compressed air studies, engineered nozzles, and hotel weatherization, were all measures that appeared to be underutilized in the region, so the program staff worked to encourage the adoption of these measures and found many savings projects.
- **The program reached its savings goals.** The program managed to meet goals even though it got a slow start to the program year and booked most of its projects from Q2 to Q4 2022. Figure 2-1 displays the accumulation of savings during the course of the year. Approximately, two-thirds of the savings came from projects completed after July.

Figure 2-1 Weekly and Cumulative Ex Ante Savings



2.5.1.2. Participant Survey Findings

Contractors and vendors are playing important roles in supporting the program. Contractors and vendors were the most common source of program awareness. Thirty-five percent of respondents learned of the program from a trade ally, contractor, vendor, or energy consultant (see Figure 2-2). Additionally, as shown in Figure 2-3, vendors and contractors assisted a majority of participants with the application. Fifty-three percent of participants reported that a contractor they had worked with before installed the equipment, 18% that it was installed by a contractor recommended to them, and 12% that it was a contractor they learned about through the program.

Figure 2-2 Initial Source of Program Awareness

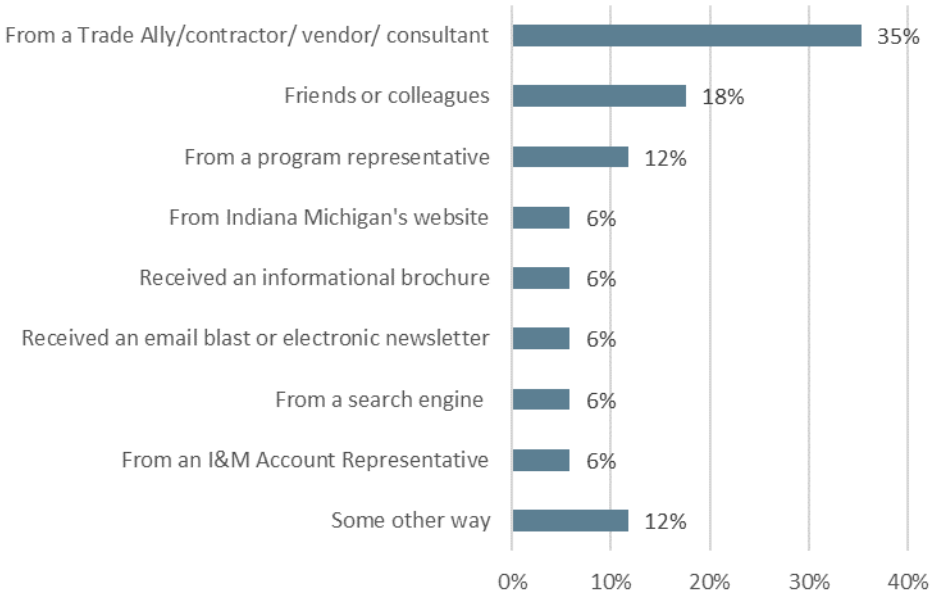
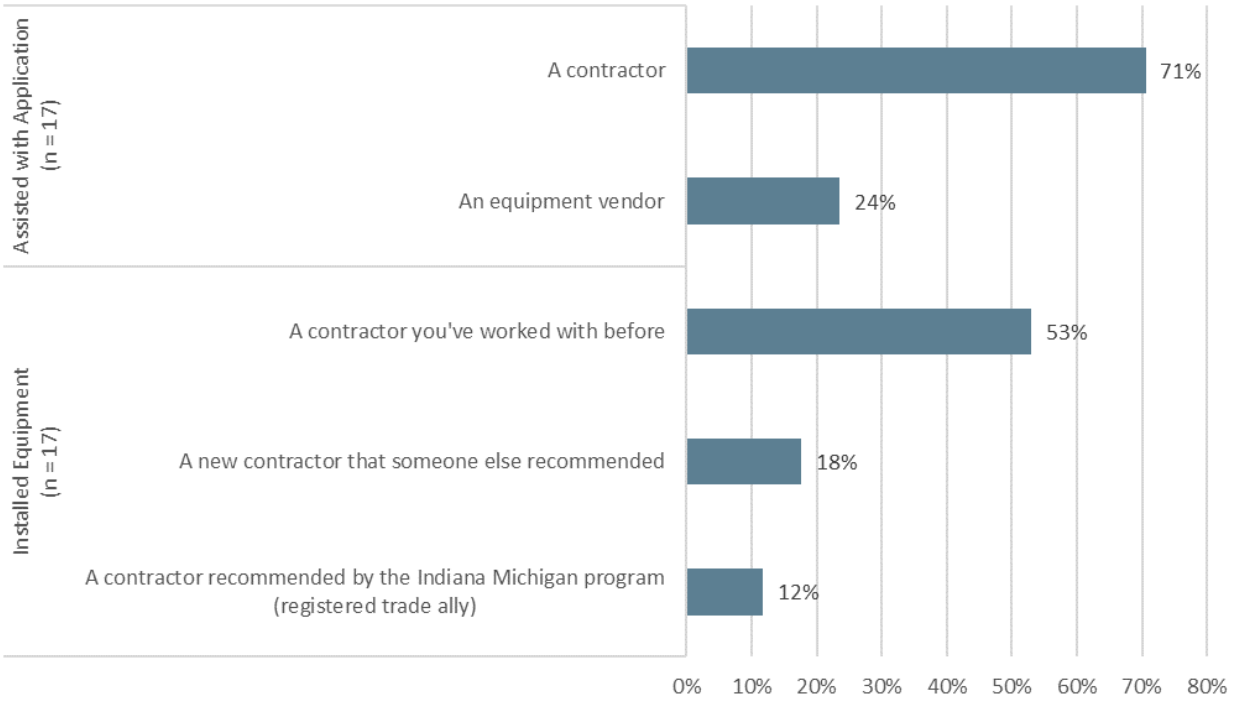


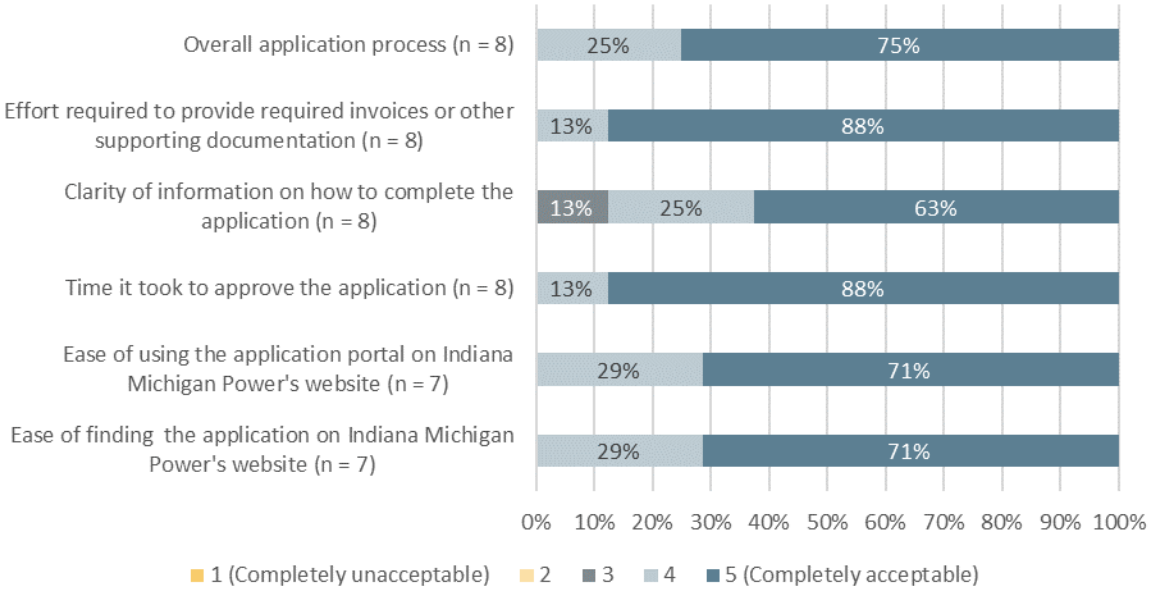
Figure 2-3 Application Assistance and Equipment Installation



Respondents found the application process to be acceptable. All respondents reported that the application process was somewhat or completely acceptable and none of the rated aspects of the

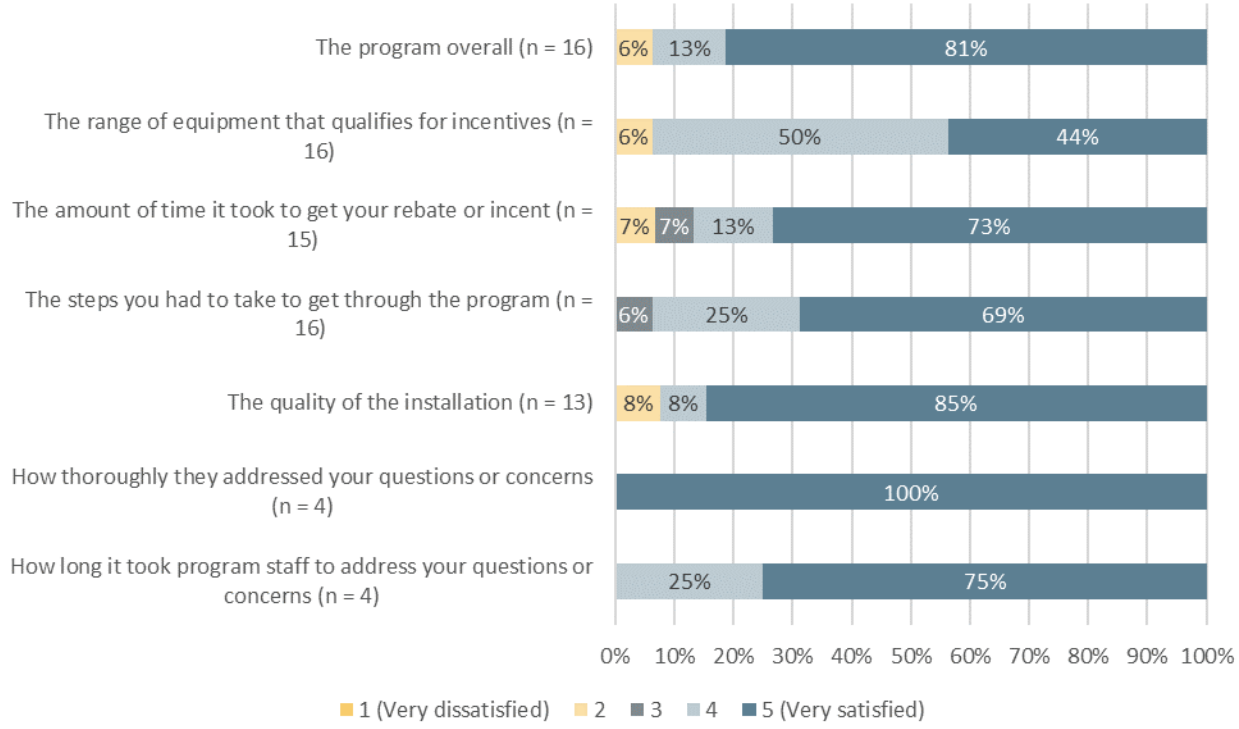
application process were rated as unacceptable by any respondents. All but one respondent reported that they had a clear sense of who to go through for assistance with the application.

Figure 2-4 Acceptability of the Application Process



Most participants (94%) were satisfied with the program overall. One respondent did indicate that they were somewhat dissatisfied with the program overall, the range of qualifying equipment, the time it took to get the rebate, and the quality of installation.

Figure 2-5 Program Satisfaction



2.6. Findings and Recommendations

Based on the results of the analysis, ADM identified several key conclusions and recommendations I&M could consider as they implement their efficiency programs for commercial and industrial customers.

Collaboration and communication between CLEAResult and I&M staff led the program to identify several key measures and incentives that would appeal to the market and encourage participation in the Work programs that led to the program meeting goals. I&M and CLEAResult staff reported positive communication and collaboration between the two groups that is carrying into 2023. This collaboration led to the encouragement of the market to adopt measure the program had not emphasized in PY2021 such as hotel and cold air weatherization and compressed air studies. Ultimately, this work led to increased savings for the program and to the program meeting savings goals.

The program increased outreach staffing and focused on large customers that participated in the programs in the past. As of late January 2023, three outreach specialists have regular communications with trade allies and key large customers in their respective territories to drive and support energy saving projects. In addition to working with the large customers and active trade allies in their region, these outreach specialists work with key account managers at the utility, chambers of commerce, and similar entities to alert the commercial and industrial entities in the region to the services and incentives offered by I&M. The program also focused on marketing

through monthly newsletters to customers and trade allies, maintaining the program website, conducting paid search, providing online advertising, and providing program collateral at conferences, meetings, and similar functions. I&M has entered into a partnership with Allumia, a third-party provider of Efficiency as a Service. As part of this collaboration, I&M will refer its customers to Allumia, who will cover the initial cost of implementing efficiency improvements. Allumia recoups these costs through the customer's energy savings over time.

- **Recommendation 1:** With the availability of additional outreach resources, the program should also focus on reaching mid-size and large customers that have not participated in the program or have not participated in the last few years while reaping the benefits of outreach to past participants. Findings from the non-participant survey completed in PY2021 found that two-thirds of C&I customers were unaware of I&M incentives, suggesting that there is an opportunity to educate the customer on the incentives I&M offers.

Participant survey findings indicate that contractors are playing important roles in supporting the program. Contractors and vendors were the most common source of program awareness among survey respondents (35% learned of the program from a trade ally, contractor, vendor, or energy consultant) and contractors assisted a majority of participants with the application.

Participants reported a positive experience with the program. Most participants (94%) were satisfied with the program overall and all respondents reported that the application process was somewhat or completely acceptable.

3. Work Custom

This chapter presents the results of both the impact and process evaluations of the Work Custom Program that Indiana Michigan Power (I&M) offered to its non-residential customers from January 2022 through December 2022.

The objectives of the evaluation are to:

- Establish a pre-approval review procedure;
- Assess gross and net energy (kWh) savings and peak demand (kW) reductions resulting from participation in the program during the program year;
- Assess satisfaction among participating customers; and
- Provide recommendations for program improvement as appropriate.

3.1. Program Description

The Work Custom Program targets commercial and industrial accounts and provides incentives to implement efficiency measures not covered by the prescriptive program. The program provides an incentive of $0.05 per kWh saved for lighting measures, and $0.06 per kWh saved for non-lighting measures. The program measures include non-prescriptive lighting and HVAC, and refrigeration measures, compressed air measures, industrial process improvements, and retro-commissioning.

3.2. Data Collection

3.2.1. Verification of Measures

3.2.1.1. Sampling Plan

The sampling approach was combined for all C&I programs in 2022. The approach is described in Section 2.2.1.1 of this document on page 7.

The table below shows the number of projects, ex ante gross kWh energy savings, and sampling statistics, by stratum, of the program sample.

Table 3-1 Population Statistics Used for Work Custom Sample Design

Variable	*Stratum 1*	*Stratum 2*	*Stratum 3*	*Stratum 4*	*Stratum 5*	*Totals*
Strata boundaries (kWh)	> 600000	330000 – 600000	130000 – 330000	20000 – 130000	< 20000	
Number of projects	5	11	24	54	58	152
Total Ex Ante Annual kWh	4,387,827	4,850,478	5,166,337	2,691,015	522,741	17,618,398
Average kWh Savings	877,565	440,953	215,264	49,834	9,013	115,911
Std. dev. Of kWh savings	265,985	85,149	61,757	26,142	5,228	444,260
Coefficient of variation	0.3	0.19	0.29	0.52	0.58	
Final design sample	5	3	4	6	2	20

3.2.1.2. Verification Data Collection Procedure

The data collection procedure for the Work Custom Program was the same as the approach described in Section 2.2 of this document on page 8.

3.2.2. Participant Survey

The survey data collection for the Work Custom Program is described in Section 2.5.1.2 of this document on page 22.

3.2.3. Staff Interviews

The staff interviews completed for the Work Custom Program is described in Section 2.5.1.1 of this document on page 19.

3.3. Estimation of Ex Post Gross Savings

3.3.1. Methodology for Estimating Ex Post Gross Savings

3.3.1.1. Review of Documentation

The process for reviewing program documentation for the Work Custom Program was the same as the approach described in Section 2.3.1.1 of this document on page 9.

3.3.1.2. Procedures for Estimating Measure-Level Gross Energy Savings

A breakdown of sampled measures for the Work Custom Program is below in Table 3-2.

Table 3-2 Breakdown of Sampled Custom Measures

Measure Category	*Ex Ante Annual kWh Savings*	*Ex Post Annual Gross kWh Savings*	*Gross Realization Rate*
Cold Air Weatherization	1,572,594	733,075	47%
Compressed Air Leak Audit and Repair	34,001	34,001	100%
LED Upgrade	4,952,992	4,949,195	100%
New Construction Lighting	612,219	484,247	79%
Total	7,171,806	6,200,518	86%

During PY2022, Work Custom participants completed 72 compressed air leak projects. Of these projects, 43 were below the upper energy savings boundary for stratum 5 (20,000 kWh) and only two projects (both of which were lighting) were sampled from this stratum to meet the precision requirements. The sampled compressed air project fell into stratum 4. The remaining compressed air projects were not part of the random sample.

The sampled compressed air project realization rate was 100%. In its analysis, ADM verified the completion of the project, the hours of operation, and the energy profile and operation of the on-

site air compressor. ADM referenced the UE Systems Compressed Gas Flow Rate Curves to calculate the air loss rate at each leak based on the ultrasonic decibel (dB) reading at each leak. The approach ADM used was the same as the approach used in the ex ante savings analysis.

ADM calculated a kWh energy savings gross realization rate and a peak kW reduction gross realization rate for each site in the M&V sample. Sites with relatively high or low gross realization rates were analyzed to determine the reasons for the discrepancy between ex ante and ex post energy savings. The site-level gross impact analysis results for each M&V sample site are presented in Volume II of the report. These reports outline the data sources and analytical approaches employed in the calculation of measure impacts.

3.3.2. Results of Ex Post Gross Savings Estimation

The kWh gross realization rate is the ratio of sampled measure ex post gross kWh energy savings to sampled measure ex ante kWh energy savings. The kW gross realization rate is the ratio of sampled measure ex post gross kW demand savings to sampled measure ex ante kW demand savings. Since a stratified sampling approach was employed for this program, stratum-level kWh and kW gross realization rates were developed for each sampling stratum.

Program-level gross ex post gross kWh energy savings are calculated as follows:

- The ex-ante kWh energy savings of non-sampled measures are factored by the applicable stratum-level kWh gross realization rates to calculate ex post gross kWh energy savings for non-sampled measures.
- The ex post gross kWh energy savings of all sampled measures and all non-sampled measures are summed.

Program-level gross ex post gross kW demand savings are calculated as follows:

- The ex-ante kW demand savings of non-sampled measures are factored by the applicable stratum-level kW gross realization rates to calculate ex post gross kW savings for non-sampled measures.
- The ex post gross kW demand savings of all sampled measures and all non-sampled measures are summed.

3.3.2.1. Ex Post Gross kWh Savings

Table 3-3 displays the ex ante and ex post gross kWh savings of the Work Custom Program including gross realization rates for sampled projects.

Table 3-3 Work Custom Project-Level Ex Ante and Ex Post kWh Savings

Stratum	*Project Number*	*Measure*	*Ex Ante kWh Savings*	*Gross Ex Post kWh Savings*	*Project Gross Realization Rate*
1	216	LED Upgrade	1,312,492	1,312,492	100%
1	211	LED Upgrade	884,884	884,938	100%

Stratum	*Project Number*	*Measure*	*Ex Ante kWh Savings*	*Gross Ex Post kWh Savings*	*Project Gross Realization Rate*
1	213	Cold air weatherization	844,243	410,260	49%
1	207	Cold air weatherization	728,352	322,815	44%
1	218	New Construction Lighting	612,219	484,247	79%
2	204	LED Upgrade	504,092	504,092	100%
2	214	LED Upgrade	470,079	472,865	101%
2	203	LED Upgrade	397,939	403,800	101%
3	201	LED Upgrade	316,728	243,230	77%
3	215	LED Upgrade	291,741	294,904	101%
3	212	LED Upgrade	283,108	343,009	121%
3	210	LED Upgrade	148,846	146,248	98%
4	217	LED Upgrade	84,021	83,068	99%
4	208	LED Upgrade	80,158	73,840	92%
4	219	LED Upgrade	65,654	65,224	99%
4	209	LED Upgrade	49,087	54,325	111%
4	205	LED Upgrade	42,666	46,762	110%
4	202	Compressed air leak audit and repair	34,001	34,001	100%
5	206	LED Upgrade	16,333	15,403	94%
5	200	LED Upgrade	5,164	4,995	97%
All Non-Sample Projects			10,423,955	10,379,361	100%
Total			17,595,760	16,579,879	94%

The realization rate for two of the 20 sample sites was greater than 110%. The factors that resulted in the realization rates were idiosyncratic to the project and are summarized below.

- Project 209 had a higher realization rate for lighting. The ex post savings included the heating cooling interactive effects from the reduced lighting load in the savings calculation for the air conditioned, gas heated manufacturing facility.
- Project 212 had a higher realization rate for lighting. The ex ante savings listed an hours of use value that differed from the ex post hours of use developed through the verification activities.

Four of the 20 samples site had realization rate lower than 90%.

- Projects 207 and 213 for cold storage weatherization applied deemed savings per gap width that were based on infiltration directly from outdoor air to cold storage space, whereas the ex post analysis applied the same savings methodology, but accounting for the warehouse loading dock buffer zone installed location and site operating schedule.

- Project 218 savings calculation for new construction lighting power density applied a code-based allowed wattage to an area that was not illuminated by the installed lighting.
- Project 201 savings calculation for HVAC scheduling applied the reduced operating hours without time of day information, whereas the ex post 8,760 bin analysis considered the time of day.

Table 3-4 Ex Post Annual Gross kWh

Ex Ante Gross kWh Savings	*Gross Audited kWh Savings*	*Gross Verified kWh Savings*	*Ex Post Gross kWh Savings*	*Gross Realization Rate*
17,595,760	16,226,554	16,579,879	16,579,879	94%

3.3.2.2. Ex Post Gross kW Reductions

Table 3-5 presents the ex post peak kW reduction for the Work Custom Program during the period January 2022 through December 2022.

Table 3-5 Ex Post Peak kW

Ex Ante Gross kW Savings	*Gross Audited kW Savings*	*Gross Verified kW Savings*	*Ex Post Gross kW Savings*	*Gross Realization Rate*
2,803.61	2,704.36	2,813.07	2,813.07	100%

3.4. Estimation of Ex Post Net Savings

3.4.1. Methodology for Estimating Ex Post Net Savings

The procedure for the estimation of program-level kWh energy savings and program-level kW demand reductions was the same as the approach described in Section 2.4.1 of this document on page 14.

3.4.2. Results of Ex Post Net Savings Estimation

Table 3-6 summarizes the net ex post kWh savings and the net ex post kW demand reduction of the Work Custom Program.

Table 3-6 Ex Post Net kWh and kW Savings

Category	*kWh*	*kW*
Ex Ante Gross Savings	17,595,760	2,803.61
Gross Audited Savings	16,226,554	2,704.36
Gross Verified Savings	16,579,879	2,813.07
Ex Post Gross Savings	16,579,879	2,813.07
Gross Realization Rate	94%	100%
Ex Post Free Ridership	1,835,085	700.83
Ex Post Non-Participant Spillover	-	-
Ex Post Participant Spillover	-	-
Ex Post Net Savings	14,744,794	2,112.24
Net-to-Gross Ratio	89%	75%
Ex Post Net Lifetime Savings	183,598,535	n/a

3.5. Process Evaluation

Methods and findings related to the process evaluation of the Work Custom Program are presented in the Work Prescriptive Chapter in Section 2.5 on page 19.

3.6. Findings and Recommendations

Applicable conclusions and recommendations are presented in Section 2.6 on page 25.

4. Public Efficient Streetlighting

This chapter presents the results of the impact evaluation of the Public Efficient Streetlighting Program that Indiana Michigan Power (I&M) offered to its local government customers from January 2022 through December 2022.

The objectives of the evaluation are to:

- Assess gross and net energy (kWh) savings and peak demand (kW) reductions that resulted from participation in the program during the program year; and
- Provide recommendations for program improvement as appropriate.

4.1. Program Description

To be eligible to participate in the Public Efficient Street Lighting Program, an eligible customer must convert I&M-owned street lighting systems to more efficient LED street lighting. The Program is targeted at local governments and will seek to convert street lighting to LED technology.

The incentive strategy for the program is to apply 100% of the difference between the cost of a LED streetlight and a baseline high pressure sodium equivalent streetlight. Rebates are calculated based on this cost differential and will offset I&M's capital cost of conversion (material and labor) of the LED streetlight fixture to the high-pressure sodium streetlight fixture. As LED streetlight conversions occur, where LED streetlights are placed in-service, I&M will use the rebate from the Public Efficient Street Lighting Program to offset the capital cost of conversion booked in I&M electric plant in-service streetlight accounts.

The program requires pre-approval for any street lighting projects before purchasing and installing equipment. Once applications are approved, they are sent to I&M for approval as the last step in the implementation process.

4.2. Data Collection

4.2.1. Verification of Measures

ADM completed a desk review of the Public Efficient Street Lighting Program for the completed projects. For the desk review, ADM reviewed the ex ante savings estimate and applied the correct baseline wattage for the fixtures, and the regional hours of use.

4.3. Estimation of Ex Post Gross Savings

The procedure for the estimation of program-level gross kWh energy savings and gross kW demand reductions for the Public Efficient Street Lighting Program.

4.3.1. Methodology for Estimating Ex Post Gross Savings

4.3.1.1. Review of Documentation

The process for reviewing program M&V and due diligence procedures for the Public Efficient Street Lighting Program is the same as the approach described in Section 2.3.1.1 of this document on page 9.

4.3.1.2. Procedures for Estimating Measure-Level Gross Energy Savings

Annual energy savings for each sampled streetlight is determined by the following formula:

$$\text{Annual Energy Savings} = kWh_{baseline} - kWh_{after}$$

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

- Location-specific dusk to dawn hours (3,934).
- Factoring the dusk to dawn hours by the baseline and post-installation demand to calculate the kWh energy consumption.

4.3.2. Results of Ex Post Gross Savings Estimation

4.3.2.1. Ex Post Gross kWh Savings

The ex post annual gross kWh savings for the Public Efficient Street Lighting Program during the period January 2022 through December 2022 are presented in Table 4-1.

Table 4-1 Ex Post Annual Gross kWh

Ex Ante Gross kWh Savings	*Gross Audited kWh Savings*	*Gross Verified kWh Savings*	*Ex Post Gross kWh Savings*	*Gross Realization Rate*
5,966,485	5,966,485	5,966,485	5,966,485	100%

4.3.2.2. Ex Post Gross kW Reductions

There are no peak kW reductions associated with the streetlighting retrofits.

4.4. Estimation of Ex Post Net Savings

4.4.1. Methodology for Estimating Ex Post Net Energy Savings

The lighting replaced under the streetlighting program is owned and maintained by I&M and municipalities. Consequently, ADM assigned a net-to-gross ratio of 1.0 to the program.

4.4.2. Results of Ex Post Net Savings Estimation

Table 4-2 summarizes the net ex post kWh savings and the net ex post kW demand reduction of the Public Efficient Street Lighting Program.

Table 4-2 Ex Post Net kWh and kW Savings

Category	*kWh*	*kW*
Ex Ante Gross Savings	5,966,485	-
Gross Audited Savings	5,966,485	-
Gross Verified Savings	5,966,485	-
Ex Post Gross Savings	5,966,485	-
Gross Realization Rate	100%	n/a
Ex Post Free Ridership	0	-
Ex Post Non-Participant Spillover	0	-
Ex Post Participant Spillover	0	-
Ex Post Net Savings	5,966,485	-
Net-to-Gross Ratio	100%	n/a
Ex Post Net Lifetime Savings	113,388,979	n/a

5. Cost Effectiveness Evaluation

The following cost effectiveness tests were performed for each program: Total Resource Cost (TRC) test, Utility Cost Test (UCT), Participant Cost Test (PCT), and Ratepayer Impact Measure (RIM) test. A score above one signifies that, from the perspective of the test, the program benefits were greater than the program costs. The benefits and costs associated with each test are defined in Table 5-1.

Table 5-1 Summary of Benefits and Costs Included in each Cost Effectiveness Test

Variable	*Definition*	*PCT*		*UCT*		*RIM*		*TRC*	
		Benefit	*Cost*	*Benefit*	*Cost*	*Benefit*	*Cost*	*Benefit*	*Cost*
Incentives	Incentives paid to customers.	✓			✓		✓		
Program Installation Costs	Installation costs paid by program.				✓		✓		✓
Bill Savings /Lost Revenue	Reduction in electricity costs faced by customers as a result of implementation of program measures. Equal to revenue lost to the utility.	✓					✓		
Avoided Energy Costs	Energy-related costs avoided by utility.			✓		✓		✓	
Avoided Capacity Costs	Capacity-related costs avoided by utility, including T&D.			✓		✓		✓	
Incremental Costs	Incremental costs associated with measure implementation, as compared with what would have been done in absence of program.		✓						✓
Program Overhead Costs	Program costs other than incentive or installation costs.				✓		✓		✓

5.1. PY2022 Cost Effectiveness Evaluation

Table 5-2 through Table 5-4 summarize key financial benefit and cost inputs for the various tests along as well as the test results for each commercial and industrial program during PY2022.

Table 5-2 Work Prescriptive Program Cost Test Inputs and Results

Variable	PCT		UCT		RIM		TRC	
	Benefit	Cost	Benefit	Cost	Benefit	Cost	Benefit	Cost
Incentives	$ 834,861			$ 834,861		$ 834,861		
Program Installation Costs				$ -		$ -		$ -
Bill Savings (NPV)	$ 9,413,880							
Lost Revenue (NPV)						$ 13,376,298		
Avoided Energy Costs (NPV)			$ 4,394,660		$ 4,394,660		$ 4,394,660	
Avoided Capacity Costs (NPV)			$ 332,077		$ 332,077		$ 332,077	
Avoided T&D Costs (NPV)			$ -		$ -		$ -	
Incremental Costs		$ 1,721,163						$ 1,721,163
Program Overhead Costs				$ 894,861		$ 894,861		$ 894,861
Total Benefits	$ 10,248,740		$ 4,726,738		$ 4,726,738		$ 4,726,738	
Total Costs	$ 1,721,163		$ 1,729,722		$ 15,106,020		$ 2,616,024	
Test Score	5.95		2.73		0.31		1.81	

Table 5-3 Work Custom Program Cost Test Inputs and Results

Variable	PCT		UCT		RIM		TRC	
	Benefit	Cost	Benefit	Cost	Benefit	Cost	Benefit	Cost
Incentives	$ 907,021			$ 907,021		$ 907,021		
Program Installation Costs				$ -		$ -		$ -
Bill Savings (NPV)	$ 8,649,437							
Lost Revenue (NPV)						$ 12,127,886		
Avoided Energy Costs (NPV)			$ 3,963,447		$ 3,963,447		$ 3,963,447	
Avoided Capacity Costs (NPV)			$ 408,023		$ 408,023		$ 408,023	
Avoided T&D Costs (NPV)			$ -		$ -		$ -	
Incremental Costs		$ 519,705						$ 519,705
Program Overhead Costs				$ 1,058,042		$ 1,058,042		$ 1,058,042
Total Benefits	$ 9,556,458		$ 4,371,471		$ 4,371,471		$ 4,371,471	
Total Costs	$ 519,705		$ 1,965,062		$ 14,092,948		$ 1,577,747	
Test Score	18.39		2.22		0.31		2.77	

Table 5-4 Public Efficient Streetlighting Program Cost Test Inputs and Results

Variable	PCT		UCT		RIM		TRC	
	Benefit	Cost	Benefit	Cost	Benefit	Cost	Benefit	Cost
Incentives	$ 1,918,102			$ 1,918,102		$ 1,918,102		
Program Installation Costs				$ -		$ -		$ -
Bill Savings (NPV)	$ 4,242,621							
Lost Revenue (NPV)						$ 6,620,456		
Avoided Energy Costs (NPV)			$ 2,235,455		$ 2,235,455		$ 2,235,455	
Avoided Capacity Costs (NPV)			$ -		$ -		$ -	
Avoided T&D Costs (NPV)			$ -		$ -		$ -	
Incremental Costs		$ 2,580,129						$ 2,580,129
Program Overhead Costs				$ 342,360		$ 342,360		$ 342,360
Total Benefits	$ 6,160,723		$ 2,235,455		$ 2,235,455		$ 2,235,455	
Total Costs	$ 2,580,129		$ 2,260,462		$ 8,880,918		$ 2,922,489	
Test Score	2.39		0.99		0.25		0.76	

5.2. PY2021 – PY2022 Cost Effectiveness Evaluation

Cost effectiveness of programs across PY2021 and PY2012 was also evaluated. The test results for each program are presented in Table 5-5.

Table 5-5 Summary of PY2021 - PY2022 Benefit-Cost Ratios

Program	*Program Administrator Cost Test (aka USCRT, or UCT)*	*Total Resource Cost Test*	*Ratepayer Impact Measure*	*Participant Cost Test*
Work Prescriptive	2.16	1.46	0.31	5.26
Work Custom	1.65	1.90	0.30	12.05
Public Efficient Streetlighting	1.23	0.83	0.26	2.40
C&I Portfolio Total	1.72	1.43	0.30	5.39

Table 5-6 through Table 5-8 summarize key financial benefit and cost inputs for the various tests along as well as the test results for each commercial and industrial program during PY2021 – PY2022.

Table 5-6 PY2021 - PY2022 Work Prescriptive Program Cost Test Inputs and Results

Variable	*PCT*		*UCT*		*RIM*		*TRC*	
	Benefit	*Cost*	*Benefit*	*Cost*	*Benefit*	*Cost*	*Benefit*	*Cost*
Incentives	$ 1,528,255			$ 1,528,255		$ 1,528,255		
Program Installation Costs				$ -		$ -		$ -
Bill Savings (NPV)	$ 15,445,842							
Lost Revenue (NPV)						$ 21,614,863		
Avoided Energy Costs (NPV)			$ 6,997,490		$ 6,997,490		$ 6,997,490	
Avoided Capacity Costs (NPV)			$ 679,336		$ 679,336		$ 679,336	
Avoided T&D Costs (NPV)			$ -		$ -		$ -	
Incremental Costs		$ 3,229,533						$ 3,229,533
Program Overhead Costs				$ 2,022,413		$ 2,022,413		$ 2,022,413
Total Benefits	$ 16,974,097		$ 7,676,826		$ 7,676,826		$ 7,676,826	
Total Costs	$ 3,229,533		$ 3,550,669		$ 25,165,531		$ 5,251,946	
Test Score	5.26		2.16		0.31		1.46	

Table 5-7 PY2021 - PY2022 Work Custom Program Cost Test Inputs and Results

Variable	*PCT*		*UCT*		*RIM*		*TRC*	
	Benefit	*Cost*	*Benefit*	*Cost*	*Benefit*	*Cost*	*Benefit*	*Cost*
Incentives	$ 2,192,345			$ 2,192,345		$ 2,192,345		
Program Installation Costs				$ -		$ -		$ -
Bill Savings (NPV)	$ 16,434,070							
Lost Revenue (NPV)						$ 22,467,144		
Avoided Energy Costs (NPV)			$ 7,441,020		$ 7,441,020		$ 7,441,020	
Avoided Capacity Costs (NPV)			$ 840,930		$ 840,930		$ 840,930	
Avoided T&D Costs (NPV)			$ -		$ -		$ -	
Incremental Costs		$ 1,545,237						$ 1,545,237
Program Overhead Costs				$ 2,814,666		$ 2,814,666		$ 2,814,666
Total Benefits	$ 18,626,414		$ 8,281,950		$ 8,281,950		$ 8,281,950	
Total Costs	$ 1,545,237		$ 5,007,010		$ 27,474,154		$ 4,359,903	
Test Score	12.05		1.65		0.30		1.90	

Table 5-8 PY2021 - PY2022 Public Efficient Streetlighting Program Cost Test Inputs and Results

Variable	*PCT*		*UCT*		*RIM*		*TRC*	
	Benefit	*Cost*	*Benefit*	*Cost*	*Benefit*	*Cost*	*Benefit*	*Cost*
Incentives	$ 2,083,946			$ 2,083,946		$ 2,083,946		
Program Installation Costs				$ -		$ -		$ -
Bill Savings (NPV)	$ 5,829,529							
Lost Revenue (NPV)						$ 9,091,842		
Avoided Energy Costs (NPV)			$ 3,049,085		$ 3,049,085		$ 3,049,085	
Avoided Capacity Costs (NPV)			$ -		$ -		$ -	
Avoided T&D Costs (NPV)			$ -		$ -		$ -	
Incremental Costs		$ 3,304,141						$ 3,304,141
Program Overhead Costs				$ 391,514		$ 391,514		$ 391,514
Total Benefits	$ 7,913,475		$ 3,049,085		$ 3,049,085		$ 3,049,085	
Total Costs	$ 3,304,141		$ 2,475,460		$ 11,567,303		$ 3,695,655	
Test Score	2.40		1.23		0.26		0.83	

2022 Indiana Commercial & Industrial Portfolio EM&V Report

Volume II of II

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Indiana Michigan Power

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Table of Contents

1. Introduction

Under contract with the Indiana Michigan Power (I&M), ADM Associates, Inc., (ADM) performed evaluation, measurement and verification (EM&V) activities to confirm the energy savings (kWh) and demand reduction (kW) realized through the demand side management programs that I&M implemented in Indiana in 2022.

This report is divided into two volumes providing information on the impact, process, and cost-effectiveness evaluation of the I&M portfolio of commercial and industrial programs implemented in Indiana during the 2022 program year. Volume II contains chapters presenting detailed information regarding evaluation methodologies, data collection instruments, and evaluation results. Volume II is organized as follows:

- Chapter 2: Site-Level Estimation of Ex Post Gross Energy Impacts
- Chapter 3: C&I Participant Survey Instrument
- Chapter 4: C&I Participant Survey Results

See report Volume I for narrative and summary information pertaining to the evaluation methods and results.

2. Site-Level Estimation of Ex Post Gross Energy Impacts

Project Number: 100 and 200

Executive Summary

Under projects 100 and 200, a program participant received prescriptive and custom incentives from I&M Power for retrofitting existing lighting with LED lamps and fixtures.

The verified annual energy savings are 485,775 kWh with ex post peak demand reduction of 139.83 kW and the gross energy savings realization rate is 106%.

Project Description

The participant replaced T8 linear fluorescent lamps, metal halide lamp/fixtures, high pressure sodium lamp/fixtures and halogen lamps with LED lamps and LED fixtures.

Measurement and Verification Effort

To verify the project savings, ADM staff reviewed project documentation, baseline wattage, and post-retrofit connected load. In addition, ADM collected the detailed light survey by the applicant and compared it with the hours to the usage area.

Lighting energy savings are calculated as:

$$kWh_{savings} = \sum_{Area} [HCIF \times Hours \times (N_{base} \times W_{base} - N_{as-built} \times W_{as-built})/1000]$$

Where:

$kWh_{savings}$ = *Annual energy savings*
N = *Number of fixtures*
W = *Wattage of each fixture*
Hours = *Lighting operating hours*
HCIF = *HVAC interactive factor*

The custom lighting retrofits are summarized as:

Custom Lighting Energy Savings Calculations

Measure	*Quantity (Fixtures)*		*Total Wattage*		*Hours Range*	*Heating Cooling Interaction Factor*	*Ex Ante Annual kWh Savings*	*Ex Post Gross kWh Savings*	*Gross Realization Rate*
	Baseline	*Efficient*	*Baseline*	*Efficient*					
Custom LED Lamps and Fixtures	4,868	4,868	190,525	30,876	100 - 8760	1.0 - 1.133	397,939	403,800	101%
Total							397,939	403,880	101%

The lighting prescriptive measure savings inputs are summarized in the following table. Hours of use was determined from the Custom measure detailed lighting survey by room and applied to their respective areas.

Prescriptive Lighting Energy Savings Calculations

Measure	*Quantity*		*Wattage*		*Hours*	*Heating Cooling Interaction Factor*	*Ex Ante Annual kWh Savings*	*Ex Post Gross kWh Savings*	*Gross Realization Rate*
	Base	*Efficient*	*Base*	*Efficient*					
Exterior HPS 175W to LED	7	7	175	49	4,380	1.13	2,419	4,377	181%
Exterior HPS400W to LED	2	2	460	109	4,380	1.13	2,160	3,484	161%
HPS300W to LED	1	1	295	63	4,380	1.13	626	1,151	184%
4L T8 32W to LED	326	326	59	27	3,219	1.13	26,758	38,051	142%
1L T8 32W to LED	7	7	32	14	3,219	1.13	575	460	80%
4L T8 32W to LED	20	10	59	53	3,219	1.13	821	2,371	289%
4L T8 32W to LED	1	1	59	14	3,219	1.13	82	164	200%
3L T8 Ubend to LED	12	12	89	26	3,219	1.13	1,452	2,758	190%
MH 250W to LED kit	9	9	288	80	3,219	1.13	7,698	6,828	89%
MH400W to LED	4	4	460	120	3,219	1.13	5,184	4,961	96%
Halogen MR15 to LED	71	71	45	6	3,219	1.13	3,763	10,100	268%
Halogen MR15 to LED	8	8	45	6	3,219	1.13	424	1,138	268%
Inc Exit sign to LED	5	5	14	5	8,760	1.13	415	83	20%
Occupancy sensors	22	22	-	1,508	3,219	1.13	6,708	6,050	90%
Total							59,085	81,975	139%

Results

Realized Gross Savings

Measure Category	*kWh Savings*			*Realized Peak kW Reduction*
	Ex Ante	*Ex Post*	*Realization Rate*	
Prescriptive Lighting	59,085	81,975	139%	15.60
Custom Lighting	397,939	403,800	101%	124.24
Total	457,024	485,775	106%	139.83

The realized annual energy savings are 485,775 kWh with a gross energy savings realization rate of 106%. The difference between the ex ante and ex post savings estimates is due to the following factors:

- The deemed savings for the prescriptive measures underestimate the measure savings as determined by the existing wattage, installed wattage, hours of use, and waste heat factor. The as-installed lighting survey from the applicant also calculated the expected savings with similar values to the ex post savings.

- The ex post custom savings were higher with a waste heat factor based on the location, the HVAC type, and building type as provided by the *IN TRM* with a value of 0.133. The ex ante savings references the same 1.115 value for all locations, building types, and HVAC types.
- The peak demand ex post savings of 139.83 kW was less than the ex ante value of 191.03, as the ex ante utilized a 1.0 CF for all measures regardless of the operating hours.

Project Number 107 and 205

Executive Summary

Under project 107 and 205, a program participant received prescriptive and custom incentives from I&M for the installation and retrofit of energy efficient lighting. The ex post annual energy savings are 70,409 kWh with ex post peak demand reduction of 16.52 kW. The project energy savings gross realization rate is 103%.

Project Description

The customer received prescriptive incentives for replacing T8 and T5 fluorescent lighting, HPS fixtures, and CFL lamps with LED lamps and fixtures.

Measurement and Verification Effort

Through remote data collection, ADM staff verified the installation of the lighting equipment, the lighting hours of operation, the type of lighting control employed (switch, occupancy sensor, photocell, etc.), and the facility's HVAC type. The following equations were used to calculate the annual savings of the lighting measures:

$$kWh_{Savings} = \left(\frac{Watts_{base} \times N_{base} - Watts_{eff} \times N_{eff}}{1000}\right) \times HOU \times (HCIF_e)$$

$$kW_{Peak} = \left(\frac{Watts_{base} \times N_{base} - Watts_{eff} \times N_{eff}}{1000}\right) \times CF \times (HCIF_d)$$

Where:

$kWh_{savings}$	*= Annual energy savings*
N	*= Number of fixtures*
Watts	*= Watts of each fixture*
HOU	*= Indicates hours of usage for the fixture*
$HCIF_e$	*= Heating and Cooling Interactive Factor*
$HCIF_d$	*= Heating and Cooling Interactive Factor during Peak Demand hours*
CF	*= Coincidence Factor for Peak Demand hours*
base	*= denotes pre-installation state*
eff	*= denotes post-installation state*

The tables below present ex ante and ex post energy savings verified lighting hours of operation, and heating and cooling interactive factors associated with the lighting equipment installed under the project.

Prescriptive Lighting Energy Savings Calculations

Measure	Quantity (Fixtures)		Wattage		Hours	Heating Cooling Interaction Factor	Ex Ante Annual kWh Savings	Ex Post Gross kWh Savings	Gross Realization Rate
	Baseline	Efficient	Baseline	Efficient					
3L T8 32W to LED 2x4 Troffer	10	10	89	32	3640	1.096	3,020	2,274	75%
1L T8 32W to LED 8' Lamp	6	6	31	15	3640	1.096	492	383	78%
2L Ubend T8 to LED 2x2 Troffer	3	3	55	30	3640	1.096	363	299	82%
6L T5HO 54W to LED High Bay	8	8	351	154	3640	1.096	2,904	6,287	217%
HPS 458W to Exterior LED Wall Pack	1	1	458	80	2780	1	1,080	1,051	97%
4L T8 32W to LED 2x4 Troffer	21	21	112	38.9	3640	1.096	9,261	6,124	66%
4L T8 32W to LED 2x4 Troffer	6	6	112	32	3640	1.096	2,406	1,915	80%
HPS 458W to Exterior LED Wall Pack	4	4	458	100	2780	1	4,320	3,981	92%
2L Ubend T8 to LED 2x4 Troffer	10	10	59	32	3640	1.096	1,210	1,077	89%
1L T8 32W to LED 8' Lamp	4	4	31	15	3640	1.096	328	255	78%
Total							25,384	23,647	93%

Custom Lighting Energy Savings Calculations

Measure	Quantity (Fixtures)		Wattage		Hours	Heating Cooling Interaction Factor	Ex Ante Annual kWh Savings	Ex Post Gross kWh Savings	Gross Realization Rate
	Baseline	Efficient	Baseline	Efficient					
6L T5HO 54W to LED High Bay	50	50	351	183	3640	1.096	42,666	33,511	110%
2L 8' T12 75W to LED 8' Lamp	25	34	173	61	3640	1.096		8,980	
4L T8 32W to LED Troffer	11	2	112	88.8	3640	1.096		4,206	
CFL 26W to LED A19	1	1	26	10	3640	1.096		64	
Total							42,666	46,762	110%

Results

Gross Energy Impacts Summary

Measure Category	kWh Savings			Ex Post Gross kW Savings
	Ex Ante	Ex Post	Realization Rate	
Prescriptive Lighting	25,384	23,647	93%	4.70
Custom Lighting	42,666	46,762	110%	11.82
Total	68,050	70,409	103%	16.52

The ex post annual energy savings are 70,409 kWh and the ex post peak demand reduction is 16.52 kW. The energy gross realization rate is 103%. The following items impacted the ex post savings:

- The ex post custom energy savings included the waste heat factor for a gas heat, airconditioned retail building, the ex ante did not include the factor.
- The ex post prescriptive energy savings were less than the deemed prescriptive savings, mostly for the measure with fluorescent tube lighting replaced by LED troffers.

Project Number: 108 and 206

Executive Summary

Under project 108 and 206, a program participant received prescriptive and custom incentives from I&M for installation and retrofit of energy efficient lighting. The ex post annual energy savings are 69,847 kWh with ex post peak demand reduction of 8.58 kW. The combined project energy savings gross realization rate is 130%.

Project Description

The customer received prescriptive incentives for replacing incandescent lamps, metal halide lamps, and T12 lighting troffers with LED A-lamps, LED recessed ceiling fixtures, and LED 2x4 troffers.

Measurement and Verification Effort

Through remote data collection, ADM staff verified the installation of the lighting equipment, the lighting hours of operation, the type of lighting control employed (switch, occupancy sensor, photocell, etc.), and the facility's HVAC type. The following equations were used to calculate the annual savings of the lighting measures:

$$kWh_{Savings} = \left(\frac{Watts_{base} \times N_{base} - Watts_{eff} \times N_{eff}}{1000}\right) \times HOU \times (HCIF_e)$$

$$kW_{Peak} = \left(\frac{Watts_{base} \times N_{base} - Watts_{eff} \times N_{eff}}{1000}\right) \times CF \times (HCIF_d)$$

Where:

$kWh_{savings}$	*= Annual energy savings*
N	*= Number of fixtures*
Watts	*= Watts of each fixture*
HOU	*= Indicates hours of usage for the fixture*
$HCIF_e$	*= Heating and Cooling Interactive Factor*
$HCIF_d$	*= Heating and Cooling Interactive Factor during Peak Demand hours*
CF	*= Coincidence Factor for Peak Demand hours*
base	*= denotes pre-installation state*
eff	*= denotes post-installation state*

The tables below present ex ante and ex post energy savings verified lighting hours of operation, and heating and cooling interactive factors associated with the lighting equipment installed under the project.

Prescriptive Lighting Energy Savings Calculations

Measure	*Quantity (Fixtures)*		*Wattage*		*Hours*	*Heating Cooling Interaction Factor*	*Ex Ante Annual kWh Savings*	*Ex Post Gross kWh Savings*	*Gross Realization Rate*
	Baseline	*Efficient*	*Baseline*	*Efficient*					
4L T12 34W to LED 2x4 Troffer	59	59	112	40	8760	1.115	26,019	41,492	159%
4L T12 34W to LED 2x4 Troffer	15	15	112	40	4380	1.115	6,615	5,274	80%
4L T12 34W to LED 2x4 Troffer	3	3	112	42	8760	1.115	1,323	2,051	155%
4L T12 34W to LED 2x4 Troffer	8	8	112	40	8760	1.115	3,528	5,626	159%
Total							37,485	54,443	145%

Custom Lighting Energy Savings Calculations

Measure	*Quantity (Fixtures)*		*Wattage*		*Hours*	*Heating Cooling Interaction Factor*	*Ex Ante Annual kWh Savings*	*Ex Post Gross kWh Savings*	*Gross Realization Rate*
	Baseline	*Efficient*	*Baseline*	*Efficient*					
MH175W to LED A21 Lamp	5	15	208	20	4380	1.115	16,333	4,591	94%
Inc 2L 60W to LED Recessed	4	4	86	26	8760	1.115		2,344	
Inc 2L 60W to LED 2x4 Troffer	4	4	86	40	4380	1.115		899	
MH175W to LED A23	10	10	208	25	8760	1.115		7,520	
Additional lamps	0	5	0	40	8760	1.115			
Total							16,333	15,403	94%

Results

Gross Energy Impacts Summary

Measure Category	*kWh Savings*			*Ex Post Gross kW Savings*
	Ex Ante	*Ex Post*	*Realization Rate*	
Prescriptive Lighting	37,485	54,443	145%	5.72
Custom Lighting	16,333	15,403	94%	2.86
Total	53,818	69,847	130%	8.58

The ex post annual energy savings are 69,847 kWh and the ex post peak demand reduction is 8.52 kW. The energy gross realization rate is 130%. The following items impacted the ex post savings:

- The ex post custom energy considered the EISA efficacy standard for GSL lighting and set the incandescent baseline wattage to the lumen equivalent wattage.
- The ex post prescriptive energy savings were more than the deemed prescriptive savings, even after setting the T12 baseline wattage to the EISA efficacy lumen equivalent wattage from 144W to 112W for a T8 fixture.

Project Number: 109 and 208

Executive Summary

Under project 109 and 208, a program participant received prescriptive and custom incentives from I&M for installation and retrofit of energy efficient lighting. The ex post annual energy savings are 430,253 kWh with ex post peak demand reduction of 55.35 kW. The combined project energy savings gross realization rate is 146%.

Project Description

The customer received prescriptive incentives for replacing incandescent lamps, CFL lamps, HID fixtures, and T8 lamps/fixtures with (24) LED A21-lamps, (158) LED recessed ceiling fixtures, (17) LED fixtures, and (2302) LED linear tubes.

Measurement and Verification Effort

Through remote data collection, ADM staff verified the installation of the lighting equipment, the lighting hours of operation, the type of lighting control employed (switch, occupancy sensor, photocell, etc.), and the facility's HVAC type. The following equations were used to calculate the annual savings of the lighting measures:

$$kWh_{Savings} = \left(\frac{Watts_{base} \times N_{base} - Watts_{eff} \times N_{eff}}{1000}\right) \times HOU \times (HCIF_e)$$

$$kW_{Peak} = \left(\frac{Watts_{base} \times N_{base} - Watts_{eff} \times N_{eff}}{1000}\right) \times CF \times (HCIF_d)$$

Where:

$kWh_{savings}$	*= Annual energy savings*
N	*= Number of fixtures*
Watts	*= Watts of each fixture*
HOU	*= Indicates hours of usage for the fixture*
$HCIF_e$	*= Heating and Cooling Interactive Factor*
$HCIF_d$	*= Heating and Cooling Interactive Factor during Peak Demand hours*
CF	*= Coincidence Factor for Peak Demand hours*
base	*= denotes pre-installation state*
eff	*= denotes post-installation state*

The tables below present ex ante and ex post energy savings verified lighting hours of operation, and heating and cooling interactive factors associated with the lighting equipment installed under the project.

Prescriptive Lighting Energy Savings Calculations

Measure	*Quantity (Fixtures)*		*Wattage*		*Hours*	*Heating Cooling Interaction Factor*	*Ex Ante Annual kWh Savings*	*Ex Post Gross kWh Savings*	*Gross Realization Rate*
	Baseline	*Efficient*	*Baseline*	*Efficient*					
1L T8 32W to LED B Type 4' Tube	1998	1998	31	10.5	6,648	1.115	163,836	303,609	185%
MH 400W to LED Fixture	17	17	400	114	4,380	1.115	22,032	23,745	108%
MH 70W to LED Recessed	13	13	70	17	4,380	1.115	4,498	3,365	75%
MV 75W to LED Recessed	17	17	75	28	4,380	1.115	5,882	3,902	66%
MV 75W to LED Recessed	6	6	75	30	4,380	1.115	2,076	1,319	64%
1L T8 32W to LED 4' Ubend Tube	148	148	32	21	6,648	1.115	12,136	12,068	99%
1L T12 40W to LED B Type 4' Tube	44	44	32	10.5	6,648	1.115	3,608	7,012	194%
1L T12 48W to LED B Type 4' Tube	8	8	34	10.5	6,648	1.115	656	1,394	212%
Total							214,724	356,413	166%

Custom Lighting Energy Savings Calculations

Measure	*Quantity (Fixtures)*		*Wattage*		*Hours*	*Heating Cooling Interaction Factor*	*Ex Ante Annual kWh Savings*	*Ex Post Gross kWh Savings*	*Gross Realization Rate*
	Baseline	*Efficient*	*Baseline*	*Efficient*					
CFL 42W to LED Recessed	102	102	44	15	8,760	1.115		28,892	
CFL 57W to LED Recessed	5	5	60	21	8,760	1.115		1,905	
1L 2' T8 17W to LED B Type 2' Tube	34	34	18	7	8,760	1.115		3,653	
2L 2' T8 17W to LED B Type 2' Tube	6	6	32	14	8,760	1.115		1,055	
3L 2' T8 17W to LED B Type 2' Tube	16	16	50	21	8,760	1.115	80,158	4,532	93%
4L 2' T8 17W to LED B Type 2' Tube	48	48	65	28	8,760	1.115		17,347	
Can Inc GSL 60W to LED Recessed	15	15	43	10	8,760	1.115		4,835	
MH 70W to LED A21	26	22	95	16.5	4,300	1.115		9,786	
MH 175W to LED A21	2	2	208	16.5	4,300	1.115		1,836	
Total							80,158	73,840	93%

Results

Gross Energy Impacts Summary

Measure Category	*kWh Savings*			*Ex Post Gross kW Savings*
	Ex Ante	*Ex Post*	*Realization Rate*	
Prescriptive Lighting	214,724	356,413	166%	47.12
Custom Lighting	80,158	73,840	93%	8.23
Total	294,882	430,253	146%	55.35

The ex post annual energy savings are 430,253 kWh and the ex post peak demand reduction is 55.35 kW. The energy gross realization rate is 146%. The following items impacted the ex post savings:

- The ex post custom energy considered the EISA efficacy standard for GSL lighting and set the incandescent baseline wattage to the lumen equivalent wattage.
- The ex post custom energy savings reviewed the lighting survey, aligned to the invoices and determined that 28 Metal Halides were replaced by 28 LED screw in A21 lamps. The application may have misaligned the items 8, 9, and 10 without indicating the corresponding replacement quantity.
- Although, the ex post prescriptive savings were higher than the ex ante, the ex post hours determined by the phone interview resulted in a decrease in lighting hours from the 8,760 indicated on the application. The areas noted to have fewer lighting hours were administrative areas, storage areas, and some private offices.

Project Number: 110 and 210

Executive Summary

Under projects 110 and 210, a program participant received prescriptive and custom incentives from I&M for installation and retrofit of energy-efficient lighting. The ex post annual energy savings are 297,691 kWh with ex post peak demand reduction of 21.43 kW. The combined project energy savings gross realization rate is 95%.

Project Description

The customer received prescriptive incentives for replacing metal halide fixtures and T8 linear fluorescent lamps/fixtures with (145) LED high bay fixtures, (26) LED wall packs, (3) LED pole fixtures, and (380) LED troffers.

Measurement and Verification Effort

Through remote data collection, ADM staff verified the installation of the lighting equipment, the lighting hours of operation by obtaining the lightning schedule, verifying hours with AMI billing data and the facility's HVAC type. The following equations were used to calculate the annual savings of the lighting measures:

$$kWh_{Savings} = \left(\frac{Watts_{base} \times N_{base} - Watts_{eff} \times N_{eff}}{1000}\right) \times HOU \times (HCIF_e)$$

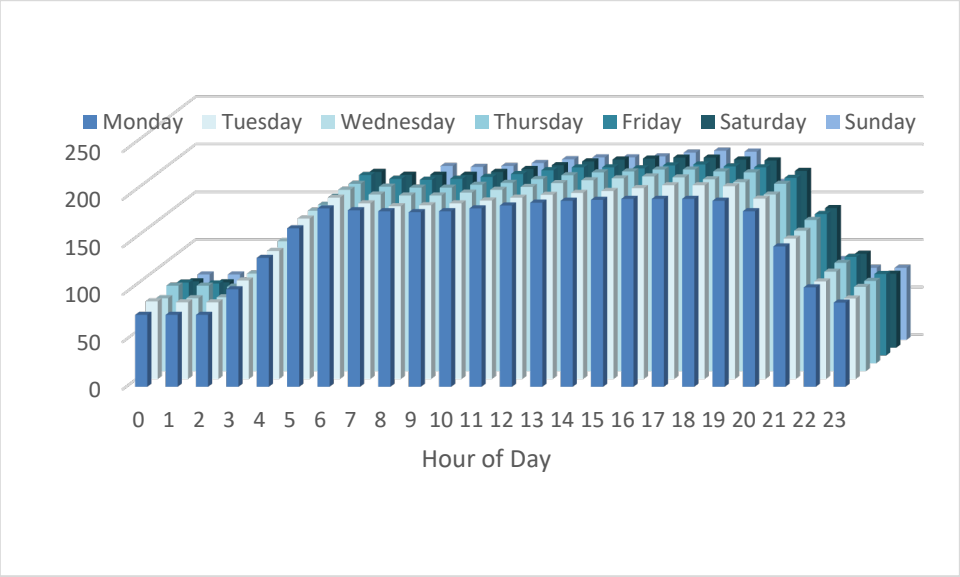
$$kW_{Peak} = \left(\frac{Watts_{base} \times N_{base} - Watts_{eff} \times N_{eff}}{1000}\right) \times CF \times (HCIF_d)$$

Where:

$kWh_{savings}$	= *Annual energy savings*
N	= *Number of fixtures*
Watts	= *Watts of each fixture*
HOU	= *Indicates hours of usage for the fixture*
$HCIF_e$	= *Heating and Cooling Interactive Factor*
$HCIF_d$	= *Heating and Cooling Interactive Factor during Peak Demand hours*
CF	= *Coincidence Factor for Peak Demand hours*
base	= *denotes pre-installation state*
eff	= *denotes post-installation state*

The AMI interval billing data supported the lighting schedules that ranged between from 5,450 to 6,500 hours per year, along with dusk to dawn light schedules.

AMI Interval Billing Data by Day and Hour



The tables below present ex ante and ex post energy savings verified lighting hours of operation, and heating and cooling interactive factors associated with the lighting equipment installed under the project.

Prescriptive Lighting Energy Savings Calculations

Measure	*Quantity (Fixtures)*		*Wattage*		*Hours*	*Heating Cooling Interaction Factor*	*Ex Ante Annual kWh Savings*	*Ex Post Gross kWh Savings*	*Gross Realization Rate*
	Baseline	*Efficient*	*Baseline*	*Efficient*					
MH 400W to LED High Bay	73	73	458	92	2,190	1.0	94,608	58,512	62%
MH 400W to LED Wall Pack	2	2	458	133	4,380	1.0	2,592	2,847	110%
MH 400W to LED Pole Fixture	3	3	458	147	4,380	1.0	3,240	4,087	126%
MH 400W to LED High Bay	17	17	458	73	4,380	1.0	18,360	28,667	156%
MH 400W to LED High Bay	12	12	458	73	4,380	1.0	12,960	20,236	156%
MH 400W to LED Wall Wash	24	24	208	44	4,380	1.0	8,294	17,240	208%
MH 1000W to LED High Bay	7	7	1080	545	4,380	1.0	21,168	16,403	77%
MH 400W to LED High Bay	3	3	458	266	4,380	1.0	3,240	2,523	78%
MH 400W to LED High Bay	1	1	458	246	4,380	1.0	1,080	929	86%
Total							165,542	151,443	91%

Custom Lighting Energy Savings Calculations

Measure	*Quantity (Fixtures)*		*Wattage*		*Hours*	*Heating Cooling Interaction Factor*	*Ex Ante Annual kWh Savings*	*Ex Post Gross kWh Savings*	*Gross Realization Rate*
	Baseline	*Efficient*	*Baseline*	*Efficient*					
2L 8' T8HO 86W to LED High Bay	40	32	160	94.3	6,110	1.126	23,684	23,270	98%
2L 4' T8 32W to LED 2x4 Troffer	435	380	59	20.5	6,110	1.126	125,162	122,977	98%
Total							148,846	146,248	98%

Results

Gross Energy Impacts Summary

Measure Category	*kWh Savings*			*Ex Post Gross kW Savings*
	Ex Ante	*Ex Post*	*Realization Rate*	
Prescriptive Lighting	165,542	151,443	91%	0.00
Custom Lighting	148,846	146,248	98%	21.43
Total	314,388	297,691	95%	21.43

The ex post annual energy savings are 297,691 kWh and the ex post peak demand reduction is 21.43 kW. The energy gross realization rate is 95%. The following items impacted the ex post savings:

- The ex post custom energy considered a *IN TRM* based waste heat factor for a big box retail store, whereas as the ex ante utilized a weighted building type factor.
- The ex post prescriptive savings were less than the deemed savings per unit for some of the lighting (73 fixtures) in the outdoor retail areas. Although the applicant hours and verified hours with the site contact were both equal to 2,190 hours, the deemed value may be based on a higher hours of use.

Project Number 114 and 212

Executive Summary

Under projects 114 and 212, a program participant received prescriptive and custom incentives from I&M for installation and retrofit of energy efficient lighting. The ex post annual energy savings are 382,365 kWh with ex post peak demand reduction of 91.83 kW. The combined project energy savings gross realization rate is 65%.

Project Description

The customer received prescriptive incentives replacing T8 linear fluorescent fixtures, halogen lamps, metal halide fixtures, and incandescent exit signs with (738) LED panels, (19) LED recessed fixtures, (74) LED wall packs/linear fixtures, and (31) LED exit signs.

Also, (140) occupancy sensors were installed to control interior lighting.

Measurement and Verification Effort

Through email exchanges with the site, ADM staff verified the original lighting survey, reviewed the AMI metered hours with the site to assign usage areas, and verified the facility's HVAC type. The following equations were used to calculate the annual savings of the lighting measures:

$$kWh_{Savings} = \left(\frac{Watts_{base} \times N_{base} - Watts_{eff} \times N_{eff}}{1000}\right) \times HOU \times (HCIF_e)$$

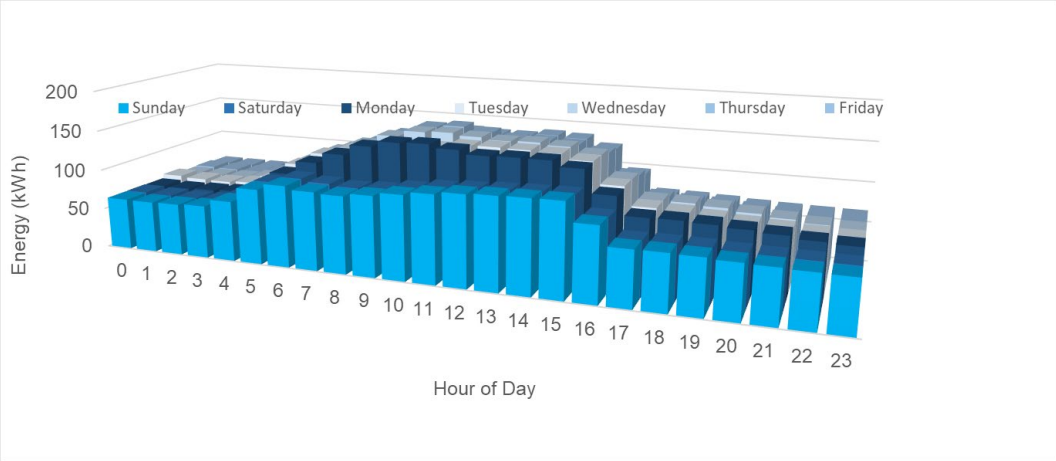
$$kW_{Peak} = \left(\frac{Watts_{base} \times N_{base} - Watts_{eff} \times N_{eff}}{1000}\right) \times CF \times (HCIF_d)$$

Where:

$kWh_{savings}$	*= Annual energy savings*
N	*= Number of fixtures*
Watts	*= Watts of each fixture*
HOU	*= Indicates hours of usage for the fixture*
$HCIF_e$	*= Heating and Cooling Interactive Factor*
$HCIF_d$	*= Heating and Cooling Interactive Factor during Peak Demand hours*
CF	*= Coincidence Factor for Peak Demand hours*
base	*= denotes pre-installation state*
eff	*= denotes post-installation state*

The AMI billing data indicated the school building's operating schedule during the school year, which was similar, but with a reduced load during the summer. The application hours of 2,000 were determined to be low for some areas, with the value of 2,500 assigned to the higher usage areas.

AMI kWh Billing Data by Day and Hour



The tables below present ex ante and ex post energy savings verified lighting hours of operation, and heating and cooling interactive factors associated with the lighting equipment installed under the project.

The existing lighting and installed lighting were extracted from the lighting survey that the site included with the application. It was observed that the prescriptive measures and custom measures on the application were sourced from the same data that was intended to be assigned to the custom program. The measures were not a complete duplicate of each other as the data was extracted from a spreadsheet pivot table that addressed different fields:

- Ex ante Custom – quantity sourced from Custom light survey measures by the existing fixture.
- Ex ante Prescriptive – quantity sourced from Custom light survey measures by the efficient fixture.

The following tables aggregate the measures by the implementer's original notation and program identification.

Prescriptive Lighting Energy Savings Calculations

Measure	*Quantity (Fixtures)*		*Wattage*		*Hours*	*Heating Cooling Interaction Factor*	*Ex Ante Annual kWh Savings*	*Ex Post Gross kWh Savings*	*Gross Realization Rate*
	Baseline	*Efficient*	*Baseline*	*Efficient*					
No controls to Occupancy Controls	-	7	-	506	2379	1.096	2,439	2,769	113%
No controls to Occupancy Controls	-	133	-	161	2379	1.096	46,653	16,731	36%
Inc Exit Sign to LED Exit Sign	31	31	0	0	2379	1.096	2,573	2,573	100%
1L T8 32W to LED Panel	7	7	29	29	2379	1.096		-	
1L T8 32W to LED Recessed	1	1	29	23	2379	1.096		16	
2L T8 32W to LED Panel	2	2	59	33	2379	1.096		136	
2L T8 32W to LED Panel	4	4	59	49	2379	1.096		104	
2L T8 32W to LED Panel	12	12	59	29	2379	1.096		939	
4L T8 32W to LED Panel	7	7	118	33	2379	1.096	252,871	1,551	17,283
4L T8 32W to LED Panel	11	11	118	49	2379	1.096		1,979	
4L T8 32W to LED Panel	7	7	118	29	2379	1.096		1,624	
6L T8 32W to LED Recessed	4	4	177	51.5	2379	1.096		1,309	
6L T8 32W to LED Panel	25	25	177	49	2379	1.096		8,344	
MH 250W to LED Fixture	2	2	295	49.5	2379	1.096		1,280	
Total							304,536	39,355	13%

Custom Lighting Energy Savings Calculations

Measure	*Quantity (Fixtures)*		*Wattage*		*Hours*	*Heating Cooling Interaction Factor*	*Ex Ante Annual kWh Savings*	*Ex Post Gross kWh Savings*	*Gross Realization Rate*
	Baseline	*Efficient*	*Baseline*	*Efficient*					
2L T8 32W to LED Panel	8	7	59	45	2379	1.096	283,108	409	121%
2L T8 32W to LED Panel	24	40	59	25	2379	1.096		1,085	
4L T8 32W to LED Panel	84	64	118	30	2379	1.096		20,838	
4L T8 32W to LED Panel	125	60	118	60	2379	1.096		29,072	
4L T8 32W to LED Panel	4	4	118	25	2379	1.096		970	
4L T8 32W to LED Panel	777	388	118	40	2379	1.096		198,594	
4L T8 32W to LED Recessed	6	4	118	42	2379	1.096		1,408	
6L T8 32W to LED Panel	69	64	177	40	2379	1.096		25,169	
6L T8 32W to LED Panel	36	36	177	60	2379	1.096		10,982	
MH 250W to LED Linear Fixture	4	9	295	45	2379	1.096		2,021	
MH 250W to LED Walpack	12	27	295	50	4380	1.096		10,513	
MH 400W to LED High Bay	32	15	455	106	2379	1.096		33,818	
MH 400W to LED Linear Fixture	3	4	455	45	2379	1.096		3,090	
Halogen 50W to LED Recessed	10	11	50	42	4380	1.096		182	
Halogen 75W to LED Linear Fixture	23	19	75	45	2379	1.096		2,268	
Halogen 75W to LED Recessed	4	4	75	40	2379	1.096		365	
Halogen 75W to LED Recessed	2	3	75	30	2379	1		143	
Halogen 75W to LED Recessed	14	7	75	25	2379	1		2,082	
Total							283,108	343,009	121%

Results

Gross Energy Impacts Summary

Measure Category	*kWh Savings*			*Ex Post Gross kW Savings*
	Ex Ante	*Ex Post*	*Realization Rate*	
Prescriptive Lighting	304,536	39,355	13%	14.53
Custom Lighting	283,108	343,009	121%	77.30
Total	587,644	382,365	65%	91.83

The ex post annual energy savings are 382,365 kWh and the ex post peak demand reduction is 91.83 kW. The energy gross realization rate is 65%. The following items impacted the ex post savings:

- The ex ante prescriptive measures duplicated many of the custom measures by an incorrect reference to the as built lighting survey from the site. The ex post savings maintained the original program assignment and determined the savings for the applicable measures.
- The ex post custom savings were higher than expected, as the operating hours were initially indicated by the AMI billing data to be larger than the applicant interior hours of 2,000. The school building has similar operating hours year-round, with a slightly lower load during the summer. The site contact verified the extended usage along with weekend usage of the gym areas.

Project Number 115 and 214

Executive Summary

Under projects 115 and 214, a program participant received prescriptive and custom incentives from I&M for installation and retrofit of energy efficient lighting. The ex post annual energy savings are 615,275kWh with ex post peak demand reduction of 46.58 kW. The combined project energy savings gross realization rate is 99%.

Project Description

The customer received prescriptive incentives replacing T5HO linear fluorescent fixtures, T8 linear fixtures, CFL pin base lamps, metal halide fixtures, and halogen lamp exit signs with (174) LED high bay, (9) LED linear fixtures, (46) LED recessed fixtures, (14) LED wall packs, (156) LED troffers, (6) LED pin based, and (9) LED exit signs.

Also, (326) fixture-mounted occupancy sensors were installed with the new fixtures to control interior lighting.

Measurement and Verification Effort

Through email exchanges with the site, ADM staff verified the original lighting survey, determined hours for the plant area and office area, and verified the facility's HVAC type. The following equations were used to calculate the annual savings of the lighting measures:

$$kWh_{Savings} = \left(\frac{Watts_{base} \times N_{base} - Watts_{eff} \times N_{eff}}{1000}\right) \times HOU \times (HCIF_e)$$

$$kW_{Peak} = \left(\frac{Watts_{base} \times N_{base} - Watts_{eff} \times N_{eff}}{1000}\right) \times CF \times (HCIF_d)$$

Where:

$kWh_{savings}$	*= Annual energy savings*
N	*= Number of fixtures*
Watts	*= Watts of each fixture*
HOU	*= Indicates hours of usage for the fixture*
$HCIF_e$	*= Heating and Cooling Interactive Factor*
$HCIF_d$	*= Heating and Cooling Interactive Factor during Peak Demand hours*
CF	*= Coincidence Factor for Peak Demand hours*
base	*= denotes pre-installation state*
eff	*= denotes post-installation state*

The tables below present ex ante and ex post energy savings verified lighting hours of operation, and heating and cooling interactive factors associated with the lighting equipment installed under the project. The new occupancy sensors mounted to the high bays controlled a larger load than the other controls dedicated to a T8 tube light fixture.

Prescriptive Lighting Energy Savings Calculations

Measure	*Quantity (Fixtures)*		*Wattage*		*Hours*	*Heating Cooling Interaction Factor*	*Ex Ante Annual kWh Savings*	*Ex Post Gross kWh Savings*	*Gross Realization Rate*
	Baseline	*Efficient*	*Baseline*	*Efficient*					
No Controls to Fixture Occupancy sensor	-	152	14	14	87,60	1.00	46,348	5,423	12%
No Controls to Fixture Occupancy sensor	-	174	200	200	8,760	1.00	53,056	91,454	172%
Inc Exit Sign to LED Exit Sign	4	4	20	4	8,760	1.00	332	561	169%
Inc Exit Sign to LED Exit Sign	5	5	30	4	8,760	1.00	415	1,139	274%
1L T8 32W to 1L LED linear tube	10	10	28	9	2,346	1.12	1,512	500	33%
3L T8 32W to LED 2x4 Panel	8	8	112	44	8,760	1.00	2,419	4,765	197%
MH 70W to LED Recessed	36	36	95	18	4,380	1.00	20,684	12,141	59%
2L T8 32W to LED linear fixture	8	8	56	23	8,760	1.00	4,596	2,313	50%
4L T8 32W to LED linear fixture	1	1	112	65	8,760	1.00	575	412	72%
2L T8 32W to LED Recessed	10	10	60	18	2,346	1.12	5,746	1,106	19%
MH 250W to LED Wallpack	1	1	295	50	4,380	1.00	626	1,073	171%
MH 400W to LED Wallpack	13	13	458	80	4,380	1.00	14,040	21,523	153%
Total							150,349	142,410	95%

The site contact referenced the original light surveys as applicable to the lighting replacement types. The original lighting and updated lighting survey listed high all high bays replaced one to one, plus the addition of new fixtures. A comparison of the lumens between the 10-lamp T5HO producing 50,000 lumens compared to the new LED high bay at 33,000 lumens supported the inclusion of the 44 new fixtures in the savings analysis.

Custom Lighting Energy Savings Calculations

Measure	*Quantity (Fixtures)*		*Wattage*		*Hours*	*Heating Cooling Interaction Factor*	*Ex Ante Annual kWh Savings*	*Ex Post Gross kWh Savings*	*Gross Realization Rate*
	Baseline	*Efficient*	*Baseline*	*Efficient*					
10L T5 HO 54W to LED Highbay	128	174	596	200	8,760	1.00	470,079	363,435	101%
4L T8 32W to LED 2x4 Troffer	148	148	112	28	8,760	1.00		108,904	
2L 2' T8 17W to LED 2x2 Troffer	4	4	32	20	8,760	1.00		420	
CFL Pinbase 18W to LED pin	3	6	20	8	8,760	1.00		105	
Total							470,079	472,865	101%

Results

Gross Energy Impacts Summary

Measure Category	*kWh Savings*			*Ex Post Gross kW Savings*
	Ex Ante	*Ex Post*	*Realization Rate*	
Prescriptive Lighting	150,349	142,410	95%	5.56
Custom Lighting	470,079	472,865	101%	41.02
Total	620,428	615,275	99%	46.58

The ex post annual energy savings are 615,275 kWh and the ex post peak demand reduction is 46.58 kW. The energy gross realization rate is 99%.

The fixture occupancy sensors installed on the higher load (200W) high bays fixtures had higher realized energy savings, whereas the occupancy sensors dedicated to each of the ceiling fixtures (14W) realized less energy savings.

Project Number 116 and 215

Executive Summary

Under projects 116 and 215, a program participant received prescriptive and custom incentives from I&M for installation and retrofit of energy efficient lighting. The ex post annual energy savings are 441,718 kWh with ex post peak demand reduction of 35.54 kW. The combined project energy savings gross realization rate is 104%.

Project Description

The customer received prescriptive incentives replacing T5HO linear fluorescent fixtures, T8 linear fixtures, T12 fluorescent fixtures, metal halide lamp fixtures, and exit signs with (178) LED high bay fixtures, (10) LED linear strip fixtures, (126) LED 2x4 troffer and (13) LED exit signs.

Also, (178) fixture mounted occupancy sensors were installed to control high bay lighting and another (121) for individual fixtures.

Measurement and Verification Effort

Through email exchanges with the site, ADM staff verified the original lighting survey, determined hours for the plant area and office area, and verified the facility's HVAC type. The following equations were used to calculate the annual savings of the lighting measures:

$$kWh_{Savings} = \left(\frac{Watts_{base} \times N_{base} - Watts_{eff} \times N_{eff}}{1000}\right) \times HOU \times (HCIF_e)$$

$$kW_{Peak} = \left(\frac{Watts_{base} \times N_{base} - Watts_{eff} \times N_{eff}}{1000}\right) \times CF \times (HCIF_d)$$

Where:

$kWh_{savings}$	= *Annual energy savings*
N	= *Number of fixtures*
Watts	= *Watts of each fixture*
HOU	= *Indicates hours of usage for the fixture*
$HCIF_e$	= *Heating and Cooling Interactive Factor*
$HCIF_d$	= *Heating and Cooling Interactive Factor during Peak Demand hours*
CF	= *Coincidence Factor for Peak Demand hours*
base	= *denotes pre-installation state*
eff	= *denotes post-installation state*

The tables below present ex ante and ex post energy savings verified lighting hours of operation, and heating and cooling interactive factors associated with the lighting equipment installed under the project.

Prescriptive Lighting Energy Savings Calculations

Measure	Quantity (Fixtures)		Wattage		Hours	Heating Cooling Interaction Factor	Ex Ante Annual kWh Savings	Ex Post Gross kWh Savings	Gross Realization Rate
	Baseline	Efficient	Baseline	Efficient					
MH 1000W to LED Flood Fixture	11	11	1080	310	4,380	1.00	33,264	37,099	112%
MH 400W Wallpack to LED Wallpack	7	7	460	80	4,380	1.00	7,560	11,651	154%
Inc Exit Sign to LED Exit Sign	11	11	50	2	8,760	1.00	1,079	4,625	429%
Halogen Exit Sign to LED Exit Sign	2	2	70	0	8,760	1.00		1,226	
No Controls to Occupancy controls	0	121	0	15	3,129	1.00	36,895	1,656	4%
No Controls to Fixture Occupancy Sensor	0	178	0	200	8,760	1.00	54,276	93,557	172%
Total							133,074	149,814	113%

The site contact referenced the original light surveys as applicable to the lighting replacement types. The final lighting survey provided the quantity of the additional LED high bays to supplement the other 1:1 figure replacement. These were included in the efficient case to determine the total installed wattage for the custom measures.

Custom Lighting Energy Savings Calculations

Measure	Quantity (Fixtures)		Wattage		Hours	Heating Cooling Interaction Factor	Ex Ante Annual kWh Savings	Ex Post Gross kWh Savings	Gross Realization Rate
	Baseline	Efficient	Baseline	Efficient					
4L T8 32W Strip to LED Highbay	1	1	113	200	3,129	1.00			
10L T5HO 54W to LED Highbay	80	80	600	200	8,760	1.00			
6L T5HO 54W to LED Highbay	17	17	379	200	8,760	1.00		284,956	
4L T8 32W to LED Highbay	1	1	113	200	8,760	1.00			
6L T8 32W to LED Highbay	3	3	169	200	3,129	1.00			
No existing to LED Highbay	0	76	0	200	8,760	1.00			
2L T12 8' 95W Strip to LED 2L Strip	1	1	209	50	8,760	1.00	291,741	1,390	101%
2L T8 59W Strip to LED 2L Strip	6	6	104	50	8,760	1.00		2,828	
2L T8 32W Strip to LED Strip	3	3	56	25	3,129	1.00		294	
4L T12 40W Troffer to LED 2x4 Troffer	5	5	172	28	8,760	1.00		6,307	
2L T8 32W Troffer to LED 2x4 Troffer	7	7	56	28	3,129	1.08		669	
4L T8 32W Troffer to LED 2x4 Troffer	114	114	112.6	28	3,129	1.08		32,592	
MH 400W Wallpack to LED Wallpack	6	6	460	80	4,380	1		11,651	
Total							291,741	294,904	101%

Results

Gross Energy Impacts Summary

Measure Category	*kWh Savings*			*Ex Post Gross kW Savings*
	Ex Ante	*Ex Post*	*Realization Rate*	
Prescriptive Lighting	133,074	149,814	113%	4.77
Custom Lighting	291,741	294,904	101%	30.77
Total	424,815	444,718	104%	35.54

The ex post annual energy savings are 444,718 kWh and the ex post peak demand reduction is 35.53 kW. The energy gross realization rate is 104%. The differences in the expected to realized savings are due to:

- There is uncertainty in the installation area of the (74) extra LED high bays that were not a 1:1 replacement. A lighting design drawing was not available. As the lumen output of the new LED is less than the lumen output of the T5 HO ten lamp fixtures, the evaluation team included 37 of the new fixtures in the post installation installed watts for the savings algorithm. The site could verify installation, but uncertain of the evaluation boundary.

Project Number 120 and 209

Executive Summary

Under projects 120 and 209, a program participant received prescriptive and custom incentives from I&M for installation and retrofit of energy efficient lighting. The ex post annual energy savings are 862,376 kWh with ex post peak demand reduction of 81.08 kW. The project energy savings gross realization rate is 202%.

Project Description

The customer received prescriptive incentives for replacing T8 and T12 linear fluorescent with LED lamps and new fixtures, replacing metal halide fixtures with LED fixtures.

Measurement and Verification Effort

Through remote data collection, ADM staff verified the installation of the lighting equipment, the lighting hours of operation, the type of lighting control employed (switch, occupancy sensor, photocell, etc.), and facility's HVAC type. The following equations were used to calculate the annual savings of the lighting measures:

$$kWh_{Savings} = \left(\frac{Watts_{base} \times N_{base} - Watts_{eff} \times N_{eff}}{1000}\right) \times HOU \times (HCIF_e)$$

$$kW_{Peak} = \left(\frac{Watts_{base} \times N_{base} - Watts_{eff} \times N_{eff}}{1000}\right) \times CF \times (HCIF_d)$$

Where:

$kWh_{savings}$	*= Annual energy savings*
N	*= Number of fixtures*
Watts	*= Watts of each fixture*
HOU	*= Indicates hours of usage for the fixture*
$HCIF_e$	*= Heating and Cooling Interactive Factor*
$HCIF_d$	*= Heating and Cooling Interactive Factor during Peak Demand hours*
CF	*= Coincidence Factor for Peak Demand hours*
base	*= denotes pre-installation state*
eff	*= denotes post-installation state*

The table below presents ex ante and ex post energy savings, verified lighting hours of operation, and heating and cooling interactive factors associated with the lighting equipment installed under the project.

Prescriptive Lighting Energy Savings Calculations

Measure	Quantity (Fixtures)		Wattage		Hours	Heating Cooling Interaction Factor	Ex Ante Annual kWh Savings	Ex Post Gross kWh Savings	Gross Realization Rate
	Baseline	Efficient	Baseline	Efficient					
2L T8 to LED Troffer	25	25	59	30	8,760	1.074	11,016	6,821	62%
MH 250W to LED shoebox	14	14	295	50	4,380	1.00	8,770	15,023	171%
4L T8 HB relamp to LED T8	2	8	149.8	15	8,760	1.074	657	1,690	257%
4L T8 relamp to LED T8	4	16	112	15	8,760	1.074	1,313	1,957	149%
4L T8 HB relamp to T8	305	1220	149.8	15	8,760	1.074	177,621	257,682	233%
4L T8 HB relamp to T8	72	288	149.8	15	8,760	1.074		60,830	
4L T8 HB relamp to T8	157	628	149.8	15	6,307	1.074		95,503	
6L T8 HB to LED HB	129	129	226	110	8,447	1.074	46,812	135,757	290%
2L T8 to LED Troffer	102	102	56	36	8,760	1.074	12,338	19,193	156%
2L T8 to LED Troffer	37	37	56	45	8,760	1.074	4,476	3,829	86%
2L T8 to LED Strip	48	48	59	34	6,570	1.074	16,330	8,467	184%
2L T8 to LED Strip	74	74	59	34	8,760	1.074		17,405	
2L T8 to LED Strip	8	8	59	34	8,760	1.074		1,882	
2L T12 to LED Strip	1	1	59	34	8,760	1.074		235	
3L T8 to LED Strip	4	4	89	34	8,760	1.074		2,070	
4L T8 to LED Strip	31	31	112	65	8,760	1.074	13,660	13,708	100%
2L T8 to LED Strip	5	5	59	90	8,760	1.074	10,575	(1,458)	23%
4L T8 to LED Strip	19	19	112	90	8,760	1.074		3,933	
2L T8 to LED Troffer	20	20	56	32	8,760	1.074	2,419	4,516	191%
2LT12Ubend toLED Troffer	2	2	32	26	8,760	1.074	968	113	47%
2L T8 Ubend to LED troffer	6	6	32	26	8,760	1.074		339	
2L T8 to LED Troffer	101	101	56	32	8,760	1.074	12,217	22,806	187%
4L T8 to LED Troffer	37	37	112	32	8,760	1.074	22,473	27,848	171%
4L T8 to LED Troffer	10	10	112	32	8,760	1.074		7,527	
4L T8 to LED Troffer	4	4	112	32	8,760	1.074		3,011	
MH 250W to LED fixture	3	3	295	150	4,380	1	9,396	1,905	486%
2L MH250W to LED pole	4	4	590	150	4,380	1		7,709	
4L MH250W to LED pole	8	8	1180	150	4,380	1		36,091	
2L T8 to LED Troffer	88	88	59	30	8,760	1.074	20,321	24,010	218%
2L T8 to LED Troffer	9	9	59	30	8,760	1.074		2,456	
2L T8 to LED Troffer	31	31	56	30	8,760	1.074		7,583	
2L T8 to LED Troffer	42	42	56	30	8,760	1.074		10,274	
4L T8 to LED Troffer	3	3	59	60	7,300	1.074	363	(24)	-
4L T8 to LED Troffer	8	8	112	60	7,300	1.074	3,525	3,262	90%
MH100W to LED fixture	1	1	128	40	4,380	1	2,419	385	16%
MH100W to LED wallpack	2	2	128	40	4,380	1		771	32%
MH175W to LED wallpack	4	4	208	40	4,380	1		2,943	122%
Total							377,667	808,050	214%

Custom Lighting Energy Savings Calculations

Measure	Quantity (Fixtures)		Wattage		Hours	Heating Cooling Interaction Factor	Ex Ante Annual kWh Savings	Ex Post Gross kWh Savings	Gross Realization Rate
	Baseline	Efficient	Baseline	Efficient					
Inc 60W A-Lamp to LED A-19	1	1	43	13	8,760	1.074	49,087	282	111%
Inc 100W PAR to LED PAR	12	12	73	13	4,380	1.00		3,154	
3L 2x2 T8 17W to LED 2x2 Troffer	30	30	44.9	26	8,760	1.074		5,334	
4L T8 32W to LED Troffer	45	45	112	30	8,760	1.074		34,716	
1L T8 32W to LED Strip	46	46	41	34	8,760	1.074		3,029	
MH 70W to LED Corncob	12	12	95	35	4,380	1.00		3,154	
MH 100W to LED Corncob	1	1	128	36	4,380	1.00		403	
Halogen 50W to LED Recessed	8	8	45	8	8,760	1.074		2,785	
2L 8' T12 to LED Strip	3	3	112	60	8,760	1.074		1,468	
Total							49,087	54,325	111%

Results

Gross Energy Impacts Summary

Measure Category	kWh Savings			Ex Post Gross kW Savings
	Ex Ante	Ex Post	Realization Rate	
Prescriptive Lighting	377,667	808,050	214%	76.47
Custom Lighting	49,087	54,325	111%	4.62
Total	426,754	862,376	202%	81.08

The ex post annual energy savings are 862,376 kWh and the ex post peak demand reduction is 81.08 kW. The energy gross realization rate is 202%. The following items impacted the ex post savings:

- The ex post prescriptive savings considered the existing fixtures, lamps, quantities from the as-built lighting survey. EISA based wattages were referenced from T12 linear fluorescent lamps and incandescent lamps for their lumen equivalent baseline. The ex ante savings were determined from deemed per unit savings values for typical replacements. The hours of use were verified as running continuously for the interior fixtures.
- The ex post custom savings included the heating cooling interactive effects for the lighting load reduction in the air conditioned, gas heated manufacturing facility.
- Data was collected for ancillary econometric IPMVP Option C – Whole Building Facility analysis to accompany the Option A analysis, but the project duration was from March to November 2022. Without enough post period data for a billing data to degree day regression, a comparison of 2022 billing data to 2021 billing data was made, indicating the in-progress savings had exceeded the expected savings.

Project Number 111,112 and 113

Executive Summary

Under projects 111,112 and 113, a program participant received prescriptive incentives from I&M for installation and retrofit of energy efficient lighting. The ex post annual energy savings are 6,219 kWh with ex post peak demand reduction of 2.28 kW. The site energy savings gross realization rate is 49%.

Project Description

The customer received prescriptive incentives for replacing T5HO linear fluorescent lamps with LED linear lamps and 2x2 LED panels. Also, the participant installed occupancy controls for the new lighting.

Measurement and Verification Effort

Through remote data collection, ADM staff verified the installation of the lighting equipment, the lighting hours of operation, the type of lighting control employed (switch, occupancy sensor, photocell, etc.), and the facility's HVAC type. The following equations were used to calculate the annual savings of the lighting measures:

$$kWh_{Savings} = \left(\frac{Watts_{base} \times N_{base} - Watts_{eff} \times N_{eff}}{1000}\right) \times HOU \times (HCIF_e)$$

$$kW_{Peak} = \left(\frac{Watts_{base} \times N_{base} - Watts_{eff} \times N_{eff}}{1000}\right) \times CF \times (HCIF_d)$$

Where:

$kWh_{savings}$	= *Annual energy savings*
N	= *Number of fixtures*
Watts	= *Watts of each fixture*
HOU	= *Indicates hours of usage for the fixture*
$HCIF_e$	= *Heating and Cooling Interactive Factor*
$HCIF_d$	= *Heating and Cooling Interactive Factor during Peak Demand hours*
CF	= *Coincidence Factor for Peak Demand hours*
base	= *denotes pre-installation state*
eff	= *denotes post-installation state*

The table below presents ex ante and ex post energy savings, verified lighting hours of operation, and heating and cooling interactive factors associated with the lighting equipment installed under the project.

Prescriptive Lighting Energy Savings Calculations

Measure	*Quantity (Fixtures)*		*Wattage*		*Hours*	*Heating Cooling Interaction Factor*	*Ex Ante Annual kWh Savings*	*Ex Post Gross kWh Savings*	*Gross Realization Rate*
	Baseline	*Efficient*	*Baseline*	*Efficient*					
1L T5HO to LED panel	13	13	55	36.3	2,500	1.101	1,572	669	43%
1L T5HO relamp LED	24	24	59	25.5	2,500	1.101	3,624	2,213	61%
Occupancy Controls	6	6	-	102.0	2,500	1.101	1,830	505	28%
1L T5HO relamp LED	25	25	59	25.5	2,500	1.101	3,780	2,305	61%
Occupancy Controls	6	6	-	106.25	2,500	1.101	1,830	526	29%
Total							12,636	6,219	49%

Results

Gross Energy Impacts Summary

Measure Category	*kWh Savings*			*Ex Post Gross kW Savings*
	Ex Ante	*Ex Post*	*Realization Rate*	
Prescriptive Lighting	12,636	6,219	49%	2.28
Total	12,636	6,219	49%	2.28

The ex post annual energy savings are 6,129 kWh and the ex post peak demand reduction is 2.28 kW. The energy gross realization rate is 49%. The following items impacted the ex post savings:

- The ex post prescriptive energy listed the existing lamp, new lamp wattage along with the hours of use provided by the site contact providing the best estimate of energy savings. The ex ante deemed savings were predetermined by other conditions.

Project Number 118 and 219

Executive Summary

Under projects 122 and 219, a program participant received prescriptive and custom incentives from I&M for installation and retrofit of energy efficient lighting. The ex post annual energy savings are 98,383 kWh with ex post peak demand reduction of 37.80 kW. The site energy savings gross realization rate is 77%.

Project Description

The customer received prescriptive incentives for replacing T8 and T12 high bay fixtures with (266) LED high bay fixtures.

Measurement and Verification Effort

Through remote data collection, ADM staff verified the installation of the lighting equipment, the lighting hours of operation, the type of lighting control employed (switch, occupancy sensor, photocell, etc.), and the facility's HVAC type. The following equations were used to calculate the annual savings of the lighting measures:

$$kWh_{Savings} = \left(\frac{Watts_{base} \times N_{base} - Watts_{eff} \times N_{eff}}{1000}\right) \times HOU \times (HCIF_e)$$

$$kW_{Peak} = \left(\frac{Watts_{base} \times N_{base} - Watts_{eff} \times N_{eff}}{1000}\right) \times CF \times (HCIF_d)$$

Where:

$kWh_{savings}$	*= Annual energy savings*
N	*= Number of fixtures*
Watts	*= Watts of each fixture*
HOU	*= Indicates hours of usage for the fixture*
$HCIF_e$	*= Heating and Cooling Interactive Factor*
$HCIF_d$	*= Heating and Cooling Interactive Factor during Peak Demand hours*
CF	*= Coincidence Factor for Peak Demand hours*
base	*= denotes pre-installation state*
eff	*= denotes post-installation state*

The tables below present ex ante and ex post energy savings verified lighting hours of operation, and heating and cooling interactive factors associated with the lighting equipment installed under the project.

Prescriptive Lighting Energy Savings Calculations

Measure	*Quantity (Fixtures)*		*Wattage*		*Hours*	*Heating Cooling Interaction Factor*	*Ex Ante Annual kWh Savings*	*Ex Post Gross kWh Savings*	*Gross Realization Rate*
	Baseline	*Efficient*	*Baseline*	*Efficient*					
6L T8 32W to LED High bay	10	10	226	105	2,340	1.121	3,629	3,174	87%
6L T8 32W to LED High bay	118	118	226	155	2,340	1.121	42,820	21,977	51%
6L T8 32W to LED High bay	43	43	226	155	2,340	1.121	15,604	8,008	51%
Total							62,052	33,159	53%

Custom Lighting Energy Savings Calculations

Measure	*Quantity (Fixtures)*		*Wattage*		*Hours*	*Heating Cooling Interaction Factor*	*Ex Ante Annual kWh Savings*	*Ex Post Gross kWh Savings*	*Gross Realization Rate*
	Baseline	*Efficient*	*Baseline*	*Efficient*					
2L T8 HO to LED High bay	435	95	79	100	2,340	1.121	65,654	65,224	99%
Total							65,654	65,224	99%

Results

Gross Energy Impacts Summary

Measure Category	*kWh Savings*			*Ex Post Gross kW Savings*
	Ex Ante	*Ex Post*	*Realization Rate*	
Prescriptive Lighting	62,052	33,159	53%	12.74
Custom Lighting	65,654	65,224	99%	25.06
Total	127,706	98,383	77%	37.80

The ex post annual energy savings are 98,383 kWh and the ex post peak demand reduction is 37.80 kW. The energy gross realization rate is 77%. The following items impacted the ex post savings:

- The ex post prescriptive energy savings method listed the existing lamp, new lamp wattage along with the hours of use provided by the site contact providing the best estimate of energy savings. The ex ante deemed savings were predetermined by other conditions.

Project Number 100 and 200

Executive Summary

Under projects 100 and 200, a program participant received prescriptive and custom incentives from I&M for installation and retrofit of energy efficient lighting. The ex post annual energy savings are 87,655 kWh with ex post peak demand reduction of 15.69 kW. The project energy savings gross realization rate is 121%.

Project Description

The customer received prescriptive incentives for relamping and also replacing T8 linear fluorescent lamp/fixtures with (222) LED 4' lamps, (8) LED retrofit kits, (125) LED high bay and (14) LED panel fixtures.

Measurement and Verification Effort

Through remote data collection, ADM staff verified the installation of the lighting equipment, the lighting hours of operation, the type of lighting control employed (switch, occupancy sensor, photocell, etc.), and the facility's HVAC type. The following equations were used to calculate the annual savings of the lighting measures:

$$kWh_{Savings} = \left(\frac{Watts_{base} \times N_{base} - Watts_{eff} \times N_{eff}}{1000}\right) \times HOU \times (HCIF_e)$$

$$kW_{Peak} = \left(\frac{Watts_{base} \times N_{base} - Watts_{eff} \times N_{eff}}{1000}\right) \times CF \times (HCIF_d)$$

Where:

$kWh_{savings}$	= *Annual energy savings*
N	= *Number of fixtures*
Watts	= *Watts of each fixture*
HOU	= *Indicates hours of usage for the fixture*
$HCIF_e$	= *Heating and Cooling Interactive Factor*
$HCIF_d$	= *Heating and Cooling Interactive Factor during Peak Demand hours*
CF	= *Coincidence Factor for Peak Demand hours*
base	= *denotes pre-installation state*
eff	= *denotes post-installation state*

The tables below present ex ante and ex post energy savings verified lighting hours of operation, and the heating and cooling interactive factors associated with the lighting equipment installed under the project.

Prescriptive Lighting Energy Savings Calculations

Measure	*Quantity (Fixtures)*		*Wattage*		*Hours*	*Heating Cooling Interaction Factor*	*Ex Ante Annual kWh Savings*	*Ex Post Gross kWh Savings*	*Gross Realization Rate*
	Baseline	*Efficient*	*Baseline*	*Efficient*					
4' T8 Lamp to LED Lamp	16	16	24.5	9	5,000	1.126	1,312	1,396	106%
4' T8 Lamp to LED Lamp	160	160	24.5	9	5,000	1.126	13,120	13,962	106%
4' T8 Lamp to LED Lamp	18	18	24.5	9	5,000	1.126	1,476	1,571	106%
4' T8 Lamp to LED Lamp	28	28	24.5	9	5,000	1.126	2,296	2,443	106%
4' 4L T8 fixture to LED retrofit kit	8	8	112	34	5,000	1.126	3,528	3,513	100%
4' 6L T8 fixture to LED highbay fixture	19	19	186	107	5,000	1.126	6,895	8,451	123%
4' 6L T8 fixture to LED highbay fixture	106	106	186	100	5,000	1.126	38,465	51,323	133%
Total							67,092	82,660	123%

Custom Lighting Energy Savings Calculations

Measure	*Quantity (Fixtures)*		*Wattage*		*Hours*	*Heating Cooling Interaction Factor*	*Ex Ante Annual kWh Savings*	*Ex Post Gross kWh Savings*	*Gross Realization Rate*
	Baseline	*Efficient*	*Baseline*	*Efficient*					
4' 4L T8 fixture to LED panel	1	1	112	32	5,000	1.126	464	450	97%
4' 4L T8 fixture to LED panel	1	1	112	32	5,000	1.126	464	450	97%
4' 4L T8 fixture to LED panel	9	9	92.6	32	5,000	1.126	3,177	3,071	97%
4' 4L T8 fixture to LED panel	1	1	92.6	32	5,000	1.126	353	341	97%
4' 4L T8 fixture to LED panel	2	2	92.6	32	5,000	1.126	706	682	97%
Total							5,164	4,995	97%

Results

Gross Energy Impacts Summary

Measure Category	*kWh Savings*			*Ex Post Gross kW Savings*
	Ex Ante	*Ex Post*	*Realization Rate*	
Prescriptive Lighting	67,092	82,660	123%	14.80
Custom Lighting	5,164	4,995	97%	0.89
Total	72,256	87,655	121%	15.69

The ex post annual energy savings are 87, 655 kWh and the ex post peak demand reduction is15.69 kW. The energy gross realization rate is 121%. The following items impacted the ex post savings:

- The ex ante custom savings estimate used a waste heat energy factor of 0.146 where the building HVAC is AC with Natural Gas Heat has a *IN TRM* factor of 0.126.

Project Number 101 and 201

Executive Summary

Under projects 101 and 201, a program participant received prescriptive and custom incentives from I&M for the buildout of an existing big box retail building. The ex post annual energy savings are 310,012 kWh with ex post peak demand reduction of 47.67 kW. The project energy savings gross realization rate is 78%.

Project Description

The program participant received custom incentives for:

- LED lighting for retail store, (30,000 SF)
- Lighting network controls
- Demand control ventilation implemented with a BMS controller and $C0_2$ sensing in the packaged rooftop units.
- Scheduling of the rooftop units for unoccupied periods

Also, prescriptive incentives received for:

- VFDs installed on the HVAC rooftop units supply fans, total of 42 HP
- Installation of (4) heat pumps, determined to be HVAC packaged units with gas heat.

Measurement and Verification Effort

Through remote data collection, ADM staff verified the installation of the lighting equipment, the lighting hours of operation, the type of lighting control employed (switch, occupancy sensor, photocell, etc.), and facility's HVAC type. The following equations were used to calculate the annual savings of the lighting measures:

$$kWh_{Savings} = \left(\frac{Watts_{base} \times N_{base} - Watts_{eff} \times N_{eff}}{1000}\right) \times HOU \times (HCIF_e)$$

$$kW_{Peak} = \left(\frac{Watts_{base} \times N_{base} - Watts_{eff} \times N_{eff}}{1000}\right) \times CF \times (HCIF_d)$$

Where:

$kWh_{savings}$	*= Annual energy savings*
N	*= Number of fixtures*
Watts	*= Watts of each fixture*
HOU	*= Indicates hours of usage for the fixture*
$HCIF_e$	*= Heating and Cooling Interactive Factor*
$HCIF_d$	*= Heating and Cooling Interactive Factor during Peak Demand hours*
CF	*= Coincidence Factor for Peak Demand hours*
base	*= denotes pre-installation state*
eff	*= denotes post-installation state*

As the HVAC units were electric cooling and gas heat, the savings were determined by the following equation:

$$kWh_{Savings} = \left(\frac{1}{SEER_{Base}} - \frac{1}{SEER_{EE}}\right) \times kBtuh \times EFLH_{cooling}$$

$$kW_{Peak} = \left(\frac{1}{EER_{Base}} - \frac{1}{EER_{EE}}\right) \times kBtuh \times CF$$

Where:

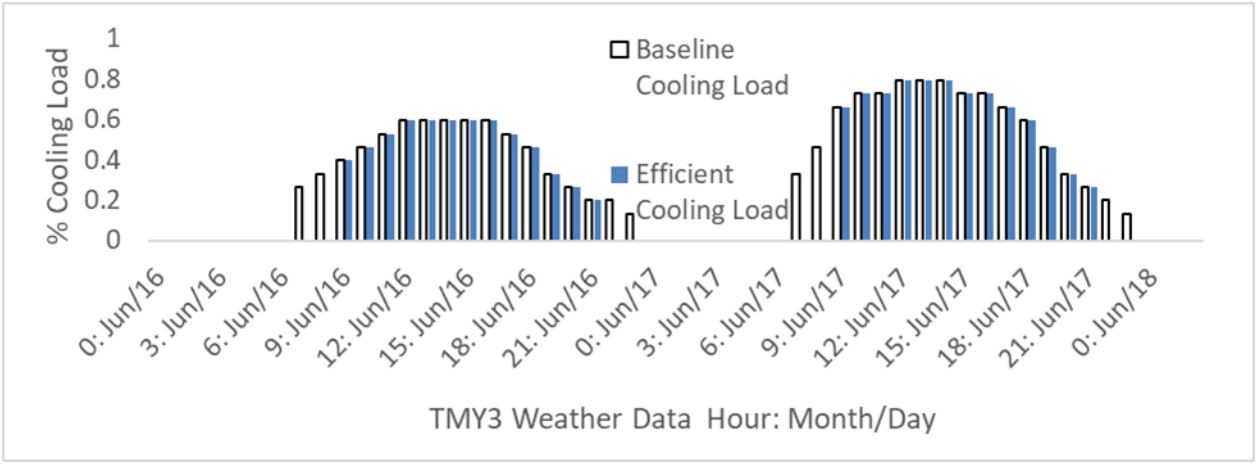
$kWh_{savings}$ = Annual energy savings
kBtuh = Net cooling capacity of the air conditioner
$SEER_{Base}$ = Seasonal Energy Efficiency Ratio of baseline unit
EER_{Base} = Energy Efficiency Ratio of baseline unit
EER_{EE} = Energy Efficiency Ratio of as-built unit
EFLH = Equivalent Full Load Hours of air conditioner operation, big box retail
CF = Coincidence Factor for Peak Demand hours

HVAC Energy Savings Calculations

Measure	*Building Type*	*Baseline IEER /SEER*	*Total Tons*	*Installed IEER / SEER*	*EFLH*	*CF*	*Ex Ante Annual kWh Savings*	*Ex Post Gross kWh Savings*	*Gross Realization Rate*
HVAC - Air Conditioner	Big Box Retail	14.0	3	17.0	1,056	0.74	2,811	479	17%
HVAC - Air Conditioner	Big Box Retail	14.0	4	17.0	1,056	0.74	2,811	639	23%
HVAC - Air Conditioner	Big Box Retail	14.0	8	17.0	1,056	0.74	5,622	1,278	23%
Total							11,245	2,396	21%

Savings from the scheduling of the units were determined by a weather load bin analysis based on TMY3 local weather data. The data provided for the new scheduled hours compared to the existing hours were utilized with the cooling load for each hour in the 8,760-hour profile. Two days of the analysis are presented in the following figure.

AMI Interval Load Distribution



The inputs used in the weather bin analysis are summarized in the following table. Although the ex ante and ex post analysis based the savings on the same reduction in operating hours, the ex post considered the load profile during the new unoccupied period. The reduced hours occurred in the early morning and at night when the cooling load is less than the average cooling load hour.

HVAC Savings Calculations

Measure	*Total Cooling Tons*	*IEER /SEER*	*Total Supply Fan Hp*	*Reduced Scheduled Hours Per Day*		*Full Load Cooling Hours Reduced*		*Expected kWh Savings*	*Realized kWh Savings*	*Realization Rate*
				Ex Ante	*Ex Post*	*Ex Ante*	*Ex Post*			
Scheduling	121	11.5 to 17	38	3.5	3.5	639	115	111,710	42,060	38%
Total								111,710	42,060	38%

Through remote data collection, ADM staff verified the installation of the lighting equipment, the lighting hours of operation, the type of lighting control employed (switch, occupancy sensor, photocell, etc.), and facility's HVAC type.

Custom Lighting Energy Savings Calculations

Measure	*Quantity (Fixtures)*		*Wattage*		*Hours*	*Heating Cooling Interaction Factor*	*Ex Ante Annual kWh Savings*	*Ex Post Gross kWh Savings*	*Gross Realization Rate*
	Baseline	*Efficient*	*Baseline*	*Efficient*					
LPD to LED High Bay 92W	108	108	292	87	4984	1.126		124,098	
LPD to LED Troffer 40W	18	18	134	40	4984	1.126		9,509	
LPD to LED Troffer 40W	4	4	134	40	4984	1.126		2,113	
LPD to LED Strip 65W	16	16	218	65	4984	1.126	180,940	13,736	98%
LPD to LED Downlight 12W	8	8	40	12	4984	1.126		1,268	
LPD to LED MR16 6W	332	332	20	6	4984	1.126		26,309	
LPD to LED PAR38 15W	1	1	50	15	4984	1.126		198	
Total							180,940	177,232	98%

The energy savings for the network lighting controls were determined by applying the Indiana TRM energy savings factor of 10% to the connected load, summarized in the following table.

Custom Lighting Network Controls Calculations

Measure	*Occupancy Sensors*	*Watts*	*Hours*	*Heating Cooling Interaction Factor*	*Ex Ante Annual kWh Savings*	*Ex Post Gross kWh Savings*	*Gross Realization Rate*
Network Controls	108	86.9	4984	1.126	5,361	5,267	98%
Network Controls	18	40	4984	1.126	411	404	98%
Network Controls	4	40	4984	1.126	91	90	98%
Network Controls	16	65	4984	1.126	594	584	98%
Network Controls	8	12	4984	1.126	55	54	98%
Network Controls	332	6	4984	1.126	1,138	1,118	98%
Network Controls	1	15	4984	1.126	15	8	98%
Total					7,665	7,525	98%

The demand control ventilation savings for the CO2 control system equipped with the new rooftop packaged HVAC units was determined by applying the *IN TRM* savings factor for the location and building type. The energy savings are the product of 30,005 square feet of building area and the savings factor of 547 kWh/1,000 SF, resulting in 16,412 kWh with 4.7 kW in demand reduction, equal to the ex ante savings estimate.

Results

Gross Energy Impacts Summary

Measure Category	*kWh Savings*			*Ex Post Gross kW Savings*
	Ex Ante	*Ex Post*	*Realization Rate*	
Prescriptive				
VFD on supply fan	67,080	64,386	96%	7.35
Packaged rooftop unit	11,245	2,396	21%	1.68
Custom				
Lighting	180,940	177,232	98%	28.04
Lighting Controls	7,665	7,525	98%	1.09
Demand Control Ventilation	16,413	16,413	100%	4.71
HVAC Scheduling	111,710	42,060	37%	4.80
Total	395,053	310,012	78%	47.67

The ex post annual energy savings are 310,012 kWh and the ex post peak demand reduction is 47.67 kW. The energy gross realization rate is 78%.

The expected scheduling savings of HVAC equipment overestimated the savings as it applied the reduced hours of operation to the effective full load of the units. The ex post savings applied the reduced hours as they occur to an 8760 weather bin load analysis, with the reduced hours occurring early before the store opens and late after closing, when the cooling load is the lowest. The reduced sum of hours were the same for the ex ante and ex post hours; only the time of day of occurrence differed.

Project Number 202

Executive Summary

Under project 202, a program participant received custom incentives from I&M for the detection and repair of compressed air leak in their industrial facility. The ex post annual energy savings are 34,001 kWh, with an ex post peak demand reduction of 3.9 kW. The project energy savings gross realization rate is 100%.

Project Description

The customer utilized a Trade Ally to locate air leaks in their facility using ultrasonic leak detection and repair the source of 38.2 CFM of air leaks.

Measurement and Verification Effort

Through remote data collection, ADM staff verified the completion of the leak repair project, the hours of operation, and the energy profile and operation of the on-site air compressor. ADM then used the *UE Systems Compressed Gas Flow Rate Curves* to calculate the air loss rate at each leak based on the ultrasonic decibel (dB) reading at each leak. To calculate the annual energy consumption reduction, this air loss calculation was used, along with compressor-specific power and annual hours of operation. The following equations were used to calculate the annual energy savings from the leak repairs:

$$SCFM_{repairs} = 0.02\ x\ db^{1.3399}$$

The Fraction Power (FP) on the air compressor demand curve, where the reduction in load occurs from repairing the air leaks, was determined by the method adapted from *Modeling and Simulation of Air Compressor Use, ACEEE.org.* Applying the FP to the product of the reduced air flow and power is summarized in the following equation:

$$kWh_{savings} = CFM_{repairs}\ x\ {}^{1}\Big/\frac{SCFM}{kW}\ x\ (FP_o + (1 - FP_o)xFC)$$

The peak demand equation:

$$kW_{Peak} = \frac{kWh_{savings}}{HOU}$$

Where:

$kWh_{savings}$	= *Annual energy savings*
CFM	= *Air leaks; CFM*
db	= *ultrasonic air leak intensity; decibels*
kW	= *Full load air compressor power, kw*
SCFM	= *Full load air compressor flow, cfm*
FP_o	= *No Production factor*
FC	= *Fraction of operating range; assume savings occur mostly idle*
kW_{peak}	= *peak demand savings*
HOU	= *Annual compressor hours of use*

The table below presents ex ante and ex post energy savings, verified hours of operation, CFM of the repaired leak, and the compressor flow per kW.

Custom Air Compressor Leak Calculation Inputs

Measure	*CFM Repaired*	*Compressor SCFM/kW*	*HOU*	*Ex Ante Gross kWh Savings*	*Ex Post Gross kWh Savings*	*Gross Realization Rate*
Repair plant air leaks	38.2	5.7	8,760	34,001	34,001	100%
Total				34,001	34,001	100%

Results

Gross Energy Impacts Summary

Measure Category	*kWh Savings*			*Ex Post Gross kW Savings*
	Ex Ante	*Ex Post*	*Realization Rate*	
Air Compressor	34,001	34,001	100%	3.9
Total	34,001	34,001	100%	3.9

The ex post annual energy savings are 34,001 kWh and the ex post peak demand reduction is 3.9 kW. The energy gross realization rate is 100%. While both the ex ante and ex post referenced the same savings method, the ex post utilizes the expression for fractional power as FPo +(1-FP_o)x FC and the ex ante applies the expression FP_o to the product of air flow and power. In this case they were equal, as the FP_o selected by both the ex ante and ex post was 0.5, (with FC = 0).

Project Number 218

Executive Summary

Under projects 218, a program participant received custom incentives from I&M for custom lighting measures for the building interior and exterior lighting. The ex post annual energy savings are 484,247 kWh with ex post peak demand reduction of 62.33 kW. The project energy savings gross realization rate is 81%.

Project Description

The customer installed efficient lighting during building new construction that exceeded the code-based lighting power density allowed wattage.

Measurement and Verification Effort

Through remote data collection, ADM staff verified the installation of the lighting equipment, the lighting hours of operation, the type of lighting control employed (switch, occupancy sensor, photocell, etc.), and the facility's HVAC type. The following equations were used to calculate the annual savings of the lighting measures:

$$kWh_{Savings} = \left(\frac{Allowed\ LPD - Installed\ LPD}{1000}\right) \times Footage \times HOU \times (HCIF_e)$$

$$kW_{Peak} = \left(\frac{Allowed\ LPD - Installed\ LPD}{1000}\right) \times Footage \times CF \times (HCIF_d)$$

Where:

$kWh_{savings}$	= *Annual energy savings*
Allowed LPD	= *Allowed lighting power density per square foot per ASHRAE Standard 90.1-2007*
Installed LPD	= *Installed lighting power density per square foot*
Footage	= *Square footage of new construction space*
HOU	= *Indicates hours of usage for the fixture*
$HCIF_e$	= *Heating and Cooling Interactive Factor*
$HCIF_d$	= *Heating and Cooling Interactive Factor during Peak Demand hours*
CF	= *Coincidence Factor for Peak Demand hours*

The tables below present the code allowed wattage, prorated to each fixture for comparison, the expected lighting hours of operation, and the heating and cooling interactive factors associated with each of the areas. The allowed wattage for each area based on units of square feet or linear feet is referenced from the *ASHRAE 90.1 2007* standards for the hospital building type.

Lighting Power Density Calculations

Measure	*Quantity (Fixtures)*	*Wattage*		*Hours*	*Heating Cooling Interaction Factor*	*Ex Post Gross kWh Savings*
		Allowed	*Efficient*			
Interior LED Panel	209	30	109	4,380	1.12	69,359
Interior LED Panel	13	45	163	4,380	1.12	6,471
Interior LED Recessed	21	26	94	4,380	1.12	6,040
Interior LED Panel	248	30	109	4,380	1.12	82,302
Interior LED Panel	8	30	109	4,380	1.12	2,655
Interior LED Panel	41	45	163	4,380	1.12	20,410
Interior LED Panel	178	38	138	4,380	1.12	74,824
Interior LED High Bay	12	130	471	4,380	1.12	17,257
Interior LED Recessed	4	17	62	4,380	1.12	752
Interior LED Pendant	2	67	243	4,380	1.12	1,482
Interior LED Strip	35	30	109	4,380	1.12	11,615
Non DLC Lighting	63	150	46	4,380	1.12	32,058
Uncovered Parking Areas LED Pole	4	138	372	4,300	1.00	4,023
Uncovered Parking Areas LED Pole 2H	1	276	744	4,300	1.00	2,011
Uncovered Parking Areas LED Pole	3	183	493	4,300	1.00	4,001
Uncovered Parking Areas LED Pole 2H	3	366	986	4,300	1.00	8,002
Uncovered Parking Areas LED Pole	2	138	372	4,300	1.00	2,011
Uncovered Parking Areas LED Pole	5	138	372	4,300	1.00	5,029
Uncovered Parking Areas LED Pole	1	125	337	4,300	1.00	911
Uncovered Parking Areas LED Pole 2H	1	250	674	4,300	1.00	1,822
Other Building Doors LED Wall pack	4	50	1,500	4,300	1.00	24,940
Walkways (< 10 ft wide) LED Wall pack	7	25	135	4,300	1.00	3,310
Walkways (< 10 ft wide) LED Wall pack	26	50	270	4,300	1.00	24,586
Walkways (< 10 ft wide) LED Wall pack	5	50	270	4,300	1.00	4,728
Walkways (< 10 ft wide) LED Pole	1	138	745	4,300	1.00	2,610
Walkways (≥ 10ft wide), LED Wall pack	16	25	120	4,300	1.00	6,553
Walkways (≥ 10ft wide), LED Wall pack	31	50	240	4,300	1.00	25,393
Walkways (≥ 10ft wide), LED Pole	3	138	664	4,300	1.00	6,782
Walkways (≥ 10ft wide), LED Pole	4	138	664	4,300	1.00	9,043
Canopies LED Recessed	38	26	168	4,300	1.00	23,266

Custom Lighting Energy Savings Calculations

Measure	Code Baseline			Installed Watts	Hours	Ex Ante Annual kWh Savings	Ex Post Gross kWh Savings	Gross Realization Rate	Ex Post Gross kW Savings
	Standard	Size	Allowed Watts						
Interior	1.2 w/sf	79,995	95,994	26,502	4,380	176,019	325,225	185%	62.33
Uncovered Parking Areas	0.12 w/sf	68,556	10,283	3,816	4,300	27,810	27,810	100%	0
Other Building Doors	20 w/lf	20	6,000	200	4,300	302,118	24,940	8%	0
Walkways (< 10 ft wide)	1.0 w/lf	10,057	10,057	1,863	4,300	35,234	35,234	100%	0
Walkways (≥ 10ft wide),	0.2 w/sf	70,128	14,026	2,916	4,300	47,771	47,771	100%	0
Canopies	1.25 w/sf	5,119	6,399	988	4,300	23,266	23,266	100%	0
Total						612,219	484,247	81%	62.33

Results

Gross Energy Impacts Summary

Measure Category	kWh Savings			Ex Post Gross kW Savings
	Ex Ante	Ex Post	Realization Rate	
New Construction Lighting	612,219	484,247	81%	62.33
Total	612,219	484,247	81%	62.33

The ex post annual energy savings are 484,247 kWh and the ex post peak demand reduction is 62.33kW. The energy gross realization rate is 81%. The differences in savings between the exterior and interior areas are provided below.

- The ex ante applied the value of 3,523 feet for the total building door width from the electrical Comcheck. The project only installed four 50W LED exterior fixtures for this building entrance area. The usage of lighting power density in ASHRAE 90.1 is qualified by “lighted” or “illuminated” areas for applying the allowance based on square feet or linear feet. The ex post analysis set the evaluation boundary at the building entrance area as described on the Comcheck as “ambulance entrance” and verified the quantity of fixtures from the electrical lighting drawing with a corresponding linear feet for the illuminated area. The realized savings were 8% of expected.
- The ex post determined the code based interior lighting power allowance on the total square footage, and all installed lighting, both DLC qualified and not qualified. The ASHRAE 90.1 lighting allowance considers both efficient equipment and efficient design utilizing natural light. Inclusion of the total area considers both factors. The ex ante savings prorated the interior installation square feet, based on the percentage of qualified DLC lighting wattage (65%).

Project Number 207

Executive Summary

Under project 207, a program participant received custom incentives from I&M for replacement of refrigerated space loading door weather seals. The ex post annual energy savings are 322,815 kWh with ex post peak demand reduction of 99.67 kW. The project energy savings gross realization rate is 44%.

Project Description

The customer received custom incentives for replacing weather seals around the loading door frames leading to a buffer zone space to frozen food storage warehouses. The existing gaps averaged ½" for 152 lineal feet, 5/8" for 88 lineal feet, ¾" for 344 lineal feet, 7/8" for 96 lineal feet and 1" for 88 lineal feet.

Measurement and Verification Effort

Through email and a phone call with the warehouse manager, the installation of new dock seals was verified along with the dates of the installation. The ex ante savings were determined by deemed savings per linear foot and width of the failed dock door seal. The initial effort validated the annual savings per foot values by applying the tables from the *ASHRAE Cooling and Heating Load Calculation manual* for Ft Wayne TMY3 weather data. The infiltration was based on the differential pressure due to stack effect wind speed, velocity head, and the building type. The sum of the hourly bin savings replicated the annual ex ante deemed savings values.

Weather Seal Energy Savings per Foot by Gap Size for Low Temp Space

	kWh/ft 1/2"Gap	*kWh/ft 5/8" Gap*	*kWh 3/4" Gap*	*kWh/ft 7/8" Gap*	*kWh/ft 1" Gap*
Ex-Ante	645	806	968	1129	1291
Ex-Post	649	812	974	1136	1298

The savings per unit are based on the temperature difference between low temperature freezer space and the outdoor air, occurring 8,760 hours per year. The project replaced the weather seal between the moving door and the frame, for the space entering the buffer zone, to low temperature space. The assumption can be made that during the workday, the buffer zone and low temperature space will reach equilibrium due to the warehousing of materials from the truck to dock. However, during unoccupied periods, the buffer zone temperature will normalize to the outdoor temperature or a tempered setpoint, with the low temperature space insulated by their own freezer doors. Also, when the exterior loading dock door is in the up position while a trailer is adjacent to the dock seal pads, will not rely on the door weather seals for exterior infiltration reduction.

To determine savings, the ex post analysis applied the number of work hours, work days, trucks loaded, and dock doors to the 8,760 weather bin analysis for the gap size identified in their repair tracking worksheet.

Weatherstrip Energy Savings by Gap and Length

	Ft and kWh ½"	*Ft and kWh 5/8"*	*Ft and kWh ¾"*	*Ft and kWh 7/8"*	*Ft and kWh 1"*	*Total Ft Total kWh*
Feet	152	88	344	96	88	768
kWh	43,693	32,667	148,451	48,352	50,651	322,815

Results

Gross Energy Impacts Summary

Measure Category	*kWh Savings*			*Ex Post Gross kW Savings*
	Ex Ante	*Ex Post*	*Realization Rate*	
Custom Building Envelope	728,351	322,815	44%	99.67
Total	728,351	322,815	44%	99.67

The ex post annual energy savings are 322,815kWh and the ex post peak demand reduction is 99.67 kW. The energy gross realization rate is 44%. The ex post savings were impacted as follows:

- The ex ante deemed energy savings values by gap and length are based on the infiltration losses between annual outdoor weather and refrigerated space. The ex post method replicated the deemed savings across an 8760 weather profile based on local weather data and wind speed. As the weatherization was installed on doors between the outdoor weather and an indoor buffer zone, full savings can be expected only when the buffer zone temperature equalizes with the refrigeration space, during warehousing operations.

Ancillary Econometric Analysis

An additional Option C – Whole Facility analysis was completed with monthly billing energy day and heating, cooling degree days using the following equation.

$$kWh_{monthly} = CDD + HDD + Post\_Flag + Intercept$$

Where:

CDD = *Cooling Degree Days for a given month and calibrated to a base temperature of 65°F*

HDD = *Heating Degree Days for a given month in the post period calibrated to base temperature of 55°F*

Post_Flag = *Binary flag for post-project completion month. 1 = Post Period, 0 = Pre Period*

Intercept = *Y intercept*

The results of the ancillary econometric analysts are presented in the table below:

Coefficients	*Value*	*T-Statistic*
CDD	194	5.2
HDD	-59	3.7
Post_Flag	(12,886)	1.6
Intercept	351,000	35

The *Post_Flag* coefficient is associated with an estimate of annual energy savings of 154,630 kWh, which is equal to 48% of the realized savings estimate. Although the regression-based savings estimate is less than the engineering equation analysis, both are much less (55% to 78%) than the ex ante savings of 728,352 kWh. The IPMVP Option-A analysis of 322,815 kWh energy savings with the Option-C analysis of 154,630 kWh, indicate that the deemed ex-ante savings values determined the ex-ante savings of 728,352 kWh, overestimated the savings per foot for weather seals installed to dock doors sealing the buffer zone. For direct exterior door sealing, the deemed values would be appropriate.

Project Number 204

Executive Summary

Under project 204, a program participant received custom incentives from I&M for installation and retrofit of energy efficient lighting. The ex post annual energy savings are 504,092 kWh with ex post peak demand reduction of 44.34 kW. The project energy savings gross realization rate is 100%.

Project Description

The customer received custom incentives for replacing 10 lamp T5 high output high bay fixtures with (187) LED high bay fixtures in a manufacturing facility.

Measurement and Verification Effort

Through remote data collection, ADM staff verified the installation of the lighting equipment, the lighting hours of operation, the type of lighting control employed (switch, occupancy sensor, photocell, etc.), and the facility's HVAC type. The following equations were used to calculate the annual savings of the lighting measures:

$$kWh_{Savings} = \left(\frac{Watts_{base} \times N_{base} - Watts_{eff} \times N_{eff}}{1000}\right) \times HOU \times (HCIF_e)$$

$$kW_{Peak} = \left(\frac{Watts_{base} \times N_{base} - Watts_{eff} \times N_{eff}}{1000}\right) \times CF \times (HCIF_d)$$

Where:

$kWh_{savings}$	*= Annual energy savings*
N	*= Number of fixtures*
Watts	*= Watts of each fixture*
HOU	*= Indicates hours of usage for the fixture*
$HCIF_e$	*= Heating and Cooling Interactive Factor*
$HCIF_d$	*= Heating and Cooling Interactive Factor during Peak Demand hours*
CF	*= Coincidence Factor for Peak Demand hours*
base	*= denotes pre-installation state*
eff	*= denotes post-installation state*

The table below presents ex ante and ex post energy savings, verified lighting hours of operation, and the heating and cooling interactive factors associated with the lighting equipment installed under the project.

Custom Lighting Energy Savings Calculations

Measure	Quantity (Fixtures)		Wattage		Hours	Heating Cooling Interaction Factor	Ex Ante Annual kWh Savings	Ex Post Gross kWh Savings	Gross Realization Rate
	Baseline	Efficient	Baseline	Efficient					
10L T5HO 54W to LED High bay	187	187	596	284	8,640	1.0	504,092	504,092	100%
Total							504,092	504,092	100%

Results

Gross Energy Impacts Summary

Measure Category	kWh Savings			Ex Post Gross kW Savings
	Ex Ante	Ex Post	Realization Rate	
Custom Lighting	504,092	504,092	100%	44.34
Total	504,092	504,092	100%	44.34

The ex post annual energy savings are 504,092 kWh and the ex post peak demand reduction is 44.34 kW. The energy gross realization rate is 100%.

Project Number 213

Executive Summary

Under project 213, a program participant received custom incentives from I&M for replacement of refrigerated space loading door weather seals. The ex post annual energy savings are 410,260 kWh with ex post peak demand reduction of 46.83 kW. The project energy savings gross realization rate is 49%.

Project Description

The customer received custom incentives for replacing weather seals around the loading door frames leading to a buffer zone space to frozen food storage warehouses. The existing gaps averaged ½" for 156 lineal feet, 5/8" for 78 lineal feet, ¾" for 78 lineal feet, 7/8" for 84 lineal feet, 1" for 288 lineal feet, 1 1/8" for 36 lineal feet, 1 ¾" for 36 lineal feet.

Measurement and Verification Effort

Through email and a phone call with the warehouse manager, the installation of new dock seals was verified, along with the dates of the installation. The ex ante savings were determined by deemed savings per linear foot and width of the failed dock door seal. The initial effort validated the annual savings per foot values by applying the tables from the *ASHRAE Cooling and Heating Load Calculation* manual for Ft Wayne TMY3 weather data. The infiltration was based on the differential pressure due to stack effect wind speed, velocity head, and the building type. The sum of the hourly bin savings replicated the annual ex ante deemed savings values.

Weather Seal Energy Savings per Foot by Gap Size for Low Temp Space

	kWh/ft ½"	*kWh/ft 5/8"*	*kW/ft ¾"*	*kWh/ft 7/8"*	*kWh/ft 1"*	*kWh/ft 1 1/8"*	*kWh/ft 1 ¾"*
Ex Ante	649	812	974	1136	1298	1461	2272
Ex Post	645	809	968	1129	1300	1461	2277

The savings per unit are based on the temperature difference between low temperature freezer space and the outdoor air, occurring 8,760 hours per year. The project replaced the weather seal between the moving door and the frame for the space entering the buffer zone to the low temperature space. The assumption can be made that during the workday, the buffer zone and low temperature space will reach equilibrium due to the warehousing of materials from the truck to the dock. However, during unoccupied periods, the buffer zone temperature will normalize to the outdoor temperature, with the low temperature space insulated by the freezer dock doors. Also, an exterior loading dock door in the up position when a truck is adjacent, will not rely on the door weather seals.

To determine savings, the ex post analysis applied the number of work hours, work days, trucks loaded, and dock doors to the 8760 weather bin analysis. For this analysis, we used the following information:

- Warehousing hours 6AM to 11PM, Monday to Friday
- Hours dock doors raised position, averaged at 2.35 hour per door.

Weatherstrip Energy Savings by Gap and Length

	Ft and kWh ½”	*Ft and kWh 5/8”*	*Ft and kWh ¾”*	*Ft and kWh 7/8”*	*Ft and kWh 1”*	*Ft and kWh 1 1/8”*	*Ft and kWh 1 ¾”*	*Feet Total kWh Total*
Feet	156	78	78	84	288	36	36	756
kWh	50,639	25,298	38,275	38,133	189,709	26,651	41,552	410,260

Results

Gross Energy Impacts Summary

Measure Category	*kWh Savings*			*Ex Post Gross kW Savings*
	Ex Ante	*Ex Post*	*Realization Rate*	
Custom Building Envelope	844,242	410,260	49%	46.83
Total	844,242	410,260	49%	46.83

The ex post annual energy savings are 410,260 kWh and the ex post peak demand reduction is 46.83 kW. The energy gross realization rate is 49%.

The deemed savings that used the size of the gap and local weather assumed that infiltration occurs 8,760 hours per year and that the temperature differential is a function of the outdoor weather conditions and a low temperature (freezer) space. However, the installed weather seals are in an area between the outdoor weather conditions and the indoor loading dock, which acts as a buffer zone between the exterior weather conditions and the low temperature (freezer) space. As a result, the temperature differential used in the ex post savings analysis differs from the differential between the freezer space and the exterior weather conditions that was used in the ex ante savings analysis. The ex post savings utilized the same method as the ex ante analysis to determine air infiltration based on local weather temperature, wind speed, stack effect along with the warehouse operating schedule.

Project Number 117 and 121

Executive Summary

Under projects 117 and 121, a program participant received prescriptive incentives from I&M for installation and retrofit of energy efficient lighting. The ex post annual energy savings are 377,239 kWh with ex post peak demand reduction of 13.1 kW. The site energy savings gross realization rate is 137%.

Project Description

The program participant received prescriptive incentives for replacing metal halide lamp fixtures and T8 linear fluorescent fixtures with (50) LED wall pack fixtures, (28) LED shoebox fixtures, (72) LED 2x2 panels, and (301) LED recessed Fixtures.

Measurement and Verification Effort

Through remote data collection, ADM staff verified the installation of the lighting equipment, the lighting hours of operation, the type of lighting control employed (switch, occupancy sensor, photocell, etc.), and the facility's HVAC type. The following equations were used to calculate the annual savings of the lighting measures:

$$kWh_{Savings} = \left(\frac{Watts_{base} \times N_{base} - Watts_{eff} \times N_{eff}}{1000}\right) \times HOU \times (HCIF_e)$$

$$kW_{Peak} = \left(\frac{Watts_{base} \times N_{base} - Watts_{eff} \times N_{eff}}{1000}\right) \times CF \times (HCIF_d)$$

Where:

$kWh_{savings}$	= *Annual energy savings*
N	= *Number of fixtures*
Watts	= *Watts of each fixture*
HOU	= *Indicates hours of usage for the fixture*
$HCIF_e$	= *Heating and Cooling Interactive Factor*
$HCIF_d$	= *Heating and Cooling Interactive Factor during Peak Demand hours*
CF	= *Coincidence Factor for Peak Demand hours*
base	= *denotes pre-installation state*
eff	= *denotes post-installation state*

The table below presents ex ante and ex post energy savings, verified lighting hours of operation, and heating and cooling interactive factors associated with the lighting equipment installed under the project.

Prescriptive Lighting Energy Savings Calculations

Measure	*Quantity (Fixtures)*		*Wattage*		*Hours*	*Heating Cooling Interaction Factor*	*Ex Ante Annual kWh Savings*	*Ex Post Gross kWh Savings*	*Gross Realization Rate*
	Baseline	*Efficient*	*Baseline*	*Efficient*					
MH100W to LED Wallpack	50	50	110	26	4308	1	28,750	18,094	63%
MH 400W Shoebox to LED Shoebox	10	10	458	149.65	4308	1	10,800	13,284	123%
MH 1000W Shoebox to LED Shoebox	18	18	1080	202.86	4308	1	54,432	68,017	125%
2L T8 Ubend to LED 2x2 Panel	72	72	53	40	8530	1.103	8,709	8,806	101%
MH100W to LED Recessed	301	301	110	15	8530	1.103	172,943	269,039	156%
Total							275,634	377,239	137%

Results

Gross Energy Impacts Summary

Measure Category	*kWh Savings*			*Ex Post Gross kW Savings*
	Ex Ante	*Ex Post*	*Realization Rate*	
Prescriptive Lighting	275,634	377,239	137%	13.11
Total	275,634	377,239	137%	13.11

The ex post annual energy savings are 377,239 kWh and the ex post peak demand reduction is 13.11kW. The energy gross realization rate is 137%. The installed fixtures replacing existing fixtures along with their usage hours were greater than the assumptions used to create the ex ante deemed savings per unit. The largest contributor to the higher savings is the 100W metal halide lamps in the hotel common areas that are on 24 hours per day. The site contact confirmed the wattage as 100W for all existing lamps.

Project Number 102,103,104 and 105

Executive Summary

Under projects 102,103,104 and 105, a program participant received prescriptive incentives from I&M for installation and retrofit of energy efficient lighting. The ex post annual energy savings are 767,848 kWh with ex post peak demand reduction of 0.00 kW. The project energy savings gross realization rate is 107%.

Project Description

The customer received prescriptive incentives for replacing exterior metal halide lamp pole fixtures with (833) LED street light fixtures.

Measurement and Verification Effort

Through remote data collection, ADM staff verified the installation of the lighting equipment, the lighting hours of operation, the type of lighting control employed (switch, occupancy sensor, photocell, etc.), and the facility's HVAC type. The following equations were used to calculate the annual savings of the lighting measures:

$$kWh_{Savings} = \left(\frac{Watts_{base} \times N_{base} - Watts_{eff} \times N_{eff}}{1000}\right) \times HOU \times (HCIF_e)$$

$$kW_{Peak} = \left(\frac{Watts_{base} \times N_{base} - Watts_{eff} \times N_{eff}}{1000}\right) \times CF \times (HCIF_d)$$

Where:

$kWh_{savings}$	*= Annual energy savings*
N	*= Number of fixtures*
Watts	*= Watts of each fixture*
HOU	*= Indicates hours of usage for the fixture*
$HCIF_e$	*= Heating and Cooling Interactive Factor*
$HCIF_d$	*= Heating and Cooling Interactive Factor during Peak Demand hours*
CF	*= Coincidence Factor for Peak Demand hours*
base	*= denotes pre-installation state*
eff	*= denotes post-installation state*

The table below presents ex ante and ex post energy savings verified lighting hours of operation, and the heating and cooling interactive factors associated with the lighting equipment installed under the project.

Prescriptive Lighting Energy Savings Calculations

Measure	Quantity (Fixtures)		Wattage		Hours	Heating Cooling Interaction Factor	Ex Ante Annual kWh Savings	Ex Post Gross kWh Savings	Gross Realization Rate
	Baseline	Efficient	Baseline	Efficient					
MH 190 to LED pole	44	44	190	54	4,380	1.00	25,281	26,210	104%
MH 146 to LED pole	2	2	146	111	4,380	1.00	1,149	307	27%
MH 140 to LED pole	34	34	140	100	4,380	1.00	19,535	5,957	30%
MH 295 to LED pole	5	5	295	111	4,380	1.00	4,104	4,030	98%
MH 295 to LED pole	8	8	295	100	4,380	1.00	6,566	6,833	104%
MH 458 to LED pole	3	3	458	146	4,380	1.00	3,888	4,100	105%
MH 458 to LED pole	1	1	458	54	4,380	1.00	1,296	1,770	137%
MH 458 to LED pole	18	18	458	111	4,380	1.00	23,328	27,357	117%
MH 190 to LED pole	53	53	190	54	4,380	1.00	30,452	31,571	104%
MH 135 to LED pole	2	2	135	100	4,380	1.00	1,149	307	27%
MH 185 to LED pole	1	1	185	100	4,380	1.00	821	372	45%
MH 295 to LED pole	2	2	295	111	4,380	1.00	1,642	1,612	98%
MH 295 to LED pole	45	45	295	100	4,380	1.00	36,936	38,435	104%
MH 458 to LED pole	138	138	458	100	4,380	1.00	178,848	216,390	121%
MH 458 to LED pole	3	3	458	111	4,380	1.00	3,888	4,560	117%
MH 190 to LED pole	84	84	190	54	4,380	1.00	48,300	50,037	104%
MH 295 to LED pole	96	96	295	100	4,380	1.00	78,816	81,994	104%
MH 458 to LED pole	55	55	458	146	4,380	1.00	71,280	75,161	105%
MH 190 to LED pole	99	99	190	54	4,380	1.00	56,925	58,972	104%
MH 295 to LED pole	116	116	295	100	4,380	1.00	95,236	99,076	104%
MH 458 to LED pole	24	24	458	146	4,380	1.00	31,104	32,797	105%
Total							720,543	767,848	107%

Results

Gross Energy Impacts Summary

Measure Category	kWh Savings			Ex Post Gross kW Savings
	Ex Ante	Ex Post	Realization Rate	
Prescriptive Lighting	720,543	767,848	107%	0.00
Total	720,543	767,848	107%	0.00

The ex post annual energy savings are 767,848 kWh and the ex post peak demand reduction is 0.00 kW. The energy gross realization rate is 107%. The following items impacted the ex post savings:

- The majority of the ex ante energy savings have base wattages that were for the nominal lamp wattage and not the fixture wattages, while the efficient watts were represented by fixture wattage. The ex post analysis was based on fixture to fixture wattages.

Project Number 211

Executive Summary

Under projects 211, a program participant received custom incentives from I&M for new construction lighting measures for a new manufacturing facility. The ex post annual energy savings are 884,938 kWh with ex post peak demand reduction of 80.19 kW. The project energy savings gross realization rate is 100%.

Project Description

The customer received custom incentives for the new construction installation of (593) LED interior fixtures and (44) LED exterior fixtures

Measurement and Verification Effort

Through remote data collection, ADM staff verified the installation of the lighting equipment, the lighting hours of operation, the type of lighting control employed (switch, occupancy sensor, photocell, etc.), and the facility's HVAC type. The following equations were used to calculate the annual savings of the lighting measures:

$$kWh_{Savings} = \left(\frac{Allowed\ LPD - Installed\ LPD}{1000}\right) \times Footage \times HOU \times (HCIF_e)$$

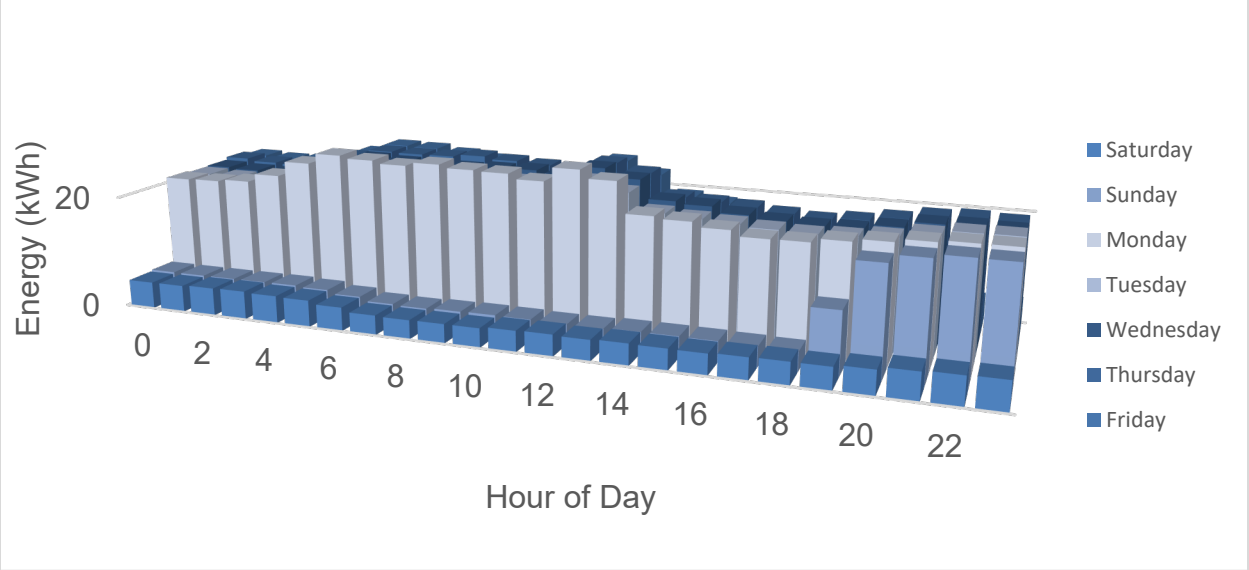
$$kW_{Peak} = \left(\frac{Allowed\ LPD - Installed\ LPD}{1000}\right) \times Footage \times CF \times (HCIF_d)$$

Where:

$kWh_{savings}$	= *Annual energy savings*
Allowed LPD	= *Allowed lighting power density per square foot per ASHRAE Standard 90.1-2007*
Installed LPD	= *Installed lighting power density per square foot*
Footage	= *Square footage of new construction space*
HOU	= *Indicates hours of usage for the fixture*
$HCIF_e$	= *Heating and Cooling Interactive Factor*
$HCIF_d$	= *Heating and Cooling Interactive Factor during Peak Demand hours*
CF	= *Coincidence Factor for Peak Demand hours*

The high bay lighting hours stated by the site contact for a typical work week of 24-hour days with some weekend was verified by AMI billing data for a three-month period, charted in the figure below.

AMI Interval Billing Energy (kWh) by Day and Hour



The tables below for new construction lighting present the allowed wattage, prorated to each fixture for comparison, expected lighting hours of operation, and heating and cooling interactive factors associated with each of the areas. The allowed wattage for each area based on units of square feet or linear feet is referenced from the *ASHRAE 90.1 2007* standards for the hospital building type.

Lighting Power Density Calculations

Measure	*Quantity (Fixtures)*	*Wattage*		*Hours*	*Heating Cooling Interaction Factor*	*Ex Post Gross kWh Savings*
		Allowed	*Efficient*			
Manuf LED High bay	136	550	144	6,672	1.00	368,068
Manuf LED Strip	168	290	87.9	6,672	1.00	226,733
Manuf LED Strip	168	290	88	6,672	1.00	226,621
Office LED Panel	29	41	26.67	3,120	1.08	723
Office LED Panel	58		38	3,120	1.08	
Office LED Strip	14		72	3,120	1.08	
Office LED Wrap	20		40	3,120	1.08	
Exterior Wall pack	4	313	108	4,300	1.00	3,517
Exterior Wall pack	4	313	108	4,300	1.00	3,517
Exterior Wall pack	6	333	108	4,300	1.00	5,814
Exterior Wall pack	6	333	108	4,300	1.00	5,814
Exterior LED Pole	7	569	244	4,300	1.00	8,114
Exterior LED Flood	5		646	4,300	1.00	
Exterior LED Wall pack	12	720	22	4,300	1.00	36,017
Total						884,938

Custom Lighting Energy Savings Calculations

Measure	Code Baseline			Installed Watts	Hours	Ex Ante Annual kWh Savings	Ex Post Gross kWh Savings	Gross Realization Rate	Ex Post Gross kW Savings
	Standard	Size	Allowed Watts						
Manufacturing Lighting	1.2 w/sf	172,250	172,250	49,135	6,672	821,242	821,422	100%	80.02
Office Lighting	1.0 w/sf	5,000	5,000	4,785	3,120	669	723	100%	22.10
Exterior Wall Lighting	20 w/ft	1,300	6,500	2,160	4,300	18,662	18,662	108%	0.17
Exterior Parking Lighting	0.15 wsf	45,550	6,825	4,938	4,300	8,114	8,114	100%	0.00
Exterior Doors Lighting	432 w/lf	70,128	8,640	264	4,300	36,017	36,017	100%	0.00
Total			188,215	61,282		884,884	884,938	100%	80.19

Results

Gross Energy Impacts Summary

Measure Category	kWh Savings			Ex Post Gross kW Savings
	Ex Ante	Ex Post	Realization Rate	
New Construction Lighting	884,884	884,938	100%	80.19
Total	884,884	884,938	100%	80.19

The ex post annual energy savings are 884,938 kWh and the ex post peak demand reduction is 80.19 kW. The energy gross realization rate is 100%. The verified inputs to the savings algorithm were the same between the ex ante and ex post, except for the ex post waste heat factor for the office area having a value of 1.08 versus 1.0.

There is some uncertainty in the operational installed wattage of the exterior LED fixtures with the adjustable light output. The site contact was not certain of the setting during installation, and unable to access the elevated fixtures for verification. There are a total of 32 exterior fixtures each with a selectable lighting output that corresponds from 18W to 108W each.

Project Number 119 and 217

Executive Summary

Under projects 119 and 217, a program participant received prescriptive and custom incentives from I&M for new construction lighting measures for a new manufacturing facility. The ex post annual energy savings are 86,866 kWh with ex post peak demand reduction of 17.05 kW. The project energy savings gross realization rate is 90%.

Project Description

The customer installed lighting during new construction that exceeded the code-based lighting power density allowances.

Measurement and Verification Effort

Through remote data collection, ADM staff verified the installation of the lighting equipment, the lighting hours of operation, the type of lighting control employed (switch, occupancy sensor, photocell, etc.), and the facility's HVAC type. The following equations were used to calculate the annual savings of the lighting measures:

$$kWh_{Savings} = \left(\frac{Allowed\ LPD - Installed\ LPD}{1000}\right) \times Footage \times HOU \times (HCIF_e)$$

$$kW_{Peak} = \left(\frac{Allowed\ LPD - Installed\ LPD}{1000}\right) \times Footage \times CF \times (HCIF_d)$$

Where:

$kWh_{savings}$	= *Annual energy savings*
Allowed LPD	= *Allowed lighting power density per square foot per ASHRAE Standard 90.1-2007*
Installed LPD	= *Installed lighting power density per square foot*
Footage	= *Square footage of new construction space*
HOU	= *Indicates hours of usage for the fixture*
$HCIF_e$	= *Heating and Cooling Interactive Factor*
$HCIF_d$	= *Heating and Cooling Interactive Factor during Peak Demand hours*
CF	= *Coincidence Factor for Peak Demand hours*

The tables below present the code allowed wattage prorated to each fixture for comparison, the expected lighting hours of operation, and the heating and cooling interactive factors associated with each of the areas. The allowed wattage for each area based on units of square feet or linear feet is referenced from the *ASHRAE 90.1 2007* standards for the big box retail building.

Lighting Power Density Calculations

Measure	*Quantity (Fixtures)*	*Wattage*		*Hours*	*Heating Cooling Interaction Factor*	*Ex Post Gross kWh Savings*
		Allowed	*Efficient*			
37W LED Troffer	319	70	37	4,836	1.133	58,171
64W LED 8' Strip	77	122	65	4,836	1.133	24,268
32W LED 4' Strip	3	61	32	4,836	1.133	473
32W LED Wall Pack	1	61	32	4,836	1.133	156
Total						83,068

Custom Lighting Energy Savings Calculations

Measure	*Code Baseline*			*Installed watts*	*Hours*	*Ex Ante Annual kWh Savings*	*Ex Post Gross kWh Savings*	*Gross Realization Rate*	*Ex Post Gross kW Savings*
	Standard	*Size*	*Allowed watts*						
Interior Lighting	21,465	172,250	32,197	17,036	4,836	84,021	83,068	99%	15.28
Total						84,021	83,068	99%	15.28

As the HVAC units were electric cooling and gas heat, the savings were determined by the following equation:

$$kWh_{Savings} = \left(\frac{1}{SEER_{Base}} - \frac{1}{SEER_{EE}}\right) \times kBtuh \times EFLH_{cooling}$$

$$kW_{Peak} = \left(\frac{1}{EER_{Base}} - \frac{1}{EER_{EE}}\right) \times kBtuh \times CF$$

Where:

$kWh_{savings}$ = *Annual energy savings*
kBtuh = *Net cooling capacity of the air conditioner*
$SEER_{Base}$ = *Seasonal Energy Efficiency Ratio of baseline unit*
$IEER_{EE}$ = *Seasonal Energy Efficiency Ratio of as-built unit*
EER_{Base} = *Energy Efficiency Ratio of baseline unit*
EER_{EE} = *Energy Efficiency Ratio of as-built unit*
EFLH = *Equivalent Full Load Hours of air conditioner operation, big box retail*
CF = *Coincidence Factor for Peak Demand hours*

HVAC Energy Savings Calculations

Measure	*Building Type*	*Baseline IEER /SEER*	*Total Tons*	*Installed IEER / SEER*	*EFLH*	*CF*	*Ex Ante Annual kWh Savings*	*Ex Post Gross kWh Savings*	*Gross Realization Rate*
HVAC - Air Conditioner	Big Box Retail	14.0	10	17.1	1056	0.74	8,070	1,563	19%
HVAC - Air Conditioner	Big Box Retail	14.0	3	18	1056	0.74	2,859	575	20%
Total							10,929	2,138	20%

Results

Gross Energy Impacts Summary

Measure Category	*kWh Savings*			*Ex Post Gross kW Savings*
	Ex Ante	*Ex Post*	*Realization Rate*	
HVAC	10,929	2,138	20%	1.57
New Construction Lighting	84,021	83,068	99%	15.28
LED Exit Signs	1,660	1,660	100%	0.20
Total	96,610	86,866	90%	17.05

The ex post annual energy savings are 86,866 kWh and the ex post peak demand reduction is 17.05 kW. The energy gross realization rate is 90%. The ex post savings analysis of the new HVAC only applied the cooling EFLH hours to the load and improved efficiency, as the installed units were not heat pumps but air conditioning with gas heat packaged units. The measure was listed as a heat pump instead of an air conditioner, which may be the source of the ex ante overestimation of the savings if heating effective full load hours were included in the analysis. The baseline efficiency is the Federal Appliance Guideline value of 14.0 for 3-phase unitary equipment less than 65,000 BTUh.

Project Number 118 and 216

Executive Summary

Under projects 118 and 216, a program participant received prescriptive and custom incentives from I&M for new construction lighting measures for a new manufacturing facility. The ex post annual energy savings are 1,365,105 kWh with ex post peak demand reduction of 143.65 kW. The project energy savings gross realization rate is 100%.

Project Description

The customer received custom incentives for installing (184) LED high bay fixtures and (6) LED wall pack fixtures, along with prescriptive incentives for attaching (184) fixture mounted occupancy sensors to the high bay lighting.

Measurement and Verification Effort

Through remote data collection, ADM staff verified the installation of the lighting equipment, the lighting hours of operation, the type of lighting control employed (switch, occupancy sensor, photocell, etc.), and the facility's HVAC type. The following equations were used to calculate the annual savings of the lighting measures:

$$kWh_{Savings} = \left(\frac{Allowed\ LPD - Installed\ LPD}{1000}\right) \times Footage \times HOU \times (HCIF_e)$$

$$kW_{Peak} = \left(\frac{Allowed\ LPD - Installed\ LPD}{1000}\right) \times Footage \times CF \times (HCIF_d)$$

Where:

$kWh_{savings}$	= *Annual energy savings*
Allowed LPD	= *Allowed lighting power density per square foot per ASHRAE Standard 90.1-2007*
Installed LPD	= *Installed lighting power density per square foot*
Footage	= *Square footage of new construction space*
HOU	= *Indicates hours of usage for the fixture*
$HCIF_e$	= *Heating and Cooling Interactive Factor*
$HCIF_d$	= *Heating and Cooling Interactive Factor during Peak Demand hours*
CF	= *Coincidence Factor for Peak Demand hours*

The tables below present code-allowed wattage, prorated to each fixture for comparison, expected lighting hours of operation, and heating and cooling interactive factors associated with each of the areas. The allow wattage for each area based on units of square feet or linear feet is referenced from the *ASHRAE 90.1 2007* standards for the hospital building type.

Lighting Power Density Calculations

Measure	*Quantity (Fixtures)*	*Wattage*		*Hours*	*Heating Cooling Interaction Factor*	*Ex Post Gross kWh Savings*
		Allowed	*Efficient*			
LED High bay	62	879	105	7,488	1.00	359,523
LED High bay	2	879	105	7,488	1.00	11,598
LED High bay	2	866	103	7,488	1.00	11,421
LED High bay	64	1206	144	7,488	1.00	508,965
LED High bay	34	1206	144	7,488	1.00	270,388
LED High bay	15	1206	144	7,488	1.00	119,289
LED High bay	3	1206	144	7,488	1.00	23,858
LED High bay	2	298	35	7,488	1.00	3,927
Exterior Wall pack	4	430	266	4,300	1.00	2,821
Exterior Wall pack	2	215	133	4,300	1.00	705
Total						1,312,492

Custom Lighting Energy Savings Calculations

Measure	*Code Baseline*			*Installed Watts*	*Hours*	*Ex Ante Annual kWh Savings*	*Ex Post Gross kWh Savings*	*Gross Realization Rate*	*Ex Post Gross kW Savings*
	Standard	*Size*	*Allowed Watts*						
LPD Lighting	0.8 w/sf	248,138	198,510	23,702	7,488	1,308,966	1,308,966	100%	138.10
Exterior Wall Lighting	5 w/sf	430	2,150	1,330	4,300	3526	3,526	100%	0.00
Total			200,660	25,032		1,312,492	1,312,492	100%	138.10

The savings for the fixture mounted occupancy sensors were estimated with the *IN TRM* based energy savings factor of 30%, summarized in the following table.

Prescriptive Lighting Controls Savings

Measure	*Occupancy Sensors*	*Watts*	*Hours*	*Heating Cooling Interaction Factor*	*Ex Ante Annual kWh Savings*	*Ex Post Gross kWh Savings*	*Gross Realization Rate*
Fixture Occupancy Sensors	62	105	7,488	1	18,910	14,624	77%
Fixture Occupancy Sensors	2	103	7,488	1	610	465	76%
Fixture Occupancy Sensors	64	144	7,488	1	19,520	20,703	106%
Fixture Occupancy Sensors	34	144	7,488	1	10,370	10,998	106%
Fixture Occupancy Sensors	15	144	7,488	1	4,575	4,852	106%
Fixture Occupancy Sensors	3	144	7,488	1	915	970	106%
Total					54,900	52,612	96%

Results

Gross Energy Impacts Summary

Measure Category	*kWh Savings*			*Ex Post Gross kW Savings*
	Ex Ante	*Ex Post*	*Realization Rate*	
Custom New Construction Lighting	1,312,492	1,312,492	100%	138.10
Prescriptive Lighting Controls	54,900	52,612	96%	5.55
Total	1,367,392	1,365,105	100%	143.65

The ex post annual energy savings are 1,366,105 kWh and the ex post peak demand reduction is 143.65 kW. The energy gross realization rate is 100%. The ex ante and ex post applied the same *ASHRAE 90.1 2007* based allowed lighting power densities by usage area, along with the installed equipment wattage and hours of use. The hours of use, based on the schedule provided by the site contact, were working 6 days, 24 hours per day, except for two months in the early Fall when 7 days are worked per week.

3. C&I Participant Survey Instrument

SCREENING / BACKGROUND [DO NOT DISPLAY IN SURVEY]

1. Our records indicate that you are the main contact for the [FR_MEAS1] project completed at [FR_LOC1].

   Were you involved in the decision to complete this project?

   1. Yes
   2. No

2. Does your company have any of the following policies or procedures in place at [FR_LOC1]?

   [FOR EACH, 1 = Yes, 2 = No, 98 = Don't know]

   a. A person or persons responsible for monitoring or managing energy usage
   b. Defined energy savings goals
   c. A specific policy requiring that energy efficiency be considered when purchasing equipment
   d. Carbon reduction goals

PROGRAM AWARENESS [DO NOT DISPLAY IN SURVEY]

3. How did you FIRST learn about Indiana Michigan Power's incentives for efficient equipment upgrades? **[RANDOMIZE 1 – 10, FIX 11 and 98]**

   1. From a Trade Ally/contractor/equipment vendor/ energy consultant
   2. From an Indiana Michigan Power Account Representative
   3. From a program representative / Lockheed Martin
   4. From a search engine (Google, Yahoo, Bing)
   5. At an event/trade show
   6. Received an email blast or electronic newsletter
   7. Received an informational brochure
   8. From a program sponsored webinar
   9. From *Indiana Michigan*'s website
   10. Friends or colleagues
   11. Some other way (please explain) [OPEN]
   98. Don't know

PROGRAM DELIVERY EFFICIENCY [DO NOT DISPLAY IN SURVEY]

4. Which of the following people worked on completing your application for program incentives (including gathering required documentation)?

   [MULTI SELECT]

1. Yourself
2. Another member of your company
3. A contractor
4. An equipment vendor
5. A designer or architect

[DISPLAY Q5 IF Q4 = 1]

5. Using a 5-point scale, where 1 means "completely unacceptable" and 5 means "completely acceptable," how would you rate . . .

[SCALE: 1 = 1 (Completely unacceptable), 2 = 2, 3 =3, 4 = 4, 5 = 5 (Completely acceptable agree), 98 = Don't know, 99 = Not applicable]

a. the ease of finding the application on Indiana Michigan Power's website

b. the ease of using the application portal on Indiana Michigan Power's website

c. the time it took to approve the application

d. the clarity of information on how to complete the application

e. the effort required to provide required invoices or other supporting documentation

f. the overall application process

[DISPLAY Q6 IF Q5a-f < 3]

6. How could the application process be improved?

   [TEXT BOX]

[DISPLAY Q7 IF Q4 = 1]

7. Did you have a clear sense of whom you could go to for assistance with the application process?
   1. Yes
   2. No
   98. Don't know

8. Who installed your program-qualified equipment or efficiency upgrades? Was it…

   1. Your own staff
   2. A contractor you've worked with before
   3. A contractor recommended by the Indiana Michigan program (registered trade ally)
   4. A new contractor that someone else recommended
   5. Someone else (Please specify)
   98. Don't know

9. How did the incentive amount compare to what you expected? Would you say…

1. It was much less
2. It was somewhat less
3. It was about the amount expected
4. It was somewhat more
5. It was much more
98. Don't know

DECISION MAKING AND EQUIPMENT SELECTION [DO NOT DISPLAY]

10. Has your organization purchased any significant energy efficient equipment in the last three years without applying for a financial incentive through an energy efficiency program at the [FR_LOC1] location?

1. Yes. Our organization purchased energy efficient equipment but did not apply for incentive.
2. No. Our organization purchased significant energy efficient equipment and applied for an incentive.
3. No significant energy efficient equipment was purchased by our organization.
98. Don't know

[DISPLAY Q11 IF Q10 = 1 OR 2]

11. Which of the following financial methods, if any, does your organization typically use to evaluate energy efficiency improvements? [**MULTISELECT**]

1. Initial Cost
2. Simple payback
3. Internal rate of return
4. Life cycle cost
5. We don't use any of these
98. Don't know

[DISPLAY Q12 IF Q11= 2]

12. What payback period do you typically require to approve an efficiency project?

[OPEN]

[DISPLAY Q13 IF Q11= 3]

13. What internal rate of return do you typically use to approve an efficiency project?

[OPEN]

14. Before participating in the [PROGRAM_NAME] Program, had you implemented any equipment or measure similar to the [FR_MEAS1] [INSTALLED_FR1] at the [FR_LOC1] location?

1. Yes
2. No
98. Don't know

15. When did you first learn about I&M's energy efficiency programs? Was it BEFORE or AFTER you finalized the specifications of your [FR_MEAS1] project, including the efficiency level and the scope of the project?

    1. Before
    2. After
    98. Don't know

16. Did you have plans to [INSTALL_FR1] the [FR_MEAS1] at the [FR_LOC1] location before participating in the program?

    1. Yes
    2. No
    98. Don't know

[DISPLAY Q17 IF Q16 = 1]

17. Prior to hearing about the program incentive, was the purchase of the [FR_MEAS1] included in your organization's capital budget?

    1. Yes
    2. No
    98. Don't know / Not applicable

[DISPLAY Q18 IF Q16 = 1]

18. Had your organization ALREADY ordered or purchased the [FR_MEAS1] BEFORE you heard about the program?

    1. Yes
    2. No
    98. Don't know

19. Did the incentive help the [FR_MEAS1] project receive implementation approval from your organization?

    1. Yes
    2. No
    98. Don't know / Not applicable

20. Would you have completed the [FR_MEAS1] project even if you had not participated in the program?

    1. Yes
    2. No
    98. Don't know

21. Did you have experience with I&M's incentive program before completing the [FR_MEAS1] project?

    1. Yes
    2. No
    98. Don't know

[DISPLAY Q22 IF Q21 = 1]

22. How important was your previous experience with Indiana-Michigan-offered programs in making your decision to [INSTALL_FR1] the [FR_MEAS1] at the [FR_LOC1] location?

    1. Very important
    2. Somewhat important
    3. Only slightly important
    4. Not at all important
    98. Don't know

23. Did a [PROGRAM_NAME] Program representative or other I&M representative recommend that you [INSTALL_FR1] the [FR_MEAS1] at the [FR_LOC1] location?

    1. Yes
    2. No
    98. Don't know

[DISPLAY Q24 IF Q23 = 1]

24. If the [PROGRAM_NAME] program representative had not recommended [INSTALLING_FR1] the [FR_MEAS1], how likely is it that you would have [INSTALLED_FR1] it anyway?

    1. Definitely would have
    2. Probably would have
    3. Probably would not have
    4. Definitely would not have
    98. Don't know

25. If the [PROGRAM_NAME] program contractor that provided the energy assessment of your facility had not recommended [INSTALLING_FR1] the [FR_MEAS1], how likely is it that you would have [INSTALLED_FR1] it anyway?

    1. Definitely would have
    2. Probably would have
    3. Probably would not have
    4. Definitely would not have
    98. Don't know

26. Would your organization have been financially able to [INSTALL_FR1] the [FR_MEAS1] at the [FR_LOC1] without the financial incentive from the program?

    1. Yes

2. No
98. Don’t know

[DISPLAY Q27 IF Q26 = 2]

27. To confirm, your organization would NOT have allocated the funds to complete a similar energy saving project if the program incentive was not available. Is that correct?

    1. Yes
    2. No
    98. Don’t know

28. If the financial incentive from the [PROGRAM_NAME] Program had not been available, how likely is it that you would have [INSTALLED_FR1] the [FR_MEAS1] at the [FR_LOC1] location anyway?

    1. Definitely would have [INSTALLED_FR1]
    2. Probably would have [INSTALLED_FR1]
    3. Probably would not have [INSTALLED_FR1]
    4. Definitely would not have [INSTALLED_FR1]
    98. Don't know

[DISPLAY Q29 IF Q26 = 2 AND Q27 = 1 AND Q16 = 1AND Q17 = 1]

29. Previously you said that your organization had plans to complete the project and would have completed it if you had not participated in the program. You also said that your organization would not have been financially able to install the equipment without the program incentive.

    In your own words, can you explain the role that the financial incentive played in your decision to complete this project?

[DISPLAY Q30 IF MEASURE_QUANT > 1]

30. We would like to know whether the availability of information and the financial incentive provided through the [PROGRAM_NAME] program affected the quantity (or number of units) of [FR_MEAS1] that you purchased and [INSTALLED_FR1] at the [FR_LOC1].

    Did you purchase and install more [FR_MEAS1] than you otherwise would have without the program?

    1. Yes
    2. No, program did not affect quantity purchased and installed.
    98. Don’t know

[DISPLAY Q31 IF ENERGY_EQUIP = YES]

31. We would like to know whether the availability of information and financial incentive provided through the [PROGRAM_NAME] program affected the level of energy efficiency you chose for the [FR_MEAS1B] at the [FR_LOC1] location.

Did you choose equipment that was more energy efficient than you would have chosen because of the program?

1. Yes
2. No, program did not affect level of efficiency chosen for equipment.
98. Don't know

[DISPLAY Q32 IF Q31 = 1]

32. What kind of equipment, if any, would you have installed if the program was not available?

1. [OPEN]
98. Don't know

33. We would like to know whether the availability of information and the financial incentive provided through the program affected the timing of the [FR_MEAS1] project at the [FR_LOC1] location.

Did you [INSTALL_FR1] the [FR_MEAS1] earlier than you otherwise would have without the program?

1. Yes
2. No, program did not affect timing of project.
98. Don't know

[DISPLAY Q34 IF Q33 = 1]

34. When would you otherwise have completed the project?

1. Less than 6 months later
2. 6-12 months later
3. 1-2 years later
4. 3-5 years later
5. More than 5 years later
98. Don't know

[DISPLAY Q35 IF MULTIPLE_MEASURE =1]

35. Our records indicate you [INSTALLED_FR2] [FR_MEAS2] at the [FR_LOC2] location in addition to [FR_MEAS1] at the [FR__LOC1] location. Did both of these projects go through the same decision making process or was a separate decision made for each?

1. The same decision making process applies to both projects.
2. A different decision making process applies to each project.
3. We did not [INSTALL_FR2] [FR_MEAS2] at the [FR_LOC2] location.
98. Don't know

[IF Q35 = 2, REPEAT Q14 THROUGH Q34 WITH FR_MEAS2]

MEASUREMENT AND VERIFICATION [DO NOT DISPLAY]

[DISPLAY Q36 IF INCENTIVE = 1]

36. After your project was completed, did a program representative inspect the work done through the program?

    1. Yes
    2. No
    98. Don't know

[DISPLAY Q37 IF Q36=1]

37. Using the following scale, please rate your agreement with the following statements:

[SCALE: 1 = 1 (Strongly disagree), 2 = 2, 3 =3, 4 = 4, 5 = 5 (Strongly agree), 98 = Don't know]

a. The inspector was courteous

b. The inspector was efficient

SPILLOVER [DO NOT DISPLAY]

[NOTE: THESE QUESTIONS SERVE TO COLLECT DATA TO QUANTIFY SPILLOVER EFFECTS FROM the INCENTIVE PROGRAMS AND DIRECT IMPACTS OF THE ENERGY ASSESSMENT TOOL]

38. Since you completed the incentive project, have you installed any energy efficient equipment at a facility that receives electrical service from I&M and that you DID NOT get a rebate or discount for from I&M?

    1. Yes
    2. No
    98. Don't know

[DISPLAY Q39 if Q38 = 1]

39. What additional energy efficient equipment have you installed? [MULTI SELECT]

    1. Lighting
    2. Lighting controls or occupancy sensors
    3. Unitary or split air conditioning system or chiller
    4. ENERGY STAR Room air conditioners
    5. Efficient motors
    6. Refrigeration equipment (including LED case lighting)
    7. Kitchen equipment
    8. Something else [OPEN ENDED]
    96. Didn't implement any measures [SKIP TO CUSTOMER SATISFACTION]
    98. Don't know

[DISPLAY Q40 IF Q38= 1]

40. Why didn't you receive incentives for those items? [MULTI SELECT RANDOMIZE ORDER, BUT FIX OTHER AND DON'T KNOW]

1. Didn't know whether equipment qualified for financial incentives
2. Equipment did not qualify for financial incentives
3. Too much paperwork for the financial incentive application
4. Financial incentive was insufficient
5. Didn't have time to complete paperwork for financial incentive application
6. Didn't know about financial incentives until after equipment was purchased
7. We did receive an incentive **[SKIP TO FIRMOGRAPHICS]**
8. Other (Please specify) [OPEN ENDED]
98. Don't know

[DISPLAY Q41 IF Q38= 1]

41. Did you work with a contractor to install that efficient equipment or did your company's staff install the equipment?

1. Worked with a contractor
2. Company self-installed the equipment
3. Both
98. Don't know

LIGHTING [DO NOT DISPLAY]

[DISPLAY Q42 IF Q38 = 1]

42. What type of lighting did you install? **[MULTI-SELECT]**

1. T8 Fluorescent linear lamps – Single (1) lamps
2. T8 Fluorescent linear lamps – 2 lamp fixtures
3. T8 Fluorescent linear lamps – 4 lamp fixtures
4. T8 Fluorescent linear lamps – 6 lamp fixtures
5. T5 Fluorescent linear lamps – Single (1) lamps
6. T5 Fluorescent linear lamps – 2 lamp fixtures
7. T5 Fluorescent linear lamps – 4 lamp fixtures
8. T5 Fluorescent linear lamps – 6 lamp fixtures
9. LED Screw-in BAR/R/ER bulbs
10. LED Screw-in Interior PAR/MR bulbs
11. LED Screw-in omnidirectional A-line bulbs
12. LED 2-foot linear replacement lamps
13. LED 4-foot linear replacement lamps
14. LED exterior flood or spot luminaires
15. LED 1x4 panel or troffer
16. LED 2x2 panel or troffer
17. LED 2x4 panel or troffer
18. LED high-bay lighting
19. Another type
98. Don't know

[DISPLAY Q43 IF Q42 = 19]

43. What other type of lighting equipment did you install?

[TEXT BOX] Lamps/Bulbs

SPILLOVER

[REPEAT Q44 - Q47 FOR EACH TYPE SELECTED IN Q42]

44. How many [Q42 RESPONSE] did you install?

[TEXT BOX] Watts

45. What was the average wattage of the [Q42 RESPONSE]?

[TEXT BOX]

46. Were the [Q42 RESPONSE] installed inside or outside?

1. Inside
2. Outside
3. Parking garage
98. Don't know

[DISPLAY Q47 IF Q46 = 1]

47. What type of building did you install the [Q42 RESPONSE] in?

1. Food Sales
2. Food Service
3. Health Care
4. Hotel/Motel
5. Office
6. Public Assembly
7. Public Services (non-food)
8. Retail
9. Warehouse
10. School
11. College
12. Industrial – 1 Shift
13. Industrial – 2 Shift
14. Industrial – 3 Shift
15. Other (Please describe)
98. Don't know

[DISPLAY Q48 IF Q46 = 1]

48. Is the inside space heated, cooled, or both?

1. Heated
2. Cooled

3. Both
98. Don't know

49. What type of lighting did the [Q42 RESPONSE] replace?

1. T12s (linear fluorescents)
2. T8s (linear fluorescents)
3. Metal-halide / High-intensity discharge
4. Incandescent
5. Compact fluorescent (CFL)
5. Something else [OPEN]
98. Don't know

50. What was the average wattage of the old lamps or bulbs?

51. How many of the old lamps or bulbs did you remove?

[DISPLAY Q52 IF Q39 =1]

52. How important was your experience with the program in your decision to install this lighting equipment?

[SCALE 0 "Not at all important" - 10 "Very important"]
98. Don't know

[DISPLAY Q53 IF Q39 =1]

53. If you had NOT participated in the program, how likely is it that your organization would still have installed this lighting equipment?

[SCALE 0 "Definitely would not have installed" - 10 "Definitely would have installed"]
98. Don't know

[DISPLAY Q54 IF [Q52=0,1,2,3 AND Q53=0,1,2,3]

OR IF [Q52=8,9,10 AND Q53=8,9,10]

54. You scored the importance of your program experience to your decision to implement additional lighting measures with [Q52 RESPONSE] out of 10 possible points. You ALSO scored the likelihood of implementing additional lighting measures if your organization had not participated in the program with [Q53 RESPONSE] out of 10 possible points.

Can you please explain the role the program made in your decision to implement this measure?

LIGHTING CONTROLS [DO NOT DISPLAY]

[DISPLAY Q55 IF Q39 = 2]

55. How many fixtures are being controlled by the lighting controls?

[TEXT BOX]

[DISPLAY Q56 IF Q39 = 2]

56. On average, how many lamps or bulbs does each fixture contain?

[TEXT BOX]

[DISPLAY Q57 IF Q39 = 2]

57. What is the average wattage of these lamps?

[TEXT BOX]

[DISPLAY Q58 IF Q39 = 2]

58. Are any of the lighting controls that you installed central time clock controls?

1. Yes
2. No
98. Don't know

[DISPLAY Q59 IF Q58 = 1]

59. How many of the fixtures are controlled by the central time clock?

[TEXT BOX]

[DISPLAY Q60 IF Q39 = 2]

60. What type of building did you install the lighting controls in?

1. Food Sales
2. Food Service
3. Health Care
4. Hotel/Motel
5. Office
6. Public Assembly
7. Public Services (non-food)
8. Retail
9. Warehouse
10. School
11. College
12. Industrial – 1 Shift
13. Industrial – 2 Shift
14. Industrial – 3 Shift
16. Other (Please specify)
98. Don't know

[DISPLAY Q61 IF Q39 = 2]

61. How important was your experience with the program in your decision to install lighting controls?

[SCALE 0 "Not at all important" - 10 "Very important"]
98. Don't know

[DISPLAY Q62 IF Q39 = 2]

62. If you had NOT participated in the program, how likely is it that your organization would still have installed lighting controls?

[SCALE 0 "Definitely would not have installed" - 10 "Definitely would have installed"
98. Don't know

[DISPLAY Q63 IF [Q61=0,1,2,3 AND Q62=0,1,2,3]

OR [Q61=8,9,10 AND Q62=8,9,10]]

63. You scored the importance of your program experience to your decision to implement lighting controls with [Q61 RESPONSE] out of 10 possible points. You ALSO scored the likelihood of implementing lighting controls if your organization had not participated in the program with [Q62 RESPONSE] out of 10 possible points. Can you please explain the role the program made in your decision to implement this measure?

[TEXT BOX]

HVAC MEASURES [DO NOT DISPLAY]

[DISPLAY Q64 IF Q39 = 3]

64. What types of energy efficient equipment did you install as part of the HVAC project? [MULTI SELECT]

1. Split air conditioning system (An A/C system that has an evaporator indoors and the compressor and condenser outdoors.)
2. Packaged air conditioning system (A type of central air conditioning that contains both the air handler fan, compressor and condenser in a single unit. These are typically mounted on the roof.)
3. Heat pump (An electric heating and cooling system)
4. Air cooled chiller (A system that produces cold liquid sent around to individual spaces used for cooling air usually found in larger facilities)
5. Water cooled chiller (A system that produces cold liquid sent around to individual spaces used for cooling air usually found in larger facilities)
6. Another type
98. Don't know

[DISPLAY Q65 IF Q64 = 6]

65. What other type of HVAC equipment did you install?

[TEXT BOX]

[REPEAT Q66 – Q68 FOR EACH SELECTED IN Q64]

66. We would like to know more about the rated efficiency and number of units of the [Q64 RESPONSE](s) that you installed.

For each level of efficiency of the equipment you installed, please provide the rated efficiency and the number of units.

67. What type of building did you install the heating/cooling equipment in?

1. Grocery
2. High School
3. Hospital
4. Light Industrial
5. Office - Large
6. Office - Small
7. Primary School
8. Religious Worship
9. Restaurant - Fast Food
10. Restaurant - Full Service
11. Retail - Big Box
12. Retail - Large
13. Retail - Small
14. University
15. Warehouse
16. Other (Please specify)
98. Don’t know

68. What city is the building where you installed the heating/cooling equipment located in?

[TEXT BOX]

[DISPLAY Q69 IF Q64 = 1-7]

69. How important was your experience with the program in your decision to install the energy efficient HVAC equipment?

[SCALE 0 “Not at all important” - 10 “Very important”]
98. Don’t know

[DISPLAY Q70 IF Q64 = 1-7]

70. If you had NOT participated in the program, how likely is it that your organization would still have installed the energy efficient HVAC equipment?

[SCALE 0 "Definitely would not have installed" - 10 "Definitely would have installed"
98. Don't know

[DISPLAY Q71 IF [Q69=0,1,2,3 AND Q70=0,1,2,3] OR [Q69=8,9,10 AND Q70=8,9,10]]

71. You scored the importance of your program experience to your decision to implement energy efficient HVAC equipment with [Q69 RESPONSE] out of 10 possible points. You ALSO scored the likelihood of implementing the energy efficient HVAC equipment if your organization had not participated in the program with [Q70 RESPONSE] out of 10 possible points. Can you please explain the role the program made in your decision to implement this measure?

[TEXT BOX]

[DISPLAY Q72 IF Q39 = 4]

72. How many ENERGY STAR room air conditioners did you install?

[TEXT BOX]

[DISPLAY Q73 IF Q39 = 4]

73. What type of building did you install the heating/cooling equipment in?

1. Grocery
2. High School
3. Hospital
4. Light Industrial
5. Office - Large
6. Office - Small
7. Primary School
8. Religious Worship
9. Restaurant - Fast Food
10. Restaurant - Full Service
11. Retail - Big Box
12. Retail - Large
13. Retail - Small
14. University
15. Warehouse
16. Other
98. Don't know

[DISPLAY Q74 IF Q39 = 4]

74. What city is the building where you installed the room air conditioners located in?

[TEXT BOX]

[DISPLAY Q75 IF Q39 = 4]

75. How important was your experience with the program in your decision to install the heating/cooling equipment?

[SCALE 0 "Not at all important" - 10 "Very important"]
98. Don't know

[DISPLAY Q76 IF Q39 = 4]

76. If you had NOT participated in the program, how likely is it that your organization would still have installed the heating/cooling equipment?

[SCALE 0 "Definitely would not have installed" - 10 "Definitely would have installed"
98. Don't know

[DISPLAY Q77 IF [Q75=0,1,2,3 AND Q76=0,1,2,3] OR [Q75=8,9,10 AND Q76=8,9,10]]

77. You scored the importance of your program experience to your decision to install the energy efficient air conditioners with [Q75 RESPONSE] out of 10 possible points. You ALSO scored the likelihood of installing the energy efficient air conditioners if your organization had not participated in the program with [Q76 RESPONSE] out of 10 possible points. Can you please explain the role the program made in your decision to implement this measure?

[TEXT BOX]

EFFICIENT MOTORS [DO NOT DISPLAY]

[DISPLAY Q78 IF Q39 = 5]

78. How many efficient motors did you install?

[TEXT BOX]

[DISPLAY Q79 IF Q39 = 5]

79. What is the approximate average horsepower of the new motors? That is, what is the average across all of the motors you installed without an incentive?

[TEXT BOX]

[DISPLAY Q80 IF Q39 = 5]

80. What is the approximate average efficiency of the new motors? That is, what is the average efficiency across all of the new motors?

[TEXT BOX] Rated efficiency (%)

[DISPLAY Q81 IF Q39 = 5]

81. On average, how many hours per day do the motors operate? That is, what the average number of hours the motors you installed operate?

[TEXT BOX] hours per day

[DISPLAY Q82 IF Q39 = 5]

82. How important was your experience with the program in your decision to install efficient motors?

[SCALE 0 "Not at all important" - 10 "Very important"]
98. Don't know

[DISPLAY Q83 IF Q39 = 5]

83. If you had NOT participated in the program, how likely is it that your organization would still have installed the efficient motors?

[SCALE 0 "Definitely would not have installed" - 10 "Definitely would have installed"
98. Don't know

[DISPLAY Q84 IF [Q82=0,1,2,3 AND Q83=0,1,2,3] OR [Q82=8,9,10 AND Q83=8,9,10]]

84. You scored the importance of your program experience to your decision to implement efficient motors with [Q82 RESPONSE] out of 10 possible points. You ALSO scored the likelihood of implementing the efficient motors if your organization had not participated in the program with [Q83 RESPONSE] out of 10 possible points. Can you please explain the role the program made in your decision to implement this measure?

[TEXT BOX]

COMMERCIAL REFRIGERATION EQUIPMENT [DO NOT DISPLAY]

[DISPLAY Q85 IF Q39 = 6]

85. What types of energy efficient refrigeration equipment did you install?

1. ENERGY STAR Commercial freezer
2. ENERGY STAR Commercial refrigerator
3. Anti-sweat heater controls
4. LED refrigerated case lighting
5. Refrigerated case covers
6. Some other type of refrigeration equipment
98. Don't know

[DISPLAY Q86 IF Q85 = 6]

86. What other type of energy efficient refrigeration equipment did you install?

[TEXT BOX]

[DISPLAY Q87 IF Q85 = 1]

87. How many ENERGY STAR commercial freezers did you install?

[TEXT BOX]

[DISPLAY Q88 IF Q87 = 1, REPEAT FOR EACH UP TO THREE TIMES]

88. What is the volume in cubic feet of the first freezer?

[TEXT BOX]

[DISPLAY Q89 IF Q87 = 1, REPEAT FOR EACH UP TO THREE TIMES]

89. Does this freezer have a solid door or a glass door?

1. Solid door
2. Glass door
98. Don't know

[DISPLAY Q90 IF Q87 = 1, REPEAT FOR EACH UP TO THREE TIMES]

90. Is this a vertical freezer or a chest type freezer?

1. Vertical
2. Chest
98. Don't know

[DISPLAY Q91 IF Q85 = 2]

91. How many ENERGY STAR commercial refrigerators did you install?

[TEXT BOX] refrigerators

[DISPLAY Q92 IF Q91 = 2, REPEAT FOR EACH UP TO THREE TIMES]

92. What is the volume in cubic feet of the first refrigerator?

[TEXT BOX] cubic feet

[DISPLAY Q93 IF Q91 = 2, REPEAT FOR EACH UP TO THREE TIMES]

93. Does this refrigerator have a solid door or a glass door?

1. Solid door
2. Glass door
98. Don't know

[DISPLAY Q94 IF Q91 = 2, REPEAT FOR EACH UP TO THREE TIMES]

94. Is this a vertical refrigerator or a chest type refrigerator?

1. Vertical
2. Chest

98. Don't know

[DISPLAY Q95 IF Q85 = 3]

95. Did you install humidity-based controls or conductivity-based controls, or both types?

1. Humidity-based controls
2. Conductivity-based controls
3. Both types
98. Don't know

[DISPLAY Q96 IF Q95= 1 OR 3]

96. How many humidity-based controls did you install?

[TEXT BOX]

[DISPLAY Q97 IF Q95= 1 OR 3]

97. What is the total number of freezer or refrigerator doors controlled by the humidity-based controls?

[TEXT BOX]

[DISPLAY Q98 IF Q95= 2 OR 3]

98. How many conductivity-based controls did you install?

[TEXT BOX]

[DISPLAY Q99 IF Q95= 2 OR 3]

99. What is the total number of freezer or refrigerator doors controlled by the conductivity-based controls?

[TEXT BOX]

[DISPLAY Q100 IF Q95 = 98]

100. How many anti-sweat heater controls did you install?

[TEXT BOX]

[DISPLAY Q101 IF Q95 = 98]

101. What is the total number of freezer or refrigerator doors controlled by the anti-sweat heater controls?

[TEXT BOX]

[DISPLAY Q102 IF Q85 = 4]

102. How many linear feet in total of LED case lighting did you install?

[TEXT BOX]

[DISPLAY Q103 IF Q85 = 5]

103. How many linear feet of refrigerated case covers did you install?

[TEXT BOX]

[DISPLAY Q104 IF Q39=6]

104. How important was your experience with the program in your decision to install the energy efficient refrigeration equipment?

[SCALE 0 "Not at all important" - 10 "Very important"]
98. Don't know

[DISPLAY Q105 IF Q39=6]

105. If you had NOT participated in the program, how likely is it that your organization would still have installed this energy efficient refrigeration equipment?

[SCALE 0 "Definitely would not have installed" - 10 "Definitely would have installed"
98. Don't know

[DISPLAY Q106 IF [Q104=0,1,2,3 AND Q105=0,1,2,3] AND [Q104=8,9,10 AND Q105=8,9,10]]

106. You scored the importance of your program experience to your decision to implement energy efficient refrigeration equipment with [Q104 RESPONSE] out of 10 possible points. You ALSO scored the likelihood of implementing energy efficient refrigeration equipment if your organization had not participated in the program with [Q105 RESPONSE] out of 10 possible points. Can you please explain the role the program made in your decision to implement this measure?

[TEXT BOX]

COMMERCIAL KITCHEN EQUIPMENT [DO NOT DISPLAY]

[DISPLAY Q107 IF Q39 = 7]

107. What type of kitchen equipment did you install?

1. Low flow pre-rinse spray valves
2. ENERGY STAR Commercial fryers
3. ENERGY STAR Commercial steam cookers
4. ENERGY STAR hot food holding cabinets
5. ENERGY STAR commercial griddles
6. ENERGY STAR commercial convection ovens
7. ENERGY STAR commercial combination ovens
8. Some other type of kitchen equipment
98. Don't know

[DISPLAY Q108 IF Q107 = 8]

108. What other type of kitchen equipment did you install?

[TEXT BOX]

[DISPLAY Q109 IF Q107 = 1]

109. Is the flow rate for any of the spray valves you installed equal to or less than 1.6 gallons per minute?

1. Yes
2. No
98. Don't know

[DISPLAY Q110 IF Q107 = 1]

110. How many pre-rinse spray valves with a flow rate equal to or less than 1.6 gallons per minute did you install?

[TEXT BOX]

[DISPLAY Q111 IF Q107 = 1]

111. Did you install the pre-rinse spray valves that the [LOCATION] location?

1. Yes
2. No
98. Don't know

[DISPLAY Q112 IF Q111= 2]

112. In what city is the building where you installed the pre-rinse spray valves located in?

[TEXT BOX]

[DISPLAY Q113 IF Q107 = 2]

113. How many ENERGY STAR commercial fryers did you install?

[TEXT BOX]

[DISPLAY Q114 IF Q107 = 3]

114. How many ENERGY STAR commercial steam cookers did you install?

1. Number of 3 pan steam cookers [NUMERIC]
2. Number of 4 pan steam cookers [NUMERIC]
3. Number of 5 pan steam cookers [NUMERIC]
4. Number of 6 pan steam cookers [NUMERIC]
98. Don't know

[DISPLAY Q115 IF Q107 = 4]

115. How many ENERGY STAR hot food holding cabinets did you install?

[TEXT BOX]

[DISPLAY Q116 IF Q107 = 5]

116. How many ENERGY STAR commercial griddles did you install?

[TEXT BOX]

[DISPLAY Q117 IF Q107 = 6]

117. How many ENERGY STAR commercial convection ovens did you install?

[TEXT BOX]

[DISPLAY Q118 IF Q107 = 7]

118. How many ENERGY STAR commercial combination ovens did you install?

[TEXT BOX]

[DISPLAY Q119 IF Q39= 1 AND Q107=1-8]

119. How important was your experience with the program in your decision to install this kitchen equipment?

[SCALE 0 "Not at all important" - 10 "Very important"]
98. Don't know

[DISPLAY Q120 IF Q39= 1 AND Q107=1-8]

120. If you had NOT participated in the program, how likely is it that your organization would still have installed this kitchen equipment?

[SCALE 0 "Definitely would not have installed" - 10 "Definitely would have installed"
98. Don't know

[DISPLAY Q121 IF [Q119=0,1,2,3 AND Q120=0,1,2,3] OR [Q119=8,9,10 AND Q120=8,9,10]]

121. You scored the importance of your program experience to your decision to implement energy efficient kitchen equipment with [Q119 RESPONSE] out of 10 possible points. You ALSO scored the likelihood of implementing energy efficient kitchen equipment if your organization had not participated in the program with [Q120 RESPONSE] out of 10 possible points.

Can you please explain the role the program made in your decision to implement this measure?

[TEXT BOX]

CUSTOMER SATISFACTION [DO NOT DISPLAY HEADING]

122. Not including any contractors that you hired, in the course of doing this project did you have any interactions with program staff about questions or concerns that you had?

1. Yes
2. No
98. (Don't know)

123. Using the scale below, please rate how dissatisfied or satisfied you are with each of the following ….

[SCALE: 1 = 1 (Very dissatisfied), 2 = 2, 3 =3, 4 = 4, 5 = 5 (Very satisfied), 98 = Don't know]

For each:

[A AND B FIRST, RANDOMIZE C - M, ASK N LAST]

a. **[DISPLAY IF Q122 = 1]** How long it took program staff to address your questions or concerns

b. **[DISPLAY IF Q122 = 1]** How thoroughly they addressed your questions or concerns

c. The steps you had to take to get through the program

d. The amount of time it took to get your rebate or incentive

e. The range of equipment that qualifies for incentives

f. The program overall

[DISPLAY Q124 IF ANY IN Q122 < 3]

124. Why were you dissatisfied with those parts of the program you mentioned?

1. [OPEN]

125. If you could change one thing about the program, what would it be?

1. [OPEN]

126. Using the same scale, how dissatisfied or satisfied are you with I&M as your electricity service provider?

[SCALE: 1 = 1 (Very dissatisfied), 2 = 2, 3 =3, 4 = 4, 5 = 5 (Very satisfied), 98 = Don't know]

FIRMOGRAPHIC [DO NOT DISPLAY]

127. Does your organization own or occupy, own and rent to someone else, or rent the facility where the project(s) took place?

1. Own and occupy
2. Own and rent to someone else
3. Rent
98. Don't know

128. Do you have any other comments that you would like to relay to I&M about energy efficiency in the commercial and industrial sector or about their programs?

4. C&I Participant Survey Results

Q1 - Our records indicate that you are the main contact for the [Field-FR_MEAS1] project completed at [Field-LOCATION]. Were you involved in the decision to complete this project?

#	Answer	%	Count
1	Yes	100.00%	17
2	No	0.00%	0
	Total	100%	17

Q8 - Does your company have any of the following policies or procedures in place at [Field-LOCATION]?

#	Question	Yes		No		Don't know		Total
1	A person or persons responsible for monitoring or managing energy usage	70.59%	12	29.41%	5	0.00%	0	17
2	Defined energy savings goals	52.94%	9	41.18%	7	5.88%	1	17
3	A specific policy requiring that energy efficiency be considered when purchasing equipment	52.94%	9	47.06%	8	0.00%	0	17
4	Carbon reduction goals	29.41%	5	64.71%	11	5.88%	1	17

Q9 - How did you FIRST learn about Indiana Michigan Power's incentives for efficient equipment upgrades?

#	Answer	%	Count
1	From a Trade Ally/contractor/equipment vendor/ energy consultant	17.65%	3
2	From an Indiana Michigan Power Account Representative	5.88%	1
3	From a program representative	5.88%	1
4	From an internet search	5.88%	1
5	At an event/trade show	0.00%	0
6	Received an email blast or electronic newsletter	5.88%	1
7	Received an informational brochure	5.88%	1
8	From a program sponsored webinar	0.00%	0
9	From Indiana Michigan's website	5.88%	1
10	Friends or colleagues	17.65%	3
11	Some other way (please explain)	29.41%	5
98	Don't know	0.00%	0
	Total	100%	17

Q10 - When your contractor first approached you about the program, did you have any concerns about participating or was it an easy decision?

#	Answer	%	Count
1	I had some concerns	0.00%	0
2	It was an easy decision	0.00%	0
98	Don’t know	0.00%	0
	Total		0

Q11 - What were your concerns?

#	Answer	%	Count
1	Upfront costs	0.00%	0
2	Time for return on investment	0.00%	0
3	Performance of new equipment	0.00%	0
4	Business disruption	0.00%	0
5	Legitimacy of the offer	0.00%	0
6	Other: Specify	0.00%	0
98	Don’t know	0.00%	0
	Total		0

Q13 - Using the scale below, please indicate how much you agree or disagree with the following statements regarding your experience with [Field-TRADE%20ALLY%20NAME]:

#	Question	Completely disagree1		2		3		4		Completely agree5		Don't know		Total
1	My contractor was professional	0.00%	0	0.00%	0	0.00%	0	0.00%	0	0.00%	0	0.00%	0	0
2	My contractor's recommendations made sense for my business	0.00%	0	0.00%	0	0.00%	0	0.00%	0	0.00%	0	0.00%	0	0
3	My contractor could answer most of my questions	0.00%	0	0.00%	0	0.00%	0	0.00%	0	0.00%	0	0.00%	0	0
4	I would recommend my contractor as a contractor to consider	0.00%	0	0.00%	0	0.00%	0	0.00%	0	0.00%	0	0.00%	0	0

Q15 - Which of the following people worked on completing your application for program incentives (including gathering required documentation)?

#	Answer	%	Count
1	Yourself	58.82%	10
2	Another member of your company	5.88%	1
3	A contractor	70.59%	12
4	An equipment vendor	23.53%	4
5	A designer or architect	0.00%	0
	Total	100%	17

Q16 - Using a 5-point scale, where 1 means “completely unacceptable” and 5 means “completely acceptable,” how would you rate . . .

#	Question	Completely unacceptable1		2		3		4		Completely acceptable5		Don't know		Not applicable		Total
1	the ease of finding the application on Indiana Michigan Power’s website	0.00%	0	0.00%	0	0.00%	0	20.00%	2	50.00%	5	20.00%	2	10.00%	1	10
2	the ease of using the application portal on Indiana Michigan Power's website	0.00%	0	0.00%	0	0.00%	0	20.00%	2	50.00%	5	20.00%	2	10.00%	1	10
3	the time it took to approve the application	0.00%	0	0.00%	0	0.00%	0	10.00%	1	70.00%	7	20.00%	2	0.00%	0	10
4	the clarity of information on how to complete the application	0.00%	0	0.00%	0	10.00%	1	20.00%	2	50.00%	5	20.00%	2	0.00%	0	10
5	the effort required to provide required	0.00%	0	0.00%	0	0.00%	0	10.00%	1	70.00%	7	20.00%	2	0.00%	0	10

	invoices or other supporting documentation															
6	the overall application process	0.00%	0	0.00%	0	0.00%	0	20.00%	2	60.00%	6	20.00%	2	0.00%	0	10

Q18 - Did you have a clear sense of whom you could go to for assistance with the application process?

#	Answer	%	Count
1	Yes	90.00%	9
2	No	10.00%	1
98	Don’t know	0.00%	0
	Total	100%	10

Q19 - Howlong did you have to wait for the equipment to be installed after the onsiteassessment was perf

#	Answer	%	Count
1	Less than 1 week	0.00%	0
2	1-2 weeks	0.00%	0
3	3-4 weeks	0.00%	0
4	5-6 weeks	0.00%	0
5	More than 6 weeks	0.00%	0
6	All equipment was installed the same day	0.00%	0
98	Don’t know	0.00%	0
	Total		0

Q20 - Who installed your program-qualified equipment or efficiency upgrades? Was it…

#	Answer	%	Count
1	Your own staff	17.65%	3
2	A contractor you've worked with before	52.94%	9
3	A contractor recommended by the Indiana Michigan program (registered Trade Ally)	11.76%	2
4	A new contractor that someone else recommended	17.65%	3
5	Someone else (Please specify)	0.00%	0
98	Don't know	0.00%	0
	Total	100%	17

Q21 - How did the incentive amount that you received compare to what you expected when you submitted your application? Would you say…

#	Answer	%	Count
1	It was much less	5.88%	1
2	It was somewhat less	11.76%	2
3	It was about the amount expected	58.82%	10
4	It was somewhat more	11.76%	2
5	It was much more	0.00%	0
98	Don't know	11.76%	2
	Total	100%	17

Q22 - How did the project cost compare to what you expected?

#	Answer	%	Count
1	It was much less	0.00%	0
2	It was somewhat less	0.00%	0
3	It was about the amount expected	0.00%	0
4	It was somewhat more	0.00%	0
5	It was much more	0.00%	0
98	Don’t know	0.00%	0
	Total		0

Q23 - Has your organization purchased any significant energy efficient equipment in the last three years without applying for a financial incentive through an energy efficiency program at [Field-LOCATION]?

#	Answer	%	Count
1	Yes. Our organization purchased energy efficient equipment but did not apply for incentive.	23.53%	4
2	No. Our organization purchased significant energy efficient equipment and applied for an incentive.	29.41%	5
3	No significant energy efficient equipment was purchased by our organization.	17.65%	3
98	Don't know	29.41%	5
	Total	100%	17

Q24 - Which of the following financial methods, if any, does your organization typically use to evaluate energy efficiency improvements? (Select all that apply.)

#	Answer	%	Count
1	Initial Cost	44.44%	4
2	Simple payback	88.89%	8
3	Internal rate of return	44.44%	4
4	Life cycle cost	33.33%	3
5	We don’t use any of these	0.00%	0
98	Don’t know	0.00%	0
	Total	100%	9

Q25 - What payback period do you typically require to approve an efficiency project?

What payback period do you typically require to approve an efficiency project?
2 years
3 years
2 years
A year or less
2 yrs
4-5 years
Depending on the scope of the project it could be up to 10 years.

Q26 - What internal rate of return do you typically use to approve an efficiency project?

What internal rate of return do you typically use to approve an efficiency project?
How long it will take to pay for itself
24 months
15% - 20%
3 - 5 years

Q27 - Before participating in the [Field-PROGRAM_NAME] Program, had you implemented any equipment or measure similar to the [Field-FR_MEAS1] [Field-INSTALLED_FR1] at [Field-LOCATION]?

#	Answer	%	Count
1	Yes	47.06%	8
2	No	47.06%	8
98	Don’t know	5.88%	1
	Total	100%	17

Q28 - When did you first learn about I&M’s energy efficiency programs? Was it BEFORE or AFTER you finalized the specifications of your [Field-FR_MEAS1] project, including the efficiency level and the scope of the project?

#	Answer	%	Count
1	Before	64.71%	11
2	After	17.65%	3
98	Don't know	17.65%	3
	Total	100%	17

Q29 - Did you have plans to [Field-INSTALL_FR1] the [Field-FR_MEAS1] at [Field-LOCATION] before participating in the program?

#	Answer	%	Count
1	Yes	47.06%	8
2	No	52.94%	9
98	Don’t know	0.00%	0
	Total	100%	17

Q30 - Would you have completed the [Field-FR_MEAS1] project even if you had not participated in the program?

#	Answer	%	Count
1	Yes	64.71%	11
2	No	29.41%	5
98	Don’t know	5.88%	1
	Total	100%	17

Q31 - Did you have experience with I&M’s incentive program before completing the [Field-FR_MEAS1] project?

#	Answer	%	Count
1	Yes	41.18%	7
2	No	58.82%	10
98	Don’t know	0.00%	0
	Total	100%	17

Q32 - How important was your previous experience with Indiana-Michigan-offered programs in making your decision to [Field-INSTALL_FR1] the [Field-FR_MEAS1] at [Field-LOCATION]?

#	Answer	%	Count
1	Very important	28.57%	2
2	Somewhat important	71.43%	5
3	Only slightly important	0.00%	0
4	Not at all important	0.00%	0
98	Don't know	0.00%	0
	Total	100%	7

Q33 - Did an [Field-PROGRAM_NAME] Program representative or other I&M representative recommend that you [Field-INSTALL_FR1] the [Field-FR_MEAS1] at [Field-LOCATION]?

#	Answer	%	Count
1	Yes	35.29%	6
2	No	58.82%	10
98	Don’t know	5.88%	1
	Total	100%	17

Q34 - If the [Field-PROGRAM_NAME] program representative had not recommended [Field-INSTALLING_FR1] the [Field-FR_MEAS1], how likely is it that you would have [Field-INSTALLED_FR1] it anyway?

#	Answer	%	Count
1	Definitely would have	16.67%	1
2	Probably would have	16.67%	1
3	Probably would not have	50.00%	3
4	Definitely would not have	0.00%	0
98	Don't know	16.67%	1
	Total	100%	6

Q35 - If the [Field-PROGRAM_NAME] program contractor that provided the energy assessment of your facility had not recommended [Field-INSTALLING_FR1] the [Field-FR_MEAS1], how likely is it that you would have [Field-INSTALLED_FR1] it anyway?

#	Answer	%	Count
1	Definitely would have	0.00%	0
2	Probably would have	0.00%	0
3	Probably would not have	0.00%	0
4	Definitely would not have	0.00%	0
98	Don’t know	0.00%	0
	Total		0

Q36 - Would your organization have been financially able to [Field-INSTALL_FR1] the [Field-FR_MEAS1] at [Field-LOCATION] without the financial incentive from the program?

#	Answer	%	Count
1	Yes	76.47%	13
2	No	17.65%	3
98	Don’t know	5.88%	1
	Total	100%	17

Q37 - To confirm, your organization would NOT have allocated the funds to complete a similar energy saving project if the program incentive was not available. Is that correct?

#	Answer	%	Count
1	Yes	33.33%	1
2	No	66.67%	2
98	Don’t know	0.00%	0
	Total	100%	3

Q38 - If the financial incentive from the [Field-PROGRAM_NAME] Program had not been available, how likely is it that you would have [Field-INSTALLED_FR1] the [Field-FR_MEAS1] at [Field-LOCATION] anyway?

#	Answer	%	Count
1	Definitely would have ${e://Field/INSTALLED_FR1}	35.29%	6
2	Probably would have ${e://Field/INSTALLED_FR1}	17.65%	3
3	Probably would not have ${e://Field/INSTALLED_FR1}	23.53%	4
4	Definitely would not have ${e://Field/INSTALLED_FR1}	0.00%	0
98	Don't know	23.53%	4
	Total	100%	17

Q40 - Did you purchase and install more [Field-FR_MEAS1] than you otherwise would have without the program?

#	Answer	%	Count
1	Yes	47.06%	8
2	No, program did not affect quantity purchased and installed.	47.06%	8
98	Don’t know	5.88%	1
	Total	100%	17

Q41 - Did you choose equipment that was more energy efficient than you would have chosen because of the program?

#	Answer	%	Count
1	Yes	33.33%	4
2	No, program did not affect level of efficiency chosen for equipment.	66.67%	8
98	Don’t know	0.00%	0
	Total	100%	12

Q42 - What kind of equipment, if any, would you have installed if the program was not available?

#	Answer	%	Count
1	Please specify	66.67%	2
98	Don't know	33.33%	1
	Total	100%	3

Q43 - Did you [Field-INSTALL_FR1] the [Field-FR_MEAS1] earlier than you otherwise would have without the program?

#	Answer	%	Count
1	Yes	31.25%	5
2	No, program did not affect timing of project.	68.75%	11
98	Don’t know	0.00%	0
	Total	100%	16

Q44 - When would you otherwise have completed the project?

#	Answer	%	Count
1	Less than 6 months later	0.00%	0
2	6-12 months later	20.00%	1
3	1-2 years later	40.00%	2
4	3-5 years later	40.00%	2
5	More than 5 years later	0.00%	0
98	Don’t know	0.00%	0
	Total	100%	5

Q158 - Not including any contractors that you hired, in the course of doing this project did you have any interactions with program staff about questions or concerns that you had?

#	Answer	%	Count
1	Yes	25.00%	4
2	No	68.75%	11
98	Don’t know	6.25%	1
	Total	100%	16

Q159 - Using the scale below, please rate how dissatisfied or satisfied you are with each of the following ….

#	Question	Very dissatisfied 1		2		3		4		Very satisfied 5		Don't know		Total
1	How long it took program staff to address your questions or concerns	0.00%	0	0.00%	0	0.00%	0	25.00%	1	75.00%	3	0.00%	0	4
2	How thoroughly they addressed your questions or concerns	0.00%	0	0.00%	0	0.00%	0	0.00%	0	100.00%	4	0.00%	0	4
6	The quality of the installation	0.00%	0	7.69%	1	0.00%	0	7.69%	1	84.62%	11	0.00%	0	13
7	The steps you had to take to get through the program	0.00%	0	0.00%	0	6.25%	1	25.00%	4	68.75%	11	0.00%	0	16
8	The amount of time it took to get your rebate or incent	0.00%	0	6.25%	1	6.25%	1	12.50%	2	68.75%	11	6.25%	1	16
9	The range of equipment that	0.00%	0	6.25%	1	0.00%	0	50.00%	8	43.75%	7	0.00%	0	16

	qualifies for incentives													
14	The program overall	0.00%	0	6.25%	1	0.00%	0	12.50%	2	81.25%	13	0.00%	0	16

Q162 - Using the same scale, how dissatisfied or satisfied are you with I&M as your electricity service provider?

#	Answer	%	Count
1	Very dissatisfied1	0.00%	0
2	2	6.25%	1
3	3	6.25%	1
4	4	31.25%	5
5	Very satisfied5	56.25%	9
98	Don't know	0.00%	0
	Total	100%	16

Q163 - Does your organization own or occupy, own and rent to someone else, or rent the facility where the project(s) took place?

#	Answer	%	Count
1	Own and occupy	93.75%	15
2	Own and rent to someone else	0.00%	0
3	Rent	6.25%	1
98	Don’t know	0.00%	0
	Total	100%	16