Evaluation of 2014 and 2015 Energy Efficiency Programs for The Imperial Irrigation District

Final Report

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1. Executive Summary

This report is a summary of the evaluation effort of the 2014 and 2015 Imperial Irrigation District's (IID) energy efficiency (EE) programs. This evaluation was led by ADM Associates Inc. ("ADM", or "the Evaluators").

1.1 Summary of IID Energy Efficiency Programs

The evaluation includes the following programs:

- Energy Rewards Rebates;
- Weatherization;
- Quality AC Maintenance Program;
- Customer Energy Solutions Program; and
- New Construction Energy Efficiency Program.

1.2 Evaluation Activities

The evaluation includes:

- Calculation of energy and demand savings attributable to the 2014 and 2015 programs;
- A process evaluation of the programs to identify actionable information aimed at program improvements;
- Recommendations for future program years and
- An evaluation report that summarizes impact and process findings.

1.3 Impact Findings

Table 1-1 and Table 1-2 present the impacts by program. The values in this table are a comparison of the savings expected by the Imperial Irrigation District ("Expected Savings") and those verified by the Evaluators ("Verified Savings").

Table 1-1 Impact Summary for 2014

Program	***Annual Energy Savings (kWh)***		***Realization Rate***	***kW***		***Realization Rate***
	Expected	***Verified***		***Expected***	***Verified***	
Energy Rewards (Residential)	6,981,706[1]	6,384,159	91.4%	1,771.59	3,636.67	205.3%
Energy Rewards (Commercial)	377,559	377,559	100.0%	128.68	128.68	100.0%
Refrigerator Recycling	82,306	82,306	100.0%	16.56	16.56	100.0%
Quality AC Maintenance	3,944,038	3,665,221	92.9%	2,038.19	3,114.65	152.8%
Quality AC Maintenance	4,037,651	4,037,651	100.0%	1,511.26	1,511.26	100.0%
Custom Energy Solutions Program	2,062,098	2,146,132	104.1%	468.73	323.56	69.0%
New Construction Energy Efficiency Program	1,375,372	1,431,420	104.1%	292.09	201.60	69.0%
Total	**18,860,729**	**18,124,44**	**96.1%**	**6,210.53**	**8,932.97**	**143.5%**

[1] Refrigerator and freezer recycling savings appear separately.

Table 1-2 Impact Summary for 2015

Program	Annual Energy Savings (kWh)		Realization Rate	kW		Realization Rate
	Expected	Verified		Expected	Verified	
Energy Rewards Rebates (Residential)	2,327,088	2,327,088	100.0%	6,780.67	1,370.97	20.2%
Energy Rewards Rebates (Commercial)	126,100	126,100	100.0%	104.68	104.68	100.0%
Refrigerator Recycling	126,793	126,793	100.0%	25.52	25.52	100.0%
Weatherization	487,366	474,541	97.4%	267.71	251.88	94.1%
Quality AC Maintenance	3,387,500	3,265,130	96.4%	2,277.69	2,538.12	111.4%
Quality AC Maintenance Program (Commercial)	425,268	425,268	100.0%	99.25	99.25	100.0%
Custom Energy Solutions Program	6,206,617	6,459,548	104.1%	292.09	201.60	69.0%
New Construction Energy	1,226,900	1,276,898	104.1%	141.75	97.85	69.0%
Total	**14,313,632**	**14,481,366**	**101.2%**	**9,989.36**	**4,689.86**	**46.9%**

While reviewing Custom Energy Solutions Program (CESP) and New Construction Energy Efficiency Program (NCEEP) IOMs the Evaluators found minor discrepancies between IOM kWh and kW totals and figures listed in E3 Tools, as well as one large NCEEP project whose savings appeared in CESP E3 totals. These discrepancies, shown below in Table 1-3 and Table 1-4, were discussed with IID staff. At the Evaluator's recommendation, CESP and NCEEP expected savings were adjusted to totals from IOMs and realizations rates were developed using these adjusted values.

Table 1-3 CESP Discrepancies

Year	E3 kWh	IOM Total kWh	kWh Discrepancy	E3 kW	IOM Total kW	kW Discrepancy
2014	2,844,305	2,062,098	*(782,207)*	820.77	468.73	*(352.05)*
2015	6,170,485	6,206,617	*36,132*	1,685.98	1,703.57	*17.59*

Table 1-4 NCEEP Discrepancies

Year	E3 kWh	IOM Total kWh	kWh Discrepancy	E3 kW	IOM Total kW	kW Discrepancy
2014	576,590	1,375,372	*798,783*	315.67	292.09	*(23.58)*
2015	1,123,872	1,226,900	*103,028*	131.87	141.75	*9.88*

1.4 Summary of Key Process Findings

ADM conducted in-depth telephone interviews with five IID staff members to gather information regarding 2014 and 2015 operational procedures and program delivery mechanisms. The interviews addressed five of the programs in IID's portfolio of energy efficiency programs. The interviews took place in April of 2018, during which time two

interviewees were affiliated with the programs but no longer are, and three of the interviewees are currently affiliated with the program but were not during the 2014 and 2015 program years. Therefore, extent to which staff could speak directly to program happenings that occurred during the evaluation period (2014-2015) was limited. For this reason, the interviews addressed high-level topics and previous year evaluation findings.

1.4.1 Overall Portfolio and Organization Findings

The following findings are related to multiple programs, to the IID portfolio of energy efficiency programs, or to IID's organizational structure and internal resources or procedures:

- **Sufficient Organizational Resources:** IID staff members stated that the organization has continued to transition resources over the past few years. Staff noted that during the 2014 and 2015 program years, several temporary employees were hired to assist with application review, approval, project tracking, and customer support. There was a consensus among staff members that in 2014 and 2015 management and operational resources were effective and sufficient for administering the portfolio of energy efficiency programs.
- **In-house Application Processing:** During the 2012 and 2013 program years, IID contracted with a 3rd party for prescriptive rebate application processing, customer support, and QA/QC for some programs. Since that time, IID has transitioned all such program support activities back in-house according to program staff.
- **Reduced Marketing in 2014 and 2015:** Program staff indicated that during the 2014 and 2015 program years, program marketing was significantly reduced. Prior to 2014 IID took part in a variety of community outreach events, most of which were scaled back during 2014 and 2015. Interviewed staff also noted that marketing staff that were previously responsible to outreach activities were reassigned to new roles within IID during 2014.
- **Omission of the Weatherization Program:** The residential Weatherization Program was discontinued after the 2015 program year. ADM was unable to speak with any staff directly involved with program management during that time, however current staff indicated that the program was deemed not cost-effective. The program offered an energy audit and up to $1000 of energy savings measures for a cost of $100, which was often waived for income-qualified customers. Staff indicated that the realized energy savings compared to the high cost to run the program were consideration that led to the determination to terminate the program.
- **Active Staff Engagement:** Similar to previous evaluation period (2012-2013), it appears that IID actively responds to issues with program performance and operation. IID staff indicated that customer or contractor issues are frequently elevated to the board members and tend to be resolved effectively and efficiently. Board members and utility staff are especially interested in maintaining customer satisfaction and have modified program offerings to address customer and contractor feedback.
- **Active Cross-program Outreach:** As discovered in previous evaluations, the IID portfolio of energy efficiency programs incorporates cross-program outreach within its

outreach and program management procedures. All programs are listed on the IID website, with links to program applications, guidelines, and contact information. Additionally, IID uses energy assessments to direct customers towards relevant programs, and program staff actively inform participants of additional energy efficiency opportunities.

- **Approved Contractor List is Mutually Beneficial**: Staff noted that developing and maintaining an approved contractor list for attic insulation and HVAC contractors has been a success. Having an approved contractor list is useful for ensuring consistent work quality and procedures among projects and allows the utility to efficiently conduct outreach and training to active contractors. According to staff, contractors are pleased with the exposure gained from having their company on the program website and being affiliated with IID.

Key trends and findings identified for individual programs are discussed in respective individual program chapters.

1.5 Report Organization

This report is organized with one chapter providing the full impact and process summary for each specified program. The report is organized as follows:

- Chapter 2 provides general methodologies;
- Chapter 3 provides results for the Energy Rewards Program;
- Chapter 4 provides results for the Refrigerator Recycling Program;
- Chapter 5 provides results for the Weatherization Program;
- Chapter 6 provides results for the Quality AC Maintenance Program;
- Chapter 7 provides results for the Custom Energy Solutions Program;
- Chapter 8 provides results for the New Construction Program and
- Appendix B provides the site-level custom reports for sampled CESP and NCEEP sites.

2. Methodology

This section details general impact evaluation methodologies by program-type as well as data collection methods applied. This section will present full descriptions of:

- Savings Estimation;
- Sampling Methodologies;
- Process Evaluation Methodologies; and
- Data Collection Procedures.

2.1 Glossary of Terminology

As a first step to detailing the evaluation methodologies, the Evaluators provide a glossary of terms to follow[2]:

- *Ex ante* – Forecasted savings used for program and portfolio planning purposes. Also referred to as "Expected Savings".
- *Ex post* – Savings estimates reported by an Evaluator after the energy impact evaluation has been completed. Also referred to as "Verified Savings".
- *Deemed Savings* – An estimate of an energy savings or demand savings for a single unit of an installed energy efficiency measure. This estimate (a) has been developed from data sources and analytical methods that are widely accepted for the measure and purpose and (b) is applicable to the situation being evaluated (e.g., assuming 112 kWh savings for a residential advanced power strip).
- *Realization Rate* – Ratio of *Ex post* Savings / *Ex ante* Savings (e.g., if the Evaluators verify 105 kWh per advanced power strip, Realization Rate = 105/112= 93.8% realization rate).

2.2 Overview of Methodology

The proposed methodology for the evaluation of the IID programs is intended to provide:

- Impact results; and
- Program feedback and recommendations via process evaluation.

In doing so, this evaluation will provide the verified savings results, recommendations for program improvement, and ensure cost-effective use of ratepayer funds. Leveraging experience and lessons learned from impact evaluations can provide greater guidance as to methods by which program and portfolio performance could be improved.

2.2.1 Methodology for Estimating Savings for Standard Projects

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

[2] Arkansas TRM V3.0, Volume 1, Pg. 80-86

2.2.1.1 Desk Review

Savings for the majority of measures offered by IID programs are calculated by deemed kWh and kW figures from several sources: 2013-14 Database for Energy Efficient Resources (DEER 2013-14) deemed savings estimates, investor-owned utility (IOU) workpapers, KEMA reports and the Savings Estimation Technical Reference Manual for the California Municipal Utilities Association ("TRM") and independent publicly-available studies. The Evaluators reviewed program tracking data and savings sources listed in the E3 Tool for each measure. Deemed per-unit savings were verified against sources and assessed for reasonableness. If the Evaluators felt a more appropriate reputable savings source and figures were available for any measure, the *ex post* savings estimate was adjusted, and the source recommend.

Energy savings was calculated using the following savings algorithms:

Total kWh Savings = Deemed per-unit savings number X number of units rebated

2.2.2 Methodology for Estimating Savings CESP and NCEEP Programs

The CESP and NCEEP programs provide a combined 32.8% of evaluated savings, however due to their custom nature, they require and in-depth analysis. ADM selected a sample, conducted on-site measurement and verification and performed in-house custom analyses of each of the 19 sampled sites.

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

- Data for the study have been collected through review of program materials, on-site inspections, and end-use metering. Based on data provided by IID, sample designs were developed for on-site data collection for the impact evaluation. Sample sizes were determined that provide savings estimates for the program with ±10% precision at the 90% confidence level.
- On-site visits were used to collect data for savings impacts calculations. The on-site visits were used to verify installations and to determine any changes to the operating parameters since the measures were first installed. Facility staff were interviewed to determine the operating hours of the installed system and to locate any additional benefits or shortcomings with the installed system.

2.2.2.1 Tracking Data Review and Sample Selection

IID provided program tracking data for CESP and NCEEP projects. The first step in the evaluation effort was to review this data and select a sample of sites to visit for verification and data collection.

Inspection of data on kWh savings for individual projects provided by IID indicated that the distribution of savings was generally positively skewed, with a relatively small number of projects accounting for a high percentage of the estimated savings. Estimation of savings for each program component is based on a ratio estimation procedure, which allows precision/confidence requirements to be met with a smaller sample size. Data provided by IID showed that during the period of January 2014 through December 2015, there were 112 Custom incentive projects for CESP and NCEEP programs, which were expected to provide a total savings of 10,870,987 kWh and 2,606.08 kW. ADM selected a sample with a sufficient number of projects to estimate the total achieved savings with

10% precision at 90% confidence. For the Custom sample, the actual precision is ±9.93%.

2.2.2.1 CESP and NCEEP Program Sample Design

The participant population was divided into five strata. Table 2-1 summarizes the strata boundaries and sample frames for the CESP and NCEEP sample:

Table 2-1 CESP and NCEEP Programs Sample Design

	Stratum 1	***Stratum 2***	***Stratum 3***	***Stratum 4***	***Stratum 5***	***Totals***
Strata boundaries (kWh)	< 34,600	34,601 - 110,000	110,001 - 270,000	270,001 - 700,000	> 270,000	
Number of projects	59	22	21	7	3	**112**
Total kWh savings	752,939	1,514,601	3,315,40	2,695,903	2,592,141	**10,870,987**
Average kWh Savings	12,762	68,846	157,876	385,129	864,047	**97,062**
Standard deviation of kWh	8,375	19,351	31,573	106,504	91,666	**163,764**
Coefficient of variation	0.66	0.28	0.20	0.28	0.11	**1.69**
Final design sample	6	3	4	4	2	**19**

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

- Documentation for the equipment changed, including (1) descriptions, (2) schematics, (3) performance data, and (4) other supporting information;
- Documentation for the new equipment installed, including (1) descriptions, (2) schematics, (3) performance data, and (4) other supporting information; and
- 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.

2.2.2.2 On-Site Data Collection Procedures

On-site visits were used to collect data that were used in calculating savings impacts. The visits to the sites of the sampled projects were used to collect primary data on the facilities participating in the program. During on site visits ADM staff verified all rebated measures had been installed and operating as expected. Facility staff was interviewed about equipment schedules and loggers were placed to monitor lighting operation for approximately two weeks. These loggers were then removed and annual lighting hours of operation were extrapolated from their data.

2.2.2.1 Savings Calculations

The majority of sampled savings came from lighting measures.

Savings for lighting retrofits was calculated using the following algorithms:

$$kWh_{savings} = \sum \left(\left[N_{fixt(i)} \times \frac{W_{fixt(i)}}{1000} \right]_{pre} - \left[N_{fixt(i)} \times \frac{W_{fixt(i)}}{1000} \right]_{post} \right) \times AOH \times IEF_E$$

$$kW_{savings} = \sum \left(\left[N_{fixt(i)} \times \frac{W_{fixt(i)}}{1000} \right]_{pre} - \left[N_{fixt(i)} \times \frac{W_{fixt(i)}}{1000} \right]_{post} \right) \times CF \times IEF_D$$

Where:

$N_{fixt(i),pre}$ = Pre-retrofit number of fixtures of type i

$N_{fixt(i),post}$ = Post-retrofit number of fixtures of type i

$W_{fixt(i),pre}$ = Rated wattage of pre-retrofit fixtures of type i

$W_{fixt(i),post}$ = Rated wattage of post-retrofit fixtures of type i

CF = Peak demand coincidence factor[3]

AOH = Annual operating hours for specified space type[4]

IEF_D = Interactive effects factor for demand savings

IEF_E = Interactive effects factor for energy savings

Inputs came from site documentation, primary data collected on site and values found in the Savings Estimation Technical Reference Manual for the California Municipal Utilities Association ("TRM").

Non-lighting savings calculations are discussed as needed in site reports.

2.2.2.1 Developing Program Realization

The realization rates from sampled sites within each stratum are then applied to the non-sampled sites within their respective stratum.

2.2.1 Methodology for Estimating Savings for the QACM Program

Most measures in the 2014 and 2015 Quality AC Maintenance Program (QACM) programs were analyzed by desk review ('Desk Review'). However, at the request of IID, two measures from the Duct Sealing (DTS) and Refrigerant Charge Adjustment (RCA) measures in single-family homes, were given and in-depth analysis. Savings algorithms are standard engineering savings algorithms taken from the Arkansas TRM 3.0. Measure inputs came from program tracking data and sources appropriate for the IID climate

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[3] Values used in this evaluation come from the TRM, Section 4 "Common Default Factors". http://cmua.org/wpcmua/wp-content/uploads/2016/06/2016-CMUA-POU-TRM_Final_v692016.pdf Tables 4-3 to 4-8.

[4] Values used in this evaluation come from primary on site data collection, calculation based on verified operating hours, non-daylight hours calculated using sunrise/sunset times retrieved from the US Naval Observatory: http://aa.usno.navy.mil/data/docs/RS_OneYear.php In the event AOH could not be obtained from any of thee sources, deemed hours by space type from the TRM were used. http://cmua.org/wpcmua/wp-content/uploads/2016/06/2016-CMUA-POU-TRM_Final_v692016.pdf Tables 4-5.

region. Specific calculations and inputs are discussed in section 6 Quality AC Maintenance.

2.2.2 Process Evaluation

The Evaluator's general approach to process evaluation begins with a review of the tests for timing and appropriateness of process.

2.2.2.1 Staff Interviews

The evaluators intend to interview relevant utility staff members in order to obtain information regarding program design, implementation, and continued operation. Specific topics to be addressed during these interviews include performance of the program(s) thus far, changes in current program(s), a description of the day-to-day operation and a description of the participants. Overall, the program staff interviews are intended to be fairly open-ended discussions that may address topics other than those identified above. The content of these discussions is likely to fluctuate based on the specific program being discussed and the role of the specific staff member being interviewed. Topics discussed in program staff interviews include:

- Program goals and objectives;
- Marketing and outreach;
- Communication processes;
- Program management and staffing; and
- Quality control and verification processes.

2.2.2.1 Literature Reviews

The evaluators will conduct a comprehensive literature review of the program design and theory of the IID program portfolio. This review will serve to inform the history of program operation and implementation, along with general program characteristics, whether program design and implementation are in accordance with current best practices and whether there are opportunities to make program improvements addressing feedback obtained from in-depth interviews.

3. Energy Rewards

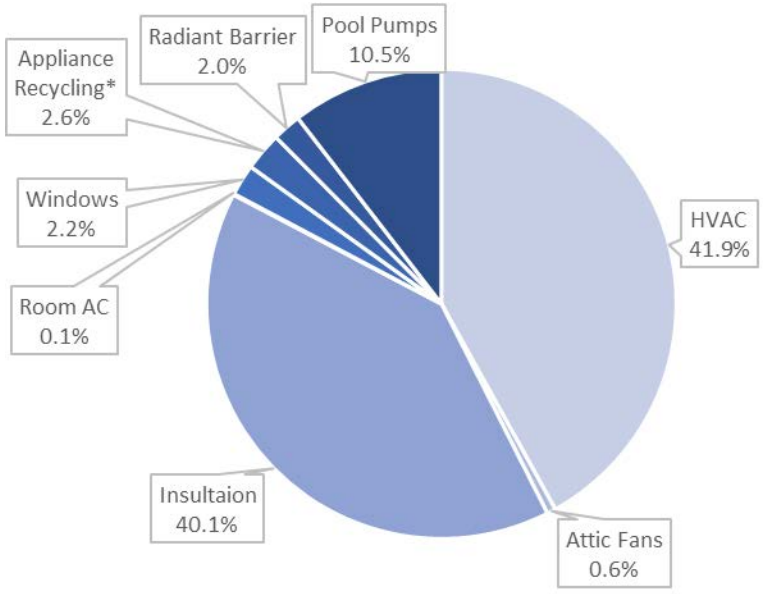
3.2 Program Description

The Energy Rewards Rebate Program is designed to provide standardized incentives to both residential and non-residential IID customers. The program offers incentives for a variety of measures, including attic insulation, lighting, motors, and HVAC equipment. Residential customers can choose their own contractor or self-install most measures; contractors installing attic insulation must be selected from IID's approved contractors list.

Qualifying equipment must replace old equipment with new, energy-efficient equipment. For non-residential customers the upgrades must meet and exceed Title 24 standards in effect at the time of installation.

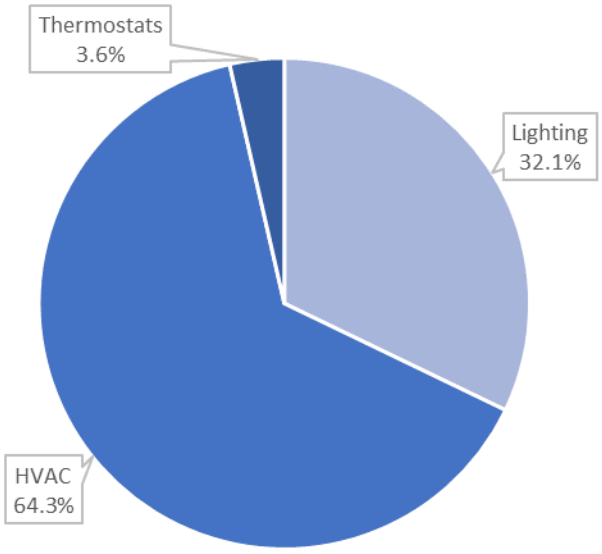
The program offered 60 residential and 29 commercial measures. Figure 3-1 and Figure 3-2 show the percentage of program savings they contributed by end use category.

Figure 3-1 Residential Savings Contribution by End Use



*Appliance recycling measures were part of the 2014 Energy Rewards Program however, their savings are discussed separately in Section 4, Refrigerator Recycling. They are shown here for illustrative purposes.

Figure 3-2 Commercial Savings Contribution by End Use



3.3 Impact Findings

Verified savings for all measures in both program years are summarized in Table 3-1 through Table 3-5:

Table 3-1 Residential Realization Summary 2014

Measure	Annual Energy Savings (kWh)		kWh Realization Rate	Peak kW		kW Realization Rate
	Expected	Verified		Expected	Verified	
Ceiling insulation, increase to R-30	36,040	29,553	82.0%	-	18.02	N/A
Ceiling insulation, increase to R-38	3,694,124	3,103,064	84.0%	-	1,847.06	N/A
Other Measures	3,251,542	3,251,542	100.0%	1,771.59	1,771.59	100.0%
Total	**6,981,706** [5]	**6,384,159**	**91.4%**	**1,771.59**	**3,636.67**	**205.3%**

Table 3-2 Residential Realization Summary 2015

Measure	Annual Energy Savings (kWh)		kWh Realization Rate	Peak kW		kW Realization Rate
	Expected	Verified		Expected	Verified	

[5] 2014 expected and realized savings numbers do not contain savings from refrigerator or freezer recycling, which are discussed in the following report chapter.

Ceiling Insulation, R-38 (baseline: no insulation)	14,751	14,751	100.0%	953.44	8.99	0.9%
Ceiling Insulation, existing plus new insulation equal to R-38	75,774	75,774	100.0%	4,510.37	45.10	1.0%
Other Measures	2,363,356	2,363,356	100.0%	1,342.38	1,342.38	100.0%
Total	**2,453,881**	**2,453,881**	**100.0%**	**6,806.19**	**1,396.48**	**20.5%**

Table 3-3 Commercial Realization Summary 2014 and 2015

Measure	***Annual Energy Savings (kWh)***		***kWh Realization Rate***	***Peak kW***		***kW Realization Rate***
	Expected	***Verified***		***Expected***	***Verified***	
2014	377,559	377,559	100.0%	128.68	128.68	100.0%
2015	126,100	126,100	100.0%	104.68	104.68	100.0%
Total	**503,658**	**503,658**	**100.0%**	**233.36**	**233.36**	**100.0%**

Table 3-4 Combined Realization Summary 2014

Measure	***Annual Energy Savings (kWh)***		***kWh Realization Rate***	***Peak kW***		***kW Realization Rate***
	Expected	***Verified***		***Expected***	***Verified***	
Residential	7,064,012	6,384,159	91.4%	1,771.59	3,636.67	205.3%
Commercial	377,559	377,559	100.0%	128.68	128.68	100.0%
Total	**7,359,265**	**6,761,718**	**91.9%**	**1,900.26**	**3,765.34**	**198.1%**

Table 3-5 Combined Realization Summary 2015

Measure	***Annual Energy Savings (kWh)***		***kWh Realization Rate***	***Peak kW***		***kW Realization Rate***
	Expected	***Verified***		***Expected***	***Verified***	
Residential	2,453,881	2,453,881	100.0%	6,806.19	1,396.48	20.5%
Commercial	126,100	126,100	100.0%	104.68	104.68	100.0%
Total	**2,579,981**	**2,579,981**	**100.0%**	**6,910.87**	**1,501.17**	**21.7%**

Two 2014 measures' savings estimates were adjusted: 'Ceiling insulation, increase to R-30' and 'increase to R-38' were adjusted from 2.00 kWh/square foot in the E3 Tool to 1.64 and 1.68 kWh/square foot in accordance with the TRM. This resulted in 82.0% and 84.0% kWh realization rates for the respective measures and a 91.5% kWh realization rate for the 2014 residential overall. Also, the E3 Tool did not attribute any peak kW savings to these measures, however a 0.001kW/square foot savings for these measures is appropriate and accounted for in *ex post* savings estimates, raising the overall 2014 kW residential realization rate to 205.3%.

Two 2015 insulation measures' kW savings estimates were also adjusted: In the E3 Tool 'Ceiling insulation, R-38 (baseline: no insulation)' and 'existing plus new insulation' are assumed to provide a peak kW reduction of 0.106 and 0.1kW/square foot, respectively. Peak kW values appropriate for these measures are closer to 0.001kW/square foot. The Evaluators adjusted *ex post* savings estimates accordingly, decreasing measure realization rates to 0.9% and 1.0%, respectively, and overall residential kW realization to 20.5%

All other measures' savings estimates were found to be appropriate and thus no further adjustments were made.

3.4 Process Findings

- **Few Program Changes:** Staff indicated that from a program design perspective, very few changes were made to the Energy Rewards Rebate Program during the 2014 and 2015 program years. The maximum incentive is 50% of the net purchase price. This requirement is in place to maintain program cost-effectiveness and to manage free-ridership potential by preventing customers from receiving incentives for measures that have already been incentivized by another source. Customers are still encouraged to use an approved contractor for attic insulation and HVAC measures.

  Staff noted that if a customer applies for an attic insulation or HVAC incentive, which was not associated with an approved contractor, the payment *will not* be denied so as not to penalize the customer. Staff will notify the customer of the approved contractor list should they decide to do a future project, and staff will also reach out the contractor to elicit their enrollment in the program. The contractor will be notified that should the contractor opt not to enroll as a participating contractor, future rebate applications payable to the contractor may be denied.

- **Sufficient Trade Ally Training and Engagement:** Having an approved contractor list is useful for ensuring consistent work quality and procedures among projects and allows the utility to efficiently conduct outreach and training to active contractors. The decision to require an approved contractor for attic insulation and HVAC installation in the Energy Rewards Program was an appropriate and important response to widespread program issues during the 2012 and 2013 program years and will likely minimize future contractor issues.

- **Significant Decrease in Attic Insulation from 2014 to 2015:** Staff noted several reasons for this shift in program activity most notable was the decreased incentive from $.60/sqft to $.30/sqft. Initially, the higher incentive attracted a flood of contractors to pursue insulation projects in IID's territory, staff indicated that in 2014 they were receiving up to one hundred applications a day. After a thorough review of other regional programs, of similar design, it was determined that the incentive could be lowered and still encourage installation of this measure type. Staff indicated that once the incentive amount was adjusted, it was much more in-line with other regional programs, activity slowed to a much more manageable pace.

- **Approximately Six Weeks for Application Processing:** Staff described the application submission and review process. Once the measure is purchased and installed the customer can apply for a rebate through completing an application and

submitting required documentation. IID customers access the program application via IID's website or pay stations throughout the service territory and submit in-person, via fax or US mail. Program staff review the application for completeness, ensures the customer has not participated in the past, validates that the invoice lists the rebated measure(s), and inputs all customer and measure information into an excel spreadsheet. After which time the applications go into the "request for check" stage and are processed in batches.

All applications are reviewed by management, finance, and sent to accounting for processing. Staff indicated that all applications that request rebate dollars more than $2500 are flagged for pre-approval, which requires and additional level of review. Staff indicated the application review and approval process take approximately eight to ten weeks.

- **Consistent Quality Assurance Procedures:** During the 2014 and 2015 program years, as with previous program years, the Energy Rewards Rebate Program outlines specific requirements for program participation, staff provided insight into the processes through which they ensure participants are meeting those requirements. IID staff review all applications for completeness and eligibility, ensuring the applicant is an IID account holder, that they have not applied for a similar incentive in the past five years, and that all proof of purchase/invoices are submitted. IID staff conduct onsite inspections for approximately 15% of all submitted rebate applications. Staff noted that they tend to focus on projects for which the estimation of square footage is required. The inspection parameters are measure specific and include, but are not limited to, verification of square footage, verification of installation quantities, and that the units are connected and in working condition. Inspectors will also take pictures on site and draft an inspection report upon completion.
- **Opportunity to Improve Current Program Tracking System:** Program staff noted that the current system used to track program activity is a series of custom excel spreadsheets. This process collects the necessary information to track program activity and associated energy savings but limits the ease with which staff edit project information, check project status, and run custom reports. Staff indicated that a more advanced relational database would be useful for online submission, searching for applications status, and running custom reports as needed.
- **Strong Internal Communication:** Staff did not describe regularly scheduled communication regarding program activity, rather they described more informal daily communication that is sufficient for supporting the administration and oversight needs of the program.

3.5 Recommendations

ADM provides the following recommendations for consideration:

- **Replace CFL Measures with LEDs:** LEDs provide greater kWh and kW savings and EULs than CFLs while maintaining the same lumen outputs. LED lighting costs have declined as the market matured and with the relaxation of the longevity standards

under ENERGY STAR 2.0 guidelines. Additionally, ENERGY STAR certified lighting has largely transitioned from CFLs to LEDs[6].

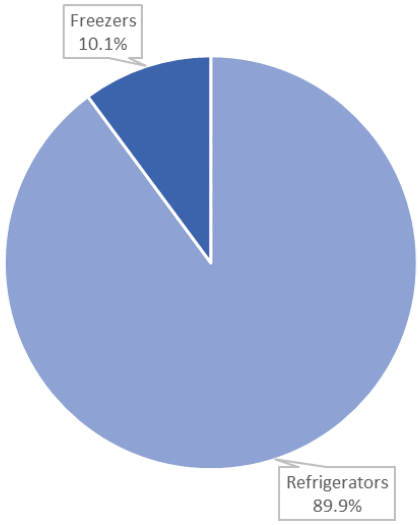
[6] As of May 2017, less than 1% of ENERGY STAR Certified lamps were CFLs.

4. Refrigerator Recycling

4.1 Program Description

Refrigerator and freezer recycling measures were part of the Energy Rewards Program through 2014 but were developed into a standalone program starting in 2015. The program is designed to remove old refrigerators and freezers from use by offering IID customers a $50 rebate for recycling the item through the Appliance Recycling Centers of America.

Figure 4-1 Savings Contribution by Appliance Type



4.2 Impact Findings

Table 4-1 Weatherization Expected and Realized Savings 2015

Measure	Annual Energy Savings (kWh)		kWh Realization Rate	Peak kW		kW Realization Rate
	Expected	Verified		Expected	Verified	
2014[7]	82,306	82,306	100.0%	16.56	16.56	100.0%
2015	126,793	126,793	100.0%	25.52	25.52	100.0%
Total	**209,099**	**209,099**	**100.0%**	**42.08**	**42.08**	**100.0%**

The Evaluators determined that all savings estimates were reasonable and did not warrant any adjustments, resulting in 100% kWh and kW realization rates.

[7] These savings estimates are from refrigerator and freezer recycling measures as part of 2014 Energy Rewards program.

5. Weatherization

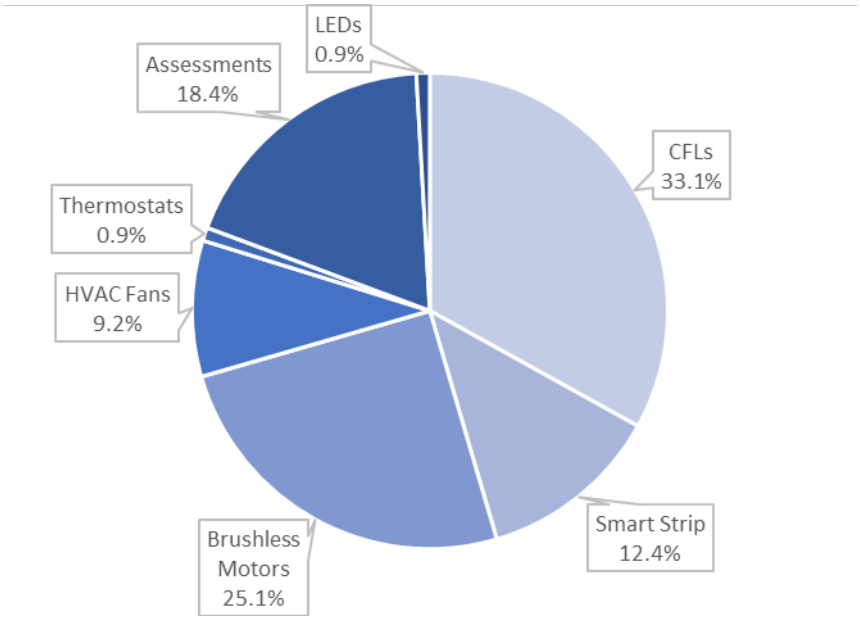
5.1 Program Description

The Residential Weatherization Program was designed to provide residential IID customers with an inspection of their home's energy usage and with a variety of energy efficiency measures including CFLs, occupancy sensors, shade screens, ceiling insulation, and building shell improvements. Participating customers paid $100 to participate in the program, which provided an energy audit and up to a total of $1,000 of measures and weatherization services. The Weatherization Program is not exclusively targeted towards income-qualified customers, although the $100 co-pay is waived for customers who qualify for IID low income discounts through the Residential Energy Assistance Program (REAP).

In 2015, IID contracted with Synergy for program implementation services and according to program staff the Weatherization Program was discontinued at the end of 2015.

The program offered 16 residential measures. Figure 5-1 shows the percentage of program savings they contributed by measure type.

Figure 5-1 Savings Contribution by End Use



5.2 Impact Findings

Table 5-1 Weatherization Expected and Realized Savings 2015

Measure	Annual Energy Savings (kWh)		kWh Realization Rate	Peak kW		kW Realization Rate
	Expected	Verified		Expected	Verified	
18 Watt CFL Exterior Fixture	16,960	9,268	54.6%	1.48	-	0.0%
36 Watt CFL Exterior Fixture	14,350	9,218	64.2%	14.35	-	0.0%
Other Measures	456,056	456,056	100.0%	251.88	251.88	100.0%
Total	**487,366**	**474,541**	**97.4%**	**267.71**	**251.88**	**94.1%**

The Evaluators determined that two measures involving the replacement of outdoor incandescent lamps with CFL was premised on a higher reduction in connected load that was appropriate given EISA lumen equivalence tables. Additionally, since these fixtures operate outdoors during non-daylight hours, not during any peak demand periods, thus no peak kW savings can be observed from them. *Ex post* savings estimates were adjusted down for these two measures. Savings estimates for all other measures were found to be reasonable, resulting in 97.4% kWh and 94.1% kW for the program overall.

5.3 Process Findings

- **Program Marketing and Outreach:** IID staff noted that promotion of the Weatherization Program was mainly conducted by Synergy, the program implementation contractor. Synergy marketed the program using IID's logo and conducted various outreach tasks including the onsite audit and installation visits.
- **Concurrent Participation in Gas Program:** During 2015, both IID and the gas utility offered separate weatherization programs, and customers receiving service from both companies were eligible to participate in both programs concurrently. The distribution of measures between programs depended on the type of heating and water heating in the home. This helped to ensure that IID was not implementing measures that would not generate electric savings, and that program resources were allocated effectively.
- **Customer Engagement and Interest:** IID staff noted that in 2015, like 2012 and 2013, the majority of interest in the Weatherization Program has been from income-qualified customers who also participate in REAP and customer interested in installing residential solar. Staff noted that many residential solar projects first require an extensive energy audit prior to array installation, therefore the audit component of the Weatherization Program became a vehicle for the required audit.

6. Quality AC Maintenance

The Quality A/C Maintenance (QACM) Program is designed to provide both residential and commercial customers with air conditioning services including duct testing and sealing, refrigerant charging, detailed equipment inspection, and cleaning of the unit. Renters are eligible to receive services through the program if the owner of their building completes the program consent form that is provided during the equipment assessment.

Enalasys serves as the program implementation contractor, and recruits contractors to deliver program services. Once a customer applies to the program, Enalasys schedules an assessment appointment in order to evaluate the customer's air conditioner maintenance needs. The AC maintenance services are provided at no additional cost to the customer.

Figure 6-1 Residential Savings Contribution by End Use

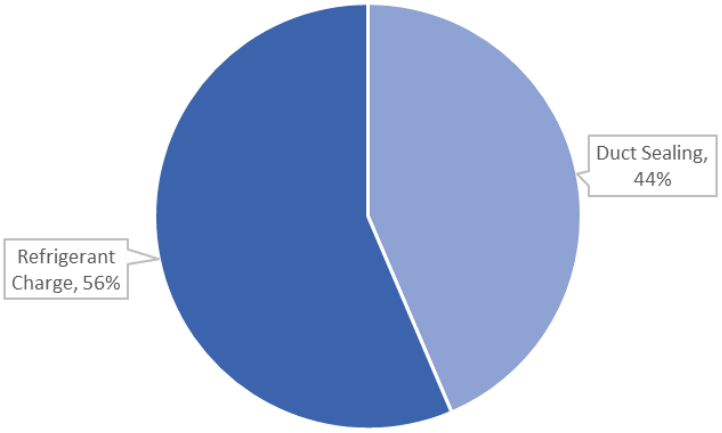
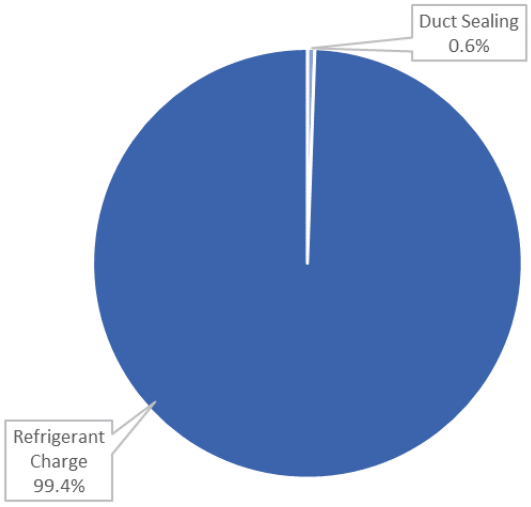


Figure 6-2 Commercial Savings Contribution by End Use



6.1 M&V Methodology

Savings algorithms are standard engineering savings algorithms taken from the Arkansas TRM 3.0. Measure inputs came from program tracking data and sources appropriate for the IID climate region. Unless otherwise noted, specific input values and source are listed below in Table 6-1 and Table 6-2.

6.1.1 Duct Sealing Savings Calculations

A sample of 2,368 single family homes was used to develop average test-in and test-out data, as well as average system tonnage and other parameters.

6.1.1.1 Cooling Savings (Electric):

$$kWh_{savings,C} = \frac{(DL_{pre} - DL_{post})\ x\ EFLH_{Cooling}\ x\ (h_{out}\rho_{out}\ - h_{in}\rho_{in})\ x\ 60}{1{,}000\ x\ SEER}$$

Where:

DL_{pre} = Pre-improvement duct leakage at 25 Pa (ft^3/min)
DL_{post} = Post-improvement duct leakage at 25 Pa (ft^3/min)
$EFLH_{Cooling}$ = Equivalent Full Load Hours
h_{out} = Outdoor design specific enthalpy (Btu/lb)
h_{in} = Indoor design specific enthalpy (Btu/lb)
ρ_{out} = Density of outdoor air at 95°F = 0.0740 (lb/ft3)[8]
ρ_{in} = Density of conditioned air at 75°F = 0.0756 (lb./ft3) [9]
60 = Constant to convert from minutes to hours
$1{,}000$ = Constant to convert from W to kW
$SEER$ = Seasonal Energy Efficiency Ratio of existing system (Btu/W·hr)

6.1.1.2 Heating Savings (Heat Pump):

$$kWh_{savings,H} = \frac{(DL_{pre} - DL_{post})x\ 60\ x\ HDD\ x\ 24\ x\ 0.018}{1{,}000\ x\ HSPF}$$

Where:

DL_{pre} = Pre-improvement duct leakage at 25 Pa (ft^3/min)
DL_{post} = Post-improvement duct leakage at 25 Pa (ft^3/min)

[8,2] ASHRAE Fundamentals 2009, Chapter 1: Psychometrics, Equation 11, Equation 41, Table 2

60 = Constant to convert from minutes to hours
HDD = Heating degree days
24 = Constant to convert from days to hours
0.018 = Volumetric heat capacity of air (Btu/ft^3°F)
$1{,}000$ = Constant to convert from W to kW
$HSPF$ = Heating Seasonal Performance Factor of existing system (Btu/W·hr)
Default value for HSPF = 7.30.[10]

6.1.1.3 Heating Savings (Electric Resistance):

$$kWh_{savings,H} = \frac{\left(DL_{pre} - DL_{post}\right)\ x\ 60\ x\ HDD\ x\ 24\ x\ 0.018}{3{,}412}$$

Where:

DL_{pre} = Pre-improvement duct leakage at 25 Pa (ft^3/min)
DL_{post} = Post-improvement duct leakage at 25 Pa (ft^3/min)
60 = Constant to convert from minutes to hours
HDD = Heating degree days
24 = Constant to convert from days to hours
0.018 = Volumetric heat capacity of air (Btu/ft3°F)
$3{,}412$ = Constant to convert from Btu to kWh

6.1.1.4 Demand Savings (Cooling):

$$kW_{savings,C} = \frac{kWh_{savings,C}}{EFLH_C}\ x\ CF$$

Where:

$kWhsavings_c$ = Calculated kWh savings for cooling
$EFLH_{Cooling}$ = Equivalent full load cooling hours
CF = Coincidence factor = 0.87[11]

[10] Average of Department of Energy minimum allowed HSPF for new heat pumps from 1992-2006 (6.8 HSPF) and after January 23, 2006 (7.7 HSPF)

[11] The Air Conditioning Contractors of America (ACCA) Manual S recommends that residential HVAC systems be sized at 115% of the maximum cooling requirement of the house. Assuming that the house's maximum cooling occurs during the hours 3 to 6 pm, this sizing guideline leads to a coincidence factor for residential HVAC of 1.0/1.15 = 0.87.

Table 6-1 Input Values for Duct Sealing Calculations

Parameter	Value	Source
DL_{pre}	335.1	Calculated from tracking data
DL_{post}	150.6	Calculated from tracking data
Average reduction	54.0%	Calculated from tracking data
$EFLH_{Cooling}$	2,092	ENERGY STAR® Central AC Calculator
HDD	1,093	PG&E workpaper[12]
h_{out}	35.5	Custom Calculation
h_{in}	26.6	Custom Calculation
SEER (average)	12.48	Calculated from tracking data

All system types are subject to cooling savings however, additional savings from duct sealing is realized by heat pumps operating in heating mode as well as forced air electric resistance heaters. Heat pump units were directly observable in tracking data. For the remainder, ADM used the California Residential Appliance Saturation Survey (RASS) to estimate the percentage to homes with electric resistance heating. The additional weighted savings was then added to the base cooling savings.

6.1.2 Refrigerant Charge Adjustment Savings Calculations

A sample of 2,715 single family homes was used to develop average test-in and test-out data, as well as average tonnage and other parameters.

Deemed savings was calculated using test-in and test-out efficiency data:

$$kWh_{Savings\_Cooling} = CAP_c \times 1{,}000\,{}^{W}/_{kW} \times \left(\frac{1}{EER_{pre}} - \frac{1}{EER_{post}}\right) \times EFLH_C$$

$$kWh_{savings,HP} = CAP \times \frac{1\,kW}{1{,}000\,W} \times \left[\left(\frac{EFLH_C}{EER_{pre}} + \frac{EFLH_H}{HSPF_{pre}}\right) - \left(\frac{EFLH_C}{EER_{post}} + \frac{EFLH_H}{HSPF_{post}}\right)\right]$$

$$kW_{Savings} = CAP_c \times 1{,}000\,{}^{W}/_{kW} \times \left(\frac{1}{EER_{pre}} - \frac{1}{EER_{post}}\right) \times \%CF$$

12 https://www.pge.com/includes/docs/pdfs/about/edusafety/training/pec/toolbox/arch/climate/california_climate_zone_15.pdf Average of Brawley and El Centro.

Where,

CAP_c = Cooling capacity (in Btu)
EER_{pre} = Efficiency of the equipment prior to tune-up
EER_{post}= Nameplate efficiency of the existing equipment
EFLHc = Equivalent Full-Load Cooling Hours
%CF = Peak Coincidence Factor

Table 6-2 Input Values for RCA Calculations

Parameter	Value	Source
CAP (average)	45,452Btu (3.788 TONS)	Calculated from tracking data
EER_{pre} (average)	9.09	Calculated based on specific maintenance
EER_{post} (average)	10.02	Calculated from tracking data
$EFLH_{Cooling}$	2,092	ENERGY STAR® Central AC Calculator

All system types are subject to cooling savings however, additional savings from RCAs are realized by heat pumps operating in heating mode as well as forced air electric resistance heaters. Heat pump units were directly observable in tracking data. The additional weighted savings was then added to the base cooling savings.

6.2 Duct Sealing and Refrigerant Charge Adjust Savings Results

Using the methods and parameters listed above, ADM calculated the average savings results presented below.

6.2.1 Duct Sealing

Table 6-3 Duct Sealing Savings

System Type	kWh Savings
Cooling Savings (all systems)	1,117.7
Heat Pump Savings (heating mode)	686.5
Forced Air Electric Resistance Heating	1,468.7
Average per Home (based on equipment saturation)	**1,276.0**

The average savings single family household in climate zone 15 is 1,276.0kWh and .465kW. The 2016 CMUA TRM provides savings estimates of 488kWh and .463kW for duct sealing in CZ15. These savings are premised on a 20% reduction in leakage, however observed leakage reduction in the sampled homes is 44.6%, resulting in higher kWh savings. Further, the CA TRM provides estimates for homes with electric cooling and gas heating only. Heat pump savings estimates are not available. This analysis includes heat pump cooling and heating mode savings, as well as homes for forced air electric resistance heating. Finally, TRM calculations are based on weather in the Blythe

area, which has lower cooling degree days than the regions in which duct sealing projects took place.

6.2.2 Refrigerant Change Adjustments

The E3 Tool used by IID reports savings and cost units per TONs cooling as opposed to per system or household. Savings results are present using the same convention.

Table 6-4 Refrigerant Charge Adjust Savings

System Type	kWh Savings
Cooling Savings (all systems)	255.0
Heat Pump Savings (heating mode)	113.6
Average per TON (based on equipment saturation)	**285.3**

The average savings single family household in climate zone 15 is 285.3kWh and .106kW per TON. The 2016 CMUA TRM provides savings estimates of 209.72kWh and .181kW for cooling system RCAs in CZ15. These savings are based on weather in the Blythe area, which has lower cooling degree days than the regions in which RCA projects took place.

6.1 Overall Savings Results

Verified savings for all measures in both program years are summarized in Table 6-5 through Table 6-9 below.

Table 6-5 Residential Realization Summary 2014

Measure	Annual Energy Savings (kWh)		kWh Realization Rate	Peak kW		kW Realization Rate
	Expected	Verified		Expected	Verified	
Duct Sealing (Single Family Home)	1,309,624	1,296,416	99.0%	1,247.65	472.44	37.9%
Refrigerant Charge Adjust (Single Family Home)	2,082,827	1,817,218	87.2%	707.01	2,558.68	361.9%
Other Measures	551,587	551,587	100.0%	83.53	83.53	100.0%
Total	**3,944,038**	**3,665,221**	**92.9%**	**2,038.19**	**3,114.65**	**152.8%**

Table 6-6 Residential Realization Summary 2015

Measure	Annual Energy Savings (kWh)		kWh Realization Rate	Peak kW		kW Realization Rate
	Expected	Verified		Expected	Verified	
Duct Sealing (Single Family Home)	1,819,664	1,884,652	103.6%	1,732.52	686.81	39.6%
Refrigerant Charge Adjust (Single Family Home)	1,469,211	1,281,853	87.2%	498.72	1,804.88	361.9%

Other Measures	98,625	98,625	100.0%	46.44	46.44	100.0%
Total	**3,387,500**	**3,265,130**	**96.4%**	**2,277.69**	**2,538.12**	**111.4%**

Table 6-7 Commercial Realization Summary 2014 and 2015

Measure	Annual Energy Savings (kWh)		kWh Realization Rate	Peak kW		kW Realization Rate
	Expected	Verified		Expected	Verified	
2014	4,037,651	4,037,651	100.0%	1,511.26	1,511.26	100.0%
2015	425,268	425,268	100.0%	99.25	99.25	100.0%
Total	**4,462,919**	**4,462,919**	**100.0%**	**1,610.52**	**1,610.52**	**100.0%**

Table 6-8 Combined Realization Summary 2014

Measure	Annual Energy Savings (kWh)		kWh Realization Rate	Peak kW		kW Realization Rate
	Expected	Verified		Expected	Verified	
Residential	3,944,038	3,665,221	92.9%	2,038.19	3,114.65	152.8%
Commercial	4,037,651	4,037,651	100.0%	1,511.26	1,511.26	100.0%
Total	**7,981,688**	**7,702,872**	**96.5%**	**3,549.45**	**4,625.91**	**130.3%**

Table 6-9 Combined Realization Summary 2015

Measure	Annual Energy Savings (kWh)		kWh Realization Rate	Peak kW		kW Realization Rate
	Expected	Verified		Expected	Verified	
Residential	3,387,500	3,265,130	96.4%	2,277.69	2,538.12	111.4%
Commercial	425,268	425,268	100.0%	99.25	99.25	100.0%
Total	**3,812,768**	**3,690,398**	**96.8%**	**2,376.94**	**2,637.38**	**111.0%**

With the exceptions of single family home duct sealing and refrigerant charge adjustment measures, all *ex ante* savings values were found to be reasonable, thus no adjustments were made. For duct sealing and refrigerant charge adjustments measures, the Evaluators based *ex post* savings on estimates developed during their analysis of these measures. Since these measures were developed using data from the IID programs and inputs specific to the IID territory, they more accurately represent savings for these measures than those found in the TRM, whose estimates based on data averages from a variety of sources, and the more general CEC Climate Zone 15. The Evaluators recommend that future program year use these numbers as *ex ante* savings estimates developed for this report.

6.2 Process Evaluation Findings

- **Consistent Program Design and Participation:** Staff reported that during the 2014 and 2015 program years the design and delivery of the AC Maintenance Program remined unchanged. Enalasys continued as the program implementation contractor,

responsible for all program administration activities from scheduling and conducting audits, to performing QA/QC visits, to managing the list of approved contractors. Staff noted that the 2014 program year launched in February, while the 2015 program year launched in April. Both years were either fully, or near-fully, subscribed.

- **High Demand for Program Offerings:** Interviewed staff indicated that demand for this program remains high due the climate zone, which can result in up to nine or ten months consistent heat load. Also, many of the customers are income qualified, therefore offering these services at no-cost is a significant benefit to many residents in the service territory.
- **Limited Contractor Enrollment:** While the program is meeting its energy savings goal with the current pool of approved contractors, staff indicated they would like to enroll additional contractors in the Quality AC Maintenance Program. Diversifying the contractor pool will ensure the program is not adversely impacted by undesirable actions of a few contractors responsible for majority of program activity. Staff noted that enrolling new contractors has been challenging for several reasons.

  Staff noted that contractors are reluctant to participate due to the technology requirements and the fact that the influx of tune-ups during spring and summer creates surges in their businesses that can be difficult to manage. According to interviewed staff, contractors would prefer to perform tune ups during their slow times in the Fall and Winter, not in the late Spring and Summer when they are experiencing high demand for their primary product and service offerings.
- **Extended Contract Implementation Contract:** Prior to 2015 the program implementation contractor, Enalasys, operated under a contract that required annual renewal. According to program staff, in 2015 IID and Enalasys executed a 3-year contract. The objective of the 3-year contract was to mitigate issues associated with the lead time required for program launch and improve overall program continuity.
- **Contractor Issues Resolved:** In 2015 the program identified a contractor that was manipulating the program and requesting rebates for projects where work was not completed. According to staff, Enalasys reimbursed IID the funds and worked to resolve the issue. The jobs were re-assigned to other contractors and the majority of the homes ultimately received the AC tune up; staff noted that some customers refused the work. IID staff were satisfied with way in which Enalasys resolved the contractor issue and since that time there have been no other incidents of wide-spread program manipulation.
- **Effective Utility-Implementer Communication:** Overall, IID staff reported that Enalasys has been able to meet IID's needs and that program operation and management had gone smoothly given budget supplementation. It is noted that this program flexibility may not always be possible due to the potential for future budgetary constraints often facing publicly owned utilities

6.3 Recommendations

- **Update Duct Sealing and Refrigerant Charge Adjust Estimation Values.** Savings estimation values in the CA TRM are developed to serve multiple utilities and

represent average values for an area larger than the IID service territory. For this report, estimated savings values for these measures were developed by the Evaluators using IID program-specific data and weather-sensitive inputs specific to the IID service territory[13] where the majority of these projects occurred. Due to this specificity, the Evaluators recommend that future program year use the values as *ex ante* savings estimates developed for this report, specifically: 1,276 kWh and 0.465 kW per home for single family duct sealing and 285.3 kWh and 0.106 kW per ton cooling for single family refrigerant charge adjustments.

[13] Brawley and El Centro

7. Custom Energy Solutions Program

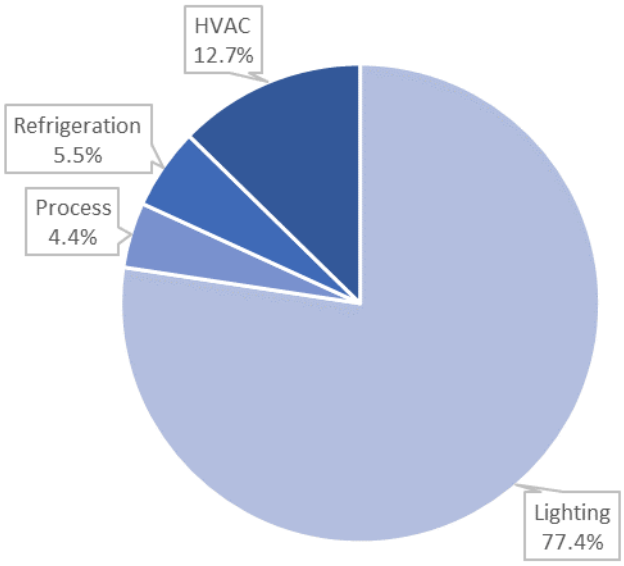
7.1 Program Description

The Custom Energy Solutions Program (CESP) seeks to provide financial incentives to IID's non-residential customers for energy efficient equipment and process improvements that reduce the customers energy consumption and demand. IID offers technical assistance to qualifying non-residential customers for purposes of identifying energy inefficiencies through a preliminary energy analysis (PEA). Eligibility for the PEA is based on IID's application review and may result in a pre-inspection site visit to identify baseline conditions and potential energy savings.

Qualifying energy efficiency measures (EEMs) must retrofit old equipment with new energy efficient technologies that exceed the applicable Title 24 requirements established by the California Energy Commission or current industry standards using IID-approved baselines.[14] Incentives are capped at $150,000 per account (or project site) and cannot exceed 50 percent of the installed cost for selected measures.

IID contracts with Optimize Energy for program implementation services.

Figure 7-1 Savings Contribution by Measure Type



[14] Custom Energy Solutions Program Guidelines 2018. (www.IID.com)

7.2 M&V Methodology

CESP and NCEEP projects were combined into a single population from which a random sample was drawn. Sampling is detailed in section 2.2.2. of this report. Sampled sites were visit for verification and to collect information about the projects. Photo loggers were left at five sites to record lighting operation of areas with irregular hours. After the site visit a custom analysis was performed to develop realized savings estimates. A total of 19 sites from the 2014 and 2015 CESP programs were sampled.

Table 7-1 CESP Participation Summary

Year	Count of Sampled Projects	Total Projects	Sampled kWh	Total kWh
2014	5	38	638,344	2,062,098
2015	14	63	2,755,029	6,206,617
Total	**19**	**101**	**3,393,373**	**8,268,715**

7.3 Impact Findings

Energy savings was estimated using proven techniques, including engineering calculations using industry standards to determine energy savings. Sampled sites' realization rates varied between 53.9% and 171.1%. Below, Table 7-2 shows expected and realized saving for each sampled site. Detailed reports for each site can be found in Appendix: Site Reports.

Table 7-2 CESP Site-Level Realization Rates

Project Number	Program	Measure Type	Facility Type	Expected kWh Savings	Realized kWh Savings	Realization Rate
Project 1	CESP 2015	Lighting	Outdoor park	2,642	4,529	171.4%
Project 2	CESP 2014	Interior Lighting	Clothing store	7,169	5,032	70.2%
Project 3	CESP 2015	HVAC	Community center	10,729	10,729	100.0%
Project 4	CESP 2015	Interior Lighting	Auto parts store	15,004	18,605	124.0%
Project 5	CESP 2015	Refrigeration and HVAC	Convenience store	15,870	13,593	85.7%
Project 6	NCEEP 2015	Envelope	Fast food	28,816	28,816	100.0%
Project 7	CESP 2014	Interior Lighting	Gym	45,937	63,832	139.0%
Project 8	CESP 2015	Refrigeration	Grocery store	67,726	70,345	103.9%
Project 9	CESP 2015	Lighting	Senior living facility	97,235	134,467	138.3%
Project 10	CESP 2015	Lighting	Elementary school	111,387	117,239	105.3%
Project 11	CESP 2015	Lighting	Middle school	112,570	115,400	102.5%
Project 12	CESP 2015	Lighting	Car dealership	178,289	96,049	53.9%

Project 13	CESP 2014	Process and Refrigeration	Manufacturing facility	178,700	135,503	75.8%
Project 14	CESP 2015	Lighting and HVAC	Middle school	346,847	270,915	78.1%
Project 15	CESP 2015	Lighting	Department store	365,022	430,241	117.9%
Project 16	CESP 2014	Interior Lighting	Department store	406,538	383,803	94.4%
Project 17	CESP 2015	Lighting and HVAC	High school	607,198	531,826	87.6%
Project 18	NCEEP 2014	Lighting and Envelope	Indoor sports complex	798,783	1,019,834	127.7%
Project 19	CESP 2015	Lighting	Casino and hotel	824,512	1,138,599	138.1%
			Total	**4,220,971**	**4,589,357**	**108.7%**

7.3.1.1 CESP and NCEEP Programs Site-level Realization

Sites chosen within each stratum are visited to verify installation of rebated measures and to collect data needed for calculation of realized savings. The realization rates for sites within each stratum are then applied to the non-sampled sites within their respective stratum.

Table 7-3 shows the expected and realized energy savings for the programs by stratum.

Table 7-3 Expected and Verified Savings by Stratum

Stratum	***# Sites***	***Expected kWh Savings***	***Realized kWh Savings***	***kWh Realization Rate***	***Expected kW Savings***	***Realized kW Savings***	***kW Realization Rate***
1	59	752,939	763,022	101.3%	203.99	201.89	99.0%
2	22	1,514,601	1,929,313	127.4%	398.35	451.32	113.3%
3	21	3,315,402	2,649,097	79.9%	873.71	230.79	26.4%
4	7	2,695,903	2,525,896	93.7%	762.11	349.22	45.8%
5	3	2,592,141	3,446,671	133.0%	367.92	565.75	153.8%
Total	**112**	**10,870,987**	**11,313,998**	**104.1%**	**2,606.08**	**1,798.95**	**69.0%**

Impact findings are discussed in detail in Sections 7. Custom Energy Solutions Program and 8. New Construction Energy Efficiency Program.

Below, Table 7-4 shows overall expected and realized saving for both program years:

Table 7-4 CESP Total Expected and Realized Savings by Year

Year	Annual Energy Savings (kWh)		kWh Realization Rate	Peak kW		kW Realization Rate
	Expected	Verified		Expected	Verified	
2014	2,062,098	2,146,132	104.1%	468.73	323.56	69.0%
2015	6,206,617	6,459,548	104.1%	1703.57	1175.96	69.0%
Total	**8,268,715**	**8,605,680**	**104.1%**	**2,172.29**	**1,499.51**	**69.0%**

7.3.1.2 CESP – Causes of Savings Deviations

Overall program-level kWh realization was high (104.1%). The peak kW realization rate is 69.0%. Some projects demonstrated savings less than 100% kWh savings. The Evaluators have summarized these projects in Table 7-5 for illustrative purposes.

Table 7-5 CESP – Causes of Low Realization

Project ID	Expected kWh	Verified kWh	Realization Rate	Causes of Low Realization
Project 2	7,169	5,032	70.2%	This project is a lighting retrofit at a boutique clothing store. The kWh realization rate is low because annual lighting hours used in *ex ante* calculations (3,650) were much lower than those verified on site and used in *ex post* calculations (2,190).
Project 5	15,870	13,593	85.7%	This project is a convenience store which installed an EMS system. Ex-ante calculations were premised on pre/post data gathered from other stores which installed EMS systems. These calculations removed 16 stores that showed negative savings comparing the 12 months before and after the EMS was installed. The reason for removal was unclear. The Evaluators included data from all sites in their calculations, resulting in a lower realized savings.
Project 12	178,289	96,049	53.9%	This project is a lighting retrofit at a car dealership. *Ex ante* calculations assumed annual lighting hours of operation of 4,368 for interior lighting and 2,184 for exterior lighting. The Evaluators developed lighting schedules based on interviews conducted with staff while on site. Verified operating schedules resulted in 4,563 AOH for interior fixtures and 1,095 AOH for exterior fixtures. This slightly increased interior realized kWh but decreased exterior realized kWh. Additionally, *ex ante* calculations assumed a peak coin factor of 100% for all areas, however the Evaluators determined that exterior fixtures only operate during non-peak hours, thus no peak kW savings can be attributed to

				them.
Project 13	178,700	135,503	75.8%	This project is process improvements at a manufacturing facility. *Ex ante* calculations only used four months of the utility data to estimate the baseline energy usage. instead of using all the available utility data without providing a reason for the exclusion. The utility data does not show large changes over time that could be related to increase in production rates. The four months included in the baseline contain two of the highest billed months which will overestimate the pre-installation annual energy consumption.
Project 14	346,847	270,915	78.1%	This project is a lighting retrofit and HVAC unit replacements at a middle school. *Ex ante* calculations assumed classroom lighting operated 1,800 hours annually, and occupancy sensors would decrease this by 28% to 1,296. The 2014 CA TRM recommends an 18% reduction for classrooms for wall or ceiling-mounted occupancy sensors, so the Evaluators revised the reduction in hours to 18%. This resulted in 1,455 post-sensor retrofit AOH for several classrooms, slightly lowering lighting kWh realization. Additionally, all exterior retrofits assumed 4,380 AOH, however this was adjusted to 4,313 to match the IID territory NDH, further reducing the realized kWh. Calculations for 24 previously-installed 18W CFLs assumed 20W per lamp, which was corrected to 18W in *ex post* calculations. The EFLHc value used in *ex ante* savings calculations is 2,883, which would reflect continuous operation of all units for approximately 13.8 hours per day for all school days during the school year. This EFLHc was adjusted to 1,267 based on the cooling EFLHc from the New Mexico TRM for a primary school in Las Cruces, NM, which is in the same ASHRAE climate zone as this school.
Project 16	406,538	383,803	94.4%	This project is a lighting retrofit at a department store. *Ex ante* calculations were premised on higher annual lighting operation hours (5,500) than those recorded by photo logging equipment left on site (5,078 for the sales floor and 5,241 for the back offices).
Project 17	607,198	531,826	87.6%	This project is a lighting retrofit and HVAC unit replacements at a high school. *Ex ante* calculations assumed classroom lighting operated 1,800 hours annually and occupancy sensors would decrease this by 28% to 1,296. The 2014 CA TRM recommends an 18% reduction for classrooms for wall or ceiling-mounted occupancy sensors, so the Evaluators revised the reduction in hours to 18%. This resulted in 1,455 post-sensor retrofit AOH for

				the majority of the classrooms, slightly lowering lighting kWh realization. Offices and administrative areas were also assumed to have a 28% reduction in operating hours due to occupancy sensors, but this was changed to 22% for the same reasons classroom hours were changed. These both contributed to lower lighting kWh realization. Additionally, all exterior retrofits assumed 4,380 AOH, however this was adjusted to 4,313 to match the IID territory NDH, further reducing the realized kWh. Calculations for 88 previously-installed 18W CFLs assumed 20W per lamp, which was corrected to 18W in *ex post* calculations. *Ex ante* HVAC calculations specified a 11.1 EER value for newly-installed equipment. The Evaluators verified nameplate information gathered during the on-site visits and found the EER values of the new equipment to be 12.0 according to the manufacture's specifications. Additionally, the EFLHc value used in *ex ante* savings calculations is 2,883, which would reflect continuous operation of all units for approximately 13.8 hours per day for all school days during the school year. This EFLHc was adjusted to 1,267 based on the cooling EFLHc from the New Mexico TRM for a primary school in Las Cruces, NM, which is in the same ASHRAE climate zone as this school

Key issues identified in site-level analyses include:

- **Calculations do not include HVAC interactive effects.** Lighting in air conditioned and refrigerated spaces adds heat to the space, increasing the cooling requirement during the cooling season and decreasing the heating requirement during the heating season. The decrease in waste heat from lighting mitigates these effects, thus reducing electricity used for cooling and increasing electricity or gas used for heating.
- **All calculations assumed a 100% peak coincidence factor.** All kW savings estimates were produced assuming all fixtures would be in operation during peak periods. IID does not specify a peak period, however system loads tend to be the highest during summer afternoon and evenings. It is unlikely that lighting will be operating during this time for many space type, such as dusk-to-dawn lighting, The Evaluators used deemed peak coincidence factors taken from the 2014 CA TRM to estimate the likelihood of connected load during these times. This was the primary driver of the low kW realization.
- **Non-daylight hours are overestimated.** Calculations for lamps controlled by photocells of otherwise operating during non-daylight hours all assumed 4,380 annual operating hours, which is continuous operation divided by two. The Evaluators used sunrise/sunset times from the US Naval Observatory to develop latitude-specific non-daylight hours for the IID territory, result in 4,313 annual

operating hours. This slightly decreased savings for fixtures operating on this schedule.

7.4 Process Evaluation Findings

- **Reduced Program Budgeting:** Staff reported that during the 2014 program year, the program utilized approximately half of the budget. Staff reported that the budget for the CESP was reduced during the 2015 program cycle. The budget reduction was in response to the effective date[15] of the California Energy Commission Title 24. Title 24 increased the baseline requirements for residential and non-residential buildings, which increased the barriers to program participation as customers were, by code, required install more efficient equipment types.
- **Program Activity Trends:** The largest portion of program savings in 2014 and 2015, similar to the previous evaluation period, was from lighting retrofits. HVAC and refrigeration projects also produced significant savings, however lighting is responsible for the "lion's share" of program activity. Staff noted that as the building codes continue to evolve, and baseline efficiency standards increase, the program will have to strategize about ways to encourage deeper, non-lighting energy savings.
- **Detailed Application Review:** As in previous program years, if IID determines that an existing application does not contain sufficient information or that the listed project does not qualify for an incentive, program staff will work with the customer by providing recommendations and commentary about why the application cannot be accepted. This provides the customer with an opportunity to revise the project or provide additional information as needed. Additionally, providing feedback to customers helps to maintain customer satisfaction levels, even if those customers' incentive applications are ultimately denied.
- **Sufficient Quality Assurance Procedures:** Staff reported that IID's quality control efforts are approximately 95% successful, with a 5% margin of error. Typically, the primary discrepancy is related to installed quantities. Staff reported that if a discrepancy exists they will contact the customer to resolve the issue, if the measure counts are not reconciled the customer will be notified of the adjust rebate amount based on actual installed quantities. Staff noted that all projects over $2500 receive a pre-inspection; this incentive threshold is an internal benchmark, set by staff, and is not predefined in the program guidelines. The object is to have a systematic approach to vet larger projects to ensure expected energy savings are achieved.

7.5 Recommendations

- **Include HVAC interactive effects in lighting impact savings calculations.** Efficient lighting wastes less heat and reduces load on HVAC systems, which are more heavily taxed in climate zone 15 than others. Omitting these interactive effects in savings calculations underestimates savings.

[15] Title 24 went into effect July 1, 2014

- **Include CA TRM deemed peak coincidence factors in lighting impact savings calculations.** Not all fixture operate during times of peak system load. Assuming they do can dramatically overestimate peak kW reductions. Different space types have different likelihoods of peak kW reduction, thus it is recommended that a peak coincidence factor be included in savings calculations to accurately calculate peak kW reductions. The CA TRM provides a suitable list of coincidence by space type.
- **Consider creating a prescriptive lighting calculator and making it available for trade allies.** These tools typically include lookups for fixture wattages including ballast factors, deemed hours by space type, interactive and coincidence factors. This tool can simplify the application and approval processes, as well reduce errors and provide more accurate savings in aggregate.
- **Consider a Relational Database for Program Tracking:** The current method for tracking program activity is Excel spreadsheets. Program staff indicated that the spreadsheets are sufficient for tracking program activity including customer information and project parameters, however it can become more difficult to extract custom reports and identifying projects status. A relational database, integrated with SAP, would created efficiencies for staff responsible for checking application/project status, performing data entry, running customer reports.
- **Invest in Program Marketing and Outreach:** During the 2014 and 2015 program years, marketing efforts were scaled back and according to program staff activity slowed. IID should strategize about low-cost ways to ensure residential and non-residential customers are aware of program offerings. Such strategies could include bill inserts or promotional mailers.
- **Ensure Consistency Among Program Documents:** Although the CESP Rebate Agreement indicates that measure savings must persist for five years, the Program Guidelines document states that "…you agree to continue using the installed EEMs for at least one year from the commission date."[16] In order to avoid customer confusion regarding this rule, IID should ensure that all CESP documentation specifies the five years, rather than one year, requirement.
- **Replace CFL Measures with LEDs:** LEDs provide greater kWh and kW savings and EULs than CFLs while maintaining the same lumen outputs. LED lighting costs have declined as the market matured and with the relaxation of the longevity standards under ENERGY STAR 2.0 guidelines. Additionally, ENERGY STAR certified lighting has largely transitioned from CFLs to LEDs[17].
- **Re-**evaluate Program Budget Allocation: Given the cost effectiveness and significant potential for energy savings, budget allocation for this program should be re-evaluated and adjusted upwards, particularly in light of regulatory requirements related to Senate Bill 350 (2017) that mandates doubling of energy efficiency goals by 2030.

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[16] From Page 7 of the Custom Energy Solutions Program (CESP) Guidelines, v. 3

[17] As of May 2017, less than 1% of ENERGY STAR Certified lamps were CFLs.

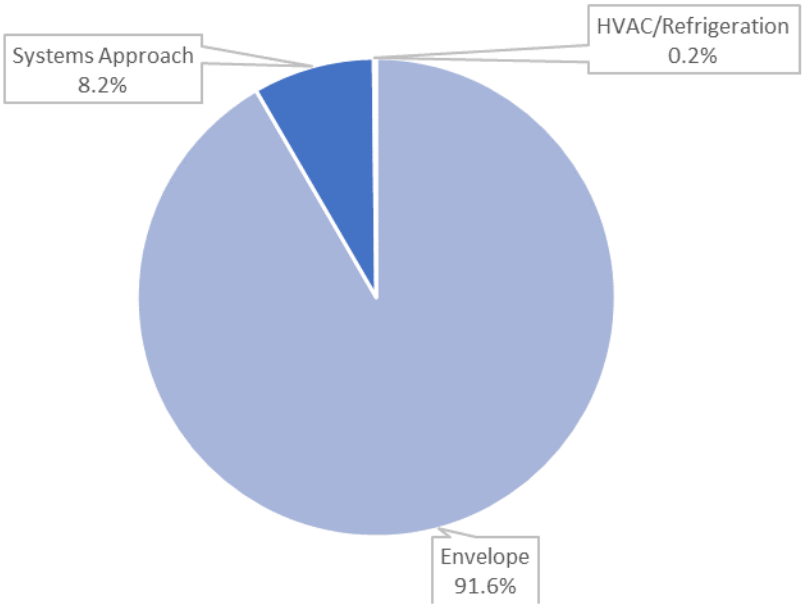
8. New Construction Energy Efficiency Program

8.1 Program Description

The New Construction Energy Efficiency Program (NCEEP) seeks to provide incentives for new construction or remodel projects that achieve at least 10% energy savings over Title 24 requirements. The program offers two tracks for qualifying participants: Whole Building approach, and the Systems approach. The Whole Building approach involves in-depth energy analysis and design assistance that seeks to optimize building energy efficiency and achieve substantial cost savings from multiple building systems.

In contrast, the Systems approach is a simplified method that allows participants to focus on individual building components. Under the Whole Building approach, the program would seek to achieve the 10% target throughout the building, while the Systems approach would focus on achieving at least 10% above Title 24 requirements for particular equipment systems.

Figure 8-1 Savings Contribution by Measure Type



8.2 M&V Methodology

The M&V methodology for NCEEP program is the same as the CESP program and is described section 2.2.2. of this report. Two sites from the 2015 NCEEP program, a fast food restaurant which performed building envelope improvements above code, and an indoor sports complex which upgrades insulation and retrofitted lighting were selected in the random sample for on site inspection and custom analysis.

Table 8-1 NCEEP Participation Summary

Year	Count of Sampled Projects	Total Projects	Sampled kWh	Total kWh
2014	1	6	798,783	1,375,372
2015	1	5	28,816	1,226,900
Total	**2**	**11**	**827,599**	**2,602,272**

8.3 Impact Findings

Energy savings was estimated using proven techniques, including engineering calculations using industry standards to determine energy savings. The sampled site realization is 126.7%, and the over NCEEP programs realization rates extrapolated from the sample are 104.1% for kWh, 69.0% for kW. Below, Table 8-2 shows overall expected and realized saving for both program years:

Table 8-2 NCEEP Total Expected and Realized Savings by Year

Year	Annual Energy Savings (kWh)		kWh Realization Rate	Peak kW		kW Realization Rate
	Expected	Verified		Expected	Verified	
2014	1,375,372	1,431,420	104.1%	292.04	201.60	69.0%
2015	1,226,900	1,276,898	104.1%	141.75	97.85	69.0%
Total	**2,602,272**	**2,708,319**	**104.1%**	**433.79**	**299.44**	**69.0%**

8.4 Process Evaluation Findings

- **Consistent Program Design and Participation:** Staff reported that during the 2014 and 2015 program years the design and delivery of the NCEEP program remained unchanged. The number of projects completed during the 2014 and 2015 program years was between 3-5 projects, which was similar to the previous evaluation period (2012-2013). Staff indicated that the current level of program activity for the NCEEP is in accordance planning assumptions. Very little outreach is done to ensure this program stays within budget.
- **Detailed Application Review:** Once an application is submitted, IID, with the technical support of Optimized Energy, reviews the design plans and energy savings calculations including assumptions and models. The level of assistance provided by the program varies based on the specific project and whether the applicant decides to pursue the Whole Building approach or the Systems approach. IID may recommend energy savings equipment or strategies to enhance the buildings/systems design and achieve deeper energy savings.

- **Potential Effectiveness of Design Phase Recruitment:** During program years 2014 and 2015, as with previous program years, the program requires customers to apply within the same calendar year of the commissioning date,[18] but there is no specific requirement that the project must still be early in the design phase to be eligible for incentives. Staff noted that approximately 90% of projects are submitted after design is complete.
- **New Service Requests Utilized as an Outreach Channel:** Interviewed staff noted that when a non-residential customer makes a new service request, the IID customer operations section will notify the NCEEP program specialist. The program specialist will then reach out to the customer regarding program offerings and determine if there is interest in design assistance and/or new construction incentives.

8.5 Recommendations

- **Include HVAC interactive effects and peak CFs per space type for lighting calculations.** See section 7.5, CESP Recommendations, for details.
- **Consider Strategies to Engage New Construction Participants Early in the Design Phase:** From our experience evaluating new construction programs in various regions around the country, early project involvement is a key program design element incorporated into many successful new construction programs. Early involvement allows for program staff, or its implementation contractor, to be integrated into the design process when decisions regarding building energy efficiency are made.

Other process-related recommendations from the CESP section (section 7.5) also apply to NCEEP.

[18] Previously, customers could submit applications up to 365 days after the commissioning date.

9. Appendix: Site Reports

Project Number Project 1

Program CESP 2015

Project Background

The participant is a park that received incentives from IID for retrofitting existing exterior lighting with energy efficient lighting. Evaluators verified the installation and operation of the following measures:

- (14) 19W LEDs, replacing (5) 150W high pressure sodium fixtures.

Lighting operation schedules were also collected through staff interviews to determine AOH.

Calculation Parameters

Savings calculations were performed using the methods described section 2.2.2. of this report. Parameters specific to this site are listed below in Table A:

Table A, Savings Parameters

Space Type	***Air Conditioned***	***Annual Hours***	***IEF_E***	***IEF_D***	***CF***
Exterior	No	4,313	1.00	1.00	0%

Savings Calculations

Table B, Lighting Retrofit kWh Savings Calculations

Measure	*Quantity (Fixtures)*		*Wattage*		*AOH*	*Expected kWh Savings*	*Realized kWh Savings*	*IEF_E*	*Realization Rate*
	Base	*Post*	*Base*	*Post*					
HPS150 to LED19W	5	14	188	19	4,313	2,642	4,529	1.00	171.4%
					Total	**2,642**	**4,529**		**171.4%**

Table C, Lighting Retrofit kW Savings Calculations

Measure	*Quantity (Fixtures)*		*Wattage*		*CF*	*Expected kW Savings*	*Realized kW Savings*	*IEF_D*	*Realization Rate*
	Base	*Post*	*Base*	*Post*					
HPS150 to LED19W	5	14	188	19	0.00	0.66	0.00	1.00	0.0%
					Total	**0.66**	**0.00**		**0.0%**

Results

The kWh and kW realization rates for Project 1 are 171.4% and 0.0%, respectively.

Ex ante calculations assumed annual lighting hours of operation of 4,105, however the lights are on photosensors, so *ex ante* calculations use non-daylight hours appropriate for the IID territory (4,313), raising the realization rate. Also, *ex ante* calculations assumed newly-installed energy efficient fixture wattage was 28W per lamp, however during the on-site inspection it was discovered that the new lighting was only 19 watts per lamp. The Evaluators also adjust pre-retrofit wattages of the high pressure sodium fixtures from 150w to 188w to account for the ballast factor. Both of these adjustments increased the kWh realization rate. Finally, these lamps only operate during non-daylight hours, thus provide no peak kW reduction.

Table D, Verified Gross Savings & Realization Rates

Measure	***Verified***			
	kWh Savings	***kW Savings***	***kWh Realization Rate***	***kW Realization Rate***
HPS150 to LED19W	4,529	0.00	171.4%	0.0%
Total	**4,529**	**0.00**	**171.4%**	**0.0%**

Project Number Project 2

Program CESP 2014

Project Background

The participant is a boutique clothing store that received incentives from IID for retrofitting existing lighting with energy efficient lighting. Evaluators verified the installation and operation of the following measures:

- (94) 9W LED lamps, replacing (94) 20W halogen lamps
- (30) 4W LED lamps, replacing (30) 35W halogen lamps

Lighting operation schedules were also collected through staff interviews to determine AOH.

Calculation Parameters

Savings calculations were performed using the methods described in section 2.2.2. of this report. Parameters specific to this site are listed below in Table A:

Table A, Savings Parameters

Space Type	***Air Conditioned***	***Annual Hours***	***IEF_E***	***IEF_D***	***CF***
Small Retail	Yes	2,190	1.17	1.24	88%

Savings Calculations

Table B, Lighting Retrofit kWh Savings Calculations

Measure	*Quantity (Fixtures)*		*Wattage*		*AOH*	*Expected kWh Savings*	*Realized kWh Savings*	*IEF_E*	*Realization Rate*
	Base	*Post*	*Base*	*Post*					
H20/1 to 9W LED	94	94	20	9	2,190	3,774	2,649	1.17	70.2%
H35/1 to 4W LED	30	30	35	4	2,190	3,395	2,383	1.17	70.2%
					Total	**7,169**	**5,032**		**70.2%**

Table C, Lighting Retrofit kW Savings Calculations

Measure	*Quantity (Fixtures)*		*Wattage*		*CF*	*Expected kW Savings*	*Realized kW Savings*	*IEF_D*	*Realization Rate*
	Base	*Post*	*Base*	*Post*					
H20/1 to 9W LED	94	94	20	9	0.88	1.03	1.13	1.24	109.7%
H35/1 to 4W LED	30	30	35	4	0.88	0.93	1.01	1.24	108.6%
					Total	**1.96**	**2.14**		**109.2%**

Results

The kWh realization rate for Project 2 is 70.2% and the kW realization rate is 109.2%.

The kWh realization rate is low because annual lighting hours used in *ex ante* calculations (3,650) were much lower than those verified on site and used in *ex post* calculations (2,190). Also, *ex ante* calculations did not use energy or demand factors to account for the reduced load on the HVAC system because of the more efficient lighting. Accounting for these in *ex post* calculations increased both kWh and peak kW realized savings.

Table D, Verified Gross Savings & Realization Rates

Measure	***Verified***			
	kWh Savings	***kW Savings***	***kWh Realization Rate***	***kW Realization Rate***
H20 to LED9W	2,649	1.13	70.2%	109.7%
H35 to LED4W	2,383	1.01	70.2%	108.6%
Total	**5,032**	**2.14**	**70.2%**	**109.2%**

Project Number Project 3

Program CESP 2015

Project Background

The participant is a community center that received incentives from IID for replacing existing HVAC units with energy efficient HVAC units. Evaluators verified the installation and operation of the following measures:

- Two 15-ton IPC units

Calculation Parameters

Savings calculations were performed using savings methodology described below using site visit data and deemed values

$$Annual\ Energy\ Savings = (kW_{Pre} - kW_{Post})\ x\ EFLH$$

$$kW_{Pre} = \frac{Tonnage\ x\ 12}{EER_{Pre}}$$

$$kW_{Post} = \frac{Tonnage\ x\ 12}{EER_{post}}$$

Where,
kW_{Pre}Baseline HVAC full load energy usage, kW
kW_{Post}InstalLED HVAC full load energy usage, kW
EER_{pre}Baseline HVAC rated energy efficiency rating, BTUh/Watt
EER_{Post}InstalLED HVAC rated energy efficiency rating, BTUh/Watt
EFLHEstimated full load hours per year, hr/yr
$Tonnage$Total HVAC rated tonnage, tons
12Conversion factor BTUh to tons (12,000 :1) and W to kW (1,000 :1)

Savings parameters specific to this site are listed below in Table A:

Table A, Savings Parameters

Space Type	*EER*	*Tons*	*kW*	*EFLH*
Pre	7.8	30	46.2	880
Post	10.6	30	34.0	880

Savings Calculations

Table B, HVAC kWh Savings Calculations

Measure	*EER*		*EFLH*	*Ton*	*Expected kWh Savings*	*Realized kWh Savings*	*Realization Rate*
	Base	*Post*					
HVAC	7.8	10.6	880	30	10,729	10,729	100.0%
				Total	**10,729**	**10,729**	**100.0%**

Table C, HVAC kW Savings Calculations

Measure	*EER*		*EFLH*	*Ton*	*Expected kW Savings*	*Realized kW Savings*	*Realization Rate*
	Base	*Post*					
HVAC	7.8	10.6	880	30	12.2	12.2	100.0%
				Total	**12.2**	**12.2**	**100.0%**

Results

The kWh and kW realization rates for Project 3 are both 100.0%.

Table D, Verified Gross Savings & Realization Rates

Measure	***Verified***			
	kWh Savings	***kW Savings***	***kWh Realization Rate***	***kW Realization Rate***
HVAC	10,729	12.2	100.0%	100.0%
Total	**10,729**	**12.2**	**100.0%**	**100.0%**

Project Number Project 4

Program CESP 2015

Project Background

The participant is an auto parts store that received incentives from IID for retrofitting existing exterior lighting with energy efficient lighting. On-site, the Evaluators verified the installation and operation of the following measures:

- (40) 30w LED - non-int. ballasts replaced (40) 4' 2-lamp T8 fixtures;
- (54) 60w LED - non-int. ballasts replaced (54) 4' 3-lamp T8 28w fixtures; and
- (3) 15w LED - non-int. ballasts replaced (3) 4' 1-lamp T8 fixtures.

Lighting operation schedules were also collected through staff interviews to determine AOH.

Calculation Parameters

Savings calculations were performed using the methods described section 2.2.2. of this report. Parameters specific to this site are listed below in Table A:

Table A, Savings Parameters

Space Type	***Air Conditioned***	***Annual Hours***	***IEF_E***	***IEF_D***	***CF***
Small Retail	Yes	5,460	1.17	1.24	88%

Savings Calculations

Table B, Lighting Retrofit kWh Savings Calculations

Measure	*Quantity (Fixtures)*		*Wattage*		*AOH*	*Expected kWh Savings*	*Realized kWh Savings*	*IEF_E*	*Realization Rate*
	Base	*Post*	*Base*	*Post*					
F32T8 to LED30W	40	40	48	30	5,460	3,931	4,875	1.24	124.0%

F32T8-28W to LED60W	54	54	97	60	5,460	10,909	13,527	1.24	124.0%
F32T8 to LED15W	3	3	25	15	5,460	164	203	1.24	123.8%
					Total	**15,004**	**18,605**		**124.0%**

Table C, Lighting Retrofit kW Savings Calculations

Measure	***Quantity (Fixtures)***		***Wattage***		***CF***	***Expected kW Savings***	***Realized kW Savings***	***IEF_D***	***Realization Rate***
	Base	***Post***	***Base***	***Post***					
F32T8 to LED30W	40	40	48	30	0.88	0.72	0.84	1.17	116.7%
F32T8-28W to LED60W	54	54	97	60	0.88	2.00	2.34	1.17	117.0%
F32T8 to LED15W	3	3	25	15	0.88	0.03	0.04	1.17	133.3%
					Total	**2.75**	**3.22**		**117.1%**

Results

The kWh and kW realization rates for project Project 4 are 124.0% and 117.1%, respectively.

Ex ante calculations did not use energy or demand factors to account for the reduced load on the HVAC system as a result of the more efficient lighting. Accounting for these in *ex post* calculations increased both kWh and peak kW realized savings.

Table D, Verified Gross Savings & Realization Rates

Measure	***Verified***			
	kWh Savings	***kW Savings***	***kWh Realization Rate***	***kW Realization Rate***
F32T8 to LED30W	4,875	0.84	124.0%	116.7%
F32T8-28W to LED60W	13,527	2.34	124.0%	117.0%
F32T8 to LED15W	203	0.04	123.8%	133.3%

Total	**18,605**	**3.22**	**124.0%**	**117.1%**

Project Number Project 5

Program CESP 2015

Project Background

The participant is a convenience store that received incentives from IID for implementing a facility Energy Management System (EMS). On-site, the Evaluators verified the installation and operation of the following measures:

- EMS controls

Calculation Parameters

Savings calculations were performed by analyzing the savings associated with this same measure on several similar systems. Savings at 179 other stores were analyzed using a billing analysis for 12 months before and after installation was completed. An average of all the facility savings is used for this store. Since this facility did not upgrade the lighting system as was done on the other sites, the potential energy savings for lighting was subtracted from the average savings.

$$Annual\ Energy\ Savings = Average\ EMS\ savings - Lighting\ Savings$$
$$Lighting\ Savings = Ext\ Light\ x\ Runtime\ Reduction\ x\ 365$$

Where,
$Average\ EMS\ Savings$Whole facility EMS savings based on past projects, kWh
$Lighting\ Savings$EMS savings associated with the exterior lighting, kWh
$Ext\ Light$Average exterior lighting wattage, kW
$Runtime\ Reduction$EMS reduced daily reduced runtime, hours/day
365Days per year, days/year

Savings parameters used are shown in Savings calculations were performed using the methods described in section 2.2.2. of this report. Parameters specific to this site are listed below in Table A:

Table A, *Savings Parameters*

Space Type	***EMS Savings***	***Lighting Savings***	***kWh Savings***
Small Retail	16,323	2,730	13,593

Savings Calculations

Table B, HVAC kWh Savings Calculations

Measure	*Expected kWh Savings*	*Realized kWh Savings*	*Realization Rate*
EMS	15,870	13,593	85.7%
Total	**15,870**	**13,593**	**85.7%**

Table C, HVAC kW Savings Calculations

Measure	*Expected kW Savings*	*Realized kW Savings*	*Realization Rate*
EMS	1.81	1.55	85.7%
Total	**1.81**	**1.55**	**85.7%**

Results

The kWh and kW realization rates for Project 5 are both 85.7%.

Ex-ante calculations removed 16 stores that showed negative savings comparing the 12 months before and after the EMS was installed. The reason for removal was unclear. The Evaluators included data from all sites in their calculations, resulting in a lower realized savings.

Table D, Verified Gross Savings & Realization Rates

Measure	***Verified***			
	kWh Savings	***kW Savings***	***kWh Realization Rate***	***kW Realization Rate***
EMS	13,593	1.55	85.7%	85.7%
Total	**13,593**	**1.55**	**85.7%**	**85.7%**

Project Number Project 6

Program NCEEP 2015

Project Background

The participant is a new construction fast food restaurant that received incentives from IID for implementing energy efficient improvements above code minimum. On-site, the Evaluators verified the installation and operation of the following measures:

- Four (4) packaged rooftop air conditioning units
- Double pane windows
- LED lighting

Calculation Parameters

Savings calculations were performed using an energy model compared to title 24 minimum building code. The evaluator checked the provided energy model for consistency with the site visit and building plans as well as doing ballpark savings estimates to validate the claimed savings.

$$Annual\ Energy\ Savings = Baseline\ Energy\ Usage - Proposed\ Energy\ Usage$$

Where,

$Baseline\ Energy\ Usage$Baseline Title 24 energy usage, kWh/yr

$Proposed\ Energy\ Usge$Proposed energy usage, kWh/yr

Savings Calculations

Table A, HVAC kWh Savings Calculations

Measure	*kWh*		*Area*	*Expected kWh Savings*	*Realized kWh Savings*	*Realization Rate*
	Baseline	*Proposed*				
New Construction	258,009	29,193	5,155	28,816	28,816	100.0%
			Total	**28,816**	**28,816**	**100.0%**

Table B, HVAC kW Savings Calculations

Measure	*kW*		*Area*	*Expected kW Savings*	*Realized kW Savings*	*Realization Rate*
	Baseline	*Proposed*				
New Construction	67.4	60.4	5,155	7.0	7.0	100.0%
			Total	**7.0**	**7.0**	**100.0%**

Results

The kWh and kW realization rates for Project 6 are both 100.0%.

Table C, Verified Gross Savings & Realization Rates

Measure	***Verified***			
	kWh Savings	***kW Savings***	***kWh Realization Rate***	***kW Realization Rate***
New Construction	28,816	7.0	100.0%	100.0%
Total	**28,816**	**7.0**	**100.0%**	**100.0%**

Project Number Project 7

Program CESP 2014

Project Background

The participant is a 24-hour gym that received incentives from IID for retrofitting existing lighting with energy efficient lighting. On-site, the Evaluators verified the installation and operation of the following measures:

- (12) 150W LED fixtures, replacing (12) 400W metal halides; and
- (12) 78W LED fixtures, replacing (12) 250W metal halides.

Lighting operation schedules were also collected through staff interviews to determine AOH.

Calculation Parameters

Savings calculations were performed using the methods described section 2.2.2. of this report. Parameters specific to this site are listed below in Table A:

Table A, Savings Parameters

Space Type	***Air Conditioned***	***Annual Hours***	***IEF_E***	***IEF_D***	***CF***
Small Retail	Yes	8,760	1.17	1.24	100%

Savings Calculations

Table B, Lighting Retrofit kWh Savings Calculations

Measure	*Quantity (Fixtures)*		*Wattage*		*AOH*	*Expected kWh Savings*	*Realized kWh Savings*	*IEF_E*	*Realization Rate*
	Base	*Post*	*Base*	*Post*					
MH400 to LED150W	12	12	456	150	8,760	16,083	37,635	1.17	234.0%
MH250 to LED78W	12	12	291	78	8,760	22,391	26,197	1.17	117.0%
					Total	**38,474**	**63,832**		**165.9%**

Table C, Lighting Retrofit kW Savings Calculations

Measure	*Quantity (Fixtures)*		*Wattage*		*CF*	*Expected kW Savings*	*Realized kW Savings*	*IEF_D*	*Realization Rate*
	Base	*Post*	*Base*	*Post*					
MH400 to LED150W	12	12	456	150	1.00	3.67	4.30	1.17	117.2%
MH250 to LED78W	12	12	291	78	1.00	2.56	2.99	1.17	116.8%
					Total	**6.23**	**7.29**		**117.0%**

Results

The kWh and kW realization rates for project Project 7 are 165.9% and 117.0%, respectively.

Ex ante calculation assumed that 12 fixtures operated 4,380 hours annually, however on site the Evaluators determined all fixtures operated continuously (8,760), resulting in high kWh savings for those lamps. Additionally, *ex ante* calculations did not account for the reduced load on the HVAC system as a result of the more efficient lighting. Accounting for this increased both kWh and peak kW savings.

Table D, Verified Gross Savings & Realization Rates

Measure	*Verified*			
	kWh Savings	*kW Savings*	*kWh Realization Rate*	*kW Realization Rate*
MH400 to LED150W	37,635	4.30	234.0%	117.2%
MH250 to LED78W	26,197	2.99	117.0%	116.8%
Total	**63,832**	**7.29**	**165.9%**	**117.0%**

Project Number Project 8

Program CESP 2015

Project Background

The participant is a grocery store that received incentives from IID for replacing shaded pole motors with electronically commutated motors (ECM) and installing night covers on open display cases. On-site, the Evaluators verified the installation and operation of the following measures:

- 26 ECMs in walk-in refrigerator
- 7 ECMs in walk-in freezers
- 107 ECMs in reach-in refrigerators
- 45 four foot vertical night covers
- 1 seven foot vertical night cover
- 4 six foot horizontal night covers

Calculation Parameters

Savings calculations were performed by using prescriptive deemed savings from SCE and PG&E workpaper studies.

$$Annual\ Energy\ Savings = ECM\ Savings + Night\ Cover\ Savings$$

$$ECM\ Savings = \sum_{ECM} \#\ of\ Motors\ x\ Savings\ per\ Motor$$

$$Night\ Cover\ Savings = \sum_{Cover} Linear\ Feet\ of\ Cover\ x\ Savings\ per\ Linear\ Foot$$

Parameters specific to this site are listed below in Table A:

Table A, Savings Parameters

Measure Type	***# of Motors or Linear Ft***	***kWh/motor or kWh/LF***	***kWh Savings***
ECM Reach-in	106	227	24,062
ECM Refrigerator Walk-in	26	566	14,716
ECM Freezer Walk-in	7	714	4,998
Horizontal Night Cover	24	28.89	693

Vertical Night Cover	187	25,875	531

Savings Calculations

Table B, HVAC kWh Savings Calculations

Measure	*Expected kWh Savings*	*Realized kWh Savings*	*Realization Rate*
ECM	55,392	43,776	79.03%
Night Covers	12,334	26,569	215.41%
Total	**67,726**	**70,345**	**103.87%**

Table C, HVAC kW Savings Calculations

Measure	*Expected kW Savings*	*Realized kW Savings*	*Realization Rate*
ECM	-	9.91	-
Night Covers	0	0	-
Total	**-**	**9.91**	**-**

Results

The kWh realization rate for Project 8 is 103.87%. While not claimed in *ex ante* calculations, the project resulted in 9.91 peak kW savings.

The realization rate is high because the *ex post* calculations used the savings values from the SCE and PG&E workpapers as the deemed savings sources. A few minor quantity variations were found between the ex-ante calculations and the invoice provided but these had a very minor effect on the savings.

Table D, Verified Gross Savings & Realization Rates

Measure	***Verified***			
	kWh Savings	***kW Savings***	***kWh Realization Rate***	***kW Realization Rate***
ECM	43,776	9.91	79.0%	-
Night Covers	26,569	-	215.4%	-
Total	**70,345**	**9.91**	**103.9%**	**-**

Project Number Project 9

Program CESP 2015

Project Background

The participant is a senior community that received incentives from IID for retrofitting existing lighting with energy efficient lighting. On-site, the Evaluators verified the installation and operation of the following measures:

- (200) 18w LED - non-int. ballasts replaced (200) 4' 1-lamp T8s;
- (42) 7w LED - non-int. ballasts replaced (42) 35w 1-lamp halogens;
- (125) 9w LED - non-int. ballasts replaced (125) 2' 1-lamp T8s;
- (252) 16w LED - non-int. ballasts replaced (252) 4' 1-lamp T8s;
- (246) 12w LED - non-int. ballasts replaced (246) 4' 1-lamp T8s;
- (76) 11w LED - non-int. ballasts replaced (76) 60w incandescent fixtures; and
- (142) 5w LED - non-int. ballasts replaced (142) 25w incandescent fixtures.

Lighting operation schedules were also collected through staff interviews to determine AOH.

Calculation Parameters

Lighting savings calculations were performed using the methods described in section 2.2.2. of this report. Parameters specific to this site are listed below in Table A:

Table A, Savings Parameters

Space Type	***Air Conditioning***	***Annual Hours***	***IEF_E***	***IEF_D***	***CF***
Small Office	Yes	5,658 5,840	1.21	1.30	100% 19
Exterior	No	4,380	1.00	1.00	0%

[19] Based upon verified operating schedules.

Savings Calculations

Table B, Lighting Retrofit kWh Savings Calculations

Measure	*Quantity (Fixtures)*		*Wattage*		*AOH*	*Expected kWh Savings*	*Realized kWh Savings*	*IEF_E*	*Realization Rate*
	Base	*Post*	*Base*	*Post*					
F32T8 to LED18W	78	78	32	18	5,658	5,182	7,475	1.21	144.3%
F32T8 to LED18W	74	74	32	18	5,658	4,917	7,092	1.21	144.2%
F32T8 to LED18W	48	48	32	18	5,840	3,189	4,749	1.21	148.9%
F17T8 to LED9W	125	125	17	9	5,840	4,745	7,066	1.21	148.9%
F32T8 to LED16W	252	252	32	16	5,840	19,132	28,492	1.21	148.9%
F32T8 to LED12W	188	188	32	12	5,840	17,841	26,570	1.21	148.9%
F32T8 to LED12W	30	30	32	12	4,313	2,848	2,588	1.00	90.9%
F32T8 to LED12W	28	28	32	12	5,658	2,657	3,834	1.21	144.3%
I60 to LED11W	49	49	60	11	5,840	11,393	16,966	1.21	148.9%
I60 to LED11W	27	27	60	11	4,313	6,279	5,706	1.00	90.9%
I25 to LED5W	72	72	25	5	5,840	6,833	10,176	1.21	148.9%
I25 to LED5W	48	48	25	5	5,840	4,555	6,784	1.21	148.9%
I25 to LED5W	10	10	25	5	4,313	949	863	1.00	90.9%
I25 to LED5W	12	12	25	5	4,313	1,139	1,035	1.00	90.9%
H35 to LED7W	24	24	35	7	4,313	3,189	2,898	1.00	90.9%
H35 to LED7W	18	18	35	7	4,313	2,391	2,174	1.00	90.9%
					Total	**97,239**	**134,467**		**138.3%**

Table C, Lighting Retrofit kW Savings Calculations

Measure	*Quantity (Fixtures)*		*Wattage*		*CF*	*Expected kW Savings*	*Realized kW Savings*	*IEF_D*	*Realization Rate*
	Base	*Post*	*Base*	*Post*					
F32T8 to LED18W	78	78	32	18	1.00	1.09	1.42	1.30	130.3%
F32T8 to LED18W	74	74	32	18	1.00	1.04	1.35	1.30	129.8%
F32T8 to LED18W	48	48	32	18	1.00	0.67	0.87	1.30	129.9%
F17T8 to LED9W	125	125	17	9	1.00	1.00	1.30	1.30	130.0%
F32T8 to LED16W	252	252	32	16	1.00	4.03	5.24	1.30	130.0%
F32T8 to LED12W	188	188	32	12	1.00	3.76	4.89	1.30	130.1%
F32T8 to LED12W	30	30	32	12	0.00	0.60	0.00	1.00	0.0%
F32T8 to LED12W	28	28	32	12	1.00	0.56	0.73	1.30	130.4%
I60 to LED11W	49	49	60	11	1.00	2.40	3.12	1.30	130.0%
I60 to LED11W	27	27	60	11	0.00	1.32	0.00	1.00	0.0%
I25 to LED5W	72	72	25	5	1.00	1.44	1.87	1.30	129.9%
I25 to LED5W	48	48	25	5	1.00	0.96	1.25	1.30	130.2%
I25 to LED5W	10	10	25	5	0.00	0.20	0.00	1.00	0.0%
I25 to LED5W	12	12	25	5	0.00	0.24	0.00	1.00	0.0%
H35 to LED7W	24	24	35	7	0.00	0.67	0.00	1.00	0.0%
H35 to LED7W	18	18	35	7	0.00	0.50	0.00	1.00	0.0%
					Total	**20.48**	**22.04**		**107.6%**

Results

The kWh and kW realization rates for Project 9 are 138.3% and 107.6%, respectively.

Ex ante calculations assumed all areas operated 4,745 hours annually. On site the Evaluators collected operating hours by area and adjusted savings calculations to reflect actual hours of operation: 5,658 and 5,840, depending upon specific area.

These changes raised kWh savings estimates. All exterior retrofits assumed 4,380 AOH, however these were also adjusted to 4,313 to match the IID territory NDH. *Ex ante* calculations did not use interactive energy or demand factors to account for the reduced load on the HVAC system because of the more efficient lighting. Accounting for these in *ex post* calculations increased both kWh and peak kW realized savings. Finally, all *ex ante* kW reduction calculations assumed a 100% peak coincidence factor for exterior lighting. The Evaluators adjusted this factor to 0% to account for dusk-to-dawn operation reducing the kW realization rate.

Table D, Verified Gross Savings & Realization Rates

Measure	***Verified***			
	kWh Savings	***kW Savings***	***kWh Realization Rate***	***kW Realization Rate***
F32T8 to LED18W	7,475	1.42	144.3%	130.3%
F32T8 to LED18W	7,092	1.35	144.2%	129.8%
F32T8 to LED18W	4,749	0.87	148.9%	129.9%
F17T8 to LED9W	7,066	1.30	148.9%	130.0%
F32T8 to LED16W	28,492	5.24	148.9%	130.0%
F32T8 to LED12W	26,570	4.89	148.9%	130.1%
F32T8 to LED12W	2,588	0.00	90.9%	0.0%
F32T8 to LED12W	3,834	0.73	144.3%	130.4%
I60 to LED11W	16,966	3.12	148.9%	130.0%
I60 to LED11W	5,706	0.00	90.9%	0.0%
I25 to LED5W	10,176	1.87	148.9%	129.9%
I25 to LED5W	6,784	1.25	148.9%	130.2%
I25 to LED5W	863	0.00	90.9%	0.0%
I25 to LED5W	1,035	0.00	90.9%	0.0%
H35 to LED7W	2,898	0.00	90.9%	0.0%

H35 to LED7W	2,174	0.00	90.9%	0.0%
Total	**134,467**	**22.04**	**138.3%**	**107.6%**

Project Number Project 10

Program CESP 2015

Project Background

The participant is an elementary school that received incentives for retrofitting interior and exterior lighting, installing occupancy sensors to control portions of the newly-installed lighting and retrofitting existing air conditioners and heat pumps with more efficient units. On-site, the Evaluators verified the installation and operation of the following measures:

- (584)4' 3-Lamp T8 28W RLOs r replaced (584) 3' 4-Lamp T8s
- (72)4' 2-Lamp T8 28W RLOs r replaced (72) 4' 2-Lamp T8s
- (18)29W LED - Non-Int. ballasts r replaced (18) 70W metal halides
- (8)29W LED - Non-Int. ballasts r replaced (8) 3' 4-Lamp T8s

Additionally, occupancy sensors were installed to control 100 of the newly-installed fixtures. On site, lighting operation schedules were also collected through staff interviews and photo-logging equipment was placed on site to monitor lighting operation.

Calculation Parameters

Lighting savings calculations were performed using the methods described section 2.2.2. of this report. Parameters specific to this site are listed below in Table A:

Table A Savings Parameters

Space Type	***Air Conditioned***	***Annual Hours***	***IEF_E***	***IEF_D***	***CF***
Primary School (classrooms)	Yes	1,800	1.21	1.30	20%
Primary School (non-classrooms)	Yes	Custom, varies by area	1.21	1.30	20%
Exterior	No	4,313	1.00	1.00	0%

Savings Calculations

Table B, Lighting Retrofit kWh Savings Calculations

Measure	*Quantity (Fixtures)*		*Wattage*		*AOH (no sensors)*	*AOH (w/ sensor reduction)*	*Expected kWh Savings*	*Realized kWh Savings*	*IEF_E*	*Realization Rate*
	Base	*Post*	*Base*	*Post*						
FU40T12 to FU32T8/6	5	5	72	48	3,000	3,000	360	436	1.21	121.0%
F32T8 to F25T8	4	4	59	42	3,000	3,000	204	247	1.21	121.0%
F32T8 to F25T8	4	4	59	42	2,800	2,800	190	230	1.21	121.3%
F32T8 to F25T8	2	2	59	42	3,000	3,000	102	123	1.21	121.0%
F32T8 to F25T8	4	4	59	42	2,800	2,800	190	230	1.21	121.3%
F32T8 to F25T8	4	4	59	42	3,000	3,000	204	247	1.21	121.0%
F32T8 to F25T8	4	4	59	42	3,000	3,000	204	247	1.21	121.0%
FU40T12 to FU32T8/6	15	15	72	48	3,500	3,500	1,260	1,525	1.21	121.0%
FU40T12 to FU32T8/6	4	4	72	48	3,500	3,500	336	407	1.21	121.0%
F32T8 to F25T8	1	1	59	42	2,400	2,400	41	49	1.21	120.4%
F32T8 to F25T8	1	1	59	42	2,800	2,800	48	58	1.21	120.0%
F32T8 to F25T8	4	4	59	42	3,000	3,000	204	247	1.21	121.0%
F32T8 to F25T8	1	1	59	42	500	500	9	10	1.21	114.3%
F32T8 to F25T8	10	10	59	42	3,000	3,000	510	617	1.21	121.0%
F32T8 to F25T8	2	2	59	42	2,800	2,800	95	115	1.21	121.3%
FU40T12 to FU32T8/6	24	24	72	48	2,200	2,200	1,267	1,533	1.21	121.0%
F32T8 to F25T8	2	2	59	42	2,200	2,200	75	91	1.21	120.7%
F32T8 to F25T8	1	1	59	42	2,400	2,400	41	49	1.21	120.4%
F32T8 to F25T8	1	1	59	42	2,400	2,400	41	49	1.21	120.4%
MH400 to LED100W	3	3	458	100	4,313	4,313	4,704	4,632	1.00	98.5%
HPS100 to LED40W	29	29	130	40	4,313	4,313	11,432	11,257	1.00	98.5%

MH400 to LED150W	30	30	453	150	4,313	4,313	39,814	39,205	1.00	98.5%
F32T8 to F25T8	20	20	59	42	1,800	1,800	612	741	1.21	121.0%
F32T8 to F25T8	1	1	59	42	1,800	1,800	31	37	1.21	119.4%
F32T8 to F25T8	1	1	59	42	1,800	1,800	31	37	1.21	119.4%
F32T8 to F25T8	3	3	59	42	1,800	1,800	92	111	1.21	120.7%
F32T8 to F25T8	1	1	59	42	1,800	1,800	31	37	1.21	119.4%
F32T8 to F25T8	20	20	59	42	1,800	1,800	612	741	1.21	121.0%
F32T8 to F25T8	1	1	59	42	1,800	1,800	31	37	1.21	119.4%
F32T8 to F25T8	1	1	59	42	1,800	1,800	31	37	1.21	119.4%
F32T8 to F25T8	20	20	59	42	1,800	1,800	612	741	1.21	121.0%
F32T8 to F25T8	1	1	59	42	1,800	1,800	31	37	1.21	119.4%
F32T8 to F25T8	1	1	59	42	1,800	1,800	31	37	1.21	119.4%
F32T8 to F25T8	3	3	59	42	1,800	1,800	92	111	1.21	120.7%
F32T8 to F25T8	1	1	59	42	1,800	1,800	31	37	1.21	119.4%
F32T8 to F25T8	20	20	59	42	1,800	1,800	612	741	1.21	121.0%
F32T8 to F25T8	1	1	59	42	1,800	1,800	31	37	1.21	119.4%
F32T8 to F25T8	1	1	59	42	1,800	1,800	31	37	1.21	119.4%
MH400 to LED100W	7	7	458	100	4,313	4,313	10,976	10,808	1.00	98.5%
F32T8 to F25T8	18	18	59	42	1,800	1,800	551	666	1.21	121.0%
F40T12/ES to F25T8	3	3	32	21	1,800	1,800	59	72	1.21	121.8%
F32T8 to F25T8	18	18	59	42	1,800	1,800	551	666	1.21	121.0%
F40T12/ES to F25T8	3	3	32	21	1,800	1,800	59	72	1.21	121.8%
F32T8 to F25T8	18	18	59	42	1,800	1,800	551	666	1.21	121.0%
F40T12/ES to F25T8	3	3	32	21	1,800	1,800	59	72	1.21	121.8%
F32T8 to F25T8	18	18	59	42	1,800	1,800	551	666	1.21	121.0%
F40T12/ES to F25T8	3	3	32	21	1,800	1,800	59	72	1.21	121.8%

F32T8 to F25T8	18	18	59	42	1,800	1,800	551	666	1.21	121.0%
F40T12/ES to F25T8	3	3	32	21	1,800	1,800	59	72	1.21	121.8%
F32T8 to F25T8	18	18	59	42	1,800	1,800	551	666	1.21	121.0%
F40T12/ES to F25T8	3	3	32	21	1,800	1,800	59	72	1.21	121.8%
F32T8 to F25T8	18	18	59	42	1,800	1,800	551	666	1.21	121.0%
F40T12/ES to F25T8	3	3	32	21	1,800	1,800	59	72	1.21	121.8%
F32T8 to F25T8	3	3	59	42	2,400	2,400	122	148	1.21	121.4%
F32T8 to F25T8	3	3	59	42	2,400	2,400	122	148	1.21	121.4%
MH100 to LED30W	2	2	130	30	4,313	4,313	876	863	1.00	98.5%
F32T8 to F25T8	18	18	59	42	1,800	1,800	551	666	1.21	121.0%
F40T12/ES to F25T8	3	3	32	21	1,800	1,800	59	72	1.21	121.8%
F32T8 to F25T8	18	18	59	42	1,800	1,800	551	666	1.21	121.0%
F40T12/ES to F25T8	3	3	32	21	1,800	1,800	59	72	1.21	121.8%
F32T8 to F25T8	18	18	59	42	1,800	1,800	551	666	1.21	121.0%
F40T12/ES to F25T8	3	3	32	21	1,800	1,800	59	72	1.21	121.8%
F32T8 to F25T8	18	18	59	42	1,800	1,800	551	666	1.21	121.0%
F40T12/ES to F25T8	3	3	32	21	1,800	1,800	59	72	1.21	121.8%
F32T8 to F25T8	18	18	59	42	1,800	1,800	551	666	1.21	121.0%
F40T12/ES to F25T8	3	3	32	21	1,800	1,800	59	72	1.21	121.8%
F32T8 to F25T8	18	18	59	42	1,800	1,800	551	666	1.21	121.0%
F40T12/ES to F25T8	3	3	32	21	1,800	1,800	59	72	1.21	121.8%
F32T8 to F25T8	18	18	59	42	1,800	1,800	551	666	1.21	121.0%
F40T12/ES to F25T8	3	3	32	21	1,800	1,800	59	72	1.21	121.8%
F32T8 to F25T8	3	3	59	42	2,400	2,400	122	148	1.21	121.4%
F32T8 to F25T8	3	3	59	42	2,400	2,400	122	148	1.21	121.4%
MH100 to LED30W	2	2	130	30	4,313	4,313	876	863	1.00	98.5%

F32T8 to F25T8	18	18	59	42	1,800	1,800	551	666	1.21	121.0%
F40T12/ES to F25T8	3	3	32	21	1,800	1,800	59	72	1.21	121.8%
F32T8 to F25T8	18	18	59	42	1,800	1,800	551	666	1.21	121.0%
F40T12/ES to F25T8	3	3	32	21	1,800	1,800	59	72	1.21	121.8%
F32T8 to F25T8	18	18	59	42	1,800	1,800	551	666	1.21	121.0%
F40T12/ES to F25T8	3	3	32	21	1,800	1,800	59	72	1.21	121.8%
F32T8 to F25T8	18	18	59	42	1,800	1,800	551	666	1.21	121.0%
F40T12/ES to F25T8	3	3	32	21	1,800	1,800	59	72	1.21	121.8%
F32T8 to F25T8	18	18	59	42	1,800	1,800	551	666	1.21	121.0%
F40T12/ES to F25T8	3	3	32	21	1,800	1,800	59	72	1.21	121.8%
F32T8 to F25T8	18	18	59	42	1,800	1,800	551	666	1.21	121.0%
F40T12/ES to F25T8	3	3	32	21	1,800	1,800	59	72	1.21	121.8%
F32T8 to F25T8	18	18	59	42	1,800	1,800	551	666	1.21	121.0%
F40T12/ES to F25T8	3	3	32	21	1,800	1,800	59	72	1.21	121.8%
F32T8 to F25T8	3	3	59	42	2,400	2,400	122	148	1.21	121.4%
F32T8 to F25T8	3	3	59	42	2,400	2,400	122	148	1.21	121.4%
MH100 to LED30W	2	2	130	30	4,313	4,313	876	863	1.00	98.5%
F32T8 to F25T8	18	18	59	42	1,800	1,800	551	666	1.21	121.0%
F40T12/ES to F25T8	3	3	32	21	1,800	1,800	59	72	1.21	121.8%
F32T8 to F25T8	18	18	59	42	1,800	1,800	551	666	1.21	121.0%
F40T12/ES to F25T8	3	3	32	21	1,800	1,800	59	72	1.21	121.8%
F32T8 to F25T8	18	18	59	42	1,800	1,800	551	666	1.21	121.0%
F40T12/ES to F25T8	3	3	32	21	1,800	1,800	59	72	1.21	121.8%
F32T8 to F25T8	18	18	59	42	1,800	1,800	551	666	1.21	121.0%
F40T12/ES to F25T8	3	3	32	21	1,800	1,800	59	72	1.21	121.8%
F32T8 to F25T8	18	18	59	42	1,800	1,800	551	666	1.21	121.0%

F40T12/ES to F25T8	3	3	32	21	1,800	1,800	59	72	1.21	121.8%
F32T8 to F25T8	18	18	59	42	1,800	1,800	551	666	1.21	121.0%
F40T12/ES to F25T8	3	3	32	21	1,800	1,800	59	72	1.21	121.8%
F32T8 to F25T8	18	18	59	42	1,800	1,800	551	666	1.21	121.0%
F40T12/ES to F25T8	3	3	32	21	1,800	1,800	59	72	1.21	121.8%
F32T8 to F25T8	3	3	59	42	2,400	2,400	122	148	1.21	121.4%
F32T8 to F25T8	3	3	59	42	2,400	2,400	122	148	1.21	121.4%
MH100 to LED30W	2	2	130	30	4,313	4,313	876	863	1.00	98.5%
F32T8 to F25T8	18	18	59	42	1,800	1,800	551	666	1.21	121.0%
F40T12/ES to F25T8	3	3	32	21	1,800	1,800	59	72	1.21	121.8%
F32T8 to F25T8	18	18	59	42	1,800	1,800	551	666	1.21	121.0%
F40T12/ES to F25T8	3	3	32	21	1,800	1,800	59	72	1.21	121.8%
F32T8 to F25T8	18	18	59	42	1,800	1,800	551	666	1.21	121.0%
F40T12/ES to F25T8	3	3	32	21	1,800	1,800	59	72	1.21	121.8%
F32T8 to F25T8	18	18	59	42	1,800	1,800	551	666	1.21	121.0%
F40T12/ES to F25T8	3	3	32	21	1,800	1,800	59	72	1.21	121.8%
F32T8 to F25T8	18	18	59	42	1,800	1,800	551	666	1.21	121.0%
F40T12/ES to F25T8	3	3	32	21	1,800	1,800	59	72	1.21	121.8%
F32T8 to F25T8	18	18	59	42	1,800	1,800	551	666	1.21	121.0%
F40T12/ES to F25T8	3	3	32	21	1,800	1,800	59	72	1.21	121.8%
F32T8 to F25T8	18	18	59	42	1,800	1,800	551	666	1.21	121.0%
F40T12/ES to F25T8	3	3	32	21	1,800	1,800	59	72	1.21	121.8%
F32T8 to F25T8	3	3	59	42	2,400	2,400	122	148	1.21	121.4%
F32T8 to F25T8	3	3	59	42	2,400	2,400	122	148	1.21	121.4%
MH100 to LED30W	2	2	130	30	4,313	4,313	876	863	1.00	98.5%
F32T8 to F32T8-28W	16	16	118	63	2,200	2,200	1,936	2,343	1.21	121.0%

F32T8 to F32T8-25W	1	1	59	38	2,200	2,200	46	56	1.21	121.5%
F32T8 to F25T8	1	1	59	42	2,200	2,200	37	45	1.21	122.3%
F32T8 to F25T8	2	2	59	42	2,200	2,200	75	91	1.21	120.7%
F32T8 to F25T8	1	1	59	42	2,200	2,200	37	45	1.21	122.3%
F32T8 to F25T8	2	2	59	42	2,200	2,200	75	91	1.21	120.7%
MH400 to LED100W	3	3	458	100	4,313	4,313	4,704	4,632	1.00	98.5%
F32T8 to F25T8 w/sensor	10	10	59	42	1,800	1,476	518	535	1.21	103.3%
CF18W to LED10W	1	1	18	10	5,000	5,000	50	48	1.21	96.8%
F32T8 to F25T8 w/sensor	10	10	59	42	1,800	1,476	518	535	1.21	103.3%
CF18W to LED10W	1	1	18	10	5,000	5,000	50	48	1.21	96.8%
F32T8 to F25T8 w/sensor	10	10	59	42	1,800	1,476	518	535	1.21	103.3%
CF18W to LED10W	1	1	18	10	5,000	5,000	50	48	1.21	96.8%
F32T8 to F25T8 w/sensor	10	10	59	42	1,800	1,476	518	535	1.21	103.3%
CF18W to LED10W	1	1	18	10	5,000	5,000	50	48	1.21	96.8%
						Total	**111,381**	**117,239**		**105.3%**

Table C, Lighting Retrofit kW Savings Calculations

Measure	*Quantity (Fixtures)*		*Wattage*		*CF (no sensors)*	*CF (w/ sensor reduction)*	*Expected kW Savings*	*Realized kW Savings*	*IEF_D*	*Realization Rate*
	Base	*Post*	*Base*	*Post*						
FU40T12 to FU32T8/6	5	5	72	48	0.020	0.020	0.16	0.00	1.34	0.0%
F32T8 to F25T8	4	4	59	42	0.020	0.020	0.09	0.00	1.34	0.0%
F32T8 to F25T8	4	4	59	42	0.020	0.020	0.08	0.00	1.34	0.0%
F32T8 to F25T8	2	2	59	42	0.020	0.020	0.05	0.00	1.34	0.0%

F32T8 to F25T8	4	4	59	42	0.020	0.020	0.08	0.00	1.34	0.0%
F32T8 to F25T8	4	4	59	42	0.020	0.020	0.09	0.00	1.34	0.0%
F32T8 to F25T8	4	4	59	42	0.020	0.020	0.09	0.00	1.34	0.0%
FU40T12 to FU32T8/6	15	15	72	48	0.020	0.020	0.56	0.01	1.34	1.8%
FU40T12 to FU32T8/6	4	4	72	48	0.020	0.020	0.15	0.00	1.34	0.0%
F32T8 to F25T8	1	1	59	42	0.020	0.020	0.02	0.00	1.34	0.0%
F32T8 to F25T8	1	1	59	42	0.020	0.020	0.02	0.00	1.34	0.0%
F32T8 to F25T8	4	4	59	42	0.020	0.020	0.09	0.00	1.34	0.0%
F32T8 to F25T8	1	1	59	42	0.020	0.020	0.00	0.00	1.34	N/A
F32T8 to F25T8	10	10	59	42	0.020	0.020	0.23	0.00	1.34	0.0%
F32T8 to F25T8	2	2	59	42	0.020	0.020	0.04	0.00	1.34	0.0%
FU40T12 to FU32T8/6	24	24	72	48	0.020	0.020	0.56	0.02	1.34	3.6%
F32T8 to F25T8	2	2	59	42	0.020	0.020	0.03	0.00	1.34	0.0%
F32T8 to F25T8	1	1	59	42	0.020	0.020	0.02	0.00	1.34	0.0%
F32T8 to F25T8	1	1	59	42	0.020	0.020	0.02	0.00	1.34	0.0%
MH400 to LED100W	3	3	458	100	0.000	0.000	2.09	0.00	1.00	0.0%
HPS100 to LED40W	29	29	130	40	0.000	0.000	5.07	0.00	1.00	0.0%
MH400 to LED150W	30	30	453	150	0.000	0.000	17.66	0.00	1.00	0.0%
F32T8 to F25T8	20	20	59	42	0.020	0.020	0.27	0.01	1.34	3.7%
F32T8 to F25T8	1	1	59	42	0.020	0.020	0.01	0.00	1.34	0.0%
F32T8 to F25T8	1	1	59	42	0.020	0.020	0.01	0.00	1.34	0.0%
F32T8 to F25T8	3	3	59	42	0.020	0.020	0.04	0.00	1.34	0.0%
F32T8 to F25T8	1	1	59	42	0.020	0.020	0.01	0.00	1.34	0.0%
F32T8 to F25T8	20	20	59	42	0.020	0.020	0.27	0.01	1.34	3.7%
F32T8 to F25T8	1	1	59	42	0.020	0.020	0.01	0.00	1.34	0.0%
F32T8 to F25T8	1	1	59	42	0.020	0.020	0.01	0.00	1.34	0.0%

F32T8 to F25T8	20	20	59	42	0.020	0.020	0.27	0.01	1.34	3.7%
F32T8 to F25T8	1	1	59	42	0.020	0.020	0.01	0.00	1.34	0.0%
F32T8 to F25T8	1	1	59	42	0.020	0.020	0.01	0.00	1.34	0.0%
F32T8 to F25T8	3	3	59	42	0.020	0.020	0.04	0.00	1.34	0.0%
F32T8 to F25T8	1	1	59	42	0.020	0.020	0.01	0.00	1.34	0.0%
F32T8 to F25T8	20	20	59	42	0.020	0.020	0.27	0.01	1.34	3.7%
F32T8 to F25T8	1	1	59	42	0.020	0.020	0.01	0.00	1.34	0.0%
F32T8 to F25T8	1	1	59	42	0.020	0.020	0.01	0.00	1.34	0.0%
MH400 to LED100W	7	7	458	100	0.000	0.000	4.87	0.00	1.00	0.0%
F32T8 to F25T8	18	18	59	42	0.020	0.020	0.24	0.01	1.34	4.2%
F40T12/ES to F25T8	3	3	32	21	0.020	0.020	0.03	0.00	1.34	0.0%
F32T8 to F25T8	18	18	59	42	0.020	0.020	0.24	0.01	1.34	4.2%
F40T12/ES to F25T8	3	3	32	21	0.020	0.020	0.03	0.00	1.34	0.0%
F32T8 to F25T8	18	18	59	42	0.020	0.020	0.24	0.01	1.34	4.2%
F40T12/ES to F25T8	3	3	32	21	0.020	0.020	0.03	0.00	1.34	0.0%
F32T8 to F25T8	18	18	59	42	0.020	0.020	0.24	0.01	1.34	4.2%
F40T12/ES to F25T8	3	3	32	21	0.020	0.020	0.03	0.00	1.34	0.0%
F32T8 to F25T8	18	18	59	42	0.020	0.020	0.24	0.01	1.34	4.2%
F40T12/ES to F25T8	3	3	32	21	0.020	0.020	0.03	0.00	1.34	0.0%
F32T8 to F25T8	18	18	59	42	0.020	0.020	0.24	0.01	1.34	4.2%
F40T12/ES to F25T8	3	3	32	21	0.020	0.020	0.03	0.00	1.34	0.0%
F32T8 to F25T8	18	18	59	42	0.020	0.020	0.24	0.01	1.34	4.2%
F40T12/ES to F25T8	3	3	32	21	0.020	0.020	0.03	0.00	1.34	0.0%
F32T8 to F25T8	3	3	59	42	0.020	0.020	0.05	0.00	1.34	0.0%
F32T8 to F25T8	3	3	59	42	0.020	0.020	0.05	0.00	1.34	0.0%
MH100 to LED30W	2	2	130	30	0.000	0.000	0.39	0.00	1.00	0.0%

F32T8 to F25T8	18	18	59	42	0.020	0.020	0.24	0.01	1.34	4.2%
F40T12/ES to F25T8	3	3	32	21	0.020	0.020	0.03	0.00	1.34	0.0%
F32T8 to F25T8	18	18	59	42	0.020	0.020	0.24	0.01	1.34	4.2%
F40T12/ES to F25T8	3	3	32	21	0.020	0.020	0.03	0.00	1.34	0.0%
F32T8 to F25T8	18	18	59	42	0.020	0.020	0.24	0.01	1.34	4.2%
F40T12/ES to F25T8	3	3	32	21	0.020	0.020	0.03	0.00	1.34	0.0%
F32T8 to F25T8	18	18	59	42	0.020	0.020	0.24	0.01	1.34	4.2%
F40T12/ES to F25T8	3	3	32	21	0.020	0.020	0.03	0.00	1.34	0.0%
F32T8 to F25T8	18	18	59	42	0.020	0.020	0.24	0.01	1.34	4.2%
F40T12/ES to F25T8	3	3	32	21	0.020	0.020	0.03	0.00	1.34	0.0%
F32T8 to F25T8	18	18	59	42	0.020	0.020	0.24	0.01	1.34	4.2%
F40T12/ES to F25T8	3	3	32	21	0.020	0.020	0.03	0.00	1.34	0.0%
F32T8 to F25T8	18	18	59	42	0.020	0.020	0.24	0.01	1.34	4.2%
F40T12/ES to F25T8	3	3	32	21	0.020	0.020	0.03	0.00	1.34	0.0%
F32T8 to F25T8	3	3	59	42	0.020	0.020	0.05	0.00	1.34	0.0%
F32T8 to F25T8	3	3	59	42	0.020	0.020	0.05	0.00	1.34	0.0%
MH100 to LED30W	2	2	130	30	0.000	0.000	0.39	0.00	1.00	0.0%
F32T8 to F25T8	18	18	59	42	0.020	0.020	0.24	0.01	1.34	4.2%
F40T12/ES to F25T8	3	3	32	21	0.020	0.020	0.03	0.00	1.34	0.0%
F32T8 to F25T8	18	18	59	42	0.020	0.020	0.24	0.01	1.34	4.2%
F40T12/ES to F25T8	3	3	32	21	0.020	0.020	0.03	0.00	1.34	0.0%
F32T8 to F25T8	18	18	59	42	0.020	0.020	0.24	0.01	1.34	4.2%
F40T12/ES to F25T8	3	3	32	21	0.020	0.020	0.03	0.00	1.34	0.0%
F32T8 to F25T8	18	18	59	42	0.020	0.020	0.24	0.01	1.34	4.2%
F40T12/ES to F25T8	3	3	32	21	0.020	0.020	0.03	0.00	1.34	0.0%
F32T8 to F25T8	18	18	59	42	0.020	0.020	0.24	0.01	1.34	4.2%

F40T12/ES to F25T8	3	3	32	21	0.020	0.020	0.03	0.00	1.34	0.0%
F32T8 to F25T8	18	18	59	42	0.020	0.020	0.24	0.01	1.34	4.2%
F40T12/ES to F25T8	3	3	32	21	0.020	0.020	0.03	0.00	1.34	0.0%
F32T8 to F25T8	18	18	59	42	0.020	0.020	0.24	0.01	1.34	4.2%
F40T12/ES to F25T8	3	3	32	21	0.020	0.020	0.03	0.00	1.34	0.0%
F32T8 to F25T8	3	3	59	42	0.020	0.020	0.05	0.00	1.34	0.0%
F32T8 to F25T8	3	3	59	42	0.020	0.020	0.05	0.00	1.34	0.0%
MH100 to LED30W	2	2	130	30	0.000	0.000	0.39	0.00	1.00	0.0%
F32T8 to F25T8	18	18	59	42	0.020	0.020	0.24	0.01	1.34	4.2%
F40T12/ES to F25T8	3	3	32	21	0.020	0.020	0.03	0.00	1.34	0.0%
F32T8 to F25T8	18	18	59	42	0.020	0.020	0.24	0.01	1.34	4.2%
F40T12/ES to F25T8	3	3	32	21	0.020	0.020	0.03	0.00	1.34	0.0%
F32T8 to F25T8	18	18	59	42	0.020	0.020	0.24	0.01	1.34	4.2%
F40T12/ES to F25T8	3	3	32	21	0.020	0.020	0.03	0.00	1.34	0.0%
F32T8 to F25T8	18	18	59	42	0.020	0.020	0.24	0.01	1.34	4.2%
F40T12/ES to F25T8	3	3	32	21	0.020	0.020	0.03	0.00	1.34	0.0%
F32T8 to F25T8	18	18	59	42	0.020	0.020	0.24	0.01	1.34	4.2%
F40T12/ES to F25T8	3	3	32	21	0.020	0.020	0.03	0.00	1.34	0.0%
F32T8 to F25T8	18	18	59	42	0.020	0.020	0.24	0.01	1.34	4.2%
F40T12/ES to F25T8	3	3	32	21	0.020	0.020	0.03	0.00	1.34	0.0%
F32T8 to F25T8	18	18	59	42	0.020	0.020	0.24	0.01	1.34	4.2%
F40T12/ES to F25T8	3	3	32	21	0.020	0.020	0.03	0.00	1.34	0.0%
F32T8 to F25T8	3	3	59	42	0.020	0.020	0.05	0.00	1.34	0.0%
F32T8 to F25T8	3	3	59	42	0.020	0.020	0.05	0.00	1.34	0.0%
MH100 to LED30W	2	2	130	30	0.000	0.000	0.39	0.00	1.00	0.0%
F32T8 to F25T8	18	18	59	42	0.020	0.020	0.24	0.01	1.34	4.2%

F40T12/ES to F25T8	3	3	32	21	0.020	0.020	0.03	0.00	1.34	0.0%
F32T8 to F25T8	18	18	59	42	0.020	0.020	0.24	0.01	1.34	4.2%
F40T12/ES to F25T8	3	3	32	21	0.020	0.020	0.03	0.00	1.34	0.0%
F32T8 to F25T8	18	18	59	42	0.020	0.020	0.24	0.01	1.34	4.2%
F40T12/ES to F25T8	3	3	32	21	0.020	0.020	0.03	0.00	1.34	0.0%
F32T8 to F25T8	18	18	59	42	0.020	0.020	0.24	0.01	1.34	4.2%
F40T12/ES to F25T8	3	3	32	21	0.020	0.020	0.03	0.00	1.34	0.0%
F32T8 to F25T8	18	18	59	42	0.020	0.020	0.24	0.01	1.34	4.2%
F40T12/ES to F25T8	3	3	32	21	0.020	0.020	0.03	0.00	1.34	0.0%
F32T8 to F25T8	18	18	59	42	0.020	0.020	0.24	0.01	1.34	4.2%
F40T12/ES to F25T8	3	3	32	21	0.020	0.020	0.03	0.00	1.34	0.0%
F32T8 to F25T8	18	18	59	42	0.020	0.020	0.24	0.01	1.34	4.2%
F40T12/ES to F25T8	3	3	32	21	0.020	0.020	0.03	0.00	1.34	0.0%
F32T8 to F25T8	3	3	59	42	0.020	0.020	0.05	0.00	1.34	0.0%
F32T8 to F25T8	3	3	59	42	0.020	0.020	0.05	0.00	1.34	0.0%
MH100 to LED30W	2	2	130	30	0.000	0.000	0.39	0.00	1.00	0.0%
F32T8 to F32T8-28W	16	16	118	63	0.020	0.020	0.86	0.02	1.34	2.3%
F32T8 to F32T8-25W	1	1	59	38	0.020	0.020	0.02	0.00	1.34	0.0%
F32T8 to F25T8	1	1	59	42	0.020	0.020	0.02	0.00	1.34	0.0%
F32T8 to F25T8	2	2	59	42	0.020	0.020	0.03	0.00	1.34	0.0%
F32T8 to F25T8	1	1	59	42	0.020	0.020	0.02	0.00	1.34	0.0%
F32T8 to F25T8	2	2	59	42	0.020	0.020	0.03	0.00	1.34	0.0%
MH400 to LED100W	3	3	458	100	0.000	0.000	2.09	0.00	1.00	0.0%
F32T8 to F25T8 w/sensor	10	10	59	42	0.020	0.016	0.23	0.01	1.34	4.3%
CF18W to LED10W	1	1	18	10	0.020	0.020	0.02	0.00	1.34	0.0%

F32T8 to F25T8 w/sensor	10	10	59	42	0.020	0.016	0.23	0.01	1.34	4.3%
CF18W to LED10W	1	1	18	10	0.020	0.020	0.02	0.00	1.34	0.0%
F32T8 to F25T8 w/sensor	10	10	59	42	0.020	0.016	0.23	0.01	1.34	4.3%
CF18W to LED10W	1	1	18	10	0.020	0.020	0.02	0.00	1.34	0.0%
F32T8 to F25T8 w/sensor	10	10	59	42	0.020	0.016	0.23	0.01	1.34	4.3%
CF18W to LED10W	1	1	18	10	0.020	0.020	0.02	0.00	1.34	0.0%
						Total	**49.30**	**0.48**		**1.0%**

Results

The kWh and kW realization rates for Project 10 are 105.3% and 1.0%, respectively.

All exterior retrofits assumed 4,380 AOH, however this was adjusted to 4,313 to match the IID territory NDH, further reducing the realized kWh. *Ex ante* calculations did not use interactive energy or demand factors to account for the reduced load on the HVAC system because of the more efficient lighting. Accounting for these in *ex post* calculations increased both kWh and peak kW realized savings. *Ex ante* calculations assumed classroom lighting operated 1,800 hours annually, and occupancy sensors would decrease this by 28% to 1,296. The 2014 CA TRM recommends an 18% reduction for classrooms for wall or ceiling-mounted occupancy sensors, so the Evaluators revised the reduction in hours to 18%. This resulted in 1,455 post-sensor retrofit AOH for several classrooms, slightly lowering lighting kWh realization. Finally, all *ex ante* kW reduction calculations assumed a 100% peak coincidence factor for interior and exterior lighting. The Evaluators adjusted this factor to 2% for interior lighting and 0% for exterior lighting, in accordance with deemed TRM specifications for secondary schools, causing the low lighting kW realization rate.

Table D, Verified Gross Savings & Realization Rates

Measure	***Verified***			
	kWh Savings	***kW Savings***	***kWh Realization Rate***	***kW Realization Rate***
FU40T12 to FU32T8/6	436	0.00	121.0%	0.0%
F32T8 to F25T8	72	0.00	121.8%	0.0%

F32T8 to F25T8	666	0.01	121.0%	4.2%
F32T8 to F25T8	72	0.00	121.8%	0.0%
F32T8 to F25T8	666	0.01	121.0%	4.2%
F32T8 to F25T8	72	0.00	121.8%	0.0%
F32T8 to F25T8	666	0.01	121.0%	4.2%
FU40T12 to FU32T8/6	72	0.00	121.8%	0.0%
FU40T12 to FU32T8/6	148	0.00	121.4%	0.0%
F32T8 to F25T8	148	0.00	121.4%	0.0%
F32T8 to F25T8	863	0.00	98.5%	0.0%
F32T8 to F25T8	666	0.01	121.0%	4.2%
F32T8 to F25T8	72	0.00	121.8%	0.0%
F32T8 to F25T8	666	0.01	121.0%	4.2%
F32T8 to F25T8	72	0.00	121.8%	0.0%
FU40T12 to FU32T8/6	666	0.01	121.0%	4.2%
F32T8 to F25T8	72	0.00	121.8%	0.0%
F32T8 to F25T8	666	0.01	121.0%	4.2%
F32T8 to F25T8	72	0.00	121.8%	0.0%
MH400 to LED100W	666	0.01	121.0%	4.2%
HPS100 to LED40W	72	0.00	121.8%	0.0%
MH400 to LED150W	666	0.01	121.0%	4.2%
F32T8 to F25T8	72	0.00	121.8%	0.0%
F32T8 to F25T8	666	0.01	121.0%	4.2%
F32T8 to F25T8	72	0.00	121.8%	0.0%
F32T8 to F25T8	148	0.00	121.4%	0.0%
F32T8 to F25T8	148	0.00	121.4%	0.0%
F32T8 to F25T8	863	0.00	98.5%	0.0%

F32T8 to F25T8	666	0.01	121.0%	4.2%
F32T8 to F25T8	72	0.00	121.8%	0.0%
F32T8 to F25T8	666	0.01	121.0%	4.2%
F32T8 to F25T8	72	0.00	121.8%	0.0%
F32T8 to F25T8	666	0.01	121.0%	4.2%
F32T8 to F25T8	72	0.00	121.8%	0.0%
F32T8 to F25T8	666	0.01	121.0%	4.2%
F32T8 to F25T8	72	0.00	121.8%	0.0%
F32T8 to F25T8	666	0.01	121.0%	4.2%
F32T8 to F25T8	72	0.00	121.8%	0.0%
MH400 to LED100W	666	0.01	121.0%	4.2%
F32T8 to F25T8	72	0.00	121.8%	0.0%
F40T12/ES to F25T8	666	0.01	121.0%	4.2%
F32T8 to F25T8	72	0.00	121.8%	0.0%
F40T12/ES to F25T8	148	0.00	121.4%	0.0%
F32T8 to F25T8	148	0.00	121.4%	0.0%
F40T12/ES to F25T8	863	0.00	98.5%	0.0%
F32T8 to F25T8	2,343	0.02	121.0%	2.3%
F40T12/ES to F25T8	56	0.00	121.5%	0.0%
F32T8 to F25T8	45	0.00	122.3%	0.0%
F40T12/ES to F25T8	91	0.00	120.7%	0.0%
F32T8 to F25T8	45	0.00	122.3%	0.0%
F40T12/ES to F25T8	91	0.00	120.7%	0.0%
F32T8 to F25T8	4,632	0.00	98.5%	0.0%
F40T12/ES to F25T8	535	0.01	103.3%	4.3%
F32T8 to F25T8	48	0.00	96.8%	0.0%

F32T8 to F25T8	535	0.01	103.3%	4.3%
MH100 to LED30W	48	0.00	96.8%	0.0%
F32T8 to F25T8	535	0.01	103.3%	4.3%
F40T12/ES to F25T8	48	0.00	96.8%	0.0%
F32T8 to F25T8	535	0.01	103.3%	4.3%
F40T12/ES to F25T8	48	0.00	96.8%	0.0%
Total	**117,239**	**0.48**	**105.3%**	**1.0%**

Project Number Project 11

Program CESP 2015

Project Background

The participant is a middle school that received incentives for retrofitting interior and exterior lighting, installing occupancy sensors to control portions of the newly-installed lighting and retrofitting existing air conditioners and heat pumps with more efficient units. On-site, the Evaluators verified the installation and operation of the following measures:

- (584)4' 3-Lamp T8 28W RLOs r replaced (584) 3' 4-Lamp T8s
- (72)4' 2-Lamp T8 28W RLOs r replaced (72) 4' 2-Lamp T8s
- (18)29W LED - Non-Int. ballasts r replaced (18) 70W metal halides
- (8)29W LED - Non-Int. ballasts r replaced (8) 3' 4-Lamp T8s

Additionally, occupancy sensors were installed to control 100 of the newly-installed fixtures. On site, lighting operation schedules were also collected through staff interviews and photo-logging equipment was placed on site to monitor lighting operation.

Calculation Parameters

Lighting savings calculations were performed using the methods described section 2.2.2. of this report. Parameters specific to this site are listed below in Table A:

Table A Savings Parameters

Space Type	***Air Conditioned***	***Annual Hours***	***IEF_E***	***IEF_D***	***CF***
Primary School (classrooms)	Yes	1,800	1.21	1.30	20%
Primary School (non-classrooms)	Yes	Custom, varies by area	1.21	1.30	20%
Exterior	No	4,313	1.00	1.00	0%

Savings Calculations

Table B, Lighting Retrofit kWh Savings Calculations

Measure	*Quantity (Fixtures)*		*Wattage*		*AOH (no sensors)*	*AOH (w/ sensor reduction)*	*Expected kWh Savings*	*Realized kWh Savings*	IEF_E	*Realization Rate*
	Base	*Post*	*Base*	*Post*						
F25T8 to F32T8-28W	18	18	90	63	1,800	1,800	875	1,059	1.21	121.0%
F25T8 to F32T8-28W	19	19	90	63	1,800	1,800	923	1,117	1.21	121.1%
F32T8 to F32T8-28W	12	12	59	42	2,800	2,800	571	711	1.21	124.6%
F25T8 to F32T8-28W	18	18	90	63	1,800	1,800	875	1,059	1.21	121.0%
F25T8 to F32T8-28W	18	18	90	63	1,800	1,800	875	1,059	1.21	121.0%
F25T8 to F32T8-28W	18	18	90	63	1,800	1,800	875	1,059	1.21	121.0%
F25T8 to F32T8-28W	19	19	90	63	1,800	1,800	923	1,117	1.21	121.1%
F32T8 to F32T8-28W	12	12	59	42	2,800	2,800	571	711	1.21	124.6%
F25T8 to F32T8-28W	17	17	90	63	1,800	1,800	826	1,000	1.21	121.0%
F25T8 to F32T8-28W	19	19	90	63	1,800	1,800	923	1,117	1.21	121.1%
F25T8 to F32T8-28W	18	18	90	63	1,800	1,800	875	1,059	1.21	121.0%
F25T8 to F32T8-28W	19	19	90	63	1,800	1,800	923	1,117	1.21	121.1%
F25T8 to F32T8-28W	18	18	90	63	1,800	1,800	875	1,059	1.21	121.0%
F32T8 to F32T8-28W	12	12	59	42	2,800	2,800	571	711	1.21	124.6%
F25T8 to F32T8-28W	18	18	90	63	1,800	1,800	875	1,059	1.21	121.0%
F25T8 to F32T8-28W	19	19	90	63	1,800	1,800	923	1,117	1.21	121.1%
F25T8 to F32T8-28W	18	18	90	63	1,800	1,800	875	1,059	1.21	121.0%
F25T8 to F32T8-28W	18	18	90	63	1,800	1,800	875	1,059	1.21	121.0%
F32T8 to F32T8-28W	12	12	59	42	2,800	2,800	571	711	1.21	124.6%
F25T8 to F32T8-28W	19	19	90	63	1,800	1,800	923	1,117	1.21	121.1%
F25T8 to F32T8-28W	17	17	90	63	1,800	1,800	826	1,000	1.21	121.0%

F25T8 to F32T8-28W	18	18	90	63	1,800	1,800	875	1,059	1.21	121.0%
F25T8 to F32T8-28W	18	18	90	63	1,800	1,800	875	1,059	1.21	121.0%
F25T8 to F32T8-28W	19	19	90	63	1,800	1,800	923	1,117	1.21	121.1%
F25T8 to F32T8-28W	18	18	90	63	1,800	1,800	875	1,059	1.21	121.0%
MH70 to LED29W	18	18	95	29	4,313	4,313	5,172	5,124	1.00	99.1%
F25T8 to F32T8-28W	18	18	90	63	1,800	1,800	875	1,059	1.21	121.0%
F25T8 to F32T8-28W	19	19	90	63	1,800	1,800	923	1,117	1.21	121.1%
F32T8 to F32T8-28W	12	12	59	42	2,800	2,800	571	711	1.21	124.6%
F25T8 to F32T8-28W	18	18	90	63	1,800	1,800	875	1,059	1.21	121.0%
F25T8 to F32T8-28W	18	18	90	63	1,800	1,800	875	1,059	1.21	121.0%
F25T8 to F32T8-28W	18	18	90	63	1,800	1,800	875	1,059	1.21	121.0%
F25T8 to F32T8-28W	19	19	90	63	1,800	1,800	923	1,117	1.21	121.1%
F32T8 to F32T8-28W	12	12	59	42	2,800	2,800	571	711	1.21	124.6%
F25T8 to F32T8-28W	17	17	90	63	1,800	1,800	826	1,000	1.21	121.0%
F25T8 to F32T8-28W	19	19	90	63	1,800	1,800	923	1,117	1.21	121.1%
F25T8 to F32T8-28W	18	18	90	63	1,800	1,800	875	1,059	1.21	121.0%
F25T8 to F32T8-28W	19	19	90	63	1,800	1,800	923	1,117	1.21	121.1%
F25T8 to F32T8-28W	18	18	90	63	1,800	1,800	875	1,059	1.21	121.0%
F25T8 to LED29W	8	8	90	29	4,313	4,313	2,299	2,105	1.00	91.6%
F32T8 to F32T8-28W	11	11	59	42	3,000	3,000	561	699	1.21	124.6%
F32T8 to F32T8-28W	11	11	59	42	3,000	3,000	561	699	1.21	124.6%
F25T8 to F32T8-28W	18	18	90	63	1,800	1,800	875	1,059	1.21	121.0%
F25T8 to F32T8-28W	19	19	90	63	1,800	1,800	923	1,117	1.21	121.1%
F32T8 to F32T8-28W	12	12	59	42	2,800	2,800	571	711	1.21	124.6%
F25T8 to F32T8-28W	18	18	90	63	1,800	1,800	875	1,059	1.21	121.0%
F25T8 to F32T8-28W	18	18	90	63	1,800	1,800	875	1,059	1.21	121.0%

F25T8 to F32T8-28W	18	18	90	63	1,800	1,800	875	1,059	1.21	121.0%
F25T8 to F32T8-28W	19	19	90	63	1,800	1,800	923	1,117	1.21	121.1%
F32T8 to F32T8-28W	12	12	59	42	2,800	2,800	571	711	1.21	124.6%
F25T8 to F32T8-28W	17	17	90	63	1,800	1,800	826	1,000	1.21	121.0%
F25T8 to F32T8-28W	19	19	90	63	1,800	1,800	923	1,117	1.21	121.1%
F25T8 to F32T8-28W	18	18	90	63	1,800	1,800	875	1,059	1.21	121.0%
F25T8 to F32T8-28W	19	19	90	63	1,800	1,800	923	1,117	1.21	121.1%
F25T8 to F32T8-28W	18	18	90	63	1,800	1,800	875	1,059	1.21	121.0%
MH70 to LED29W	8	8	95	29	4,313	4,313	2,299	2,277	1.00	99.1%
F25T8 to F32T8-28W	21	21	90	63	1,800	1,800	1,021	1,235	1.21	121.0%
F25T8 to F32T8-28W	21	21	90	63	1,800	1,800	1,021	1,235	1.21	121.0%
F25T8 to F32T8-28W	7	7	90	48	3,500	3,500	1,029	1,245	1.21	121.0%
F25T8 to F32T8-28W	22	22	90	63	1,800	1,800	1,069	1,294	1.21	121.0%
F25T8 to F32T8-28W	22	22	90	63	1,800	1,800	1,069	1,294	1.21	121.0%
F32T8 to F32T8-28W	3	3	59	42	3,000	3,000	153	191	1.21	124.6%
F32T8 to F32T8-28W	3	3	59	42	3,000	3,000	153	191	1.21	124.6%
MH70 to LED29W	10	10	95	29	4,313	4,313	2,873	2,847	1.00	99.1%
F25T8 to F32T8-28W	18	18	90	63	1,800	1,800	875	1,059	1.21	121.0%
F25T8 to F32T8-28W	19	19	90	63	1,800	1,800	923	1,117	1.21	121.1%
F32T8 to F32T8-28W	12	12	59	42	2,800	2,800	571	711	1.21	124.6%
F25T8 to F32T8-28W	18	18	90	63	1,800	1,800	875	1,059	1.21	121.0%
F25T8 to F32T8-28W	18	18	90	63	1,800	1,800	875	1,059	1.21	121.0%
F25T8 to F32T8-28W	18	18	90	63	1,800	1,800	875	1,059	1.21	121.0%
F25T8 to F32T8-28W	19	19	90	63	1,800	1,800	923	1,117	1.21	121.1%
F32T8 to F32T8-28W	12	12	59	42	2,800	2,800	571	711	1.21	124.6%
F25T8 to F32T8-28W	17	17	90	63	1,800	1,800	826	1,000	1.21	121.0%

F25T8 to F32T8-28W	19	19	90	63	1,800	1,800	923	1,117	1.21	121.1%
F25T8 to F32T8-28W	18	18	90	63	1,800	1,800	875	1,059	1.21	121.0%
F25T8 to F32T8-28W	19	19	90	63	1,800	1,800	923	1,117	1.21	121.1%
F25T8 to F32T8-28W	18	18	90	63	1,800	1,800	875	1,059	1.21	121.0%
MH70 to LED29W	8	8	95	29	4,313	4,313	2,299	2,277	1.00	99.1%
F32T8 to F32T8-28W	32	32	59	42	1,800	1,800	979	1,220	1.21	124.6%
F25T8 to F32T8-28W	6	6	90	63	1,800	1,800	292	353	1.21	120.8%
F25T8 to F32T8-28W	6	6	90	63	1,800	1,800	292	353	1.21	120.8%
F25T8 to F32T8-28W	6	6	90	63	1,800	1,800	292	353	1.21	120.8%
F25T8 to F32T8-28W	6	6	90	63	1,800	1,800	292	353	1.21	120.8%
F32T8 to F32T8-28W	32	32	59	42	1,800	1,800	979	1,220	1.21	124.6%
F32T8 to F32T8-28W w/sensor	1	1	59	42	3,000	2,340	86	97	1.21	112.4%
F32T8 to F32T8-28W w/sensor	1	1	59	42	3,000	2,340	86	97	1.21	112.4%
MH70 to LED29W	5	5	95	29	4,313	4,313	1,437	1,423	1.00	99.0%
F32T8 to F32T8-28W	16	16	59	42	1,300	1,300	354	440	1.21	124.4%
F25T8 to F32T8-28W	28	28	90	63	1,800	1,800	1,361	1,647	1.21	121.0%
F25T8 to F32T8-28W w/sensor	2	2	90	63	1,800	1,476	161	167	1.21	103.7%
F25T8 to F32T8-28W	6	6	90	63	1,800	1,800	292	353	1.21	120.8%
MH70 to LED29W	17	17	95	29	4,313	4,313	4,885	4,839	1.00	99.1%
F25T8 to F32T8-28W	18	18	42	63	1,800	1,800	875	-823	1.21	-94.1%
F25T8 to F32T8-28W	18	18	90	63	1,800	1,800	875	1,059	1.21	121.0%
F25T8 to F32T8-28W	18	18	90	63	1,800	1,800	875	1,059	1.21	121.0%
F25T8 to F32T8-28W	18	18	90	63	1,800	1,800	875	1,059	1.21	121.0%
F25T8 to F32T8-28W	18	18	90	63	1,800	1,800	875	1,059	1.21	121.0%

F25T8 to F32T8-28W	18	18	90	63	1,800	1,800	875	1,059	1.21	121.0%
F25T8 to F32T8-28W	18	18	90	63	1,800	1,800	875	1,059	1.21	121.0%
F25T8 to F32T8-28W	18	18	90	63	1,800	1,800	875	1,059	1.21	121.0%
F25T8 to F32T8-28W	18	18	90	63	1,800	1,800	875	1,059	1.21	121.0%
F25T8 to F32T8-28W	18	18	90	63	1,800	1,800	875	1,059	1.21	121.0%
F25T8 to F32T8-28W	18	18	90	63	1,800	1,800	875	1,059	1.21	121.0%
F32T8 to F32T8-28W w/sensor	12	12	118	63	1,800	1,476	1,569	1,734	1.21	110.5%
HPS70 to LED10W	1	1	95	10	5,000	5,000	425	514	1.21	121.0%
F32T8 to F32T8-28W w/sensor	12	12	118	63	1,800	1,476	1,569	1,734	1.21	110.5%
HPS70 to LED10W	1	1	95	10	5,000	5,000	425	514	1.21	121.0%
F32T8 to F32T8-28W w/sensor	12	12	118	63	1,800	1,476	1,569	1,734	1.21	110.5%
HPS70 to LED10W	1	1	95	10	5,000	5,000	425	514	1.21	121.0%
F32T8 to F32T8-28W w/sensor	12	12	18	63	1,800	1,476	1,569	-880	1.21	-56.1%
HPS70 to LED10W	1	1	95	10	5,000	5,000	425	514	1.21	121.0%
F32T8 to F32T8-28W w/sensor	12	12	18	63	1,800	1,476	1,569	-880	1.21	-56.1%
HPS70 to LED10W	1	1	95	10	5,000	5,000	425	514	1.21	121.0%
F32T8 to F32T8-28W w/sensor	12	12	18	63	1,800	1,476	1,569	-880	1.21	-56.1%
HPS70 to LED10W	1	1	95	10	5,000	5,000	425	514	1.21	121.0%
F32T8 to F32T8-28W w/sensor	12	12	18	63	1,800	1,476	1,569	-880	1.21	-56.1%
HPS70 to LED10W	1	1	95	10	5,000	5,000	425	514	1.21	121.0%
F32T8 to F32T8-28W w/sensor	12	12	18	63	1,800	1,476	1,569	-880	1.21	-56.1%
HPS70 to LED10W	1	1	95	10	5,000	5,000	425	514	1.21	121.0%

Total	**112,571**	**115,400**		**102.5%**

Table C, Lighting Retrofit kW Savings Calculations

Measure	*Quantity (Fixtures)*		*Wattage*		*CF (no sensors)*	*CF (w/ sensor reduction)*	*Expected kW Savings*	*Realized kW Savings*	IEF_D	*Realization Rate*
	Base	*Post*	*Base*	*Post*						
F25T8 to F32T8-28W	18	18	90	63	0.020	0.020	0.38	0.01	1.34	2.6%
F25T8 to F32T8-28W	19	19	90	63	0.020	0.020	0.40	0.01	1.34	2.5%
F32T8 to F32T8-28W	12	12	59	42	0.020	0.020	0.25	0.01	1.34	4.0%
F25T8 to F32T8-28W	18	18	90	63	0.020	0.020	0.38	0.01	1.34	2.6%
F25T8 to F32T8-28W	18	18	90	63	0.020	0.020	0.38	0.01	1.34	2.6%
F25T8 to F32T8-28W	18	18	90	63	0.020	0.020	0.38	0.01	1.34	2.6%
F25T8 to F32T8-28W	19	19	90	63	0.020	0.020	0.40	0.01	1.34	2.5%
F32T8 to F32T8-28W	12	12	59	42	0.020	0.020	0.25	0.01	1.34	4.0%
F25T8 to F32T8-28W	17	17	90	63	0.020	0.020	0.36	0.01	1.34	2.8%
F25T8 to F32T8-28W	19	19	90	63	0.020	0.020	0.40	0.01	1.34	2.5%
F25T8 to F32T8-28W	18	18	90	63	0.020	0.020	0.38	0.01	1.34	2.6%
F25T8 to F32T8-28W	19	19	90	63	0.020	0.020	0.40	0.01	1.34	2.5%
F25T8 to F32T8-28W	18	18	90	63	0.020	0.020	0.38	0.01	1.34	2.6%
F32T8 to F32T8-28W	12	12	59	42	0.020	0.020	0.25	0.01	1.34	4.0%
F25T8 to F32T8-28W	18	18	90	63	0.020	0.020	0.38	0.01	1.34	2.6%
F25T8 to F32T8-28W	19	19	90	63	0.020	0.020	0.40	0.01	1.34	2.5%
F25T8 to F32T8-28W	18	18	90	63	0.020	0.020	0.38	0.01	1.34	2.6%
F25T8 to F32T8-28W	18	18	90	63	0.020	0.020	0.38	0.01	1.34	2.6%
F32T8 to F32T8-28W	12	12	59	42	0.020	0.020	0.25	0.01	1.34	4.0%
F25T8 to F32T8-28W	19	19	90	63	0.020	0.020	0.40	0.01	1.34	2.5%

F25T8 to F32T8-28W	17	17	90	63	0.020	0.020	0.36	0.01	1.34	2.8%
F25T8 to F32T8-28W	18	18	90	63	0.020	0.020	0.38	0.01	1.34	2.6%
F25T8 to F32T8-28W	18	18	90	63	0.020	0.020	0.38	0.01	1.34	2.6%
F25T8 to F32T8-28W	19	19	90	63	0.020	0.020	0.40	0.01	1.34	2.5%
F25T8 to F32T8-28W	18	18	90	63	0.020	0.020	0.38	0.01	1.34	2.6%
MH70 to LED29W	18	18	95	29	0.000	0.000	2.25	0.00	1.00	0.0%
F25T8 to F32T8-28W	18	18	90	63	0.020	0.020	0.38	0.01	1.34	2.6%
F25T8 to F32T8-28W	19	19	90	63	0.020	0.020	0.40	0.01	1.34	2.5%
F32T8 to F32T8-28W	12	12	59	42	0.020	0.020	0.25	0.01	1.34	4.0%
F25T8 to F32T8-28W	18	18	90	63	0.020	0.020	0.38	0.01	1.34	2.6%
F25T8 to F32T8-28W	18	18	90	63	0.020	0.020	0.38	0.01	1.34	2.6%
F25T8 to F32T8-28W	18	18	90	63	0.020	0.020	0.38	0.01	1.34	2.6%
F25T8 to F32T8-28W	19	19	90	63	0.020	0.020	0.40	0.01	1.34	2.5%
F32T8 to F32T8-28W	12	12	59	42	0.020	0.020	0.25	0.01	1.34	4.0%
F25T8 to F32T8-28W	17	17	90	63	0.020	0.020	0.36	0.01	1.34	2.8%
F25T8 to F32T8-28W	19	19	90	63	0.020	0.020	0.40	0.01	1.34	2.5%
F25T8 to F32T8-28W	18	18	90	63	0.020	0.020	0.38	0.01	1.34	2.6%
F25T8 to F32T8-28W	19	19	90	63	0.020	0.020	0.40	0.01	1.34	2.5%
F25T8 to F32T8-28W	18	18	90	63	0.020	0.020	0.38	0.01	1.34	2.6%
F25T8 to LED29W	8	8	90	29	0.000	0.000	1.00	0.00	1.00	0.0%
F32T8 to F32T8-28W	11	11	59	42	0.020	0.020	0.24	0.01	1.34	4.2%
F32T8 to F32T8-28W	11	11	59	42	0.020	0.020	0.24	0.01	1.34	4.2%
F25T8 to F32T8-28W	18	18	90	63	0.020	0.020	0.38	0.01	1.34	2.6%
F25T8 to F32T8-28W	19	19	90	63	0.020	0.020	0.40	0.01	1.34	2.5%
F32T8 to F32T8-28W	12	12	59	42	0.020	0.020	0.25	0.01	1.34	4.0%
F25T8 to F32T8-28W	18	18	90	63	0.020	0.020	0.38	0.01	1.34	2.6%

F25T8 to F32T8-28W	18	18	90	63	0.020	0.020	0.38	0.01	1.34	2.6%
F25T8 to F32T8-28W	18	18	90	63	0.020	0.020	0.38	0.01	1.34	2.6%
F25T8 to F32T8-28W	19	19	90	63	0.020	0.020	0.40	0.01	1.34	2.5%
F32T8 to F32T8-28W	12	12	59	42	0.020	0.020	0.25	0.01	1.34	4.0%
F25T8 to F32T8-28W	17	17	90	63	0.020	0.020	0.36	0.01	1.34	2.8%
F25T8 to F32T8-28W	19	19	90	63	0.020	0.020	0.40	0.01	1.34	2.5%
F25T8 to F32T8-28W	18	18	90	63	0.020	0.020	0.38	0.01	1.34	2.6%
F25T8 to F32T8-28W	19	19	90	63	0.020	0.020	0.40	0.01	1.34	2.5%
F25T8 to F32T8-28W	18	18	90	63	0.020	0.020	0.38	0.01	1.34	2.6%
MH70 to LED29W	8	8	95	29	0.000	0.000	1.00	0.00	1.00	0.0%
F25T8 to F32T8-28W	21	21	90	63	0.020	0.020	0.44	0.02	1.34	4.5%
F25T8 to F32T8-28W	21	21	90	63	0.020	0.020	0.44	0.02	1.34	4.5%
F25T8 to F32T8-28W	7	7	90	48	0.020	0.020	0.45	0.01	1.34	2.2%
F25T8 to F32T8-28W	22	22	90	63	0.020	0.020	0.46	0.02	1.34	4.3%
F25T8 to F32T8-28W	22	22	90	63	0.020	0.020	0.46	0.02	1.34	4.3%
F32T8 to F32T8-28W	3	3	59	42	0.020	0.020	0.07	0.00	1.34	0.0%
F32T8 to F32T8-28W	3	3	59	42	0.020	0.020	0.07	0.00	1.34	0.0%
MH70 to LED29W	10	10	95	29	0.000	0.000	1.25	0.00	1.00	0.0%
F25T8 to F32T8-28W	18	18	90	63	0.020	0.020	0.38	0.01	1.34	2.6%
F25T8 to F32T8-28W	19	19	90	63	0.020	0.020	0.40	0.01	1.34	2.5%
F32T8 to F32T8-28W	12	12	59	42	0.020	0.020	0.25	0.01	1.34	4.0%
F25T8 to F32T8-28W	18	18	90	63	0.020	0.020	0.38	0.01	1.34	2.6%
F25T8 to F32T8-28W	18	18	90	63	0.020	0.020	0.38	0.01	1.34	2.6%
F25T8 to F32T8-28W	18	18	90	63	0.020	0.020	0.38	0.01	1.34	2.6%
F25T8 to F32T8-28W	19	19	90	63	0.020	0.020	0.40	0.01	1.34	2.5%
F32T8 to F32T8-28W	12	12	59	42	0.020	0.020	0.25	0.01	1.34	4.0%

F25T8 to F32T8-28W	17	17	90	63	0.020	0.020	0.36	0.01	1.34	2.8%
F25T8 to F32T8-28W	19	19	90	63	0.020	0.020	0.40	0.01	1.34	2.5%
F25T8 to F32T8-28W	18	18	90	63	0.020	0.020	0.38	0.01	1.34	2.6%
F25T8 to F32T8-28W	19	19	90	63	0.020	0.020	0.40	0.01	1.34	2.5%
F25T8 to F32T8-28W	18	18	90	63	0.020	0.020	0.38	0.01	1.34	2.6%
MH70 to LED29W	8	8	95	29	0.000	0.000	1.00	0.00	1.00	0.0%
F32T8 to F32T8-28W	32	32	59	42	0.020	0.020	0.43	0.02	1.34	4.7%
F25T8 to F32T8-28W	6	6	90	63	0.020	0.020	0.13	0.00	1.34	0.0%
F25T8 to F32T8-28W	6	6	90	63	0.020	0.020	0.13	0.00	1.34	0.0%
F25T8 to F32T8-28W	6	6	90	63	0.020	0.020	0.13	0.00	1.34	0.0%
F25T8 to F32T8-28W	6	6	90	63	0.020	0.020	0.13	0.00	1.34	0.0%
F32T8 to F32T8-28W	32	32	59	42	0.020	0.020	0.43	0.02	1.34	4.7%
F32T8 to F32T8-28W w/sensor	1	1	59	42	0.020	0.016	0.04	0.00	1.34	0.0%
F32T8 to F32T8-28W w/sensor	1	1	59	42	0.020	0.016	0.04	0.00	1.34	0.0%
MH70 to LED29W	5	5	95	29	0.000	0.000	0.62	0.00	1.00	0.0%
F32T8 to F32T8-28W	16	16	59	42	0.020	0.020	0.15	0.01	1.34	6.7%
F25T8 to F32T8-28W	28	28	90	63	0.020	0.020	0.59	0.02	1.34	3.4%
F25T8 to F32T8-28W w/sensor	2	2	90	63	0.020	0.016	0.07	0.00	1.34	0.0%
F25T8 to F32T8-28W	6	6	90	63	0.020	0.020	0.13	0.00	1.34	0.0%
MH70 to LED29W	17	17	95	29	0.000	0.000	2.12	0.00	1.00	0.0%
F25T8 to F32T8-28W	18	18	42	63	0.020	0.020	0.38	-0.01	1.34	-2.6%
F25T8 to F32T8-28W	18	18	90	63	0.020	0.020	0.38	0.01	1.34	2.6%
F25T8 to F32T8-28W	18	18	90	63	0.020	0.020	0.38	0.01	1.34	2.6%
F25T8 to F32T8-28W	18	18	90	63	0.020	0.020	0.38	0.01	1.34	2.6%

F25T8 to F32T8-28W	18	18	90	63	0.020	0.020	0.38	0.01	1.34	2.6%
F25T8 to F32T8-28W	18	18	90	63	0.020	0.020	0.38	0.01	1.34	2.6%
F25T8 to F32T8-28W	18	18	90	63	0.020	0.020	0.38	0.01	1.34	2.6%
F25T8 to F32T8-28W	18	18	90	63	0.020	0.020	0.38	0.01	1.34	2.6%
F25T8 to F32T8-28W	18	18	90	63	0.020	0.020	0.38	0.01	1.34	2.6%
F25T8 to F32T8-28W	18	18	90	63	0.020	0.020	0.38	0.01	1.34	2.6%
F25T8 to F32T8-28W	18	18	90	63	0.020	0.020	0.38	0.01	1.34	2.6%
F32T8 to F32T8-28W w/sensor	12	12	118	63	0.020	0.016	0.68	0.02	1.34	2.9%
HPS70 to LED10W	1	1	95	10	0.020	0.020	0.18	0.00	1.34	0.0%
F32T8 to F32T8-28W w/sensor	12	12	118	63	0.020	0.016	0.68	0.02	1.34	2.9%
HPS70 to LED10W	1	1	95	10	0.020	0.020	0.18	0.00	1.34	0.0%
F32T8 to F32T8-28W w/sensor	12	12	118	63	0.020	0.016	0.68	0.02	1.34	2.9%
HPS70 to LED10W	1	1	95	10	0.020	0.020	0.18	0.00	1.34	0.0%
F32T8 to F32T8-28W w/sensor	12	12	18	63	0.020	0.016	0.68	-0.01	1.34	-1.5%
HPS70 to LED10W	1	1	95	10	0.020	0.020	0.18	0.00	1.34	0.0%
F32T8 to F32T8-28W w/sensor	12	12	18	63	0.020	0.016	0.68	-0.01	1.34	-1.5%
HPS70 to LED10W	1	1	95	10	0.020	0.020	0.18	0.00	1.34	0.0%
F32T8 to F32T8-28W w/sensor	12	12	18	63	0.020	0.016	0.68	-0.01	1.34	-1.5%
HPS70 to LED10W	1	1	95	10	0.020	0.020	0.18	0.00	1.34	0.0%
F32T8 to F32T8-28W w/sensor	12	12	18	63	0.020	0.016	0.68	-0.01	1.34	-1.5%
HPS70 to LED10W	1	1	95	10	0.020	0.020	0.18	0.00	1.34	0.0%
F32T8 to F32T8-28W w/sensor	12	12	18	63	0.020	0.016	0.68	-0.01	1.34	-1.5%

HPS70 to LED10W	1	1	95	10	0.020	0.020	0.18	0.00	1.34	0.0%
						Total	**48.87**	**0.92**		**1.9%**

Results

The kWh and kW realization rates for Project 11 are 102.5% and 1.9%, respectively.

Ex ante calculations assumed classroom lighting operated 1,800 hours annually, and occupancy sensors would decrease this by 28% to 1,296. The 2014 CA TRM recommends an 18% reduction for classrooms for wall or ceiling-mounted occupancy sensors, so the Evaluators revised the reduction in hours to 18%. This resulted in 1,455 post-sensor retrofit AOH for several classrooms, slightly lowering lighting kWh realization. Additionally, all exterior retrofits assumed 4,380 AOH, however this was adjusted to 4,313 to match the IID territory NDH, further reducing the realized kWh. *Ex ante* calculations did not use interactive energy or demand factors to account for the reduced load on the HVAC system because of the more efficient lighting. Accounting for these in *ex post* calculations increased both kWh and peak kW realized savings. Finally, all *ex ante* kW reduction calculations assumed a 100% peak coincidence factor for interior and exterior lighting. The Evaluators adjusted this factor to 2% for interior lighting and 0% for exterior lighting, in accordance with deemed TRM specifications for secondary schools, causing the low lighting kW realization rate.

Table D, Verified Gross Savings & Realization Rates

Measure	***Verified***			
	kWh Savings	***kW Savings***	***kWh Realization Rate***	***kW Realization Rate***
F25T8 to F32T8-28W	1,059	0.01	121.0%	2.6%
F25T8 to F32T8-28W	353	0.00	120.8%	0.0%
F32T8 to F32T8-28W	353	0.00	120.8%	0.0%
F25T8 to F32T8-28W	353	0.00	120.8%	0.0%
F25T8 to F32T8-28W	1,220	0.02	124.6%	4.7%
F25T8 to F32T8-28W	97	0.00	112.4%	0.0%
F25T8 to F32T8-28W	97	0.00	112.4%	0.0%
F32T8 to F32T8-28W	1,423	0.00	99.0%	0.0%

F25T8 to F32T8-28W	440	0.01	124.4%	6.7%
F25T8 to F32T8-28W	1,647	0.02	121.0%	3.4%
F25T8 to F32T8-28W	167	0.00	103.7%	0.0%
F25T8 to F32T8-28W	353	0.00	120.8%	0.0%
F25T8 to F32T8-28W	4,839	0.00	99.1%	0.0%
F32T8 to F32T8-28W	-823	-0.01	-94.1%	-2.6%
F25T8 to F32T8-28W	1,059	0.01	121.0%	2.6%
F25T8 to F32T8-28W	1,059	0.01	121.0%	2.6%
F25T8 to F32T8-28W	1,059	0.01	121.0%	2.6%
F25T8 to F32T8-28W	1,059	0.01	121.0%	2.6%
F32T8 to F32T8-28W	1,059	0.01	121.0%	2.6%
F25T8 to F32T8-28W	1,059	0.01	121.0%	2.6%
F25T8 to F32T8-28W	1,059	0.01	121.0%	2.6%
F25T8 to F32T8-28W	1,059	0.01	121.0%	2.6%
F25T8 to F32T8-28W	1,059	0.01	121.0%	2.6%
F25T8 to F32T8-28W	1,059	0.01	121.0%	2.6%
F25T8 to F32T8-28W	1,734	0.02	110.5%	2.9%
MH70 to LED29W	514	0.00	121.0%	0.0%
F25T8 to F32T8-28W	1,734	0.02	110.5%	2.9%
F25T8 to F32T8-28W	514	0.00	121.0%	0.0%
F32T8 to F32T8-28W	1,734	0.02	110.5%	2.9%
F25T8 to F32T8-28W	514	0.00	121.0%	0.0%
F25T8 to F32T8-28W	-880	-0.01	-56.1%	-1.5%
F25T8 to F32T8-28W	514	0.00	121.0%	0.0%
F25T8 to F32T8-28W	-880	-0.01	-56.1%	-1.5%
F32T8 to F32T8-28W	514	0.00	121.0%	0.0%

F25T8 to F32T8-28W	-880	-0.01	-56.1%	-1.5%
F25T8 to F32T8-28W	514	0.00	121.0%	0.0%
F25T8 to F32T8-28W	-880	-0.01	-56.1%	-1.5%
F25T8 to F32T8-28W	514	0.00	121.0%	0.0%
F25T8 to F32T8-28W	-880	-0.01	-56.1%	-1.5%
F25T8 to LED29W	514	0.00	121.0%	0.0%
Total	**115,400**	**0.92**	**102.5%**	**1.9%**

Project Number Project 12

Program CESP 2015

Project Background

The participant is a car dealership that received incentives from IID for retrofitting existing exterior lighting with energy efficient lighting in their showroom and facility exterior. On-site, the Evaluators verified the installation and operation of the following measures:

- (8) fluorescent fixtures were delamped
- (52) 77W LED fixtures replaced (51) 68W incandescent lamps
- (8) 196W LED fixtures replaced (8) 1000W metal halide fixtures
- (84) 276W LED fixtures replaced (84) 1000W metal halide fixtures
- (6) 60W LED fixtures replaced (6) metal halide wall packs

Lighting operation schedules were also collected through staff interviews to determine AOH.

Calculation Parameters

Savings calculations were performed using the methods described section 2.2.2. of this report. Parameters specific to this site are listed below in Table A:

Table A, Savings Parameters

Space Type	*Air Conditioned*	*Annual Hours*	*IEF_E*	*IEF_D*	*CF*
Small Retail	Yes	4,563[20]	1.17	1.24	100%[1]
Exterior	No	1,092[1]	1.00	1.00	0%

[20] Calculated based upon verified operating schedule.

Savings Calculations

Table B, Lighting Retrofit kWh Savings Calculations

Measure	*Quantity (Fixtures)*		*Wattage*		*AOH*	*Expected kWh Savings*	*Realized kWh Savings*	IEF_E	*Realization Rate*
	Base	*Post*	*Base*	*Post*					
LED upgrade	8	0	205	76	4,563	7,164	8,755	1.17	122.2%
LED upgrade	13	18	68	77	4,563	-2,193	-2,680	1.17	122.2%
LED upgrade	38	34	205	77	1,095	5,578	5,663	1.00	101.5%
LED upgrade	8	8	1,080	196	1,095	15,445	7,744	1.00	50.1%
LED upgrade	84	84	1,080	276	1,095	147,866	73,952	1.00	50.0%
LED upgrade	6	6	458	60	1,095	4,429	2,615	1.00	59.0%
					Total	**178,289**	**96,049**		**53.9%**

Table C, Lighting Retrofit kW Savings Calculations

Measure	***Quantity (Fixtures)***		***Wattage***		***CF***	***Expected kW Savings***	***Realized kW Savings***	IEF_D	***Realization Rate***
	Base	***Post***	***Base***	***Post***					
LED upgrade	8	0	205	76	1.00	1.64	2.03	1.24	123.8%
LED upgrade	13	18	68	77	1.00	-0.50	-0.62	1.24	124.0%
LED upgrade	38	34	205	77	0.00	1.28	0.00	1.00	0.0%
LED upgrade	8	8	1,080	196	0.00	3.54	0.00	1.00	0.0%
LED upgrade	84	84	1,080	276	0.00	33.85	0.00	1.00	0.0%
LED upgrade	6	6	458	60	0.00	1.01	0.00	1.00	0.0%
					Total	**40.82**	**1.41**		**3.5%**

Results

The kWh realization rate for Project 12 is 53.9% and the kW realization rate is 3.5%.

Ex ante calculations assumed annual lighting hours of operation of 4,368 for interior lighting and 2,184 for exterior lighting. The Evaluators developed lighting schedules based on interviews conducted with staff while on site. Verified operating schedules resulted in 4,563 AOH for interior fixtures and 1,095 AOH for exterior fixtures. This slightly increased interior realized kWh but decreased exterior realized kWh. Additionally, *ex ante* calculations assumed a peak coin factor of 100% for all areas, however the Evaluators determined that exterior fixtures only operate during non-peak hours, thus no peak kW savings can be attributed to them.

Table D, Verified Gross Savings & Realization Rates

Measure	***Verified***			
	kWh Savings	***kW Savings***	***kWh Realization Rate***	***kW Realization Rate***
LED upgrade	8,755	2.03	122.2%	123.8%
LED upgrade	-2,680	-0.62	122.2%	124.0%
LED upgrade	5,663	0.00	101.5%	0.0%
LED upgrade	7,744	0.00	50.1%	0.0%
LED upgrade	73,952	0.00	50.0%	0.0%
LED upgrade	2,615	0.00	59.0%	0.0%
Total	**96,049**	**1.41**	**53.9%**	**3.5%**

Project Number Project 13

Program CESP 2014

Project Background

The participant is a manufacturing facility that received incentives from IID for improving their process equipment energy efficiency with an increase in production. On-site, the Evaluators verified the installation and operation of the following measures:

- 250 ton all electric injection molder
- 110 ton all electric injection molder

Calculation Parameters

Savings calculations were performed using utility data and savings methodology described below using site visit data. With the increased production the baseline energy usage needs to be normalized to the post production amount. The utility data did not show any correlation with outdoor weather data so this variable was not used in the calculations.

$$Annual\ Energy\ Savings = (Adjusted\ kWh_{Pre} - kWh_{Post})$$

$$kWh_{Pre} = \frac{\sum(kWh_{month})}{days_{pre}} \times 365\ days/yr$$

$$kWh_{Post} = \frac{\sum(kWh_{month})}{days_{post}} \times 365\ days/yr$$

$$Adjusted\ kWh_{Pre} = kWh_{pre} \times \frac{Prod_{post}}{Prod_{pre}}$$

$$kW_{peak} = \frac{Annual\ Energy\ Savings}{Hours}$$

Where,

kWh_{Pre} Average baseline annual energy usage, kWh/yr

kWh_{Post} Estimated post annual energy usage, kWh/yr

$Adjusted\ kWh_{Pre}$ Baseline annual energy usage adjusted for increase plant production, kWh/yr

kWh_{month} BilLED kWh from utility bills for the pre and post time period, kWh/mo

$days_{pre,post}$ BilLED time period based on utility meter reading date, days

$Prod_{pre}$ Typical plant production rate before improved equipment, lbs/day

$Prod_{post}$ Typical plant production rate after improved equipment, lbs/day

Hours Estimated annual operating hours of the plant, hours/yr

Parameters specific to this site are listed below in Table A:

Table A, Savings Parameters

	Prod (lb/day)	***kWh/day***	***kWh/yr***	***kW_{peak}***
Pre	1,187	294	157,580	26.26
Post	1,741	60	22,077	3.68

Savings Calculations

Table B, Normalized kWh Savings Calculations

Measure	*kWh/day*		*kWh/yr*		*Expected kWh Savings*	*Realized kWh Savings*	*Realization Rate*
	Pre	*Post*	*Pre*	*Post*			
Process Improvement	294	60	157,580	22,077	178,700	135,503	75.8%
				Total	**178,700**	**135,503**	**75.8%**

Table C, HVAC kW Savings Calculations

Measure	*kW_{peak}*		*Expected kW Savings*	*Realized kW Savings*	*Realization Rate*
	Pre	*Post*			
Process Improvement	26.26	3.68	29.25	22.58	77.2%
		Total	**29.25**	**22.58**	**77.2%**

Results

The kWh realization rate for Project 13 is 75.8% and the kW realization rate is 77.2%.

Ex ante calculations only used four months of the utility data to estimate the baseline energy usage. instead of using all the available utility data without providing a reason for the exclusion. The utility data does not show large changes over time that could be related to increase in production rates. The four months included in the baseline contain two of the highest billed months which will overestimate the pre-installation annual energy consumption.

Table D, Verified Gross Savings & Realization Rates

Measure	***Verified***			
	kWh Savings	***kW Savings***	***kWh Realization Rate***	***kW Realization Rate***
Process Improvement	135,503	22.58	75.8%	77.2%
Total	**135,503**	**22.58**	**75.8%**	**77.2%**

Project Number Project 14

Program CESP 2015

Project Background

The participant is a junior high school that received incentives for retrofitting interior and exterior lighting, installing occupancy sensors to control portions of the newly-installed lighting and retrofitting existing air conditioners and heat pumps with more efficient units. On-site, the Evaluators verified the installation and operation of the following measures:

- (126)3' 1-Lamp T8 RLOs r replaced (126) 4' 1-Lamp T8s
- (1892)4' 2-Lamp T8 28W RLOs r replaced (1892) 4' 2-Lamp T8s
- (68)29W LED - Non-Int. ballasts r replaced (68) 100W metal halides
- (18)100W LED - Non-Int. ballasts r replaced (18) 400W metal halides
- (20)40W LED - Non-Int. ballasts r replaced (20) 150W HPSs
- (32)91W LED - Non-Int. ballasts r replaced (32) 250W metal halides
- (4)10W LED - Non-Int. ballasts r replaced (4) 70W HPSs

Additionally, occupancy sensors were installed to control 236 of the newly-installed fixtures.

The site also replaced existing HVAC equipment with newer, more efficient units:

- (48) air conditioning units (totaling 240 tons)
- (14) heat pumps (totaling 61 tons)

On site, lighting operation schedules were also collected through staff interviews and photo-logging equipment was placed on site to monitor lighting operation.

Calculation Parameters

Lighting savings calculations were performed using the methods section 2.2.2. of this report. Parameters specific to this site are listed below in Table A:

Table A Savings Parameters

Space Type	***Air Conditioned***	***Annual Hours***	***IEF_E***	***IEF_D***	***CF***
Primary School (classrooms)	Yes	1,800	1.21	1.30	20%
Primary School (non-classrooms)	Yes	Custom, varies by area	1.21	1.30	20%

Exterior	No	4,313	1.00	1.00	0%

HVAC savings calculations were performed using savings methodology described below incorporating deemed EFLH from the 2014 CA TRM and data gathered on site.

$$Annual\ Energy\ Savings = (kW_{Pre} - kW_{Post})\ x\ EFLH$$

$$kW_{Pre} = \frac{Tonnage\ x\ 12}{EER_{Pre}}$$

$$kW_{Post} = \frac{Tonnage\ x\ 12}{EER_{post}}$$

Where,
kW_{Pre}Baseline HVAC full load energy usage, kW
kW_{Post}InstalLED HVAC full load energy usage, kW
EER_{pre}Baseline HVAC rated energy efficiency rating, BTUh/Watt
EER_{Post}InstalLED HVAC rated energy efficiency rating, BTUh/Watt
EFLHEstimated full load hours per year, hr/yr
$Tonnage$Total HVAC rated tonnage, tons
12Conversion factor BTUh to tons (12,000 :1) and W to kW (1,000 :1)

Parameters specific to this site are listed below in Table B:

Table B, Savings Parameters

HVAC Type	***EER_{Pre}***	***EER_{Post}***	***Tons***	***kW_{Pre}***	***kW_{Post}***	***EFLH***
Package/Split	9.4	12.0	61	77.9	61.0	1,267
Heat Pump	8.9	12.0	84	113.3	84.0	1,267

Savings Calculations

Table C, Lighting Retrofit kWh Savings Calculations

Measure	*Quantity (Fixtures)*		*Wattage*		*AOH (no sensors)*	*AOH (w/ sensor reduction)*	*Expected kWh Savings*	*Realized kWh Savings*	*IEF_E*	*Realization Rate*
	Base	*Post*	*Base*	*Post*						
F32T8 to F25T8	15	15	32	21	3,000	3,000	495	599	1.21	121.0%

F32T8 to F32T8-28W	5	5	59	42	3,000	3,000	255	309	1.21	121.0%
F32T8 to F32T8-28W	2	2	59	42	2,800	2,800	95	115	1.21	121.3%
F32T8 to F32T8-28W	3	3	59	42	2,800	2,800	143	173	1.21	120.8%
F32T8 to F32T8-28W	4	4	59	42	3,000	3,000	204	247	1.21	121.0%
F32T8 to F32T8-28W	4	4	59	42	2,800	2,800	190	230	1.21	121.3%
F32T8 to F32T8-28W	1	1	59	42	1,100	1,100	19	23	1.21	122.6%
F32T8 to F32T8-28W	8	8	59	42	3,500	3,500	476	576	1.21	121.0%
F32T8 to F32T8-28W	9	9	59	42	3,000	3,000	459	555	1.21	121.0%
F32T8 to F32T8-28W	2	2	59	42	1,100	1,100	37	45	1.21	122.3%
F32T8 to F32T8-28W	2	2	59	42	1,100	1,100	37	45	1.21	122.3%
F32T8 to F32T8-28W	2	2	59	42	2,800	2,800	95	115	1.21	121.3%
F32T8 to F32T8-28W	2	2	59	42	2,800	2,800	95	115	1.21	121.3%
F32T8 to F32T8-28W	2	2	59	42	2,800	2,800	95	115	1.21	121.3%
F32T8 to F32T8-28W	2	2	59	42	2,800	2,800	95	115	1.21	121.3%
MH100 to LED29W	7	7	130	29	4,313	4,313	3,084	3,037	1.00	98.5%
MH400 to LED100W	4	4	458	100	4,313	4,313	6,272	6,176	1.00	98.5%
HPS150 to LED40W	3	3	195	40	4,313	4,313	2,037	2,006	1.00	98.5%
MH250 to LED91W	16	16	295	91	4,313	4,313	14,296	14,078	1.00	98.5%
F32T8 to F32T8-28W	18	18	59	42	1,800	1,800	551	666	1.21	121.0%
F32T8 to F32T8-28W	18	18	59	42	1,800	1,800	551	666	1.21	121.0%
F32T8 to F32T8-28W	18	18	59	42	1,800	1,800	551	666	1.21	121.0%
F32T8 to F32T8-28W	18	18	59	42	1,800	1,800	551	666	1.21	121.0%
F32T8 to F32T8-28W	16	16	59	42	1,800	1,800	490	592	1.21	120.9%
F32T8 to F32T8-28W	18	18	59	42	1,800	1,800	551	666	1.21	121.0%
F32T8 to F32T8-28W	16	16	59	42	1,800	1,800	490	592	1.21	120.9%
F32T8 to F32T8-28W	18	18	59	42	1,800	1,800	551	666	1.21	121.0%

F32T8 to F32T8-28W	16	16	59	42	1,800	1,800	490	592	1.21	120.9%
F32T8 to F32T8-28W	18	18	59	42	1,800	1,800	551	666	1.21	121.0%
F32T8 to F32T8-28W	16	16	59	42	1,800	1,800	490	592	1.21	120.9%
F32T8 to F32T8-28W	18	18	59	42	1,800	1,800	551	666	1.21	121.0%
F32T8 to F32T8-28W	6	6	59	42	3,000	3,000	306	370	1.21	121.0%
F32T8 to F32T8-28W	6	6	59	42	3,000	3,000	306	370	1.21	121.0%
F32T8 to F25T8	48	48	32	21	2,800	2,800	1,478	1,789	1.21	121.0%
F32T8 to F32T8-28W	39	39	59	42	2,800	2,800	1,856	2,246	1.21	121.0%
MH100 to LED29W	6	6	130	29	4,313	4,313	2,644	2,603	1.00	98.5%
MH400 to LED100W	1	1	458	100	4,313	4,313	1,568	1,544	1.00	98.5%
HPS150 to LED40W	1	1	195	40	4,313	4,313	679	669	1.00	98.5%
F32T8 to F32T8-28W	16	16	59	42	1,800	1,800	490	592	1.21	120.9%
F32T8 to F32T8-28W	47	47	59	42	8,760	8,760	1,758	8,469	1.21	481.7%
F32T8 to F32T8-28W	47	47	59	42	8,760	8,760	1,758	8,469	1.21	481.7%
F32T8 to F32T8-28W w/sensor	2	2	59	42	2,200	1,716	127	140	1.21	110.0%
F32T8 to F32T8-28W	7	7	59	42	2,200	2,200	262	317	1.21	120.9%
F32T8 to F32T8-28W	6	6	59	42	2,200	2,200	224	272	1.21	121.2%
F32T8 to F32T8-28W	6	6	59	42	2,200	2,200	224	272	1.21	121.2%
HPS150 to LED40W	1	1	195	40	4,313	4,313	679	669	1.00	98.5%
MH100 to LED29W	6	6	130	29	4,313	4,313	2,644	2,603	1.00	98.5%
MH400 to LED100W	1	1	458	100	4,313	4,313	1,568	1,544	1.00	98.5%
HPS150 to LED40W	1	1	195	40	4,313	4,313	679	669	1.00	98.5%
HPS70 to LED10W	2	2	95	10	4,313	4,313	745	733	1.00	98.4%
F32T8 to F32T8-28W	16	16	59	42	1,800	1,800	490	592	1.21	120.9%
F32T8 to F32T8-28W	16	16	59	42	1,800	1,800	490	592	1.21	120.9%

F32T8 to F32T8-28W	16	16	59	42	1,800	1,800	490	592	1.21	120.9%
F32T8 to F32T8-28W	16	16	59	42	1,800	1,800	490	592	1.21	120.9%
F32T8 to F32T8-28W	16	16	59	42	1,800	1,800	490	592	1.21	120.9%
F32T8 to F32T8-28W	16	16	59	42	1,800	1,800	490	592	1.21	120.9%
F32T8 to F32T8-28W	16	16	59	42	1,800	1,800	490	592	1.21	120.9%
F32T8 to F32T8-28W	16	16	59	42	1,800	1,800	490	592	1.21	120.9%
F32T8 to F32T8-28W	16	16	59	42	1,800	1,800	490	592	1.21	120.9%
F32T8 to F32T8-28W	16	16	59	42	1,800	1,800	490	592	1.21	120.9%
F32T8 to F32T8-28W	16	16	59	42	1,800	1,800	490	592	1.21	120.9%
F32T8 to F32T8-28W	16	16	59	42	1,800	1,800	490	592	1.21	120.9%
F32T8 to F32T8-28W	16	16	59	42	1,800	1,800	490	592	1.21	120.9%
F32T8 to F32T8-28W	16	16	59	42	1,800	1,800	490	592	1.21	120.9%
F32T8 to F32T8-28W	16	16	59	42	1,800	1,800	490	592	1.21	120.9%
F32T8 to F32T8-28W	16	16	59	42	1,800	1,800	490	592	1.21	120.9%
F32T8 to F32T8-28W	16	16	59	42	1,800	1,800	490	592	1.21	120.9%
F32T8 to F32T8-28W	14	14	59	42	1,800	1,800	428	518	1.21	121.1%
F32T8 to F32T8-28W	16	16	59	42	1,800	1,800	490	592	1.21	120.9%
F32T8 to F32T8-28W	76	76	59	42	2,800	2,800	3,618	4,377	1.21	121.0%
F32T8 to F32T8-28W	16	16	59	42	1,800	1,800	490	592	1.21	120.9%
F32T8 to F32T8-28W	16	16	59	42	1,800	1,800	490	592	1.21	120.9%
MH100 to LED29W	15	15	130	29	4,313	4,313	6,609	6,508	1.00	98.5%
MH400 to LED100W	3	3	458	100	4,313	4,313	4,704	4,632	1.00	98.5%
HPS150 to LED40W	3	3	195	40	4,313	4,313	2,037	2,006	1.00	98.5%
HPS150 to LED40W	1	1	195	40	4,313	4,313	679	669	1.00	98.5%
F32T8 to F32T8-28W	19	19	59	42	1,800	1,800	581	703	1.21	121.1%
F32T8 to F32T8-28W	22	22	59	42	1,800	1,800	673	815	1.21	121.0%

F32T8 to F32T8-28W	22	22	59	42	1,800	1,800	673	815	1.21	121.0%
F32T8 to F32T8-28W	16	16	59	42	1,800	1,800	490	592	1.21	120.9%
F32T8 to F32T8-28W	19	19	59	42	1,800	1,800	581	703	1.21	121.1%
F32T8 to F32T8-28W	32	32	59	42	1,800	1,800	979	1,185	1.21	121.0%
F32T8 to F32T8-28W	24	24	59	42	2,600	2,600	1,061	1,284	1.21	121.0%
F32T8 to F32T8-28W	8	8	59	42	1,300	1,300	177	214	1.21	120.9%
F32T8 to F32T8-28W	2	2	59	42	1,300	1,300	44	53	1.21	121.6%
F32T8 to F32T8-28W	14	14	59	42	2,800	2,800	666	806	1.21	121.1%
F32T8 to F32T8-28W	9	9	59	42	2,200	2,200	337	407	1.21	120.9%
F32T8 to F32T8-28W	4	4	59	42	2,200	2,200	150	181	1.21	120.7%
F32T8 to F32T8-28W	2	2	59	42	2,200	2,200	75	91	1.21	120.7%
F32T8 to F32T8-28W	8	8	59	42	2,200	2,200	299	362	1.21	121.1%
MH100 to LED29W	6	6	130	29	4,313	4,313	2,644	2,603	1.00	98.5%
MH400 to LED100W	3	3	458	100	4,313	4,313	4,704	4,632	1.00	98.5%
HPS150 to LED40W	1	1	42	40	4,313	4,313	679	9	1.00	1.3%
HPS150 to LED40W	1	1	195	40	4,313	4,313	679	669	1.00	98.5%
F32T8 to F32T8-28W	4	4	90	63	3,500	3,500	378	457	1.21	121.0%
MH400 to LED223W	27	27	458	223	4,000	4,000	25,380	30,710	1.21	121.0%
F32T8 to F32T8-28W	20	20	59	42	3,500	3,500	1,190	1,440	1.21	121.0%
F32T8 to F32T8-28W	17	17	59	42	3,500	3,500	1,012	1,224	1.21	120.9%
F32T8 to F32T8-28W	2	2	59	42	2,500	2,500	85	103	1.21	121.0%
F32T8 to F32T8-28W w/sensor	1	1	59	42	1,100	858	32	35	1.21	109.1%
F32T8 to F32T8-28W	17	17	59	42	3,500	3,500	1,012	1,224	1.21	120.9%
F32T8 to F32T8-28W	2	2	59	42	2,500	2,500	85	103	1.21	121.0%
F32T8 to F32T8-28W w/sensor	1	1	59	42	1,100	858	32	35	1.21	109.1%

MH100 to LED29W	4	4	130	29	4,313	4,313	1,763	1,736	1.00	98.4%
MH400 to LED100W	4	4	458	100	4,313	4,313	6,272	6,176	1.00	98.5%
HPS150 to LED40W	3	3	195	40	4,313	4,313	2,037	2,006	1.00	98.5%
HPS150 to LED40W	6	6	195	40	4,313	4,313	4,073	4,011	1.00	98.5%
MH100 to LED29W	9	9	130	29	4,313	4,313	3,966	3,905	1.00	98.5%
F32T8 to F32T8-28W w/sensor	10	10	59	42	1,800	1,476	518	535	1.21	103.3%
CFM18W to LED10W	1	1	18	10	5,000	5,000	50	48	1.21	96.8%
F32T8 to F32T8-28W w/sensor	10	10	59	42	1,800	1,476	518	535	1.21	103.3%
CFM18W to LED10W	1	1	18	10	5,000	5,000	50	48	1.21	96.8%
F32T8 to F32T8-28W w/sensor	10	10	59	42	1,800	1,476	518	535	1.21	103.3%
CFM18W to LED10W	1	1	18	10	5,000	5,000	50	48	1.21	96.8%
F32T8 to F32T8-28W w/sensor	10	10	59	42	1,800	1,476	518	535	1.21	103.3%
CFM18W to LED10W	1	1	18	10	5,000	5,000	50	48	1.21	96.8%
F32T8 to F32T8-28W w/sensor	10	10	59	42	1,800	1,476	518	535	1.21	103.3%
CFM18W to LED10W	1	1	18	10	5,000	5,000	50	48	1.21	96.8%
F32T8 to F32T8-28W w/sensor	10	10	59	42	1,800	1,476	518	535	1.21	103.3%
CFM18W to LED10W	1	1	18	10	5,000	5,000	50	48	1.21	96.8%
F32T8 to F32T8-28W	2	2	59	42	3,000	3,000	102	123	1.21	121.0%
F32T8 to F32T8-28W	2	2	59	42	3,000	3,000	102	123	1.21	121.0%
F32T8 to F32T8-28W w/sensor	1	1	59	42	3,000	2,160	86	104	1.21	121.4%
CFM18W to LED10W	1	1	18	10	5,000	5,000	50	48	1.21	96.8%
F32T8 to F32T8-28W w/sensor	12	12	118	63	1,800	1,476	1,569	1,734	1.21	110.5%

CFM18W to LED10W	1	1	18	10	5,000	5,000	50	48	1.21	96.8%
F32T8 to F32T8-28W w/sensor	12	12	118	63	1,800	1,476	1,569	1,734	1.21	110.5%
CFM18W to LED10W	1	1	18	10	5,000	5,000	50	48	1.21	96.8%
F32T8 to F32T8-28W w/sensor	12	12	118	63	1,800	1,476	1,569	1,734	1.21	110.5%
CFM18W to LED10W	1	1	18	10	5,000	5,000	50	48	1.21	96.8%
F32T8 to F32T8-28W w/sensor	8	8	59	42	1,800	1,476	414	428	1.21	103.4%
CFM18W to LED10W	1	1	18	10	5,000	5,000	50	48	1.21	96.8%
F32T8 to F32T8-28W w/sensor	8	8	59	42	1,800	1,476	414	428	1.21	103.4%
CFM18W to LED10W	1	1	18	10	5,000	5,000	50	48	1.21	96.8%
F32T8 to F32T8-28W w/sensor	12	12	118	63	1,800	1,476	1,569	1,734	1.21	110.5%
CFM18W to LED10W	1	1	18	10	5,000	5,000	50	48	1.21	96.8%
F32T8 to F32T8-28W w/sensor	12	12	118	63	1,800	1,476	1,569	1,734	1.21	110.5%
CFM18W to LED10W	1	1	18	10	5,000	5,000	50	48	1.21	96.8%
F32T8 to F32T8-28W w/sensor	12	12	118	63	1,800	1,476	1,569	1,734	1.21	110.5%
CFM18W to LED10W	1	1	18	10	5,000	5,000	50	48	1.21	96.8%
F32T8 to F32T8-28W w/sensor	12	12	118	63	1,800	1,476	1,569	1,734	1.21	110.5%
CFM18W to LED10W	1	1	18	10	5,000	5,000	50	48	1.21	96.8%
F32T8 to F32T8-28W w/sensor	8	8	59	42	1,800	1,476	414	428	1.21	103.4%
CFM18W to LED10W	1	1	18	10	5,000	5,000	50	48	1.21	96.8%
F32T8 to F32T8-28W w/sensor	10	10	59	42	1,800	1,476	518	535	1.21	103.3%
CFM18W to LED10W	1	1	18	10	5,000	5,000	50	48	1.21	96.8%

F32T8 to F32T8-28W w/sensor	10	10	59	42	1,800	1,476	518	535	1.21	103.3%
CFM18W to LED10W	1	1	18	10	5,000	5,000	50	48	1.21	96.8%
F32T8 to F32T8-28W w/sensor	12	12	118	63	1,800	1,476	1,569	1,734	1.21	110.5%
CFM18W to LED10W	1	1	18	10	5,000	5,000	50	48	1.21	96.8%
F32T8 to F32T8-28W w/sensor	10	10	59	42	1,800	1,476	518	535	1.21	103.3%
CFM18W to LED10W	1	1	18	10	5,000	5,000	50	48	1.21	96.8%
F32T8 to F32T8-28W w/sensor	12	12	118	63	1,800	1,476	1,569	1,734	1.21	110.5%
CFM18W to LED10W	1	1	18	10	5,000	5,000	50	48	1.21	96.8%
F32T8 to F32T8-28W w/sensor	8	8	59	42	1,800	1,476	414	428	1.21	103.4%
CFM18W to LED10W	1	1	18	10	5,000	5,000	50	48	1.21	96.8%
F32T8 to F32T8-28W	2	2	59	42	3,000	3,000	102	123	1.21	121.0%
F32T8 to F32T8-28W	2	2	59	42	3,000	3,000	102	123	1.21	121.0%
F32T8 to F32T8-28W w/sensor	1	1	59	42	3,000	2,160	86	104	1.21	121.4%
CFM18W to LED10W	1	1	18	10	5,000	5,000	50	48	1.21	96.8%
						Total	**167,745**	**181,511**		**108.2%**

Table D, Lighting Retrofit kW Savings Calculations

Measure	*Quantity (Fixtures)*		*Wattage*		*CF (no sensors)*	*CF (w/ sensor reduction)*	*Expected kW Savings*	*Realized kW Savings*	IEF_D	*Realization Rate*
	Base	*Post*	*Base*	*Post*						
F32T8 to F25T8	15	15	32	21	0.020	0.020	0.18	0.00	1.34	0.0%
F32T8 to F32T8-28W	5	5	59	42	0.020	0.020	0.09	0.00	1.34	0.0%
F32T8 to F32T8-28W	2	2	59	42	0.020	0.020	0.03	0.00	1.34	0.0%

F32T8 to F32T8-28W	3	3	59	42	0.020	0.020	0.05	0.00	1.34	0.0%
F32T8 to F32T8-28W	4	4	59	42	0.020	0.020	0.07	0.00	1.34	0.0%
F32T8 to F32T8-28W	4	4	59	42	0.020	0.020	0.07	0.00	1.34	0.0%
F32T8 to F32T8-28W	1	1	59	42	0.020	0.020	0.01	0.00	1.34	0.0%
F32T8 to F32T8-28W	8	8	59	42	0.020	0.020	0.17	0.00	1.34	0.0%
F32T8 to F32T8-28W	9	9	59	42	0.020	0.020	0.16	0.00	1.34	0.0%
F32T8 to F32T8-28W	2	2	59	42	0.020	0.020	0.01	0.00	1.34	0.0%
F32T8 to F32T8-28W	2	2	59	42	0.020	0.020	0.01	0.00	1.34	0.0%
F32T8 to F32T8-28W	2	2	59	42	0.020	0.020	0.03	0.00	1.34	0.0%
F32T8 to F32T8-28W	2	2	59	42	0.020	0.020	0.03	0.00	1.34	0.0%
F32T8 to F32T8-28W	2	2	59	42	0.020	0.020	0.03	0.00	1.34	0.0%
F32T8 to F32T8-28W	2	2	59	42	0.020	0.020	0.03	0.00	1.34	0.0%
MH100 to LED29W	7	7	130	29	0.000	0.000	1.09	0.00	1.00	0.0%
MH400 to LED100W	4	4	458	100	0.000	0.000	2.22	0.00	1.00	0.0%
HPS150 to LED40W	3	3	195	40	0.000	0.000	0.72	0.00	1.00	0.0%
MH250 to LED91W	16	16	295	91	0.000	0.000	5.06	0.00	1.00	0.0%
F32T8 to F32T8-28W	18	18	59	42	0.020	0.016	0.20	0.01	1.34	5.0%
F32T8 to F32T8-28W	18	18	59	42	0.020	0.016	0.20	0.01	1.34	5.0%
F32T8 to F32T8-28W	18	18	59	42	0.020	0.016	0.20	0.01	1.34	5.0%
F32T8 to F32T8-28W	18	18	59	42	0.020	0.016	0.20	0.01	1.34	5.0%
F32T8 to F32T8-28W	16	16	59	42	0.020	0.016	0.17	0.01	1.34	5.9%
F32T8 to F32T8-28W	18	18	59	42	0.020	0.016	0.20	0.01	1.34	5.0%
F32T8 to F32T8-28W	16	16	59	42	0.020	0.016	0.17	0.01	1.34	5.9%
F32T8 to F32T8-28W	18	18	59	42	0.020	0.016	0.20	0.01	1.34	5.0%
F32T8 to F32T8-28W	16	16	59	42	0.020	0.016	0.17	0.01	1.34	5.9%
F32T8 to F32T8-28W	18	18	59	42	0.020	0.016	0.20	0.01	1.34	5.0%

F32T8 to F32T8-28W	16	16	59	42	0.020	0.016	0.17	0.01	1.34	5.9%
F32T8 to F32T8-28W	18	18	59	42	0.020	0.016	0.20	0.01	1.34	5.0%
F32T8 to F32T8-28W	6	6	59	42	0.020	0.020	0.11	0.00	1.34	0.0%
F32T8 to F32T8-28W	6	6	59	42	0.020	0.020	0.11	0.00	1.34	0.0%
F32T8 to F25T8	48	48	32	21	0.020	0.020	0.52	0.01	1.34	1.9%
F32T8 to F32T8-28W	39	39	59	42	0.020	0.020	0.66	0.02	1.34	3.0%
MH100 to LED29W	6	6	130	29	0.000	0.000	0.94	0.00	1.00	0.0%
MH400 to LED100W	1	1	458	100	0.000	0.000	0.56	0.00	1.00	0.0%
HPS150 to LED40W	1	1	195	40	0.000	0.000	0.24	0.00	1.00	0.0%
F32T8 to F32T8-28W	16	16	59	42	0.020	0.016	0.17	0.01	1.34	5.9%
F32T8 to F32T8-28W	47	47	59	42	0.020	0.020	0.62	0.02	1.34	3.2%
F32T8 to F32T8-28W	47	47	59	42	0.020	0.020	0.62	0.02	1.34	3.2%
F32T8 to F32T8-28W w/sensor	2	2	59	42	0.020	0.020	0.04	0.00	1.34	0.0%
F32T8 to F32T8-28W	7	7	59	42	0.020	0.020	0.09	0.00	1.34	0.0%
F32T8 to F32T8-28W	6	6	59	42	0.020	0.020	0.08	0.00	1.34	0.0%
F32T8 to F32T8-28W	6	6	59	42	0.020	0.020	0.08	0.00	1.34	0.0%
HPS150 to LED40W	1	1	195	40	0.000	0.000	0.24	0.00	1.00	0.0%
MH100 to LED29W	6	6	130	29	0.000	0.000	0.94	0.00	1.00	0.0%
MH400 to LED100W	1	1	458	100	0.000	0.000	0.56	0.00	1.00	0.0%
HPS150 to LED40W	1	1	195	40	0.000	0.000	0.24	0.00	1.00	0.0%
HPS70 to LED10W	2	2	95	10	0.000	0.000	0.26	0.00	1.00	0.0%
F32T8 to F32T8-28W	16	16	59	42	0.020	0.016	0.17	0.01	1.34	5.9%
F32T8 to F32T8-28W	16	16	59	42	0.020	0.016	0.17	0.01	1.34	5.9%
F32T8 to F32T8-28W	16	16	59	42	0.020	0.016	0.17	0.01	1.34	5.9%
F32T8 to F32T8-28W	16	16	59	42	0.020	0.016	0.17	0.01	1.34	5.9%

F32T8 to F32T8-28W	16	16	59	42	0.020	0.016	0.17	0.01	1.34	5.9%
F32T8 to F32T8-28W	16	16	59	42	0.020	0.016	0.17	0.01	1.34	5.9%
F32T8 to F32T8-28W	16	16	59	42	0.020	0.016	0.17	0.01	1.34	5.9%
F32T8 to F32T8-28W	16	16	59	42	0.020	0.016	0.17	0.01	1.34	5.9%
F32T8 to F32T8-28W	16	16	59	42	0.020	0.016	0.17	0.01	1.34	5.9%
F32T8 to F32T8-28W	16	16	59	42	0.020	0.016	0.17	0.01	1.34	5.9%
F32T8 to F32T8-28W	16	16	59	42	0.020	0.016	0.17	0.01	1.34	5.9%
F32T8 to F32T8-28W	16	16	59	42	0.020	0.016	0.17	0.01	1.34	5.9%
F32T8 to F32T8-28W	16	16	59	42	0.020	0.016	0.17	0.01	1.34	5.9%
F32T8 to F32T8-28W	16	16	59	42	0.020	0.016	0.17	0.01	1.34	5.9%
F32T8 to F32T8-28W	16	16	59	42	0.020	0.016	0.17	0.01	1.34	5.9%
F32T8 to F32T8-28W	16	16	59	42	0.020	0.016	0.17	0.01	1.34	5.9%
F32T8 to F32T8-28W	16	16	59	42	0.020	0.016	0.17	0.01	1.34	5.9%
F32T8 to F32T8-28W	14	14	59	42	0.020	0.016	0.15	0.01	1.34	6.7%
F32T8 to F32T8-28W	16	16	59	42	0.020	0.016	0.17	0.01	1.34	5.9%
F32T8 to F32T8-28W	76	76	59	42	0.020	0.020	1.28	0.03	1.34	2.3%
F32T8 to F32T8-28W	16	16	59	42	0.020	0.016	0.17	0.01	1.34	5.9%
F32T8 to F32T8-28W	16	16	59	42	0.020	0.016	0.17	0.01	1.34	5.9%
MH100 to LED29W	15	15	130	29	0.000	0.000	2.34	0.00	1.00	0.0%
MH400 to LED100W	3	3	458	100	0.000	0.000	1.67	0.00	1.00	0.0%
HPS150 to LED40W	3	3	195	40	0.000	0.000	0.72	0.00	1.00	0.0%
HPS150 to LED40W	1	1	195	40	0.000	0.000	0.24	0.00	1.00	0.0%
F32T8 to F32T8-28W	19	19	59	42	0.020	0.016	0.21	0.01	1.34	4.8%
F32T8 to F32T8-28W	22	22	59	42	0.020	0.016	0.24	0.02	1.34	8.3%
F32T8 to F32T8-28W	22	22	59	42	0.020	0.016	0.24	0.02	1.34	8.3%
F32T8 to F32T8-28W	16	16	59	42	0.020	0.016	0.17	0.01	1.34	5.9%

F32T8 to F32T8-28W	19	19	59	42	0.020	0.016	0.21	0.01	1.34	4.8%
F32T8 to F32T8-28W	32	32	59	42	0.020	0.016	0.35	0.02	1.34	5.7%
F32T8 to F32T8-28W	24	24	59	42	0.020	0.020	0.38	0.01	1.34	2.6%
F32T8 to F32T8-28W	8	8	59	42	0.020	0.020	0.06	0.00	1.34	0.0%
F32T8 to F32T8-28W	2	2	59	42	0.020	0.020	0.02	0.00	1.34	0.0%
F32T8 to F32T8-28W	14	14	59	42	0.020	0.020	0.24	0.01	1.34	4.2%
F32T8 to F32T8-28W	9	9	59	42	0.020	0.020	0.12	0.00	1.34	0.0%
F32T8 to F32T8-28W	4	4	59	42	0.020	0.020	0.05	0.00	1.34	0.0%
F32T8 to F32T8-28W	2	2	59	42	0.020	0.020	0.03	0.00	1.34	0.0%
F32T8 to F32T8-28W	8	8	59	42	0.020	0.020	0.11	0.00	1.34	0.0%
MH100 to LED29W	6	6	130	29	0.000	0.000	0.94	0.00	1.00	0.0%
MH400 to LED100W	3	3	458	100	0.000	0.000	1.67	0.00	1.00	0.0%
HPS150 to LED40W	1	1	42	40	0.000	0.000	0.24	0.00	1.00	0.0%
HPS150 to LED40W	1	1	195	40	0.000	0.000	0.24	0.00	1.00	0.0%
F32T8 to F32T8-28W	4	4	90	63	0.020	0.020	0.13	0.00	1.34	0.0%
MH400 to LED223W	27	27	458	223	0.020	0.020	8.99	0.17	1.34	1.9%
F32T8 to F32T8-28W	20	20	59	42	0.020	0.020	0.42	0.01	1.34	2.4%
F32T8 to F32T8-28W	17	17	59	42	0.020	0.020	0.36	0.01	1.34	2.8%
F32T8 to F32T8-28W	2	2	59	42	0.020	0.020	0.03	0.00	1.34	0.0%
F32T8 to F32T8-28W w/sensor	1	1	59	42	0.020	0.020	0.01	0.00	1.34	0.0%
F32T8 to F32T8-28W	17	17	59	42	0.020	0.020	0.36	0.01	1.34	2.8%
F32T8 to F32T8-28W	2	2	59	42	0.020	0.020	0.03	0.00	1.34	0.0%
F32T8 to F32T8-28W w/sensor	1	1	59	42	0.020	0.020	0.01	0.00	1.34	0.0%
MH100 to LED29W	4	4	130	29	0.000	0.000	0.62	0.00	1.00	0.0%
MH400 to LED100W	4	4	458	100	0.000	0.000	2.22	0.00	1.00	0.0%

HPS150 to LED40W	3	3	195	40	0.000	0.000	0.72	0.00	1.00	0.0%
HPS150 to LED40W	6	6	195	40	0.000	0.000	1.44	0.00	1.00	0.0%
MH100 to LED29W	9	9	130	29	0.000	0.000	1.40	0.00	1.00	0.0%
F32T8 to F32T8-28W w/sensor	10	10	59	42	0.020	0.016	0.18	0.01	1.34	5.6%
CFM18W to LED10W	1	1	18	10	0.020	0.020	0.02	0.00	1.34	0.0%
F32T8 to F32T8-28W w/sensor	10	10	59	42	0.020	0.016	0.18	0.01	1.34	5.6%
CFM18W to LED10W	1	1	18	10	0.020	0.020	0.02	0.00	1.34	0.0%
F32T8 to F32T8-28W w/sensor	10	10	59	42	0.020	0.016	0.18	0.01	1.34	5.6%
CFM18W to LED10W	1	1	18	10	0.020	0.020	0.02	0.00	1.34	0.0%
F32T8 to F32T8-28W w/sensor	10	10	59	42	0.020	0.016	0.18	0.01	1.34	5.6%
CFM18W to LED10W	1	1	18	10	0.020	0.020	0.02	0.00	1.34	0.0%
F32T8 to F32T8-28W w/sensor	10	10	59	42	0.020	0.016	0.18	0.01	1.34	5.6%
CFM18W to LED10W	1	1	18	10	0.020	0.020	0.02	0.00	1.34	0.0%
F32T8 to F32T8-28W w/sensor	10	10	59	42	0.020	0.016	0.18	0.01	1.34	5.6%
CFM18W to LED10W	1	1	18	10	0.020	0.020	0.02	0.00	1.34	0.0%
F32T8 to F32T8-28W	2	2	59	42	0.020	0.020	0.04	0.00	1.34	0.0%
F32T8 to F32T8-28W	2	2	59	42	0.020	0.020	0.04	0.00	1.34	0.0%
F32T8 to F32T8-28W w/sensor	1	1	59	42	0.020	0.020	0.03	0.00	1.34	0.0%
CFM18W to LED10W	1	1	18	10	0.020	0.020	0.02	0.00	1.34	0.0%
F32T8 to F32T8-28W w/sensor	12	12	118	63	0.020	0.016	0.56	0.02	1.34	3.6%
CFM18W to LED10W	1	1	18	10	0.020	0.020	0.02	0.00	1.34	0.0%

F32T8 to F32T8-28W w/sensor	12	12	118	63	0.020	0.016	0.56	0.02	1.34	3.6%
CFM18W to LED10W	1	1	18	10	0.020	0.020	0.02	0.00	1.34	0.0%
F32T8 to F32T8-28W w/sensor	12	12	118	63	0.020	0.016	0.56	0.02	1.34	3.6%
CFM18W to LED10W	1	1	18	10	0.020	0.020	0.02	0.00	1.34	0.0%
F32T8 to F32T8-28W w/sensor	8	8	59	42	0.020	0.016	0.15	0.01	1.34	6.7%
CFM18W to LED10W	1	1	18	10	0.020	0.020	0.02	0.00	1.34	0.0%
F32T8 to F32T8-28W w/sensor	8	8	59	42	0.020	0.016	0.15	0.01	1.34	6.7%
CFM18W to LED10W	1	1	18	10	0.020	0.020	0.02	0.00	1.34	0.0%
F32T8 to F32T8-28W w/sensor	12	12	118	63	0.020	0.016	0.56	0.02	1.34	3.6%
CFM18W to LED10W	1	1	18	10	0.020	0.020	0.02	0.00	1.34	0.0%
F32T8 to F32T8-28W w/sensor	12	12	118	63	0.020	0.016	0.56	0.02	1.34	3.6%
CFM18W to LED10W	1	1	18	10	0.020	0.020	0.02	0.00	1.34	0.0%
F32T8 to F32T8-28W w/sensor	12	12	118	63	0.020	0.016	0.56	0.02	1.34	3.6%
CFM18W to LED10W	1	1	18	10	0.020	0.020	0.02	0.00	1.34	0.0%
F32T8 to F32T8-28W w/sensor	12	12	118	63	0.020	0.016	0.56	0.02	1.34	3.6%
CFM18W to LED10W	1	1	18	10	0.020	0.020	0.02	0.00	1.34	0.0%
F32T8 to F32T8-28W w/sensor	8	8	59	42	0.020	0.016	0.15	0.01	1.34	6.7%
CFM18W to LED10W	1	1	18	10	0.020	0.020	0.02	0.00	1.34	0.0%
F32T8 to F32T8-28W w/sensor	10	10	59	42	0.020	0.016	0.18	0.01	1.34	5.6%
CFM18W to LED10W	1	1	18	10	0.020	0.020	0.02	0.00	1.34	0.0%

F32T8 to F32T8-28W w/sensor	10	10	59	42	0.020	0.016	0.18	0.01	1.34	5.6%
CFM18W to LED10W	1	1	18	10	0.020	0.020	0.02	0.00	1.34	0.0%
F32T8 to F32T8-28W w/sensor	12	12	118	63	0.020	0.016	0.56	0.02	1.34	3.6%
CFM18W to LED10W	1	1	18	10	0.020	0.020	0.02	0.00	1.34	0.0%
F32T8 to F32T8-28W w/sensor	10	10	59	42	0.020	0.016	0.18	0.01	1.34	5.6%
CFM18W to LED10W	1	1	18	10	0.020	0.020	0.02	0.00	1.34	0.0%
F32T8 to F32T8-28W w/sensor	12	12	118	63	0.020	0.016	0.56	0.02	1.34	3.6%
CFM18W to LED10W	1	1	18	10	0.020	0.020	0.02	0.00	1.34	0.0%
F32T8 to F32T8-28W w/sensor	8	8	59	42	0.020	0.016	0.15	0.01	1.34	6.7%
CFM18W to LED10W	1	1	18	10	0.020	0.020	0.02	0.00	1.34	0.0%
F32T8 to F32T8-28W	2	2	59	42	0.020	0.020	0.04	0.00	1.34	0.0%
F32T8 to F32T8-28W	2	2	59	42	0.020	0.020	0.04	0.00	1.34	0.0%
F32T8 to F32T8-28W w/sensor	1	1	59	42	0.020	0.020	0.03	0.00	1.34	0.0%
CFM18W to LED10W	1	1	18	10	0.020	0.020	0.02	0.00	1.34	0.0%
						Total	**59.44**	**1.06**		**1.8%**

Table E, HVAC kWh Savings Calculations

Measure	*EER*		*EFLH*	*Ton*	*Expected kWh Savings*	*Realized kWh Savings*	*Realization Rate*
	Base	*Post*					
Package/Split	9.4	11	1,267	240	132,934	56,464	42.47%
Heat Pump	8.9	11	1,267	61	46,181	19,894	43.08%
				Total	**179,115**	**76,358**	**42.63%**

Table F, HVAC kW Savings Calculations

Measure	*EER*		*EFLH*	*Ton*	*Expected kW Savings*	*Realized kW Savings*	*Realization Rate*
	Base	*Post*					
Package/Split	9.4	11	1,267	240	46.9	44.6	95.02%
Heat Pump	8.9	11	1,267	61	16.3	15.7	96.33%
				Total	**63.2**	**60.27**	**95.36%**

Results

The kWh and kW realization rates for Project 14 are 78.1% and 50.0%, respectively.

Ex ante calculations assumed classroom lighting operated 1,800 hours annually, and occupancy sensors would decrease this by 28% to 1,296. The 2014 CA TRM recommends an 18% reduction for classrooms for wall or ceiling-mounted occupancy sensors, so the Evaluators revised the reduction in hours to 18%. This resulted in 1,455 post-sensor retrofit AOH for several classrooms, slightly lowering lighting kWh realization. Additionally, all exterior retrofits assumed 4,380 AOH, however this was adjusted to 4,313 to match the IID territory NDH, further reducing the realized kWh. Calculations for 24 previously-installed 18W CFLs assumed 20W per lamp, which was corrected to 18W in *ex post* calculations. *Ex ante* calculations did not use interactive energy or demand factors to account for the reduced load on the HVAC system because of the more efficient lighting. Accounting for these in *ex post* calculations increased both kWh and peak kW realized savings. Finally, all *ex ante* kW reduction calculations assumed a 100% peak coincidence factor for interior and exterior lighting. The Evaluators adjusted this factor to 2% for interior lighting and 0% for exterior lighting, in accordance with deemed TRM specifications for secondary schools, causing the low lighting kW realization rate.

The EFLHc value used in *ex ante* savings calculations is 2,883, which would reflect continuous operation of all units for approximately 13.8 hours per day for all school days during the school year. This EFLHc was adjusted to 1,267 based on the cooling EFLHc from the New Mexico TRM for a primary school in Las Cruces, NM, which is in the same ASHRAE climate zone as this school.

Table G, Verified Gross Savings & Realization Rates

Measure	***Verified***			
	kWh Savings	***kW Savings***	***kWh Realization Rate***	***kW Realization Rate***
Lighting	194,557	1.06	116.0%	1.8%
HVAC	76,358	60.27	42.6%	95.4%
Total	**270,915**	**61.33**	**78.1%**	**50.0%**

Project Number Project 15

Program CESP 2015

Project Background

The participant is a department store that received incentives from IID for retrofitting existing lighting with energy efficient lighting. On-site, the Evaluators verified the installation and operation of the following measures:

- (156) 4' 2-lamp T8 reduced output fixtures replaced (156) 4' 4-lamp T8 fixtures ;
- (85) 4' 1-lamp T8 28ws replaced (85) 4' 2-lamp T8 30w fixtures;
- (897) 36w LED - non-int. ballasts replaced (897) 4' 3-lamp T8 fixtures;
- (9) 18w LED - non-int. ballasts replaced (9) 4' 2-lamp T8 fixtures
- (143) 3' 1-lamp T8 reduced output fixtures replaced (143) 3' 2-lamp T8 fixtures ;
- (34) 13w CFLs replaced (34) 13w cfl fixtures;
- (2) 4' 2-lamp T8 reduced output fixtures replaced (2) 4' 3-lamp T8 fixtures;
- (2) 4' 3-lamp T8 30ws replaced (2) 4' 3-lamp T8 fixtures;
- (31) 4' 2-lamp T8 reduced output fixtures replaced (31) 4' 3-lamp T8 fixtures;
- (9) 2' 2-lamp T8 reduced output fixtures replaced (9) 4' 2-lamp T8 fixtures; and
- (81) 3' 1-lamp T8 reduced output fixtures replaced (81) 3' 4-lamp T8s.

On site, lighting operation schedules were also collected through staff interviews.

Calculation Parameters

Savings calculations were performed using the methods described section 2.2.2. of this report. Parameters specific to this site are listed below in Table A:

Table A, Savings Parameters

Space Type	*Air Conditioned*	*Annual Hours*	*IEF_E*	*IEF_D*	*CF*
Department Store: Stockrooms	Yes	5,700	1.24	1.17	76%

Department Store: Offices, Spot Lighting, Main store	Yes	5,100	1.24	1.17	76%
Department: Alternative Stockroom	Yes	4,080	1.24	1.17	76%
Department: Fitting Room	Yes	5,700	1.24	1.17	76%

Savings Calculations

Table B, Lighting Retrofit kWh Savings Calculations

Measure	*Quantity (Fixtures)*		*Wattage*		*AOH*	*Expected kWh Savings*	*Realized kWh Savings*	IEF_E	*Realization Rate*
	Base	*Post*	*Base*	*Post*					
F44ILL to F42GLL-R	46	46	112	47	5,700	17,043	19,940	1.17	117.0%
F44ILL to F42GLL-R	35	35	112	47	5,700	12,968	15,172	1.17	117.0%
F42IELL to F41IRLU	13	13	55	25	5,700	2,223	2,601	1.17	117.0%
F44ILL to F42GLL-R	1	1	112	47	5,700	371	433	1.17	116.8%
F44ILL to F42GLL-R	3	3	112	47	5,700	1,112	1,300	1.17	116.9%
F42IELL to F41IRLU	6	6	55	25	5,700	1,026	1,200	1.17	117.0%
F44ILL to F42GLL-R	1	1	112	47	5,700	371	433	1.17	116.8%
F43GLL to LED036-FIXT	8	8	88	36	5,700	2,371	2,774	1.17	117.0%
F43GLL to LED036-FIXT	2	2	88	36	5,100	530	621	1.17	117.1%
F43GLL to LED036-FIXT	3	3	88	36	5,100	796	931	1.17	116.9%
F43GLL to LED036-FIXT	4	4	88	36	5,100	1,061	1,241	1.17	117.0%
F42GLL to LED018-FIXT	7	7	59	18	5,100	1,464	1,713	1.17	117.0%

F42GLL to LED018-FIXT	1	1	59	18	5,100	209	245	1.17	117.1%
F43GLL to LED036-FIXT	16	16	88	36	4,080	3,395	3,972	1.17	117.0%
F43GLL to LED036-FIXT	15	15	88	36	4,080	3,182	3,723	1.17	117.0%
F42GLL to LED018-FIXT	1	1	59	18	5,100	209	245	1.17	117.1%
F42IELL to F41IRLU	1	1	55	25	5,100	153	179	1.17	117.0%
F32ILL/2-R to F31ILU/T3-R	4	4	44	19	5,100	510	597	1.17	117.0%
F43GLL to LED036-FIXT	1	1	88	36	5,100	265	310	1.17	117.1%
F44ILL to F42GLL-R	2	2	112	47	5,100	663	776	1.17	117.0%
F42IELL to F41IRLU	2	2	55	25	5,100	306	358	1.17	117.0%
F44ILL to F42GLL-R	2	2	112	47	5,100	663	776	1.17	117.0%
F42IELL to F41IRLU	2	2	55	25	5,100	306	358	1.17	117.0%
F32ILL/2-R to F31ILU/T3-R	2	2	44	19	5,100	255	298	1.17	117.0%
F43GLL to F43IELU	3	3	88	77	5,100	168	197	1.17	117.2%
F43GLL to F42GLL-R	2	2	88	47	5,100	418	489	1.17	117.1%
F43GLL to F43IELU	2	2	88	77	5,100	112	131	1.17	117.2%
F43GLL to F42GLL-R	2	2	88	47	5,100	418	489	1.17	117.1%
F43GLL to LED036-FIXT	5	5	88	36	5,100	1,326	1,551	1.17	117.0%
F42GLL to LED018-FIXT	3	3	59	18	5,100	539	734	1.17	136.2%
F43GLL to LED036-FIXT	5	5	88	36	5,100	1,326	1,551	1.17	117.0%
F42GLL to LED018-FIXT	8	8	59	18	5,100	1,437	1,957	1.17	136.2%

F43GLL to LED036-FIXT	10	10	88	36	5,100	2,278	3,103	1.17	136.2%
F42GLL to LED018-FIXT	6	6	59	18	5,100	1,077	1,468	1.17	136.3%
F43GLL to LED036-FIXT	6	6	88	36	5,100	1,367	1,862	1.17	136.2%
F42GLL to LED018-FIXT	1	1	59	18	5,100	180	245	1.17	135.9%
F43GLL to LED036-FIXT	7	7	88	36	5,100	1,594	2,172	1.17	136.3%
F42GLL to LED018-FIXT	1	1	59	18	5,100	180	245	1.17	135.9%
F43GLL to LED036-FIXT	18	18	88	36	5,100	4,100	5,585	1.17	136.2%
F42GLL to LED018-FIXT	1	1	59	18	5,100	180	245	1.17	135.9%
F43GLL to LED036-FIXT	7	7	88	36	5,100	1,594	2,172	1.17	136.3%
F43GLL to LED036-FIXT	27	27	88	36	5,100	7,160	8,378	1.17	117.0%
F43GLL to F42GLL-R	14	14	88	47	5,100	2,927	3,425	1.17	117.0%
F43GLL to LED036-FIXT	6	6	88	36	5,100	1,273	1,862	1.17	146.2%
F43GLL to F42GLL-R	12	12	88	47	4,380	2,155	2,521	1.17	117.0%
F43GLL to F42GLL-R	5	5	88	47	4,080	836	979	1.17	117.1%
F42GLL to F22ILU/T4-R	8	8	59	26	4,080	1,077	1,260	1.17	117.0%
F42GLL to F22ILU/T4-R	1	1	59	26	4,080	135	158	1.17	116.7%
F44ILL to F42GLL-R	3	3	112	47	5,100	995	1,164	1.17	116.9%
F44ILL to F42GLL-R	61	61	112	47	5,100	20,222	23,659	1.17	117.0%
F34ILL to F31ILL/T2-R	81	81	88	37	5,100	21,068	24,650	1.17	117.0%

F42IELL to F41IRLU	61	61	55	25	5,100	9,333	10,920	1.17	117.0%
F32ILL/2-R to F31ILU/T3-R	117	117	44	19	5,100	14,918	17,453	1.17	117.0%
F32ILL/2-R to F31ILL/T2-R	5	5	44	37	5,100	179	209	1.17	116.7%
F32ILL/2-R to F31ILL/T2-R	5	5	44	37	5,100	179	209	1.17	116.7%
F32ILL/2-R to F31ILL/T2-R	10	10	44	37	5,100	357	418	1.17	117.0%
F43GLL to LED036-FIXT	757	757	88	36	5,100	200,756	234,885	1.17	117.0%
F42GLL to LED018-FIXT	56	56	59	18	5,100	11,710	13,700	1.17	117.0%
					Total	**365,026**	**430,241**		**117.9%**

Table C, Lighting Retrofit kW Savings Calculations

Measure	***Quantity (Fixtures)***		***Wattage***		***CF***	***Expected kW Savings***	***Realized kW Savings***	***IEF_D***	***Realization Rate***
	Base	***Post***	***Base***	***Post***					
F44ILL to F42GLL-R	46	46	112	47	1.00	2.99	3.71	1.24	124.1%
F44ILL to F42GLL-R	35	35	112	47	1.00	2.28	2.82	1.24	123.7%
F42IELL to F41IRLU	13	13	55	25	1.00	0.39	0.48	1.24	123.1%
F44ILL to F42GLL-R	1	1	112	47	1.00	0.07	0.08	1.24	114.3%
F44ILL to F42GLL-R	3	3	112	47	1.00	0.20	0.24	1.24	120.0%
F42IELL to F41IRLU	6	6	55	25	1.00	0.18	0.22	1.24	122.2%
F44ILL to F42GLL-R	1	1	112	47	1.00	0.07	0.08	1.24	114.3%
F43GLL to LED036-FIXT	8	8	88	36	1.00	0.42	0.52	1.24	123.8%
F43GLL to LED036-FIXT	2	2	88	36	1.00	0.09	0.13	1.24	144.4%

F43GLL to LED036-FIXT	3	3	88	36	1.00	0.14	0.19	1.24	135.7%
F43GLL to LED036-FIXT	4	4	88	36	1.00	0.19	0.26	1.24	136.8%
F42GLL to LED018-FIXT	7	7	59	18	1.00	0.26	0.36	1.24	138.5%
F42GLL to LED018-FIXT	1	1	59	18	1.00	0.04	0.05	1.24	125.0%
F43GLL to LED036-FIXT	16	16	88	36	1.00	0.60	1.03	1.24	171.7%
F43GLL to LED036-FIXT	15	15	88	36	1.00	0.56	0.97	1.24	173.2%
F42GLL to LED018-FIXT	1	1	59	18	1.00	0.04	0.05	1.24	125.0%
F42IELL to F41IRLU	1	1	55	25	1.00	0.03	0.04	1.24	133.3%
F32ILL/2-R to F31ILU/T3-R	4	4	44	19	1.00	0.09	0.12	1.24	133.3%
F43GLL to LED036-FIXT	1	1	88	36	1.00	0.05	0.06	1.24	120.0%
F44ILL to F42GLL-R	2	2	112	47	1.00	0.12	0.16	1.24	133.3%
F42IELL to F41IRLU	2	2	55	25	1.00	0.05	0.07	1.24	140.0%
F44ILL to F42GLL-R	2	2	112	47	1.00	0.12	0.16	1.24	133.3%
F42IELL to F41IRLU	2	2	55	25	1.00	0.05	0.07	1.24	140.0%
F32ILL/2-R to F31ILU/T3-R	2	2	44	19	1.00	0.04	0.06	1.24	150.0%
F43GLL to F43IELU	3	3	88	77	1.00	0.03	0.04	1.24	133.3%
F43GLL to F42GLL-R	2	2	88	47	1.00	0.07	0.10	1.24	142.9%
F43GLL to F43IELU	2	2	88	77	1.00	0.02	0.03	1.24	150.0%
F43GLL to F42GLL-R	2	2	88	47	1.00	0.07	0.10	1.24	142.9%
F43GLL to LED036-FIXT	5	5	88	36	1.00	0.23	0.32	1.24	139.1%

F42GLL to LED018-FIXT	3	3	59	18	1.00	0.09	0.15	1.24	166.7%
F43GLL to LED036-FIXT	5	5	88	36	1.00	0.23	0.32	1.24	139.1%
F42GLL to LED018-FIXT	8	8	59	18	1.00	0.25	0.41	1.24	164.0%
F43GLL to LED036-FIXT	10	10	88	36	1.00	0.40	0.64	1.24	160.0%
F42GLL to LED018-FIXT	6	6	59	18	1.00	0.19	0.31	1.24	163.2%
F43GLL to LED036-FIXT	6	6	88	36	1.00	0.24	0.39	1.24	162.5%
F42GLL to LED018-FIXT	1	1	59	18	1.00	0.03	0.05	1.24	166.7%
F43GLL to LED036-FIXT	7	7	88	36	1.00	0.28	0.45	1.24	160.7%
F42GLL to LED018-FIXT	1	1	59	18	1.00	0.03	0.05	1.24	166.7%
F43GLL to LED036-FIXT	18	18	88	36	1.00	0.72	1.16	1.24	161.1%
F42GLL to LED018-FIXT	1	1	59	18	1.00	0.03	0.05	1.24	166.7%
F43GLL to LED036-FIXT	7	7	88	36	1.00	0.28	0.45	1.24	160.7%
F43GLL to LED036-FIXT	27	27	88	36	1.00	1.26	1.74	1.24	138.1%
F43GLL to F42GLL-R	14	14	88	47	1.00	0.51	0.71	1.24	139.2%
F43GLL to LED036-FIXT	6	6	88	36	1.00	0.22	0.39	1.24	177.3%
F43GLL to F42GLL-R	12	12	88	47	1.00	0.38	0.61	1.24	160.5%
F43GLL to F42GLL-R	5	5	88	47	1.00	0.15	0.25	1.24	166.7%
F42GLL to F22ILU/T4-R	8	8	59	26	1.00	0.19	0.33	1.24	173.7%

F42GLL to F22ILU/T4-R	1	1	59	26	1.00	0.02	0.04	1.24	200.0%
F44ILL to F42GLL-R	3	3	112	47	1.00	0.17	0.24	1.24	141.2%
F44ILL to F42GLL-R	61	61	112	47	1.00	3.55	4.92	1.24	138.6%
F34ILL to F31ILL/T2-R	81	81	88	37	1.00	3.70	5.12	1.24	138.4%
F42IELL to F41IRLU	61	61	55	25	1.00	1.64	2.27	1.24	138.4%
F32ILL/2-R to F31ILU/T3-R	117	117	44	19	1.00	2.62	3.63	1.24	138.5%
F32ILL/2-R to F31ILL/T2-R	5	5	44	37	1.00	0.03	0.04	1.24	133.3%
F32ILL/2-R to F31ILL/T2-R	5	5	44	37	1.00	0.03	0.04	1.24	133.3%
F32ILL/2-R to F31ILL/T2-R	10	10	44	37	1.00	0.06	0.09	1.24	150.0%
F43GLL to LED036-FIXT	757	757	88	36	1.00	35.22	48.81	1.24	138.6%
F42GLL to LED018-FIXT	56	56	59	18	1.00	2.05	2.85	1.24	139.0%
					Total	**64.06**	**89.03**		**139.0%**

Results

The kWh realization rate for Project 15 is 117.9% and the kW realization rate is 139.0%.

Fitting room hours were adjusted from 4,380 to 5,100. *Ex ante* calculations did not include the reduced load on the HVAC system as a result of the more efficient lighting as a result of the more efficient lighting. These factors increased both kWh and kW savings. Additionally, while final *ex ante* kWh figures were calculated using appropriate AOH per space, the kW was calculated from kWh figures which all used the same lighting hours of operation (5,100). This underestimated the kW savings slightly as actual hours varied by area of the store. *Ex post* kW savings were calculated per line item, resulting in higher kW savings.

Table D, Verified Gross Savings & Realization Rates

Measure	Verified			
	kWh Savings	kW Savings	kWh Realization Rate	kW Realization Rate
F44ILL to F42GLL-R	19,940	3.71	117.0%	124.1%
F44ILL to F42GLL-R	15,172	2.82	117.0%	123.7%
F42IELL to F41IRLU	2,601	0.48	117.0%	123.1%
F44ILL to F42GLL-R	433	0.08	116.8%	114.3%
F44ILL to F42GLL-R	1,300	0.24	116.9%	120.0%
F42IELL to F41IRLU	1,200	0.22	117.0%	122.2%
F44ILL to F42GLL-R	433	0.08	116.8%	114.3%
F43GLL to LED036-FIXT	2,774	0.52	117.0%	123.8%
F43GLL to LED036-FIXT	621	0.13	117.1%	144.4%
F43GLL to LED036-FIXT	931	0.19	116.9%	135.7%
F43GLL to LED036-FIXT	1,241	0.26	117.0%	136.8%
F42GLL to LED018-FIXT	1,713	0.36	117.0%	138.5%
F42GLL to LED018-FIXT	245	0.05	117.1%	125.0%
F43GLL to LED036-FIXT	3,972	1.03	117.0%	171.7%
F43GLL to LED036-FIXT	3,723	0.97	117.0%	173.2%
F42GLL to LED018-FIXT	245	0.05	117.1%	125.0%
F42IELL to F41IRLU	179	0.04	117.0%	133.3%
F32ILL/2-R to F31ILU/T3-R	597	0.12	117.0%	133.3%
F43GLL to LED036-FIXT	310	0.06	117.1%	120.0%
F44ILL to F42GLL-R	776	0.16	117.0%	133.3%
F42IELL to F41IRLU	358	0.07	117.0%	140.0%
F44ILL to F42GLL-R	776	0.16	117.0%	133.3%

F42IELL to F41IRLU	358	0.07	117.0%	140.0%
F32ILL/2-R to F31ILU/T3-R	298	0.06	117.0%	150.0%
F43GLL to F43IELU	197	0.04	117.2%	133.3%
F43GLL to F42GLL-R	489	0.10	117.1%	142.9%
F43GLL to F43IELU	131	0.03	117.2%	150.0%
F43GLL to F42GLL-R	489	0.10	117.1%	142.9%
F43GLL to LED036-FIXT	1,551	0.32	117.0%	139.1%
F42GLL to LED018-FIXT	734	0.15	136.2%	166.7%
F43GLL to LED036-FIXT	1,551	0.32	117.0%	139.1%
F42GLL to LED018-FIXT	1,957	0.41	136.2%	164.0%
F43GLL to LED036-FIXT	3,103	0.64	136.2%	160.0%
F42GLL to LED018-FIXT	1,468	0.31	136.3%	163.2%
F43GLL to LED036-FIXT	1,862	0.39	136.2%	162.5%
F42GLL to LED018-FIXT	245	0.05	135.9%	166.7%
F43GLL to LED036-FIXT	2,172	0.45	136.3%	160.7%
F42GLL to LED018-FIXT	245	0.05	135.9%	166.7%
F43GLL to LED036-FIXT	5,585	1.16	136.2%	161.1%
F42GLL to LED018-FIXT	245	0.05	135.9%	166.7%
F43GLL to LED036-FIXT	2,172	0.45	136.3%	160.7%
F43GLL to LED036-FIXT	8,378	1.74	117.0%	138.1%
F43GLL to F42GLL-R	3,425	0.71	117.0%	139.2%
F43GLL to LED036-FIXT	1,862	0.39	146.2%	177.3%
F43GLL to F42GLL-R	2,521	0.61	117.0%	160.5%
F43GLL to F42GLL-R	979	0.25	117.1%	166.7%
F42GLL to F22ILU/T4-R	1,260	0.33	117.0%	173.7%
F42GLL to F22ILU/T4-R	158	0.04	116.7%	200.0%

F44ILL to F42GLL-R	1,164	0.24	116.9%	141.2%
F44ILL to F42GLL-R	23,659	4.92	117.0%	138.6%
F34ILL to F31ILL/T2-R	24,650	5.12	117.0%	138.4%
F42IELL to F41IRLU	10,920	2.27	117.0%	138.4%
F32ILL/2-R to F31ILU/T3-R	17,453	3.63	117.0%	138.5%
F32ILL/2-R to F31ILL/T2-R	209	0.04	116.7%	133.3%
F32ILL/2-R to F31ILL/T2-R	209	0.04	116.7%	133.3%
F32ILL/2-R to F31ILL/T2-R	418	0.09	117.0%	150.0%
F43GLL to LED036-FIXT	234,885	48.81	117.0%	138.6%
F42GLL to LED018-FIXT	13,700	2.85	117.0%	139.0%
Total	**430,241**	**89.03**	**117.9%**	**139.0%**

Project Number Project 16

Program CESP 2014

Project Background

The participant is a department store that received incentives from IID for implementing energy efficient lighting on its sales floor in and back offices. On-site, the Evaluators verified the installation and operation of the following measures:

- (1087) 44w LED - non-int. ballasts replaced (1087) 4' 4-lamp T8s.

On site, lighting operation schedules were also collected through staff interviews and photo-logging equipment was placed on site to monitor lighting operation.

Calculation Parameters

Savings calculations were performed using the methods described section 2.2.2. of this report. Parameters specific to this site are listed below in Table A:

Table A, Savings Parameters

Space Type	***Air Conditioned***	***Annual Hours***	***IEF_E***	***IEF_D***	***CF***
Department Store (floor)	Yes	5,078	1.17	1.24	100% [21]
Department Store (offices)	Yes	5,241	1.17	1.24	100%[1]

[21] Based on actual hours of operation

Savings Calculations

Table B, Lighting Retrofit kWh Savings Calculations

Measure	*Quantity (Fixtures)*		*Wattage*		*AOH*	*Expected kWh Savings*	*Realized kWh Savings*	IEF_E	*Realization Rate*
	Base	*Post*	*Base*	*Post*					
F32T8 to LED44W	950	950	112	44	5,078		383,803	1.17	N/A
F32T8 to LED44W	137	137	112	44	5,241		57,121	1.17	N/A
					Total	**406,538**	**383,803**		**94.4%**

Table C, Lighting Retrofit kW Savings Calculations

Measure	*Quantity (Fixtures)*		*Wattage*		*CF*	*Expected kW Savings*	*Realized kW Savings*	IEF_D	*Realization Rate*
	Base	*Post*	*Base*	*Post*					
F32T8 to LED44W	950	950	112	44	1.00		80.10	1.24	N/A
F32T8 to LED44W	137	137	112	44	1.00		11.55	1.24	N/A
					Total	**73.92**	**80.10**		**108.4%**

Results

The kWh realization rate for Project 16 is 94.4% and the kW realization rate is 108.4%%.

Ex ante calculations were premised on higher annual lighting operation hours (5,500) than those recorded by photo logging equipment left on site (5,078 for the sales floor and 5,241 for the back offices). Logged lighting also reflects lighting hours of operation calculated by posted store hours. *Ex ante* calculation did not include the reduced load on the HVAC system as a result of the more efficient lighting as a result of the more efficient lighting. These factors increased both kWh and kW savings.

Table D, Verified Gross Savings & Realization Rates

Measure	***Verified***			
	kWh Savings	***kW Savings***	***kWh Realization Rate***	***kW Realization Rate***
F32T8 to LED44W	383,803	80.10	94.4%	108.4%
Total	**383,803**	**80.10**	**94.4%**	**108.4%**

Project Number Project 17

Program CESP 2015

Project Background

The participant is a high school that received incentives for retrofitting interior and exterior lighting, installing occupancy sensors to control portions of the newly-installed lighting and retrofitting existing air conditioners and heat pumps with more efficient units. On-site, the Evaluators verified the installation and operation of the following measures:

- (82) 4' 2-Lamp T8 28Ws replaced (82) 4' 1-Lamp T8s
- (234) 4' 3-Lamp T8 28W RLOs replaced (234) 4' 1-Lamp T8s
- (56) 135W LED - Non-Int. ballasts replaced (56) 250W metal halides
- (1205) 4' 2-Lamp T8 28W RLOs replaced (1205) 2' 4-Lamp T8s
- (28) 20W LED - Non-Int. ballasts replaced (28) 70W HPSs
- (2) 4' 1-Lamp T8 28W RLOs replaced (2) 4' 1-Lamp T8s
- (2) 155W LED - Non-Int. ballasts replaced (2) 400W metal halides
- (12) 30W LED - Non-Int. ballasts replaced (12) 175W metal halides
- (25) 40W LED - Non-Int. ballasts replaced (25) 150W HPSs
- (7) 100W LED - Non-Int. ballasts replaced (7) 400W metal halides
- (1) 100W LED - Non-Int. ballasts replaced (2) 1000W metal halides
- (1) 2' 4-lamp T8s replaced (1) 42W CFLs
- (31) 40W LED - Non-Int. ballasts replaced (31) 175W metal halides
- (14) 223W LED fixtures replaced (28) 1000W metal halides
- (276) 4' 3-Lamp T8 28W RLOs replaced (276) 4' 4-Lamp T8s
- (42) 223W LED fixtures replaced (42) 400W metal halides
- (146) 4' 2-Lamp T8 28W RLOs replaced (146) 4' 4-Lamp T8s
- (41) 4' 2-Lamp T8 28W RLOs replaced (41) 4' 1-Lamp T8s
- (5) 10W LED - Non-Int. ballasts replaced (5) 70W HPSs
- (30) 10W LED - Non-Int. ballasts replaced (30) 18W CFLs

Additionally, occupancy sensors were installed to control 2,272 of the newly-installed fixtures.

The site also replaced existing HVAC equipment with newer, more efficient units:

- (15) air conditioning units (totaling 61 tons)
- (20) heat pumps (totaling 84 tons)

On site, lighting operation schedules were also collected through staff interviews and photo-logging equipment was placed on site to monitor lighting operation.

Calculation Parameters

Lighting savings calculations were performed using the methods described section 2.2.2. of this report. Parameters specific to this site are listed below in Table A:

Table A Savings Parameters

Space Type	***Air Conditioned***	***Annual Hours***	***IEF_E***	***IEF_D***	***CF***
Secondary School (classrooms)	Yes	1,800	1.21	1.30	20%
Secondary School (non-classrooms)	Yes	Custom, varies by area	1.21	1.30	20%
Exterior	No	4,313	1.00	1.00	0%

HVAC savings calculations were performed using savings methodology described below incorporating deemed EFLH from the 2014 CA TRM and data gathered on site.

$$Annual\ Energy\ Savings = (kW_{Pre} - kW_{Post})\ x\ EFLH$$

$$kW_{Pre} = \frac{Tonnage\ x\ 12}{EER_{Pre}}$$

$$kW_{Post} = \frac{Tonnage\ x\ 12}{EER_{post}}$$

Where,
kW_{Pre}Baseline HVAC full load energy usage, kW
kW_{Post}InstalLED HVAC full load energy usage, kW
EER_{pre}Baseline HVAC rated energy efficiency rating, BTUh/Watt
EER_{Post}InstalLED HVAC rated energy efficiency rating, BTUh/Watt
EFLHEstimated full load hours per year, hr/yr
$Tonnage$Total HVAC rated tonnage, tons
12Conversion factor BTUh to tons (12,000 :1) and W to kW (1,000 :1)

Savings parameters used are shown in Savings calculations were performed using the methods described in section X.Y.Z. of this report. Parameters specific to this site are listed below in Table B:

Table B, Savings Parameters

HVAC Type	***EER_{Pre}***	***EER_{Post}***	***Tons***	***kW_{Pre}***	***kW_{Post}***	***EFLH***
Package/Split	9.4	12.0	61	77.9	61.0	1,267
Heat Pump	8.9	12.0	84	113.3	84.0	1,267

Savings Calculations

Table C, Lighting Retrofit kWh Savings Calculations

Measure	*Quantity (Fixtures)*		*Wattage*		*AOH (no sensors)*	*AOH (w/ sensor reduction)*	*Expected kWh Savings*	*Realized kWh Savings*	*IEF_E*	*Realization Rate*
	Base	*Post*	*Base*	*Post*						
F32T8 to F32T8-28W	6	6	90	48	3,000	3,000	756	915	1.21	121.0%
F32T8 to F32T8-28W w/sensor	4	4	90	63	2,800	2,184	500	554	1.21	110.7%
F32T8 to F32T8-28W w/sensor	1	1	90	48	1,100	858	61	70	1.21	114.7%
F32T8 to F32T8-28W w/sensor	2	2	90	48	3,000	2,340	333	382	1.21	114.6%
F32T8 to F32T8-28W	2	2	90	48	3,000	3,000	252	305	1.21	121.0%
F32T8 to F32T8-28W w/sensor	1	1	90	63	2,800	2,184	125	138	1.21	110.7%
F32T8 to F32T8-28W w/sensor	2	2	90	63	2,800	2,184	250	277	1.21	110.7%
F32T8 to F32T8-28W w/sensor	2	2	90	63	2,800	2,184	250	277	1.21	110.7%
F32T8 to F32T8-28W w/sensor	2	2	90	63	2,800	2,184	250	277	1.21	110.7%
F32T8 to F32T8-28W	12	12	90	48	3,000	3,000	1,512	1,830	1.21	121.0%
F32T8 to F32T8-28W w/sensor	2	2	90	63	2,800	2,184	250	277	1.21	110.7%

F32T8 to F32T8-28W w/sensor	2	2	90	63	2,800	2,184	250	277	1.21	110.7%
F32T8 to F32T8-28W w/sensor	2	2	90	63	2,800	2,184	250	277	1.21	110.7%
F32T8 to F32T8-28W	18	18	90	63	2,200	2,200	1,069	1,294	1.21	121.0%
MH250 to LED135W w/sensor	56	56	295	135	2,200	1,716	24,369	28,279	1.21	116.0%
F17T8 to F32T8-28W	3	3	59	42	3,000	3,000	153	185	1.21	121.0%
F17T8 to F32T8-28W	3	3	59	42	3,000	3,000	153	185	1.21	121.0%
F32T8 to F32T8-28W w/sensor	8	8	90	48	2,200	1,716	976	1,119	1.21	114.7%
F32T8 to F32T8-28W w/sensor	8	8	90	63	2,200	1,430	786	1,045	1.21	132.9%
F32T8 to F32T8-28W w/sensor	4	4	90	48	2,200	1,584	488	590	1.21	121.0%
F32T8 to F32T8-28W	16	16	90	63	2,200	2,200	950	1,150	1.21	121.1%
F32T8 to F32T8-28W	4	4	90	48	2,200	2,200	370	447	1.21	120.9%
F32T8 to F32T8-28W	4	4	90	48	2,200	2,200	370	447	1.21	120.9%
F32T8 to F32T8-28W	4	4	90	48	2,200	2,200	370	447	1.21	120.9%
HPS70 to LED20W	1	1	95	20	4,313	4,313	329	323	1.00	98.3%
F32T8 to F32T8-28W	2	2	32	22	4,313	4,313	88	86	1.00	98.0%
MH400 to LED155W	2	2	458	155	4,313	4,313	2,654	2,614	1.00	98.5%
MH175 to LED30W	2	2	215	30	4,313	4,313	1,621	1,596	1.00	98.4%
HPS150 to LED40W	25	25	195	40	4,313	4,313	16,973	16,713	1.00	98.5%
F32T8 to F32T8-28W	18	18	90	48	2,800	2,800	2,117	2,561	1.21	121.0%
F32T8 to F32T8-28W	2	2	90	63	2,500	2,500	135	163	1.21	121.0%
F32T8 to F32T8-28W	2	2	90	63	2,500	2,500	135	163	1.21	121.0%
F32T8 to F32T8-28W	2	2	90	63	2,500	2,500	135	163	1.21	121.0%
F32T8 to F32T8-28W	2	2	90	63	2,500	2,500	135	163	1.21	121.0%

F32T8 to F32T8-28W	2	2	90	63	2,500	2,500	135	163	1.21	121.0%
F32T8 to F32T8-28W	2	2	90	63	2,500	2,500	135	163	1.21	121.0%
F32T8 to F32T8-28W	2	2	90	63	2,500	2,500	135	163	1.21	121.0%
F32T8 to F32T8-28W	2	2	90	63	2,500	2,500	135	163	1.21	121.0%
F32T8 to F32T8-28W	19	19	90	63	2,500	2,500	1,283	1,552	1.21	121.0%
F32T8 to F32T8-28W	2	2	90	63	2,500	2,500	135	163	1.21	121.0%
F32T8 to F32T8-28W	2	2	90	63	2,500	2,500	135	163	1.21	121.0%
F32T8 to F32T8-28W	2	2	90	63	2,500	2,500	135	163	1.21	121.0%
F32T8 to F32T8-28W	2	2	90	63	2,500	2,500	135	163	1.21	121.0%
F17T8 to F32T8-28W w/sensor	12	12	59	42	1,800	1,455	621	655	1.21	105.4%
F17T8 to F32T8-28W w/sensor	12	12	59	42	1,800	1,455	621	655	1.21	105.4%
F17T8 to F32T8-28W w/sensor	12	12	59	42	1,800	1,455	621	655	1.21	105.4%
F32T8 to F32T8-28W w/sensor	12	12	90	63	1,800	1,455	964	1,021	1.21	105.9%
F17T8 to F32T8-28W w/sensor	18	18	59	42	1,800	1,455	932	982	1.21	105.4%
F17T8 to F32T8-28W w/sensor	18	18	59	42	1,800	1,455	932	982	1.21	105.4%
F17T8 to F32T8-28W w/sensor	18	18	59	42	1,800	1,455	932	982	1.21	105.4%
F17T8 to F32T8-28W w/sensor	18	18	59	42	1,800	1,455	932	982	1.21	105.4%
F17T8 to F32T8-28W w/sensor	18	18	59	42	1,800	1,455	932	982	1.21	105.4%
F32T8 to F32T8-28W w/sensor	8	8	90	63	1,800	1,455	643	681	1.21	105.9%
F32T8 to F32T8-28W w/sensor	15	15	90	63	1,800	1,455	1,205	1,277	1.21	105.9%

F17T8 to F32T8-28W w/sensor	16	16	59	42	1,800	1,455	828	873	1.21	105.4%
F32T8 to F32T8-28W w/sensor	12	12	90	63	1,800	1,455	964	1,021	1.21	105.9%
F17T8 to F32T8-28W	2	2	59	42	1,800	1,800	61	74	1.21	121.4%
F17T8 to F32T8-28W w/sensor	18	18	59	42	1,800	1,455	932	982	1.21	105.4%
F17T8 to F32T8-28W w/sensor	18	18	59	42	1,800	1,455	932	982	1.21	105.4%
F17T8 to F32T8-28W	6	6	59	42	500	500	51	62	1.21	121.0%
F32T8 to F32T8-28W w/sensor	12	12	90	63	1,800	1,455	964	1,021	1.21	105.9%
F32T8 to F32T8-28W w/sensor	12	12	90	63	1,800	1,455	964	1,021	1.21	105.9%
F32T8 to F32T8-28W w/sensor	12	12	90	63	1,800	1,455	964	1,021	1.21	105.9%
F32T8 to F32T8-28W w/sensor	12	12	90	63	1,800	1,455	964	1,021	1.21	105.9%
F32T8 to F32T8-28W w/sensor	6	6	90	63	1,800	1,455	482	511	1.21	105.9%
F17T8 to F32T8-28W w/sensor	18	18	59	42	1,800	1,455	932	982	1.21	105.4%
F17T8 to F32T8-28W w/sensor	18	18	59	42	1,800	1,455	932	982	1.21	105.4%
F17T8 to F32T8-28W w/sensor	18	18	59	42	1,800	1,455	932	982	1.21	105.4%
F17T8 to F32T8-28W w/sensor	18	18	59	42	1,800	1,455	932	982	1.21	105.4%
F17T8 to F32T8-28W w/sensor	1	1	59	42	1,100	858	32	35	1.21	109.1%
F17T8 to F32T8-28W w/sensor	1	1	59	42	1,100	858	32	35	1.21	109.1%
F17T8 to F32T8-28W w/sensor	18	18	59	42	1,800	1,455	932	982	1.21	105.4%

F17T8 to F32T8-28W w/sensor	18	18	59	42	1,800	1,455	932	982	1.21	105.4%
F17T8 to F32T8-28W w/sensor	18	18	59	42	1,800	1,455	932	982	1.21	105.4%
F17T8 to F32T8-28W w/sensor	18	18	59	42	1,800	1,455	932	982	1.21	105.4%
HPS70 to LED20W	20	20	95	20	4,313	4,313	6,570	6,470	1.00	98.5%
MH400 to LED100W	1	1	458	100	4,313	4,313	1,568	1,544	1.00	98.5%
MH1000 to LED100W	1	2	1,080	100	4,313	4,313	3,854	3,795	1.00	98.5%
F17T8 to F32T8-28W w/sensor	24	24	59	42	1,800	1,455	1,242	1,309	1.21	105.4%
F17T8 to F32T8-28W w/sensor	24	24	59	42	1,800	1,455	1,242	1,309	1.21	105.4%
F17T8 to F32T8-28W w/sensor	24	24	59	42	1,800	1,455	1,242	1,309	1.21	105.4%
F17T8 to F32T8-28W w/sensor	24	24	59	42	1,800	1,455	1,242	1,309	1.21	105.4%
F17T8 to F32T8-28W w/sensor	24	24	59	42	1,800	1,455	1,242	1,309	1.21	105.4%
F17T8 to F32T8-28W w/sensor	24	24	59	42	1,800	1,455	1,242	1,309	1.21	105.4%
F17T8 to F32T8-28W w/sensor	24	24	59	42	1,800	1,455	1,242	1,309	1.21	105.4%
F17T8 to F32T8-28W w/sensor	18	18	59	42	1,800	1,455	932	982	1.21	105.4%
F17T8 to F32T8-28W w/sensor	18	18	59	42	1,800	1,455	932	982	1.21	105.4%
HPS70 to LED20W	1	1	95	20	4,380	4,380	329	397	1.21	120.8%
F17T8 to F32T8-28W	18	18	59	42	4,000	4,000	1,224	1,481	1.21	121.0%
F17T8 to F32T8-28W w/sensor	1	1	59	42	4,000	3,120	115	127	1.21	110.4%
F17T8 to F32T8-28W	12	12	59	42	4,000	4,000	816	987	1.21	121.0%

F17T8 to F32T8-28W	1	1	59	42	4,000	4,000	68	82	1.21	121.0%
#N/A	1	1	42	45	4,000	3,120	50	33	1.21	66.8%
HPS70 to LED20W	3	3	95	20	4,313	4,313	986	970	1.00	98.4%
MH175 to LED40W	4	4	215	40	4,313	4,313	3,066	3,019	1.00	98.5%
MH400 to LED100W	2	2	458	100	4,313	4,313	3,136	3,088	1.00	98.5%
MH175 to LED30W	1	1	215	30	4,313	4,313	810	798	1.00	98.5%
1000W metal halide to 223 LED	14	28	1,080	223	5,000	5,000	113,307	53,700	1.21	47.4%
F17T8 to F32T8-28W	2	2	59	42	3,000	3,000	102	123	1.21	121.0%
F17T8 to F32T8-28W	2	2	59	42	3,000	3,000	102	123	1.21	121.0%
F32T8 to F32T8-28W w/sensor	36	36	118	63	2,800	2,184	7,322	8,399	1.21	114.7%
MH175 to LED40W	6	6	215	40	4,313	4,313	4,599	4,529	1.00	98.5%
F17T8 to F32T8-28W w/sensor	18	18	59	42	1,800	1,455	932	982	1.21	105.4%
F17T8 to F32T8-28W w/sensor	18	18	59	42	1,800	1,455	932	982	1.21	105.4%
F17T8 to F32T8-28W	4	4	59	42	3,000	3,000	204	247	1.21	121.0%
F17T8 to F32T8-28W	4	4	59	42	3,000	3,000	204	247	1.21	121.0%
F17T8 to F32T8-28W w/sensor	18	18	59	42	1,800	1,455	932	982	1.21	105.4%
F17T8 to F32T8-28W w/sensor	18	18	59	42	1,800	1,455	932	982	1.21	105.4%
F17T8 to F32T8-28W w/sensor	18	18	59	42	1,800	1,455	932	982	1.21	105.4%
F17T8 to F32T8-28W w/sensor	18	18	59	42	1,800	1,455	932	982	1.21	105.4%
F17T8 to F32T8-28W w/sensor	18	18	59	42	1,800	1,455	932	982	1.21	105.4%
F17T8 to F32T8-28W w/sensor	18	18	59	42	1,800	1,455	932	982	1.21	105.4%

F17T8 to F32T8-28W	4	4	59	42	3,000	3,000	204	247	1.21	121.0%
F17T8 to F32T8-28W	4	4	59	42	3,000	3,000	204	247	1.21	121.0%
F17T8 to F32T8-28W w/sensor	18	18	59	42	1,800	1,455	932	982	1.21	105.4%
F17T8 to F32T8-28W w/sensor	18	18	59	42	1,800	1,455	932	982	1.21	105.4%
400W metal halide to 223 LED	42	42	458	223	5,000	5,000	62,462	59,714	1.21	95.6%
F17T8 to F32T8-28W	7	7	59	42	4,000	4,000	476	576	1.21	121.0%
F17T8 to F32T8-28W	7	7	59	42	4,000	4,000	476	576	1.21	121.0%
F17T8 to F32T8-28W	9	9	59	42	4,000	4,000	612	741	1.21	121.0%
F17T8 to F32T8-28W w/sensor	1	1	59	42	4,000	3,120	115	127	1.21	110.4%
F17T8 to F32T8-28W w/sensor	2	2	59	42	4,000	3,120	230	254	1.21	110.4%
F17T8 to F32T8-28W	26	26	59	42	4,000	4,000	1,768	2,139	1.21	121.0%
F17T8 to F32T8-28W w/sensor	44	44	59	42	4,000	2,880	5,062	6,125	1.21	121.0%
F17T8 to F32T8-28W	2	2	59	42	8,760	8,760	298	360	1.21	120.9%
HPS70 to LED20W	3	3	95	20	4,313	4,313	986	970	1.00	98.4%
MH400 to LED100W	2	2	458	100	4,313	4,313	3,136	3,088	1.00	98.5%
MH175 to LED30W	2	2	215	30	4,313	4,313	1,621	1,596	1.00	98.4%
MH175 to LED30W	4	4	215	30	4,313	4,313	3,241	3,192	1.00	98.5%
MH175 to LED40W	5	5	215	40	4,313	4,313	3,833	3,774	1.00	98.5%
MH175 to LED40W	8	8	215	40	4,313	4,313	7,000	6,038	1.00	86.3%
F32T8 to F32T8-28W w/sensor	16	16	90	63	1,800	1,455	1,286	1,362	1.21	105.9%
F17T8 to F32T8-28W	1	1	59	42	1,800	1,800	31	37	1.21	119.4%
F17T8 to F32T8-28W	1	1	59	42	1,800	1,800	31	37	1.21	119.4%

F17T8 to F32T8-28W	1	1	59	42	1,800	1,800	31	37	1.21	119.4%
F32T8 to F32T8-28W w/sensor	42	42	112	42	1,800	1,455	6,181	7,140	1.21	115.5%
F32T8 to F32T8-28W	4	4	112	42	1,800	1,800	504	610	1.21	121.0%
F32T8 to F32T8-28W	4	4	112	42	1,800	1,800	504	610	1.21	121.0%
F32T8 to F32T8-28W w/sensor	42	42	112	42	1,800	1,455	6,181	7,140	1.21	115.5%
F32T8 to F32T8-28W	3	3	112	42	1,800	1,800	378	457	1.21	121.0%
F32T8 to F32T8-28W	3	3	112	42	1,800	1,800	378	457	1.21	121.0%
F32T8 to F32T8-28W w/sensor	42	42	112	42	1,800	1,455	6,181	7,140	1.21	115.5%
F32T8 to F32T8-28W	3	3	112	42	1,800	1,800	378	457	1.21	121.0%
F32T8 to F32T8-28W	3	3	112	42	1,800	1,800	378	457	1.21	121.0%
F17T8 to F32T8-28W w/sensor	40	40	59	42	1,800	1,455	2,071	2,182	1.21	105.4%
F17T8 to F32T8-28W	2	2	59	42	1,800	1,800	61	74	1.21	121.4%
F17T8 to F32T8-28W	2	2	59	42	1,800	1,800	61	74	1.21	121.4%
F32T8 to F32T8-28W w/sensor	15	15	90	63	2,800	2,184	1,875	2,077	1.21	110.7%
F32T8 to F32T8-28W w/sensor	15	15	90	48	2,800	2,184	2,328	2,671	1.21	114.7%
F17T8 to F32T8-28W	5	5	59	42	3,000	3,000	255	309	1.21	121.0%
F17T8 to F32T8-28W	5	5	59	42	3,000	3,000	255	309	1.21	121.0%
MH400 to LED100W	1	1	458	100	4,313	4,313	1,568	1,544	1.00	98.5%
MH400 to LED100W	1	1	458	100	4,313	4,313	1,568	1,544	1.00	98.5%
MH175 to LED30W	3	3	215	30	4,313	4,313	2,431	2,394	1.00	98.5%
MH175 to LED40W	5	5	215	40	4,313	4,313	3,833	3,774	1.00	98.5%
F17T8 to F32T8-28W	9	9	59	42	1,800	1,800	275	333	1.21	121.2%
F17T8 to F32T8-28W	9	9	59	42	1,800	1,800	275	333	1.21	121.2%

F17T8 to F32T8-28W	9	9	59	42	1,800	1,800	275	333	1.21	121.2%
F17T8 to F32T8-28W	9	9	59	42	1,800	1,800	275	333	1.21	121.2%
F17T8 to F32T8-28W	9	9	59	42	1,800	1,800	275	333	1.21	121.2%
F17T8 to F32T8-28W	9	9	59	42	1,800	1,800	275	333	1.21	121.2%
F17T8 to F32T8-28W	9	9	59	42	1,800	1,800	275	333	1.21	121.2%
F17T8 to F32T8-28W	9	9	59	42	1,800	1,800	275	333	1.21	121.2%
F17T8 to F32T8-28W	9	9	59	42	1,800	1,800	275	333	1.21	121.2%
F17T8 to F32T8-28W	9	9	59	42	1,800	1,800	275	333	1.21	121.2%
F17T8 to F32T8-28W	9	9	59	42	1,800	1,800	275	333	1.21	121.2%
F17T8 to F32T8-28W	9	9	59	42	1,800	1,800	275	333	1.21	121.2%
F17T8 to F32T8-28W	1	1	59	42	3,000	3,000	51	62	1.21	121.0%
F17T8 to F32T8-28W	1	1	59	42	3,000	3,000	51	62	1.21	121.0%
F17T8 to F32T8-28W	9	9	59	42	1,800	1,800	275	333	1.21	121.2%
F32T8 to F32T8-28W	21	21	90	42	2,200	2,200	2,218	2,683	1.21	121.0%
F32T8 to F32T8-28W w/sensor	2	2	90	48	2,200	1,716	244	280	1.21	114.7%
F17T8 to F32T8-28W	1	1	59	42	2,200	2,200	37	45	1.21	122.3%
F32T8 to F32T8-28W	20	20	90	42	2,200	2,200	2,112	2,556	1.21	121.0%
HPS70 to LED10W	5	5	95	10	4,313	4,313	1,862	1,833	1.00	98.4%
F17T8 to F32T8-28W	2	2	59	42	3,000	3,000	102	123	1.21	121.0%
F17T8 to F32T8-28W	2	2	59	42	3,000	3,000	102	123	1.21	121.0%
F17T8 to F32T8-28W w/sensor	1	1	59	42	1,100	858	32	35	1.21	109.1%
F17T8 to F32T8-28W w/sensor	1	1	59	42	1,100	858	32	35	1.21	109.1%
F17T8 to F32T8-28W w/sensor	10	10	59	42	1,800	1,455	518	546	1.21	105.3%

F17T8 to F32T8-28W w/sensor	10	10	59	42	1,800	1,455	518	546	1.21	105.3%
F32T8 to F32T8-28W w/sensor	12	12	118	63	1,800	1,455	1,569	1,753	1.21	111.7%
F32T8 to F32T8-28W w/sensor	12	12	118	63	1,800	1,455	1,569	1,753	1.21	111.7%
F32T8 to F32T8-28W w/sensor	12	12	118	63	1,800	1,455	1,569	1,753	1.21	111.7%
F32T8 to F32T8-28W w/sensor	12	12	118	63	1,800	1,455	1,569	1,753	1.21	111.7%
F32T8 to F32T8-28W w/sensor	12	12	118	63	1,800	1,455	1,569	1,753	1.21	111.7%
F32T8 to F32T8-28W w/sensor	12	12	118	63	1,800	1,455	1,569	1,753	1.21	111.7%
F32T8 to F32T8-28W w/sensor	12	12	118	63	1,800	1,455	1,569	1,753	1.21	111.7%
F32T8 to F32T8-28W w/sensor	12	12	118	63	1,800	1,455	1,569	1,753	1.21	111.7%
F32T8 to F32T8-28W w/sensor	12	12	118	63	1,800	1,455	1,569	1,753	1.21	111.7%
F32T8 to F32T8-28W w/sensor	12	12	118	63	1,800	1,455	1,569	1,753	1.21	111.7%
F32T8 to F32T8-28W w/sensor	12	12	118	63	1,800	1,455	1,569	1,753	1.21	111.7%
F32T8 to F32T8-28W w/sensor	12	12	118	63	1,800	1,455	1,569	1,753	1.21	111.7%
F32T8 to F32T8-28W w/sensor	12	12	118	63	1,800	1,455	1,569	1,753	1.21	111.7%
F32T8 to F32T8-28W w/sensor	12	12	118	63	1,800	1,455	1,569	1,753	1.21	111.7%
F32T8 to F32T8-28W w/sensor	12	12	118	63	1,800	1,455	1,569	1,753	1.21	111.7%
F32T8 to F32T8-28W w/sensor	12	12	118	63	1,800	1,455	1,569	1,753	1.21	111.7%

CF18W to LED10W	20	20	18	10	4,313	4,313	1,000	690	1.00	69.0%
MH175 to LED40W	2	2	215	40	4,313	4,313	1,750	1,510	1.00	86.3%
F17T8 to F32T8-28W w/sensor	10	10	59	42	1,800	1,455	518	546	1.21	105.3%
CF18W to LED10W	1	1	18	10	5,000	5,000	50	48	1.21	96.8%
F17T8 to F32T8-28W w/sensor	10	10	59	42	1,800	1,455	518	546	1.21	105.3%
CF18W to LED10W	1	1	18	10	5,000	5,000	50	48	1.21	96.8%
F17T8 to F32T8-28W w/sensor	10	10	59	42	1,800	1,455	518	546	1.21	105.3%
CF18W to LED10W	1	1	18	10	5,000	5,000	50	48	1.21	96.8%
F17T8 to F32T8-28W w/sensor	10	10	59	42	1,800	1,455	518	546	1.21	105.3%
CF18W to LED10W	1	1	18	10	5,000	5,000	50	48	1.21	96.8%
F32T8 to F32T8-28W w/sensor	12	12	118	63	1,800	1,455	1,569	1,753	1.21	111.7%
CF18W to LED10W	1	1	18	10	5,000	5,000	50	48	1.21	96.8%
F32T8 to F32T8-28W w/sensor	12	12	118	63	1,800	1,455	1,569	1,753	1.21	111.7%
CF18W to LED10W	1	1	18	10	5,000	5,000	50	48	1.21	96.8%
F32T8 to F32T8-28W w/sensor	12	12	118	63	1,800	1,455	1,569	1,753	1.21	111.7%
CF18W to LED10W	1	1	18	10	5,000	5,000	50	48	1.21	96.8%
F32T8 to F32T8-28W w/sensor	12	12	118	63	1,800	1,455	1,569	1,753	1.21	111.7%
CF18W to LED10W	1	1	18	10	5,000	5,000	50	48	1.21	96.8%
F17T8 to F32T8-28W w/sensor	10	10	59	42	1,800	1,455	518	546	1.21	105.3%
F17T8 to F32T8-28W w/sensor	10	10	59	42	1,800	1,455	518	546	1.21	105.3%

F17T8 to F32T8-28W w/sensor	10	10	59	42	1,800	1,455	518	546	1.21	105.3%
F17T8 to F32T8-28W w/sensor	10	10	59	42	1,800	1,455	518	546	1.21	105.3%
F17T8 to F32T8-28W w/sensor	10	10	59	42	1,800	1,455	518	546	1.21	105.3%
F17T8 to F32T8-28W w/sensor	10	10	59	42	1,800	1,455	518	546	1.21	105.3%
CF18W to LED10W	2	2	18	10	4,313	4,313	100	69	1.00	69.0%
MH175 to LED40W	1	1	215	40	4,313	4,313	875	755	1.00	86.3%
F17T8 to F32T8-28W w/sensor	10	10	59	42	1,800	1,455	518	546	1.21	105.3%
F17T8 to F32T8-28W w/sensor	10	10	59	42	1,800	1,455	518	546	1.21	105.3%
F17T8 to F32T8-28W w/sensor	10	10	59	42	1,800	1,455	518	546	1.21	105.3%
HPS70 to LED20W	2	2	95	20	4,313	4,313	750	647	1.00	86.3%
F17T8 to F32T8-28W w/sensor	10	10	59	42	1,800	1,455	518	546	1.21	105.3%
F17T8 to F32T8-28W w/sensor	10	10	59	42	1,800	1,455	518	546	1.21	105.3%
F17T8 to F32T8-28W w/sensor	10	10	59	42	1,800	1,455	518	546	1.21	105.3%
F17T8 to F32T8-28W w/sensor	10	10	59	42	1,800	1,455	518	546	1.21	105.3%
F17T8 to F32T8-28W w/sensor	10	10	59	42	1,800	1,455	518	546	1.21	105.3%
F17T8 to F32T8-28W w/sensor	10	10	59	42	1,800	1,455	518	546	1.21	105.3%
F17T8 to F32T8-28W	2	2	59	42	3,000	3,000	102	123	1.21	121.0%
F17T8 to F32T8-28W	2	2	59	42	3,000	3,000	102	123	1.21	121.0%
F17T8 to F32T8-28W w/sensor	1	1	59	42	1,100	858	32	35	1.21	109.1%

F17T8 to F32T8-28W w/sensor	1	1	59	42	1,100	858	32	35	1.21	109.1%
F17T8 to F32T8-28W w/sensor	10	10	59	42	1,800	1,455	518	546	1.21	105.3%
F17T8 to F32T8-28W w/sensor	10	10	59	42	1,800	1,455	518	546	1.21	105.3%
F17T8 to F32T8-28W w/sensor	10	10	59	42	1,800	1,455	518	546	1.21	105.3%
F17T8 to F32T8-28W w/sensor	10	10	59	42	1,800	1,455	518	546	1.21	105.3%
F17T8 to F32T8-28W w/sensor	10	10	59	42	1,800	1,455	518	546	1.21	105.3%
F17T8 to F32T8-28W w/sensor	10	10	59	42	1,800	1,455	518	546	1.21	105.3%
CF18W to LED10W	15	15	18	10	4,313	4,313	750	518	1.00	69.0%
F32T8 to F32T8-28W w/sensor	12	12	118	63	1,800	1,455	1,569	1,753	1.21	111.7%
F32T8 to F32T8-28W w/sensor	12	12	118	63	1,800	1,455	1,569	1,753	1.21	111.7%
F32T8 to F32T8-28W w/sensor	12	12	118	63	1,800	1,455	1,569	1,753	1.21	111.7%
F32T8 to F32T8-28W w/sensor	12	12	118	63	1,800	1,455	1,569	1,753	1.21	111.7%
F32T8 to F32T8-28W w/sensor	12	12	118	63	1,800	1,455	1,569	1,753	1.21	111.7%
F32T8 to F32T8-28W w/sensor	12	12	118	63	1,800	1,455	1,569	1,753	1.21	111.7%
F32T8 to F32T8-28W w/sensor	12	12	118	63	1,800	1,455	1,569	1,753	1.21	111.7%
F32T8 to F32T8-28W w/sensor	12	12	118	63	1,800	1,455	1,569	1,753	1.21	111.7%
F32T8 to F32T8-28W w/sensor	12	12	118	63	1,800	1,455	1,569	1,753	1.21	111.7%

F32T8 to F32T8-28W w/sensor	12	12	118	63	1,800	1,455	1,569	1,753	1.21	111.7%
F17T8 to F32T8-28W w/sensor	10	10	59	42	1,800	1,455	518	546	1.21	105.3%
F17T8 to F32T8-28W w/sensor	10	10	59	42	1,800	1,455	518	546	1.21	105.3%
F17T8 to F32T8-28W w/sensor	10	10	59	42	1,800	1,455	518	546	1.21	105.3%
F17T8 to F32T8-28W w/sensor	10	10	59	42	1,800	1,455	518	546	1.21	105.3%
F17T8 to F32T8-28W w/sensor	10	10	59	42	1,800	1,455	518	546	1.21	105.3%
F32T8 to F32T8-28W w/sensor	12	12	118	63	1,800	1,455	1,569	1,753	1.21	111.7%
F32T8 to F32T8-28W w/sensor	12	12	118	63	1,800	1,455	1,569	1,753	1.21	111.7%
F32T8 to F32T8-28W w/sensor	12	12	118	63	1,800	1,455	1,569	1,753	1.21	111.7%
F17T8 to F32T8-28W w/sensor	10	10	59	42	1,800	1,455	518	546	1.21	105.3%
CF18W to LED10W	19	19	18	10	4,313	4,313	950	656	1.00	69.0%
F32T8 to F32T8-28W w/sensor	12	12	118	63	1,800	1,455	1,569	1,753	1.21	111.7%
F32T8 to F32T8-28W w/sensor	12	12	118	63	1,800	1,455	1,569	1,753	1.21	111.7%
F32T8 to F32T8-28W w/sensor	12	12	118	63	1,800	1,455	1,569	1,753	1.21	111.7%
F17T8 to F32T8-28W w/sensor	10	10	59	42	1,800	1,455	518	546	1.21	105.3%
F17T8 to F32T8-28W w/sensor	10	10	59	42	1,800	1,455	518	546	1.21	105.3%
F17T8 to F32T8-28W w/sensor	10	10	59	42	1,800	1,455	518	546	1.21	105.3%
F17T8 to F32T8-28W	2	2	59	42	3,000	3,000	102	123	1.21	121.0%

F17T8 to F32T8-28W	2	2	59	42	3,000	3,000	102	123	1.21	121.0%
F17T8 to F32T8-28W w/sensor	1	1	59	42	1,100	858	32	35	1.21	109.1%
F17T8 to F32T8-28W w/sensor	1	1	59	42	1,100	858	32	35	1.21	109.1%
F32T8 to F32T8-28W w/sensor	12	12	118	63	1,800	1,455	1,569	1,753	1.21	111.7%
F32T8 to F32T8-28W w/sensor	12	12	118	63	1,800	1,455	1,569	1,753	1.21	111.7%
F32T8 to F32T8-28W w/sensor	12	12	118	63	1,800	1,455	1,569	1,753	1.21	111.7%
F17T8 to F32T8-28W w/sensor	10	10	59	42	1,800	1,455	518	546	1.21	105.3%
F17T8 to F32T8-28W w/sensor	10	10	59	42	1,800	1,455	518	546	1.21	105.3%
CF18W to LED10W	14	14	18	10	4,313	4,313	700	483	1.00	69.0%
F32T8 to F32T8-28W w/sensor	12	12	118	63	1,800	1,455	1,569	1,753	1.21	111.7%
F32T8 to F32T8-28W w/sensor	12	12	118	63	1,800	1,455	1,569	1,753	1.21	111.7%
F32T8 to F32T8-28W w/sensor	12	12	118	63	1,800	1,455	1,569	1,753	1.21	111.7%
F32T8 to F32T8-28W w/sensor	12	12	118	63	1,800	1,455	1,569	1,753	1.21	111.7%
F32T8 to F32T8-28W w/sensor	12	12	118	63	1,800	1,455	1,569	1,753	1.21	111.7%
F32T8 to F32T8-28W w/sensor	12	12	118	63	1,800	1,455	1,569	1,753	1.21	111.7%
CF18W to LED10W	6	6	18	10	4,313	4,313	300	207	1.00	69.0%
F32T8 to F32T8-28W w/sensor	12	12	118	63	1,800	1,455	1,569	1,753	1.21	111.7%
F32T8 to F32T8-28W w/sensor	12	12	118	63	1,800	1,455	1,569	1,753	1.21	111.7%

F32T8 to F32T8-28W w/sensor	12	12	118	63	1,800	1,455	1,569	1,753	1.21	111.7%
F32T8 to F32T8-28W w/sensor	12	12	118	63	1,800	1,455	1,569	1,753	1.21	111.7%
CF18W to LED10W	4	4	18	10	4,313	4,313	200	138	1.00	69.0%
F17T8 to F32T8-28W w/sensor	34	34	59	42	1,800	1,455	1,760	1,855	1.21	105.4%
F32T8 to F32T8-28W	2	2	90	63	1,800	1,800	97	118	1.21	121.2%
F32T8 to F32T8-28W	2	2	90	63	1,800	1,800	97	118	1.21	121.2%
F17T8 to F32T8-28W w/sensor	60	60	59	42	1,800	1,455	3,106	3,274	1.21	105.4%
F17T8 to F32T8-28W	1	1	59	42	1,800	1,800	31	37	1.21	119.4%
F17T8 to F32T8-28W	1	1	59	42	1,800	1,800	31	37	1.21	119.4%
F17T8 to F32T8-28W	1	1	59	42	1,800	1,800	31	37	1.21	119.4%
F17T8 to F32T8-28W	1	1	59	42	1,800	1,800	31	37	1.21	119.4%
F17T8 to F32T8-28W	1	1	59	42	1,800	1,800	31	37	1.21	119.4%
F17T8 to F32T8-28W	1	1	59	42	1,800	1,800	31	37	1.21	119.4%
MH175 to LED30W	2	2	215	30	4,313	4,313	1,621	1,596	1.00	98.4%
HPS70 to LED20W	1	1	95	20	4,313	4,313	329	323	1.00	98.3%
MH400 to F32T8-28W	1	1	458	42	4,313	4,313	1,822	1,794	1.00	98.5%
						Total	**509,833**	**473,378**		**92.8%**

Table D, Lighting Retrofit kW Savings Calculations

Measure	*Quantity (Fixtures)*		*Wattage*		*CF (no sensors)*	*CF (w/ sensor reduction)*	*Expected kW Savings*	*Realized kW Savings*	*IEF_D*	*Realization Rate*
	Base	*Post*	*Base*	*Post*						
F32T8 to F32T8-28W	6	6	90	48	0.020	0.020	0.25	0.01	1.30	4.0%

F32T8 to F32T8-28W w/sensor	4	4	90	63	0.020	0.016	0.25	0.00	1.30	0.0%
F32T8 to F32T8-28W w/sensor	1	1	90	48	0.020	0.016	0.08	0.00	1.30	0.0%
F32T8 to F32T8-28W w/sensor	2	2	90	48	0.020	0.016	0.15	0.00	1.30	0.0%
F32T8 to F32T8-28W	2	2	90	48	0.020	0.020	0.08	0.00	1.30	0.0%
F32T8 to F32T8-28W w/sensor	1	1	90	63	0.020	0.016	0.06	0.00	1.30	0.0%
F32T8 to F32T8-28W w/sensor	2	2	90	63	0.020	0.016	0.12	0.00	1.30	0.0%
F32T8 to F32T8-28W w/sensor	2	2	90	63	0.020	0.016	0.12	0.00	1.30	0.0%
F32T8 to F32T8-28W w/sensor	2	2	90	63	0.020	0.016	0.12	0.00	1.30	0.0%
F32T8 to F32T8-28W	12	12	90	48	0.020	0.020	0.50	0.01	1.30	2.0%
F32T8 to F32T8-28W w/sensor	2	2	90	63	0.020	0.016	0.12	0.00	1.30	0.0%
F32T8 to F32T8-28W w/sensor	2	2	90	63	0.020	0.016	0.12	0.00	1.30	0.0%
F32T8 to F32T8-28W w/sensor	2	2	90	63	0.020	0.016	0.12	0.00	1.30	0.0%
F32T8 to F32T8-28W	18	18	90	63	0.020	0.020	0.49	0.01	1.30	2.0%
MH250 to LED135W w/sensor	56	56	295	135	0.020	0.016	15.38	0.28	1.30	1.8%
F17T8 to F32T8-28W	3	3	59	42	0.020	0.020	0.05	0.00	1.30	0.0%
F17T8 to F32T8-28W	3	3	59	42	0.020	0.020	0.05	0.00	1.30	0.0%
F32T8 to F32T8-28W w/sensor	8	8	90	48	0.020	0.016	0.62	0.01	1.30	1.6%
F32T8 to F32T8-28W w/sensor	8	8	90	63	0.020	0.016	0.50	0.01	1.30	2.0%
F32T8 to F32T8-28W w/sensor	4	4	90	48	0.020	0.016	0.31	0.01	1.30	3.2%

F32T8 to F32T8-28W	16	16	90	63	0.020	0.020	0.43	0.01	1.30	2.3%
F32T8 to F32T8-28W	4	4	90	48	0.020	0.020	0.17	0.00	1.30	0.0%
F32T8 to F32T8-28W	4	4	90	48	0.020	0.020	0.17	0.00	1.30	0.0%
F32T8 to F32T8-28W	4	4	90	48	0.020	0.020	0.17	0.00	1.30	0.0%
HPS70 to LED20W	1	1	95	20	0.000	0.000	0.08	0.00	1.00	0.0%
F32T8 to F32T8-28W	2	2	32	22	0.000	0.000	0.02	0.00	1.00	0.0%
MH400 to LED155W	2	2	458	155	0.000	0.000	0.61	0.00	1.00	0.0%
MH175 to LED30W	2	2	215	30	0.000	0.000	0.37	0.00	1.00	0.0%
HPS150 to LED40W	25	25	195	40	0.000	0.000	3.88	0.00	1.00	0.0%
F32T8 to F32T8-28W	18	18	90	48	0.020	0.020	0.76	0.02	1.30	2.6%
F32T8 to F32T8-28W	2	2	90	63	0.020	0.020	0.05	0.00	1.30	0.0%
F32T8 to F32T8-28W	2	2	90	63	0.020	0.020	0.05	0.00	1.30	0.0%
F32T8 to F32T8-28W	2	2	90	63	0.020	0.020	0.05	0.00	1.30	0.0%
F32T8 to F32T8-28W	2	2	90	63	0.020	0.020	0.05	0.00	1.30	0.0%
F32T8 to F32T8-28W	2	2	90	63	0.020	0.020	0.05	0.00	1.30	0.0%
F32T8 to F32T8-28W	2	2	90	63	0.020	0.020	0.05	0.00	1.30	0.0%
F32T8 to F32T8-28W	2	2	90	63	0.020	0.020	0.05	0.00	1.30	0.0%
F32T8 to F32T8-28W	2	2	90	63	0.020	0.020	0.05	0.00	1.30	0.0%
F32T8 to F32T8-28W	19	19	90	63	0.020	0.020	0.51	0.01	1.30	2.0%
F32T8 to F32T8-28W	2	2	90	63	0.020	0.020	0.05	0.00	1.30	0.0%
F32T8 to F32T8-28W	2	2	90	63	0.020	0.020	0.05	0.00	1.30	0.0%
F32T8 to F32T8-28W	2	2	90	63	0.020	0.020	0.05	0.00	1.30	0.0%
F32T8 to F32T8-28W	2	2	90	63	0.020	0.020	0.05	0.00	1.30	0.0%
F17T8 to F32T8-28W w/sensor	12	12	59	42	0.020	0.016	0.48	0.01	1.30	2.1%
F17T8 to F32T8-28W w/sensor	12	12	59	42	0.020	0.016	0.48	0.01	1.30	2.1%

F17T8 to F32T8-28W w/sensor	12	12	59	42	0.020	0.016	0.48	0.01	1.30	2.1%
F32T8 to F32T8-28W w/sensor	12	12	90	63	0.020	0.016	0.74	0.01	1.30	1.4%
F17T8 to F32T8-28W w/sensor	18	18	59	42	0.020	0.016	0.72	0.01	1.30	1.4%
F17T8 to F32T8-28W w/sensor	18	18	59	42	0.020	0.016	0.72	0.01	1.30	1.4%
F17T8 to F32T8-28W w/sensor	18	18	59	42	0.020	0.016	0.72	0.01	1.30	1.4%
F17T8 to F32T8-28W w/sensor	18	18	59	42	0.020	0.016	0.72	0.01	1.30	1.4%
F17T8 to F32T8-28W w/sensor	18	18	59	42	0.020	0.016	0.72	0.01	1.30	1.4%
F32T8 to F32T8-28W w/sensor	8	8	90	63	0.020	0.016	0.50	0.01	1.30	2.0%
F32T8 to F32T8-28W w/sensor	15	15	90	63	0.020	0.016	0.93	0.01	1.30	1.1%
F17T8 to F32T8-28W w/sensor	16	16	59	42	0.020	0.016	0.64	0.01	1.30	1.6%
F32T8 to F32T8-28W w/sensor	12	12	90	63	0.020	0.016	0.74	0.01	1.30	1.4%
F17T8 to F32T8-28W	2	2	59	42	0.020	0.020	0.03	0.00	1.30	0.0%
F17T8 to F32T8-28W w/sensor	18	18	59	42	0.020	0.016	0.72	0.01	1.30	1.4%
F17T8 to F32T8-28W w/sensor	18	18	59	42	0.020	0.016	0.72	0.01	1.30	1.4%
F17T8 to F32T8-28W	6	6	59	42	0.020	0.020	0.10	0.00	1.30	0.0%
F32T8 to F32T8-28W w/sensor	12	12	90	63	0.020	0.016	0.74	0.01	1.30	1.4%
F32T8 to F32T8-28W w/sensor	12	12	90	63	0.020	0.016	0.74	0.01	1.30	1.4%
F32T8 to F32T8-28W w/sensor	12	12	90	63	0.020	0.016	0.74	0.01	1.30	1.4%

F32T8 to F32T8-28W w/sensor	12	12	90	63	0.020	0.016	0.74	0.01	1.30	1.4%
F32T8 to F32T8-28W w/sensor	6	6	90	63	0.020	0.016	0.37	0.01	1.30	2.7%
F17T8 to F32T8-28W w/sensor	18	18	59	42	0.020	0.016	0.72	0.01	1.30	1.4%
F17T8 to F32T8-28W w/sensor	18	18	59	42	0.020	0.016	0.72	0.01	1.30	1.4%
F17T8 to F32T8-28W w/sensor	18	18	59	42	0.020	0.016	0.72	0.01	1.30	1.4%
F17T8 to F32T8-28W w/sensor	18	18	59	42	0.020	0.016	0.72	0.01	1.30	1.4%
F17T8 to F32T8-28W w/sensor	1	1	59	42	0.020	0.016	0.04	0.00	1.30	0.0%
F17T8 to F32T8-28W w/sensor	1	1	59	42	0.020	0.016	0.04	0.00	1.30	0.0%
F17T8 to F32T8-28W w/sensor	18	18	59	42	0.020	0.016	0.72	0.01	1.30	1.4%
F17T8 to F32T8-28W w/sensor	18	18	59	42	0.020	0.016	0.72	0.01	1.30	1.4%
F17T8 to F32T8-28W w/sensor	18	18	59	42	0.020	0.016	0.72	0.01	1.30	1.4%
F17T8 to F32T8-28W w/sensor	18	18	59	42	0.020	0.016	0.72	0.01	1.30	1.4%
HPS70 to LED20W	20	20	95	20	0.000	0.000	1.50	0.00	1.00	0.0%
MH400 to LED100W	1	1	458	100	0.000	0.000	0.36	0.00	1.00	0.0%
MH1000 to LED100W	1	2	1,080	100	0.000	0.000	0.88	0.00	1.00	0.0%
F17T8 to F32T8-28W w/sensor	24	24	59	42	0.020	0.016	0.96	0.02	1.30	2.1%
F17T8 to F32T8-28W w/sensor	24	24	59	42	0.020	0.016	0.96	0.02	1.30	2.1%
F17T8 to F32T8-28W w/sensor	24	24	59	42	0.020	0.016	0.96	0.02	1.30	2.1%

F17T8 to F32T8-28W w/sensor	24	24	59	42	0.020	0.016	0.96	0.02	1.30	2.1%
F17T8 to F32T8-28W w/sensor	24	24	59	42	0.020	0.016	0.96	0.02	1.30	2.1%
F17T8 to F32T8-28W w/sensor	24	24	59	42	0.020	0.016	0.96	0.02	1.30	2.1%
F17T8 to F32T8-28W w/sensor	24	24	59	42	0.020	0.016	0.96	0.02	1.30	2.1%
F17T8 to F32T8-28W w/sensor	18	18	59	42	0.020	0.016	0.72	0.01	1.30	1.4%
F17T8 to F32T8-28W w/sensor	18	18	59	42	0.020	0.016	0.72	0.01	1.30	1.4%
HPS70 to LED20W	1	1	95	20	0.020	0.020	0.08	0.00	1.30	0.0%
F17T8 to F32T8-28W	18	18	59	42	0.020	0.020	0.31	0.01	1.30	3.2%
F17T8 to F32T8-28W w/sensor	1	1	59	42	0.020	0.016	0.04	0.00	1.30	0.0%
F17T8 to F32T8-28W	12	12	59	42	0.020	0.020	0.20	0.01	1.30	5.0%
F17T8 to F32T8-28W	1	1	59	42	0.020	0.020	0.02	0.00	1.30	0.0%
#N/A	1	1	42	45	0.020	0.016	0.02	0.00	1.30	0.0%
HPS70 to LED20W	3	3	95	20	0.000	0.000	0.23	0.00	1.00	0.0%
MH175 to LED40W	4	4	215	40	0.000	0.000	0.70	0.00	1.00	0.0%
MH400 to LED100W	2	2	458	100	0.000	0.000	0.72	0.00	1.00	0.0%
MH175 to LED30W	1	1	215	30	0.000	0.000	0.19	0.00	1.00	0.0%
1000W metal halide to 223 LED	14	28	1,080	223	0.020	0.020	36.96	0.23	1.30	0.6%
F17T8 to F32T8-28W	2	2	59	42	0.020	0.020	0.03	0.00	1.30	0.0%
F17T8 to F32T8-28W	2	2	59	42	0.020	0.020	0.03	0.00	1.30	0.0%
F32T8 to F32T8-28W w/sensor	36	36	118	63	0.020	0.016	3.63	0.06	1.30	1.7%
MH175 to LED40W	6	6	215	40	0.000	0.000	1.05	0.00	1.00	0.0%

F17T8 to F32T8-28W w/sensor	18	18	59	42	0.020	0.016	0.72	0.01	1.30	1.4%
F17T8 to F32T8-28W w/sensor	18	18	59	42	0.020	0.016	0.72	0.01	1.30	1.4%
F17T8 to F32T8-28W	4	4	59	42	0.020	0.020	0.07	0.00	1.30	0.0%
F17T8 to F32T8-28W	4	4	59	42	0.020	0.020	0.07	0.00	1.30	0.0%
F17T8 to F32T8-28W w/sensor	18	18	59	42	0.020	0.016	0.72	0.01	1.30	1.4%
F17T8 to F32T8-28W w/sensor	18	18	59	42	0.020	0.016	0.72	0.01	1.30	1.4%
F17T8 to F32T8-28W w/sensor	18	18	59	42	0.020	0.016	0.72	0.01	1.30	1.4%
F17T8 to F32T8-28W w/sensor	18	18	59	42	0.020	0.016	0.72	0.01	1.30	1.4%
F17T8 to F32T8-28W w/sensor	18	18	59	42	0.020	0.016	0.72	0.01	1.30	1.4%
F17T8 to F32T8-28W w/sensor	18	18	59	42	0.020	0.016	0.72	0.01	1.30	1.4%
F17T8 to F32T8-28W	4	4	59	42	0.020	0.020	0.07	0.00	1.30	0.0%
F17T8 to F32T8-28W	4	4	59	42	0.020	0.020	0.07	0.00	1.30	0.0%
F17T8 to F32T8-28W w/sensor	18	18	59	42	0.020	0.016	0.72	0.01	1.30	1.4%
F17T8 to F32T8-28W w/sensor	18	18	59	42	0.020	0.016	0.72	0.01	1.30	1.4%
400W metal halide to 223 LED	42	42	458	223	0.020	0.020	17.35	0.26	1.30	1.5%
F17T8 to F32T8-28W	7	7	59	42	0.020	0.020	0.12	0.00	1.30	0.0%
F17T8 to F32T8-28W	7	7	59	42	0.020	0.020	0.12	0.00	1.30	0.0%
F17T8 to F32T8-28W	9	9	59	42	0.020	0.020	0.15	0.00	1.30	0.0%
F17T8 to F32T8-28W w/sensor	1	1	59	42	0.020	0.016	0.04	0.00	1.30	0.0%

F17T8 to F32T8-28W w/sensor	2	2	59	42	0.020	0.016	0.08	0.00	1.30	0.0%
F17T8 to F32T8-28W	26	26	59	42	0.020	0.020	0.44	0.01	1.30	2.3%
F17T8 to F32T8-28W w/sensor	44	44	59	42	0.020	0.016	1.76	0.03	1.30	1.7%
F17T8 to F32T8-28W	2	2	59	42	0.020	0.020	0.03	0.00	1.30	0.0%
HPS70 to LED20W	3	3	95	20	0.000	0.000	0.23	0.00	1.00	0.0%
MH400 to LED100W	2	2	458	100	0.000	0.000	0.72	0.00	1.00	0.0%
MH175 to LED30W	2	2	215	30	0.000	0.000	0.37	0.00	1.00	0.0%
MH175 to LED30W	4	4	215	30	0.000	0.000	0.74	0.00	1.00	0.0%
MH175 to LED40W	5	5	215	40	0.000	0.000	0.88	0.00	1.00	0.0%
MH175 to LED40W	8	8	215	40	0.000	0.000	1.40	0.00	1.00	0.0%
F32T8 to F32T8-28W w/sensor	16	16	90	63	0.020	0.016	0.99	0.02	1.30	2.0%
F17T8 to F32T8-28W	1	1	59	42	0.020	0.020	0.02	0.00	1.30	0.0%
F17T8 to F32T8-28W	1	1	59	42	0.020	0.020	0.02	0.00	1.30	0.0%
F17T8 to F32T8-28W	1	1	59	42	0.020	0.020	0.02	0.00	1.30	0.0%
F32T8 to F32T8-28W w/sensor	42	42	112	42	0.020	0.016	4.77	0.08	1.30	1.7%
F32T8 to F32T8-28W	4	4	112	42	0.020	0.020	0.28	0.01	1.30	3.6%
F32T8 to F32T8-28W	4	4	112	42	0.020	0.020	0.28	0.01	1.30	3.6%
F32T8 to F32T8-28W w/sensor	42	42	112	42	0.020	0.016	4.77	0.08	1.30	1.7%
F32T8 to F32T8-28W	3	3	112	42	0.020	0.020	0.21	0.01	1.30	4.8%
F32T8 to F32T8-28W	3	3	112	42	0.020	0.020	0.21	0.01	1.30	4.8%
F32T8 to F32T8-28W w/sensor	42	42	112	42	0.020	0.016	4.77	0.08	1.30	1.7%
F32T8 to F32T8-28W	3	3	112	42	0.020	0.020	0.21	0.01	1.30	4.8%
F32T8 to F32T8-28W	3	3	112	42	0.020	0.020	0.21	0.01	1.30	4.8%

F17T8 to F32T8-28W w/sensor	40	40	59	42	0.020	0.016	1.60	0.03	1.30	1.9%
F17T8 to F32T8-28W	2	2	59	42	0.020	0.020	0.03	0.00	1.30	0.0%
F17T8 to F32T8-28W	2	2	59	42	0.020	0.020	0.03	0.00	1.30	0.0%
F32T8 to F32T8-28W w/sensor	15	15	90	63	0.020	0.016	0.93	0.02	1.30	2.2%
F32T8 to F32T8-28W w/sensor	15	15	90	48	0.020	0.016	1.16	0.02	1.30	1.7%
F17T8 to F32T8-28W	5	5	59	42	0.020	0.020	0.09	0.00	1.30	0.0%
F17T8 to F32T8-28W	5	5	59	42	0.020	0.020	0.09	0.00	1.30	0.0%
MH400 to LED100W	1	1	458	100	0.000	0.000	0.36	0.00	1.00	0.0%
MH400 to LED100W	1	1	458	100	0.000	0.000	0.36	0.00	1.00	0.0%
MH175 to LED30W	3	3	215	30	0.000	0.000	0.56	0.00	1.00	0.0%
MH175 to LED40W	5	5	215	40	0.000	0.000	0.88	0.00	1.00	0.0%
F17T8 to F32T8-28W	9	9	59	42	0.020	0.020	0.15	0.00	1.30	0.0%
F17T8 to F32T8-28W	9	9	59	42	0.020	0.020	0.15	0.00	1.30	0.0%
F17T8 to F32T8-28W	9	9	59	42	0.020	0.020	0.15	0.00	1.30	0.0%
F17T8 to F32T8-28W	9	9	59	42	0.020	0.020	0.15	0.00	1.30	0.0%
F17T8 to F32T8-28W	9	9	59	42	0.020	0.020	0.15	0.00	1.30	0.0%
F17T8 to F32T8-28W	9	9	59	42	0.020	0.020	0.15	0.00	1.30	0.0%
F17T8 to F32T8-28W	9	9	59	42	0.020	0.020	0.15	0.00	1.30	0.0%
F17T8 to F32T8-28W	9	9	59	42	0.020	0.020	0.15	0.00	1.30	0.0%
F17T8 to F32T8-28W	9	9	59	42	0.020	0.020	0.15	0.00	1.30	0.0%
F17T8 to F32T8-28W	9	9	59	42	0.020	0.020	0.15	0.00	1.30	0.0%
F17T8 to F32T8-28W	9	9	59	42	0.020	0.020	0.15	0.00	1.30	0.0%
F17T8 to F32T8-28W	9	9	59	42	0.020	0.020	0.15	0.00	1.30	0.0%
F17T8 to F32T8-28W	1	1	59	42	0.020	0.020	0.02	0.00	1.30	0.0%

F17T8 to F32T8-28W	1	1	59	42	0.020	0.020	0.02	0.00	1.30	0.0%
F17T8 to F32T8-28W	9	9	59	42	0.020	0.020	0.15	0.00	1.30	0.0%
F32T8 to F32T8-28W	21	21	90	42	0.020	0.020	1.01	0.03	1.30	3.0%
F32T8 to F32T8-28W w/sensor	2	2	90	48	0.020	0.016	0.15	0.00	1.30	0.0%
F17T8 to F32T8-28W	1	1	59	42	0.020	0.020	0.02	0.00	1.30	0.0%
F32T8 to F32T8-28W	20	20	90	42	0.020	0.020	0.96	0.02	1.30	2.1%
HPS70 to LED10W	5	5	95	10	0.000	0.000	0.43	0.00	1.00	0.0%
F17T8 to F32T8-28W	2	2	59	42	0.020	0.020	0.03	0.00	1.30	0.0%
F17T8 to F32T8-28W	2	2	59	42	0.020	0.020	0.03	0.00	1.30	0.0%
F17T8 to F32T8-28W w/sensor	1	1	59	42	0.020	0.016	0.04	0.00	1.30	0.0%
F17T8 to F32T8-28W w/sensor	1	1	59	42	0.020	0.016	0.04	0.00	1.30	0.0%
F17T8 to F32T8-28W w/sensor	10	10	59	42	0.020	0.016	0.40	0.01	1.30	2.5%
F17T8 to F32T8-28W w/sensor	10	10	59	42	0.020	0.016	0.40	0.01	1.30	2.5%
F32T8 to F32T8-28W w/sensor	12	12	118	63	0.020	0.016	1.21	0.02	1.30	1.7%
F32T8 to F32T8-28W w/sensor	12	12	118	63	0.020	0.016	1.21	0.02	1.30	1.7%
F32T8 to F32T8-28W w/sensor	12	12	118	63	0.020	0.016	1.21	0.02	1.30	1.7%
F32T8 to F32T8-28W w/sensor	12	12	118	63	0.020	0.016	1.21	0.02	1.30	1.7%
F32T8 to F32T8-28W w/sensor	12	12	118	63	0.020	0.016	1.21	0.02	1.30	1.7%
F32T8 to F32T8-28W w/sensor	12	12	118	63	0.020	0.016	1.21	0.02	1.30	1.7%
F32T8 to F32T8-28W w/sensor	12	12	118	63	0.020	0.016	1.21	0.02	1.30	1.7%

F32T8 to F32T8-28W w/sensor	12	12	118	63	0.020	0.016	1.21	0.02	1.30	1.7%
F32T8 to F32T8-28W w/sensor	12	12	118	63	0.020	0.016	1.21	0.02	1.30	1.7%
F32T8 to F32T8-28W w/sensor	12	12	118	63	0.020	0.016	1.21	0.02	1.30	1.7%
F32T8 to F32T8-28W w/sensor	12	12	118	63	0.020	0.016	1.21	0.02	1.30	1.7%
F32T8 to F32T8-28W w/sensor	12	12	118	63	0.020	0.016	1.21	0.02	1.30	1.7%
F32T8 to F32T8-28W w/sensor	12	12	118	63	0.020	0.016	1.21	0.02	1.30	1.7%
F32T8 to F32T8-28W w/sensor	12	12	118	63	0.020	0.016	1.21	0.02	1.30	1.7%
F32T8 to F32T8-28W w/sensor	12	12	118	63	0.020	0.016	1.21	0.02	1.30	1.7%
F32T8 to F32T8-28W w/sensor	12	12	118	63	0.020	0.016	1.21	0.02	1.30	1.7%
CF18W to LED10W	20	20	18	10	0.000	0.000	0.20	0.00	1.00	0.0%
MH175 to LED40W	2	2	215	40	0.000	0.000	0.35	0.00	1.00	0.0%
F17T8 to F32T8-28W w/sensor	10	10	59	42	0.020	0.016	0.40	0.01	1.30	2.5%
CF18W to LED10W	1	1	18	10	0.020	0.020	0.01	0.00	1.30	0.0%
F17T8 to F32T8-28W w/sensor	10	10	59	42	0.020	0.016	0.40	0.01	1.30	2.5%
CF18W to LED10W	1	1	18	10	0.020	0.020	0.01	0.00	1.30	0.0%
F17T8 to F32T8-28W w/sensor	10	10	59	42	0.020	0.016	0.40	0.01	1.30	2.5%
CF18W to LED10W	1	1	18	10	0.020	0.020	0.01	0.00	1.30	0.0%
F17T8 to F32T8-28W w/sensor	10	10	59	42	0.020	0.016	0.40	0.01	1.30	2.5%
CF18W to LED10W	1	1	18	10	0.020	0.020	0.01	0.00	1.30	0.0%

F32T8 to F32T8-28W w/sensor	12	12	118	63	0.020	0.016	1.21	0.02	1.30	1.7%
CF18W to LED10W	1	1	18	10	0.020	0.020	0.01	0.00	1.30	0.0%
F32T8 to F32T8-28W w/sensor	12	12	118	63	0.020	0.016	1.21	0.02	1.30	1.7%
CF18W to LED10W	1	1	18	10	0.020	0.020	0.01	0.00	1.30	0.0%
F32T8 to F32T8-28W w/sensor	12	12	118	63	0.020	0.016	1.21	0.02	1.30	1.7%
CF18W to LED10W	1	1	18	10	0.020	0.020	0.01	0.00	1.30	0.0%
F32T8 to F32T8-28W w/sensor	12	12	118	63	0.020	0.016	1.21	0.02	1.30	1.7%
CF18W to LED10W	1	1	18	10	0.020	0.020	0.01	0.00	1.30	0.0%
F17T8 to F32T8-28W w/sensor	10	10	59	42	0.020	0.016	0.40	0.01	1.30	2.5%
F17T8 to F32T8-28W w/sensor	10	10	59	42	0.020	0.016	0.40	0.01	1.30	2.5%
F17T8 to F32T8-28W w/sensor	10	10	59	42	0.020	0.016	0.40	0.01	1.30	2.5%
F17T8 to F32T8-28W w/sensor	10	10	59	42	0.020	0.016	0.40	0.01	1.30	2.5%
F17T8 to F32T8-28W w/sensor	10	10	59	42	0.020	0.016	0.40	0.01	1.30	2.5%
F17T8 to F32T8-28W w/sensor	10	10	59	42	0.020	0.016	0.40	0.01	1.30	2.5%
CF18W to LED10W	2	2	18	10	0.000	0.000	0.02	0.00	1.00	0.0%
MH175 to LED40W	1	1	215	40	0.000	0.000	0.18	0.00	1.00	0.0%
F17T8 to F32T8-28W w/sensor	10	10	59	42	0.020	0.016	0.40	0.01	1.30	2.5%
F17T8 to F32T8-28W w/sensor	10	10	59	42	0.020	0.016	0.40	0.01	1.30	2.5%
F17T8 to F32T8-28W w/sensor	10	10	59	42	0.020	0.016	0.40	0.01	1.30	2.5%

HPS70 to LED20W	2	2	95	20	0.000	0.000	0.15	0.00	1.00	0.0%
F17T8 to F32T8-28W w/sensor	10	10	59	42	0.020	0.016	0.40	0.01	1.30	2.5%
F17T8 to F32T8-28W w/sensor	10	10	59	42	0.020	0.016	0.40	0.01	1.30	2.5%
F17T8 to F32T8-28W w/sensor	10	10	59	42	0.020	0.016	0.40	0.01	1.30	2.5%
F17T8 to F32T8-28W w/sensor	10	10	59	42	0.020	0.016	0.40	0.01	1.30	2.5%
F17T8 to F32T8-28W w/sensor	10	10	59	42	0.020	0.016	0.40	0.01	1.30	2.5%
F17T8 to F32T8-28W w/sensor	10	10	59	42	0.020	0.016	0.40	0.01	1.30	2.5%
F17T8 to F32T8-28W	2	2	59	42	0.020	0.020	0.03	0.00	1.30	0.0%
F17T8 to F32T8-28W	2	2	59	42	0.020	0.020	0.03	0.00	1.30	0.0%
F17T8 to F32T8-28W w/sensor	1	1	59	42	0.020	0.016	0.04	0.00	1.30	0.0%
F17T8 to F32T8-28W w/sensor	1	1	59	42	0.020	0.016	0.04	0.00	1.30	0.0%
F17T8 to F32T8-28W w/sensor	10	10	59	42	0.020	0.016	0.40	0.01	1.30	2.5%
F17T8 to F32T8-28W w/sensor	10	10	59	42	0.020	0.016	0.40	0.01	1.30	2.5%
F17T8 to F32T8-28W w/sensor	10	10	59	42	0.020	0.016	0.40	0.01	1.30	2.5%
F17T8 to F32T8-28W w/sensor	10	10	59	42	0.020	0.016	0.40	0.01	1.30	2.5%
F17T8 to F32T8-28W w/sensor	10	10	59	42	0.020	0.016	0.40	0.01	1.30	2.5%
F17T8 to F32T8-28W w/sensor	10	10	59	42	0.020	0.016	0.40	0.01	1.30	2.5%
CF18W to LED10W	15	15	18	10	0.000	0.000	0.15	0.00	1.00	0.0%

F32T8 to F32T8-28W w/sensor	12	12	118	63	0.020	0.016	1.21	0.02	1.30	1.7%
F32T8 to F32T8-28W w/sensor	12	12	118	63	0.020	0.016	1.21	0.02	1.30	1.7%
F32T8 to F32T8-28W w/sensor	12	12	118	63	0.020	0.016	1.21	0.02	1.30	1.7%
F32T8 to F32T8-28W w/sensor	12	12	118	63	0.020	0.016	1.21	0.02	1.30	1.7%
F32T8 to F32T8-28W w/sensor	12	12	118	63	0.020	0.016	1.21	0.02	1.30	1.7%
F32T8 to F32T8-28W w/sensor	12	12	118	63	0.020	0.016	1.21	0.02	1.30	1.7%
F32T8 to F32T8-28W w/sensor	12	12	118	63	0.020	0.016	1.21	0.02	1.30	1.7%
F32T8 to F32T8-28W w/sensor	12	12	118	63	0.020	0.016	1.21	0.02	1.30	1.7%
F32T8 to F32T8-28W w/sensor	12	12	118	63	0.020	0.016	1.21	0.02	1.30	1.7%
F32T8 to F32T8-28W w/sensor	12	12	118	63	0.020	0.016	1.21	0.02	1.30	1.7%
F17T8 to F32T8-28W w/sensor	10	10	59	42	0.020	0.016	0.40	0.01	1.30	2.5%
F17T8 to F32T8-28W w/sensor	10	10	59	42	0.020	0.016	0.40	0.01	1.30	2.5%
F17T8 to F32T8-28W w/sensor	10	10	59	42	0.020	0.016	0.40	0.01	1.30	2.5%
F17T8 to F32T8-28W w/sensor	10	10	59	42	0.020	0.016	0.40	0.01	1.30	2.5%
F17T8 to F32T8-28W w/sensor	10	10	59	42	0.020	0.016	0.40	0.01	1.30	2.5%
F32T8 to F32T8-28W w/sensor	12	12	118	63	0.020	0.016	1.21	0.02	1.30	1.7%
F32T8 to F32T8-28W w/sensor	12	12	118	63	0.020	0.016	1.21	0.02	1.30	1.7%

F32T8 to F32T8-28W w/sensor	12	12	118	63	0.020	0.016	1.21	0.02	1.30	1.7%
F17T8 to F32T8-28W w/sensor	10	10	59	42	0.020	0.016	0.40	0.01	1.30	2.5%
CF18W to LED10W	19	19	18	10	0.000	0.000	0.19	0.00	1.00	0.0%
F32T8 to F32T8-28W w/sensor	12	12	118	63	0.020	0.016	1.21	0.02	1.30	1.7%
F32T8 to F32T8-28W w/sensor	12	12	118	63	0.020	0.016	1.21	0.02	1.30	1.7%
F32T8 to F32T8-28W w/sensor	12	12	118	63	0.020	0.016	1.21	0.02	1.30	1.7%
F17T8 to F32T8-28W w/sensor	10	10	59	42	0.020	0.016	0.40	0.01	1.30	2.5%
F17T8 to F32T8-28W w/sensor	10	10	59	42	0.020	0.016	0.40	0.01	1.30	2.5%
F17T8 to F32T8-28W w/sensor	10	10	59	42	0.020	0.016	0.40	0.01	1.30	2.5%
F17T8 to F32T8-28W	2	2	59	42	0.020	0.020	0.03	0.00	1.30	0.0%
F17T8 to F32T8-28W	2	2	59	42	0.020	0.020	0.03	0.00	1.30	0.0%
F17T8 to F32T8-28W w/sensor	1	1	59	42	0.020	0.016	0.04	0.00	1.30	0.0%
F17T8 to F32T8-28W w/sensor	1	1	59	42	0.020	0.016	0.04	0.00	1.30	0.0%
F32T8 to F32T8-28W w/sensor	12	12	118	63	0.020	0.016	1.21	0.02	1.30	1.7%
F32T8 to F32T8-28W w/sensor	12	12	118	63	0.020	0.016	1.21	0.02	1.30	1.7%
F32T8 to F32T8-28W w/sensor	12	12	118	63	0.020	0.016	1.21	0.02	1.30	1.7%
F17T8 to F32T8-28W w/sensor	10	10	59	42	0.020	0.016	0.40	0.01	1.30	2.5%
F17T8 to F32T8-28W w/sensor	10	10	59	42	0.020	0.016	0.40	0.01	1.30	2.5%

CF18W to LED10W	14	14	18	10	0.000	0.000	0.14	0.00	1.00	0.0%
F32T8 to F32T8-28W w/sensor	12	12	118	63	0.020	0.016	1.21	0.02	1.30	1.7%
F32T8 to F32T8-28W w/sensor	12	12	118	63	0.020	0.016	1.21	0.02	1.30	1.7%
F32T8 to F32T8-28W w/sensor	12	12	118	63	0.020	0.016	1.21	0.02	1.30	1.7%
F32T8 to F32T8-28W w/sensor	12	12	118	63	0.020	0.016	1.21	0.02	1.30	1.7%
F32T8 to F32T8-28W w/sensor	12	12	118	63	0.020	0.016	1.21	0.02	1.30	1.7%
F32T8 to F32T8-28W w/sensor	12	12	118	63	0.020	0.016	1.21	0.02	1.30	1.7%
CF18W to LED10W	6	6	18	10	0.000	0.000	0.06	0.00	1.00	0.0%
F32T8 to F32T8-28W w/sensor	12	12	118	63	0.020	0.016	1.21	0.02	1.30	1.7%
F32T8 to F32T8-28W w/sensor	12	12	118	63	0.020	0.016	1.21	0.02	1.30	1.7%
F32T8 to F32T8-28W w/sensor	12	12	118	63	0.020	0.016	1.21	0.02	1.30	1.7%
F32T8 to F32T8-28W w/sensor	12	12	118	63	0.020	0.016	1.21	0.02	1.30	1.7%
CF18W to LED10W	4	4	18	10	0.000	0.000	0.04	0.00	1.00	0.0%
F17T8 to F32T8-28W w/sensor	34	34	59	42	0.020	0.016	1.36	0.02	1.30	1.5%
F32T8 to F32T8-28W	2	2	90	63	0.020	0.020	0.05	0.00	1.30	0.0%
F32T8 to F32T8-28W	2	2	90	63	0.020	0.020	0.05	0.00	1.30	0.0%
F17T8 to F32T8-28W w/sensor	60	60	59	42	0.020	0.016	2.40	0.04	1.30	1.7%
F17T8 to F32T8-28W	1	1	59	42	0.020	0.020	0.02	0.00	1.30	0.0%
F17T8 to F32T8-28W	1	1	59	42	0.020	0.020	0.02	0.00	1.30	0.0%
F17T8 to F32T8-28W	1	1	59	42	0.020	0.020	0.02	0.00	1.30	0.0%

F17T8 to F32T8-28W	1	1	59	42	0.020	0.020	0.02	0.00	1.30	0.0%
F17T8 to F32T8-28W	1	1	59	42	0.020	0.020	0.02	0.00	1.30	0.0%
F17T8 to F32T8-28W	1	1	59	42	0.020	0.020	0.02	0.00	1.30	0.0%
MH175 to LED30W	2	2	215	30	0.000	0.000	0.37	0.00	1.00	0.0%
HPS70 to LED20W	1	1	95	20	0.000	0.000	0.08	0.00	1.00	0.0%
MH400 to F32T8-28W	1	1	458	42	0.000	0.000	0.42	0.00	1.00	0.0%
						Total	**242.34**	**3.39**		**1.4%**

Table E, HVAC kWh Savings Calculations

Measure	*EER*		*EFLH*	*Ton*	*Expected kWh Savings*	*Realized kWh Savings*	*Realization Rate*
	Base	*Post*					
Package/Split	9.4	12.0	1,267	61	33,787	21,377	63.3%
Heat Pump	8.9	12.0	1,267	84	63,594	37,070	58.3%
				Total	**97,381**	**58,448**	**60.0%**

Table F, HVAC kW Savings Calculations

Measure	*EER*		*EFLH*	*Ton*	*Expected kW Savings*	*Realized kW Savings*	*Realization Rate*
	Base	*Post*					
Package/Split	9.4	12.0	1,267	61	11.93	16.87	141.4%
Heat Pump	8.9	12.0	1,267	84	22.45	29.26	130.3%
				Total	**34.38**	**46.13**	**134.2%**

Results

The kWh and kW realization rates for Project 17 are 87.6% and 1.5%, respectively.

Ex ante calculations assumed classroom lighting operated 1,800 hours annually and occupancy sensors would decrease this by 28% to 1,296. The 2014 CA TRM recommends an 18% reduction for classrooms for wall or ceiling-mounted occupancy sensors, so the Evaluators revised the reduction in hours to 18%. This resulted in 1,455 post-sensor retrofit AOH for the majority of the classrooms, slightly lowering lighting kWh realization. Offices and administrative areas were also assumed to have a 28% reduction in operating hours due to occupancy sensors, but this was changed to 22% for the same reasons classroom hours were changed. These both contributed to lower lighting kWh realization. Additionally, all exterior retrofits assumed 4,380 AOH, however this was adjusted to 4,313 to match the IID territory NDH, further reducing the realized kWh. Calculations for 88 previously-installed 18W CFLs assumed 20W per lamp, which was corrected to 18W in *ex post* calculations. *Ex ante* calculations did not use interactive energy or demand factors to account for the reduced load on the HVAC system because of the more efficient lighting. Accounting for these in *ex post* calculations increased both kWh and peak kW realized savings. Finally, all *ex ante* kW reduction calculations assumed a 100% peak coincidence factor for interior and exterior lighting. The Evaluators adjusted this factor to 2% for interior lighting and 0% for exterior lighting, in accordance with deemed TRM specifications for secondary schools, causing the low lighting kW realization rate.

Ex ante HVAC calculations specified a 11.1 EER value for newly-installed equipment. The Evaluators verified nameplate information gathered during the on-site visits and found the EER values of the new equipment to be 12.0 according to the manufacture's specifications. Additionally, the EFLHc value used in *ex ante* savings calculations is 2,883, which would reflect continuous operation of all units for approximately 13.8 hours per day for all school days during the school year. This EFLHc was adjusted to 1,267 based on the cooling EFLHc from the New Mexico TRM for a primary school in Las Cruces, NM, which is in the same ASHRAE climate zone as this school.

Table G, Verified Gross Savings & Realization Rates

Measure	***Verified***			
	kWh Savings	***kW Savings***	***kWh Realization Rate***	***kW Realization Rate***
Lighting	473,378	3.39	92.8%	1.4%
HVAC	58,448	0.46	60.0%	134.2%
Total	**531,826**	**3.85**	**87.6%**	**1.5%**

Project Number Project 18

Program NCEEP 2014

Project Background

The participant is an indoor amusement center that received incentives from IID for retrofitting existing lighting with energy efficient lighting and upgrading ceiling insulation. On-site, the Evaluators verified the installation and operation of the following measures:

- (175) 4' 4-lamp T8s replaced (265) 400w metal halides;
- (150) LED - non-int. ballast tubes replaced (265) 400w metal halides.
- Ceiling insulation upgrades from R-19 to R-30

Lighting operation schedules were also collected through staff interviews to determine AOH.

Calculation Parameters

Lighting savings calculations were performed using the methods described section 2.2.2. of this report. Parameters specific to this site are listed below in Table A:

Table A, Savings Parameters

Space Type	***Air Conditioned***	***Annual Hours***	***IEF_E***	***IEF_D***	***CF***
Conditioned Storage	Yes	4,589	1.11	1.30	100% [22]

The Evaluators obtained the original Energy Pro models used to develop savings estimates for the increased ceiling insulation in the facility. The model design and inputs were reviewed.

[22] Based on actual lighting operation.

Savings Calculations

Table B, Lighting Retrofit kWh Savings Calculations

Measure	*Quantity (Fixtures)*		*Wattage*		*AOH*	*Expected kWh Savings*	*Realized kWh Savings*	IEF_E	*Realization Rate*
	Base	*Post*	*Base*	*Post*					
MH400 to F32T8	265	175	429	109	4,589	421,678	482,057	1.11	114.3%
MH400 to LED54W	265	150	429	54	4,589	371,238	537,778	1.11	144.9%
					Total	**792,916**	**1,019,834**		**128.6%**

Table C, Lighting Retrofit kW Savings Calculations

Measure	***Quantity (Fixtures)***		***Wattage***		***CF***	***Expected kW Savings***	***Realized kW Savings***	IEF_D	***Realization Rate***
	Base	***Post***	***Base***	***Post***					
MH400 to F32T8	265	175	429	109	1.00	83.60	123.04	1.30	147.2%
MH400 to LED54W	265	150	429	54	1.00	73.60	137.26	1.30	186.5%
					Total	**157.20**	**260.30**		**165.6%**

Results

The kWh realization rate for Project 18 is 127.7% and the kW realization rate is 159.5%.

Ex ante calculations assumed 5,044 annual lighting hours of operation, but on site the Evaluators found that the facility lighting operated only 4,589 hours annually, decreasing the kWh realization rate. However, *Ex ante* calculations did not include ballast factors for either pre or post-retrofit lighting, or the reduced load on the HVAC system as a result of the more efficient lighting as a result of the more efficient lighting. *Ex post* calculations included these, raising both the kWh and kW realization rates.

Table D, Verified Gross Savings & Realization Rates

Measure	***Verified***			
	kWh Savings	***kW Savings***	***kWh Realization Rate***	***kW Realization Rate***
MH400 to F32T8	482,057	123.04	114.3%	147.2%
MH400 to LED54W	537,778	137.26	144.9%	186.5%
R-19 to R-30 Ceiling Insulation	5,866	6.00	100.0%	100.0%
Total	**1,019,834**	**260.30**	**127.7%**	**159.5%**

Project Number Project 19

Program CESP 2015

Project Background

The participant is a casino and hotel that received incentives from IID for retrofitting existing lighting with energy efficient lighting. On-site, the Evaluators verified the installation and operation of the following measures:

- (925) 10w LED - non-int. ballasts replaced (925) 65w incandescent fixtures;
- (44) 8w LED - non-int. ballasts replaced (44) 30w incandescent fixtures;
- (200) 7w LED - non-int. ballasts replaced (200) 35w 1-lamp halogens;
- (84) 100w LED - non-int. ballasts replaced (84) 400w metal halides;
- (135) 17w LED - non-int. ballasts replaced (135) 4' 2-lamp T8s;
- (65) 17w LED - non-int. ballasts replaced (65) 4' 2-lamp T8s;
- (138) 50w LED - non-int. ballasts replaced (138) 250w metal halides;
- (60) 17w LED - non-int. ballasts replaced (60) 100w metal halides; and
- (15) 150w LED - non-int. ballasts replaced (15) 400w metal halides.

Lighting operation schedules were also collected through staff interviews to determine AOH.

Calculation Parameters

Savings calculations were performed using the methods described section 2.2.2. of this report. Parameters specific to this site are listed below in Table A:

Table A, Savings Parameters

Space Type	***Air Conditioned***	***Annual Hours***	***IEF_E***	***IEF_D***	***CF***
Hotel	Yes	8,760	1.16	1.29	100%
Hotel	Yes	2,928	1.16	1.29	24%
Exterior	None	4,313	1.00	1.00	0%

Savings Calculations

Table B, Lighting Retrofit kWh Savings Calculations

Measure	*Quantity (Fixtures)*		*Wattage*		*AOH*	*Expected kWh Savings*	*Realized kWh Savings*	IEF_E	*Realization Rate*
	Base	*Post*	*Base*	*Post*					
I65 to LED10W	925	925	65	10	8,760	445,665	516,971	1.16	116.0%
I30 to LED8W	44	44	30	8	8,760	8,480	9,836	1.16	116.0%
H35 to LED7W	200	200	35	7	8,760	49,056	56,905	1.16	116.0%
MH400 to LED100W	84	84	450	100	2,928	86,083	99,857	1.16	116.0%
F32T8 to LED17W	135	135	64	17	8,760	27,791	64,475	1.16	232.0%
F32T8 to LED17W	65	65	64	17	8,760	26,762	31,044	1.16	116.0%
MH250 to LED50W	138	138	275	50	8,760	135,999	315,518	1.16	232.0%
MH100 to LED17W	60	60	110	17	4,313	24,440	24,067	1.00	98.5%
MH400 to LED150W	15	15	458	150	4,313	20,236	19,926	1.00	98.5%
					Total	**824,512**	**1,138,599**		**138.1%**

Table C, Lighting Retrofit kW Savings Calculations

Measure	***Quantity (Fixtures)***		***Wattage***		***CF***	***Expected kW Savings***	***Realized kW Savings***	IEF_D	***Realization Rate***
	Base	***Post***	***Base***	***Post***					
I65 to LED10W	925	925	65	10	1.00	50.88	65.63	1.29	129.0%
I30 to LED8W	44	44	30	8	1.00	0.97	1.25	1.29	128.9%
H35 to LED7W	200	200	35	7	1.00	5.60	7.22	1.29	128.9%
MH400 to LED100W	84	84	450	100	0.24	9.83	9.10	1.29	92.6%
F32T8 to LED17W	135	135	64	17	1.00	3.17	8.19	1.29	258.4%
F32T8 to LED17W	65	65	64	17	1.00	3.06	3.94	1.29	128.8%

MH250 to LED50W	138	138	275	50	1.00	15.53	40.05	1.29	257.9%
MH100 to LED17W	60	60	110	17	0.00	2.79	0.00	1.00	0.0%
MH400 to LED150W	15	15	458	150	0.00	2.31	0.00	1.00	0.0%
					Total	**94.14**	**135.38**		**143.8%**

Results

The kWh realization rate for Project 19 is 138.1% and the kW realization rate is 143.8%.

Ex ante calculations assumed lights in two areas operated 4,380 hours annually, however on site the Evaluators determined that these lights operated continuously (8,760). *Ex ante* calculations did not account for the reduced load on the HVAC system as a result of the more efficient lighting. Accounting for this increased both kWh and peak kW savings. Despite area type and annual lighting hours of operation, all areas were assumed to have a peak coincidence factor 0f 100%, however this was adjusted to 24% for one area and 0% for the exterior to account for verified hours of operation. This slightly reduced realized kW savings.

Table D, Verified Gross Savings & Realization Rates

Measure	***Verified***			
	kWh Savings	***kW Savings***	***kWh Realization Rate***	***kW Realization Rate***
I65 to LED10W	516,971	65.63	116.0%	129.0%
I30 to LED8W	9,836	1.25	116.0%	128.9%
H35 to LED7W	56,905	7.22	116.0%	128.9%
MH400 to LED100W	99,857	9.10	116.0%	92.6%
F32T8 to LED17W	64,475	8.19	232.0%	258.4%
F32T8 to LED17W	31,044	3.94	116.0%	128.8%
MH250 to LED50W	315,518	40.05	232.0%	257.9%
MH100 to LED17W	24,067	0.00	98.5%	0.0%
MH400 to LED150W	19,926	0.00	98.5%	0.0%
Total	**1,138,599**	**135.38**	**138.1%**	**143.8%**