National Grid USA
2008 Custom Lighting Impact Evaluation

Final Report

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1. Introduction

This document summarizes work performed by KEMA, Inc. (KEMA) during 2009 to quantify gross savings impacts associated with Custom lighting measure installations in the National Grid USA retail affiliates' Commercial and Industrial Programs, Design 2000 (D2) and Energy Initiative (EI), in the 2008 program year.

1.1 Purpose of Study

The objective of this study is to provide in-field verification or re-estimation of electric energy and demand savings estimates for ten Custom lighting projects through site-specific inspection, monitoring, and analysis.

This impact study consists of the following four tasks:

1. Develop Site Measurement and Evaluation Plans
2. Site Visit Administration
3. Data Gathering and Analysis
4. Report Writing and Follow-up

1.2 Scope

The EI and D2 programs assist commercial, industrial, institutional and governmental customers in the National Grid's Massachusetts, Rhode Island and New Hampshire service territories to install a wide range of retrofit and new construction energy saving technologies. This study concentrates on the lighting measures installed through the Custom component of EI and D2.

2. Description of Methodology

2.1 Measurement and Evaluation Plans

National Grid, with the help of KEMA (through a separate contract) randomly selected ten Custom lighting applications for the evaluation and provided KEMA with all available information on the sample projects at the beginning of the study.

KEMA detailed its standard lighting evaluation methodology in the project work plan, which outlined on-site methods, strategies, monitoring equipment placement and calibration, analysis issues and HVAC interaction. Besides fixture and lamp/ballast replacement, several of the Custom lighting projects included fixtures with occupancy controls or energy management system controls.

The site evaluation plan played an important role in establishing approved field methods and ensuring that the ultimate objectives were met. Each site visit culminated in an independent engineering assessment of the actual (e.g. as observed and monitored) annual energy, on-peak energy, diversified summer peak demand, and diversified winter peak demand savings associated with each project.

2.2 Data Gathering, Analysis, and Reporting

Data collection included physical inspection and inventory, interview with facility personnel, observation of site operating conditions and equipment, and short-term metering of usage. KEMA performed a full facility walk-through that focused on verifying the post-retrofit or existing conditions of each EEM. Lighting surveys gathered data by functional use types, e.g. open office area, conference rooms, corridors etc. and the data were recorded and entered into a lighting analysis spreadsheet. Instrumentation such as Time-Of-Use (TOU) lighting loggers, current loggers, and power recorders were installed to monitor the usage of the installed lighting.

The analysis spreadsheet was developed and refined with the input of the National Grid project manager. Annual hourly (8,760) operating profiles for each lighting schedule with careful consideration of daily, weekly and other seasonal effects were developed. This comprehensive hourly analysis was used to estimate diversified coincident peak demand. A typical meteorological year (TMY) dataset of ambient temperatures was used in conjunction with facility

temperature set points and HVAC schedules to compute estimates of interactive heating and cooling hours.

KEMA worked with National Grid to develop a site report template. Engineers submitted draft site reports to the study manager upon completion of each site evaluation, which after review and comment resulted in the final reports found in Appendix A. This executive summary provides a concise overview of the evaluation methods and findings.

3. Description of Sample Projects

Site 1 Parking Garage, RI

EI Program, Appl #: 518666

A lighting retrofit of a parking garage was done to replace older inefficient lighting fixtures with new more efficient fixtures. A total of (638) 175 watt metal halide fixtures and (126) one lamp F40/T12 fixtures were replaced with (638) three lamp F32T8 fixtures and (126) one lamp F32T8 fixtures. The tracking savings estimated the (427) three lamp fixtures operate 4,380 hours per year while the remaining fixtures operate 8,760 hours per year.

Site 2 Grocery Store, RI

EI Program, Appl #: 523359

This project included the replacement of T8 lighting inside each of the frozen food cases in a grocery store. A frozen food case is described as a 5-door, 4-door, 3-door or 2-door case. Each frozen food case contains one more lighting fixture than number of doors. For example, a 5-door case contains six vertical lighting fixtures. The baseline lighting fixture for each case was a one lamp, five foot F58/T8 fixture rated at 58 watts per fixture. These T8 fixtures were to be replaced with 14 and 26 watt LED strips. For example a 5-door case would have one 14 watt LED strip on each end and one 26 watt LED strip in between each door for a total of two 14 watt strips and four 26 watt strips. It was estimated that these fixtures would operate 5,895 hours per year.

Site 3 Manufacturing Facility, Southeastern, MA

EI Program, Appl #: 525316

This project included a lighting retrofit of a manufacturing facility. Included in the retrofit are the primary manufacturing and shop areas of the facility. A total of (179) older technology fluorescent and metal halide fixtures were replaced with (260) new

high efficiency fixtures. The existing fixtures included; (88) 1,000 watt metal halide fixtures, (35) 400 watt metal halide fixtures, (22) two lamp F96/T12 fixtures and (34) one lamp F96/T12 fixtures. These fixtures were replaced by various size high bay T8 lamps and ballasts.

Site 4 Distribution Office/Warehouse, Southeastern, MA

EI Program, Appl #: 525336

This project included a lighting retrofit of a distribution office and warehouse. Included in the retrofit are offices and warehouse space. A total of (983) older technology lighting fixtures were replaced with (786) new high efficiency fixtures. The existing fixtures were replaced by various size high efficiencyT5 and T8 lamps and ballasts. Also included in this project were (156) occupancy sensors that were installed in approximately 50% of the warehouse high bay fixtures as well as all of the private offices. Occupancy sensors accounted for approximately 14% of the total tracking energy savings.

Site 5 Recreation Facility, North Shore, MA

EI Program, Appl #: 525359

A lighting retrofit of a recreation club was done to replace older inefficient lighting fixtures with new more efficient fixtures. The spaces affected by the retrofit include the indoor tennis courts. A total of (34) 1,000 watt metal halide fixtures were replaced with (32) 12 lamp F54/T5 fixtures.

Site 6 High School, North Shore, MA

D2 Program, Appl #: 525879

This project involves lighting that was installed in a newly built high school. Tracking savings for this Performance Lighting project were calculated using a building lighting density method. This facility received a Tier 1 rebate by exceeding the requirements for total wattage of the entire building. This is a 204,940 square foot school with an estimated installed wattage of 211,595 watts. The maximum allowable wattage is less than 75% of the total wattage allowed based on the energy code of 1.5 watts per square foot. Included in the lighting installation were 2,385 total fixtures. This includes T8 and T5 lighting, compact fluorescents, metal halides and other types such as incandescent and halogen fixtures in the entrances. The total installed wattage, including inefficient lighting, is considered in the whole building lighting density method.

Site 7 Manufacturing Facility, Southeastern, MA

EI Program, Appl #: 528318

This project included a retrofit of inefficient lighting in a manufacturing facility. Included in the retrofit are office and plant areas. A total of 398 older technology lighting fixtures were replaced with 398 new high efficiency fixtures. The new fixtures included various size high efficiency T8 and T5 lamps and high efficiency ballasts. Also installed were lower wattage pulse start metal halides in place of existing higher wattage metal halides. Tracking documentation proposed occupancy sensors to be installed in offices and plant areas; however, no savings were calculated for occupancy sensors in the tracking estimate.

Site 8 High School, Southeastern, MA

EI Program, Appl #: 528960

A lighting retrofit of a school was done to replace older inefficient lighting fixtures with new more efficient fixtures. Included in the retrofit are classrooms, offices, corridors, locker rooms, auditorium and gymnasium. A total of 2,547 older technology lighting fixtures were replaced with 2,505 new high efficiency fixtures. The new fixtures included various size high efficiency T8 lamps and ballasts and compact fluorescent fixtures. Also included in this project were occupancy sensors that were to be installed in the girl's locker room and the gymnasium. The connected load of the rooms that had occupancy sensors installed was 9% of the total connected load included in this project. Though these occupancy sensors were included in the project documentation, no savings were calculated for them in the tracking analysis.

Site 9 Parking Garage, Central, MA

D2 Program, Appl #: 529332

New lighting was installed in a parking garage under the Design 2000 program. The new fixtures included (335) two lamp F32/T8 fixtures. The baseline system included (112) 250 watt metal halide fixtures. The tracking savings estimated that (268) two lamp fixtures could be shut off during the day using controls. These fixtures were estimated to operate 4,460 hours per year. The remaining fixtures were assumed to operate 8,760 hours per year.

Site 10 Manufacturing Facility, Southeastern, MA

EI Program, Appl #: 532719

This project included a lighting retrofit of a manufacturing facility. Included in the retrofit are labs, offices and manufacturing space. A total of (697) older technology lighting fixtures were replaced with new high efficiency fixtures. The existing fixtures were replaced by various size high efficiency T8 lamps and ballasts. Also included in this project were (17) occupancy sensors that were to be installed mostly in private offices. Occupancy sensors were installed on fixtures that represent approximately 8% of the total connected load included in this retrofit and accounted for approximately 10% of the total tracking kWh savings.

4. Results

4.1 Major Findings and Observable Trends

Figure 1 displays a scatter plot of the evaluation results. As evidenced by the figure, most projects trended at or about 100% realization. The two sites with the lowest realization rates of 70% and 83% were the parking garages. The two sites with the highest realization rates of 141% and 142% were both manufacturing facilities. The remaining projects had realization rates between 96% and 127%. The non-weighted realization rate for the ten sample points is 102%.

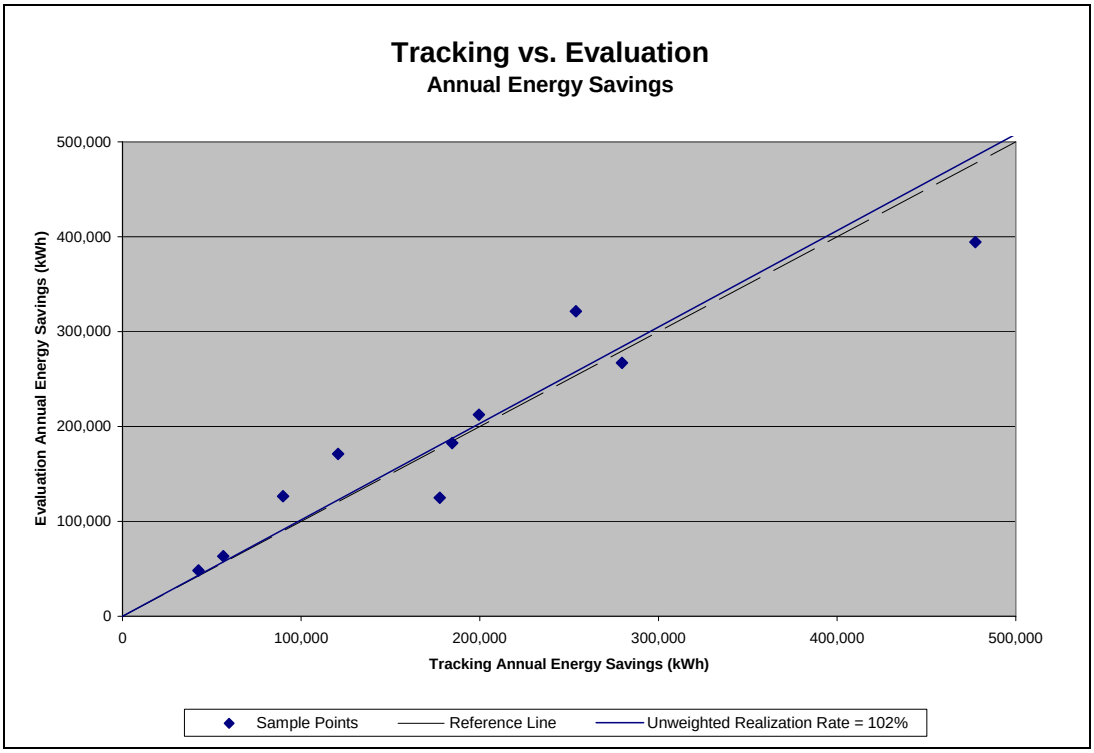

Figure 1: Scatter Plot of Evaluation Results

4.2 Presentation of Results

Table 1 presents a tabular summary of the site level results. The site realization rates ranged from a low of 70% for Site #9 to a high of 142% for Site #10.

			Nat. Grid TRACKING EST. SVGS				KEMA EVALUATION SVGS				RATIO KEMA / TRACKING			
				On-	Peak Coinc.			On-	Peak Coinc.			On-	Peak Coinc.	
KEMA ID	EI / D2	CUSTOMER TYPE & LOCATION LOCATION & APPLICATION ID	kWh/yr	Peak %	Sum. kW	Wint. kW	kWh/yr	Peak %	Sum. kW	Wint. kW	kWh/yr	Peak %	Sum. kW	Wint. kW
1	EI	Parking Garage, RI Appl #: 518666	477,416	38%	84.79	84.80	394,371	40%	24.32	61.53	83%	105%	29%	73%
2	EI	Grocery Store, RI Appl #: 523359	56,388	56%	9.56	9.56	63,285	64%	10.07	9.95	112%	114%	105%	104%
3	EI	Manufacturing Facility, Southeastern, MA Appl #: 525316	199,514	45%	69.75	69.76	212,373	90%	60.95	13.61	106%	200%	87%	20%
4	EI	Distribution Office/Warehouse, Southeastern, MA Appl #: 525336	253,784	45%	63.30	63.31	321,483	73%	66.74	55.14	127%	161%	105%	87%
5	EI	Recreation Facility, North Shore, MA Appl #: 525359	42,579	69%	11.30	11.30	48,118	75%	4.62	11.10	113%	109%	41%	98%
6	D2	High School, North Shore, MA Appl #: 525879	184,492	92%	19.16	4.80	182,595	80%	25.12	18.67	99%	87%	131%	389%
7	EI	Manufacturing Facility, Southeastern, MA Appl #: 528318	89,817	45%	32.72	32.72	126,490	63%	21.80	16.62	141%	139%	67%	51%
8	EI	High School, Southeastern, MA Appl #: 528960	279,561	45%	42.33	63.50	267,151	77%	36.50	27.16	96%	171%	86%	43%
9	D2	Parking Garage, Central, MA Appl #: 529332	177,593	64%	28.50	12.40	124,934	50%	17.56	11.62	70%	79%	62%	94%
10	EI	Manufacturing Facility, Southeastern, MA Appl #: 532719	120,638	60%	26.41	26.41	171,118	61%	31.81	21.87	142%	101%	120%	83%
TOTALS			1,881,782	51%	387.8	378.6	1,911,919	66%	299.5	247.3	102%	128%	77%	65%

Table 1: Detailed Site Results

4.3 Summary of Discrepancies

Table 2 summarizes the primary reason for discrepancy between the tracking and evaluation estimates of annual energy savings. For six of the ten sites, hours-of-use was the most significant influence on the savings revision. There were two instances where the tracking documentation was incorrect, which led to significant savings adjustments. Quantity discrepancies had an impact on the two parking garages. This was either that the quantity was different or the number of fixtures that were being controlled was different. HVAC interaction was the primary reason for the increase in savings for the grocery store, which is Site #2.

KEMA ID	EI / D2	CUSTOMER TYPE & LOCATION LOCATION & APPLICATION ID	RATIO KEMA / TRACKING				Primary Reason for Discrepancy
			kWh/yr	On-Peak %	Peak Coinc. Sum. kW	Peak Coinc. Wint. kW	
1	EI	Parking Garage, RI Appl #: 518666	83%	105%	29%	73%	Tracking assumed 210 watts for all baseline fixtures including one lamp F40/T12 and 111 watts for all installed fixtures including the one lamp F32/T8. Missing (42) 3L and (25) 1L fixtures.
2	EI	Grocery Store, RI Appl #: 523359	112%	114%	105%	104%	HVAC Interactive savings greater than tracking estimate.
3	EI	Manufacturing Facility, Southeastern, MA Appl #: 525316	106%	200%	87%	20%	Overall increase in operating hours (3,072 on-site weighed average, 2,860 tracking weighted average)
4	EI	Distribution Office/Warehouse, Southeastern, MA Appl #: 525336	127%	161%	105%	87%	Overall increase in operating hours (4,654 on-site weighed average, 3,617 tracking weighted average)
5	EI	Recreation Facility, North Shore, MA Appl #: 525359	113%	109%	41%	98%	Documentation error. Tracking used original estimate of (36) fixtures rather than (32) as found in the post-inspection.
6	D2	High School, North Shore, MA Appl #: 525879	99%	87%	131%	389%	Overall decrease in operating hours (1,686 on-site weighed average, 1,926 tracking weighted average)
7	EI	Manufacturing Facility, Southeastern, MA Appl #: 528318	141%	139%	67%	51%	Overall increase in operating hours (3,572 on-site weighed average, 2,604 tracking weighted average)
8	EI	High School, Southeastern, MA Appl #: 528960	96%	171%	86%	43%	Overall decrease in operating hours (2,084 on-site weighed average, 2,200 tracking weighted average)
9	D2	Parking Garage, Central, MA Appl #: 529332	70%	79%	62%	94%	Only 40% of fixtures controlled compared to 80% in the tracking.
10	EI	Manufacturing Facility, Southeastern, MA Appl #: 532719	142%	101%	120%	83%	Overall increase in operating hours (5,653 on-site weighed average, 4,284 tracking weighted average)

Table 2: Site Discrepancies

Site #1 produced 83% of the tracking annual energy savings. There were two reasons for this decrease. First, the tracking savings calculation was computed by using the same wattage for both types of fixtures in the baseline and installed cases. The tracking savings assumed 210 watts for the baseline for both the 175 watt metal halides and the one lamp F40/T12 fixtures. The tracking savings also assumed 110 watts for the installed case for both the one and three lamp F32/T8 fixtures. Additionally, evaluators found (42) fewer three lamp fixtures and (25) fewer one lamp fixtures during the site visit.

Site #2 produced 112% of the tracking annual energy savings. The largest reason for the discrepancy was that the tracking savings underestimated the impact of this measure on the refrigeration system that serves the freezer cases. Typically, HVAC savings are not counted in

tracking estimations, but because this measure was installed in grocery store freezer cases, the tracking savings estimated 14,703 kWh saved per year on the refrigeration system. This was calculated by assuming a cooling system efficiency of 1.24 kW per ton. Evaluators found that the cooling system efficiency was approximately 2.5 kW per ton based on manufacturers specifications for the compressors used at the facility. This resulted in an increase of savings equal to 10,806 kWh per year.

At Site #3, the increase in savings was due to a conservative estimate of annual operating hours in the tracking system. The tracking savings estimated the annual hours of use for all of the installed fixtures to be 2,860 hours per year. The weighted average of the evaluated annual operating hours was 3,072 hours per year.

The primary reason for the large savings increase for Site #4 was the increase in annual operating hours. The tracking estimate of savings estimated the weighted average of operating hours of all the installed fixtures to be 3,617 hours per year prior to the installation of occupancy sensors. The monitoring data combined with reported operating schedules showed that the weighted average of the post-installation operating hours is 4,654 hours per year prior to the installation of occupancy sensors. Note that the reduction in annual hours associated with the occupancy sensors was very close to tracking estimates.

Site #5 showed an increase in savings which was the result of a documentation error. According to the original tracking estimate, there were to be (36) 12 lamp F54/T5 fixtures installed, which were replacing (34) 1,000 watt metal halide fixtures. However, there was a second option proposed by the vendor that used (32) 12 lamp F54/T5 fixtures rather than (36) in the calculation. Evaluators assumed that the existing (34) 1,000 watt metal halide fixtures was a fixed quantity based on pre-inspection documentation and the two energy savings options that were proposed by the vendor. The post-installation inspection performed by National Grid showed that (32) 12 lamp F54/T5 fixtures were installed. However, this change was not reflected in the tracking savings. The evaluation confirmed the installation of (32) fixtures, not (36). Had the original tracking estimate been updated to reflect the change discovered during the post-installation inspection, the tracking savings would have been 10,626 kWh higher.

The savings for Site #6 were very close to the tracking savings with a 99% realization. There were some discrepancies that combined to make up the difference in savings. The most significant difference was the lower annual hours of use. The tracking assumed the annual hours of this school to be 1,926 hours compared to 1,686 found in the evaluation. However, there was a large increase in savings associated with the total wattage that was installed in this

facility. There was less wattage installed in the school resulting in an increase in savings because the baseline remained fixed with the lighting density calculation that was employed in both the tracking and the evaluation.

The primary reason for the large savings increase for Site #7 was the increase in annual operating hours. The tracking estimate of savings estimated the weighted average of operating hours of all the installed fixtures to be 2,604 hours per year prior to the installation of occupancy sensors. The monitoring data combined with reported operating schedules showed that the weighted average of the post-installation operating hours is 3,572 hours per year prior to the installation of occupancy sensors.

At Site #8, the decrease in savings was due to a decrease in annual operating hours for the school. The tracking savings estimated the annual hours of use for all of the installed fixtures to be 2,200 hours per year. The weighted average of the evaluated annual operating hours was 2,084 hours per year. A portion of the decrease in savings was offset by an increase in savings associated with occupancy sensors. Though the project proposed and installed occupancy sensors in a couple spaces, the savings from the sensors were not counted in the tracking estimate. Evaluators verified the installation of the occupancy sensors and calculated the additional energy savings associated with them.

Site #9 produced 70% of the tracking annual savings. The primary reason for this reduction involved the quantity of fixtures being controlled in this parking garage and the amount of time that they are operating. The tracking estimate proposed that 80% of all of the fixtures would be shut off during the day using a computerized control system. These lights were estimated to be off for 4,300 hours per year as the result of the control system. Evaluators found that approximately 40% of the fixtures were being controlled and that they would be off for 3,012 hours per year. The baseline hours of use were 8,760 hours for both the tracking and on-site estimates meaning that the reduction in the quantity of fixtures controlled and the reduction in actual off time of these lights resulted in a large decrease in annual savings.

At Site #10, the increase in savings was due to a conservative estimate of annual operating hours in the tracking system. The tracking savings estimated a weighted average of annual hours of use for all of the installed fixtures to be 4,284 hours per year. The weighted average of the evaluated annual operating hours was 5,653 hours per year.

4.4 Conclusions

Overall, the Custom lighting component of the Energy Initiative and Design 2000plus Programs appears to be successfully delivering energy savings to National Grid customers. Overall, the tracking estimates of fixture counts and hours of use were close to what was found on-site. This resulted in a non-weighted realization rate of annual energy savings of 102% for this sample.

This evaluation produced summer and winter peak diversified kW reductions that were lower than estimated in the tracking savings. Though the overall hours of use proposed in the tracking estimates were typically close, the tracking estimates for the summer and winter peak kW reductions were calculated using somewhat aggressive summer and winter peak coincidence factors. One reason for this is that 8 of the 10 sites used a coincidence factor of 100% for the calculation of the summer peak demand reduction and 7 of the 10 sites used 100% for the calculation of the winter peak demand reduction. The two sites that didn't assume 100% operation for both the summer and winter peak periods were the two high schools.

Lighting contractors have been improving at estimating the annual hours of use of the lighting that is being installed, but assuming all of the lights operate 100% of the time during the summer and winter peak periods is usually unrealistic. This tends to happen more for the summer period because the summer peak is defined as June through August weekdays between 1 pm and 5 pm. Typically, a business might be operating during these hours, but the likelihood of all of the fixtures operating 100% of these hours is small. One example is a parking garage that was evaluated. This application assumed that a portion of the lights would be off during the day in both the baseline and installed cases, yet the tracking estimate assumed that 100% of the connected kW reduction would be realized during the summer peak period. However, these lights were found to be off during the summer peak period, and did not contribute to the summer peak kW reduction at all.

Lighting contractors and vendors should be encouraged to not only obtain the general facility operating hours, but also provide a more accurate estimate of how the lighting will operate during the summer and winter peak periods. For the parking garage example, it would be as simple as calculating the kW reduction of only the fixtures that remain on 24/7 and dividing this number by the total connected kW reduction of the entire project.

One other area of confusion involved the estimates of on-peak kWh. There were many instances where large variances were found between the tracking and on-site estimates of on-peak kWh reduction. National Grid currently defines the on-peak period to be non-holiday

weekdays between 6 am and 10 pm. However, there is an older definition of on-peak that may have been employed in some of the Custom lighting applications. Many of the applications did not specify or did not provide enough detail to know which definition was used for on-peak kWh reduction, or how this savings parameter was calculated at all. Lighting contractors and vendors should also be encouraged to provide spreadsheets that clearly show all the assumptions made to calculate all of the applicable savings parameters.

There were two projects that included significant quantity discrepancies. One of these was picked up in the post-inspection performed by National Grid, but was not reflected in the final tracking savings. This change should have been updated in the final tracking savings since it was known prior to finalizing the project. This type of savings adjustment is typically done by National Grid following the post-inspection. KEMA believes that this was an isolated occurrence and not reflective of the program. However, National Grid should continue to monitor any changes that result from the post-inspection process and make sure that these changes are reflected in the final tracking savings estimates.

The other project that had a significant quantity discrepancy was one of the parking garages. Evaluators found (67) fewer fixtures installed than proposed in the tracking analysis. The contractor who performed the savings analysis and installation claims that all of the fixtures were delivered. However, evaluators performed two complete walkthroughs of the entire parking garage and concluded that (67) fixtures were not installed. Typically, there may be some small quantity differences that do not have a significant effect on savings estimates. Usually, these differences are the result of minor changes or small miscounts somewhere along the line, but rarely are the quantities off by such a large number. This site also had other issues that were not identified prior to this evaluation. Specifically, the tracking savings were calculated by assuming the same wattage for all of the fixtures installed, even though there were two different types installed, for both the baseline and installed cases. Quantity and wattage differences such as these are typically identified during the post-installation process. National Grid should be certain that any major quantity or technology changes are identified during the post-installation process and reflected in the final tracking estimate.

There was one Performance Lighting project in this sample that used a whole building lighting density calculation to estimate savings for the project. Evaluators found that the information included in the project file was not as detailed as the other Custom lighting projects. For example, there were no descriptions of space types included or detailed fixture types for some of the installed lighting. However, discussions with National Grid personnel revealed that they have taken many steps to improve the Performance Lighting application process since the time

of this project. This includes improvements to the Minimum Requirements Document and requesting as-built plans, bills of materials and other useful information. This shows that National Grid recognizes that in order to continuously deliver successful programs, ongoing improvements are always necessary.

4.5 Lessons Learned

Though the energy savings were close to the tracking estimates for the sample as a whole, the evaluation found large discrepancies between the tracking and evaluation estimates of on-peak kWh and the summer and winter peak kW reductions. These parameters are all determined by estimates of how the annual hours of use are dispersed by hour of day. National Grid should require more detail from lighting contractors and vendors regarding how these values were calculated. Consider providing, as part of the application process, a worksheet designed to construct the annual operating hours using a bottom-up approach. An example would be to calculate the total annual operating hours of a facility by using weekday and weekend hourly profiles of the percent of connected lighting load that is operating at each hour.

Evaluators also found two sites with large quantity discrepancies and tracking errors. On one occasion, the quantity discrepancy was identified during the post-installation inspection, but not updated in the tracking savings. National Grid should utilize the post-installation process to its fullest capabilities so that errors in the tracking savings can be identified prior to finalizing a project. This will help to avoid tracking errors and major quantity discrepancies.

National Grid should continue to work towards improving the Custom lighting program by focusing on these two key recommendations. National Grid has shown in the past, its ability to apply the recommendations from these evaluations towards improving program results. In 2004, it was recommended that a greater focus be put on verifying fixture quantities, and the 2006 evaluation showed improvement in this parameter. In 2006, it was recommended that National Grid put more focus on the annual operating hours that were reported by vendors. This evaluation found that in general, the annual operating hours reported in the tracking estimate were much closer to the actual operation. The two key recommendations presented here are steps that can be taken, in addition to a continued focus on previous recommendations, to help this program achieve even greater success.

Appendix A: Individual Site Reports

Site 1, Application ID: 518666

Facility Type: Parking Garage

Summary

A lighting retrofit of a parking garage was done to replace older inefficient lighting fixtures with new more efficient fixtures. A total of (638) 175 watt metal halide fixtures and (126) one lamp F40/T12 fixtures were replaced with (638) three lamp F32T8 fixtures and (126) one lamp F32T8 fixtures. The tracking savings estimated that (427) three lamp fixtures operate 4,380 hours per year while the remaining fixtures operate 8,760 hours per year.

Evaluators found (596) three lamp F32/T8 fixtures and (101) one lamp F32/T8 fixtures during the site visit. It was also determined from site inspection that (410) of the three lamp F32/T8 fixtures are controlled to go off during the day rather than (427) fixtures as proposed in the tracking estimate.

Table 3 presents the summary of the tracking and on-site savings results.

Savings Quantity	Tracking Estimate	On-site Savings	Evaluated/ Tracking
Annual Energy (kWh)	477,416	394,371	83%
% Energy Savings On-Peak	38%	40%	105%
Summer Peak Diversified kW	84.79	24.32	29%
Winter Peak Diversified kW	84.80	61.53	73%

Table 3: Summary of Tracking and On-site Savings Results

The overall on-site savings estimate is 17% lower than predicted in the tracking estimate. The on-site estimates of summer and winter peak diversified kW was lower than the tracking values. The following factors influenced the difference between the tracking and on-site estimates of energy and demand savings:

- The majority of the decrease in savings was the result of a documentation error in the calculation of the tracking savings. This project was supposed to include the replacement of (638) 175 watt metal halide fixtures with (638) three lamp F32/T8 fixtures

as well as the replacement of (126) one lamp F40/T12 fixtures with (126) one lamp F32/T8 fixtures. However, the tracking savings calculated the annual energy reduction for all (764) fixtures using the 175 watt metal halide fixture wattage for the existing case and the three lamp F32/T8 fixture wattage for the proposed case for all fixtures. Since (126) of these fixtures were supposed to be one lamp fixtures, evaluators recalculated the tracking savings using the appropriate wattages for the single lamp T12 (existing) and T8 (proposed) fixtures. This resulted in a reduction in savings equal to 81,679 kWh per year.

- There was also a decrease in savings resulting from fewer fixtures being installed than proposed in the tracking estimate. The tracking estimate proposed the installation of (638) three lamp F32/T8 fixtures and (126) one lamp F32/T8 fixtures. Evaluators found (596) three lamp F32/T8 fixtures and (101) one lamp F32/T8 fixtures installed in the parking garage during the site visit. Since this was a one to one replacement of existing to new fixtures, evaluators adjusted the baseline quantity to represent the number that was found to have been installed. The decreased quantity resulted in a reduction in energy savings equal to 34,528 kWh per year.

- There was an increase in savings associated with the annual operating hours of the garage lighting. The tracking savings estimated that (427) three lamp F32/T8 fixtures would operate 4,380 hours per year and the remaining three lamp and one lamp F32/T8 fixtures would operate 8,760 hours per year for both the baseline and installed cases. This resulted in a weighted average of annual operating hours to be 6,014 hours per year for the tracking estimate. Evaluators found through site inspection that (410) three lamp fixtures are controlled to go off during the day. It was estimated through monitoring and interviews with facility staff that these fixtures operate approximately 5,197 hours per year. Lighting logger data verified that the remaining fixtures operate 24/7. The on-site estimate for the weighted average of annual operating hours was determined to be 6,443 hours per year for both the baseline and installed cases. This increase in overall operation of the lights resulted in an increase in savings equal to 33,161 kWh per year.

- The on-peak kWh savings was estimated to be 40% of the annual on-site kWh savings, which showed no significant difference from the tracking estimate of 38%.

- The summer diversified kW reduction was 24.32 kW or 71% lower than predicted in the tracking estimate. There were three reasons for the large decrease in the summer

diversified kW reduction. First, there was a second documentation error associated only with the calculation of the tracking summer and winter peak kW reductions. The tracking savings estimated the summer and winter peak kW reductions based on the connected wattage of the installed fixture rather than the difference in wattage between the existing and proposed fixtures. This documentation error was in addition to the tracking savings not using the appropriate wattage for the one lamp T12 and T8 fixtures as previously explained. The combination of these documentation errors resulted in a decrease of the summer and winter diversified kW reductions equal to 18.49 kW each. The quantity adjustment explained previously led to a reduction of 4.78 kW from both the summer and winter diversified kW reduction estimates. The summer diversified kW reduction was also reduced by 37.21 kW because the tracking estimate assumed 100% operation of all the fixtures during the summer peak period. However, lighting logger data and discussions with facility personnel showed that the majority of the lighting is off during the day. The on-site estimate for summer peak diversity was determined to be 51%. The winter diversified kW reduction was 61.53 kW or 27% lower than the tracking estimate due to the tracking errors and quantity discrepancies described above. The reason the winter peak kW reduction isn't as low as the summer is because the evaluation found all of the fixtures to be operating 100% of the time during the winter peak period.

Project Description

This project was completed under the Energy Initiative program. Table 4 presents a summary of the baseline system as outlined in the customer application.

Baseline Case				
Space	**Fixture Type**	**Wattage**	**Quantity**	**Annual Hours**
Parking Garage	175 Watt Metal Halide	210	427	4,380
Parking Garage	175 Watt Metal Halide	210	211	8,760
Elevator Landings/Stairs	One Lamp F40/T12/HO	210[1]	126	8,760
	Total	160,440	764	NA

Table 4: Baseline Lighting System

Table 5 presents the installed fixtures and quantities as proposed in the customer application.

Installed Case				
Space	**Fixture Type**	**Wattage**	**Quantity**	**Annual Hours**
Parking Garage	Three Lamp F32/T8/HO	111	427	4,380
Parking Garage	Three Lamp F32/T8/HO	111	211	8,760
Elevator Landings/Stairs	One Lamp F32/T8/HO	111[2]	126	8,760
	Total	84,804	764	NA

Table 5: Installed Lighting System

[1] *The tracking savings used 210 watts for the one lamp F40/T12 fixture. Evaluators recalculated the tracking savings using 63 watts for this fixture because it was described in the tracking documentation as being a single lamp, four foot T12, high output fixture.*
[2] *The tracking savings used 111 watts for the one lamp F32/T8 fixture. Evaluators recalculated the tracking savings using 38 watts for this fixture based on lamp and ballast model numbers taken during the on-site visit.*

Evaluation Methodology

Tracking Estimates

The tracking estimates of energy use were calculated based on the difference in wattage between the existing and proposed fixtures. The spaces being controlled by the energy management system (EMS) were reported to operate 4,380 hours per year while all other fixtures operate 8,760 hours per year. The energy savings were calculated as the difference in the pre and post installation energy use. Note that the tracking analysis assumed the same existing and installed wattage for the one lamp fixtures as they did for the three lamp fixtures.

Evaluation Approach

The evaluation included a verification of installed fixtures, on-site monitoring and interview. Some fixtures are controlled by an EMS, while the remaining fixtures operate 8,760 hours per year.

The base case used in the evaluation of the lighting savings was developed from information contained in the customer application. Evaluators visited the facility to verify the installed fixtures and install monitoring equipment to quantify the hours of use of the different spaces. Evaluators surveyed facility personnel to obtain information on the lighting usage throughout the year. They also inquired about any HVAC equipment serving the space.

To determine the hours of use for the new fixtures, field evaluators installed fourteen time-of-use lighting loggers throughout the building. Nine loggers were installed on lights that operate 8,760 hours per year and five loggers were installed on fixtures that are controlled by the EMS. Table 6 presents the fixtures monitored by the evaluation engineers.

Logger #	Equipment Monitored	Parameter Measured	Test Equip. Make & Model	Measurement Type	Installation Method	Frequency of Observations	Monitoring Duration
940824-091	4th Fl - 3L/T8 Controlled	On/Off Operation	PS&T TOU Lighting Logger	Event Logger	Proximity	Based on Schedule	3/26/09 - 4/24/09
940824-111	1st Fl - 3L/T8 Always On	On/Off Operation	PS&T TOU Lighting Logger	Event Logger	Proximity	Based on Schedule	3/26/09 - 4/24/09
940824-153	1st Fl - 3L/T8 Always On	On/Off Operation	PS&T TOU Lighting Logger	Event Logger	Proximity	Based on Schedule	3/26/09 - 4/24/09
940824-174	1st Fl - 3L/T8 Controlled	On/Off Operation	PS&T TOU Lighting Logger	Event Logger	Proximity	Based on Schedule	3/26/09 - 4/24/09
940824-176	5th Fl - 3L/T8 Always On	On/Off Operation	PS&T TOU Lighting Logger	Event Logger	Proximity	Based on Schedule	3/26/09 - 4/24/09
940824-182	2nd Fl - 3L/T8 Always On	On/Off Operation	PS&T TOU Lighting Logger	Event Logger	Proximity	Based on Schedule	3/26/09 - 4/24/09
940824-201	2nd Fl - 3L/T8 Controlled	On/Off Operation	PS&T TOU Lighting Logger	Event Logger	Proximity	Based on Schedule	3/26/09 - 4/24/09
940824-202	3rd Fl - 1L/T8 Always On	On/Off Operation	PS&T TOU Lighting Logger	Event Logger	Proximity	Based on Schedule	3/26/09 - 4/24/09
940824-234	3rd Fl - 3L/T8 Controlled	On/Off Operation	PS&T TOU Lighting Logger	Event Logger	Proximity	Based on Schedule	3/26/09 - 4/24/09
940824-252	4th Fl - 3L/T8 Always On	On/Off Operation	PS&T TOU Lighting Logger	Event Logger	Proximity	Based on Schedule	3/26/09 - 4/24/09
940824-253	2nd Fl - 1L/T8 Always On	On/Off Operation	PS&T TOU Lighting Logger	Event Logger	Proximity	Based on Schedule	3/26/09 - 4/24/09
940824-254	2nd Fl - 3L/T8 Always On	On/Off Operation	PS&T TOU Lighting Logger	Event Logger	Proximity	Based on Schedule	3/26/09 - 4/24/09
940824-262	3rd Fl - 3L/T8 Always On	On/Off Operation	PS&T TOU Lighting Logger	Event Logger	Proximity	Based on Schedule	3/26/09 - 4/24/09
940824-269	5th Fl - 3L/T8 Controlled	On/Off Operation	PS&T TOU Lighting Logger	Event Logger	Proximity	Based on Schedule	3/26/09 - 4/24/09

Table 6: Spaces Monitored

Verification of Equipment and Operating Parameters

This was a retrofit that included the installation of one and three lamp F32/T8 lighting in a parking garage in place of one lamp F40/T12 fixtures and 175 watt metal halide fixtures, respectively. The tracking savings estimated a total of (638) three lamp F32/T8 fixtures and (126) one lamp F32/T8 fixtures were to be installed. A count of the entire parking garage by evaluators found there to be (596) three lamp F32/T8 fixtures and (101) one lamp F32/T8 fixtures. Evaluators found that (410) of the three lamp F32/T8 fixtures were being controlled by the EMS. This was determined by walking through the entire parking garage and recording the number of lights that were off during the daytime visit.

This is a parking garage that serves a public transportation facility. This facility operates 24 hours a day, seven days a week. There are no observed holidays at this location. Table 7 presents the values obtained from the monitored data including annual operation, summer and winter diversity factors, and on-peak hours of use.

According to facility personnel, the operating schedules of the controlled fixtures are changed monthly by the parking garage management company. Lighting loggers were installed at this facility between March 26, 2009 and April 24, 2009. On April 23, 2009 the lighting logger data for each controlled fixture that was monitored showed a different lighting schedule than all the days prior. This new operation showed the lights coming on later in the day than on the previous days. Facility personnel confirmed that this was likely the adjusted operating schedule for May.

To annualize each of the operating schedules of the controlled fixtures that were monitored, evaluators compared the monitored operation of the lights to the average monthly percent darkness for Providence, RI[3].

Schedule 15 was constructed to represent the annual operation of the controlled fixtures on the 2nd through 4th floors. This schedule was generated in two steps. The first step was to average the three loggers that monitored the controlled fixtures on these floors (Schedules 1, 7 and 9). All three loggers showed similar daily operation of approximately 4 pm to 7 am from March 27 through April 22 and between 7 pm and 7 am beginning April 23. Evaluators assumed the first period to represent April and the second period to represent May.

[3] *Average monthly percent darkness for Providence, RI was obtained from the US Naval Observatory. Data retrieved May 2009 from http://aa.usno.navy.mil/data/docs/RS_OneYear.php.*

The second step was to adjust the daytime operation monthly based on percent darkness. According to facility personnel, the operating schedules are updated manually on a monthly basis. To adjust the logger data by month, evaluators compared the logger data that was assumed to represent April to the average percent darkness for April. It was found that the logger data includes more hours of operation than actual darkness in April. This is likely because it is a parking structure that is partially enclosed. It appears that the operation of the lights is scheduled to account for this "lag" in daylight. Evaluators adjusted this April data to estimate each month of January through March and October through December by adding the appropriate amount of additional usage to each month depending on the darkness of each month. For example, evaluators noted that the monitored data for April showed two additional hours of usage in the morning hours than actual darkness in the day. Between hours ending 6 and 7 am, it is almost completely light outside, yet the logger data showed 100% operation during these hours. Based on this observation, evaluators added two full hours of operation beyond the last hour in the morning of each month in which it is completely dark outside. A similar scenario occurred at night where the first hour of complete darkness occurs at hour ending 9 pm, but the logger data showed 100% usage starting at hour ending 6 pm.

Evaluators assumed September would operate similar to April based on the similarities in darkness between the two months. Likewise, evaluators adjusted the logger data that was assumed to represent May to estimate the operation for June and July. Evaluators also assumed August would operate similar to May based on the similarities in darkness between these two months. Evaluators used the same process to estimate the operation of the controlled lights for the 1st floor (Schedule 16) and the 5th floor (Schedule 17). Table 8 at the end of this report provides the average monthly percent darkness for Providence, RI. Table 9 through Table 11 provides the estimated monthly operating schedules for the 2nd through 4th floors (Schedule 15), 1st floor (Schedule 16) and 5th floor (Schedule 17), respectively.

Schedule ID	Logger #	Description	Annual Hours	Summer Diversity	Winter Diversity	On-Peak Hours
1	940824-091	4th Fl - 3L/T8 Controlled	5,436	16%	95%	1,727
2	940824-111	1st Fl - 3L/T8 Always On	8,760	100%	100%	4,032
3	940824-153	1st Fl - 3L/T8 Always On	8,760	100%	100%	4,032
4	940824-174	1st Fl - 3L/T8 Controlled	3,494	8%	88%	1,266
5	940824-176	5th Fl - 3L/T8 Always On	8,760	100%	100%	4,032
6	940824-182	2nd Fl - 3L/T8 Always On	8,760	100%	100%	4,032
7	940824-201	2nd Fl - 3L/T8 Controlled	5,254	8%	88%	1,601
8	940824-202	3rd Fl - 1L/T8 Always On	8,760	100%	100%	4,032
9	940824-234	3rd Fl - 3L/T8 Controlled	5,436	16%	95%	1,727
10	940824-252	4th Fl - 3L/T8 Always On	8,760	100%	100%	4,032
11	940824-253	2nd Fl - 1L/T8 Always On	8,760	100%	100%	4,032
12	940824-254	2nd Fl - 3L/T8 Always On	8,760	100%	100%	4,032
13	940824-262	3rd Fl - 3L/T8 Always On	8,760	100%	100%	4,032
14	940824-269	5th Fl - 3L/T8 Controlled	6,663	49%	93%	2,568
15	NA	Annualized 2nd - 4th Floor Controlled Fixtures	5,365	0%	100%	1,688
16	NA	Annualized 1st Floor Controlled Fixture	3,836	0%	100%	1,432
17	NA	Annualized 5th Floor Controlled Fixture	7,045	57%	100%	2,844

Table 7: Annual Hours of Use and Diversity Factors of Monitored Data

To estimate annual energy and demand savings, a spreadsheet method was employed. The summary of this spreadsheet is presented in Table 12. Annual hours and diversity factors from Table 7 are used with wattages from Table 12 to calculate energy and demand savings. The schedule ID's from Table 7 are presented in Table 12 to show which schedule was used with each fixture ID. The final on-site savings estimates are presented in Table 12.

The facility is neither heated nor cooled. Therefore, there are no interactive effects associated with the new lighting and any HVAC systems.

The average daily lighting profiles for the all the monitored spaces are presented in Figure 2 through Figure 15. This represents the average daily operation across the monitoring period. The x-axis represents one full day and the y-axis is the percentage that the lights are on for each hour. Schedules 15 through 17 are also presented graphically in Figure 16 through Figure 18.

An hourly summary of the site kW savings for an average summer (June through August), non-holiday, weekday is presented in Table 13. This summary is provided so that the summer diversified peak kW can be estimated across any range of hours in the event that the FCM definition for summer peak changes in the future. The same summary was also provided for the average winter (December and January), non-holiday, weekday in Table 14.

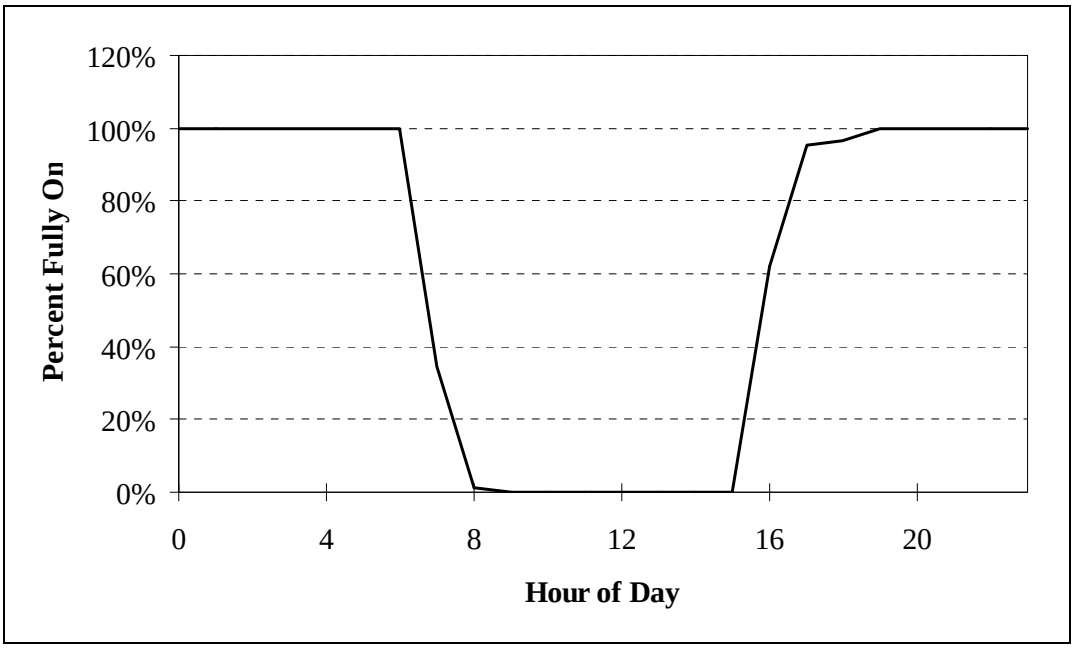

Figure 2: Average Daily Lighting Profile for Schedule 1 (4th Floor, Controlled Fixture) from 3/26/09 to 4/24/09

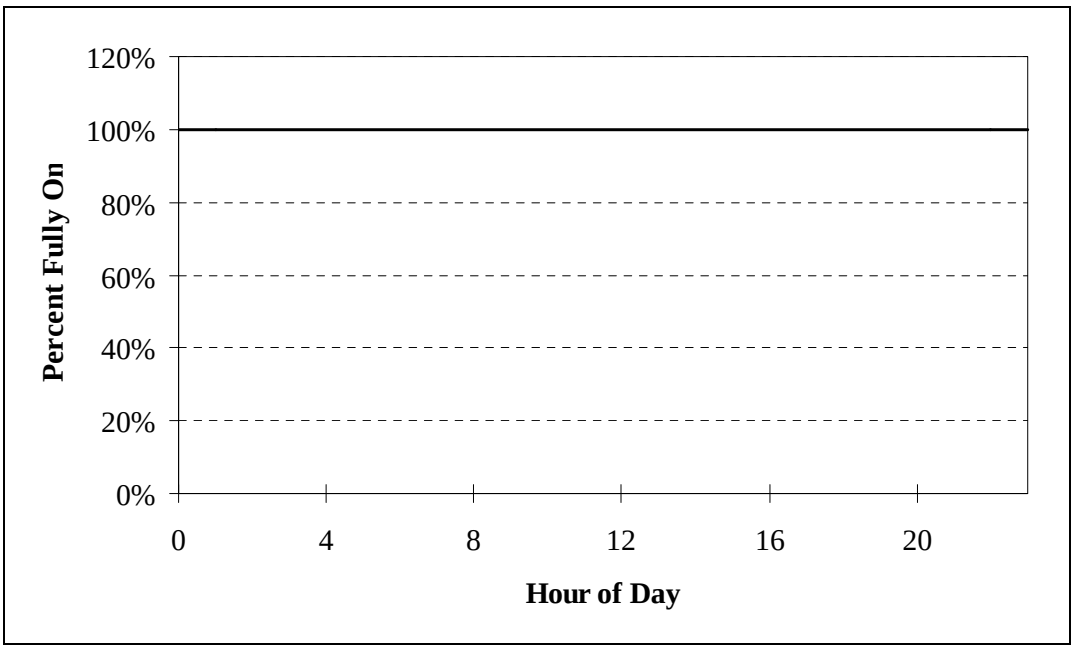

Figure 3: Average Daily Profile for Schedule 2 (1st Floor, 24/7 Fixture) from 3/26/09 to 4/24/09

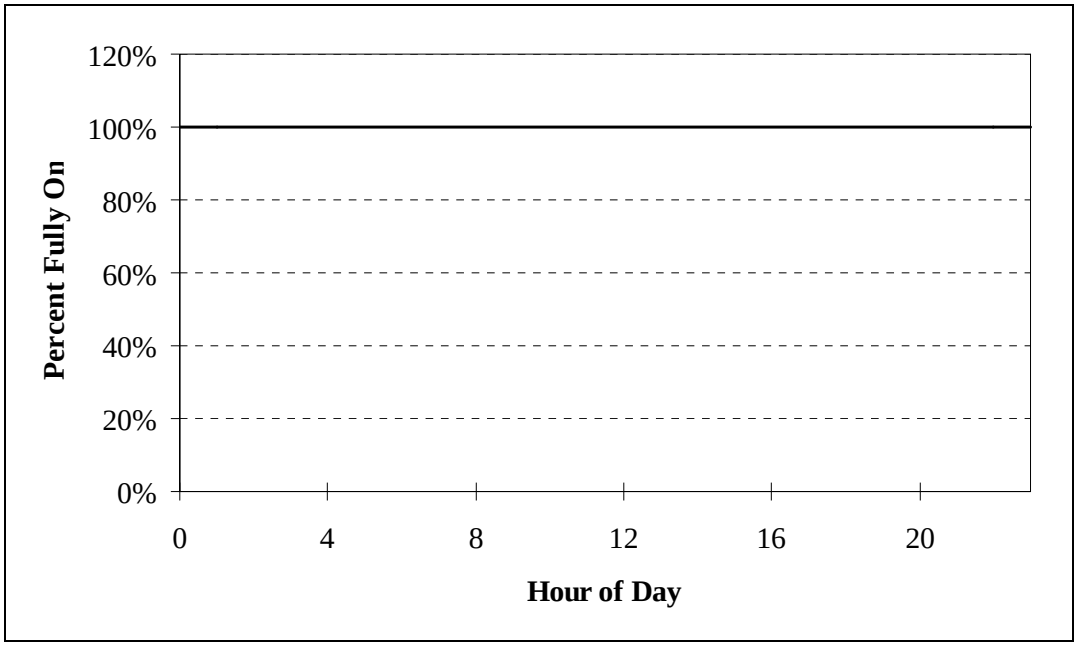

Figure 4: Average Daily Lighting Profile for Schedule 3 (1st Floor, 24/7 Fixture) from 3/26/09 to 4/24/09

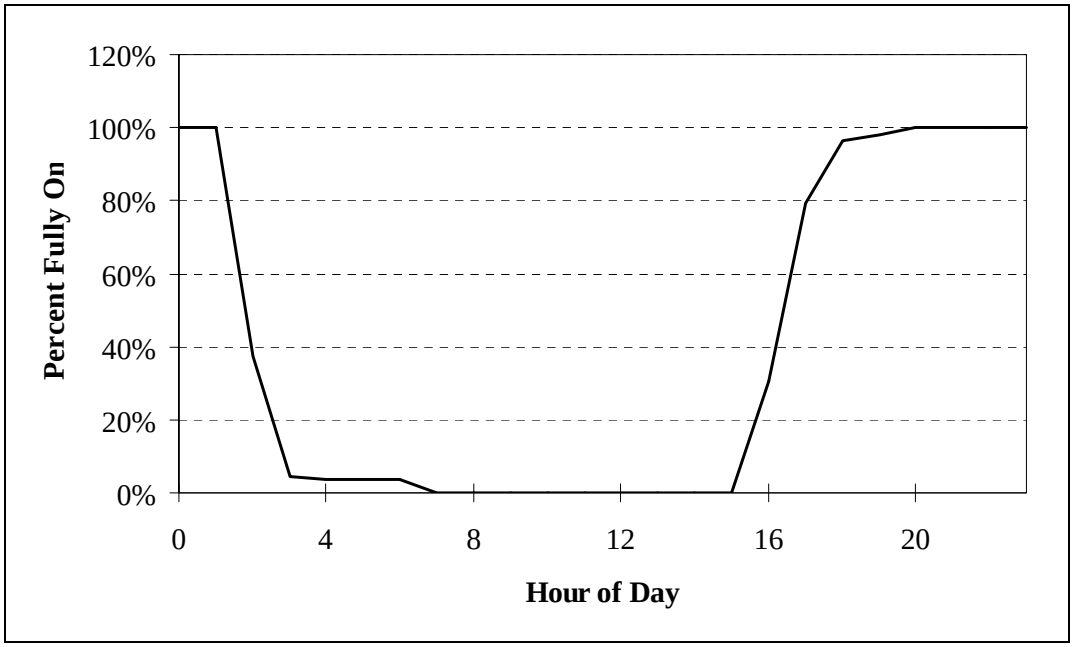

Figure 5: Average Daily Lighting Profile for Schedule 4 (1st Floor, Controlled Fixture) from 3/26/09 to 4/24/09

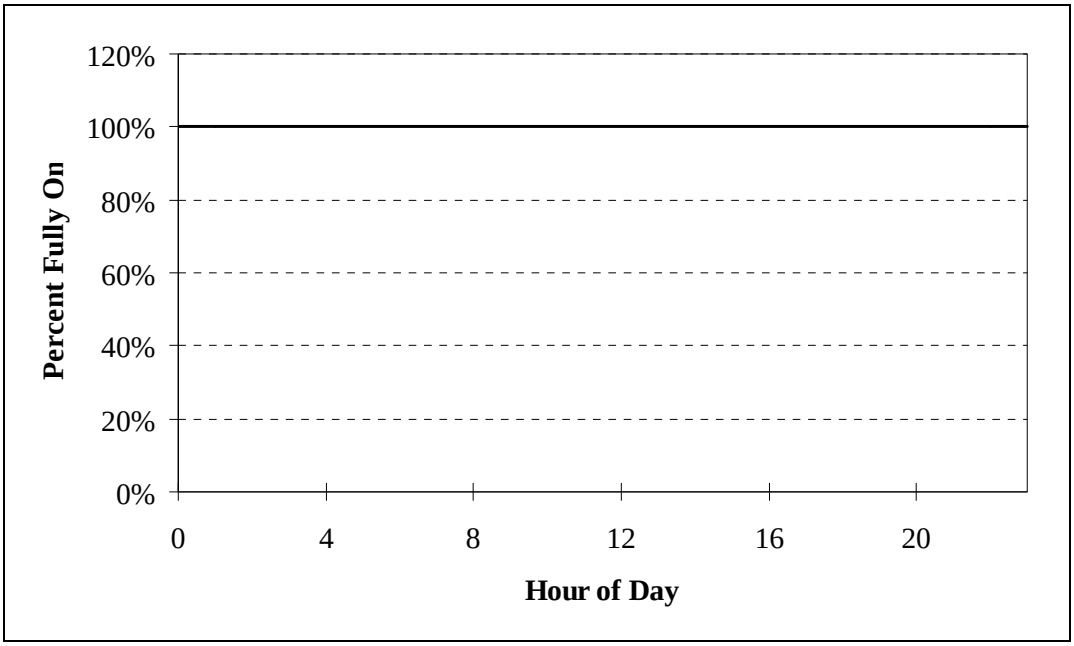

Figure 6: Average Daily Lighting Profile for Schedule 5 (5th Floor, 24/7 Fixture) from 3/26/09 to 4/24/09

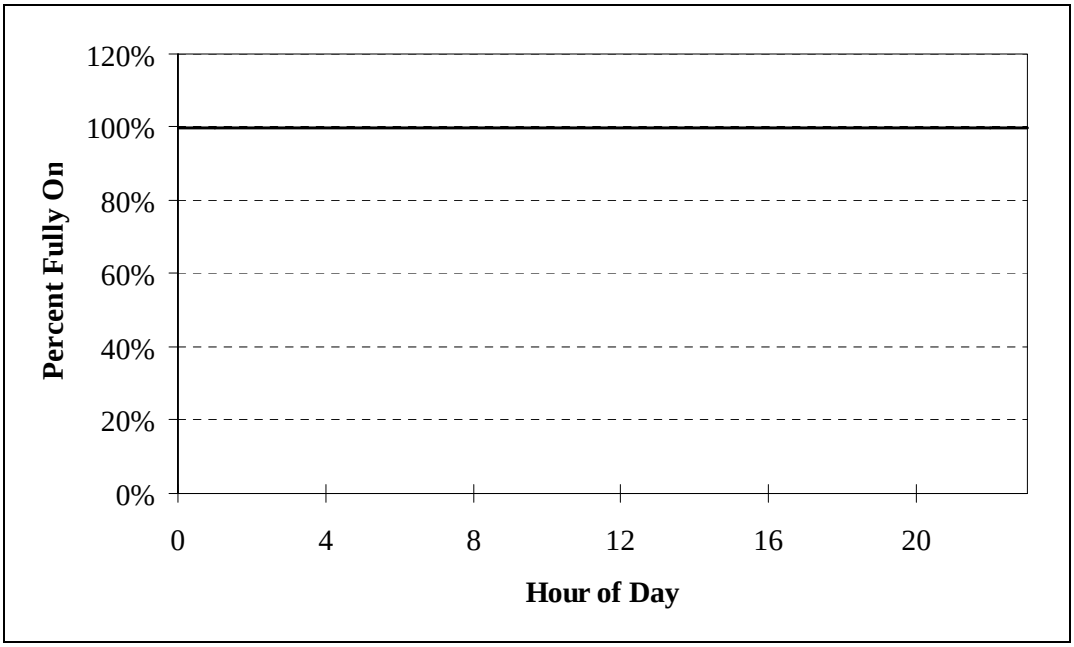

Figure 7: Average Daily Lighting Profile for Schedule 6 (2nd Floor, 24/7 Fixture) from 3/26/09 to 4/24/09

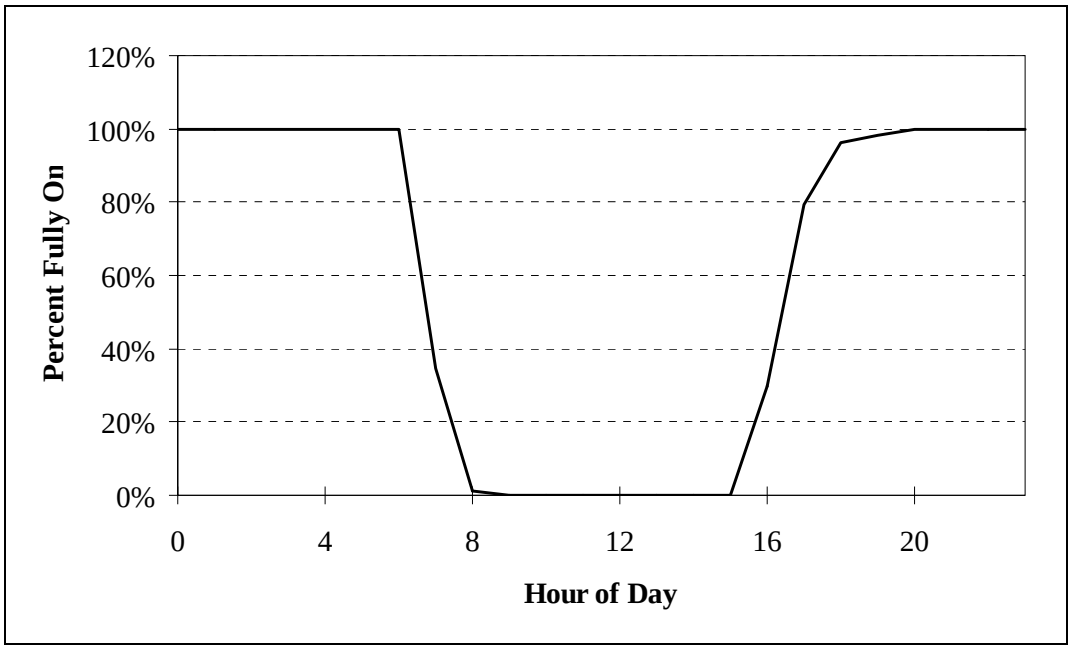

Figure 8: Average Daily Lighting Profile for Schedule 7 (2nd Floor, Controlled Fixture) from 3/26/09 to 4/24/09

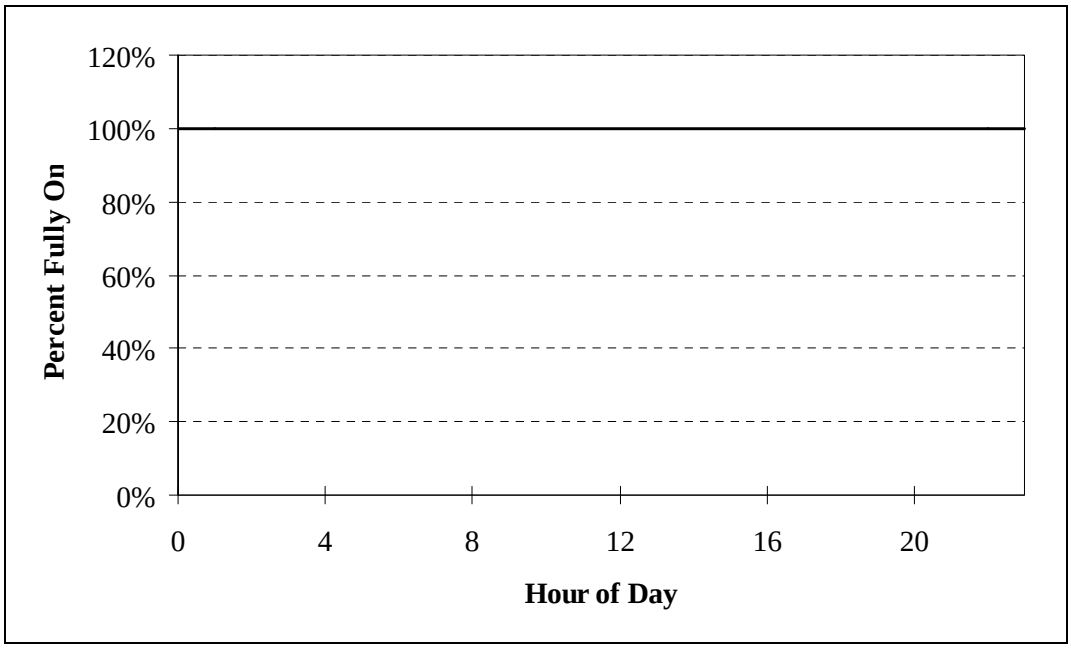

Figure 9: Average Daily Lighting Profile for Schedule 8 (3rd Floor, 24/7 Fixture) from 3/26/09 to 4/24/09

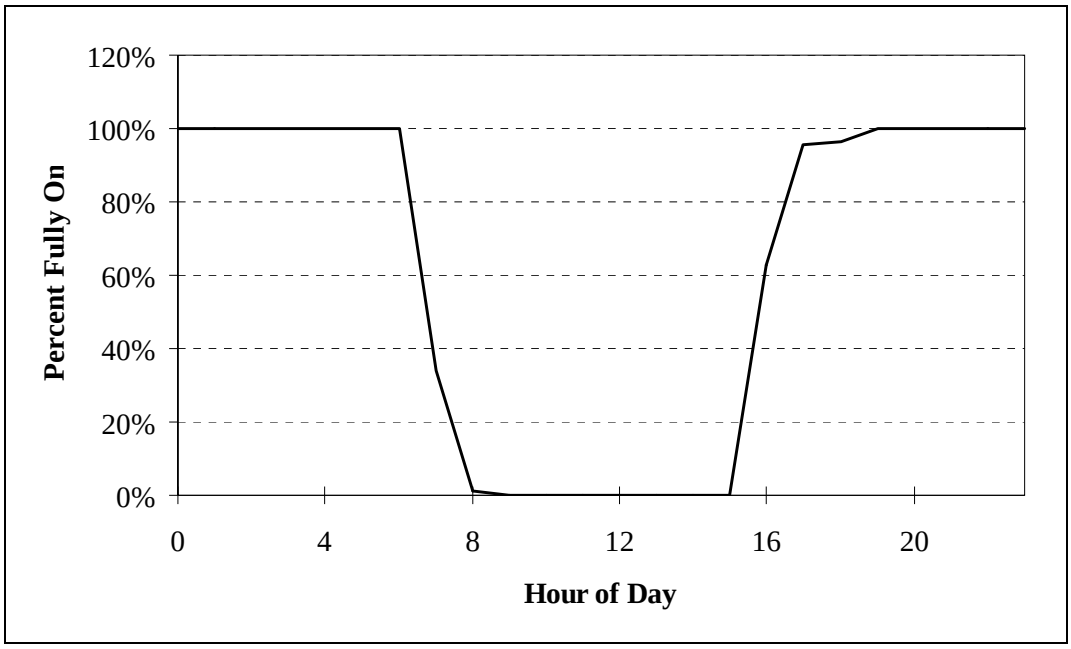

Figure 10: Average Daily Lighting Profile for Schedule 9 (3rd Floor, Controlled Fixture) from 3/26/09 to 4/24/09

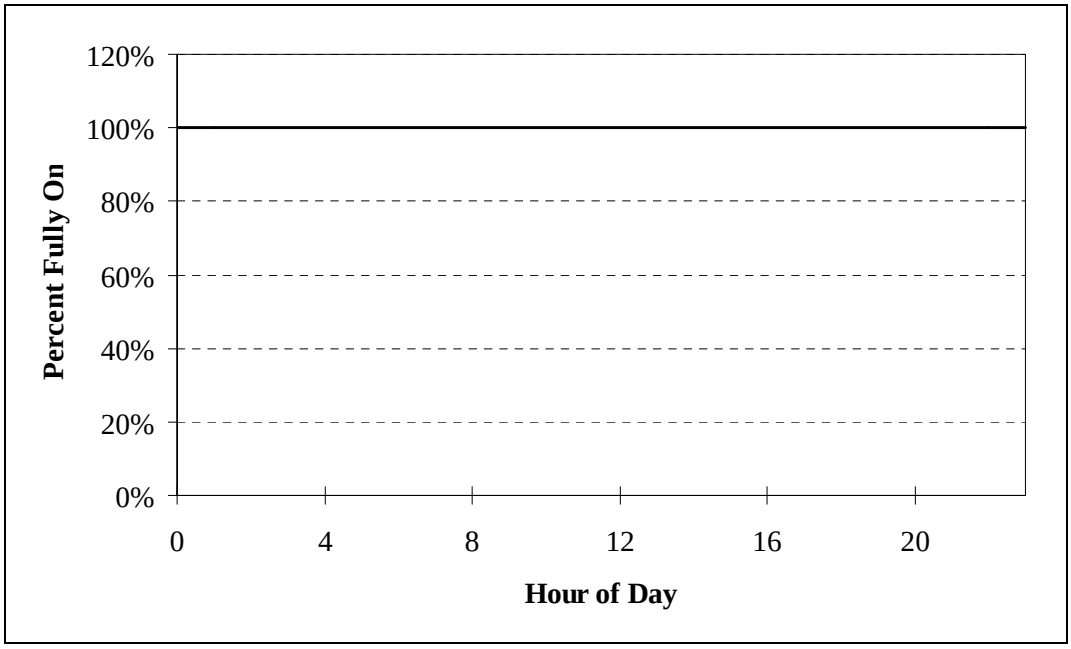

Figure 11: Average Daily Lighting Profile for Schedule 10 (4th Floor, 24/7 Fixture) from 3/26/09 to 4/24/09

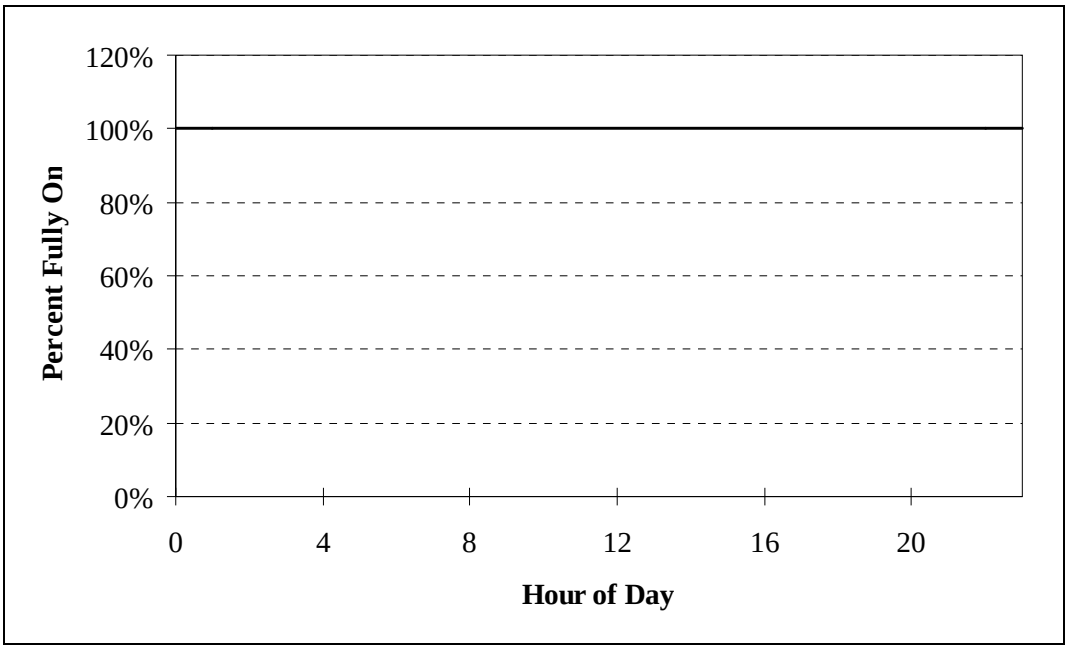

Figure 12: Average Daily Lighting Profile for Schedule 11 (2nd Floor, 24/7 Fixture) from 3/26/09 to 4/24/09

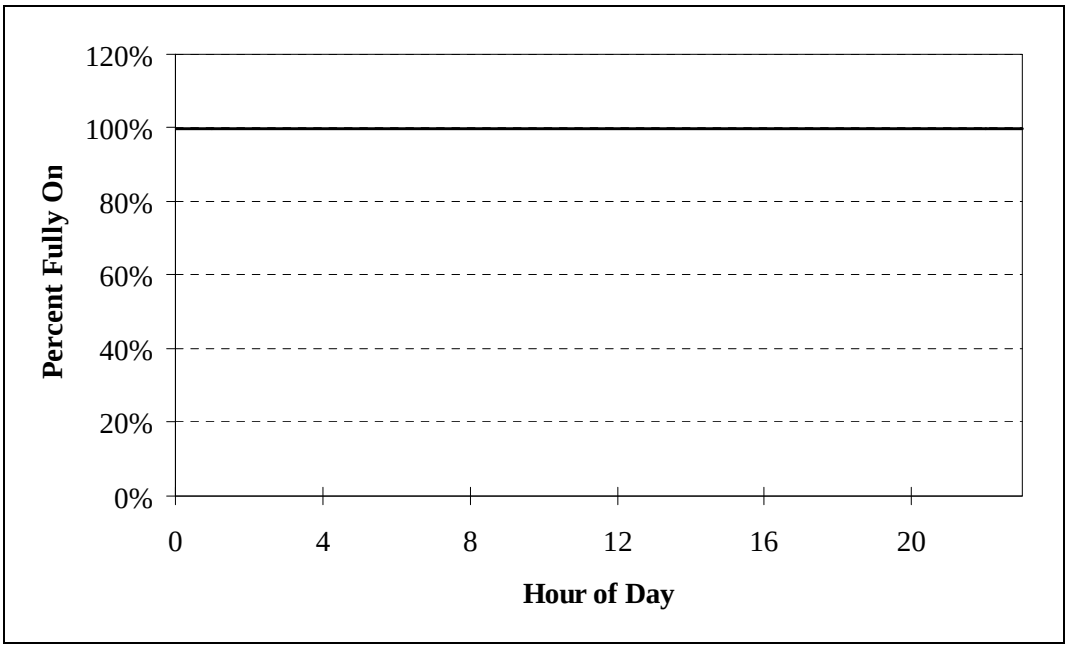

Figure 13: Average Daily Lighting Profile for Schedule 12 (2nd Floor, 24/7 Fixture) from 3/26/09 to 4/24/09

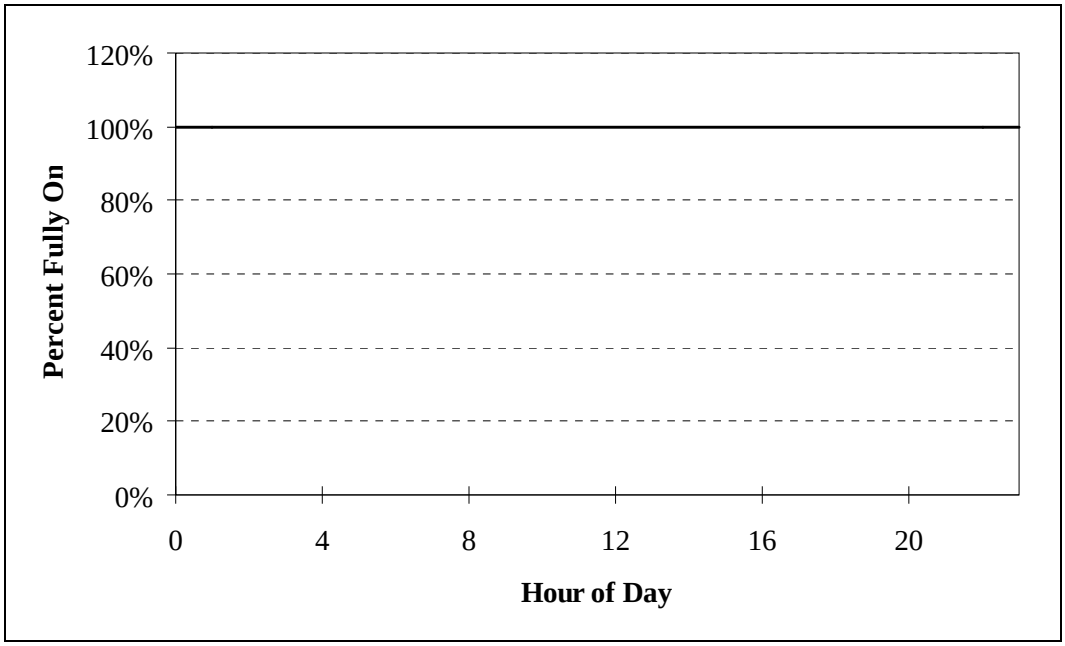

Figure 14: Average Daily Lighting Profile for Schedule 13 (3rd Floor, 24/7 Fixture) from 3/26/09 to 4/24/09

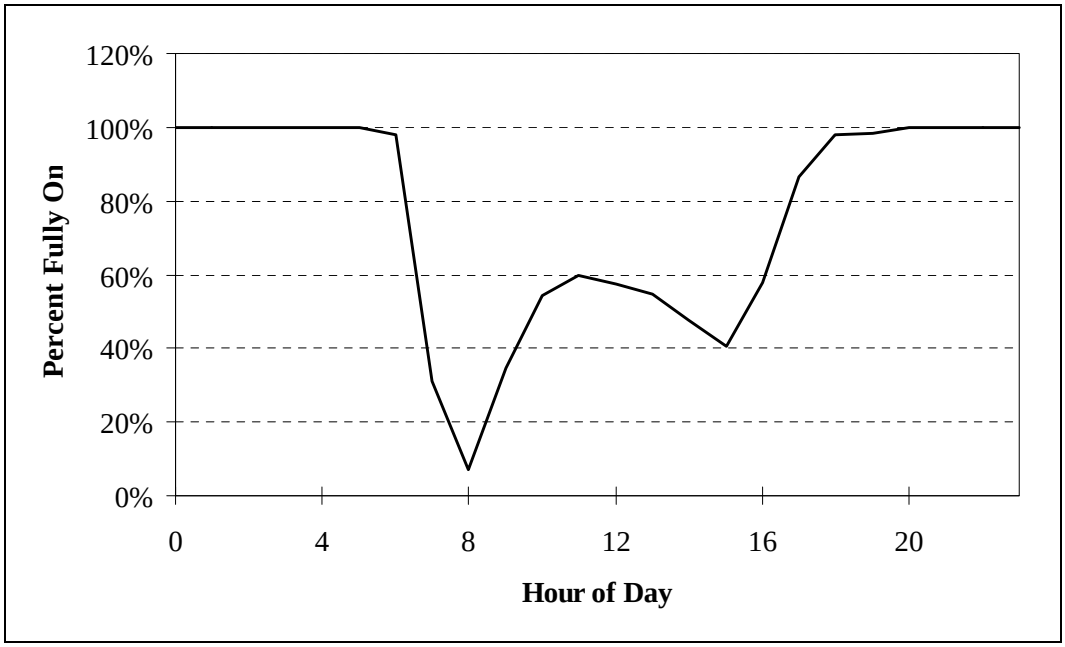

Figure 15: Average Daily Lighting Profile for Schedule 14 (5th Floor, Controlled Fixture) from 3/26/09 to 4/24/09

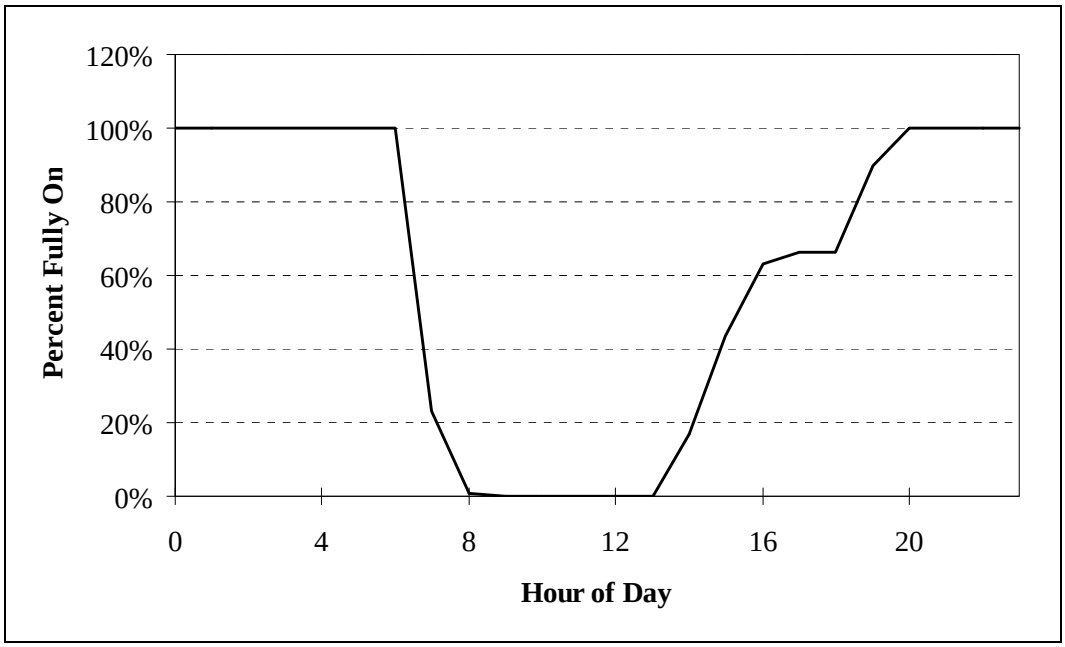

Figure 16: Average Daily Lighting Profile for Schedule 15 (Avg. 2nd – 4th Floor, Controlled Fixture)

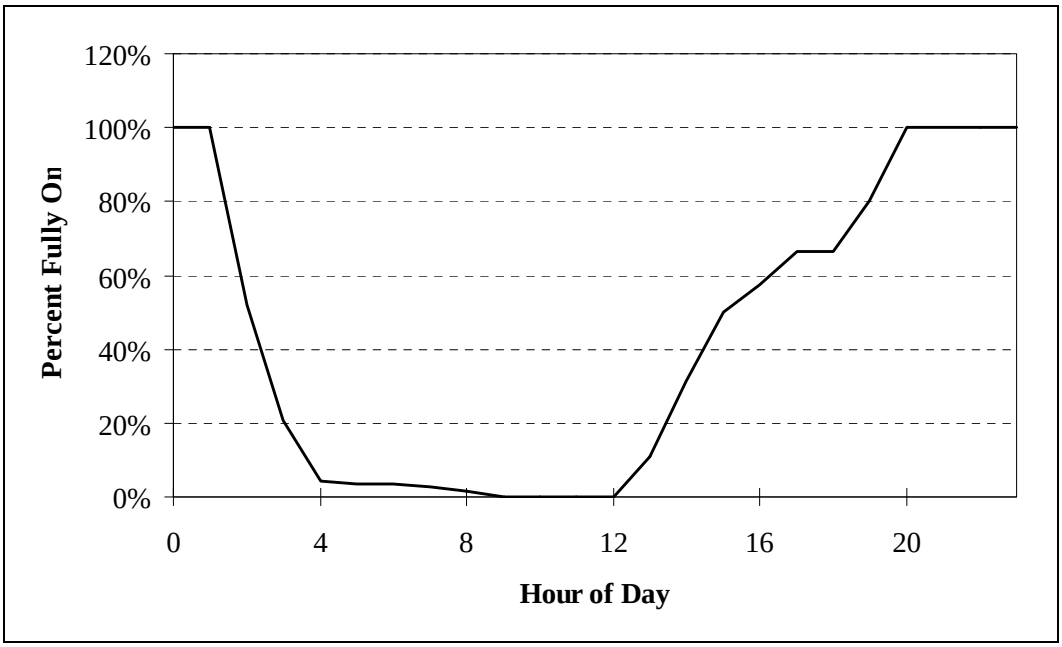

Figure 17: Average Daily Lighting Profile for Schedule 16 (Avg. 1st Floor, Controlled Fixture)

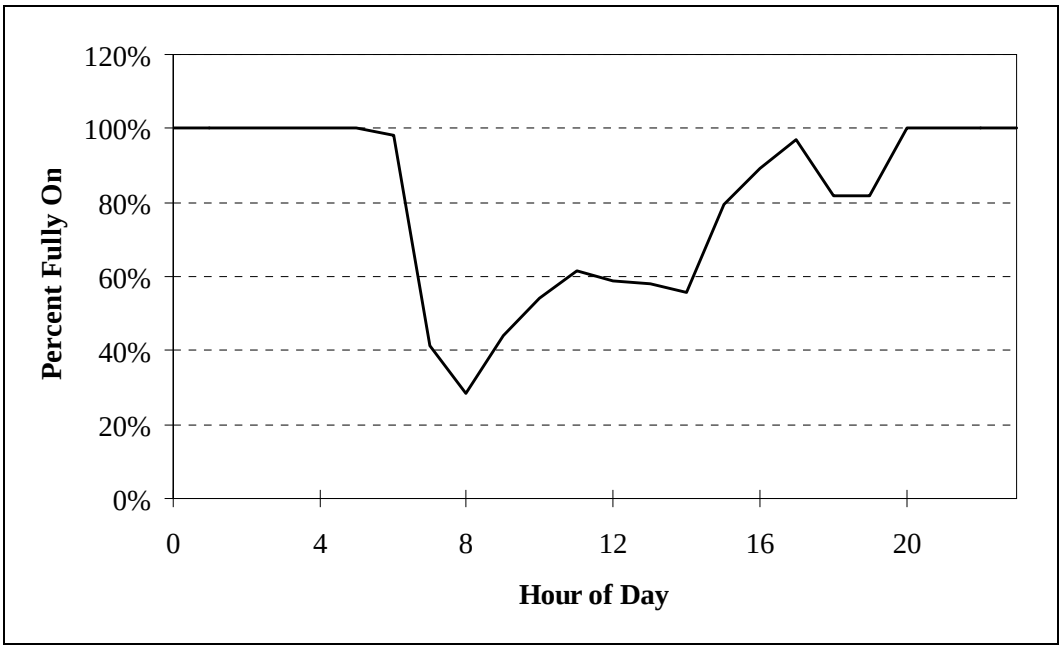

Figure 18: Average Daily Lighting Profile for Schedule 17 (Avg. 5th Floor, Controlled Fixture)

Hour Ending	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sept	Oct	Nov	Dec
1	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%
2	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%
3	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%
4	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%
5	100%	100%	100%	94%	43%	19%	43%	89%	100%	100%	100%	100%
6	100%	100%	85%	14%	0%	0%	0%	3%	44%	92%	100%	100%
7	100%	69%	7%	0%	0%	0%	0%	0%	0%	7%	60%	99%
8	15%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	11%
9	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
10	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
11	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
12	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
13	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
14	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
15	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
16	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
17	30%	0%	0%	0%	0%	0%	0%	0%	0%	0%	57%	71%
18	100%	69%	14%	0%	0%	0%	0%	0%	0%	8%	100%	100%
19	100%	100%	97%	8%	0%	0%	0%	0%	17%	87%	100%	100%
20	100%	100%	100%	56%	7%	0%	0%	28%	94%	100%	100%	100%
21	100%	100%	100%	100%	94%	64%	72%	100%	100%	100%	100%	100%
22	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%
23	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%
24	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%

Table 8: Average Percent Darkness by Month for Providence, RI

Hour Ending	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sept	Oct	Nov	Dec
1	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%
2	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%
3	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%
4	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%
5	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%
6	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%
7	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%
8	**100%**	**29%**	3%	3%	3%	3%	3%	3%	3%	3%	**25%**	**100%**
9	**6%**	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	**5%**
10	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
11	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
12	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
13	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
14	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
15	**100%**	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	**100%**
16	**100%**	**80%**	**80%**	0%	0%	0%	0%	0%	0%	**80%**	**80%**	**100%**
17	**100%**	**100%**	**100%**	80%	0%	0%	0%	0%	80%	**100%**	**100%**	**100%**
18	100%	100%	100%	100%	0%	0%	0%	0%	100%	100%	100%	100%
19	100%	100%	100%	100%	0%	0%	0%	0%	100%	100%	100%	100%
20	100%	100%	100%	100%	80%	**55%**	**61%**	80%	100%	100%	100%	100%
21	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%
22	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%
23	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%
24	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%

Table 9: Monthly Operation of 2nd – 4th Floor Controlled Fixtures

Hour Ending	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sept	Oct	Nov	Dec
1	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%
2	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%
3	**100%**	**100%**	**100%**	8%	3%	3%	3%	3%	8%	**100%**	**100%**	**100%**
4	**100%**	**8%**	**8%**	6%	0%	0%	0%	0%	6%	**8%**	**8%**	**100%**
5	**8%**	**6%**	**6%**	6%	0%	0%	0%	0%	6%	**6%**	**6%**	**8%**
6	**6%**	**6%**	**6%**	6%	0%	0%	0%	0%	6%	**6%**	**6%**	**6%**
7	**6%**	**6%**	**6%**	6%	0%	0%	0%	0%	6%	**6%**	**6%**	**6%**
8	**6%**	**6%**	**6%**	0%	0%	0%	0%	0%	0%	**6%**	**6%**	**6%**
9	**6%**	0%	0%	0%	2%	2%	2%	2%	0%	0%	0%	**6%**
10	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
11	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
12	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
13	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
14	**25%**	0%	0%	0%	0%	0%	0%	0%	0%	0%	**48%**	**59%**
15	**100%**	**58%**	**11%**	0%	0%	0%	0%	0%	0%	**6%**	**100%**	**100%**
16	**100%**	**100%**	**100%**	0%	0%	0%	0%	0%	0%	**100%**	**100%**	**100%**
17	**100%**	**100%**	**100%**	47%	0%	0%	0%	0%	47%	**100%**	**100%**	**100%**
18	100%	100%	100%	100%	0%	0%	0%	0%	100%	100%	100%	100%
19	100%	100%	100%	100%	0%	0%	0%	0%	100%	100%	100%	100%
20	100%	100%	100%	100%	47%	**32%**	**36%**	47%	100%	100%	100%	100%
21	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%
22	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%
23	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%
24	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%

Table 10: Monthly Operation of 1st Floor Controlled Fixtures

Hour Ending	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sept	Oct	Nov	Dec
1	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%
2	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%
3	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%
4	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%
5	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%
6	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%
7	**100%**	**100%**	**100%**	97%	96%	96%	96%	96%	97%	**100%**	**100%**	**100%**
8	**100%**	**100%**	**50%**	0%	0%	0%	0%	0%	0%	**48%**	**100%**	**100%**
9	**98%**	10%	10%	10%	27%	27%	27%	27%	10%	10%	10%	**73%**
10	46%	46%	46%	46%	41%	41%	41%	41%	46%	46%	46%	46%
11	70%	70%	70%	70%	23%	23%	23%	23%	70%	70%	70%	70%
12	74%	74%	74%	74%	38%	38%	38%	38%	74%	74%	74%	74%
13	65%	65%	65%	65%	47%	47%	47%	47%	65%	65%	65%	65%
14	59%	59%	59%	59%	56%	56%	56%	56%	59%	59%	59%	59%
15	**100%**	56%	56%	56%	22%	22%	22%	22%	56%	56%	**100%**	**100%**
16	**100%**	**100%**	**100%**	44%	67%	67%	67%	67%	44%	**100%**	**100%**	**100%**
17	**100%**	**100%**	**100%**	71%	82%	82%	82%	82%	71%	**100%**	**100%**	**100%**
18	100%	100%	100%	100%	92%	92%	92%	92%	100%	100%	100%	100%
19	100%	100%	100%	100%	46%	46%	46%	46%	100%	100%	100%	100%
20	100%	100%	100%	100%	54%	**37%**	**41%**	54%	100%	100%	100%	100%
21	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%
22	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%
23	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%
24	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%

Table 11: Monthly Operation of 5th Floor Controlled Fixtures

Facility Type: Parking Garage
Application ID: 518666

Fixture Information

		Pre-retrofit Lighting							Post-retrofit Lighting							HVAC				Schedule ID from Table 5	
	(a)	(b)	(c)	(d)	(e)	(f)	(g)	(h)	(i)	(j)	(k)	(l)	(m)	(n)	(o)	(p)	(q)	(r)	(s)		
					Hours of Use		FCM Diversity Factor					Hours of Use		FCM Diversity Factor			COP				
Fixture ID	Space Type	Fixture Type	Fixture Quantity	Fixture Wattage	Annual	Peak	Summer	Winter	Fixture Type	Fixture Quantity	Fixture Wattage	Annual	Peak	Summer	Winter	Cooling	Heating	% Space Cooled	% Space Heated	Pre Retrofit	Post Retrofit
1	1st Floor 24/7	175W METAL HALIDE	24	210	8,760	4,032	100%	100%	3L4' T8/ELIG HIGH LMN	24	111	8,760	4,032	100%	100%	NA	NA	0%	0%	3	3
2	1st Floor	175W METAL HALIDE	60	210	3,836	1,432	0%	100%	3L4' T8/ELIG HIGH LMN	60	111	3,836	1,432	0%	100%	NA	NA	0%	0%	16	16
3	Ramp FL 1-2 24/7	175W METAL HALIDE	23	210	8,760	4,032	100%	100%	3L4' T8/ELIG HIGH LMN	23	111	8,760	4,032	100%	100%	NA	NA	0%	0%	3	3
4	Ramp FL 1-2	175W METAL HALIDE	51	210	3,836	1,432	0%	100%	3L4' T8/ELIG HIGH LMN	51	111	3,836	1,432	0%	100%	NA	NA	0%	0%	16	16
5	2nd Floor 24/7	175W METAL HALIDE	18	210	8,760	4,032	100%	100%	3L4' T8/ELIG HIGH LMN	18	111	8,760	4,032	100%	100%	NA	NA	0%	0%	3	3
6	2nd Floor	175W METAL HALIDE	40	210	5,365	1,688	0%	100%	3L4' T8/ELIG HIGH LMN	40	111	5,365	1,688	0%	100%	NA	NA	0%	0%	15	15
7	Ramp FL 2-3 24/7	175W METAL HALIDE	19	210	8,760	4,032	100%	100%	3L4' T8/ELIG HIGH LMN	19	111	8,760	4,032	100%	100%	NA	NA	0%	0%	3	3
8	Ramp FL 2-3	175W METAL HALIDE	39	210	5,365	1,688	0%	100%	3L4' T8/ELIG HIGH LMN	39	111	5,365	1,688	0%	100%	NA	NA	0%	0%	15	15
9	3rd Floor 24/7	175W METAL HALIDE	18	210	8,760	4,032	100%	100%	3L4' T8/ELIG HIGH LMN	18	111	8,760	4,032	100%	100%	NA	NA	0%	0%	3	3
10	3rd Floor	175W METAL HALIDE	41	210	5,365	1,688	0%	100%	3L4' T8/ELIG HIGH LMN	41	111	5,365	1,688	0%	100%	NA	NA	0%	0%	15	15
11	Ramp FL 3-4 24/7	175W METAL HALIDE	18	210	8,760	4,032	100%	100%	3L4' T8/ELIG HIGH LMN	18	111	8,760	4,032	100%	100%	NA	NA	0%	0%	3	3
12	Ramp FL 3-4	175W METAL HALIDE	39	210	5,365	1,688	0%	100%	3L4' T8/ELIG HIGH LMN	39	111	5,365	1,688	0%	100%	NA	NA	0%	0%	15	15
13	4th Floor 24/7	175W METAL HALIDE	18	210	8,760	4,032	100%	100%	3L4' T8/ELIG HIGH LMN	18	111	8,760	4,032	100%	100%	NA	NA	0%	0%	3	3
14	4th Floor	175W METAL HALIDE	40	210	5,365	1,688	0%	100%	3L4' T8/ELIG HIGH LMN	40	111	5,365	1,688	0%	100%	NA	NA	0%	0%	15	15
15	Ramp FL 4-5 24/7	175W METAL HALIDE	20	210	8,760	4,032	100%	100%	3L4' T8/ELIG HIGH LMN	20	111	8,760	4,032	100%	100%	NA	NA	0%	0%	3	3
16	Ramp FL 4-5	175W METAL HALIDE	40	210	5,365	1,688	0%	100%	3L4' T8/ELIG HIGH LMN	40	111	5,365	1,688	0%	100%	NA	NA	0%	0%	15	15
17	5th Floor 24/7	175W METAL HALIDE	18	210	8,760	4,032	100%	100%	3L4' T8/ELIG HIGH LMN	18	111	8,760	4,032	100%	100%	NA	NA	0%	0%	3	3
18	5th Floor	175W METAL HALIDE	40	210	7,045	2,844	57%	100%	3L4' T8/ELIG HIGH LMN	40	111	7,045	2,844	57%	100%	NA	NA	0%	0%	17	17
19	Ramp FL 5-6 24/7	175W METAL HALIDE	10	210	8,760	4,032	100%	100%	3L4' T8/ELIG HIGH LMN	10	111	8,760	4,032	100%	100%	NA	NA	0%	0%	3	3
20	Ramp FL 5-6	175W METAL HALIDE	20	210	7,045	2,844	57%	100%	3L4' T8/ELIG HIGH LMN	20	111	7,045	2,844	57%	100%	NA	NA	0%	0%	17	17
21	Stairs	1L4' EE HO/STD	25	63	8,760	4,032	100%	100%	1L4' T8/ELIG HIGH LMN	25	38	8,760	4,032	100%	100%	NA	NA	0%	0%	3	3
22	Elevator Landings	1L4' EE HO/STD	76	63	8,760	4,032	100%	100%	1L4' T8/ELIG HIGH LMN	76	38	8,760	4,032	100%	100%	NA	NA	0%	0%	3	3
23	Missing 3 Lamp 24/7	175W METAL HALIDE	0	210	8,760		0%	0%	3L4' T8/ELIG HIGH LMN	0	111	8,760		0%	0%	NA	NA	0%	0%	0	0
24	Missing 3 Lamp	175W METAL HALIDE	0	210	4,380		0%	0%	3L4' T8/ELIG HIGH LMN	0	111	4,380		0%	0%	NA	NA	0%	0%	0	0
25	Missing 1 Lamp	1L4' EE HO/STD	0	63	8,760		0%	0%	1L4' T8/ELIG HIGH LMN	0	38	8,760		0%	0%	NA	NA	0%	0%	0	0
		Totals	697	131,523					Totals	697	69,994										

Pre-Retrofit Demand and Energy Consumption

Fixture ID	Lighting Demand and Energy Consumption (t) Connected kW	(u) FCM Diversified kW Summer	(v) FCM Diversified kW Winter	(w) Annual kWh	(x) Peak kWh	Interactive Hours (y) Cooling Hours	(z) Heating Hours	Interactive Energy Consumption (aa) Cooling kWh	(ab) Heating kWh	On-Peak Interactive Hours (ac) Cooling Hours	(ad) Heating Hours	On-Peak Interactive Demand and Energy Consumption (ae) FCM Diversified kW Summer	(af) FCM Diversified kW Winter	(ag) Cooling kWh	(ah) Heating kWh	Lighting and Interactive Demand and Energy Consumption (ai) FCM Diversified kW Summer	(aj) FCM Diversified kW Winter	(ak) Annual kWh	(al) Peak kWh
1	5.04	5.04	5.04	44,150	20,321	0	0	0	0	0	0	0.00	0.00	0	0	5.04	5.04	44,150	20,321
2	12.60	0.00	12.60	48,337	18,045	0	0	0	0	0	0	0.00	0.00	0	0	0.00	12.60	48,337	18,045
3	4.83	4.83	4.83	42,311	19,475	0	0	0	0	0	0	0.00	0.00	0	0	4.83	4.83	42,311	19,475
4	10.71	0.00	10.71	41,087	15,338	0	0	0	0	0	0	0.00	0.00	0	0	0.00	10.71	41,087	15,338
5	3.78	3.78	3.78	33,113	15,241	0	0	0	0	0	0	0.00	0.00	0	0	3.78	3.78	33,113	15,241
6	8.40	0.00	8.40	45,067	14,179	0	0	0	0	0	0	0.00	0.00	0	0	0.00	8.40	45,067	14,179
7	3.99	3.99	3.99	34,952	16,088	0	0	0	0	0	0	0.00	0.00	0	0	3.99	3.99	34,952	16,088
8	8.19	0.00	8.19	43,940	13,825	0	0	0	0	0	0	0.00	0.00	0	0	0.00	8.19	43,940	13,825
9	3.78	3.78	3.78	33,113	15,241	0	0	0	0	0	0	0.00	0.00	0	0	3.78	3.78	33,113	15,241
10	8.61	0.00	8.61	46,193	14,534	0	0	0	0	0	0	0.00	0.00	0	0	0.00	8.61	46,193	14,534
11	3.78	3.78	3.78	33,113	15,241	0	0	0	0	0	0	0.00	0.00	0	0	3.78	3.78	33,113	15,241
12	8.19	0.00	8.19	43,940	13,825	0	0	0	0	0	0	0.00	0.00	0	0	0.00	8.19	43,940	13,825
13	3.78	3.78	3.78	33,113	15,241	0	0	0	0	0	0	0.00	0.00	0	0	3.78	3.78	33,113	15,241
14	8.40	0.00	8.40	45,067	14,179	0	0	0	0	0	0	0.00	0.00	0	0	0.00	8.40	45,067	14,179
15	4.20	4.20	4.20	36,792	16,934	0	0	0	0	0	0	0.00	0.00	0	0	4.20	4.20	36,792	16,934
16	8.40	0.00	8.40	45,067	14,179	0	0	0	0	0	0	0.00	0.00	0	0	0.00	8.40	45,067	14,179
17	3.78	3.78	3.78	33,113	15,241	0	0	0	0	0	0	0.00	0.00	0	0	3.78	3.78	33,113	15,241
18	8.40	4.78	8.40	59,176	23,894	0	0	0	0	0	0	0.00	0.00	0	0	4.78	8.40	59,176	23,894
19	2.10	2.10	2.10	18,396	8,467	0	0	0	0	0	0	0.00	0.00	0	0	2.10	2.10	18,396	8,467
20	4.20	2.39	4.20	29,588	11,947	0	0	0	0	0	0	0.00	0.00	0	0	2.39	4.20	29,588	11,947
21	1.58	1.58	1.58	13,797	6,350	0	0	0	0	0	0	0.00	0.00	0	0	1.58	1.58	13,797	6,350
22	4.79	4.79	4.79	41,943	19,305	0	0	0	0	0	0	0.00	0.00	0	0	4.79	4.79	41,943	19,305
23	0.00	0.00	0.00	0				0	0			0.00	0.00			0.00	0.00	0	
24	0.00	0.00	0.00	0				0	0			0.00	0.00			0.00	0.00	0	
25	0.00	0.00	0.00	0				0	0			0.00	0.00			0.00	0.00	0	
Totals	131.52	52.59	131.52	845,366	337,090			0	0			0.00	0.00	0	0	52.59	131.52	845,366	337,090

Post-Retrofit Demand and Energy Consumption

Fixture ID	Lighting Demand and Energy Consumption (am) Connected kW	(an) FCM Diversified kW Summer	(ao) FCM Diversified kW Winter	(ap) Annual kWh	(aq) Peak kWh	Interactive Hours (ar) Cooling Hours	(as) Heating Hours	Interactive Energy Consumption (at) Cooling kWh	(au) Heating kWh	On-Peak Interactive Hours (av) Cooling Hours	(aw) Heating Hours	On-Peak Interactive Demand and Energy Consumption (ax) FCM Diversified kW Summer	(ay) FCM Diversified kW Winter	(az) Cooling kWh	(ba) Heating kWh	Lighting and Interactive Demand and Energy Consumption (bb) FCM Diversified kW Summer	(bc) FCM Diversified kW Winter	(bd) Annual kWh	(be) Peak kWh
1	2.66	2.66	2.66	23,337	10,741	0	0	0	0	0	0	0.00	0.00	0	0	2.66	2.66	23,337	10,741
2	6.66	0.00	6.66	25,550	9,538	0	0	0	0	0	0	0.00	0.00	0	0	0.00	6.66	25,550	9,538
3	2.55	2.55	2.55	22,364	10,294	0	0	0	0	0	0	0.00	0.00	0	0	2.55	2.55	22,364	10,294
4	5.66	0.00	5.66	21,717	8,107	0	0	0	0	0	0	0.00	0.00	0	0	0.00	5.66	21,717	8,107
5	2.00	2.00	2.00	17,502	8,056	0	0	0	0	0	0	0.00	0.00	0	0	2.00	2.00	17,502	8,056
6	4.44	0.00	4.44	23,821	7,495	0	0	0	0	0	0	0.00	0.00	0	0	0.00	4.44	23,821	7,495
7	2.11	2.11	2.11	18,475	8,503	0	0	0	0	0	0	0.00	0.00	0	0	2.11	2.11	18,475	8,503
8	4.33	0.00	4.33	23,225	7,307	0	0	0	0	0	0	0.00	0.00	0	0	0.00	4.33	23,225	7,307
9	2.00	2.00	2.00	17,502	8,056	0	0	0	0	0	0	0.00	0.00	0	0	2.00	2.00	17,502	8,056
10	4.55	0.00	4.55	24,416	7,682	0	0	0	0	0	0	0.00	0.00	0	0	0.00	4.55	24,416	7,682
11	2.00	2.00	2.00	17,502	8,056	0	0	0	0	0	0	0.00	0.00	0	0	2.00	2.00	17,502	8,056
12	4.33	0.00	4.33	23,225	7,307	0	0	0	0	0	0	0.00	0.00	0	0	0.00	4.33	23,225	7,307
13	2.00	2.00	2.00	17,502	8,056	0	0	0	0	0	0	0.00	0.00	0	0	2.00	2.00	17,502	8,056
14	4.44	0.00	4.44	23,821	7,495	0	0	0	0	0	0	0.00	0.00	0	0	0.00	4.44	23,821	7,495
15	2.22	2.22	2.22	19,447	8,951	0	0	0	0	0	0	0.00	0.00	0	0	2.22	2.22	19,447	8,951
16	4.44	0.00	4.44	23,821	7,495	0	0	0	0	0	0	0.00	0.00	0	0	0.00	4.44	23,821	7,495
17	2.00	2.00	2.00	17,502	8,056	0	0	0	0	0	0	0.00	0.00	0	0	2.00	2.00	17,502	8,056
18	4.44	2.52	4.44	31,278	12,629	0	0	0	0	0	0	0.00	0.00	0	0	2.52	4.44	31,278	12,629
19	1.11	1.11	1.11	9,724	4,476	0	0	0	0	0	0	0.00	0.00	0	0	1.11	1.11	9,724	4,476
20	2.22	1.26	2.22	15,639	6,315	0	0	0	0	0	0	0.00	0.00	0	0	1.26	2.22	15,639	6,315
21	0.95	0.95	0.95	8,322	3,830	0	0	0	0	0	0	0.00	0.00	0	0	0.95	0.95	8,322	3,830
22	2.89	2.89	2.89	25,299	11,644	0	0	0	0	0	0	0.00	0.00	0	0	2.89	2.89	25,299	11,644
23	0.00	0.00	0.00	0				0	0			0.00	0.00			0.00	0.00	0	
24	0.00	0.00	0.00	0				0	0			0.00	0.00			0.00	0.00	0	
25	0.00	0.00	0.00	0				0	0			0.00	0.00			0.00	0.00	0	
Totals	69.99	28.27	69.99	450,995	180,090			0	0			0.00	0.00	0	0	28.27	69.99	450,995	180,090

Total Savings Summary

	Energy kWh	Summer kW	Winter kW	Connected kW
Annual Lighting Only	394,371	24.32	61.53	61.53
Annual Interactive	0	0.00	0.00	N/A
Annual Lighting and Interactive	394,371	24.32	61.53	61.53
On-Peak Lighting Only	157,000			
On-Peak Interactive	0			
On-Peak Lighting and Interactive	157,000			

	MMBTU
Annual Non-Electric Heating Savings	0

Savings Adjustment Factors

Parameter	Annual KWH	Difference %	Summer kW	Difference %	Winter kW	Difference %
Gross (TRACKING) Savings	477,416	N/A	84.79	N/A	84.80	N/A
Adjustment - Documentation Change	-81,679	-17%	-18.49	-22%	-18.49	-22%
Adjustment - Technology Change	0	0%	0.00	0%	0.00	0%
Adjustment - Quantity Change	-34,528	-7%	-4.78	-6%	-4.78	-6%
Adjustment - Operation Change	33,161	7%	N/A	N/A	N/A	N/A
Adjustment - Coincident Change	N/A	N/A	-37.21	-44%	0.00	0%
Adjustment - Heating Interaction	0	0%	N/A	N/A	0.00	0%
Adjustment - Cooling Interaction	0	0%	0.00	0%	N/A	N/A
Adjustment - TOTAL	-83,045	-17%	-60.48	-71%	-23.27	-27%
Adjusted Gross (ONSITE) Savings	394,371	83%	24.32	29%	61.53	73%

Table 12: Summary of On-Site Energy and Demand Savings

Hour Ending	Average kW Reduction
1	61.5
2	61.5
3	50.8
4	50.5
5	50.5
6	50.5
7	50.3
8	21.6
9	22.7
10	23.4
11	22.3
12	23.2
13	23.7
14	24.3
15	22.3
16	24.9
17	25.8
18	26.4
19	23.6
20	43.3
21	61.5
22	61.5
23	61.5
24	61.5

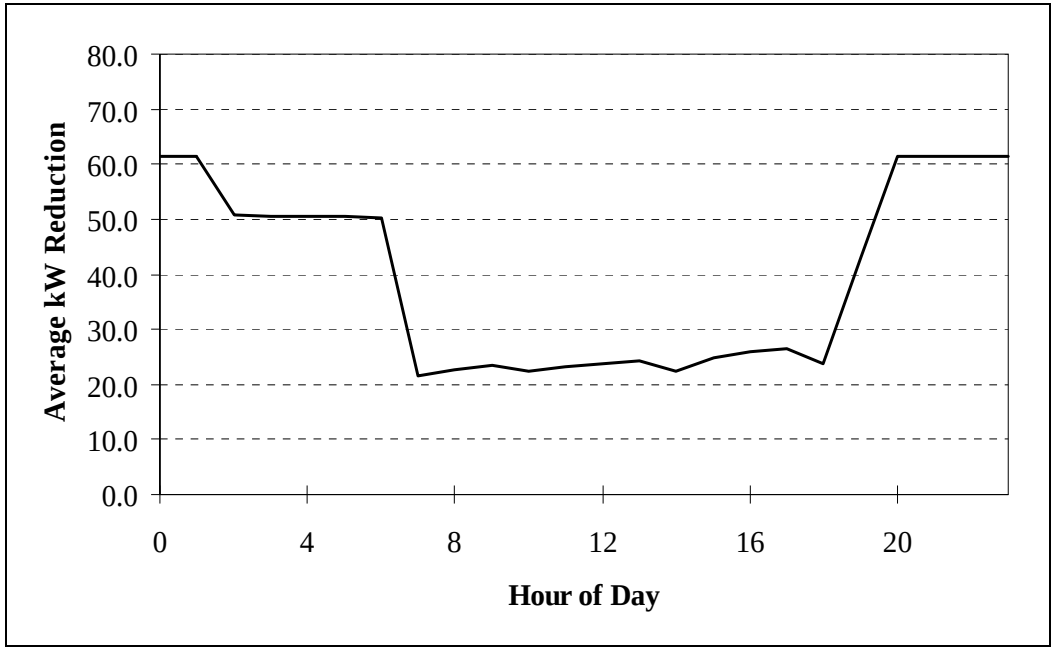

Table 13: Average Summer Weekday kW Reduction

Hour Ending	Average kW Reduction
1	61.5
2	61.5
3	61.5
4	61.5
5	51.4
6	51.2
7	51.2
8	51.2
9	27.9
10	23.7
11	25.1
12	25.3
13	24.8
14	29.1
15	61.5
16	61.5
17	61.5
18	61.5
19	61.5
20	61.5
21	61.5
22	61.5
23	61.5
24	61.5

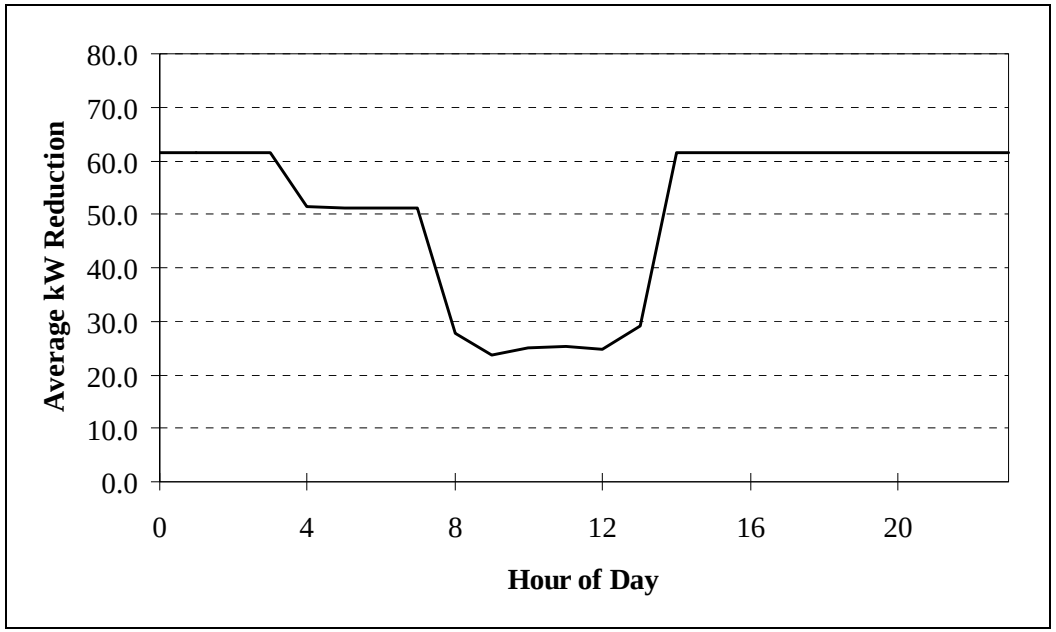

Table 14: Average Winter Weekday kW Reduction

Column Definitions for Lighting Calculations
(a) Brief description of area where lighting is installed

Pre-retrofit Lighting			Post-retrofit Lighting		
(b) Description of fixture type			(i) Description of fixture type		
(c) Fixture quantity from application documentation			(j) Fixture quantity from on-site inspection		
(d) Fixture wattage from application documentation			(k) Fixture wattage from application documentation		
(e) Annual hours of use	TMY2 Query	Eq. 1.1	(l) Annual hours of use	TMY2 Query	Eq. 1.1
(f) On-peak hours of use	TMY2 Query	Eq. 1.2	(m) On-peak hours of use	TMY2 Query	Eq. 1.2
(g) FCM Summer peak demand diversity factor	TMY2 Query	Eq. 1.3	(n) FCM Summer peak demand diversity factor	TMY2 Query	Eq. 1.3
(h) FCM Winter peak demand diversity factor	TMY2 Query	Eq. 1.4	(o) FCM Winter peak demand diversity factor	TMY2 Query	Eq. 1.4

HVAC Interaction Inputs	
(p) Electric cooling coefficient of performance	(r) Percent of space that is cooled
(q) Electric heating coefficient of performance	(s) Percent of space that is heated

Pre-retrofit Lighting Demand and Energy Consumption			Post-retrofit Lighting Demand and Energy Consumption		
(t) Connected lighting Demand	(t) = (c) x (d) / 1,000	Eq. 2.1	(am) Connected lighting Demand	(am) = (j) x (k) / 1,000	Eq. 3.1
(u) Summer diversified peak lighting demand (FCM)	(u) = (t) x (g)	Eq. 2.2	(an) Summer diversified peak lighting demand (FCM)	(an) = (am) x (n)	Eq. 3.2
(v) Winter diversified peak lighting demand (FCM)	(v) = (t) x (h)	Eq. 2.3	(ao) Winter diversified peak lighting demand (FCM)	(ao) = (am) x (o)	Eq. 3.3
(w) Annual energy consumption	(w) = (t) x (e)	Eq. 2.4	(ap) Annual energy consumption	(ap) = (am) x (l)	Eq. 3.4
(x) Annual On-peak energy consumption	(x) = (t) x (f)	Eq. 2.5	(aq) Annual On-peak energy consumption	(aq) = (am) x (m)	Eq. 3.5
(y) Annual cooling hours	TMY2 Qyery	Eq. 2.6	(ar) Annual cooling hours	TMY2 Query	Eq. 3.6
(z) Annual heating hours	TMY2 Qyery	Eq. 2.7	(as) Annual heating hours	TMY2 Query	Eq. 3.7
(aa) Electric cooling interactive energy effects	(aa) = (t) x (y) x (r) x 0.8 / (p)	Eq. 2.8	(at) Electric cooling interactive energy effects	(at) = (am) x (aq) x (r) x 0.8 / (p)	Eq. 3.8
(ab) Electric heating interactive energy effects	(ab) = -(t) x (z) x (s) x 0.8 / (q)	Eq. 2.9	(au) Electric heating interactive energy effects	(au) = -(am) x (as) x (s) x 0.8 / (q)	Eq. 3.9
(ac) Annual On-peak cooling hours	TMY2 Qyery	Eq. 2.10	(av) Annual On-peak cooling hours	TMY2 Query	Eq. 3.10
(ad) Annual On-peak heating hours	TMY2 Qyery	Eq. 2.11	(aw) Annual On-peak heating hours	TMY2 Query	Eq. 3.11
(ae) On-peak interactive cooling demand (FCM)	(ae) = (u) x (r) x 0.8 / (p)	Eq. 2.12	(ax) On-peak interactive cooling demand (FCM)	(ax) = (an) x (r) x 0.8 / (p)	Eq. 3.12
(af) On-peak interactive heating demand (FCM)	(af) = -(v) x (s) x 0.8 / (q)	Eq. 2.13	(ay) On-peak interactive heating demand (FCM)	(ay) = (ao) x (s) x 0.8 / (q)	Eq. 3.13
(ag) On-peak interactive electric cooling energy	(ag) = (t) x (ac) x (r) x 0.8 / (p)	Eq. 2.14	(az) On-peak interactive electric cooling energy	(az) = (am) x (av) x (r) x 0.8 / (p)	Eq. 3.14
(ah) On-peak interactive electric heating energy	(ah) = -(t) x (ad) x (s) x 0.8 / (q)	Eq. 2.15	(ba) On-peak interactive electric heating energy	(ba) = -(am) x (aw) x (s) x 0.8 / (q)	Eq. 3.15
(ai) Lighting and interactive summer demand (FCM)	(ai) = (u) + (ae)	Eq. 2.16	(bb) Lighting and interactive summer demand (FCM)	(bb) = (an) + (ax)	Eq. 3.16
(aj) Lighting and interactive winter demand (FCM)	(aj) = (v) + (af)	Eq. 2.17	(bc) Lighting and interactive winter demand (FCM)	(bc) = (ao) + (ay)	Eq. 3.17
(ak) Annual lighting and interactive energy consumption	(ak) = (w) + (aa) + (ab)	Eq. 2.18	(bd) Annual lighting and interactive energy consumption	(bd) = (ap) + (at) + (au)	Eq. 3.18
(al) Annual on-peak lighting and interactive energy consumption	(al) = (x) + (ag) + (ah)	Eq. 2.19	(be) Annual on-peak lighting and interactive energy consumption	(be) = (aq) + (az) + (ba)	Eq. 3.19

Total Savings Summary					
Annual Lighting Only Energy Consumption	Σ (w) - Σ (ap)	Eq. 4.1	Annual Lighting and Interactive Energy Consumption	Σ (ak) - Σ (bd)	Eq. 4.8
Annual Lighting Only Summer Demand (FCM)	Σ (u) - Σ (an)	Eq. 4.2	Annual Lighting and Interactive Summer Demand (FCM)	Σ (ai) - Σ (bb)	Eq. 4.9
Annual Lighting Only Winter Demand (FCM)	Σ (v) - Σ (ao)	Eq. 4.3	Annual Lighting and Interactive Winter Demand (FCM)	Σ (aj) - Σ (bc)	Eq. 4.10
Annual Lighting Only Connected Demand	Σ (t) - Σ (am)	Eq. 4.4	On-Peak Lighting Only Energy Consumption	Σ (x) - Σ (aq)	Eq. 4.11
Annual Interactive Energy Consumption	[Σ (aa) - Σ (at)] + [Σ (ab) - Σ (au)]	Eq. 4.5	On-Peak Interactive Energy Consumption	[Σ (ag) - Σ (az)] + [Σ (ah) - Σ (ba)]	Eq. 4.12
Annual Interactive Summer Demand (FCM)	Σ (ae) - Σ (ax)	Eq. 4.6			
Annual Interactive Winter Demand (FCM)	Σ (af) - Σ (ay)	Eq. 4.7			

Site 2, Application ID: 523359

Facility Type: Retail

Summary

A lighting retrofit of a grocery store was done to replace older inefficient lighting fixtures with new more efficient fixtures. The spaces affected by the retrofit include the all of the frozen food cases. A frozen food case is described as a 5-door, 4-door, 3-door or 2-door case. Each frozen food case contains one more lighting fixture than number of doors. For example, a 5-door case contains six vertical lighting fixtures. The baseline lighting fixture for each case was a one lamp, five foot F58/T8 fixture rated at 58 watts per fixture. These T8 fixtures were to be replaced with 14 and 26 watt LED strips. For example a 5-door case would have one 14 watt LED strip on each end and one 26 watt LED strip in between each door for a total of two 14 watt strips and four 26 watt strips.

A count of LED strips taken during the on-site visit revealed that installed quantities matched the proposed quantities.

Table 15 presents the summary of the tracking and on-site savings results.

Savings Quantity	Tracking Estimate	On-site Savings	Evaluated/ Tracking
Annual Energy (kWh)	56,388	63,285	112%
% Energy Savings On-Peak	56%	64%	114%
Summer Peak Diversified kW	9.56	10.07	105%
Winter Peak Diversified kW	9.56	9.95	104%

Table 15: Summary of Tracking and On-site Savings Results

The overall on-site savings estimate is 12% higher than predicted in the tracking estimate. The on-site estimates of summer and winter peak diversified kW was higher than the tracking values. The following factors influenced the difference between the tracking and on-site estimates of energy and demand savings:

- The majority of the increase in savings was a result of the impact of the reduced heat from the new lighting fixtures on the refrigeration system that serves the freezer cases. Each freezer case is served by a compressor that cools the air to the required

temperature. The tracking savings estimated the cooling reduction to be 14,703 kWh per year based on a cooling efficiency of 1.24 kW/ton. The on-site savings estimated the cooling reduction to be 25,509 kWh per year based on a cooling efficiency of 2.5 kW/ton. Evaluators determined the efficiency of the compressors serving the freezer cases from nameplate data and manufacturer's ratings. This resulted in an increase in savings equal to 10,806 kWh per year.

- There was also an increase of savings resulting from higher annual hours of use. The tracking savings estimated the operating hours of all the installed fixtures to be 5,895 hours per year. The monitoring data combined with reported operating schedules revealed that the operating hours are 6,286 hours per year. This increase in annual operating hours results in the annual savings being increased by 2,351 kWh.

- There was a decrease of savings resulting from a technology adjustment. Specifically, power measurements done on the installed LED fixtures showed that these LED strips draw more wattage than estimated in the tracking savings. For example, the tracking savings estimated the 26 watt LED strip to draw 26 watts. Power measurements on these fixtures showed that the 26 watt LED strip was actually drawing 33.2 watts. Likewise, the 14 watt LED strip was drawing 16.6 watts as opposed to the 14 watts estimated in the tracking savings. Evaluators also performed spot power measurements on the existing F58/T8 fixture in a different store that hadn't yet been retrofit with LEDs. Evaluators found that the F58/T8 fixture draws 58 watts, which is consistent with the tracking estimate. Since the evaluation found that the existing fixture draws the same wattage and the installed fixtures draw more wattage than estimated in the tracking savings, this resulted in a decrease in savings equal to 6,265 kWh per year.

- The on-peak kWh savings was estimated to be 64% of the annual on-site kWh savings. This value is 14% higher than the tracking estimate for on-peak kWh savings of 56%. The on-peak period defined by National Grid is non-holiday weekdays between 6 am and 10 pm. The reason for the increase in this metric is partially due to the assumed operating hours used to develop the tracking savings. The tracking savings estimated weekday operation to be between 7 am and 10 pm. Monitoring data found that typical weekday operation starts at 6 am.

- The summer diversified kW reduction was 10.07 kW or 5% higher than predicted in the tracking estimate. The increase is due to the combination of the technology and HVAC

interaction adjustments described above. The winter diversified kW reduction was 9.95 kW or 4% higher than the tracking estimate. This increase is also due to the combination of the technology and HVAC interaction adjustments described above. There were no significant coincidence adjustments on either the summer or winter diversified kW reductions. The tracking savings estimated the summer and winter diversified kW reductions based on 100% operation during these hours. The evaluation found the summer diversity factor to be 100% and the winter to be 99%.

Project Description

This project was completed under the Energy Initiative program. Table 16 presents a summary of the existing system as outlined in the customer application.

Existing Case				
Space	**Fixture Type**	**Wattage**	**Quantity**	**Annual Hours**
Five Door Freezer Case	1L5' T8	58	120	5,895
Four Door Freezer Case	1L5' T8	58	60	5,895
Three Door Freezer Case	1L5' T8	58	8	5,895
Two Door Freezer Case	1L5' T8	58	6	5,895
	Total	11,252	194	NA

Table 16: Existing Lighting System

Table 17 presents the installed fixtures and quantities as proposed in the customer application.

Installed Case				
Space	**Fixture Type**	**Wattage**	**Quantity**	**Annual Hours**
Five Door Freezer Case	4-26W, 2-14W Strips	132	20	5,895
Four Door Freezer Case	3-26W, 2-14W Strips	106	12	5,895
Three Door Freezer Case	2-26W, 2-14W Strips	80	2	5,895
Two Door Freezer Case	1-26W, 2-14W Strips	54	2	5,895
	Total	4,180	36	NA

Table 17: Installed Lighting System

Evaluation Methodology

Tracking Estimates

The tracking estimates of energy use were calculated based on the full load of the existing and proposed fixtures. The energy savings were calculated as the difference in the pre and post installation energy use. Annual operating hours were assumed to be 5,895 hours for all of the fixtures.

Evaluation Approach

The evaluation included a verification of installed fixtures, on-site monitoring and interview. All freezer case fixtures are controlled by a central energy management system.

The base case used in the evaluation of the lighting savings was developed from information contained in the customer application. The pre-existing fixture types were confirmed while on-site with the facility contact. Evaluators visited a second store that had not yet been retrofit, and confirmed the pre-existing fixture type and wattage using spot power measurements.

Evaluators visited the facility to verify the installed fixtures, take spot power measurements and install monitoring equipment to quantify the hours of use of the different spaces. Evaluators surveyed facility personnel to obtain information on the lighting usage throughout the year. They also inquired about the refrigeration system serving the freezer cases.

To determine the hours of use for the new fixtures, field evaluators installed four time-of-use CT loggers on four separate circuits that control the freezer case lighting. These four loggers were installed on circuits that serve approximately 44% of all of the freezer cases. Table 18 presents the fixtures monitored by the evaluation engineers.

Logger #	Equipment Monitored	Parameter Measured	Test Equip. Make & Model	Measurement Type	Installation Method	Frequency of Observations	Monitoring Duration
CT07120018	Circuit A11 (3 - 5 Door cases)	On/Off Operation	PS&T TOU CT logger	Event Logger	Clamp-On	Based on Schedule	4/2/09 - 4/24/09
CT07120021	Circuit A3 (3 - 5 Door cases)	On/Off Operation	PS&T TOU CT logger	Event Logger	Clamp-On	Based on Schedule	4/2/09 - 4/24/09
CT08010021	Circuit A4 (3 - 4 Door cases & 1 - 5 Door case)	On/Off Operation	PS&T TOU CT logger	Event Logger	Clamp-On	Based on Schedule	4/2/09 - 4/24/09
CT08010034	Circuit A12 (3 - 4 Door cases, 1 - 5 Door & 1 - 2 Door)	On/Off Operation	PS&T TOU CT logger	Event Logger	Clamp-On	Based on Schedule	4/2/09 - 4/24/09

Table 18: Spaces Monitored

Verification of Equipment and Operating Parameters

This project replaced all of the T8 lighting in each of the freezer cases with LED strips. There were (194) one lamp F58/T8 fixtures replaced with (122) 33 watt LED strips and (52) 17 watt LED strips. Evaluators found that these quantities matched exactly with the quantities proposed in the tracking estimate of savings.

Evaluators determined the wattages of 33 and 17 watts based on spot power measurements taken during the initial site visit as well as during the return visit to retrieve the CT loggers. Evaluators determined that each individual LED bulb draws approximately 1.1 watts. Evaluators found 30 bulbs in each 33 watt LED strip and 15 bulbs in each 17 watt strip. The tracking savings estimated these LED strips to draw 26 watts and 14 watts, respectively.

Evaluators also took spot power measurements on the existing fixture from another store that had yet to be retrofit. It was confirmed that these one lamp F58/T8 fixtures were the same fixture type as the existing fixture for this retrofit. Evaluators found that the one lamp F58/T8 fixture draws 58 watts. This value is consistent with tracking estimate for the existing fixture wattage.

An inspection of the refrigeration system was done during the site visit because these lights are completely enclosed within the freezer cases. Therefore, any interactive effects resulting from the reduced heat produced by the new lighting fixtures would be present in the freezer case's refrigeration system. Evaluators recorded the make and model of the compressors used in this refrigeration system. A lookup of this manufacturer's specifications showed that these compressors have a cooling efficiency of 2.5 kW/ton at a saturated suction temperature (SST) of -20˚F, which is what the store would be using for its freezer cases.

Evaluators obtained the operating hours of the store through discussions with facility personnel. The freezer case lights are supposed to operate the same hours that the store is open. The store hours are Monday through Saturday from 6 am to 12 am and Sundays from 7 am to 9 pm. The facility observes two holidays in which the store is closed and the freezer case lighting is off. These include Thanksgiving Day and Christmas Day. In addition, on Christmas Eve the store closes at 6 pm. The monitoring period did not cover any of the facility holidays. Therefore, evaluators assumed that the lights would be off on these days.

Table 19 presents the values obtained from the monitored data including annual operation, summer and winter diversity factors, and on-peak hours of use.

Schedule 5 represents the average freezer case schedule and was calculated as the average of Schedules 1 – 4. This schedule was used to calculate the energy savings for the entire project. This was done because each of the monitored circuits operates on nearly identical schedules. This was expected because these lights are all controlled by the central energy management system and are all set to go on and off at the same time.

Schedule ID	Logger #	Description	Annual Hours	Summer Diversity	Winter Diversity	On-Peak Hours
1	CT07120018	Circuit A11 (3 - 5 Door cases)	6,286	100%	99%	4,028
2	CT07120021	Circuit A3 (3 - 5 Door cases)	6,286	100%	99%	4,025
3	CT08010021	Circuit A4 (3 - 4 Door cases & 1 - 5 Door case)	6,286	100%	99%	4,025
4	CT08010034	Circuit A12 (3 - 4 Door cases, 1 - 5 Door & 1 - 2 Door)	6,286	100%	99%	4,024
5	NA	Average Freezer Case	6,286	100%	99%	4,026

Table 19: Annual Hours of Use and Diversity Factors of Monitored Data

To estimate annual energy and demand savings, a spreadsheet method was employed. The summary of this spreadsheet is presented in Table 20. Annual hours and diversity factors from Table 19 are used with wattages from Table 20 to calculate energy and demand savings. The schedule ID's from Table 19 are presented in Table 20 to show which schedule was used with each fixture ID. The final on-site savings estimates are presented in Table 20.

There is assumed to be no interaction between this measure and the facility's space conditioning systems because the installed fixtures are enclosed within the freezer cases. The lights do not have any significant contact with the store space because these lights are mounted on the interior frame of the freezer case. The freezers are refrigerated using a compressor rack system. Evaluators calculated energy savings resulting from reduced cooling loads on the refrigeration system. This is because there is less heat going into the freezer case due to the installation of more efficient lighting. Evaluators assumed an efficiency rating of 2.5 kW/ton for the refrigeration system based on manufacturer's specifications. It was also assumed that 95% of the energy that went into the lighting system would eventually turn into heat that needs to be removed from the space by the refrigeration system. Since the refrigeration system is required to operate 24/7 in order to keep their products frozen, evaluators calculated cooling savings during all of the hours in which the lights operate, or 6,286 hours per year.

The average daily lighting profiles for the all the monitored spaces are presented in Figure 19 through Figure 23. This includes the average weekday, weekend day and holiday. The x-axis represents one full day and the y-axis is the percentage that the lights are on for each hour.

An hourly summary of the site kW savings for an average summer (June through August), non-holiday, weekday is presented in Table 21. This summary is provided so that the summer diversified peak kW can be estimated across any range of hours in the event that the FCM definition for summer peak changes in the future. The same summary was also provided for the average winter (December and January), non-holiday, weekday in Table 22.

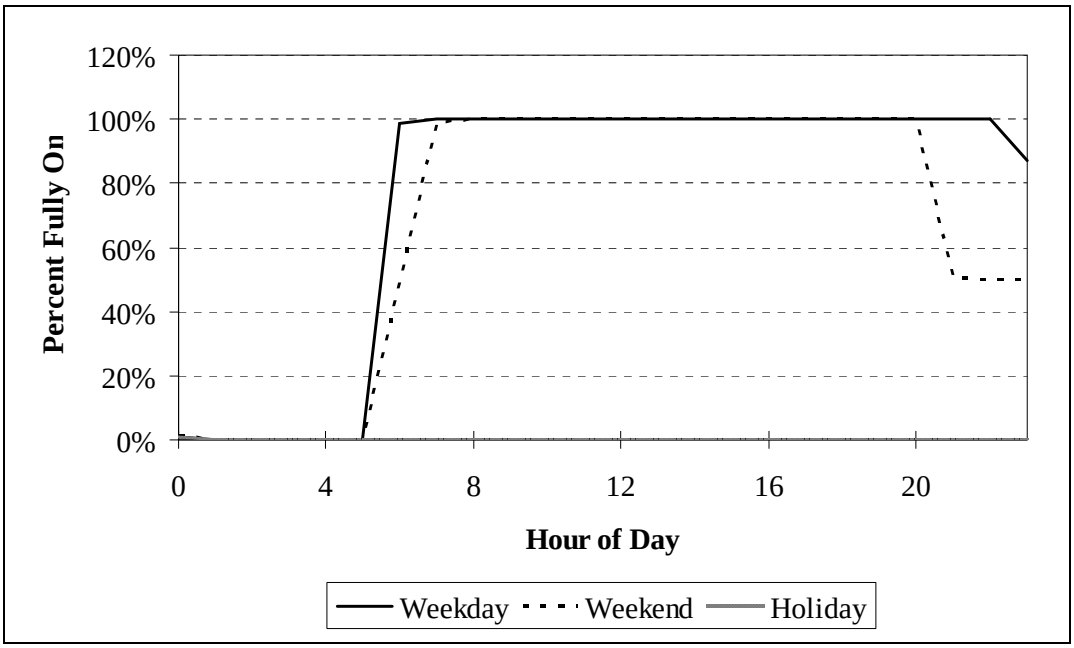

Figure 19: Average Daily Lighting Profile for Schedule 1 from 4/2/09 to 4/24/09

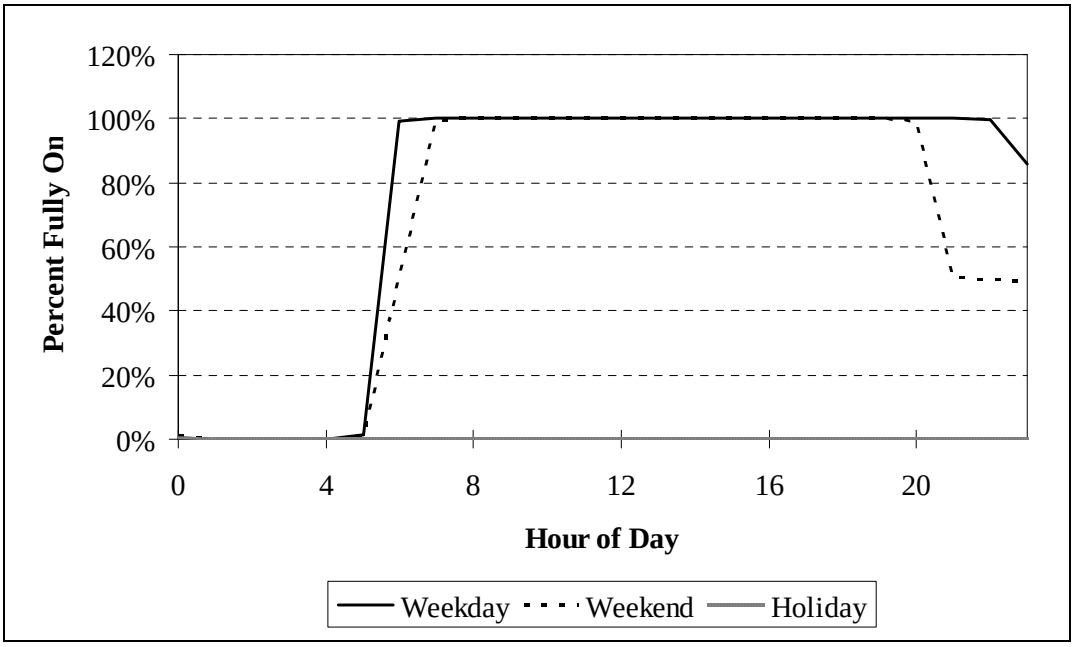

Figure 20: Average Daily Profile for Schedule 2 from 4/2/09 to 4/24/09

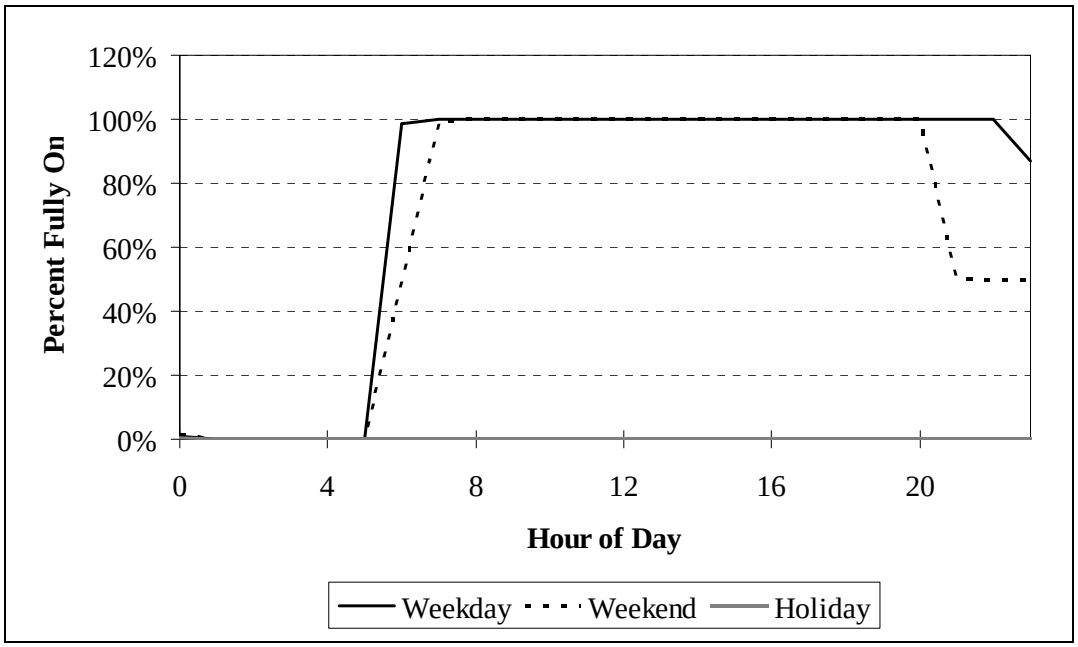

Figure 21: Average Daily Lighting Profile for Schedule 3 from 4/2/09 to 4/24/09

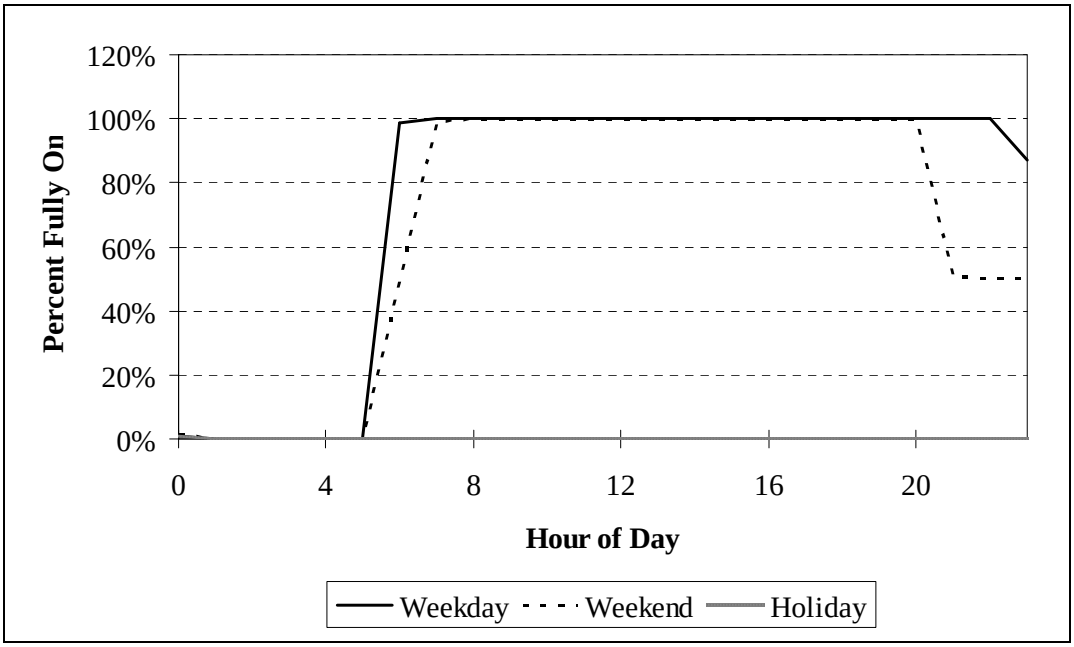

Figure 22: Average Daily Lighting Profile for Schedule 4 from 4/2/09 to 4/24/09

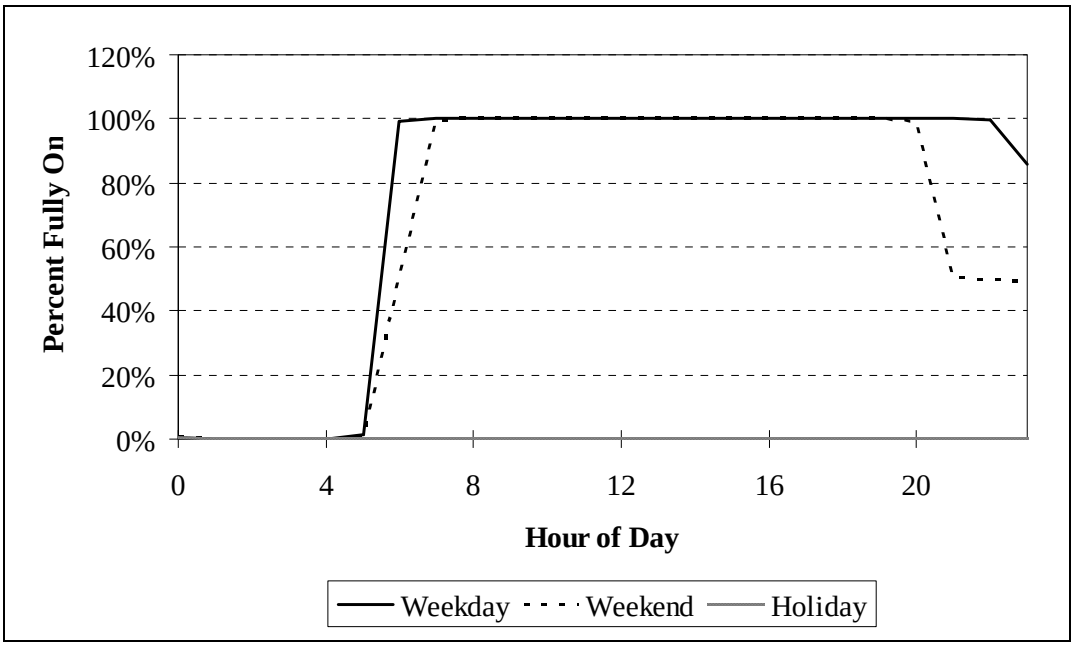

Figure 23: Average Daily Lighting Profile for Schedule 5 (Average Freezer Case) from 4/2/09 to 4/24/09

Facility Type: Retail
Application ID: 523359

Fixture Information

Fixture ID	(a) Space Type	Pre-retrofit Lighting (b) Fixture Type	(c) Fixture Quantity	(d) Fixture Wattage	(e) Hours of Use Annual	(f) Hours of Use Peak	(g) FCM Diversity Factor Summer	(h) FCM Diversity Factor Winter	Post-retrofit Lighting (i) Fixture Type	(j) Fixture Quantity	(k) Fixture Wattage	(l) Hours of Use Annual	(m) Hours of Use Peak	(n) FCM Diversity Factor Summer	(o) FCM Diversity Factor Winter	HVAC (p) COP Cooling	(q) COP Heating	(r) % Space Cooled	(s) % Space Heated	Schedule ID from Table 5 Pre Retrofit	Post Retrofit
1	Five Door Freezer Case	1L5' T8	120	58	6,286	4,026	100%	99%	4-33.2 W, 2-16.6 W Strip	20	166	6,286	4,026	100%	99%	1.4	NA	100%	0%	5	5
2	Four Door Freezer Case	1L5' T8	60	58	6,286	4,026	100%	99%	3-33.2 W, 2-16.6 W Strip	12	133	6,286	4,026	100%	99%	1.4	NA	100%	0%	5	5
3	Three Door Freezer Case	1L5' T8	8	58	6,286	4,026	100%	99%	2-33.2 W, 2-16.6 W Strip	2	100	6,286	4,026	100%	99%	1.4	NA	100%	0%	5	5
4	Two Door Freezer Case	1L5' T8	6	58	6,286	4,026	100%	99%	1-33.2 W, 2-16.6 W Strip	2	66	6,286	4,026	100%	99%	1.4	NA	100%	0%	5	5
		Totals	194	11,252					Totals	36	5,243										

Pre-Retrofit Demand and Energy Consumption

Fixture ID	Lighting Demand and Energy Consumption (t) Connected kW	(u) FCM Diversified kW Summer	(v) FCM Diversified kW Winter	(w) Annual kWh	(x) Peak kWh	Interactive Hours (y) Cooling Hours	(z) Heating Hours	Interactive Energy Consumption (aa) Cooling kWh	(ab) Heating kWh	On-Peak Interactive Hours (ac) Cooling Hours	(ad) Heating Hours	On-Peak Interactive Demand and Energy Consumption (ae) FCM Diversified kW Summer	(af) FCM Diversified kW Winter	(ag) Cooling kWh	(ah) Heating kWh	Lighting and Interactive Demand and Energy Consumption (ai) FCM Diversified kW Summer	(aj) FCM Diversified kW Winter	(ak) Annual kWh	(al) Peak kWh
1	6.96	6.96	6.88	43,752	28,018	6,286	0	29,545	0	4,026	0	4.70	4.65	18,920	0	11.66	11.53	73,297	46,939
2	3.48	3.48	3.44	21,876	14,009	6,286	0	14,773	0	4,026	0	2.35	2.32	9,460	0	5.83	5.76	36,648	23,469
3	0.46	0.46	0.46	2,917	1,868	6,286	0	1,970	0	4,026	0	0.31	0.31	1,261	0	0.78	0.77	4,886	3,129
4	0.35	0.35	0.34	2,188	1,401	6,286	0	1,477	0	4,026	0	0.24	0.23	946	0	0.58	0.58	3,665	2,347
Totals	11.25	11.25	11.12	70,732	45,296			47,765	0			7.60	7.51	30,588	0	18.85	18.64	118,496	75,884

Post-Retrofit Demand and Energy Consumption

Fixture ID	Lighting Demand and Energy Consumption (am) Connected kW	(an) FCM Diversified kW Summer	(ao) FCM Diversified kW Winter	(ap) Annual kWh	(aq) Peak kWh	Interactive Hours (ar) Cooling Hours	(as) Heating Hours	Interactive Energy Consumption (at) Cooling kWh	(au) Heating kWh	On-Peak Interactive Hours (av) Cooling Hours	(aw) Heating Hours	On-Peak Interactive Demand and Energy Consumption (ax) FCM Diversified kW Summer	(ay) FCM Diversified kW Winter	(az) Cooling kWh	(ba) Heating kWh	Lighting and Interactive Demand and Energy Consumption (bb) FCM Diversified kW Summer	(bc) FCM Diversified kW Winter	(bd) Annual kWh	(be) Peak kWh
1	3.32	3.32	3.28	20,859	13,358	6,286	0	14,086	0	4,026	0	2.24	2.22	9,020	0	5.56	5.50	34,944	22,378
2	1.59	1.59	1.57	10,012	6,412	6,286	0	6,761	0	4,026	0	1.08	1.06	4,330	0	2.67	2.64	16,773	10,741
3	0.20	0.20	0.20	1,252	801	6,286	0	845	0	4,026	0	0.13	0.13	541	0	0.33	0.33	2,097	1,343
4	0.13	0.13	0.13	834	534	6,286	0	563	0	4,026	0	0.09	0.09	361	0	0.22	0.22	1,398	895
Totals	5.24	5.24	5.18	32,957	21,105			22,255	0			3.54	3.50	14,252	0	8.78	8.68	55,212	35,357

Total Savings Summary

	Energy kWh	Summer kW	Winter kW	Connected kW
Annual Lighting Only	37,775	6.01	5.94	6.01
Annual Interactive	25,509	4.06	4.01	N/A
Annual Lighting and Interactive	63,285	10.07	9.95	6.01
On-Peak Lighting Only	24,191			
On-Peak Interactive	16,336			
On-Peak Lighting and Interactive	40,527			

	MMBTU
Annual Non-Electric Heating Savings	0

Savings Adjustment Factors

Parameter	Annual KWH	Difference %	Summer kW	Difference %	Winter kW	Difference %
Gross (TRACKING) Savings	56,388	N/A	9.56	N/A	9.56	N/A
Adjustment - Documentation Change	4	0%	0.01	0%	0.01	0%
Adjustment - Technology Change	-6,265	-11%	-1.06	-11%	-1.06	-11%
Adjustment - Quantity Change	0	0%	0.00	0%	0.00	0%
Adjustment - Operation Change	2,351	4%	N/A	N/A	N/A	N/A
Adjustment - Coincident Change	N/A	N/A	0.00	0%	-0.07	-1%
Adjustment - Heating Interaction	0	0%	N/A	N/A	N/A	N/A
Adjustment - Cooling Interaction	10,806	19%	1.56	16%	1.52	16%
Adjustment - TOTAL	6,897	12%	0.51	5%	0.39	4%
Adjusted Gross (ONSITE) Savings	63,285	112%	10.07	105%	9.95	104%

Table 20: Summary of On-Site Energy and Demand Savings

Hour Ending	Average kW Reduction
1	0.1
2	0.0
3	0.0
4	0.0
5	0.0
6	0.1
7	10.0
8	10.1
9	10.1
10	10.1
11	10.1
12	10.1
13	10.1
14	10.1
15	10.1
16	10.1
17	10.1
18	10.1
19	10.1
20	10.1
21	10.1
22	10.1
23	10.0
24	8.6

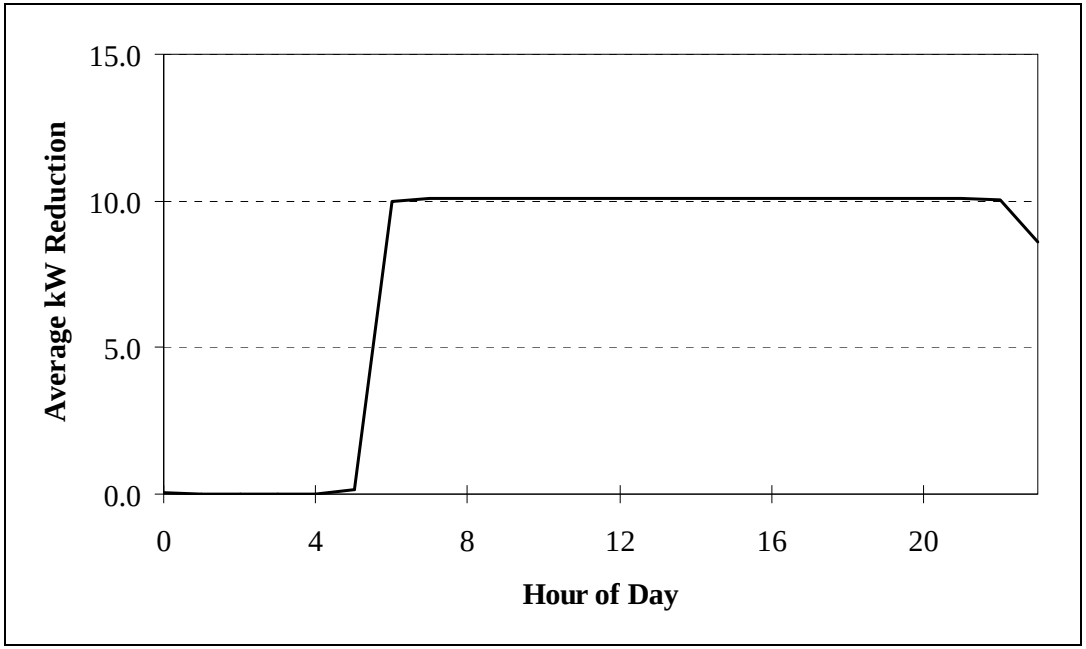

Table 21: Average Summer Weekday kW Reduction

Hour Ending	Average kW Reduction
1	0.1
2	0.0
3	0.0
4	0.0
5	0.0
6	0.1
7	10.0
8	10.1
9	10.1
10	10.1
11	10.1
12	10.1
13	10.1
14	10.1
15	10.1
16	10.1
17	10.1
18	10.1
19	9.8
20	9.8
21	9.8
22	9.8
23	9.8
24	8.4

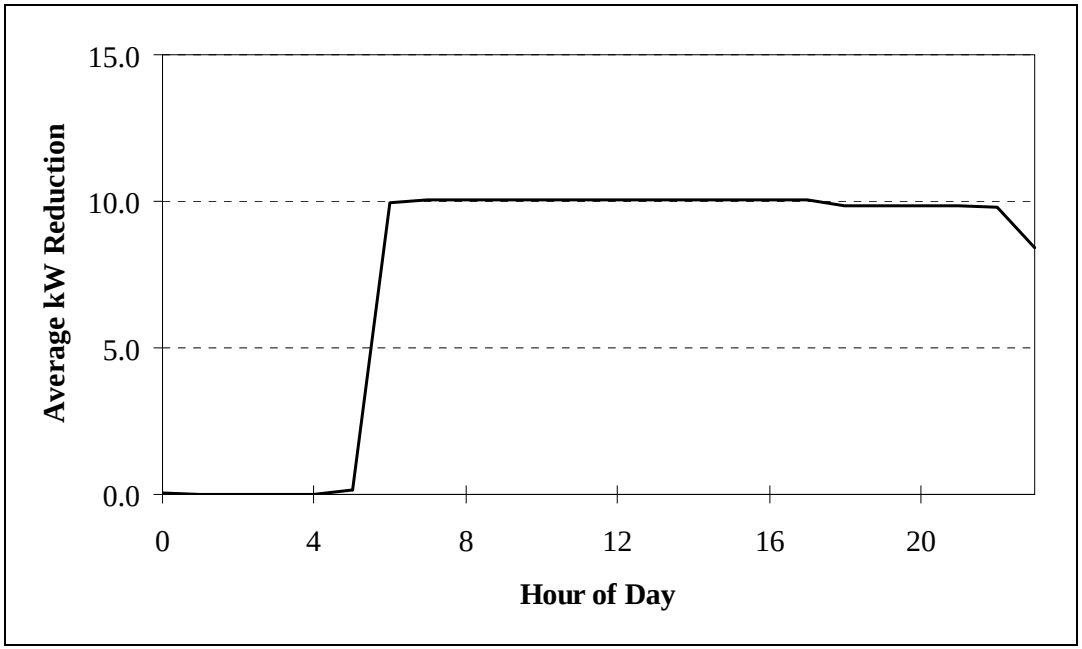

Table 22: Average Winter Weekday kW Reduction

Column Definitions for Lighting Calculations
(a) Brief description of area where lighting is installed

Pre-retrofit Lighting			Post-retrofit Lighting		
(b) Description of fixture type			(i) Description of fixture type		
(c) Fixture quantity from application documentation			(j) Fixture quantity from on-site inspection		
(d) Fixture wattage from application documentation			(k) Fixture wattage from application documentation		
(e) Annual hours of use	TMY2 Query	Eq. 1.1	(l) Annual hours of use	TMY2 Query	Eq. 1.1
(f) On-peak hours of use	TMY2 Query	Eq. 1.2	(m) On-peak hours of use	TMY2 Query	Eq. 1.2
(g) FCM Summer peak demand diversity factor	TMY2 Query	Eq. 1.3	(n) FCM Summer peak demand diversity factor	TMY2 Query	Eq. 1.3
(h) FCM Winter peak demand diversity factor	TMY2 Query	Eq. 1.4	(o) FCM Winter peak demand diversity factor	TMY2 Query	Eq. 1.4

HVAC Interaction Inputs	
(p) Electric cooling coefficient of performance	(r) Percent of space that is cooled
(q) Electric heating coefficient of performance	(s) Percent of space that is heated

Pre-retrofit Lighting Demand and Energy Consumption			Post-retrofit Lighting Demand and Energy Consumption		
(t) Connected lighting Demand	(t) = (c) x (d) / 1,000	Eq. 2.1	(am) Connected lighting Demand	(am) = (j) x (k) / 1,000	Eq. 3.1
(u) Summer diversified peak lighting demand (FCM)	(u) = (t) x (g)	Eq. 2.2	(an) Summer diversified peak lighting demand (FCM)	(an) = (am) x (n)	Eq. 3.2
(v) Winter diversified peak lighting demand (FCM)	(v) = (t) x (h)	Eq. 2.3	(ao) Winter diversified peak lighting demand (FCM)	(ao) = (am) x (o)	Eq. 3.3
(w) Annual energy consumption	(w) = (t) x (e)	Eq. 2.4	(ap) Annual energy consumption	(ap) = (am) x (l)	Eq. 3.4
(x) Annual On-peak energy consumption	(x) = (t) x (f)	Eq. 2.5	(aq) Annual On-peak energy consumption	(aq) = (am) x (m)	Eq. 3.5
(y) Annual cooling hours	TMY2 Qyery	Eq. 2.6	(ar) Annual cooling hours	TMY2 Query	Eq. 3.6
(z) Annual heating hours	TMY2 Qyery	Eq. 2.7	(as) Annual heating hours	TMY2 Query	Eq. 3.7
(aa) Electric cooling interactive energy effects	(aa) = (t) x (y) x (r) x 0.8 / (p)	Eq. 2.8	(at) Electric cooling interactive energy effects	(at) = (am) x (aq) x (r) x 0.8 / (p)	Eq. 3.8
(ab) Electric heating interactive energy effects	(ab) = -(t) x (z) x (s) x 0.8 / (q)	Eq. 2.9	(au) Electric heating interactive energy effects	(au) = -(am) x (as) x (s) x 0.8 / (q)	Eq. 3.9
(ac) Annual On-peak cooling hours	TMY2 Qyery	Eq. 2.10	(av) Annual On-peak cooling hours	TMY2 Query	Eq. 3.10
(ad) Annual On-peak heating hours	TMY2 Qyery	Eq. 2.11	(aw) Annual On-peak heating hours	TMY2 Query	Eq. 3.11
(ae) On-peak interactive cooling demand (FCM)	(ae) = (u) x (r) x 0.8 / (p)	Eq. 2.12	(ax) On-peak interactive cooling demand (FCM)	(ax) = (an) x (r) x 0.8 / (p)	Eq. 3.12
(af) On-peak interactive heating demand (FCM)	(af) = -(v) x (s) x 0.8 / (q)	Eq. 2.13	(ay) On-peak interactive heating demand (FCM)	(ay) = (ao) x (s) x 0.8 / (q)	Eq. 3.13
(ag) On-peak interactive electric cooling energy	(ag) = (t) x (ac) x (r) x 0.8 / (p)	Eq. 2.14	(az) On-peak interactive electric cooling energy	(az) = (am) x (av) x (r) x 0.8 / (p)	Eq. 3.14
(ah) On-peak interactive electric heating energy	(ah) = -(t) x (ad) x (s) x 0.8 / (q)	Eq. 2.15	(ba) On-peak interactive electric heating energy	(ba) = -(am) x (aw) x (s) x 0.8 / (q)	Eq. 3.15
(ai) Lighting and interactive summer demand (FCM)	(ai) = (u) + (ae)	Eq. 2.16	(bb) Lighting and interactive summer demand (FCM)	(bb) = (an) + (ax)	Eq. 3.16
(aj) Lighting and interactive winter demand (FCM)	(aj) = (v) + (af)	Eq. 2.17	(bc) Lighting and interactive winter demand (FCM)	(bc) = (ao) + (ay)	Eq. 3.17
(ak) Annual lighting and interactive energy consumption	(ak) = (w) + (aa) + (ab)	Eq. 2.18	(bd) Annual lighting and interactive energy consumption	(bd) = (ap) + (at) + (au)	Eq. 3.18
(al) Annual on-peak lighting and interactive energy consumption	(al) = (x) + (ag) + (ah)	Eq. 2.19	(be) Annual on-peak lighting and interactive energy consumption	(be) = (aq) + (az) + (ba)	Eq. 3.19

Total Savings Summary					
Annual Lighting Only Energy Consumption	Σ (w) - Σ (ap)	Eq. 4.1	Annual Lighting and Interactive Energy Consumption	Σ (ak) - Σ (bd)	Eq. 4.8
Annual Lighting Only Summer Demand (FCM)	Σ (u) - Σ (an)	Eq. 4.2	Annual Lighting and Interactive Summer Demand (FCM)	Σ (ai) - Σ (bb)	Eq. 4.9
Annual Lighting Only Winter Demand (FCM)	Σ (v) - Σ (ao)	Eq. 4.3	Annual Lighting and Interactive Winter Demand (FCM)	Σ (aj) - Σ (bc)	Eq. 4.10
Annual Lighting Only Connected Demand	Σ (t) - Σ (am)	Eq. 4.4	On-Peak Lighting Only Energy Consumption	Σ (x) - Σ (aq)	Eq. 4.11
Annual Interactive Energy Consumption	[Σ (aa) - Σ (at)] + [Σ (ab) - Σ (au)]	Eq. 4.5	On-Peak Interactive Energy Consumption	[Σ (ag) - Σ (az)] + [Σ (ah) - Σ (ba)]	Eq. 4.12
Annual Interactive Summer Demand (FCM)	Σ (ae) - Σ (ax)	Eq. 4.6			
Annual Interactive Winter Demand (FCM)	Σ (af) - Σ (ay)	Eq. 4.7			

Site 3, Application ID: 525316

Facility Type: Manufacturing

Summary

A lighting retrofit of a manufacturing facility was done to replace older inefficient lighting fixtures with new more efficient fixtures. Included in the retrofit are the manufacturing and shop areas of the facility. A total of (179) older technology fluorescent and metal halide fixtures were replaced with (260) new high efficiency fixtures. The existing fixtures included; (88) 1,000 watt metal halide fixtures, (35) 400 watt metal halide fixtures, (22) two lamp F96/T12 fixtures and (34) one lamp F96/T12 fixtures. These fixtures were replaced by various size high bay T8 lamps and ballasts.

A count of fixtures during the on-site visit revealed that (257) total fixtures were installed. The missing fixtures included (3) six lamp F32/T8 high output fixtures that were to be installed in the machine shop.

Table 23 presents the summary of the tracking and on-site savings results.

Savings Quantity	Tracking Estimate	On-site Savings	Evaluated/ Tracking
Annual Energy (kWh)	199,514	212,373	106%
% Energy Savings On-Peak	45%	90%	200%
Summer Peak Diversified kW	69.75	60.95	87%
Winter Peak Diversified kW	69.76	13.61	20%

Table 23: Summary of Tracking and On-site Savings Results

The overall on-site savings estimate is 6% higher than predicted in the tracking estimate. The on-site estimates of summer and winter peak diversified kW was lower than the tracking value. The following factors influenced the difference between the tracking and on-site estimates of energy and demand savings:

- The increase in annual energy savings was the result of higher annual operating hours of the fixtures. The tracking savings estimated the annual operating hours of all of the fixtures to be 2,860 hours per year. The monitoring data combined with reported operating schedules show that the weighted average of annual operating hours of all the

fixtures are 3,072 hours per year. This increase in annual operating hours results in the annual savings being increased by 14,868 kWh.

- There was a decrease in savings associated with a quantity discrepancy. Evaluators found (3) fewer six lamp F32/T8 high output fixtures than proposed in the tracking estimate. These fixtures were to have been installed in the machine shop area, but were not identified there or anywhere else in the facility. The tracking savings assumed a one-to-one replacement of fixtures in this location. Therefore, evaluators adjusted the baseline quantity to reflect the difference in the installed quantity. This quantity adjustment yielded a decrease in savings equal to 2,008 kWh per year.

- The on-peak kWh savings was estimated to be 90% of the annual on-site kWh savings. The on-peak period defined by National Grid is non-holiday weekdays between 6 am and 10 pm. The tracking estimate for on-peak kWh savings was estimated to be 45% of the annual tracking kWh savings. It is unclear how the 45% used in the tracking analysis was developed, but this number implies that less than half of the total annual operating hours occur during the defined on-peak period. However, monitoring data and discussions with facility personnel show that the operating hours of the facility are typically weekdays between 5:30 am and 6:00 pm. According to monitoring data, there was a small number of Saturday operating hours and no Sunday operation.

- The summer diversified kW reduction was 60.95 kW or 13% lower than predicted in the tracking estimate using the FCM summer peak definition. The decrease is due mostly to a lower summer diversity estimate. The tracking savings estimated the lights to operate 100% of the time during the defined summer peak period of weekdays between 1 pm and 5 pm. Monitoring data showed that these lights operate approximately 88% of the time during this period. The winter diversified kW reduction was 13.61 kW or 80% lower than the tracking estimate. The reason for this decrease is that the tracking savings estimated the lights to operate 100% of the time during the defined winter peak period of weekdays between 5 pm and 7 pm. The monitoring data showed that the lights operate approximately 20% of the time during the defined winter peak period.

Project Description

This project was completed under the Energy Initiative program. Table 24 presents a summary of the existing system as outlined in the customer application.

Existing Case				
Space	**Fixture Type**	**Wattage**	**Quantity**	**Annual Hours**
Machine Shop	One Lamp F96/T12/HO	135	12	2,860
Machine Shop	400 Watt Metal Halide	455	32	2,860
Machine Shop	Two Lam F96/T12/HO	228	8	2,860
Main Manufacturing	One Lamp F96/T12/HO	135	22	2,860
Main Manufacturing	400 Watt Metal Halide	455	3	2,860
Main Manufacturing	1,000 Watt Meta Halide	1075	66	2,860
Main Manufacturing	Two Lam F96/T12/HO	228	14	2,860
PMC Bay	1,000 Watt Meta Halide	1075	22	2,860
	Total	120,131	179	NA

Table 24: Existing Lighting System

Table 25 presents the installed fixtures and quantities as proposed in the customer application.

Installed Case				
Space	**Fixture Type**	**Wattage**	**Quantity**	**Annual Hours**
Machine Shop	Two Lamp F32/T8/HO	74	12	2,860
Machine Shop	Four Lamp F32/T8/LP	98	8	2,860
Machine Shop	Six Lamp F32/T8/HO	221	26	2,860
Main Manufacturing	Two Lamp F32/T8/HO	74	22	2,860
Main Manufacturing	Four Lamp F32/T8/LP	98	9	2,860
Main Manufacturing	Six Lamp F32/T8/HO	221	139	2,860
PMC Bay	Six Lamp F32/T8/HO	221	44	2,860
	Total	50,371	260	NA

Table 25: Installed Lighting System

Evaluation Methodology

Tracking Estimates

The tracking estimates of energy use were calculated based on the full load of the existing and proposed fixtures. The energy savings were calculated as the difference in the pre and post installation energy use based on annual operation of 2,860 hours per year.

Evaluation Approach

The evaluation included a verification of installed fixtures, on-site monitoring and interview. All fixtures are controlled manually using wall switches.

The base case used in the evaluation of the lighting savings was developed from information contained in the customer application. The pre-existing fixture types were confirmed while on-site with the facility contact. An evaluator visited the facility to verify the installed fixtures and install monitoring equipment to quantify the hours of use of the different spaces. The evaluator surveyed facility personnel to obtain information on the lighting usage throughout the year. He also inquired about any HVAC equipment serving the space.

To determine the hours of use for the new fixtures, the field engineer installed two time-of-use current transformer (CT) loggers and two time-of-use lighting loggers. Each logger recorded the on/off of the lighting fixtures monitored. Table 26 presents the fixtures monitored by the evaluation engineer.

Logger #	Equipment Monitored	Parameter Measured	Test Equip. Make & Model	Measurement Type	Installation Method	Frequency of Observations	Monitoring Duration
CT07120009	PMC Bay (6L - F32/T8/HO)	On/Off Operation	PS&T CT Lighting Logger	Event Logger	Clamp-On	Based on Schedule	3/31/09 - 4/28/09
CT08010026	Main Manufacturing (6L - F32/T8/HO)	On/Off Operation	PS&T CT Lighting Logger	Event Logger	Clamp-On	Based on Schedule	3/31/09 - 4/28/09
T040303360	Machine Shop (6L - F32/T8/HO)	On/Off Operation	PS&T TOU Lighting Logger	Event Logger	Proximity	Based on Schedule	3/31/09 - 4/28/09
T040303238	Machine Shop Office (4L - F32/T8/LP)	On/Off Operation	PS&T TOU Lighting Logger	Event Logger	Proximity	Based on Schedule	3/31/09 - 4/28/09

Table 26: Spaces Monitored

Verification of Equipment and Operating Parameters

This project involved the retrofitting of older lighting fixtures in three separate areas of the facility. These spaces included the main manufacturing area, the PMC bay and the machine shop (which was in a separate building). Included in this retrofit were the replacement of (88) 1,000 watt metal halide fixtures, (35) 400 watt metal halide fixtures, (22) two lamp F96/T12 fixtures and (34) one lamp F96/T12 fixtures with (209) six lamp F32/T8 high output fixtures, (34) two lamp F32/T8 high output fixtures and (17) four lamp F32/T8 low power fixtures. Evaluators identified all of the installed fixtures with the exception of (3) six lamp F32/T8 high output fixtures that were supposed to have been installed in the machine shop.

This facility operates year round using the same operating schedule throughout the year. The operating hours are Monday through Friday between 5:30 am and 6 pm according to facility personnel. In addition, the facility sometimes operates on Saturdays depending on production needs. The facility observes nine holidays in which it is closed and unoccupied. These include New Year's Eve, New Year's Day, Memorial Day, Independence Day, Labor Day, Thanksgiving Day, Thanksgiving Friday, Christmas Eve and Christmas Day. The monitoring period did not cover any of the facility holidays. Therefore, evaluators assumed that each holiday would operate the same as a Sunday, which showed zero hours of operation during the monitoring period.

Table 27 presents the values obtained from the monitored data including annual operation, summer and winter diversity factors, and on-peak hours of use. These values were used for both the pre and post installation calculations because there was no difference in operation with the new lighting according to facility personnel.

Schedule ID	Logger #	Description	Annual Hours	Summer Diversity	Winter Diversity	On-Peak Hours
1	CT07120009	PMC Bay	2,744	82%	9%	2,579
2	CT08010026	Main Manufacturing	3,235	93%	26%	2,896
3	T040303360	Machine Shop	2,922	79%	11%	2,524
4	T040303238	Machine Shop Office	2,919	79%	11%	2,525

Table 27: Annual Hours of Use and Diversity Factors of Monitored Data

To estimate annual energy and demand savings, a spreadsheet method was employed. The summary of this spreadsheet is presented in Table 28. Annual hours and diversity factors from Table 27 are used with wattages from Table 28 to calculate energy and demand savings. The schedule ID's from Table 27 are presented in Table 28 to show which schedule was used with each fixture ID. The final on-site savings estimates are presented in Table 28.

The facility's heat is provided by natural gas which has no electrical interaction with the new lighting. However, because of the reduced heat going into the space due to the installation of more efficient lighting, there will be a need for additional heat from the facility's forced air system. It was estimated that this heating penalty is equal to approximately 399 MMBTU's of natural gas per year. This is calculated using a heating efficiency of 74% for the forced air system. This efficiency is assumed to be a standard efficiency for this type of heating system. There is no air-conditioning in this building resulting in zero electrical interactive effects.

The average daily lighting profiles for all the monitored spaces are presented in Figure 24 through Figure 27. This includes the average weekday, weekend day and holiday. The x-axis represents one full day and the y-axis is the percentage that the lights are on for each hour.

An hourly summary of the site kW savings for an average summer (June through August), non-holiday, weekday is presented in Table 29. This summary is provided so that the summer diversified peak kW can be estimated across any range of hours in the event that the FCM definition for summer peak changes in the future. The same summary was also provided for the average winter (December and January), non-holiday, weekday in Table 30.

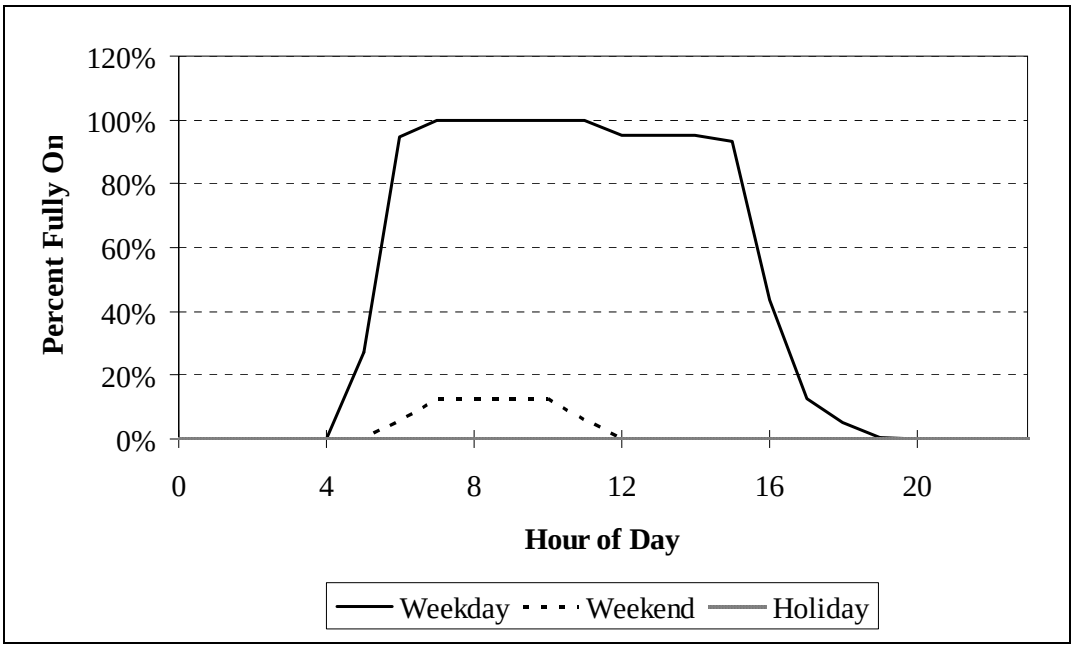

Figure 24: Average Daily Lighting Profile for Schedule 1 (PMC Bay) from 3/31/09 to 4/28/09

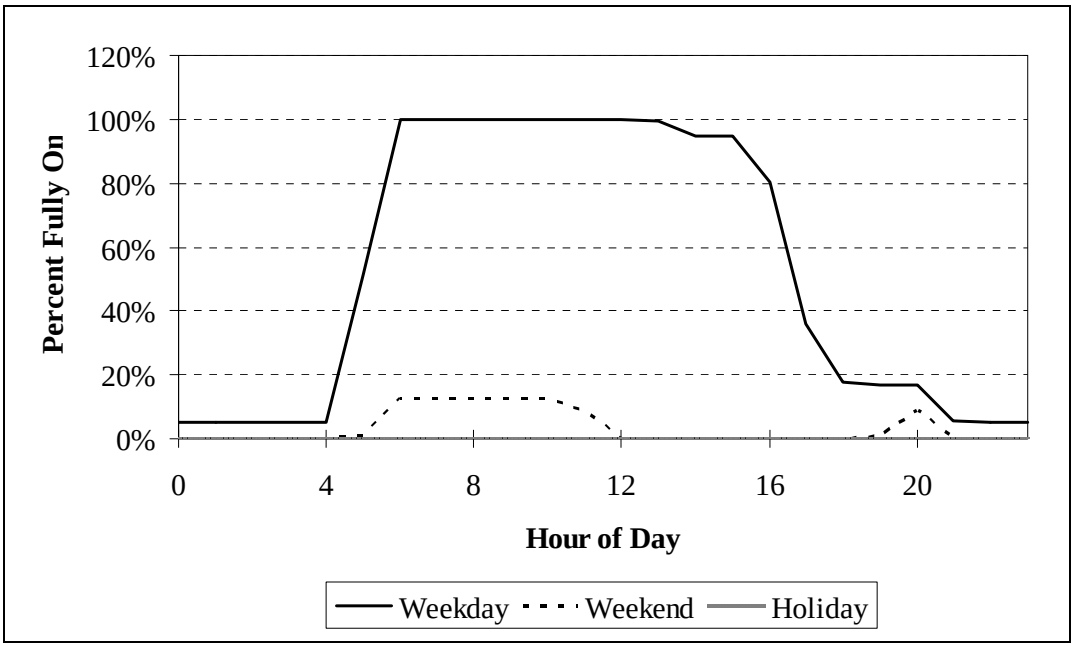

Figure 25: Average Daily Profile for Schedule 2 (Main Manufacturing) from 3/31/09 to 4/28/09

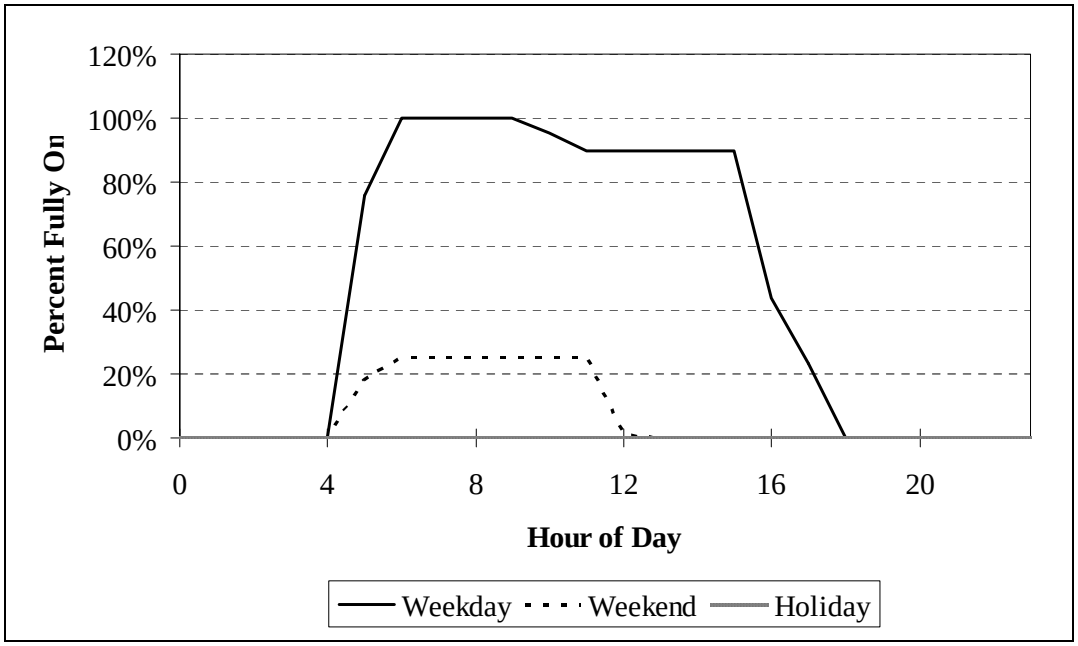

Figure 26: Average Daily Lighting Profile for Schedule 3 (Machine Shop) from 3/31/09 to 4/28/09

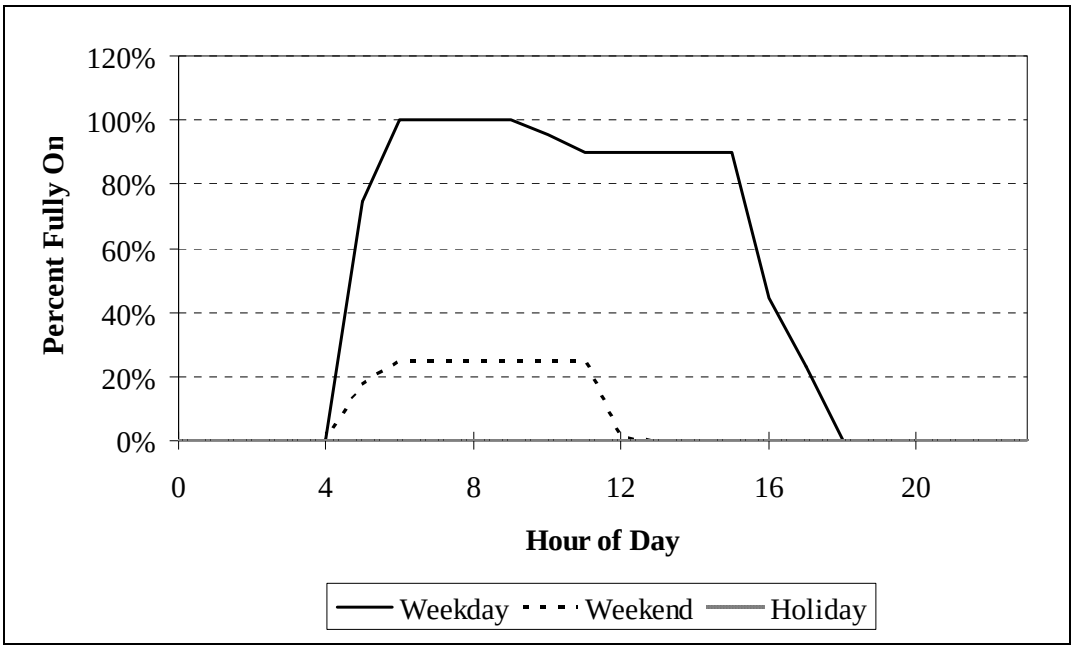

Figure 27: Average Daily Lighting Profile for Schedule 4 (Machine Shop Office) from 3/31/09 to 4/28/09

Facility Type: Manufacturing
Application ID: 525316

Fixture Information

		Pre-retrofit Lighting							Post-retrofit Lighting						HVAC					
	(a)	(b)	(c)	(d)	(e)	(f)	(g)	(h)	(i)	(j)	(k)	(l)	(m)	(n)	(o)	(p)	(q)	(r)	(s)	Schedule ID from Table 5
					Hours of Use		FCM Diversity Factor					Hours of Use		FCM Diversity Factor		COP				
Fixture ID	Space Type	Fixture Type	Fixture Quantity	Fixture Wattage	Annual	Peak	Summer	Winter	Fixture Type	Fixture Quantity	Fixture Wattage	Annual	Peak	Summer	Winter	Cooling	Heating	% Space Cooled	% Space Heated	Pre Retrofit	Post Retrofit
1	Main Manufacturing	1000 WATT MH	64	1075	3,235	2,896	93%	26%	6L4' T8/ELIG HIGH LMN	128	221	3,235	2,896	93%	26%	NA	NA	0%	100%	2	2
2	Main Manufacturing	1L8' EE HO/STD	22	135	3,235	2,896	93%	26%	2L4' T8/ELIG HIGH LMN	22	74	3,235	2,896	93%	26%	NA	NA	0%	100%	2	2
3	Main Manufacturing	2L8' HO/EE/STD	9	228	3,235	2,896	93%	26%	4L4' T8/ELIG LOW PWR	9	98	3,235	2,896	93%	26%	NA	NA	0%	100%	2	2
4	PMC Bay	2L8' HO/EE/STD	2	228	2,744	2,579	82%	9%	6L4' T8/ELIG HIGH LMN	0	221	2,744	2,579	82%	9%	NA	NA	0%	100%	1	1
5	PMC Bay	400W METAL HALIDE	3	455	2,744	2,579	82%	9%	6L4' T8/ELIG HIGH LMN	0	221	2,744	2,579	82%	9%	NA	NA	0%	100%	1	1
6	PMC Bay	2L8' HO/EE/STD	3	228	2,744	2,579	82%	9%	6L4' T8/ELIG HIGH LMN	0	221	2,744	2,579	82%	9%	NA	NA	0%	100%	1	1
7	PMC Bay	1000 WATT MH	24	1075	2,744	2,579	82%	9%	6L4' T8/ELIG HIGH LMN	55	221	2,744	2,579	82%	9%	NA	NA	0%	100%	1	1
8	Machine Shop	400W METAL HALIDE	29	455	2,922	2,524	79%	11%	6L4' T8/ELIG HIGH LMN	23	221	2,922	2,524	79%	11%	NA	NA	0%	100%	3	3
9	Machine Shop	1L8' EE HO/STD	12	135	2,922	2,524	79%	11%	2L4' T8/ELIG HIGH LMN	12	74	2,922	2,524	79%	11%	NA	NA	0%	100%	3	3
10	Machine Shop	2L8' HO/EE/STD	6	228	2,922	2,524	79%	11%	4L4' T8/ELIG LOW PWR	6	98	2,922	2,524	79%	11%	NA	NA	0%	100%	3	3
11	Machine Shop Office	2L8' HO/EE/STD	2	228	2,919	2,525	79%	11%	4L4' T8/ELIG LOW PWR	2	98	2,919	2,525	79%	11%	NA	NA	0%	100%	4	4
12	Machine Shop	400W METAL HALIDE	0	455	2,922	2,524	79%	11%	6L4' T8/ELIG HIGH LMN	0	221	2,922	2,524	79%	11%	NA	NA	0%	100%	3	3
		Totals	176	118,766					Totals	257	49,708										

Pre-Retrofit Demand and Energy Consumption

	Lighting Demand and Energy Consumption					Interactive Hours		Interactive Energy Consumption		On-Peak Interactive Hours		On-Peak Interactive Demand and Energy Consumption				Lighting and Interactive Demand and Energy Consumption			
	(t)	(u)	(v)	(w)	(x)	(y)	(z)	(aa)	(ab)	(ac)	(ad)	(ae)	(af)	(ag)	(ah)	(ai)	(aj)	(ak)	(al)
		FCM Diversified kW										FCM Diversified kW				FCM Diversified kW			
Fixture ID	Connected kW	Summer	Winter	Annual kWh	Peak kWh	Cooling Hours	Heating Hours	Cooling kWh	Heating kWh	Cooling Hours	Heating Hours	Summer	Winter	Cooling kWh	Heating kWh	Summer	Winter	Annual kWh	Peak kWh
1	68.80	63.77	17.78	222,559	199,222	0	1,651	0	0	0	1,447	0.00	0.00	0	0	63.77	17.78	222,559	199,222
2	2.97	2.75	0.77	9,608	8,600	0	1,651	0	0	0	1,447	0.00	0.00	0	0	2.75	0.77	9,608	8,600
3	2.05	1.90	0.53	6,638	5,942	0	1,651	0	0	0	1,447	0.00	0.00	0	0	1.90	0.53	6,638	5,942
4	0.46	0.37	0.04	1,251	1,176	0	1,389	0	0	0	1,284	0.00	0.00	0	0	0.37	0.04	1,251	1,176
5	1.37	1.12	0.12	3,746	3,521	0	1,389	0	0	0	1,284	0.00	0.00	0	0	1.12	0.12	3,746	3,521
6	0.68	0.56	0.06	1,877	1,764	0	1,389	0	0	0	1,284	0.00	0.00	0	0	0.56	0.06	1,877	1,764
7	25.80	21.21	2.25	70,801	66,545	0	1,389	0	0	0	1,284	0.00	0.00	0	0	21.21	2.25	70,801	66,545
8	13.20	10.41	1.44	38,551	33,305	0	1,491	0	0	0	1,259	0.00	0.00	0	0	10.41	1.44	38,551	33,305
9	1.62	1.28	0.18	4,733	4,089	0	1,491	0	0	0	1,259	0.00	0.00	0	0	1.28	0.18	4,733	4,089
10	1.37	1.08	0.15	3,997	3,453	0	1,491	0	0	0	1,259	0.00	0.00	0	0	1.08	0.15	3,997	3,453
11	0.46	0.36	0.05	1,331	1,152	0	1,490	0	0	0	1,260	0.00	0.00	0	0	0.36	0.05	1,331	1,152
12	0.00	0.00	0.00	0	0	0	1,491	0	0	0	1,259	0.00	0.00	0	0	0.00	0.00	0	0
Totals	118.77	104.82	23.36	365,092	328,768			0	0			0.00	0.00	0	0	104.82	23.36	365,092	328,768

Post-Retrofit Demand and Energy Consumption

	Lighting Demand and Energy Consumption					Interactive Hours		Interactive Energy Consumption		On-Peak Interactive Hours		On-Peak Interactive Demand and Energy Consumption				Lighting and Interactive Demand and Energy Consumption			
	(am)	(an)	(ao)	(ap)	(aq)	(ar)	(as)	(at)	(au)	(av)	(aw)	(ax)	(ay)	(az)	(ba)	(bb)	(bc)	(bd)	(be)
		FCM Diversified kW										FCM Diversified kW				FCM Diversified kW			
Fixture ID	Connected kW	Summer	Winter	Annual kWh	Peak kWh	Cooling Hours	Heating Hours	Cooling kWh	Heating kWh	Cooling Hours	Heating Hours	Summer	Winter	Cooling kWh	Heating kWh	Summer	Winter	Annual kWh	Peak kWh
1	28.29	26.22	7.31	91,508	81,913	0	1,651	0	0	0	1,447	0.00	0.00	0	0	26.22	7.31	91,508	81,913
2	1.63	1.51	0.42	5,266	4,714	0	1,651	0	0	0	1,447	0.00	0.00	0	0	1.51	0.42	5,266	4,714
3	0.88	0.82	0.23	2,853	2,554	0	1,651	0	0	0	1,447	0.00	0.00	0	0	0.82	0.23	2,853	2,554
4	0.00	0.00	0.00	0	0	0	1,389	0	0	0	1,284	0.00	0.00	0	0	0.00	0.00	0	0
5	0.00	0.00	0.00	0	0	0	1,389	0	0	0	1,284	0.00	0.00	0	0	0.00	0.00	0	0
6	0.00	0.00	0.00	0	0	0	1,389	0	0	0	1,284	0.00	0.00	0	0	0.00	0.00	0	0
7	12.16	9.99	1.06	33,356	31,351	0	1,389	0	0	0	1,284	0.00	0.00	0	0	9.99	1.06	33,356	31,351
8	5.08	4.01	0.56	14,851	12,830	0	1,491	0	0	0	1,259	0.00	0.00	0	0	4.01	0.56	14,851	12,830
9	0.89	0.70	0.10	2,594	2,241	0	1,491	0	0	0	1,259	0.00	0.00	0	0	0.70	0.10	2,594	2,241
10	0.59	0.46	0.06	1,718	1,484	0	1,491	0	0	0	1,259	0.00	0.00	0	0	0.46	0.06	1,718	1,484
11	0.20	0.15	0.02	572	495	0	1,490	0	0	0	1,260	0.00	0.00	0	0	0.15	0.02	572	495
12	0.00	0.00	0.00	0	0	0	1,491	0	0	0	1,259	0.00	0.00	0	0	0.00	0.00	0	0
Totals	49.71	43.87	9.76	152,719	137,582			0	0			0.00	0.00	0	0	43.87	9.76	152,719	137,582

Total Savings Summary

	Energy kWh	Summer kW	Winter kW	Connected kW
Annual Lighting Only	212,373	60.95	13.61	69.06
Annual Interactive	0	0.00	0.00	N/A
Annual Lighting and Interactive	212,373	60.95	13.61	69.06
On-Peak Lighting Only	191,186			
On-Peak Interactive	0			
On-Peak Lighting and Interactive	191,186			

	MMBTU
Annual Non-Electric Heating Savings	(399)

Savings Adjustment Factors

Parameter	Annual KWH	Difference %	Summer kW	Difference %	Winter kW	Difference %
Gross (TRACKING) Savings	199,514	N/A	69.75	N/A	69.76	N/A
Adjustment - Documentation Change	0	0%	0.01	0%	0.00	0%
Adjustment - Technology Change	0	0%	0.00	0%	0.00	0%
Adjustment - Quantity Change	-2,008	-1%	-0.70	-1%	-0.70	-1%
Adjustment - Operation Change	14,868	7%	N/A	N/A	N/A	N/A
Adjustment - Coincident Change	N/A	N/A	-8.11	-12%	-55.45	-79%
Adjustment - Heating Interaction	0	0%	N/A	N/A	0.00	0%
Adjustment - Cooling Interaction	0	0%	0.00	0%	N/A	N/A
Adjustment - TOTAL	12,859	6%	-8.80	-13%	-56.15	-80%
Adjusted Gross (ONSITE) Savings	212,373	106%	60.95	87%	13.61	20%

Table 28: Summary of On-Site Energy and Demand Savings

Hour Ending	Average kW Reduction
1	2.2
2	2.2
3	2.2
4	2.2
5	2.2
6	34.1
7	68.3
8	69.1
9	69.1
10	69.1
11	68.6
12	68.1
13	67.4
14	67.1
15	65.4
16	65.1
17	46.3
18	20.0
19	8.5
20	7.3
21	7.3
22	2.4
23	2.2
24	2.2

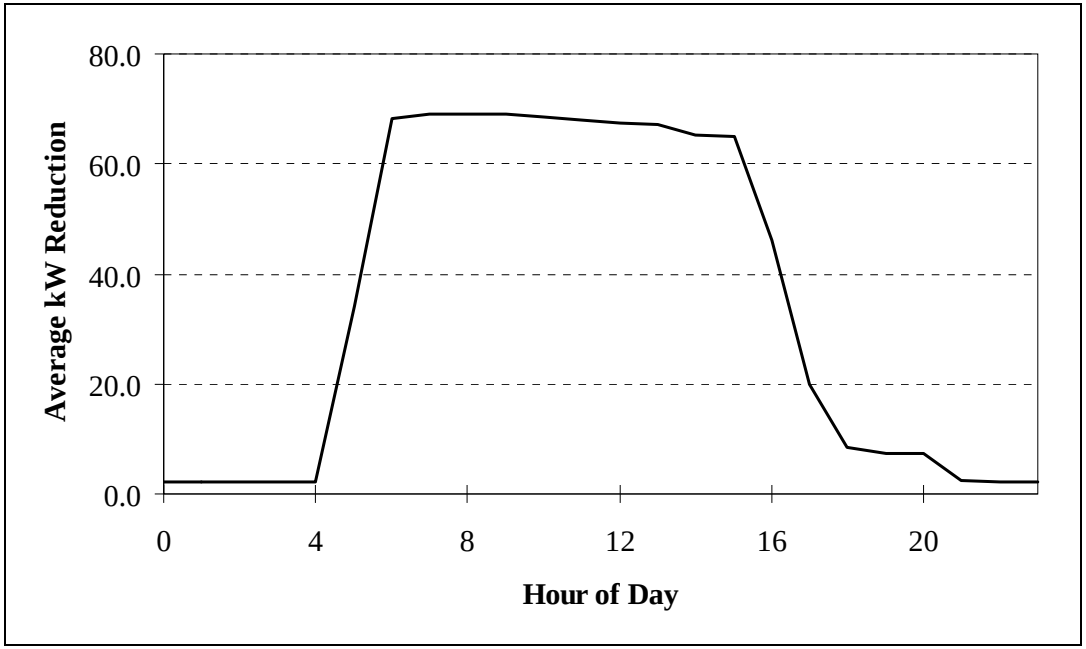

Table 29: Average Summer Weekday kW Reduction

Hour Ending	Average kW Reduction
1	2.0
2	2.0
3	2.0
4	2.0
5	2.0
6	32.4
7	65.2
8	65.9
9	65.9
10	65.9
11	65.5
12	65.0
13	64.3
14	64.0
15	62.3
16	62.1
17	43.8
18	18.9
19	8.3
20	7.1
21	7.1
22	2.2
23	2.0
24	2.0

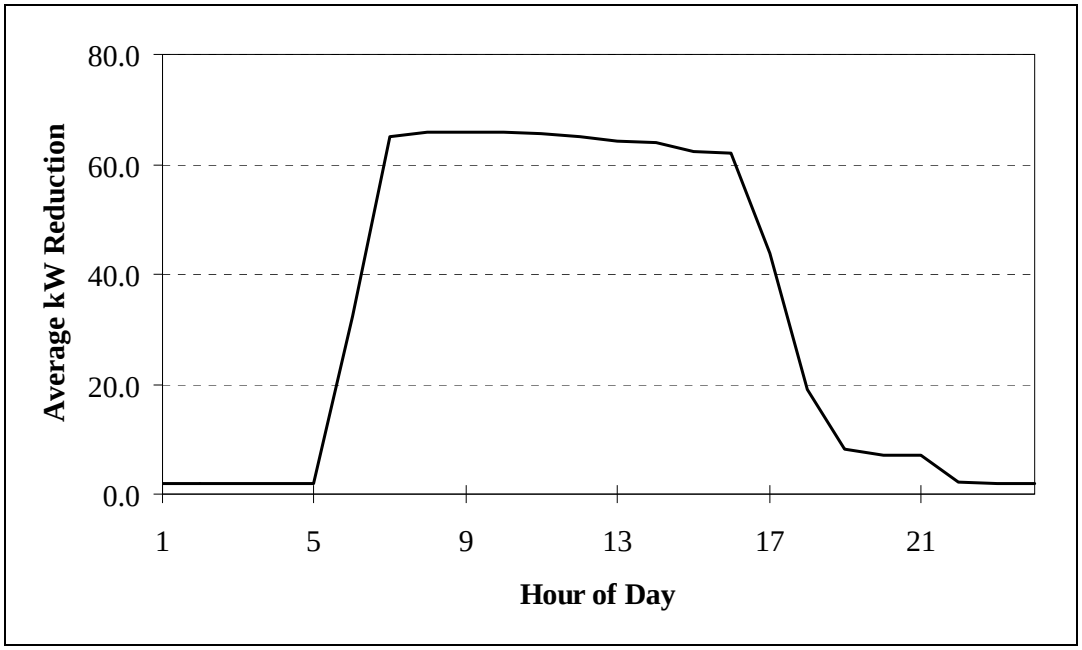

Table 30: Average Winter Weekday kW Reduction

Column Definitions for Lighting Calculations		
(a) Brief description of area where lighting is installed		

Pre-retrofit Lighting			Post-retrofit Lighting		
(b) Description of fixture type			(i) Description of fixture type		
(c) Fixture quantity from application documentation			(j) Fixture quantity from on-site inspection		
(d) Fixture wattage from application documentation			(k) Fixture wattage from application documentation		
(e) Annual hours of use	TMY2 Query	Eq. 1.1	(l) Annual hours of use	TMY2 Query	Eq. 1.1
(f) On-peak hours of use	TMY2 Query	Eq. 1.2	(m) On-peak hours of use	TMY2 Query	Eq. 1.2
(g) FCM Summer peak demand diversity factor	TMY2 Query	Eq. 1.3	(n) FCM Summer peak demand diversity factor	TMY2 Query	Eq. 1.3
(h) FCM Winter peak demand diversity factor	TMY2 Query	Eq. 1.4	(o) FCM Winter peak demand diversity factor	TMY2 Query	Eq. 1.4

HVAC Interaction Inputs	
(p) Electric cooling coefficient of performance	(r) Percent of space that is cooled
(q) Electric heating coefficient of performance	(s) Percent of space that is heated

Pre-retrofit Lighting Demand and Energy Consumption			Post-retrofit Lighting Demand and Energy Consumption		
(t) Connected lighting Demand	(t) = (c) x (d) / 1,000	Eq. 2.1	(am) Connected lighting Demand	(am) = (j) x (k) / 1,000	Eq. 3.1
(u) Summer diversified peak lighting demand (FCM)	(u) = (t) x (g)	Eq. 2.2	(an) Summer diversified peak lighting demand (FCM)	(an) = (am) x (n)	Eq. 3.2
(v) Winter diversified peak lighting demand (FCM)	(v) = (t) x (h)	Eq. 2.3	(ao) Winter diversified peak lighting demand (FCM)	(ao) = (am) x (o)	Eq. 3.3
(w) Annual energy consumption	(w) = (t) x (e)	Eq. 2.4	(ap) Annual energy consumption	(ap) = (am) x (l)	Eq. 3.4
(x) Annual On-peak energy consumption	(x) = (t) x (f)	Eq. 2.5	(aq) Annual On-peak energy consumption	(aq) = (am) x (m)	Eq. 3.5
(y) Annual cooling hours	TMY2 Qyery	Eq. 2.6	(ar) Annual cooling hours	TMY2 Query	Eq. 3.6
(z) Annual heating hours	TMY2 Qyery	Eq. 2.7	(as) Annual heating hours	TMY2 Query	Eq. 3.7
(aa) Electric cooling interactive energy effects	(aa) = (t) x (y) x (r) x 0.8 / (p)	Eq. 2.8	(at) Electric cooling interactive energy effects	(at) = (am) x (aq) x (r) x 0.8 / (p)	Eq. 3.8
(ab) Electric heating interactive energy effects	(ab) = -(t) x (z) x (s) x 0.8 / (q)	Eq. 2.9	(au) Electric heating interactive energy effects	(au) = -(am) x (as) x (s) x 0.8 / (q)	Eq. 3.9
(ac) Annual On-peak cooling hours	TMY2 Qyery	Eq. 2.10	(av) Annual On-peak cooling hours	TMY2 Query	Eq. 3.10
(ad) Annual On-peak heating hours	TMY2 Qyery	Eq. 2.11	(aw) Annual On-peak heating hours	TMY2 Query	Eq. 3.11
(ae) On-peak interactive cooling demand (FCM)	(ae) = (u) x (r) x 0.8 / (p)	Eq. 2.12	(ax) On-peak interactive cooling demand (FCM)	(ax) = (an) x (r) x 0.8 / (p)	Eq. 3.12
(af) On-peak interactive heating demand (FCM)	(af) = -(v) x (s) x 0.8 / (q)	Eq. 2.13	(ay) On-peak interactive heating demand (FCM)	(ay) = (ao) x (s) x 0.8 / (q)	Eq. 3.13
(ag) On-peak interactive electric cooling energy	(ag) = (t) x (ac) x (r) x 0.8 / (p)	Eq. 2.14	(az) On-peak interactive electric cooling energy	(az) = (am) x (av) x (r) x 0.8 / (p)	Eq. 3.14
(ah) On-peak interactive electric heating energy	(ah) = -(t) x (ad) x (s) x 0.8 / (q)	Eq. 2.15	(ba) On-peak interactive electric heating energy	(ba) = -(am) x (aw) x (s) x 0.8 / (q)	Eq. 3.15
(ai) Lighting and interactive summer demand (FCM)	(ai) = (u) + (ae)	Eq. 2.16	(bb) Lighting and interactive summer demand (FCM)	(bb) = (an) + (ax)	Eq. 3.16
(aj) Lighting and interactive winter demand (FCM)	(aj) = (v) + (af)	Eq. 2.17	(bc) Lighting and interactive winter demand (FCM)	(bc) = (ao) + (ay)	Eq. 3.17
(ak) Annual lighting and interactive energy consumption	(ak) = (w) + (aa) + (ab)	Eq. 2.18	(bd) Annual lighting and interactive energy consumption	(bd) = (ap) + (at) + (au)	Eq. 3.18
(al) Annual on-peak lighting and interactive energy consumption	(al) = (x) + (ag) + (ah)	Eq. 2.19	(be) Annual on-peak lighting and interactive energy consumption	(be) = (aq) + (az) + (ba)	Eq. 3.19

Total Savings Summary					
Annual Lighting Only Energy Consumption	Σ (w) - Σ (ap)	Eq. 4.1	Annual Lighting and Interactive Energy Consumption	Σ (ak) - Σ (bd)	Eq. 4.8
Annual Lighting Only Summer Demand (FCM)	Σ (u) - Σ (an)	Eq. 4.2	Annual Lighting and Interactive Summer Demand (FCM)	Σ (ai) - Σ (bb)	Eq. 4.9
Annual Lighting Only Winter Demand (FCM)	Σ (v) - Σ (ao)	Eq. 4.3	Annual Lighting and Interactive Winter Demand (FCM)	Σ (aj) - Σ (bc)	Eq. 4.10
Annual Lighting Only Connected Demand	Σ (t) - Σ (am)	Eq. 4.4	On-Peak Lighting Only Energy Consumption	Σ (x) - Σ (aq)	Eq. 4.11
Annual Interactive Energy Consumption	[Σ (aa) - Σ (at)] + [Σ (ab) - Σ (au)]	Eq. 4.5	On-Peak Interactive Energy Consumption	[Σ (ag) - Σ (az)] + [Σ (ah) - Σ (ba)]	Eq. 4.12
Annual Interactive Summer Demand (FCM)	Σ (ae) - Σ (ax)	Eq. 4.6			
Annual Interactive Winter Demand (FCM)	Σ (af) - Σ (ay)	Eq. 4.7			

Site 4, Application ID: 525336

Facility Type: Distribution Warehouse/Office

Summary

A lighting retrofit of a distribution office and warehouse was done to replace older inefficient lighting fixtures with new more efficient fixtures. Included in the retrofit are offices and warehouse space. A total of (983) older technology lighting fixtures were replaced with (786) new high efficiency fixtures. The existing fixtures were replaced by various size high efficiency T5 and T8 lamps and ballasts. Also included in this project were (156) occupancy sensors that were installed. Occupancy sensors accounted for approximately 14% of the total tracking energy savings.

A count of fixtures taken during the on-site visit revealed that installed quantities and types of lighting fixtures closely matched the proposed quantities and fixture types.

Table 31 presents the summary of the tracking and on-site savings results.

Savings Quantity	Tracking Estimate	On-site Savings	Evaluated/ Tracking
Annual Energy (kWh)	253,784	321,483	127%
% Energy Savings On-Peak	45%	73%	161%
Summer Peak Diversified kW	63.30	66.74	105%
Winter Peak Diversified kW	63.31	55.14	87%

Table 31: Summary of Tracking and On-site Savings Results

The overall on-site savings estimate is 27% higher than predicted in the tracking estimate. The on-site estimate of summer peak diversified kW was higher than the tracking value while the winter peak diversified kW was lower than the tracking value. The following factors influenced the difference between the tracking and on-site estimates of energy and demand savings:

- The increase in savings was the result of higher annual hours of use. The tracking estimate of savings estimated the weighted average of operating hours of all the installed fixtures to be 3,617 hours per year prior to the installation of occupancy sensors. The monitoring data combined with reported operating schedules showed that the weighted average of the post-installation operating hours is 4,654 hours per year

prior to the installation of occupancy sensors. This increase in annual operating hours results in the annual savings being increased by 61,046 kWh.

- Although the overall operating hours were shown to be higher than what the tracking savings estimated, the reduction in operating hours due to the installation of occupancy sensors was consistent with the tracking estimate. The evaluation found that the occupancy sensors reduced the total operating hours of the controlled fixtures by 1,330 hours per year compared to 1,331 in the tracking. This small decrease in reduction in operating hours resulted in a reduction in savings equal to 807 kWh per year.

- Evaluators also identified more fixtures during the facility walkthrough than proposed in the tracking analysis. The evaluation found 793 total fixtures installed in the facility compared to 786 fixtures proposed in the tracking analysis. In the case where a space was found to have more fixtures, evaluators also adjusted the baseline fixture quantity for this space to reflect this adjustment, resulting in additional savings. In the case where there is a one-to-one replacement, the baseline quantity is adjusted using the quantity found during the site inspection. When the quantity discrepancy occurred in a space that wasn't a one-to-one replacement, evaluators adjusted the baseline using the same ratio of existing to installed fixtures as the tracking system. Though the total number of fixtures was higher than the tracking estimate, there were some missing fixtures in the warehouse area that resulted in an overall decrease in savings. The reason the savings decreased was because the warehouse fixtures are mostly a higher wattage with higher operating hours than the office areas, which contained the additional fixtures. The decrease in the warehouse fixtures resulted in a reduction in savings equal to 3,342 kWh per year.

- There was an increase in savings resulting from a technology adjustment. Specifically, evaluators found some spaces in the office that contained two lamp F17/T8 fixtures instead of three lamp F17/T8 fixtures as proposed. Evaluators did not change any baseline fixture types in this case, leading to an overall increase in demand savings. This decrease in installed wattage resulted in an increase in savings equal to 631 kWh per year.

- There was an increase in savings resulting from the interaction between the new lighting and the facility's HVAC systems. Only the office areas of this facility are air-conditioned using rooftop packaged DX units. The decrease in lighting wattage resulting from this

efficiency measure results in less heat going into the air-conditioned space. Therefore, additional savings are realized from the reduced cooling requirements of the building. It is estimated that the added benefit is equal to 8,567 kWh per year.

- The on-peak kWh savings was estimated to be 73% of the annual on-site kWh savings. The tracking estimate for on-peak kWh savings was 45%. The on-peak period defined by National Grid is non-holiday weekdays between 6 am and 10 pm. The reason for the difference in on-peak kWh estimates is because almost all of the energy savings associated with the offices occurs during the on-peak period while approximately 70% of the warehouse energy savings occurs during the on-peak period.

- The summer diversified kW reduction was 66.74 kW or 5% higher than predicted in the tracking estimate. The increase was the result of the additional HVAC savings presented above. The reduced air-conditioning requirements due to the installation of the new lighting increase the summer peak demand savings by 4.27 kW. The winter diversified kW reduction was 55.14 kW or 13% lower than the tracking estimate. The reason for this decrease is that the tracking savings estimated the lights to operate 100% of the time during the winter peak hours of 5 pm to 7 pm. The monitoring data shows that the weighted average winter diversity factor is approximately 81%. This is mostly due to the office areas that begin to close down around 5 pm. The winter diversity factor for the warehouse areas is around 95%.

Project Description

This project was completed under the Energy Initiative program. Table 32 presents a summary of the existing system as outlined in the customer application.

Existing Case				
Space	**Fixture Type**	**Wattage**	**Quantity**	**Annual Hours**
Warehouse	250 Watt High Pressure Sodium	295	77	4,932
Warehouse	175 Watt Metal Halide	205	134	3,762
Warehouse	400 Watt Metal Halide	460	16	3,762
Warehouse	Two Lamp F40/T12	70	289	4,670
Warehouse	Two Lamp F96/T12	170	15	2,887
Warehouse	Two Lamp F96/T12/HO	227	20	4,281
Warehouse	Four Lamp F40/T12	140	72	2,789
Cafeteria	Four Lamp F40/T12	140	6	3,884
1st Floor	Three Lamp F40/T12	125	2	5,414
1st Floor	Four Lamp F40/T12	140	44	2,200
2nd Floor	250 Watt High Pressure Sodium	295	7	3,920
2nd Floor	135 Watt Incandescent	135	68	1,725
2nd Floor	150 Watt Incandescent	150	3	4,433
2nd Floor	100 Watt Metal Halide	130	6	2,271
2nd Floor	Two Lamp F24/T12	48	16	3,500
2nd Floor	Two Lamp F32/T8	60	102	2,432
2nd Floor	Two Lamp F40/T12	80	16	2,200
2nd Floor	Two Lamp F96/T12	170	15	5,086
2nd Floor	Three Lamp F32/T8	90	56	2,414
2nd Floor	65 Watt Incandescent	65	5	3,500
Throughout	40 Watt Incandescent	40	14	5,414
	Total	131,313	983	N/A

Table 32: Existing Lighting System

Table 33 presents the installed fixtures and quantities as proposed in the customer application.

Installed Case				
Space	**Fixture Type**	**Wattage**	**Quantity**	**Annual Hours**
Warehouse	Three Lamp F32/T8/LP	67	10	2,887
Warehouse	Three Lamp F54/T5/HO	177	77	4,397
Warehouse	Two Lamp F54/T5/HO	117	134	2,835
Warehouse	Four Lamp F54/T5/HO	234	16	2,890
Warehouse	Four Lamp F32/T8/HO	144	36	3,536
Warehouse	Four Lamp F32/T8 High Bay	148	20	2,983
Warehouse	Two Lamp F32/T8/LP	55	55	3,342
Warehouse	Two Lamp F32/T8/HO	74	72	2,789
Warehouse	One Lamp F32/T8	30	5	4,500
Warehouse	Three Lamp F32/T8/LP	73	12	5,263
Warehouse	Two Lamp F32/Super T8	50	1	6,240
Cafeteria	Three Lamp F32/T8/LP	67	6	2,200
1st Floor	Three Lamp F32/T8/LP	67	14	1,619
1st Floor	Two Lamp F32/T8/LP	55	2	5,414
1st Floor	Three Lamp F32/T8	81.6	30	2,200
2nd Floor	26 Watt CFL	28	68	1,725
2nd Floor	Three Lamp F17/T8	53	16	2,000
2nd Floor	Three Lamp F32/T8/LP	67	56	2,231
2nd Floor	Three Lamp F32/T8/LP	73	10	5,086
2nd Floor	Three Lamp F14/T5/HO	60	9	3,920
2nd Floor	Two Lamp F17/T8	38	2	4,433
2nd Floor	Two Lamp F40/Biax	60	6	2,271
2nd Floor	Three Lamp F17/T8/LP	39	102	2,054
2nd Floor	Four Lamp F17/T8	62	8	3,500
2nd Floor	13 Watt CFL	15	5	3,500
Throughout	1 Watt LED Exit Sign	1	14	5,414
	Total	67,965	786	N/A

Table 33: Installed Lighting System

Evaluation Methodology

Tracking Estimates

The tracking estimates of energy use were calculated based on the difference in the wattage between the existing and proposed fixtures. The tracking savings assumed an average of 3,617 hours of operation per year for all of the affected fixtures. Savings from occupancy sensors were calculated based on a weighted average in reduction of annual operating hours equal to 1,331 hours per year for the fixtures with occupancy sensors installed.

Evaluation Approach

The evaluation included a verification of installed fixtures, on-site monitoring and interview. All fixtures are controlled by wall switches, occupancy sensors and circuit breakers. All of the private offices had occupancy sensors installed as well as the cafeteria and half of the warehouse T5 lighting.

The base case used in the evaluation of the lighting savings was developed from information contained in the customer application. The pre-existing fixture types were confirmed while on-site with the facility contact. Evaluators visited the facility to verify the installed fixtures and install monitoring equipment to quantify the hours of use of the different spaces. Evaluators surveyed facility personnel to obtain information on the lighting usage throughout the year. They also inquired about any HVAC equipment serving the space.

To determine the hours of use for the new fixtures, field evaluators installed (11) time-of-use (TOU) lighting loggers throughout the building. In addition, evaluators installed two power loggers in the warehouse lighting panels to record the operation of all the warehouse lighting. Three lighting loggers were installed in private offices, two were installed in open offices and one logger was installed in several other types of spaces such as a restroom, cafeteria and graphics department. Table 34 presents the fixtures monitored by the evaluation engineers.

Logger #	Equipment Monitored	Parameter Measured	Test Equip. Make & Model	Measurement Type	Installation Method	Frequency of Observations	Monitoring Duration
940629-268	Restroom 3F32/T8	On/Off Operation	PS&T TOU Lighting Logger	Event Logger	Proximity	Based on Schedule	4/2/09 - 4/28/09
940824-013	Open Office 3F32/T8	On/Off Operation	PS&T TOU Lighting Logger	Event Logger	Proximity	Based on Schedule	4/2/09 - 4/28/09
T040303245	Private Office 3F32/T8	On/Off Operation	PS&T TOU Lighting Logger	Event Logger	Proximity	Based on Schedule	4/2/09 - 4/28/09
T040303327	Private Office 2F17/T8	On/Off Operation	PS&T TOU Lighting Logger	Event Logger	Proximity	Based on Schedule	4/2/09 - 4/28/09
T040303333	Private Office 2F17/T8	On/Off Operation	PS&T TOU Lighting Logger	Event Logger	Proximity	Based on Schedule	4/2/09 - 4/28/09
T040303395	Open Office 3F32/T8	On/Off Operation	PS&T TOU Lighting Logger	Event Logger	Proximity	Based on Schedule	4/2/09 - 4/28/09
T040406309	Graphics 3LF32/T8	On/Off Operation	PS&T TOU Lighting Logger	Event Logger	Proximity	Based on Schedule	4/2/09 - 4/28/09
T040406343	Training 3F32/T8	On/Off Operation	PS&T TOU Lighting Logger	Event Logger	Proximity	Based on Schedule	4/2/09 - 4/28/09
T040406373	Hall 2F17/T8	On/Off Operation	PS&T TOU Lighting Logger	Event Logger	Proximity	Based on Schedule	4/2/09 - 4/28/09
T040406377	Conference 3F32/T8	On/Off Operation	PS&T TOU Lighting Logger	Event Logger	Proximity	Based on Schedule	4/2/09 - 4/28/09
T040406382	Cafeteria 3F32/T8	On/Off Operation	PS&T TOU Lighting Logger	Event Logger	Proximity	Based on Schedule	4/2/09 - 4/28/09
E7C19 CH1	Warehouse 1 2F32/T8	Volts, Amps, kW	Dent Instruments ElitePRO Power	Power Logger	Clamp-On CT and Voltage	15 Minute	4/2/09 - 4/28/09
E7C19 CH 3 & 4	Warehouse 1 2F54/T5 Lighting	Volts, Amps, kW	Dent Instruments ElitePRO Power	Power Logger	Clamp-On CT and Voltage	15 Minute	4/2/09 - 4/28/09
E7C25	Warehouse 2 3F54/T5	Volts, Amps, kW	Dent Instruments ElitePRO Power	Power Logger	Clamp-On CT and Voltage	15 Minute	4/2/09 - 4/28/09

Table 34: Spaces Monitored

Verification of Equipment and Operating Parameters

This project included retrofitting an entire facility to replace older inefficient lighting fixtures with new more efficient fixtures. Included in the retrofit are warehouse and office spaces. The existing fixtures included metal halide fixtures, incandescent fixtures as well as T12 and T8 fluorescent fixtures. These fixtures were replaced by various size high efficiency T8/T5 lamps and ballasts and high efficiency compact fluorescent lamps.

Also included in this project were occupancy sensors that were installed in the warehouse and all the private offices. Approximately half of the new warehouse T5 fixtures had their own integrated occupancy sensor installed. There was a total of (156) occupancy sensors installed as part of this measure. The evaluation found that savings from occupancy sensors made up approximately 11% of the total on-site estimate of energy savings, compared to 14% assumed in the tracking analysis.

Evaluators found that the quantities and fixture types closely matched those that were proposed in the tracking savings estimate. There were some minor discrepancies found which led to a decrease in savings of approximately 1%. In the event where additional fixtures were found during the on-site visit, evaluators adjusted the baseline quantity to reflect this change. This resulted in an increase in savings. Likewise, if fewer fixtures were found in a space, the baseline quantity was also adjusted, which led to a reduction in savings. In the case where there is a one-to-one replacement, the baseline quantity is adjusted using the quantity found during the site inspection. When the quantity discrepancy occurred in a space that wasn't a one-to-one replacement, evaluators adjusted the baseline using the same ratio of existing to installed fixtures as the tracking system. Table 35 presents the comparison between the tracking and evaluation fixture counts.

Although there were more fixtures found during the on-site visit, the savings decreased slightly because there were missing fixtures in the warehouse. For example, evaluators found four fewer four lamp F54/T5 fixtures and three fewer four lamp F32/T8 high output fixtures in the warehouse. These missing fixtures had greater influence on the total savings due to their higher wattage and operating hours than the additional three lamp F32/T8 fixtures found in the office areas.

Fixture Type	Fixture Quantity	
	Tracking	Evaluation
13 Watt CFL	5	5
26 Watt CFL	68	68
1 Watt LED Exit Sign	14	14
One Lamp F32/T8	5	5
Two Lamp F17/T8	120	120
Two Lamp F32/T8/LP	57	53
Two Lamp F32/T8/HO	72	72
Two Lamp F32/Super T8	1	1
Two Lamp F54/T5/HO	134	134
Three Lamp F14/T5/HO	15	13
Three Lamp F32/T8/LP	108	126
Three Lamp F32/T8	30	32
Three Lamp F54/T5/HO	77	77
Four Lamp F17/T8	8	8
Four Lamp F32/T8/HO	36	33
Four Lamp F32/T8 High Bay	20	20
Four Lamp F54/T5/HO	16	12
Total	**786**	**793**

Table 35: Tracking vs. Evaluation Fixture Quantities

Evaluators found all of the occupancy sensors that were to be installed. These were identified in all the private offices, cafeteria and warehouse. Occupancy sensors that were installed in the warehouses were identified by visually inspecting each fixture. Evaluators counted all of the warehouse fixtures with occupancy sensors and those without.

Evaluators interviewed facility personnel to determine the general occupancy schedule for the entire year. This facility is separated by office and warehouse. The office areas typically operate Monday through Friday between 7 am and 6 pm. The warehouse typically operates continuously beginning on Monday at 6 am through Friday at 6 pm. The facility observes seven holidays including New Year's Day, Memorial Day, Independence Day, Labor Day, Thanksgiving (Thursday and Friday) and Christmas Day. During holidays, the facility is closed and remains unoccupied. The monitoring period did not include any site holidays. Evaluators assumed no operation of the lighting during all of the holidays.

Table 36 presents the values obtained from the monitored data including annual operation, summer and winter diversity factors, and on-peak hours of use.

Schedule 12 represents the baseline operation of the first floor private offices. As stated above, each of the private offices had and occupancy sensor installed. Evaluators were unable to monitor a private office with no occupancy sensor to use as the baseline hours because every private office had an occupancy sensor. To estimate the baseline hours of use for these fixtures, evaluators assumed that the lights in this first floor office (Schedule 3) would operate during the same hours that were monitored, but they would operate 90% of the time between these hours.

Schedule 13 represents the average second floor private office schedule. Evaluators monitored two similar second floor private offices (Schedules 4 and 5) with occupancy sensors. Schedule 13 was created by taking the average of Schedules 4 and 5. This schedule was applied to the installed case for all the second floor private offices. Schedule 14 was created to represent the baseline hours of use for the second floor private offices using the same method described above to create Schedule 12. The reason the first floor and second floor offices were split up was because the first floor offices are used by the sales staff and the second floor offices are used by the administrative staff. The first floor offices operate less frequently than the second floor offices, which operate on a more typical office schedule.

Schedule 15 was created to represent the baseline schedule for the cafeteria. This space also had an occupancy sensor installed and was monitored (Schedule 11) during the site visit. Schedule 15 was developed in the same manner as Schedules 12 and 14 above, however, evaluators assumed the cafeteria lights would have been on 100% of the time between the hours when the monitoring data showed operation. This is because this is a common space that is used frequently throughout the day.

Schedule 16 was developed to represent the 8,760 hour operation of the LED exit signs. Evaluators created this schedule by assuming the exit signs would be on for each hour of the year.

Schedules 17 through 19 were created using monitored data from the power logger (E7C19) installed in the lighting panel for Warehouse 1. Evaluators used three separate channels from this logger to estimate the annual operation of all the Warehouse 1 T8 and T5 lighting, including those T5 fixtures that had occupancy sensors. Channel 1 of this logger included (27) two lamp F32/T8 fixtures. None of these fixtures had occupancy sensors installed on them. Therefore, the monitored power taken in 15 minute intervals represents the full load of all (27) fixtures. Therefore, evaluators divided the interval kW data by the maximum recorded power to determine the percent operation of the Warehouse 1 T8 fixtures. The data were then annualized in the same manner as typical lighting logger data and presented as Schedule 17.

Channel 3 of this power logger (E7C19) included (7) two lamp F54/T5 fixtures, none of which had occupancy sensors. Schedule 18 was developed from this data to represent the baseline operation of the T5 lighting in Warehouse 1. This operating schedule was created using the same method described above to create Schedule 17.

Channel 4 of this power logger (E7C19) included (13) two lamp F54/T5 fixtures. Five of these fixtures were found to be on occupancy sensors and the remaining was not. Evaluators generated Schedule 19 to represent the occupancy sensor operation of the T5 fixtures that had sensors installed. To do this, evaluators subtracted the full load kW of (8) two lamp F54/T5 fixtures so that the remaining kW represented only those fixtures with occupancy sensors. From there, the adjusted interval data were divided by the full load kW of (5) two lamp F54/T5 fixtures to estimate the percent operation of the fixtures with occupancy sensors. This schedule was then used as the installed case for the (68) two lamp F54/T5 fixtures as well as the (12) four lamp F54/T5 fixtures that had occupancy sensors in Warehouse 1.

Schedules 20 and 21 were created using monitored data from the power logger (E7C25) installed in the lighting panel for Warehouse 2. Evaluators used four separate channels from this logger and aggregated them to estimate the baseline and installed operation of the three lamp F54/T5 fixtures in Warehouse 2. Each channel monitored a circuit that contained (11) three lamp F54/T5 fixtures. Channel 1 had (4) fixtures with occupancy sensors and (7) without, while Channels 2 through 4 each had (6) fixtures with occupancy sensors and (5) without.

The baseline schedule (Schedule 20) was created by subtracting the full load kW, for the appropriate number of fixtures that did not have an occupancy sensor, from each channel's monitored kW. Evaluators then averaged each of the four channels into one schedule, which was assumed to be the baseline schedule for all of the three lamp F54/T5 fixtures in Warehouse 2.

Schedule 21 was created by assuming the remaining kW from each monitored channel represented the occupancy sensor operation of the fixtures with sensors. This remaining kW was divided by the full load kW, for the appropriate number of fixtures that had an occupancy sensor. This schedule was then applied to the installed case for the (39) three lamp F54/T5 fixtures that had occupancy sensors in Warehouse 2.

Schedule ID	Logger #	Description	Annual Hours	Summer Diversity	Winter Diversity	On-Peak Hours
1	940629-268	1st Flr Mens/Womens Rm	1,112	18%	12%	815
2	940824-013	1st Flr Back Open Office	3,074	91%	57%	2,940
3	T040303245	1st Flr Private Office	545	25%	2%	539
4	T040303327	2nd Flr Office	1,026	44%	12%	1,015
5	T040303333	2nd Flr Private Office	1,172	51%	25%	1,004
6	T040303395	1st Flr Open Area	3,057	97%	28%	2,908
7	T040406309	Graphics Dept	3,344	97%	76%	3,140
8	T040406343	2nd Flr Presentation Rm	759	12%	8%	680
9	T040406373	2nd Flr Hall	3,570	95%	91%	3,321
10	T040406377	2nd Flr Conference Rm	745	21%	5%	719
11	T040406382	1st Flr Cafeteria	4,502	94%	83%	3,405
12	NA	1st Flr Private Office (Base)	1,466	58%	2%	1,451
13	NA	Average 2nd Fl Private Office	1,099	48%	19%	1,010
14	NA	2nd Flr Private Office (Base)	2,417	87%	36%	2,188
15	NA	Cafeteria (Base)	5,531	100%	96%	3,852
16	NA	Exit Signs	8,760	100%	100%	4,032
17	E7C19 CH1	Warehouse 1 T8 Lighting	5,481	99%	95%	3,764
18	E7C19 CH 3	Warehouse 1 T5 Lighting (Base)	5,481	99%	95%	3,764
19	E7C19 CH 4	Warehouse 1 T5 Lighting (OS)	4,792	86%	80%	3,368
20	E7C25	Warehouse 2 T5 Lighting (Base)	5,422	98%	92%	3,731
21	E7C25	Warehouse 2 T5 Lighting (OS)	2,747	48%	55%	1,932

Table 36: Annual Hours of Use and Diversity Factors of Monitored Data

To estimate annual energy and demand savings, a spreadsheet method was employed. The summary of this spreadsheet is presented in Table 37. Annual hours and diversity factors from Table 36 are used with wattages from Table 37 to calculate energy and demand savings. The schedule ID's from Table 36 are presented in Table 37 to show which schedule was used with each fixture ID. The final on-site savings estimates are presented in Table 37.

The facility's heat is provided by natural gas which has no electrical interaction with the new lighting. However, because of the reduced heat going into the space due to the installation of more efficient lighting, there will be a need for additional heat from the facility's forced air system. It was estimated that this heating penalty is equal to approximately 378 MMBTU's per year. This was calculated using a heating efficiency of 74% for a forced air system. This estimate for efficiency is an assumption based on a standard efficiency for a forced air system. Note that the office is heated to maintain comfortable space temperatures for the employees while the warehouse is heated only to prevent the product from freezing. Evaluators calculated the heating penalty for the offices by assuming that the heat would run between 6 am and 6 pm at temperatures below 55˚F. The warehouse heating calculations were done at all hours when the outdoor air temperature is at or below 40˚F, to prevent the formation of ice inside the beverages.

Likewise, the offices are air-conditioned using several rooftop packaged DX units. Evaluators calculated additional energy savings resulting from reduced cooling loads on the system. Evaluators assumed an efficiency rating of 1.2 kW/ton for the packaged DX units. Though the warehouse is not air-conditioned, there were some fixtures installed in the walk-in coolers. Therefore, evaluators calculated additional energy savings across the entire year resulting from the reduced cooling loads on the refrigeration system. Evaluators assumed an efficiency rating of 2.0 kW/ton for the refrigeration system. The efficiencies used are assumed to be the standard efficiencies for these types of air-conditioning and refrigeration systems.

The average daily lighting profiles for all the monitored spaces are presented in Figure 28 through Figure 48. This includes the average weekday, weekend day and holiday. The x-axis represents one full day and the y-axis is the percentage that the lights are on for each hour.

An hourly summary of the site kW savings for an average summer (June through August), non-holiday, weekday is presented in Table 38. This summary is provided so that the summer diversified peak kW can be estimated across any range of hours in the event that the FCM definition for summer peak changes in the future. The same summary was also provided for the average winter (December and January), non-holiday, weekday in Table 39.

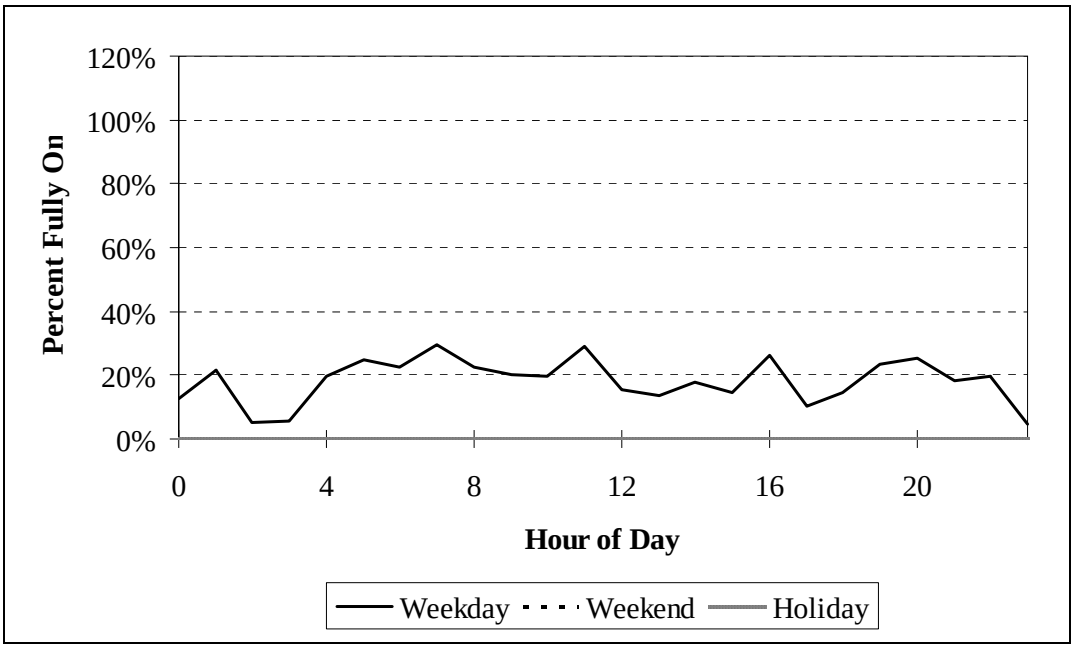

Figure 28: Average Daily Lighting Profile for Schedule 1 (Restroom) from 4/2/09 to 4/28/09

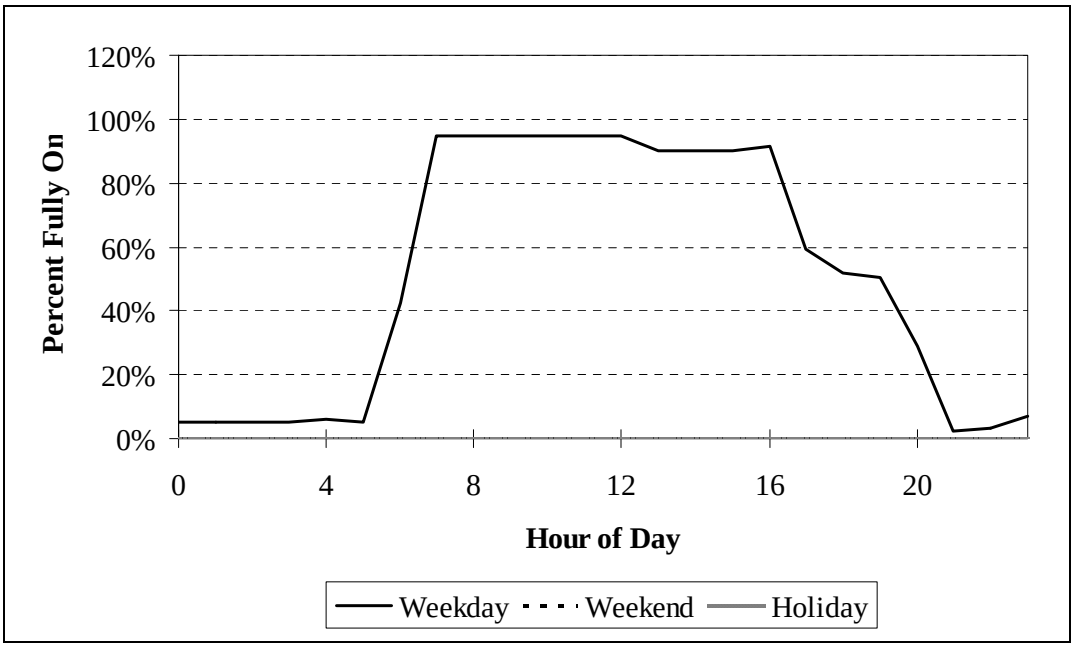

Figure 29: Average Daily Profile for Schedule 2 (Open Office) from 4/2/09 to 4/28/09

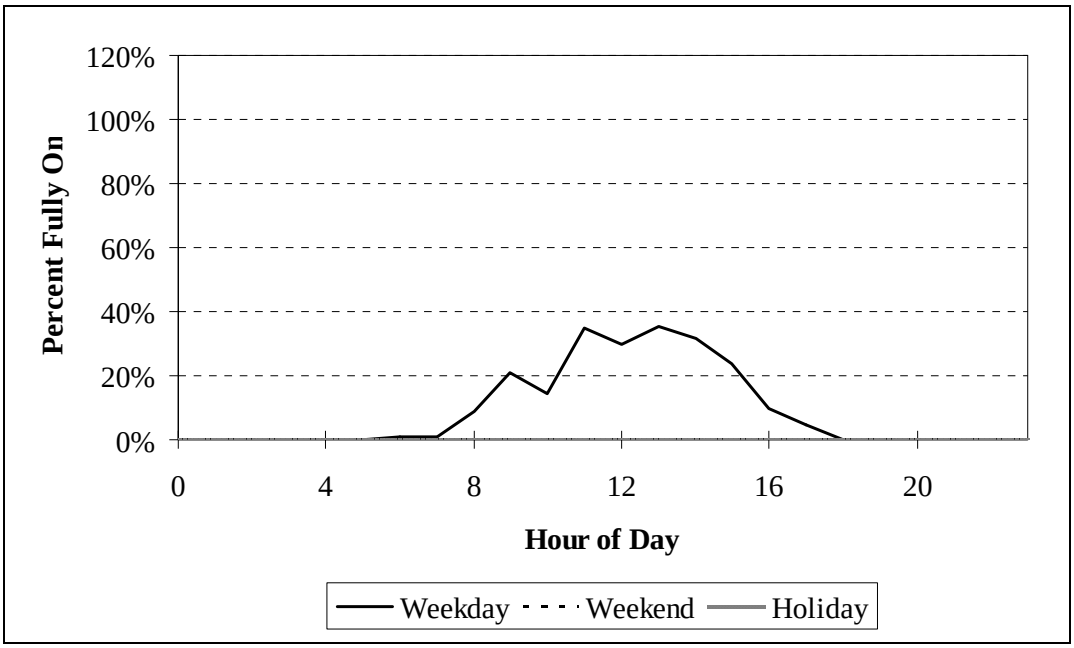

Figure 30: Average Daily Lighting Profile for Schedule 3 (1st Floor Private Office w/OS) from 4/2/09 to 4/28/09

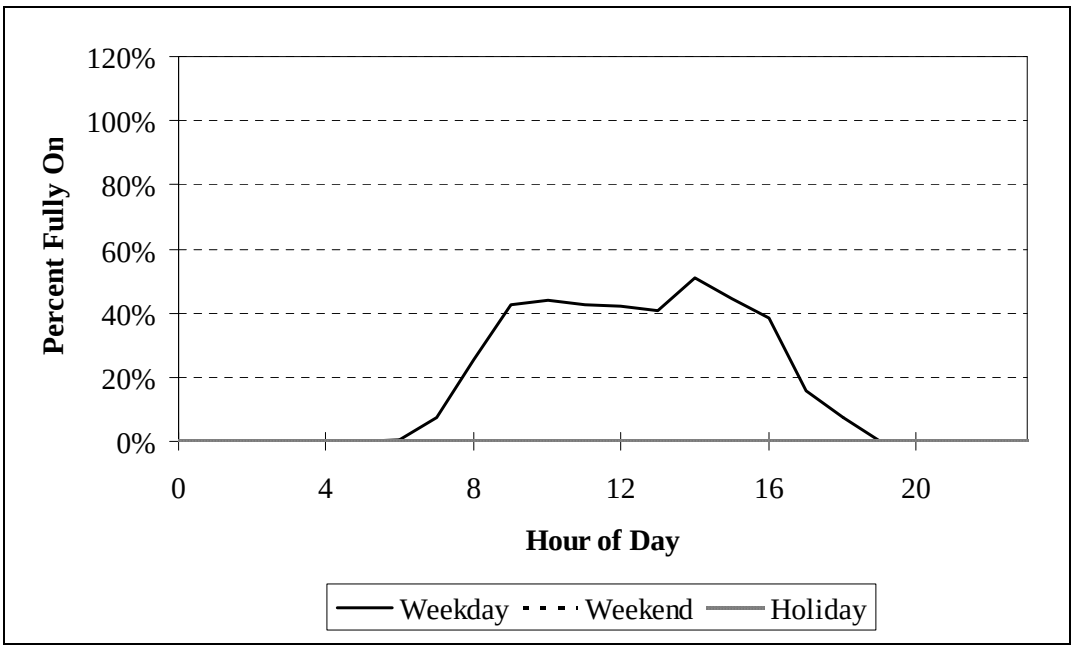

Figure 31: Average Daily Lighting Profile for Schedule 4 (2nd Floor Private Office w/OS) from 4/2/09 to 4/28/09

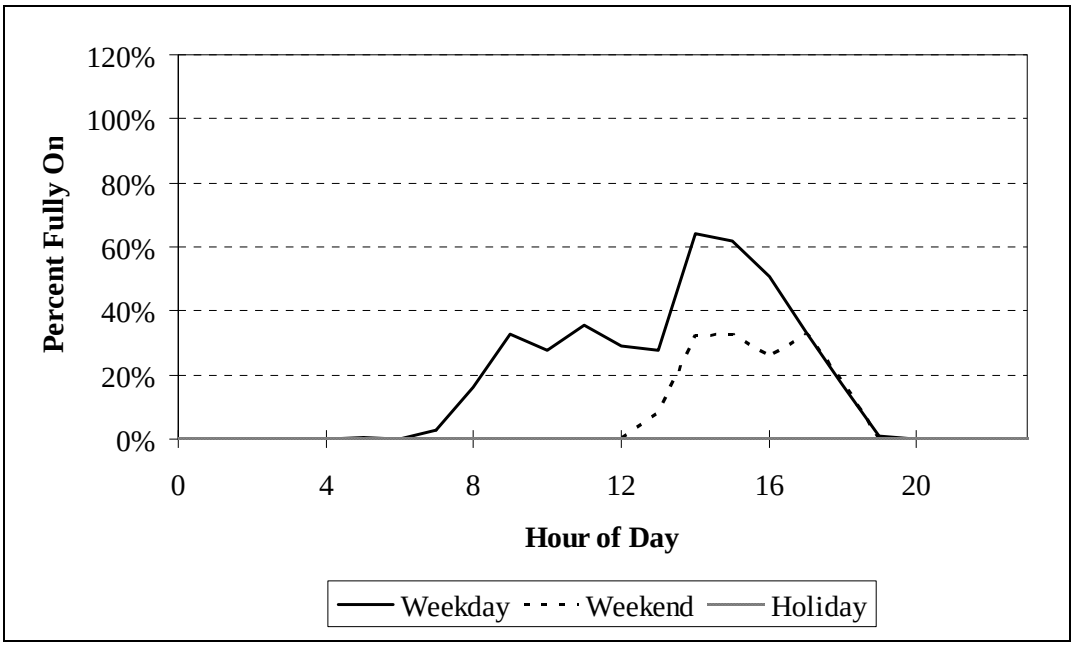

Figure 32: Average Daily Lighting Profile for Schedule 5 (2nd Floor Private Office w/OS) from 4/2/09 to 4/28/09

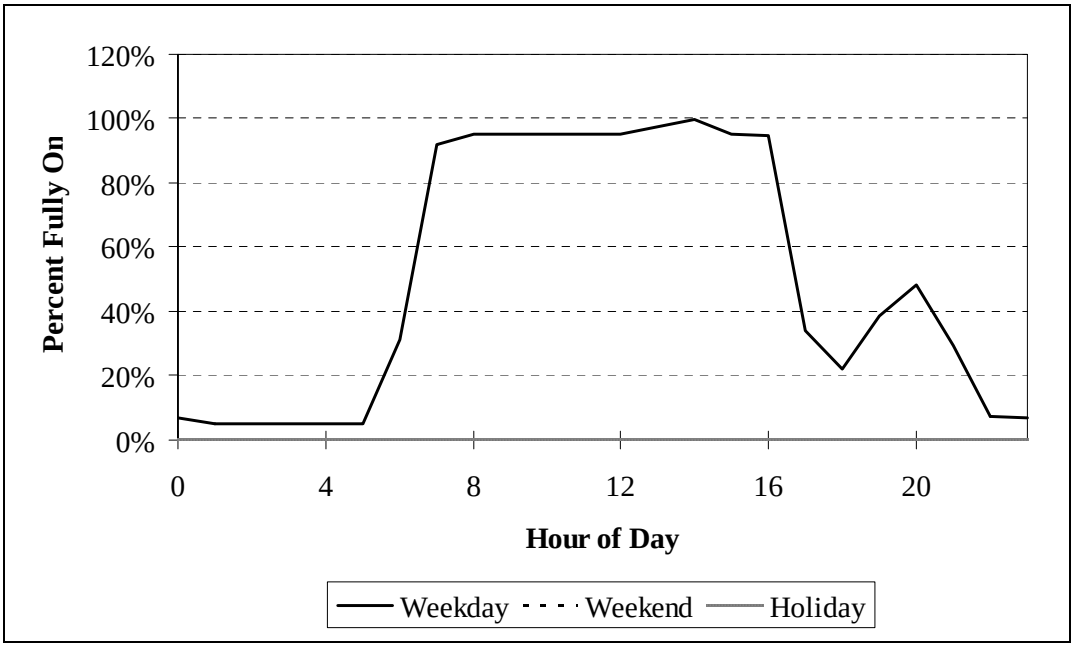

Figure 33: Average Daily Lighting Profile for Schedule 6 (Open Office) from 4/2/09 to 4/28/09

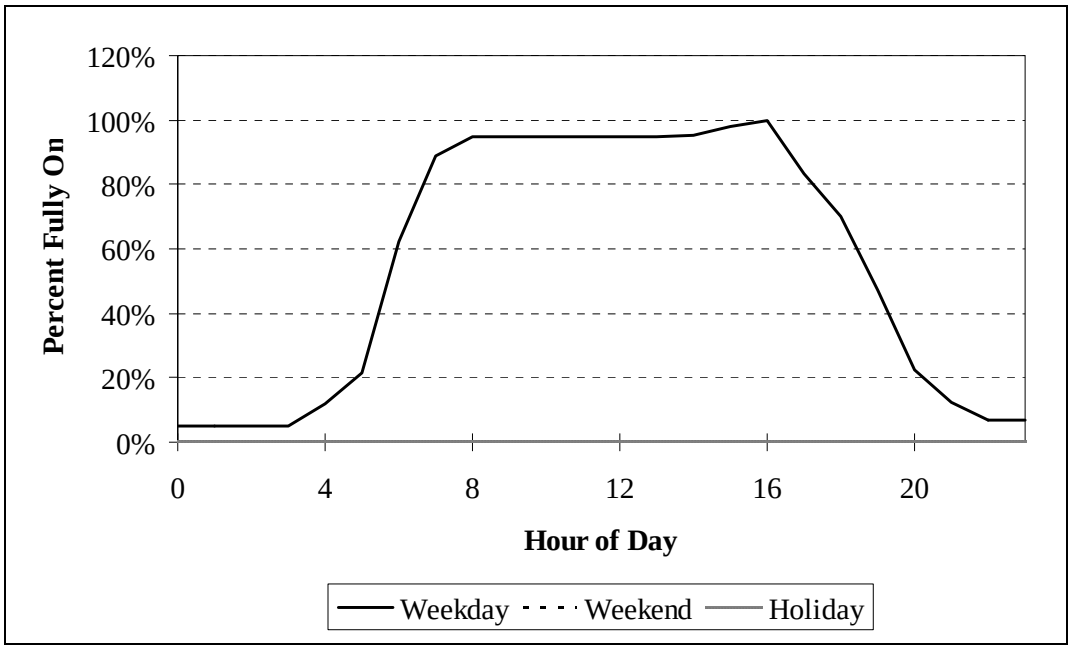

Figure 34: Average Daily Lighting Profile for Schedule 7 (Graphics Dept.) from 4/2/09 to 4/28/09

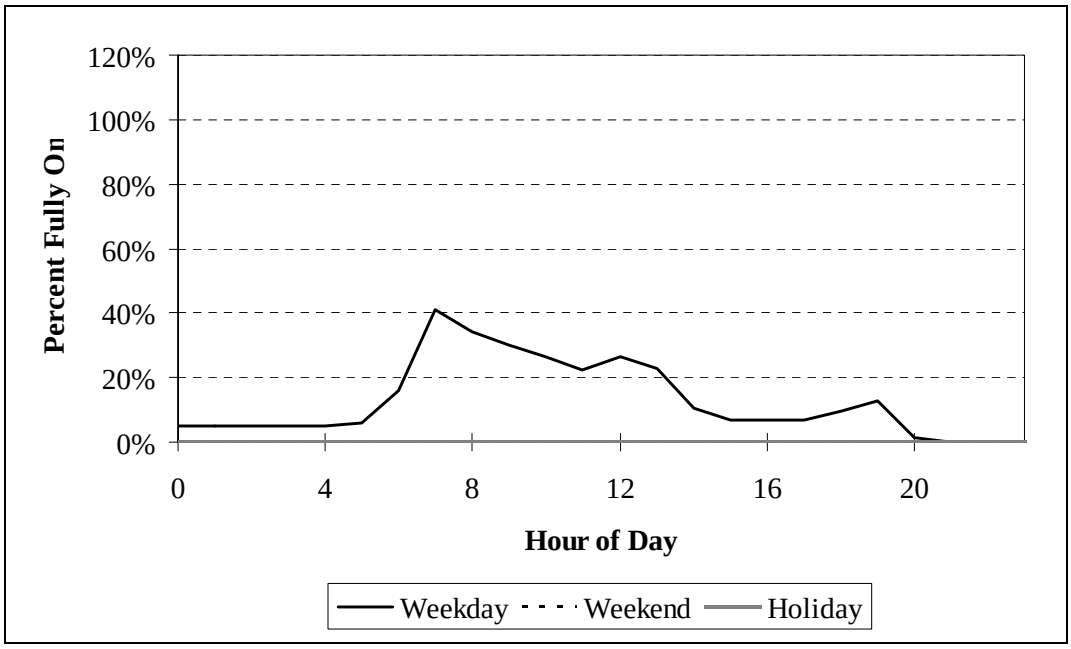

Figure 35: Average Daily Lighting Profile for Schedule 8 (Presentation Room) from 4/2/09 to 4/28/09

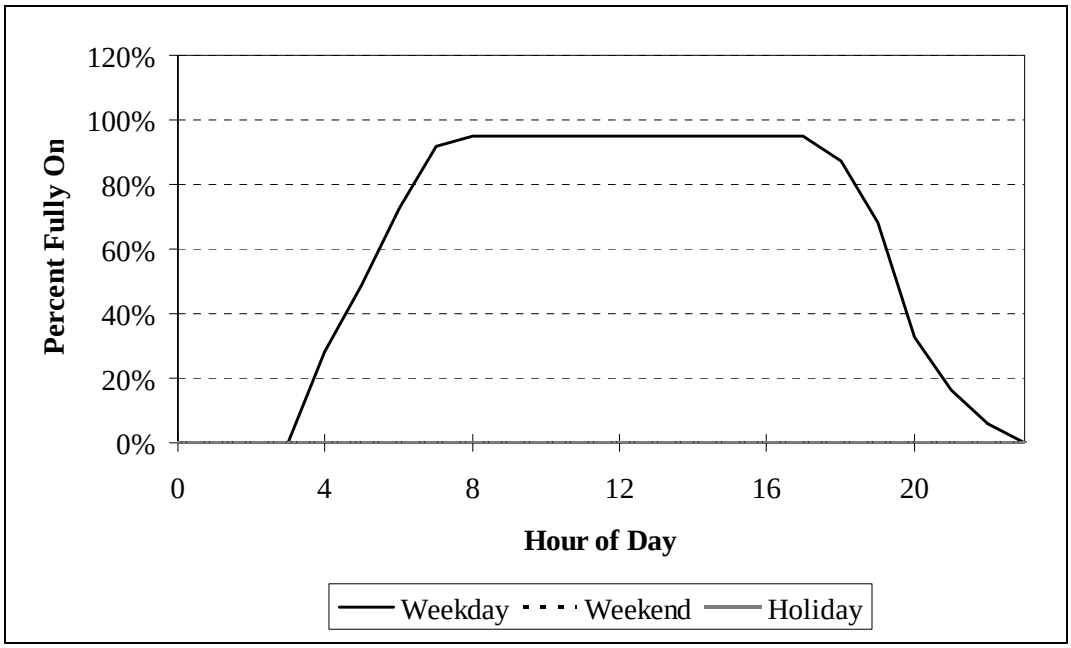

Figure 36: Average Daily Lighting Profile for Schedule 9 (Corridor) from 4/2/09 to 4/28/09

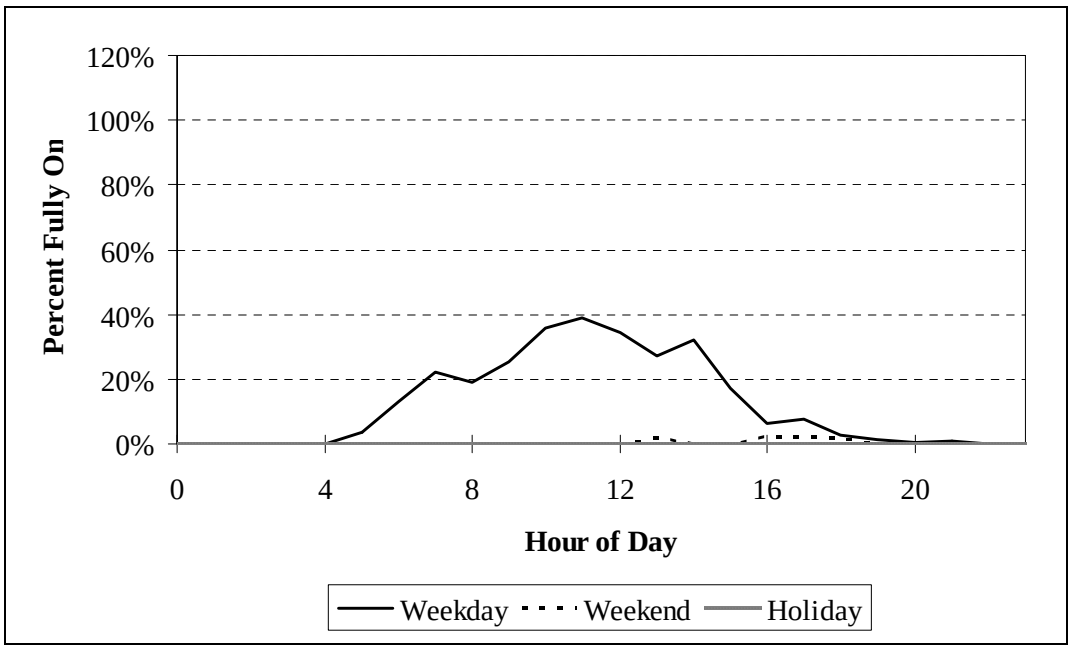

Figure 37: Average Daily Lighting Profile for Schedule 10 (Conference Room) from 4/2/09 to 4/28/09

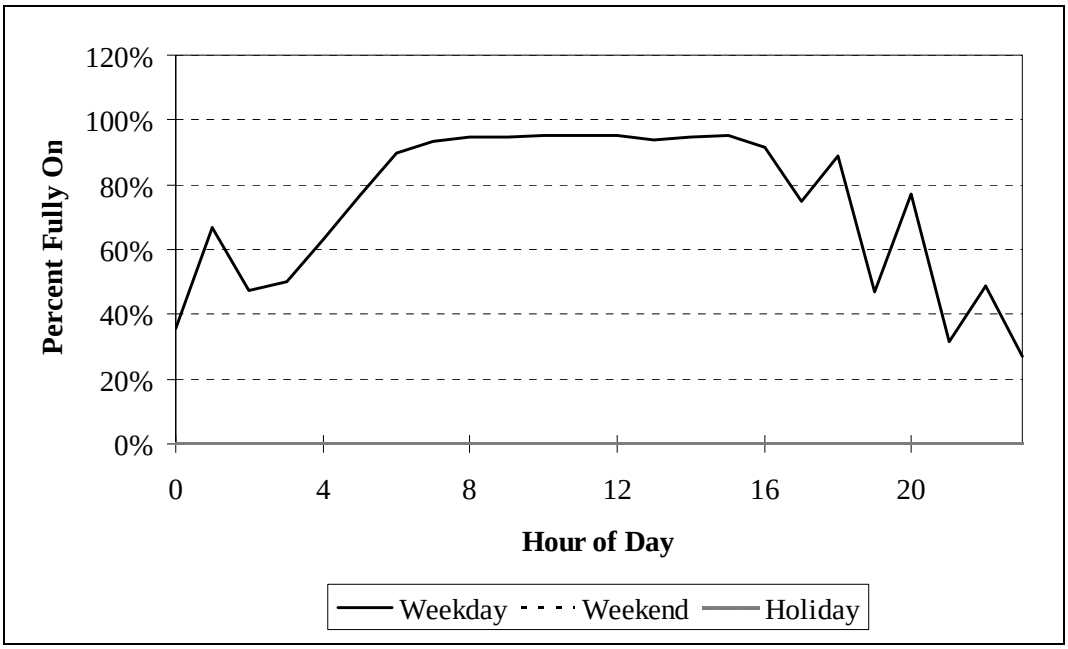

Figure 38: Average Daily Lighting Profile for Schedule 11 (Cafeteria w/ OS) from 4/2/09 to 4/28/09

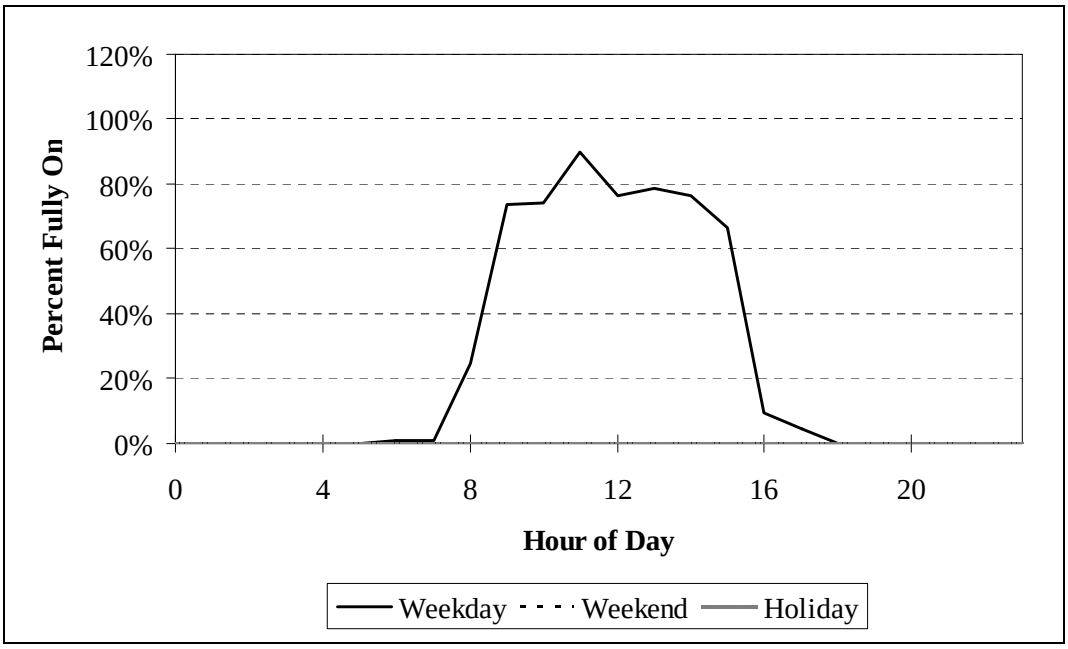

Figure 39: Average Daily Lighting Profile for Schedule 12 (1st Floor Private Office Baseline) from 4/2/09 to 4/28/09

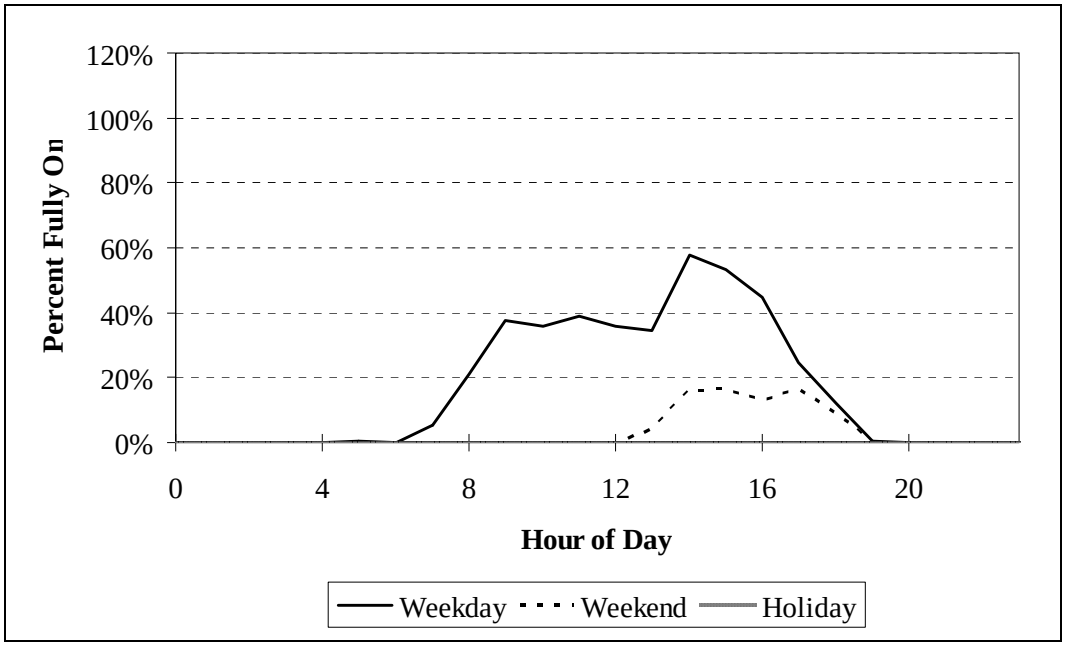

Figure 40: Average Daily Lighting Profile for Schedule 13 (Avg. 2nd Floor Private Office w/OS) from 4/2/09 to 4/28/09

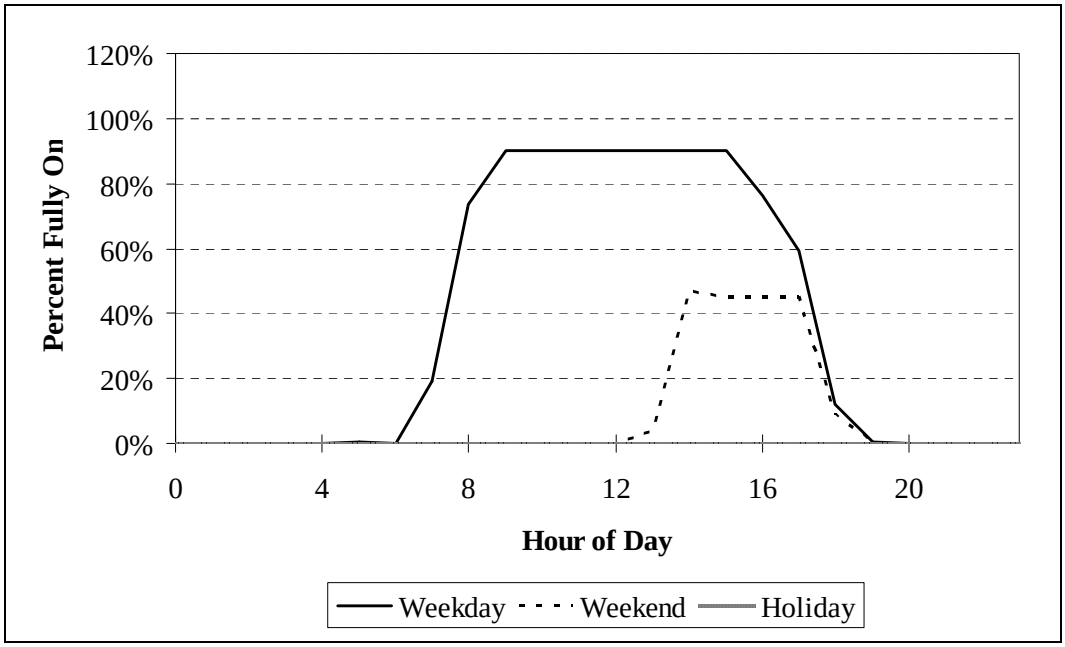

Figure 41: Average Daily Lighting Profile for Schedule 14 (Avg. 2nd Floor Private Office Baseline) from 4/2/09 to 4/28/09

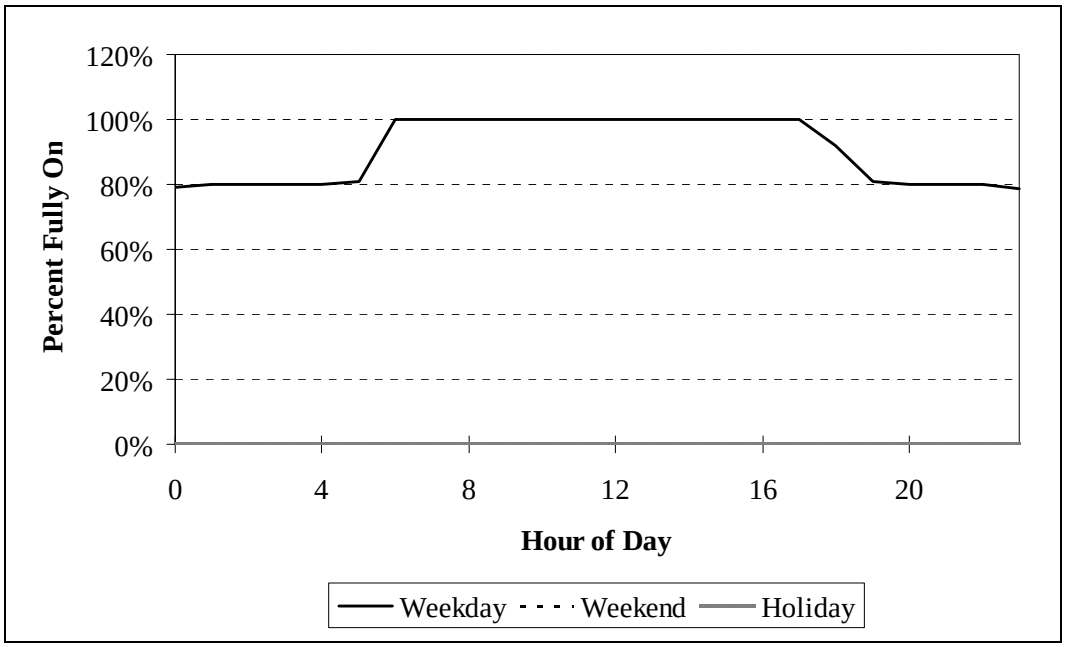

Figure 42: Average Daily Lighting Profile for Schedule 15 (Cafeteria Baseline) from 4/2/09 to 4/28/09

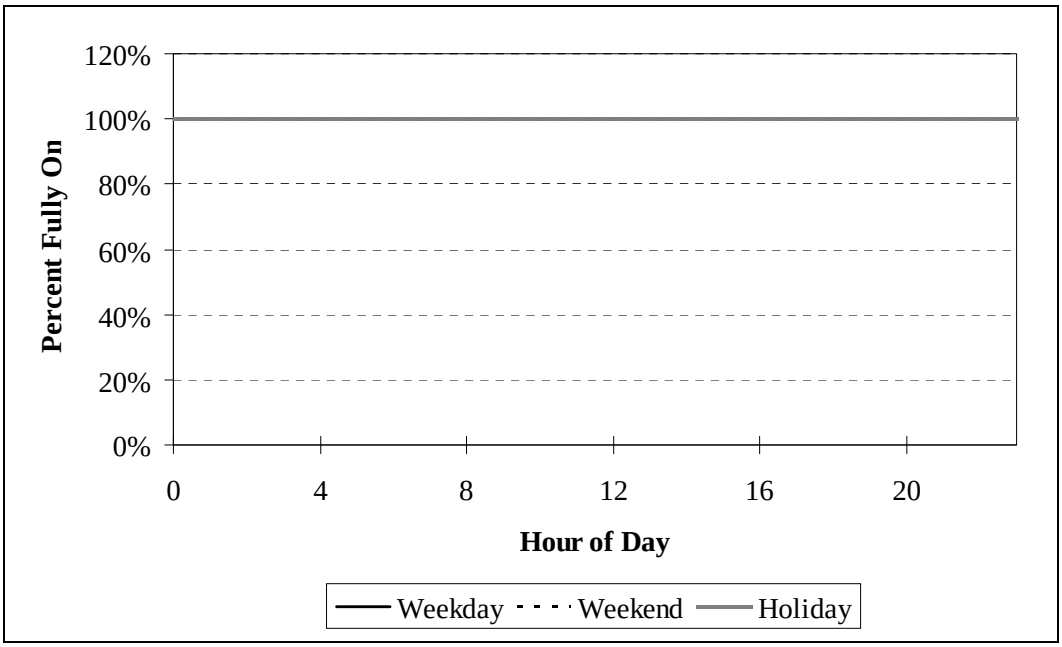

Figure 43: Average Daily Lighting Profile for Schedule 16 (Exit Signs)

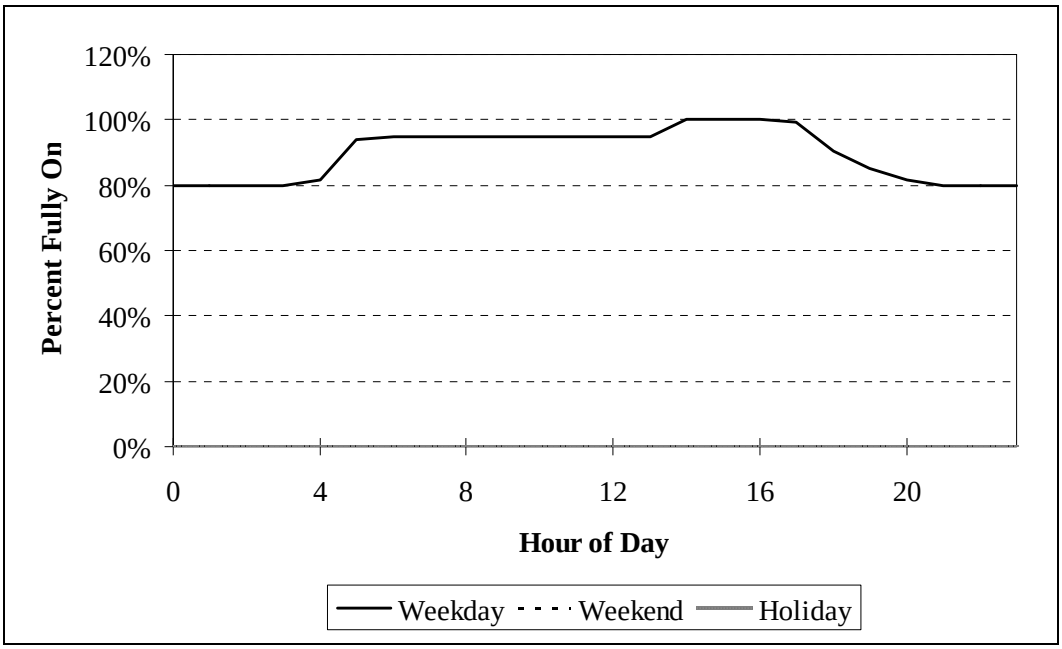

Figure 44: Average Daily Lighting Profile for Schedule 17 (Warehouse 1 T8 Lighting) from 4/2/09 to 4/28/09

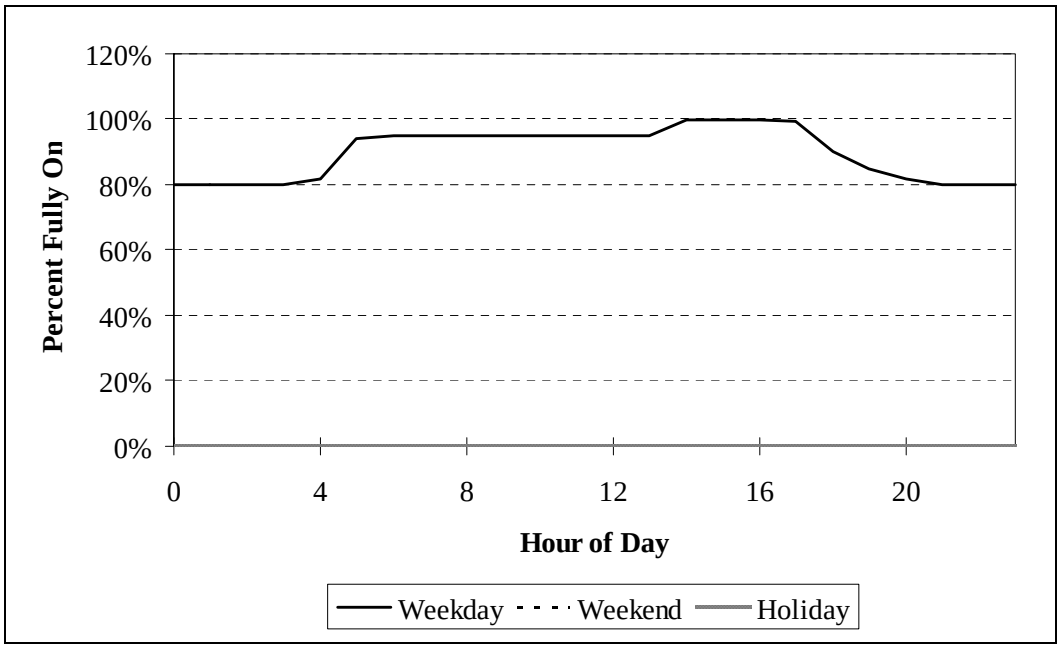

Figure 45: Average Daily Lighting Profile for Schedule 18 (Warehouse 1 T5 Lighting) from 4/2/09 to 4/28/09

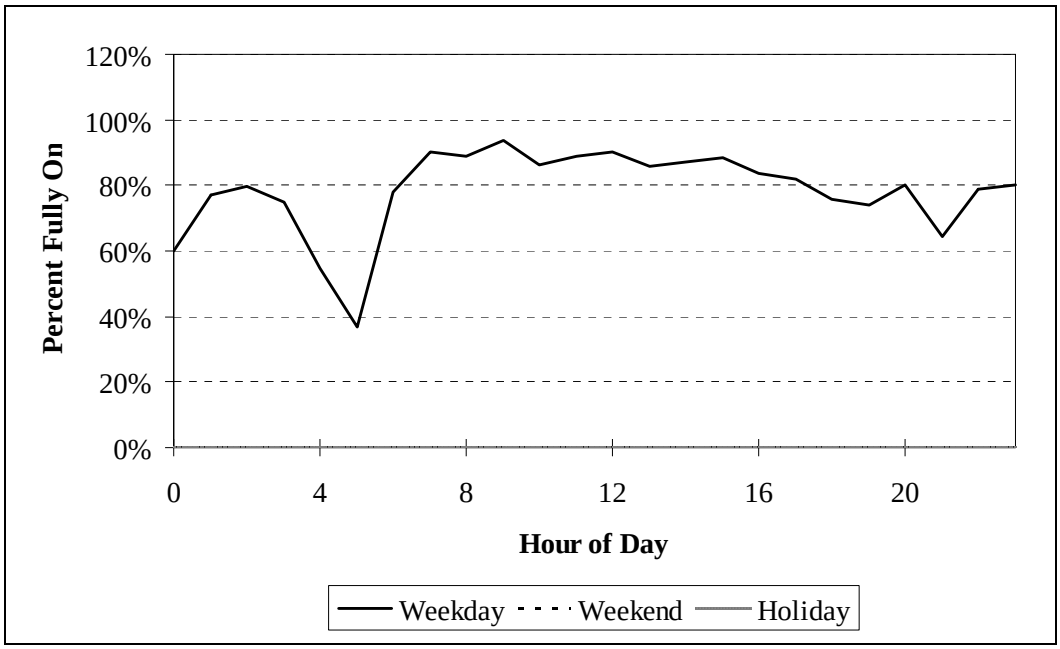

Figure 46: Average Daily Lighting Profile for Schedule 19 (Warehouse 1 T5 Lighting w/OS) from 4/2/09 to 4/28/09

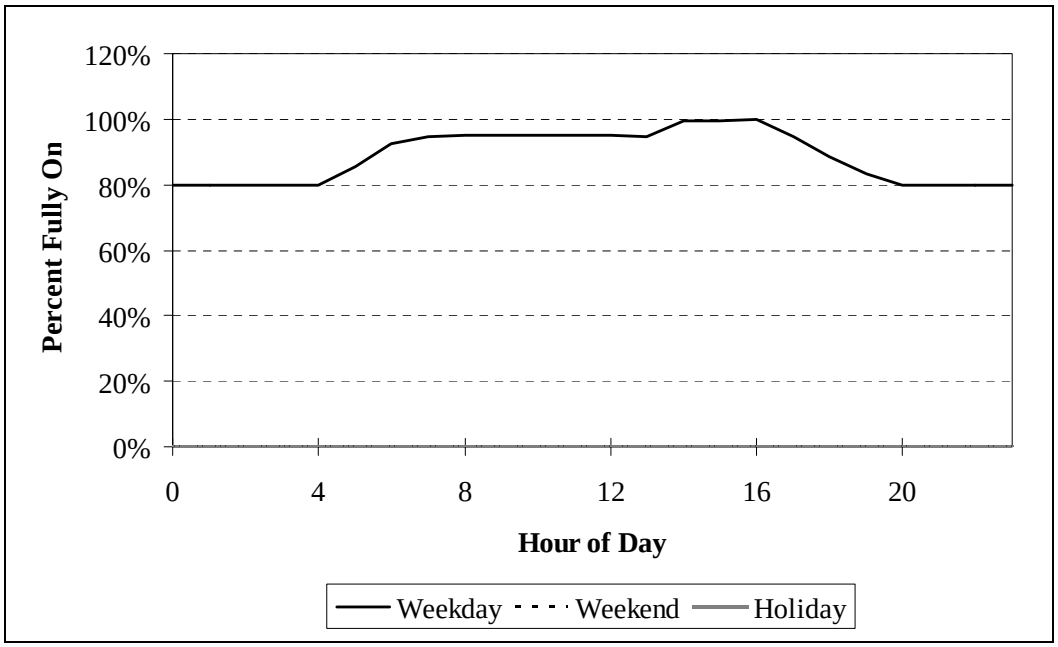

Figure 47: Average Daily Lighting Profile for Schedule 20 (Warehouse 2 T5 Lighting) from 4/2/09 to 4/28/09

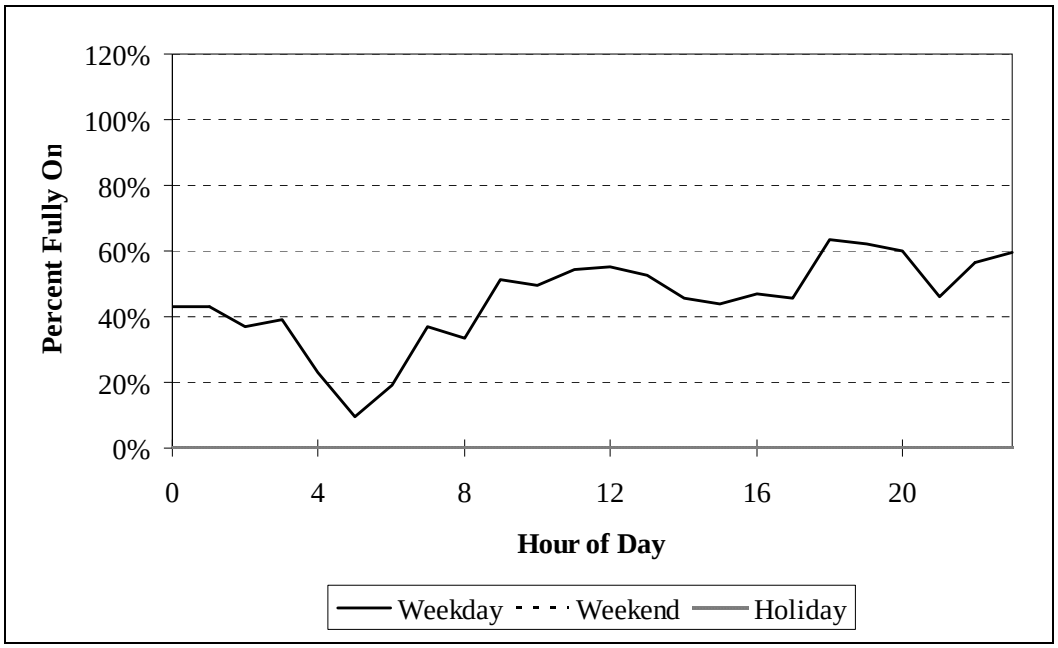

Figure 48: Average Daily Lighting Profile for Schedule 21 (Warehouse 2 T5 Lighting w/OS) from 4/2/09 to 4/28/09

Facility Type: Distribution Office/Warehouse
Application ID: 525336

Fixture Information

		Pre-retrofit Lighting							Post-retrofit Lighting						HVAC				Schedule ID from Table 6	
Fixture ID	(a) Space Type	(b) Fixture Type	(c) Fixture Quantity	(d) Fixture Wattage	(e) Hours of Use Annual	(f) Hours of Use Peak	(g) FCM Diversity Factor Summer	(h) FCM Diversity Factor Winter	(i) Fixture Type	(j) Fixture Quantity	(k) Fixture Wattage	(l) Hours of Use Annual	(m) Hours of Use Peak	(n) FCM Diversity Factor Summer	(o) FCM Diversity Factor Winter	(p) COP Cooling	(q) COP Heating	(r) % Space Cooled	(s) % Space Heated	Pre Retrofit	Post Retrofit
1	Warehouse 1	175W METAL HALIDE	66	205	5,481	3,764	99%	95%	2L4' T5 HO/ELIG	66	117	5,481	3,764	99%	95%	NA	NA	0%	100%	18	18
2	Warehouse 1	175W METAL HALIDE	68	205	5,481	3,764	99%	95%	2L4' T5 HO/ELIG	68	117	4,792	3,368	86%	80%	NA	NA	0%	100%	18	19
3	Warehouse 1	400W METAL HALIDE	12	460	5,481	3,764	99%	95%	4L4' T5 HO/ELIG	12	234	4,792	3,368	86%	80%	NA	NA	0%	100%	18	19
4	Warehouse 2	250W HPS	39	295	5,422	3,731	98%	92%	3L4' T5 HO/ELIG	39	177	2,747	1,932	48%	55%	NA	NA	0%	100%	20	21
5	Warehouse 2	250W HPS	38	295	5,422	3,731	98%	92%	3L4' T5 HO/ELIG	38	177	5,422	3,731	98%	92%	NA	NA	0%	100%	20	20
6	Warehouse 1	2L4' EE/EEMAG	100	70	5,481	3,764	99%	95%	4L4' T8/ELIG HIGH LMN	25	144	5,481	3,764	99%	95%	NA	NA	0%	100%	17	17
7	Coolers	2L8' HO/EE/STD	8	227	5,481	3,764	99%	95%	4L4' T8/ELIG HIGH LMN	8	148	4,792	3,368	86%	80%	1.8	NA	100%	0%	17	19
8	Coolers	2L8' HO/EE/STD	12	227	5,481	3,764	99%	95%	4L4' T8/ELIG HIGH LMN	12	148	4,792	3,368	86%	80%	1.8	NA	100%	0%	17	19
9	Loading Bay	2L8' HO/EE/ELIG	15	170	5,481	3,764	99%	95%	3L4' T8EE/EEESUPER T8	10	67	5,481	3,764	99%	95%	NA	NA	0%	100%	17	17
10	Bottle Area	2L4' EE/EEMAG	102	70	5,481	3,764	99%	95%	2L4' T8EE/ELEE LOW PW	51	55	5,481	3,764	99%	95%	NA	NA	0%	100%	17	17
11	Bottle Area	4L4' STD/ELIG	63	140	5,481	3,764	99%	95%	2L4' T8/ELIG HIGH LMN	63	74	5,481	3,764	99%	95%	NA	NA	0%	100%	17	17
12	Shop	2L4' EE/EEMAG	24	70	5,481	3,764	99%	95%	4L4' T8/ELIG HIGH LMN	8	144	5,481	3,764	99%	95%	NA	NA	0%	100%	17	17
13	Shop	4L4' STD/ELIG	9	140	5,481	3,764	99%	95%	2L4' T8/ELIG HIGH LMN	9	74	5,481	3,764	99%	95%	NA	NA	0%	100%	17	17
14	Shop	2L4' EE/EEMAG	2	70	5,481	3,764	99%	95%	1L4' T8/ELIG	2	30	5,481	3,764	99%	95%	NA	NA	0%	100%	17	17
15	Warehouse Offices	2L4' EE/EEMAG	3	70	2,417	2,188	87%	36%	1L4' T8/ELIG	3	30	2,417	2,188	87%	36%	NA	NA	0%	100%	14	14
16	Warehouse Offices	2L4' EE/EEMAG	15	70	2,417	2,188	87%	36%	3L4' T8/ELIG LOW PWR	5	73	2,417	2,188	87%	36%	NA	NA	0%	100%	14	14
17	Men's Room	2L4' EE/EEMAG	9	70	1,112	815	18%	12%	3L4' T8/ELIG LOW PWR	3	73	1,112	815	18%	12%	NA	NA	0%	100%	1	1
18	Office	2L4' EE/EEMAG	9	70	3,074	2,940	91%	57%	3L4' T8/ELIG LOW PWR	3	73	3,074	2,940	91%	57%	NA	NA	0%	100%	2	2
19	Office	2L4' EE/EEMAG	2	70	3,074	2,940	91%	57%	2L4' T8/ELIG LOW PWR	1	50	3,074	2,940	91%	57%	NA	NA	0%	100%	2	2
20	Stock Room	2L4' EE/EEMAG	3	70	5,481	3,764	99%	95%	3L4' T8/ELIG LOW PWR	1	73	5,481	3,764	99%	95%	NA	NA	0%	100%	17	17
21	Café	4L4' STD/ELIG	6	140	5,531	3,852	100%	96%	3L4' T8EE/EEESUPER T8	6	67	4,502	3,405	94%	83%	2.9	NA	100%	100%	15	11
22	Large Office Area	4L4' STD/ELIG	10	140	3,074	2,940	91%	57%	3L4' T8EE/EEESUPER T8	10	67	3,074	2,940	91%	57%	2.9	NA	100%	100%	2	2
23	Open Office Area	4L4' STD/ELIG	32	140	3,057	2,908	97%	28%	3L4' T8/ELIG	32	81.6	3,057	2,908	97%	28%	2.9	NA	100%	100%	6	6
24	Private Office	4L4' STD/ELIG	12	140	1,466	1,451	58%	2%	3L4' T8EE/EEESUPER T8	12	67	545	539	25%	2%	2.9	NA	100%	100%	12	3
25	Private Office	2L4' EE/STD	16	80	2,417	2,188	87%	36%	2L2' T8/ELIG	16	38	1,099	1,010	48%	19%	2.9	NA	100%	100%	14	13
26	Large Office Area	3L4' EE/STD	2	125	3,074	2,940	91%	57%	2L4' T8EE/ELEE LOW PW	2	55	3,074	2,940	91%	57%	2.9	NA	100%	100%	2	2
27	Foyer	250W HPS	7	295	3,570	3,321	95%	91%	3L2' T5	7	60	3,570	3,321	95%	91%	2.9	NA	100%	100%	9	9
28	Foyer	150W INC	3	150	3,570	3,321	95%	91%	2L2' T8/ELIG	2	38	3,570	3,321	95%	91%	2.9	NA	100%	100%	9	9
29	Hall	65W INC	3	65	3,570	3,321	95%	91%	13W COMPACT HW ELIG	3	15	3,570	3,321	95%	91%	2.9	NA	100%	100%	9	9
30	Conference Rm	65W INC	2	65	745	719	21%	5%	13W COMPACT HW ELIG	2	15	745	719	21%	5%	2.9	NA	100%	100%	10	10
31	Secretary	135W INC	10	135	3,570	3,321	95%	91%	26W COMPACT HW	10	28	3,570	3,321	95%	91%	2.9	NA	100%	100%	9	9
32	Conference Rm	135W INC	2	135	745	719	21%	5%	26W COMPACT HW	2	28	745	719	21%	5%	2.9	NA	100%	100%	10	10
33	Hall	135W INC	10	135	3,570	3,321	95%	91%	26W COMPACT HW	10	28	3,570	3,321	95%	91%	2.9	NA	100%	100%	9	9
34	Conference Rm	135W INC	4	135	745	719	21%	5%	26W COMPACT HW	4	28	745	719	21%	5%	2.9	NA	100%	100%	10	10
35	Training	135W INC	2	135	759	680	12%	8%	26W COMPACT HW	2	28	759	680	12%	8%	2.9	NA	100%	100%	8	8
36	Conference Rm	135W INC	8	135	745	719	21%	5%	26W COMPACT HW	8	28	745	719	21%	5%	2.9	NA	100%	100%	10	10
37	Conference Rm	135W INC	8	135	745	719	21%	5%	26W COMPACT HW	8	28	745	719	21%	5%	2.9	NA	100%	100%	10	10
38	Training	135W INC	24	135	759	680	12%	8%	26W COMPACT HW	24	28	759	680	12%	8%	2.9	NA	100%	100%	8	8
39	Exits	40W INC	14	40	8,760	4,032	100%	100%	1.0 WATT LED	14	1	8,760	4,032	100%	100%	2.9	NA	100%	100%	16	16
40	Foyer	100W METAL HALIDE	6	130	3,570	3,321	95%	91%	3L2' T5	6	60	3,570	3,321	95%	91%	2.9	NA	100%	100%	9	9
41	Private Office	3L4' T8/ELIG	12	90	2,417	2,188	87%	36%	3L4' T8EE/EEESUPER T8	12	67	1,099	1,010	48%	19%	2.9	NA	100%	100%	14	13
42	Conference Rm	3L4' T8/ELIG	3	90	745	719	21%	5%	3L4' T8EE/EEESUPER T8	3	67	745	719	21%	5%	2.9	NA	100%	100%	10	10
43	File Area	3L4' T8/ELIG	2	90	3,570	3,321	95%	91%	3L4' T8EE/EEESUPER T8	2	67	3,570	3,321	95%	91%	2.9	NA	100%	100%	9	9
44	Hall	3L4' T8/ELIG	9	90	3,570	3,321	95%	91%	3L4' T8EE/EEESUPER T8	9	67	3,570	3,321	95%	91%	2.9	NA	100%	100%	9	9
45	Copy Room	3L4' T8/ELIG	3	90	3,570	3,321	95%	91%	3L4' T8EE/EEESUPER T8	3	67	3,570	3,321	95%	91%	2.9	NA	100%	100%	9	9
46	Kitchen	3L4' T8/ELIG	1	90	3,570	3,321	95%	91%	3L4' T8EE/EEESUPER T8	1	67	3,570	3,321	95%	91%	2.9	NA	100%	100%	9	9
47	Training	3L4' T8/ELIG	26	90	759	680	12%	8%	3L4' T8EE/EEESUPER T8	26	67	759	680	12%	8%	2.9	NA	100%	100%	8	8
48	Private Office	2L4' T8/ELIG	64	60	2,417	2,188	87%	36%	2L2' T8/ELIG	64	38	1,099	1,010	48%	19%	2.9	NA	100%	100%	14	13
49	Secretary	2L4' T8/ELIG	4	60	3,570	3,321	95%	91%	2L2' T8/ELIG	4	38	3,570	3,321	95%	91%	2.9	NA	100%	100%	9	9
50	Training	2L4' T8/ELIG	16	60	759	680	12%	8%	2L2' T8/ELIG	16	38	759	680	12%	8%	2.9	NA	100%	100%	8	8
51	Hall	2L4' T8/ELIG	18	60	3,570	3,321	95%	91%	2L2' T8/ELIG	18	38	3,570	3,321	95%	91%	2.9	NA	100%	100%	9	9
52	Hall	2L2' T8/ELIG	16	48	3,570	3,321	95%	91%	4L2' T8/ELIG	8	62	3,570	3,321	95%	91%	2.9	NA	100%	100%	9	9
53	Graphics Print Shop	2L8' HO/EE/ELIG	20	170	3,344	3,140	97%	76%	3L4' T8/ELIG LOW PWR	20	73	3,344	3,140	97%	76%	NA	NA	0%	100%	7	7
		Totals	974	130,323					Totals	793	67,344										

Pre-Retrofit Demand and Energy Consumption

Fixture ID	Lighting Demand and Energy Consumption (t) Connected kW	(u) FCM Diversified kW Summer	(v) FCM Diversified kW Winter	(w) Annual kWh	(x) Peak kWh	Interactive Hours (y) Cooling Hours	(z) Heating Hours	Interactive Energy Consumption (aa) Cooling kWh	(ab) Heating kWh	On-Peak Interactive Hours (ac) Cooling Hours	(ad) Heating Hours	On-Peak Interactive Demand and Energy Consumption (ae) FCM Diversified kW Summer	(af) FCM Diversified kW Winter	(ag) Cooling kWh	(ah) Heating kWh	Lighting and Interactive Demand and Energy Consumption (ai) FCM Diversified kW Summer	(aj) FCM Diversified kW Winter	(ak) Annual kWh	(al) Peak kWh
1	13.53	13.36	12.90	74,164	50,931	888	1,744	0	0	888	1,458	0.00	0.00	0	0	13.36	12.90	74,164	50,931
2	13.94	13.76	13.29	76,412	52,474	888	1,744	0	0	888	1,458	0.00	0.00	0	0	13.76	13.29	76,412	52,474
3	5.52	5.45	5.26	30,258	20,779	888	1,744	0	0	888	1,458	0.00	0.00	0	0	5.45	5.26	30,258	20,779
4	11.51	11.32	10.63	62,375	42,920	882	1,723	0	0	882	1,447	0.00	0.00	0	0	11.32	10.63	62,375	42,920
5	11.21	11.03	10.36	60,776	41,819	882	1,723	0	0	882	1,447	0.00	0.00	0	0	11.03	10.36	60,776	41,819
6	7.00	6.91	6.67	38,366	26,348	5,481	1,744	0	0	3,764	1,458	0.00	0.00	0	0	6.91	6.67	38,366	26,348
7	1.82	1.79	1.73	9,953	6,835	5,481	1,744	4,528	0	3,764	1,458	0.82	0.79	3,110	0	2.61	2.52	14,481	9,945
8	2.72	2.69	2.60	14,930	10,253	5,481	1,744	6,792	0	3,764	1,458	1.22	1.18	4,664	0	3.91	3.78	21,722	14,918
9	2.55	2.52	2.43	13,976	9,598	5,481	1,744	0	0	3,764	1,458	0.00	0.00	0	0	2.52	2.43	13,976	9,598
10	7.14	7.05	6.81	39,133	26,875	5,481	1,744	0	0	3,764	1,458	0.00	0.00	0	0	7.05	6.81	39,133	26,875
11	8.82	8.71	8.41	48,341	33,198	5,481	1,744	0	0	3,764	1,458	0.00	0.00	0	0	8.71	8.41	48,341	33,198
12	1.68	1.66	1.60	9,208	6,324	5,481	1,744	0	0	3,764	1,458	0.00	0.00	0	0	1.66	1.60	9,208	6,324
13	1.26	1.24	1.20	6,906	4,743	5,481	1,744	0	0	3,764	1,458	0.00	0.00	0	0	1.24	1.20	6,906	4,743
14	0.14	0.14	0.13	767	527	5,481	1,744	0	0	3,764	1,458	0.00	0.00	0	0	0.14	0.13	767	527
15	0.21	0.18	0.08	508	459	749	1,181	0	0	686	1,062	0.00	0.00	0	0	0.18	0.08	508	459
16	1.05	0.91	0.38	2,538	2,297	749	1,181	0	0	686	1,062	0.00	0.00	0	0	0.91	0.38	2,538	2,297
17	0.63	0.11	0.08	700	513	181	312	0	0	181	307	0.00	0.00	0	0	0.11	0.08	700	513
18	0.63	0.57	0.36	1,937	1,852	802	1,325	0	0	802	1,297	0.00	0.00	0	0	0.57	0.36	1,937	1,852
19	0.14	0.13	0.08	430	412	802	1,325	0	0	802	1,297	0.00	0.00	0	0	0.13	0.08	430	412
20	0.21	0.21	0.20	1,151	790	5,481	1,744	0	0	3,764	1,458	0.00	0.00	0	0	0.21	0.20	1,151	790
21	0.84	0.84	0.81	4,646	3,236	920	1,544	211	0	920	1,508	0.20	0.00	211	0	1.04	0.81	4,857	3,447
22	1.40	1.27	0.80	4,304	4,116	802	1,325	306	0	802	1,297	0.30	0.00	306	0	1.57	0.80	4,610	4,422
23	4.48	4.34	1.26	13,695	13,030	797	1,304	975	0	797	1,275	1.03	0.00	975	0	5.37	1.26	14,671	14,005
24	1.68	0.97	0.04	2,463	2,437	468	719	215	0	468	703	0.23	0.00	215	0	1.20	0.04	2,677	2,652
25	1.28	1.11	0.47	3,094	2,801	749	1,181	262	0	686	1,062	0.26	0.00	240	0	1.38	0.47	3,355	3,040
26	0.25	0.23	0.14	769	735	802	1,325	55	0	802	1,297	0.05	0.00	55	0	0.28	0.14	823	790
27	2.07	1.96	1.88	7,373	6,857	856	1,431	482	0	856	1,402	0.46	0.00	482	0	2.42	1.88	7,855	7,339
28	0.45	0.43	0.41	1,607	1,494	856	1,431	105	0	856	1,402	0.10	0.00	105	0	0.53	0.41	1,712	1,599
29	0.20	0.19	0.18	696	648	856	1,431	46	0	856	1,402	0.04	0.00	46	0	0.23	0.18	742	693
30	0.13	0.03	0.01	97	94	221	362	8	0	218	352	0.01	0.00	8	0	0.03	0.01	105	101
31	1.35	1.28	1.23	4,820	4,483	856	1,431	315	0	856	1,402	0.30	0.00	315	0	1.58	1.23	5,135	4,798
32	0.27	0.06	0.01	201	194	221	362	16	0	218	352	0.01	0.00	16	0	0.07	0.01	217	210
33	1.35	1.28	1.23	4,820	4,483	856	1,431	315	0	856	1,402	0.30	0.00	315	0	1.58	1.23	5,135	4,798
34	0.54	0.11	0.03	402	388	221	362	33	0	218	352	0.03	0.00	32	0	0.14	0.03	435	421
35	0.27	0.03	0.02	205	184	175	300	13	0	175	297	0.01	0.00	13	0	0.04	0.02	218	196
36	1.08	0.23	0.06	804	777	221	362	65	0	218	352	0.05	0.00	64	0	0.28	0.06	869	841
37	1.08	0.23	0.06	804	777	221	362	65	0	218	352	0.05	0.00	64	0	0.28	0.06	869	841
38	3.24	0.37	0.25	2,458	2,202	175	300	155	0	175	297	0.07	0.00	155	0	0.45	0.25	2,613	2,357
39	0.56	0.56	0.56	4,906	2,258	1,336	2,225	204	0	920	1,520	0.13	0.00	141	0	0.69	0.56	5,110	2,399
40	0.78	0.74	0.71	2,785	2,590	856	1,431	182	0	856	1,402	0.17	0.00	182	0	0.91	0.71	2,967	2,772
41	1.08	0.94	0.39	2,610	2,363	749	1,181	221	0	686	1,062	0.22	0.00	202	0	1.16	0.39	2,831	2,565
42	0.27	0.06	0.01	201	194	221	362	16	0	218	352	0.01	0.00	16	0	0.07	0.01	217	210
43	0.18	0.17	0.16	643	598	856	1,431	42	0	856	1,402	0.04	0.00	42	0	0.21	0.16	685	640
44	0.81	0.77	0.74	2,892	2,690	856	1,431	189	0	856	1,402	0.18	0.00	189	0	0.95	0.74	3,081	2,879
45	0.27	0.26	0.25	964	897	856	1,431	63	0	856	1,402	0.06	0.00	63	0	0.32	0.25	1,027	960
46	0.09	0.09	0.08	321	299	856	1,431	21	0	856	1,402	0.02	0.00	21	0	0.11	0.08	342	320
47	2.34	0.27	0.18	1,775	1,591	175	300	112	0	175	297	0.05	0.00	112	0	0.32	0.18	1,887	1,702
48	3.84	3.33	1.40	9,281	8,402	749	1,181	785	0	686	1,062	0.79	0.00	719	0	4.13	1.40	10,066	9,120
49	0.24	0.23	0.22	857	797	856	1,431	56	0	856	1,402	0.05	0.00	56	0	0.28	0.22	913	853
50	0.96	0.11	0.07	728	653	175	300	46	0	175	297	0.02	0.00	46	0	0.13	0.07	774	698
51	1.08	1.03	0.98	3,856	3,586	856	1,431	252	0	856	1,402	0.24	0.00	252	0	1.27	0.98	4,108	3,839
52	0.77	0.73	0.70	2,742	2,550	856	1,431	179	0	856	1,402	0.17	0.00	179	0	0.90	0.70	2,921	2,730
53	3.40	3.30	2.57	11,371	10,677	846	1,404	0	0	846	1,374	0.00	0.00	0	0	3.30	2.57	11,371	10,677
Totals	130.32	117.26	103.11	592,018	429,027			17,331	0			7.73	1.97	13,612	0	124.99	105.08	609,348	442,639

Post-Retrofit Demand and Energy Consumption

Fixture ID	Lighting Demand and Energy Consumption (am) Connected kW	(an) FCM Diversified kW Summer	(ao) FCM Diversified kW Winter	(ap) Annual kWh	(aq) Peak kWh	Interactive Hours (ar) Cooling Hours	(as) Heating Hours	Interactive Energy Consumption (at) Cooling kWh	(au) Heating kWh	On-Peak Interactive Hours (av) Cooling Hours	(aw) Heating Hours	On-Peak Interactive Demand and Energy Consumption (ax) FCM Diversified kW Summer	(ay) FCM Diversified kW Winter	(az) Cooling kWh	(ba) Heating kWh	Lighting and Interactive Demand and Energy Consumption (bb) FCM Diversified kW Summer	(bc) FCM Diversified kW Winter	(bd) Annual kWh	(be) Peak kWh
1	7.72	7.62	7.36	42,328	29,068	888	1,744	0	0	888	1,458	0.00	0.00	0	0	7.62	7.36	42,328	29,068
2	7.96	6.88	6.35	38,127	26,794	4,792	1,517	0	0	3,368	1,314	0.00	0.00	0	0	6.88	6.35	38,127	26,794
3	2.81	2.43	2.24	13,457	9,457	4,792	1,517	0	0	3,368	1,314	0.00	0.00	0	0	2.43	2.24	13,457	9,457
4	6.90	3.29	3.82	18,965	13,333	418	862	0	0	418	668	0.00	0.00	0	0	3.29	3.82	18,965	13,333
5	6.73	6.62	6.22	36,465	25,092	882	1,723	0	0	882	1,447	0.00	0.00	0	0	6.62	6.22	36,465	25,092
6	3.60	3.55	3.43	19,731	13,550	5,481	1,744	0	0	3,764	1,458	0.00	0.00	0	0	3.55	3.43	19,731	13,550
7	1.18	1.02	0.95	5,674	3,987	4,792	1,517	2,581	0	3,368	1,314	0.47	0.43	1,814	0	1.49	1.38	8,255	5,801
8	1.78	1.54	1.42	8,511	5,981	4,792	1,517	3,872	0	3,368	1,314	0.70	0.64	2,721	0	2.23	2.06	12,383	8,702
9	0.67	0.66	0.64	3,672	2,522	5,481	1,744	0	0	3,764	1,458	0.00	0.00	0	0	0.66	0.64	3,672	2,522
10	2.81	2.77	2.67	15,374	10,558	5,481	1,744	0	0	3,764	1,458	0.00	0.00	0	0	2.77	2.67	15,374	10,558
11	4.66	4.60	4.44	25,552	17,548	5,481	1,744	0	0	3,764	1,458	0.00	0.00	0	0	4.60	4.44	25,552	17,548
12	1.15	1.14	1.10	6,314	4,336	5,481	1,744	0	0	3,764	1,458	0.00	0.00	0	0	1.14	1.10	6,314	4,336
13	0.67	0.66	0.63	3,650	2,507	5,481	1,744	0	0	3,764	1,458	0.00	0.00	0	0	0.66	0.63	3,650	2,507
14	0.06	0.06	0.06	329	226	5,481	1,744	0	0	3,764	1,458	0.00	0.00	0	0	0.06	0.06	329	226
15	0.09	0.08	0.03	218	197	749	1,181	0	0	686	1,062	0.00	0.00	0	0	0.08	0.03	218	197
16	0.37	0.32	0.13	882	799	749	1,181	0	0	686	1,062	0.00	0.00	0	0	0.32	0.13	882	799
17	0.22	0.04	0.03	243	178	181	312	0	0	181	307	0.00	0.00	0	0	0.04	0.03	243	178
18	0.22	0.20	0.12	673	644	802	1,325	0	0	802	1,297	0.00	0.00	0	0	0.20	0.12	673	644
19	0.05	0.05	0.03	154	147	802	1,325	0	0	802	1,297	0.00	0.00	0	0	0.05	0.03	154	147
20	0.07	0.07	0.07	400	275	5,481	1,744	0	0	3,764	1,458	0.00	0.00	0	0	0.07	0.07	400	275
21	0.40	0.38	0.33	1,810	1,369	849	1,424	93	0	849	1,395	0.09	0.00	93	0	0.47	0.33	1,903	1,462
22	0.67	0.61	0.38	2,060	1,970	802	1,325	147	0	802	1,297	0.14	0.00	147	0	0.75	0.38	2,206	2,116
23	2.61	2.53	0.74	7,983	7,594	797	1,304	568	0	797	1,275	0.60	0.00	568	0	3.13	0.74	8,551	8,163
24	0.80	0.20	0.02	438	434	173	266	38	0	173	261	0.05	0.00	38	0	0.25	0.02	476	472
25	0.61	0.29	0.11	668	614	333	521	55	0	311	477	0.07	0.00	52	0	0.36	0.11	724	665
26	0.11	0.10	0.06	338	323	802	1,325	24	0	802	1,297	0.02	0.00	24	0	0.12	0.06	362	347
27	0.42	0.40	0.38	1,500	1,395	856	1,431	98	0	856	1,402	0.09	0.00	98	0	0.49	0.38	1,598	1,493
28	0.08	0.07	0.07	271	252	856	1,431	18	0	856	1,402	0.02	0.00	18	0	0.09	0.07	289	270
29	0.05	0.04	0.04	161	149	856	1,431	11	0	856	1,402	0.01	0.00	11	0	0.05	0.04	171	160
30	0.03	0.01	0.00	22	22	221	362	2	0	218	352	0.00	0.00	2	0	0.01	0.00	24	23
31	0.28	0.27	0.26	1,000	930	856	1,431	65	0	856	1,402	0.06	0.00	65	0	0.33	0.26	1,065	995
32	0.06	0.01	0.00	42	40	221	362	3	0	218	352	0.00	0.00	3	0	0.01	0.00	45	44
33	0.28	0.27	0.26	1,000	930	856	1,431	65	0	856	1,402	0.06	0.00	65	0	0.33	0.26	1,065	995
34	0.11	0.02	0.01	83	81	221	362	7	0	218	352	0.01	0.00	7	0	0.03	0.01	90	87
35	0.06	0.01	0.00	42	38	175	300	3	0	175	297	0.00	0.00	3	0	0.01	0.00	45	41
36	0.22	0.05	0.01	167	161	221	362	13	0	218	352	0.01	0.00	13	0	0.06	0.01	180	174
37	0.22	0.05	0.01	167	161	221	362	13	0	218	352	0.01	0.00	13	0	0.06	0.01	180	174
38	0.67	0.08	0.05	510	457	175	300	32	0	175	297	0.01	0.00	32	0	0.09	0.05	542	489
39	0.01	0.01	0.01	123	56	1,336	2,225	5	0	920	1,520	0.00	0.00	4	0	0.02	0.01	128	60
40	0.36	0.34	0.33	1,285	1,195	856	1,431	84	0	856	1,402	0.08	0.00	84	0	0.42	0.33	1,369	1,280
41	0.80	0.38	0.15	884	812	333	521	73	0	311	477	0.09	0.00	68	0	0.47	0.15	957	880
42	0.20	0.04	0.01	150	145	221	362	12	0	218	352	0.01	0.00	12	0	0.05	0.01	162	157
43	0.13	0.13	0.12	478	445	856	1,431	31	0	856	1,402	0.03	0.00	31	0	0.16	0.12	510	476
44	0.60	0.57	0.55	2,153	2,002	856	1,431	141	0	856	1,402	0.13	0.00	141	0	0.71	0.55	2,294	2,143
45	0.20	0.19	0.18	718	667	856	1,431	47	0	856	1,402	0.04	0.00	47	0	0.24	0.18	765	714
46	0.07	0.06	0.06	239	222	856	1,431	16	0	856	1,402	0.01	0.00	16	0	0.08	0.06	255	238
47	1.74	0.20	0.13	1,322	1,184	175	300	83	0	175	297	0.04	0.00	83	0	0.24	0.13	1,405	1,267
48	2.43	1.16	0.46	2,673	2,455	333	521	221	0	311	477	0.27	0.00	206	0	1.43	0.46	2,894	2,662
49	0.15	0.14	0.14	543	505	856	1,431	36	0	856	1,402	0.03	0.00	36	0	0.18	0.14	578	540
50	0.61	0.07	0.05	461	413	175	300	29	0	175	297	0.01	0.00	29	0	0.08	0.05	490	442
51	0.68	0.65	0.62	2,442	2,271	856	1,431	160	0	856	1,402	0.15	0.00	160	0	0.80	0.62	2,602	2,431
52	0.50	0.47	0.45	1,771	1,647	856	1,431	116	0	856	1,402	0.11	0.00	116	0	0.58	0.45	1,887	1,763
53	1.46	1.42	1.10	4,883	4,585	846	1,404	0	0	846	1,374	0.00	0.00	0	0	1.42	1.10	4,883	4,585
Totals	67.34	54.80	48.86	279,101	202,724			8,764	0			3.45	1.07	6,820	0	58.25	49.94	287,865	209,543

Total Savings Summary	Energy kWh	Summer kW	Winter kW	Connected kW
Annual Lighting Only	312,916	62.46	54.25	62.98
Annual Interactive	8,567	4.27	0.89	N/A
Annual Lighting and Interactive	321,483	66.74	55.14	62.98
On-Peak Lighting Only	226,303			
On-Peak Interactive	6,792			
On-Peak Lighting and Interactive	233,095			

	MMBTU
Annual Non-Electric Heating Savings	(378)

Savings Adjustment Factors						
Parameter	Annual KWH	Difference %	Summer kW	Difference %	Winter kW	Difference %
Gross (TRACKING) Savings	253,784	N/A	63.30	N/A	63.31	N/A
Adjustment - Documentation Change	-1	0%	0.04	0%	0.04	0%
Adjustment - Technology Change	631	0%	0.34	1%	0.34	1%
Adjustment - Quantity Change	-3,342	-1%	-0.71	-1%	-0.71	-1%
Adjustment - Operation Change	61,844	24%	N/A	N/A	N/A	N/A
Adjustment - Coincident Change	N/A	N/A	-0.51	-1%	-8.73	-14%
Adjustment - Heating Interaction	0	0%	N/A	N/A	N/A	N/A
Adjustment - Cooling Interaction	8,567	3%	4.27	7%	0.89	1%
Adjustment - TOTAL	67,699	27%	3.44	5%	-8.16	-13%
Adjusted Gross (ONSITE) Savings	321,483	127%	66.74	105%	55.14	87%

Table 37: Summary of On-Site Energy and Demand Savings

Hour Ending	Average kW Reduction
1	39.8
2	37.1
3	37.1
4	37.7
5	44.5
6	56.3
7	56.4
8	60.8
9	65.4
10	65.1
11	66.5
12	65.8
13	65.4
14	65.9
15	68.0
16	67.3
17	65.8
18	62.4
19	50.4
20	46.2
21	40.3
22	41.1
23	36.9
24	36.2

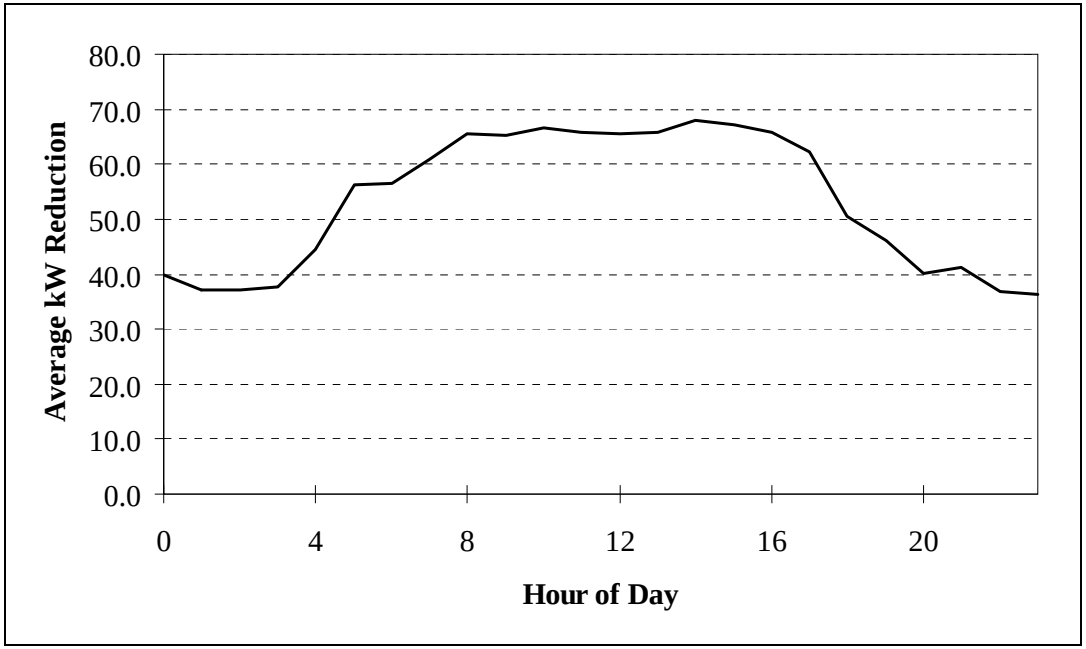

Table 38: Average Summer Weekday kW Reduction

Hour Ending	Average kW Reduction
1	39.7
2	37.0
3	37.1
4	37.6
5	44.5
6	56.3
7	55.0
8	58.0
9	62.0
10	61.2
11	62.7
12	62.0
13	61.6
14	62.0
15	64.4
16	63.9
17	62.8
18	59.8
19	50.5
20	46.4
21	40.4
22	41.3
23	37.1
24	36.4

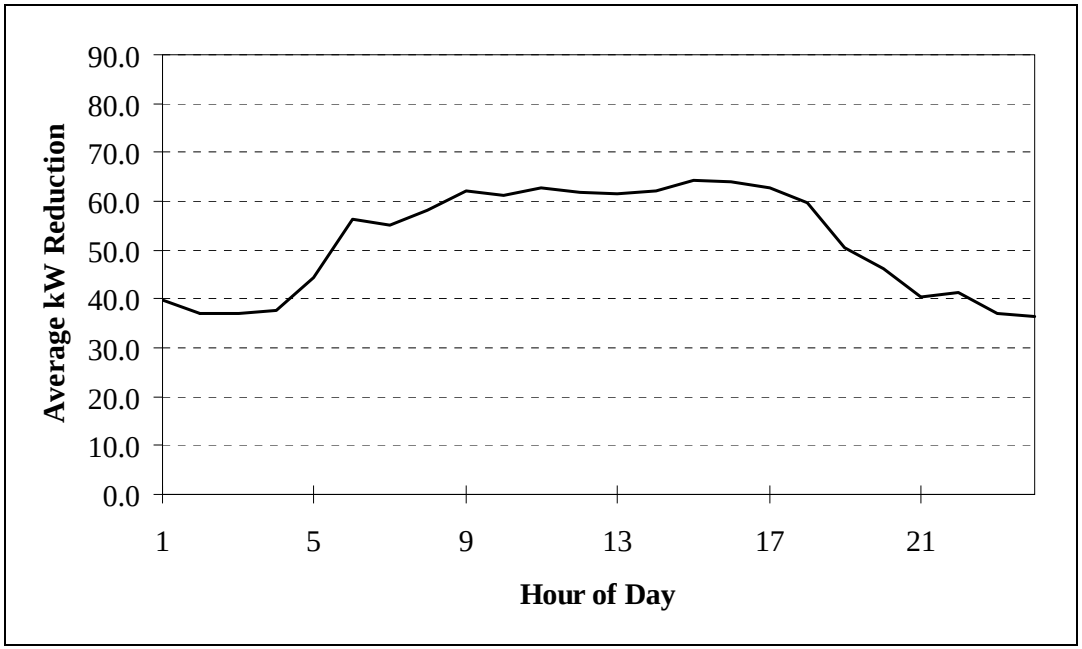

Table 39: Average Winter Weekday kW Reduction

Column Definitions for Lighting Calculations
(a) Brief description of area where lighting is installed

Pre-retrofit Lighting			Post-retrofit Lighting		
(b) Description of fixture type			(i) Description of fixture type		
(c) Fixture quantity from application documentation			(j) Fixture quantity from on-site inspection		
(d) Fixture wattage from application documentation			(k) Fixture wattage from application documentation		
(e) Annual hours of use	TMY2 Query	Eq. 1.1	(l) Annual hours of use	TMY2 Query	Eq. 1.1
(f) On-peak hours of use	TMY2 Query	Eq. 1.2	(m) On-peak hours of use	TMY2 Query	Eq. 1.2
(g) FCM Summer peak demand diversity factor	TMY2 Query	Eq. 1.3	(n) FCM Summer peak demand diversity factor	TMY2 Query	Eq. 1.3
(h) FCM Winter peak demand diversity factor	TMY2 Query	Eq. 1.4	(o) FCM Winter peak demand diversity factor	TMY2 Query	Eq. 1.4

HVAC Interaction Inputs	
(p) Electric cooling coefficient of performance	(r) Percent of space that is cooled
(q) Electric heating coefficient of performance	(s) Percent of space that is heated

Pre-retrofit Lighting Demand and Energy Consumption			Post-retrofit Lighting Demand and Energy Consumption		
(t) Connected lighting Demand	(t) = (c) x (d) / 1,000	Eq. 2.1	(am) Connected lighting Demand	(am) = (j) x (k) / 1,000	Eq. 3.1
(u) Summer diversified peak lighting demand (FCM)	(u) = (t) x (g)	Eq. 2.2	(an) Summer diversified peak lighting demand (FCM)	(an) = (am) x (n)	Eq. 3.2
(v) Winter diversified peak lighting demand (FCM)	(v) = (t) x (h)	Eq. 2.3	(ao) Winter diversified peak lighting demand (FCM)	(ao) = (am) x (o)	Eq. 3.3
(w) Annual energy consumption	(w) = (t) x (e)	Eq. 2.4	(ap) Annual energy consumption	(ap) = (am) x (l)	Eq. 3.4
(x) Annual On-peak energy consumption	(x) = (t) x (f)	Eq. 2.5	(aq) Annual On-peak energy consumption	(aq) = (am) x (m)	Eq. 3.5
(y) Annual cooling hours	TMY2 Qyery	Eq. 2.6	(ar) Annual cooling hours	TMY2 Query	Eq. 3.6
(z) Annual heating hours	TMY2 Qyery	Eq. 2.7	(as) Annual heating hours	TMY2 Query	Eq. 3.7
(aa) Electric cooling interactive energy effects	(aa) = (t) x (y) x (r) x 0.8 / (p)	Eq. 2.8	(at) Electric cooling interactive energy effects	(at) = (am) x (aq) x (r) x 0.8 / (p)	Eq. 3.8
(ab) Electric heating interactive energy effects	(ab) = -(t) x (z) x (s) x 0.8 / (q)	Eq. 2.9	(au) Electric heating interactive energy effects	(au) = -(am) x (as) x (s) x 0.8 / (q)	Eq. 3.9
(ac) Annual On-peak cooling hours	TMY2 Qyery	Eq. 2.10	(av) Annual On-peak cooling hours	TMY2 Query	Eq. 3.10
(ad) Annual On-peak heating hours	TMY2 Qyery	Eq. 2.11	(aw) Annual On-peak heating hours	TMY2 Query	Eq. 3.11
(ae) On-peak interactive cooling demand (FCM)	(ae) = (u) x (r) x 0.8 / (p)	Eq. 2.12	(ax) On-peak interactive cooling demand (FCM)	(ax) = (an) x (r) x 0.8 / (p)	Eq. 3.12
(af) On-peak interactive heating demand (FCM)	(af) = -(v) x (s) x 0.8 / (q)	Eq. 2.13	(ay) On-peak interactive heating demand (FCM)	(ay) = (ao) x (s) x 0.8 / (q)	Eq. 3.13
(ag) On-peak interactive electric cooling energy	(ag) = (t) x (ac) x (r) x 0.8 / (p)	Eq. 2.14	(az) On-peak interactive electric cooling energy	(az) = (am) x (av) x (r) x 0.8 / (p)	Eq. 3.14
(ah) On-peak interactive electric heating energy	(ah) = -(t) x (ad) x (s) x 0.8 / (q)	Eq. 2.15	(ba) On-peak interactive electric heating energy	(ba) = -(am) x (aw) x (s) x 0.8 / (q)	Eq. 3.15
(ai) Lighting and interactive summer demand (FCM)	(ai) = (u) + (ae)	Eq. 2.16	(bb) Lighting and interactive summer demand (FCM)	(bb) = (an) + (ax)	Eq. 3.16
(aj) Lighting and interactive winter demand (FCM)	(aj) = (v) + (af)	Eq. 2.17	(bc) Lighting and interactive winter demand (FCM)	(bc) = (ao) + (ay)	Eq. 3.17
(ak) Annual lighting and interactive energy consumption	(ak) = (w) + (aa) + (ab)	Eq. 2.18	(bd) Annual lighting and interactive energy consumption	(bd) = (ap) + (at) + (au)	Eq. 3.18
(al) Annual on-peak lighting and interactive energy consumption	(al) = (x) + (ag) + (ah)	Eq. 2.19	(be) Annual on-peak lighting and interactive energy consumption	(be) = (aq) + (az) + (ba)	Eq. 3.19

Total Savings Summary					
Annual Lighting Only Energy Consumption	Σ (w) - Σ (ap)	Eq. 4.1	Annual Lighting and Interactive Energy Consumption	Σ (ak) - Σ (bd)	Eq. 4.8
Annual Lighting Only Summer Demand (FCM)	Σ (u) - Σ (an)	Eq. 4.2	Annual Lighting and Interactive Summer Demand (FCM)	Σ (ai) - Σ (bb)	Eq. 4.9
Annual Lighting Only Winter Demand (FCM)	Σ (v) - Σ (ao)	Eq. 4.3	Annual Lighting and Interactive Winter Demand (FCM)	Σ (aj) - Σ (bc)	Eq. 4.10
Annual Lighting Only Connected Demand	Σ (t) - Σ (am)	Eq. 4.4	On-Peak Lighting Only Energy Consumption	Σ (x) - Σ (aq)	Eq. 4.11
Annual Interactive Energy Consumption	[Σ (aa) - Σ (at)] + [Σ (ab) - Σ (au)]	Eq. 4.5	On-Peak Interactive Energy Consumption	[Σ (ag) - Σ (az)] + [Σ (ah) - Σ (ba)]	Eq. 4.12
Annual Interactive Summer Demand (FCM)	Σ (ae) - Σ (ax)	Eq. 4.6			
Annual Interactive Winter Demand (FCM)	Σ (af) - Σ (ay)	Eq. 4.7			

Site 5, Application ID: 525359

Facility Type: Recreation Complex

Summary

A lighting retrofit of a recreation club was done to replace older inefficient lighting fixtures with new more efficient fixtures. The spaces affected by the retrofit include the indoor tennis courts. A total of (34) 1,000 watt metal halide fixtures were replaced with (32) 12 lamp F54/T5 fixtures. The new T5 fixtures are rated at 702 watts per fixture.

A count of fixtures during the on-site visit revealed that (32) 12 lamp F54/T5 fixtures were installed.

Table 40 presents the summary of the tracking and on-site savings results.

Savings Quantity	Tracking Estimate	On-site Savings	Evaluated/ Tracking
Annual Energy (kWh)	42,579	48,118	113%
% Energy Savings On-Peak	69%	75%	109%
Summer Peak Diversified kW	11.30	4.62	41%
Winter Peak Diversified kW	11.30	11.10	98%

Table 40: Summary of Tracking and On-site Savings Results

The overall on-site savings estimate is 13% higher than predicted in the tracking estimate. The on-site estimates of summer and winter peak diversified kW was lower than the tracking value. The following factors influenced the difference between the tracking and on-site estimates of energy and demand savings:

- The increase in savings was the result of a documentation error. According to the original tracking estimate, there were to be (36) 12 lamp F54/T5 fixtures installed, which were replacing (34) 1,000 watt metal halide fixtures. However, there was a second option proposed by the vendor that used (32) 12 lamp F54/T5 fixtures rather than (36) in the calculation. Evaluators assumed that the existing (34) 1,000 watt metal halide fixtures was a fixed quantity based on pre-inspection documentation and the two energy savings options that were proposed by the vendor. The post-installation inspection performed by National Grid showed that (32) 12 lamp F54/T5 fixtures were installed.

However, this change was not reflected in the tracking savings. The evaluation confirmed the installation of (32) fixtures, not (36). Had the original tracking estimate been updated to reflect the change discovered during the post-installation inspection, the annual savings would have been 10,626 kWh higher. Note that there was also an additional documentation adjustment of 97 kWh assumed to be due to rounding.

- There was also a decrease in savings associated with the annual operating hours of the fixtures. The tracking savings estimated the annual operating hours of all of the fixtures to be 3,784 hours per year. The monitoring data combined with reported operating schedules show that the weighted average of annual operating hours of all the fixtures are 3,417 hours per year. This reduction in annual operating hours results in the annual savings being decreased by 5,183 kWh.

- The on-peak kWh savings was estimated to be 75% of the annual on-site kWh savings. The on-peak period defined by National Grid is non-holiday weekdays between 6 am and 10 pm. The tracking estimate for on-peak kWh savings was estimated to be 69% of the annual tracking kWh savings. The on-site estimate was 9% higher than the tracking estimate because the tracking estimate used the old definition for on-peak hours of 8 am to 9 pm. Logger data showed that the majority of the annual savings occur during the weekday hours. Even though there is weekend usage at this facility, there are fewer operating hours on weekends and no Sunday operation between May and September. According to the facility manager, and verified with logger data, none of the installed lights remain on overnight.

- The summer diversified kW reduction was 4.62 kW or 59% lower than predicted in the tracking estimate using the current summer peak definition. The decrease is due to a lower summer diversity estimate. The tracking savings estimated the lights to operate 100% of the time during the defined summer peak period. Though the monitoring data does show operation during the defined hours of 1 pm to 5 pm, the monitoring period covered the month of April. According to facility personnel, from about mid May through the beginning of September, the indoor recreation space is used less frequently. Most club members play outdoors during the summer months. Therefore, the logger data were adjusted during these dates to represent more typical summer usage. This resulted in a lower on-site estimate for summer diversified kW reduction. The winter diversified kW reduction was 11.10 kW or 2% lower than the tracking estimate. The reason for this decrease is that the tracking savings estimated the lights to operate

100% of the time during the defined winter peak period. The monitoring data showed that the lights operate close to 100% of the time during the defined winter peak hours of 5 pm to 7 pm.

Project Description

This project was completed under the Energy Initiative program. Table 41presents a summary of the existing system as outlined in the customer application.

Existing Case				
Space	**Fixture Type**	**Wattage**	**Quantity**	**Annual Hours**
Tennis Courts	1,000 Watt MH	1,075	34	3,784

Table 41: Existing Lighting System

Table 42 presents the installed fixtures and quantities as proposed in the customer application.

Installed Case				
Space	**Fixture Type**	**Wattage**	**Quantity**	**Annual Hours**
Tennis Courts	Twelve Lamp F54/T5	702	32	3,784

Table 42: Installed Lighting System

Evaluation Methodology

Tracking Estimates

The tracking estimates of energy use were calculated based on the full load of the existing and proposed fixtures. The energy savings were calculated as the difference in the pre and post installation energy use based on annual operation of 3,784 hours per year.

Evaluation Approach

The evaluation included a verification of installed fixtures, on-site monitoring and interview. All fixtures are controlled manually using wall switches.

The base case used in the evaluation of the lighting savings was developed from information contained in the customer application. The pre-existing fixture types were confirmed while on-site with the facility contact. An evaluator visited the facility to verify the installed fixtures and install monitoring equipment to quantify the hours of use of the different spaces. The evaluator surveyed facility personnel to obtain information on the lighting usage throughout the year. He also inquired about any HVAC equipment serving the space.

To determine the hours of use for the new fixtures, the field engineer installed three time-of-use current transformer (CT) loggers. Each logger recorded the on/off of the lighting fixtures associated with each of the three tennis courts in the building containing the new lighting. Table 43 presents the fixtures monitored by the evaluation engineer.

Logger #	Equipment Monitored	Parameter Measured	Test Equip. Make & Model	Measurement Type	Installation Method	Frequency of Observations	Monitoring Duration
931215-211	Court #6 - 12 Lamp F54/T5 (11.5 fixtures)	On/Off Operation	PS&T TOU CT Logger	Event Logger	Clamp-On	Based on Schedule	3/24/09 - 4/29/09
970801-022	Court #7 - 12 Lamp F54/T5 (9 fixtures)	On/Off Operation	PS&T TOU Lighting Logger	Event Logger	Clamp-On	Based on Schedule	3/24/09 - 4/29/09
950104-078	Court #8 - 12 Lamp F54/T5 (11.5 fixtures)	On/Off Operation	PS&T TOU Lighting Logger	Event Logger	Clamp-On	Based on Schedule	3/24/09 - 4/29/09

Table 43: Spaces Monitored

Verification of Equipment and Operating Parameters

One building containing three tennis courts was retrofit with new twelve lamp F54/T5 fixtures. This building is one of three buildings that house tennis courts at this recreation complex. There were (34) 1,000 watt metal halide fixtures replaced with (32) twelve lamp F54/T5 fixtures in this building. Each of the outer two courts are lit using (11.5) twelve lamp F54/T5 fixtures, or (23) six lamp F54/T5 fixtures because each twelve lamp configuration contains (2) six lamp fixtures. The center court is illuminated by (18) six lamp F54/T5 fixtures. Each court has a switch that turns their respective lights on and off.

The facility operates year round, but with reduced occupancy during the summer. From the first week in September through the second week of May, the facility operates weekdays from 7 am to 11 pm and weekends from 7 am to 9 pm. During the summer months the operating hours change to Monday through Thursday between 7 am and 9 pm, Friday between 7 am and 6 pm, Saturday between 7 am and 11 am and is closed on Sundays. Additionally, the summer period sees reduced usage on the indoor courts because the facility has outdoor surfaces that serve as the primary courts during this period. On days with inclement weather or when all the outdoor courts are booked, the facility will then open the indoor courts for use. According to facility staff, lights remain off in the building during the summer hours unless that building is being used. Facility staff also mentioned that the indoor courts usually are unoccupied during the summer.

Since the monitoring period did not cover any of the summer months, the logger data were adjusted to represent the summer usage based on interviews with facility staff. First, each set of logger data was adjusted for the change in operating schedule from the winter period to the summer period. To do this, evaluators found the hours during the summer when the facility would be closed according to the reported schedule (i.e. Sundays or Fridays after 6 pm) and set these hours to zero. This was consistent with the monitoring period when the hours that the facility was actually closed, the usage was shown to be zero. Second, to account for the reduced use of the indoor courts during the summer, the logger data during summer occupied hours were multiplied by 40%. This value was used because it is rare that the indoor courts are used during the summer, according to facility personnel. However, on rainy or busy days, the indoor courts will be booked. It is assumed that the usage will be no more than 40% based on these discussions with facility personnel.

The facility closes for Memorial Day, Independence Day, Labor Day, Thanksgiving Day, Christmas Day and has half days on New Year's Day and Easter Sunday. During these holidays, the lights in the facility all remain off. The monitoring period did not include a facility holiday to verify this.

Table 44 presents the values obtained from the monitored data including annual operation, summer and winter diversity factors, and on-peak hours of use. These values were used for both the pre and post installation calculations because there was no difference in operation with the new lighting according to facility personnel.

Schedule ID	Logger #	Description	Annual Hours	Summer Diversity	Winter Diversity	On-Peak Hours
1	931215-211	Court 6	3,559	41%	80%	2,687
2	970801-022	Court 7	3,499	41%	80%	2,680
3	950104-078	Court 8	3,483	41%	77%	2,630

Table 44: Annual Hours of Use and Diversity Factors of Monitored Data

To estimate annual energy and demand savings, a spreadsheet method was employed. The summary of this spreadsheet is presented in Table 45. Annual hours and diversity factors from Table 44 are used with wattages from Table 45 to calculate energy and demand savings. The schedule ID's from Table 44 are presented in Table 45 to show which schedule was used with each fixture ID. The final on-site savings estimates are presented in Table 45.

The facility's heat is provided by propane which has no electrical interaction with the new lighting. However, because of the reduced heat going into the space due to the installation of more efficient lighting, there will be a need for additional heat from the facility's forced air system. It was estimated that this heating penalty is equal to approximately 112 MMBTU's of propane per year. This is calculated using a heating efficiency of 74% for the forced air system which is assumed to be a standard efficiency for this type of heating system. There is no air-conditioning in this building resulting in zero electrical interactive effects.

The average daily lighting profiles for all the monitored spaces are presented in Figure 49 through Figure 51. This includes the average weekday, weekend day and holiday. The x-axis represents one full day and the y-axis is the percentage that the lights are on for each hour.

An hourly summary of the site kW savings for an average summer (June through August), non-holiday, weekday is presented in Table 46. This summary is provided so that the summer diversified peak kW can be estimated across any range of hours in the event that the FCM definition for summer peak changes in the future. The same summary was also provided for the average winter (December and January), non-holiday, weekday in Table 47.

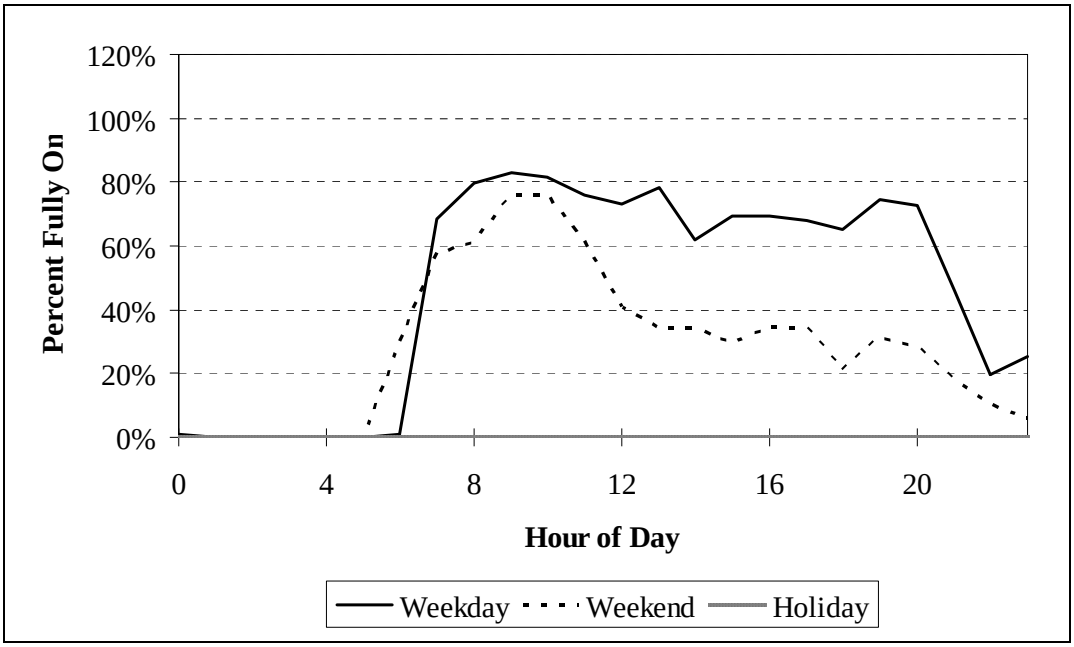

Figure 49: Average Daily Lighting Profile for Schedule 1 (Court #6)

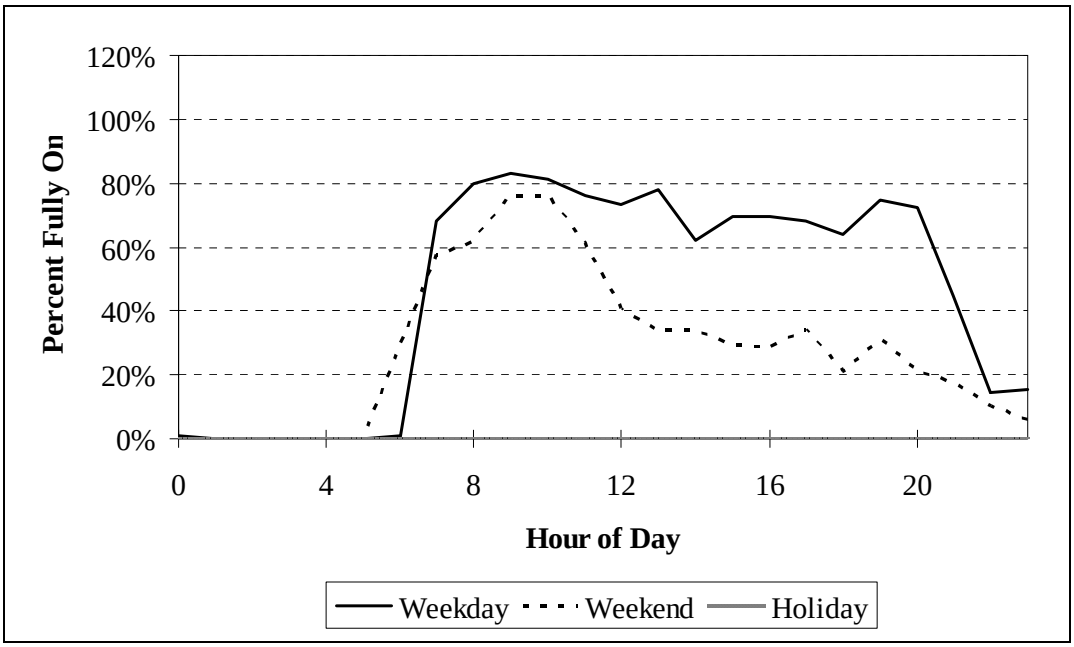

Figure 50: Average Daily Profile for Schedule 2 (Court #7)

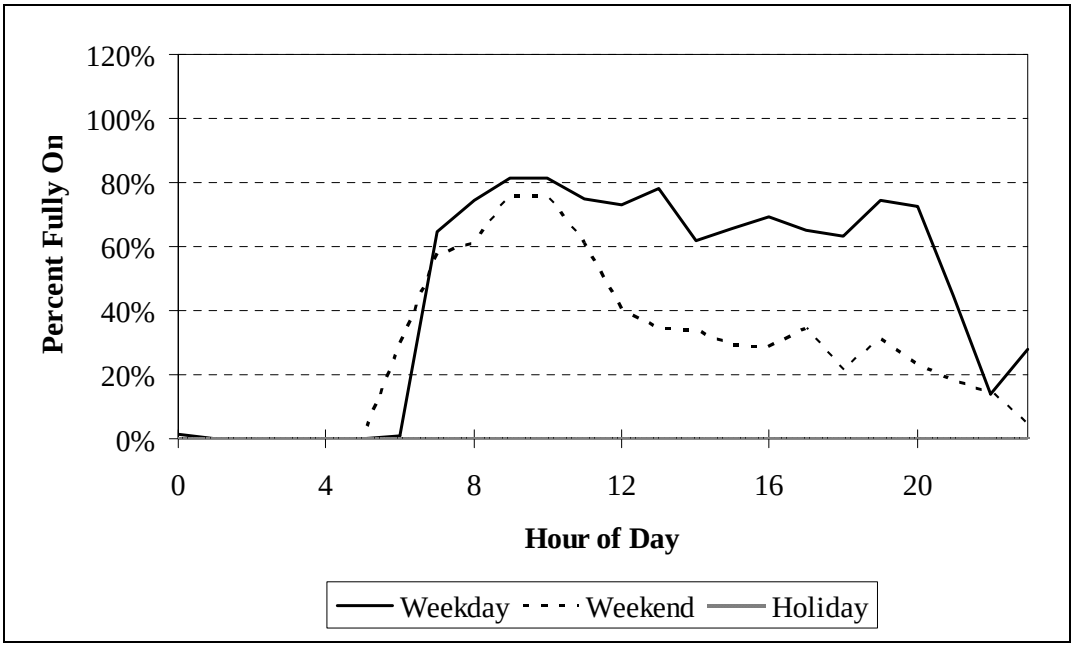

Figure 51: Average Daily Lighting Profile for Schedule 3 (Court #8)

Facility Type: Recreation
Application ID: 525359

Fixture Information

		Pre-retrofit Lighting							Post-retrofit Lighting							HVAC				Schedule ID from Table 5	
	(a)	(b)	(c)	(d)	(e)	(f)	(g)	(h)	(i)	(j)	(k)	(l)	(m)	(n)	(o)	(p)	(q)	(r)	(s)		
Fixture ID	Space Type	Fixture Type	Fixture Quantity	Fixture Wattage	Hours of Use Annual	Hours of Use Peak	FCM Diversity Factor Summer	FCM Diversity Factor Winter	Fixture Type	Fixture Quantity	Fixture Wattage	Hours of Use Annual	Hours of Use Peak	FCM Diversity Factor Summer	FCM Diversity Factor Winter	COP Cooling	COP Heating	% Space Cooled	% Space Heated	Pre Retrofit	Post Retrofit
1	Court 6	1000 WATT MH	12	1075	3,460	2,593	33%	80%	6L 4' F54T5	23	351	3,460	2,593	33%	80%	NA	NA	0%	100%	1	1
2	Court 7	1000 WATT MH	10	1075	3,401	2,587	33%	80%	6L 4' F54T5	18	351	3,401	2,587	33%	80%	NA	NA	0%	100%	2	2
3	Court 8	1000 WATT MH	12	1075	3,386	2,537	32%	77%	6L 4' F54T5	23	351	3,386	2,537	32%	77%	NA	NA	0%	100%	3	3
		Totals	34	36,550					Totals	64	22,464										

Pre-Retrofit Demand and Energy Consumption

	Lighting Demand and Energy Consumption					Interactive Hours		Interactive Energy Consumption		On-Peak Interactive Hours		On-Peak Interactive Demand and Energy Consumption				Lighting and Interactive Demand and Energy Consumption			
	(t)	(u)	(v)	(w)	(x)	(y)	(z)	(aa)	(ab)	(ac)	(ad)	(ae)	(af)	(ag)	(ah)	(ai)	(aj)	(ak)	(al)
Fixture ID	Connected kW	FCM Diversified kW Summer	FCM Diversified kW Winter	Annual kWh	Peak kWh	Cooling Hours	Heating Hours	Cooling kWh	Heating kWh	Cooling Hours	Heating Hours	FCM Diversified kW Summer	FCM Diversified kW Winter	Cooling kWh	Heating kWh	FCM Diversified kW Summer	FCM Diversified kW Winter	Annual kWh	Peak kWh
1	12.90	4.25	10.29	44,634	33,452	555	2,169	0	0	465	1,633	0.00	0.00	0	0	4.25	10.29	44,634	33,452
2	10.75	3.54	8.57	36,564	27,813	551	2,158	0	0	462	1,632	0.00	0.00	0	0	3.54	8.57	36,564	27,813
3	12.90	4.19	9.94	43,674	32,731	545	2,124	0	0	456	1,597	0.00	0.00	0	0	4.19	9.94	43,674	32,731
Totals	36.55	11.99	28.80	124,873	93,996			0	0			0.00	0.00	0	0	11.99	28.80	124,873	93,996

Post-Retrofit Demand and Energy Consumption

	Lighting Demand and Energy Consumption					Interactive Hours		Interactive Energy Consumption		On-Peak Interactive Hours		On-Peak Interactive Demand and Energy Consumption				Lighting and Interactive Demand and Energy Consumption			
	(am)	(an)	(ao)	(ap)	(aq)	(ar)	(as)	(at)	(au)	(av)	(aw)	(ax)	(ay)	(az)	(ba)	(bb)	(bc)	(bd)	(be)
Fixture ID	Connected kW	FCM Diversified kW Summer	FCM Diversified kW Winter	Annual kWh	Peak kWh	Cooling Hours	Heating Hours	Cooling kWh	Heating kWh	Cooling Hours	Heating Hours	FCM Diversified kW Summer	FCM Diversified kW Winter	Cooling kWh	Heating kWh	FCM Diversified kW Summer	FCM Diversified kW Winter	Annual kWh	Peak kWh
1	8.07	2.66	6.44	27,933	20,935	555	2,169	0	0	465	1,633	0.00	0.00	0	0	2.66	6.44	27,933	20,935
2	6.32	2.08	5.04	21,490	16,347	551	2,158	0	0	462	1,632	0.00	0.00	0	0	2.08	5.04	21,490	16,347
3	8.07	2.62	6.22	27,332	20,483	545	2,124	0	0	456	1,597	0.00	0.00	0	0	2.62	6.22	27,332	20,483
Totals	22.46	7.37	17.69	76,754	57,764			0	0			0.00	0.00	0	0	7.37	17.69	76,754	57,764

Total Savings Summary

	Energy kWh	Summer kW	Winter kW	Connected kW
Annual Lighting Only	48,118	4.62	11.10	14.09
Annual Interactive	0	0.00	0.00	N/A
Annual Lighting and Interactive	48,118	4.62	11.10	14.09
On-Peak Lighting Only	36,231			
On-Peak Interactive	0			
On-Peak Lighting and Interactive	36,231			

	MMBTU
Annual Non-Electric Heating Savings	(112)

Savings Adjustment Factors

Parameter	Annual KWH	Difference %	Summer kW	Difference %	Winter kW	Difference %
Gross (TRACKING) Savings	42,579	N/A	11.30	N/A	11.30	N/A
Adjustment - Documentation Change	10,722	25%	2.79	25%	2.79	25%
Adjustment - Technology Change	0	0%	0.00	0%	0.00	0%
Adjustment - Quantity Change	0	0%	0.00	0%	0.00	0%
Adjustment - Operation Change	-5,183	-12%	N/A	N/A	N/A	N/A
Adjustment - Coincident Change	N/A	N/A	-9.47	-84%	-2.98	-26%
Adjustment - Heating Interaction	0	0%	N/A	N/A	0.00	0%
Adjustment - Cooling Interaction	0	0%	0.00	0%	N/A	N/A
Adjustment - TOTAL	5,539	13%	-6.68	-59%	-0.20	-2%
Adjusted Gross (ONSITE) Savings	48,118	113%	4.62	41%	11.10	98%

Table 45: Summary of On-Site Energy and Demand Savings

Hour Ending	Average kW Reduction
1	0.0
2	0.0
3	0.0
4	0.0
5	0.0
6	0.0
7	0.0
8	4.4
9	5.2
10	5.5
11	5.4
12	5.0
13	4.9
14	5.2
15	4.1
16	4.5
17	4.7
18	4.5
19	4.0
20	4.3
21	4.1
22	1.6
23	0.0
24	0.0

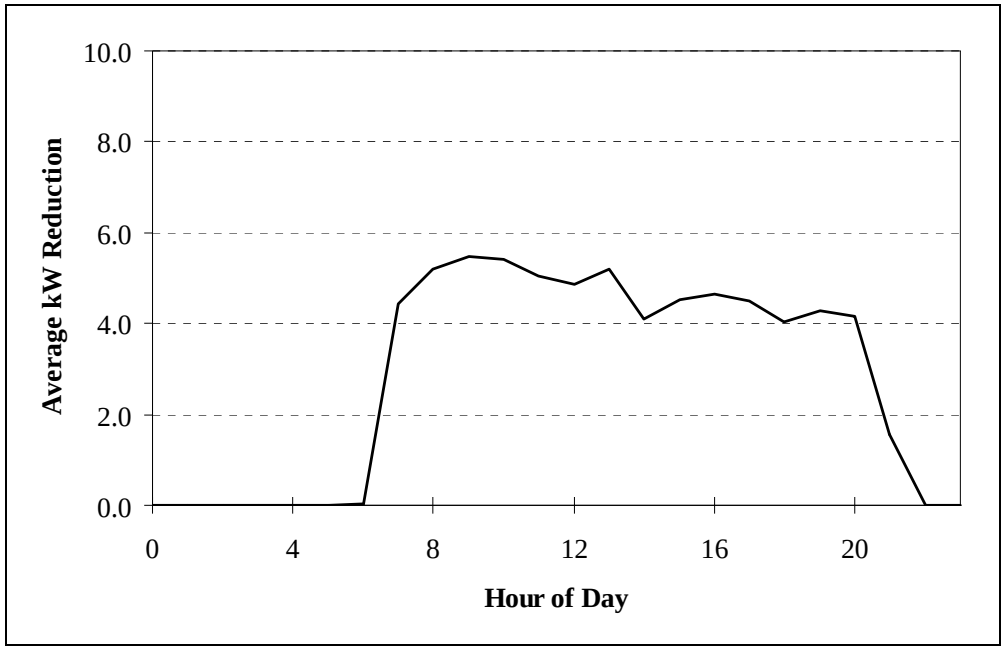

Table 46: Average Summer Weekday kW Reduction

Hour Ending	Average kW Reduction
1	0.2
2	0.0
3	0.0
4	0.0
5	0.0
6	0.0
7	0.1
8	11.1
9	13.0
10	13.7
11	13.5
12	12.6
13	12.2
14	13.0
15	10.3
16	11.4
17	11.8
18	11.3
19	10.9
20	12.9
21	12.6
22	8.5
23	3.3
24	4.7

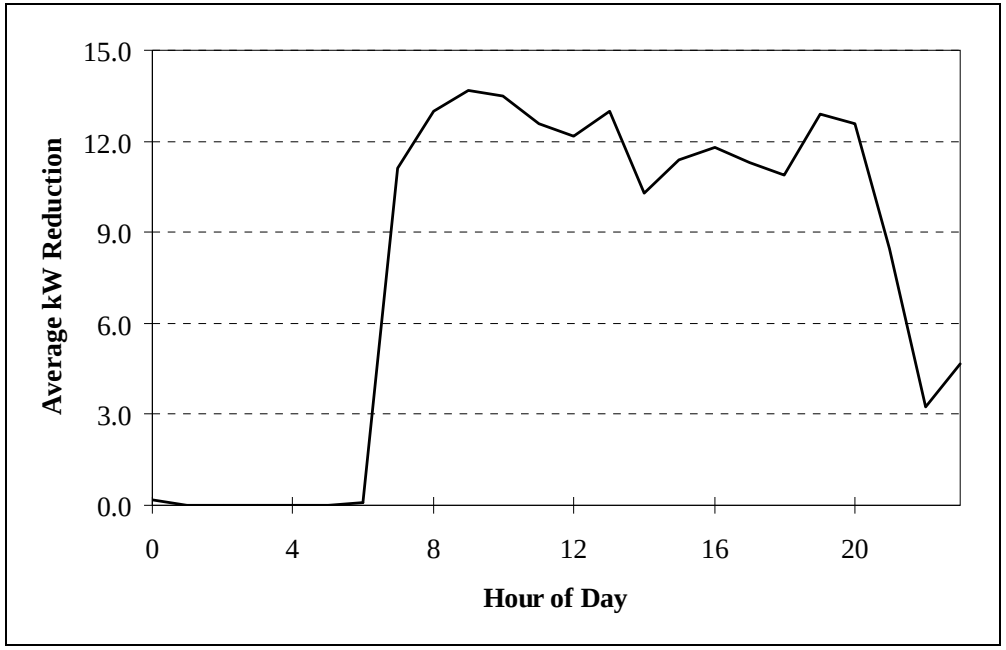

Table 47: Average Winter Weekday kW Reduction

Column Definitions for Lighting Calculations
(a) Brief description of area where lighting is installed

Pre-retrofit Lighting			Post-retrofit Lighting		
(b) Description of fixture type			(i) Description of fixture type		
(c) Fixture quantity from application documentation			(j) Fixture quantity from on-site inspection		
(d) Fixture wattage from application documentation			(k) Fixture wattage from application documentation		
(e) Annual hours of use	TMY2 Query	Eq. 1.1	(l) Annual hours of use	TMY2 Query	Eq. 1.1
(f) On-peak hours of use	TMY2 Query	Eq. 1.2	(m) On-peak hours of use	TMY2 Query	Eq. 1.2
(g) FCM Summer peak demand diversity factor	TMY2 Query	Eq. 1.3	(n) FCM Summer peak demand diversity factor	TMY2 Query	Eq. 1.3
(h) FCM Winter peak demand diversity factor	TMY2 Query	Eq. 1.4	(o) FCM Winter peak demand diversity factor	TMY2 Query	Eq. 1.4

HVAC Interaction Inputs	
(p) Electric cooling coefficient of performance	(r) Percent of space that is cooled
(q) Electric heating coefficient of performance	(s) Percent of space that is heated

Pre-retrofit Lighting Demand and Energy Consumption			Post-retrofit Lighting Demand and Energy Consumption		
(t) Connected lighting Demand	(t) = (c) x (d) / 1,000	Eq. 2.1	(am) Connected lighting Demand	(am) = (j) x (k) / 1,000	Eq. 3.1
(u) Summer diversified peak lighting demand (FCM)	(u) = (t) x (g)	Eq. 2.2	(an) Summer diversified peak lighting demand (FCM)	(an) = (am) x (n)	Eq. 3.2
(v) Winter diversified peak lighting demand (FCM)	(v) = (t) x (h)	Eq. 2.3	(ao) Winter diversified peak lighting demand (FCM)	(ao) = (am) x (o)	Eq. 3.3
(w) Annual energy consumption	(w) = (t) x (e)	Eq. 2.4	(ap) Annual energy consumption	(ap) = (am) x (l)	Eq. 3.4
(x) Annual On-peak energy consumption	(x) = (t) x (f)	Eq. 2.5	(aq) Annual On-peak energy consumption	(aq) = (am) x (m)	Eq. 3.5
(y) Annual cooling hours	TMY2 Qyery	Eq. 2.6	(ar) Annual cooling hours	TMY2 Query	Eq. 3.6
(z) Annual heating hours	TMY2 Qyery	Eq. 2.7	(as) Annual heating hours	TMY2 Query	Eq. 3.7
(aa) Electric cooling interactive energy effects	(aa) = (t) x (y) x (r) x 0.8 / (p)	Eq. 2.8	(at) Electric cooling interactive energy effects	(at) = (am) x (aq) x (r) x 0.8 / (p)	Eq. 3.8
(ab) Electric heating interactive energy effects	(ab) = -(t) x (z) x (s) x 0.8 / (q)	Eq. 2.9	(au) Electric heating interactive energy effects	(au) = -(am) x (as) x (s) x 0.8 / (q)	Eq. 3.9
(ac) Annual On-peak cooling hours	TMY2 Qyery	Eq. 2.10	(av) Annual On-peak cooling hours	TMY2 Query	Eq. 3.10
(ad) Annual On-peak heating hours	TMY2 Qyery	Eq. 2.11	(aw) Annual On-peak heating hours	TMY2 Query	Eq. 3.11
(ae) On-peak interactive cooling demand (FCM)	(ae) = (u) x (r) x 0.8 / (p)	Eq. 2.12	(ax) On-peak interactive cooling demand (FCM)	(ax) = (an) x (r) x 0.8 / (p)	Eq. 3.12
(af) On-peak interactive heating demand (FCM)	(af) = -(v) x (s) x 0.8 / (q)	Eq. 2.13	(ay) On-peak interactive heating demand (FCM)	(ay) = (ao) x (s) x 0.8 / (q)	Eq. 3.13
(ag) On-peak interactive electric cooling energy	(ag) = (t) x (ac) x (r) x 0.8 / (p)	Eq. 2.14	(az) On-peak interactive electric cooling energy	(az) = (am) x (av) x (r) x 0.8 / (p)	Eq. 3.14
(ah) On-peak interactive electric heating energy	(ah) = -(t) x (ad) x (s) x 0.8 / (q)	Eq. 2.15	(ba) On-peak interactive electric heating energy	(ba) = -(am) x (aw) x (s) x 0.8 / (q)	Eq. 3.15
(ai) Lighting and interactive summer demand (FCM)	(ai) = (u) + (ae)	Eq. 2.16	(bb) Lighting and interactive summer demand (FCM)	(bb) = (an) + (ax)	Eq. 3.16
(aj) Lighting and interactive winter demand (FCM)	(aj) = (v) + (af)	Eq. 2.17	(bc) Lighting and interactive winter demand (FCM)	(bc) = (ao) + (ay)	Eq. 3.17
(ak) Annual lighting and interactive energy consumption	(ak) = (w) + (aa) + (ab)	Eq. 2.18	(bd) Annual lighting and interactive energy consumption	(bd) = (ap) + (at) + (au)	Eq. 3.18
(al) Annual on-peak lighting and interactive energy consumption	(al) = (x) + (ag) + (ah)	Eq. 2.19	(be) Annual on-peak lighting and interactive energy consumption	(be) = (aq) + (az) + (ba)	Eq. 3.19

Total Savings Summary					
Annual Lighting Only Energy Consumption	Σ (w) - Σ (ap)	Eq. 4.1	Annual Lighting and Interactive Energy Consumption	Σ (ak) - Σ (bd)	Eq. 4.8
Annual Lighting Only Summer Demand (FCM)	Σ (u) - Σ (an)	Eq. 4.2	Annual Lighting and Interactive Summer Demand (FCM)	Σ (ai) - Σ (bb)	Eq. 4.9
Annual Lighting Only Winter Demand (FCM)	Σ (v) - Σ (ao)	Eq. 4.3	Annual Lighting and Interactive Winter Demand (FCM)	Σ (aj) - Σ (bc)	Eq. 4.10
Annual Lighting Only Connected Demand	Σ (t) - Σ (am)	Eq. 4.4	On-Peak Lighting Only Energy Consumption	Σ (x) - Σ (aq)	Eq. 4.11
Annual Interactive Energy Consumption	[Σ (aa) - Σ (at)] + [Σ (ab) - Σ (au)]	Eq. 4.5	On-Peak Interactive Energy Consumption	[Σ (ag) - Σ (az)] + [Σ (ah) - Σ (ba)]	Eq. 4.12
Annual Interactive Summer Demand (FCM)	Σ (ae) - Σ (ax)	Eq. 4.6			
Annual Interactive Winter Demand (FCM)	Σ (af) - Σ (ay)	Eq. 4.7			

Site 6, Application ID: 525879

Facility Type: High School

Summary

This project involves lighting that was installed in a newly built high school. Tracking savings were calculated using a building lighting density method. This facility received a Tier 1 rebate by exceeding the requirements for total wattage of the entire building. This is a 204,940 square foot school with an estimated installed wattage of 211,595 watts. The maximum allowable wattage is less than 75% of the total wattage allowed based on the energy code of 1.5 watts per square foot. Included in the lighting installation were 2,385 total fixtures. This includes T8 and T5 lighting, compact fluorescents, metal halides and other types such as incandescent and halogen fixtures in the entrances. The total installed wattage, including inefficient lighting, is considered in the whole building lighting density method.

A count of fixtures taken during the on-site visit revealed that installed quantities and types of lighting fixtures differed from the tracking estimate. Evaluators found 2,330 fixtures installed in the school for a total of 202,375 watts.

Table 48 presents the summary of the tracking and on-site savings results.

Savings Quantity	Tracking Estimate	On-site Savings	Evaluated/ Tracking
Annual Energy (kWh)	184,492	182,595	99%
% Energy Savings On-Peak	92%	80%	87%
Summer Peak Diversified kW	19.16	25.12	131%
Winter Peak Diversified kW	4.80	18.67	389%

Table 48: Summary of Tracking and On-site Savings Results

The overall on-site savings estimate is 1% lower than predicted in the tracking estimate. The on-site estimates of summer and winter peak diversified kW was higher than the tracking values. The following factors influenced the difference between the tracking and on-site estimates of energy and demand savings:

- The decrease in savings was the result of lower annual hours of use. The tracking savings estimated the operating hours of all the installed fixtures to be 1,926 hours per

year. The monitoring data combined with reported operating schedules showed that the weighted average of the post-installation operating hours is 1,686 hours per year. This decrease in annual operating hours results in the annual savings being decreased by 25,184 kWh.

- There was also an increase in savings because there was less lighting installed in this school than proposed in the tracking estimate. Evaluators found 2,330 lighting fixtures totaling 202,375 watts. The tracking savings proposed the installation of 2,385 lighting fixtures totaling 211,595 watts. Since the savings for this project were calculated using the Performance Lighting method, the baseline was not adjusted from the tracking estimate. The baseline was assumed to be 1.5 watts per square foot for this 204,940 square foot school, which was the same as the tracking estimate. Evaluators verified the square footage of the school through discussions with facility personnel. It could be assumed that a design change took place between the time of the original savings analysis and the actual installation of the fixtures. The reduction of total lighting wattage installed in this school resulted in an increase in energy savings equal to 17,753 kWh per year.

- There was an increase in savings resulting from the interaction between the new lighting and the facility's HVAC systems. Almost the entire facility is air-conditioned using several rooftop packaged DX units. According to facility personnel, the only space that is not air-conditioned is the gymnasium. The decrease in lighting wattage resulting from this efficiency measure results in less heat going into the air-conditioned space. Therefore, additional savings are realized from the reduced cooling requirements of the building. It is estimated that the added benefit is equal to 5,534 kWh per year.

- The on-peak kWh savings was estimated to be 80% of the annual on-site kWh savings. The tracking estimate for on-peak kWh savings was 92%. The on-peak period defined by National Grid is non-holiday weekdays between 6 am and 10 pm. The reason why the on-site estimate is lower than the tracking estimate is because there are some hallway fixtures that operate twenty four hours a day, including weekends. Additionally, the gymnasium is used sometimes during weekends.

- The summer diversified kW reduction was 25.12 kW or 31% higher than predicted in the tracking estimate. The primary reason for the increase is because of the reduced quantity of fixtures found during the on-site visit. This increased the overall connected

demand savings. The winter diversified kW reduction was 18.67 kW or more than three times the tracking estimate. The increase is due to both the reduced number of fixtures found and because the tracking savings estimated the lights to operate 5% of the time during the winter peak period, while the monitoring data shows that the weighted average winter diversity factor is approximately 18%.

Project Description

This project was completed under the Design 2000 program using a Performance Lighting application. Table 49 presents a summary of the energy savings calculations outlined in the customer application. The method used, employs the lighting density calculation shown below.

Tracking Savings Calculations	
Total Area (Square Feet)	204,940
Lighting Code (Watts per Square Feet)	1.5
Total Watts Allowed by Energy Code (Baseline)	307,410
Total Wattage Installed	211,595
Total Wattage Reduction	95,815
Annual Hours	1,926
Annual Energy Savings (kWh)	184,492

Table 49: Lighting Density Savings Estimate

Table 50 presents the installed fixtures and quantities as proposed in the customer application.

Installed Case			
Fixture Type	**Wattage**	**Quantity**	**Annual Hours**
500 Watt Halogen	500	32	1,926
350 Watt Metal Halide	375	63	1,926
150 Watt Metal Halide	172	33	1,926
Three Lamp F32/T8	88	822	1,926
Two Lamp F24/T8/HO	85	181	1,926
Two Lamp F32/T8	60	567	1,926
2-32 Watt CFL	68	29	1,926
Two Lamp F17/T8	37	4	1,926
2-26 Watt CFL	54	253	1,926
Four Lamp F32/T8/LP	84	90	1,926
Two Lamp F40/Biax	72	8	1,926
One lamp F40/Biax	46	110	1,926
2-18 Watt CFL	40	48	1,926
Four Lamp F40/Biax	144	8	1,926
One Lamp F54/T5	59	97	1,926
6-32 Watt CFL	278	9	1,926
2-13 Watt CFL	28	7	1,926
1-22 Watt and 1-32 Watt CFL	59	8	1,926
200 Watt Incandescent	200	5	1,926
Four Lamp F40/Biax/HO	170	1	1,926
6-40 Watt Incandescent	244	10	1,926
Total	211,595	2,385	N/A

Table 50: Installed Lighting System

Evaluation Methodology

Tracking Estimates

The tracking estimates of energy use were calculated using the lighting density method described above. The facility is a 204,940 square foot school. The maximum allowable wattage for this school is 307,410 watts based on the lighting code of 1.5 watts per square foot. The tracking savings assumed a total installed wattage of 211,595 watts. The annual energy savings were calculated by subtracting the installed wattage from the maximum allowable wattage, which represents the baseline for this case. The tracking savings assumed 1,926 hours of operation per year for all of the installed lighting fixtures.

Evaluation Approach

The evaluation included a verification of all of the installed fixtures, on-site monitoring and interviews. All fixtures are controlled by wall switches with the exception of the gymnasium, which were controlled by a computerized control system. A small number of classrooms were controlled by occupancy sensors, but savings from sensors were not included in the project. For the spaces controlled by occupancy sensors savings were calculated using the controlled hours for the base and proposed fixtures. It was estimated that approximately 7% of the total connected load had occupancy sensors control.

The base case used in the evaluation of the lighting savings was developed from information contained in the customer application. Evaluators made no adjustments to the tracking system baseline estimate of 1.5 watts per square foot for a 204,940 square foot facility. The baseline is established based on the lighting code for a school, while the size of the school was verified through discussions with facility personnel.

Evaluators visited the facility to verify the installed fixtures and install monitoring equipment to quantify the hours of use of the different spaces. Evaluators surveyed facility personnel to obtain information on the lighting usage throughout the year. They also inquired about any HVAC equipment serving the space.

To determine the hours of use for the new fixtures, field evaluators installed (25) time-of-use (TOU) lighting loggers throughout the building. In addition, evaluators installed (4) TOU-CT loggers in the lighting panel that controls the high bay gym lighting. Eleven lighting loggers were installed in classrooms. Some of these loggers were installed on the main classroom lights, and some were installed on the indirect 2F40/Biax fixtures above the chalkboards. The remaining lighting loggers were installed throughout different areas of the school such as the offices, hallways, locker room and chorus room. Table 51 presents the fixtures monitored by the evaluation engineers.

Logger #	Equipment Monitored	Parameter Measured	Test Equip. Make & Model	Measurement Type	Installation Method	Frequency of Observations	Monitoring Duration
940629-232	Chorus Rm 3F32/T8	On/Off Operation	PS&T TOU Lighting Logger	Event Logger	Proximity	Based on Schedule	3/31/09 - 4/28/09
940629-253	Art Room 3F32/T8	On/Off Operation	PS&T TOU Lighting Logger	Event Logger	Proximity	Based on Schedule	3/31/09 - 4/28/09
940629-270	Teachers Planning Rm 3F32/T8	On/Off Operation	PS&T TOU Lighting Logger	Event Logger	Proximity	Based on Schedule	3/31/09 - 4/28/09
940629-275	Health Suite 2F32/T8	On/Off Operation	PS&T TOU Lighting Logger	Event Logger	Proximity	Based on Schedule	3/31/09 - 4/28/09
940629-295	CLRM C215 3F32/T8	On/Off Operation	PS&T TOU Lighting Logger	Event Logger	Proximity	Based on Schedule	3/31/09 - 4/28/09
940629-355	CLRM C332 2F40/Biax	On/Off Operation	PS&T TOU Lighting Logger	Event Logger	Proximity	Based on Schedule	3/31/09 - 4/28/09
940629-356	CLRM C332 3F32/T8	On/Off Operation	PS&T TOU Lighting Logger	Event Logger	Proximity	Based on Schedule	3/31/09 - 4/28/09
940629-363	Asst Principal Office 3F32/T8	On/Off Operation	PS&T TOU Lighting Logger	Event Logger	Proximity	Based on Schedule	3/31/09 - 4/28/09
940629-367	Cafeteria 2F32/T8	On/Off Operation	PS&T TOU Lighting Logger	Event Logger	Proximity	Based on Schedule	3/31/09 - 4/28/09
940629-400	Locker Room Boys 2F32/T8	On/Off Operation	PS&T TOU Lighting Logger	Event Logger	Proximity	Based on Schedule	3/31/09 - 4/28/09
940629-404	CLRM C317 2F40/Biax	On/Off Operation	PS&T TOU Lighting Logger	Event Logger	Proximity	Based on Schedule	3/31/09 - 4/28/09
940824-001	CLRM C202 2F40/Biax	On/Off Operation	PS&T TOU Lighting Logger	Event Logger	Proximity	Based on Schedule	3/31/09 - 4/28/09
940824-048	CLRM C317 3F32/T8	On/Off Operation	PS&T TOU Lighting Logger	Event Logger	Proximity	Based on Schedule	3/31/09 - 4/28/09
940824-060	Hallway 4F25/T8	On/Off Operation	PS&T TOU Lighting Logger	Event Logger	Proximity	Based on Schedule	3/31/09 - 4/28/09
940824-066	CLRM C202 3F32/T8	On/Off Operation	PS&T TOU Lighting Logger	Event Logger	Proximity	Based on Schedule	3/31/09 - 4/28/09
940824-077	CLRM C207 3F32/T8	On/Off Operation	PS&T TOU Lighting Logger	Event Logger	Proximity	Based on Schedule	3/31/09 - 4/28/09
940824-085	Office B207 3F32/T8	On/Off Operation	PS&T TOU Lighting Logger	Event Logger	Proximity	Based on Schedule	3/31/09 - 4/28/09
940824-103	Hallway 4F25/T8	On/Off Operation	PS&T TOU Lighting Logger	Event Logger	Proximity	Based on Schedule	3/31/09 - 4/28/09
940824-106	Storage Rm C220 2F32/T8	On/Off Operation	PS&T TOU Lighting Logger	Event Logger	Proximity	Based on Schedule	3/31/09 - 4/28/09
940824-108	CLRM C307 3F32/T8	On/Off Operation	PS&T TOU Lighting Logger	Event Logger	Proximity	Based on Schedule	3/31/09 - 4/28/09
940824-130	CLRM C103 3F32/T8	On/Off Operation	PS&T TOU Lighting Logger	Event Logger	Proximity	Based on Schedule	3/31/09 - 4/28/09
940824-132	3rd Fl Hallway 4F25/T8	On/Off Operation	PS&T TOU Lighting Logger	Event Logger	Proximity	Based on Schedule	3/31/09 - 4/28/09
940824-168	Counselor Office 3F32/T8	On/Off Operation	PS&T TOU Lighting Logger	Event Logger	Proximity	Based on Schedule	3/31/09 - 4/28/09
940824-216	CLRM C215 2F40/Biax	On/Off Operation	PS&T TOU Lighting Logger	Event Logger	Proximity	Based on Schedule	3/31/09 - 4/28/09
CT08010018	Relay 8 Gym 350W MH	On/Off Operation	PS&T TOU CT Logger	Event Logger	Clamp-On	Based on Schedule	3/31/09 - 4/28/09
CT08010039	Relay 6 Gym 350W MH	On/Off Operation	PS&T TOU CT Logger	Event Logger	Clamp-On	Based on Schedule	3/31/09 - 4/28/09
CT08010043	Relay 1 Gym 350W MH	On/Off Operation	PS&T TOU CT Logger	Event Logger	Clamp-On	Based on Schedule	3/31/09 - 4/28/09
CT08010047	Relay 12 Gym 350W MH	On/Off Operation	PS&T TOU CT Logger	Event Logger	Clamp-On	Based on Schedule	3/31/09 - 4/28/09
T040303236	Library Office 2F32/T8	On/Off Operation	PS&T TOU Lighting Logger	Event Logger	Proximity	Based on Schedule	3/31/09 - 4/28/09

Table 51: Spaces Monitored

Verification of Equipment and Operating Parameters

This project included the installation of all of the lighting in a newly constructed high school. Lighting types included two, three and four lamp T8 fixtures, two and four lamp F40/Biax fixtures, metal halide fixtures, compact fluorescents and other decorative incandescent lighting.

Evaluators found that the quantities and fixture types differed somewhat from what was proposed in the tracking analysis. Evaluators found a total of 2,330 fixtures in the entire school as compared to 2,385 as proposed in the tracking. Some of the major discrepancies include an additional (88) four lamp F25/T8 fixtures, (123) two lamp F25/T8 fixtures and (175) two lamp F40/Biax fixtures. Although there were more of these fixtures found than in the tracking estimate, some of these were assumed to be installed in place of the missing (72) four lamp F32/T8 fixtures, (97) one lamp F54/T5 fixtures and (181) two lamp F24/T8 fixtures. Table 52 presents the comparison between the tracking and evaluation fixture counts.

Fixture Type	Fixture Quantity	
	Tracking	Evaluation
500 Watt Halogen	32	32
350 Watt Metal Halide	63	63
150 Watt Metal Halide	33	41
Three Lamp F32/T8	822	806
Two Lamp F24/T8/HO	181	0
Two Lamp F32/T8	567	512
2-32 Watt CFL	29	7
Two Lamp F17/T8	4	3
2-26 Watt CFL	253	240
Four Lamp F32/T8/LP	90	18
Two Lamp F40/Biax	8	183
One lamp F40/Biax	110	100
2-18 Watt CFL	48	48
Four Lamp F40/Biax	8	7
One Lamp F54/T5	97	0
6-32 Watt CFL	9	0
2-13 Watt CFL	7	7
1-22 Watt and 1-32 Watt CFL	8	7
200 Watt Incandescent	5	5
Four Lamp F40/Biax/HO	1	0
6-40 Watt Incandescent	10	0
Four Lamp F25/T8	0	88
Two Lamp F96/T12	0	1
Two Lamp F25/T8	0	123
100 Watt Incandescent	0	25
26 Watt CFL	0	11
18 Watt CFL	0	3
Total	**2,385**	**2,330**

Table 52: Tracking vs. Evaluation Fixture Quantities

Evaluators interviewed the site contact person to obtain school occupancy schedules for the entire year. Facility personnel provided the school calendar so that the evaluation could determine the holidays, breaks and summer vacation days used for the analysis. The school holidays include New Year's Day, Martin Luther King's Birthday, Washington's Birthday, Good Friday, Patriot's Day, Memorial Day, Independence Day, Labor Day, Rosh Hashanah, Yom Kippur, Columbus Day, Veteran's Day, Thanksgiving (Wednesday through Friday) Christmas Eve and Christmas Day. School breaks include the week of Washington's Birthday in February, the week of Patriot's Day in April and the week following Christmas through New Year's Day. Summer vacation begins the last week of June and ends the first week of September. The monitoring period covered the entire spring break from April 20 – 24, 2009.

Discussions with facility personnel revealed that there is very minimal usage during the summer vacation. According to facility personnel, there is no summer school at this facility, and all the classrooms remain unoccupied except for cleaning. There is typically some usage in the gymnasium and main offices during the summer. Evaluators assumed that the operation captured during the spring break was reasonable to use for the summer period as well as holidays. During this time period, the lighting loggers showed that the classrooms were mostly off during the break, while the gymnasium and offices showed some daytime usage similar to how the school operates in the summer.

Table 53 presents the values obtained from the monitored data including annual operation, summer and winter diversity factors, and on-peak hours of use.

Schedules 30 and 31 represent the average center and outer gym fixtures, respectively. The gym is controlled by a system that operates similar to a time clock, but can be overridden by faculty using wall switches. The system allows the lights to operate weekdays between 5 am and 10 pm. During this time, the wall switches are used by faculty to turn on and off the lights as desired. If the lights are required outside of this time window or on weekends, the system can be temporarily overridden. According to facility personnel, the gym teachers usually operate the middle eight rows of lights more than the outer four rows of lights. Therefore, evaluators monitored four circuits of lights using TOU-CT loggers. The monitored lights included two middle rows of fixtures (Schedules 25 and 26) and the four outer rows (Schedules 27 and 28). Schedule 30 was created as the average of Schedules 25 and 26, while Schedule 31 was created as the average of Schedules 27 and 28. Note that (12) of the (84) metal halides in the gymnasium are considered emergency fixtures and are on 8,760 hours per year. This was accounted for in the analysis.

Schedules 32 and 33 were created to represent the average classroom main lights and indirect biax lighting, respectively. Evaluators monitored several of the main pendant fixtures in several classrooms as well as some of the indirect biax fixtures located above the blackboards in each classroom. Schedules 7, 13, 15, 16 20 and 21 were averaged together to create Schedule 32. Each of these loggers was placed in classrooms that did not have occupancy sensors. This schedule was used to represent the operation of all of the classroom main lighting fixtures that were not on occupancy sensors. Schedules 6, 11, 12 and 24 were averaged together to create Schedule 33. Each of these loggers was placed within the indirect biax fixtures. Schedule 33 was used to represent all of the indirect biax fixtures in each of the classrooms.

For classrooms with occupancy sensors, evaluators assigned Schedule 5 to these spaces for both the baseline and installed operation. Schedule 5 represents the logger that was installed in a classroom with occupancy sensor control.

Schedule 34 was created to represent the average storage room in the school. Evaluators monitored one storage space (Schedule 19) that showed approximately 2 hours of use per year. Evaluators assumed that the average storage space would operate more than 2 hours a year and decided to combine the operation of this space with the operation of the classroom that showed the least amount of usage (Schedule 21). The result is an operation that equals approximately 56 hours per year. Evaluators believed that this was a more reasonable estimate of operation for this type of space.

Schedule 35 represents the average hallway schedule and was calculated as the average of Schedules 14 and 22. According to facility personnel, almost all of the hallway lighting is shut off at night, with the exception of some main entrance lobby lighting and approximately (8) four lamp F25/T8 fixtures that operate 8,760 hours per year. Evaluators monitored one of the continuously operating hallway fixtures, (Schedule 18) and used this for all of the hallway and stairway lighting that remains on 24/7. All other hallway lighting was assumed to operate according to Schedule 35.

Evaluators were unable to install any lighting loggers due to the height of the ceiling or any CT or power loggers due to the size of the circuit breakers controlling the auditorium lighting, which represents approximately 8% of the total wattage of the school. In the absence of monitoring data, evaluators created Schedule 36 to estimate the operation of the auditorium lighting based on information taken from facility personnel. According to the site contact, there is minimal usage of the auditorium lights during the day. Evaluators assumed 10% operation on school days between 7 am and 2 pm. Afternoons typically see more usage of the space, assumed to be approximately 50% of the time between 2 pm and 6 pm, Monday through Thursday and 2 pm to 4 pm on Friday due to rehearsals and after school activities. Evenings, the auditorium is used for weekly town meetings and the occasional school production. Evaluators estimated the evening/night usage to be approximately 25% between 6 pm and 9 pm, Monday through Thursday. This estimated night usage equates to approximately one meeting or school production per week. There is typically no usage of this space on weekends or holidays.

Schedule ID	Logger #	Description	Annual Hours	Summer Diversity	Winter Diversity	On-Peak Hours
1	940629-232	Chorus Rm	1,415	25%	19%	1,329
2	940629-253	Art Room	462	1%	0%	462
3	940629-270	Teachers Planning Rm	1,668	21%	5%	1,650
4	940629-275	Health Suite	1,301	17%	0%	1,300
5	940629-295	CLRM C215 Main Lights (OS)	708	6%	3%	707
6	940629-355	CLRM C332 Biax Fixtures	678	7%	8%	678
7	940629-356	CLRM C332 Main Lights (NS)	498	5%	3%	498
8	940629-363	Asst Principal Office	1,481	39%	4%	1,356
9	940629-367	Cafeteria	2,498	23%	16%	2,022
10	940629-400	Locker Room Boys	2,702	63%	70%	2,581
11	940629-404	CLRM C317 Biax Fixtures	1,331	12%	10%	1,252
12	940824-001	CLRM C202 Biax Fixtures	1,184	15%	3%	1,183
13	940824-048	CLRM C317 Main Lights (NS)	997	12%	11%	997
14	940824-060	Hallway outside C201	1,833	26%	16%	1,819
15	940824-066	CLRM C202 Main Lights (NS)	1,190	15%	3%	1,190
16	940824-077	CLRM C207 Main Lights (NS)	1,223	14%	2%	1,222
17	940824-085	Office B207 METCO Office	-	0%	0%	-
18	940824-103	Hallway outside C215	8,760	100%	100%	4,032
19	940824-106	Storage Rm C220	2	0%	0%	2
20	940824-108	CLRM C307 (NS)	1,185	14%	7%	1,185
21	940824-130	CLRM C103 (NS)	110	2%	1%	110
22	940824-132	3rd Fl Hallway	1,872	26%	23%	1,860
23	940824-168	Adjustment Counselor Office	1,392	23%	0%	1,371
24	940824-216	CLRM C215 Biax Fixtures	792	8%	3%	791
25	CT08010018	Relay 8 Gym central fixtures	2,721	28%	32%	2,258
26	CT08010039	Relay 6 Gym central fixtures	2,708	27%	30%	2,234
27	CT08010043	Relay 1 Gym First two rows	2,120	15%	20%	1,657
28	CT08010047	Relay 12 Gym Last two rows	2,062	14%	17%	1,600
29	T040303236	Office B201B Library Office	192	3%	0%	192
30	NA	Average Center Gym Fixtures	2,715	28%	31%	2,246
31	NA	Average Outer Gym Fixtures	2,091	15%	18%	1,629
32	NA	Average (NS) Classroom	867	10%	5%	867
33	NA	Average Classroom Biax	996	10%	6%	976
34	NA	Average Storage	56	1%	1%	56
35	NA	Average Hallway	1,852	26%	19%	1,839
36	NA	Estimated Auditorium Usage	584	12%	26%	584

Table 53: Annual Hours of Use and Diversity Factors of Monitored Data

To estimate annual energy and demand savings, a spreadsheet method was employed. The summary of this spreadsheet is presented in Table 54. Annual hours and diversity factors from Table 53 are used with wattages from Table 54 to calculate energy and demand savings. The schedule ID's from Table 53 are presented in Table 54 to show which schedule was used with each fixture ID. The final on-site savings estimates are presented in Table 54.

The facility's heat is provided by natural gas which has no electrical interaction with the new lighting. However, because of the reduced heat going into the space due to the installation of more efficient lighting, there will be a need for additional heat from the facility's forced air system. It was estimated that this heating penalty is equal to approximately 263 MMBTU's per year. This was calculated using a heating efficiency of 77% for a hot water boiler. This estimate for efficiency is an assumption based on a standard efficiency for a hot water boiler. Likewise, most of the school is air-conditioned using packaged DX units. According to facility personnel, the only space that is not cooled is the gymnasium. Evaluators calculated additional energy savings resulting from reduced cooling loads on the system. Evaluators assumed an efficiency rating of 1.2 kW/ton for the packaged DX units. This is assumed to be the standard efficiency for this type of air-conditioning system.

The average daily lighting profiles for the all the monitored spaces are presented in Figure 52 through Figure 87. This includes the average weekday, weekend day and holiday. The x-axis represents one full day and the y-axis is the percentage that the lights are on for each hour.

An hourly summary of the site kW savings for an average summer (June through August), non-holiday, weekday is presented in Table 55. This summary is provided so that the summer diversified peak kW can be estimated across any range of hours in the event that the FCM definition for summer peak changes in the future. The same summary was also provided for the average winter (December and January), non-holiday, weekday in Table 56.

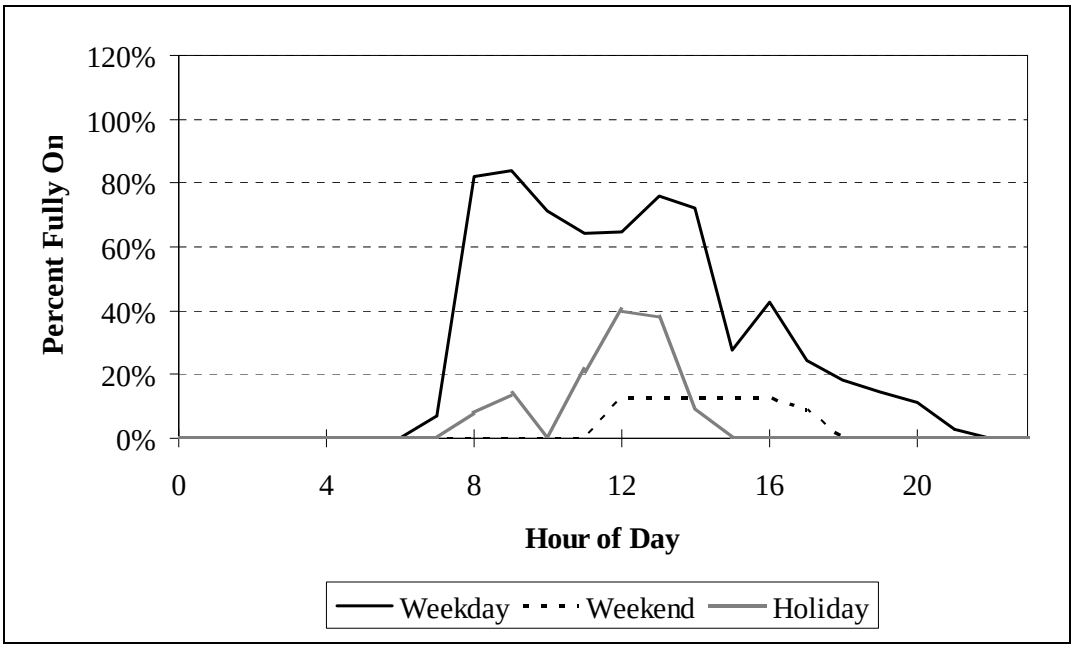

Figure 52: Average Daily Lighting Profile for Schedule 1 (Chorus Room) from 3/31/09 to 4/28/09

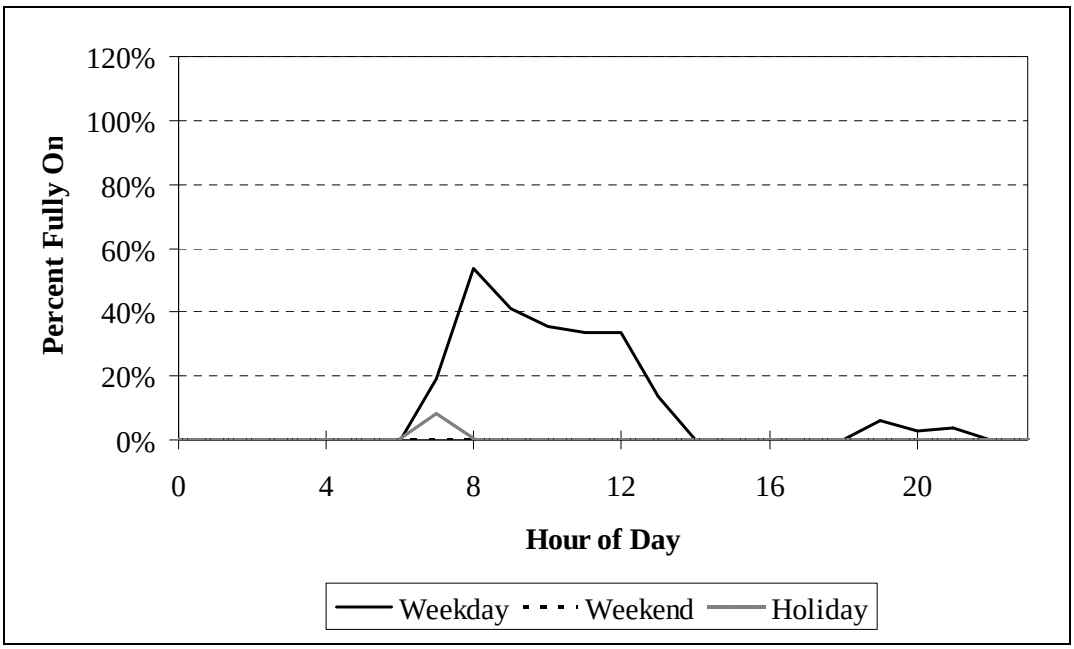

Figure 53: Average Daily Profile for Schedule 2 (Art Room) from 3/31/09 to 4/28/09

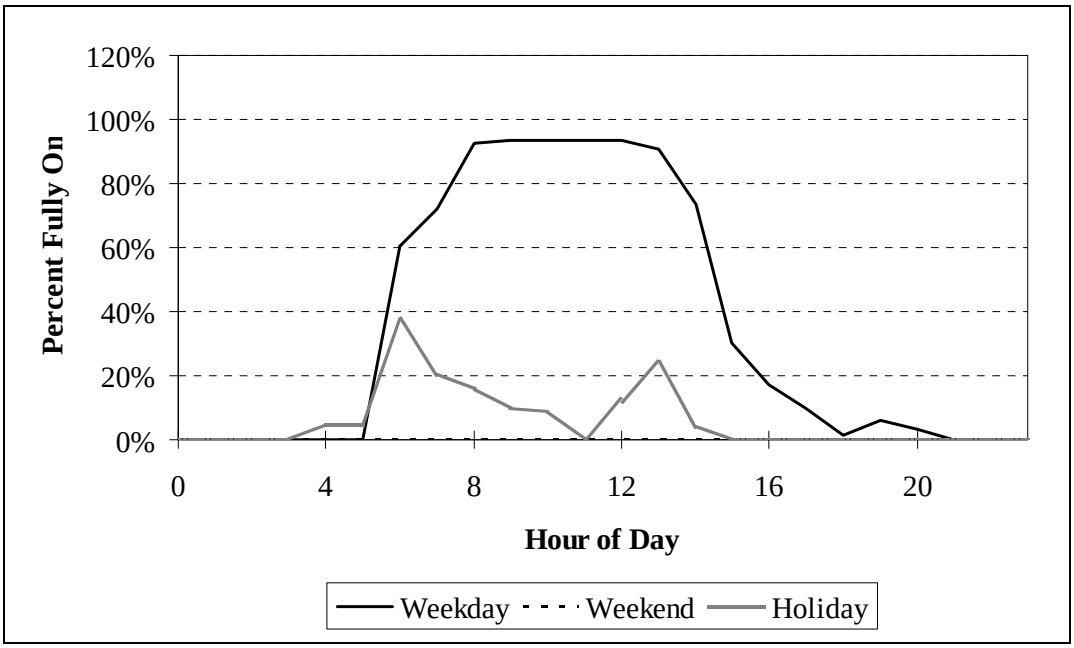

Figure 54: Average Daily Lighting Profile for Schedule 3 (Teachers Planning) from 3/31/09 to 4/28/09

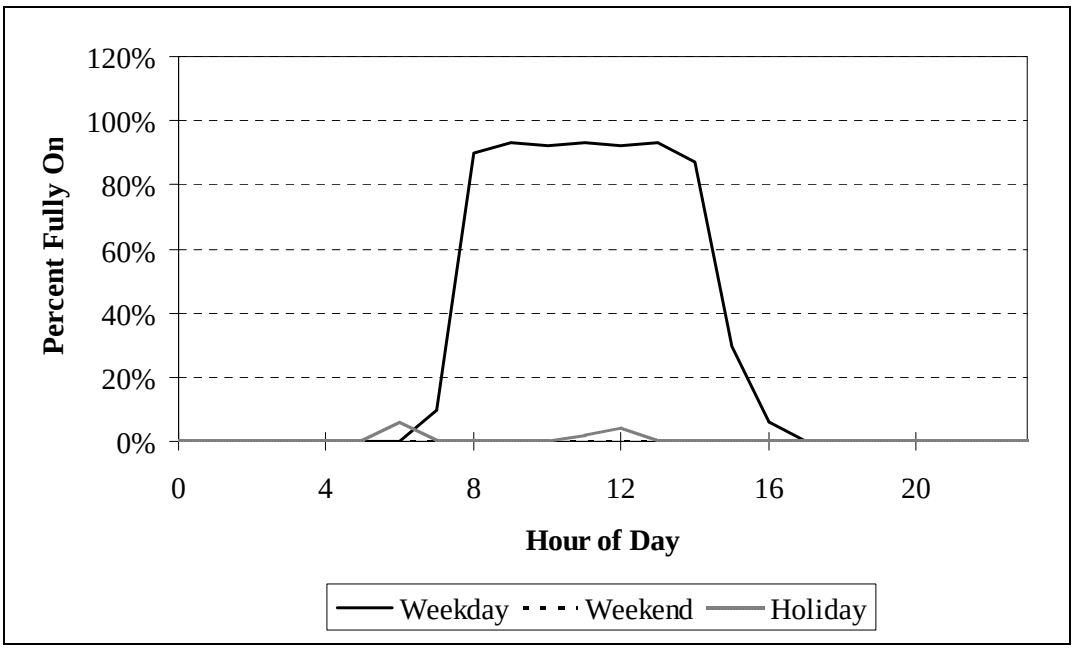

Figure 55: Average Daily Lighting Profile for Schedule 4 (Health Suite) from 3/31/09 to 4/28/09

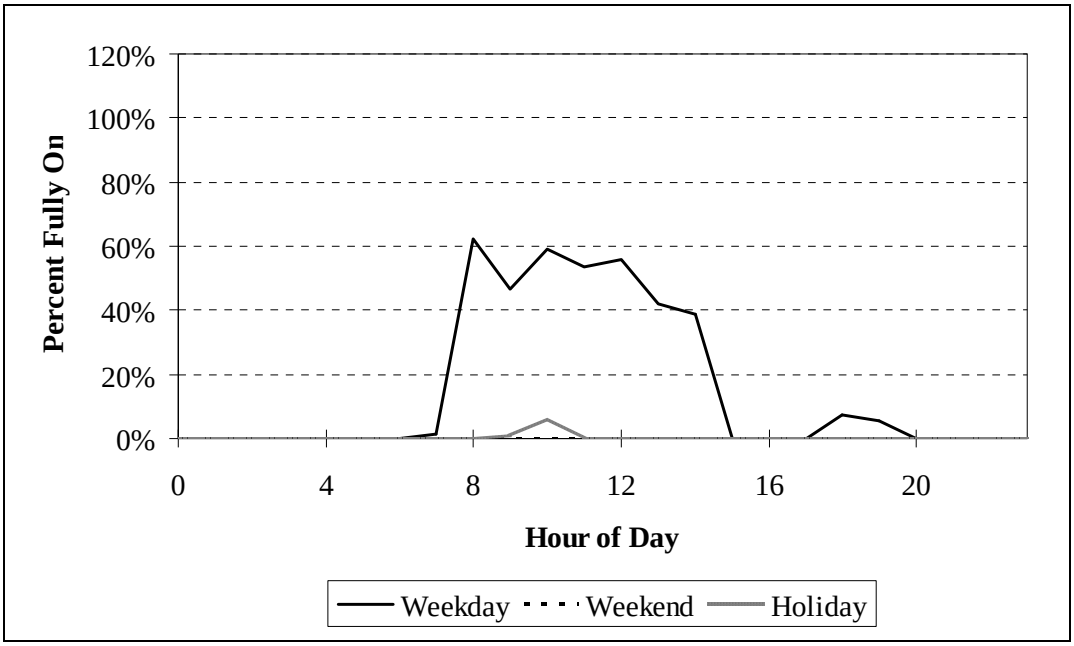

Figure 56: Average Daily Lighting Profile for Schedule 5 (Classroom C215 Main Lights w/OS) from 3/31/09 to 4/28/09

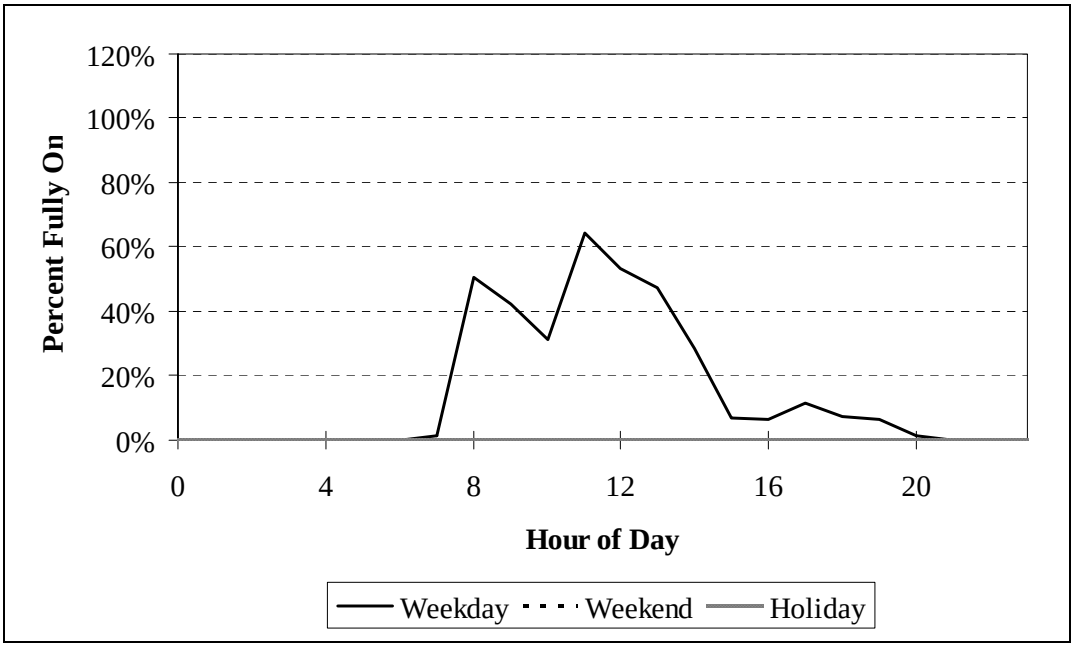

Figure 57: Average Daily Lighting Profile for Schedule 6 (Classroom C332 Biax) from 3/31/09 to 4/28/09

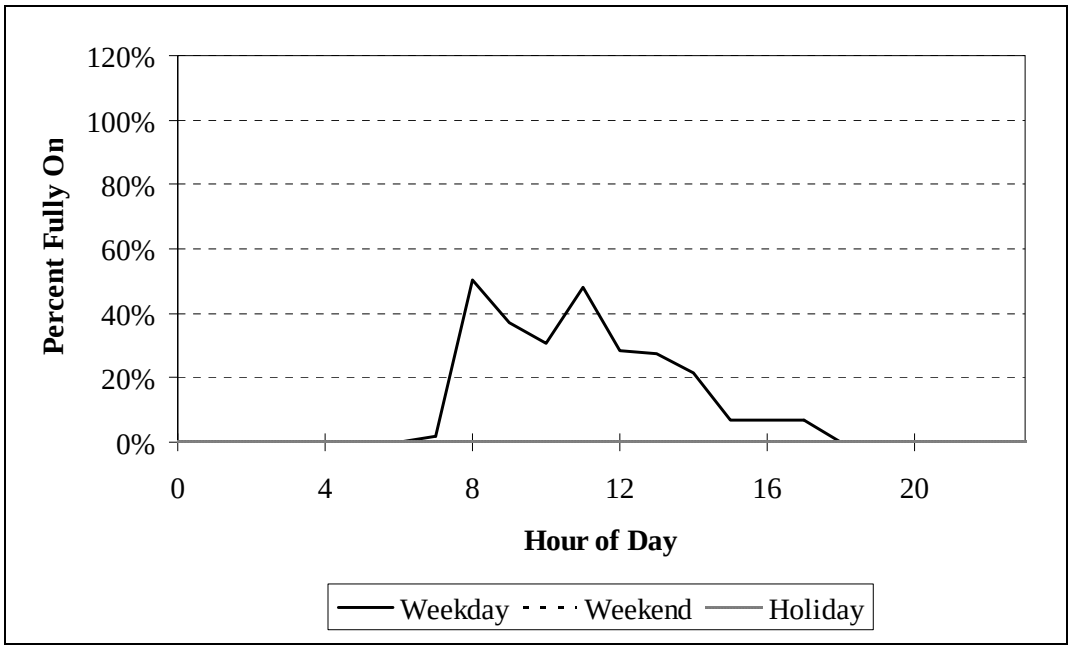

Figure 58: Average Daily Lighting Profile for Schedule 7 (Classroom C332 Main Lights) from 3/31/09 to 4/28/09

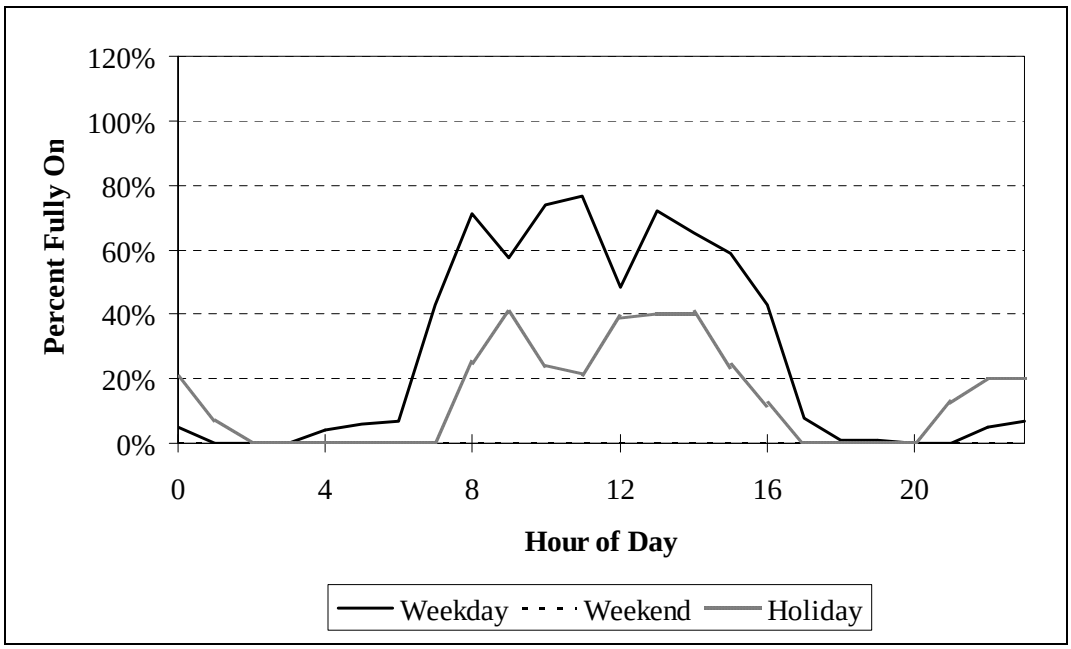

Figure 59: Average Daily Lighting Profile for Schedule 8 (Asst. Principal Office) from 3/31/09 to 4/28/09

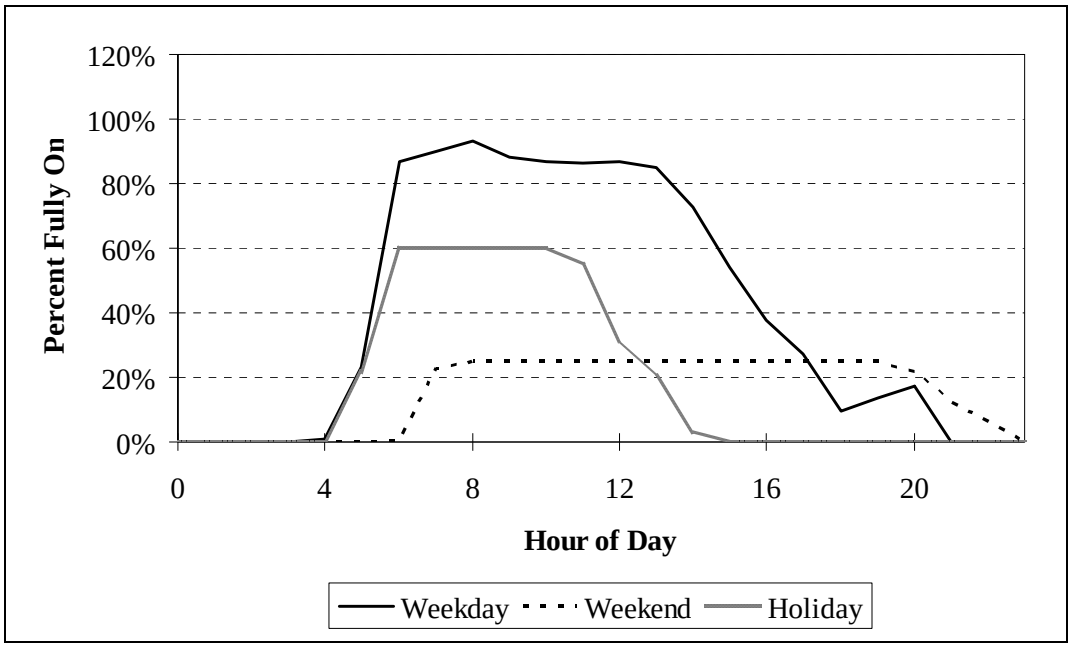

Figure 60: Average Daily Lighting Profile for Schedule 9 (Cafeteria) from 3/31/09 to 4/28/09

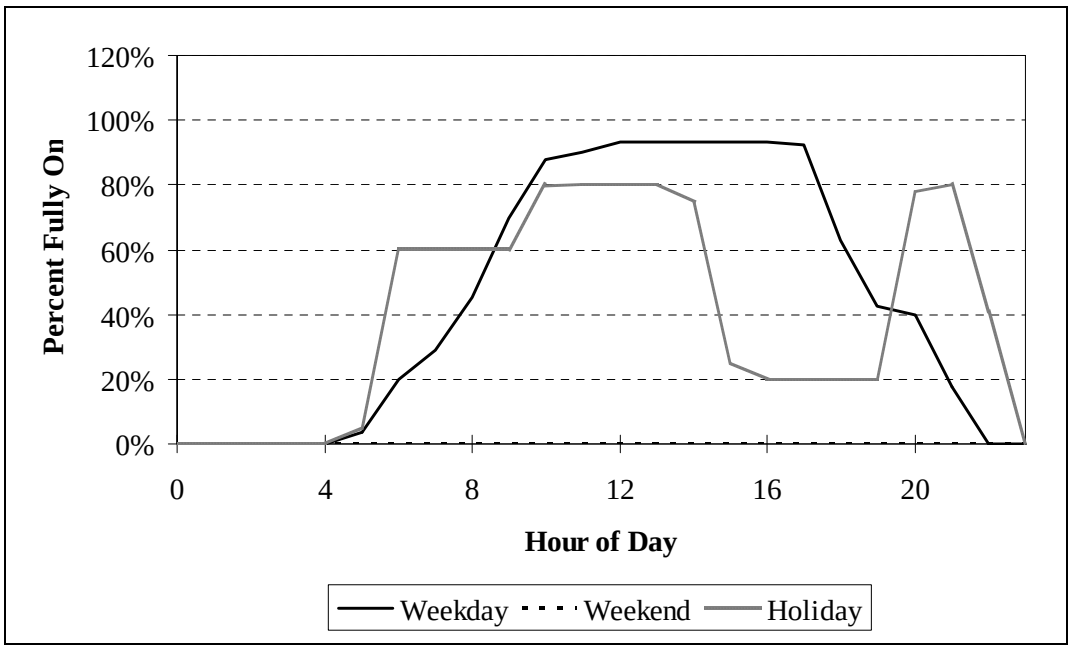

Figure 61: Average Daily Lighting Profile for Schedule 10 (Boys Locker Room) from 3/31/09 to 4/28/09

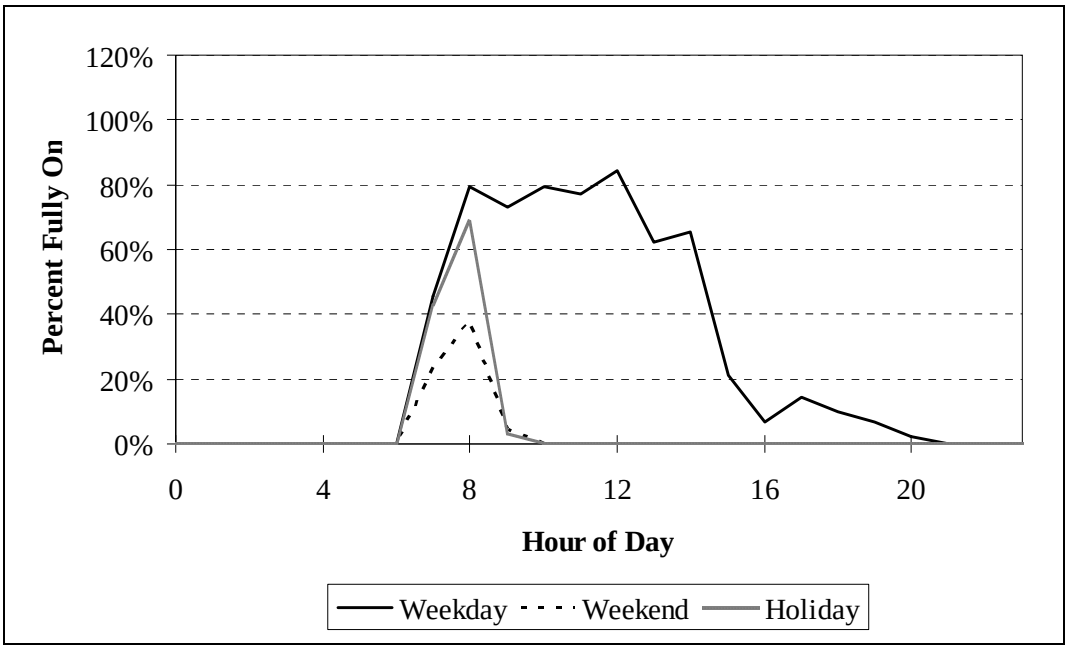

Figure 62: Average Daily Lighting Profile for Schedule 11 (Classroom C317 Biax) from 3/31/09 to 4/28/09

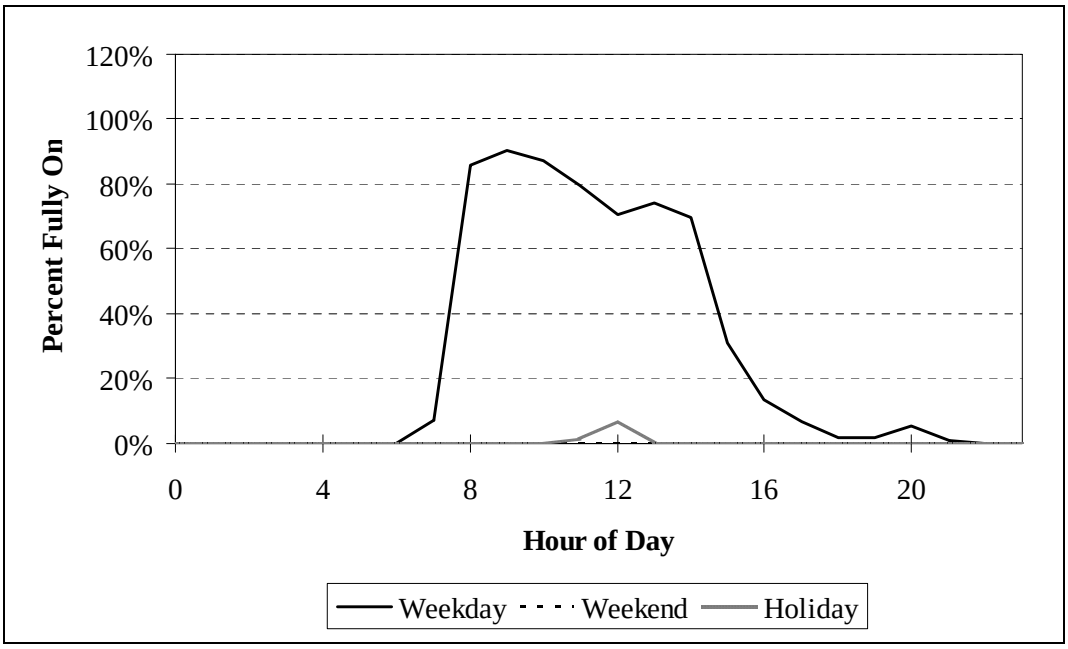

Figure 63: Average Daily Lighting Profile for Schedule 12 (Classroom C202 Biax) from 3/31/09 to 4/28/09

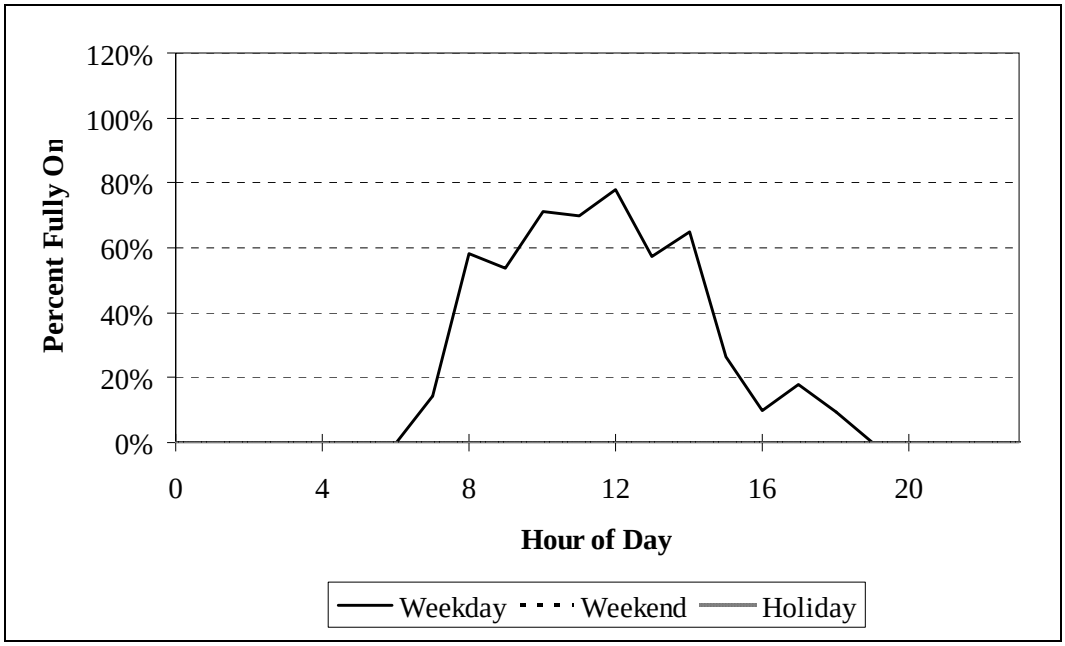

Figure 64: Average Daily Lighting Profile for Schedule 13 (Classroom C317 Main Lights) from 3/31/09 to 4/28/09

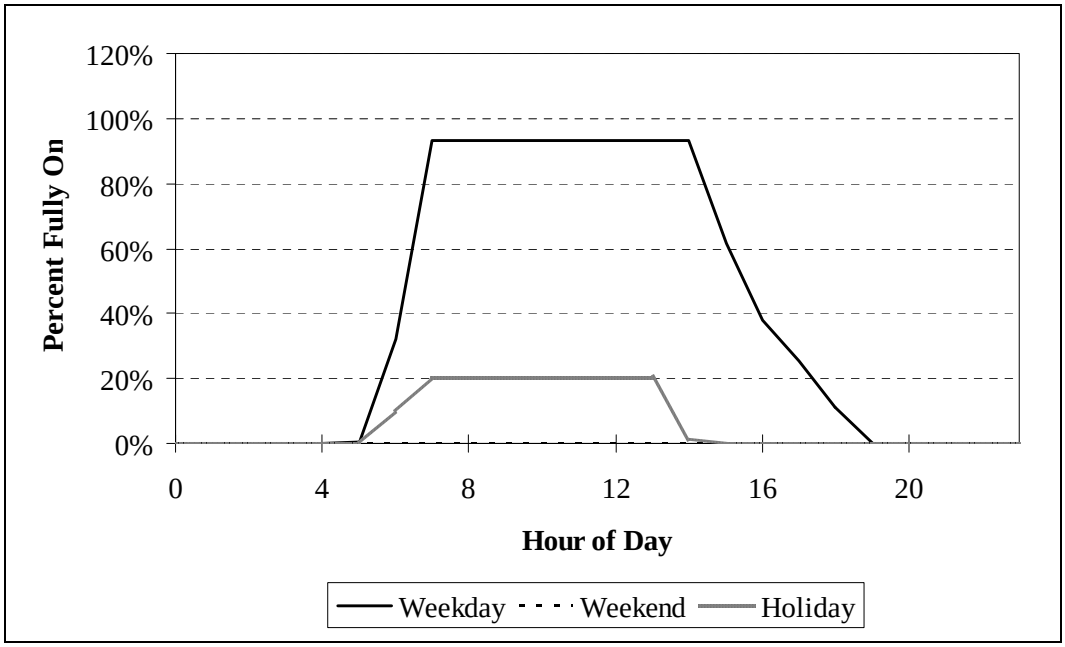

Figure 65: Average Daily Lighting Profile for Schedule 14 (Hallway) from 3/31/09 to 4/28/09

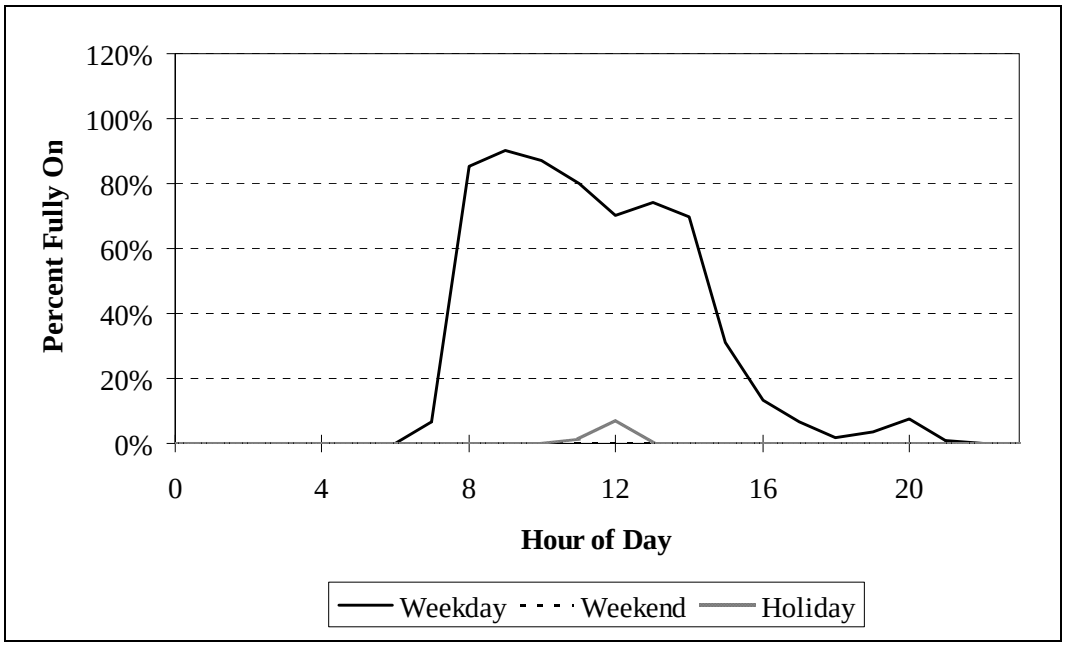

Figure 66: Average Daily Lighting Profile for Schedule 15 (Classroom C202 Main Lights) from 3/31/09 to 4/28/09

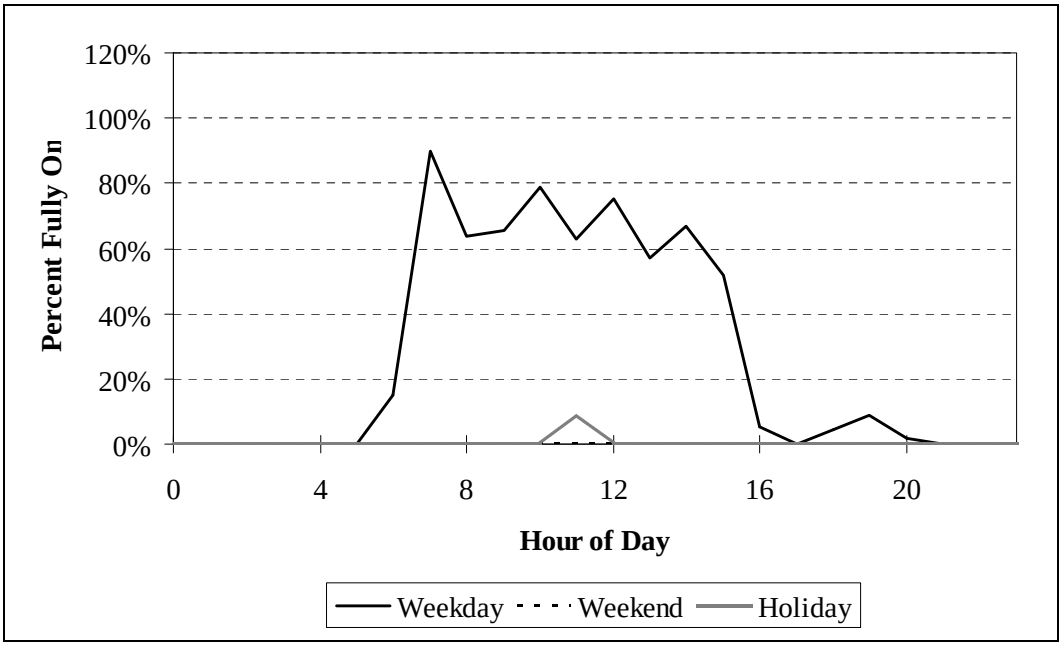

Figure 67: Average Daily Lighting Profile for Schedule 16 (Classroom C201 Main Lights) from 3/31/09 to 4/28/09

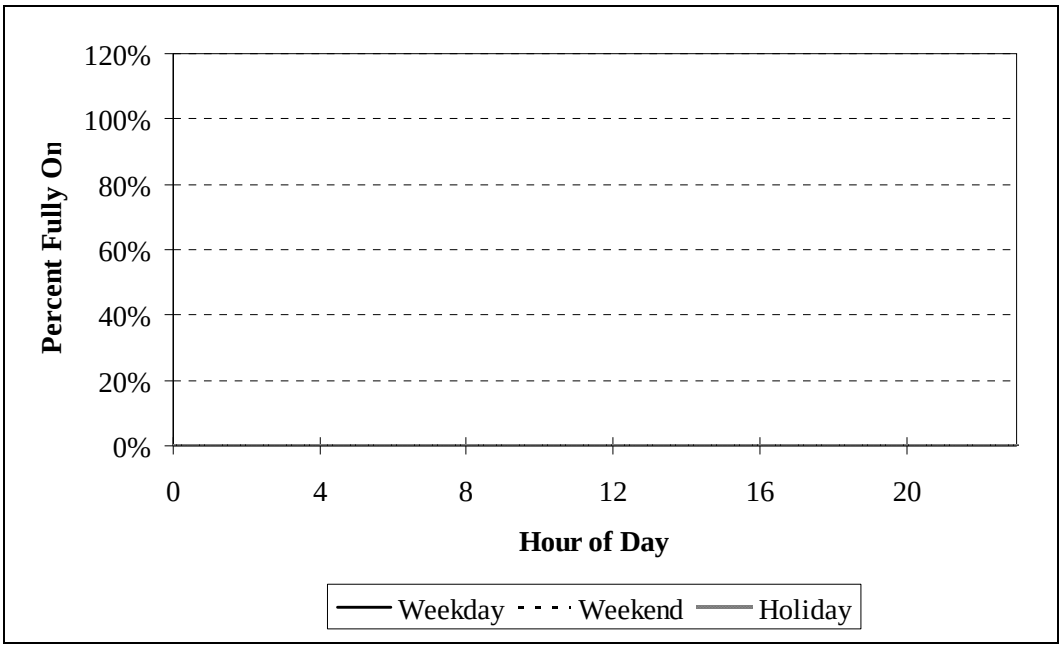

Figure 68: Average Daily Lighting Profile for Schedule 17 (Private Office) from 3/31/09 to 4/28/09

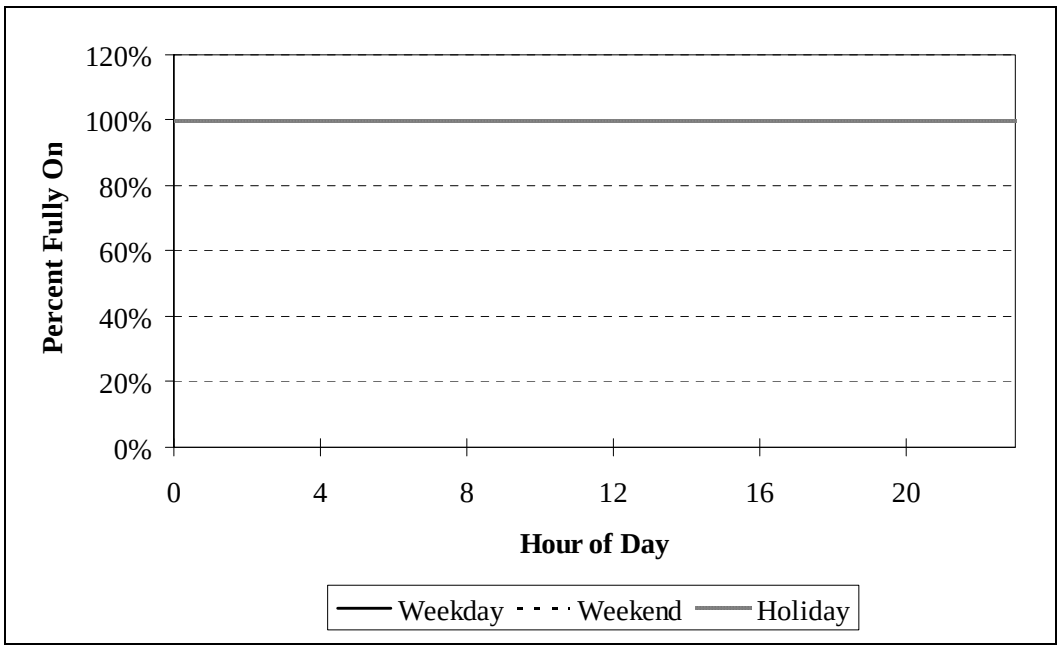

Figure 69: Average Daily Lighting Profile for Schedule 18 (Hallway) from 3/31/09 to 4/28/09

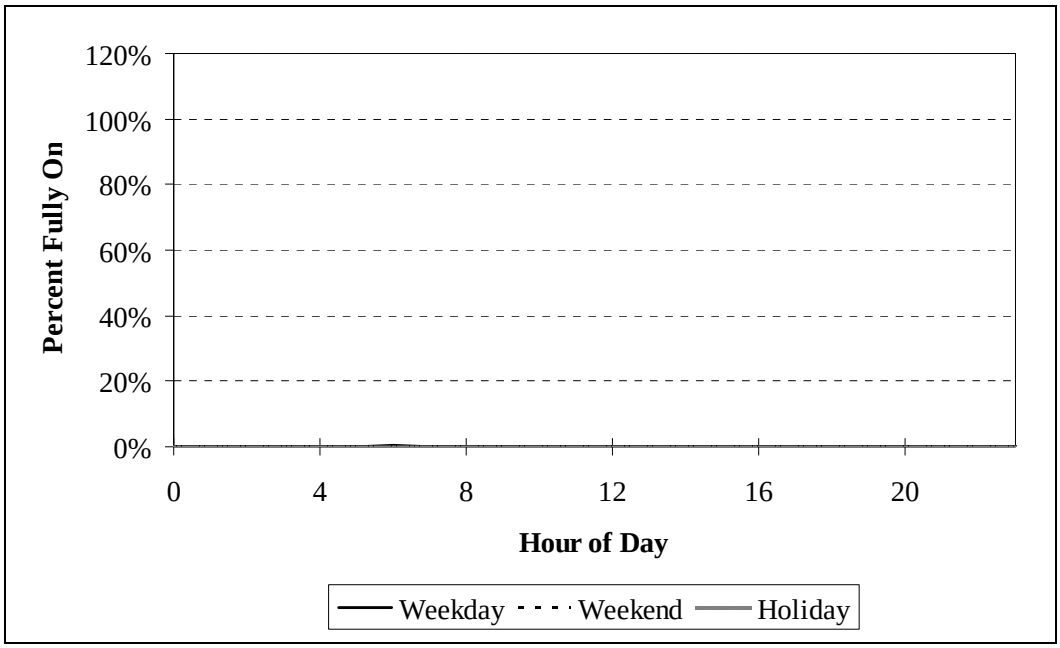

Figure 70: Average Daily Lighting Profile for Schedule 19 (Storage Room) from 3/31/09 to 4/28/09

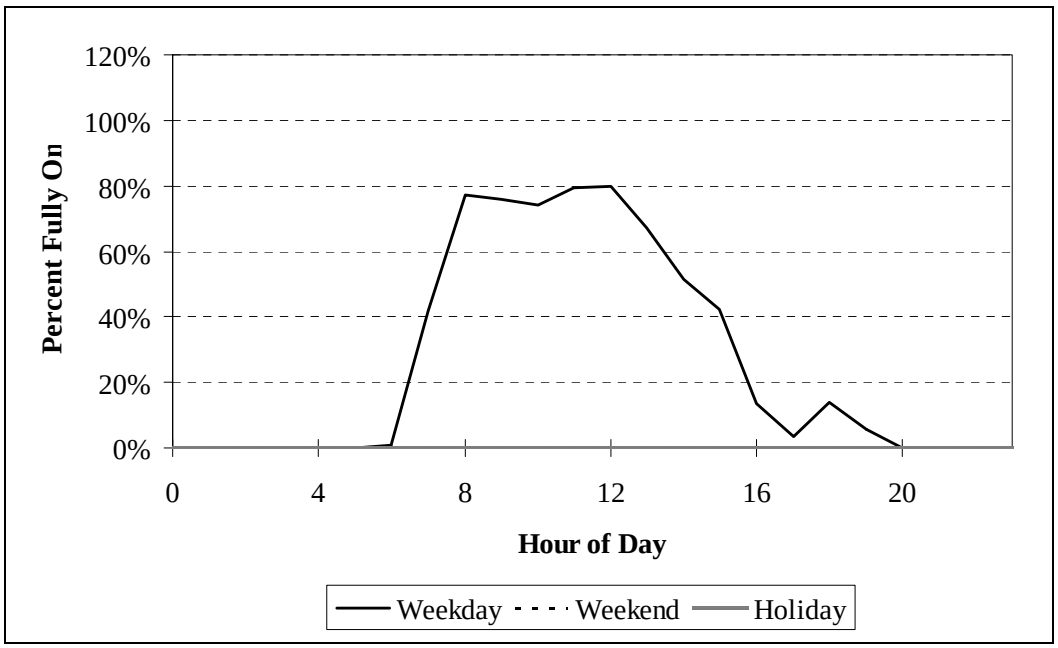

Figure 71: Average Daily Lighting Profile for Schedule 20 (Classroom C307 Main Lights) from 3/31/09 to 4/28/09

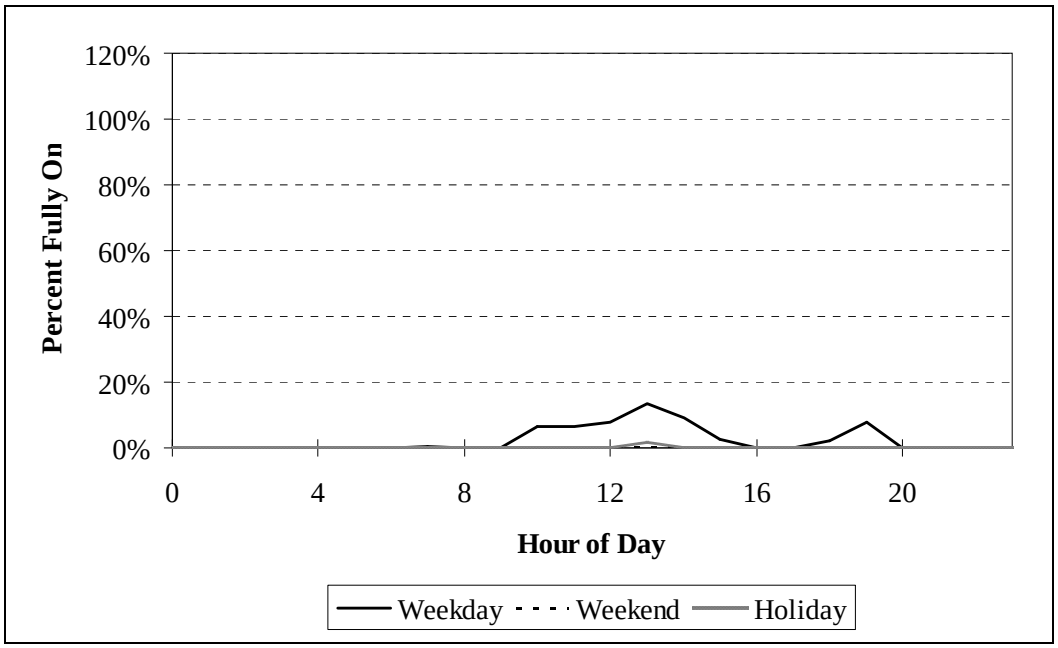

Figure 72: Average Daily Lighting Profile for Schedule 21 (Classroom C103 Main Lights) from 3/31/09 to 4/28/09

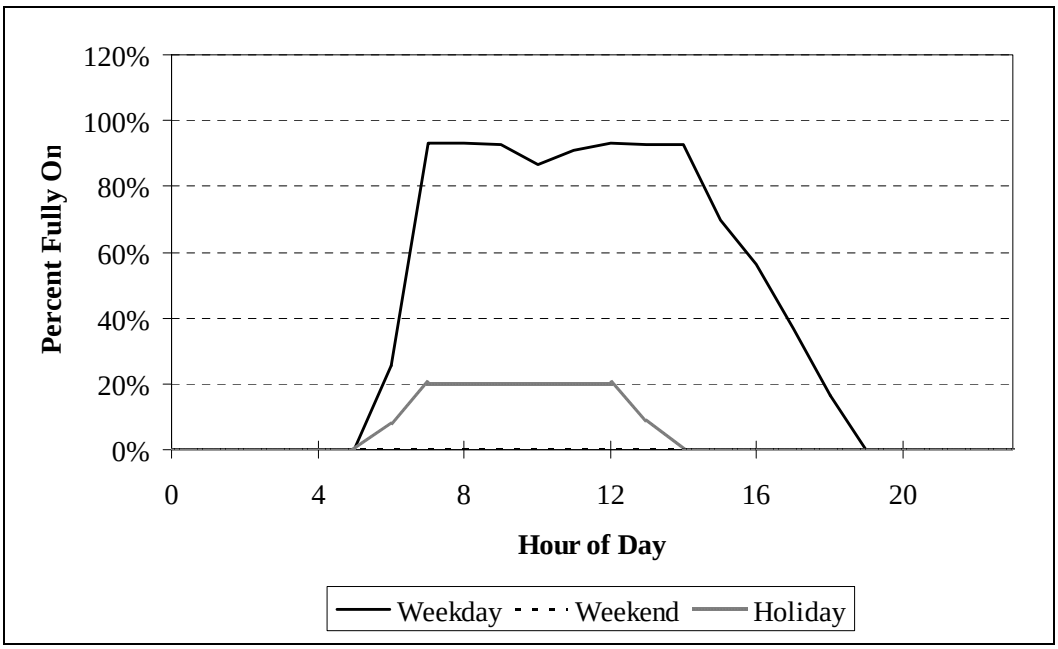

Figure 73: Average Daily Lighting Profile for Schedule 22 (Hallway) from 3/31/09 to 4/28/09

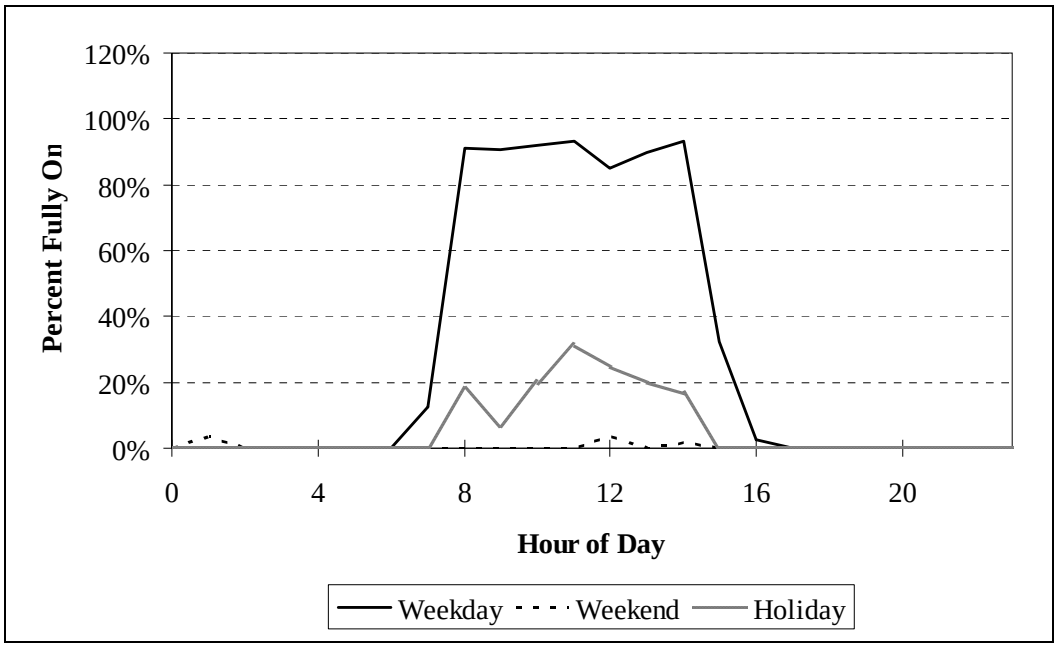

Figure 74: Average Daily Lighting Profile for Schedule 23 (Counselor Office) from 3/31/09 to 4/28/09

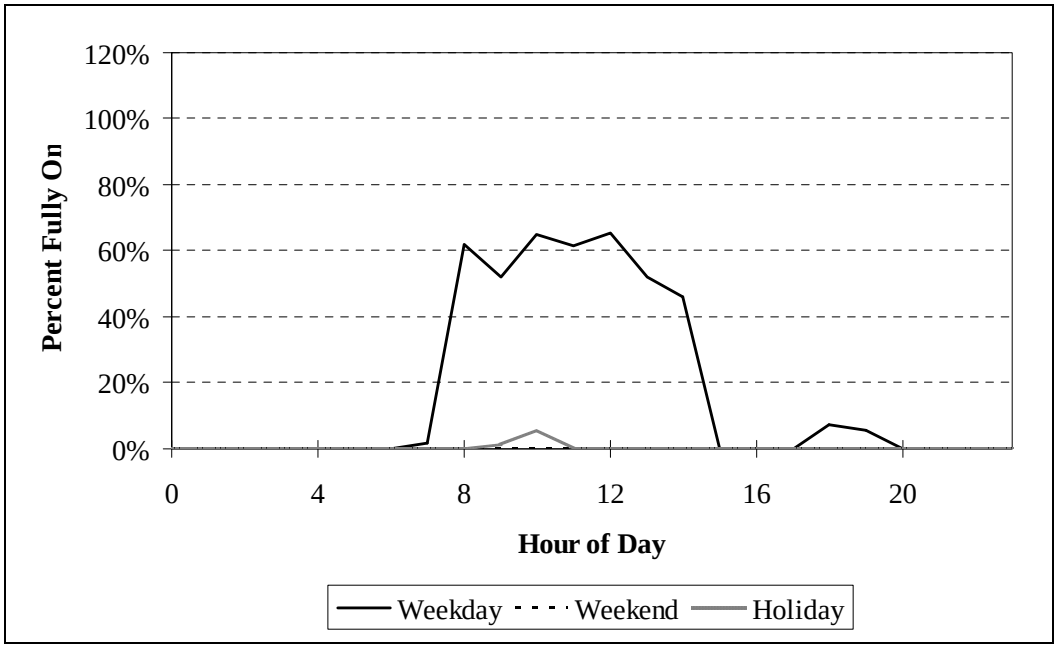

Figure 75: Average Daily Lighting Profile for Schedule 24 (Classroom C315 Biax) from 3/31/09 to 4/28/09

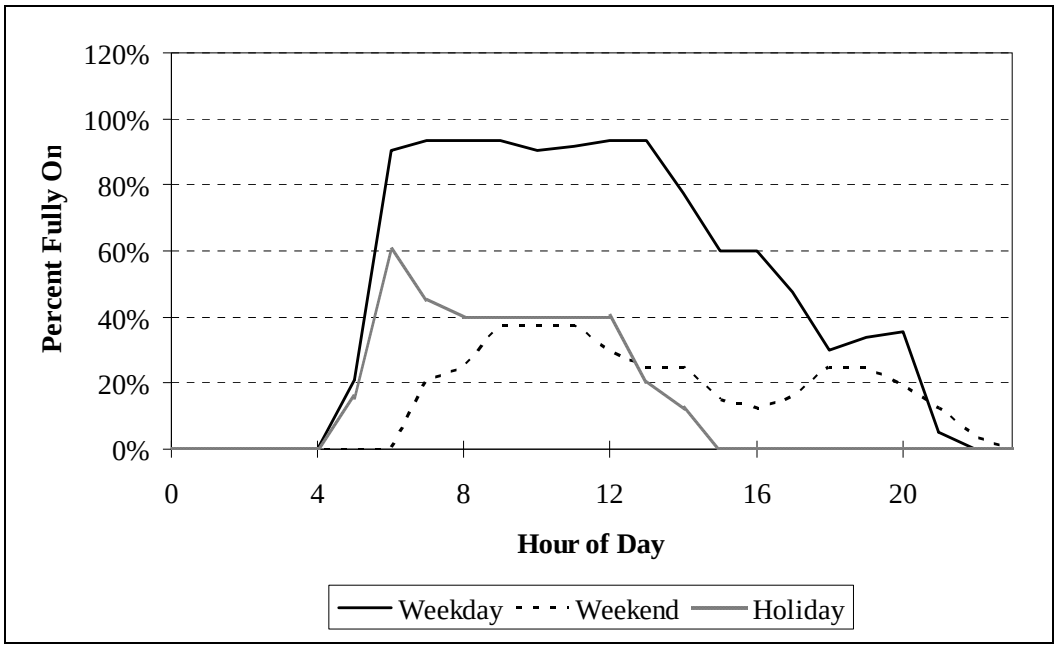

Figure 76: Average Daily Lighting Profile for Schedule 25 (Gym Central Fixtures) from 3/31/09 to 4/28/09

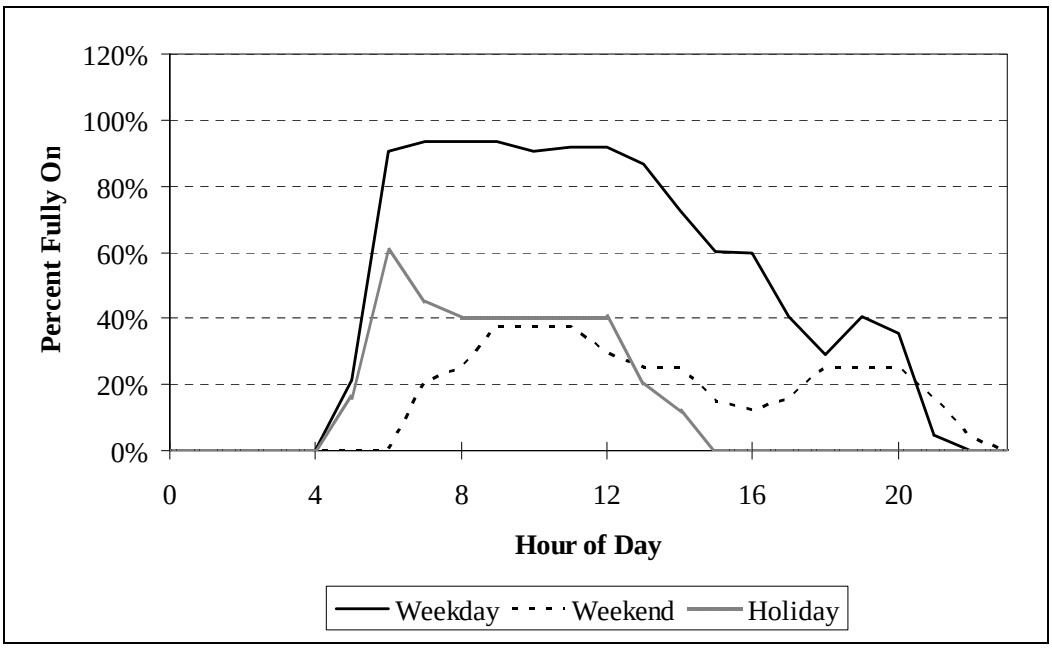

Figure 77: Average Daily Lighting Profile for Schedule 26 (Gym Central Fixtures) from 3/31/09 to 4/28/09

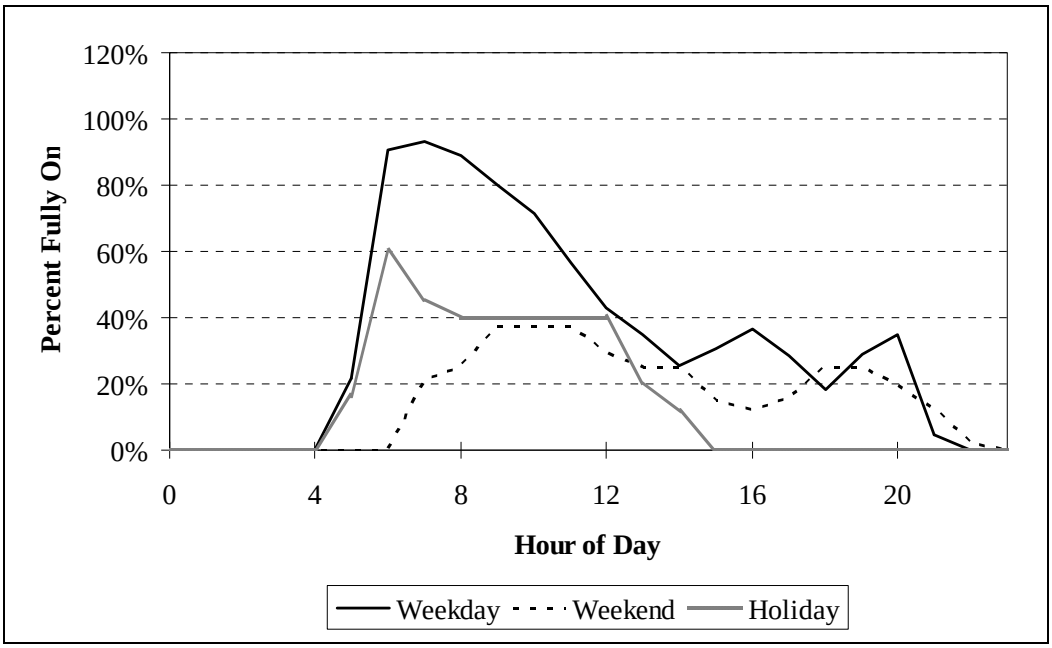

Figure 78: Average Daily Lighting Profile for Schedule 27 (Gym First Two Rows) from 3/31/09 to 4/28/09

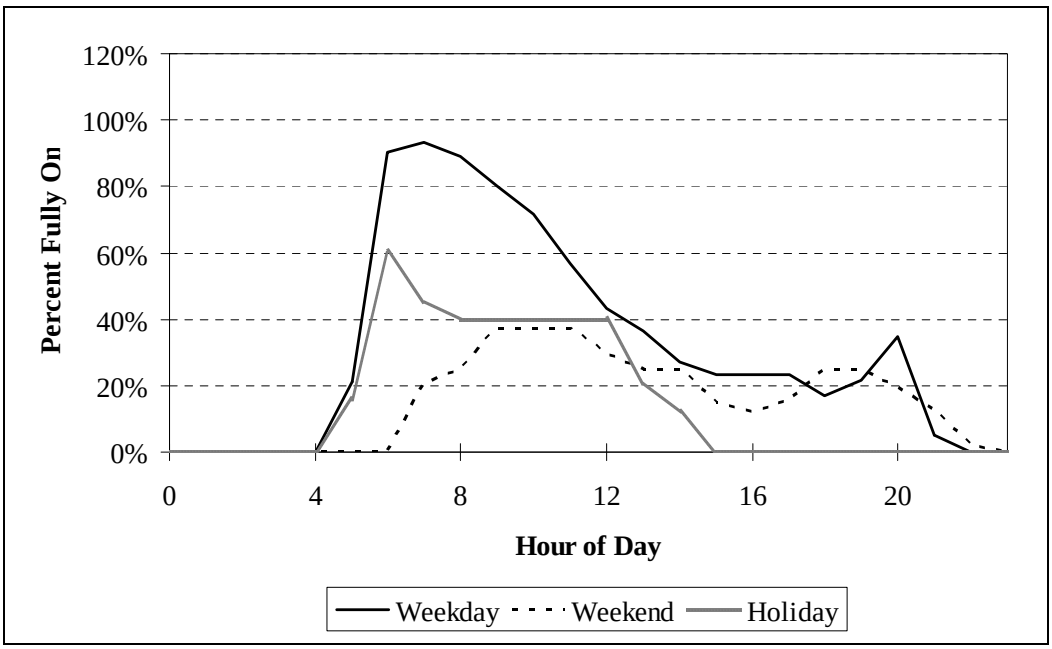

Figure 79: Average Daily Lighting Profile for Schedule 28 (Gym Last Two Rows) from 3/31/09 to 4/28/09

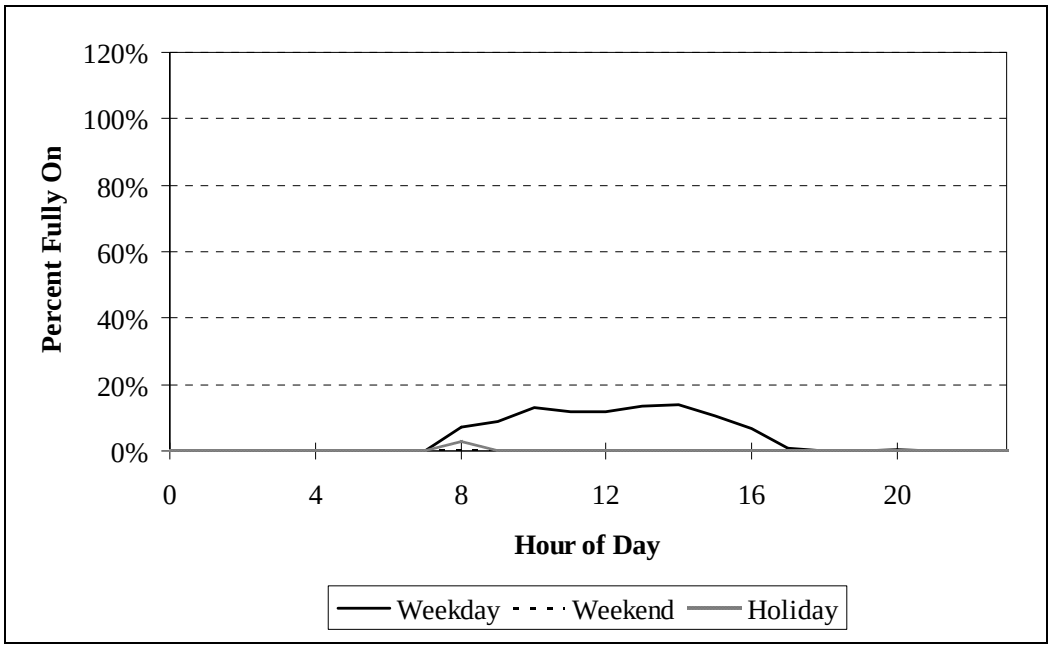

Figure 80: Average Daily Lighting Profile for Schedule 29 (Library Office) from 3/31/09 to 4/28/09

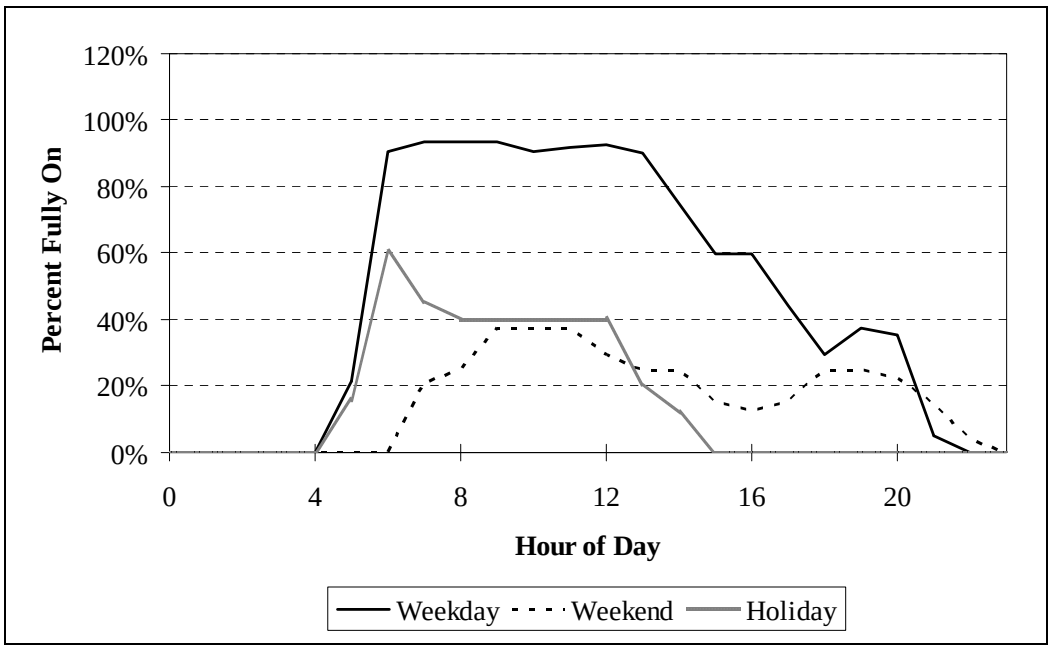

Figure 81: Average Daily Lighting Profile for Schedule 30 (Average Center Gym Fixture) from 3/31/09 to 4/28/09

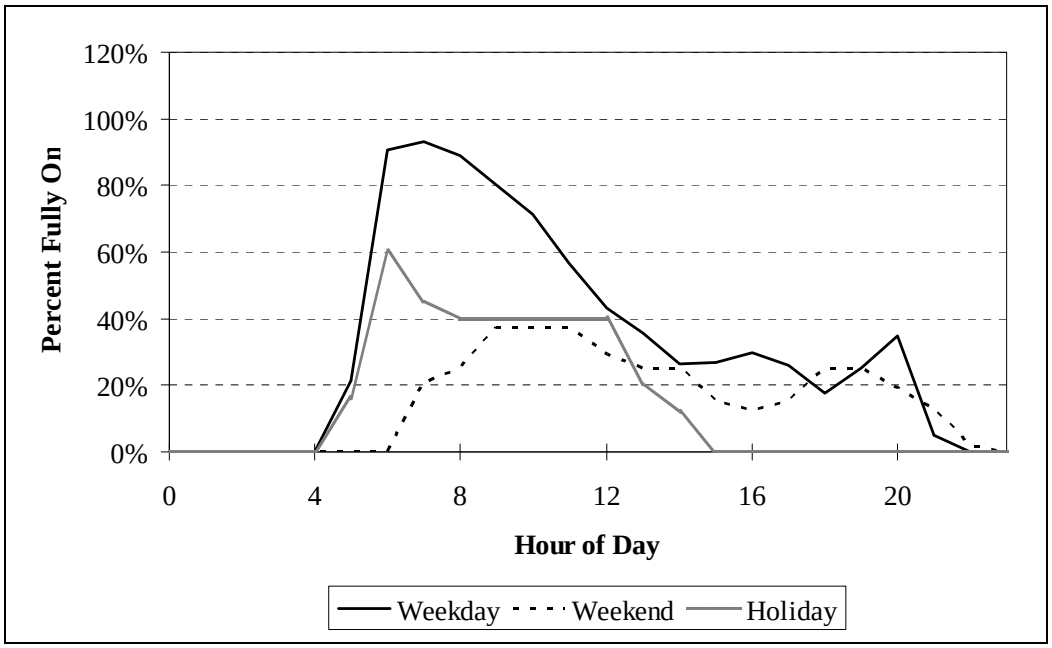

Figure 82: Average Daily Lighting Profile for Schedule 31 (Average Outer Gym Fixture) from 3/31/09 to 4/28/09

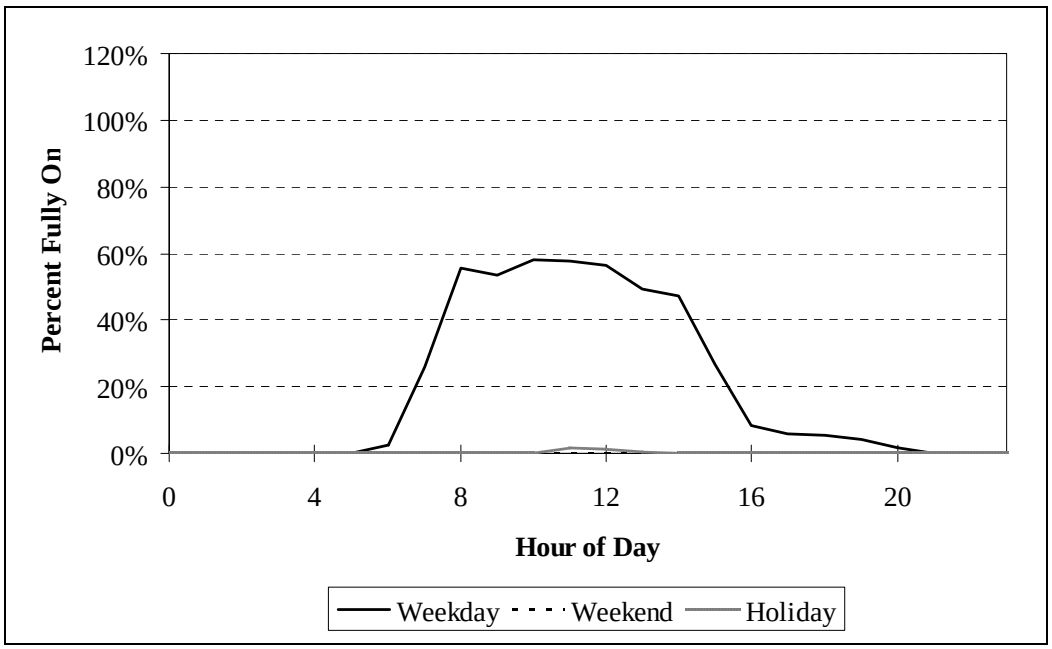

Figure 83: Average Daily Lighting Profile for Schedule 32 (Average Classroom Main Lights) from 3/31/09 to 4/28/09

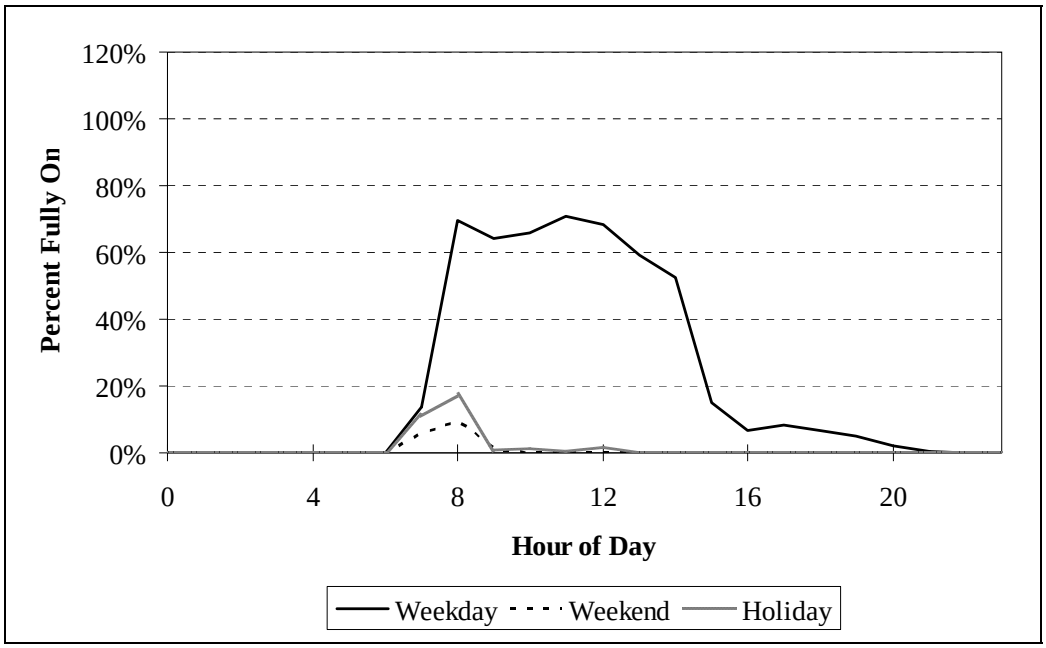

Figure 84: Average Daily Lighting Profile for Schedule 33 (Average Classroom Biax) from 3/31/09 to 4/28/09

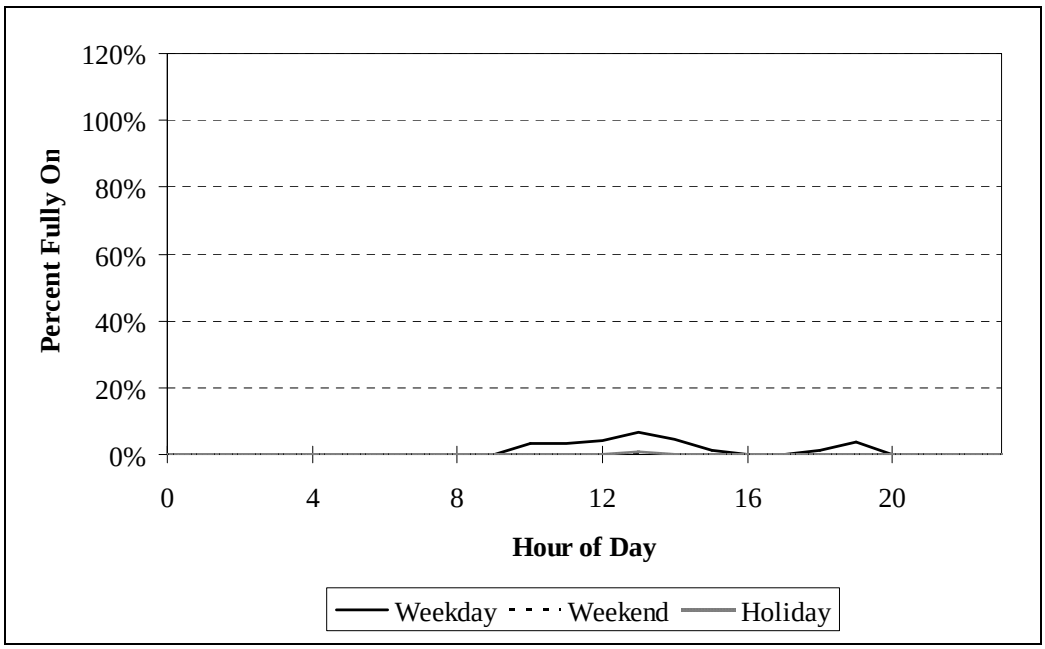

Figure 85: Average Daily Lighting Profile for Schedule 34 (Average Storage) from 3/31/09 to 4/28/09

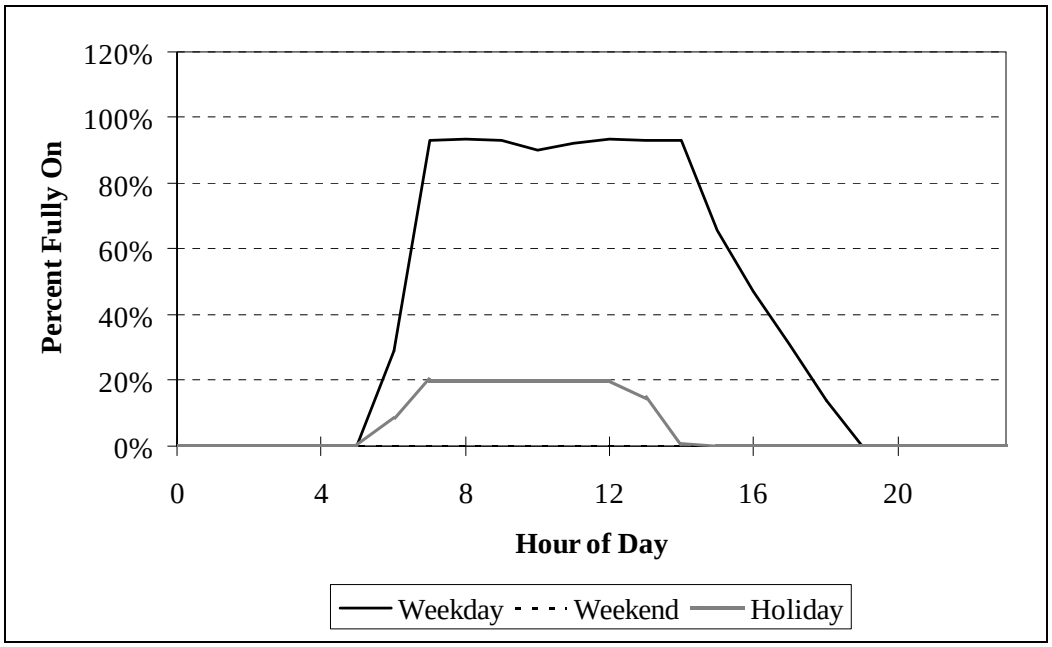

Figure 86: Average Daily Lighting Profile for Schedule 35 (Average Hallway) from 3/31/09 to 4/28/09

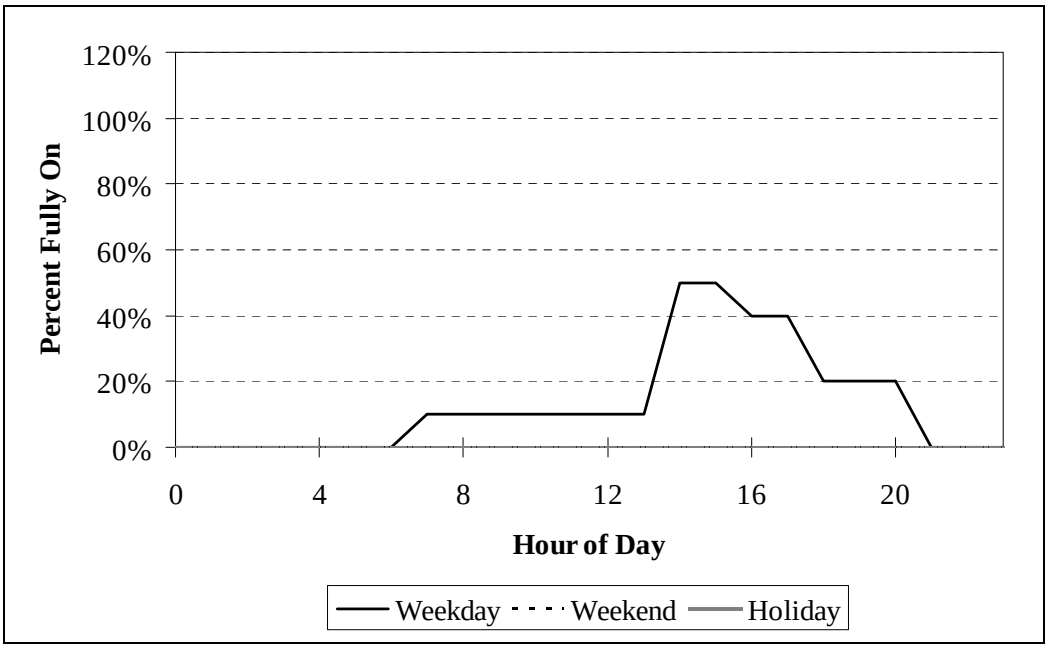

Figure 87: Average Daily Lighting Profile for Schedule 36 (Estimated Auditorium)

Facility Type: High School
Application ID: 525879

Fixture Information

Fixture ID	(a) Space Type	Pre-retrofit Lighting (b) Fixture Type	(c) Fixture Quantity	(d) Fixture Wattage	(e) Hours of Use Annual	(f) Hours of Use Peak	(g) FCM Diversity Factor Summer	(h) FCM Diversity Factor Winter	Post-retrofit Lighting (i) Fixture Type	(j) Fixture Quantity	(k) Fixture Wattage	(l) Hours of Use Annual	(m) Hours of Use Peak	(n) FCM Diversity Factor Summer	(o) FCM Diversity Factor Winter	HVAC (p) COP Cooling	(q) COP Heating	(r) % Space Cooled	(s) % Space Heated	Schedule ID from Table 6 Pre Retrofit	Post Retrofit
1	Autidorium	1.5 Watts/Sqft	32	726	584	584	12%	26%	500W INC	32	500	584	584	12%	26%	2.9	NA	100%	100%	36	36
2	Gym	1.5 Watts/Sqft	51	545	2,715	2,246	28%	31%	350W METAL HALIDE	51	375	2,715	2,246	28%	31%	NA	NA	0%	100%	30	30
3	Gym	1.5 Watts/Sqft	12	545	8,760	4,032	100%	100%	350W METAL HALIDE	12	375	8,760	4,032	100%	100%	NA	NA	0%	100%	18	18
4	Gym	1.5 Watts/Sqft	33	250	2,091	1,629	15%	18%	150W METAL HALIDE	33	172	2,091	1,629	15%	18%	NA	NA	0%	100%	31	31
5	C228 Classroom	1.5 Watts/Sqft	10	128	867	867	10%	5%	3L4' T8/ELIG	10	88	867	867	10%	5%	2.9	NA	100%	100%	32	32
6	C228 Classroom	1.5 Watts/Sqft	3	123	996	976	10%	6%	2L2' F40BX/ELIG	3	72	996	976	10%	6%	2.9	NA	100%	100%	33	33
7	C226 Classroom	1.5 Watts/Sqft	10	128	867	867	10%	5%	3L4' T8/ELIG	10	88	867	867	10%	5%	2.9	NA	100%	100%	32	32
8	C226 Classroom	1.5 Watts/Sqft	3	123	996	976	10%	6%	2L2' F40BX/ELIG	3	72	996	976	10%	6%	2.9	NA	100%	100%	33	33
9	C219 Classroom	1.5 Watts/Sqft	10	128	867	867	10%	5%	3L4' T8/ELIG	10	88	867	867	10%	5%	2.9	NA	100%	100%	32	32
10	C219 Classroom	1.5 Watts/Sqft	3	123	996	976	10%	6%	2L2' F40BX/ELIG	3	72	996	976	10%	6%	2.9	NA	100%	100%	33	33
11	C217 Classroom	1.5 Watts/Sqft	10	128	708	707	6%	3%	3L4' T8/ELIG	10	88	708	707	6%	3%	2.9	NA	100%	100%	5	5
12	C217 Classroom	1.5 Watts/Sqft	3	123	996	976	10%	6%	2L2' F40BX/ELIG	3	72	996	976	10%	6%	2.9	NA	100%	100%	33	33
13	C224 Classroom	1.5 Watts/Sqft	10	128	708	707	6%	3%	3L4' T8/ELIG	10	88	708	707	6%	3%	2.9	NA	100%	100%	5	5
14	C224 Classroom	1.5 Watts/Sqft	3	123	996	976	10%	6%	2L2' F40BX/ELIG	3	72	996	976	10%	6%	2.9	NA	100%	100%	33	33
15	C222 Classroom	1.5 Watts/Sqft	6	128	708	707	6%	3%	3L4' T8/ELIG	6	88	708	707	6%	3%	2.9	NA	100%	100%	5	5
16	C222 Classroom	1.5 Watts/Sqft	3	123	996	976	10%	6%	2L2' F40BX/ELIG	3	72	996	976	10%	6%	2.9	NA	100%	100%	33	33
17	C215 Classroom	1.5 Watts/Sqft	10	128	708	707	6%	3%	3L4' T8/ELIG	10	88	708	707	6%	3%	2.9	NA	100%	100%	5	5
18	C215 Classroom	1.5 Watts/Sqft	3	123	996	976	10%	6%	2L2' F40BX/ELIG	3	72	996	976	10%	6%	2.9	NA	100%	100%	33	33
19	S-C220 electrical space	1.5 Watts/Sqft	3	87	56	56	1%	1%	2L4' T8/ELIG	3	60	56	56	1%	1%	2.9	NA	100%	100%	34	34
20	C213 Classroom	1.5 Watts/Sqft	10	128	867	867	10%	5%	3L4' T8/ELIG	10	88	867	867	10%	5%	2.9	NA	100%	100%	32	32
21	C213 Classroom	1.5 Watts/Sqft	3	123	996	976	10%	6%	2L2' F40BX/ELIG	3	72	996	976	10%	6%	2.9	NA	100%	100%	33	33
22	C218 Classroom	1.5 Watts/Sqft	10	128	867	867	10%	5%	3L4' T8/ELIG	10	88	867	867	10%	5%	2.9	NA	100%	100%	32	32
23	C218 Classroom	1.5 Watts/Sqft	3	123	996	976	10%	6%	2L2' F40BX/ELIG	3	72	996	976	10%	6%	2.9	NA	100%	100%	33	33
24	C216 teacher planning	1.5 Watts/Sqft	2	99	1,668	1,650	21%	5%	26W COMPACT HW	2	28	1,668	1,650	21%	5%	2.9	NA	100%	100%	3	3
25	C216 teacher planning	1.5 Watts/Sqft	4	128	1,668	1,650	21%	5%	3L4' T8/ELIG	4	88	1,668	1,650	21%	5%	2.9	NA	100%	100%	3	3
26	C216 F&E teacher planning off	1.5 Watts/Sqft	2	128	1,668	1,650	21%	5%	3L4' T8/ELIG	2	88	1,668	1,650	21%	5%	2.9	NA	100%	100%	3	3
27	C216D teacher planning storag	1.5 Watts/Sqft	2	87	56	56	1%	1%	2L4' T8/ELIG	2	60	56	56	1%	1%	2.9	NA	100%	100%	34	34
28	C216C storage	1.5 Watts/Sqft	2	87	56	56	1%	1%	2L4' T8/ELIG	2	60	56	56	1%	1%	2.9	NA	100%	100%	34	34
29	Toilet w/in C216	1.5 Watts/Sqft	2	87	867	867	10%	5%	2L3' T8/ELIG	2	47	867	867	10%	5%	2.9	NA	100%	100%	32	32
30	Toilet w/in C216	1.5 Watts/Sqft	2	87	867	867	10%	5%	2L3' T8/ELIG	2	47	867	867	10%	5%	2.9	NA	100%	100%	32	32
31	C211 Classroom	1.5 Watts/Sqft	11	128	867	867	10%	5%	3L4' T8/ELIG	10	88	867	867	10%	5%	2.9	NA	100%	100%	32	32
32	C211 Classroom	1.5 Watts/Sqft	3	123	996	976	10%	6%	2L2' F40BX/ELIG	3	72	996	976	10%	6%	2.9	NA	100%	100%	33	33
33	C209 Classroom	1.5 Watts/Sqft	11	128	867	867	10%	5%	3L4' T8/ELIG	10	88	867	867	10%	5%	2.9	NA	100%	100%	32	32
34	C209 Classroom	1.5 Watts/Sqft	3	123	996	976	10%	6%	2L2' F40BX/ELIG	3	72	996	976	10%	6%	2.9	NA	100%	100%	33	33
35	C207 Classroom	1.5 Watts/Sqft	11	128	867	867	10%	5%	3L4' T8/ELIG	10	88	867	867	10%	5%	2.9	NA	100%	100%	32	32
36	C207 Classroom	1.5 Watts/Sqft	3	123	996	976	10%	6%	2L2' F40BX/ELIG	3	72	996	976	10%	6%	2.9	NA	100%	100%	33	33
37	Boys Restroom	1.5 Watts/Sqft	2	87	1,852	1,839	26%	19%	2L3' T8/ELIG	2	47	1,852	1,839	26%	19%	2.9	NA	100%	100%	35	35
38	Boys Restroom	1.5 Watts/Sqft	4	99	1,852	1,839	26%	19%	26W COMPACT HW	4	28	1,852	1,839	26%	19%	2.9	NA	100%	100%	35	35
39	Boys Restroom	1.5 Watts/Sqft	2	87	1,852	1,839	26%	19%	2L3' T8/ELIG	5	47	1,852	1,839	26%	19%	2.9	NA	100%	100%	35	35
40	Girls Restroom	1.5 Watts/Sqft	2	87	1,852	1,839	26%	19%	2L3' T8/ELIG	2	47	1,852	1,839	26%	19%	2.9	NA	100%	100%	35	35
41	Girls Restroom	1.5 Watts/Sqft	4	99	1,852	1,839	26%	19%	26W COMPACT HW	4	28	1,852	1,839	26%	19%	2.9	NA	100%	100%	35	35
42	Girls Restroom	1.5 Watts/Sqft	2	87	1,852	1,839	26%	19%	2L3' T8/ELIG	5	47	1,852	1,839	26%	19%	2.9	NA	100%	100%	35	35
43	S-C208 Janitor Closet	1.5 Watts/Sqft	2	87	56	56	1%	1%	2L4' T8/ELIG	2	60	56	56	1%	1%	2.9	NA	100%	100%	34	34
44	C205 Classroom	1.5 Watts/Sqft	11	128	867	867	10%	5%	3L4' T8/ELIG	10	88	867	867	10%	5%	2.9	NA	100%	100%	32	32
45	C205 Classroom	1.5 Watts/Sqft	3	123	996	976	10%	6%	2L2' F40BX/ELIG	3	72	996	976	10%	6%	2.9	NA	100%	100%	33	33
46	C206 Classroom	1.5 Watts/Sqft	11	128	867	867	10%	5%	3L4' T8/ELIG	10	88	867	867	10%	5%	2.9	NA	100%	100%	32	32
47	C206 Classroom	1.5 Watts/Sqft	3	123	996	976	10%	6%	2L2' F40BX/ELIG	3	72	996	976	10%	6%	2.9	NA	100%	100%	33	33
48	C204 Classroom	1.5 Watts/Sqft	11	128	867	867	10%	5%	3L4' T8/ELIG	10	88	867	867	10%	5%	2.9	NA	100%	100%	32	32
49	C204 Classroom	1.5 Watts/Sqft	3	123	996	976	10%	6%	2L2' F40BX/ELIG	3	72	996	976	10%	6%	2.9	NA	100%	100%	33	33
50	C203 Classroom	1.5 Watts/Sqft	11	128	867	867	10%	5%	3L4' T8/ELIG	10	88	867	867	10%	5%	2.9	NA	100%	100%	32	32
51	C203 Classroom	1.5 Watts/Sqft	3	123	996	976	10%	6%	2L2' F40BX/ELIG	3	72	996	976	10%	6%	2.9	NA	100%	100%	33	33
52	C202 Classroom	1.5 Watts/Sqft	11	128	867	867	10%	5%	3L4' T8/ELIG	10	88	867	867	10%	5%	2.9	NA	100%	100%	32	32
53	C202 Classroom	1.5 Watts/Sqft	3	123	996	976	10%	6%	2L2' F40BX/ELIG	3	72	996	976	10%	6%	2.9	NA	100%	100%	33	33
54	C201 Classroom	1.5 Watts/Sqft	11	128	867	867	10%	5%	3L4' T8/ELIG	10	88	867	867	10%	5%	2.9	NA	100%	100%	32	32
55	C201 Classroom	1.5 Watts/Sqft	3	123	996	976	10%	6%	2L2' F40BX/ELIG	3	72	996	976	10%	6%	2.9	NA	100%	100%	33	33
56	S-B219A electrical space	1.5 Watts/Sqft	2	87	56	56	1%	1%	2L4' T8/ELIG	2	60	56	56	1%	1%	2.9	NA	100%	100%	34	34
57	S-B219 emergency electrical sp	1.5 Watts/Sqft	1	54	56	56	1%	1%	2L2' T8/ELIG	1	37	56	56	1%	1%	2.9	NA	100%	100%	34	34
58	S-B217 data rm	1.5 Watts/Sqft	2	87	56	56	1%	1%	2L4' T8/ELIG	2	60	56	56	1%	1%	2.9	NA	100%	100%	34	34
59	B209 Classroom	1.5 Watts/Sqft	11	128	867	867	10%	5%	3L4' T8/ELIG	10	88	867	867	10%	5%	2.9	NA	100%	100%	32	32
60	B209 Classroom	1.5 Watts/Sqft	3	123	996	976	10%	6%	2L2' F40BX/ELIG	3	72	996	976	10%	6%	2.9	NA	100%	100%	33	33
61	S-B211 storage	1.5 Watts/Sqft	2	78	56	56	1%	1%	18W COMPACT HW	2	20	56	56	1%	1%	2.9	NA	100%	100%	34	34
62	B208 LG Group Instruction	1.5 Watts/Sqft	16	78	867	867	10%	5%	2/26W COMP. HW ELIG	16	54	867	867	10%	5%	2.9	NA	100%	100%	32	32
63	B208A kitchen	1.5 Watts/Sqft	3	87	2,498	2,022	23%	16%	2L4' T8/ELIG	3	60	2,498	2,022	23%	16%	2.9	NA	100%	100%	9	9
64	B215 Classroom	1.5 Watts/Sqft	11	128	867	867	10%	5%	3L4' T8/ELIG	10	88	867	867	10%	5%	2.9	NA	100%	100%	32	32
65	B215 Classroom	1.5 Watts/Sqft	3	123	996	976	10%	6%	2L2' F40BX/ELIG	3	72	996	976	10%	6%	2.9	NA	100%	100%	33	33
66	B213 Classroom	1.5 Watts/Sqft	13	128	867	867	10%	5%	3L4' T8/ELIG	12	88	867	867	10%	5%	2.9	NA	100%	100%	32	32
67	B213 Classroom	1.5 Watts/Sqft	3	123	996	976	10%	6%	2L2' F40BX/ELIG	3	72	996	976	10%	6%	2.9	NA	100%	100%	33	33
68	B210 Computer Room	1.5 Watts/Sqft	15	128	867	867	10%	5%	3L4' T8/ELIG	14	88	867	867	10%	5%	2.9	NA	100%	100%	32	32
69	B210 Computer Room	1.5 Watts/Sqft	3	128	867	867	10%	5%	3L4' T8/ELIG	3	88	867	867	10%	5%	2.9	NA	100%	100%	32	32
70	B207 METCO office	1.5 Watts/Sqft	2	128	0	0	0%	0%	3L4' T8/ELIG	2	88	0	0	0%	0%	2.9	NA	100%	100%	17	17

Fixture Information																						
		Pre-retrofit Lighting							Post-retrofit Lighting						HVAC				Schedule ID from Table 6	
	(a)	(b)	(c)	(d)	(e)	(f)	(g)	(h)	(i)	(j)	(k)	(l)	(m)	(n)	(o)	(p)	(q)	(r)	(s)		
Fixture ID	Space Type	Fixture Type	Fixture Quantity	Fixture Wattage	Hours of Use Annual	Hours of Use Peak	FCM Diversity Factor Summer	FCM Diversity Factor Winter	Fixture Type	Fixture Quantity	Fixture Wattage	Hours of Use Annual	Hours of Use Peak	FCM Diversity Factor Summer	FCM Diversity Factor Winter	COP Cooling	COP Heating	% Space Cooled	% Space Heated	Pre Retrofit	Post Retrofit
71	B205C copy rm	1.5 Watts/Sqft	2	128	1,668	1,650	21%	5%	3L4' T8/ELIG	2	88	1,668	1,650	21%	5%	2.9	NA	100%	100%	3	3
72	mens rr	1.5 Watts/Sqft	2	87	1,852	1,839	26%	19%	2L3' T8/ELIG	3	47	1,852	1,839	26%	19%	2.9	NA	100%	100%	35	35
73	mens rr	1.5 Watts/Sqft	2	78	1,852	1,839	26%	19%	2/26W COMP. HW ELIG	2	54	1,852	1,839	26%	19%	2.9	NA	100%	100%	35	35
74	womens rr	1.5 Watts/Sqft	2	87	1,852	1,839	26%	19%	2L3' T8/ELIG	3	47	1,852	1,839	26%	19%	2.9	NA	100%	100%	35	35
75	womens rr	1.5 Watts/Sqft	2	78	1,852	1,839	26%	19%	2/26W COMP. HW ELIG	2	54	1,852	1,839	26%	19%	2.9	NA	100%	100%	35	35
76	B205D teachers wkrm	1.5 Watts/Sqft	13	128	1,668	1,650	21%	5%	3L4' T8/ELIG	13	88	1,668	1,650	21%	5%	2.9	NA	100%	100%	3	3
77	B205D teachers wkrm	1.5 Watts/Sqft	1	78	1,668	1,650	21%	5%	2/26W COMP. HW ELIG	1	54	1,668	1,650	21%	5%	2.9	NA	100%	100%	3	3
78	B201 library	1.5 Watts/Sqft	8	105	1,415	1,329	25%	19%	2L2' F40BX/ELIG	8	72	1,415	1,329	25%	19%	2.9	NA	100%	100%	1	1
79	B201 library	1.5 Watts/Sqft	5	87	1,415	1,329	25%	19%	2L4' T8/ELIG	5	60	1,415	1,329	25%	19%	2.9	NA	100%	100%	1	1
80	B201C Classroom	1.5 Watts/Sqft	13	128	867	867	10%	5%	3L4' T8/ELIG	12	88	867	867	10%	5%	2.9	NA	100%	100%	32	32
81	B201B office	1.5 Watts/Sqft	2	128	1,392	1,371	23%	0%	3L4' T8/ELIG	2	88	1,392	1,371	23%	0%	2.9	NA	100%	100%	23	23
82	B201C wkrm	1.5 Watts/Sqft	2	128	1,668	1,650	21%	5%	3L4' T8/ELIG	2	88	1,668	1,650	21%	5%	2.9	NA	100%	100%	3	3
83	B201C wkrm	1.5 Watts/Sqft	1	87	1,668	1,650	21%	5%	2L4' T8/ELIG	1	60	1,668	1,650	21%	5%	2.9	NA	100%	100%	3	3
84	B206 Hallway	1.5 Watts/Sqft	6	78	1,852	1,839	26%	19%	2/26W COMP. HW ELIG	6	54	1,852	1,839	26%	19%	2.9	NA	100%	100%	35	35
85	B206E tele rm	1.5 Watts/Sqft	1	78	56	56	1%	1%	2/26W COMP. HW ELIG	1	54	56	56	1%	1%	2.9	NA	100%	100%	34	34
86	B206D tele rm	1.5 Watts/Sqft	1	78	56	56	1%	1%	2/26W COMP. HW ELIG	1	54	56	56	1%	1%	2.9	NA	100%	100%	34	34
87	B206A office	1.5 Watts/Sqft	2	87	1,392	1,371	23%	0%	2L4' T8/ELIG	2	60	1,392	1,371	23%	0%	2.9	NA	100%	100%	23	23
88	B206B testing	1.5 Watts/Sqft	1	128	867	867	10%	5%	3L4' T8/ELIG	1	88	867	867	10%	5%	2.9	NA	100%	100%	32	32
89	B206C Conference Room	1.5 Watts/Sqft	2	128	1,392	1,371	23%	0%	3L4' T8/ELIG	2	88	1,392	1,371	23%	0%	2.9	NA	100%	100%	23	23
90	S-B204 storage	1.5 Watts/Sqft	4	87	56	56	1%	1%	2L4' T8/ELIG	4	60	56	56	1%	1%	2.9	NA	100%	100%	34	34
91	S-B202 control rooms	1.5 Watts/Sqft	5	78	56	56	1%	1%	2/26W COMP. HW ELIG	5	54	56	56	1%	1%	2.9	NA	100%	100%	34	34
92	A207 storage/cat walk access	1.5 Watts/Sqft	4	87	56	56	1%	1%	2L4' T8/ELIG	4	60	56	56	1%	1%	2.9	NA	100%	100%	34	34
93	SA206 trainers rm	1.5 Watts/Sqft	4	128	2,702	2,581	63%	70%	3L4' T8/ELIG	4	88	2,702	2,581	63%	70%	2.9	NA	100%	100%	10	10
94	SA206 trainers rm	1.5 Watts/Sqft	1	54	2,702	2,581	63%	70%	2L2' T8/ELIG	1	37	2,702	2,581	63%	70%	2.9	NA	100%	100%	10	10
95	S-A205 electrical space	1.5 Watts/Sqft	1	87	56	56	1%	1%	2L4' T8/ELIG	1	60	56	56	1%	1%	2.9	NA	100%	100%	34	34
96	S-A204 Janitor Closet	1.5 Watts/Sqft	2	87	56	56	1%	1%	2L4' T8/ELIG	2	60	56	56	1%	1%	2.9	NA	100%	100%	34	34
97	storage by gym storage	1.5 Watts/Sqft	1	122	56	56	1%	1%	2L8' EE/ELIG	1	109	56	56	1%	1%	2.9	NA	100%	100%	34	34
98	mens rr	1.5 Watts/Sqft	4	78	1,852	1,839	26%	19%	2/26W COMP. HW ELIG	4	54	1,852	1,839	26%	19%	2.9	NA	100%	100%	35	35
99	mens rr	1.5 Watts/Sqft	2	87	1,852	1,839	26%	19%	2L4' T8/ELIG	2	60	1,852	1,839	26%	19%	2.9	NA	100%	100%	35	35
100	mens rr	1.5 Watts/Sqft	3	87	1,852	1,839	26%	19%	2L4' T8/ELIG	3	60	1,852	1,839	26%	19%	2.9	NA	100%	100%	35	35
101	womens rr	1.5 Watts/Sqft	4	78	1,852	1,839	26%	19%	2/26W COMP. HW ELIG	4	54	1,852	1,839	26%	19%	2.9	NA	100%	100%	35	35
102	womens rr	1.5 Watts/Sqft	2	87	1,852	1,839	26%	19%	2L4' T8/ELIG	2	60	1,852	1,839	26%	19%	2.9	NA	100%	100%	35	35
103	womens rr	1.5 Watts/Sqft	3	87	1,852	1,839	26%	19%	2L4' T8/ELIG	3	60	1,852	1,839	26%	19%	2.9	NA	100%	100%	35	35
104	1st/2nd level biax lighting outs	1.5 Watts/Sqft	110	67	1,852	1,839	26%	19%	1L2' F40BX/ELIG	100	46	1,852	1,839	26%	19%	2.9	NA	100%	100%	35	35
105	gym hall	1.5 Watts/Sqft	26	78	1,852	1,839	26%	19%	2/26W COMP. HW ELIG	26	54	1,852	1,839	26%	19%	2.9	NA	100%	100%	35	35
106	gym hall	1.5 Watts/Sqft	2	87	1,852	1,839	26%	19%	2L3' T8/ELIG	16	47	1,852	1,839	26%	19%	2.9	NA	100%	100%	35	35
107	library hall	1.5 Watts/Sqft	1	87	1,852	1,839	26%	19%	2L4' T8/ELIG	1	60	1,852	1,839	26%	19%	2.9	NA	100%	100%	35	35
108	library hall	1.5 Watts/Sqft	2	87	1,852	1,839	26%	19%	2L3' T8/ELIG	2	47	1,852	1,839	26%	19%	2.9	NA	100%	100%	35	35
109	library hall	1.5 Watts/Sqft	2	87	1,852	1,839	26%	19%	2L4' T8/ELIG	2	60	1,852	1,839	26%	19%	2.9	NA	100%	100%	35	35
110	library hall	1.5 Watts/Sqft	2	87	1,852	1,839	26%	19%	2L3' T8/ELIG	14	47	1,852	1,839	26%	19%	2.9	NA	100%	100%	35	35
111	library hall	1.5 Watts/Sqft	6	58	1,852	1,839	26%	19%	2/18W COMP. HW ELIG	6	40	1,852	1,839	26%	19%	2.9	NA	100%	100%	35	35
112	library hall	1.5 Watts/Sqft	2	87	1,852	1,839	26%	19%	2L3' T8/ELIG	11	47	1,852	1,839	26%	19%	2.9	NA	100%	100%	35	35
113	library hall	1.5 Watts/Sqft	1	58	1,852	1,839	26%	19%	2/18W COMP. HW ELIG	1	40	1,852	1,839	26%	19%	2.9	NA	100%	100%	35	35
114	library hall	1.5 Watts/Sqft	9	58	1,852	1,839	26%	19%	2/18W COMP. HW ELIG	9	40	1,852	1,839	26%	19%	2.9	NA	100%	100%	35	35
115	library hall	1.5 Watts/Sqft	2	87	1,852	1,839	26%	19%	2L3' T8/ELIG	28	47	1,852	1,839	26%	19%	2.9	NA	100%	100%	35	35
116	library hall	1.5 Watts/Sqft	6	58	1,852	1,839	26%	19%	2/18W COMP. HW ELIG	6	40	1,852	1,839	26%	19%	2.9	NA	100%	100%	35	35
117	library hall	1.5 Watts/Sqft	6	87	1,852	1,839	26%	19%	2L4' T8/ELIG	6	60	1,852	1,839	26%	19%	2.9	NA	100%	100%	35	35
118	prep	1.5 Watts/Sqft	3	87	867	867	10%	5%	2L4' T8/ELIG	3	60	867	867	10%	5%	2.9	NA	100%	100%	32	32
119	C311 Classroom	1.5 Watts/Sqft	6	128	867	867	10%	5%	3L4' T8/ELIG	6	88	867	867	10%	5%	2.9	NA	100%	100%	32	32
120	C311 Classroom	1.5 Watts/Sqft	3	123	996	976	10%	6%	2L2' F40BX/ELIG	3	72	996	976	10%	6%	2.9	NA	100%	100%	33	33
121	SC326 Classroom	1.5 Watts/Sqft	3	87	867	867	10%	5%	2L4' T8/ELIG	3	60	867	867	10%	5%	2.9	NA	100%	100%	32	32
122	SC326 Classroom	1.5 Watts/Sqft	11	87	867	867	10%	5%	2L4' T8/ELIG	11	60	867	867	10%	5%	2.9	NA	100%	100%	32	32
123	C322 Classroom	1.5 Watts/Sqft	1	78	867	867	10%	5%	2/26W COMP. HW ELIG	1	54	867	867	10%	5%	2.9	NA	100%	100%	32	32
124	C322E Classroom	1.5 Watts/Sqft	1	128	867	867	10%	5%	3L4' T8/ELIG	1	88	867	867	10%	5%	2.9	NA	100%	100%	32	32
125	C322D Classroom	1.5 Watts/Sqft	1	128	867	867	10%	5%	3L4' T8/ELIG	1	88	867	867	10%	5%	2.9	NA	100%	100%	32	32
126	SC-322E Classroom	1.5 Watts/Sqft	2	87	867	867	10%	5%	2L4' T8/ELIG	2	60	867	867	10%	5%	2.9	NA	100%	100%	32	32
127	Boys Restroom	1.5 Watts/Sqft	4	78	1,852	1,839	26%	19%	2/26W COMP. HW ELIG	4	54	1,852	1,839	26%	19%	2.9	NA	100%	100%	35	35
128	Girls Restroom	1.5 Watts/Sqft	4	78	1,852	1,839	26%	19%	2/26W COMP. HW ELIG	4	54	1,852	1,839	26%	19%	2.9	NA	100%	100%	35	35
129	C301 Classroom	1.5 Watts/Sqft	2	87	867	867	10%	5%	2L4' T8/ELIG	2	60	867	867	10%	5%	2.9	NA	100%	100%	32	32
130	C304 Classroom	1.5 Watts/Sqft	2	87	867	867	10%	5%	2L4' T8/ELIG	2	60	867	867	10%	5%	2.9	NA	100%	100%	32	32
131	S-C306	1.5 Watts/Sqft	2	54	56	56	1%	1%	2L2' T8/ELIG	1	37	56	56	1%	1%	2.9	NA	100%	100%	34	34
132	S-C314	1.5 Watts/Sqft	4	87	56	56	1%	1%	2L4' T8/ELIG	2	60	56	56	1%	1%	2.9	NA	100%	100%	34	34
133	S-C316	1.5 Watts/Sqft	1	78	56	56	1%	1%	2/26W COMP. HW ELIG	1	54	56	56	1%	1%	2.9	NA	100%	100%	34	34
134	C332 Classroom	1.5 Watts/Sqft	13	128	867	867	10%	5%	3L4' T8/ELIG	13	88	867	867	10%	5%	2.9	NA	100%	100%	32	32
135	C332 Classroom	1.5 Watts/Sqft	3	123	996	976	10%	6%	2L2' F40BX/ELIG	3	72	996	976	10%	6%	2.9	NA	100%	100%	33	33
136	C330 Classroom	1.5 Watts/Sqft	13	128	867	867	10%	5%	3L4' T8/ELIG	13	88	867	867	10%	5%	2.9	NA	100%	100%	32	32
137	C330 Classroom	1.5 Watts/Sqft	3	123	996	976	10%	6%	2L2' F40BX/ELIG	3	72	996	976	10%	6%	2.9	NA	100%	100%	33	33
138	C305 Classroom	1.5 Watts/Sqft	13	128	867	867	10%	5%	3L4' T8/ELIG	13	88	867	867	10%	5%	2.9	NA	100%	100%	32	32
139	C305 Classroom	1.5 Watts/Sqft	3	123	996	976	10%	6%	2L2' F40BX/ELIG	3	72	996	976	10%	6%	2.9	NA	100%	100%	33	33
140	C308 Classroom	1.5 Watts/Sqft	13	128	867	867	10%	5%	3L4' T8/ELIG	13	88	867	867	10%	5%	2.9	NA	100%	100%	32	32

Fixture Information																						
		Pre-retrofit Lighting							Post-retrofit Lighting						HVAC				Schedule ID from Table 6	
	(a)	(b)	(c)	(d)	(e)	(f)	(g)	(h)	(i)	(j)	(k)	(l)	(m)	(n)	(o)	(p)	(q)	(r)	(s)		
Fixture ID	Space Type	Fixture Type	Fixture Quantity	Fixture Wattage	Hours of Use Annual	Hours of Use Peak	FCM Diversity Factor Summer	FCM Diversity Factor Winter	Fixture Type	Fixture Quantity	Fixture Wattage	Hours of Use Annual	Hours of Use Peak	FCM Diversity Factor Summer	FCM Diversity Factor Winter	COP Cooling	COP Heating	% Space Cooled	% Space Heated	Pre Retrofit	Post Retrofit
141	C308 Classroom	1.5 Watts/Sqft	3	123	996	976	10%	6%	2L2' F40BX/ELIG	3	72	996	976	10%	6%	2.9	NA	100%	100%	33	33
142	C312 Classroom	1.5 Watts/Sqft	13	128	867	867	10%	5%	3L4' T8/ELIG	13	88	867	867	10%	5%	2.9	NA	100%	100%	32	32
143	C312 Classroom	1.5 Watts/Sqft	3	123	996	976	10%	6%	2L2' F40BX/ELIG	3	72	996	976	10%	6%	2.9	NA	100%	100%	33	33
144	C321 Classroom	1.5 Watts/Sqft	11	128	867	867	10%	5%	3L4' T8/ELIG	10	88	867	867	10%	5%	2.9	NA	100%	100%	32	32
145	C321 Classroom	1.5 Watts/Sqft	3	123	996	976	10%	6%	2L2' F40BX/ELIG	3	72	996	976	10%	6%	2.9	NA	100%	100%	33	33
146	C319 Classroom	1.5 Watts/Sqft	11	128	867	867	10%	5%	3L4' T8/ELIG	10	88	867	867	10%	5%	2.9	NA	100%	100%	32	32
147	C319 Classroom	1.5 Watts/Sqft	3	123	996	976	10%	6%	2L2' F40BX/ELIG	3	72	996	976	10%	6%	2.9	NA	100%	100%	33	33
148	C317 Classroom	1.5 Watts/Sqft	10	128	867	867	10%	5%	3L4' T8/ELIG	10	88	867	867	10%	5%	2.9	NA	100%	100%	32	32
149	C317 Classroom	1.5 Watts/Sqft	3	123	996	976	10%	6%	2L2' F40BX/ELIG	3	72	996	976	10%	6%	2.9	NA	100%	100%	33	33
150	C315 Classroom	1.5 Watts/Sqft	10	128	867	867	10%	5%	3L4' T8/ELIG	10	88	867	867	10%	5%	2.9	NA	100%	100%	32	32
151	C315 Classroom	1.5 Watts/Sqft	3	123	996	976	10%	6%	2L2' F40BX/ELIG	3	72	996	976	10%	6%	2.9	NA	100%	100%	33	33
152	C324 Classroom	1.5 Watts/Sqft	10	128	867	867	10%	5%	3L4' T8/ELIG	10	88	867	867	10%	5%	2.9	NA	100%	100%	32	32
153	C324 Classroom	1.5 Watts/Sqft	3	123	996	976	10%	6%	2L2' F40BX/ELIG	3	72	996	976	10%	6%	2.9	NA	100%	100%	33	33
154	C313 Classroom	1.5 Watts/Sqft	10	128	867	867	10%	5%	3L4' T8/ELIG	10	88	867	867	10%	5%	2.9	NA	100%	100%	32	32
155	C313 Classroom	1.5 Watts/Sqft	3	123	996	976	10%	6%	2L2' F40BX/ELIG	3	72	996	976	10%	6%	2.9	NA	100%	100%	33	33
156	C303 Classroom	1.5 Watts/Sqft	10	128	867	867	10%	5%	3L4' T8/ELIG	10	88	867	867	10%	5%	2.9	NA	100%	100%	32	32
157	C303 Classroom	1.5 Watts/Sqft	3	123	996	976	10%	6%	2L2' F40BX/ELIG	3	72	996	976	10%	6%	2.9	NA	100%	100%	33	33
158	C309 Classroom	1.5 Watts/Sqft	10	128	867	867	10%	5%	3L4' T8/ELIG	10	88	867	867	10%	5%	2.9	NA	100%	100%	32	32
159	C309 Classroom	1.5 Watts/Sqft	3	123	996	976	10%	6%	2L2' F40BX/ELIG	3	72	996	976	10%	6%	2.9	NA	100%	100%	33	33
160	C328 Classroom	1.5 Watts/Sqft	6	128	867	867	10%	5%	3L4' T8/ELIG	6	88	867	867	10%	5%	2.9	NA	100%	100%	32	32
161	C328 Classroom	1.5 Watts/Sqft	3	123	996	976	10%	6%	2L2' F40BX/ELIG	3	72	996	976	10%	6%	2.9	NA	100%	100%	33	33
162	S-C326	1.5 Watts/Sqft	3	87	56	56	1%	1%	2L4' T8/ELIG	3	60	56	56	1%	1%	2.9	NA	100%	100%	34	34
163	S-C326	1.5 Watts/Sqft	1	87	56	56	1%	1%	2L4' T8/ELIG	1	60	56	56	1%	1%	2.9	NA	100%	100%	34	34
164	C322 Classroom	1.5 Watts/Sqft	8	128	867	867	10%	5%	3L4' T8/ELIG	8	88	867	867	10%	5%	2.9	NA	100%	100%	32	32
165	mens rr	1.5 Watts/Sqft	1	122	1,852	1,839	26%	19%	4L3' T8/ELIG	1	90	1,852	1,839	26%	19%	2.9	NA	100%	100%	35	35
166	womens rr	1.5 Watts/Sqft	1	122	1,852	1,839	26%	19%	4L3' T8/ELIG	1	90	1,852	1,839	26%	19%	2.9	NA	100%	100%	35	35
167	S-C322C	1.5 Watts/Sqft	2	87	56	56	1%	1%	2L4' T8/ELIG	2	60	56	56	1%	1%	2.9	NA	100%	100%	34	34
168	Boys Restroom	1.5 Watts/Sqft	4	122	1,852	1,839	26%	19%	4L3' T8/ELIG	4	90	1,852	1,839	26%	19%	2.9	NA	100%	100%	35	35
169	Boys Restroom	1.5 Watts/Sqft	8	87	1,852	1,839	26%	19%	2L4' T8/ELIG	4	60	1,852	1,839	26%	19%	2.9	NA	100%	100%	35	35
170	Girls Restroom	1.5 Watts/Sqft	4	122	1,852	1,839	26%	19%	4L3' T8/ELIG	4	90	1,852	1,839	26%	19%	2.9	NA	100%	100%	35	35
171	Girls Restroom	1.5 Watts/Sqft	8	87	1,852	1,839	26%	19%	2L4' T8/ELIG	4	60	1,852	1,839	26%	19%	2.9	NA	100%	100%	35	35
172	C301A Classroom	1.5 Watts/Sqft	8	87	867	867	10%	5%	2L4' T8/ELIG	4	60	867	867	10%	5%	2.9	NA	100%	100%	32	32
173	C301 Classroom	1.5 Watts/Sqft	13	128	867	867	10%	5%	3L4' T8/ELIG	13	88	867	867	10%	5%	2.9	NA	100%	100%	32	32
174	C301 Classroom	1.5 Watts/Sqft	3	123	996	976	10%	6%	2L2' F40BX/ELIG	2	72	996	976	10%	6%	2.9	NA	100%	100%	33	33
175	C302 Classroom	1.5 Watts/Sqft	13	128	867	867	10%	5%	3L4' T8/ELIG	13	88	867	867	10%	5%	2.9	NA	100%	100%	32	32
176	C302 Classroom	1.5 Watts/Sqft	3	123	996	976	10%	6%	2L2' F40BX/ELIG	2	72	996	976	10%	6%	2.9	NA	100%	100%	33	33
177	C304 Classroom	1.5 Watts/Sqft	6	128	867	867	10%	5%	3L4' T8/ELIG	6	88	867	867	10%	5%	2.9	NA	100%	100%	32	32
178	C304 Classroom	1.5 Watts/Sqft	3	123	996	976	10%	6%	2L2' F40BX/ELIG	2	72	996	976	10%	6%	2.9	NA	100%	100%	33	33
179	S-C304A	1.5 Watts/Sqft	2	87	56	56	1%	1%	2L4' T8/ELIG	1	60	56	56	1%	1%	2.9	NA	100%	100%	34	34
180	S-C306	1.5 Watts/Sqft	4	87	56	56	1%	1%	2L4' T8/ELIG	2	60	56	56	1%	1%	2.9	NA	100%	100%	34	34
181	C307 Classroom	1.5 Watts/Sqft	16	128	867	867	10%	5%	3L4' T8/ELIG	16	88	867	867	10%	5%	2.9	NA	100%	100%	32	32
182	C307 Classroom	1.5 Watts/Sqft	3	123	996	976	10%	6%	2L2' F40BX/ELIG	3	72	996	976	10%	6%	2.9	NA	100%	100%	33	33
183	Hallway	1.5 Watts/Sqft	18	122	1,852	1,839	26%	19%	4L3' T8/ELIG	27	90	1,852	1,839	26%	19%	2.9	NA	100%	100%	35	35
184	Hallway	1.5 Watts/Sqft	16	78	1,852	1,839	26%	19%	2/26W COMP. HW ELIG	16	54	1,852	1,839	26%	19%	2.9	NA	100%	100%	35	35
185	prep	1.5 Watts/Sqft	6	87	867	867	10%	5%	2L4' T8/ELIG	6	60	867	867	10%	5%	2.9	NA	100%	100%	32	32
186	C128 Woodshop	1.5 Watts/Sqft	23	87	1,415	1,329	25%	19%	2L4' T8/ELIG	23	60	1,415	1,329	25%	19%	2.9	NA	100%	100%	1	1
187	C128 Storage/Spray Booth	1.5 Watts/Sqft	2	87	56	56	1%	1%	2L4' T8/ELIG	2	60	56	56	1%	1%	2.9	NA	100%	100%	34	34
188	C127 Computer Room	1.5 Watts/Sqft	14	128	708	707	6%	3%	3L4' T8/ELIG	14	88	708	707	6%	3%	2.9	NA	100%	100%	5	5
189	C127 Computer Room	1.5 Watts/Sqft	3	123	996	976	10%	6%	2L2' F40BX/ELIG	3	72	996	976	10%	6%	2.9	NA	100%	100%	33	33
190	C126 Auto Shop	1.5 Watts/Sqft	11	128	1,415	1,329	25%	19%	3L4' T8/ELIG	11	88	1,415	1,329	25%	19%	2.9	NA	100%	100%	1	1
191	C124 Storage	1.5 Watts/Sqft	1	128	56	56	1%	1%	3L4' T8/ELIG	1	88	56	56	1%	1%	2.9	NA	100%	100%	34	34
192	Data/Elec/Water Heater	1.5 Watts/Sqft	5	87	56	56	1%	1%	2L4' T8/ELIG	5	60	56	56	1%	1%	2.9	NA	100%	100%	34	34
193	C125 Classroom	1.5 Watts/Sqft	20	128	708	707	6%	3%	3L4' T8/ELIG	20	88	708	707	6%	3%	2.9	NA	100%	100%	5	5
194	C120 Classroom	1.5 Watts/Sqft	10	128	708	707	6%	3%	3L4' T8/ELIG	10	88	708	707	6%	3%	2.9	NA	100%	100%	5	5
195	C120 Classroom	1.5 Watts/Sqft	3	123	996	976	10%	6%	2L2' F40BX/ELIG	3	72	996	976	10%	6%	2.9	NA	100%	100%	33	33
196	C123 Store	1.5 Watts/Sqft	10	128	708	707	6%	3%	3L4' T8/ELIG	10	88	708	707	6%	3%	2.9	NA	100%	100%	5	5
197	C123 Store	1.5 Watts/Sqft	3	123	996	976	10%	6%	2L2' F40BX/ELIG	3	72	996	976	10%	6%	2.9	NA	100%	100%	33	33
198	C123 Store	1.5 Watts/Sqft	3	87	708	707	6%	3%	2L4' T8/ELIG	3	60	708	707	6%	3%	2.9	NA	100%	100%	5	5
199	C123 Toilet	1.5 Watts/Sqft	2	87	867	867	10%	5%	2L3' T8/ELIG	2	47	867	867	10%	5%	2.9	NA	100%	100%	32	32
200	C118 Classroom	1.5 Watts/Sqft	6	128	708	707	6%	3%	3L4' T8/ELIG	6	88	708	707	6%	3%	2.9	NA	100%	100%	5	5
201	C118 Classroom	1.5 Watts/Sqft	3	123	996	976	10%	6%	2L2' F40BX/ELIG	3	72	996	976	10%	6%	2.9	NA	100%	100%	33	33
202	C121 Computer Room	1.5 Watts/Sqft	14	128	708	707	6%	3%	3L4' T8/ELIG	14	88	708	707	6%	3%	2.9	NA	100%	100%	5	5
203	C121 Computer Room	1.5 Watts/Sqft	3	123	996	976	10%	6%	2L2' F40BX/ELIG	3	72	996	976	10%	6%	2.9	NA	100%	100%	33	33
204	Girls Restroom	1.5 Watts/Sqft	6	87	1,852	1,839	26%	19%	2L4' T8/ELIG	6	60	1,852	1,839	26%	19%	2.9	NA	100%	100%	35	35
205	Girls Restroom	1.5 Watts/Sqft	3	78	1,852	1,839	26%	19%	2/26W COMP. HW ELIG	3	54	1,852	1,839	26%	19%	2.9	NA	100%	100%	35	35
206	Girls Restroom	1.5 Watts/Sqft	1	58	1,852	1,839	26%	19%	2/18W COMP. HW ELIG	1	40	1,852	1,839	26%	19%	2.9	NA	100%	100%	35	35
207	Boys Restroom	1.5 Watts/Sqft	6	87	1,852	1,839	26%	19%	2L4' T8/ELIG	6	60	1,852	1,839	26%	19%	2.9	NA	100%	100%	35	35
208	Boys Restroom	1.5 Watts/Sqft	3	78	1,852	1,839	26%	19%	2/26W COMP. HW ELIG	3	54	1,852	1,839	26%	19%	2.9	NA	100%	100%	35	35
209	Boys Restroom	1.5 Watts/Sqft	1	58	1,852	1,839	26%	19%	2/18W COMP. HW ELIG	1	40	1,852	1,839	26%	19%	2.9	NA	100%	100%	35	35
210	Elevator Machine Rm	1.5 Watts/Sqft	1	87	56	56	1%	1%	2L4' T8/ELIG	1	60	56	56	1%	1%	2.9	NA	100%	100%	34	34

Fixture Information

Fixture ID	(a) Space Type	Pre-retrofit Lighting (b) Fixture Type	(c) Fixture Quantity	(d) Fixture Wattage	(e) Hours of Use Annual	(f) Hours of Use Peak	(g) FCM Diversity Factor Summer	(h) FCM Diversity Factor Winter	Post-retrofit Lighting (i) Fixture Type	(j) Fixture Quantity	(k) Fixture Wattage	(l) Hours of Use Annual	(m) Hours of Use Peak	(n) FCM Diversity Factor Summer	(o) FCM Diversity Factor Winter	HVAC (p) COP Cooling	(q) COP Heating	(r) % Space Cooled	(s) % Space Heated	Schedule ID from Table 6 Pre Retrofit	Schedule ID from Table 6 Post Retrofit
211	Storage	1.5 Watts/Sqft	1	87	56	56	1%	1%	2L4' T8/ELIG	1	60	56	56	1%	1%	2.9	NA	100%	100%	34	34
212	C107 Classroom	1.5 Watts/Sqft	10	128	867	867	10%	5%	3L4' T8/ELIG	10	88	867	867	10%	5%	2.9	NA	100%	100%	32	32
213	C107 Classroom	1.5 Watts/Sqft	3	123	996	976	10%	6%	2L2' F40BX/ELIG	3	72	996	976	10%	6%	2.9	NA	100%	100%	33	33
214	C105 Classroom	1.5 Watts/Sqft	10	128	867	867	10%	5%	3L4' T8/ELIG	10	88	867	867	10%	5%	2.9	NA	100%	100%	32	32
215	C105 Classroom	1.5 Watts/Sqft	3	123	996	976	10%	6%	2L2' F40BX/ELIG	3	72	996	976	10%	6%	2.9	NA	100%	100%	33	33
216	C106 Teachers Planning	1.5 Watts/Sqft	5	128	1,668	1,650	21%	5%	3L4' T8/ELIG	5	88	1,668	1,650	21%	5%	2.9	NA	100%	100%	3	3
217	C106 Teachers Planning	1.5 Watts/Sqft	1	99	1,668	1,650	21%	5%	26W COMPACT HW	1	28	1,668	1,650	21%	5%	2.9	NA	100%	100%	3	3
218	C106 Mens Room	1.5 Watts/Sqft	2	87	1,668	1,650	21%	5%	2L3' T8/ELIG	1	47	1,668	1,650	21%	5%	2.9	NA	100%	100%	3	3
219	C106 Womens Room	1.5 Watts/Sqft	1	87	1,668	1,650	21%	5%	2L3' T8/ELIG	1	47	1,668	1,650	21%	5%	2.9	NA	100%	100%	3	3
220	C106 Storage	1.5 Watts/Sqft	2	87	56	56	1%	1%	2L4' T8/ELIG	2	60	56	56	1%	1%	2.9	NA	100%	100%	34	34
221	C106 Office	1.5 Watts/Sqft	1	128	1,668	1,650	21%	5%	3L4' T8/ELIG	1	88	1,668	1,650	21%	5%	2.9	NA	100%	100%	3	3
222	C106 Office	1.5 Watts/Sqft	1	128	1,668	1,650	21%	5%	3L4' T8/ELIG	1	88	1,668	1,650	21%	5%	2.9	NA	100%	100%	3	3
223	C106 Office	1.5 Watts/Sqft	1	128	1,668	1,650	21%	5%	3L4' T8/ELIG	1	88	1,668	1,650	21%	5%	2.9	NA	100%	100%	3	3
224	C104 Computer Room	1.5 Watts/Sqft	14	128	708	707	6%	3%	3L4' T8/ELIG	14	88	708	707	6%	3%	2.9	NA	100%	100%	5	5
225	C104 Computer Room	1.5 Watts/Sqft	3	123	996	976	10%	6%	2L2' F40BX/ELIG	3	72	996	976	10%	6%	2.9	NA	100%	100%	33	33
226	C103 Classroom	1.5 Watts/Sqft	10	128	867	867	10%	5%	3L4' T8/ELIG	10	88	867	867	10%	5%	2.9	NA	100%	100%	32	32
227	C103 Classroom	1.5 Watts/Sqft	3	123	996	976	10%	6%	2L2' F40BX/ELIG	3	72	996	976	10%	6%	2.9	NA	100%	100%	33	33
228	C101 Classroom	1.5 Watts/Sqft	10	128	867	867	10%	5%	3L4' T8/ELIG	10	88	867	867	10%	5%	2.9	NA	100%	100%	32	32
229	C101 Classroom	1.5 Watts/Sqft	3	123	996	976	10%	6%	2L2' F40BX/ELIG	3	72	996	976	10%	6%	2.9	NA	100%	100%	33	33
230	C102 Classroom	1.5 Watts/Sqft	6	128	867	867	10%	5%	3L4' T8/ELIG	6	88	867	867	10%	5%	2.9	NA	100%	100%	32	32
231	C102 Classroom	1.5 Watts/Sqft	3	123	996	976	10%	6%	2L2' F40BX/ELIG	3	72	996	976	10%	6%	2.9	NA	100%	100%	33	33
232	Hallway	1.5 Watts/Sqft	13	78	1,852	1,839	26%	19%	2/26W COMP. HW ELIG	13	54	1,852	1,839	26%	19%	2.9	NA	100%	100%	35	35
233	Hallway	1.5 Watts/Sqft	17	122	1,852	1,839	26%	19%	4L3' T8/ELIG	23	90	1,852	1,839	26%	19%	2.9	NA	100%	100%	35	35
234	Hallway	1.5 Watts/Sqft	1	58	1,852	1,839	26%	19%	2/18W COMP. HW ELIG	1	40	1,852	1,839	26%	19%	2.9	NA	100%	100%	35	35
235	Stair 8/9 Stair	1.5 Watts/Sqft	2	99	8,760	4,032	100%	100%	2/32W COMPACT HW ELI	2	68	8,760	4,032	100%	100%	2.9	NA	100%	100%	18	18
236	Stair 8/9 Stair	1.5 Watts/Sqft	6	122	8,760	4,032	100%	100%	4L4' T8/ELIG LOW PWR	6	84	8,760	4,032	100%	100%	2.9	NA	100%	100%	18	18
237	Stair 8/9 Stair	1.5 Watts/Sqft	6	87	8,760	4,032	100%	100%	2L4' T8/ELIG	6	60	8,760	4,032	100%	100%	2.9	NA	100%	100%	18	18
238	Stair 8/9 Stair	1.5 Watts/Sqft	4	87	8,760	4,032	100%	100%	2L4' T8/ELIG	4	60	8,760	4,032	100%	100%	2.9	NA	100%	100%	18	18
239	B128 Classroom	1.5 Watts/Sqft	10	128	708	707	6%	3%	3L4' T8/ELIG	10	88	708	707	6%	3%	2.9	NA	100%	100%	5	5
240	B128 Classroom	1.5 Watts/Sqft	3	123	996	976	10%	6%	2L2' F40BX/ELIG	3	72	996	976	10%	6%	2.9	NA	100%	100%	33	33
241	Equip Rm Equipment Room	1.5 Watts/Sqft	1	87	56	56	1%	1%	2L4' T8/ELIG	1	60	56	56	1%	1%	2.9	NA	100%	100%	34	34
242	Storage	1.5 Watts/Sqft	2	87	56	56	1%	1%	2L4' T8/ELIG	2	60	56	56	1%	1%	2.9	NA	100%	100%	34	34
243	Data Rm	1.5 Watts/Sqft	2	87	56	56	1%	1%	2L4' T8/ELIG	2	60	56	56	1%	1%	2.9	NA	100%	100%	34	34
244	Electric	1.5 Watts/Sqft	2	87	56	56	1%	1%	2L4' T8/ELIG	2	60	56	56	1%	1%	2.9	NA	100%	100%	34	34
245	B132 Classroom	1.5 Watts/Sqft	6	128	867	867	10%	5%	3L4' T8/ELIG	6	88	867	867	10%	5%	2.9	NA	100%	100%	32	32
246	B129 Large Group Instruction	1.5 Watts/Sqft	22	128	708	707	6%	3%	3L4' T8/ELIG	22	88	708	707	6%	3%	2.9	NA	100%	100%	5	5
247	B129 Large Group Instruction	1.5 Watts/Sqft	8	78	867	867	10%	5%	2/26W COMP. HW ELIG	8	54	867	867	10%	5%	2.9	NA	100%	100%	32	32
248	B129 Large Group Instruction	1.5 Watts/Sqft	3	123	996	976	10%	6%	2L2' F40BX/ELIG	3	72	996	976	10%	6%	2.9	NA	100%	100%	33	33
249	Art Storage	1.5 Watts/Sqft	3	87	56	56	1%	1%	2L4' T8/ELIG	3	60	56	56	1%	1%	2.9	NA	100%	100%	34	34
250	Acid Waste Rm	1.5 Watts/Sqft	2	87	56	56	1%	1%	2L4' T8/ELIG	2	60	56	56	1%	1%	2.9	NA	100%	100%	34	34
251	B134 Art Room	1.5 Watts/Sqft	13	128	462	462	1%	0%	3L4' T8/ELIG	13	88	462	462	1%	0%	2.9	NA	100%	100%	2	2
252	B134 Kiln	1.5 Watts/Sqft	1	87	462	462	1%	0%	2L4' T8/ELIG	1	60	462	462	1%	0%	2.9	NA	100%	100%	2	2
253	Storage	1.5 Watts/Sqft	1	58	56	56	1%	1%	2/18W COMP. HW ELIG	1	40	56	56	1%	1%	2.9	NA	100%	100%	34	34
254	B136 Photo Art Room	1.5 Watts/Sqft	8	87	462	462	1%	0%	2L4' T8/ELIG	8	60	462	462	1%	0%	2.9	NA	100%	100%	2	2
255	B136 Photo Art Room	1.5 Watts/Sqft	3	123	462	462	1%	0%	2L2' F40BX/ELIG	2	72	462	462	1%	0%	2.9	NA	100%	100%	2	2
256	Auditorium Storage	1.5 Watts/Sqft	4	87	56	56	1%	1%	2L4' T8/ELIG	4	60	56	56	1%	1%	2.9	NA	100%	100%	34	34
257	Auditorium Storage	1.5 Watts/Sqft	1	87	56	56	1%	1%	2L4' T8/ELIG	1	60	56	56	1%	1%	2.9	NA	100%	100%	34	34
258	Electric	1.5 Watts/Sqft	1	87	56	56	1%	1%	2L4' T8/ELIG	1	60	56	56	1%	1%	2.9	NA	100%	100%	34	34
259	Storage	1.5 Watts/Sqft	1	87	56	56	1%	1%	2L4' T8/ELIG	1	60	56	56	1%	1%	2.9	NA	100%	100%	34	34
260	mens rr Mens Room	1.5 Watts/Sqft	3	58	1,852	1,839	26%	19%	2/18W COMP. HW ELIG	3	40	1,852	1,839	26%	19%	2.9	NA	100%	100%	35	35
261	mens rr Mens Room	1.5 Watts/Sqft	1	87	1,852	1,839	26%	19%	2L4' T8/ELIG	1	60	1,852	1,839	26%	19%	2.9	NA	100%	100%	35	35
262	mens rr Mens Room	1.5 Watts/Sqft	1	87	1,852	1,839	26%	19%	2L3' T8/ELIG	2	47	1,852	1,839	26%	19%	2.9	NA	100%	100%	35	35
263	womens rr Womens Room	1.5 Watts/Sqft	3	58	1,852	1,839	26%	19%	2/18W COMP. HW ELIG	3	40	1,852	1,839	26%	19%	2.9	NA	100%	100%	35	35
264	womens rr Womens Room	1.5 Watts/Sqft	1	87	1,852	1,839	26%	19%	2L4' T8/ELIG	1	60	1,852	1,839	26%	19%	2.9	NA	100%	100%	35	35
265	womens rr Womens Room	1.5 Watts/Sqft	1	87	1,852	1,839	26%	19%	2L3' T8/ELIG	2	47	1,852	1,839	26%	19%	2.9	NA	100%	100%	35	35
266	Hallway	1.5 Watts/Sqft	12	122	1,852	1,839	26%	19%	4L3' T8/ELIG	14	90	1,852	1,839	26%	19%	2.9	NA	100%	100%	35	35
267	Hallway	1.5 Watts/Sqft	8	78	1,852	1,839	26%	19%	2/26W COMP. HW ELIG	8	54	1,852	1,839	26%	19%	2.9	NA	100%	100%	35	35
268	Lobby	1.5 Watts/Sqft	9	78	1,852	1,839	26%	19%	2/26W COMP. HW ELIG	9	54	1,852	1,839	26%	19%	2.9	NA	100%	100%	35	35
269	D106 Studio Art	1.5 Watts/Sqft	11	87	462	462	1%	0%	2L4' T8/ELIG	11	60	462	462	1%	0%	2.9	NA	100%	100%	2	2
270	D106 Studio Art	1.5 Watts/Sqft	10	78	462	462	1%	0%	100W INC	8	100	462	462	1%	0%	2.9	NA	100%	100%	2	2
271	D106 Studio Art	1.5 Watts/Sqft	8	78	462	462	1%	0%	2/26W COMP. HW ELIG	8	54	462	462	1%	0%	2.9	NA	100%	100%	2	2
272	D112 Band	1.5 Watts/Sqft	16	128	1,415	1,329	25%	19%	3L4' T8/ELIG	16	88	1,415	1,329	25%	19%	2.9	NA	100%	100%	1	1
273	D108 Office	1.5 Watts/Sqft	4	87	1,415	1,329	25%	19%	2L4' T8/ELIG	4	60	1,415	1,329	25%	19%	2.9	NA	100%	100%	1	1
274	Practice	1.5 Watts/Sqft	2	87	1,415	1,329	25%	19%	2L4' T8/ELIG	2	60	1,415	1,329	25%	19%	2.9	NA	100%	100%	1	1
275	Practice	1.5 Watts/Sqft	2	128	1,415	1,329	25%	19%	3L4' T8/ELIG	2	88	1,415	1,329	25%	19%	2.9	NA	100%	100%	1	1
276	Band Hall	1.5 Watts/Sqft	2	87	1,852	1,839	26%	19%	2L4' T8/ELIG	2	60	1,852	1,839	26%	19%	2.9	NA	100%	100%	35	35
277	Band Hall	1.5 Watts/Sqft	1	58	1,852	1,839	26%	19%	2/18W COMP. HW ELIG	1	40	1,852	1,839	26%	19%	2.9	NA	100%	100%	35	35
278	D114 Piano Rm	1.5 Watts/Sqft	8	128	1,415	1,329	25%	19%	3L4' T8/ELIG	8	88	1,415	1,329	25%	19%	2.9	NA	100%	100%	1	1
279	D114 Piano Rm	1.5 Watts/Sqft	2	87	1,415	1,329	25%	19%	2L4' T8/ELIG	2	60	1,415	1,329	25%	19%	2.9	NA	100%	100%	1	1
280	D114 Piano Rm	1.5 Watts/Sqft	1	58	1,415	1,329	25%	19%	2/18W COMP. HW ELIG	1	40	1,415	1,329	25%	19%	2.9	NA	100%	100%	1	1

Fixture Information																					
		Pre-retrofit Lighting							Post-retrofit Lighting						HVAC				Schedule ID from Table 6	
	(a)	(b)	(c)	(d)	(e)	(f)	(g)	(h)	(i)	(j)	(k)	(l)	(m)	(n)	(o)	(p)	(q)	(r)	(s)		
Fixture ID	Space Type	Fixture Type	Fixture Quantity	Fixture Wattage	Hours of Use Annual	Hours of Use Peak	FCM Diversity Factor Summer	FCM Diversity Factor Winter	Fixture Type	Fixture Quantity	Fixture Wattage	Hours of Use Annual	Hours of Use Peak	FCM Diversity Factor Summer	FCM Diversity Factor Winter	COP Cooling	COP Heating	% Space Cooled	% Space Heated	Pre Retrofit	Post Retrofit
281	D116 Music Storage	1.5 Watts/Sqft	4	87	56	56	1%	1%	2L4' T8/ELIG	4	60	56	56	1%	1%	2.9	NA	100%	100%	34	34
282	D102 Chorus	1.5 Watts/Sqft	6	87	1,415	1,329	25%	19%	2L4' T8/ELIG	6	60	1,415	1,329	25%	19%	2.9	NA	100%	100%	1	1
283	D102 Chorus	1.5 Watts/Sqft	10	128	1,415	1,329	25%	19%	3L4' T8/ELIG	10	88	1,415	1,329	25%	19%	2.9	NA	100%	100%	1	1
284	D102 Chorus	1.5 Watts/Sqft	1	99	1,415	1,329	25%	19%	2/32W COMPACT HW ELI	1	68	1,415	1,329	25%	19%	2.9	NA	100%	100%	1	1
285	D101D TV Edit	1.5 Watts/Sqft	3	128	1,415	1,329	25%	19%	3L4' T8/ELIG	3	88	1,415	1,329	25%	19%	2.9	NA	100%	100%	1	1
286	D101C TV Clrm	1.5 Watts/Sqft	10	87	1,415	1,329	25%	19%	2L4' T8/ELIG	10	60	1,415	1,329	25%	19%	2.9	NA	100%	100%	1	1
287	D101B TV Studio	1.5 Watts/Sqft	2	87	1,415	1,329	25%	19%	2L4' T8/ELIG	2	60	1,415	1,329	25%	19%	2.9	NA	100%	100%	1	1
288	D101B TV Studio	1.5 Watts/Sqft	6	122	1,415	1,329	25%	19%	4L4' T8/ELIG LOW PWR	6	84	1,415	1,329	25%	19%	2.9	NA	100%	100%	1	1
289	D101A TV Control	1.5 Watts/Sqft	2	128	1,415	1,329	25%	19%	3L4' T8/ELIG	2	88	1,415	1,329	25%	19%	2.9	NA	100%	100%	1	1
290	D101A TV Control	1.5 Watts/Sqft	1	87	1,415	1,329	25%	19%	2L4' T8/ELIG	1	60	1,415	1,329	25%	19%	2.9	NA	100%	100%	1	1
291	D101 TV Entry	1.5 Watts/Sqft	2	87	1,415	1,329	25%	19%	2L4' T8/ELIG	2	60	1,415	1,329	25%	19%	2.9	NA	100%	100%	1	1
292	Hallway	1.5 Watts/Sqft	6	122	1,852	1,839	26%	19%	4L3' T8/ELIG	6	90	1,852	1,839	26%	19%	2.9	NA	100%	100%	35	35
293	Lobby	1.5 Watts/Sqft	3	404	1,852	1,839	26%	19%	150W METAL HALIDE	3	172	1,852	1,839	26%	19%	2.9	NA	100%	100%	35	35
294	Stair 3 Stair	1.5 Watts/Sqft	3	404	8,760	4,032	100%	100%	150W METAL HALIDE	2	172	8,760	4,032	100%	100%	2.9	NA	100%	100%	18	18
295	Stair 3 Stair	1.5 Watts/Sqft	2	99	8,760	4,032	100%	100%	2/32W COMPACT HW ELI	2	68	8,760	4,032	100%	100%	2.9	NA	100%	100%	18	18
296	Stage	1.5 Watts/Sqft	28	87	56	56	1%	1%	2L4' T8/ELIG	28	60	56	56	1%	1%	2.9	NA	100%	100%	34	34
297	Hallway	1.5 Watts/Sqft	3	404	1,852	1,839	26%	19%	150W METAL HALIDE	3	172	1,852	1,839	26%	19%	2.9	NA	100%	100%	35	35
298	Hallway	1.5 Watts/Sqft	9	87	1,852	1,839	26%	19%	2L4' T8/ELIG	9	60	1,852	1,839	26%	19%	2.9	NA	100%	100%	35	35
299	A136 Music Storage	1.5 Watts/Sqft	2	87	56	56	1%	1%	2L4' T8/ELIG	2	60	56	56	1%	1%	2.9	NA	100%	100%	34	34
300	Boys/Girls Locker	1.5 Watts/Sqft	24	87	2,702	2,581	63%	70%	2L4' T8/ELIG	24	60	2,702	2,581	63%	70%	2.9	NA	100%	100%	10	10
301	Boys/Girls Locker	1.5 Watts/Sqft	2	87	2,702	2,581	63%	70%	2L4' T8/ELIG	2	60	2,702	2,581	63%	70%	2.9	NA	100%	100%	10	10
302	Boys/Girls Locker Teacher Rm	1.5 Watts/Sqft	4	128	2,702	2,581	63%	70%	3L4' T8/ELIG	4	88	2,702	2,581	63%	70%	2.9	NA	100%	100%	10	10
303	Boys/Girls Locker Toilet	1.5 Watts/Sqft	6	87	2,702	2,581	63%	70%	2L4' T8/ELIG	6	60	2,702	2,581	63%	70%	2.9	NA	100%	100%	10	10
304	Boys/Girls Locker Toilet	1.5 Watts/Sqft	2	78	2,702	2,581	63%	70%	2/26W COMP. HW ELIG	2	54	2,702	2,581	63%	70%	2.9	NA	100%	100%	10	10
305	Boys/Girls Locker Shower	1.5 Watts/Sqft	8	78	2,702	2,581	63%	70%	2/26W COMP. HW ELIG	8	54	2,702	2,581	63%	70%	2.9	NA	100%	100%	10	10
306	A135 Health Clrm	1.5 Watts/Sqft	10	128	867	867	10%	5%	3L4' T8/ELIG	10	88	867	867	10%	5%	2.9	NA	100%	100%	32	32
307	A135 Health Clrm	1.5 Watts/Sqft	3	123	996	976	10%	6%	2L2' F40BX/ELIG	3	72	996	976	10%	6%	2.9	NA	100%	100%	33	33
308	Stair 2 Stair	1.5 Watts/Sqft	3	122	8,760	4,032	100%	100%	4L4' T8/ELIG LOW PWR	3	84	8,760	4,032	100%	100%	2.9	NA	100%	100%	18	18
309	Stair 2 Stair	1.5 Watts/Sqft	3	87	8,760	4,032	100%	100%	2L4' T8/ELIG	3	60	8,760	4,032	100%	100%	2.9	NA	100%	100%	18	18
310	Hallway	1.5 Watts/Sqft	11	87	1,852	1,839	26%	19%	2L4' T8/ELIG	11	60	1,852	1,839	26%	19%	2.9	NA	100%	100%	35	35
311	Loading Dock	1.5 Watts/Sqft	14	87	1,852	1,839	26%	19%	2L4' T8/ELIG	14	60	1,852	1,839	26%	19%	2.9	NA	100%	100%	35	35
312	Loading Dock	1.5 Watts/Sqft	13	78	1,852	1,839	26%	19%	2/26W COMP. HW ELIG	13	54	1,852	1,839	26%	19%	2.9	NA	100%	100%	35	35
313	A134 Storage	1.5 Watts/Sqft	2	128	56	56	1%	1%	3L4' T8/ELIG	2	88	56	56	1%	1%	2.9	NA	100%	100%	34	34
314	A132 Storage	1.5 Watts/Sqft	2	128	56	56	1%	1%	3L4' T8/ELIG	2	88	56	56	1%	1%	2.9	NA	100%	100%	34	34
315	A130 Storage	1.5 Watts/Sqft	2	128	56	56	1%	1%	3L4' T8/ELIG	2	88	56	56	1%	1%	2.9	NA	100%	100%	34	34
316	Toilets Toilet	1.5 Watts/Sqft	2	87	1,852	1,839	26%	19%	2L4' T8/ELIG	2	60	1,852	1,839	26%	19%	2.9	NA	100%	100%	35	35
317	Toilets Toilet	1.5 Watts/Sqft	1	87	1,852	1,839	26%	19%	2L3' T8/ELIG	2	47	1,852	1,839	26%	19%	2.9	NA	100%	100%	35	35
318	A138 Storage	1.5 Watts/Sqft	2	128	56	56	1%	1%	3L4' T8/ELIG	2	88	56	56	1%	1%	2.9	NA	100%	100%	34	34
319	A126 Aerobics/Dance	1.5 Watts/Sqft	8	128	1,415	1,329	25%	19%	3L4' T8/ELIG	8	88	1,415	1,329	25%	19%	2.9	NA	100%	100%	1	1
320	Kitchen Storage Storage	1.5 Watts/Sqft	2	87	56	56	1%	1%	2L4' T8/ELIG	2	60	56	56	1%	1%	2.9	NA	100%	100%	34	34
321	Kitchen Storage Storage	1.5 Watts/Sqft	5	99	56	56	1%	1%	100W INC	5	100	56	56	1%	1%	2.9	NA	100%	100%	34	34
322	Kitchen Storage Storage	1.5 Watts/Sqft	1	58	56	56	1%	1%	2/18W COMP. HW ELIG	1	40	56	56	1%	1%	2.9	NA	100%	100%	34	34
323	Toilets Toilet	1.5 Watts/Sqft	1	87	1,852	1,839	26%	19%	2L3' T8/ELIG	4	47	1,852	1,839	26%	19%	2.9	NA	100%	100%	35	35
324	Kitchen Office Office	1.5 Watts/Sqft	1	128	192	192	3%	0%	3L4' T8/ELIG	1	88	192	192	3%	0%	2.9	NA	100%	100%	29	29
325	Kitchen	1.5 Watts/Sqft	13	87	2,498	2,022	23%	16%	2L4' T8/ELIG	13	60	2,498	2,022	23%	16%	2.9	NA	100%	100%	9	9
326	Kitchen	1.5 Watts/Sqft	12	87	2,498	2,022	23%	16%	2L4' T8/ELIG	12	60	2,498	2,022	23%	16%	2.9	NA	100%	100%	9	9
327	Kitchen Servery Kitchen	1.5 Watts/Sqft	6	99	2,498	2,022	23%	16%	100W INC	12	100	2,498	2,022	23%	16%	2.9	NA	100%	100%	9	9
328	A124 Weight Rm	1.5 Watts/Sqft	8	128	2,091	1,629	15%	18%	3L4' T8/ELIG	8	88	2,091	1,629	15%	18%	2.9	NA	100%	100%	31	31
329	A124 Weight Rm	1.5 Watts/Sqft	3	87	2,091	1,629	15%	18%	2L4' T8/ELIG	3	60	2,091	1,629	15%	18%	2.9	NA	100%	100%	31	31
330	Elevator Machine Rm	1.5 Watts/Sqft	1	87	56	56	1%	1%	2L4' T8/ELIG	1	60	56	56	1%	1%	2.9	NA	100%	100%	34	34
331	A124 Weight Rm Storage	1.5 Watts/Sqft	2	87	2,091	1,629	15%	18%	2L4' T8/ELIG	2	60	2,091	1,629	15%	18%	2.9	NA	100%	100%	31	31
332	Cyber Café	1.5 Watts/Sqft	7	128	2,498	2,022	23%	16%	3L4' T8/ELIG	7	88	2,498	2,022	23%	16%	2.9	NA	100%	100%	9	9
333	Custodian Entry	1.5 Watts/Sqft	5	87	2,091	1,629	15%	18%	2L4' T8/ELIG	5	60	2,091	1,629	15%	18%	2.9	NA	100%	100%	31	31
334	Custodian Storage Storage	1.5 Watts/Sqft	6	87	56	56	1%	1%	2L4' T8/ELIG	6	60	56	56	1%	1%	2.9	NA	100%	100%	34	34
335	Custodian Office Office	1.5 Watts/Sqft	3	128	2,091	1,629	15%	18%	3L4' T8/ELIG	3	88	2,091	1,629	15%	18%	2.9	NA	100%	100%	31	31
336	Custodian Office Office	1.5 Watts/Sqft	4	87	2,091	1,629	15%	18%	2L4' T8/ELIG	4	60	2,091	1,629	15%	18%	2.9	NA	100%	100%	31	31
337	Electric	1.5 Watts/Sqft	1	87	56	56	1%	1%	2L4' T8/ELIG	1	60	56	56	1%	1%	2.9	NA	100%	100%	34	34
338	Toilets Toilet	1.5 Watts/Sqft	1	87	1,852	1,839	26%	19%	2L4' T8/ELIG	1	60	1,852	1,839	26%	19%	2.9	NA	100%	100%	35	35
339	Toilets Toilet	1.5 Watts/Sqft	1	58	1,852	1,839	26%	19%	2/18W COMP. HW ELIG	1	40	1,852	1,839	26%	19%	2.9	NA	100%	100%	35	35
340	Boiler Rm	1.5 Watts/Sqft	2	87	1,852	1,839	26%	19%	2L4' T8/ELIG	2	60	1,852	1,839	26%	19%	2.9	NA	100%	100%	35	35
341	Cafeteria	1.5 Watts/Sqft	40	87	8,760	4,032	100%	100%	2L4' T8/ELIG	40	60	8,760	4,032	100%	100%	2.9	NA	100%	100%	18	18
342	Cafeteria	1.5 Watts/Sqft	32	87	2,498	2,022	23%	16%	2L4' T8/ELIG	32	60	2,498	2,022	23%	16%	2.9	NA	100%	100%	9	9
343	Cafeteria	1.5 Watts/Sqft	4	78	2,498	2,022	23%	16%	2/26W COMP. HW ELIG	4	54	2,498	2,022	23%	16%	2.9	NA	100%	100%	9	9
344	Cafeteria	1.5 Watts/Sqft	2	41	8,760	4,032	100%	100%	2/13W COMPACT HW ELI	2	28	8,760	4,032	100%	100%	2.9	NA	100%	100%	18	18
345	Cafeteria	1.5 Watts/Sqft	5	41	2,498	2,022	23%	16%	2/13W COMPACT HW ELI	5	28	2,498	2,022	23%	16%	2.9	NA	100%	100%	9	9
346	Cafeteria	1.5 Watts/Sqft	8	86	2,498	2,022	23%	16%	22/32W CIRCLINE HW	7	59	2,498	2,022	23%	16%	2.9	NA	100%	100%	9	9
347	Stair 1 Stair	1.5 Watts/Sqft	2	58	8,760	4,032	100%	100%	2/18W COMP. HW ELIG	2	40	8,760	4,032	100%	100%	2.9	NA	100%	100%	18	18
348	Storage	1.5 Watts/Sqft	2	87	56	56	1%	1%	2L4' T8/ELIG	2	60	56	56	1%	1%	2.9	NA	100%	100%	34	34
349	Hallway	1.5 Watts/Sqft	1	78	1,852	1,839	26%	19%	18W COMPACT HW	1	20	1,852	1,839	26%	19%	2.9	NA	100%	100%	35	35
350	Mens/Womens Restroom	1.5 Watts/Sqft	6	58	1,852	1,839	26%	19%	2/18W COMP. HW ELIG	6	40	1,852	1,839	26%	19%	2.9	NA	100%	100%	35	35

Fixture Information

		Pre-retrofit Lighting							Post-retrofit Lighting							HVAC					
	(a)	(b)	(c)	(d)	(e)	(f)	(g)	(h)	(i)	(j)	(k)	(l)	(m)	(n)	(o)	(p)	(q)	(r)	(s)	Schedule ID from Table 6	
					Hours of Use		FCM Diversity Factor					Hours of Use		FCM Diversity Factor			COP				
Fixture ID	Space Type	Fixture Type	Fixture Quantity	Fixture Wattage	Annual	Peak	Summer	Winter	Fixture Type	Fixture Quantity	Fixture Wattage	Annual	Peak	Summer	Winter	Cooling	Heating	% Space Cooled	% Space Heated	Pre Retrofit	Post Retrofit
351	Mens/Womens Restroom	1.5 Watts/Sqft	6	87	1,852	1,839	26%	19%	2L4' T8/ELIG	6	60	1,852	1,839	26%	19%	2.9	NA	100%	100%	35	35
352	Mens/Womens Restroom	1.5 Watts/Sqft	1	87	1,852	1,839	26%	19%	2L3' T8/ELIG	6	47	1,852	1,839	26%	19%	2.9	NA	100%	100%	35	35
353	Main Lobby	1.5 Watts/Sqft	12	78	8,760	4,032	100%	100%	2/26W COMP. HW ELIG	12	54	8,760	4,032	100%	100%	2.9	NA	100%	100%	18	18
354	Main Lobby	1.5 Watts/Sqft	37	78	1,852	1,839	26%	19%	2/26W COMP. HW ELIG	37	54	1,852	1,839	26%	19%	2.9	NA	100%	100%	35	35
355	Main Lobby	1.5 Watts/Sqft	5	291	1,852	1,839	26%	19%	200W INC	5	200	1,852	1,839	26%	19%	2.9	NA	100%	100%	35	35
356	Main Office Reception	1.5 Watts/Sqft	2	78	2,498	2,022	23%	16%	2/26W COMP. HW ELIG	2	54	2,498	2,022	23%	16%	2.9	NA	100%	100%	9	9
357	Main Office Reception	1.5 Watts/Sqft	13	87	2,498	2,022	23%	16%	2L4' T8/ELIG	13	60	2,498	2,022	23%	16%	2.9	NA	100%	100%	9	9
358	Main Office Conference Room	1.5 Watts/Sqft	3	87	1,481	1,356	39%	4%	2L4' T8/ELIG	3	60	1,481	1,356	39%	4%	2.9	NA	100%	100%	8	8
359	Main Office Principal Office	1.5 Watts/Sqft	4	128	1,481	1,356	39%	4%	3L4' T8/ELIG	4	88	1,481	1,356	39%	4%	2.9	NA	100%	100%	8	8
360	Main Offices Private Offices	1.5 Watts/Sqft	14	128	1,481	1,356	39%	4%	3L4' T8/ELIG	14	88	1,481	1,356	39%	4%	2.9	NA	100%	100%	8	8
361	Main Offices Toilet	1.5 Watts/Sqft	1	87	1,481	1,356	39%	4%	2L3' T8/ELIG	4	47	1,481	1,356	39%	4%	2.9	NA	100%	100%	8	8
362	Main Offices Storage	1.5 Watts/Sqft	2	87	56	56	1%	1%	2L4' T8/ELIG	2	60	56	56	1%	1%	2.9	NA	100%	100%	34	34
363	Main Offices Records Storage	1.5 Watts/Sqft	3	87	56	56	1%	1%	2L4' T8/ELIG	3	60	56	56	1%	1%	2.9	NA	100%	100%	34	34
364	Main Offices Conference Room	1.5 Watts/Sqft	2	87	1,481	1,356	39%	4%	2L4' T8/ELIG	2	60	1,481	1,356	39%	4%	2.9	NA	100%	100%	8	8
365	Main Offices Conference Room	1.5 Watts/Sqft	8	78	1,481	1,356	39%	4%	2/26W COMP. HW ELIG	8	54	1,481	1,356	39%	4%	2.9	NA	100%	100%	8	8
366	Main Offices Guidance Suite	1.5 Watts/Sqft	2	128	1,392	1,371	23%	0%	3L4' T8/ELIG	2	88	1,392	1,371	23%	0%	2.9	NA	100%	100%	23	23
367	Main Offices Guidance Recepti	1.5 Watts/Sqft	2	87	1,392	1,371	23%	0%	2L4' T8/ELIG	2	60	1,392	1,371	23%	0%	2.9	NA	100%	100%	23	23
368	Main Offices Guidance Recepti	1.5 Watts/Sqft	6	78	1,392	1,371	23%	0%	2/26W COMP. HW ELIG	6	54	1,392	1,371	23%	0%	2.9	NA	100%	100%	23	23
369	Main Offices Guidance Recepti	1.5 Watts/Sqft	2	78	8,760	4,032	100%	100%	2/26W COMP. HW ELIG	2	54	8,760	4,032	100%	100%	2.9	NA	100%	100%	18	18
370	Main Offices Records Storage	1.5 Watts/Sqft	4	87	56	56	1%	1%	2L4' T8/ELIG	4	60	56	56	1%	1%	2.9	NA	100%	100%	34	34
371	Health Storage	1.5 Watts/Sqft	1	128	56	56	1%	1%	3L4' T8/ELIG	1	88	56	56	1%	1%	2.9	NA	100%	100%	34	34
372	Health Toilet	1.5 Watts/Sqft	1	87	1,301	1,300	17%	0%	2L3' T8/ELIG	4	47	1,301	1,300	17%	0%	2.9	NA	100%	100%	4	4
373	Health Health Suite	1.5 Watts/Sqft	4	87	1,301	1,300	17%	0%	2L4' T8/ELIG	4	60	1,301	1,300	17%	0%	2.9	NA	100%	100%	4	4
374	Health Health Suite	1.5 Watts/Sqft	6	123	1,301	1,300	17%	0%	2L2' F40BX/ELIG	4	72	1,301	1,300	17%	0%	2.9	NA	100%	100%	4	4
375	Health Health Suite	1.5 Watts/Sqft	3	58	1,301	1,300	17%	0%	2/18W COMP. HW ELIG	3	40	1,301	1,300	17%	0%	2.9	NA	100%	100%	4	4
376	Health Exam Rm	1.5 Watts/Sqft	1	247	1,301	1,300	17%	0%	4L2' F40BX/ELIG	1	144	1,301	1,300	17%	0%	2.9	NA	100%	100%	4	4
377	Health Office	1.5 Watts/Sqft	2	128	1,301	1,300	17%	0%	3L4' T8/ELIG	2	88	1,301	1,300	17%	0%	2.9	NA	100%	100%	4	4
378	Health Office	1.5 Watts/Sqft	2	128	1,301	1,300	17%	0%	3L4' T8/ELIG	2	88	1,301	1,300	17%	0%	2.9	NA	100%	100%	4	4
379	Health Storage	1.5 Watts/Sqft	1	58	56	56	1%	1%	2/18W COMP. HW ELIG	1	40	56	56	1%	1%	2.9	NA	100%	100%	34	34
380	Health Storage	1.5 Watts/Sqft	1	87	56	56	1%	1%	2L4' T8/ELIG	1	60	56	56	1%	1%	2.9	NA	100%	100%	34	34
381	Stair 5 Stair	1.5 Watts/Sqft	2	99	8,760	4,032	100%	100%	2/32W COMPACT HW ELI	2	68	8,760	4,032	100%	100%	2.9	NA	100%	100%	18	18
382	Stair 5 Stair	1.5 Watts/Sqft	3	122	8,760	4,032	100%	100%	4L4' T8/ELIG LOW PWR	3	84	8,760	4,032	100%	100%	2.9	NA	100%	100%	18	18
383	Stair 5 Stair	1.5 Watts/Sqft	4	87	8,760	4,032	100%	100%	2L4' T8/ELIG	4	60	8,760	4,032	100%	100%	2.9	NA	100%	100%	18	18
384	Hallway	1.5 Watts/Sqft	8	122	8,760	4,032	100%	100%	4L3' T8/ELIG	8	90	8,760	4,032	100%	100%	2.9	NA	100%	100%	18	18
385	Main Lobby	1.5 Watts/Sqft	8	209	1,852	1,839	26%	19%	4L2' F40BX/ELIG	6	144	1,852	1,839	26%	19%	2.9	NA	100%	100%	35	35
386	Auditorium Entry	1.5 Watts/Sqft	10	123	584	584	12%	26%	2L2' F40BX/ELIG	10	72	584	584	12%	26%	2.9	NA	100%	100%	36	36
387	Classrooms Classroom	1.5 Watts/Sqft	97	86	996	976	10%	6%		0	0	996	976	10%	6%	2.9	NA	100%	100%	33	33
388	Entry	1.5 Watts/Sqft	10	354	1,852	1,839	26%	19%		0	0	1,852	1,839	26%	19%	2.9	NA	100%	100%	35	35
		Totals	2,385	307,410					Totals	2,330	202,375										

Pre-Retrofit Demand and Energy Consumption

Fixture ID	Lighting Demand and Energy Consumption (t) Connected kW	(u) FCM Diversified kW Summer	(v) FCM Diversified kW Winter	(w) Annual kWh	(x) Peak kWh	Interactive Hours (y) Cooling Hours	(z) Heating Hours	Interactive Energy Consumption (aa) Cooling kWh	(ab) Heating kWh	On-Peak Interactive Hours (ac) Cooling Hours	(ad) Heating Hours	On-Peak Interactive Demand and Energy Consumption (ae) FCM Diversified kW Summer	(af) FCM Diversified kW Winter	(ag) Cooling kWh	(ah) Heating kWh	Lighting and Interactive Demand and Energy Consumption (ai) FCM Diversified kW Summer	(aj) FCM Diversified kW Winter	(ak) Annual kWh	(al) Peak kWh
1	23.25	2.72	6.14	13,572	13,572	69	282	435	0	69	282	0.50	0.00	435	0	3.23	6.14	14,007	14,007
2	27.79	7.74	8.65	75,425	62,407	492	1,360	0	0	395	1,184	0.00	0.00	0	0	7.74	8.65	75,425	62,407
3	6.54	6.54	6.54	57,270	26,360	1,208	2,325	0	0	812	1,582	0.00	0.00	0	0	6.54	6.54	57,270	26,360
4	8.25	1.23	1.50	17,243	13,431	400	1,028	0	0	304	852	0.00	0.00	0	0	1.23	1.50	17,243	13,431
5	1.28	0.13	0.06	1,109	1,108	125	509	44	0	125	509	0.03	0.00	44	0	0.16	0.06	1,152	1,152
6	0.37	0.04	0.02	369	362	156	574	16	0	151	562	0.01	0.00	15	0	0.05	0.02	385	377
7	1.28	0.13	0.06	1,109	1,108	125	509	44	0	125	509	0.03	0.00	44	0	0.16	0.06	1,152	1,152
8	0.37	0.04	0.02	369	362	156	574	16	0	151	562	0.01	0.00	15	0	0.05	0.02	385	377
9	1.28	0.13	0.06	1,109	1,108	125	509	44	0	125	509	0.03	0.00	44	0	0.16	0.06	1,152	1,152
10	0.37	0.04	0.02	369	362	156	574	16	0	151	562	0.01	0.00	15	0	0.05	0.02	385	377
11	1.28	0.08	0.04	905	904	102	408	36	0	102	408	0.02	0.00	36	0	0.10	0.04	941	940
12	0.37	0.04	0.02	369	362	156	574	16	0	151	562	0.01	0.00	15	0	0.05	0.02	385	377
13	1.28	0.08	0.04	905	904	102	408	36	0	102	408	0.02	0.00	36	0	0.10	0.04	941	940
14	0.37	0.04	0.02	369	362	156	574	16	0	151	562	0.01	0.00	15	0	0.05	0.02	385	377
15	0.77	0.05	0.02	543	542	102	408	21	0	102	408	0.01	0.00	21	0	0.06	0.02	564	564
16	0.37	0.04	0.02	369	362	156	574	16	0	151	562	0.01	0.00	15	0	0.05	0.02	385	377
17	1.28	0.08	0.04	905	904	102	408	36	0	102	408	0.02	0.00	36	0	0.10	0.04	941	940
18	0.37	0.04	0.02	369	362	156	574	16	0	151	562	0.01	0.00	15	0	0.05	0.02	385	377
19	0.26	0.00	0.00	15	15	8	28	1	0	8	28	0.00	0.00	1	0	0.00	0.00	15	15
20	1.28	0.13	0.06	1,109	1,108	125	509	44	0	125	509	0.03	0.00	44	0	0.16	0.06	1,152	1,152
21	0.37	0.04	0.02	369	362	156	574	16	0	151	562	0.01	0.00	15	0	0.05	0.02	385	377
22	1.28	0.13	0.06	1,109	1,108	125	509	44	0	125	509	0.03	0.00	44	0	0.16	0.06	1,152	1,152
23	0.37	0.04	0.02	369	362	156	574	16	0	151	562	0.01	0.00	15	0	0.05	0.02	385	377
24	0.20	0.04	0.01	330	326	276	977	15	0	273	969	0.01	0.00	15	0	0.05	0.01	345	341
25	0.51	0.11	0.03	853	844	276	977	38	0	273	969	0.02	0.00	38	0	0.13	0.03	892	882
26	0.26	0.05	0.01	427	422	276	977	19	0	273	969	0.01	0.00	19	0	0.07	0.01	446	441
27	0.17	0.00	0.00	10	10	8	28	0	0	8	28	0.00	0.00	0	0	0.00	0.00	10	10
28	0.17	0.00	0.00	10	10	8	28	0	0	8	28	0.00	0.00	0	0	0.00	0.00	10	10
29	0.17	0.02	0.01	151	151	125	509	6	0	125	509	0.00	0.00	6	0	0.02	0.01	157	157
30	0.17	0.02	0.01	151	151	125	509	6	0	125	509	0.00	0.00	6	0	0.02	0.01	157	157
31	1.41	0.15	0.06	1,220	1,219	125	509	48	0	125	509	0.03	0.00	48	0	0.17	0.06	1,268	1,267
32	0.37	0.04	0.02	369	362	156	574	16	0	151	562	0.01	0.00	15	0	0.05	0.02	385	377
33	1.41	0.15	0.06	1,220	1,219	125	509	48	0	125	509	0.03	0.00	48	0	0.17	0.06	1,268	1,267
34	0.37	0.04	0.02	369	362	156	574	16	0	151	562	0.01	0.00	15	0	0.05	0.02	385	377
35	1.41	0.15	0.06	1,220	1,219	125	509	48	0	125	509	0.03	0.00	48	0	0.17	0.06	1,268	1,267
36	0.37	0.04	0.02	369	362	156	574	16	0	151	562	0.01	0.00	15	0	0.05	0.02	385	377
37	0.17	0.05	0.03	323	321	306	1,077	15	0	303	1,069	0.01	0.00	14	0	0.05	0.03	337	335
38	0.40	0.10	0.08	732	727	306	1,077	33	0	303	1,069	0.02	0.00	33	0	0.12	0.08	765	759
39	0.17	0.05	0.03	323	321	306	1,077	15	0	303	1,069	0.01	0.00	14	0	0.05	0.03	337	335
40	0.17	0.05	0.03	323	321	306	1,077	15	0	303	1,069	0.01	0.00	14	0	0.05	0.03	337	335
41	0.40	0.10	0.08	732	727	306	1,077	33	0	303	1,069	0.02	0.00	33	0	0.12	0.08	765	759
42	0.17	0.05	0.03	323	321	306	1,077	15	0	303	1,069	0.01	0.00	14	0	0.05	0.03	337	335
43	0.17	0.00	0.00	10	10	8	28	0	0	8	28	0.00	0.00	0	0	0.00	0.00	10	10
44	1.41	0.15	0.06	1,220	1,219	125	509	48	0	125	509	0.03	0.00	48	0	0.17	0.06	1,268	1,267
45	0.37	0.04	0.02	369	362	156	574	16	0	151	562	0.01	0.00	15	0	0.05	0.02	385	377
46	1.41	0.15	0.06	1,220	1,219	125	509	48	0	125	509	0.03	0.00	48	0	0.17	0.06	1,268	1,267
47	0.37	0.04	0.02	369	362	156	574	16	0	151	562	0.01	0.00	15	0	0.05	0.02	385	377
48	1.41	0.15	0.06	1,220	1,219	125	509	48	0	125	509	0.03	0.00	48	0	0.17	0.06	1,268	1,267
49	0.37	0.04	0.02	369	362	156	574	16	0	151	562	0.01	0.00	15	0	0.05	0.02	385	377
50	1.41	0.15	0.06	1,220	1,219	125	509	48	0	125	509	0.03	0.00	48	0	0.17	0.06	1,268	1,267
51	0.37	0.04	0.02	369	362	156	574	16	0	151	562	0.01	0.00	15	0	0.05	0.02	385	377
52	1.41	0.15	0.06	1,220	1,219	125	509	48	0	125	509	0.03	0.00	48	0	0.17	0.06	1,268	1,267
53	0.37	0.04	0.02	369	362	156	574	16	0	151	562	0.01	0.00	15	0	0.05	0.02	385	377
54	1.41	0.15	0.06	1,220	1,219	125	509	48	0	125	509	0.03	0.00	48	0	0.17	0.06	1,268	1,267
55	0.37	0.04	0.02	369	362	156	574	16	0	151	562	0.01	0.00	15	0	0.05	0.02	385	377
56	0.17	0.00	0.00	10	10	8	28	0	0	8	28	0.00	0.00	0	0	0.00	0.00	10	10
57	0.05	0.00	0.00	3	3	8	28	0	0	8	28	0.00	0.00	0	0	0.00	0.00	3	3
58	0.17	0.00	0.00	10	10	8	28	0	0	8	28	0.00	0.00	0	0	0.00	0.00	10	10
59	1.41	0.15	0.06	1,220	1,219	125	509	48	0	125	509	0.03	0.00	48	0	0.17	0.06	1,268	1,267
60	0.37	0.04	0.02	369	362	156	574	16	0	151	562	0.01	0.00	15	0	0.05	0.02	385	377
61	0.16	0.00	0.00	9	9	8	28	0	0	8	28	0.00	0.00	0	0	0.00	0.00	9	9
62	1.26	0.13	0.06	1,089	1,088	125	509	43	0	125	509	0.03	0.00	43	0	0.16	0.06	1,131	1,131
63	0.26	0.06	0.04	653	529	500	1,284	36	0	404	1,108	0.01	0.00	29	0	0.07	0.04	689	558
64	1.41	0.15	0.06	1,220	1,219	125	509	48	0	125	509	0.03	0.00	48	0	0.17	0.06	1,268	1,267
65	0.37	0.04	0.02	369	362	156	574	16	0	151	562	0.01	0.00	15	0	0.05	0.02	385	377
66	1.66	0.17	0.08	1,441	1,441	125	509	57	0	125	509	0.03	0.00	57	0	0.21	0.08	1,498	1,498
67	0.37	0.04	0.02	369	362	156	574	16	0	151	562	0.01	0.00	15	0	0.05	0.02	385	377
68	1.92	0.20	0.09	1,663	1,663	125	509	65	0	125	509	0.04	0.00	65	0	0.24	0.09	1,729	1,728
69	0.38	0.04	0.02	333	333	125	509	13	0	125	509	0.01	0.00	13	0	0.05	0.02	346	346
70	0.26	0.00	0.00	0	0	0	0	0	0	0	0	0.00	0.00	0	0	0.00	0.00	0	0

Pre-Retrofit Demand and Energy Consumption																			
	Lighting Demand and Energy Consumption					Interactive Hours		Interactive Energy Consumption		On-Peak Interactive Hours		On-Peak Interactive Demand and Energy Consumption				Lighting and Interactive Demand and Energy Consumption			
	(t)	(u)	(v)	(w)	(x)	(y)	(z)	(aa)	(ab)	(ac)	(ad)	(ae)	(af)	(ag)	(ah)	(ai)	(aj)	(ak)	(al)
Fixture	Connected	FCM Diversified kW		Annual	Peak	Cooling	Heating	Cooling	Heating	Cooling	Heating	FCM Diversified kW		Cooling	Heating	FCM Diversified kW		Annual	Peak
ID	kW	Summer	Winter	kWh	kWh	Hours	Hours	kWh	kWh	Hours	Hours	Summer	Winter	kWh	kWh	Summer	Winter	kWh	kWh
71	0.26	0.05	0.01	427	422	276	977	19	0	273	969	0.01	0.00	19	0	0.07	0.01	446	441
72	0.17	0.05	0.03	323	321	306	1,077	15	0	303	1,069	0.01	0.00	14	0	0.05	0.03	337	335
73	0.16	0.04	0.03	291	289	306	1,077	13	0	303	1,069	0.01	0.00	13	0	0.05	0.03	304	302
74	0.17	0.05	0.03	323	321	306	1,077	15	0	303	1,069	0.01	0.00	14	0	0.05	0.03	337	335
75	0.16	0.04	0.03	291	289	306	1,077	13	0	303	1,069	0.01	0.00	13	0	0.05	0.03	304	302
76	1.66	0.35	0.09	2,773	2,742	276	977	125	0	273	969	0.08	0.00	124	0	0.43	0.09	2,898	2,866
77	0.08	0.02	0.00	131	129	276	977	6	0	273	969	0.00	0.00	6	0	0.02	0.00	137	135
78	0.84	0.21	0.16	1,184	1,112	258	763	59	0	230	716	0.05	0.00	53	0	0.26	0.16	1,243	1,165
79	0.44	0.11	0.08	617	579	258	763	31	0	230	716	0.02	0.00	27	0	0.13	0.08	647	607
80	1.66	0.17	0.08	1,441	1,441	125	509	57	0	125	509	0.03	0.00	57	0	0.21	0.08	1,498	1,498
81	0.26	0.06	0.00	356	351	253	799	18	0	249	788	0.01	0.00	17	0	0.07	0.00	374	368
82	0.26	0.05	0.01	427	422	276	977	19	0	273	969	0.01	0.00	19	0	0.07	0.01	446	441
83	0.09	0.02	0.00	145	144	276	977	7	0	273	969	0.00	0.00	7	0	0.02	0.00	152	150
84	0.47	0.12	0.09	872	866	306	1,077	39	0	303	1,069	0.02	0.00	39	0	0.15	0.09	911	905
85	0.08	0.00	0.00	4	4	8	28	0	0	8	28	0.00	0.00	0	0	0.00	0.00	5	5
86	0.08	0.00	0.00	4	4	8	28	0	0	8	28	0.00	0.00	0	0	0.00	0.00	5	5
87	0.17	0.04	0.00	243	239	253	799	12	0	249	788	0.01	0.00	12	0	0.05	0.00	255	251
88	0.13	0.01	0.01	111	111	125	509	4	0	125	509	0.00	0.00	4	0	0.02	0.01	115	115
89	0.26	0.06	0.00	356	351	253	799	18	0	249	788	0.01	0.00	17	0	0.07	0.00	374	368
90	0.35	0.00	0.00	19	19	8	28	1	0	8	28	0.00	0.00	1	0	0.00	0.00	20	20
91	0.39	0.00	0.00	22	22	8	28	1	0	8	28	0.00	0.00	1	0	0.01	0.00	23	23
92	0.35	0.00	0.00	19	19	8	28	1	0	8	28	0.00	0.00	1	0	0.00	0.00	20	20
93	0.51	0.32	0.36	1,382	1,320	553	1,181	77	0	540	1,139	0.07	0.00	75	0	0.40	0.36	1,459	1,395
94	0.05	0.03	0.04	145	139	553	1,181	8	0	540	1,139	0.01	0.00	8	0	0.04	0.04	153	147
95	0.09	0.00	0.00	5	5	8	28	0	0	8	28	0.00	0.00	0	0	0.00	0.00	5	5
96	0.17	0.00	0.00	10	10	8	28	0	0	8	28	0.00	0.00	0	0	0.00	0.00	10	10
97	0.12	0.00	0.00	7	7	8	28	0	0	8	28	0.00	0.00	0	0	0.00	0.00	7	7
98	0.31	0.08	0.06	581	577	306	1,077	26	0	303	1,069	0.02	0.00	26	0	0.10	0.06	607	603
99	0.17	0.05	0.03	323	321	306	1,077	15	0	303	1,069	0.01	0.00	14	0	0.05	0.03	337	335
100	0.26	0.07	0.05	484	481	306	1,077	22	0	303	1,069	0.01	0.00	22	0	0.08	0.05	506	503
101	0.31	0.08	0.06	581	577	306	1,077	26	0	303	1,069	0.02	0.00	26	0	0.10	0.06	607	603
102	0.17	0.05	0.03	323	321	306	1,077	15	0	303	1,069	0.01	0.00	14	0	0.05	0.03	337	335
103	0.26	0.07	0.05	484	481	306	1,077	22	0	303	1,069	0.01	0.00	22	0	0.08	0.05	506	503
104	7.35	1.91	1.43	13,617	13,520	306	1,077	614	0	303	1,069	0.36	0.00	608	0	2.27	1.43	14,231	14,128
105	2.04	0.53	0.40	3,778	3,751	306	1,077	170	0	303	1,069	0.10	0.00	169	0	0.63	0.40	3,949	3,920
106	0.17	0.05	0.03	323	321	306	1,077	15	0	303	1,069	0.01	0.00	14	0	0.05	0.03	337	335
107	0.09	0.02	0.02	161	160	306	1,077	7	0	303	1,069	0.00	0.00	7	0	0.03	0.02	169	168
108	0.17	0.05	0.03	323	321	306	1,077	15	0	303	1,069	0.01	0.00	14	0	0.05	0.03	337	335
109	0.17	0.05	0.03	323	321	306	1,077	15	0	303	1,069	0.01	0.00	14	0	0.05	0.03	337	335
110	0.17	0.05	0.03	323	321	306	1,077	15	0	303	1,069	0.01	0.00	14	0	0.05	0.03	337	335
111	0.35	0.09	0.07	646	641	306	1,077	29	0	303	1,069	0.02	0.00	29	0	0.11	0.07	675	670
112	0.17	0.05	0.03	323	321	306	1,077	15	0	303	1,069	0.01	0.00	14	0	0.05	0.03	337	335
113	0.06	0.02	0.01	108	107	306	1,077	5	0	303	1,069	0.00	0.00	5	0	0.02	0.01	112	112
114	0.52	0.14	0.10	969	962	306	1,077	44	0	303	1,069	0.03	0.00	43	0	0.16	0.10	1,012	1,005
115	0.17	0.05	0.03	323	321	306	1,077	15	0	303	1,069	0.01	0.00	14	0	0.05	0.03	337	335
116	0.35	0.09	0.07	646	641	306	1,077	29	0	303	1,069	0.02	0.00	29	0	0.11	0.07	675	670
117	0.52	0.14	0.10	969	962	306	1,077	44	0	303	1,069	0.03	0.00	43	0	0.16	0.10	1,012	1,005
118	0.26	0.03	0.01	227	227	125	509	9	0	125	509	0.01	0.00	9	0	0.03	0.01	236	236
119	0.77	0.08	0.04	665	665	125	509	26	0	125	509	0.02	0.00	26	0	0.10	0.04	691	691
120	0.37	0.04	0.02	369	362	156	574	16	0	151	562	0.01	0.00	15	0	0.05	0.02	385	377
121	0.26	0.03	0.01	227	227	125	509	9	0	125	509	0.01	0.00	9	0	0.03	0.01	236	236
122	0.96	0.10	0.04	832	831	125	509	33	0	125	509	0.02	0.00	33	0	0.12	0.04	864	864
123	0.08	0.01	0.00	68	68	125	509	3	0	125	509	0.00	0.00	3	0	0.01	0.00	71	71
124	0.13	0.01	0.01	111	111	125	509	4	0	125	509	0.00	0.00	4	0	0.02	0.01	115	115
125	0.13	0.01	0.01	111	111	125	509	4	0	125	509	0.00	0.00	4	0	0.02	0.01	115	115
126	0.17	0.02	0.01	151	151	125	509	6	0	125	509	0.00	0.00	6	0	0.02	0.01	157	157
127	0.31	0.08	0.06	581	577	306	1,077	26	0	303	1,069	0.02	0.00	26	0	0.10	0.06	607	603
128	0.31	0.08	0.06	581	577	306	1,077	26	0	303	1,069	0.02	0.00	26	0	0.10	0.06	607	603
129	0.17	0.02	0.01	151	151	125	509	6	0	125	509	0.00	0.00	6	0	0.02	0.01	157	157
130	0.17	0.02	0.01	151	151	125	509	6	0	125	509	0.00	0.00	6	0	0.02	0.01	157	157
131	0.11	0.00	0.00	6	6	8	28	0	0	8	28	0.00	0.00	0	0	0.00	0.00	6	6
132	0.35	0.00	0.00	19	19	8	28	1	0	8	28	0.00	0.00	1	0	0.00	0.00	20	20
133	0.08	0.00	0.00	4	4	8	28	0	0	8	28	0.00	0.00	0	0	0.00	0.00	5	5
134	1.66	0.17	0.08	1,441	1,441	125	509	57	0	125	509	0.03	0.00	57	0	0.21	0.08	1,498	1,498
135	0.37	0.04	0.02	369	362	156	574	16	0	151	562	0.01	0.00	15	0	0.05	0.02	385	377
136	1.66	0.17	0.08	1,441	1,441	125	509	57	0	125	509	0.03	0.00	57	0	0.21	0.08	1,498	1,498
137	0.37	0.04	0.02	369	362	156	574	16	0	151	562	0.01	0.00	15	0	0.05	0.02	385	377
138	1.66	0.17	0.08	1,441	1,441	125	509	57	0	125	509	0.03	0.00	57	0	0.21	0.08	1,498	1,498
139	0.37	0.04	0.02	369	362	156	574	16	0	151	562	0.01	0.00	15	0	0.05	0.02	385	377
140	1.66	0.17	0.08	1,441	1,441	125	509	57	0	125	509	0.03	0.00	57	0	0.21	0.08	1,498	1,498

Pre-Retrofit Demand and Energy Consumption																			
	Lighting Demand and Energy Consumption					Interactive Hours		Interactive Energy Consumption		On-Peak Interactive Hours		On-Peak Interactive Demand and Energy Consumption				Lighting and Interactive Demand and Energy Consumption			
	(t)	(u)	(v)	(w)	(x)	(y)	(z)	(aa)	(ab)	(ac)	(ad)	(ae)	(af)	(ag)	(ah)	(ai)	(aj)	(ak)	(al)
Fixture	Connected	FCM Diversified kW		Annual	Peak	Cooling	Heating	Cooling	Heating	Cooling	Heating	FCM Diversified kW		Cooling	Heating	FCM Diversified kW		Annual	Peak
ID	kW	Summer	Winter	kWh	kWh	Hours	Hours	kWh	kWh	Hours	Hours	Summer	Winter	kWh	kWh	Summer	Winter	kWh	kWh
141	0.37	0.04	0.02	369	362	156	574	16	0	151	562	0.01	0.00	15	0	0.05	0.02	385	377
142	1.66	0.17	0.08	1,441	1,441	125	509	57	0	125	509	0.03	0.00	57	0	0.21	0.08	1,498	1,498
143	0.37	0.04	0.02	369	362	156	574	16	0	151	562	0.01	0.00	15	0	0.05	0.02	385	377
144	1.41	0.15	0.06	1,220	1,219	125	509	48	0	125	509	0.03	0.00	48	0	0.17	0.06	1,268	1,267
145	0.37	0.04	0.02	369	362	156	574	16	0	151	562	0.01	0.00	15	0	0.05	0.02	385	377
146	1.41	0.15	0.06	1,220	1,219	125	509	48	0	125	509	0.03	0.00	48	0	0.17	0.06	1,268	1,267
147	0.37	0.04	0.02	369	362	156	574	16	0	151	562	0.01	0.00	15	0	0.05	0.02	385	377
148	1.28	0.13	0.06	1,109	1,108	125	509	44	0	125	509	0.03	0.00	44	0	0.16	0.06	1,152	1,152
149	0.37	0.04	0.02	369	362	156	574	16	0	151	562	0.01	0.00	15	0	0.05	0.02	385	377
150	1.28	0.13	0.06	1,109	1,108	125	509	44	0	125	509	0.03	0.00	44	0	0.16	0.06	1,152	1,152
151	0.37	0.04	0.02	369	362	156	574	16	0	151	562	0.01	0.00	15	0	0.05	0.02	385	377
152	1.28	0.13	0.06	1,109	1,108	125	509	44	0	125	509	0.03	0.00	44	0	0.16	0.06	1,152	1,152
153	0.37	0.04	0.02	369	362	156	574	16	0	151	562	0.01	0.00	15	0	0.05	0.02	385	377
154	1.28	0.13	0.06	1,109	1,108	125	509	44	0	125	509	0.03	0.00	44	0	0.16	0.06	1,152	1,152
155	0.37	0.04	0.02	369	362	156	574	16	0	151	562	0.01	0.00	15	0	0.05	0.02	385	377
156	1.28	0.13	0.06	1,109	1,108	125	509	44	0	125	509	0.03	0.00	44	0	0.16	0.06	1,152	1,152
157	0.37	0.04	0.02	369	362	156	574	16	0	151	562	0.01	0.00	15	0	0.05	0.02	385	377
158	1.28	0.13	0.06	1,109	1,108	125	509	44	0	125	509	0.03	0.00	44	0	0.16	0.06	1,152	1,152
159	0.37	0.04	0.02	369	362	156	574	16	0	151	562	0.01	0.00	15	0	0.05	0.02	385	377
160	0.77	0.08	0.04	665	665	125	509	26	0	125	509	0.02	0.00	26	0	0.10	0.04	691	691
161	0.37	0.04	0.02	369	362	156	574	16	0	151	562	0.01	0.00	15	0	0.05	0.02	385	377
162	0.26	0.00	0.00	15	15	8	28	1	0	8	28	0.00	0.00	1	0	0.00	0.00	15	15
163	0.09	0.00	0.00	5	5	8	28	0	0	8	28	0.00	0.00	0	0	0.00	0.00	5	5
164	1.02	0.11	0.05	887	887	125	509	35	0	125	509	0.02	0.00	35	0	0.13	0.05	922	922
165	0.12	0.03	0.02	226	224	306	1,077	10	0	303	1,069	0.01	0.00	10	0	0.04	0.02	236	235
166	0.12	0.03	0.02	226	224	306	1,077	10	0	303	1,069	0.01	0.00	10	0	0.04	0.02	236	235
167	0.17	0.00	0.00	10	10	8	28	0	0	8	28	0.00	0.00	0	0	0.00	0.00	10	10
168	0.49	0.13	0.09	904	898	306	1,077	41	0	303	1,069	0.02	0.00	40	0	0.15	0.09	945	938
169	0.70	0.18	0.14	1,292	1,283	306	1,077	58	0	303	1,069	0.03	0.00	58	0	0.22	0.14	1,350	1,340
170	0.49	0.13	0.09	904	898	306	1,077	41	0	303	1,069	0.02	0.00	40	0	0.15	0.09	945	938
171	0.70	0.18	0.14	1,292	1,283	306	1,077	58	0	303	1,069	0.03	0.00	58	0	0.22	0.14	1,350	1,340
172	0.70	0.07	0.03	605	605	125	509	24	0	125	509	0.01	0.00	24	0	0.09	0.03	629	628
173	1.66	0.17	0.08	1,441	1,441	125	509	57	0	125	509	0.03	0.00	57	0	0.21	0.08	1,498	1,498
174	0.37	0.04	0.02	369	362	156	574	16	0	151	562	0.01	0.00	15	0	0.05	0.02	385	377
175	1.66	0.17	0.08	1,441	1,441	125	509	57	0	125	509	0.03	0.00	57	0	0.21	0.08	1,498	1,498
176	0.37	0.04	0.02	369	362	156	574	16	0	151	562	0.01	0.00	15	0	0.05	0.02	385	377
177	0.77	0.08	0.04	665	665	125	509	26	0	125	509	0.02	0.00	26	0	0.10	0.04	691	691
178	0.37	0.04	0.02	369	362	156	574	16	0	151	562	0.01	0.00	15	0	0.05	0.02	385	377
179	0.17	0.00	0.00	10	10	8	28	0	0	8	28	0.00	0.00	0	0	0.00	0.00	10	10
180	0.35	0.00	0.00	19	19	8	28	1	0	8	28	0.00	0.00	1	0	0.00	0.00	20	20
181	2.05	0.21	0.09	1,774	1,774	125	509	70	0	125	509	0.04	0.00	70	0	0.25	0.09	1,844	1,843
182	0.37	0.04	0.02	369	362	156	574	16	0	151	562	0.01	0.00	15	0	0.05	0.02	385	377
183	2.20	0.57	0.43	4,069	4,040	306	1,077	183	0	303	1,069	0.11	0.00	182	0	0.68	0.43	4,252	4,222
184	1.26	0.33	0.24	2,325	2,309	306	1,077	105	0	303	1,069	0.06	0.00	104	0	0.39	0.24	2,430	2,412
185	0.52	0.05	0.02	454	453	125	509	18	0	125	509	0.01	0.00	18	0	0.06	0.02	471	471
186	2.00	0.50	0.38	2,837	2,665	258	763	141	0	230	716	0.11	0.00	126	0	0.62	0.38	2,978	2,791
187	0.17	0.00	0.00	10	10	8	28	0	0	8	28	0.00	0.00	0	0	0.00	0.00	10	10
188	1.79	0.11	0.06	1,267	1,266	102	408	50	0	102	408	0.02	0.00	50	0	0.14	0.06	1,317	1,316
189	0.37	0.04	0.02	369	362	156	574	16	0	151	562	0.01	0.00	15	0	0.05	0.02	385	377
190	1.41	0.35	0.26	1,990	1,869	258	763	99	0	230	716	0.08	0.00	88	0	0.43	0.26	2,089	1,958
191	0.13	0.00	0.00	7	7	8	28	0	0	8	28	0.00	0.00	0	0	0.00	0.00	7	7
192	0.44	0.00	0.00	24	24	8	28	1	0	8	28	0.00	0.00	1	0	0.01	0.00	25	25
193	2.56	0.16	0.08	1,810	1,808	102	408	71	0	102	408	0.03	0.00	71	0	0.20	0.08	1,881	1,880
194	1.28	0.08	0.04	905	904	102	408	36	0	102	408	0.02	0.00	36	0	0.10	0.04	941	940
195	0.37	0.04	0.02	369	362	156	574	16	0	151	562	0.01	0.00	15	0	0.05	0.02	385	377
196	1.28	0.08	0.04	905	904	102	408	36	0	102	408	0.02	0.00	36	0	0.10	0.04	941	940
197	0.37	0.04	0.02	369	362	156	574	16	0	151	562	0.01	0.00	15	0	0.05	0.02	385	377
198	0.26	0.02	0.01	185	185	102	408	7	0	102	408	0.00	0.00	7	0	0.02	0.01	192	192
199	0.17	0.02	0.01	151	151	125	509	6	0	125	509	0.00	0.00	6	0	0.02	0.01	157	157
200	0.77	0.05	0.02	543	542	102	408	21	0	102	408	0.01	0.00	21	0	0.06	0.02	564	564
201	0.37	0.04	0.02	369	362	156	574	16	0	151	562	0.01	0.00	15	0	0.05	0.02	385	377
202	1.79	0.11	0.06	1,267	1,266	102	408	50	0	102	408	0.02	0.00	50	0	0.14	0.06	1,317	1,316
203	0.37	0.04	0.02	369	362	156	574	16	0	151	562	0.01	0.00	15	0	0.05	0.02	385	377
204	0.52	0.14	0.10	969	962	306	1,077	44	0	303	1,069	0.03	0.00	43	0	0.16	0.10	1,012	1,005
205	0.24	0.06	0.05	436	433	306	1,077	20	0	303	1,069	0.01	0.00	19	0	0.07	0.05	456	452
206	0.06	0.02	0.01	108	107	306	1,077	5	0	303	1,069	0.00	0.00	5	0	0.02	0.01	112	112
207	0.52	0.14	0.10	969	962	306	1,077	44	0	303	1,069	0.03	0.00	43	0	0.16	0.10	1,012	1,005
208	0.24	0.06	0.05	436	433	306	1,077	20	0	303	1,069	0.01	0.00	19	0	0.07	0.05	456	452
209	0.06	0.02	0.01	108	107	306	1,077	5	0	303	1,069	0.00	0.00	5	0	0.02	0.01	112	112
210	0.09	0.00	0.00	5	5	8	28	0	0	8	28	0.00	0.00	0	0	0.00	0.00	5	5

Pre-Retrofit Demand and Energy Consumption																			
	Lighting Demand and Energy Consumption					Interactive Hours		Interactive Energy Consumption		On-Peak Interactive Hours		On-Peak Interactive Demand and Energy Consumption				Lighting and Interactive Demand and Energy Consumption			
	(t)	(u)	(v)	(w)	(x)	(y)	(z)	(aa)	(ab)	(ac)	(ad)	(ae)	(af)	(ag)	(ah)	(ai)	(aj)	(ak)	(al)
Fixture	Connected	FCM Diversified kW		Annual	Peak	Cooling	Heating	Cooling	Heating	Cooling	Heating	FCM Diversified kW		Cooling	Heating	FCM Diversified kW		Annual	Peak
ID	kW	Summer	Winter	kWh	kWh	Hours	Hours	kWh	kWh	Hours	Hours	Summer	Winter	kWh	kWh	Summer	Winter	kWh	kWh
211	0.09	0.00	0.00	5	5	8	28	0	0	8	28	0.00	0.00	0	0	0.00	0.00	5	5
212	1.28	0.13	0.06	1,109	1,108	125	509	44	0	125	509	0.03	0.00	44	0	0.16	0.06	1,152	1,152
213	0.37	0.04	0.02	369	362	156	574	16	0	151	562	0.01	0.00	15	0	0.05	0.02	385	377
214	1.28	0.13	0.06	1,109	1,108	125	509	44	0	125	509	0.03	0.00	44	0	0.16	0.06	1,152	1,152
215	0.37	0.04	0.02	369	362	156	574	16	0	151	562	0.01	0.00	15	0	0.05	0.02	385	377
216	0.64	0.14	0.03	1,067	1,055	276	977	48	0	273	969	0.03	0.00	48	0	0.17	0.03	1,115	1,102
217	0.10	0.02	0.01	165	163	276	977	7	0	273	969	0.00	0.00	7	0	0.03	0.01	172	170
218	0.17	0.04	0.01	291	288	276	977	13	0	273	969	0.01	0.00	13	0	0.05	0.01	304	301
219	0.09	0.02	0.00	145	144	276	977	7	0	273	969	0.00	0.00	7	0	0.02	0.00	152	150
220	0.17	0.00	0.00	10	10	8	28	0	0	8	28	0.00	0.00	0	0	0.00	0.00	10	10
221	0.13	0.03	0.01	213	211	276	977	10	0	273	969	0.01	0.00	10	0	0.03	0.01	223	220
222	0.13	0.03	0.01	213	211	276	977	10	0	273	969	0.01	0.00	10	0	0.03	0.01	223	220
223	0.13	0.03	0.01	213	211	276	977	10	0	273	969	0.01	0.00	10	0	0.03	0.01	223	220
224	1.79	0.11	0.06	1,267	1,266	102	408	50	0	102	408	0.02	0.00	50	0	0.14	0.06	1,317	1,316
225	0.37	0.04	0.02	369	362	156	574	16	0	151	562	0.01	0.00	15	0	0.05	0.02	385	377
226	1.28	0.13	0.06	1,109	1,108	125	509	44	0	125	509	0.03	0.00	44	0	0.16	0.06	1,152	1,152
227	0.37	0.04	0.02	369	362	156	574	16	0	151	562	0.01	0.00	15	0	0.05	0.02	385	377
228	1.28	0.13	0.06	1,109	1,108	125	509	44	0	125	509	0.03	0.00	44	0	0.16	0.06	1,152	1,152
229	0.37	0.04	0.02	369	362	156	574	16	0	151	562	0.01	0.00	15	0	0.05	0.02	385	377
230	0.77	0.08	0.04	665	665	125	509	26	0	125	509	0.02	0.00	26	0	0.10	0.04	691	691
231	0.37	0.04	0.02	369	362	156	574	16	0	151	562	0.01	0.00	15	0	0.05	0.02	385	377
232	1.02	0.26	0.20	1,889	1,876	306	1,077	85	0	303	1,069	0.05	0.00	84	0	0.31	0.20	1,974	1,960
233	2.07	0.54	0.40	3,843	3,815	306	1,077	173	0	303	1,069	0.10	0.00	172	0	0.64	0.40	4,016	3,987
234	0.06	0.02	0.01	108	107	306	1,077	5	0	303	1,069	0.00	0.00	5	0	0.02	0.01	112	112
235	0.20	0.20	0.20	1,731	797	1,208	2,325	65	0	812	1,582	0.05	0.00	44	0	0.24	0.20	1,796	840
236	0.73	0.73	0.73	6,414	2,952	1,208	2,325	241	0	812	1,582	0.17	0.00	162	0	0.91	0.73	6,656	3,115
237	0.52	0.52	0.52	4,582	2,109	1,208	2,325	172	0	812	1,582	0.12	0.00	116	0	0.65	0.52	4,754	2,225
238	0.35	0.35	0.35	3,054	1,406	1,208	2,325	115	0	812	1,582	0.08	0.00	77	0	0.43	0.35	3,169	1,483
239	1.28	0.08	0.04	905	904	102	408	36	0	102	408	0.02	0.00	36	0	0.10	0.04	941	940
240	0.37	0.04	0.02	369	362	156	574	16	0	151	562	0.01	0.00	15	0	0.05	0.02	385	377
241	0.09	0.00	0.00	5	5	8	28	0	0	8	28	0.00	0.00	0	0	0.00	0.00	5	5
242	0.17	0.00	0.00	10	10	8	28	0	0	8	28	0.00	0.00	0	0	0.00	0.00	10	10
243	0.17	0.00	0.00	10	10	8	28	0	0	8	28	0.00	0.00	0	0	0.00	0.00	10	10
244	0.17	0.00	0.00	10	10	8	28	0	0	8	28	0.00	0.00	0	0	0.00	0.00	10	10
245	0.77	0.08	0.04	665	665	125	509	26	0	125	509	0.02	0.00	26	0	0.10	0.04	691	691
246	2.81	0.18	0.09	1,991	1,989	102	408	79	0	102	408	0.04	0.00	78	0	0.22	0.09	2,070	2,068
247	0.63	0.06	0.03	544	544	125	509	21	0	125	509	0.01	0.00	21	0	0.08	0.03	566	566
248	0.37	0.04	0.02	369	362	156	574	16	0	151	562	0.01	0.00	15	0	0.05	0.02	385	377
249	0.26	0.00	0.00	15	15	8	28	1	0	8	28	0.00	0.00	1	0	0.00	0.00	15	15
250	0.17	0.00	0.00	10	10	8	28	0	0	8	28	0.00	0.00	0	0	0.00	0.00	10	10
251	1.66	0.02	0.00	768	767	64	265	29	0	64	265	0.00	0.00	29	0	0.02	0.00	797	796
252	0.09	0.00	0.00	40	40	64	265	2	0	64	265	0.00	0.00	2	0	0.00	0.00	42	42
253	0.06	0.00	0.00	3	3	8	28	0	0	8	28	0.00	0.00	0	0	0.00	0.00	3	3
254	0.70	0.01	0.00	322	322	64	265	12	0	64	265	0.00	0.00	12	0	0.01	0.00	335	334
255	0.37	0.00	0.00	171	171	64	265	6	0	64	265	0.00	0.00	6	0	0.00	0.00	178	177
256	0.35	0.00	0.00	19	19	8	28	1	0	8	28	0.00	0.00	1	0	0.00	0.00	20	20
257	0.09	0.00	0.00	5	5	8	28	0	0	8	28	0.00	0.00	0	0	0.00	0.00	5	5
258	0.09	0.00	0.00	5	5	8	28	0	0	8	28	0.00	0.00	0	0	0.00	0.00	5	5
259	0.09	0.00	0.00	5	5	8	28	0	0	8	28	0.00	0.00	0	0	0.00	0.00	5	5
260	0.17	0.05	0.03	323	321	306	1,077	15	0	303	1,069	0.01	0.00	14	0	0.05	0.03	337	335
261	0.09	0.02	0.02	161	160	306	1,077	7	0	303	1,069	0.00	0.00	7	0	0.03	0.02	169	168
262	0.09	0.02	0.02	161	160	306	1,077	7	0	303	1,069	0.00	0.00	7	0	0.03	0.02	169	168
263	0.17	0.05	0.03	323	321	306	1,077	15	0	303	1,069	0.01	0.00	14	0	0.05	0.03	337	335
264	0.09	0.02	0.02	161	160	306	1,077	7	0	303	1,069	0.00	0.00	7	0	0.03	0.02	169	168
265	0.09	0.02	0.02	161	160	306	1,077	7	0	303	1,069	0.00	0.00	7	0	0.03	0.02	169	168
266	1.46	0.38	0.28	2,713	2,693	306	1,077	122	0	303	1,069	0.07	0.00	121	0	0.45	0.28	2,835	2,814
267	0.63	0.16	0.12	1,163	1,154	306	1,077	52	0	303	1,069	0.03	0.00	52	0	0.19	0.12	1,215	1,206
268	0.71	0.18	0.14	1,308	1,299	306	1,077	59	0	303	1,069	0.03	0.00	58	0	0.22	0.14	1,367	1,357
269	0.96	0.01	0.00	443	443	64	265	17	0	64	265	0.00	0.00	17	0	0.01	0.00	460	459
270	0.78	0.01	0.00	363	362	64	265	14	0	64	265	0.00	0.00	14	0	0.01	0.00	376	376
271	0.63	0.01	0.00	290	290	64	265	11	0	64	265	0.00	0.00	11	0	0.01	0.00	301	301
272	2.05	0.51	0.38	2,895	2,719	258	763	144	0	230	716	0.12	0.00	129	0	0.63	0.38	3,038	2,847
273	0.35	0.09	0.07	493	463	258	763	25	0	230	716	0.02	0.00	22	0	0.11	0.07	518	485
274	0.17	0.04	0.03	247	232	258	763	12	0	230	716	0.01	0.00	11	0	0.05	0.03	259	243
275	0.26	0.06	0.05	362	340	258	763	18	0	230	716	0.01	0.00	16	0	0.08	0.05	380	356
276	0.17	0.05	0.03	323	321	306	1,077	15	0	303	1,069	0.01	0.00	14	0	0.05	0.03	337	335
277	0.06	0.02	0.01	108	107	306	1,077	5	0	303	1,069	0.00	0.00	5	0	0.02	0.01	112	112
278	1.02	0.26	0.19	1,447	1,359	258	763	72	0	230	716	0.06	0.00	64	0	0.32	0.19	1,519	1,424
279	0.17	0.04	0.03	247	232	258	763	12	0	230	716	0.01	0.00	11	0	0.05	0.03	259	243
280	0.06	0.01	0.01	82	77	258	763	4	0	230	716	0.00	0.00	4	0	0.02	0.01	86	81

Pre-Retrofit Demand and Energy Consumption

Fixture ID	Lighting Demand and Energy Consumption (t) Connected kW	(u) FCM Diversified kW Summer	(v) FCM Diversified kW Winter	(w) Annual kWh	(x) Peak kWh	Interactive Hours (y) Cooling Hours	(z) Heating Hours	Interactive Energy Consumption (aa) Cooling kWh	(ab) Heating kWh	On-Peak Interactive Hours (ac) Cooling Hours	(ad) Heating Hours	On-Peak Interactive Demand and Energy Consumption (ae) FCM Diversified kW Summer	(af) FCM Diversified kW Winter	(ag) Cooling kWh	(ah) Heating kWh	Lighting and Interactive Demand and Energy Consumption (ai) FCM Diversified kW Summer	(aj) FCM Diversified kW Winter	(ak) Annual kWh	(al) Peak kWh
281	0.35	0.00	0.00	19	19	8	28	1	0	8	28	0.00	0.00	1	0	0.00	0.00	20	20
282	0.52	0.13	0.10	740	695	258	763	37	0	230	716	0.03	0.00	33	0	0.16	0.10	777	728
283	1.28	0.32	0.24	1,809	1,699	258	763	90	0	230	716	0.07	0.00	80	0	0.39	0.24	1,899	1,780
284	0.10	0.02	0.02	140	131	258	763	7	0	230	716	0.01	0.00	6	0	0.03	0.02	147	138
285	0.38	0.10	0.07	543	510	258	763	27	0	230	716	0.02	0.00	24	0	0.12	0.07	570	534
286	0.87	0.22	0.16	1,233	1,159	258	763	61	0	230	716	0.05	0.00	55	0	0.27	0.16	1,295	1,213
287	0.17	0.04	0.03	247	232	258	763	12	0	230	716	0.01	0.00	11	0	0.05	0.03	259	243
288	0.73	0.18	0.14	1,036	973	258	763	52	0	230	716	0.04	0.00	46	0	0.23	0.14	1,088	1,019
289	0.26	0.06	0.05	362	340	258	763	18	0	230	716	0.01	0.00	16	0	0.08	0.05	380	356
290	0.09	0.02	0.02	123	116	258	763	6	0	230	716	0.00	0.00	5	0	0.03	0.02	129	121
291	0.17	0.04	0.03	247	232	258	763	12	0	230	716	0.01	0.00	11	0	0.05	0.03	259	243
292	0.73	0.19	0.14	1,356	1,347	306	1,077	61	0	303	1,069	0.04	0.00	61	0	0.23	0.14	1,417	1,407
293	1.21	0.31	0.24	2,244	2,228	306	1,077	101	0	303	1,069	0.06	0.00	100	0	0.37	0.24	2,346	2,329
294	1.21	1.21	1.21	10,614	4,885	1,208	2,325	400	0	812	1,582	0.29	0.00	269	0	1.50	1.21	11,014	5,154
295	0.20	0.20	0.20	1,731	797	1,208	2,325	65	0	812	1,582	0.05	0.00	44	0	0.24	0.20	1,796	840
296	2.44	0.03	0.01	136	136	8	28	5	0	8	28	0.01	0.00	5	0	0.03	0.01	141	141
297	1.21	0.31	0.24	2,244	2,228	306	1,077	101	0	303	1,069	0.06	0.00	100	0	0.37	0.24	2,346	2,329
298	0.78	0.20	0.15	1,453	1,443	306	1,077	65	0	303	1,069	0.04	0.00	65	0	0.24	0.15	1,519	1,508
299	0.17	0.00	0.00	10	10	8	28	0	0	8	28	0.00	0.00	0	0	0.00	0.00	10	10
300	2.09	1.33	1.47	5,652	5,400	553	1,181	316	0	540	1,139	0.30	0.00	308	0	1.63	1.47	5,968	5,708
301	0.17	0.11	0.12	471	450	553	1,181	26	0	540	1,139	0.03	0.00	26	0	0.14	0.12	497	476
302	0.51	0.32	0.36	1,382	1,320	553	1,181	77	0	540	1,139	0.07	0.00	75	0	0.40	0.36	1,459	1,395
303	0.52	0.33	0.37	1,413	1,350	553	1,181	79	0	540	1,139	0.08	0.00	77	0	0.41	0.37	1,492	1,427
304	0.16	0.10	0.11	424	405	553	1,181	24	0	540	1,139	0.02	0.00	23	0	0.12	0.11	448	428
305	0.63	0.40	0.44	1,696	1,620	553	1,181	95	0	540	1,139	0.09	0.00	93	0	0.49	0.44	1,790	1,712
306	1.28	0.13	0.06	1,109	1,108	125	509	44	0	125	509	0.03	0.00	44	0	0.16	0.06	1,152	1,152
307	0.37	0.04	0.02	369	362	156	574	16	0	151	562	0.01	0.00	15	0	0.05	0.02	385	377
308	0.37	0.37	0.37	3,207	1,476	1,208	2,325	121	0	812	1,582	0.09	0.00	81	0	0.45	0.37	3,328	1,557
309	0.26	0.26	0.26	2,291	1,054	1,208	2,325	86	0	812	1,582	0.06	0.00	58	0	0.32	0.26	2,377	1,112
310	0.96	0.25	0.19	1,776	1,763	306	1,077	80	0	303	1,069	0.05	0.00	79	0	0.30	0.19	1,856	1,843
311	1.22	0.32	0.24	2,261	2,244	306	1,077	102	0	303	1,069	0.06	0.00	101	0	0.38	0.24	2,362	2,345
312	1.02	0.26	0.20	1,889	1,876	306	1,077	85	0	303	1,069	0.05	0.00	84	0	0.31	0.20	1,974	1,960
313	0.26	0.00	0.00	14	14	8	28	1	0	8	28	0.00	0.00	1	0	0.00	0.00	15	15
314	0.26	0.00	0.00	14	14	8	28	1	0	8	28	0.00	0.00	1	0	0.00	0.00	15	15
315	0.26	0.00	0.00	14	14	8	28	1	0	8	28	0.00	0.00	1	0	0.00	0.00	15	15
316	0.17	0.05	0.03	323	321	306	1,077	15	0	303	1,069	0.01	0.00	14	0	0.05	0.03	337	335
317	0.09	0.02	0.02	161	160	306	1,077	7	0	303	1,069	0.00	0.00	7	0	0.03	0.02	169	168
318	0.26	0.00	0.00	14	14	8	28	1	0	8	28	0.00	0.00	1	0	0.00	0.00	15	15
319	1.02	0.26	0.19	1,447	1,359	258	763	72	0	230	716	0.06	0.00	64	0	0.32	0.19	1,519	1,424
320	0.17	0.00	0.00	10	10	8	28	0	0	8	28	0.00	0.00	0	0	0.00	0.00	10	10
321	0.49	0.01	0.00	27	27	8	28	1	0	8	28	0.00	0.00	1	0	0.01	0.00	29	28
322	0.06	0.00	0.00	3	3	8	28	0	0	8	28	0.00	0.00	0	0	0.00	0.00	3	3
323	0.09	0.02	0.02	161	160	306	1,077	7	0	303	1,069	0.00	0.00	7	0	0.03	0.02	169	168
324	0.13	0.00	0.00	25	25	26	116	1	0	26	115	0.00	0.00	1	0	0.01	0.00	25	25
325	1.13	0.27	0.18	2,831	2,291	500	1,284	155	0	404	1,108	0.05	0.00	125	0	0.32	0.18	2,985	2,416
326	1.05	0.25	0.17	2,613	2,115	500	1,284	143	0	404	1,108	0.05	0.00	115	0	0.29	0.17	2,756	2,230
327	0.59	0.14	0.09	1,481	1,198	500	1,284	81	0	404	1,108	0.03	0.00	65	0	0.17	0.09	1,562	1,264
328	1.02	0.15	0.19	2,139	1,666	400	1,028	112	0	304	852	0.03	0.00	85	0	0.19	0.19	2,250	1,751
329	0.26	0.04	0.05	547	426	400	1,028	29	0	304	852	0.01	0.00	22	0	0.05	0.05	575	448
330	0.09	0.00	0.00	5	5	8	28	0	0	8	28	0.00	0.00	0	0	0.00	0.00	5	5
331	0.17	0.03	0.03	365	284	400	1,028	19	0	304	852	0.01	0.00	14	0	0.03	0.03	384	298
332	0.89	0.21	0.14	2,235	1,809	500	1,284	122	0	404	1,108	0.04	0.00	99	0	0.25	0.14	2,358	1,908
333	0.44	0.06	0.08	911	710	400	1,028	48	0	304	852	0.01	0.00	36	0	0.08	0.08	959	746
334	0.52	0.01	0.00	29	29	8	28	1	0	8	28	0.00	0.00	1	0	0.01	0.00	30	30
335	0.38	0.06	0.07	802	625	400	1,028	42	0	304	852	0.01	0.00	32	0	0.07	0.07	844	656
336	0.35	0.05	0.06	729	568	400	1,028	38	0	304	852	0.01	0.00	29	0	0.06	0.06	767	597
337	0.09	0.00	0.00	5	5	8	28	0	0	8	28	0.00	0.00	0	0	0.00	0.00	5	5
338	0.09	0.02	0.02	161	160	306	1,077	7	0	303	1,069	0.00	0.00	7	0	0.03	0.02	169	168
339	0.06	0.02	0.01	108	107	306	1,077	5	0	303	1,069	0.00	0.00	5	0	0.02	0.01	112	112
340	0.17	0.05	0.03	323	321	306	1,077	15	0	303	1,069	0.01	0.00	14	0	0.05	0.03	337	335
341	3.49	3.49	3.49	30,544	14,059	1,208	2,325	1,150	0	812	1,582	0.83	0.00	773	0	4.31	3.49	31,694	14,831
342	2.79	0.65	0.44	6,968	5,640	500	1,284	381	0	404	1,108	0.13	0.00	308	0	0.78	0.44	7,348	5,947
343	0.31	0.07	0.05	784	634	500	1,284	43	0	404	1,108	0.01	0.00	35	0	0.09	0.05	827	669
344	0.08	0.08	0.08	713	328	1,208	2,325	27	0	812	1,582	0.02	0.00	18	0	0.10	0.08	740	346
345	0.20	0.05	0.03	508	411	500	1,284	28	0	404	1,108	0.01	0.00	22	0	0.06	0.03	536	434
346	0.69	0.16	0.11	1,713	1,386	500	1,284	94	0	404	1,108	0.03	0.00	76	0	0.19	0.11	1,806	1,462
347	0.12	0.12	0.12	1,018	469	1,208	2,325	38	0	812	1,582	0.03	0.00	26	0	0.14	0.12	1,056	494
348	0.17	0.00	0.00	10	10	8	28	0	0	8	28	0.00	0.00	0	0	0.00	0.00	10	10
349	0.08	0.02	0.02	145	144	306	1,077	7	0	303	1,069	0.00	0.00	6	0	0.02	0.02	152	151
350	0.35	0.09	0.07	646	641	306	1,077	29	0	303	1,069	0.02	0.00	29	0	0.11	0.07	675	670

Pre-Retrofit Demand and Energy Consumption																			
	Lighting Demand and Energy Consumption					Interactive Hours		Interactive Energy Consumption		On-Peak Interactive Hours		On-Peak Interactive Demand and Energy Consumption				Lighting and Interactive Demand and Energy Consumption			
	(t)	(u)	(v)	(w)	(x)	(y)	(z)	(aa)	(ab)	(ac)	(ad)	(ae)	(af)	(ag)	(ah)	(ai)	(aj)	(ak)	(al)
Fixture	Connected	FCM Diversified kW		Annual	Peak	Cooling	Heating	Cooling	Heating	Cooling	Heating	FCM Diversified kW		Cooling	Heating	FCM Diversified kW		Annual	Peak
ID	kW	Summer	Winter	kWh	kWh	Hours	Hours	kWh	kWh	Hours	Hours	Summer	Winter	kWh	kWh	Summer	Winter	kWh	kWh
351	0.52	0.14	0.10	969	962	306	1,077	44	0	303	1,069	0.03	0.00	43	0	0.16	0.10	1,012	1,005
352	0.09	0.02	0.02	161	160	306	1,077	7	0	303	1,069	0.00	0.00	7	0	0.03	0.02	169	168
353	0.94	0.94	0.94	8,247	3,796	1,208	2,325	310	0	812	1,582	0.22	0.00	209	0	1.16	0.94	8,557	4,005
354	2.90	0.75	0.56	5,377	5,338	306	1,077	242	0	303	1,069	0.14	0.00	240	0	0.90	0.56	5,619	5,579
355	1.45	0.38	0.28	2,691	2,672	306	1,077	121	0	303	1,069	0.07	0.00	120	0	0.45	0.28	2,812	2,792
356	0.16	0.04	0.02	392	317	500	1,284	21	0	404	1,108	0.01	0.00	17	0	0.04	0.02	413	335
357	1.13	0.27	0.18	2,831	2,291	500	1,284	155	0	404	1,108	0.05	0.00	125	0	0.32	0.18	2,985	2,416
358	0.26	0.10	0.01	387	354	293	771	21	0	287	755	0.02	0.00	21	0	0.12	0.01	408	375
359	0.51	0.20	0.02	757	693	293	771	41	0	287	755	0.05	0.00	40	0	0.24	0.02	798	733
360	1.79	0.69	0.07	2,650	2,426	293	771	143	0	287	755	0.16	0.00	140	0	0.85	0.07	2,793	2,567
361	0.09	0.03	0.00	129	118	293	771	7	0	287	755	0.01	0.00	7	0	0.04	0.00	136	125
362	0.17	0.00	0.00	10	10	8	28	0	0	8	28	0.00	0.00	0	0	0.00	0.00	10	10
363	0.26	0.00	0.00	15	15	8	28	1	0	8	28	0.00	0.00	1	0	0.00	0.00	15	15
364	0.17	0.07	0.01	258	236	293	771	14	0	287	755	0.02	0.00	14	0	0.08	0.01	272	250
365	0.63	0.24	0.03	929	851	293	771	50	0	287	755	0.06	0.00	49	0	0.30	0.03	979	900
366	0.26	0.06	0.00	356	351	253	799	18	0	249	788	0.01	0.00	17	0	0.07	0.00	374	368
367	0.17	0.04	0.00	243	239	253	799	12	0	249	788	0.01	0.00	12	0	0.05	0.00	255	251
368	0.47	0.11	0.00	655	645	253	799	33	0	249	788	0.02	0.00	32	0	0.13	0.00	688	677
369	0.16	0.16	0.16	1,374	633	1,208	2,325	52	0	812	1,582	0.04	0.00	35	0	0.19	0.16	1,426	667
370	0.35	0.00	0.00	19	19	8	28	1	0	8	28	0.00	0.00	1	0	0.00	0.00	20	20
371	0.13	0.00	0.00	7	7	8	28	0	0	8	28	0.00	0.00	0	0	0.00	0.00	7	7
372	0.09	0.01	0.00	113	113	196	771	5	0	195	771	0.00	0.00	5	0	0.02	0.00	118	118
373	0.35	0.06	0.00	454	453	196	771	19	0	195	771	0.01	0.00	19	0	0.07	0.00	472	472
374	0.74	0.13	0.00	964	963	196	771	40	0	195	771	0.02	0.00	40	0	0.15	0.00	1,004	1,003
375	0.17	0.03	0.00	227	227	196	771	9	0	195	771	0.01	0.00	9	0	0.03	0.00	236	236
376	0.25	0.04	0.00	321	321	196	771	13	0	195	771	0.01	0.00	13	0	0.05	0.00	335	334
377	0.26	0.04	0.00	333	332	196	771	14	0	195	771	0.01	0.00	14	0	0.05	0.00	346	346
378	0.26	0.04	0.00	333	332	196	771	14	0	195	771	0.01	0.00	14	0	0.05	0.00	346	346
379	0.06	0.00	0.00	3	3	8	28	0	0	8	28	0.00	0.00	0	0	0.00	0.00	3	3
380	0.09	0.00	0.00	5	5	8	28	0	0	8	28	0.00	0.00	0	0	0.00	0.00	5	5
381	0.20	0.20	0.20	1,731	797	1,208	2,325	65	0	812	1,582	0.05	0.00	44	0	0.24	0.20	1,796	840
382	0.37	0.37	0.37	3,207	1,476	1,208	2,325	121	0	812	1,582	0.09	0.00	81	0	0.45	0.37	3,328	1,557
383	0.35	0.35	0.35	3,054	1,406	1,208	2,325	115	0	812	1,582	0.08	0.00	77	0	0.43	0.35	3,169	1,483
384	0.98	0.98	0.98	8,552	3,936	1,208	2,325	322	0	812	1,582	0.23	0.00	216	0	1.21	0.98	8,874	4,153
385	1.67	0.43	0.33	3,100	3,078	306	1,077	140	0	303	1,069	0.08	0.00	138	0	0.52	0.33	3,240	3,216
386	1.23	0.14	0.33	721	721	69	282	23	0	69	282	0.03	0.00	23	0	0.17	0.33	744	744
387	8.31	0.86	0.51	8,282	8,115	156	574	355	0	151	562	0.18	0.00	342	0	1.04	0.51	8,637	8,457
388	3.54	0.92	0.69	6,566	6,519	306	1,077	296	0	303	1,069	0.17	0.00	293	0	1.09	0.69	6,862	6,813
Totals	307.41	65.63	57.31	533,876	427,227			16,457	0			10.49	0.00	14,793	0	76.12	57.31	550,332	442,020

Post-Retrofit Demand and Energy Consumption

Fixture ID	Lighting Demand and Energy Consumption (am) Connected kW	(an) FCM Diversified kW Summer	(ao) FCM Diversified kW Winter	(ap) Annual kWh	(aq) Peak kWh	Interactive Hours (ar) Cooling Hours	(as) Heating Hours	Interactive Energy Consumption (at) Cooling kWh	(au) Heating kWh	On-Peak Interactive Hours (av) Cooling Hours	(aw) Heating Hours	On-Peak Interactive Demand and Energy Consumption (ax) FCM Diversified kW Summer	(ay) FCM Diversified kW Winter	(az) Cooling kWh	(ba) Heating kWh	Lighting and Interactive Demand and Energy Consumption (bb) FCM Diversified kW Summer	(bc) FCM Diversified kW Winter	(bd) Annual kWh	(be) Peak kWh
1	16.00	1.88	4.23	9,342	9,342	69	282	300	0	69	282	0.35	0.00	300	0	2.22	4.23	9,641	9,641
2	19.13	5.33	5.95	51,916	42,956	492	1,360	0	0	395	1,184	0.00	0.00	0	0	5.33	5.95	51,916	42,956
3	4.50	4.50	4.50	39,420	18,144	1,208	2,325	0	0	812	1,582	0.00	0.00	0	0	4.50	4.50	39,420	18,144
4	5.68	0.84	1.04	11,869	9,245	400	1,028	0	0	304	852	0.00	0.00	0	0	0.84	1.04	11,869	9,245
5	0.88	0.09	0.04	763	763	125	509	30	0	125	509	0.02	0.00	30	0	0.11	0.04	793	793
6	0.22	0.02	0.01	215	211	156	574	9	0	151	562	0.00	0.00	9	0	0.03	0.01	224	220
7	0.88	0.09	0.04	763	763	125	509	30	0	125	509	0.02	0.00	30	0	0.11	0.04	793	793
8	0.22	0.02	0.01	215	211	156	574	9	0	151	562	0.00	0.00	9	0	0.03	0.01	224	220
9	0.88	0.09	0.04	763	763	125	509	30	0	125	509	0.02	0.00	30	0	0.11	0.04	793	793
10	0.22	0.02	0.01	215	211	156	574	9	0	151	562	0.00	0.00	9	0	0.03	0.01	224	220
11	0.88	0.06	0.03	623	622	102	408	25	0	102	408	0.01	0.00	25	0	0.07	0.03	647	647
12	0.22	0.02	0.01	215	211	156	574	9	0	151	562	0.00	0.00	9	0	0.03	0.01	224	220
13	0.88	0.06	0.03	623	622	102	408	25	0	102	408	0.01	0.00	25	0	0.07	0.03	647	647
14	0.22	0.02	0.01	215	211	156	574	9	0	151	562	0.00	0.00	9	0	0.03	0.01	224	220
15	0.53	0.03	0.02	374	373	102	408	15	0	102	408	0.01	0.00	15	0	0.04	0.02	388	388
16	0.22	0.02	0.01	215	211	156	574	9	0	151	562	0.00	0.00	9	0	0.03	0.01	224	220
17	0.88	0.06	0.03	623	622	102	408	25	0	102	408	0.01	0.00	25	0	0.07	0.03	647	647
18	0.22	0.02	0.01	215	211	156	574	9	0	151	562	0.00	0.00	9	0	0.03	0.01	224	220
19	0.18	0.00	0.00	10	10	8	28	0	0	8	28	0.00	0.00	0	0	0.00	0.00	10	10
20	0.88	0.09	0.04	763	763	125	509	30	0	125	509	0.02	0.00	30	0	0.11	0.04	793	793
21	0.22	0.02	0.01	215	211	156	574	9	0	151	562	0.00	0.00	9	0	0.03	0.01	224	220
22	0.88	0.09	0.04	763	763	125	509	30	0	125	509	0.02	0.00	30	0	0.11	0.04	793	793
23	0.22	0.02	0.01	215	211	156	574	9	0	151	562	0.00	0.00	9	0	0.03	0.01	224	220
24	0.06	0.01	0.00	93	92	276	977	4	0	273	969	0.00	0.00	4	0	0.01	0.00	98	97
25	0.35	0.08	0.02	587	581	276	977	26	0	273	969	0.02	0.00	26	0	0.09	0.02	614	607
26	0.18	0.04	0.01	294	290	276	977	13	0	273	969	0.01	0.00	13	0	0.05	0.01	307	303
27	0.12	0.00	0.00	7	7	8	28	0	0	8	28	0.00	0.00	0	0	0.00	0.00	7	7
28	0.12	0.00	0.00	7	7	8	28	0	0	8	28	0.00	0.00	0	0	0.00	0.00	7	7
29	0.09	0.01	0.00	82	81	125	509	3	0	125	509	0.00	0.00	3	0	0.01	0.00	85	85
30	0.09	0.01	0.00	82	81	125	509	3	0	125	509	0.00	0.00	3	0	0.01	0.00	85	85
31	0.88	0.09	0.04	763	763	125	509	30	0	125	509	0.02	0.00	30	0	0.11	0.04	793	793
32	0.22	0.02	0.01	215	211	156	574	9	0	151	562	0.00	0.00	9	0	0.03	0.01	224	220
33	0.88	0.09	0.04	763	763	125	509	30	0	125	509	0.02	0.00	30	0	0.11	0.04	793	793
34	0.22	0.02	0.01	215	211	156	574	9	0	151	562	0.00	0.00	9	0	0.03	0.01	224	220
35	0.88	0.09	0.04	763	763	125	509	30	0	125	509	0.02	0.00	30	0	0.11	0.04	793	793
36	0.22	0.02	0.01	215	211	156	574	9	0	151	562	0.00	0.00	9	0	0.03	0.01	224	220
37	0.09	0.02	0.02	174	173	306	1,077	8	0	303	1,069	0.00	0.00	8	0	0.03	0.02	182	181
38	0.11	0.03	0.02	207	206	306	1,077	9	0	303	1,069	0.01	0.00	9	0	0.03	0.02	217	215
39	0.24	0.06	0.05	435	432	306	1,077	20	0	303	1,069	0.01	0.00	19	0	0.07	0.05	455	452
40	0.09	0.02	0.02	174	173	306	1,077	8	0	303	1,069	0.00	0.00	8	0	0.03	0.02	182	181
41	0.11	0.03	0.02	207	206	306	1,077	9	0	303	1,069	0.01	0.00	9	0	0.03	0.02	217	215
42	0.24	0.06	0.05	435	432	306	1,077	20	0	303	1,069	0.01	0.00	19	0	0.07	0.05	455	452
43	0.12	0.00	0.00	7	7	8	28	0	0	8	28	0.00	0.00	0	0	0.00	0.00	7	7
44	0.88	0.09	0.04	763	763	125	509	30	0	125	509	0.02	0.00	30	0	0.11	0.04	793	793
45	0.22	0.02	0.01	215	211	156	574	9	0	151	562	0.00	0.00	9	0	0.03	0.01	224	220
46	0.88	0.09	0.04	763	763	125	509	30	0	125	509	0.02	0.00	30	0	0.11	0.04	793	793
47	0.22	0.02	0.01	215	211	156	574	9	0	151	562	0.00	0.00	9	0	0.03	0.01	224	220
48	0.88	0.09	0.04	763	763	125	509	30	0	125	509	0.02	0.00	30	0	0.11	0.04	793	793
49	0.22	0.02	0.01	215	211	156	574	9	0	151	562	0.00	0.00	9	0	0.03	0.01	224	220
50	0.88	0.09	0.04	763	763	125	509	30	0	125	509	0.02	0.00	30	0	0.11	0.04	793	793
51	0.22	0.02	0.01	215	211	156	574	9	0	151	562	0.00	0.00	9	0	0.03	0.01	224	220
52	0.88	0.09	0.04	763	763	125	509	30	0	125	509	0.02	0.00	30	0	0.11	0.04	793	793
53	0.22	0.02	0.01	215	211	156	574	9	0	151	562	0.00	0.00	9	0	0.03	0.01	224	220
54	0.88	0.09	0.04	763	763	125	509	30	0	125	509	0.02	0.00	30	0	0.11	0.04	793	793
55	0.22	0.02	0.01	215	211	156	574	9	0	151	562	0.00	0.00	9	0	0.03	0.01	224	220
56	0.12	0.00	0.00	7	7	8	28	0	0	8	28	0.00	0.00	0	0	0.00	0.00	7	7
57	0.04	0.00	0.00	2	2	8	28	0	0	8	28	0.00	0.00	0	0	0.00	0.00	2	2
58	0.12	0.00	0.00	7	7	8	28	0	0	8	28	0.00	0.00	0	0	0.00	0.00	7	7
59	0.88	0.09	0.04	763	763	125	509	30	0	125	509	0.02	0.00	30	0	0.11	0.04	793	793
60	0.22	0.02	0.01	215	211	156	574	9	0	151	562	0.00	0.00	9	0	0.03	0.01	224	220
61	0.04	0.00	0.00	2	2	8	28	0	0	8	28	0.00	0.00	0	0	0.00	0.00	2	2
62	0.86	0.09	0.04	749	749	125	509	29	0	125	509	0.02	0.00	29	0	0.11	0.04	779	779
63	0.18	0.04	0.03	450	364	500	1,284	25	0	404	1,108	0.01	0.00	20	0	0.05	0.03	474	384
64	0.88	0.09	0.04	763	763	125	509	30	0	125	509	0.02	0.00	30	0	0.11	0.04	793	793
65	0.22	0.02	0.01	215	211	156	574	9	0	151	562	0.00	0.00	9	0	0.03	0.01	224	220
66	1.06	0.11	0.05	916	916	125	509	36	0	125	509	0.02	0.00	36	0	0.13	0.05	952	952
67	0.22	0.02	0.01	215	211	156	574	9	0	151	562	0.00	0.00	9	0	0.03	0.01	224	220
68	1.23	0.13	0.06	1,069	1,068	125	509	42	0	125	509	0.03	0.00	42	0	0.15	0.06	1,111	1,110
69	0.26	0.03	0.01	229	229	125	509	9	0	125	509	0.01	0.00	9	0	0.03	0.01	238	238
70	0.18	0.00	0.00	0	0	0	0	0	0	0	0	0.00	0.00	0	0	0.00	0.00	0	0

Post-Retrofit Demand and Energy Consumption

Fixture ID	Lighting Demand and Energy Consumption (am) Connected kW	(an) FCM Diversified kW Summer	(ao) FCM Diversified kW Winter	(ap) Annual kWh	(aq) Peak kWh	Interactive Hours (ar) Cooling Hours	(as) Heating Hours	Interactive Energy Consumption (at) Cooling kWh	(au) Heating kWh	On-Peak Interactive Hours (av) Cooling Hours	(aw) Heating Hours	On-Peak Interactive Demand and Energy Consumption (ax) FCM Diversified kW Summer	(ay) FCM Diversified kW Winter	(az) Cooling kWh	(ba) Heating kWh	Lighting and Interactive Demand and Energy Consumption (bb) FCM Diversified kW Summer	(bc) FCM Diversified kW Winter	(bd) Annual kWh	(be) Peak kWh
71	0.18	0.04	0.01	294	290	276	977	13	0	273	969	0.01	0.00	13	0	0.05	0.01	307	303
72	0.14	0.04	0.03	261	259	306	1,077	12	0	303	1,069	0.01	0.00	12	0	0.04	0.03	273	271
73	0.11	0.03	0.02	200	199	306	1,077	9	0	303	1,069	0.01	0.00	9	0	0.03	0.02	209	208
74	0.14	0.04	0.03	261	259	306	1,077	12	0	303	1,069	0.01	0.00	12	0	0.04	0.03	273	271
75	0.11	0.03	0.02	200	199	306	1,077	9	0	303	1,069	0.01	0.00	9	0	0.03	0.02	209	208
76	1.14	0.24	0.06	1,909	1,887	276	977	86	0	273	969	0.05	0.00	85	0	0.30	0.06	1,995	1,973
77	0.05	0.01	0.00	90	89	276	977	4	0	273	969	0.00	0.00	4	0	0.01	0.00	94	93
78	0.58	0.14	0.11	815	766	258	763	41	0	230	716	0.03	0.00	36	0	0.18	0.11	856	802
79	0.30	0.08	0.06	425	399	258	763	21	0	230	716	0.02	0.00	19	0	0.09	0.06	446	418
80	1.06	0.11	0.05	916	916	125	509	36	0	125	509	0.02	0.00	36	0	0.13	0.05	952	952
81	0.18	0.04	0.00	245	241	253	799	12	0	249	788	0.01	0.00	12	0	0.05	0.00	257	253
82	0.18	0.04	0.01	294	290	276	977	13	0	273	969	0.01	0.00	13	0	0.05	0.01	307	303
83	0.06	0.01	0.00	100	99	276	977	5	0	273	969	0.00	0.00	4	0	0.02	0.00	105	103
84	0.32	0.08	0.06	600	596	306	1,077	27	0	303	1,069	0.02	0.00	27	0	0.10	0.06	627	623
85	0.05	0.00	0.00	3	3	8	28	0	0	8	28	0.00	0.00	0	0	0.00	0.00	3	3
86	0.05	0.00	0.00	3	3	8	28	0	0	8	28	0.00	0.00	0	0	0.00	0.00	3	3
87	0.12	0.03	0.00	167	165	253	799	8	0	249	788	0.01	0.00	8	0	0.03	0.00	175	173
88	0.09	0.01	0.00	76	76	125	509	3	0	125	509	0.00	0.00	3	0	0.01	0.00	79	79
89	0.18	0.04	0.00	245	241	253	799	12	0	249	788	0.01	0.00	12	0	0.05	0.00	257	253
90	0.24	0.00	0.00	13	13	8	28	1	0	8	28	0.00	0.00	1	0	0.00	0.00	14	14
91	0.27	0.00	0.00	15	15	8	28	1	0	8	28	0.00	0.00	1	0	0.00	0.00	16	16
92	0.24	0.00	0.00	13	13	8	28	1	0	8	28	0.00	0.00	1	0	0.00	0.00	14	14
93	0.35	0.22	0.25	951	909	553	1,181	53	0	540	1,139	0.05	0.00	52	0	0.27	0.25	1,004	960
94	0.04	0.02	0.03	100	96	553	1,181	6	0	540	1,139	0.01	0.00	5	0	0.03	0.03	106	101
95	0.06	0.00	0.00	3	3	8	28	0	0	8	28	0.00	0.00	0	0	0.00	0.00	3	3
96	0.12	0.00	0.00	7	7	8	28	0	0	8	28	0.00	0.00	0	0	0.00	0.00	7	7
97	0.11	0.00	0.00	6	6	8	28	0	0	8	28	0.00	0.00	0	0	0.00	0.00	6	6
98	0.22	0.06	0.04	400	397	306	1,077	18	0	303	1,069	0.01	0.00	18	0	0.07	0.04	418	415
99	0.12	0.03	0.02	222	221	306	1,077	10	0	303	1,069	0.01	0.00	10	0	0.04	0.02	232	231
100	0.18	0.05	0.04	333	331	306	1,077	15	0	303	1,069	0.01	0.00	15	0	0.06	0.04	348	346
101	0.22	0.06	0.04	400	397	306	1,077	18	0	303	1,069	0.01	0.00	18	0	0.07	0.04	418	415
102	0.12	0.03	0.02	222	221	306	1,077	10	0	303	1,069	0.01	0.00	10	0	0.04	0.02	232	231
103	0.18	0.05	0.04	333	331	306	1,077	15	0	303	1,069	0.01	0.00	15	0	0.06	0.04	348	346
104	4.60	1.19	0.89	8,521	8,460	306	1,077	384	0	303	1,069	0.23	0.00	380	0	1.42	0.89	8,905	8,840
105	1.40	0.36	0.27	2,601	2,582	306	1,077	117	0	303	1,069	0.07	0.00	116	0	0.43	0.27	2,718	2,698
106	0.75	0.20	0.15	1,393	1,383	306	1,077	63	0	303	1,069	0.04	0.00	62	0	0.23	0.15	1,456	1,445
107	0.06	0.02	0.01	111	110	306	1,077	5	0	303	1,069	0.00	0.00	5	0	0.02	0.01	116	115
108	0.09	0.02	0.02	174	173	306	1,077	8	0	303	1,069	0.00	0.00	8	0	0.03	0.02	182	181
109	0.12	0.03	0.02	222	221	306	1,077	10	0	303	1,069	0.01	0.00	10	0	0.04	0.02	232	231
110	0.66	0.17	0.13	1,219	1,210	306	1,077	55	0	303	1,069	0.03	0.00	54	0	0.20	0.13	1,274	1,265
111	0.24	0.06	0.05	445	441	306	1,077	20	0	303	1,069	0.01	0.00	20	0	0.07	0.05	465	461
112	0.52	0.13	0.10	958	951	306	1,077	43	0	303	1,069	0.03	0.00	43	0	0.16	0.10	1,001	994
113	0.04	0.01	0.01	74	74	306	1,077	3	0	303	1,069	0.00	0.00	3	0	0.01	0.01	77	77
114	0.36	0.09	0.07	667	662	306	1,077	30	0	303	1,069	0.02	0.00	30	0	0.11	0.07	697	692
115	1.32	0.34	0.26	2,438	2,420	306	1,077	110	0	303	1,069	0.06	0.00	109	0	0.41	0.26	2,548	2,529
116	0.24	0.06	0.05	445	441	306	1,077	20	0	303	1,069	0.01	0.00	20	0	0.07	0.05	465	461
117	0.36	0.09	0.07	667	662	306	1,077	30	0	303	1,069	0.02	0.00	30	0	0.11	0.07	697	692
118	0.18	0.02	0.01	156	156	125	509	6	0	125	509	0.00	0.00	6	0	0.02	0.01	162	162
119	0.53	0.05	0.02	458	458	125	509	18	0	125	509	0.01	0.00	18	0	0.07	0.02	476	476
120	0.22	0.02	0.01	215	211	156	574	9	0	151	562	0.00	0.00	9	0	0.03	0.01	224	220
121	0.18	0.02	0.01	156	156	125	509	6	0	125	509	0.00	0.00	6	0	0.02	0.01	162	162
122	0.66	0.07	0.03	572	572	125	509	22	0	125	509	0.01	0.00	22	0	0.08	0.03	595	595
123	0.05	0.01	0.00	47	47	125	509	2	0	125	509	0.00	0.00	2	0	0.01	0.00	49	49
124	0.09	0.01	0.00	76	76	125	509	3	0	125	509	0.00	0.00	3	0	0.01	0.00	79	79
125	0.09	0.01	0.00	76	76	125	509	3	0	125	509	0.00	0.00	3	0	0.01	0.00	79	79
126	0.12	0.01	0.01	104	104	125	509	4	0	125	509	0.00	0.00	4	0	0.01	0.01	108	108
127	0.22	0.06	0.04	400	397	306	1,077	18	0	303	1,069	0.01	0.00	18	0	0.07	0.04	418	415
128	0.22	0.06	0.04	400	397	306	1,077	18	0	303	1,069	0.01	0.00	18	0	0.07	0.04	418	415
129	0.12	0.01	0.01	104	104	125	509	4	0	125	509	0.00	0.00	4	0	0.01	0.01	108	108
130	0.12	0.01	0.01	104	104	125	509	4	0	125	509	0.00	0.00	4	0	0.01	0.01	108	108
131	0.04	0.00	0.00	2	2	8	28	0	0	8	28	0.00	0.00	0	0	0.00	0.00	2	2
132	0.12	0.00	0.00	7	7	8	28	0	0	8	28	0.00	0.00	0	0	0.00	0.00	7	7
133	0.05	0.00	0.00	3	3	8	28	0	0	8	28	0.00	0.00	0	0	0.00	0.00	3	3
134	1.14	0.12	0.05	992	992	125	509	39	0	125	509	0.02	0.00	39	0	0.14	0.05	1,031	1,031
135	0.22	0.02	0.01	215	211	156	574	9	0	151	562	0.00	0.00	9	0	0.03	0.01	224	220
136	1.14	0.12	0.05	992	992	125	509	39	0	125	509	0.02	0.00	39	0	0.14	0.05	1,031	1,031
137	0.22	0.02	0.01	215	211	156	574	9	0	151	562	0.00	0.00	9	0	0.03	0.01	224	220
138	1.14	0.12	0.05	992	992	125	509	39	0	125	509	0.02	0.00	39	0	0.14	0.05	1,031	1,031
139	0.22	0.02	0.01	215	211	156	574	9	0	151	562	0.00	0.00	9	0	0.03	0.01	224	220
140	1.14	0.12	0.05	992	992	125	509	39	0	125	509	0.02	0.00	39	0	0.14	0.05	1,031	1,031

Post-Retrofit Demand and Energy Consumption																			
	Lighting Demand and Energy Consumption					Interactive Hours		Interactive Energy Consumption		On-Peak Interactive Hours		On-Peak Interactive Demand and Energy Consumption				Lighting and Interactive Demand and Energy Consumption			
	(am)	(an)	(ao)	(ap)	(aq)	(ar)	(as)	(at)	(au)	(av)	(aw)	(ax)	(ay)	(az)	(ba)	(bb)	(bc)	(bd)	(be)
Fixture ID	Connected kW	FCM Diversified kW Summer	FCM Diversified kW Winter	Annual kWh	Peak kWh	Cooling Hours	Heating Hours	Cooling kWh	Heating kWh	Cooling Hours	Heating Hours	FCM Diversified kW Summer	FCM Diversified kW Winter	Cooling kWh	Heating kWh	FCM Diversified kW Summer	FCM Diversified kW Winter	Annual kWh	Peak kWh
141	0.22	0.02	0.01	215	211	156	574	9	0	151	562	0.00	0.00	9	0	0.03	0.01	224	220
142	1.14	0.12	0.05	992	992	125	509	39	0	125	509	0.02	0.00	39	0	0.14	0.05	1,031	1,031
143	0.22	0.02	0.01	215	211	156	574	9	0	151	562	0.00	0.00	9	0	0.03	0.01	224	220
144	0.88	0.09	0.04	763	763	125	509	30	0	125	509	0.02	0.00	30	0	0.11	0.04	793	793
145	0.22	0.02	0.01	215	211	156	574	9	0	151	562	0.00	0.00	9	0	0.03	0.01	224	220
146	0.88	0.09	0.04	763	763	125	509	30	0	125	509	0.02	0.00	30	0	0.11	0.04	793	793
147	0.22	0.02	0.01	215	211	156	574	9	0	151	562	0.00	0.00	9	0	0.03	0.01	224	220
148	0.88	0.09	0.04	763	763	125	509	30	0	125	509	0.02	0.00	30	0	0.11	0.04	793	793
149	0.22	0.02	0.01	215	211	156	574	9	0	151	562	0.00	0.00	9	0	0.03	0.01	224	220
150	0.88	0.09	0.04	763	763	125	509	30	0	125	509	0.02	0.00	30	0	0.11	0.04	793	793
151	0.22	0.02	0.01	215	211	156	574	9	0	151	562	0.00	0.00	9	0	0.03	0.01	224	220
152	0.88	0.09	0.04	763	763	125	509	30	0	125	509	0.02	0.00	30	0	0.11	0.04	793	793
153	0.22	0.02	0.01	215	211	156	574	9	0	151	562	0.00	0.00	9	0	0.03	0.01	224	220
154	0.88	0.09	0.04	763	763	125	509	30	0	125	509	0.02	0.00	30	0	0.11	0.04	793	793
155	0.22	0.02	0.01	215	211	156	574	9	0	151	562	0.00	0.00	9	0	0.03	0.01	224	220
156	0.88	0.09	0.04	763	763	125	509	30	0	125	509	0.02	0.00	30	0	0.11	0.04	793	793
157	0.22	0.02	0.01	215	211	156	574	9	0	151	562	0.00	0.00	9	0	0.03	0.01	224	220
158	0.88	0.09	0.04	763	763	125	509	30	0	125	509	0.02	0.00	30	0	0.11	0.04	793	793
159	0.22	0.02	0.01	215	211	156	574	9	0	151	562	0.00	0.00	9	0	0.03	0.01	224	220
160	0.53	0.05	0.02	458	458	125	509	18	0	125	509	0.01	0.00	18	0	0.07	0.02	476	476
161	0.22	0.02	0.01	215	211	156	574	9	0	151	562	0.00	0.00	9	0	0.03	0.01	224	220
162	0.18	0.00	0.00	10	10	8	28	0	0	8	28	0.00	0.00	0	0	0.00	0.00	10	10
163	0.06	0.00	0.00	3	3	8	28	0	0	8	28	0.00	0.00	0	0	0.00	0.00	3	3
164	0.70	0.07	0.03	611	610	125	509	24	0	125	509	0.01	0.00	24	0	0.09	0.03	635	634
165	0.09	0.02	0.02	167	166	306	1,077	8	0	303	1,069	0.00	0.00	7	0	0.03	0.02	174	173
166	0.09	0.02	0.02	167	166	306	1,077	8	0	303	1,069	0.00	0.00	7	0	0.03	0.02	174	173
167	0.12	0.00	0.00	7	7	8	28	0	0	8	28	0.00	0.00	0	0	0.00	0.00	7	7
168	0.36	0.09	0.07	667	662	306	1,077	30	0	303	1,069	0.02	0.00	30	0	0.11	0.07	697	692
169	0.24	0.06	0.05	445	441	306	1,077	20	0	303	1,069	0.01	0.00	20	0	0.07	0.05	465	461
170	0.36	0.09	0.07	667	662	306	1,077	30	0	303	1,069	0.02	0.00	30	0	0.11	0.07	697	692
171	0.24	0.06	0.05	445	441	306	1,077	20	0	303	1,069	0.01	0.00	20	0	0.07	0.05	465	461
172	0.24	0.02	0.01	208	208	125	509	8	0	125	509	0.00	0.00	8	0	0.03	0.01	216	216
173	1.14	0.12	0.05	992	992	125	509	39	0	125	509	0.02	0.00	39	0	0.14	0.05	1,031	1,031
174	0.14	0.01	0.01	143	141	156	574	6	0	151	562	0.00	0.00	6	0	0.02	0.01	150	146
175	1.14	0.12	0.05	992	992	125	509	39	0	125	509	0.02	0.00	39	0	0.14	0.05	1,031	1,031
176	0.14	0.01	0.01	143	141	156	574	6	0	151	562	0.00	0.00	6	0	0.02	0.01	150	146
177	0.53	0.05	0.02	458	458	125	509	18	0	125	509	0.01	0.00	18	0	0.07	0.02	476	476
178	0.14	0.01	0.01	143	141	156	574	6	0	151	562	0.00	0.00	6	0	0.02	0.01	150	146
179	0.06	0.00	0.00	3	3	8	28	0	0	8	28	0.00	0.00	0	0	0.00	0.00	3	3
180	0.12	0.00	0.00	7	7	8	28	0	0	8	28	0.00	0.00	0	0	0.00	0.00	7	7
181	1.41	0.15	0.06	1,221	1,221	125	509	48	0	125	509	0.03	0.00	48	0	0.17	0.06	1,269	1,269
182	0.22	0.02	0.01	215	211	156	574	9	0	151	562	0.00	0.00	9	0	0.03	0.01	224	220
183	2.43	0.63	0.47	4,501	4,469	306	1,077	203	0	303	1,069	0.12	0.00	201	0	0.75	0.47	4,704	4,670
184	0.86	0.22	0.17	1,600	1,589	306	1,077	72	0	303	1,069	0.04	0.00	71	0	0.27	0.17	1,673	1,660
185	0.36	0.04	0.02	312	312	125	509	12	0	125	509	0.01	0.00	12	0	0.04	0.02	325	324
186	1.38	0.35	0.26	1,953	1,834	258	763	97	0	230	716	0.08	0.00	87	0	0.43	0.26	2,050	1,921
187	0.12	0.00	0.00	7	7	8	28	0	0	8	28	0.00	0.00	0	0	0.00	0.00	7	7
188	1.23	0.08	0.04	872	871	102	408	34	0	102	408	0.02	0.00	34	0	0.09	0.04	906	906
189	0.22	0.02	0.01	215	211	156	574	9	0	151	562	0.00	0.00	9	0	0.03	0.01	224	220
190	0.97	0.24	0.18	1,370	1,287	258	763	68	0	230	716	0.06	0.00	61	0	0.30	0.18	1,438	1,347
191	0.09	0.00	0.00	5	5	8	28	0	0	8	28	0.00	0.00	0	0	0.00	0.00	5	5
192	0.30	0.00	0.00	17	17	8	28	1	0	8	28	0.00	0.00	1	0	0.00	0.00	17	17
193	1.76	0.11	0.06	1,246	1,245	102	408	49	0	102	408	0.02	0.00	49	0	0.14	0.06	1,295	1,294
194	0.88	0.06	0.03	623	622	102	408	25	0	102	408	0.01	0.00	25	0	0.07	0.03	647	647
195	0.22	0.02	0.01	215	211	156	574	9	0	151	562	0.00	0.00	9	0	0.03	0.01	224	220
196	0.88	0.06	0.03	623	622	102	408	25	0	102	408	0.01	0.00	25	0	0.07	0.03	647	647
197	0.22	0.02	0.01	215	211	156	574	9	0	151	562	0.00	0.00	9	0	0.03	0.01	224	220
198	0.18	0.01	0.01	127	127	102	408	5	0	102	408	0.00	0.00	5	0	0.01	0.01	132	132
199	0.09	0.01	0.00	82	81	125	509	3	0	125	509	0.00	0.00	3	0	0.01	0.00	85	85
200	0.53	0.03	0.02	374	373	102	408	15	0	102	408	0.01	0.00	15	0	0.04	0.02	388	388
201	0.22	0.02	0.01	215	211	156	574	9	0	151	562	0.00	0.00	9	0	0.03	0.01	224	220
202	1.23	0.08	0.04	872	871	102	408	34	0	102	408	0.02	0.00	34	0	0.09	0.04	906	906
203	0.22	0.02	0.01	215	211	156	574	9	0	151	562	0.00	0.00	9	0	0.03	0.01	224	220
204	0.36	0.09	0.07	667	662	306	1,077	30	0	303	1,069	0.02	0.00	30	0	0.11	0.07	697	692
205	0.16	0.04	0.03	300	298	306	1,077	14	0	303	1,069	0.01	0.00	13	0	0.05	0.03	314	311
206	0.04	0.01	0.01	74	74	306	1,077	3	0	303	1,069	0.00	0.00	3	0	0.01	0.01	77	77
207	0.36	0.09	0.07	667	662	306	1,077	30	0	303	1,069	0.02	0.00	30	0	0.11	0.07	697	692
208	0.16	0.04	0.03	300	298	306	1,077	14	0	303	1,069	0.01	0.00	13	0	0.05	0.03	314	311
209	0.04	0.01	0.01	74	74	306	1,077	3	0	303	1,069	0.00	0.00	3	0	0.01	0.01	77	77
210	0.06	0.00	0.00	3	3	8	28	0	0	8	28	0.00	0.00	0	0	0.00	0.00	3	3

Post-Retrofit Demand and Energy Consumption

Fixture ID	Lighting Demand and Energy Consumption (am) Connected kW	(an) FCM Diversified kW Summer	(ao) FCM Diversified kW Winter	(ap) Annual kWh	(aq) Peak kWh	Interactive Hours (ar) Cooling Hours	(as) Heating Hours	Interactive Energy Consumption (at) Cooling kWh	(au) Heating kWh	On-Peak Interactive Hours (av) Cooling Hours	(aw) Heating Hours	On-Peak Interactive Demand and Energy Consumption (ax) FCM Diversified kW Summer	(ay) FCM Diversified kW Winter	(az) Cooling kWh	(ba) Heating kWh	Lighting and Interactive Demand and Energy Consumption (bb) FCM Diversified kW Summer	(bc) FCM Diversified kW Winter	(bd) Annual kWh	(be) Peak kWh
211	0.06	0.00	0.00	3	3	8	28	0	0	8	28	0.00	0.00	0	0	0.00	0.00	3	3
212	0.88	0.09	0.04	763	763	125	509	30	0	125	509	0.02	0.00	30	0	0.11	0.04	793	793
213	0.22	0.02	0.01	215	211	156	574	9	0	151	562	0.00	0.00	9	0	0.03	0.01	224	220
214	0.88	0.09	0.04	763	763	125	509	30	0	125	509	0.02	0.00	30	0	0.11	0.04	793	793
215	0.22	0.02	0.01	215	211	156	574	9	0	151	562	0.00	0.00	9	0	0.03	0.01	224	220
216	0.44	0.09	0.02	734	726	276	977	33	0	273	969	0.02	0.00	33	0	0.11	0.02	767	759
217	0.03	0.01	0.00	47	46	276	977	2	0	273	969	0.00	0.00	2	0	0.01	0.00	49	48
218	0.05	0.01	0.00	78	78	276	977	4	0	273	969	0.00	0.00	4	0	0.01	0.00	82	81
219	0.05	0.01	0.00	78	78	276	977	4	0	273	969	0.00	0.00	4	0	0.01	0.00	82	81
220	0.12	0.00	0.00	7	7	8	28	0	0	8	28	0.00	0.00	0	0	0.00	0.00	7	7
221	0.09	0.02	0.00	147	145	276	977	7	0	273	969	0.00	0.00	7	0	0.02	0.00	153	152
222	0.09	0.02	0.00	147	145	276	977	7	0	273	969	0.00	0.00	7	0	0.02	0.00	153	152
223	0.09	0.02	0.00	147	145	276	977	7	0	273	969	0.00	0.00	7	0	0.02	0.00	153	152
224	1.23	0.08	0.04	872	871	102	408	34	0	102	408	0.02	0.00	34	0	0.09	0.04	906	906
225	0.22	0.02	0.01	215	211	156	574	9	0	151	562	0.00	0.00	9	0	0.03	0.01	224	220
226	0.88	0.09	0.04	763	763	125	509	30	0	125	509	0.02	0.00	30	0	0.11	0.04	793	793
227	0.22	0.02	0.01	215	211	156	574	9	0	151	562	0.00	0.00	9	0	0.03	0.01	224	220
228	0.88	0.09	0.04	763	763	125	509	30	0	125	509	0.02	0.00	30	0	0.11	0.04	793	793
229	0.22	0.02	0.01	215	211	156	574	9	0	151	562	0.00	0.00	9	0	0.03	0.01	224	220
230	0.53	0.05	0.02	458	458	125	509	18	0	125	509	0.01	0.00	18	0	0.07	0.02	476	476
231	0.22	0.02	0.01	215	211	156	574	9	0	151	562	0.00	0.00	9	0	0.03	0.01	224	220
232	0.70	0.18	0.14	1,300	1,291	306	1,077	59	0	303	1,069	0.03	0.00	58	0	0.22	0.14	1,359	1,349
233	2.07	0.54	0.40	3,834	3,807	306	1,077	173	0	303	1,069	0.10	0.00	171	0	0.64	0.40	4,007	3,978
234	0.04	0.01	0.01	74	74	306	1,077	3	0	303	1,069	0.00	0.00	3	0	0.01	0.01	77	77
235	0.14	0.14	0.14	1,191	548	1,208	2,325	45	0	812	1,582	0.03	0.00	30	0	0.17	0.14	1,236	578
236	0.50	0.50	0.50	4,415	2,032	1,208	2,325	166	0	812	1,582	0.12	0.00	112	0	0.62	0.50	4,581	2,144
237	0.36	0.36	0.36	3,154	1,452	1,208	2,325	119	0	812	1,582	0.09	0.00	80	0	0.45	0.36	3,272	1,531
238	0.24	0.24	0.24	2,102	968	1,208	2,325	79	0	812	1,582	0.06	0.00	53	0	0.30	0.24	2,182	1,021
239	0.88	0.06	0.03	623	622	102	408	25	0	102	408	0.01	0.00	25	0	0.07	0.03	647	647
240	0.22	0.02	0.01	215	211	156	574	9	0	151	562	0.00	0.00	9	0	0.03	0.01	224	220
241	0.06	0.00	0.00	3	3	8	28	0	0	8	28	0.00	0.00	0	0	0.00	0.00	3	3
242	0.12	0.00	0.00	7	7	8	28	0	0	8	28	0.00	0.00	0	0	0.00	0.00	7	7
243	0.12	0.00	0.00	7	7	8	28	0	0	8	28	0.00	0.00	0	0	0.00	0.00	7	7
244	0.12	0.00	0.00	7	7	8	28	0	0	8	28	0.00	0.00	0	0	0.00	0.00	7	7
245	0.53	0.05	0.02	458	458	125	509	18	0	125	509	0.01	0.00	18	0	0.07	0.02	476	476
246	1.94	0.12	0.06	1,370	1,369	102	408	54	0	102	408	0.03	0.00	54	0	0.15	0.06	1,424	1,423
247	0.43	0.04	0.02	375	375	125	509	15	0	125	509	0.01	0.00	15	0	0.05	0.02	389	389
248	0.22	0.02	0.01	215	211	156	574	9	0	151	562	0.00	0.00	9	0	0.03	0.01	224	220
249	0.18	0.00	0.00	10	10	8	28	0	0	8	28	0.00	0.00	0	0	0.00	0.00	10	10
250	0.12	0.00	0.00	7	7	8	28	0	0	8	28	0.00	0.00	0	0	0.00	0.00	7	7
251	1.14	0.01	0.00	529	528	64	265	20	0	64	265	0.00	0.00	20	0	0.01	0.00	549	548
252	0.06	0.00	0.00	28	28	64	265	1	0	64	265	0.00	0.00	1	0	0.00	0.00	29	29
253	0.04	0.00	0.00	2	2	8	28	0	0	8	28	0.00	0.00	0	0	0.00	0.00	2	2
254	0.48	0.01	0.00	222	222	64	265	8	0	64	265	0.00	0.00	8	0	0.01	0.00	230	230
255	0.14	0.00	0.00	67	66	64	265	3	0	64	265	0.00	0.00	2	0	0.00	0.00	69	69
256	0.24	0.00	0.00	13	13	8	28	1	0	8	28	0.00	0.00	1	0	0.00	0.00	14	14
257	0.06	0.00	0.00	3	3	8	28	0	0	8	28	0.00	0.00	0	0	0.00	0.00	3	3
258	0.06	0.00	0.00	3	3	8	28	0	0	8	28	0.00	0.00	0	0	0.00	0.00	3	3
259	0.06	0.00	0.00	3	3	8	28	0	0	8	28	0.00	0.00	0	0	0.00	0.00	3	3
260	0.12	0.03	0.02	222	221	306	1,077	10	0	303	1,069	0.01	0.00	10	0	0.04	0.02	232	231
261	0.06	0.02	0.01	111	110	306	1,077	5	0	303	1,069	0.00	0.00	5	0	0.02	0.01	116	115
262	0.09	0.02	0.02	174	173	306	1,077	8	0	303	1,069	0.00	0.00	8	0	0.03	0.02	182	181
263	0.12	0.03	0.02	222	221	306	1,077	10	0	303	1,069	0.01	0.00	10	0	0.04	0.02	232	231
264	0.06	0.02	0.01	111	110	306	1,077	5	0	303	1,069	0.00	0.00	5	0	0.02	0.01	116	115
265	0.09	0.02	0.02	174	173	306	1,077	8	0	303	1,069	0.00	0.00	8	0	0.03	0.02	182	181
266	1.26	0.33	0.25	2,334	2,317	306	1,077	105	0	303	1,069	0.06	0.00	104	0	0.39	0.25	2,439	2,421
267	0.43	0.11	0.08	800	794	306	1,077	36	0	303	1,069	0.02	0.00	36	0	0.13	0.08	836	830
268	0.49	0.13	0.09	900	894	306	1,077	41	0	303	1,069	0.02	0.00	40	0	0.15	0.09	941	934
269	0.66	0.01	0.00	305	305	64	265	11	0	64	265	0.00	0.00	11	0	0.01	0.00	317	316
270	0.80	0.01	0.00	370	369	64	265	14	0	64	265	0.00	0.00	14	0	0.01	0.00	384	383
271	0.43	0.00	0.00	200	199	64	265	8	0	64	265	0.00	0.00	7	0	0.01	0.00	207	207
272	1.41	0.35	0.26	1,992	1,871	258	763	99	0	230	716	0.08	0.00	89	0	0.43	0.26	2,091	1,960
273	0.24	0.06	0.04	340	319	258	763	17	0	230	716	0.01	0.00	15	0	0.07	0.04	356	334
274	0.12	0.03	0.02	170	159	258	763	8	0	230	716	0.01	0.00	8	0	0.04	0.02	178	167
275	0.18	0.04	0.03	249	234	258	763	12	0	230	716	0.01	0.00	11	0	0.05	0.03	261	245
276	0.12	0.03	0.02	222	221	306	1,077	10	0	303	1,069	0.01	0.00	10	0	0.04	0.02	232	231
277	0.04	0.01	0.01	74	74	306	1,077	3	0	303	1,069	0.00	0.00	3	0	0.01	0.01	77	77
278	0.70	0.18	0.13	996	936	258	763	50	0	230	716	0.04	0.00	44	0	0.22	0.13	1,046	980
279	0.12	0.03	0.02	170	159	258	763	8	0	230	716	0.01	0.00	8	0	0.04	0.02	178	167
280	0.04	0.01	0.01	57	53	258	763	3	0	230	716	0.00	0.00	3	0	0.01	0.01	59	56

Post-Retrofit Demand and Energy Consumption

Fixture ID	Lighting Demand and Energy Consumption (am) Connected kW	(an) FCM Diversified kW Summer	(ao) FCM Diversified kW Winter	(ap) Annual kWh	(aq) Peak kWh	Interactive Hours (ar) Cooling Hours	(as) Heating Hours	Interactive Energy Consumption (at) Cooling kWh	(au) Heating kWh	On-Peak Interactive Hours (av) Cooling Hours	(aw) Heating Hours	On-Peak Interactive Demand and Energy Consumption (ax) FCM Diversified kW Summer	(ay) FCM Diversified kW Winter	(az) Cooling kWh	(ba) Heating kWh	Lighting and Interactive Demand and Energy Consumption (bb) FCM Diversified kW Summer	(bc) FCM Diversified kW Winter	(bd) Annual kWh	(be) Peak kWh
281	0.24	0.00	0.00	13	13	8	28	1	0	8	28	0.00	0.00	1	0	0.00	0.00	14	14
282	0.36	0.09	0.07	509	478	258	763	25	0	230	716	0.02	0.00	23	0	0.11	0.07	535	501
283	0.88	0.22	0.16	1,245	1,170	258	763	62	0	230	716	0.05	0.00	55	0	0.27	0.16	1,307	1,225
284	0.07	0.02	0.01	96	90	258	763	5	0	230	716	0.00	0.00	4	0	0.02	0.01	101	95
285	0.26	0.07	0.05	374	351	258	763	19	0	230	716	0.02	0.00	17	0	0.08	0.05	392	367
286	0.60	0.15	0.11	849	797	258	763	42	0	230	716	0.03	0.00	38	0	0.19	0.11	891	835
287	0.12	0.03	0.02	170	159	258	763	8	0	230	716	0.01	0.00	8	0	0.04	0.02	178	167
288	0.50	0.13	0.09	713	670	258	763	35	0	230	716	0.03	0.00	32	0	0.16	0.09	749	702
289	0.18	0.04	0.03	249	234	258	763	12	0	230	716	0.01	0.00	11	0	0.05	0.03	261	245
290	0.06	0.02	0.01	85	80	258	763	4	0	230	716	0.00	0.00	4	0	0.02	0.01	89	84
291	0.12	0.03	0.02	170	159	258	763	8	0	230	716	0.01	0.00	8	0	0.04	0.02	178	167
292	0.54	0.14	0.11	1,000	993	306	1,077	45	0	303	1,069	0.03	0.00	45	0	0.17	0.11	1,045	1,038
293	0.52	0.13	0.10	956	949	306	1,077	43	0	303	1,069	0.03	0.00	43	0	0.16	0.10	999	992
294	0.34	0.34	0.34	3,013	1,387	1,208	2,325	113	0	812	1,582	0.08	0.00	76	0	0.43	0.34	3,127	1,463
295	0.14	0.14	0.14	1,191	548	1,208	2,325	45	0	812	1,582	0.03	0.00	30	0	0.17	0.14	1,236	578
296	1.68	0.02	0.01	93	93	8	28	4	0	8	28	0.00	0.00	4	0	0.02	0.01	97	97
297	0.52	0.13	0.10	956	949	306	1,077	43	0	303	1,069	0.03	0.00	43	0	0.16	0.10	999	992
298	0.54	0.14	0.11	1,000	993	306	1,077	45	0	303	1,069	0.03	0.00	45	0	0.17	0.11	1,045	1,038
299	0.12	0.00	0.00	7	7	8	28	0	0	8	28	0.00	0.00	0	0	0.00	0.00	7	7
300	1.44	0.91	1.01	3,890	3,717	553	1,181	217	0	540	1,139	0.21	0.00	212	0	1.12	1.01	4,108	3,929
301	0.12	0.08	0.08	324	310	553	1,181	18	0	540	1,139	0.02	0.00	18	0	0.09	0.08	342	327
302	0.35	0.22	0.25	951	909	553	1,181	53	0	540	1,139	0.05	0.00	52	0	0.27	0.25	1,004	960
303	0.36	0.23	0.25	973	929	553	1,181	54	0	540	1,139	0.05	0.00	53	0	0.28	0.25	1,027	982
304	0.11	0.07	0.08	292	279	553	1,181	16	0	540	1,139	0.02	0.00	16	0	0.08	0.08	308	295
305	0.43	0.27	0.30	1,167	1,115	553	1,181	65	0	540	1,139	0.06	0.00	64	0	0.34	0.30	1,232	1,179
306	0.88	0.09	0.04	763	763	125	509	30	0	125	509	0.02	0.00	30	0	0.11	0.04	793	793
307	0.22	0.02	0.01	215	211	156	574	9	0	151	562	0.00	0.00	9	0	0.03	0.01	224	220
308	0.25	0.25	0.25	2,208	1,016	1,208	2,325	83	0	812	1,582	0.06	0.00	56	0	0.31	0.25	2,291	1,072
309	0.18	0.18	0.18	1,577	726	1,208	2,325	59	0	812	1,582	0.04	0.00	40	0	0.22	0.18	1,636	766
310	0.66	0.17	0.13	1,223	1,214	306	1,077	55	0	303	1,069	0.03	0.00	55	0	0.20	0.13	1,278	1,268
311	0.84	0.22	0.16	1,556	1,545	306	1,077	70	0	303	1,069	0.04	0.00	69	0	0.26	0.16	1,626	1,614
312	0.70	0.18	0.14	1,300	1,291	306	1,077	59	0	303	1,069	0.03	0.00	58	0	0.22	0.14	1,359	1,349
313	0.18	0.00	0.00	10	10	8	28	0	0	8	28	0.00	0.00	0	0	0.00	0.00	10	10
314	0.18	0.00	0.00	10	10	8	28	0	0	8	28	0.00	0.00	0	0	0.00	0.00	10	10
315	0.18	0.00	0.00	10	10	8	28	0	0	8	28	0.00	0.00	0	0	0.00	0.00	10	10
316	0.12	0.03	0.02	222	221	306	1,077	10	0	303	1,069	0.01	0.00	10	0	0.04	0.02	232	231
317	0.09	0.02	0.02	174	173	306	1,077	8	0	303	1,069	0.00	0.00	8	0	0.03	0.02	182	181
318	0.18	0.00	0.00	10	10	8	28	0	0	8	28	0.00	0.00	0	0	0.00	0.00	10	10
319	0.70	0.18	0.13	996	936	258	763	50	0	230	716	0.04	0.00	44	0	0.22	0.13	1,046	980
320	0.12	0.00	0.00	7	7	8	28	0	0	8	28	0.00	0.00	0	0	0.00	0.00	7	7
321	0.50	0.01	0.00	28	28	8	28	1	0	8	28	0.00	0.00	1	0	0.01	0.00	29	29
322	0.04	0.00	0.00	2	2	8	28	0	0	8	28	0.00	0.00	0	0	0.00	0.00	2	2
323	0.19	0.05	0.04	348	346	306	1,077	16	0	303	1,069	0.01	0.00	16	0	0.06	0.04	364	361
324	0.09	0.00	0.00	17	17	26	116	1	0	26	115	0.00	0.00	1	0	0.00	0.00	18	18
325	0.78	0.18	0.12	1,948	1,577	500	1,284	106	0	404	1,108	0.03	0.00	86	0	0.22	0.12	2,055	1,663
326	0.72	0.17	0.11	1,799	1,456	500	1,284	98	0	404	1,108	0.03	0.00	79	0	0.20	0.11	1,897	1,535
327	1.20	0.28	0.19	2,998	2,426	500	1,284	164	0	404	1,108	0.05	0.00	132	0	0.34	0.19	3,161	2,558
328	0.70	0.10	0.13	1,472	1,147	400	1,028	77	0	304	852	0.02	0.00	58	0	0.13	0.13	1,549	1,205
329	0.18	0.03	0.03	376	293	400	1,028	20	0	304	852	0.01	0.00	15	0	0.03	0.03	396	308
330	0.06	0.00	0.00	3	3	8	28	0	0	8	28	0.00	0.00	0	0	0.00	0.00	3	3
331	0.12	0.02	0.02	251	195	400	1,028	13	0	304	852	0.00	0.00	10	0	0.02	0.02	264	205
332	0.62	0.14	0.10	1,539	1,245	500	1,284	84	0	404	1,108	0.03	0.00	68	0	0.17	0.10	1,623	1,313
333	0.30	0.04	0.05	627	489	400	1,028	33	0	304	852	0.01	0.00	25	0	0.05	0.05	660	513
334	0.36	0.00	0.00	20	20	8	28	1	0	8	28	0.00	0.00	1	0	0.01	0.00	21	21
335	0.26	0.04	0.05	552	430	400	1,028	29	0	304	852	0.01	0.00	22	0	0.05	0.05	581	452
336	0.24	0.04	0.04	502	391	400	1,028	26	0	304	852	0.01	0.00	20	0	0.04	0.04	528	411
337	0.06	0.00	0.00	3	3	8	28	0	0	8	28	0.00	0.00	0	0	0.00	0.00	3	3
338	0.06	0.02	0.01	111	110	306	1,077	5	0	303	1,069	0.00	0.00	5	0	0.02	0.01	116	115
339	0.04	0.01	0.01	74	74	306	1,077	3	0	303	1,069	0.00	0.00	3	0	0.01	0.01	77	77
340	0.12	0.03	0.02	222	221	306	1,077	10	0	303	1,069	0.01	0.00	10	0	0.04	0.02	232	231
341	2.40	2.40	2.40	21,024	9,677	1,208	2,325	791	0	812	1,582	0.57	0.00	532	0	2.97	2.40	21,815	10,209
342	1.92	0.45	0.31	4,796	3,882	500	1,284	262	0	404	1,108	0.09	0.00	212	0	0.54	0.31	5,058	4,094
343	0.22	0.05	0.03	540	437	500	1,284	29	0	404	1,108	0.01	0.00	24	0	0.06	0.03	569	461
344	0.06	0.06	0.06	491	226	1,208	2,325	18	0	812	1,582	0.01	0.00	12	0	0.07	0.06	509	238
345	0.14	0.03	0.02	350	283	500	1,284	19	0	404	1,108	0.01	0.00	15	0	0.04	0.02	369	298
346	0.41	0.10	0.07	1,032	835	500	1,284	56	0	404	1,108	0.02	0.00	46	0	0.12	0.07	1,088	881
347	0.08	0.08	0.08	701	323	1,208	2,325	26	0	812	1,582	0.02	0.00	18	0	0.10	0.08	727	340
348	0.12	0.00	0.00	7	7	8	28	0	0	8	28	0.00	0.00	0	0	0.00	0.00	7	7
349	0.02	0.01	0.00	37	37	306	1,077	2	0	303	1,069	0.00	0.00	2	0	0.01	0.00	39	38
350	0.24	0.06	0.05	445	441	306	1,077	20	0	303	1,069	0.01	0.00	20	0	0.07	0.05	465	461

Post-Retrofit Demand and Energy Consumption

Fixture ID	Lighting Demand and Energy Consumption (am) Connected kW	(an) FCM Diversified kW Summer	(ao) FCM Diversified kW Winter	(ap) Annual kWh	(aq) Peak kWh	Interactive Hours (ar) Cooling Hours	(as) Heating Hours	Interactive Energy Consumption (at) Cooling kWh	(au) Heating kWh	On-Peak Interactive Hours (av) Cooling Hours	(aw) Heating Hours	On-Peak Interactive Demand and Energy Consumption (ax) FCM Diversified kW Summer	(ay) FCM Diversified kW Winter	(az) Cooling kWh	(ba) Heating kWh	Lighting and Interactive Demand and Energy Consumption (bb) FCM Diversified kW Summer	(bc) FCM Diversified kW Winter	(bd) Annual kWh	(be) Peak kWh
351	0.36	0.09	0.07	667	662	306	1,077	30	0	303	1,069	0.02	0.00	30	0	0.11	0.07	697	692
352	0.28	0.07	0.05	522	519	306	1,077	24	0	303	1,069	0.01	0.00	23	0	0.09	0.05	546	542
353	0.65	0.65	0.65	5,676	2,613	1,208	2,325	214	0	812	1,582	0.15	0.00	144	0	0.80	0.65	5,890	2,756
354	2.00	0.52	0.39	3,701	3,675	306	1,077	167	0	303	1,069	0.10	0.00	165	0	0.62	0.39	3,868	3,840
355	1.00	0.26	0.19	1,852	1,839	306	1,077	83	0	303	1,069	0.05	0.00	83	0	0.31	0.19	1,936	1,922
356	0.11	0.03	0.02	270	218	500	1,284	15	0	404	1,108	0.00	0.00	12	0	0.03	0.02	285	230
357	0.78	0.18	0.12	1,948	1,577	500	1,284	106	0	404	1,108	0.03	0.00	86	0	0.22	0.12	2,055	1,663
358	0.18	0.07	0.01	267	244	293	771	14	0	287	755	0.02	0.00	14	0	0.09	0.01	281	258
359	0.35	0.14	0.01	521	477	293	771	28	0	287	755	0.03	0.00	28	0	0.17	0.01	549	505
360	1.23	0.47	0.05	1,824	1,670	293	771	98	0	287	755	0.11	0.00	97	0	0.59	0.05	1,923	1,767
361	0.19	0.07	0.01	278	255	293	771	15	0	287	755	0.02	0.00	15	0	0.09	0.01	293	270
362	0.12	0.00	0.00	7	7	8	28	0	0	8	28	0.00	0.00	0	0	0.00	0.00	7	7
363	0.18	0.00	0.00	10	10	8	28	0	0	8	28	0.00	0.00	0	0	0.00	0.00	10	10
364	0.12	0.05	0.00	178	163	293	771	10	0	287	755	0.01	0.00	9	0	0.06	0.00	187	172
365	0.43	0.17	0.02	640	586	293	771	35	0	287	755	0.04	0.00	34	0	0.21	0.02	674	620
366	0.18	0.04	0.00	245	241	253	799	12	0	249	788	0.01	0.00	12	0	0.05	0.00	257	253
367	0.12	0.03	0.00	167	165	253	799	8	0	249	788	0.01	0.00	8	0	0.03	0.00	175	173
368	0.32	0.08	0.00	451	444	253	799	22	0	249	788	0.02	0.00	22	0	0.09	0.00	473	466
369	0.11	0.11	0.11	946	435	1,208	2,325	36	0	812	1,582	0.03	0.00	24	0	0.13	0.11	982	459
370	0.24	0.00	0.00	13	13	8	28	1	0	8	28	0.00	0.00	1	0	0.00	0.00	14	14
371	0.09	0.00	0.00	5	5	8	28	0	0	8	28	0.00	0.00	0	0	0.00	0.00	5	5
372	0.19	0.03	0.00	245	244	196	771	10	0	195	771	0.01	0.00	10	0	0.04	0.00	255	254
373	0.24	0.04	0.00	312	312	196	771	13	0	195	771	0.01	0.00	13	0	0.05	0.00	325	325
374	0.29	0.05	0.00	375	374	196	771	15	0	195	771	0.01	0.00	15	0	0.06	0.00	390	390
375	0.12	0.02	0.00	156	156	196	771	6	0	195	771	0.00	0.00	6	0	0.02	0.00	163	162
376	0.14	0.02	0.00	187	187	196	771	8	0	195	771	0.00	0.00	8	0	0.03	0.00	195	195
377	0.18	0.03	0.00	229	229	196	771	9	0	195	771	0.01	0.00	9	0	0.04	0.00	238	238
378	0.18	0.03	0.00	229	229	196	771	9	0	195	771	0.01	0.00	9	0	0.04	0.00	238	238
379	0.04	0.00	0.00	2	2	8	28	0	0	8	28	0.00	0.00	0	0	0.00	0.00	2	2
380	0.06	0.00	0.00	3	3	8	28	0	0	8	28	0.00	0.00	0	0	0.00	0.00	3	3
381	0.14	0.14	0.14	1,191	548	1,208	2,325	45	0	812	1,582	0.03	0.00	30	0	0.17	0.14	1,236	578
382	0.25	0.25	0.25	2,208	1,016	1,208	2,325	83	0	812	1,582	0.06	0.00	56	0	0.31	0.25	2,291	1,072
383	0.24	0.24	0.24	2,102	968	1,208	2,325	79	0	812	1,582	0.06	0.00	53	0	0.30	0.24	2,182	1,021
384	0.72	0.72	0.72	6,307	2,903	1,208	2,325	237	0	812	1,582	0.17	0.00	160	0	0.89	0.72	6,545	3,063
385	0.86	0.22	0.17	1,600	1,589	306	1,077	72	0	303	1,069	0.04	0.00	71	0	0.27	0.17	1,673	1,660
386	0.72	0.08	0.19	420	420	69	282	13	0	69	282	0.02	0.00	13	0	0.10	0.19	434	434
387	0.00	0.00	0.00	0	0	156	574	0	0	151	562	0.00	0.00	0	0	0.00	0.00	0	0
388	0.00	0.00	0.00	0	0	306	1,077	0	0	303	1,069	0.00	0.00	0	0	0.00	0.00	0	0
Totals	202.38	44.03	38.64	356,815	285,288			10,922	0			6.97	0.00	9,818	0	51.00	38.64	367,737	295,106

Total Savings Summary

	Energy kWh	Summer kW	Winter kW	Connected kW
Annual Lighting Only	177,061	21.60	18.67	105.03
Annual Interactive	5,534	3.52	0.00	N/A
Annual Lighting and Interactive	182,595	25.12	18.67	105.03
On-Peak Lighting Only	141,938			
On-Peak Interactive	4,975			
On-Peak Lighting and Interactive	146,913			

	MMBTU
Annual Non-Electric Heating Savings	(263)

Savings Adjustment Factors

Parameter	Annual KWH	Difference %	Summer kW	Difference %	Winter kW	Difference %
Gross (TRACKING) Savings	184,492	N/A	19.16	N/A	4.80	N/A
Adjustment - Documentation Change	0	0%	0.00	0%	0.00	0%
Adjustment - Technology Change	21,698	12%	11.27	59%	11.27	235%
Adjustment - Quantity Change	-3,945	-2%	-2.05	-11%	-2.05	-43%
Adjustment - Operation Change	-25,184	-14%	N/A	N/A	N/A	N/A
Adjustment - Coincident Change	N/A	N/A	-6.79	-35%	4.65	97%
Adjustment - Heating Interaction	0	0%	N/A	N/A	0.00	0%
Adjustment - Cooling Interaction	5,534	3%	3.52	18%	N/A	N/A
Adjustment - TOTAL	-1,897	-1%	5.95	31%	13.87	289%
Adjusted Gross (ONSITE) Savings	182,595	99%	25.12	131%	18.67	389%

Table 54: Summary of On-Site Energy and Demand Savings

Hour Ending	Average kW Reduction
1	5.9
2	5.8
3	5.8
4	5.8
5	5.8
6	8.5
7	21.4
8	30.6
9	41.1
10	38.2
11	38.5
12	39.0
13	39.5
14	35.2
15	30.3
16	19.4
17	15.6
18	13.4
19	9.6
20	9.0
21	9.1
22	7.0
23	6.3
24	5.9

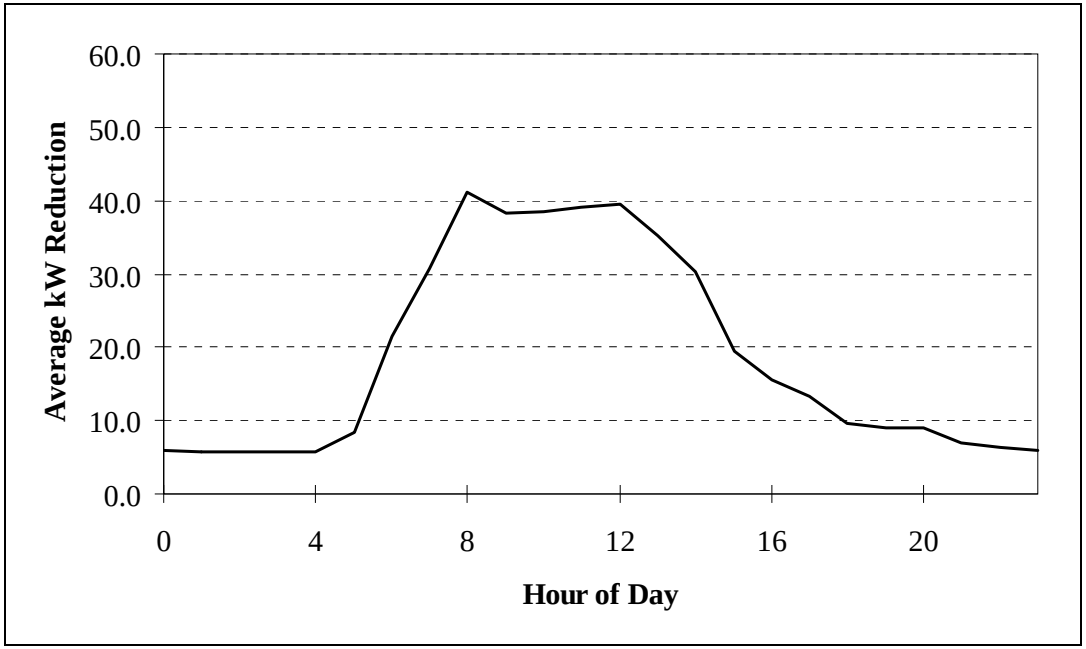

Table 55: Average Summer Weekday kW Reduction

Hour Ending	Average kW Reduction
1	5.8
2	5.8
3	5.8
4	5.8
5	5.8
6	8.9
7	23.8
8	41.5
9	64.1
10	61.5
11	62.5
12	62.5
13	61.8
14	57.6
15	55.5
16	35.0
17	26.7
18	21.7
19	15.7
20	14.2
21	12.8
22	6.9
23	5.9
24	5.8

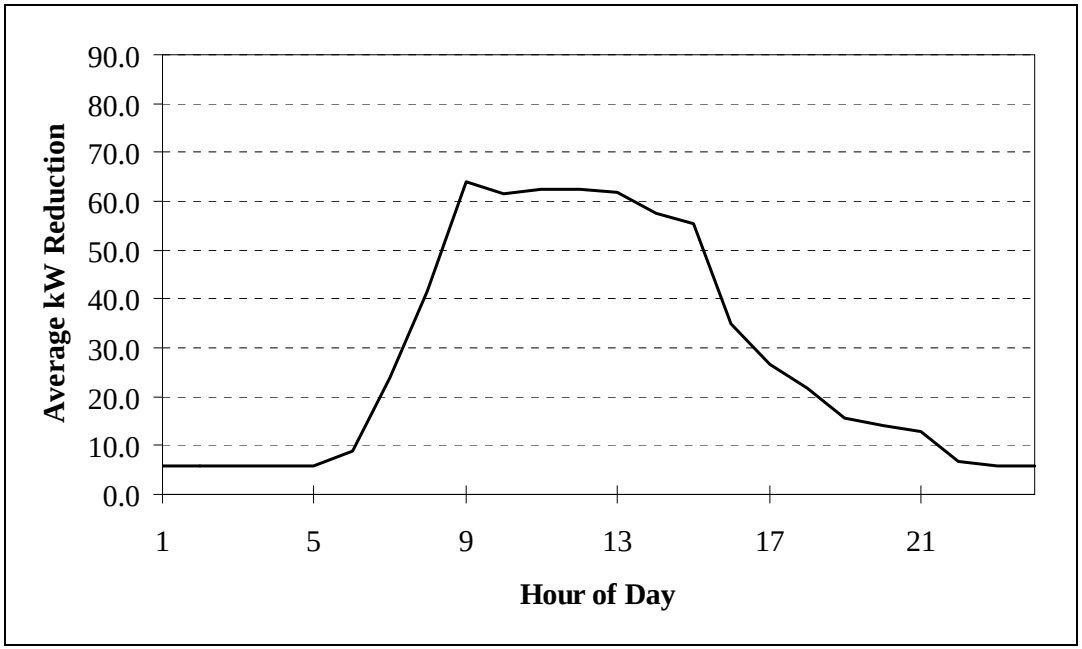

Table 56: Average Winter Weekday kW Reduction

Column Definitions for Lighting Calculations
(a) Brief description of area where lighting is installed

Pre-retrofit Lighting			Post-retrofit Lighting		
(b) Description of fixture type			(i) Description of fixture type		
(c) Fixture quantity from application documentation			(j) Fixture quantity from on-site inspection		
(d) Fixture wattage from application documentation			(k) Fixture wattage from application documentation		
(e) Annual hours of use	TMY2 Query	Eq. 1.1	(l) Annual hours of use	TMY2 Query	Eq. 1.1
(f) On-peak hours of use	TMY2 Query	Eq. 1.2	(m) On-peak hours of use	TMY2 Query	Eq. 1.2
(g) FCM Summer peak demand diversity factor	TMY2 Query	Eq. 1.3	(n) FCM Summer peak demand diversity factor	TMY2 Query	Eq. 1.3
(h) FCM Winter peak demand diversity factor	TMY2 Query	Eq. 1.4	(o) FCM Winter peak demand diversity factor	TMY2 Query	Eq. 1.4

HVAC Interaction Inputs	
(p) Electric cooling coefficient of performance	(r) Percent of space that is cooled
(q) Electric heating coefficient of performance	(s) Percent of space that is heated

Pre-retrofit Lighting Demand and Energy Consumption			Post-retrofit Lighting Demand and Energy Consumption		
(t) Connected lighting Demand	(t) = (c) x (d) / 1,000	Eq. 2.1	(am) Connected lighting Demand	(am) = (j) x (k) / 1,000	Eq. 3.1
(u) Summer diversified peak lighting demand (FCM)	(u) = (t) x (g)	Eq. 2.2	(an) Summer diversified peak lighting demand (FCM)	(an) = (am) x (n)	Eq. 3.2
(v) Winter diversified peak lighting demand (FCM)	(v) = (t) x (h)	Eq. 2.3	(ao) Winter diversified peak lighting demand (FCM)	(ao) = (am) x (o)	Eq. 3.3
(w) Annual energy consumption	(w) = (t) x (e)	Eq. 2.4	(ap) Annual energy consumption	(ap) = (am) x (l)	Eq. 3.4
(x) Annual On-peak energy consumption	(x) = (t) x (f)	Eq. 2.5	(aq) Annual On-peak energy consumption	(aq) = (am) x (m)	Eq. 3.5
(y) Annual cooling hours	TMY2 Qyery	Eq. 2.6	(ar) Annual cooling hours	TMY2 Query	Eq. 3.6
(z) Annual heating hours	TMY2 Qyery	Eq. 2.7	(as) Annual heating hours	TMY2 Query	Eq. 3.7
(aa) Electric cooling interactive energy effects	(aa) = (t) x (y) x (r) x 0.8 / (p)	Eq. 2.8	(at) Electric cooling interactive energy effects	(at) = (am) x (aq) x (r) x 0.8 / (p)	Eq. 3.8
(ab) Electric heating interactive energy effects	(ab) = -(t) x (z) x (s) x 0.8 / (q)	Eq. 2.9	(au) Electric heating interactive energy effects	(au) = -(am) x (as) x (s) x 0.8 / (q)	Eq. 3.9
(ac) Annual On-peak cooling hours	TMY2 Qyery	Eq. 2.10	(av) Annual On-peak cooling hours	TMY2 Query	Eq. 3.10
(ad) Annual On-peak heating hours	TMY2 Qyery	Eq. 2.11	(aw) Annual On-peak heating hours	TMY2 Query	Eq. 3.11
(ae) On-peak interactive cooling demand (FCM)	(ae) = (u) x (r) x 0.8 / (p)	Eq. 2.12	(ax) On-peak interactive cooling demand (FCM)	(ax) = (an) x (r) x 0.8 / (p)	Eq. 3.12
(af) On-peak interactive heating demand (FCM)	(af) = -(v) x (s) x 0.8 / (q)	Eq. 2.13	(ay) On-peak interactive heating demand (FCM)	(ay) = (ao) x (s) x 0.8 / (q)	Eq. 3.13
(ag) On-peak interactive electric cooling energy	(ag) = (t) x (ac) x (r) x 0.8 / (p)	Eq. 2.14	(az) On-peak interactive electric cooling energy	(az) = (am) x (av) x (r) x 0.8 / (p)	Eq. 3.14
(ah) On-peak interactive electric heating energy	(ah) = -(t) x (ad) x (s) x 0.8 / (q)	Eq. 2.15	(ba) On-peak interactive electric heating energy	(ba) = -(am) x (aw) x (s) x 0.8 / (q)	Eq. 3.15
(ai) Lighting and interactive summer demand (FCM)	(ai) = (u) + (ae)	Eq. 2.16	(bb) Lighting and interactive summer demand (FCM)	(bb) = (an) + (ax)	Eq. 3.16
(aj) Lighting and interactive winter demand (FCM)	(aj) = (v) + (af)	Eq. 2.17	(bc) Lighting and interactive winter demand (FCM)	(bc) = (ao) + (ay)	Eq. 3.17
(ak) Annual lighting and interactive energy consumption	(ak) = (w) + (aa) + (ab)	Eq. 2.18	(bd) Annual lighting and interactive energy consumption	(bd) = (ap) + (at) + (au)	Eq. 3.18
(al) Annual on-peak lighting and interactive energy consumption	(al) = (x) + (ag) + (ah)	Eq. 2.19	(be) Annual on-peak lighting and interactive energy consumption	(be) = (aq) + (az) + (ba)	Eq. 3.19

Total Savings Summary					
Annual Lighting Only Energy Consumption	Σ (w) - Σ (ap)	Eq. 4.1	Annual Lighting and Interactive Energy Consumption	Σ (ak) - Σ (bd)	Eq. 4.8
Annual Lighting Only Summer Demand (FCM)	Σ (u) - Σ (an)	Eq. 4.2	Annual Lighting and Interactive Summer Demand (FCM)	Σ (ai) - Σ (bb)	Eq. 4.9
Annual Lighting Only Winter Demand (FCM)	Σ (v) - Σ (ao)	Eq. 4.3	Annual Lighting and Interactive Winter Demand (FCM)	Σ (aj) - Σ (bc)	Eq. 4.10
Annual Lighting Only Connected Demand	Σ (t) - Σ (am)	Eq. 4.4	On-Peak Lighting Only Energy Consumption	Σ (x) - Σ (aq)	Eq. 4.11
Annual Interactive Energy Consumption	[Σ (aa) - Σ (at)] + [Σ (ab) - Σ (au)]	Eq. 4.5	On-Peak Interactive Energy Consumption	[Σ (ag) - Σ (az)] + [Σ (ah) - Σ (ba)]	Eq. 4.12
Annual Interactive Summer Demand (FCM)	Σ (ae) - Σ (ax)	Eq. 4.6			
Annual Interactive Winter Demand (FCM)	Σ (af) - Σ (ay)	Eq. 4.7			

Site 7, Application ID: 528318

Facility Type: Manufacturing

Summary

A lighting retrofit of a manufacturing facility was done to replace older inefficient lighting fixtures with new more efficient fixtures. Included in the retrofit are office and plant areas. A total of 398 older technology lighting fixtures were replaced with 398 new high efficiency fixtures. The existing fixtures included; (132) two lamp F96/T12 fixtures, (89) two lamp F40/T12 fixtures, (56) four lamp F40/T12 fixtures, (3) three lamp F40/T12 fixtures, (22) two lamp F32/T8 fixtures and (76) 400 watt metal halide fixtures. These fixtures were replaced by various size high efficiency T8 and T5 lamps and high efficiency ballasts. Also installed were lower wattage pulse start metal halides. Tracking documentation proposed occupancy sensors to be installed in offices and plant areas; however, no savings were calculated for occupancy sensors in the tracking estimate.

A count of fixtures taken during the on-site visit revealed that there were fewer fixtures installed than proposed in the tracking estimate. One reason for this was that one section of the facility was in the process of being shut down. Therefore, the site decided not to install (25) four lamp F32/T8 fixtures. This change was not reflected in the tracking savings estimate.

Table 57 presents the summary of the tracking and on-site savings results.

Savings Quantity	Tracking Estimate	On-site Savings	Evaluated/ Tracking
Annual Energy (kWh)	89,817	126,490	141%
% Energy Savings On-Peak	45%	63%	139%
Summer Peak Diversified kW	32.72	21.80	67%
Winter Peak Diversified kW	32.72	16.62	51%

Table 57: Summary of Tracking and On-site Savings Results

The overall on-site savings estimate is 41% higher than predicted in the tracking estimate. The on-site estimates of summer and winter peak diversified kW was lower than the tracking values. The following factors influenced the difference between the tracking and on-site estimates of energy and demand savings:

- The primary reason for the increase in savings was the increase in operating hours throughout the entire facility. The tracking estimate of savings estimated the weighted average of operating hours of all of the fixtures to be 2,604 hours per year. The monitoring data combined with discussions with facility personnel showed that the weighted average of operating hours was 3,572 hours per year prior to the installation of occupancy sensors. This increase in annual operating hours results in the annual savings being increased by 32,393 kWh per year.

- The operational adjustment would have been higher if one section of the facility, known as the Besser Area, had not been shut down. According to facility personnel, this area was shut down approximately six months after the installation of this lighting. The work that was performed in this area was moved out of state. There are no immediate plans to reopen the space, though the site indicated that in the next few years it was likely the space would be used again. Due to the uncertainty involving this section of the facility, the annual operating hours for this space were estimated to be 50% of the annual operating hours of another similar manufacturing space at this facility. Had this section not been shut down, evaluators estimate that there would have been additional energy savings of approximately 46,000 kWh per year based on the full operating hours of the similar space.

- The addition of occupancy sensors also contributed positively to the savings estimate. The tracking documentation stated that occupancy sensors were to be installed on each of the high bay T8 and T5 fixtures in the plant areas as well as throughout the offices. However, the tracking savings did not calculate any reduction associated with occupancy sensors. Evaluators identified the occupancy sensors and confirmed that the installation of these sensors was included in this project. The evaluation found that the occupancy sensors reduced the total operating hours of the controlled fixtures by 850 hours per year. This resulted in an increase in energy savings equal to 9,374 kWh per year.

- Evaluators also identified fewer fixtures during the facility walkthrough than proposed in the tracking analysis. The evaluation found 375 total fixtures installed in the facility compared to 398 fixtures proposed in the tracking analysis. The largest discrepancy was found to be in the aforementioned Besser Area where evaluators found (25) fewer four lamp F32/T8 fixtures. In the case where a space was found to have a different number of fixtures, evaluators also adjusted the baseline fixture quantity. If the space

was to have undergone a one-to-one replacement, evaluators adjusted the baseline fixture quantity to equal the installed fixture quantity. If the replacement was not one-to-one, evaluators adjusted the baseline quantity using the same percentage of installed fixtures that were missing. The decrease in the installed number of fixtures in this project resulted in a reduction in savings equal to 3,500 kWh per year.

- There was also a decrease in savings resulting from a technology adjustment. Specifically, evaluators found (6) six lamp F32/T8 high output fixtures installed in one area of the Besser plant instead of the (8) four lamp F32/Super T8 fixtures proposed in the tracking savings. It makes sense that the facility installed the six lamp fixtures because these were replacing two lamp F96/T12 high output fixtures in the plant. The four lamp F32/Super T8 fixtures are not a comparable replacement for this high bay application. The increase in installed wattage resulted in decrease in savings equal to 2,719 kWh per year.

- There was an increase in savings resulting from the interaction between the new lighting and the facility's HVAC systems. Only the office areas of this facility is air-conditioned using rooftop packaged DX units. The decrease in lighting wattage resulting from this efficiency measure results in less heat going into the air-conditioned space. Therefore, additional savings are realized from the reduced cooling requirements of the building. It is estimated that the added benefit is equal to 941 kWh per year.

- The on-peak kWh savings was estimated to be 63% of the annual on-site kWh savings. The tracking estimate for on-peak kWh savings was 45%. The on-peak period defined by National Grid is non-holiday weekdays between 6 am and 10 pm. The reason for the difference in on-peak kWh estimates is because almost all of the energy savings associated with the offices occurs during the on-peak period while approximately 55% of the manufacturing area energy savings occurs during the on-peak period.

- The summer diversified kW reduction was 21.80 kW or 33% lower than predicted in the tracking estimate. The reason for this decrease is that the tracking savings estimated all of the lights to operate 100% of the time during the summer peak hours of 1 pm to 5 pm. The monitoring data shows that the weighted average winter diversity factor is approximately 60%. This is primarily associated with the shutdown of the Besser plant. The winter diversified kW reduction was 16.62 kW or 49% lower than the tracking estimate. The reason for this decrease is that the tracking savings estimated the lights

to operate 100% of the time during the winter peak hours of 5 pm to 7 pm. The monitoring data shows that the weighted average winter diversity factor is approximately 48%. In addition to the Besser area being shutdown, most of the offices are unoccupied during these hours.

Project Description

This project was completed under the Energy Initiative program. Table 58 presents a summary of the existing system as outlined in the customer application.

Existing Case				
Space	**Fixture Type**	**Wattage**	**Quantity**	**Annual Hours**
Besser Area	400 Watt Metal Halide	455	33	2,600
Besser Area	Two Lamp F96/T12/HO	257	8	2,600
Besser Area	Two Lamp F96/T12	173	122	2,600
Besser Area	Four Lamp F40/T12	160	6	2,600
Drying Ports	400 Watt Metal Halide	455	15	2,600
Exit Signs	40 Watt Incandescent	40	20	8,760
New Paver Plant	400 Watt Metal Halide	455	22	2,600
Office Area	Two Lamp F40/T12	80	88	2,600
Office Area	Three Lamp F40/T12	130	3	2,600
Office Area	Four Lamp F40/T12	160	12	2,600
Office Area/Storage	Two Lamp F96/T12	173	2	2,600
Old Dispatch Office	Two Lamp F40/T12	80	1	2,600
Old Dispatch Office	Four Lamp F40/T12	160	16	2,600
Paver Plant	400 Watt Metal Halide	455	6	2,600
Paver Plant	Two Lamp F32/T8	60	22	2,600
Paver Plant	Four Lamp F40/T12	160	4	2,600
Tumbler Building	Four Lamp F40/T12	160	18	2,600
	Total	76,678	398	N/A

Table 58: Existing Lighting System

Table 59 presents the installed fixtures and quantities as proposed in the customer application.

Installed Case				
Space	**Fixture Type**	**Wattage**	**Quantity**	**Annual Hours**
Besser Area	Four Lamp F32/Super T8	89	14	2,600
Besser Area	Four Lamp F32/Super T8	89	8	2,600
Besser Area	Four Lamp F32/LP	103	114	2,600
Besser Area	Six lamp F32/T8/HO	220	33	2,600
Drying Ports	320 Watt Metal Halide	345	15	2,600
Exit Signs	1.5 Watt LED Exit Sign	1.5	20	8,760
New Paver Plant	Five Lamp F54/T5/HO	292	22	2,600
Office Area	Two Lamp F32/Super T8	47	88	2,600
Office Area	Three Lamp F32/Super T8	67	3	2,600
Office Area	Four Lamp F32/Super T8	89	12	2,600
Office Area/Storage	Four Lamp F32/Super T8	89	2	2,600
Old Dispatch Office	Two Lamp F32/Super T8	47	1	2,600
Old Dispatch Office	Four Lamp F32/Super T8	89	16	2,600
Paver Plant	Two Lamp F32/Super T8	47	22	2,600
Paver Plant	Four Lamp F32/Super T8	89	4	2,600
Paver Plant	Six lamp F32/T8/HO	220	6	2,600
Tumbler Building	Four Lamp F32/Super T8	89	18	2,600
	Total	43,957	398	N/A

Table 59: Installed Lighting System

Evaluation Methodology

Tracking Estimates

The tracking estimates of energy use were calculated based on the full wattage of the existing and proposed fixtures. The tracking savings assumed an average of 2,604 hours of operation per year for all of the affected fixtures. Though occupancy sensors were installed as part of this measure, energy savings were not calculated for them in the tracking analysis.

Evaluation Approach

The evaluation included a verification of installed fixtures, on-site monitoring and interview. All fixtures are controlled by wall switches, occupancy sensors and circuit breakers. All of the private offices including the conference room had occupancy sensors installed as well as the high bay T8 and T5 lighting in the plant areas.

The base case used in the evaluation of the lighting savings was developed from information contained in the customer application. The pre-existing fixture types were confirmed while on-site with the facility contact. Evaluators visited the facility to verify the installed fixtures and install monitoring equipment to quantify the hours of use of the different spaces. Evaluators surveyed facility personnel to obtain information on the lighting usage throughout the year. They also inquired about any HVAC equipment serving the space.

To determine the hours of use for the new fixtures, field evaluators installed (15) time-of-use (TOU) lighting loggers throughout the facility. In addition, evaluators installed two power loggers in the two paver plant lighting panels to record the operation of all the high bay lighting. Table 60 presents the fixtures monitored by the evaluation engineers.

Logger #	Equipment Monitored	Parameter Measured	Test Equip. Make & Model	Measurement Type	Installation Method	Frequency of Observations	Monitoring Duration
940824-067	Locker Room, 2F32/Super T8	On/Off Operation	PS&T TOU Lighting Logger	Event Logger	Proximity	Based on Schedule	3/25/09 - 4/29/09
940824-069	Electric/Control Rm 2F32/Super T8	On/Off Operation	PS&T TOU Lighting Logger	Event Logger	Proximity	Based on Schedule	3/25/09 - 4/29/09
940824-070	Lunchroom/kitchen 4F32/Super T8	On/Off Operation	PS&T TOU Lighting Logger	Event Logger	Proximity	Based on Schedule	3/25/09 - 4/29/09
940824-071	Private Office 2F32/Super T8	On/Off Operation	PS&T TOU Lighting Logger	Event Logger	Proximity	Based on Schedule	3/25/09 - 4/29/09
940824-114	Paver Plant, Control 2F32/Super T8	On/Off Operation	PS&T TOU Lighting Logger	Event Logger	Proximity	Based on Schedule	3/25/09 - 4/29/09
940824-121	Drying Ports, 320 Watt MH	On/Off Operation	PS&T TOU Lighting Logger	Event Logger	Proximity	Based on Schedule	3/25/09 - 4/29/09
940824-141	Old Dispatch Office, 4F32/Super T8	On/Off Operation	PS&T TOU Lighting Logger	Event Logger	Proximity	Based on Schedule	3/25/09 - 4/29/09
940824-147	Private Office 2F32/Super T8	On/Off Operation	PS&T TOU Lighting Logger	Event Logger	Proximity	Based on Schedule	3/25/09 - 4/29/09
940824-151	Printer room 4F32/Super T8	On/Off Operation	PS&T TOU Lighting Logger	Event Logger	Proximity	Based on Schedule	3/25/09 - 4/29/09
940824-179	Conference room 4F32/Super T8	On/Off Operation	PS&T TOU Lighting Logger	Event Logger	Proximity	Based on Schedule	3/25/09 - 4/29/09
940824-197	Garage 4F32/Super T8	On/Off Operation	PS&T TOU Lighting Logger	Event Logger	Proximity	Based on Schedule	3/25/09 - 4/29/09
940824-207	Bathroom 2F32/Super T8	On/Off Operation	PS&T TOU Lighting Logger	Event Logger	Proximity	Based on Schedule	3/25/09 - 4/29/09
940824-214	Shed 3F32/Super T8	On/Off Operation	PS&T TOU Lighting Logger	Event Logger	Proximity	Based on Schedule	3/25/09 - 4/29/09
940824-246	Main hallway 2F32/Super T8	On/Off Operation	PS&T TOU Lighting Logger	Event Logger	Proximity	Based on Schedule	3/25/09 - 4/29/09
940824-257	Lobby 4F32/Super T8	On/Off Operation	PS&T TOU Lighting Logger	Event Logger	Proximity	Based on Schedule	3/25/09 - 4/29/09
E6686	Paver Plant High Bay 6F32/T8/HO	Volts, Amps, kW	Dent Instruments ElitePRO Power	Power Logger	Clamp-On CT and Voltage	15 Minute	3/25/09 - 4/29/09
E7B24	New Paver Plant High Bay 5F54/T5	Volts, Amps, kW	Dent Instruments ElitePRO Power	Power Logger	Clamp-On CT and Voltage	15 Minute	3/25/09 - 4/29/09

Table 60: Spaces Monitored

Verification of Equipment and Operating Parameters

This project included retrofitting specific areas of a larger facility to replace older inefficient lighting fixtures with new more efficient fixtures. Included in the retrofit are some plant areas as well as two different office areas. The existing fixtures included metal halide fixtures, incandescent fixtures as well as T12 and T8 fluorescent fixtures. These fixtures were replaced by various size high efficiency T8/T5 lamps and ballasts and lower wattage metal halides.

Also included in this project were occupancy sensors that were installed on the high bay lighting in the manufacturing areas as well as the private offices and conference rooms. All of the high bay lighting in the paver plants had occupancy sensors installed on each fixture. This included the (6) six lamp F32/T8 high output fixtures in the paver plant. These occupancy sensors were installed to control four of the six lamps during the facilities operating hours. The remaining two lamps are switched and are turned on and off manually. Likewise, the (22) five lamp F54/T5 fixtures identified in the new paver plant each had an occupancy sensor that controlled three of the five lamps. Occupancy sensors were installed on approximately 27% of the total connected wattage.

Evaluators found that the quantities and fixture types differed from those that were proposed in the tracking savings estimate. The largest discrepancy was the (25) four lamp F32/T8 fixtures that were not installed in the Besser area. This resulted in zero savings for these fixtures because the existing fixtures were still in place. Additionally, evaluators found two more four lamp F32/T8 fixtures in another area of the facility for a net difference of (23) four lamp F32/T8 fixtures. Evaluators also found four more two lamp F32/T8 fixtures, two less six lamp F32/T8 high output fixtures and one less 320 watt metal halide fixture. These discrepancies were found in spaces that were part of a one-to-one replacement according to the tracking savings. Therefore, evaluators adjusted the baseline quantity for these spaces based on a one-to-one replacement. The quantity discrepancies resulted in a 4% reduction in energy savings. Table 61 presents the comparison between the tracking and evaluation fixture counts.

Fixture Type	Fixture Quantity	
	Tracking	Evaluation
Three Lamp F32/Super T8	3	3
Two Lamp F32/Super T8	111	115
Four Lamp F32/Super T8	66	52
Six lamp F32/T8/HO	47	45
Five Lamp F54/T5/HO	22	22
Four Lamp F32/LP	114	105
320 Watt Metal Halide	15	14
1.5 Watt LED Exit Sign	20	20
Total	**398**	**376**

Table 61: Tracking vs. Evaluation Fixture Quantities

Evaluators interviewed facility personnel to determine the general occupancy schedule for the entire year. This facility is separated by office and manufacturing space. The office areas typically operate Monday through Friday between 7 am and 5 pm. The manufacturing areas typically operate three shifts between Monday and Friday. The facility observes eight holidays including New Year's Day, Washington's Birthday, Memorial Day, Independence Day, Labor Day, Thanksgiving (Thursday and Friday) and Christmas Day. During holidays, the facility is closed and remains unoccupied. The monitoring period did not include any site holidays. Evaluators assumed the holidays would operate similar to a typical Sunday because the facility is also closed on Sundays.

Table 62 presents the values obtained from the monitored data including annual operation, summer and winter diversity factors, and on-peak hours of use.

Schedule 16 represents the average private office schedule. Evaluators monitored two similar private offices (Schedules 4 and 8) with occupancy sensors. Schedule 16 was created by taking the average of Schedules 4 and 8. This schedule was applied to the installed case for all the main office private offices. Schedule 17 was created to represent the baseline hours of use for the main office private offices. To estimate the baseline hours of use for these fixtures, evaluators assumed that the lights in these private offices would operate during the same hours that were monitored. Evaluators assumed the lights would operate 90% of the time during these hours if the logger data showed more than 10% usage. Otherwise, evaluators assumed the lights operate the same amount of time as was monitored.

Schedule 18 represents the baseline operation of the conference room. The conference room also had an occupancy sensor installed as part of this project. To estimate the baseline hours of use for these fixtures, evaluators assumed that the lights in this conference room (Schedule 10) would operate during the same hours that were monitored, but they would operate 90% of the time between these hours if the logger data showed more than 10% usage, similar to the private offices.

Evaluators created Schedule 19 to represent the annual operation of the lighting that was installed in the Besser areas. As mentioned previously, this area had been shut down shortly after the lighting was installed. Facility staff stated that there are no immediate plans to open this space back up for manufacturing. An account manager for National Grid inquired with the facility as to the future plans of this space. It was determined that it is likely that this space will reopen in a few years. Evaluators assumed that this space would operate approximately 50% of the time over the life of this measure. Evaluators utilized the lighting logger data from the Paver plant (Schedule 5), which is a similar space, and multiplied it by 50% to account for the reduction in usage in the Besser areas. This adjusted schedule (Schedule 19) was used for all of the fixtures in the Besser areas that are currently not being utilized.

Schedule 24 was manually generated to represent the operation of the maintenance space inside the Besser area. According to facility personnel, this space is occupied Monday through Friday between 3 am and 5 pm and Saturdays between 3 am and 11 am. This schedule was applied to the (22) four lamp F32/T8 fixtures in the maintenance shop.

Schedules 20 and 21 were created using monitored data from the power logger (E6686) installed in the lighting panel for the paver plant. This logger was installed on one circuit that contained all (6) six lamp F32/T8 high output fixtures with occupancy sensors. Since evaluators were able to monitor all six fixtures on one channel, the post-installation operating hours were simply estimated by dividing the 15 minute interval kW data by the maximum recorded power to determine the percent operation of the high bay fixtures. The data were then annualized by averaging the data by day of week and by hour and creating an 8,760 hour annual profile. The annualized data are presented as Schedule 20. Since each fixture had its own occupancy sensor installed on it to control four of the six lamps, evaluators estimated the baseline operation of these fixtures in the same manner as Schedules 17 and 18 above. Schedule 21 was created by assuming these lights would have operated 100% of the time during the time that the power logger showed any operation.

Schedules 22 and 23 were created using monitored data from the power logger (E7B24) installed in the lighting panel for the new paver plant. This logger was installed on four circuits that contained all (22) five lamp F54/T5 high output fixtures with occupancy sensors. Since evaluators were able to monitor all of these fixtures, the post-installation operating hours were simply estimated by dividing the 15 minute interval kW data by the maximum recorded power to determine the percent operation of the high bay fixtures for each channel. Evaluators then averaged the four channels of data into one weighted average operating schedule. This operating schedule was weighted based on the number of fixtures on each channel. Channels 1 through 4 contained 9, 1, 5 and 7 fixtures, respectively. The data were then annualized by averaging the data by day of week and by hour and creating an 8,760 hour annual profile. The annualized data are presented as Schedule 22. Since each fixture had its own occupancy sensor installed on it to control three of the five lamps, evaluators estimated the baseline operation of these fixtures in the same manner as Schedule 21 above. Schedule 23 was created by assuming these lights would have operated 100% of the time during the time that the power logger showed any operation.

Schedule ID	Logger #	Description	Annual Hours	Summer Diversity	Winter Diversity	On-Peak Hours
1	940824-067	Paver Plant, Locker Room	7,406	100%	99%	4,003
2	940824-069	Paver Plant, Electric/Control room	859	12%	13%	543
3	940824-070	Main Offices, Lunchroom/kitchen	1,448	47%	17%	1,273
4	940824-071	Main Offices, Office	542	18%	3%	482
5	940824-114	Paver Plant, Control floor	6,482	100%	98%	3,984
6	940824-121	Drying Ports, Inside of paver plant	268	0%	0%	6
7	940824-141	Old Dispatch Office, Office	855	11%	0%	772
8	940824-147	Main Offices, Office in rear	198	5%	5%	177
9	940824-151	Old Dispatch Office, Printer room	4,541	99%	64%	3,422
10	940824-179	Main Offices, Conference room	1,701	53%	16%	1,577
11	940824-197	Old Dispatch Office, Garage	8,760	100%	100%	4,032
12	940824-207	Old Dispatch Office, Bathroom	3,220	45%	22%	1,719
13	940824-214	Shed	6,132	87%	80%	3,131
14	940824-246	Main Offices, Main hallway	2,840	99%	31%	2,687
15	940824-257	Old Dispatch Office, Lobby	3,289	83%	38%	2,898
16	NA	Average Main Office, Private Office (OS)	370	12%	4%	330
17	NA	Average Main Office, Private Office (Base)	1,064	33%	4%	1,019
18	NA	Conference Room (Base)	2,549	87%	16%	2,274
19	NA	Assumed Besser Area Operation	3,241	50%	49%	1,992
20	E6686	Paver Plant High Bay T8 (OS)	4,382	62%	57%	2,692
21	NA	Paver Plant High Bay T8 (Base)	6,630	100%	100%	4,017
22	E7B24	New Paver Plant High Bay T5 (OS)	5,972	94%	95%	3,804
23	NA	New Paver Plant High Bay T5 (Base)	6,603	100%	100%	4,016
24	NA	Assumed Besser Maintenance Shop	3,562	90%	0%	2,485

Table 62: Annual Hours of Use and Diversity Factors of Monitored Data

To estimate annual energy and demand savings, a spreadsheet method was employed. The summary of this spreadsheet is presented in Table 63. Annual hours and diversity factors from Table 62 are used with wattages from Table 63 to calculate energy and demand savings. The schedule ID's from Table 62 are presented in Table 63 to show which schedule was used with each fixture ID. The final on-site savings estimates are presented in Table 63.

The facility's heat is provided by natural gas which has no electrical interaction with the new lighting. However, because of the reduced heat going into the space due to the installation of more efficient lighting, there will be a need for additional heat from the facility's forced air system. It was estimated that this heating penalty is equal to approximately 127 MMBTU's per year. This was calculated using a heating efficiency of 74% for a forced air system. This estimate for efficiency is an assumption based on a standard efficiency for a forced air system. Likewise, the offices are air-conditioned using several rooftop packaged DX units. Evaluators calculated additional energy savings resulting from reduced cooling loads on the system. Evaluators assumed an efficiency rating of 1.2 kW/ton for the packaged DX units. The efficiency used is assumed to be the standard efficiency this type of air-conditioning systems.

The average daily lighting profiles for the all the monitored spaces are presented in Figure 88 through Figure 111. This includes the average weekday, weekend day and holiday. The x-axis represents one full day and the y-axis is the percentage that the lights are on for each hour.

An hourly summary of the site kW savings for an average summer (June through August), non-holiday, weekday is presented in Table 64. This summary is provided so that the summer diversified peak kW can be estimated across any range of hours in the event that the FCM definition for summer peak changes in the future. The same summary was also provided for the average winter (December and January), non-holiday, weekday in Table 65.

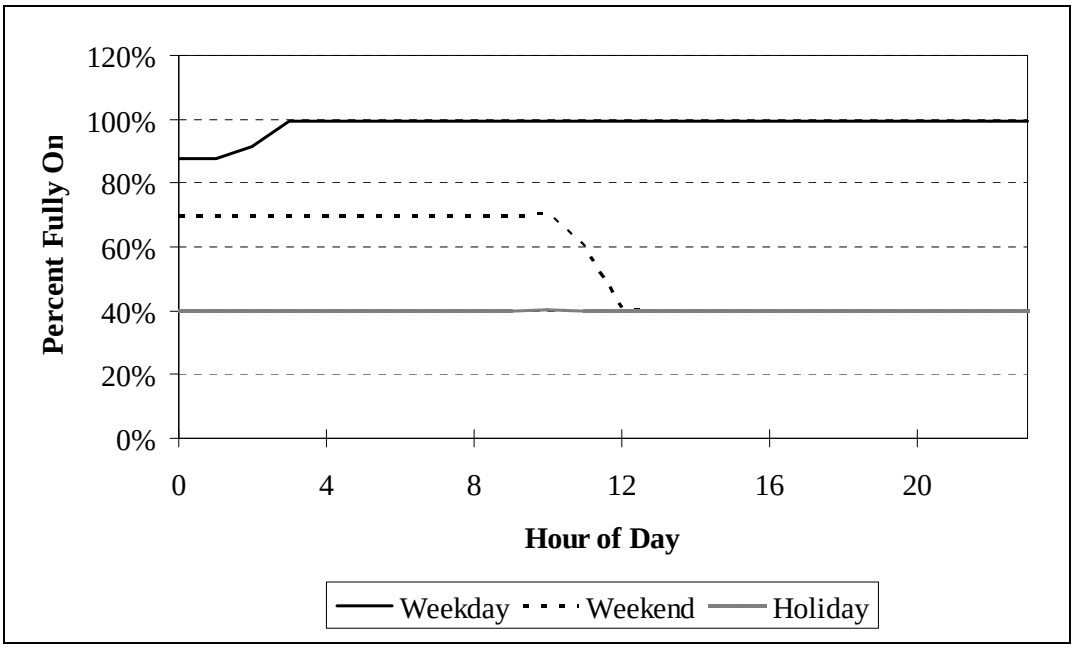

Figure 88: Average Daily Lighting Profile for Schedule 1 (Locker Room) from 3/25/09 to 4/29/09

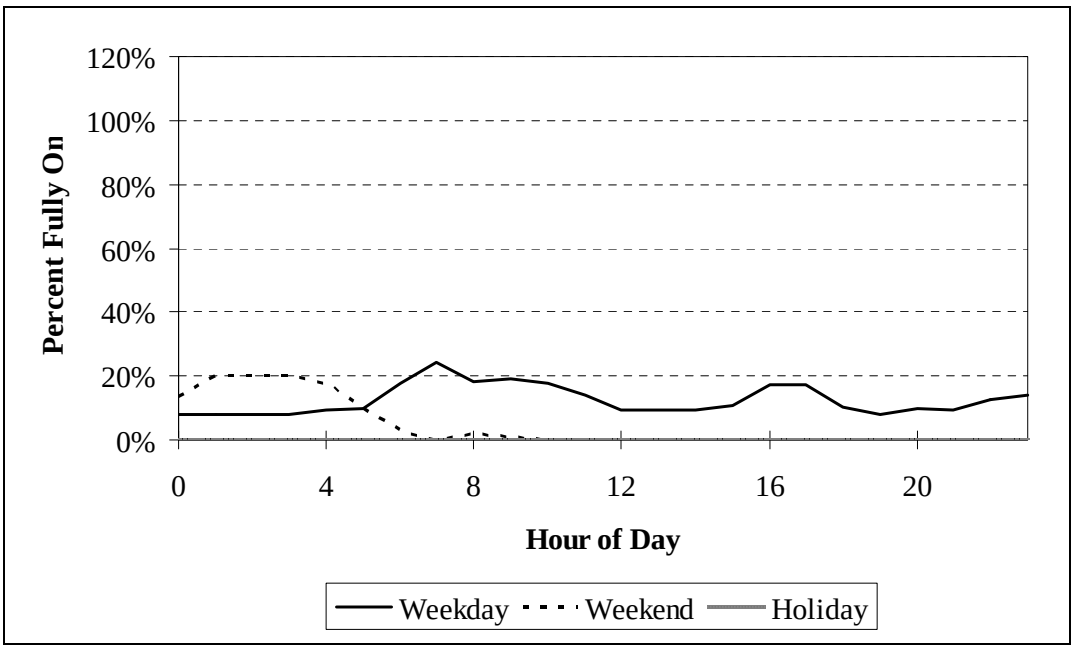

Figure 89: Average Daily Profile for Schedule 2 (Electric Room) from 3/25/09 to 4/29/09

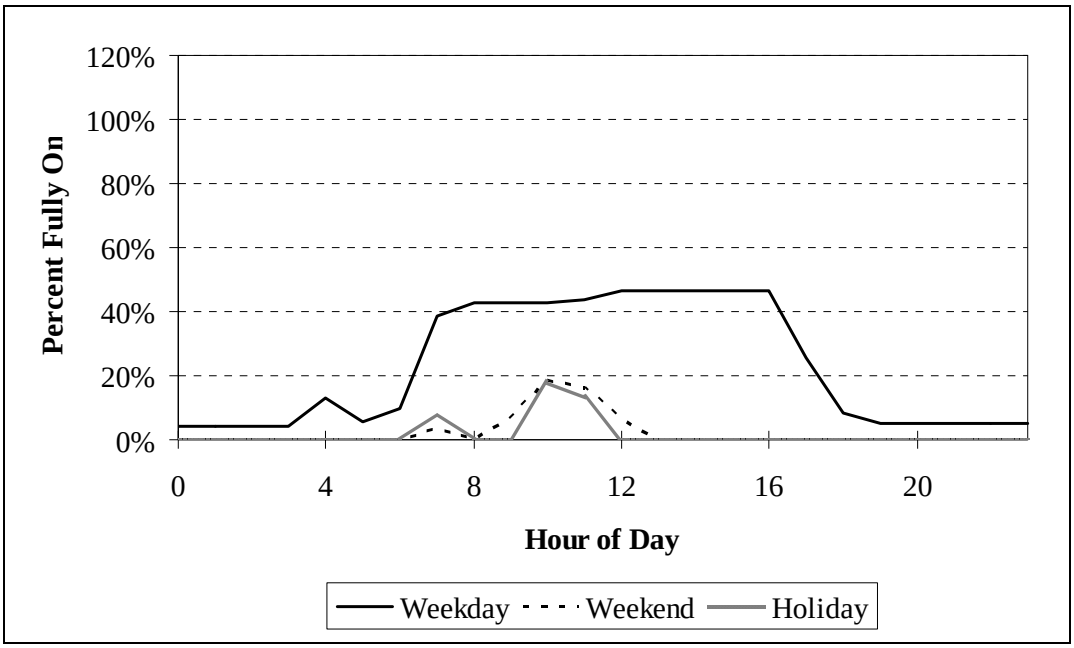

Figure 90: Average Daily Lighting Profile for Schedule 3 (Lunch/Kitchen) from 3/25/09 to 4/29/09

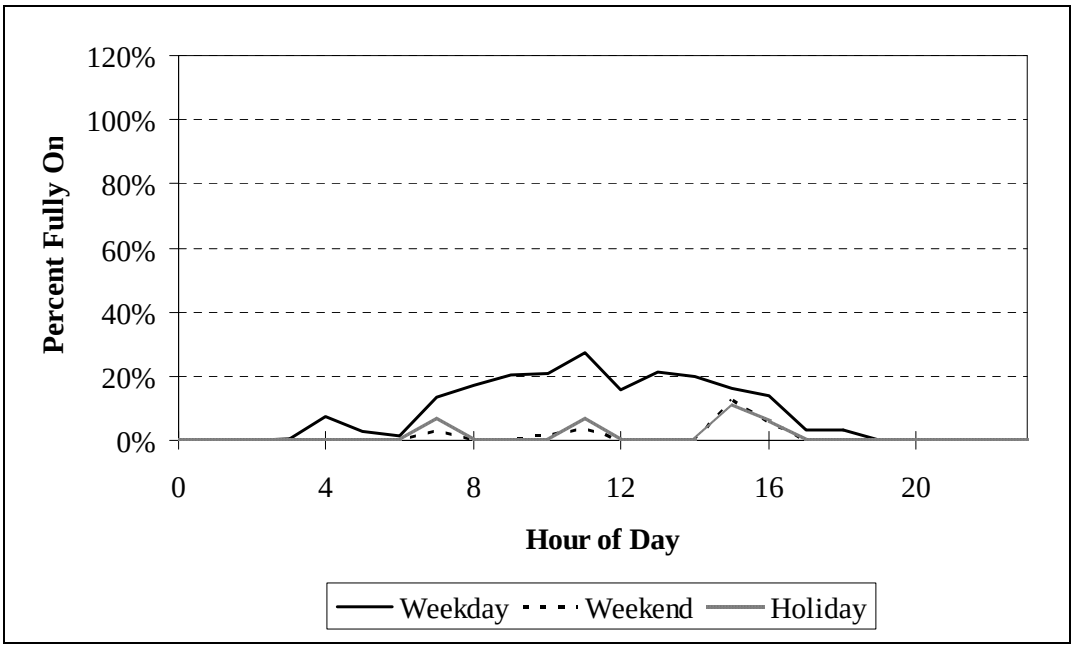

Figure 91: Average Daily Lighting Profile for Schedule 4 (Private Office w/OS) from 3/25/09 to 4/29/09

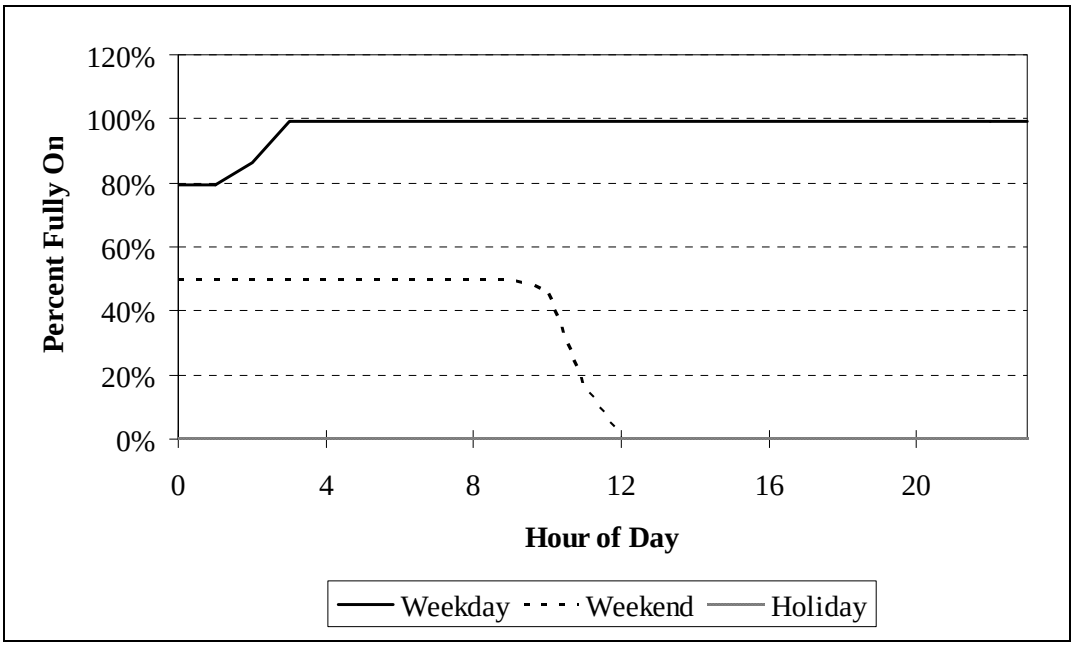

Figure 92: Average Daily Lighting Profile for Schedule 5 (Paver Plant Control Rm) from 3/25/09 to 4/29/09

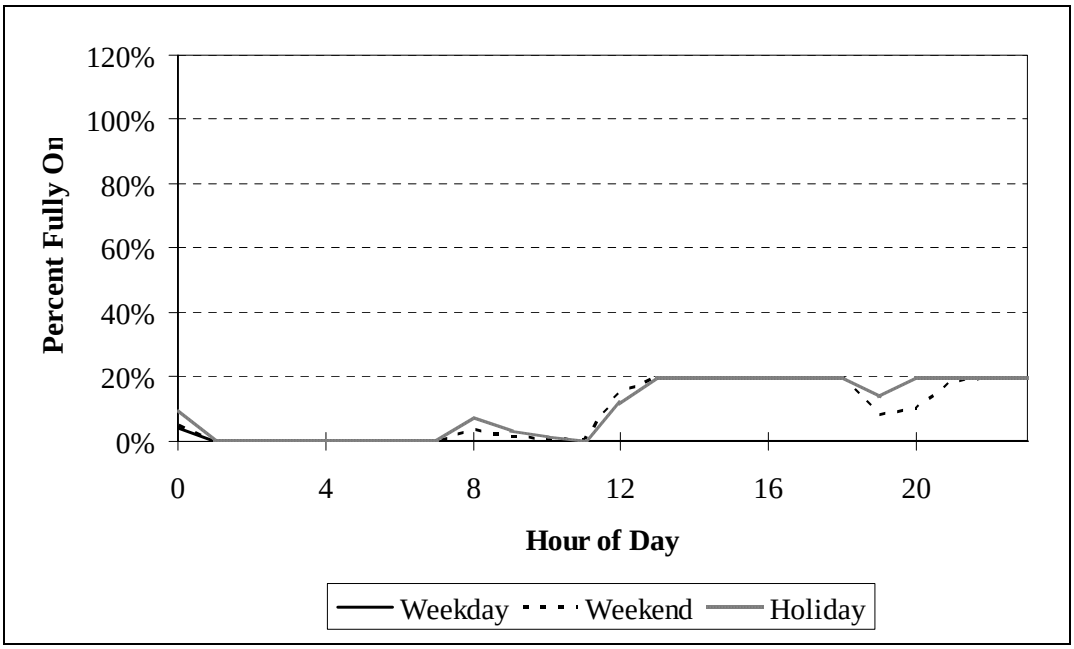

Figure 93: Average Daily Lighting Profile for Schedule 6 (Drying Ports) from 3/25/09 to 4/29/09

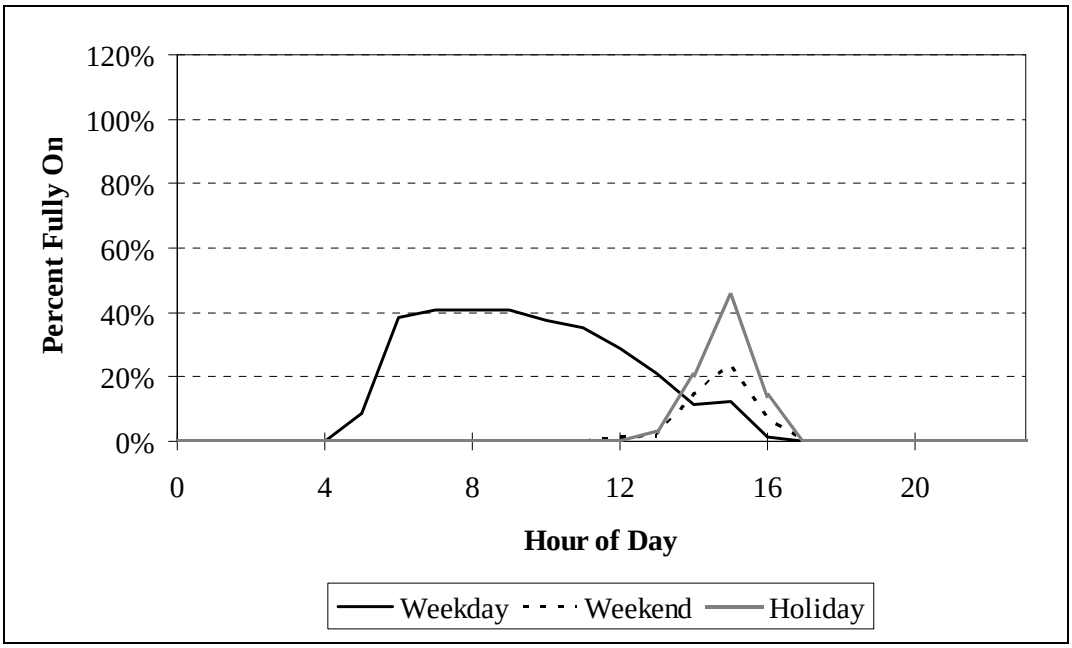

Figure 94: Average Daily Lighting Profile for Schedule 7 (Old Dispatch Office) from 3/25/09 to 4/29/09

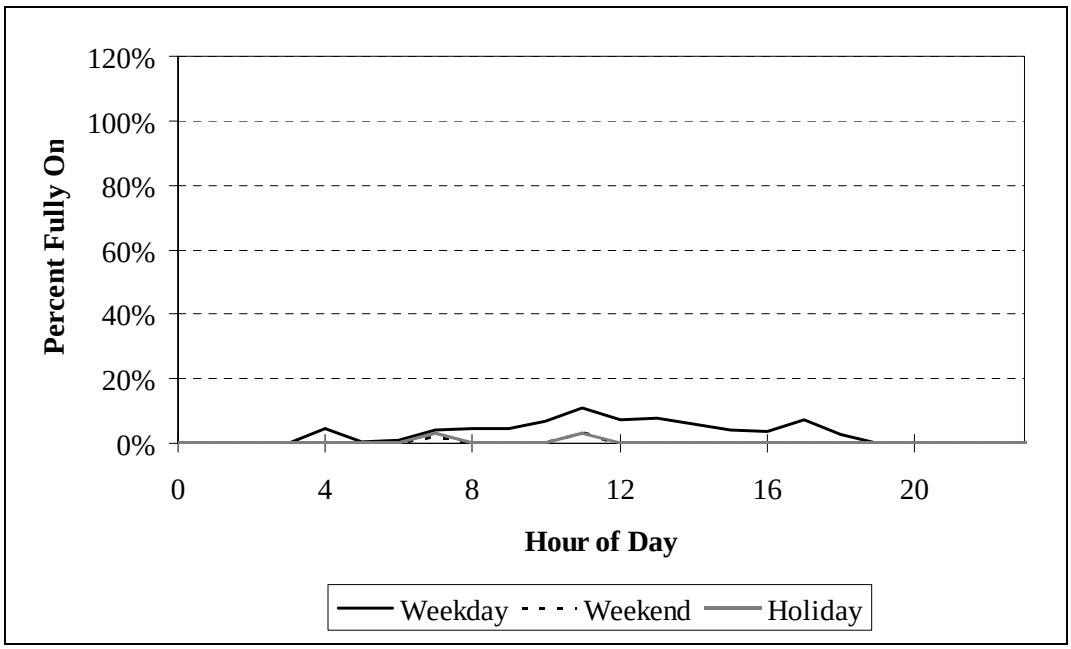

Figure 95: Average Daily Lighting Profile for Schedule 8 (Private Office w/ OS) from 3/25/09 to 4/29/09

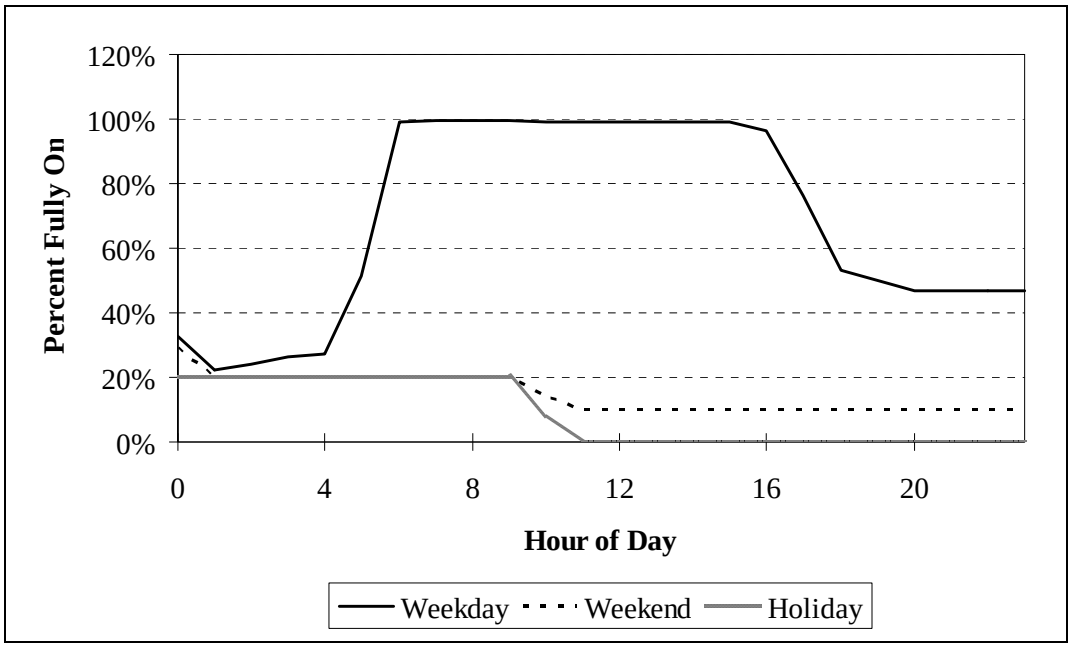

Figure 96: Average Daily Lighting Profile for Schedule 9 (Printer Room) from 3/25/09 to 4/29/09

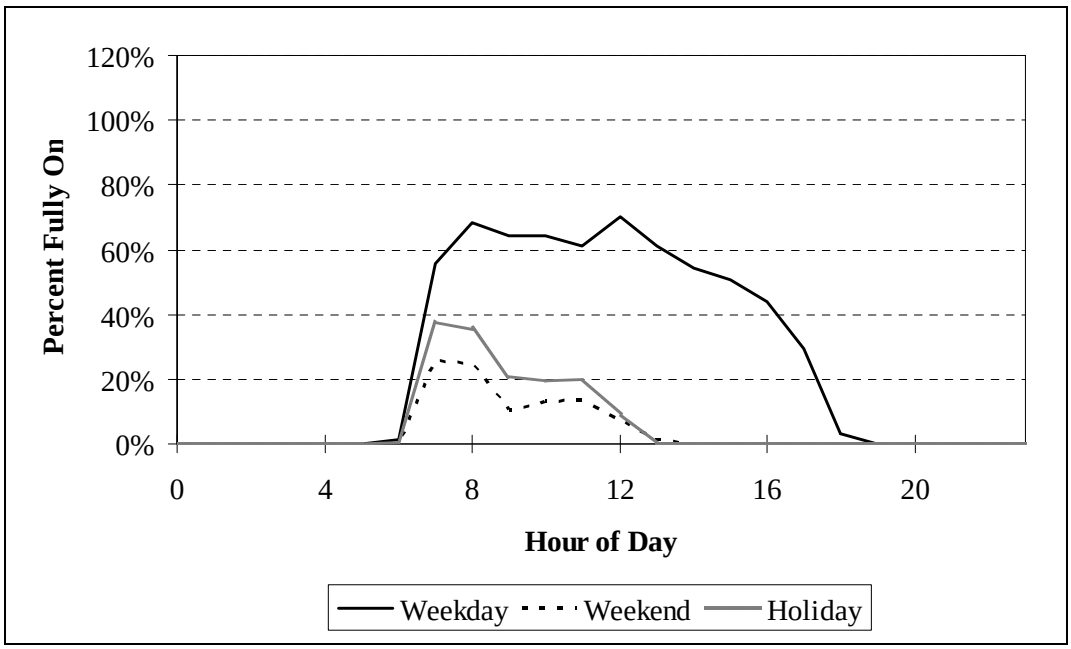

Figure 97: Average Daily Lighting Profile for Schedule 10 (Conference Room w/ OS) from 3/25/09 to 4/29/09

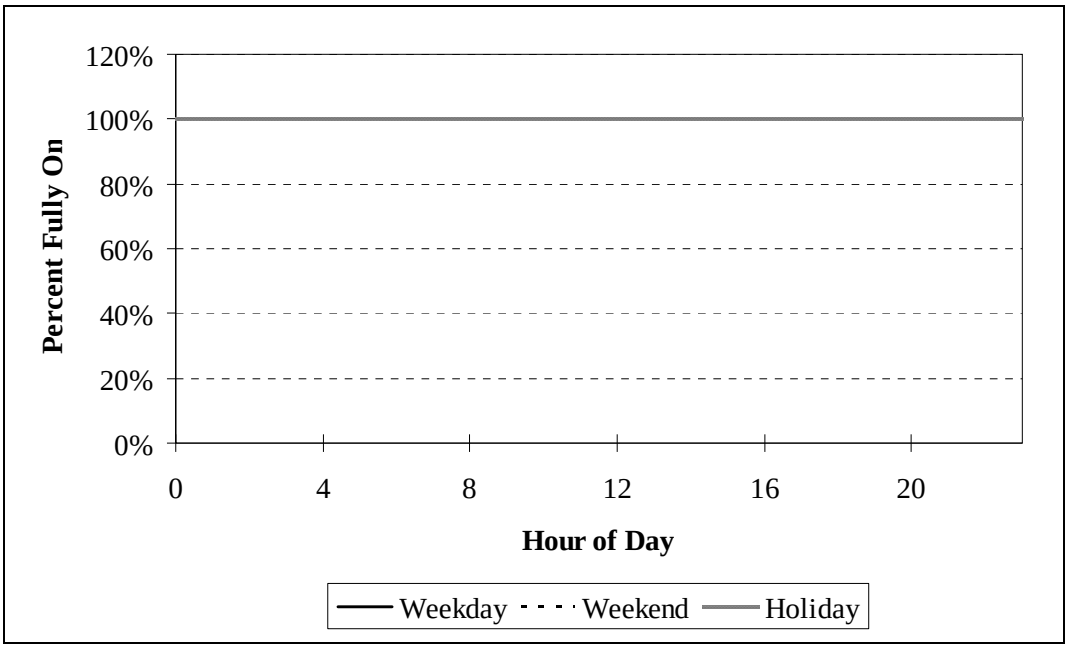

Figure 98: Average Daily Lighting Profile for Schedule 11 (Garage) from 3/25/09 to 4/29/09

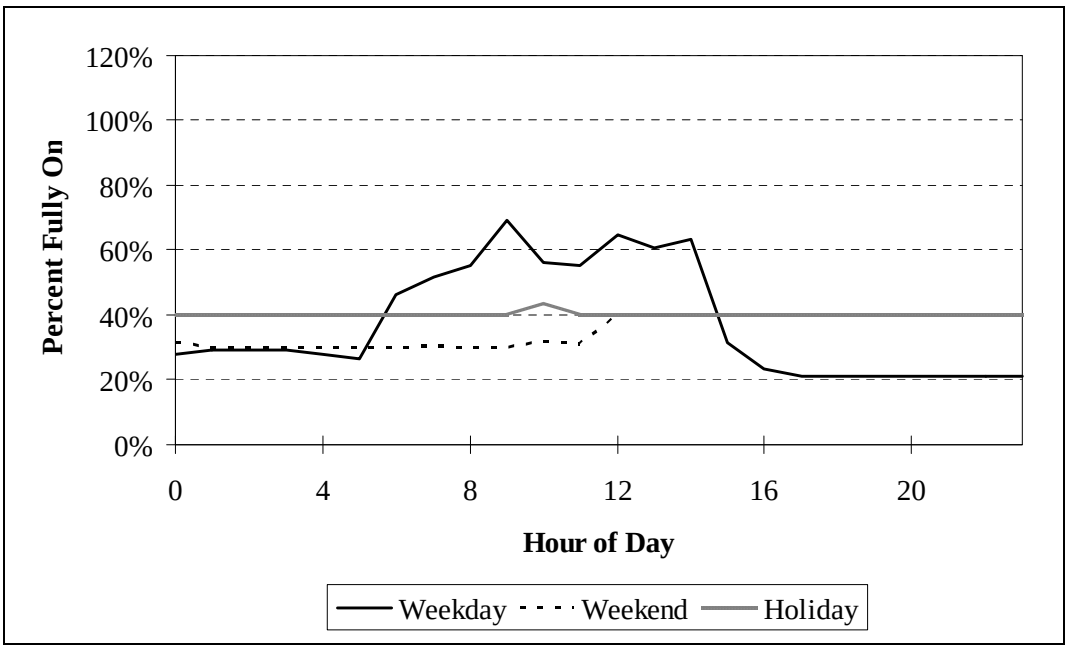

Figure 99: Average Daily Lighting Profile for Schedule 12 (Restroom) from 3/25/09 to 4/29/09

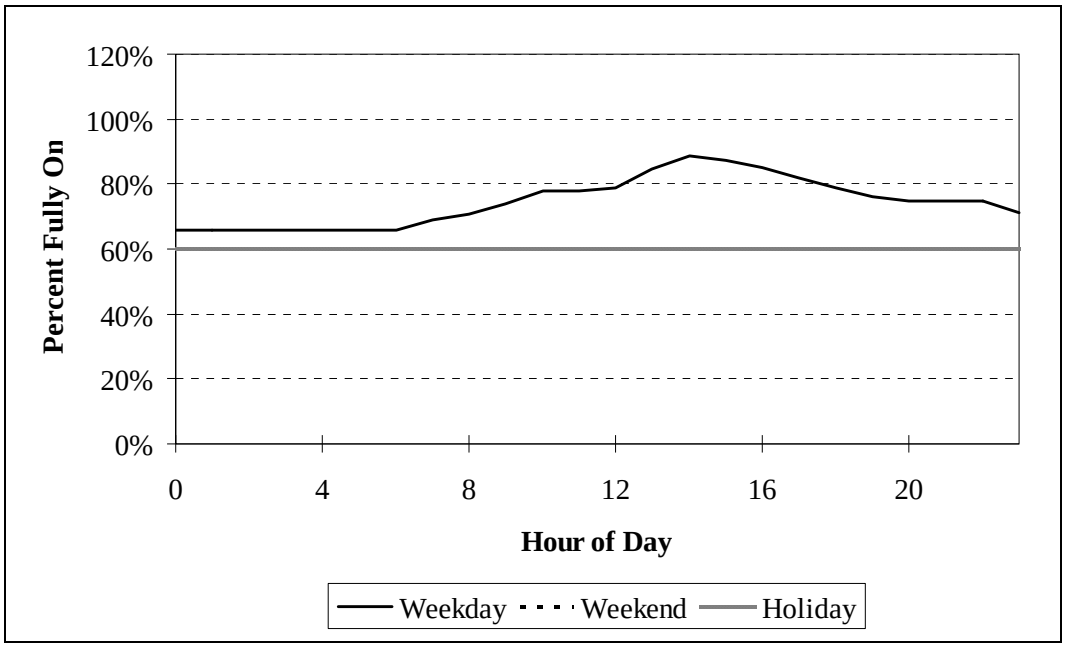

Figure 100: Average Daily Lighting Profile for Schedule 13 (Shed) from 3/25/09 to 4/29/09

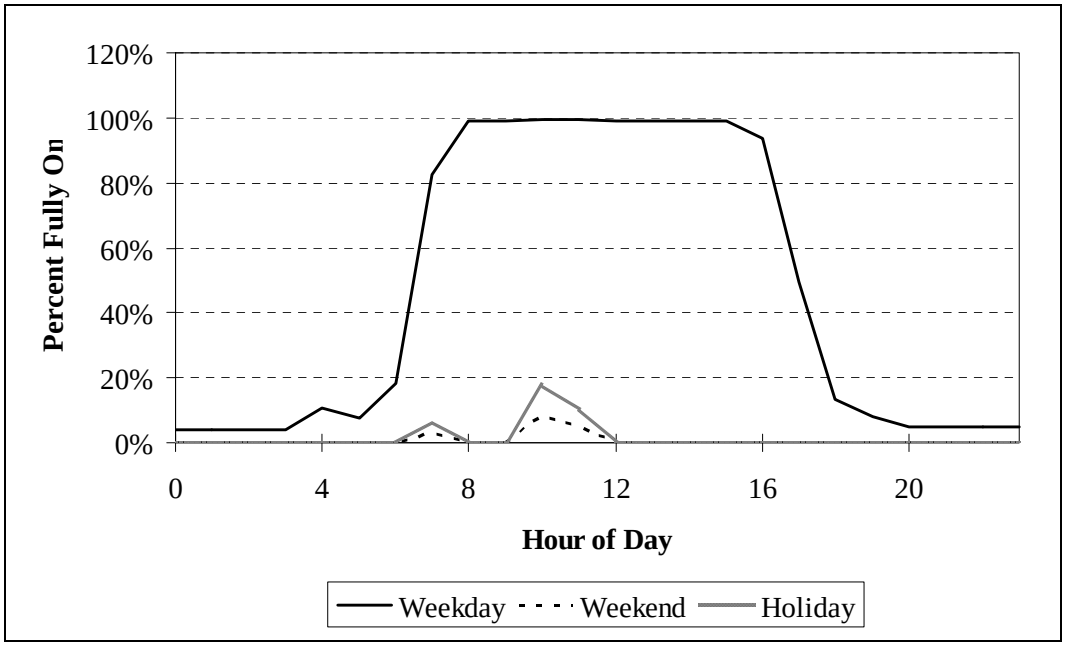

Figure 101: Average Daily Lighting Profile for Schedule 14 (Main Corridor) from 3/25/09 to 4/29/09

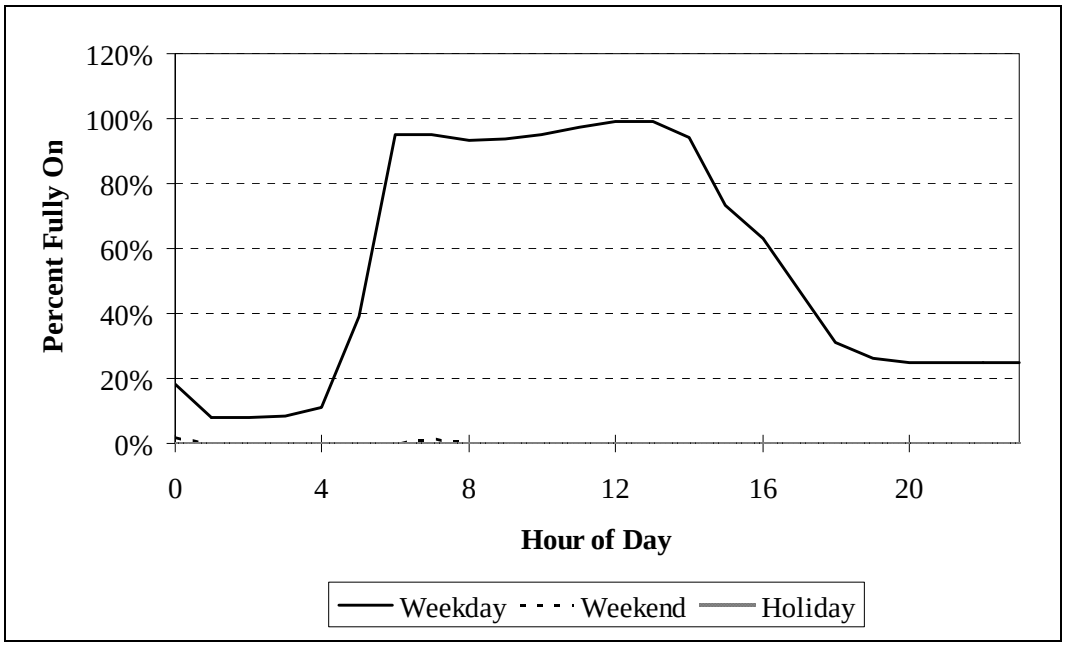

Figure 102: Average Daily Lighting Profile for Schedule 15 (Old Dispatch Office Lobby) from 3/25/09 to 4/29/09

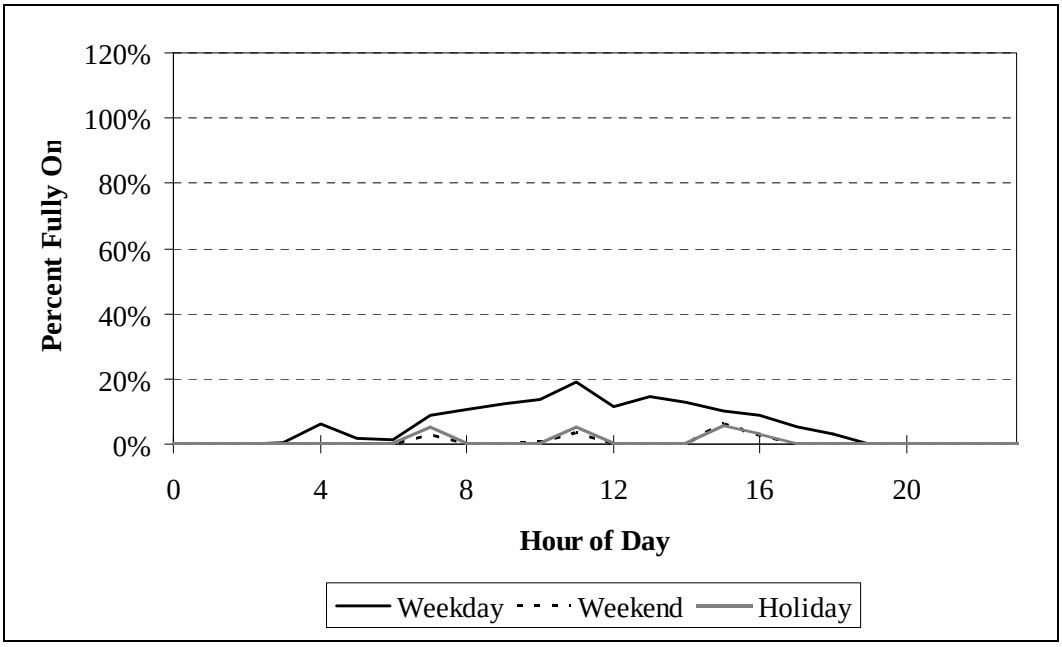

Figure 103: Average Daily Lighting Profile for Schedule 16 (Average Private Office w/OS) from 3/25/09 to 4/29/09

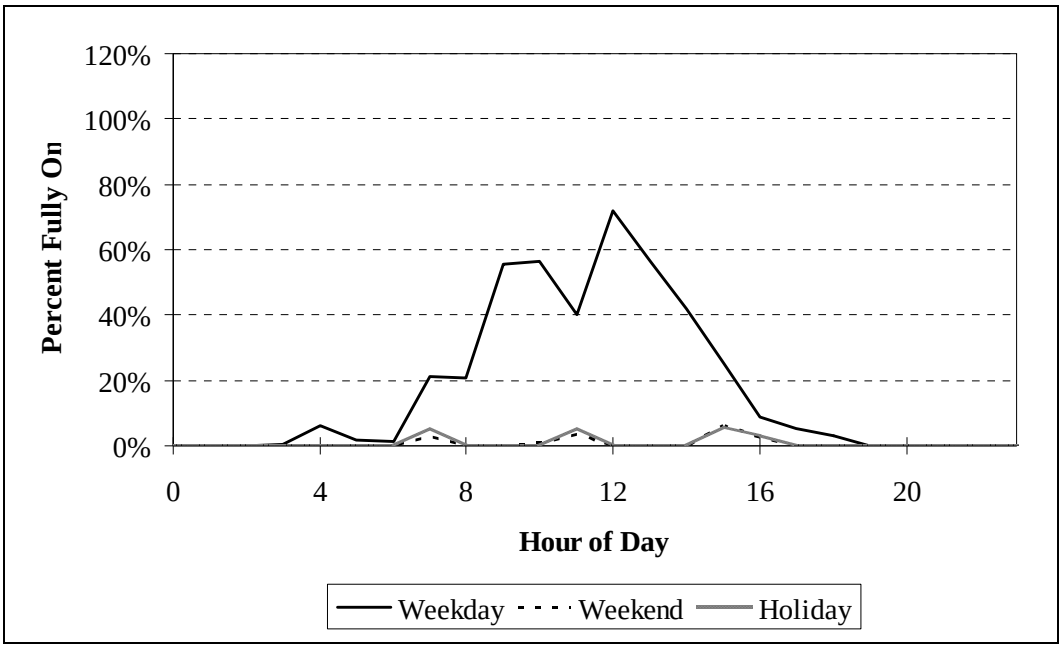

Figure 104: Average Daily Lighting Profile for Schedule 17 (Average Private Office Baseline) from 3/25/09 to 4/29/09

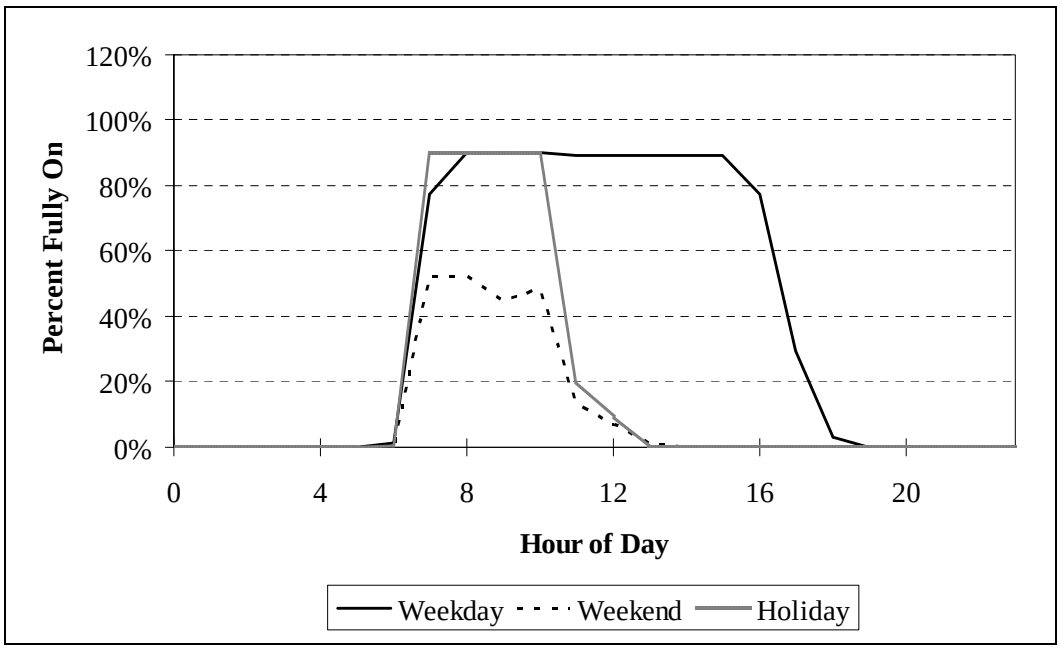

Figure 105: Average Daily Lighting Profile for Schedule 18 (Conference Room Baseline) from 3/25/09 to 4/29/09

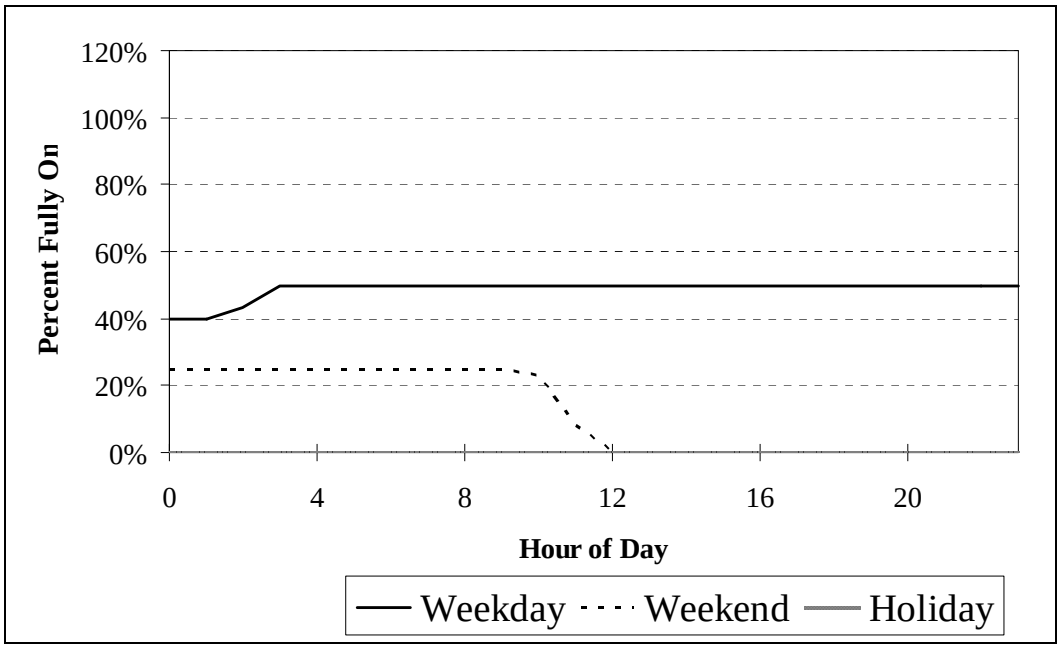

Figure 106: Average Daily Lighting Profile for Schedule 19 (Assumed Besser Operation)

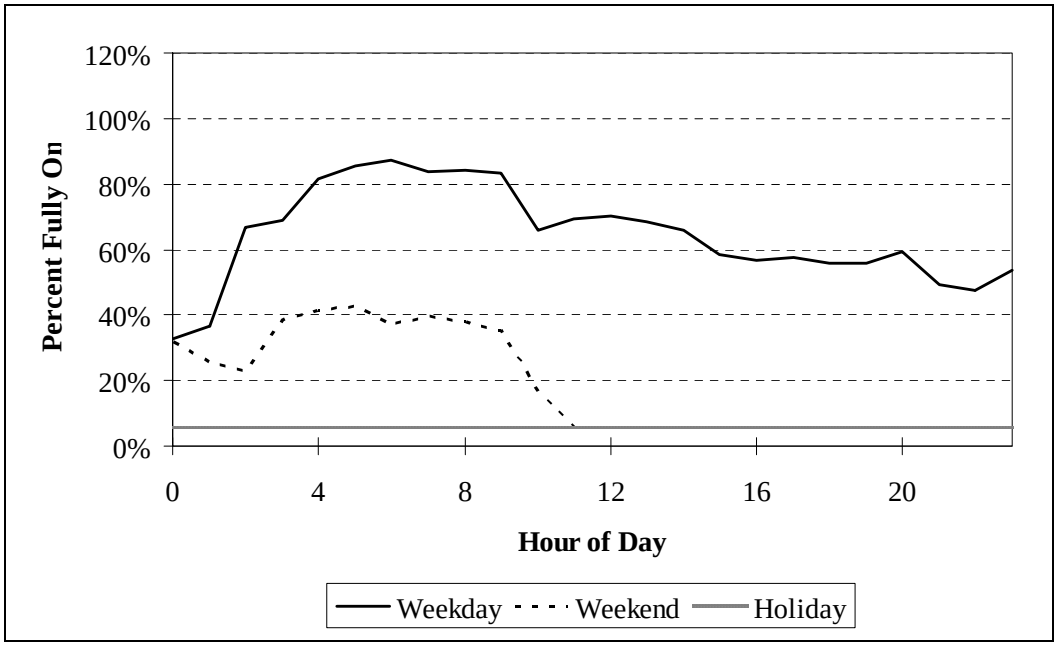

Figure 107: Average Daily Lighting Profile for Schedule 20 (Paver Plant High Bay T8 w/OS) from 3/25/09 to 4/29/09

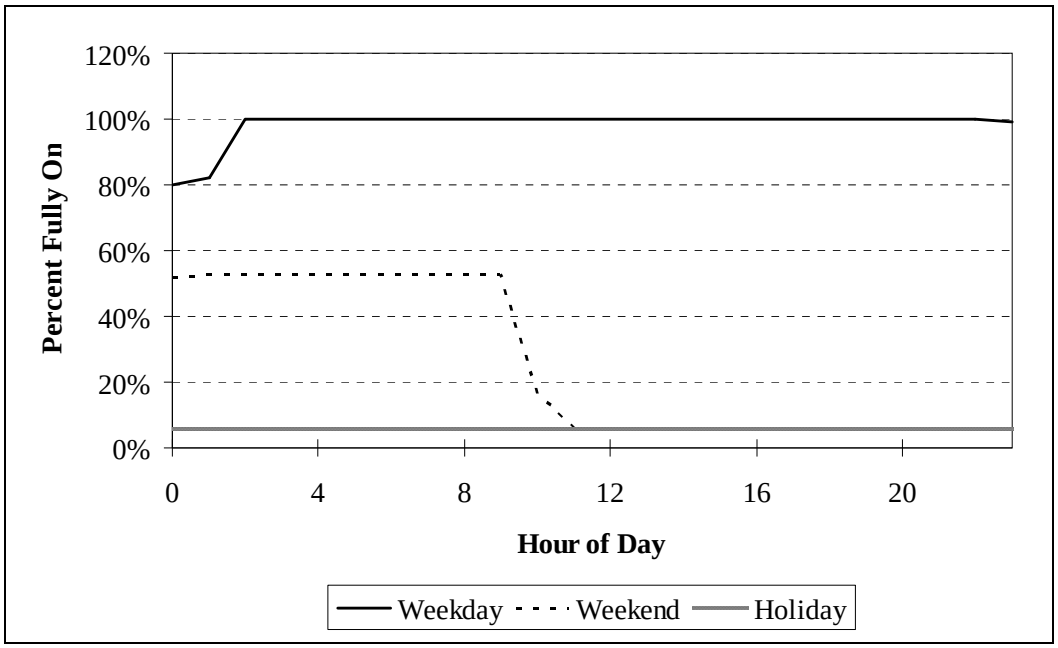

Figure 108: Average Daily Lighting Profile for Schedule 21 (Paver Plant High Bay T8 Baseline) from 3/25/09 to 4/29/09

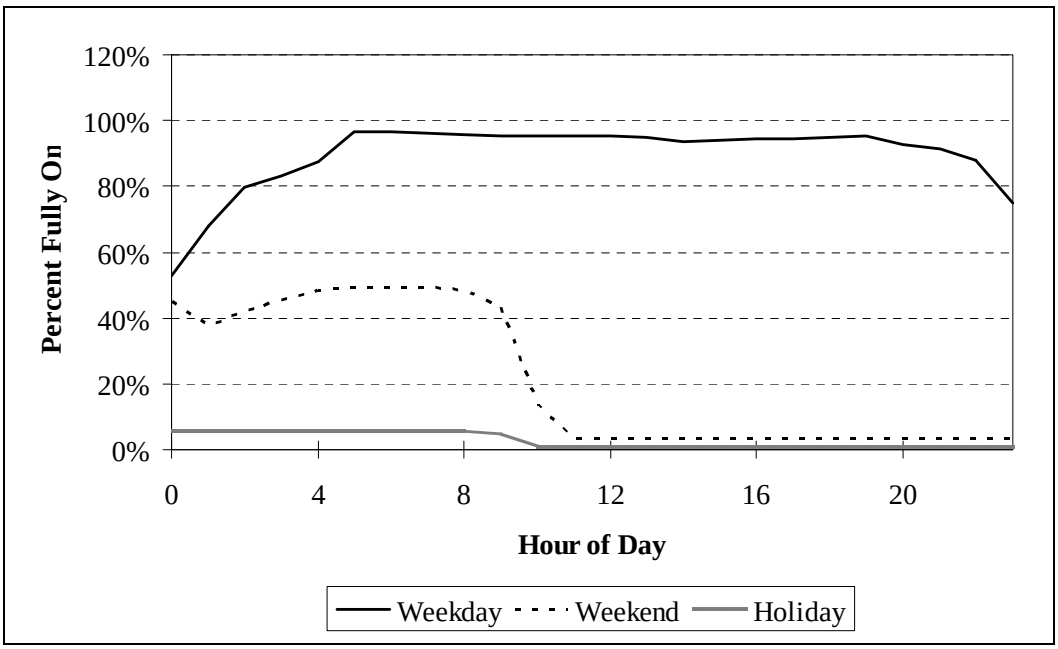

Figure 109: Average Daily Lighting Profile for Schedule 22 (New Paver Plant High Bay T8 w/OS) from 3/25/09 to 4/29/09

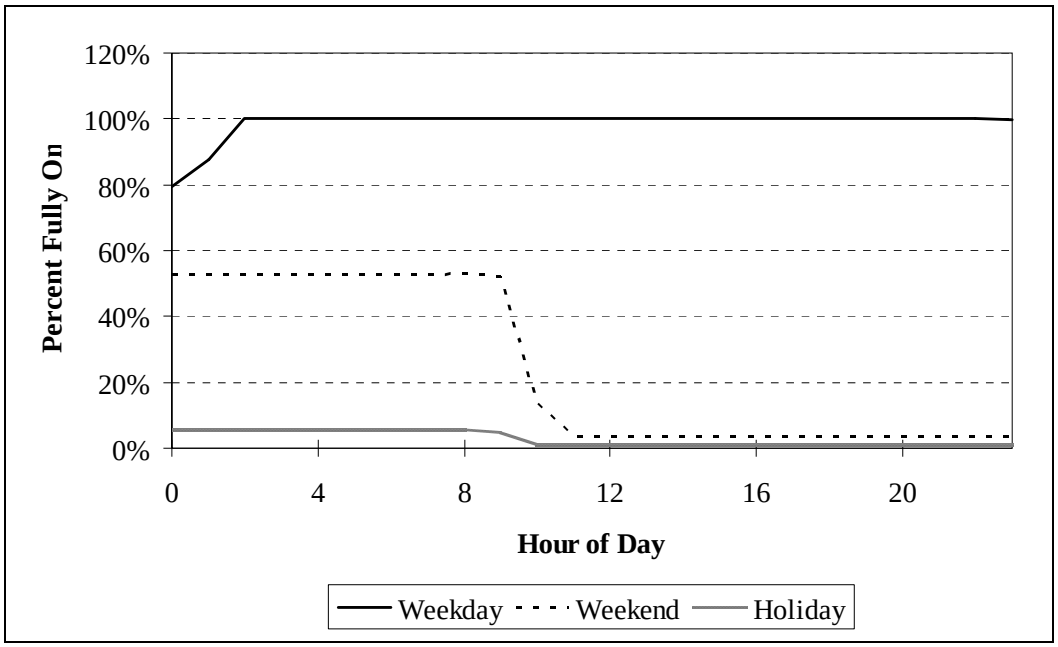

Figure 110: Average Daily Lighting Profile for Schedule 23 (New Paver Plant High Bay T8 Baseline) from 3/25/09 to 4/29/09

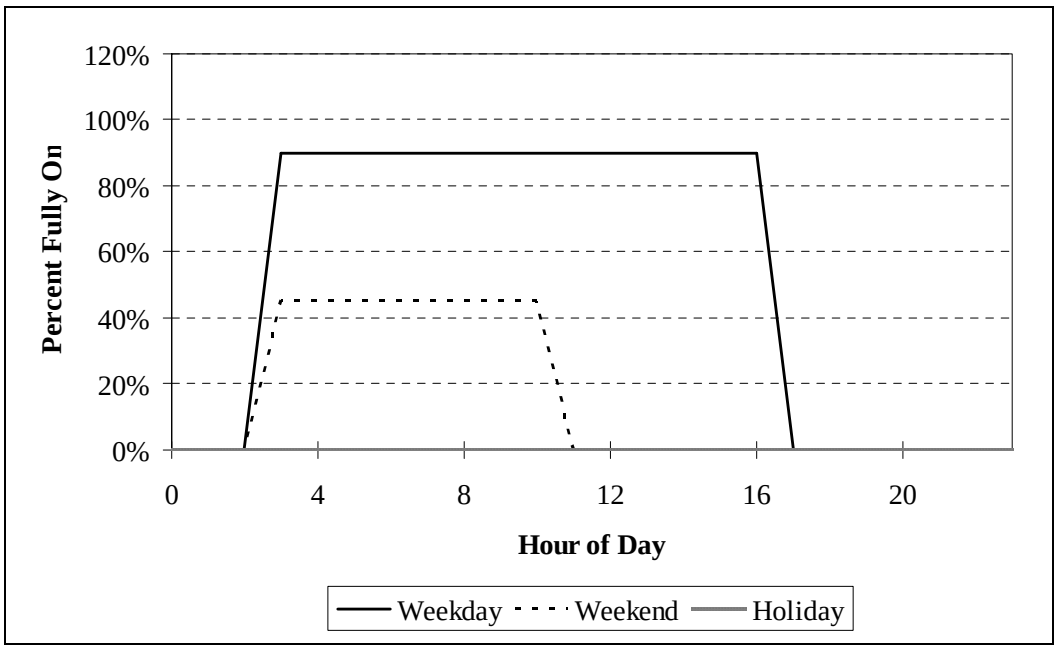

Figure 111: Average Daily Lighting Profile for Schedule 24 (Assumed Besser Maintenance Shop)

Facility Type: Manufacturing
Application ID: 528318

Fixture Information

		Pre-retrofit Lighting							Post-retrofit Lighting							HVAC				Schedule ID from Table 6	
Fixture ID	(a) Space Type	(b) Fixture Type	(c) Fixture Quantity	(d) Fixture Wattage	(e) Hours of Use Annual	(f) Hours of Use Peak	(g) FCM Diversity Factor Summer	(h) FCM Diversity Factor Winter	(i) Fixture Type	(j) Fixture Quantity	(k) Fixture Wattage	(l) Hours of Use Annual	(m) Hours of Use Peak	(n) FCM Diversity Factor Summer	(o) FCM Diversity Factor Winter	(p) COP Cooling	(q) COP Heating	(r) % Space Cooled	(s) % Space Heated	Pre Retrofit	Post Retrofit
1	Office Area (Private Offices)	2L4' EE/STD	53	80	1,064	1,019	33%	4%	2L4' T8EE/EEE SUPER T8	53	47	370	330	12%	4%	2.9	NA	100%	100%	17	16
2	Office Area (Private Offices)	2L4' EE/STD	8	80	1,064	1,019	33%	4%	2L4' T8EE/EEE SUPER T8	8	47	370	330	12%	4%	2.9	NA	100%	100%	17	16
3	Office Area/Storage (Garage)	2L8' STD/STD	2	173	8,760	4,032	100%	100%	4L4' T8EE/EEESUPER T8	2	89	8,760	4,032	100%	100%	NA	NA	0%	100%	11	11
4	Office Area (Shed)	3L4' EE/STD	3	130	6,132	3,131	87%	80%	3L4' T8EE/EEESUPER T8	3	67	6,132	3,131	87%	80%	NA	NA	0%	100%	13	13
5	Besser Area	400W METAL HALIDE	33	455	3,241	1,992	50%	49%	6L4' T8/ELIG HIGH LMN	33	220	3,241	1,992	50%	49%	NA	NA	0%	100%	19	19
6	Paver Plant	400W METAL HALIDE	6	455	6,630	4,017	100%	100%	6L4' T8/ELIG HIGH LMN	6	220	4,382	2,692	62%	57%	NA	NA	0%	100%	21	20
7	New Paver Plant	400W METAL HALIDE	22	455	6,603	4,016	100%	100%	5L4' T5 HO/ELIG	22	292	5,972	3,804	94%	95%	NA	NA	0%	100%	23	22
8	Tumbler Building	4L4' EE/STD	18	160	6,482	3,984	100%	98%	4L4' T8EE/EEESUPER T8	18	89	6,482	3,984	100%	98%	NA	NA	0%	100%	5	5
9	Besser Area	2L8' STD/STD	83	173	3,241	1,992	50%	49%	4L4' T8/ELIG LOW PWR	83	103	3,241	1,992	50%	49%	NA	NA	0%	100%	19	19
10	Besser Area	2L8' HO/STD/STD	8	257	3,241	1,992	50%	49%	6L4' T8/ELIG HIGH LMN	6	220	3,241	1,992	50%	49%	NA	NA	0%	100%	19	19
11	Paver Plant (Control Floor)	2L4' T8/ELIG	18	60	6,482	3,984	100%	98%	2L4' T8EE/EEE SUPER T8	18	47	6,482	3,984	100%	98%	NA	NA	0%	100%	5	5
12	Besser Area	2L8' STD/STD	0	173	3,241	1,992	50%	49%	4L4' T8EE/EEESUPER T8	0	89	3,241	1,992	50%	49%	NA	NA	0%	100%	19	19
13	Besser Area	4L4' EE/STD	0	160	3,241	1,992	50%	49%	4L4' T8EE/EEESUPER T8	0	89	3,241	1,992	50%	49%	NA	NA	0%	100%	19	19
14	Drying Ports	400W METAL HALIDE	14	455	268	6	0%	0%	320W MH CWA	14	345	268	6	0%	0%	NA	NA	0%	100%	6	6
15	Exit Signs	40W INC	20	40	8,760	4,032	100%	100%	1.5 WATT LED	20	1.5	8,760	4,032	100%	100%	NA	NA	0%	100%	11	11
16	Paver Plant (Electric/Control R	2L4' T8/ELIG	6	60	859	543	12%	13%	2L4' T8EE/EEE SUPER T8	6	47	859	543	12%	13%	NA	NA	0%	100%	2	2
17	Paver Plant (Locker Room)	2L4' T8/ELIG	2	60	7,406	4,003	100%	99%	2L4' T8EE/EEE SUPER T8	2	47	7,406	4,003	100%	99%	NA	NA	0%	100%	1	1
18	Paver Plant	4L4' EE/STD	4	160	6,482	3,984	100%	98%	4L4' T8EE/EEESUPER T8	4	89	6,482	3,984	100%	98%	NA	NA	0%	100%	5	5
19	Old Dispatch Office (Lobby)	4L4' EE/STD	8	160	3,289	2,898	83%	38%	4L4' T8EE/EEESUPER T8	8	89	3,289	2,898	83%	38%	2.9	NA	100%	100%	15	15
20	Old Dispatch Office (Office)	4L4' EE/STD	4	160	855	772	11%	0%	4L4' T8EE/EEESUPER T8	4	89	855	772	11%	0%	2.9	NA	100%	100%	7	7
21	Old Dispatch Office (Print Roor	4L4' EE/STD	2	160	4,541	3,422	99%	64%	4L4' T8EE/EEESUPER T8	2	89	4,541	3,422	99%	64%	2.9	NA	100%	100%	9	9
22	Old Dispatch Office (Kitchen)	4L4' EE/STD	2	160	3,289	2,898	83%	38%	4L4' T8EE/EEESUPER T8	2	89	3,289	2,898	83%	38%	2.9	NA	100%	100%	15	15
23	Office Area (Lunch Room)	4L4' EE/STD	4	160	1,448	1,273	47%	17%	4L4' T8EE/EEESUPER T8	4	89	1,448	1,273	47%	17%	2.9	NA	100%	100%	3	3
24	Office Area (Conference Room	4L4' EE/STD	4	160	2,549	2,274	87%	16%	4L4' T8EE/EEESUPER T8	4	89	1,701	1,577	53%	16%	2.9	NA	100%	100%	18	10
25	Office Area (Office)	4L4' EE/STD	4	160	1,064	1,019	33%	4%	4L4' T8EE/EEESUPER T8	4	89	370	330	12%	4%	2.9	NA	100%	100%	17	16
26	Besser Area (Maintenance Sho	2L8' STD/STD	22	173	3,562	2,485	90%	0%	4L4' T8/ELIG LOW PWR	22	103	3,562	2,485	90%	0%	NA	NA	0%	100%	24	24
27	Office Area (Lobby/Reception)	2L4' EE/STD	13	80	2,840	2,687	99%	31%	2L4' T8EE/EEE SUPER T8	13	47	2,840	2,687	99%	31%	2.9	NA	100%	100%	14	14
28	Office Area (Copy Area)	2L4' EE/STD	1	80	2,840	2,687	99%	31%	2L4' T8EE/EEE SUPER T8	1	47	2,840	2,687	99%	31%	2.9	NA	100%	100%	14	14
29	Office Area (Hallway)	2L4' EE/STD	13	80	2,840	2,687	99%	31%	2L4' T8EE/EEE SUPER T8	13	47	2,840	2,687	99%	31%	2.9	NA	100%	100%	14	14
30	Old Dispatch Office (Restroom	2L4' EE/STD	1	80	3,220	1,719	45%	22%	2L4' T8EE/EEE SUPER T8	1	47	3,220	1,719	45%	22%	2.9	NA	100%	100%	12	12
		Totals	378	72,562					Totals	376	42,233										

Pre-Retrofit Demand and Energy Consumption

Fixture ID	Lighting Demand and Energy Consumption (t) Connected kW	(u) FCM Diversified kW Summer	(v) FCM Diversified kW Winter	(w) Annual kWh	(x) Peak kWh	Interactive Hours (y) Cooling Hours	(z) Heating Hours	Interactive Energy Consumption (aa) Cooling kWh	(ab) Heating kWh	On-Peak Interactive Hours (ac) Cooling Hours	(ad) Heating Hours	On-Peak Interactive Demand and Energy Consumption (ae) FCM Diversified kW Summer	(af) FCM Diversified kW Winter	(ag) Cooling kWh	(ah) Heating kWh	Lighting and Interactive Demand and Energy Consumption (ai) FCM Diversified kW Summer	(aj) FCM Diversified kW Winter	(ak) Annual kWh	(al) Peak kWh
1	4.24	1.40	0.17	4,512	4,321	330	506	382	0	324	490	0.34	0.00	375	0	1.74	0.17	4,894	4,697
2	0.64	0.21	0.03	681	652	330	506	58	0	324	490	0.05	0.00	57	0	0.26	0.03	739	709
3	0.35	0.35	0.35	3,031	1,395	1,336	2,225	0	0	920	1,520	0.00	0.00	0	0	0.35	0.35	3,031	1,395
4	0.39	0.34	0.31	2,391	1,221	982	1,603	0	0	733	1,173	0.00	0.00	0	0	0.34	0.31	2,391	1,221
5	15.02	7.51	7.34	48,664	29,910	499	829	0	0	460	742	0.00	0.00	0	0	7.51	7.34	48,664	29,910
6	2.73	2.73	2.73	18,100	10,966	1,000	1,687	0	0	920	1,509	0.00	0.00	0	0	2.73	2.73	18,100	10,966
7	10.01	10.01	10.01	66,096	40,204	993	1,674	0	0	920	1,508	0.00	0.00	0	0	10.01	10.01	66,096	40,204
8	2.88	2.88	2.81	18,668	11,474	999	1,658	0	0	920	1,484	0.00	0.00	0	0	2.88	2.81	18,668	11,474
9	14.36	7.18	7.02	46,538	28,603	499	829	0	0	460	742	0.00	0.00	0	0	7.18	7.02	46,538	28,603
10	2.06	1.03	1.00	6,664	4,096	499	829	0	0	460	742	0.00	0.00	0	0	1.03	1.00	6,664	4,096
11	1.08	1.08	1.06	7,001	4,303	999	1,658	0	0	920	1,484	0.00	0.00	0	0	1.08	1.06	7,001	4,303
12	0.00	0.00	0.00	0	0	499	829	0	0	460	742	0.00	0.00	0	0	0.00	0.00	0	0
13	0.00	0.00	0.00	0	0	499	829	0	0	460	742	0.00	0.00	0	0	0.00	0.00	0	0
14	6.37	0.00	0.03	1,705	38	45	71	0	0	0	4	0.00	0.00	0	0	0.00	0.03	1,705	38
15	0.80	0.80	0.80	7,008	3,226	1,336	2,225	0	0	920	1,520	0.00	0.00	0	0	0.80	0.80	7,008	3,226
16	0.36	0.04	0.05	309	196	140	230	0	0	138	223	0.00	0.00	0	0	0.04	0.05	309	196
17	0.12	0.12	0.12	889	480	1,138	1,892	0	0	920	1,498	0.00	0.00	0	0	0.12	0.12	889	480
18	0.64	0.64	0.63	4,149	2,550	999	1,658	0	0	920	1,484	0.00	0.00	0	0	0.64	0.63	4,149	2,550
19	1.28	1.07	0.49	4,210	3,709	809	1,326	282	0	808	1,305	0.25	0.00	282	0	1.32	0.49	4,492	3,991
20	0.64	0.07	0.00	547	494	245	417	43	0	227	385	0.02	0.00	40	0	0.09	0.00	590	534
21	0.32	0.32	0.21	1,453	1,095	956	1,570	84	0	902	1,455	0.08	0.00	79	0	0.39	0.21	1,537	1,174
22	0.32	0.27	0.12	1,053	927	809	1,326	71	0	808	1,305	0.06	0.00	71	0	0.33	0.12	1,123	998
23	0.64	0.30	0.11	927	815	389	634	68	0	371	600	0.07	0.00	65	0	0.37	0.11	995	880
24	0.64	0.56	0.10	1,632	1,455	795	1,267	139	0	715	1,116	0.13	0.00	125	0	0.69	0.10	1,770	1,580
25	0.64	0.21	0.03	681	652	330	506	58	0	324	490	0.05	0.00	57	0	0.26	0.03	739	709
26	3.81	3.43	0.00	13,558	9,458	830	1,391	0	0	763	1,243	0.00	0.00	0	0	3.43	0.00	13,558	9,458
27	1.04	1.03	0.33	2,954	2,794	827	1,313	235	0	821	1,282	0.24	0.00	233	0	1.27	0.33	3,189	3,027
28	0.08	0.08	0.03	227	215	827	1,313	18	0	821	1,282	0.02	0.00	18	0	0.10	0.03	245	233
29	1.04	1.03	0.33	2,954	2,794	827	1,313	235	0	821	1,282	0.24	0.00	233	0	1.27	0.33	3,189	3,027
30	0.08	0.04	0.02	258	138	616	1,008	13	0	467	754	0.01	0.00	10	0	0.04	0.02	271	148
Totals	72.56	44.70	36.18	266,858	168,180			1,685	0			1.56	0.00	1,644	0	46.26	36.18	268,543	169,824

Post-Retrofit Demand and Energy Consumption

Fixture ID	Lighting Demand and Energy Consumption (am) Connected kW	(an) FCM Diversified kW Summer	(ao) FCM Diversified kW Winter	(ap) Annual kWh	(aq) Peak kWh	Interactive Hours (ar) Cooling Hours	(as) Heating Hours	Interactive Energy Consumption (at) Cooling kWh	(au) Heating kWh	On-Peak Interactive Hours (av) Cooling Hours	(aw) Heating Hours	On-Peak Interactive Demand and Energy Consumption (ax) FCM Diversified kW Summer	(ay) FCM Diversified kW Winter	(az) Cooling kWh	(ba) Heating kWh	Lighting and Interactive Demand and Energy Consumption (bb) FCM Diversified kW Summer	(bc) FCM Diversified kW Winter	(bd) Annual kWh	(be) Peak kWh
1	2.49	0.29	0.10	922	822	107	166	73	0	101	154	0.07	0.00	69	0	0.36	0.10	995	890
2	0.38	0.04	0.02	139	124	107	166	11	0	101	154	0.01	0.00	10	0	0.05	0.02	150	134
3	0.18	0.18	0.18	1,559	718	1,336	2,225	0	0	920	1,520	0.00	0.00	0	0	0.18	0.18	1,559	718
4	0.20	0.17	0.16	1,232	629	982	1,603	0	0	733	1,173	0.00	0.00	0	0	0.17	0.16	1,232	629
5	7.26	3.63	3.55	23,530	14,462	499	829	0	0	460	742	0.00	0.00	0	0	3.63	3.55	23,530	14,462
6	1.32	0.82	0.75	5,784	3,554	708	1,211	0	0	645	1,076	0.00	0.00	0	0	0.82	0.75	5,784	3,554
7	6.42	6.05	6.08	38,366	24,438	940	1,588	0	0	874	1,435	0.00	0.00	0	0	6.05	6.08	38,366	24,438
8	1.60	1.60	1.57	10,384	6,382	999	1,658	0	0	920	1,484	0.00	0.00	0	0	1.60	1.57	10,384	6,382
9	8.55	4.27	4.18	27,708	17,030	499	829	0	0	460	742	0.00	0.00	0	0	4.27	4.18	27,708	17,030
10	1.32	0.66	0.65	4,278	2,629	499	829	0	0	460	742	0.00	0.00	0	0	0.66	0.65	4,278	2,629
11	0.85	0.85	0.83	5,484	3,370	999	1,658	0	0	920	1,484	0.00	0.00	0	0	0.85	0.83	5,484	3,370
12	0.00	0.00	0.00	0	0	499	829	0	0	460	742	0.00	0.00	0	0	0.00	0.00	0	0
13	0.00	0.00	0.00	0	0	499	829	0	0	460	742	0.00	0.00	0	0	0.00	0.00	0	0
14	4.83	0.00	0.02	1,293	29	45	71	0	0	0	4	0.00	0.00	0	0	0.00	0.02	1,293	29
15	0.03	0.03	0.03	263	121	1,336	2,225	0	0	920	1,520	0.00	0.00	0	0	0.03	0.03	263	121
16	0.28	0.03	0.04	242	153	140	230	0	0	138	223	0.00	0.00	0	0	0.03	0.04	242	153
17	0.09	0.09	0.09	696	376	1,138	1,892	0	0	920	1,498	0.00	0.00	0	0	0.09	0.09	696	376
18	0.36	0.36	0.35	2,308	1,418	999	1,658	0	0	920	1,484	0.00	0.00	0	0	0.36	0.35	2,308	1,418
19	0.71	0.59	0.27	2,342	2,063	809	1,326	157	0	808	1,305	0.14	0.00	157	0	0.73	0.27	2,499	2,220
20	0.36	0.04	0.00	304	275	245	417	24	0	227	385	0.01	0.00	22	0	0.05	0.00	328	297
21	0.18	0.18	0.11	808	609	956	1,570	46	0	902	1,455	0.04	0.00	44	0	0.22	0.11	855	653
22	0.18	0.15	0.07	585	516	809	1,326	39	0	808	1,305	0.04	0.00	39	0	0.18	0.07	625	555
23	0.36	0.17	0.06	515	453	389	634	38	0	371	600	0.04	0.00	36	0	0.20	0.06	553	489
24	0.36	0.19	0.06	605	561	528	845	51	0	493	774	0.04	0.00	48	0	0.23	0.06	657	609
25	0.36	0.04	0.01	132	117	107	166	10	0	101	154	0.01	0.00	10	0	0.05	0.01	142	127
26	2.27	2.04	0.00	8,072	5,631	830	1,391	0	0	763	1,243	0.00	0.00	0	0	2.04	0.00	8,072	5,631
27	0.61	0.60	0.19	1,735	1,642	827	1,313	138	0	821	1,282	0.14	0.00	137	0	0.75	0.19	1,873	1,779
28	0.05	0.05	0.01	133	126	827	1,313	11	0	821	1,282	0.01	0.00	11	0	0.06	0.01	144	137
29	0.61	0.60	0.19	1,735	1,642	827	1,313	138	0	821	1,282	0.14	0.00	137	0	0.75	0.19	1,873	1,779
30	0.05	0.02	0.01	151	81	616	1,008	8	0	467	754	0.01	0.00	6	0	0.03	0.01	159	87
Totals	42.23	23.76	19.57	141,309	89,972			744	0			0.70	0.00	725	0	24.46	19.57	142,053	90,698

Total Savings Summary

	Energy kWh	Summer kW	Winter kW	Connected kW
Annual Lighting Only	125,549	20.94	16.62	30.33
Annual Interactive	941	0.86	0.00	N/A
Annual Lighting and Interactive	126,490	21.80	16.62	30.33
On-Peak Lighting Only	78,208			
On-Peak Interactive	918			
On-Peak Lighting and Interactive	79,126			

	MMBTU
Annual Non-Electric Heating Savings	(127)

Savings Adjustment Factors

Parameter	Annual KWH	Difference %	Summer kW	Difference %	Winter kW	Difference %
Gross (TRACKING) Savings	89,817	N/A	32.72	N/A	32.72	N/A
Adjustment - Documentation Change	0	0%	0.00	0%	0.00	0%
Adjustment - Technology Change	-2,719	-3%	-1.05	-3%	-1.05	-3%
Adjustment - Quantity Change	-3,500	-4%	-1.35	-4%	-1.35	-4%
Adjustment - Operation Change	41,951	47%	N/A	N/A	N/A	N/A
Adjustment - Coincident Change	N/A	N/A	-9.38	-29%	-13.71	-42%
Adjustment - Heating Interaction	0	0%	N/A	N/A	0.00	0%
Adjustment - Cooling Interaction	941	1%	0.86	3%	N/A	N/A
Adjustment - TOTAL	36,673	41%	-10.91	-33%	-16.10	-49%
Adjusted Gross (ONSITE) Savings	126,490	141%	21.80	67%	16.62	51%

Table 63: Summary of On-Site Energy and Demand Savings

Hour Ending	Average kW Reduction
1	14.9
2	14.5
3	15.7
4	18.1
5	17.9
6	17.3
7	18.2
8	20.5
9	20.6
10	23.1
11	23.4
12	22.0
13	24.5
14	23.4
15	22.4
16	21.4
17	20.0
18	17.5
19	16.5
20	16.3
21	16.4
22	16.6
23	16.8
24	17.5

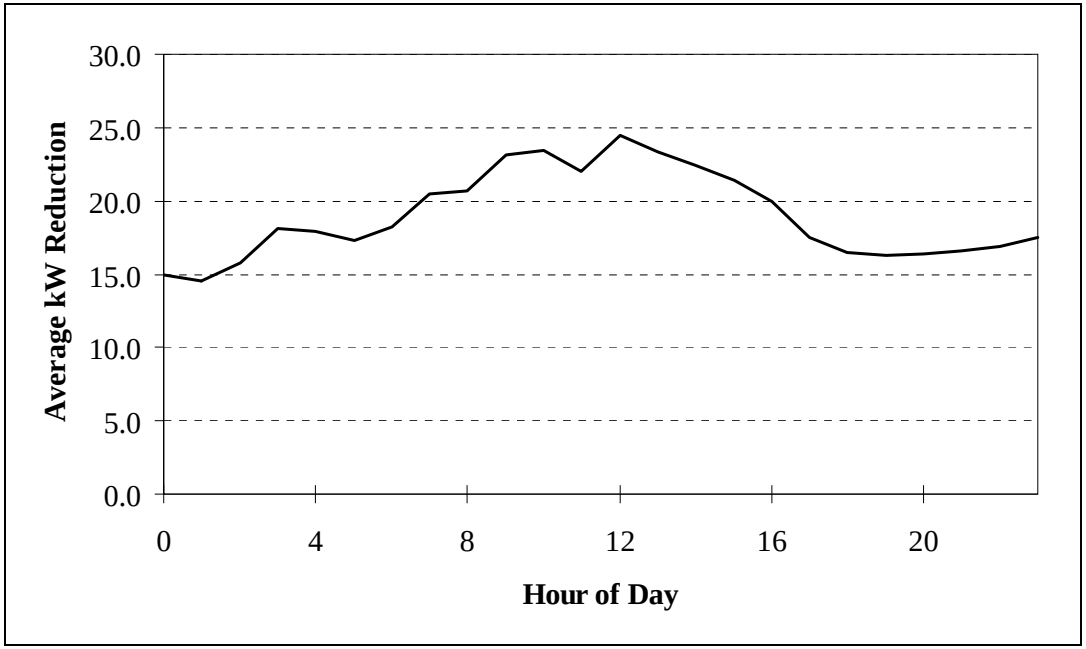

Table 64: Average Summer Weekday kW Reduction

Hour Ending	Average kW Reduction
1	14.6
2	14.5
3	15.6
4	17.9
5	17.7
6	17.1
7	17.7
8	19.6
9	19.7
10	21.5
11	22.0
12	20.8
13	22.8
14	21.9
15	21.3
16	20.5
17	19.3
18	16.9
19	16.3
20	16.1
21	16.2
22	16.4
23	16.7
24	17.2

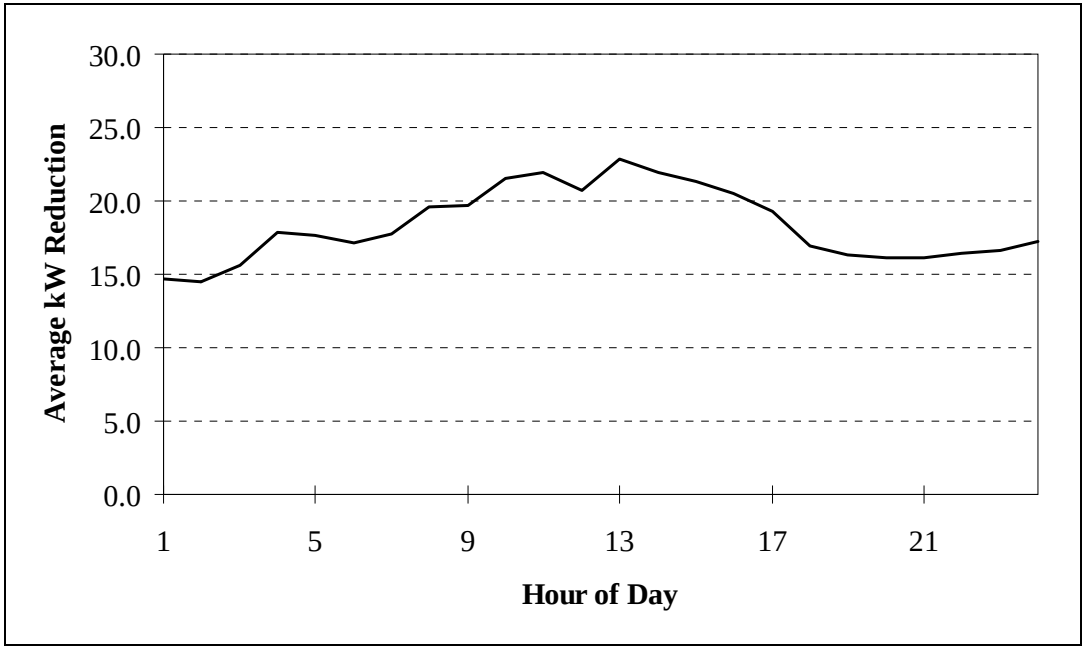

Table 65: Average Winter Weekday kW Reduction

Column Definitions for Lighting Calculations
(a) Brief description of area where lighting is installed

Pre-retrofit Lighting			Post-retrofit Lighting		
(b) Description of fixture type			(i) Description of fixture type		
(c) Fixture quantity from application documentation			(j) Fixture quantity from on-site inspection		
(d) Fixture wattage from application documentation			(k) Fixture wattage from application documentation		
(e) Annual hours of use	TMY2 Query	Eq. 1.1	(l) Annual hours of use	TMY2 Query	Eq. 1.1
(f) On-peak hours of use	TMY2 Query	Eq. 1.2	(m) On-peak hours of use	TMY2 Query	Eq. 1.2
(g) FCM Summer peak demand diversity factor	TMY2 Query	Eq. 1.3	(n) FCM Summer peak demand diversity factor	TMY2 Query	Eq. 1.3
(h) FCM Winter peak demand diversity factor	TMY2 Query	Eq. 1.4	(o) FCM Winter peak demand diversity factor	TMY2 Query	Eq. 1.4

HVAC Interaction Inputs	
(p) Electric cooling coefficient of performance	(r) Percent of space that is cooled
(q) Electric heating coefficient of performance	(s) Percent of space that is heated

Pre-retrofit Lighting Demand and Energy Consumption			Post-retrofit Lighting Demand and Energy Consumption		
(t) Connected lighting Demand	(t) = (c) x (d) / 1,000	Eq. 2.1	(am) Connected lighting Demand	(am) = (j) x (k) / 1,000	Eq. 3.1
(u) Summer diversified peak lighting demand (FCM)	(u) = (t) x (g)	Eq. 2.2	(an) Summer diversified peak lighting demand (FCM)	(an) = (am) x (n)	Eq. 3.2
(v) Winter diversified peak lighting demand (FCM)	(v) = (t) x (h)	Eq. 2.3	(ao) Winter diversified peak lighting demand (FCM)	(ao) = (am) x (o)	Eq. 3.3
(w) Annual energy consumption	(w) = (t) x (e)	Eq. 2.4	(ap) Annual energy consumption	(ap) = (am) x (l)	Eq. 3.4
(x) Annual On-peak energy consumption	(x) = (t) x (f)	Eq. 2.5	(aq) Annual On-peak energy consumption	(aq) = (am) x (m)	Eq. 3.5
(y) Annual cooling hours	TMY2 Qyery	Eq. 2.6	(ar) Annual cooling hours	TMY2 Query	Eq. 3.6
(z) Annual heating hours	TMY2 Qyery	Eq. 2.7	(as) Annual heating hours	TMY2 Query	Eq. 3.7
(aa) Electric cooling interactive energy effects	(aa) = (t) x (y) x (r) x 0.8 / (p)	Eq. 2.8	(at) Electric cooling interactive energy effects	(at) = (am) x (aq) x (r) x 0.8 / (p)	Eq. 3.8
(ab) Electric heating interactive energy effects	(ab) = -(t) x (z) x (s) x 0.8 / (q)	Eq. 2.9	(au) Electric heating interactive energy effects	(au) = -(am) x (as) x (s) x 0.8 / (q)	Eq. 3.9
(ac) Annual On-peak cooling hours	TMY2 Qyery	Eq. 2.10	(av) Annual On-peak cooling hours	TMY2 Query	Eq. 3.10
(ad) Annual On-peak heating hours	TMY2 Qyery	Eq. 2.11	(aw) Annual On-peak heating hours	TMY2 Query	Eq. 3.11
(ae) On-peak interactive cooling demand (FCM)	(ae) = (u) x (r) x 0.8 / (p)	Eq. 2.12	(ax) On-peak interactive cooling demand (FCM)	(ax) = (an) x (r) x 0.8 / (p)	Eq. 3.12
(af) On-peak interactive heating demand (FCM)	(af) = -(v) x (s) x 0.8 / (q)	Eq. 2.13	(ay) On-peak interactive heating demand (FCM)	(ay) = (ao) x (s) x 0.8 / (q)	Eq. 3.13
(ag) On-peak interactive electric cooling energy	(ag) = (t) x (ac) x (r) x 0.8 / (p)	Eq. 2.14	(az) On-peak interactive electric cooling energy	(az) = (am) x (av) x (r) x 0.8 / (p)	Eq. 3.14
(ah) On-peak interactive electric heating energy	(ah) = -(t) x (ad) x (s) x 0.8 / (q)	Eq. 2.15	(ba) On-peak interactive electric heating energy	(ba) = -(am) x (aw) x (s) x 0.8 / (q)	Eq. 3.15
(ai) Lighting and interactive summer demand (FCM)	(ai) = (u) + (ae)	Eq. 2.16	(bb) Lighting and interactive summer demand (FCM)	(bb) = (an) + (ax)	Eq. 3.16
(aj) Lighting and interactive winter demand (FCM)	(aj) = (v) + (af)	Eq. 2.17	(bc) Lighting and interactive winter demand (FCM)	(bc) = (ao) + (ay)	Eq. 3.17
(ak) Annual lighting and interactive energy consumption	(ak) = (w) + (aa) + (ab)	Eq. 2.18	(bd) Annual lighting and interactive energy consumption	(bd) = (ap) + (at) + (au)	Eq. 3.18
(al) Annual on-peak lighting and interactive energy consumption	(al) = (x) + (ag) + (ah)	Eq. 2.19	(be) Annual on-peak lighting and interactive energy consumption	(be) = (aq) + (az) + (ba)	Eq. 3.19

Total Savings Summary					
Annual Lighting Only Energy Consumption	Σ (w) - Σ (ap)	Eq. 4.1	Annual Lighting and Interactive Energy Consumption	Σ (ak) - Σ (bd)	Eq. 4.8
Annual Lighting Only Summer Demand (FCM)	Σ (u) - Σ (an)	Eq. 4.2	Annual Lighting and Interactive Summer Demand (FCM)	Σ (ai) - Σ (bb)	Eq. 4.9
Annual Lighting Only Winter Demand (FCM)	Σ (v) - Σ (ao)	Eq. 4.3	Annual Lighting and Interactive Winter Demand (FCM)	Σ (aj) - Σ (bc)	Eq. 4.10
Annual Lighting Only Connected Demand	Σ (t) - Σ (am)	Eq. 4.4	On-Peak Lighting Only Energy Consumption	Σ (x) - Σ (aq)	Eq. 4.11
Annual Interactive Energy Consumption	[Σ (aa) - Σ (at)] + [Σ (ab) - Σ (au)]	Eq. 4.5	On-Peak Interactive Energy Consumption	[Σ (ag) - Σ (az)] + [Σ (ah) - Σ (ba)]	Eq. 4.12
Annual Interactive Summer Demand (FCM)	Σ (ae) - Σ (ax)	Eq. 4.6			
Annual Interactive Winter Demand (FCM)	Σ (af) - Σ (ay)	Eq. 4.7			

Site 8, Application ID: 528960

Facility Type: High School

Summary

A lighting retrofit of a school was done to replace older inefficient lighting fixtures with new more efficient fixtures. Included in the retrofit are classrooms, offices, corridors, locker rooms, auditorium and gymnasium. A total of 2,547 older technology lighting fixtures were replaced with 2,505 new high efficiency fixtures. The existing fixtures included; (66) metal halide fixtures, (119) incandescent fixtures, (358) two lamp compact fluorescent fixtures, (74) one lamp T8 fixtures, (450) two lamp T8 fixtures, (447) three lamp T8 fixtures and (1,033) four lamp T8 fixtures. These fixtures were replaced by various size high efficiency T8 lamps and ballasts. In the case where a two lamp compact fluorescent was removed, it was replaced with a single lamp compact fluorescent fixture.

Also included in this project were four occupancy sensors that were to be installed in the girl's locker room. The gymnasium was to also receive (36) six lamp F32/T8 fixtures, each with its own integrated occupancy sensor. The total connected load of the rooms that had occupancy sensors installed was 9.9 kW out of a total connected load of 116.4 kW. Though these occupancy sensors were included in the project documentation, no savings were calculated for the occupancy sensors in the tracking analysis. The evaluation counted occupancy sensor savings from these spaces in the calculation of the on-site savings estimates.

A count of fixtures taken during the on-site visit revealed that installed quantities and types of lighting fixtures closely matched the proposed quantities and fixture types. In total, evaluators found 2,539 fixtures compared to 2,505 proposed in the tracking estimate. A detailed summary of the quantity of fixtures identified compared to the tracking estimate is provided in Table 70

Table 66 presents the summary of the tracking and on-site savings results.

Savings Quantity	Tracking Estimate	On-site Savings	Evaluated/ Tracking
Annual Energy (kWh)	279,561	267,151	96%
% Energy Savings On-Peak	45%	77%	171%
Summer Peak Diversified kW	42.33	36.50	86%
Winter Peak Diversified kW	63.50	27.16	43%

Table 66: Summary of Tracking and On-site Savings Results

The overall on-site savings estimate is 4% lower than predicted in the tracking estimate. The on-site estimates of summer and winter peak diversified kW was lower than the tracking values. The following factors influenced the difference between the tracking and on-site estimates of energy and demand savings:

- The decrease in savings was the result of lower annual hours of use. The tracking estimate of savings estimated the operating hours of all the installed fixtures to be 2,200 hours per year. The monitoring data combined with reported operating schedules showed that the weighted average of the post-installation operating hours is 2,084 hours per year. This decrease in annual operating hours results in the annual savings being decreased by 26,701 kWh.

- Though there was an overall decrease in savings resulting from fewer annual operating hours, there was an increase in savings resulting from the installation of the occupancy sensors that wasn't captured in the original tracking estimate. Evaluators identified the occupancy sensors installed in the gymnasium and the girl's locker room. Monitoring data showed that the fixtures in the gymnasium operate approximately 2,640 hours per year. Evaluators estimated the baseline hours of operation to be approximately 3,074 hours per year. It was assumed that the gymnasium lights would have been on 100% of the time during the daytime hours. Likewise, the girl's locker room operates 2,303 hours per year according to logger data. Evaluators estimated the baseline hours of operation in this space to be 2,919 hours per year. The addition of the occupancy sensors resulted in an increase in savings equal to 5,815 kWh per year.

- Evaluators also identified more fixtures during the facility walkthrough than proposed in the tracking analysis. The evaluation found 2,539 total fixtures installed in the school compared to 2,505 fixtures proposed in the tracking analysis. Spaces such as the

library, cafeteria and fitness areas contained more fixtures than originally estimated. In the case where a space was found to have more fixtures, evaluators also adjusted the baseline fixture quantity for this space to reflect this adjustment, resulting in additional savings. If the tracking savings proposed a one-to-one replacement, evaluators adjusted the baseline quantity assuming a one-to-one replacement. In the case where the tracking estimate was not a one-to-one replacement, evaluators adjusted the baseline using the same ratio of existing to installed fixtures as the tracking estimate. The increase in the total number of fixtures resulted in additional savings of 3,095 kWh per year.

- There was an increase in savings resulting from a technology adjustment. Specifically, evaluators found that the corridors contained all two lamp F17/T8 fixtures instead of the two lamp F32/T8 low power fixtures as proposed in the tracking analysis. These fixtures were confirmed through visual inspection by removing the outer lens of the fixture. These fixtures draw less wattage than the two lamp F32/T8 low power fixture which accounts for the positive component of the technology adjustment. Also, evaluators determined that the auditorium had been retrofit with 42 watt compact fluorescents rather than 32 watt compact fluorescents based on power monitoring data. This increase in installed wattage resulted in a decrease in savings in this space. The combination of these two scenarios resulted in a small positive increase in savings equal to 383 kWh per year.

- There was an increase in savings resulting from the interaction between the new lighting and the facility's HVAC systems. Almost the entire facility is air-conditioned using either a large central chilled water system or several rooftop packaged DX units. The only spaces that are not air-conditioned include the gymnasium, auditorium and kitchen. The decrease in lighting wattage resulting from this efficiency measure results in less heat going into the air-conditioned space. Therefore, additional savings are realized from the reduced cooling requirements of the building. It is estimated that the added benefit is equal to 6,065 kWh per year.

- The on-peak kWh savings was estimated to be 77% of the annual on-site kWh savings. The tracking estimate for on-peak kWh savings was 45%. The on-peak period defined by National Grid is non-holiday weekdays between 6 am and 10 pm. It is unclear how the tracking estimate for on-peak kWh savings was derived, but this facility is a high school with typical operation that occurs weekdays between 7 am and 4 pm. Logger

data did show some night and weekend usage, but this was mostly found in the corridors.

- The summer diversified kW reduction was 36.50 kW or 14% lower than predicted in the tracking estimate. The tracking estimate assumed that approximately 33% of the lighting would be operating during the summer peak hours. The evaluation found that approximately 26% of all the lighting would be operating during the summer peak. According to facility personnel, there is very little activity in the school during the summer months of July and August. There is a summer program that will use a classroom or two, but the majority of the school is unoccupied aside from cleaning. The winter diversified kW reduction was 27.16 kW or 57% lower than the tracking estimate. The reason for this decrease is that the tracking savings estimated the lights to operate 50% of the time during the winter peak period. The monitoring data shows that the weighted average winter diversity factor is approximately 22%. The winter peak period is defined as December and January non-holiday weekdays between 5 pm and 7 pm. Two reasons why the evaluation found a lower diversity factor are because most of the lighting in the building is shut off between 4 pm and 5 pm according to logger data and these two winter months include the holiday break during which most of the lighting is off.

Project Description

This project was completed under the Energy Initiative program. Table 67 presents a summary of the existing system as outlined in the customer application.

Existing Case				
Space	**Fixture Type**	**Wattage**	**Quantity**	**Annual Hours**
Auditorium	120 Watt Incandescent	120	117	2,200
Child Care	Three Lamp F32/T8	88	12	2,200
Connector Corridor	Two Lamp F32/T8	60	24	2,200
Girls Lockers	One Lamp F32/T8	30	74	2,200
Gym	400 Watt Metal Halide	455	36	2,200
Kitchen	Two Lamp F32/T8	60	8	2,200
Kitchen	Three Lamp F32/T8	88	1	2,200
Kitchen	Four Lamp F32/T8	112	17	2,200
Library	Two Lamp F32/T8	60	26	2,200
Library	Three Lamp F32/T8	88	55	2,200
Library	Four Lamp F32/T8	112	43	2,200
Prep Room	Two Lamp F32/T8	60	8	2,200
Prep Room	Three Lamp F32/T8	88	26	2,200
Prep Room	Four Lamp F32/T8	112	3	2,200
Stage	200 Watt Incandescent	200	2	2,200
Stage	200 Watt Metal Halide	232	6	2,200
Storage	Two Lamp F32/T8	60	10	2,200
Storage	Three Lamp F32/T8	88	19	2,200
Storage	Four Lamp F32/T8	112	11	2,200
Lobby/Corridor	70 Watt Metal Halide	95	9	2,200
Lobby/Corridor	2-26 Watt CFL	56	352	2,200
Lobby/Corridor	Two Lamp F32/T8	60	276	2,200
Lobby/Corridor	Three Lamp F32/T8	88	2	2,200
Lobby/Corridor	Two Lamp F80/T12	160	6	2,200
Vocational Classroom	Two Lamp F32/T8	60	9	2,200
Vocational Classroom	Three Lamp F32/T8	88	22	2,200
Vocational Classroom	Four Lamp F32/T8	112	143	2,200
Main Office	Three Lamp F32/T8	88	21	2,200
Private Office	Three Lamp F32/T8	88	25	2,200
Private Office	Four Lamp F32/T8	112	4	2,200
Health and Dept Offices	Three Lamp F32/T8	88	84	2,200
Health and Dept Offices	Four Lamp F32/T8	112	26	2,200
Fitness/Training	Three Lamp F32/T8	88	20	2,200
Special Education	Two Lamp F32/T8	60	4	2,200
Special Education	Three Lamp F32/T8	88	20	2,200
Classroom	Two Lamp F32/T8	60	13	2,200

Existing Case (cont.)				
Space	**Fixture Type**	**Wattage**	**Quantity**	**Annual Hours**
Classroom	Three Lamp F32/T8	88	22	2,200
Classroom	Four Lamp F32/T8	112	639	2,200
Computer Lab	Two Lamp F32/T8	60	5	2,200
Computer Lab	Three Lamp F32/T8	88	5	2,200
Computer Lab	Four Lamp F32/T8	112	90	2,200
Restroom	2-26 Watt CFL	56	6	2,200
Restroom	Two Lamp F32/T8	60	28	2,200
Cosmo/Cooking Lab	Three Lamp F32/T8	88	56	2,200
Cosmo/Cooking Lab	Four Lamp F32/T8	112	24	2,200
Data Room/Electrical	Two Lamp F32/T8	60	33	2,200
Data Room/Electrical	Four Lamp F32/T8	112	33	2,200
Cafeteria/Dining	320 Watt Metal Halide	365	15	2,200
Cafeteria/Dining	Three Lamp F32/T8	88	56	2,200
Guidance Private Office	Three Lamp F32/T8	88	1	2,200
	Total	243,442	2,547	N/A

Table 67: Existing Lighting System

Table 68 presents the installed fixtures and quantities as proposed in the customer application.

Installed Case				
Space	**Fixture Type**	**Wattage**	**Quantity**	**Annual Hours**
Auditorium	1-32 Watt CFL	34	117	2,200
Child Care	Four Lamp F32/Super T8 Tandem	30.5	12	2,200
Connector Corridor	Two Lamp F32/T8 Low Power	37	24	2,200
Girls Lockers	Two Lamp F32/T8 Low Power	37	3	2,200
Girls Lockers	Three Lamp F32/Super T8	46	29	2,200
Gym	Six Lamp F32/T8 High Output	234	36	2,200
Kitchen	Two Lamp F32/T8 Low Power	37	8	2,200
Kitchen	Four Lamp F32/Super T8	61	17	2,200
Kitchen	Four Lamp F32/Super T8 Tandem	30.5	1	2,200
Library	Two Lamp F17/T8 Low Power	27	55	2,200
Library	Two Lamp F32/Super T8	33	26	2,200
Library	Four Lamp F32/Super T8	61	43	2,200
Prep Room	Two Lamp F32/Super T8	33	7	2,200
Prep Room	Two Lamp F32/T8 Low Power	37	4	2,200
Prep Room	Four Lamp F32/Super T8 Tandem	30.5	26	2,200
Stage	Four Lamp F32/Super T8	61	8	2,200
Storage	Two Lamp F32/Super T8	33	10	2,200
Storage	Four Lamp F32/Super T8	61	11	2,200
Storage	Four Lamp F32/Super T8 Tandem	30.5	19	2,200
Lobby/Corridor	1-26 Watt CFL	28	352	2,200
Lobby/Corridor	1-32 Watt CFL	34	9	2,200
Lobby/Corridor	Two Lamp F17/T8 Low Power	27	1	2,200
Lobby/Corridor	Two Lamp F32/T8 Low Power	37	273	2,200
Lobby/Corridor	Four Lamp F32/Super T8 Tandem	30.5	1	2,200
Lobby/Corridor	Two Lamp F32/Super T8	33	3	2,200
Lobby/Corridor	Four Lamp F32/Super T8	61	6	2,200
Vocational Classroom	Two Lamp F17/T8 Low Power	27	13	2,200
Vocational Classroom	Two Lamp F32/Super T8	33	9	2,200
Vocational Classroom	Two Lamp F32/T8 Low Power	37	79	2,200
Vocational Classroom	Four Lamp F32/Super T8	61	64	2,200
Vocational Classroom	Four Lamp F32/Super T8 Tandem	30.5	9	2,200
Main Office	Two Lamp F17/T8 Low Power	27	16	2,200
Main Office	Four Lamp F32/Super T8 Tandem	30.5	5	2,200
Private Office	Two Lamp F17/T8 Low Power	27	2	2,200
Private Office	Four Lamp F32/Super T8	61	4	2,200
Private Office	Four Lamp F32/Super T8 Tandem	30.5	23	2,200
Health and Dept Offices	Two Lamp F17/T8 Low Power	27	26	2,200
Health and Dept Offices	Two Lamp F32/T8 Low Power	37	3	2,200
Health and Dept Offices	Four Lamp F32/Super T8	61	23	2,200
Health and Dept Offices	Four Lamp F32/Super T8 Tandem	30.5	58	2,200

Installed Case (cont.)				
Space	**Fixture Type**	**Wattage**	**Quantity**	**Annual Hours**
Fitness/Training	Four Lamp F32/Super T8 Tandem	30.5	20	2,200
Special Education	Two Lamp F17/T8 Low Power	27	10	2,200
Special Education	Two Lamp F32/Super T8	33	4	2,200
Special Education	Four Lamp F32/Super T8 Tandem	30.5	10	2,200
Classroom	Two Lamp F17/T8 Low Power	27	2	2,200
Classroom	Two Lamp F32/Super T8	33	13	2,200
Classroom	Two Lamp F32/T8 Low Power	37	3	2,200
Classroom	Four Lamp F32/Super T8	61	636	2,200
Classroom	Four Lamp F32/Super T8 Tandem	30.5	20	2,200
Computer Lab	Two Lamp F17/T8 Low Power	27	1	2,200
Computer Lab	Two Lamp F32/Super T8	33	5	2,200
Computer Lab	Four Lamp F32/Super T8	61	90	2,200
Computer Lab	Four Lamp F32/Super T8 Tandem	30.5	4	2,200
Restroom	1-26 Watt CFL	28	6	2,200
Restroom	Two Lamp F32/Super T8	33	2	2,200
Restroom	Two Lamp F32/T8 Low Power	37	26	2,200
Cosmo/Cooking Lab	Two Lamp F17/T8 Low Power	27	4	2,200
Cosmo/Cooking Lab	Four Lamp F32/Super T8	61	24	2,200
Cosmo/Cooking Lab	Four Lamp F32/Super T8 Tandem	30.5	52	2,200
Data Room/Electrical	One Lamp F32/T8 Low Power	19	33	2,200
Data Room/Electrical	Two Lamp F32/T8 Low Power	37	33	2,200
Cafeteria/Dining	Two Lamp F17/T8 Low Power	27	33	2,200
Cafeteria/Dining	Three Lamp F17/T8	53	2	2,200
Cafeteria/Dining	Three Lamp F54/T5 High Output	177	15	2,200
Cafeteria/Dining	Four Lamp F32/Super T8 Tandem	30.5	21	2,200
Guidance Private Office	Four Lamp F32/Super T8 Tandem	30.5	1	2,200
	Total	116,421	2,505	N/A

Table 68: Installed Lighting System

Evaluation Methodology

Tracking Estimates

The tracking estimates of energy use were calculated based on the full load of the existing and proposed fixtures. The tracking savings assumed 2,200 hours of operation per year for all of the affected fixtures. Savings from occupancy sensors were not counted in the final tracking estimates.

Evaluation Approach

The evaluation included a verification of installed fixtures, on-site monitoring and interview. All fixtures are controlled by wall switches with the exception of the gymnasium and girls locker room which had occupancy sensors installed.

The base case used in the evaluation of the lighting savings was developed from information contained in the customer application. The pre-existing fixture types were confirmed while on-site with the facility contact. Evaluators visited the facility to verify the installed fixtures and install monitoring equipment to quantify the hours of use of the different spaces. Evaluators surveyed facility personnel to obtain information on the lighting usage throughout the year. They also inquired about any HVAC equipment serving the space.

To determine the hours of use for the new fixtures, field evaluators installed (35) time-of-use (TOU) lighting loggers throughout the building. In addition, evaluators installed one TOU-CT logger and one power logger in the gymnasium panel to record the operation of all the gymnasium lights and one power logger in the auditorium control panel to record the operation of a sample of auditorium lights. Seven lighting loggers were installed in classrooms, four were installed in corridors, four in prep rooms and one logger was installed in several other types of spaces such as the locker room, a restroom, offices and special classrooms. Table 69 presents the fixtures monitored by the evaluation engineers.

Logger #	Equipment Monitored	Parameter Measured	Test Equip. Make & Model	Measurement Type	Installation Method	Frequency of Observations	Monitoring Duration
940629-249	Classroom - Four Lamp F32/T8	On/Off Operation	PS&T TOU Lighting Logger	Event Logger	Proximity	Based on Schedule	4/1/09 - 4/29/09
940629-250	Corridor - Two Lamp F17/T8	On/Off Operation	PS&T TOU Lighting Logger	Event Logger	Proximity	Based on Schedule	4/1/09 - 4/29/09
940629-251	Health Office - Two Lamp F32/T8	On/Off Operation	PS&T TOU Lighting Logger	Event Logger	Proximity	Based on Schedule	4/1/09 - 4/29/09
940629-256	Prep Room - Two Lamp F32/T8	On/Off Operation	PS&T TOU Lighting Logger	Event Logger	Proximity	Based on Schedule	4/1/09 - 4/29/09
940629-257	Classroom - Four Lamp F32/T8	On/Off Operation	PS&T TOU Lighting Logger	Event Logger	Proximity	Based on Schedule	4/1/09 - 4/29/09
940629-264	Special Ed - Four Lamp F32/T8	On/Off Operation	PS&T TOU Lighting Logger	Event Logger	Proximity	Based on Schedule	4/1/09 - 4/29/09
940629-285	Girls Locker - Three Lamp F32/T8	On/Off Operation	PS&T TOU Lighting Logger	Event Logger	Proximity	Based on Schedule	4/1/09 - 4/29/09
940629-291	Data Room - Two Lamp F32/T8	On/Off Operation	PS&T TOU Lighting Logger	Event Logger	Proximity	Based on Schedule	4/1/09 - 4/29/09
940629-338	Child Care - Four Lamp F32/T8	On/Off Operation	PS&T TOU Lighting Logger	Event Logger	Proximity	Based on Schedule	4/1/09 - 4/29/09
940629-357	Stage - Four Lamp F32/T8	On/Off Operation	PS&T TOU Lighting Logger	Event Logger	Proximity	Based on Schedule	4/1/09 - 4/29/09
940629-368	Computer Lab - Four Lamp F32/T8	On/Off Operation	PS&T TOU Lighting Logger	Event Logger	Proximity	Based on Schedule	4/1/09 - 4/29/09
940824-009	Corridor - Two Lamp F17/T8	On/Off Operation	PS&T TOU Lighting Logger	Event Logger	Proximity	Based on Schedule	4/1/09 - 4/29/09
940824-010	Prep Room - Two Lamp F32/T8	On/Off Operation	PS&T TOU Lighting Logger	Event Logger	Proximity	Based on Schedule	4/1/09 - 4/29/09
940824-017	Classroom - Four Lamp F32/T8	On/Off Operation	PS&T TOU Lighting Logger	Event Logger	Proximity	Based on Schedule	4/1/09 - 4/29/09
940824-021	Private Office - Four Lamp F32/T8	On/Off Operation	PS&T TOU Lighting Logger	Event Logger	Proximity	Based on Schedule	4/1/09 - 4/29/09
940824-022	Library - Two Lamp F17/T8	On/Off Operation	PS&T TOU Lighting Logger	Event Logger	Proximity	Based on Schedule	4/1/09 - 4/29/09
940824-023	Classroom - Two Lamp F32/T8	On/Off Operation	PS&T TOU Lighting Logger	Event Logger	Proximity	Based on Schedule	4/1/09 - 4/29/09
940824-025	Storage - Four Lamp F32/T8	On/Off Operation	PS&T TOU Lighting Logger	Event Logger	Proximity	Based on Schedule	4/1/09 - 4/29/09
940824-027	Corridor - Two Lamp F17/T8	On/Off Operation	PS&T TOU Lighting Logger	Event Logger	Proximity	Based on Schedule	4/1/09 - 4/29/09
940824-028	Corridor - Two Lamp F17/T8	On/Off Operation	PS&T TOU Lighting Logger	Event Logger	Proximity	Based on Schedule	4/1/09 - 4/29/09
940824-031	Restroom - Two Lamp F32/T8	On/Off Operation	PS&T TOU Lighting Logger	Event Logger	Proximity	Based on Schedule	4/1/09 - 4/29/09
940824-044	Prep Room - Two Lamp F32/T8	On/Off Operation	PS&T TOU Lighting Logger	Event Logger	Proximity	Based on Schedule	4/1/09 - 4/29/09
940824-110	Fitness - Three Lamp F32/T8	On/Off Operation	PS&T TOU Lighting Logger	Event Logger	Proximity	Based on Schedule	4/1/09 - 4/29/09
940824-119	Vocational Class - Four Lamp F32/T8	On/Off Operation	PS&T TOU Lighting Logger	Event Logger	Proximity	Based on Schedule	4/1/09 - 4/29/09
940824-123	Café - Three Lamp F54/T5	On/Off Operation	PS&T TOU Lighting Logger	Event Logger	Proximity	Based on Schedule	4/1/09 - 4/29/09

Logger #	Equipment Monitored	Parameter Measured	Test Equip. Make & Model	Measurement Type	Installation Method	Frequency of Observations	Monitoring Duration
940824-135	Classroom - Four Lamp F32/T8	On/Off Operation	PS&T TOU Lighting Logger	Event Logger	Proximity	Based on Schedule	4/1/09 - 4/29/09
940824-155	Corridor - Two Lamp F17/T8	On/Off Operation	PS&T TOU Lighting Logger	Event Logger	Proximity	Based on Schedule	4/1/09 - 4/29/09
940824-160	Classroom - Two Lamp F32/T8	On/Off Operation	PS&T TOU Lighting Logger	Event Logger	Proximity	Based on Schedule	4/1/09 - 4/29/09
940824-161	Classroom - Four Lamp F32/T8	On/Off Operation	PS&T TOU Lighting Logger	Event Logger	Proximity	Based on Schedule	4/1/09 - 4/29/09
940824-163	Classroom - Four Lamp F32/T8	On/Off Operation	PS&T TOU Lighting Logger	Event Logger	Proximity	Based on Schedule	4/1/09 - 4/29/09
940824-167	Prep Room - Two Lamp F32/T8	On/Off Operation	PS&T TOU Lighting Logger	Event Logger	Proximity	Based on Schedule	4/1/09 - 4/29/09
940824-185	Private Office - Four Lamp F32/T8	On/Off Operation	PS&T TOU Lighting Logger	Event Logger	Proximity	Based on Schedule	4/1/09 - 4/29/09
940824-226	Main Office - Two Lamp F17/T8	On/Off Operation	PS&T TOU Lighting Logger	Event Logger	Proximity	Based on Schedule	4/1/09 - 4/29/09
940824-244	Kitchen - Two Lamp F32/T8	On/Off Operation	PS&T TOU Lighting Logger	Event Logger	Proximity	Based on Schedule	4/1/09 - 4/29/09
940902-139	Cosmo - Four Lamp F32/T8	On/Off Operation	PS&T TOU Lighting Logger	Event Logger	Proximity	Based on Schedule	4/1/09 - 4/29/09
CT08010005	Gymnasium - Four Lamp F32/T8	On/Off Operation	PS&T TOU CT Logger	Event Logger	Clamp-On	Based on Schedule	4/1/09 - 4/29/09
E3299	Gymnasium - Six Lamp F32/T8	Volts, Amps, kW	Dent Instruments ElitePRO Power	Power Logger	Clamp-On CT and Voltage	15 Minute	4/1/09 - 4/29/09
E7B26	Auditorium - 32 Watt CFL	Volts, Amps, kW	Dent Instruments ElitePRO Power	Power Logger	Clamp-On CT and Voltage	15 Minute	4/1/09 - 4/29/09

Table 69: Spaces Monitored

Verification of Equipment and Operating Parameters

This project included retrofitting one entire wing of a high school to replace older inefficient lighting fixtures with new more efficient fixtures. Included in the retrofit are classrooms, offices, corridors, locker rooms, auditorium and gymnasium. The existing fixtures included metal halide fixtures, incandescent fixtures, two lamp compact fluorescent fixtures, one lamp T8 fixtures, two lamp T8 fixtures, three lamp T8 fixtures and four lamp T8 fixtures. These fixtures were replaced by various size high efficiency T8/T5 lamps and ballasts and high efficiency compact fluorescent lamps.

Also included in this project were four occupancy sensors that were to be installed in the girl's locker room. The gymnasium was also to receive (36) six lamp F32/T8 fixtures, each with its own integrated occupancy sensor.

Evaluators found that the quantities and fixture types closely matched those that were proposed in the tracking savings estimate. There were some discrepancies found which led to an increase in savings of approximately 1%. Specifically, the tracking savings proposed the installation of approximately (300) two lamp F32 Super T8 fixtures in the corridors. However, evaluators found that the corridors contained mostly two lamp F17/T8 fixtures. Evaluators found that the auditorium contained 42 watt compact fluorescents rather than 32 watt compact fluorescents based on power measurements taken on-site.

In the event where additional fixtures were found during the on-site visit, evaluators adjusted the baseline quantity to reflect this change. This resulted in an increase in savings. Likewise, if fewer fixtures were found in a space, the baseline quantity was also adjusted, which led to a reduction in savings. Baseline adjustments were done differently depending on if the tracking savings assumed a one-to-one replacement. If a one-to-one replacement was assumed, the baseline quantity was adjusted to equal the number of fixtures found on-site. If the tracking savings did not propose a one-to-one replacement, evaluators adjusted the baseline using the same ratio of existing to installed fixtures used in the tracking estimate. Overall, evaluators found more fixtures than proposed in the tracking analysis, which resulted in greater savings reduction. Table 70 presents the comparison between the tracking and evaluation fixture counts.

Fixture Type	Fixture Quantity	
	Tracking	Evaluation
1-26 Watt CFL	358	355
1-32 Watt CFL	126	9
1-42 Watt CFL	0	111
One Lamp F32/T8 Low Power	33	33
Two Lamp F17/T8 Low Power	163	463
Three Lamp F17/T8	2	2
Two Lamp F32/Super T8	535	229
Three Lamp F32/Super T8	29	60
Three Lamp F54/T5 High Output	15	13
Four Lamp F32/Super T8 Tandem	282	308
Four Lamp F32/Super T8	926	920
Six Lamp F32/T8 High Output	36	36
Total	**2,505**	**2,539**

Table 70: Tracking vs. Evaluation Fixture Quantities

Evaluators found all of the occupancy sensors that were to be installed. These were identified in the gymnasium and the girl's locker room.

Evaluators interviewed the site contact person to obtain school occupancy schedules for the entire year. Facility personnel provided the school calendar so that the evaluation could determine the holidays, breaks and summer vacation days used for the analysis. The school holidays include New Year's Day, Martin Luther King's Birthday, Washington's Birthday, Good Friday, Patriot's Day, Memorial Day, Independence Day, Labor Day, Columbus Day, Veteran's Day, Thanksgiving (Wednesday through Friday) Christmas Eve and Christmas Day. School breaks include the week of Washington's Birthday in February, the week of Patriot's Day in April and the week following Christmas through New Year's Day. Summer vacation begins the last week of June and ends the first week of September. The monitoring period covered the entire spring break from April 20 – 24, 2009.

Discussions with facility personnel revealed that there is very minimal usage during the summer vacation. Typically there is a summer science program that utilizes one or two classrooms during the summer. Besides this, there is typically no occupancy other than summer cleaning that takes place. Therefore, evaluators assumed that the operation captured during the spring break was reasonable to use for the summer period as well as holidays. For example, the average classroom operated approximately 5% of the time during the spring break between 8 am and 6 pm.

Table 71 presents the values obtained from the monitored data including annual operation, summer and winter diversity factors, and on-peak hours of use.

Schedule 37 represents the average corridor schedule for the hallway lights that go off each night. It was calculated as the straight average of Schedules 2, 12, 19 and 20, which are all the hallway schedules. Note that evaluators found that approximately 25% of the two lamp F17/T8 fixtures and approximately 80% of the 26 watt compact fluorescent fixtures throughout the hallways remain on 24/7. For these fixtures, Schedule 36, or the gym emergency lights schedule, was used to represent the 8,760 operation of these fixtures. Evaluators determined the number of 8,760 hour fixtures in the hallways by walking through the facility after all of the regular lighting had been shut off for the night and counting the number that remained on.

Schedule 38 represents the average classroom schedule and was calculated as the straight average of Schedules 1, 5, 14, 17, 26, 28, 29 and 30 or all the classroom schedules. This schedule was used to calculate the energy savings for all the classrooms. Likewise, Schedule 39 represents the average prep room schedule and was calculated as the average of Schedules 4, 13 and 31. A prep room is a small room that is located between two classrooms. It serves as a space to store classroom equipment or materials. These are similar to storage rooms in that the lights do not operate very many hours.

Schedule 41 represents the operating schedule of the main gym lights. This was generated using power logger data in which the power (kW) of the lights was monitored in fifteen minute intervals. Evaluators were able to measure all (36) six lamp F32/T8 high output fixtures in the gymnasium using one power logger. A spot power measurement was taken on each of three circuits that contained all (36) fixtures. One circuit contained (18) fixtures and had a measured power of 3.99 kW, or 221 watts per fixture. The second circuit served (12) fixtures and had a measured power of 2.68 kW, or 224 watts per fixture. The third circuit had (6) fixtures and had a measured power of 1.38 kW, or 230 watts per fixture. Though the measured wattages were less than the proposed wattage of 234 watts per fixture, evaluators did not change the tracking estimate of wattage for the installed gym fixtures because it is possible that the wattage of the existing fixture would have had a similar discrepancy. The measured values were used to calculate the total percent on of the gym fixtures by dividing the fifteen minute monitored kW by the maximum (measured) kW. From this, evaluators were able to create an average weekly profile of operation identical to those created using the lighting loggers.

As stated above, each of the (36) six lamp F32/T8 high output fixtures in the gymnasium had their own individual occupancy sensor. To estimate the baseline hours of use for these fixtures, evaluators assumed that the gymnasium lights would operate during the same hours that were monitored, but they would operate 100% of the time between these hours. This assumes that on a given weekday, the gym lights would have been turned on at the circuit panel and would have remained on until the end of the day. This was the method used to develop Schedule 42. This same method was used to calculate the baseline hours of operation for the girl's locker room, which is represented by Schedule 40.

Schedule 43 represents the operating schedule of the auditorium lights. This schedule was generated using power logger data in the same method used to develop the schedule for the gymnasium lights. Evaluators were able to measure four different circuits containing a different quantity of 32 watt compact fluorescent fixtures. A spot power measurement was taken on each of four circuits that contained a total of (19) fixtures. The first circuit contained (5) fixtures and had a measured power of 0.23 kW, or 45 watts per fixture. The second and third circuits each served (4) fixtures and had measured powers of 0.20 kW, or 50 watts per fixture and 0.18, or 45 watts per fixture, respectively. The fourth circuit had (6) fixtures and had a measured power of 0.28 kW, or 47 watts per fixture. The measure power of these compact fluorescent fixtures was significantly higher than the tracking estimate for a 32 watt CFL. In fact, the average wattage of 46 watts per fixture indicates that these may have been a higher wattage CFL fixture, such as a 42 watt CFL. Evaluators were unable to identify the exact wattage of the fixture due to the height of the ceiling. However, evaluators double counted the measured circuits to be sure that the correct number was being utilized in the calculation. Therefore, the on-site savings were adjusted to assume that the auditorium lights had been retrofit with 42 watt CFLs rather than 32 watt CFLs.

Schedule ID	Logger #	Description	Annual Hours	Summer Diversity	Winter Diversity	On-Peak Hours
1	940629-249	Rm 2077	1,238	11%	2%	1,235
2	940629-250	Hall outside 2077	2,796	50%	55%	2,566
3	940629-251	Health Office	1,561	20%	17%	1,557
4	940629-256	Rm 2007 Prep Room	1,083	12%	11%	1,061
5	940629-257	Rm 2007	1,136	12%	8%	957
6	940629-264	Sp. Clrm 2037	1,942	25%	22%	1,759
7	940629-285	Girls Locker Rm	2,640	30%	67%	2,174
8	940629-291	3007 Data Rm	39	0%	0%	36
9	940629-338	Child Care	1,632	16%	2%	1,382
10	940629-357	Stage	466	9%	20%	431
11	940629-368	Computer Lab Room 110	941	12%	1%	908

Schedule ID	Logger #	Description	Annual Hours	Summer Diversity	Winter Diversity	On-Peak Hours
12	940824-009	Hall Fix outside Rm 3026	2,189	32%	23%	2,029
13	940824-010	Rm 2011 Prep Rm	97	1%	1%	88
14	940824-017	Rm 3026	1,209	13%	20%	1,203
15	940824-021	Guidance Private Office 1029	-	0%	0%	-
16	940824-022	Library	1,834	25%	23%	1,716
17	940824-023	Rm 3064	854	9%	3%	847
18	940824-025	3008 Storage	26	0%	0%	26
19	940824-027	Hall outside 2007	3,255	38%	16%	2,093
20	940824-028	Hall Fix outside Rm 3018	2,212	26%	27%	2,026
21	940824-031	3rd Fl Boys RR	3,023	41%	79%	2,809
22	940824-044	Rm 3018 Prep Rm	8,760	100%	100%	4,032
23	940824-110	Fitness (Wrestling Room)	297	2%	17%	297
24	940824-119	Woodshop	1,527	28%	6%	1,513
25	940824-123	Cafeteria	1,137	3%	15%	1,081
26	940824-135	Rm 2011	1,264	10%	0%	1,183
27	940824-155	Walkway to old building	934	8%	1%	717
28	940824-160	Rm 3065	1,135	20%	4%	1,120
29	940824-161	Rm 2076	1,360	15%	12%	1,350
30	940824-163	Rm 3018	1,128	11%	13%	1,118
31	940824-167	Rm 3026 Prep Room	1,073	13%	14%	1,069
32	940824-185	Office #1011	727	23%	4%	709
33	940824-226	Main Office Reception	2,246	67%	8%	2,188
34	940824-244	Kitchen	1,951	34%	7%	1,644
35	940902-139	1053 Cosmo Front Desk	1,310	11%	7%	1,305
36	CT08010005	Gymnasium 4 Lamp Fixtures	8,760	100%	100%	4,032
37	NA	Average Corridor	2,613	37%	30%	2,178
38	NA	Average Classroom	1,165	13%	8%	1,126
39	NA	Average Prep Room	751	9%	9%	740
40	NA	Girls Locker Baseline	3,074	33%	77%	2,547
41	E3299	Main Gym Lights	2,303	38%	30%	1,761
42	NA	Main Gym Lights Baseline	2,919	45%	38%	2,372
43	E7B26	Auditorium Lights	715	11%	8%	617

Table 71: Annual Hours of Use and Diversity Factors of Monitored Data

To estimate annual energy and demand savings, a spreadsheet method was employed. The summary of this spreadsheet is presented in Table 72. Annual hours and diversity factors from Table 71 are used with wattages from Table 72 to calculate energy and demand savings. The schedule ID's from Table 71 are presented in Table 72 to show which schedule was used with each fixture ID. The final on-site savings estimates are presented in Table 72.

The facility's heat is provided by natural gas which has no electrical interaction with the new lighting. However, because of the reduced heat going into the space due to the installation of more efficient lighting, there will be a need for additional heat from the facility's forced air system. It was estimated that this heating penalty is equal to approximately 387 MMBTU's per year. This was calculated using a heating efficiency of 77% for a hot water boiler. This estimate for efficiency is an assumption based on a standard efficiency for a hot water boiler. Likewise, most of the school is air-conditioned using a central chiller plant. This includes all of the classrooms and specialty rooms. In addition, the library and cafeteria each have their own rooftop packaged DX units. Spaces that are not cooled include the gymnasium, auditorium and kitchens. Evaluators calculated additional energy savings resulting from reduced cooling loads on the system. Evaluators assumed an efficiency rating of 0.64 kW/ton for the chiller system and 1.2 kW/ton for the packaged DX units. These efficiencies are assumed to be the standard efficiencies for these types of air-conditioning systems.

The average daily lighting profiles for all the monitored spaces are presented in Figure 112 through Figure 154. This includes the average weekday, weekend day and holiday. The x-axis represents one full day and the y-axis is the percentage that the lights are on for each hour.

An hourly summary of the site kW savings for an average summer (June through August), non-holiday, weekday is presented in Table 73. This summary is provided so that the summer diversified peak kW can be estimated across any range of hours in the event that the FCM definition for summer peak changes in the future. The same summary was also provided for the average winter (December and January), non-holiday, weekday in Table 74.

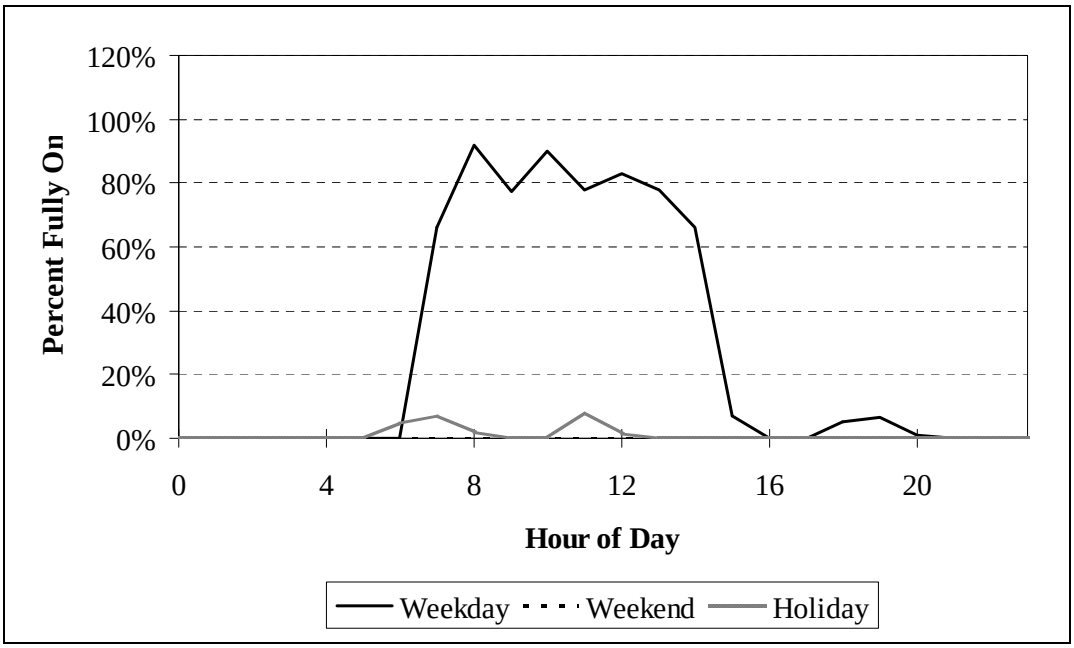

Figure 112: Average Daily Lighting Profile for Schedule 1 (Classroom 2077) from 4/1/09 to 4/29/09

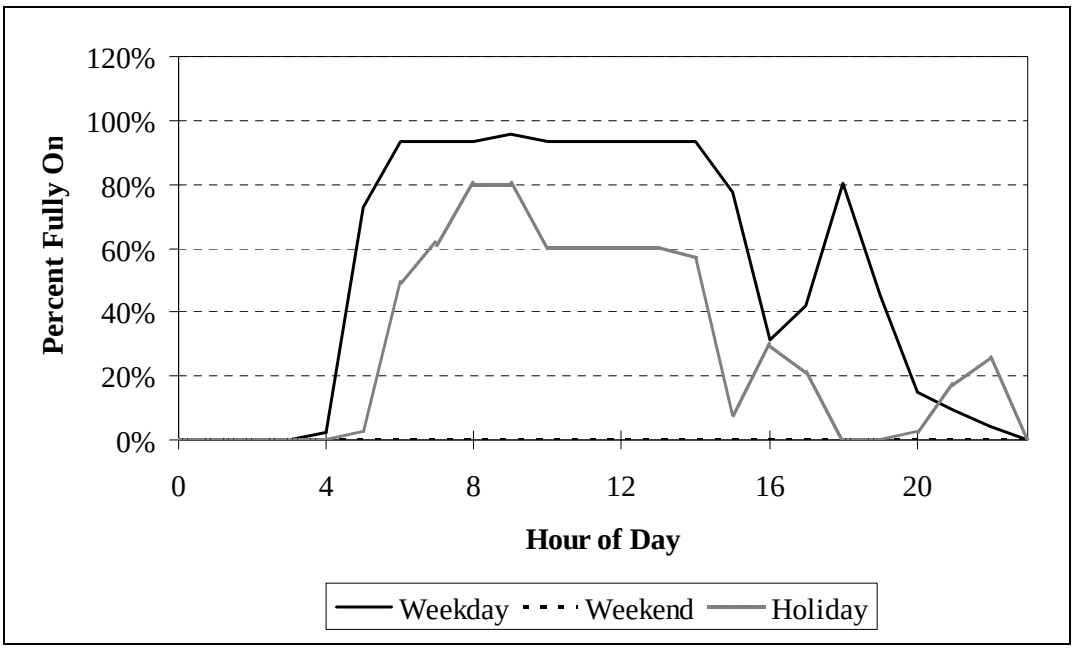

Figure 113: Average Daily Profile for Schedule 2 (Hallway) from 4/1/09 to 4/29/09

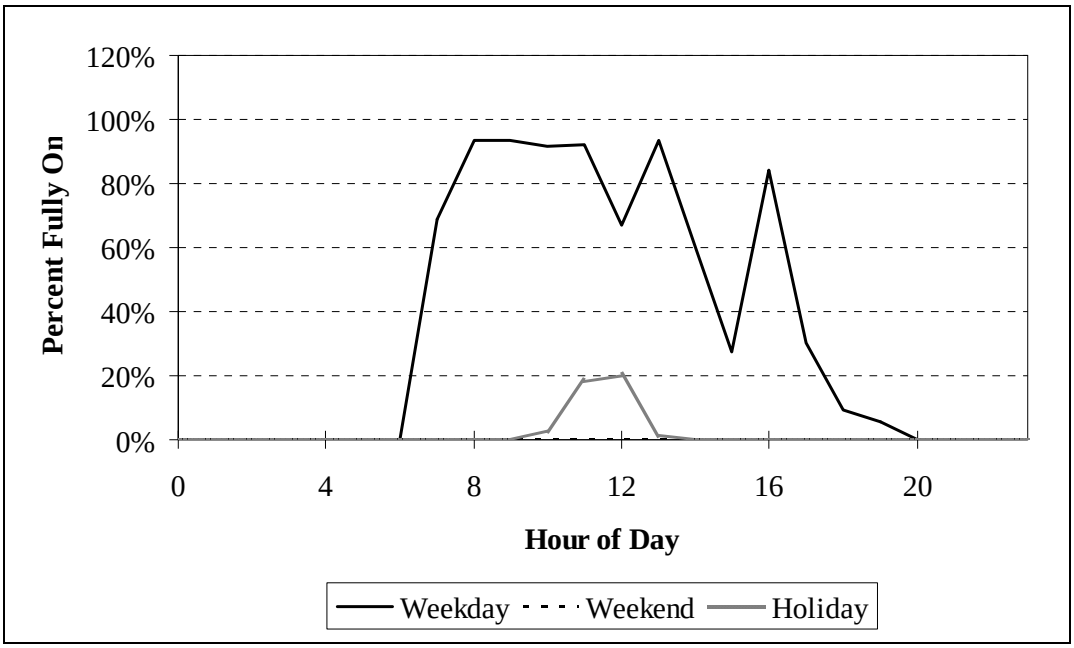

Figure 114: Average Daily Lighting Profile for Schedule 3 (Health Office) from 4/1/09 to 4/29/09

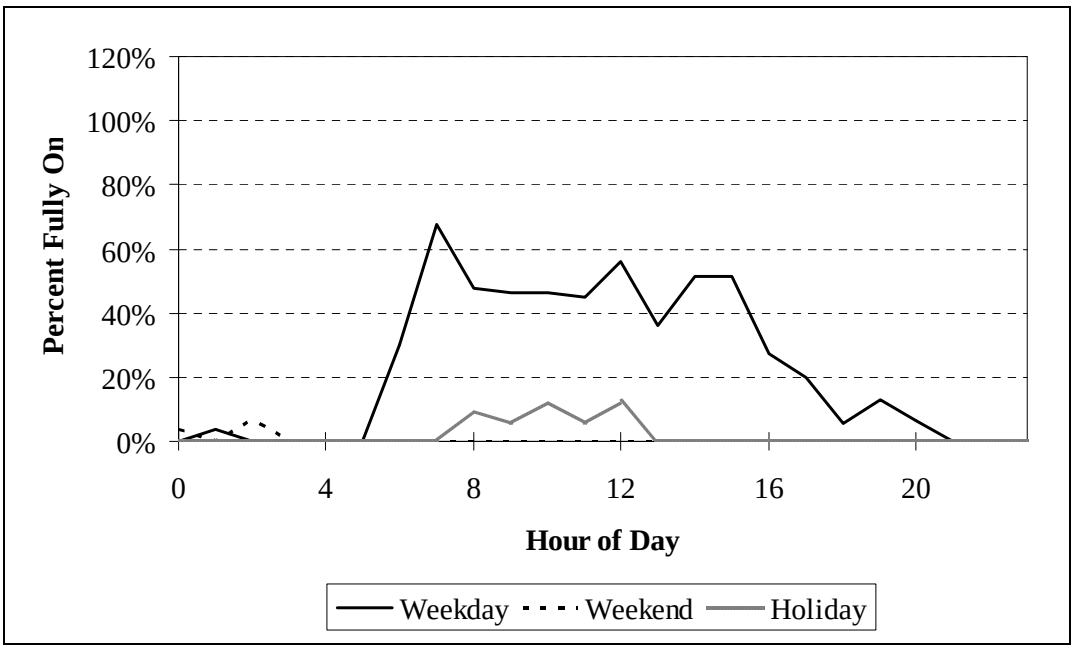

Figure 115: Average Daily Lighting Profile for Schedule 4 (Rm 2007 Prep Room) from 4/1/09 to 4/29/09

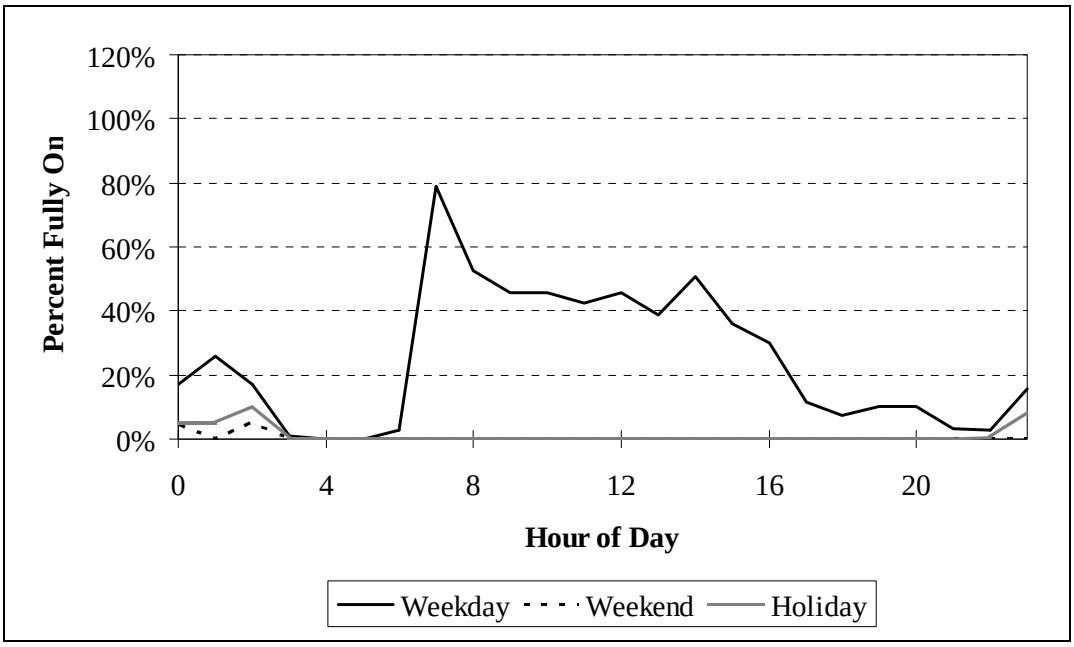

Figure 116: Average Daily Lighting Profile for Schedule 5 (Classroom 2007) from 4/1/09 to 4/29/09

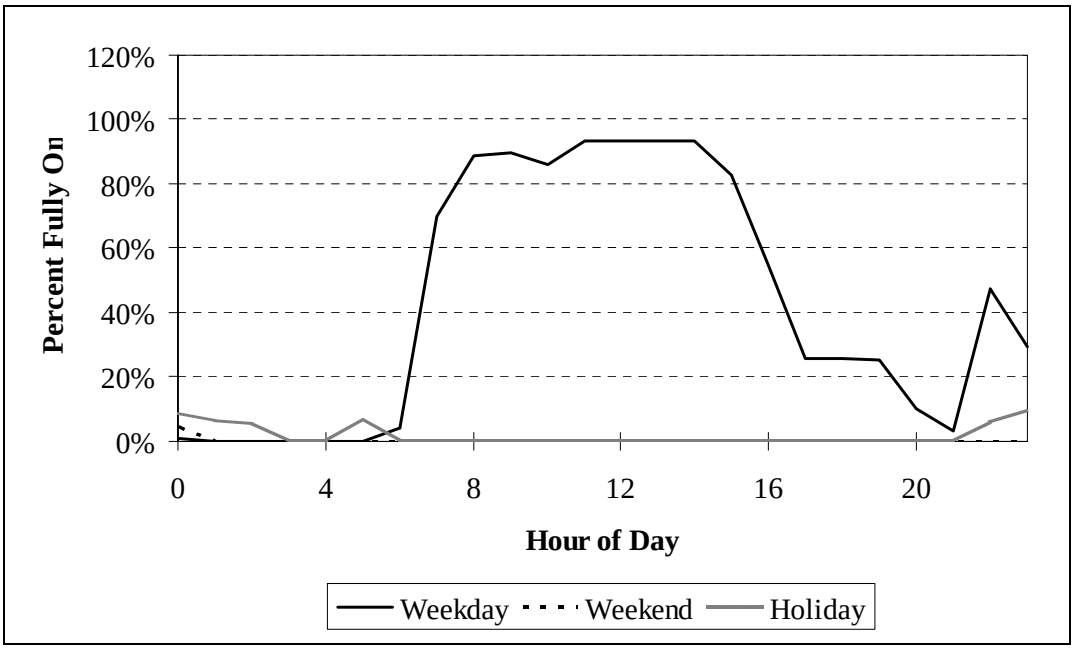

Figure 117: Average Daily Lighting Profile for Schedule 6 (Special Ed Room 2037) from 4/1/09 to 4/29/09

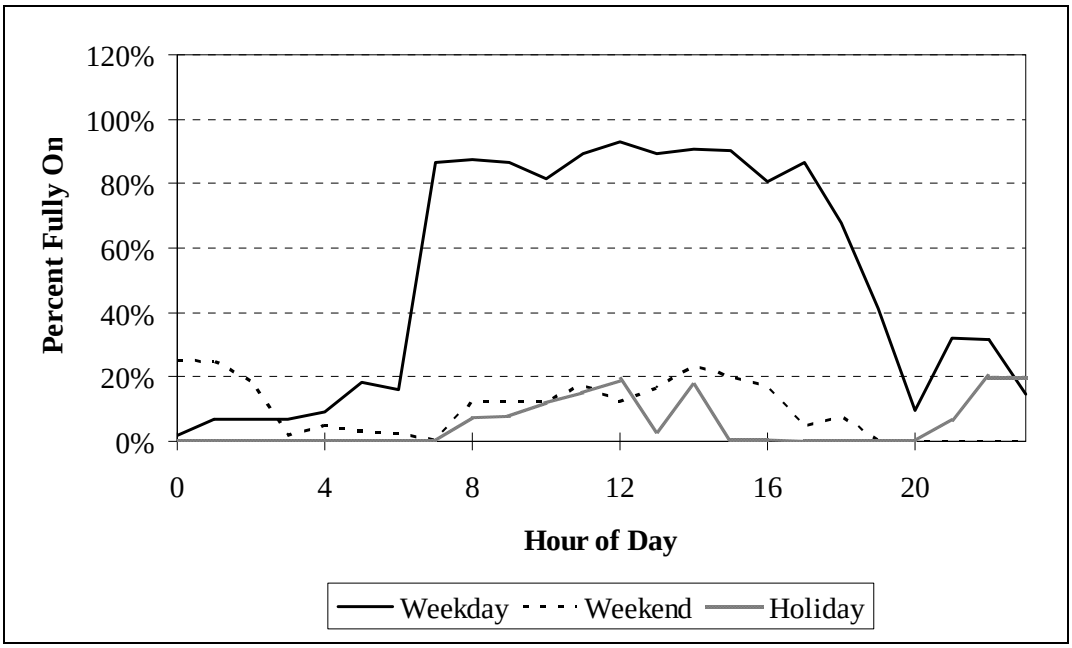

Figure 118: Average Daily Lighting Profile for Schedule 7 (Girls Locker Rm w/OS) from 4/1/09 to 4/29/09

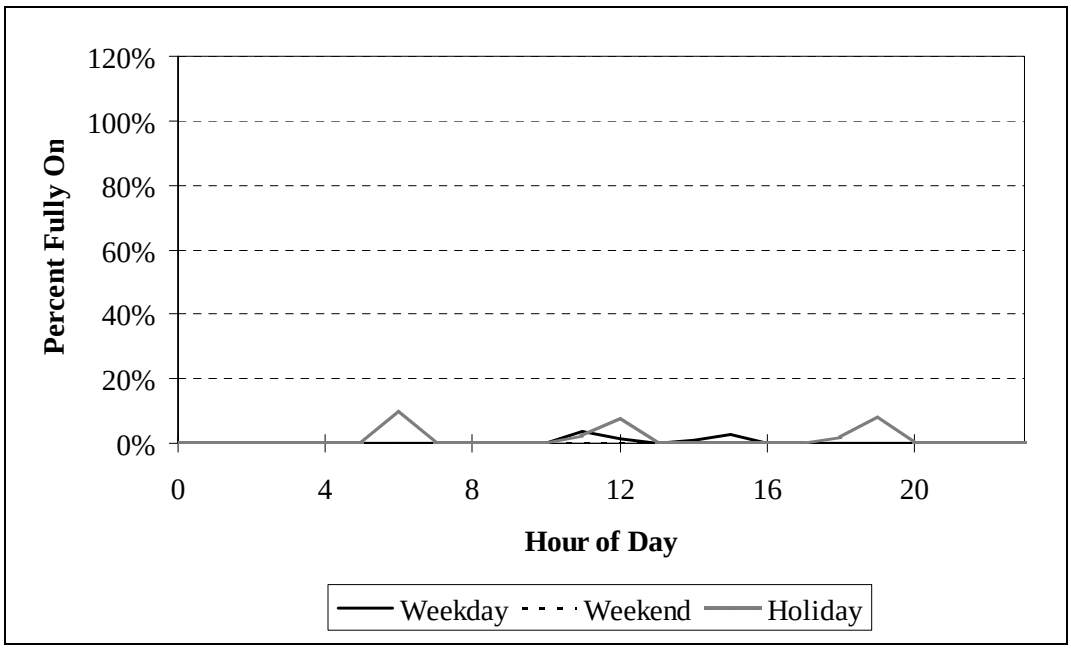

Figure 119: Average Daily Lighting Profile for Schedule 8 (Data Room) from 4/1/09 to 4/29/09

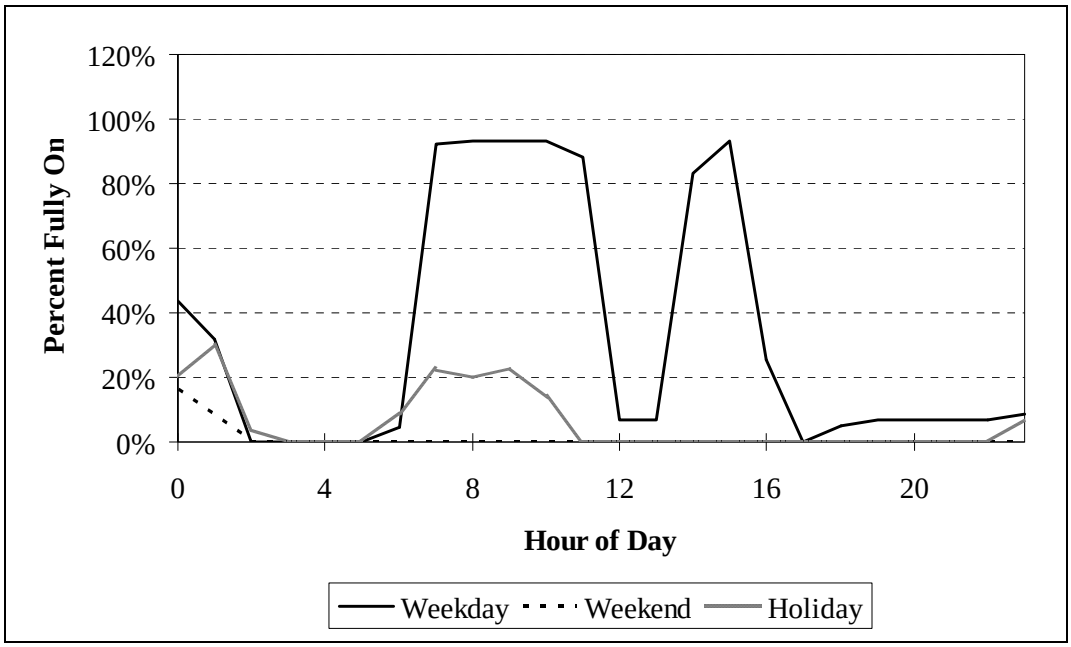

Figure 120: Average Daily Lighting Profile for Schedule 9 (Child Care) from 4/1/09 to 4/29/09

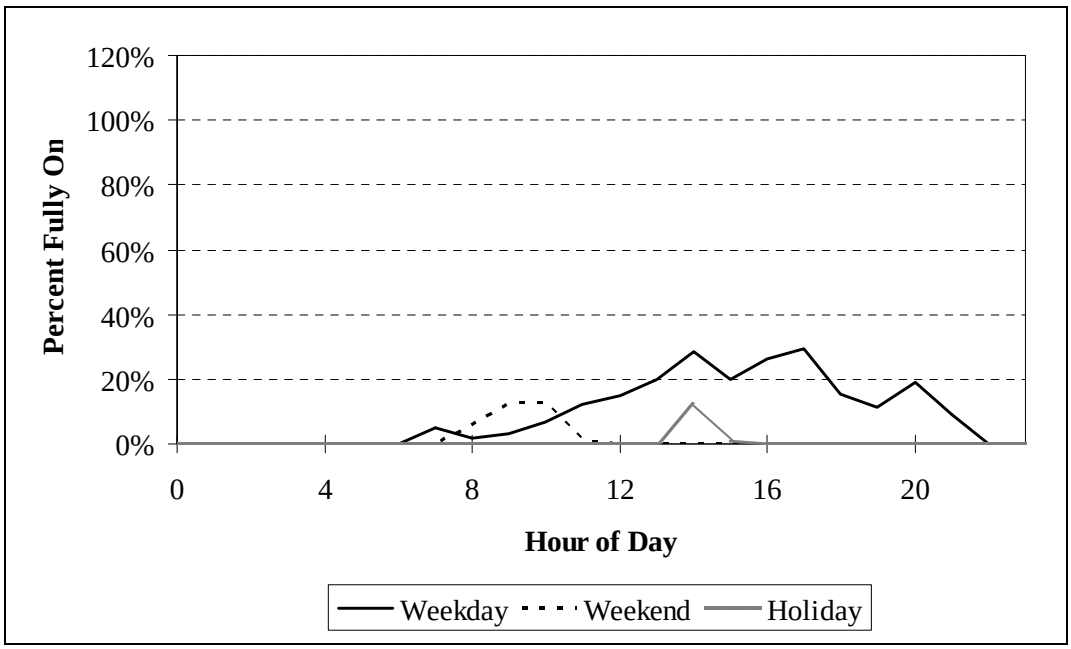

Figure 121: Average Daily Lighting Profile for Schedule 10 (Stage) from 4/1/09 to 4/29/09

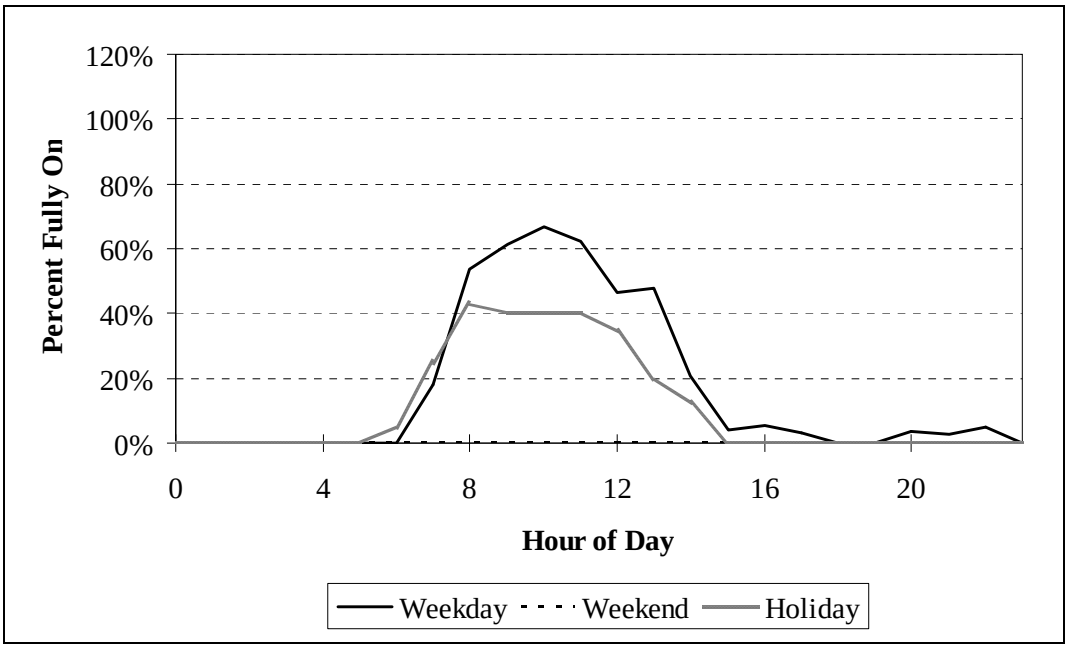

Figure 122: Average Daily Lighting Profile for Schedule 11 (Computer Lab) from 4/1/09 to 4/29/09

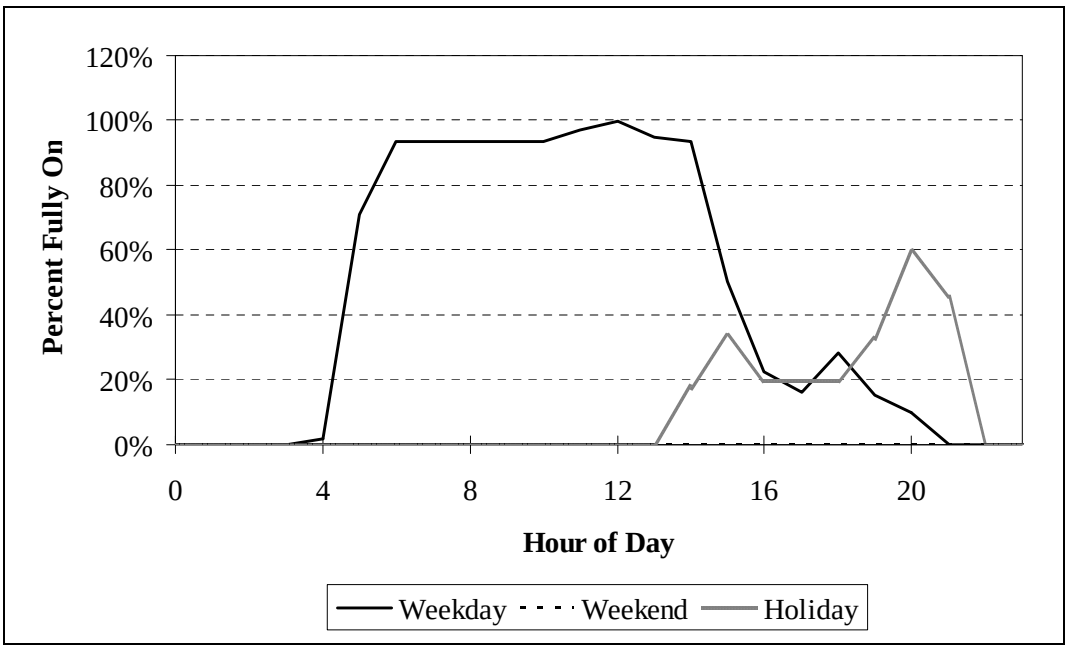

Figure 123: Average Daily Lighting Profile for Schedule 12 (Hallway) from 4/1/09 to 4/29/09

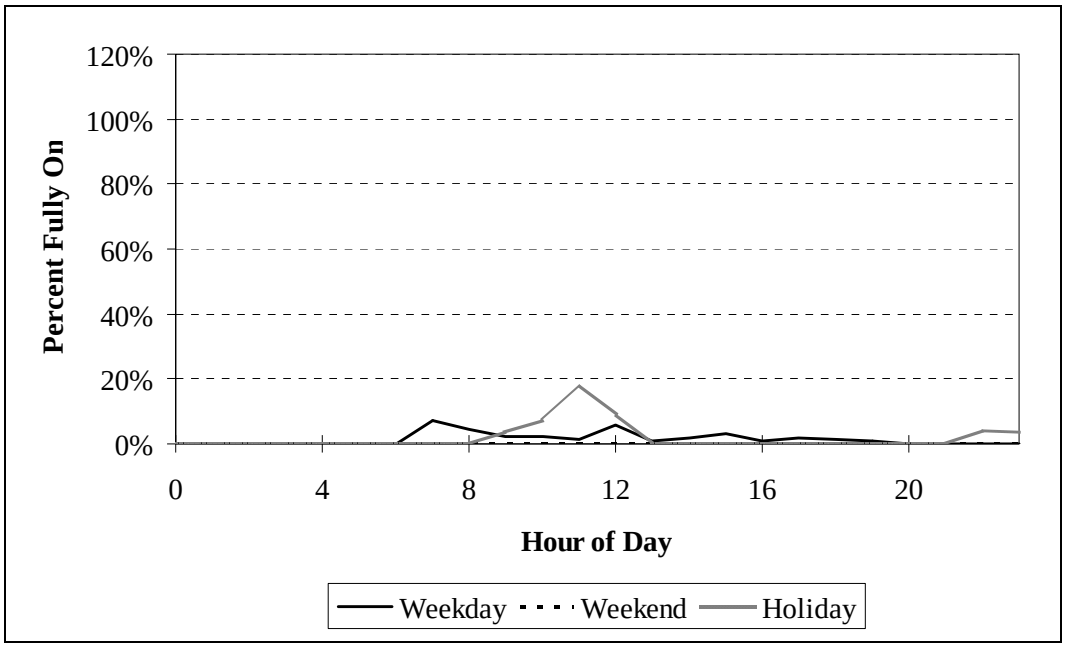

Figure 124: Average Daily Lighting Profile for Schedule 13 (Rm 2011 Prep Room) from 4/1/09 to 4/29/09

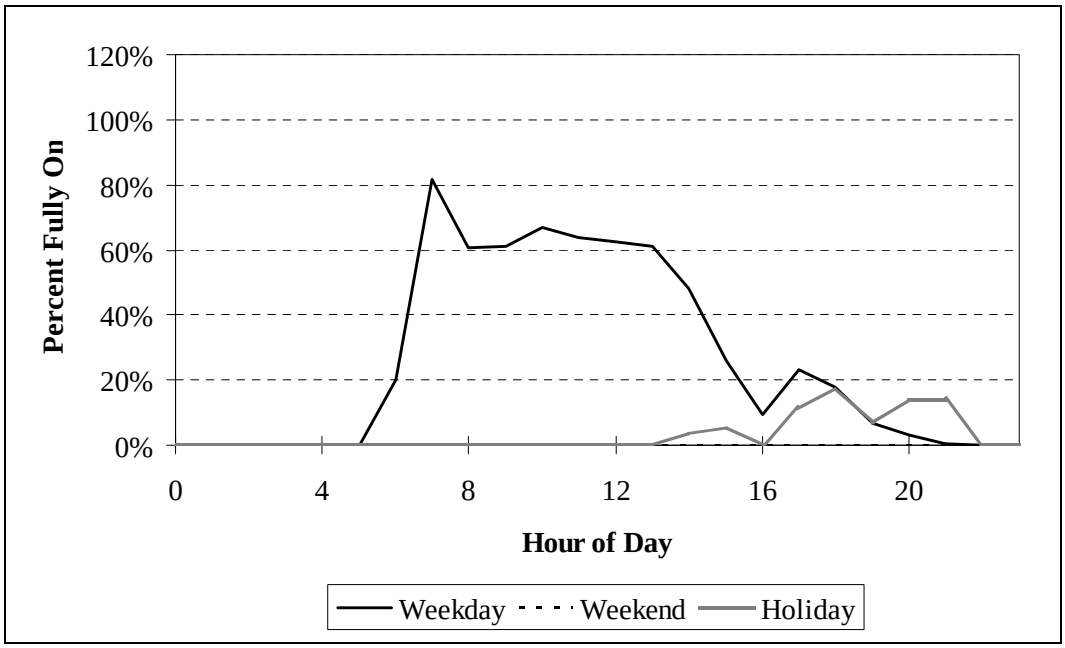

Figure 125: Average Daily Lighting Profile for Schedule 14 (Classroom 3026) from 4/1/09 to 4/29/09

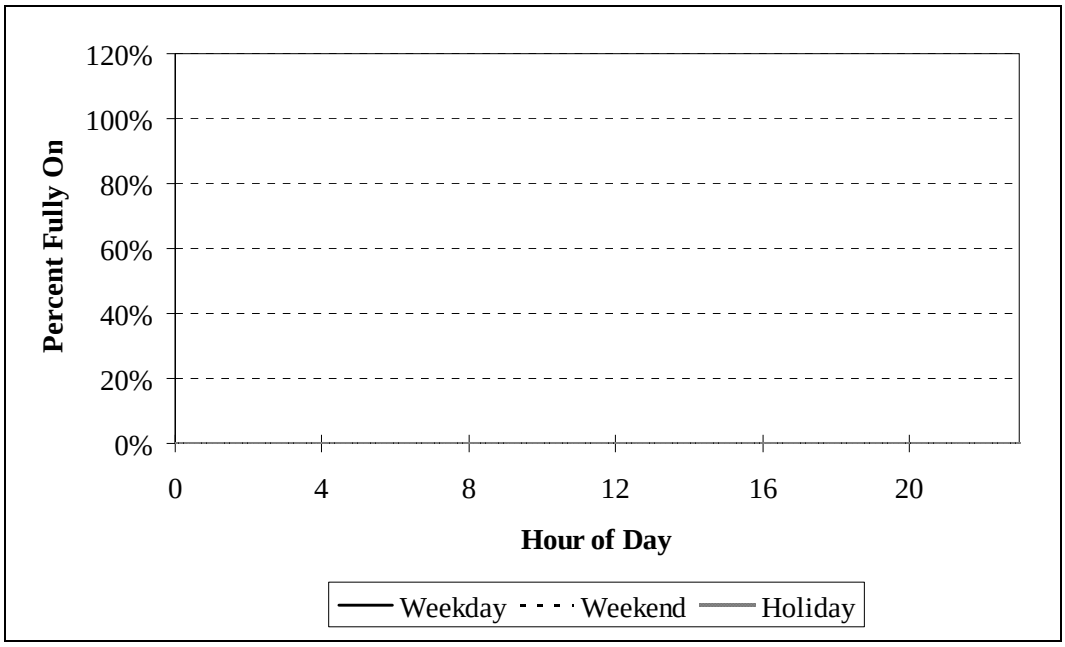

Figure 126: Average Daily Lighting Profile for Schedule 15 (Guidance Private Office) from 4/1/09 to 4/29/09

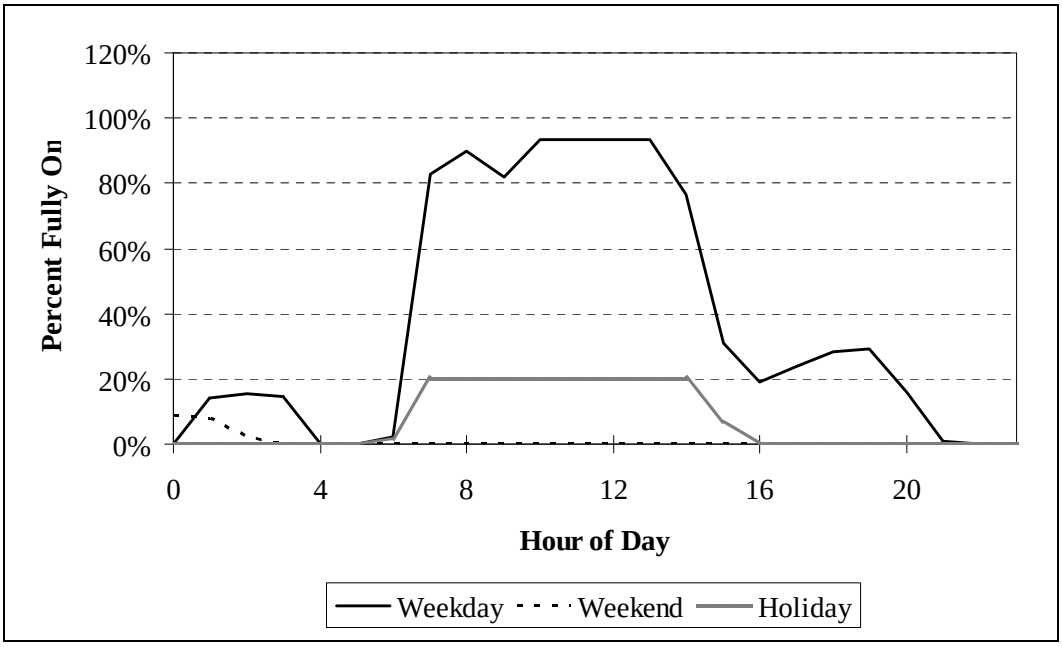

Figure 127: Average Daily Lighting Profile for Schedule 16 (Library) from 4/1/09 to 4/29/09

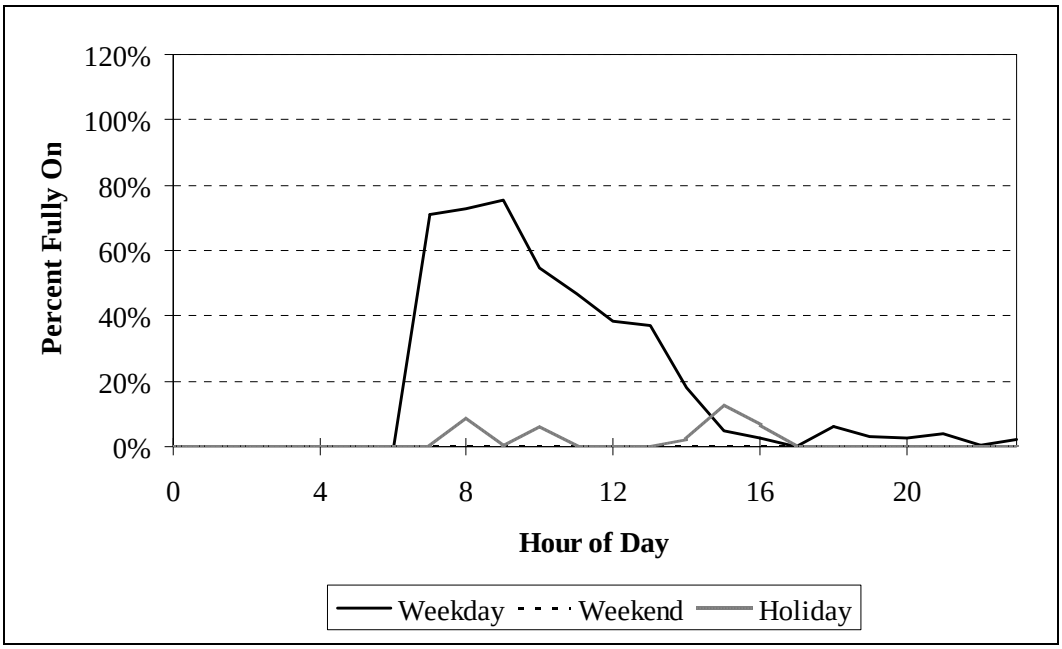

Figure 128: Average Daily Lighting Profile for Schedule 17 (Classroom 3064) from 4/1/09 to 4/29/09

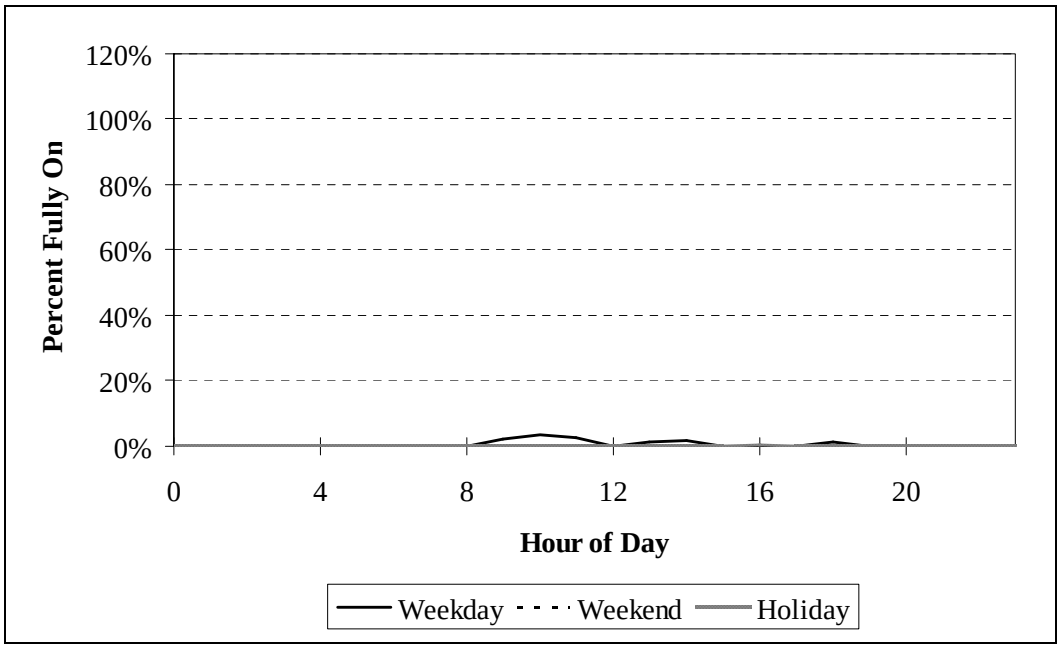

Figure 129: Average Daily Lighting Profile for Schedule 18 (Storage) from 4/1/09 to 4/29/09

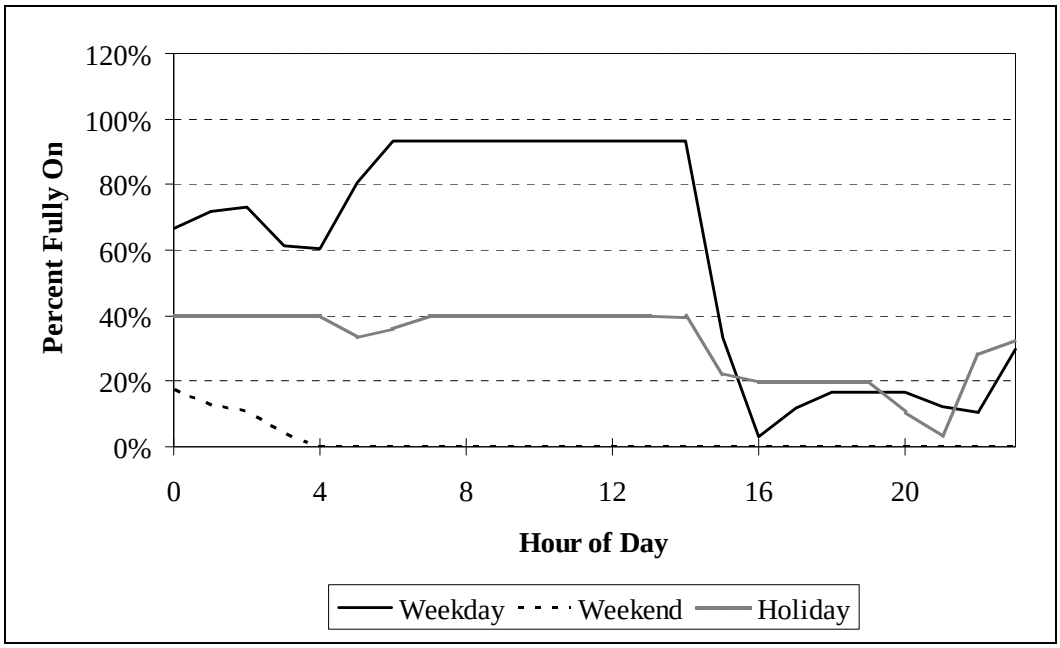

Figure 130: Average Daily Lighting Profile for Schedule 19 (Hallway) from 4/1/09 to 4/29/09

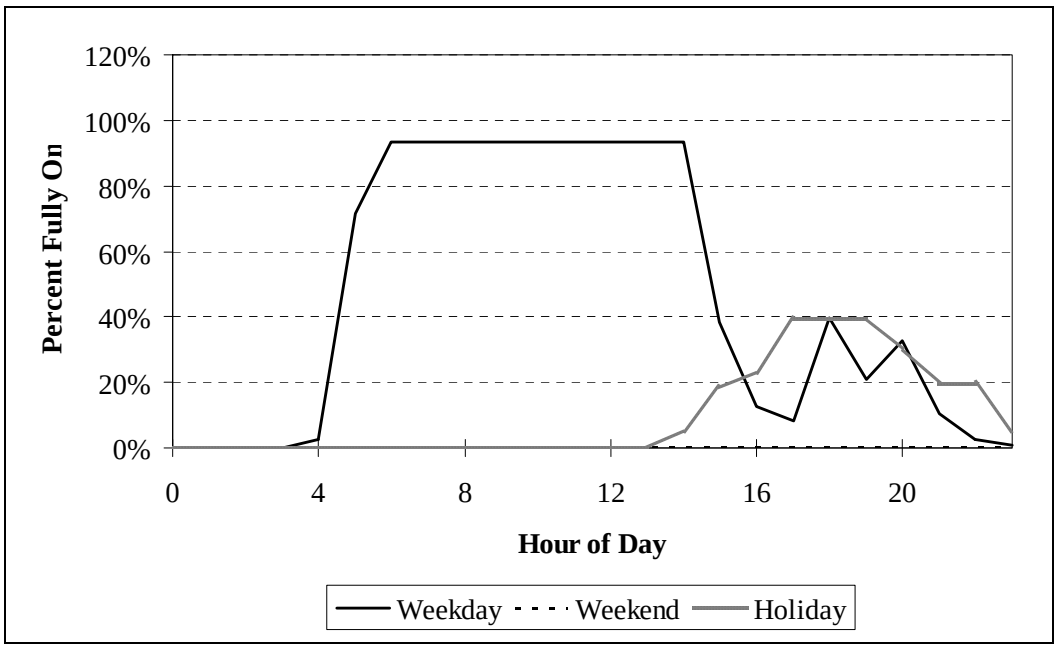

Figure 131: Average Daily Lighting Profile for Schedule 20 (Hallway) from 4/1/09 to 4/29/09

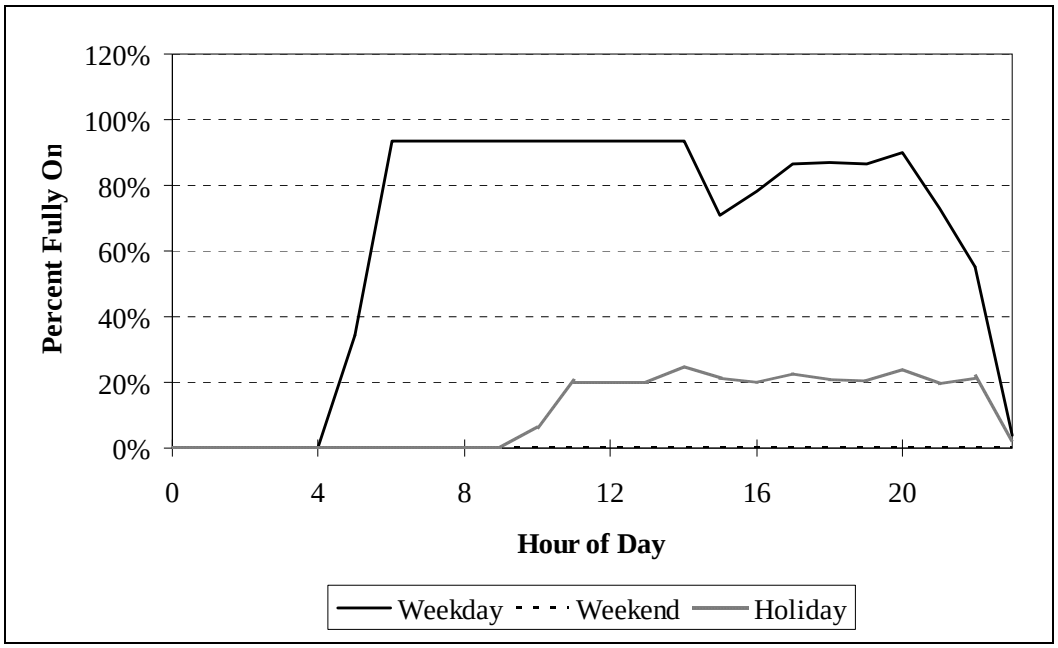

Figure 132: Average Daily Lighting Profile for Schedule 21 (Restroom) from 4/1/09 to 4/29/09

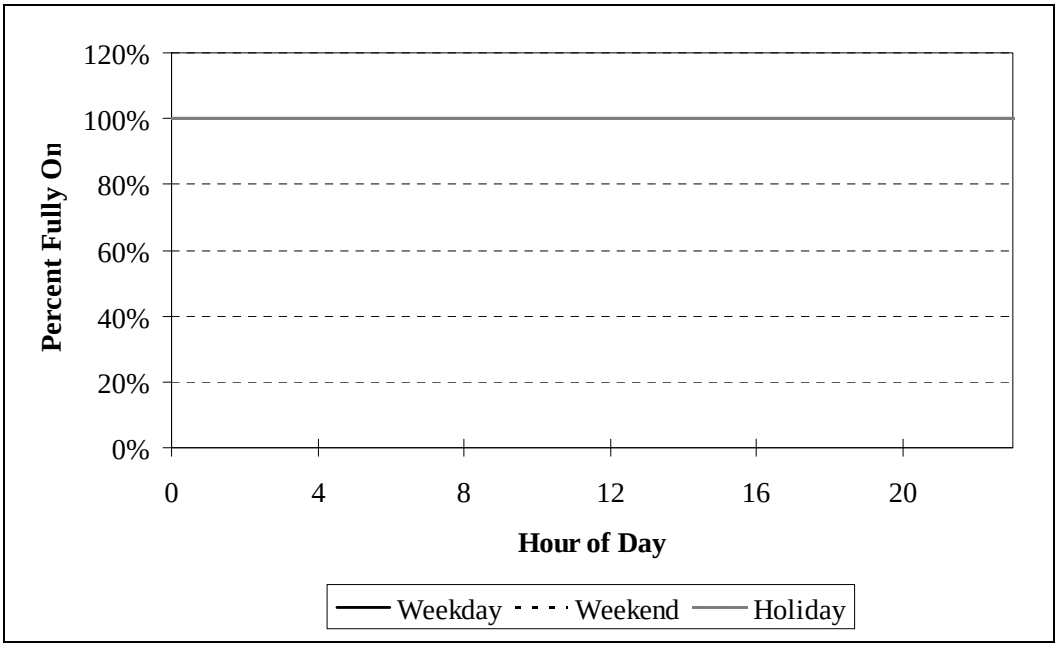

Figure 133: Average Daily Lighting Profile for Schedule 22 (Rm 3018 Prep Room) from 4/1/09 to 4/29/09

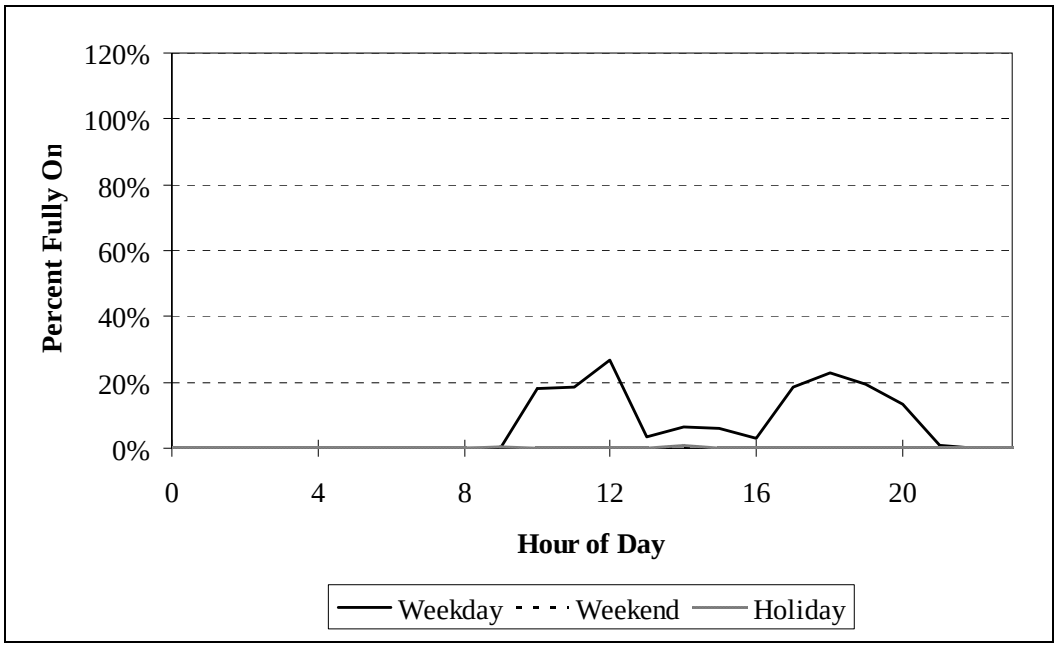

Figure 134: Average Daily Lighting Profile for Schedule 23 (Fitness) from 4/1/09 to 4/29/09

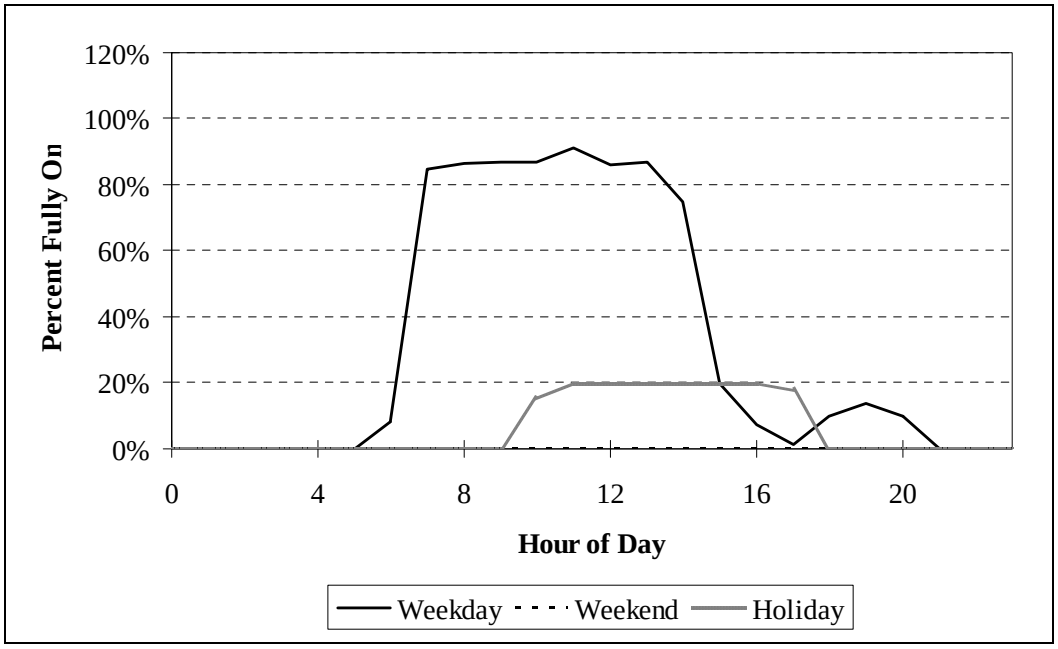

Figure 135: Average Daily Lighting Profile for Schedule 24 (Woodshop) from 4/1/09 to 4/29/09

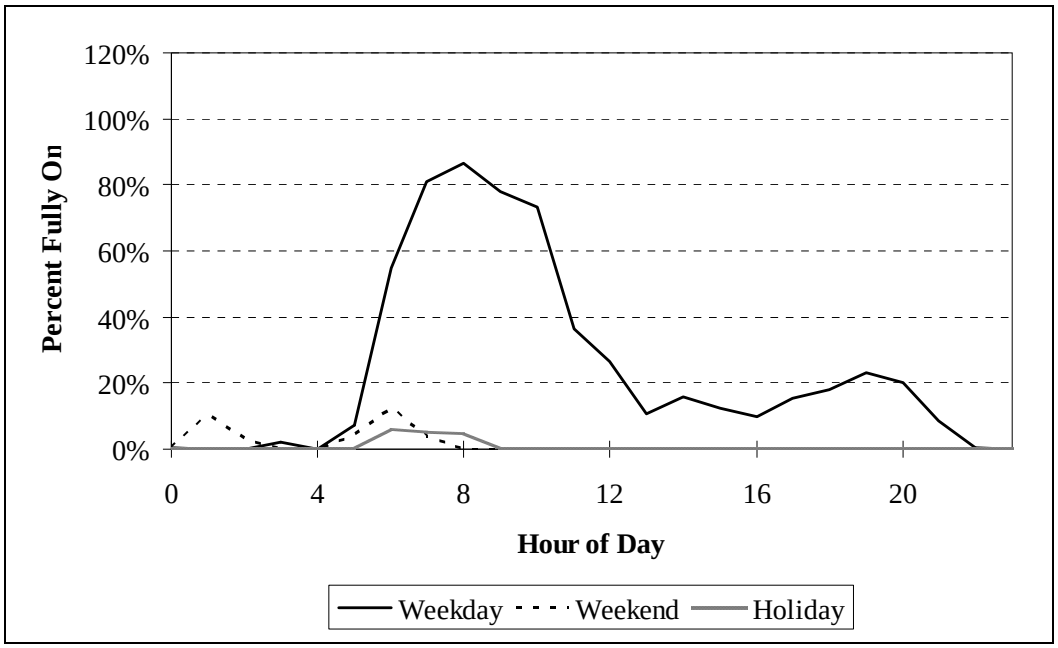

Figure 136: Average Daily Lighting Profile for Schedule 25 (Cafeteria) from 4/1/09 to 4/29/09

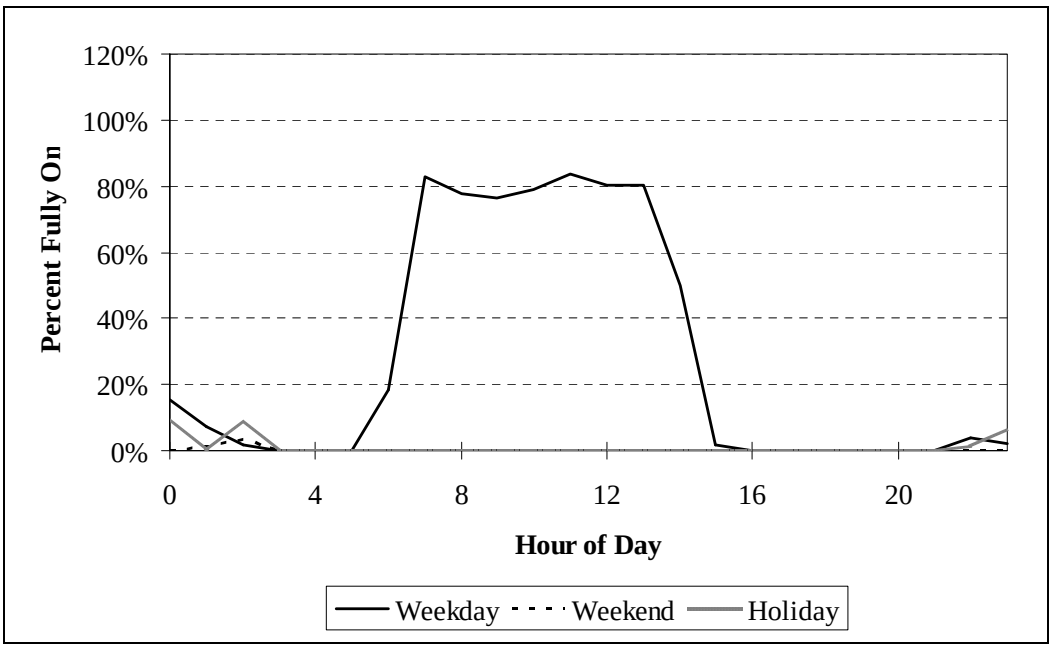

Figure 137: Average Daily Lighting Profile for Schedule 26 (Classroom 2011) from 4/1/09 to 4/29/09

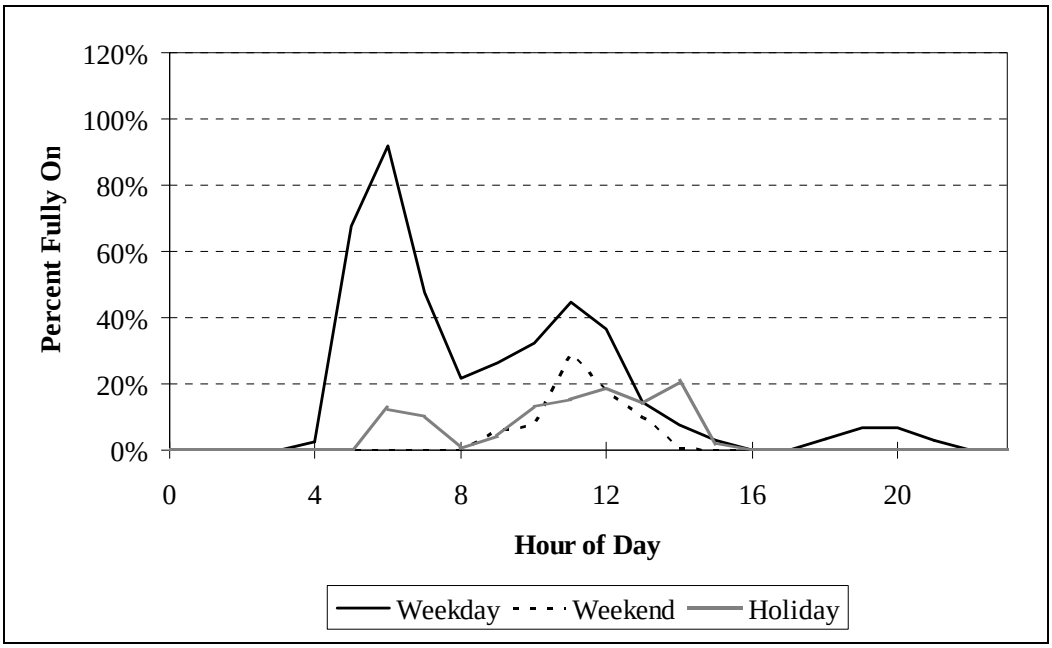

Figure 138: Average Daily Lighting Profile for Schedule 27 (Connecting Corridor) from 4/1/09 to 4/29/09

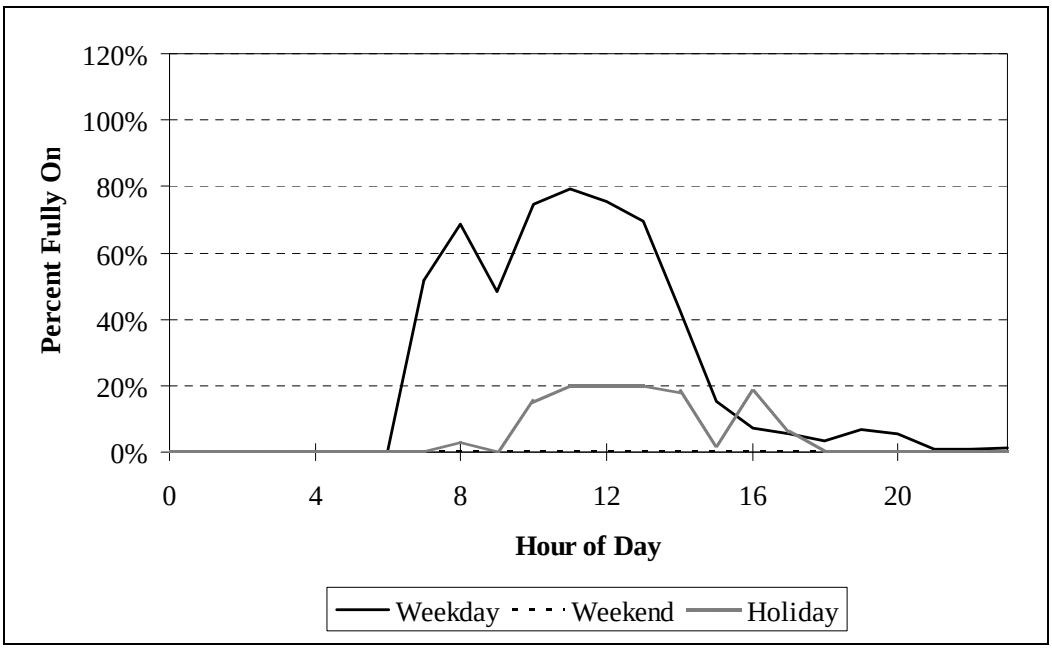

Figure 139: Average Daily Lighting Profile for Schedule 28 (Classroom 3065) from 4/1/09 to 4/29/09

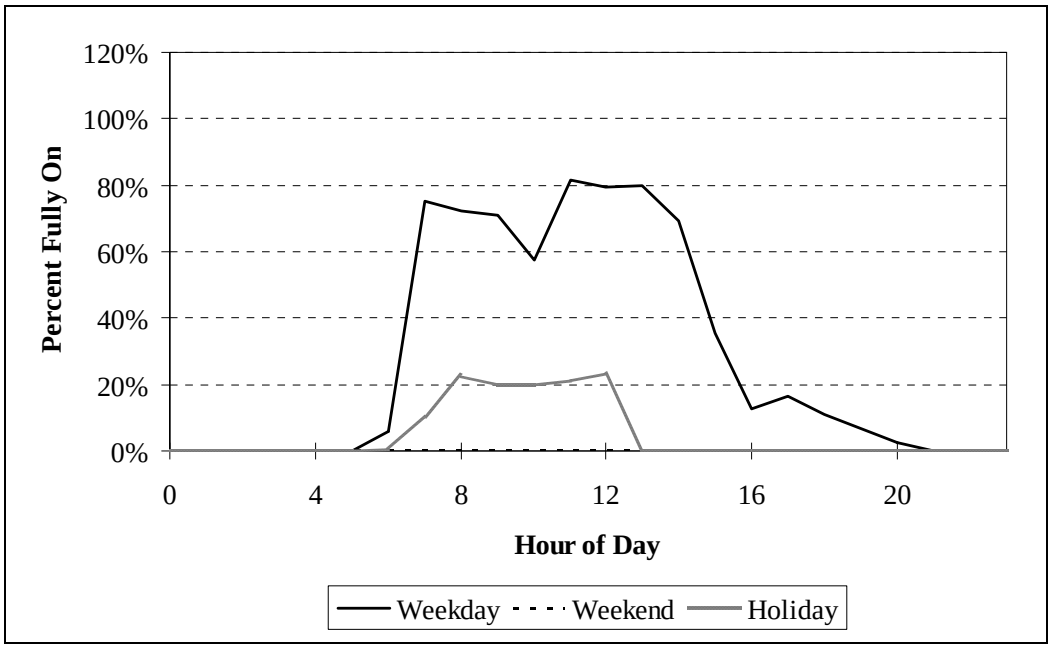

Figure 140: Average Daily Lighting Profile for Schedule 29 (Classroom 2076) from 4/1/09 to 4/29/09

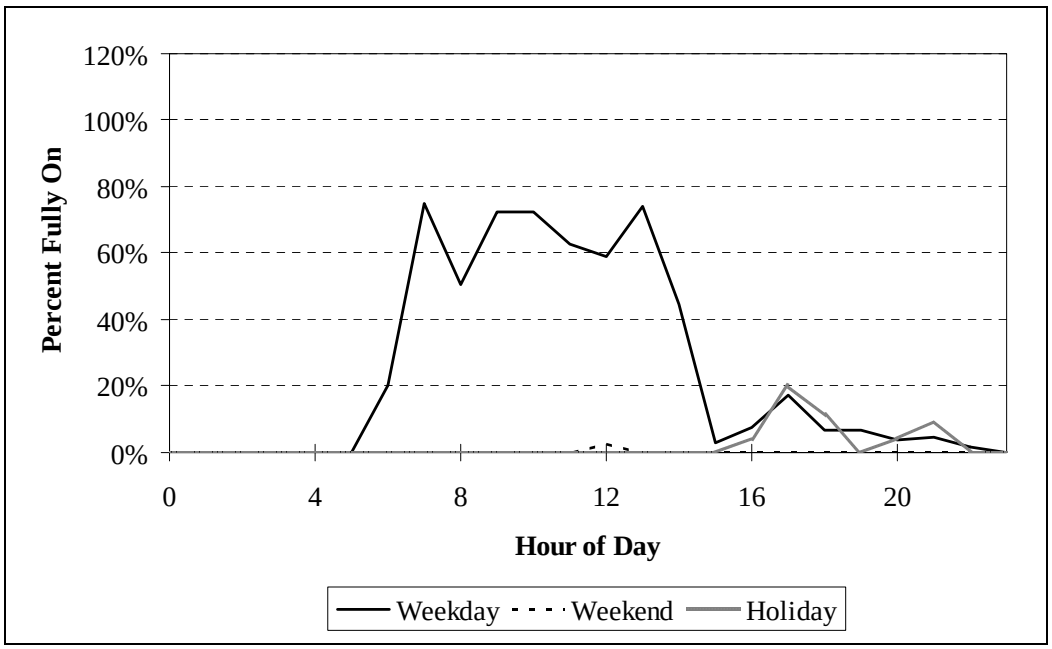

Figure 141: Average Daily Lighting Profile for Schedule 30 (Classroom 3018) from 4/1/09 to 4/29/09

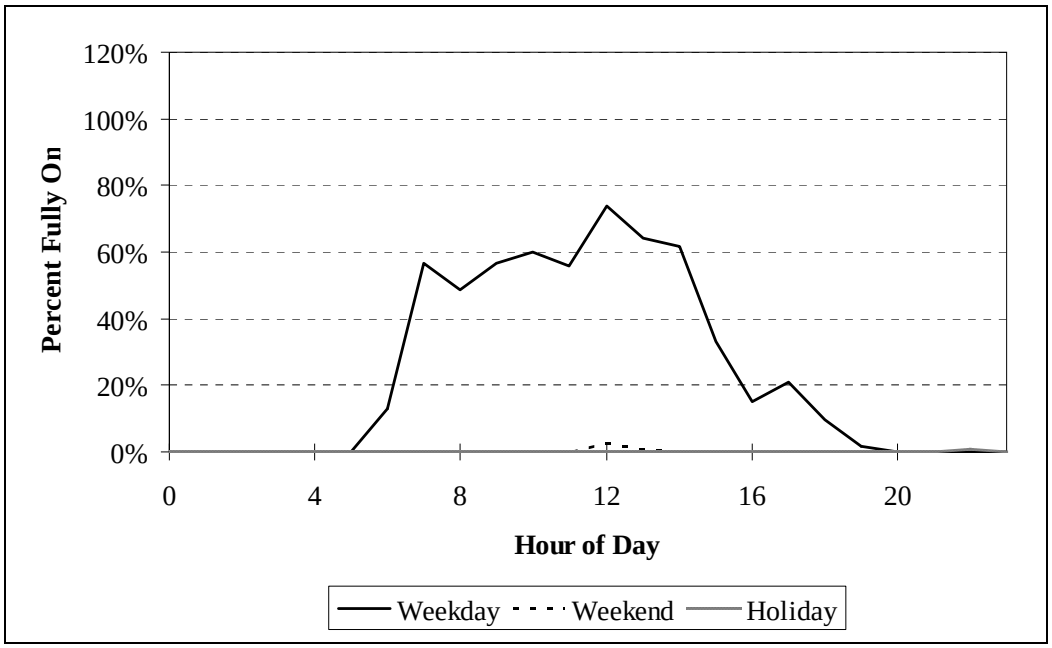

Figure 142: Average Daily Lighting Profile for Schedule 31 (Rm 3026 Prep Room) from 4/1/09 to 4/29/09

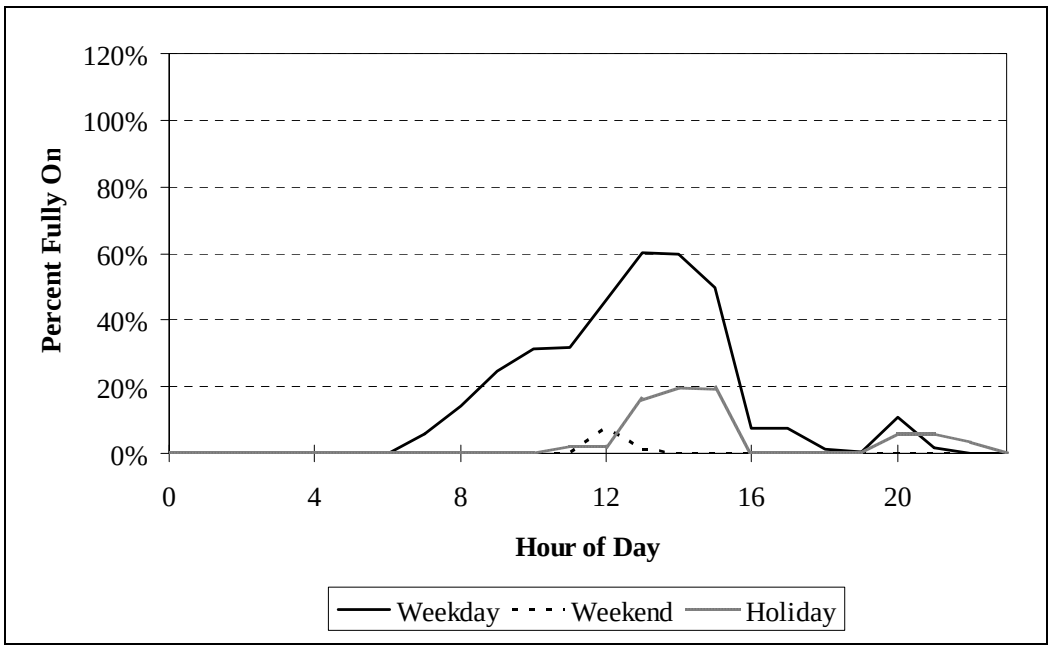

Figure 143: Average Daily Lighting Profile for Schedule 32 (Private Office 1011) from 4/1/09 to 4/29/09

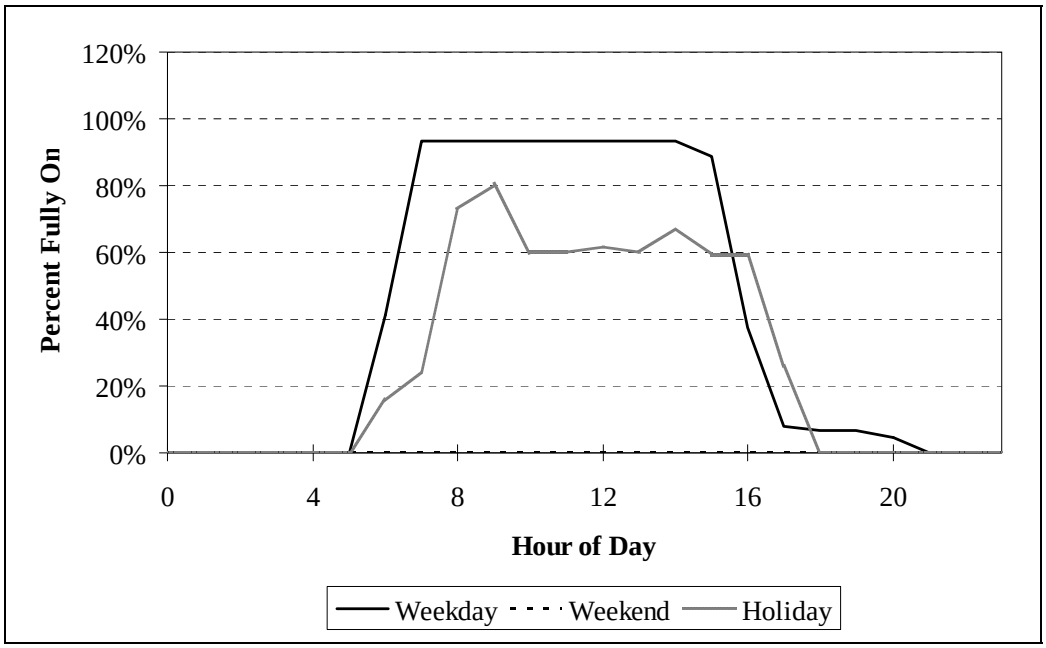

Figure 144: Average Daily Lighting Profile for Schedule 33 (Main Office) from 4/1/09 to 4/29/09

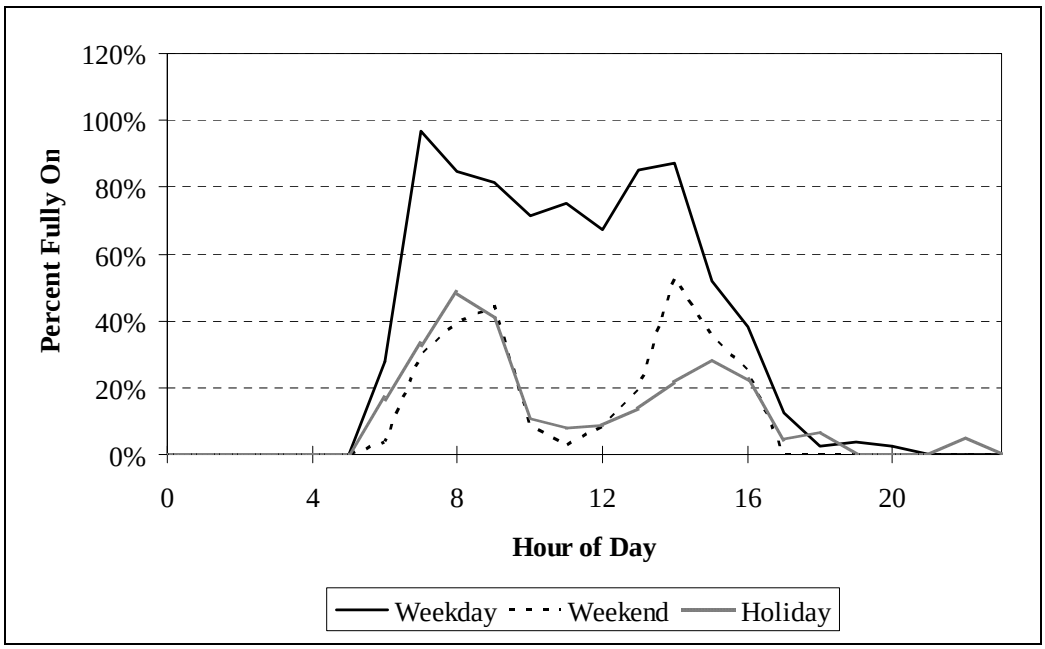

Figure 145: Average Daily Lighting Profile for Schedule 34 (Kitchen) from 4/1/09 to 4/29/09

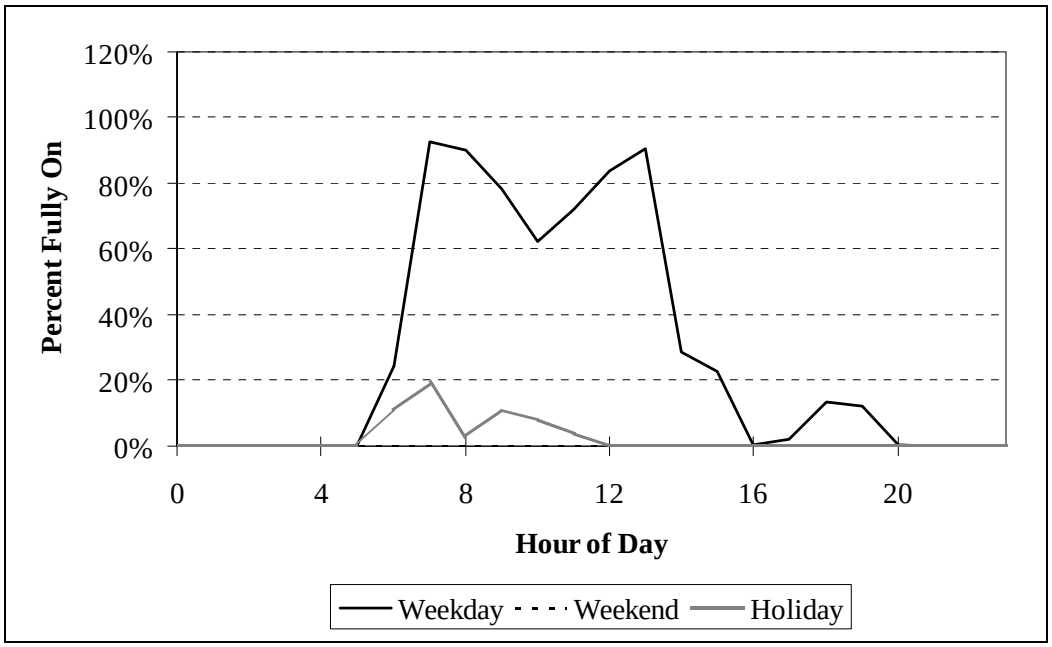

Figure 146: Average Daily Lighting Profile for Schedule 35 (Cosmo) from 4/1/09 to 4/29/09

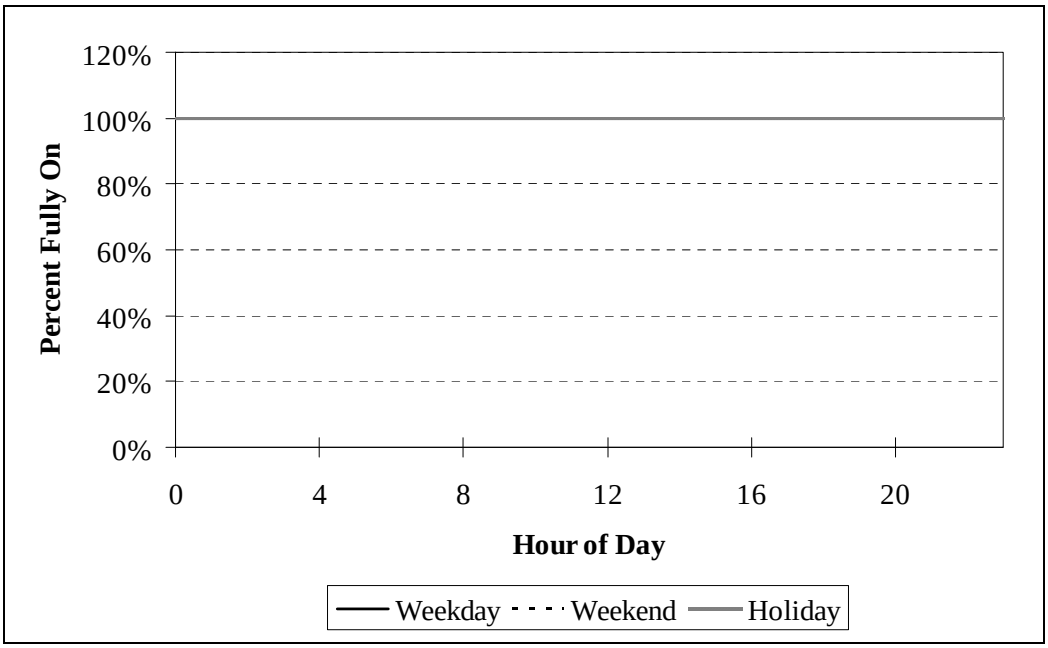

Figure 147: Average Daily Lighting Profile for Schedule 36 (Gym 4L Fixtures) from 4/1/09 to 4/29/09

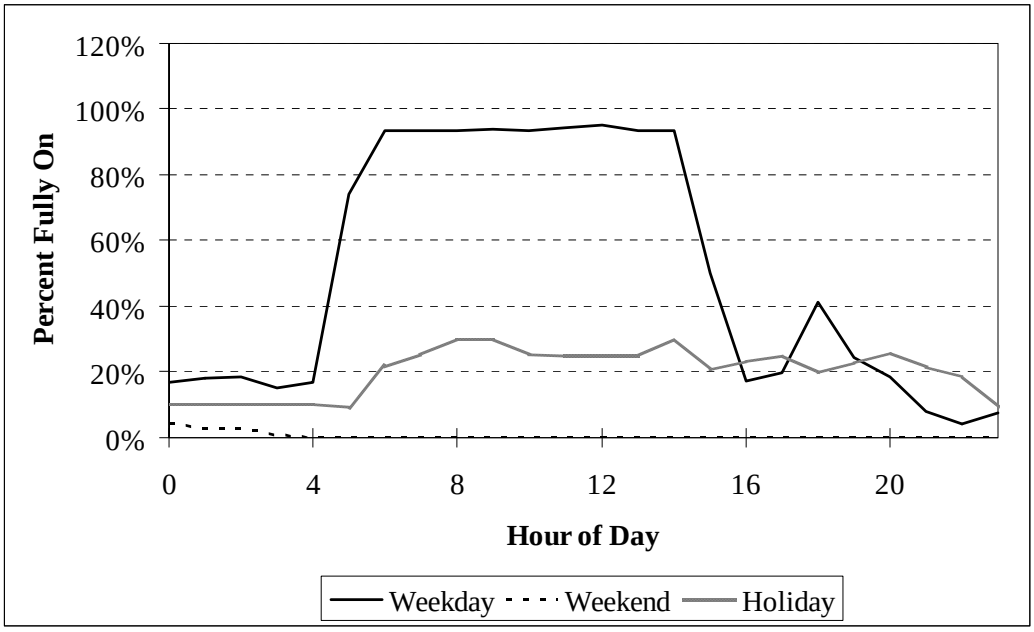

Figure 148: Average Daily Lighting Profile for Schedule 37 (Average Corridor) from 4/1/09 to 4/29/09

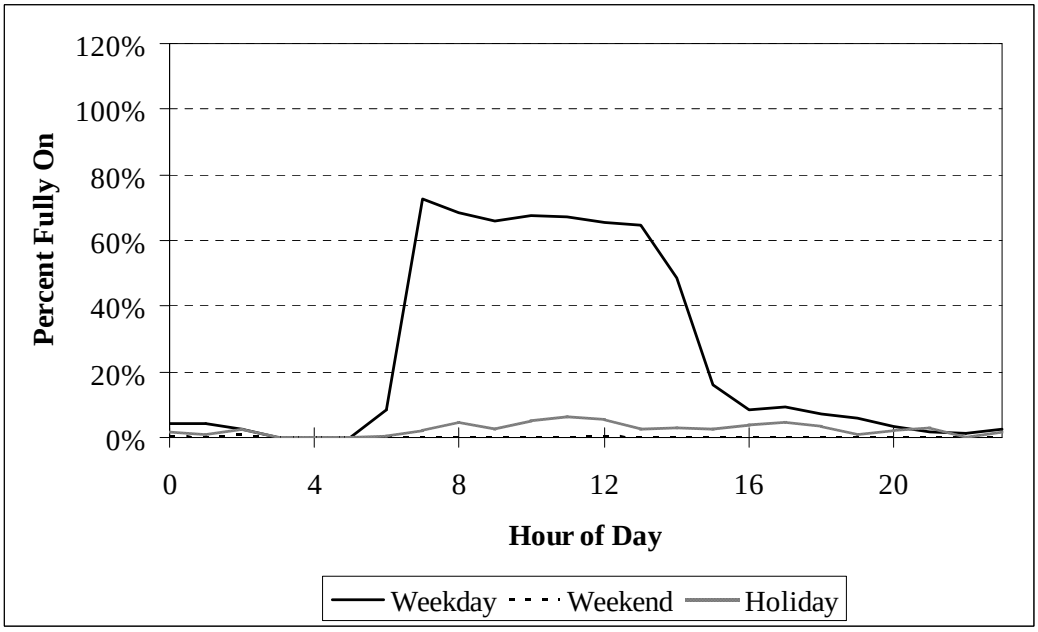

Figure 149: Average Daily Lighting Profile for Schedule 38 (Average Classroom) from 4/1/09 to 4/29/09

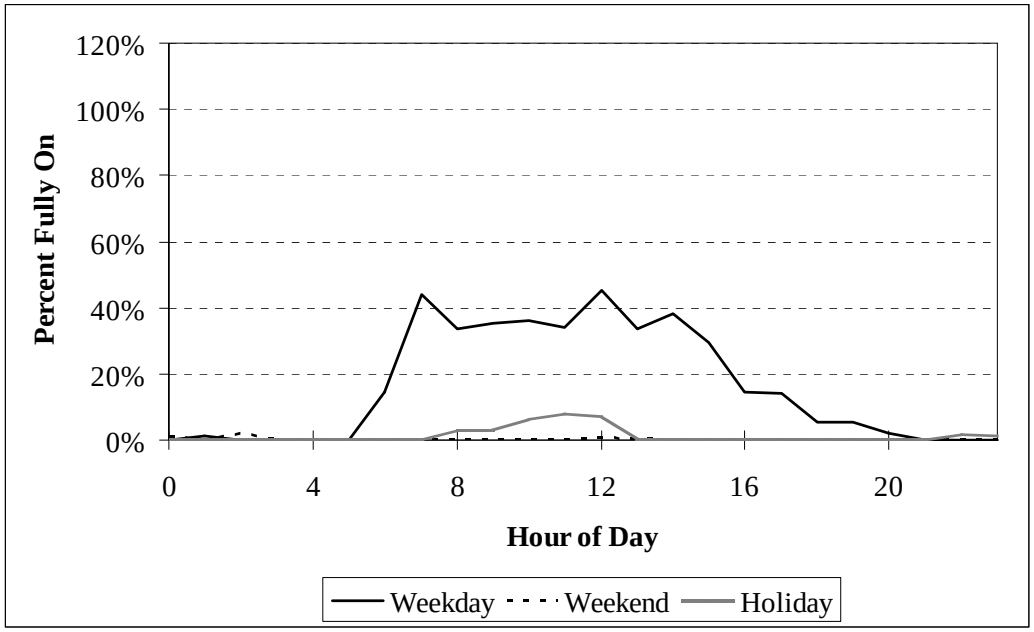

Figure 150: Average Daily Lighting Profile for Schedule 39 (Average Prep Room) from 4/1/09 to 4/29/09

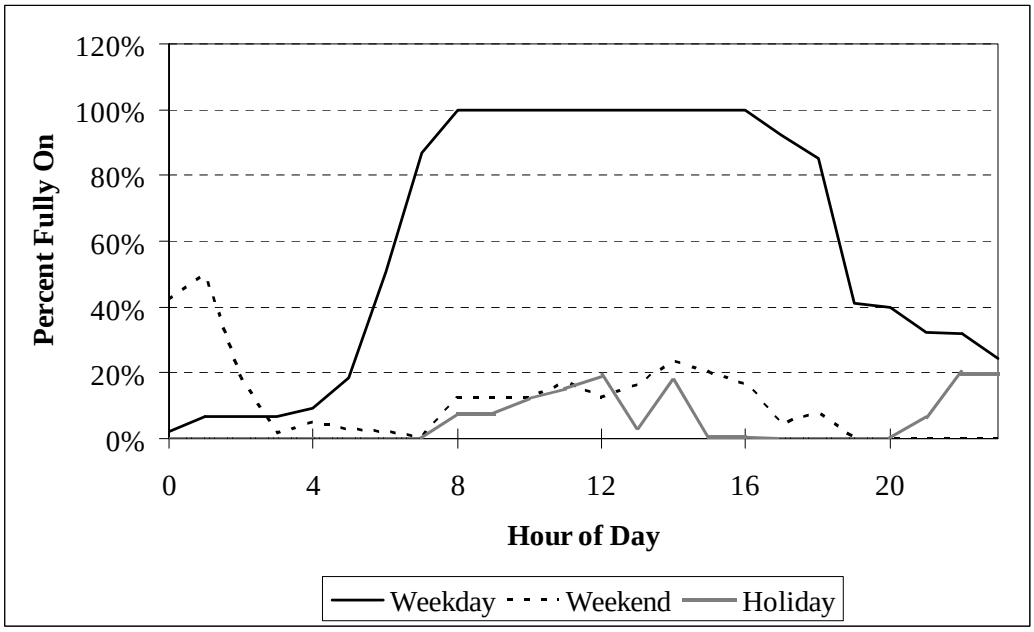

Figure 151: Average Daily Lighting Profile for Schedule 40 (Girls Locker Baseline) from 4/1/09 to 4/29/09

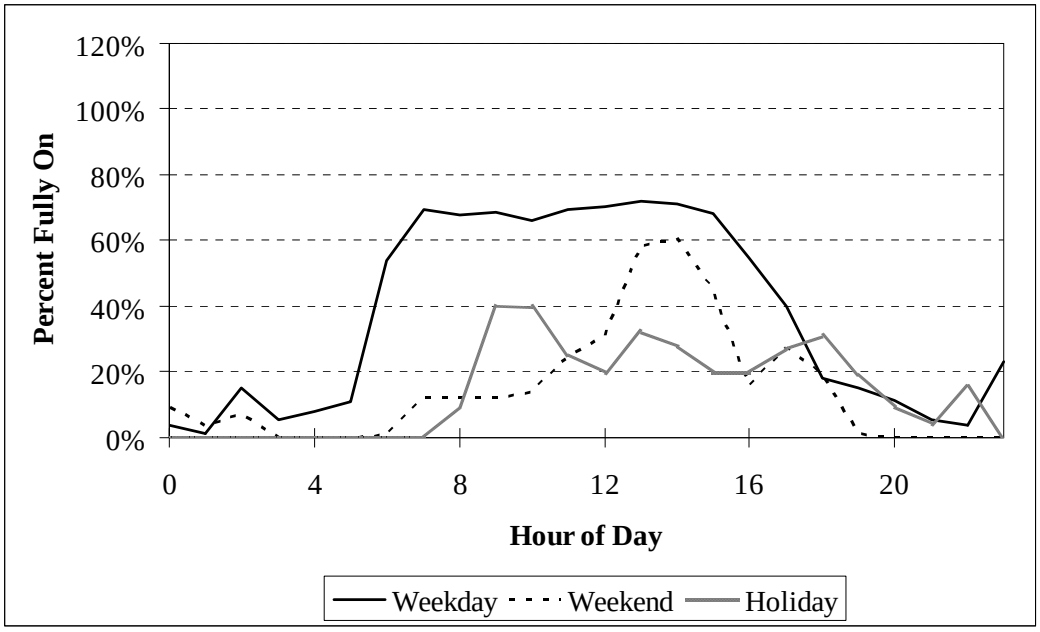

Figure 152: Average Daily Lighting Profile for Schedule 41 (Main Gym) from 4/1/09 to 4/29/09

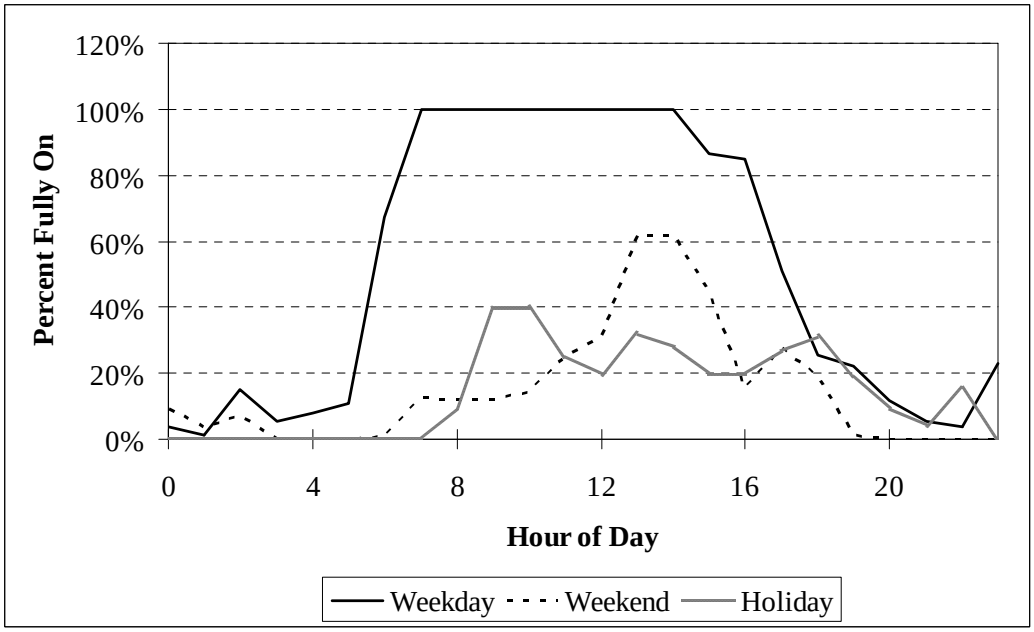

Figure 153: Average Daily Lighting Profile for Schedule 42 (Main Gym Baseline) from 4/1/09 to 4/29/09

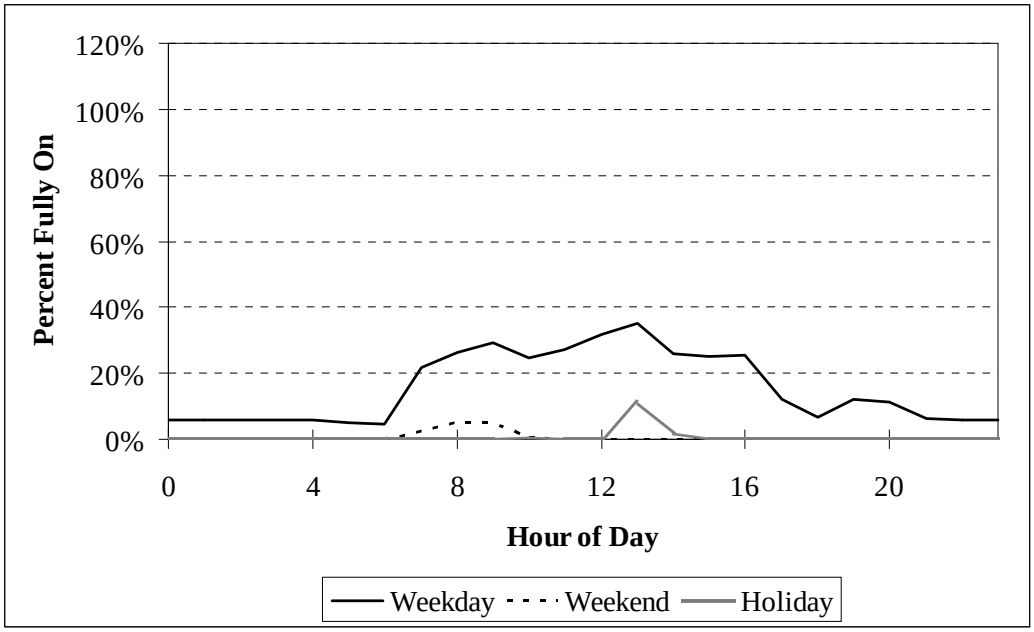

Figure 154: Average Daily Lighting Profile for Schedule 43 (Auditorium) from 4/1/09 to 4/29/09

Facility Type: High School
Application ID: 528960

Fixture Information

		Pre-retrofit Lighting							Post-retrofit Lighting							HVAC				Schedule ID from Table 6	
	(a)	(b)	(c)	(d)	(e)	(f)	(g)	(h)	(i)	(j)	(k)	(l)	(m)	(n)	(o)	(p)	(q)	(r)	(s)		
					Hours of Use		FCM Diversity Factor					Hours of Use		FCM Diversity Factor			COP				
Fixture ID	Space Type	Fixture Type	Fixture Quantity	Fixture Wattage	Annual	Peak	Summer	Winter	Fixture Type	Fixture Quantity	Fixture Wattage	Annual	Peak	Summer	Winter	Cooling	Heating	% Space Cooled	% Space Heated	Pre Retrofit	Post Retrofit
1	Lobby/Corridor	2/26W COMP. HW ELIG	16	56	2,613	2,178	37%	30%	26W COMPACT HW	16	28	2,613	2,178	37%	30%	5.5	NA	100%	100%	37	37
2	Lobby/Corridor 24/7	2/26W COMP. HW ELIG	8	56	8,760	4,032	100%	100%	26W COMPACT HW	8	28	8,760	4,032	100%	100%	5.5	NA	100%	100%	36	36
3	Lobby/Corridor	2L4' T8/ELIG	9	60	2,613	2,178	37%	30%	2L2' T8/ELIG/LP	9	31	2,613	2,178	37%	30%	5.5	NA	100%	100%	37	37
4	Vocational Classroom	3L4' T8/ELIG	3	88	1,527	1,513	28%	6%	4L4' T8EE/EEESUPER T8/	3	30.5	1,527	1,513	28%	6%	5.5	NA	100%	100%	24	24
5	Vocational Classroom	3L4' T8/ELIG	2	88	1,527	1,513	28%	6%	2L2' T8/ULTRA	2	27	1,527	1,513	28%	6%	5.5	NA	100%	100%	24	24
6	Main Office	3L4' T8/ELIG	13	88	2,246	2,188	67%	8%	2L2' T8/ULTRA	13	27	2,246	2,188	67%	8%	5.5	NA	100%	100%	33	33
7	Private Office	3L4' T8/ELIG	2	88	727	709	23%	4%	4L4' T8EE/EEESUPER T8/	2	30.5	727	709	23%	4%	5.5	NA	100%	100%	32	32
8	Private Office	3L4' T8/ELIG	1	88	727	709	23%	4%	4L4' T8EE/EEESUPER T8/	1	30.5	727	709	23%	4%	5.5	NA	100%	100%	32	32
9	Health and Dept Offices	3L4' T8/ELIG	1	88	1,561	1,557	20%	17%	4L4' T8EE/EEESUPER T8/	1	30.5	1,561	1,557	20%	17%	5.5	NA	100%	100%	3	3
10	Health and Dept Offices	3L4' T8/ELIG	1	88	1,561	1,557	20%	17%	4L4' T8EE/EEESUPER T8/	1	30.5	1,561	1,557	20%	17%	5.5	NA	100%	100%	3	3
11	Health and Dept Offices	4L4' T8/ELIG	2	112	1,561	1,557	20%	17%	4L4' T8EE/EEESUPER T8	2	61	1,561	1,557	20%	17%	5.5	NA	100%	100%	3	3
12	Private Office	3L4' T8/ELIG	2	88	727	709	23%	4%	4L4' T8EE/EEESUPER T8/	2	30.5	727	709	23%	4%	5.5	NA	100%	100%	32	32
13	Private Office	3L4' T8/ELIG	2	88	727	709	23%	4%	2L2' T8/ULTRA	2	27	727	709	23%	4%	5.5	NA	100%	100%	32	32
14	Lobby/Corridor 24/7	2L4' T8/ELIG	4	60	8,760	4,032	100%	100%	2L2' T8/ELIG/LP	4	31	8,760	4,032	100%	100%	5.5	NA	100%	100%	36	36
15	Private Office	4L4' T8/ELIG	3	112	727	709	23%	4%	4L4' T8EE/EEESUPER T8	3	61	727	709	23%	4%	5.5	NA	100%	100%	32	32
16	Health and Dept Offices	3L4' T8/ELIG	3	88	1,561	1,557	20%	17%	4L4' T8EE/EEESUPER T8/	3	30.5	1,561	1,557	20%	17%	5.5	NA	100%	100%	3	3
17	Health and Dept Offices	3L4' T8/ELIG	1	88	1,561	1,557	20%	17%	4L4' T8EE/EEESUPER T8/	1	30.5	1,561	1,557	20%	17%	5.5	NA	100%	100%	3	3
18	Health and Dept Offices	3L4' T8/ELIG	1	88	1,561	1,557	20%	17%	4L4' T8EE/EEESUPER T8/	1	30.5	1,561	1,557	20%	17%	5.5	NA	100%	100%	3	3
19	Health and Dept Offices	4L4' T8/ELIG	4	112	1,561	1,557	20%	17%	4L4' T8EE/EEESUPER T8	4	61	1,561	1,557	20%	17%	5.5	NA	100%	100%	3	3
20	Private Office	3L4' T8/ELIG	2	88	727	709	23%	4%	4L4' T8EE/EEESUPER T8/	2	30.5	727	709	23%	4%	5.5	NA	100%	100%	32	32
21	Health and Dept Offices	3L4' T8/ELIG	2	88	1,561	1,557	20%	17%	4L4' T8EE/EEESUPER T8/	2	30.5	1,561	1,557	20%	17%	5.5	NA	100%	100%	3	3
22	Health and Dept Offices	3L4' T8/ELIG	0	88	1,561	1,557	20%	17%	4L4' T8EE/EEESUPER T8/	0	30.5	1,561	1,557	20%	17%	5.5	NA	100%	100%	3	3
23	Health and Dept Offices	4L4' T8/ELIG	2	112	1,561	1,557	20%	17%	4L4' T8EE/EEESUPER T8	2	61	1,561	1,557	20%	17%	5.5	NA	100%	100%	3	3
24	Private Office	3L4' T8/ELIG	1	88	727	709	23%	4%	4L4' T8EE/EEESUPER T8/	1	30.5	727	709	23%	4%	5.5	NA	100%	100%	32	32
25	Fitness/Training	3L4' T8/ELIG	31	88	297	297	2%	17%	3L4' T8EE/EEESUPER T8	31	46	297	297	2%	17%	5.5	NA	100%	100%	23	23
26	Fitness/Training	3L4' T8/ELIG	3	88	297	297	2%	17%	4L4' T8EE/EEESUPER T8/	3	30.5	297	297	2%	17%	NA	NA	0%	100%	23	23
27	Health and Dept Offices	3L4' T8/ELIG	2	88	1,561	1,557	20%	17%	4L4' T8EE/EEESUPER T8/	2	30.5	1,561	1,557	20%	17%	5.5	NA	100%	100%	3	3
28	Health and Dept Offices	3L4' T8/ELIG	2	88	1,561	1,557	20%	17%	2L2' T8/ULTRA	2	27	1,561	1,557	20%	17%	5.5	NA	100%	100%	3	3
29	Fitness/Training	3L4' T8/ELIG	4	88	297	297	2%	17%	4L4' T8EE/EEESUPER T8/	4	30.5	297	297	2%	17%	5.5	NA	100%	100%	23	23
30	Health and Dept Offices	3L4' T8/ELIG	1	88	1,561	1,557	20%	17%	4L4' T8EE/EEESUPER T8/	1	30.5	1,561	1,557	20%	17%	5.5	NA	100%	100%	3	3
31	Health and Dept Offices	3L4' T8/ELIG	3	88	1,561	1,557	20%	17%	2L2' T8/ULTRA	3	27	1,561	1,557	20%	17%	5.5	NA	100%	100%	3	3
32	Health and Dept Offices	3L4' T8/ELIG	3	88	1,561	1,557	20%	17%	2L2' T8/ULTRA	3	27	1,561	1,557	20%	17%	5.5	NA	100%	100%	3	3
33	Health and Dept Offices	3L4' T8/ELIG	5	88	1,561	1,557	20%	17%	2L2' T8/ULTRA	5	27	1,561	1,557	20%	17%	5.5	NA	100%	100%	3	3
34	Health and Dept Offices	3L4' T8/ELIG	3	88	1,561	1,557	20%	17%	2L2' T8/ULTRA	3	27	1,561	1,557	20%	17%	5.5	NA	100%	100%	3	3
35	Health and Dept Offices	3L4' T8/ELIG	1	88	1,561	1,557	20%	17%	4L4' T8EE/EEESUPER T8/	1	30.5	1,561	1,557	20%	17%	5.5	NA	100%	100%	3	3
36	Fitness/Training	3L4' T8/ELIG	1	88	297	297	2%	17%	4L4' T8EE/EEESUPER T8/	1	30.5	297	297	2%	17%	5.5	NA	100%	100%	23	23
37	Lobby/Corridor	3L4' T8/ELIG	1	88	2,613	2,178	37%	30%	4L4' T8EE/EEESUPER T8/	1	30.5	2,613	2,178	37%	30%	5.5	NA	100%	100%	37	37
38	Lobby/Corridor	3L4' T8/ELIG	1	88	2,613	2,178	37%	30%	2L4' T8EE/EEE SUPER T8	1	33	2,613	2,178	37%	30%	5.5	NA	100%	100%	37	37
39	Lobby/Corridor	2/26W COMP. HW ELIG	24	56	2,613	2,178	37%	30%	26W COMPACT HW	24	28	2,613	2,178	37%	30%	5.5	NA	100%	100%	37	37
40	Lobby/Corridor 24/7	2/26W COMP. HW ELIG	12	56	8,760	4,032	100%	100%	26W COMPACT HW	12	28	8,760	4,032	100%	100%	5.5	NA	100%	100%	36	36
41	Lobby/Corridor	70W METAL HALIDE	5	95	2,613	2,178	37%	30%	32W COMPACT HW ELIG	5	34	2,613	2,178	37%	30%	5.5	NA	100%	100%	37	37
42	Lobby/Corridor 24/7	70W METAL HALIDE	4	95	8,760	4,032	100%	100%	32W COMPACT HW ELIG	4	34	8,760	4,032	100%	100%	5.5	NA	100%	100%	36	36
43	Lobby/Corridor	2L4' T8/ELIG	9	60	2,613	2,178	37%	30%	2L2' T8/ELIG/LP	9	31	2,613	2,178	37%	30%	5.5	NA	100%	100%	37	37
44	Lobby/Corridor 24/7	2/26W COMP. HW ELIG	10	56	8,760	4,032	100%	100%	26W COMPACT HW	10	28	8,760	4,032	100%	100%	5.5	NA	100%	100%	36	36
45	Lobby/Corridor 24/7	2L4' T8/ELIG	3	60	8,760	4,032	100%	100%	2L2' T8/ELIG/LP	3	31	8,760	4,032	100%	100%	5.5	NA	100%	100%	36	36
46	Lobby/Corridor	2/26W COMP. HW ELIG	2	56	2,613	2,178	37%	30%	26W COMPACT HW	2	28	2,613	2,178	37%	30%	5.5	NA	100%	100%	37	37
47	Connector Corridor	2L4' T8/ELIG	24	60	934	717	8%	1%	2L2' T8/ELIG/LP	24	31	934	717	8%	1%	5.5	NA	100%	100%	27	27
48	Lobby/Corridor 24/7	2L4' T8/ELIG	4	60	8,760	4,032	100%	100%	2L2' T8/ELIG/LP	4	31	8,760	4,032	100%	100%	5.5	NA	100%	100%	36	36
49	Special Education	3L4' T8/ELIG	3	88	1,942	1,759	25%	22%	4L4' T8EE/EEESUPER T8/	3	30.5	1,942	1,759	25%	22%	5.5	NA	100%	100%	6	6
50	Special Education	3L4' T8/ELIG	4	88	1,942	1,759	25%	22%	2L2' T8/ULTRA	4	27	1,942	1,759	25%	22%	5.5	NA	100%	100%	6	6
51	Special Education	3L4' T8/ELIG	2	88	1,942	1,759	25%	22%	4L4' T8EE/EEESUPER T8/	2	30.5	1,942	1,759	25%	22%	5.5	NA	100%	100%	6	6
52	Special Education	3L4' T8/ELIG	6	88	1,942	1,759	25%	22%	2L2' T8/ULTRA	6	27	1,942	1,759	25%	22%	5.5	NA	100%	100%	6	6
53	Special Education	3L4' T8/ELIG	1	88	1,942	1,759	25%	22%	4L4' T8EE/EEESUPER T8/	1	30.5	1,942	1,759	25%	22%	5.5	NA	100%	100%	6	6
54	Classroom	3L4' T8/ELIG	5	88	1,165	1,126	13%	8%	4L4' T8EE/EEESUPER T8/	5	30.5	1,165	1,126	13%	8%	5.5	NA	100%	100%	38	38
55	Special Education	3L4' T8/ELIG	1	88	1,942	1,759	25%	22%	4L4' T8EE/EEESUPER T8/	1	30.5	1,942	1,759	25%	22%	5.5	NA	100%	100%	6	6
56	Computer Lab	4L4' T8/ELIG	14	112	941	908	12%	1%	4L4' T8EE/EEESUPER T8	14	61	941	908	12%	1%	5.5	NA	100%	100%	11	11
57	Computer Lab	2L4' T8/ELIG	1	60	941	908	12%	1%	2L4' T8EE/EEE SUPER T8	1	33	941	908	12%	1%	5.5	NA	100%	100%	11	11
58	Classroom	4L4' T8/ELIG	9	112	1,165	1,126	13%	8%	4L4' T8EE/EEESUPER T8	9	61	1,165	1,126	13%	8%	5.5	NA	100%	100%	38	38
59	Classroom	4L4' T8/ELIG	8	112	1,165	1,126	13%	8%	4L4' T8EE/EEESUPER T8	8	61	1,165	1,126	13%	8%	5.5	NA	100%	100%	38	38
60	Classroom	2L4' T8/ELIG	1	60	1,165	1,126	13%	8%	2L4' T8EE/EEE SUPER T8	1	33	1,165	1,126	13%	8%	5.5	NA	100%	100%	38	38
61	Classroom	4L4' T8/ELIG	9	112	1,165	1,126	13%	8%	4L4' T8EE/EEESUPER T8	9	61	1,165	1,126	13%	8%	5.5	NA	100%	100%	38	38
62	Classroom	4L4' T8/ELIG	15	112	1,165	1,126	13%	8%	4L4' T8EE/EEESUPER T8	15	61	1,165	1,126	13%	8%	5.5	NA	100%	100%	38	38
63	Classroom	4L4' T8/ELIG	15	112	1,165	1,126	13%	8%	4L4' T8EE/EEESUPER T8	15	61	1,165	1,126	13%	8%	5.5	NA	100%	100%	38	38
64	Prep Room	3L4' T8/ELIG	3	88	751	740	9%	9%	4L4' T8EE/EEESUPER T8/	3	30.5	751	740	9%	9%	5.5	NA	100%	100%	39	39
65	Prep Room	3L4' T8/ELIG	3	88	751	740	9%	9%	4L4' T8EE/EEESUPER T8/	3	30.5	751	740	9%	9%	5.5	NA	100%	100%	39	39
66	Storage	4L4' T8/ELIG	3	112	26	26	0%	0%	4L4' T8EE/EEESUPER T8	3	61	26	26	0%	0%	5.5	NA	100%	100%	18	18
67	Lobby/Corridor	2/26W COMP. HW ELIG	19	56	2,613	2,178	37%	30%	26W COMPACT HW	19	28	2,613	2,178	37%	30%	5.5	NA	100%	100%	37	37
68	Lobby/Corridor 24/7	2/26W COMP. HW ELIG	10	56	8,760	4,032	100%	100%	26W COMPACT HW	10	28	8,760	4,032	100%	100%	5.5	NA	100%	100%	36	36
69	Lobby/Corridor	2L4' T8/ELIG	9	60	2,613	2,178	37%	30%	2L2' T8/ELIG/LP	9	31	2,613	2,178	37%	30%	5.5	NA	100%	100%	37	37
70	Lobby/Corridor 24/7	2/26W COMP. HW ELIG	8	56	8,760	4,032	100%	100%	26W COMPACT HW	8	28	8,760	4,032	100%	100%	5.5	NA	100%	100%	36	36

Fixture Information

		Pre-retrofit Lighting							Post-retrofit Lighting							HVAC				Schedule ID from Table 6	
	(a)	(b)	(c)	(d)	(e)	(f)	(g)	(h)	(i)	(j)	(k)	(l)	(m)	(n)	(o)	(p)	(q)	(r)	(s)		
					Hours of Use		FCM Diversity Factor					Hours of Use		FCM Diversity Factor			COP	% Space	% Space		
Fixture ID	Space Type	Fixture Type	Fixture Quantity	Fixture Wattage	Annual	Peak	Summer	Winter	Fixture Type	Fixture Quantity	Fixture Wattage	Annual	Peak	Summer	Winter	Cooling	Heating	Cooled	Heated	Pre Retrofit	Post Retrofit
71	Lobby/Corridor 24/7	2L4' T8/ELIG	3	60	8,760	4,032	100%	100%	2L2' T8/ELIG/LP	3	31	8,760	4,032	100%	100%	5.5	NA	100%	100%	36	36
72	Lobby/Corridor	2/26W COMP. HW ELIG	2	56	2,613	2,178	37%	30%	26W COMPACT HW	2	28	2,613	2,178	37%	30%	5.5	NA	100%	100%	37	37
73	Storage	3L4' T8/ELIG	4	88	26	26	0%	0%	4L4' T8EE/EEESUPER T8/	4	30.5	26	26	0%	0%	5.5	NA	100%	100%	18	18
74	Storage	2L4' T8/ELIG	3	60	26	26	0%	0%	2L4' T8EE/EEE SUPER T8	3	33	26	26	0%	0%	5.5	NA	100%	100%	18	18
75	Health and Dept Offices	3L4' T8/ELIG	4	88	1,561	1,557	20%	17%	4L4' T8EE/EEESUPER T8/	4	30.5	1,561	1,557	20%	17%	5.5	NA	100%	100%	3	3
76	Health and Dept Offices	3L4' T8/ELIG	1	88	1,561	1,557	20%	17%	2L2' T8/ELIG/LP	1	31	1,561	1,557	20%	17%	5.5	NA	100%	100%	3	3
77	Classroom	4L4' T8/ELIG	15	112	1,165	1,126	13%	8%	4L4' T8EE/EEESUPER T8	15	61	1,165	1,126	13%	8%	5.5	NA	100%	100%	38	38
78	Classroom	4L4' T8/ELIG	15	112	1,165	1,126	13%	8%	4L4' T8EE/EEESUPER T8	15	61	1,165	1,126	13%	8%	5.5	NA	100%	100%	38	38
79	Prep Room	3L4' T8/ELIG	6	88	8,760	4,032	100%	100%	4L4' T8EE/EEESUPER T8/	6	30.5	8,760	4,032	100%	100%	5.5	NA	100%	100%	22	22
80	Prep Room	3L4' T8/ELIG	6	88	751	740	9%	9%	4L4' T8EE/EEESUPER T8/	6	30.5	751	740	9%	9%	5.5	NA	100%	100%	39	39
81	Private Office	3L4' T8/ELIG	4	88	727	709	23%	4%	4L4' T8EE/EEESUPER T8/	4	30.5	727	709	23%	4%	5.5	NA	100%	100%	32	32
82	Classroom	4L4' T8/ELIG	9	112	1,165	1,126	13%	8%	4L4' T8EE/EEESUPER T8	9	61	1,165	1,126	13%	8%	5.5	NA	100%	100%	38	38
83	Classroom	4L4' T8/ELIG	9	112	1,165	1,126	13%	8%	4L4' T8EE/EEESUPER T8	9	61	1,165	1,126	13%	8%	5.5	NA	100%	100%	38	38
84	Classroom	4L4' T8/ELIG	8	112	1,165	1,126	13%	8%	4L4' T8EE/EEESUPER T8	8	61	1,165	1,126	13%	8%	5.5	NA	100%	100%	38	38
85	Classroom	2L4' T8/ELIG	2	60	1,165	1,126	13%	8%	2L4' T8EE/EEE SUPER T8	2	33	1,165	1,126	13%	8%	5.5	NA	100%	100%	38	38
86	Storage	2L4' T8/ELIG	3	60	26	26	0%	0%	2L4' T8EE/EEE SUPER T8	3	33	26	26	0%	0%	5.5	NA	100%	100%	18	18
87	Classroom	4L4' T8/ELIG	8	112	1,165	1,126	13%	8%	4L4' T8EE/EEESUPER T8	8	61	1,165	1,126	13%	8%	5.5	NA	100%	100%	38	38
88	Classroom	2L4' T8/ELIG	1	60	1,165	1,126	13%	8%	2L4' T8EE/EEE SUPER T8	1	33	1,165	1,126	13%	8%	5.5	NA	100%	100%	38	38
89	Lobby/Corridor	2L4' T8/ELIG	18	60	2,613	2,178	37%	30%	2L2' T8/ELIG/LP	18	31	2,613	2,178	37%	30%	5.5	NA	100%	100%	37	37
90	Lobby/Corridor 24/7	2/26W COMP. HW ELIG	14	56	8,760	4,032	100%	100%	26W COMPACT HW	14	28	8,760	4,032	100%	100%	5.5	NA	100%	100%	36	36
91	Lobby/Corridor 24/7	2L4' T8/ELIG	5	60	8,760	4,032	100%	100%	2L2' T8/ELIG/LP	5	31	8,760	4,032	100%	100%	5.5	NA	100%	100%	36	36
92	Lobby/Corridor	2/26W COMP. HW ELIG	3	56	2,613	2,178	37%	30%	26W COMPACT HW	3	28	2,613	2,178	37%	30%	5.5	NA	100%	100%	37	37
93	Classroom	4L4' T8/ELIG	15	112	1,165	1,126	13%	8%	4L4' T8EE/EEESUPER T8	15	61	1,165	1,126	13%	8%	5.5	NA	100%	100%	38	38
94	Classroom	4L4' T8/ELIG	15	112	1,165	1,126	13%	8%	4L4' T8EE/EEESUPER T8	15	61	1,165	1,126	13%	8%	5.5	NA	100%	100%	38	38
95	Classroom	4L4' T8/ELIG	15	112	1,165	1,126	13%	8%	4L4' T8EE/EEESUPER T8	15	61	1,165	1,126	13%	8%	5.5	NA	100%	100%	38	38
96	Classroom	4L4' T8/ELIG	15	112	1,165	1,126	13%	8%	4L4' T8EE/EEESUPER T8	15	61	1,165	1,126	13%	8%	5.5	NA	100%	100%	38	38
97	Prep Room	3L4' T8/ELIG	3	88	751	740	9%	9%	4L4' T8EE/EEESUPER T8/	3	30.5	751	740	9%	9%	5.5	NA	100%	100%	39	39
98	Classroom	3L4' T8/ELIG	2	88	1,165	1,126	13%	8%	4L4' T8EE/EEESUPER T8/	2	30.5	1,165	1,126	13%	8%	5.5	NA	100%	100%	38	38
99	Classroom	4L4' T8/ELIG	15	112	1,165	1,126	13%	8%	4L4' T8EE/EEESUPER T8	15	61	1,165	1,126	13%	8%	5.5	NA	100%	100%	38	38
100	Health and Dept Offices	3L4' T8/ELIG	4	88	1,561	1,557	20%	17%	4L4' T8EE/EEESUPER T8/	4	30.5	1,561	1,557	20%	17%	5.5	NA	100%	100%	3	3
101	Classroom	3L4' T8/ELIG	1	88	1,165	1,126	13%	8%	2L2' T8/ULTRA	1	27	1,165	1,126	13%	8%	5.5	NA	100%	100%	38	38
102	Classroom	4L4' T8/ELIG	6	112	1,165	1,126	13%	8%	4L4' T8EE/EEESUPER T8	6	61	1,165	1,126	13%	8%	5.5	NA	100%	100%	38	38
103	Computer Lab	3L4' T8/ELIG	4	88	941	908	12%	1%	4L4' T8EE/EEESUPER T8/	4	30.5	941	908	12%	1%	5.5	NA	100%	100%	11	11
104	Computer Lab	3L4' T8/ELIG	1	88	941	908	12%	1%	2L2' T8/ULTRA	1	27	941	908	12%	1%	5.5	NA	100%	100%	11	11
105	Classroom	4L4' T8/ELIG	15	112	1,165	1,126	13%	8%	4L4' T8EE/EEESUPER T8	15	61	1,165	1,126	13%	8%	5.5	NA	100%	100%	38	38
106	Storage	4L4' T8/ELIG	2	112	26	26	0%	0%	4L4' T8EE/EEESUPER T8	2	61	26	26	0%	0%	5.5	NA	100%	100%	18	18
107	Prep Room	2L4' T8/ELIG	7	60	751	740	9%	9%	2L4' T8EE/EEE SUPER T8	7	33	751	740	9%	9%	5.5	NA	100%	100%	39	39
108	Prep Room	2L4' T8/ELIG	1	60	751	740	9%	9%	2L4' T8/ULTRA	1	37	751	740	9%	9%	5.5	NA	100%	100%	39	39
109	Vocational Classroom	3L4' T8/ELIG	5	88	1,527	1,513	28%	6%	2L2' T8/ULTRA	5	27	1,527	1,513	28%	6%	5.5	NA	100%	100%	24	24
110	Vocational Classroom	3L4' T8/ELIG	2	88	1,527	1,513	28%	6%	4L4' T8EE/EEESUPER T8/	2	30.5	1,527	1,513	28%	6%	5.5	NA	100%	100%	24	24
111	Vocational Classroom	3L4' T8/ELIG	2	88	1,527	1,513	28%	6%	4L4' T8EE/EEESUPER T8/	2	30.5	1,527	1,513	28%	6%	5.5	NA	100%	100%	24	24
112	Vocational Classroom	4L4' T8/ELIG	6	112	1,527	1,513	28%	6%	4L4' T8EE/EEESUPER T8	6	61	1,527	1,513	28%	6%	5.5	NA	100%	100%	24	24
113	Vocational Classroom	2L4' T8/ELIG	2	60	1,527	1,513	28%	6%	2L4' T8EE/EEE SUPER T8	2	33	1,527	1,513	28%	6%	5.5	NA	100%	100%	24	24
114	Classroom	4L4' T8/ELIG	18	112	1,165	1,126	13%	8%	4L4' T8EE/EEESUPER T8	18	61	1,165	1,126	13%	8%	5.5	NA	100%	100%	38	38
115	Restroom	2L4' T8/ELIG	2	60	3,023	2,809	41%	79%	2L4' T8EE/EEE SUPER T8	2	33	3,023	2,809	41%	79%	5.5	NA	100%	100%	21	21
116	Restroom	2L4' T8/ELIG	3	60	3,023	2,809	41%	79%	2L4' T8/ULTRA	3	37	3,023	2,809	41%	79%	5.5	NA	100%	100%	21	21
117	Restroom	2/26W COMP. HW ELIG	1	56	3,023	2,809	41%	79%	26W COMPACT HW	1	28	3,023	2,809	41%	79%	5.5	NA	100%	100%	21	21
118	Restroom	2L4' T8/ELIG	3	60	3,023	2,809	41%	79%	2L4' T8/ULTRA	3	37	3,023	2,809	41%	79%	5.5	NA	100%	100%	21	21
119	Restroom	2/26W COMP. HW ELIG	1	56	3,023	2,809	41%	79%	26W COMPACT HW	1	28	3,023	2,809	41%	79%	5.5	NA	100%	100%	21	21
120	Lobby/Corridor	2L4' T8/ELIG	18	60	2,613	2,178	37%	30%	2L2' T8/ELIG/LP	18	31	2,613	2,178	37%	30%	5.5	NA	100%	100%	37	37
121	Lobby/Corridor 24/7	2/26W COMP. HW ELIG	16	56	8,760	4,032	100%	100%	26W COMPACT HW	16	28	8,760	4,032	100%	100%	5.5	NA	100%	100%	36	36
122	Lobby/Corridor 24/7	2L4' T8/ELIG	5	60	8,760	4,032	100%	100%	2L2' T8/ELIG/LP	5	31	8,760	4,032	100%	100%	5.5	NA	100%	100%	36	36
123	Lobby/Corridor	2/26W COMP. HW ELIG	3	56	2,613	2,178	37%	30%	26W COMPACT HW	3	28	2,613	2,178	37%	30%	5.5	NA	100%	100%	37	37
124	Classroom	4L4' T8/ELIG	18	112	1,165	1,126	13%	8%	4L4' T8EE/EEESUPER T8	18	61	1,165	1,126	13%	8%	5.5	NA	100%	100%	38	38
125	Classroom	4L4' T8/ELIG	15	112	1,165	1,126	13%	8%	4L4' T8EE/EEESUPER T8	15	61	1,165	1,126	13%	8%	5.5	NA	100%	100%	38	38
126	Classroom	4L4' T8/ELIG	15	112	1,165	1,126	13%	8%	4L4' T8EE/EEESUPER T8	15	61	1,165	1,126	13%	8%	5.5	NA	100%	100%	38	38
127	Classroom	3L4' T8/ELIG	8	88	1,165	1,126	13%	8%	4L4' T8EE/EEESUPER T8/	8	30.5	1,165	1,126	13%	8%	5.5	NA	100%	100%	38	38
128	Health and Dept Offices	3L4' T8/ELIG	5	88	1,561	1,557	20%	17%	2L4' T8EE/EEE SUPER T8	5	33	1,561	1,557	20%	17%	5.5	NA	100%	100%	3	3
129	Prep Room	3L4' T8/ELIG	6	88	751	740	9%	9%	4L4' T8EE/EEESUPER T8/	6	30.5	751	740	9%	9%	5.5	NA	100%	100%	39	39
130	Classroom	4L4' T8/ELIG	15	112	1,165	1,126	13%	8%	4L4' T8EE/EEESUPER T8	15	61	1,165	1,126	13%	8%	5.5	NA	100%	100%	38	38
131	Classroom	4L4' T8/ELIG	15	112	1,165	1,126	13%	8%	4L4' T8EE/EEESUPER T8	15	61	1,165	1,126	13%	8%	5.5	NA	100%	100%	38	38
132	Prep Room	3L4' T8/ELIG	4	88	751	740	9%	9%	4L4' T8EE/EEESUPER T8/	4	30.5	751	740	9%	9%	5.5	NA	100%	100%	39	39
133	Health and Dept Offices	4L4' T8/ELIG	16	112	1,561	1,557	20%	17%	4L4' T8EE/EEESUPER T8	16	61	1,561	1,557	20%	17%	5.5	NA	100%	100%	3	3
134	Storage	3L4' T8/ELIG	1	88	26	26	0%	0%	4L4' T8EE/EEESUPER T8/	1	30.5	26	26	0%	0%	5.5	NA	100%	100%	18	18
135	Prep Room	3L4' T8/ELIG	4	88	751	740	9%	9%	4L4' T8EE/EEESUPER T8/	4	30.5	751	740	9%	9%	5.5	NA	100%	100%	39	39
136	Prep Room	3L4' T8/ELIG	1	88	751	740	9%	9%	4L4' T8EE/EEESUPER T8/	1	30.5	751	740	9%	9%	5.5	NA	100%	100%	39	39
137	Restroom	2L4' T8/ELIG	3	60	3,023	2,809	41%	79%	2L2' T8/ELIG/LP	3	31	3,023	2,809	41%	79%	5.5	NA	100%	100%	21	21
138	Restroom	2/26W COMP. HW ELIG	1	56	3,023	2,809	41%	79%	26W COMPACT HW	1	28	3,023	2,809	41%	79%	5.5	NA	100%	100%	21	21
139	Restroom	2L4' T8/ELIG	3	60	3,023	2,809	41%	79%	2L2' T8/ELIG/LP	3	31	3,023	2,809	41%	79%	5.5	NA	100%	100%	21	21
140	Restroom	2/26W COMP. HW ELIG	1	56	3,023	2,809	41%	79%	26W COMPACT HW	1	28	3,023	2,809	41%	79%	5.5	NA	100%	100%	21	21

Fixture Information																					
		Pre-retrofit Lighting							Post-retrofit Lighting						HVAC				Schedule ID from Table 6	
	(a)	(b)	(c)	(d)	(e)	(f)	(g)	(h)	(i)	(j)	(k)	(l)	(m)	(n)	(o)	(p)	(q)	(r)	(s)		
Fixture ID	Space Type	Fixture Type	Fixture Quantity	Fixture Wattage	Hours of Use Annual	Hours of Use Peak	FCM Diversity Factor Summer	FCM Diversity Factor Winter	Fixture Type	Fixture Quantity	Fixture Wattage	Hours of Use Annual	Hours of Use Peak	FCM Diversity Factor Summer	FCM Diversity Factor Winter	COP Cooling	COP Heating	% Space Cooled	% Space Heated	Pre Retrofit	Post Retrofit
141	Lobby/Corridor	2L4' T8/ELIG	17	60	2,613	2,178	37%	30%	2L2' T8/ELIG/LP	17	31	2,613	2,178	37%	30%	5.5	NA	100%	100%	37	37
142	Lobby/Corridor 24/7	2/26W COMP. HW ELIG	12	56	8,760	4,032	100%	100%	26W COMPACT HW	12	28	8,760	4,032	100%	100%	5.5	NA	100%	100%	36	36
143	Lobby/Corridor 24/7	2L4' T8/ELIG	5	60	8,760	4,032	100%	100%	2L2' T8/ELIG/LP	5	31	8,760	4,032	100%	100%	5.5	NA	100%	100%	36	36
144	Lobby/Corridor	2/26W COMP. HW ELIG	4	56	2,613	2,178	37%	30%	26W COMPACT HW	4	28	2,613	2,178	37%	30%	5.5	NA	100%	100%	37	37
145	Vocational Classroom	4L4' T8/ELIG	9	112	1,527	1,513	28%	6%	4L4' T8EE/EEESUPER T8	9	61	1,527	1,513	28%	6%	5.5	NA	100%	100%	24	24
146	Vocational Classroom	4L4' T8/ELIG	10	112	1,527	1,513	28%	6%	4L4' T8EE/EEESUPER T8	10	61	1,527	1,513	28%	6%	5.5	NA	100%	100%	24	24
147	Vocational Classroom	2L4' T8/ELIG	5	60	1,527	1,513	28%	6%	2L4' T8EE/EEE SUPER T8	5	33	1,527	1,513	28%	6%	5.5	NA	100%	100%	24	24
148	Health and Dept Offices	3L4' T8/ELIG	4	88	1,561	1,557	20%	17%	4L4' T8EE/EEESUPER T8/	4	30.5	1,561	1,557	20%	17%	5.5	NA	100%	100%	3	3
149	Classroom	3L4' T8/ELIG	1	88	1,165	1,126	13%	8%	2L2' T8/ULTRA	1	27	1,165	1,126	13%	8%	5.5	NA	100%	100%	38	38
150	Cosmo/Cooking Lab	3L4' T8/ELIG	9	88	1,310	1,305	11%	7%	4L4' T8EE/EEESUPER T8/	9	30.5	1,310	1,305	11%	7%	5.5	NA	100%	100%	35	35
151	Storage	4L4' T8/ELIG	3	112	26	26	0%	0%	4L4' T8EE/EEESUPER T8	3	61	26	26	0%	0%	5.5	NA	100%	100%	18	18
152	Vocational Classroom	4L4' T8/ELIG	42	112	1,527	1,513	28%	6%	2L4' T8/ULTRA	42	37	1,527	1,513	28%	6%	5.5	NA	100%	100%	24	24
153	Vocational Classroom	3L4' T8/ELIG	1	88	1,527	1,513	28%	6%	4L4' T8EE/EEESUPER T8/	1	30.5	1,527	1,513	28%	6%	5.5	NA	100%	100%	24	24
154	Vocational Classroom	4L4' T8/ELIG	21	112	1,527	1,513	28%	6%	4L4' T8EE/EEESUPER T8	21	61	1,527	1,513	28%	6%	5.5	NA	100%	100%	24	24
155	Vocational Classroom	2L4' T8/ELIG	1	60	1,527	1,513	28%	6%	2L4' T8EE/EEE SUPER T8	1	33	1,527	1,513	28%	6%	5.5	NA	100%	100%	24	24
156	Vocational Classroom	3L4' T8/ELIG	1	88	1,527	1,513	28%	6%	2L2' T8/ULTRA	1	27	1,527	1,513	28%	6%	5.5	NA	100%	100%	24	24
157	Vocational Classroom	2L4' T8/ELIG	1	60	1,527	1,513	28%	6%	2L4' T8EE/EEE SUPER T8	1	33	1,527	1,513	28%	6%	5.5	NA	100%	100%	24	24
158	Vocational Classroom	3L4' T8/ELIG	1	88	1,527	1,513	28%	6%	4L4' T8EE/EEESUPER T8/	1	30.5	1,527	1,513	28%	6%	5.5	NA	100%	100%	24	24
159	Storage	3L4' T8/ELIG	2	88	26	26	0%	0%	4L4' T8EE/EEESUPER T8/	2	30.5	26	26	0%	0%	5.5	NA	100%	100%	18	18
160	Vocational Classroom	4L4' T8/ELIG	37	112	1,527	1,513	28%	6%	2L4' T8/ULTRA	37	37	1,527	1,513	28%	6%	5.5	NA	100%	100%	24	24
161	Private Office	3L4' T8/ELIG	1	88	727	709	23%	4%	4L4' T8EE/EEESUPER T8/	1	30.5	727	709	23%	4%	5.5	NA	100%	100%	32	32
162	Cosmo/Cooking Lab	3L4' T8/ELIG	9	88	1,310	1,305	11%	7%	4L4' T8EE/EEESUPER T8/	9	30.5	1,310	1,305	11%	7%	5.5	NA	100%	100%	35	35
163	Data Room/Electrical	4L4' T8/ELIG	30	112	39	36	0%	0%	2L4' T8/ULTRA	30	37	39	36	0%	0%	5.5	NA	100%	100%	8	8
164	Data Room/Electrical	2L4' T8/ELIG	4	60	39	36	0%	0%	1L4' T8EE/ELEE LOW PW	4	19	39	36	0%	0%	5.5	NA	100%	100%	8	8
165	Cosmo/Cooking Lab	4L4' T8/ELIG	3	112	1,310	1,305	11%	7%	4L4' T8EE/EEESUPER T8	3	61	1,310	1,305	11%	7%	5.5	NA	100%	100%	35	35
166	Lobby/Corridor	2L4' T8/ELIG	16	60	2,613	2,178	37%	30%	2L2' T8/ELIG/LP	16	31	2,613	2,178	37%	30%	5.5	NA	100%	100%	37	37
167	Lobby/Corridor 24/7	2/26W COMP. HW ELIG	11	56	8,760	4,032	100%	100%	26W COMPACT HW	11	28	8,760	4,032	100%	100%	5.5	NA	100%	100%	36	36
168	Lobby/Corridor 24/7	2L4' T8/ELIG	5	60	8,760	4,032	100%	100%	2L2' T8/ELIG/LP	5	31	8,760	4,032	100%	100%	5.5	NA	100%	100%	36	36
169	Lobby/Corridor	2/26W COMP. HW ELIG	2	56	2,613	2,178	37%	30%	26W COMPACT HW	2	28	2,613	2,178	37%	30%	5.5	NA	100%	100%	37	37
170	Classroom	4L4' T8/ELIG	9	112	1,165	1,126	13%	8%	4L4' T8EE/EEESUPER T8	9	61	1,165	1,126	13%	8%	5.5	NA	100%	100%	38	38
171	Vocational Classroom	4L4' T8/ELIG	9	112	1,527	1,513	28%	6%	4L4' T8EE/EEESUPER T8	9	61	1,527	1,513	28%	6%	5.5	NA	100%	100%	24	24
172	Storage	4L4' T8/ELIG	3	112	26	26	0%	0%	4L4' T8EE/EEESUPER T8	3	61	26	26	0%	0%	5.5	NA	100%	100%	18	18
173	Storage	3L4' T8/ELIG	1	88	26	26	0%	0%	4L4' T8EE/EEESUPER T8/	1	30.5	26	26	0%	0%	5.5	NA	100%	100%	18	18
174	Vocational Classroom	4L4' T8/ELIG	9	112	1,527	1,513	28%	6%	4L4' T8EE/EEESUPER T8	9	61	1,527	1,513	28%	6%	5.5	NA	100%	100%	24	24
175	Computer Lab	4L4' T8/ELIG	18	112	941	908	12%	1%	4L4' T8EE/EEESUPER T8	18	61	941	908	12%	1%	5.5	NA	100%	100%	11	11
176	Classroom	4L4' T8/ELIG	9	112	1,165	1,126	13%	8%	4L4' T8EE/EEESUPER T8	9	61	1,165	1,126	13%	8%	5.5	NA	100%	100%	38	38
177	Computer Lab	4L4' T8/ELIG	18	112	941	908	12%	1%	4L4' T8EE/EEESUPER T8	18	61	941	908	12%	1%	5.5	NA	100%	100%	11	11
178	Storage	3L4' T8/ELIG	1	88	26	26	0%	0%	4L4' T8EE/EEESUPER T8/	1	30.5	26	26	0%	0%	5.5	NA	100%	100%	18	18
179	Lobby/Corridor	2/26W COMP. HW ELIG	36	56	2,613	2,178	37%	30%	26W COMPACT HW	36	28	2,613	2,178	37%	30%	5.5	NA	100%	100%	37	37
180	Lobby/Corridor 24/7	2/26W COMP. HW ELIG	4	56	8,760	4,032	100%	100%	26W COMPACT HW	4	28	8,760	4,032	100%	100%	5.5	NA	100%	100%	36	36
181	Lobby/Corridor	2L4' T8/ELIG	14	60	2,613	2,178	37%	30%	2L2' T8/ELIG/LP	14	31	2,613	2,178	37%	30%	5.5	NA	100%	100%	37	37
182	Lobby/Corridor 24/7	2/26W COMP. HW ELIG	13	56	8,760	4,032	100%	100%	26W COMPACT HW	13	28	8,760	4,032	100%	100%	5.5	NA	100%	100%	36	36
183	Lobby/Corridor 24/7	2/26W COMP. HW ELIG	82	56	8,760	4,032	100%	100%	26W COMPACT HW	82	28	8,760	4,032	100%	100%	5.5	NA	100%	100%	36	36
184	Lobby/Corridor 24/7	2L4' T8/ELIG	5	60	8,760	4,032	100%	100%	2L2' T8/ELIG/LP	5	31	8,760	4,032	100%	100%	5.5	NA	100%	100%	36	36
185	Private Office	3L4' T8/ELIG	1	88	727	709	23%	4%	4L4' T8EE/EEESUPER T8/	1	30.5	727	709	23%	4%	5.5	NA	100%	100%	32	32
186	Private Office	3L4' T8/ELIG	1	88	727	709	23%	4%	4L4' T8EE/EEESUPER T8/	1	30.5	727	709	23%	4%	5.5	NA	100%	100%	32	32
187	Cafeteria/Dining	3L4' T8/ELIG	4	88	1,137	1,081	3%	15%	4L4' T8EE/EEESUPER T8/	4	30.5	1,137	1,081	3%	15%	5.5	NA	100%	100%	25	25
188	Cafeteria/Dining	3L4' T8/ELIG	1	88	1,137	1,081	3%	15%	2L2' T8/ULTRA	1	27	1,137	1,081	3%	15%	5.5	NA	100%	100%	25	25
189	Data Room/Electrical	2L4' T8/ELIG	1	60	39	36	0%	0%	1L4' T8EE/ELEE LOW PW	1	19	39	36	0%	0%	5.5	NA	100%	100%	8	8
190	Child Care	3L4' T8/ELIG	28	88	1,632	1,382	16%	2%	4L4' T8EE/EEESUPER T8/	28	30.5	1,632	1,382	16%	2%	5.5	NA	100%	100%	9	9
191	Private Office	3L4' T8/ELIG	1	88	727	709	23%	4%	4L4' T8EE/EEESUPER T8/	1	30.5	727	709	23%	4%	5.5	NA	100%	100%	32	32
192	Kitchen	3L4' T8/ELIG	1	88	1,951	1,644	34%	7%	4L4' T8EE/EEESUPER T8/	1	30.5	1,951	1,644	34%	7%	NA	NA	0%	100%	34	34
193	Private Office	3L4' T8/ELIG	4	88	727	709	23%	4%	4L4' T8EE/EEESUPER T8/	4	30.5	727	709	23%	4%	5.5	NA	100%	100%	32	32
194	Health and Dept Offices	3L4' T8/ELIG	4	88	1,561	1,557	20%	17%	4L4' T8EE/EEESUPER T8/	4	30.5	1,561	1,557	20%	17%	5.5	NA	100%	100%	3	3
195	Restroom	2L4' T8/ELIG	4	60	3,023	2,809	41%	79%	2L4' T8/ULTRA	4	37	3,023	2,809	41%	79%	5.5	NA	100%	100%	21	21
196	Restroom	2L4' T8/ELIG	4	60	3,023	2,809	41%	79%	2L4' T8/ULTRA	4	37	3,023	2,809	41%	79%	5.5	NA	100%	100%	21	21
197	Main Office	3L4' T8/ELIG	1	88	2,246	2,188	67%	8%	4L4' T8EE/EEESUPER T8/	1	30.5	2,246	2,188	67%	8%	5.5	NA	100%	100%	33	33
198	Main Office	3L4' T8/ELIG	1	88	2,246	2,188	67%	8%	4L4' T8EE/EEESUPER T8/	1	30.5	2,246	2,188	67%	8%	5.5	NA	100%	100%	33	33
199	Private Office	3L4' T8/ELIG	1	88	727	709	23%	4%	4L4' T8EE/EEESUPER T8/	1	30.5	727	709	23%	4%	5.5	NA	100%	100%	32	32
200	Cosmo/Cooking Lab	3L4' T8/ELIG	1	88	1,310	1,305	11%	7%	4L4' T8EE/EEESUPER T8/	1	30.5	1,310	1,305	11%	7%	5.5	NA	100%	100%	35	35
201	Prep Room	3L4' T8/ELIG	1	88	751	740	9%	9%	4L4' T8EE/EEESUPER T8/	1	30.5	751	740	9%	9%	5.5	NA	100%	100%	39	39
202	Cosmo/Cooking Lab	3L4' T8/ELIG	3	88	1,310	1,305	11%	7%	4L4' T8EE/EEESUPER T8/	3	30.5	1,310	1,305	11%	7%	5.5	NA	100%	100%	35	35
203	Private Office	3L4' T8/ELIG	1	88	727	709	23%	4%	4L4' T8EE/EEESUPER T8/	1	30.5	727	709	23%	4%	5.5	NA	100%	100%	32	32
204	Cosmo/Cooking Lab	3L4' T8/ELIG	5	88	1,310	1,305	11%	7%	4L4' T8EE/EEESUPER T8/	5	30.5	1,310	1,305	11%	7%	5.5	NA	100%	100%	35	35
205	Cosmo/Cooking Lab	3L4' T8/ELIG	5	88	1,310	1,305	11%	7%	4L4' T8EE/EEESUPER T8/	5	30.5	1,310	1,305	11%	7%	5.5	NA	100%	100%	35	35
206	Cosmo/Cooking Lab	3L4' T8/ELIG	2	88	1,310	1,305	11%	7%	2L2' T8/ULTRA	2	27	1,310	1,305	11%	7%	5.5	NA	100%	100%	35	35
207	Health and Dept Offices	3L4' T8/ELIG	4	88	1,561	1,557	20%	17%	4L4' T8EE/EEESUPER T8/	4	30.5	1,561	1,557	20%	17%	5.5	NA	100%	100%	3	3
208	Health and Dept Offices	3L4' T8/ELIG	4	88	1,561	1,557	20%	17%	2L2' T8/ULTRA	4	27	1,561	1,557	20%	17%	5.5	NA	100%	100%	3	3
209	Main Office	3L4' T8/ELIG	3	88	2,246	2,188	67%	8%	2L2' T8/ULTRA	3	27	2,246	2,188	67%	8%	5.5	NA	100%	100%	33	33
210	Main Office	3L4' T8/ELIG	2	88	2,246	2,188	67%	8%	4L4' T8EE/EEESUPER T8/	2	30.5	2,246	2,188	67%	8%	5.5	NA	100%	100%	33	33

Fixture Information

Fixture ID	(a) Space Type	Pre-retrofit Lighting (b) Fixture Type	(c) Fixture Quantity	(d) Fixture Wattage	(e) Hours of Use Annual	(f) Hours of Use Peak	(g) FCM Diversity Factor Summer	(h) FCM Diversity Factor Winter	Post-retrofit Lighting (i) Fixture Type	(j) Fixture Quantity	(k) Fixture Wattage	(l) Hours of Use Annual	(m) Hours of Use Peak	(n) FCM Diversity Factor Summer	(o) FCM Diversity Factor Winter	HVAC (p) COP Cooling	(q) COP Heating	(r) % Space Cooled	(s) % Space Heated	Schedule ID from Table 6 Pre Retrofit	Schedule ID from Table 6 Post Retrofit
211	Main Office	3L4' T8/ELIG	1	88	2,246	2,188	67%	8%	4L4' T8EE/EEESUPER T8/	1	30.5	2,246	2,188	67%	8%	5.5	NA	100%	100%	33	33
212	Guidance Private Office	3L4' T8/ELIG	1	88	0	0	0%	0%	4L4' T8EE/EEESUPER T8/	1	30.5	0	0	0%	0%	5.5	NA	100%	100%	15	15
213	Private Office	3L4' T8/ELIG	1	88	727	709	23%	4%	4L4' T8EE/EEESUPER T8/	1	30.5	727	709	23%	4%	5.5	NA	100%	100%	32	32
214	Private Office	3L4' T8/ELIG	1	88	727	709	23%	4%	4L4' T8EE/EEESUPER T8/	1	30.5	727	709	23%	4%	5.5	NA	100%	100%	32	32
215	Library	3L4' T8/ELIG	54	88	1,834	1,716	25%	23%	2L2' T8/ULTRA	54	27	1,834	1,716	25%	23%	2.9	NA	100%	100%	16	16
216	Library	4L4' T8/ELIG	49	112	1,834	1,716	25%	23%	4L4' T8EE/EEESUPER T8	49	61	1,834	1,716	25%	23%	2.9	NA	100%	100%	16	16
217	Library	2L4' T8/ELIG	27	60	1,834	1,716	25%	23%	2L4' T8EE/EEE SUPER T8	27	33	1,834	1,716	25%	23%	2.9	NA	100%	100%	16	16
218	Cosmo/Cooking Lab	3L4' T8/ELIG	18	88	1,310	1,305	11%	7%	4L4' T8EE/EEESUPER T8/	18	30.5	1,310	1,305	11%	7%	5.5	NA	100%	100%	35	35
219	Cosmo/Cooking Lab	3L4' T8/ELIG	2	88	1,310	1,305	11%	7%	2L2' T8/ULTRA	2	27	1,310	1,305	11%	7%	5.5	NA	100%	100%	35	35
220	Cosmo/Cooking Lab	3L4' T8/ELIG	2	88	1,310	1,305	11%	7%	4L4' T8EE/EEESUPER T8/	2	30.5	1,310	1,305	11%	7%	5.5	NA	100%	100%	35	35
221	Classroom	3L4' T8/ELIG	1	88	1,165	1,126	13%	8%	4L4' T8EE/EEESUPER T8/	1	30.5	1,165	1,126	13%	8%	5.5	NA	100%	100%	38	38
222	Classroom	3L4' T8/ELIG	1	88	1,165	1,126	13%	8%	4L4' T8EE/EEESUPER T8/	1	30.5	1,165	1,126	13%	8%	5.5	NA	100%	100%	38	38
223	Data Room/Electrical	2L4' T8/ELIG	2	60	39	36	0%	0%	1L4' T8EE/ELEE LOW PW	2	19	39	36	0%	0%	5.5	NA	100%	100%	8	8
224	Lobby/Corridor	2L4' T8/ELIG	11	60	2,613	2,178	37%	30%	2L2' T8/ELIG/LP	11	31	2,613	2,178	37%	30%	5.5	NA	100%	100%	37	37
225	Lobby/Corridor 24/7	2/26W COMP. HW ELIG	10	56	8,760	4,032	100%	100%	26W COMPACT HW	10	28	8,760	4,032	100%	100%	5.5	NA	100%	100%	36	36
226	Lobby/Corridor 24/7	2L4' T8/ELIG	4	60	8,760	4,032	100%	100%	2L2' T8/ELIG/LP	4	31	8,760	4,032	100%	100%	5.5	NA	100%	100%	36	36
227	Lobby/Corridor	2/26W COMP. HW ELIG	2	56	2,613	2,178	37%	30%	26W COMPACT HW	2	28	2,613	2,178	37%	30%	5.5	NA	100%	100%	37	37
228	Lobby/Corridor	2L4' T8/ELIG	9	60	2,613	2,178	37%	30%	2L2' T8/ELIG/LP	9	31	2,613	2,178	37%	30%	5.5	NA	100%	100%	37	37
229	Lobby/Corridor 24/7	2/26W COMP. HW ELIG	1	56	8,760	4,032	100%	100%	26W COMPACT HW	1	28	8,760	4,032	100%	100%	5.5	NA	100%	100%	36	36
230	Classroom	4L4' T8/ELIG	9	112	1,165	1,126	13%	8%	4L4' T8EE/EEESUPER T8	9	61	1,165	1,126	13%	8%	5.5	NA	100%	100%	38	38
231	Prep Room	3L4' T8/ELIG	2	88	751	740	9%	9%	4L4' T8EE/EEESUPER T8/	2	30.5	751	740	9%	9%	5.5	NA	100%	100%	39	39
232	Classroom	4L4' T8/ELIG	9	112	1,165	1,126	13%	8%	4L4' T8EE/EEESUPER T8	9	61	1,165	1,126	13%	8%	5.5	NA	100%	100%	38	38
233	Health and Dept Offices	3L4' T8/ELIG	9	88	1,561	1,557	20%	17%	4L4' T8EE/EEESUPER T8/	9	30.5	1,561	1,557	20%	17%	5.5	NA	100%	100%	3	3
234	Classroom	4L4' T8/ELIG	9	112	1,165	1,126	13%	8%	4L4' T8EE/EEESUPER T8	9	61	1,165	1,126	13%	8%	5.5	NA	100%	100%	38	38
235	Classroom	4L4' T8/ELIG	9	112	1,165	1,126	13%	8%	4L4' T8EE/EEESUPER T8	9	61	1,165	1,126	13%	8%	5.5	NA	100%	100%	38	38
236	Classroom	2L4' T8/ELIG	1	60	1,165	1,126	13%	8%	2L4' T8EE/EEE SUPER T8	1	33	1,165	1,126	13%	8%	5.5	NA	100%	100%	38	38
237	Health and Dept Offices	3L4' T8/ELIG	5	88	1,561	1,557	20%	17%	4L4' T8EE/EEESUPER T8/	5	30.5	1,561	1,557	20%	17%	5.5	NA	100%	100%	3	3
238	Storage	3L4' T8/ELIG	1	88	26	26	0%	0%	4L4' T8EE/EEESUPER T8/	1	30.5	26	26	0%	0%	5.5	NA	100%	100%	18	18
239	Special Education	3L4' T8/ELIG	3	88	1,942	1,759	25%	22%	4L4' T8EE/EEESUPER T8/	3	30.5	1,942	1,759	25%	22%	5.5	NA	100%	100%	6	6
240	Classroom	4L4' T8/ELIG	9	112	1,165	1,126	13%	8%	4L4' T8EE/EEESUPER T8	9	61	1,165	1,126	13%	8%	5.5	NA	100%	100%	38	38
241	Restroom	2L4' T8/ELIG	3	60	3,023	2,809	41%	79%	2L2' T8/ELIG/LP	3	31	3,023	2,809	41%	79%	5.5	NA	100%	100%	21	21
242	Restroom	2/26W COMP. HW ELIG	1	56	3,023	2,809	41%	79%	26W COMPACT HW	1	28	3,023	2,809	41%	79%	5.5	NA	100%	100%	21	21
243	Classroom	4L4' T8/ELIG	9	112	1,165	1,126	13%	8%	4L4' T8EE/EEESUPER T8	9	61	1,165	1,126	13%	8%	5.5	NA	100%	100%	38	38
244	Restroom	2L4' T8/ELIG	3	60	3,023	2,809	41%	79%	2L2' T8/ELIG/LP	3	31	3,023	2,809	41%	79%	5.5	NA	100%	100%	21	21
245	Restroom	2/26W COMP. HW ELIG	1	56	3,023	2,809	41%	79%	26W COMPACT HW	1	28	3,023	2,809	41%	79%	5.5	NA	100%	100%	21	21
246	Classroom	4L4' T8/ELIG	9	112	1,165	1,126	13%	8%	4L4' T8EE/EEESUPER T8	9	61	1,165	1,126	13%	8%	5.5	NA	100%	100%	38	38
247	Classroom	4L4' T8/ELIG	9	112	1,165	1,126	13%	8%	4L4' T8EE/EEESUPER T8	9	61	1,165	1,126	13%	8%	5.5	NA	100%	100%	38	38
248	Classroom	4L4' T8/ELIG	8	112	1,165	1,126	13%	8%	4L4' T8EE/EEESUPER T8	8	61	1,165	1,126	13%	8%	5.5	NA	100%	100%	38	38
249	Classroom	2L4' T8/ELIG	1	60	1,165	1,126	13%	8%	2L4' T8EE/EEE SUPER T8	1	33	1,165	1,126	13%	8%	5.5	NA	100%	100%	38	38
250	Classroom	4L4' T8/ELIG	9	112	1,165	1,126	13%	8%	4L4' T8EE/EEESUPER T8	9	61	1,165	1,126	13%	8%	5.5	NA	100%	100%	38	38
251	Classroom	4L4' T8/ELIG	8	112	1,165	1,126	13%	8%	4L4' T8EE/EEESUPER T8	8	61	1,165	1,126	13%	8%	5.5	NA	100%	100%	38	38
252	Classroom	2L4' T8/ELIG	1	60	1,165	1,126	13%	8%	2L4' T8EE/EEE SUPER T8	1	33	1,165	1,126	13%	8%	5.5	NA	100%	100%	38	38
253	Classroom	4L4' T8/ELIG	9	112	1,165	1,126	13%	8%	4L4' T8EE/EEESUPER T8	9	61	1,165	1,126	13%	8%	5.5	NA	100%	100%	38	38
254	Classroom	4L4' T8/ELIG	8	112	1,165	1,126	13%	8%	4L4' T8EE/EEESUPER T8	8	61	1,165	1,126	13%	8%	5.5	NA	100%	100%	38	38
255	Classroom	2L4' T8/ELIG	1	60	1,165	1,126	13%	8%	2L4' T8EE/EEE SUPER T8	1	33	1,165	1,126	13%	8%	5.5	NA	100%	100%	38	38
256	Classroom	4L4' T8/ELIG	9	112	1,165	1,126	13%	8%	4L4' T8EE/EEESUPER T8	9	61	1,165	1,126	13%	8%	5.5	NA	100%	100%	38	38
257	Classroom	4L4' T8/ELIG	8	112	1,165	1,126	13%	8%	4L4' T8EE/EEESUPER T8	8	61	1,165	1,126	13%	8%	5.5	NA	100%	100%	38	38
258	Classroom	2L4' T8/ELIG	1	60	1,165	1,126	13%	8%	2L4' T8EE/EEE SUPER T8	1	33	1,165	1,126	13%	8%	5.5	NA	100%	100%	38	38
259	Lobby/Corridor 24/7	2L4' T8/ELIG	6	60	8,760	4,032	100%	100%	2L2' T8/ELIG/LP	6	31	8,760	4,032	100%	100%	5.5	NA	100%	100%	36	36
260	Lobby/Corridor 24/7	2/26W COMP. HW ELIG	15	56	8,760	4,032	100%	100%	26W COMPACT HW	15	28	8,760	4,032	100%	100%	5.5	NA	100%	100%	36	36
261	Lobby/Corridor	2L4' T8/ELIG	18	60	2,613	2,178	37%	30%	2L2' T8/ELIG/LP	18	31	2,613	2,178	37%	30%	5.5	NA	100%	100%	37	37
262	Lobby/Corridor	2/26W COMP. HW ELIG	3	56	2,613	2,178	37%	30%	26W COMPACT HW	3	28	2,613	2,178	37%	30%	5.5	NA	100%	100%	37	37
263	Lobby/Corridor	2L4' T8/ELIG	7	60	2,613	2,178	37%	30%	2L2' T8/ELIG/LP	7	31	2,613	2,178	37%	30%	5.5	NA	100%	100%	37	37
264	Lobby/Corridor 24/7	2/26W COMP. HW ELIG	1	56	8,760	4,032	100%	100%	26W COMPACT HW	1	28	8,760	4,032	100%	100%	5.5	NA	100%	100%	36	36
265	Computer Lab	4L4' T8/ELIG	18	112	941	908	12%	1%	4L4' T8EE/EEESUPER T8	18	61	941	908	12%	1%	5.5	NA	100%	100%	11	11
266	Classroom	4L4' T8/ELIG	9	112	1,165	1,126	13%	8%	4L4' T8EE/EEESUPER T8	9	61	1,165	1,126	13%	8%	5.5	NA	100%	100%	38	38
267	Classroom	4L4' T8/ELIG	6	112	1,165	1,126	13%	8%	4L4' T8EE/EEESUPER T8	6	61	1,165	1,126	13%	8%	5.5	NA	100%	100%	38	38
268	Classroom	4L4' T8/ELIG	9	112	1,165	1,126	13%	8%	4L4' T8EE/EEESUPER T8	9	61	1,165	1,126	13%	8%	5.5	NA	100%	100%	38	38
269	Health and Dept Offices	3L4' T8/ELIG	10	88	1,561	1,557	20%	17%	4L4' T8EE/EEESUPER T8/	10	30.5	1,561	1,557	20%	17%	5.5	NA	100%	100%	3	3
270	Health and Dept Offices	3L4' T8/ELIG	1	88	1,561	1,557	20%	17%	2L2' T8/ULTRA	1	27	1,561	1,557	20%	17%	5.5	NA	100%	100%	3	3
271	Health and Dept Offices	3L4' T8/ELIG	1	88	1,561	1,557	20%	17%	4L4' T8EE/EEESUPER T8/	1	30.5	1,561	1,557	20%	17%	5.5	NA	100%	100%	3	3
272	Storage	3L4' T8/ELIG	5	88	26	26	0%	0%	4L4' T8EE/EEESUPER T8/	5	30.5	26	26	0%	0%	5.5	NA	100%	100%	18	18
273	Computer Lab	4L4' T8/ELIG	22	112	941	908	12%	1%	4L4' T8EE/EEESUPER T8	22	61	941	908	12%	1%	5.5	NA	100%	100%	11	11
274	Computer Lab	2L4' T8/ELIG	2	60	941	908	12%	1%	2L4' T8EE/EEE SUPER T8	2	33	941	908	12%	1%	5.5	NA	100%	100%	11	11
275	Special Education	2L4' T8/ELIG	4	60	1,942	1,759	25%	22%	2L4' T8EE/EEE SUPER T8	4	33	1,942	1,759	25%	22%	5.5	NA	100%	100%	6	6
276	Storage	3L4' T8/ELIG	2	88	26	26	0%	0%	4L4' T8EE/EEESUPER T8/	2	30.5	26	26	0%	0%	5.5	NA	100%	100%	18	18
277	Storage	2L4' T8/ELIG	4	60	26	26	0%	0%	2L4' T8EE/EEE SUPER T8	4	33	26	26	0%	0%	5.5	NA	100%	100%	18	18
278	Classroom	3L4' T8/ELIG	3	88	1,165	1,126	13%	8%	4L4' T8EE/EEESUPER T8/	3	30.5	1,165	1,126	13%	8%	5.5	NA	100%	100%	38	38
279	Classroom	4L4' T8/ELIG	9	112	1,165	1,126	13%	8%	4L4' T8EE/EEESUPER T8	9	61	1,165	1,126	13%	8%	5.5	NA	100%	100%	38	38
280	Classroom	4L4' T8/ELIG	9	112	1,165	1,126	13%	8%	4L4' T8EE/EEESUPER T8	9	61	1,165	1,126	13%	8%	5.5	NA	100%	100%	38	38

Fixture Information

		Pre-retrofit Lighting							Post-retrofit Lighting							HVAC				Schedule ID from Table 6	
Fixture ID	(a) Space Type	(b) Fixture Type	(c) Fixture Quantity	(d) Fixture Wattage	(e) Hours of Use Annual	(f) Hours of Use Peak	(g) FCM Diversity Factor Summer	(h) FCM Diversity Factor Winter	(i) Fixture Type	(j) Fixture Quantity	(k) Fixture Wattage	(l) Hours of Use Annual	(m) Hours of Use Peak	(n) FCM Diversity Factor Summer	(o) FCM Diversity Factor Winter	(p) COP Cooling	(q) COP Heating	(r) % Space Cooled	(s) % Space Heated	Pre Retrofit	Post Retrofit
281	Classroom	4L4' T8/ELIG	9	112	1,165	1,126	13%	8%	4L4' T8EE/EEESUPER T8	9	61	1,165	1,126	13%	8%	5.5	NA	100%	100%	38	38
282	Classroom	4L4' T8/ELIG	8	112	1,165	1,126	13%	8%	4L4' T8EE/EEESUPER T8	8	61	1,165	1,126	13%	8%	5.5	NA	100%	100%	38	38
283	Classroom	2L4' T8/ELIG	1	60	1,165	1,126	13%	8%	2L4' T8EE/EEE SUPER T8	1	33	1,165	1,126	13%	8%	5.5	NA	100%	100%	38	38
284	Classroom	4L4' T8/ELIG	9	112	1,165	1,126	13%	8%	4L4' T8EE/EEESUPER T8	9	61	1,165	1,126	13%	8%	5.5	NA	100%	100%	38	38
285	Classroom	4L4' T8/ELIG	8	112	1,165	1,126	13%	8%	4L4' T8EE/EEESUPER T8	8	61	1,165	1,126	13%	8%	5.5	NA	100%	100%	38	38
286	Classroom	2L4' T8/ELIG	1	60	1,165	1,126	13%	8%	2L4' T8EE/EEE SUPER T8	1	33	1,165	1,126	13%	8%	5.5	NA	100%	100%	38	38
287	Classroom	4L4' T8/ELIG	9	112	1,165	1,126	13%	8%	4L4' T8EE/EEESUPER T8	9	61	1,165	1,126	13%	8%	5.5	NA	100%	100%	38	38
288	Classroom	4L4' T8/ELIG	8	112	1,165	1,126	13%	8%	4L4' T8EE/EEESUPER T8	8	61	1,165	1,126	13%	8%	5.5	NA	100%	100%	38	38
289	Classroom	2L4' T8/ELIG	1	60	1,165	1,126	13%	8%	2L4' T8EE/EEE SUPER T8	1	33	1,165	1,126	13%	8%	5.5	NA	100%	100%	38	38
290	Classroom	4L4' T8/ELIG	9	112	1,165	1,126	13%	8%	4L4' T8EE/EEESUPER T8	9	61	1,165	1,126	13%	8%	5.5	NA	100%	100%	38	38
291	Classroom	4L4' T8/ELIG	8	112	1,165	1,126	13%	8%	4L4' T8EE/EEESUPER T8	8	61	1,165	1,126	13%	8%	5.5	NA	100%	100%	38	38
292	Classroom	2L4' T8/ELIG	1	60	1,165	1,126	13%	8%	2L4' T8EE/EEE SUPER T8	1	33	1,165	1,126	13%	8%	5.5	NA	100%	100%	38	38
293	Lobby/Corridor	2/26W COMP. HW ELIG	3	56	2,613	2,178	37%	30%	26W COMPACT HW	3	28	2,613	2,178	37%	30%	5.5	NA	100%	100%	37	37
294	Cafeteria/Dining	3L4' T8/ELIG	9	88	1,137	1,081	3%	15%	4L4' T8EE/EEESUPER T8/	9	30.5	1,137	1,081	3%	15%	2.9	NA	100%	100%	25	25
295	Cafeteria/Dining	3L4' T8/ELIG	2	88	1,137	1,081	3%	15%	3L2' T8/ELIG	2	53	1,137	1,081	3%	15%	2.9	NA	100%	100%	25	25
296	Cafeteria/Dining	3L4' T8/ELIG	31	88	1,137	1,081	3%	15%	2L2' T8/ULTRA	31	27	1,137	1,081	3%	15%	2.9	NA	100%	100%	25	25
297	Cafeteria/Dining	320W MH CWA	13	365	1,137	1,081	3%	15%	3L4' T5 HO/ELIG	13	177	1,137	1,081	3%	15%	2.9	NA	100%	100%	25	25
298	Kitchen	4L4' T8/ELIG	14	112	1,951	1,644	34%	7%	4L4' T8EE/EEESUPER T8	14	61	1,951	1,644	34%	7%	NA	NA	0%	100%	34	34
299	Kitchen	2L4' T8/ELIG	2	60	1,951	1,644	34%	7%	2L2' T8/ELIG/LP	2	31	1,951	1,644	34%	7%	NA	NA	0%	100%	34	34
300	Data Room/Electrical	2L4' T8/ELIG	15	60	39	36	0%	0%	1L4' T8EE/ELEE LOW PW	15	19	39	36	0%	0%	5.5	NA	100%	100%	8	8
301	Storage	3L4' T8/ELIG	1	88	26	26	0%	0%	4L4' T8EE/EEESUPER T8/	1	30.5	26	26	0%	0%	5.5	NA	100%	100%	18	18
302	Cosmo/Cooking Lab	4L4' T8/ELIG	21	112	1,310	1,305	11%	7%	4L4' T8EE/EEESUPER T8	21	61	1,310	1,305	11%	7%	5.5	NA	100%	100%	35	35
303	Lobby/Corridor	2L4' T8/ELIG	7	60	2,613	2,178	37%	30%	2L2' T8/ELIG/LP	7	31	2,613	2,178	37%	30%	5.5	NA	100%	100%	37	37
304	Kitchen	4L4' T8/ELIG	1	112	1,951	1,644	34%	7%	4L4' T8EE/EEESUPER T8	1	61	1,951	1,644	34%	7%	5.5	NA	100%	100%	34	34
305	Storage	3L4' T8/ELIG	1	88	26	26	0%	0%	4L4' T8EE/EEESUPER T8/	1	30.5	26	26	0%	0%	5.5	NA	100%	100%	18	18
306	Cafeteria/Dining	3L4' T8/ELIG	16	88	1,137	1,081	3%	15%	4L4' T8EE/EEESUPER T8/	16	30.5	1,137	1,081	3%	15%	5.5	NA	100%	100%	25	25
307	Cafeteria/Dining	3L4' T8/ELIG	1	88	1,137	1,081	3%	15%	2L2' T8/ULTRA	1	27	1,137	1,081	3%	15%	5.5	NA	100%	100%	25	25
308	Data Room/Electrical	2L4' T8/ELIG	1	60	39	36	0%	0%	1L4' T8EE/ELEE LOW PW	1	19	39	36	0%	0%	5.5	NA	100%	100%	8	8
309	Data Room/Electrical	2L4' T8/ELIG	3	60	39	36	0%	0%	1L4' T8EE/ELEE LOW PW	3	19	39	36	0%	0%	5.5	NA	100%	100%	8	8
310	Lobby/Corridor	2L4' T8/ELIG	10	60	2,613	2,178	37%	30%	2L2' T8/ELIG/LP	10	31	2,613	2,178	37%	30%	5.5	NA	100%	100%	37	37
311	Lobby/Corridor 24/7	2/26W COMP. HW ELIG	3	56	8,760	4,032	100%	100%	26W COMPACT HW	3	28	8,760	4,032	100%	100%	5.5	NA	100%	100%	36	36
312	Lobby/Corridor 24/7	2L4' T8/ELIG	1	60	8,760	4,032	100%	100%	2L2' T8/ELIG/LP	1	31	8,760	4,032	100%	100%	5.5	NA	100%	100%	36	36
313	Lobby/Corridor 24/7	2L4' T8/ELIG	3	60	8,760	4,032	100%	100%	2L4' T8EE/EEE SUPER T8	3	33	8,760	4,032	100%	100%	5.5	NA	100%	100%	36	36
314	Gym	400W METAL HALIDE	36	455	2,919	2,372	45%	38%	6L4' T8/ELIG HIGH LMN	36	234	2,303	1,761	38%	30%	NA	NA	0%	100%	42	41
315	Lobby/Corridor 24/7	2L8' T8 HO/ELIG	4	160	8,760	4,032	100%	100%	4L4' T8EE/EEESUPER T8	4	61	8,760	4,032	100%	100%	NA	NA	0%	100%	36	36
316	Auditorium	120W INC	111	120	715	617	11%	8%	42W CIRCLINE HW	111	46	715	617	11%	8%	NA	NA	0%	100%	43	43
317	Girls Lockers	1L4' T8/ELIG	6	30	3,074	2,547	33%	77%	2L4' T8/ULTRA	3	37	2,640	2,174	30%	67%	5.5	NA	100%	100%	40	7
318	Girls Lockers	1L4' T8/ELIG	68	30	3,074	2,547	33%	77%	3L4' T8EE/EEESUPER T8	29	46	2,640	2,174	30%	67%	5.5	NA	100%	100%	40	7
319	Stage	200W INC	2	200	466	431	9%	20%	4L4' T8EE/EEESUPER T8	2	61	466	431	9%	20%	5.5	NA	100%	100%	10	10
320	Stage	200W MH CWA	6	232	466	431	9%	20%	4L4' T8EE/EEESUPER T8	6	61	466	431	9%	20%	5.5	NA	100%	100%	10	10
321	Data Room/Electrical	4L4' T8/ELIG	1	112	39	36	0%	0%	2L4' T8/ULTRA	1	37	39	36	0%	0%	5.5	NA	100%	100%	8	8
322	Data Room/Electrical	2L4' T8/ELIG	1	60	39	36	0%	0%	1L4' T8EE/ELEE LOW PW	1	19	39	36	0%	0%	5.5	NA	100%	100%	8	8
323	Data Room/Electrical	4L4' T8/ELIG	1	112	39	36	0%	0%	2L4' T8/ULTRA	1	37	39	36	0%	0%	5.5	NA	100%	100%	8	8
324	Data Room/Electrical	2L4' T8/ELIG	1	60	39	36	0%	0%	1L4' T8EE/ELEE LOW PW	1	19	39	36	0%	0%	5.5	NA	100%	100%	8	8
325	Data Room/Electrical	2L4' T8/ELIG	1	60	39	36	0%	0%	1L4' T8EE/ELEE LOW PW	1	19	39	36	0%	0%	5.5	NA	100%	100%	8	8
326	Prep Room	4L4' T8/ELIG	1	112	751	740	9%	9%	2L4' T8/ULTRA	1	37	751	740	9%	9%	5.5	NA	100%	100%	39	39
327	Data Room/Electrical	4L4' T8/ELIG	1	112	39	36	0%	0%	2L4' T8/ULTRA	1	37	39	36	0%	0%	5.5	NA	100%	100%	8	8
328	Data Room/Electrical	2L4' T8/ELIG	1	60	39	36	0%	0%	1L4' T8EE/ELEE LOW PW	1	19	39	36	0%	0%	5.5	NA	100%	100%	8	8
329	Data Room/Electrical	2L4' T8/ELIG	1	60	39	36	0%	0%	1L4' T8EE/ELEE LOW PW	1	19	39	36	0%	0%	5.5	NA	100%	100%	8	8
330	Data Room/Electrical	2L4' T8/ELIG	1	60	39	36	0%	0%	1L4' T8EE/ELEE LOW PW	1	19	39	36	0%	0%	5.5	NA	100%	100%	8	8
331	Data Room/Electrical	2L4' T8/ELIG	1	60	39	36	0%	0%	1L4' T8EE/ELEE LOW PW	1	19	39	36	0%	0%	5.5	NA	100%	100%	8	8
332	Lobby/Corridor 24/7	2L4' T8/ELIG	10	60	8,760	4,032	100%	100%	2L2' T8/ELIG/LP	10	31	8,760	4,032	100%	100%	5.5	NA	100%	100%	36	36
333	Lobby/Corridor 24/7	2L4' T8/ELIG	13	60	8,760	4,032	100%	100%	2L2' T8/ELIG/LP	13	31	8,760	4,032	100%	100%	5.5	NA	100%	100%	36	36
334	Lobby/Corridor	2L4' T8/ELIG	17	60	2,613	2,178	37%	30%	2L2' T8/ELIG/LP	17	31	2,613	2,178	37%	30%	5.5	NA	100%	100%	37	37
335	Lobby/Corridor 24/7	2L4' T8/ELIG	5	60	8,760	4,032	100%	100%	2L2' T8/ELIG/LP	5	31	8,760	4,032	100%	100%	5.5	NA	100%	100%	36	36
336	Lobby/Corridor 24/7	2L4' T8/ELIG	3	60	8,760	4,032	100%	100%	2L2' T8/ELIG/LP	3	31	8,760	4,032	100%	100%	5.5	NA	100%	100%	36	36
337	Lobby/Corridor 24/7	2L4' T8/ELIG	3	60	8,760	4,032	100%	100%	2L2' T8/ELIG/LP	3	31	8,760	4,032	100%	100%	5.5	NA	100%	100%	36	36
338	Health and Dept Offices	4L4' T8/ELIG	2	112	1,561	1,557	20%	17%	2L4' T8/ULTRA	2	37	1,561	1,557	20%	17%	5.5	NA	100%	100%	3	3
339	Health and Dept Offices	4L4' T8/ELIG	1	112	1,561	1,557	20%	17%	2L4' T8/ULTRA	1	37	1,561	1,557	20%	17%	5.5	NA	100%	100%	3	3
340	Kitchen	4L4' T8/ELIG	1	112	1,951	1,644	34%	7%	4L4' T8EE/EEESUPER T8	1	61	1,951	1,644	34%	7%	5.5	NA	100%	100%	34	34
341	Kitchen	4L4' T8/ELIG	1	112	1,951	1,644	34%	7%	4L4' T8EE/EEESUPER T8	1	61	1,951	1,644	34%	7%	5.5	NA	100%	100%	34	34
342	Prep Room	4L4' T8/ELIG	2	112	751	740	9%	9%	2L4' T8/ULTRA	2	37	751	740	9%	9%	5.5	NA	100%	100%	39	39
343	Kitchen	2L4' T8/ELIG	6	60	1,951	1,644	34%	7%	2L4' T8/ULTRA	6	37	1,951	1,644	34%	7%	NA	NA	0%	100%	34	34
344	Classroom	4L4' T8/ELIG	3	112	1,165	1,126	13%	8%	2L4' T8/ULTRA	3	37	1,165	1,126	13%	8%	5.5	NA	100%	100%	38	38
345	Classroom	4L4' T8/ELIG	9	112	1,165	1,126	13%	8%	4L4' T8EE/EEESUPER T8	9	61	1,165	1,126	13%	8%	5.5	NA	100%	100%	38	38
346	Classroom	4L4' T8/ELIG	15	112	1,165	1,126	13%	8%	4L4' T8EE/EEESUPER T8	15	61	1,165	1,126	13%	8%	5.5	NA	100%	100%	38	38
347	Classroom	4L4' T8/ELIG	15	112	1,165	1,126	13%	8%	4L4' T8EE/EEESUPER T8	15	61	1,165	1,126	13%	8%	5.5	NA	100%	100%	38	38
348	Classroom	4L4' T8/ELIG	15	112	1,165	1,126	13%	8%	4L4' T8EE/EEESUPER T8	15	61	1,165	1,126	13%	8%	5.5	NA	100%	100%	38	38
349	Private Office	4L4' T8/ELIG	1	112	727	709	23%	4%	4L4' T8EE/EEESUPER T8	1	61	727	709	23%	4%	5.5	NA	100%	100%	32	32
		Totals	2,581	245,572					Totals	2,539	116,970										

Pre-Retrofit Demand and Energy Consumption

Fixture ID	Lighting Demand and Energy Consumption (t) Connected kW	(u) FCM Diversified kW Summer	(v) FCM Diversified kW Winter	(w) Annual kWh	(x) Peak kWh	Interactive Hours (y) Cooling Hours	(z) Heating Hours	Interactive Energy Consumption (aa) Cooling kWh	(ab) Heating kWh	On-Peak Interactive Hours (ac) Cooling Hours	(ad) Heating Hours	On-Peak Interactive Demand and Energy Consumption (ae) FCM Diversified kW Summer	(af) FCM Diversified kW Winter	(ag) Cooling kWh	(ah) Heating kWh	Lighting and Interactive Demand and Energy Consumption (ai) FCM Diversified kW Summer	(aj) FCM Diversified kW Winter	(ak) Annual kWh	(al) Peak kWh
1	0.90	0.33	0.27	2,342	1,952	458	1,095	59	0	452	1,076	0.04	0.00	59	0	0.37	0.27	2,401	2,011
2	0.45	0.45	0.45	3,924	1,806	1,336	2,225	87	0	920	1,520	0.06	0.00	60	0	0.50	0.45	4,011	1,866
3	0.54	0.20	0.16	1,411	1,176	458	1,095	36	0	452	1,076	0.02	0.00	35	0	0.22	0.16	1,447	1,212
4	0.26	0.07	0.02	403	399	328	824	13	0	325	815	0.01	0.00	12	0	0.08	0.02	416	412
5	0.18	0.05	0.01	269	266	328	824	8	0	325	815	0.01	0.00	8	0	0.06	0.01	277	275
6	1.14	0.77	0.10	2,570	2,503	620	1,161	103	0	607	1,122	0.10	0.00	101	0	0.87	0.10	2,672	2,603
7	0.18	0.04	0.01	128	125	165	374	4	0	161	366	0.00	0.00	4	0	0.05	0.01	132	129
8	0.09	0.02	0.00	64	62	165	374	2	0	161	366	0.00	0.00	2	0	0.02	0.00	66	64
9	0.09	0.02	0.02	137	137	308	882	4	0	307	880	0.00	0.00	4	0	0.02	0.02	141	141
10	0.09	0.02	0.02	137	137	308	882	4	0	307	880	0.00	0.00	4	0	0.02	0.02	141	141
11	0.22	0.05	0.04	350	349	308	882	10	0	307	880	0.00	0.00	10	0	0.05	0.04	360	359
12	0.18	0.04	0.01	128	125	165	374	4	0	161	366	0.00	0.00	4	0	0.05	0.01	132	129
13	0.18	0.04	0.01	128	125	165	374	4	0	161	366	0.00	0.00	4	0	0.05	0.01	132	129
14	0.24	0.24	0.24	2,102	968	1,336	2,225	46	0	920	1,520	0.03	0.00	32	0	0.27	0.24	2,149	1,000
15	0.34	0.08	0.01	244	238	165	374	8	0	161	366	0.01	0.00	8	0	0.09	0.01	252	246
16	0.26	0.05	0.05	412	411	308	882	12	0	307	880	0.01	0.00	12	0	0.06	0.05	424	423
17	0.09	0.02	0.02	137	137	308	882	4	0	307	880	0.00	0.00	4	0	0.02	0.02	141	141
18	0.09	0.02	0.02	137	137	308	882	4	0	307	880	0.00	0.00	4	0	0.02	0.02	141	141
19	0.45	0.09	0.08	699	698	308	882	20	0	307	880	0.01	0.00	20	0	0.10	0.08	719	718
20	0.18	0.04	0.01	128	125	165	374	4	0	161	366	0.00	0.00	4	0	0.05	0.01	132	129
21	0.18	0.04	0.03	275	274	308	882	8	0	307	880	0.00	0.00	8	0	0.04	0.03	283	282
22	0.00	0.00	0.00	0	0	308	882	0	0	307	880	0.00	0.00	0	0	0.00	0.00	0	0
23	0.22	0.05	0.04	350	349	308	882	10	0	307	880	0.00	0.00	10	0	0.05	0.04	360	359
24	0.09	0.02	0.00	64	62	165	374	2	0	161	366	0.00	0.00	2	0	0.02	0.00	66	64
25	2.73	0.05	0.46	811	811	39	106	16	0	39	106	0.00	0.00	16	0	0.05	0.46	827	827
26	0.26	0.00	0.04	79	78	39	106	0	0	39	106	0.00	0.00	0	0	0.00	0.04	79	78
27	0.18	0.04	0.03	275	274	308	882	8	0	307	880	0.00	0.00	8	0	0.04	0.03	283	282
28	0.18	0.04	0.03	275	274	308	882	8	0	307	880	0.00	0.00	8	0	0.04	0.03	283	282
29	0.35	0.01	0.06	105	105	39	106	2	0	39	106	0.00	0.00	2	0	0.01	0.06	107	107
30	0.09	0.02	0.02	137	137	308	882	4	0	307	880	0.00	0.00	4	0	0.02	0.02	141	141
31	0.26	0.05	0.05	412	411	308	882	12	0	307	880	0.01	0.00	12	0	0.06	0.05	424	423
32	0.26	0.05	0.05	412	411	308	882	12	0	307	880	0.01	0.00	12	0	0.06	0.05	424	423
33	0.44	0.09	0.08	687	685	308	882	20	0	307	880	0.01	0.00	20	0	0.10	0.08	706	705
34	0.26	0.05	0.05	412	411	308	882	12	0	307	880	0.01	0.00	12	0	0.06	0.05	424	423
35	0.09	0.02	0.02	137	137	308	882	4	0	307	880	0.00	0.00	4	0	0.02	0.02	141	141
36	0.09	0.00	0.01	26	26	39	106	1	0	39	106	0.00	0.00	1	0	0.00	0.01	27	27
37	0.09	0.03	0.03	230	192	458	1,095	6	0	452	1,076	0.00	0.00	6	0	0.04	0.03	236	197
38	0.09	0.03	0.03	230	192	458	1,095	6	0	452	1,076	0.00	0.00	6	0	0.04	0.03	236	197
39	1.34	0.49	0.40	3,512	2,928	458	1,095	89	0	452	1,076	0.06	0.00	88	0	0.55	0.40	3,601	3,016
40	0.67	0.67	0.67	5,887	2,710	1,336	2,225	130	0	920	1,520	0.08	0.00	89	0	0.76	0.67	6,017	2,799
41	0.48	0.17	0.14	1,241	1,035	458	1,095	31	0	452	1,076	0.02	0.00	31	0	0.19	0.14	1,273	1,066
42	0.38	0.38	0.38	3,329	1,532	1,336	2,225	73	0	920	1,520	0.05	0.00	51	0	0.43	0.38	3,402	1,583
43	0.54	0.20	0.16	1,411	1,176	458	1,095	36	0	452	1,076	0.02	0.00	35	0	0.22	0.16	1,447	1,212
44	0.56	0.56	0.56	4,906	2,258	1,336	2,225	108	0	920	1,520	0.07	0.00	75	0	0.63	0.56	5,014	2,332
45	0.18	0.18	0.18	1,577	726	1,336	2,225	35	0	920	1,520	0.02	0.00	24	0	0.20	0.18	1,612	750
46	0.11	0.04	0.03	293	244	458	1,095	7	0	452	1,076	0.00	0.00	7	0	0.05	0.03	300	251
47	1.44	0.12	0.02	1,345	1,032	175	422	36	0	148	380	0.02	0.00	31	0	0.14	0.02	1,381	1,063
48	0.24	0.24	0.24	2,102	968	1,336	2,225	46	0	920	1,520	0.03	0.00	32	0	0.27	0.24	2,149	1,000
49	0.26	0.07	0.06	513	464	322	947	12	0	322	947	0.01	0.00	12	0	0.07	0.06	525	477
50	0.35	0.09	0.08	684	619	322	947	16	0	322	947	0.01	0.00	16	0	0.10	0.08	700	636
51	0.18	0.04	0.04	342	310	322	947	8	0	322	947	0.00	0.00	8	0	0.05	0.04	350	318
52	0.53	0.13	0.12	1,026	929	322	947	25	0	322	947	0.01	0.00	25	0	0.14	0.12	1,050	953
53	0.09	0.02	0.02	171	155	322	947	4	0	322	947	0.00	0.00	4	0	0.02	0.02	175	159
54	0.44	0.06	0.03	513	496	220	626	14	0	219	624	0.01	0.00	14	0	0.06	0.03	527	510
55	0.09	0.02	0.02	171	155	322	947	4	0	322	947	0.00	0.00	4	0	0.02	0.02	175	159
56	1.57	0.18	0.02	1,475	1,424	258	490	59	0	253	474	0.02	0.00	57	0	0.21	0.02	1,534	1,481
57	0.06	0.01	0.00	56	54	258	490	2	0	253	474	0.00	0.00	2	0	0.01	0.00	59	57
58	1.01	0.13	0.08	1,175	1,135	220	626	32	0	219	624	0.01	0.00	32	0	0.14	0.08	1,207	1,167
59	0.90	0.11	0.07	1,044	1,009	220	626	28	0	219	624	0.01	0.00	28	0	0.12	0.07	1,073	1,038
60	0.06	0.01	0.00	70	68	220	626	2	0	219	624	0.00	0.00	2	0	0.01	0.00	72	69
61	1.01	0.13	0.08	1,175	1,135	220	626	32	0	219	624	0.01	0.00	32	0	0.14	0.08	1,207	1,167
62	1.68	0.21	0.13	1,958	1,892	220	626	53	0	219	624	0.02	0.00	53	0	0.23	0.13	2,011	1,946
63	1.68	0.21	0.13	1,958	1,892	220	626	53	0	219	624	0.02	0.00	53	0	0.23	0.13	2,011	1,946
64	0.26	0.02	0.02	198	195	145	410	6	0	144	408	0.00	0.00	5	0	0.02	0.02	204	201
65	0.26	0.02	0.02	198	195	145	410	6	0	144	408	0.00	0.00	5	0	0.02	0.02	204	201
66	0.34	0.00	0.00	9	9	5	13	0	0	5	13	0.00	0.00	0	0	0.00	0.00	9	9
67	1.06	0.39	0.32	2,781	2,318	458	1,095	71	0	452	1,076	0.05	0.00	70	0	0.43	0.32	2,851	2,388
68	0.56	0.56	0.56	4,906	2,258	1,336	2,225	108	0	920	1,520	0.07	0.00	75	0	0.63	0.56	5,014	2,332
69	0.54	0.20	0.16	1,411	1,176	458	1,095	36	0	452	1,076	0.02	0.00	35	0	0.22	0.16	1,447	1,212
70	0.45	0.45	0.45	3,924	1,806	1,336	2,225	87	0	920	1,520	0.06	0.00	60	0	0.50	0.45	4,011	1,866

Pre-Retrofit Demand and Energy Consumption																			
	Lighting Demand and Energy Consumption					Interactive Hours		Interactive Energy Consumption		On-Peak Interactive Hours		On-Peak Interactive Demand and Energy Consumption				Lighting and Interactive Demand and Energy Consumption			
	(t)	(u)	(v)	(w)	(x)	(y)	(z)	(aa)	(ab)	(ac)	(ad)	(ae)	(af)	(ag)	(ah)	(ai)	(aj)	(ak)	(al)
Fixture	Connected	FCM Diversified kW		Annual	Peak	Cooling	Heating	Cooling	Heating	Cooling	Heating	FCM Diversified kW		Cooling	Heating	FCM Diversified kW		Annual	Peak
ID	kW	Summer	Winter	kWh	kWh	Hours	Hours	kWh	kWh	Hours	Hours	Summer	Winter	kWh	kWh	Summer	Winter	kWh	kWh
71	0.18	0.18	0.18	1,577	726	1,336	2,225	35	0	920	1,520	0.02	0.00	24	0	0.20	0.18	1,612	750
72	0.11	0.04	0.03	293	244	458	1,095	7	0	452	1,076	0.00	0.00	7	0	0.05	0.03	300	251
73	0.35	0.00	0.00	9	9	5	13	0	0	5	13	0.00	0.00	0	0	0.00	0.00	10	9
74	0.18	0.00	0.00	5	5	5	13	0	0	5	13	0.00	0.00	0	0	0.00	0.00	5	5
75	0.35	0.07	0.06	549	548	308	882	16	0	307	880	0.01	0.00	16	0	0.08	0.06	565	564
76	0.09	0.02	0.02	137	137	308	882	4	0	307	880	0.00	0.00	4	0	0.02	0.02	141	141
77	1.68	0.21	0.13	1,958	1,892	220	626	53	0	219	624	0.02	0.00	53	0	0.23	0.13	2,011	1,946
78	1.68	0.21	0.13	1,958	1,892	220	626	53	0	219	624	0.02	0.00	53	0	0.23	0.13	2,011	1,946
79	0.53	0.53	0.53	4,625	2,129	1,336	2,225	102	0	920	1,520	0.07	0.00	70	0	0.59	0.53	4,727	2,199
80	0.53	0.05	0.05	397	390	145	410	11	0	144	408	0.00	0.00	11	0	0.05	0.05	408	401
81	0.35	0.08	0.01	256	250	165	374	8	0	161	366	0.01	0.00	8	0	0.09	0.01	264	258
82	1.01	0.13	0.08	1,175	1,135	220	626	32	0	219	624	0.01	0.00	32	0	0.14	0.08	1,207	1,167
83	1.01	0.13	0.08	1,175	1,135	220	626	32	0	219	624	0.01	0.00	32	0	0.14	0.08	1,207	1,167
84	0.90	0.11	0.07	1,044	1,009	220	626	28	0	219	624	0.01	0.00	28	0	0.12	0.07	1,073	1,038
85	0.12	0.02	0.01	140	135	220	626	4	0	219	624	0.00	0.00	4	0	0.02	0.01	144	139
86	0.18	0.00	0.00	5	5	5	13	0	0	5	13	0.00	0.00	0	0	0.00	0.00	5	5
87	0.90	0.11	0.07	1,044	1,009	220	626	28	0	219	624	0.01	0.00	28	0	0.12	0.07	1,073	1,038
88	0.06	0.01	0.00	70	68	220	626	2	0	219	624	0.00	0.00	2	0	0.01	0.00	72	69
89	1.08	0.40	0.32	2,822	2,353	458	1,095	72	0	452	1,076	0.05	0.00	71	0	0.44	0.32	2,894	2,423
90	0.78	0.78	0.78	6,868	3,161	1,336	2,225	152	0	920	1,520	0.10	0.00	104	0	0.88	0.78	7,019	3,265
91	0.30	0.30	0.30	2,628	1,210	1,336	2,225	58	0	920	1,520	0.04	0.00	40	0	0.34	0.30	2,686	1,250
92	0.17	0.06	0.05	439	366	458	1,095	11	0	452	1,076	0.01	0.00	11	0	0.07	0.05	450	377
93	1.68	0.21	0.13	1,958	1,892	220	626	53	0	219	624	0.02	0.00	53	0	0.23	0.13	2,011	1,946
94	1.68	0.21	0.13	1,958	1,892	220	626	53	0	219	624	0.02	0.00	53	0	0.23	0.13	2,011	1,946
95	1.68	0.21	0.13	1,958	1,892	220	626	53	0	219	624	0.02	0.00	53	0	0.23	0.13	2,011	1,946
96	1.68	0.21	0.13	1,958	1,892	220	626	53	0	219	624	0.02	0.00	53	0	0.23	0.13	2,011	1,946
97	0.26	0.02	0.02	198	195	145	410	6	0	144	408	0.00	0.00	5	0	0.02	0.02	204	201
98	0.18	0.02	0.01	205	198	220	626	6	0	219	624	0.00	0.00	6	0	0.02	0.01	211	204
99	1.68	0.21	0.13	1,958	1,892	220	626	53	0	219	624	0.02	0.00	53	0	0.23	0.13	2,011	1,946
100	0.35	0.07	0.06	549	548	308	882	16	0	307	880	0.01	0.00	16	0	0.08	0.06	565	564
101	0.09	0.01	0.01	103	99	220	626	3	0	219	624	0.00	0.00	3	0	0.01	0.01	105	102
102	0.67	0.08	0.05	783	757	220	626	21	0	219	624	0.01	0.00	21	0	0.09	0.05	805	778
103	0.35	0.04	0.00	331	320	258	490	13	0	253	474	0.01	0.00	13	0	0.05	0.00	344	333
104	0.09	0.01	0.00	83	80	258	490	3	0	253	474	0.00	0.00	3	0	0.01	0.00	86	83
105	1.68	0.21	0.13	1,958	1,892	220	626	53	0	219	624	0.02	0.00	53	0	0.23	0.13	2,011	1,946
106	0.22	0.00	0.00	6	6	5	13	0	0	5	13	0.00	0.00	0	0	0.00	0.00	6	6
107	0.42	0.04	0.04	316	311	145	410	9	0	144	408	0.00	0.00	9	0	0.04	0.04	324	319
108	0.06	0.01	0.01	45	44	145	410	1	0	144	408	0.00	0.00	1	0	0.01	0.01	46	46
109	0.44	0.12	0.03	672	666	328	824	21	0	325	815	0.02	0.00	21	0	0.14	0.03	693	686
110	0.18	0.05	0.01	269	266	328	824	8	0	325	815	0.01	0.00	8	0	0.06	0.01	277	275
111	0.18	0.05	0.01	269	266	328	824	8	0	325	815	0.01	0.00	8	0	0.06	0.01	277	275
112	0.67	0.19	0.04	1,026	1,017	328	824	32	0	325	815	0.02	0.00	32	0	0.21	0.04	1,058	1,048
113	0.12	0.03	0.01	183	182	328	824	6	0	325	815	0.00	0.00	6	0	0.04	0.01	189	187
114	2.02	0.25	0.16	2,350	2,271	220	626	64	0	219	624	0.03	0.00	64	0	0.28	0.16	2,414	2,335
115	0.12	0.05	0.09	363	337	446	1,223	8	0	444	1,214	0.01	0.00	8	0	0.05	0.09	371	345
116	0.18	0.07	0.14	544	506	446	1,223	12	0	444	1,214	0.01	0.00	12	0	0.08	0.14	556	517
117	0.06	0.02	0.04	169	157	446	1,223	4	0	444	1,214	0.00	0.00	4	0	0.03	0.04	173	161
118	0.18	0.07	0.14	544	506	446	1,223	12	0	444	1,214	0.01	0.00	12	0	0.08	0.14	556	517
119	0.06	0.02	0.04	169	157	446	1,223	4	0	444	1,214	0.00	0.00	4	0	0.03	0.04	173	161
120	1.08	0.40	0.32	2,822	2,353	458	1,095	72	0	452	1,076	0.05	0.00	71	0	0.44	0.32	2,894	2,423
121	0.90	0.90	0.90	7,849	3,613	1,336	2,225	173	0	920	1,520	0.11	0.00	119	0	1.01	0.90	8,022	3,732
122	0.30	0.30	0.30	2,628	1,210	1,336	2,225	58	0	920	1,520	0.04	0.00	40	0	0.34	0.30	2,686	1,250
123	0.17	0.06	0.05	439	366	458	1,095	11	0	452	1,076	0.01	0.00	11	0	0.07	0.05	450	377
124	2.02	0.25	0.16	2,350	2,271	220	626	64	0	219	624	0.03	0.00	64	0	0.28	0.16	2,414	2,335
125	1.68	0.21	0.13	1,958	1,892	220	626	53	0	219	624	0.02	0.00	53	0	0.23	0.13	2,011	1,946
126	1.68	0.21	0.13	1,958	1,892	220	626	53	0	219	624	0.02	0.00	53	0	0.23	0.13	2,011	1,946
127	0.70	0.09	0.06	820	793	220	626	22	0	219	624	0.01	0.00	22	0	0.10	0.06	843	815
128	0.44	0.09	0.08	687	685	308	882	20	0	307	880	0.01	0.00	20	0	0.10	0.08	706	705
129	0.53	0.05	0.05	397	390	145	410	11	0	144	408	0.00	0.00	11	0	0.05	0.05	408	401
130	1.68	0.21	0.13	1,958	1,892	220	626	53	0	219	624	0.02	0.00	53	0	0.23	0.13	2,011	1,946
131	1.68	0.21	0.13	1,958	1,892	220	626	53	0	219	624	0.02	0.00	53	0	0.23	0.13	2,011	1,946
132	0.35	0.03	0.03	264	260	145	410	7	0	144	408	0.00	0.00	7	0	0.03	0.03	272	268
133	1.79	0.36	0.31	2,797	2,791	308	882	80	0	307	880	0.04	0.00	80	0	0.40	0.31	2,877	2,870
134	0.09	0.00	0.00	2	2	5	13	0	0	5	13	0.00	0.00	0	0	0.00	0.00	2	2
135	0.35	0.03	0.03	264	260	145	410	7	0	144	408	0.00	0.00	7	0	0.03	0.03	272	268
136	0.09	0.01	0.01	66	65	145	410	2	0	144	408	0.00	0.00	2	0	0.01	0.01	68	67
137	0.18	0.07	0.14	544	506	446	1,223	12	0	444	1,214	0.01	0.00	12	0	0.08	0.14	556	517
138	0.06	0.02	0.04	169	157	446	1,223	4	0	444	1,214	0.00	0.00	4	0	0.03	0.04	173	161
139	0.18	0.07	0.14	544	506	446	1,223	12	0	444	1,214	0.01	0.00	12	0	0.08	0.14	556	517
140	0.06	0.02	0.04	169	157	446	1,223	4	0	444	1,214	0.00	0.00	4	0	0.03	0.04	173	161

Pre-Retrofit Demand and Energy Consumption

Fixture ID	Lighting Demand and Energy Consumption (t) Connected kW	(u) FCM Diversified kW Summer	(v) FCM Diversified kW Winter	(w) Annual kWh	(x) Peak kWh	Interactive Hours (y) Cooling Hours	(z) Heating Hours	Interactive Energy Consumption (aa) Cooling kWh	(ab) Heating kWh	On-Peak Interactive Hours (ac) Cooling Hours	(ad) Heating Hours	On-Peak Interactive Demand and Energy Consumption (ae) FCM Diversified kW Summer	(af) FCM Diversified kW Winter	(ag) Cooling kWh	(ah) Heating kWh	Lighting and Interactive Demand and Energy Consumption (ai) FCM Diversified kW Summer	(aj) FCM Diversified kW Winter	(ak) Annual kWh	(al) Peak kWh
141	1.02	0.37	0.31	2,666	2,222	458	1,095	68	0	452	1,076	0.04	0.00	67	0	0.42	0.31	2,733	2,289
142	0.67	0.67	0.67	5,887	2,710	1,336	2,225	130	0	920	1,520	0.08	0.00	89	0	0.76	0.67	6,017	2,799
143	0.30	0.30	0.30	2,628	1,210	1,336	2,225	58	0	920	1,520	0.04	0.00	40	0	0.34	0.30	2,686	1,250
144	0.22	0.08	0.07	585	488	458	1,095	15	0	452	1,076	0.01	0.00	15	0	0.09	0.07	600	503
145	1.01	0.29	0.06	1,539	1,525	328	824	48	0	325	815	0.03	0.00	47	0	0.32	0.06	1,587	1,572
146	1.12	0.32	0.07	1,710	1,694	328	824	53	0	325	815	0.04	0.00	53	0	0.36	0.07	1,763	1,747
147	0.30	0.09	0.02	458	454	328	824	14	0	325	815	0.01	0.00	14	0	0.10	0.02	472	468
148	0.35	0.07	0.06	549	548	308	882	16	0	307	880	0.01	0.00	16	0	0.08	0.06	565	564
149	0.09	0.01	0.01	103	99	220	626	3	0	219	624	0.00	0.00	3	0	0.01	0.01	105	102
150	0.79	0.09	0.06	1,038	1,034	251	730	29	0	250	727	0.01	0.00	29	0	0.09	0.06	1,066	1,062
151	0.34	0.00	0.00	9	9	5	13	0	0	5	13	0.00	0.00	0	0	0.00	0.00	9	9
152	4.70	1.34	0.30	7,181	7,116	328	824	224	0	325	815	0.16	0.00	222	0	1.50	0.30	7,404	7,338
153	0.09	0.02	0.01	134	133	328	824	4	0	325	815	0.00	0.00	4	0	0.03	0.01	139	137
154	2.35	0.67	0.15	3,590	3,558	328	824	112	0	325	815	0.08	0.00	111	0	0.75	0.15	3,702	3,669
155	0.06	0.02	0.00	92	91	328	824	3	0	325	815	0.00	0.00	3	0	0.02	0.00	94	94
156	0.09	0.02	0.01	134	133	328	824	4	0	325	815	0.00	0.00	4	0	0.03	0.01	139	137
157	0.06	0.02	0.00	92	91	328	824	3	0	325	815	0.00	0.00	3	0	0.02	0.00	94	94
158	0.09	0.02	0.01	134	133	328	824	4	0	325	815	0.00	0.00	4	0	0.03	0.01	139	137
159	0.18	0.00	0.00	5	5	5	13	0	0	5	13	0.00	0.00	0	0	0.00	0.00	5	5
160	4.14	1.18	0.27	6,326	6,269	328	824	197	0	325	815	0.14	0.00	195	0	1.32	0.27	6,523	6,464
161	0.09	0.02	0.00	64	62	165	374	2	0	161	366	0.00	0.00	2	0	0.02	0.00	66	64
162	0.79	0.09	0.06	1,038	1,034	251	730	29	0	250	727	0.01	0.00	29	0	0.09	0.06	1,066	1,062
163	3.36	0.01	0.01	131	122	12	15	6	0	12	14	0.00	0.00	6	0	0.01	0.01	137	127
164	0.24	0.00	0.00	9	9	12	15	0	0	12	14	0.00	0.00	0	0	0.00	0.00	10	9
165	0.34	0.04	0.02	440	439	251	730	12	0	250	727	0.00	0.00	12	0	0.04	0.02	452	451
166	0.96	0.35	0.29	2,509	2,091	458	1,095	64	0	452	1,076	0.04	0.00	63	0	0.39	0.29	2,572	2,154
167	0.62	0.62	0.62	5,396	2,484	1,336	2,225	119	0	920	1,520	0.08	0.00	82	0	0.69	0.62	5,515	2,566
168	0.30	0.30	0.30	2,628	1,210	1,336	2,225	58	0	920	1,520	0.04	0.00	40	0	0.34	0.30	2,686	1,250
169	0.11	0.04	0.03	293	244	458	1,095	7	0	452	1,076	0.00	0.00	7	0	0.05	0.03	300	251
170	1.01	0.13	0.08	1,175	1,135	220	626	32	0	219	624	0.01	0.00	32	0	0.14	0.08	1,207	1,167
171	1.01	0.29	0.06	1,539	1,525	328	824	48	0	325	815	0.03	0.00	47	0	0.32	0.06	1,587	1,572
172	0.34	0.00	0.00	9	9	5	13	0	0	5	13	0.00	0.00	0	0	0.00	0.00	9	9
173	0.09	0.00	0.00	2	2	5	13	0	0	5	13	0.00	0.00	0	0	0.00	0.00	2	2
174	1.01	0.29	0.06	1,539	1,525	328	824	48	0	325	815	0.03	0.00	47	0	0.32	0.06	1,587	1,572
175	2.02	0.24	0.03	1,897	1,831	258	490	75	0	253	474	0.03	0.00	74	0	0.27	0.03	1,972	1,905
176	1.01	0.13	0.08	1,175	1,135	220	626	32	0	219	624	0.01	0.00	32	0	0.14	0.08	1,207	1,167
177	2.02	0.24	0.03	1,897	1,831	258	490	75	0	253	474	0.03	0.00	74	0	0.27	0.03	1,972	1,905
178	0.09	0.00	0.00	2	2	5	13	0	0	5	13	0.00	0.00	0	0	0.00	0.00	2	2
179	2.02	0.74	0.60	5,268	4,392	458	1,095	134	0	452	1,076	0.09	0.00	132	0	0.82	0.60	5,402	4,524
180	0.22	0.22	0.22	1,962	903	1,336	2,225	43	0	920	1,520	0.03	0.00	30	0	0.25	0.22	2,006	933
181	0.84	0.31	0.25	2,195	1,830	458	1,095	56	0	452	1,076	0.04	0.00	55	0	0.34	0.25	2,251	1,885
182	0.73	0.73	0.73	6,377	2,935	1,336	2,225	141	0	920	1,520	0.09	0.00	97	0	0.82	0.73	6,518	3,032
183	4.59	4.59	4.59	40,226	18,515	1,336	2,225	888	0	920	1,520	0.58	0.00	612	0	5.17	4.59	41,114	19,126
184	0.30	0.30	0.30	2,628	1,210	1,336	2,225	58	0	920	1,520	0.04	0.00	40	0	0.34	0.30	2,686	1,250
185	0.09	0.02	0.00	64	62	165	374	2	0	161	366	0.00	0.00	2	0	0.02	0.00	66	64
186	0.09	0.02	0.00	64	62	165	374	2	0	161	366	0.00	0.00	2	0	0.02	0.00	66	64
187	0.35	0.01	0.05	400	380	169	581	9	0	165	570	0.00	0.00	8	0	0.01	0.05	409	389
188	0.09	0.00	0.01	100	95	169	581	2	0	165	570	0.00	0.00	2	0	0.00	0.01	102	97
189	0.06	0.00	0.00	2	2	12	15	0	0	12	14	0.00	0.00	0	0	0.00	0.00	2	2
190	2.46	0.39	0.06	4,020	3,405	280	772	100	0	279	767	0.04	0.00	99	0	0.43	0.06	4,120	3,504
191	0.09	0.02	0.00	64	62	165	374	2	0	161	366	0.00	0.00	2	0	0.02	0.00	66	64
192	0.09	0.03	0.01	172	145	476	1,047	0	0	381	893	0.00	0.00	0	0	0.03	0.01	172	145
193	0.35	0.08	0.01	256	250	165	374	8	0	161	366	0.01	0.00	8	0	0.09	0.01	264	258
194	0.35	0.07	0.06	549	548	308	882	16	0	307	880	0.01	0.00	16	0	0.08	0.06	565	564
195	0.24	0.10	0.19	726	674	446	1,223	16	0	444	1,214	0.01	0.00	15	0	0.11	0.19	741	689
196	0.24	0.10	0.19	726	674	446	1,223	16	0	444	1,214	0.01	0.00	15	0	0.11	0.19	741	689
197	0.09	0.06	0.01	198	193	620	1,161	8	0	607	1,122	0.01	0.00	8	0	0.07	0.01	206	200
198	0.09	0.06	0.01	198	193	620	1,161	8	0	607	1,122	0.01	0.00	8	0	0.07	0.01	206	200
199	0.09	0.02	0.00	64	62	165	374	2	0	161	366	0.00	0.00	2	0	0.02	0.00	66	64
200	0.09	0.01	0.01	115	115	251	730	3	0	250	727	0.00	0.00	3	0	0.01	0.01	118	118
201	0.09	0.01	0.01	66	65	145	410	2	0	144	408	0.00	0.00	2	0	0.01	0.01	68	67
202	0.26	0.03	0.02	346	345	251	730	10	0	250	727	0.00	0.00	10	0	0.03	0.02	355	354
203	0.09	0.02	0.00	64	62	165	374	2	0	161	366	0.00	0.00	2	0	0.02	0.00	66	64
204	0.44	0.05	0.03	576	574	251	730	16	0	250	727	0.00	0.00	16	0	0.05	0.03	592	590
205	0.44	0.05	0.03	576	574	251	730	16	0	250	727	0.00	0.00	16	0	0.05	0.03	592	590
206	0.18	0.02	0.01	231	230	251	730	6	0	250	727	0.00	0.00	6	0	0.02	0.01	237	236
207	0.35	0.07	0.06	549	548	308	882	16	0	307	880	0.01	0.00	16	0	0.08	0.06	565	564
208	0.35	0.07	0.06	549	548	308	882	16	0	307	880	0.01	0.00	16	0	0.08	0.06	565	564
209	0.26	0.18	0.02	593	578	620	1,161	24	0	607	1,122	0.02	0.00	23	0	0.20	0.02	617	601
210	0.18	0.12	0.01	395	385	620	1,161	16	0	607	1,122	0.01	0.00	15	0	0.13	0.01	411	401

Pre-Retrofit Demand and Energy Consumption																			
	Lighting Demand and Energy Consumption					Interactive Hours		Interactive Energy Consumption		On-Peak Interactive Hours		On-Peak Interactive Demand and Energy Consumption				Lighting and Interactive Demand and Energy Consumption			
	(t)	(u)	(v)	(w)	(x)	(y)	(z)	(aa)	(ab)	(ac)	(ad)	(ae)	(af)	(ag)	(ah)	(ai)	(aj)	(ak)	(al)
Fixture	Connected	FCM Diversified kW		Annual	Peak	Cooling	Heating	Cooling	Heating	Cooling	Heating	FCM Diversified kW		Cooling	Heating	FCM Diversified kW		Annual	Peak
ID	kW	Summer	Winter	kWh	kWh	Hours	Hours	kWh	kWh	Hours	Hours	Summer	Winter	kWh	kWh	Summer	Winter	kWh	kWh
211	0.09	0.06	0.01	198	193	620	1,161	8	0	607	1,122	0.01	0.00	8	0	0.07	0.01	206	200
212	0.09	0.00	0.00	0	0	0	0	0	0	0	0	0.00	0.00	0	0	0.00	0.00	0	0
213	0.09	0.02	0.00	64	62	165	374	2	0	161	366	0.00	0.00	2	0	0.02	0.00	66	64
214	0.09	0.02	0.00	64	62	165	374	2	0	161	366	0.00	0.00	2	0	0.02	0.00	66	64
215	4.75	1.19	1.09	8,714	8,153	358	887	465	0	355	876	0.26	0.00	460	0	1.44	1.09	9,179	8,613
216	5.49	1.37	1.26	10,064	9,415	358	887	537	0	355	876	0.29	0.00	532	0	1.67	1.26	10,600	9,947
217	1.62	0.41	0.37	2,971	2,779	358	887	158	0	355	876	0.09	0.00	157	0	0.49	0.37	3,129	2,936
218	1.58	0.17	0.11	2,075	2,067	251	730	57	0	250	727	0.02	0.00	57	0	0.19	0.11	2,133	2,125
219	0.18	0.02	0.01	231	230	251	730	6	0	250	727	0.00	0.00	6	0	0.02	0.01	237	236
220	0.18	0.02	0.01	231	230	251	730	6	0	250	727	0.00	0.00	6	0	0.02	0.01	237	236
221	0.09	0.01	0.01	103	99	220	626	3	0	219	624	0.00	0.00	3	0	0.01	0.01	105	102
222	0.09	0.01	0.01	103	99	220	626	3	0	219	624	0.00	0.00	3	0	0.01	0.01	105	102
223	0.12	0.00	0.00	5	4	12	15	0	0	12	14	0.00	0.00	0	0	0.00	0.00	5	5
224	0.66	0.24	0.20	1,725	1,438	458	1,095	44	0	452	1,076	0.03	0.00	43	0	0.27	0.20	1,769	1,481
225	0.56	0.56	0.56	4,906	2,258	1,336	2,225	108	0	920	1,520	0.07	0.00	75	0	0.63	0.56	5,014	2,332
226	0.24	0.24	0.24	2,102	968	1,336	2,225	46	0	920	1,520	0.03	0.00	32	0	0.27	0.24	2,149	1,000
227	0.11	0.04	0.03	293	244	458	1,095	7	0	452	1,076	0.00	0.00	7	0	0.05	0.03	300	251
228	0.54	0.20	0.16	1,411	1,176	458	1,095	36	0	452	1,076	0.02	0.00	35	0	0.22	0.16	1,447	1,212
229	0.06	0.06	0.06	491	226	1,336	2,225	11	0	920	1,520	0.01	0.00	7	0	0.06	0.06	501	233
230	1.01	0.13	0.08	1,175	1,135	220	626	32	0	219	624	0.01	0.00	32	0	0.14	0.08	1,207	1,167
231	0.18	0.02	0.02	132	130	145	410	4	0	144	408	0.00	0.00	4	0	0.02	0.02	136	134
232	1.01	0.13	0.08	1,175	1,135	220	626	32	0	219	624	0.01	0.00	32	0	0.14	0.08	1,207	1,167
233	0.79	0.16	0.14	1,236	1,233	308	882	35	0	307	880	0.02	0.00	35	0	0.18	0.14	1,272	1,268
234	1.01	0.13	0.08	1,175	1,135	220	626	32	0	219	624	0.01	0.00	32	0	0.14	0.08	1,207	1,167
235	1.01	0.13	0.08	1,175	1,135	220	626	32	0	219	624	0.01	0.00	32	0	0.14	0.08	1,207	1,167
236	0.06	0.01	0.00	70	68	220	626	2	0	219	624	0.00	0.00	2	0	0.01	0.00	72	69
237	0.44	0.09	0.08	687	685	308	882	20	0	307	880	0.01	0.00	20	0	0.10	0.08	706	705
238	0.09	0.00	0.00	2	2	5	13	0	0	5	13	0.00	0.00	0	0	0.00	0.00	2	2
239	0.26	0.07	0.06	513	464	322	947	12	0	322	947	0.01	0.00	12	0	0.07	0.06	525	477
240	1.01	0.13	0.08	1,175	1,135	220	626	32	0	219	624	0.01	0.00	32	0	0.14	0.08	1,207	1,167
241	0.18	0.07	0.14	544	506	446	1,223	12	0	444	1,214	0.01	0.00	12	0	0.08	0.14	556	517
242	0.06	0.02	0.04	169	157	446	1,223	4	0	444	1,214	0.00	0.00	4	0	0.03	0.04	173	161
243	1.01	0.13	0.08	1,175	1,135	220	626	32	0	219	624	0.01	0.00	32	0	0.14	0.08	1,207	1,167
244	0.18	0.07	0.14	544	506	446	1,223	12	0	444	1,214	0.01	0.00	12	0	0.08	0.14	556	517
245	0.06	0.02	0.04	169	157	446	1,223	4	0	444	1,214	0.00	0.00	4	0	0.03	0.04	173	161
246	1.01	0.13	0.08	1,175	1,135	220	626	32	0	219	624	0.01	0.00	32	0	0.14	0.08	1,207	1,167
247	1.01	0.13	0.08	1,175	1,135	220	626	32	0	219	624	0.01	0.00	32	0	0.14	0.08	1,207	1,167
248	0.90	0.11	0.07	1,044	1,009	220	626	28	0	219	624	0.01	0.00	28	0	0.12	0.07	1,073	1,038
249	0.06	0.01	0.00	70	68	220	626	2	0	219	624	0.00	0.00	2	0	0.01	0.00	72	69
250	1.01	0.13	0.08	1,175	1,135	220	626	32	0	219	624	0.01	0.00	32	0	0.14	0.08	1,207	1,167
251	0.90	0.11	0.07	1,044	1,009	220	626	28	0	219	624	0.01	0.00	28	0	0.12	0.07	1,073	1,038
252	0.06	0.01	0.00	70	68	220	626	2	0	219	624	0.00	0.00	2	0	0.01	0.00	72	69
253	1.01	0.13	0.08	1,175	1,135	220	626	32	0	219	624	0.01	0.00	32	0	0.14	0.08	1,207	1,167
254	0.90	0.11	0.07	1,044	1,009	220	626	28	0	219	624	0.01	0.00	28	0	0.12	0.07	1,073	1,038
255	0.06	0.01	0.00	70	68	220	626	2	0	219	624	0.00	0.00	2	0	0.01	0.00	72	69
256	1.01	0.13	0.08	1,175	1,135	220	626	32	0	219	624	0.01	0.00	32	0	0.14	0.08	1,207	1,167
257	0.90	0.11	0.07	1,044	1,009	220	626	28	0	219	624	0.01	0.00	28	0	0.12	0.07	1,073	1,038
258	0.06	0.01	0.00	70	68	220	626	2	0	219	624	0.00	0.00	2	0	0.01	0.00	72	69
259	0.36	0.36	0.36	3,154	1,452	1,336	2,225	70	0	920	1,520	0.05	0.00	48	0	0.41	0.36	3,223	1,499
260	0.84	0.84	0.84	7,358	3,387	1,336	2,225	162	0	920	1,520	0.11	0.00	112	0	0.95	0.84	7,521	3,499
261	1.08	0.40	0.32	2,822	2,353	458	1,095	72	0	452	1,076	0.05	0.00	71	0	0.44	0.32	2,894	2,423
262	0.17	0.06	0.05	439	366	458	1,095	11	0	452	1,076	0.01	0.00	11	0	0.07	0.05	450	377
263	0.42	0.15	0.13	1,098	915	458	1,095	28	0	452	1,076	0.02	0.00	27	0	0.17	0.13	1,125	942
264	0.06	0.06	0.06	491	226	1,336	2,225	11	0	920	1,520	0.01	0.00	7	0	0.06	0.06	501	233
265	2.02	0.24	0.03	1,897	1,831	258	490	75	0	253	474	0.03	0.00	74	0	0.27	0.03	1,972	1,905
266	1.01	0.13	0.08	1,175	1,135	220	626	32	0	219	624	0.01	0.00	32	0	0.14	0.08	1,207	1,167
267	0.67	0.08	0.05	783	757	220	626	21	0	219	624	0.01	0.00	21	0	0.09	0.05	805	778
268	1.01	0.13	0.08	1,175	1,135	220	626	32	0	219	624	0.01	0.00	32	0	0.14	0.08	1,207	1,167
269	0.88	0.18	0.15	1,374	1,370	308	882	39	0	307	880	0.02	0.00	39	0	0.20	0.15	1,413	1,409
270	0.09	0.02	0.02	137	137	308	882	4	0	307	880	0.00	0.00	4	0	0.02	0.02	141	141
271	0.09	0.02	0.02	137	137	308	882	4	0	307	880	0.00	0.00	4	0	0.02	0.02	141	141
272	0.44	0.00	0.00	12	12	5	13	0	0	5	13	0.00	0.00	0	0	0.00	0.00	12	12
273	2.46	0.29	0.03	2,318	2,238	258	490	92	0	253	474	0.04	0.00	90	0	0.33	0.03	2,410	2,328
274	0.12	0.01	0.00	113	109	258	490	4	0	253	474	0.00	0.00	4	0	0.02	0.00	117	113
275	0.24	0.06	0.05	466	422	322	947	11	0	322	947	0.01	0.00	11	0	0.07	0.05	477	433
276	0.18	0.00	0.00	5	5	5	13	0	0	5	13	0.00	0.00	0	0	0.00	0.00	5	5
277	0.24	0.00	0.00	6	6	5	13	0	0	5	13	0.00	0.00	0	0	0.00	0.00	7	6
278	0.26	0.03	0.02	308	297	220	626	8	0	219	624	0.00	0.00	8	0	0.04	0.02	316	306
279	1.01	0.13	0.08	1,175	1,135	220	626	32	0	219	624	0.01	0.00	32	0	0.14	0.08	1,207	1,167
280	1.01	0.13	0.08	1,175	1,135	220	626	32	0	219	624	0.01	0.00	32	0	0.14	0.08	1,207	1,167

Pre-Retrofit Demand and Energy Consumption

Fixture ID	Lighting Demand and Energy Consumption (t) Connected kW	(u) FCM Diversified kW Summer	(v) FCM Diversified kW Winter	(w) Annual kWh	(x) Peak kWh	Interactive Hours (y) Cooling Hours	(z) Heating Hours	Interactive Energy Consumption (aa) Cooling kWh	(ab) Heating kWh	On-Peak Interactive Hours (ac) Cooling Hours	(ad) Heating Hours	On-Peak Interactive Demand and Energy Consumption (ae) FCM Diversified kW Summer	(af) FCM Diversified kW Winter	(ag) Cooling kWh	(ah) Heating kWh	Lighting and Interactive Demand and Energy Consumption (ai) FCM Diversified kW Summer	(aj) FCM Diversified kW Winter	(ak) Annual kWh	(al) Peak kWh
281	1.01	0.13	0.08	1,175	1,135	220	626	32	0	219	624	0.01	0.00	32	0	0.14	0.08	1,207	1,167
282	0.90	0.11	0.07	1,044	1,009	220	626	28	0	219	624	0.01	0.00	28	0	0.12	0.07	1,073	1,038
283	0.06	0.01	0.00	70	68	220	626	2	0	219	624	0.00	0.00	2	0	0.01	0.00	72	69
284	1.01	0.13	0.08	1,175	1,135	220	626	32	0	219	624	0.01	0.00	32	0	0.14	0.08	1,207	1,167
285	0.90	0.11	0.07	1,044	1,009	220	626	28	0	219	624	0.01	0.00	28	0	0.12	0.07	1,073	1,038
286	0.06	0.01	0.00	70	68	220	626	2	0	219	624	0.00	0.00	2	0	0.01	0.00	72	69
287	1.01	0.13	0.08	1,175	1,135	220	626	32	0	219	624	0.01	0.00	32	0	0.14	0.08	1,207	1,167
288	0.90	0.11	0.07	1,044	1,009	220	626	28	0	219	624	0.01	0.00	28	0	0.12	0.07	1,073	1,038
289	0.06	0.01	0.00	70	68	220	626	2	0	219	624	0.00	0.00	2	0	0.01	0.00	72	69
290	1.01	0.13	0.08	1,175	1,135	220	626	32	0	219	624	0.01	0.00	32	0	0.14	0.08	1,207	1,167
291	0.90	0.11	0.07	1,044	1,009	220	626	28	0	219	624	0.01	0.00	28	0	0.12	0.07	1,073	1,038
292	0.06	0.01	0.00	70	68	220	626	2	0	219	624	0.00	0.00	2	0	0.01	0.00	72	69
293	0.17	0.06	0.05	439	366	458	1,095	11	0	452	1,076	0.01	0.00	11	0	0.07	0.05	450	377
294	0.79	0.03	0.12	901	856	169	581	37	0	165	570	0.00	0.00	36	0	0.03	0.12	937	892
295	0.18	0.01	0.03	200	190	169	581	8	0	165	570	0.00	0.00	8	0	0.01	0.03	208	198
296	2.73	0.09	0.41	3,103	2,948	169	581	126	0	165	570	0.02	0.00	123	0	0.11	0.41	3,229	3,071
297	4.75	0.16	0.71	5,397	5,127	169	581	219	0	165	570	0.03	0.00	214	0	0.19	0.71	5,616	5,341
298	1.57	0.54	0.12	3,059	2,578	476	1,047	0	0	381	893	0.00	0.00	0	0	0.54	0.12	3,059	2,578
299	0.12	0.04	0.01	234	197	476	1,047	0	0	381	893	0.00	0.00	0	0	0.04	0.01	234	197
300	0.90	0.00	0.00	35	33	12	15	2	0	12	14	0.00	0.00	2	0	0.00	0.00	37	34
301	0.09	0.00	0.00	2	2	5	13	0	0	5	13	0.00	0.00	0	0	0.00	0.00	2	2
302	2.35	0.25	0.17	3,081	3,070	251	730	85	0	250	727	0.03	0.00	85	0	0.28	0.17	3,167	3,155
303	0.42	0.15	0.13	1,098	915	458	1,095	28	0	452	1,076	0.02	0.00	27	0	0.17	0.13	1,125	942
304	0.11	0.04	0.01	219	184	476	1,047	8	0	381	893	0.00	0.00	6	0	0.04	0.01	226	190
305	0.09	0.00	0.00	2	2	5	13	0	0	5	13	0.00	0.00	0	0	0.00	0.00	2	2
306	1.41	0.05	0.21	1,601	1,521	169	581	34	0	165	570	0.00	0.00	34	0	0.05	0.21	1,636	1,555
307	0.09	0.00	0.01	100	95	169	581	2	0	165	570	0.00	0.00	2	0	0.00	0.01	102	97
308	0.06	0.00	0.00	2	2	12	15	0	0	12	14	0.00	0.00	0	0	0.00	0.00	2	2
309	0.18	0.00	0.00	7	7	12	15	0	0	12	14	0.00	0.00	0	0	0.00	0.00	7	7
310	0.60	0.22	0.18	1,568	1,307	458	1,095	40	0	452	1,076	0.03	0.00	39	0	0.25	0.18	1,608	1,346
311	0.17	0.17	0.17	1,472	677	1,336	2,225	32	0	920	1,520	0.02	0.00	22	0	0.19	0.17	1,504	700
312	0.06	0.06	0.06	526	242	1,336	2,225	12	0	920	1,520	0.01	0.00	8	0	0.07	0.06	537	250
313	0.18	0.18	0.18	1,577	726	1,336	2,225	35	0	920	1,520	0.02	0.00	24	0	0.20	0.18	1,612	750
314	16.38	7.45	6.20	47,817	38,847	611	1,411	0	0	495	1,233	0.00	0.00	0	0	7.45	6.20	47,817	38,847
315	0.64	0.64	0.64	5,606	2,580	1,336	2,225	0	0	920	1,520	0.00	0.00	0	0	0.64	0.64	5,606	2,580
316	13.32	1.41	1.09	9,530	8,223	119	321	0	0	114	312	0.00	0.00	0	0	1.41	1.09	9,530	8,223
317	0.18	0.06	0.14	553	458	487	1,320	13	0	433	1,239	0.01	0.00	11	0	0.07	0.14	566	470
318	2.04	0.68	1.58	6,272	5,195	487	1,320	144	0	433	1,239	0.07	0.00	128	0	0.75	1.58	6,416	5,323
319	0.40	0.04	0.08	186	172	78	194	5	0	67	175	0.00	0.00	4	0	0.04	0.08	191	176
320	1.39	0.13	0.28	648	600	78	194	16	0	67	175	0.01	0.00	13	0	0.14	0.28	664	613
321	0.11	0.00	0.00	4	4	12	15	0	0	12	14	0.00	0.00	0	0	0.00	0.00	5	4
322	0.06	0.00	0.00	2	2	12	15	0	0	12	14	0.00	0.00	0	0	0.00	0.00	2	2
323	0.11	0.00	0.00	4	4	12	15	0	0	12	14	0.00	0.00	0	0	0.00	0.00	5	4
324	0.06	0.00	0.00	2	2	12	15	0	0	12	14	0.00	0.00	0	0	0.00	0.00	2	2
325	0.06	0.00	0.00	2	2	12	15	0	0	12	14	0.00	0.00	0	0	0.00	0.00	2	2
326	0.11	0.01	0.01	84	83	145	410	2	0	144	408	0.00	0.00	2	0	0.01	0.01	86	85
327	0.11	0.00	0.00	4	4	12	15	0	0	12	14	0.00	0.00	0	0	0.00	0.00	5	4
328	0.06	0.00	0.00	2	2	12	15	0	0	12	14	0.00	0.00	0	0	0.00	0.00	2	2
329	0.06	0.00	0.00	2	2	12	15	0	0	12	14	0.00	0.00	0	0	0.00	0.00	2	2
330	0.06	0.00	0.00	2	2	12	15	0	0	12	14	0.00	0.00	0	0	0.00	0.00	2	2
331	0.06	0.00	0.00	2	2	12	15	0	0	12	14	0.00	0.00	0	0	0.00	0.00	2	2
332	0.60	0.60	0.60	5,256	2,419	1,336	2,225	116	0	920	1,520	0.08	0.00	80	0	0.68	0.60	5,372	2,499
333	0.78	0.78	0.78	6,833	3,145	1,336	2,225	151	0	920	1,520	0.10	0.00	104	0	0.88	0.78	6,984	3,249
334	1.02	0.37	0.31	2,666	2,222	458	1,095	68	0	452	1,076	0.04	0.00	67	0	0.42	0.31	2,733	2,289
335	0.30	0.30	0.30	2,628	1,210	1,336	2,225	58	0	920	1,520	0.04	0.00	40	0	0.34	0.30	2,686	1,250
336	0.18	0.18	0.18	1,577	726	1,336	2,225	35	0	920	1,520	0.02	0.00	24	0	0.20	0.18	1,612	750
337	0.18	0.18	0.18	1,577	726	1,336	2,225	35	0	920	1,520	0.02	0.00	24	0	0.20	0.18	1,612	750
338	0.22	0.05	0.04	350	349	308	882	10	0	307	880	0.00	0.00	10	0	0.05	0.04	360	359
339	0.11	0.02	0.02	175	174	308	882	5	0	307	880	0.00	0.00	5	0	0.02	0.02	180	179
340	0.11	0.04	0.01	219	184	476	1,047	8	0	381	893	0.00	0.00	6	0	0.04	0.01	226	190
341	0.11	0.04	0.01	219	184	476	1,047	8	0	381	893	0.00	0.00	6	0	0.04	0.01	226	190
342	0.22	0.02	0.02	168	166	145	410	5	0	144	408	0.00	0.00	5	0	0.02	0.02	173	170
343	0.36	0.12	0.03	702	592	476	1,047	0	0	381	893	0.00	0.00	0	0	0.12	0.03	702	592
344	0.34	0.04	0.03	392	378	220	626	11	0	219	624	0.00	0.00	11	0	0.05	0.03	402	389
345	1.01	0.13	0.08	1,175	1,135	220	626	32	0	219	624	0.01	0.00	32	0	0.14	0.08	1,207	1,167
346	1.68	0.21	0.13	1,958	1,892	220	626	53	0	219	624	0.02	0.00	53	0	0.23	0.13	2,011	1,946
347	1.68	0.21	0.13	1,958	1,892	220	626	53	0	219	624	0.02	0.00	53	0	0.23	0.13	2,011	1,946
348	1.68	0.21	0.13	1,958	1,892	220	626	53	0	219	624	0.02	0.00	53	0	0.23	0.13	2,011	1,946
349	0.11	0.03	0.00	81	79	165	374	3	0	161	366	0.00	0.00	3	0	0.03	0.00	84	82
Totals	245.57	62.98	51.81	499,003	378,261			11,734	0			6.49	0.00	10,488	0	69.47	51.81	510,737	388,749

Post-Retrofit Demand and Energy Consumption

Fixture ID	Lighting Demand and Energy Consumption (am) Connected kW	(an) FCM Diversified kW Summer	(ao) FCM Diversified kW Winter	(ap) Annual kWh	(aq) Peak kWh	Interactive Hours (ar) Cooling Hours	(as) Heating Hours	Interactive Energy Consumption (at) Cooling kWh	(au) Heating kWh	On-Peak Interactive Hours (av) Cooling Hours	(aw) Heating Hours	On-Peak Interactive Demand and Energy Consumption (ax) FCM Diversified kW Summer	(ay) FCM Diversified kW Winter	(az) Cooling kWh	(ba) Heating kWh	Lighting and Interactive Demand and Energy Consumption (bb) FCM Diversified kW Summer	(bc) FCM Diversified kW Winter	(bd) Annual kWh	(be) Peak kWh
1	0.45	0.16	0.13	1,171	976	458	1,095	30	0	452	1,076	0.02	0.00	29	0	0.18	0.13	1,200	1,005
2	0.22	0.22	0.22	1,962	903	1,336	2,225	43	0	920	1,520	0.03	0.00	30	0	0.25	0.22	2,006	933
3	0.28	0.10	0.08	729	608	458	1,095	18	0	452	1,076	0.01	0.00	18	0	0.11	0.08	748	626
4	0.09	0.03	0.01	140	138	328	824	4	0	325	815	0.00	0.00	4	0	0.03	0.01	144	143
5	0.05	0.02	0.00	82	82	328	824	3	0	325	815	0.00	0.00	3	0	0.02	0.00	85	84
6	0.35	0.24	0.03	788	768	620	1,161	31	0	607	1,122	0.03	0.00	31	0	0.27	0.03	820	799
7	0.06	0.01	0.00	44	43	165	374	1	0	161	366	0.00	0.00	1	0	0.02	0.00	46	45
8	0.03	0.01	0.00	22	22	165	374	1	0	161	366	0.00	0.00	1	0	0.01	0.00	23	22
9	0.03	0.01	0.01	48	47	308	882	1	0	307	880	0.00	0.00	1	0	0.01	0.01	49	49
10	0.03	0.01	0.01	48	47	308	882	1	0	307	880	0.00	0.00	1	0	0.01	0.01	49	49
11	0.12	0.02	0.02	190	190	308	882	5	0	307	880	0.00	0.00	5	0	0.03	0.02	196	195
12	0.06	0.01	0.00	44	43	165	374	1	0	161	366	0.00	0.00	1	0	0.02	0.00	46	45
13	0.05	0.01	0.00	39	38	165	374	1	0	161	366	0.00	0.00	1	0	0.01	0.00	41	40
14	0.12	0.12	0.12	1,086	500	1,336	2,225	24	0	920	1,520	0.02	0.00	17	0	0.14	0.12	1,110	516
15	0.18	0.04	0.01	133	130	165	374	4	0	161	366	0.01	0.00	4	0	0.05	0.01	137	134
16	0.09	0.02	0.02	143	142	308	882	4	0	307	880	0.00	0.00	4	0	0.02	0.02	147	147
17	0.03	0.01	0.01	48	47	308	882	1	0	307	880	0.00	0.00	1	0	0.01	0.01	49	49
18	0.03	0.01	0.01	48	47	308	882	1	0	307	880	0.00	0.00	1	0	0.01	0.01	49	49
19	0.24	0.05	0.04	381	380	308	882	11	0	307	880	0.01	0.00	11	0	0.05	0.04	392	391
20	0.06	0.01	0.00	44	43	165	374	1	0	161	366	0.00	0.00	1	0	0.02	0.00	46	45
21	0.06	0.01	0.01	95	95	308	882	3	0	307	880	0.00	0.00	3	0	0.01	0.01	98	98
22	0.00	0.00	0.00	0	0	308	882	0	0	307	880	0.00	0.00	0	0	0.00	0.00	0	0
23	0.12	0.02	0.02	190	190	308	882	5	0	307	880	0.00	0.00	5	0	0.03	0.02	196	195
24	0.03	0.01	0.00	22	22	165	374	1	0	161	366	0.00	0.00	1	0	0.01	0.00	23	22
25	1.43	0.02	0.24	424	424	39	106	8	0	39	106	0.00	0.00	8	0	0.03	0.24	432	432
26	0.09	0.00	0.02	27	27	39	106	0	0	39	106	0.00	0.00	0	0	0.00	0.02	27	27
27	0.06	0.01	0.01	95	95	308	882	3	0	307	880	0.00	0.00	3	0	0.01	0.01	98	98
28	0.05	0.01	0.01	84	84	308	882	2	0	307	880	0.00	0.00	2	0	0.01	0.01	87	86
29	0.12	0.00	0.02	36	36	39	106	1	0	39	106	0.00	0.00	1	0	0.00	0.02	37	37
30	0.03	0.01	0.01	48	47	308	882	1	0	307	880	0.00	0.00	1	0	0.01	0.01	49	49
31	0.08	0.02	0.01	126	126	308	882	4	0	307	880	0.00	0.00	4	0	0.02	0.01	130	130
32	0.08	0.02	0.01	126	126	308	882	4	0	307	880	0.00	0.00	4	0	0.02	0.01	130	130
33	0.14	0.03	0.02	211	210	308	882	6	0	307	880	0.00	0.00	6	0	0.03	0.02	217	216
34	0.08	0.02	0.01	126	126	308	882	4	0	307	880	0.00	0.00	4	0	0.02	0.01	130	130
35	0.03	0.01	0.01	48	47	308	882	1	0	307	880	0.00	0.00	1	0	0.01	0.01	49	49
36	0.03	0.00	0.01	9	9	39	106	0	0	39	106	0.00	0.00	0	0	0.00	0.01	9	9
37	0.03	0.01	0.01	80	66	458	1,095	2	0	452	1,076	0.00	0.00	2	0	0.01	0.01	82	68
38	0.03	0.01	0.01	86	72	458	1,095	2	0	452	1,076	0.00	0.00	2	0	0.01	0.01	88	74
39	0.67	0.25	0.20	1,756	1,464	458	1,095	45	0	452	1,076	0.03	0.00	44	0	0.27	0.20	1,801	1,508
40	0.34	0.34	0.34	2,943	1,355	1,336	2,225	65	0	920	1,520	0.04	0.00	45	0	0.38	0.34	3,008	1,399
41	0.17	0.06	0.05	444	370	458	1,095	11	0	452	1,076	0.01	0.00	11	0	0.07	0.05	456	381
42	0.14	0.14	0.14	1,191	548	1,336	2,225	26	0	920	1,520	0.02	0.00	18	0	0.15	0.14	1,218	566
43	0.28	0.10	0.08	729	608	458	1,095	18	0	452	1,076	0.01	0.00	18	0	0.11	0.08	748	626
44	0.28	0.28	0.28	2,453	1,129	1,336	2,225	54	0	920	1,520	0.04	0.00	37	0	0.32	0.28	2,507	1,166
45	0.09	0.09	0.09	815	375	1,336	2,225	18	0	920	1,520	0.01	0.00	12	0	0.10	0.09	833	387
46	0.06	0.02	0.02	146	122	458	1,095	4	0	452	1,076	0.00	0.00	4	0	0.02	0.02	150	126
47	0.74	0.06	0.01	695	533	175	422	19	0	148	380	0.01	0.00	16	0	0.07	0.01	714	549
48	0.12	0.12	0.12	1,086	500	1,336	2,225	24	0	920	1,520	0.02	0.00	17	0	0.14	0.12	1,110	516
49	0.09	0.02	0.02	178	161	322	947	4	0	322	947	0.00	0.00	4	0	0.02	0.02	182	165
50	0.11	0.03	0.02	210	190	322	947	5	0	322	947	0.00	0.00	5	0	0.03	0.02	215	195
51	0.06	0.02	0.01	118	107	322	947	3	0	322	947	0.00	0.00	3	0	0.02	0.01	121	110
52	0.16	0.04	0.04	315	285	322	947	8	0	322	947	0.00	0.00	8	0	0.04	0.04	322	293
53	0.03	0.01	0.01	59	54	322	947	1	0	322	947	0.00	0.00	1	0	0.01	0.01	61	55
54	0.15	0.02	0.01	178	172	220	626	5	0	219	624	0.00	0.00	5	0	0.02	0.01	183	177
55	0.03	0.01	0.01	59	54	322	947	1	0	322	947	0.00	0.00	1	0	0.01	0.01	61	55
56	0.85	0.10	0.01	804	776	258	490	32	0	253	474	0.01	0.00	31	0	0.11	0.01	835	807
57	0.03	0.00	0.00	31	30	258	490	1	0	253	474	0.00	0.00	1	0	0.00	0.00	32	31
58	0.55	0.07	0.04	640	618	220	626	17	0	219	624	0.01	0.00	17	0	0.08	0.04	657	636
59	0.49	0.06	0.04	569	550	220	626	16	0	219	624	0.01	0.00	15	0	0.07	0.04	584	565
60	0.03	0.00	0.00	38	37	220	626	1	0	219	624	0.00	0.00	1	0	0.00	0.00	40	38
61	0.55	0.07	0.04	640	618	220	626	17	0	219	624	0.01	0.00	17	0	0.08	0.04	657	636
62	0.92	0.11	0.07	1,066	1,031	220	626	29	0	219	624	0.01	0.00	29	0	0.13	0.07	1,096	1,060
63	0.92	0.11	0.07	1,066	1,031	220	626	29	0	219	624	0.01	0.00	29	0	0.13	0.07	1,096	1,060
64	0.09	0.01	0.01	69	68	145	410	2	0	144	408	0.00	0.00	2	0	0.01	0.01	71	70
65	0.09	0.01	0.01	69	68	145	410	2	0	144	408	0.00	0.00	2	0	0.01	0.01	71	70
66	0.18	0.00	0.00	5	5	5	13	0	0	5	13	0.00	0.00	0	0	0.00	0.00	5	5
67	0.53	0.19	0.16	1,390	1,159	458	1,095	35	0	452	1,076	0.02	0.00	35	0	0.22	0.16	1,426	1,194
68	0.28	0.28	0.28	2,453	1,129	1,336	2,225	54	0	920	1,520	0.04	0.00	37	0	0.32	0.28	2,507	1,166
69	0.28	0.10	0.08	729	608	458	1,095	18	0	452	1,076	0.01	0.00	18	0	0.11	0.08	748	626
70	0.22	0.22	0.22	1,962	903	1,336	2,225	43	0	920	1,520	0.03	0.00	30	0	0.25	0.22	2,006	933

Post-Retrofit Demand and Energy Consumption

Fixture ID	Lighting Demand and Energy Consumption (am) Connected kW	(an) FCM Diversified kW Summer	(ao) FCM Diversified kW Winter	(ap) Annual kWh	(aq) Peak kWh	Interactive Hours (ar) Cooling Hours	(as) Heating Hours	Interactive Energy Consumption (at) Cooling kWh	(au) Heating kWh	On-Peak Interactive Hours (av) Cooling Hours	(aw) Heating Hours	On-Peak Interactive Demand and Energy Consumption (ax) FCM Diversified kW Summer	(ay) FCM Diversified kW Winter	(az) Cooling kWh	(ba) Heating kWh	Lighting and Interactive Demand and Energy Consumption (bb) FCM Diversified kW Summer	(bc) FCM Diversified kW Winter	(bd) Annual kWh	(be) Peak kWh
71	0.09	0.09	0.09	815	375	1,336	2,225	18	0	920	1,520	0.01	0.00	12	0	0.10	0.09	833	387
72	0.06	0.02	0.02	146	122	458	1,095	4	0	452	1,076	0.00	0.00	4	0	0.02	0.02	150	126
73	0.12	0.00	0.00	3	3	5	13	0	0	5	13	0.00	0.00	0	0	0.00	0.00	3	3
74	0.10	0.00	0.00	3	3	5	13	0	0	5	13	0.00	0.00	0	0	0.00	0.00	3	3
75	0.12	0.02	0.02	190	190	308	882	5	0	307	880	0.00	0.00	5	0	0.03	0.02	196	195
76	0.03	0.01	0.01	48	48	308	882	1	0	307	880	0.00	0.00	1	0	0.01	0.01	50	50
77	0.92	0.11	0.07	1,066	1,031	220	626	29	0	219	624	0.01	0.00	29	0	0.13	0.07	1,096	1,060
78	0.92	0.11	0.07	1,066	1,031	220	626	29	0	219	624	0.01	0.00	29	0	0.13	0.07	1,096	1,060
79	0.18	0.18	0.18	1,603	738	1,336	2,225	35	0	920	1,520	0.02	0.00	24	0	0.21	0.18	1,638	762
80	0.18	0.02	0.02	137	135	145	410	4	0	144	408	0.00	0.00	4	0	0.02	0.02	141	139
81	0.12	0.03	0.00	89	87	165	374	3	0	161	366	0.00	0.00	3	0	0.03	0.00	92	89
82	0.55	0.07	0.04	640	618	220	626	17	0	219	624	0.01	0.00	17	0	0.08	0.04	657	636
83	0.55	0.07	0.04	640	618	220	626	17	0	219	624	0.01	0.00	17	0	0.08	0.04	657	636
84	0.49	0.06	0.04	569	550	220	626	16	0	219	624	0.01	0.00	15	0	0.07	0.04	584	565
85	0.07	0.01	0.01	77	74	220	626	2	0	219	624	0.00	0.00	2	0	0.01	0.01	79	76
86	0.10	0.00	0.00	3	3	5	13	0	0	5	13	0.00	0.00	0	0	0.00	0.00	3	3
87	0.49	0.06	0.04	569	550	220	626	16	0	219	624	0.01	0.00	15	0	0.07	0.04	584	565
88	0.03	0.00	0.00	38	37	220	626	1	0	219	624	0.00	0.00	1	0	0.00	0.00	40	38
89	0.56	0.20	0.17	1,458	1,216	458	1,095	37	0	452	1,076	0.02	0.00	37	0	0.23	0.17	1,495	1,252
90	0.39	0.39	0.39	3,434	1,581	1,336	2,225	76	0	920	1,520	0.05	0.00	52	0	0.44	0.39	3,510	1,633
91	0.16	0.16	0.16	1,358	625	1,336	2,225	30	0	920	1,520	0.02	0.00	21	0	0.17	0.16	1,388	646
92	0.08	0.03	0.03	220	183	458	1,095	6	0	452	1,076	0.00	0.00	5	0	0.03	0.03	225	188
93	0.92	0.11	0.07	1,066	1,031	220	626	29	0	219	624	0.01	0.00	29	0	0.13	0.07	1,096	1,060
94	0.92	0.11	0.07	1,066	1,031	220	626	29	0	219	624	0.01	0.00	29	0	0.13	0.07	1,096	1,060
95	0.92	0.11	0.07	1,066	1,031	220	626	29	0	219	624	0.01	0.00	29	0	0.13	0.07	1,096	1,060
96	0.92	0.11	0.07	1,066	1,031	220	626	29	0	219	624	0.01	0.00	29	0	0.13	0.07	1,096	1,060
97	0.09	0.01	0.01	69	68	145	410	2	0	144	408	0.00	0.00	2	0	0.01	0.01	71	70
98	0.06	0.01	0.00	71	69	220	626	2	0	219	624	0.00	0.00	2	0	0.01	0.00	73	71
99	0.92	0.11	0.07	1,066	1,031	220	626	29	0	219	624	0.01	0.00	29	0	0.13	0.07	1,096	1,060
100	0.12	0.02	0.02	190	190	308	882	5	0	307	880	0.00	0.00	5	0	0.03	0.02	196	195
101	0.03	0.00	0.00	31	30	220	626	1	0	219	624	0.00	0.00	1	0	0.00	0.00	32	31
102	0.37	0.05	0.03	427	412	220	626	12	0	219	624	0.00	0.00	12	0	0.05	0.03	438	424
103	0.12	0.01	0.00	115	111	258	490	5	0	253	474	0.00	0.00	4	0	0.02	0.00	119	115
104	0.03	0.00	0.00	25	25	258	490	1	0	253	474	0.00	0.00	1	0	0.00	0.00	26	26
105	0.92	0.11	0.07	1,066	1,031	220	626	29	0	219	624	0.01	0.00	29	0	0.13	0.07	1,096	1,060
106	0.12	0.00	0.00	3	3	5	13	0	0	5	13	0.00	0.00	0	0	0.00	0.00	3	3
107	0.23	0.02	0.02	174	171	145	410	5	0	144	408	0.00	0.00	5	0	0.02	0.02	178	176
108	0.04	0.00	0.00	28	27	145	410	1	0	144	408	0.00	0.00	1	0	0.00	0.00	29	28
109	0.14	0.04	0.01	206	204	328	824	6	0	325	815	0.00	0.00	6	0	0.04	0.01	212	211
110	0.06	0.02	0.00	93	92	328	824	3	0	325	815	0.00	0.00	3	0	0.02	0.00	96	95
111	0.06	0.02	0.00	93	92	328	824	3	0	325	815	0.00	0.00	3	0	0.02	0.00	96	95
112	0.37	0.10	0.02	559	554	328	824	17	0	325	815	0.01	0.00	17	0	0.12	0.02	576	571
113	0.07	0.02	0.00	101	100	328	824	3	0	325	815	0.00	0.00	3	0	0.02	0.00	104	103
114	1.10	0.14	0.09	1,280	1,237	220	626	35	0	219	624	0.01	0.00	35	0	0.15	0.09	1,315	1,272
115	0.07	0.03	0.05	200	185	446	1,223	4	0	444	1,214	0.00	0.00	4	0	0.03	0.05	204	190
116	0.11	0.05	0.09	336	312	446	1,223	7	0	444	1,214	0.01	0.00	7	0	0.05	0.09	343	319
117	0.03	0.01	0.02	85	79	446	1,223	2	0	444	1,214	0.00	0.00	2	0	0.01	0.02	86	80
118	0.11	0.05	0.09	336	312	446	1,223	7	0	444	1,214	0.01	0.00	7	0	0.05	0.09	343	319
119	0.03	0.01	0.02	85	79	446	1,223	2	0	444	1,214	0.00	0.00	2	0	0.01	0.02	86	80
120	0.56	0.20	0.17	1,458	1,216	458	1,095	37	0	452	1,076	0.02	0.00	37	0	0.23	0.17	1,495	1,252
121	0.45	0.45	0.45	3,924	1,806	1,336	2,225	87	0	920	1,520	0.06	0.00	60	0	0.50	0.45	4,011	1,866
122	0.16	0.16	0.16	1,358	625	1,336	2,225	30	0	920	1,520	0.02	0.00	21	0	0.17	0.16	1,388	646
123	0.08	0.03	0.03	220	183	458	1,095	6	0	452	1,076	0.00	0.00	5	0	0.03	0.03	225	188
124	1.10	0.14	0.09	1,280	1,237	220	626	35	0	219	624	0.01	0.00	35	0	0.15	0.09	1,315	1,272
125	0.92	0.11	0.07	1,066	1,031	220	626	29	0	219	624	0.01	0.00	29	0	0.13	0.07	1,096	1,060
126	0.92	0.11	0.07	1,066	1,031	220	626	29	0	219	624	0.01	0.00	29	0	0.13	0.07	1,096	1,060
127	0.24	0.03	0.02	284	275	220	626	8	0	219	624	0.00	0.00	8	0	0.03	0.02	292	283
128	0.17	0.03	0.03	258	257	308	882	7	0	307	880	0.00	0.00	7	0	0.04	0.03	265	264
129	0.18	0.02	0.02	137	135	145	410	4	0	144	408	0.00	0.00	4	0	0.02	0.02	141	139
130	0.92	0.11	0.07	1,066	1,031	220	626	29	0	219	624	0.01	0.00	29	0	0.13	0.07	1,096	1,060
131	0.92	0.11	0.07	1,066	1,031	220	626	29	0	219	624	0.01	0.00	29	0	0.13	0.07	1,096	1,060
132	0.12	0.01	0.01	92	90	145	410	3	0	144	408	0.00	0.00	3	0	0.01	0.01	94	93
133	0.98	0.20	0.17	1,524	1,520	308	882	43	0	307	880	0.02	0.00	43	0	0.22	0.17	1,567	1,563
134	0.03	0.00	0.00	1	1	5	13	0	0	5	13	0.00	0.00	0	0	0.00	0.00	1	1
135	0.12	0.01	0.01	92	90	145	410	3	0	144	408	0.00	0.00	3	0	0.01	0.01	94	93
136	0.03	0.00	0.00	23	23	145	410	1	0	144	408	0.00	0.00	1	0	0.00	0.00	24	23
137	0.09	0.04	0.07	281	261	446	1,223	6	0	444	1,214	0.00	0.00	6	0	0.04	0.07	287	267
138	0.03	0.01	0.02	85	79	446	1,223	2	0	444	1,214	0.00	0.00	2	0	0.01	0.02	86	80
139	0.09	0.04	0.07	281	261	446	1,223	6	0	444	1,214	0.00	0.00	6	0	0.04	0.07	287	267
140	0.03	0.01	0.02	85	79	446	1,223	2	0	444	1,214	0.00	0.00	2	0	0.01	0.02	86	80

Post-Retrofit Demand and Energy Consumption																			
	Lighting Demand and Energy Consumption					Interactive Hours		Interactive Energy Consumption		On-Peak Interactive Hours		On-Peak Interactive Demand and Energy Consumption				Lighting and Interactive Demand and Energy Consumption			
	(am)	(an)	(ao)	(ap)	(aq)	(ar)	(as)	(at)	(au)	(av)	(aw)	(ax)	(ay)	(az)	(ba)	(bb)	(bc)	(bd)	(be)
Fixture ID	Connected kW	FCM Diversified kW Summer	FCM Diversified kW Winter	Annual kWh	Peak kWh	Cooling Hours	Heating Hours	Cooling kWh	Heating kWh	Cooling Hours	Heating Hours	FCM Diversified kW Summer	FCM Diversified kW Winter	Cooling kWh	Heating kWh	FCM Diversified kW Summer	FCM Diversified kW Winter	Annual kWh	Peak kWh
141	0.53	0.19	0.16	1,377	1,148	458	1,095	35	0	452	1,076	0.02	0.00	34	0	0.22	0.16	1,412	1,183
142	0.34	0.34	0.34	2,943	1,355	1,336	2,225	65	0	920	1,520	0.04	0.00	45	0	0.38	0.34	3,008	1,399
143	0.16	0.16	0.16	1,358	625	1,336	2,225	30	0	920	1,520	0.02	0.00	21	0	0.17	0.16	1,388	646
144	0.11	0.04	0.03	293	244	458	1,095	7	0	452	1,076	0.00	0.00	7	0	0.05	0.03	300	251
145	0.55	0.16	0.04	838	831	328	824	26	0	325	815	0.02	0.00	26	0	0.17	0.04	864	856
146	0.61	0.17	0.04	931	923	328	824	29	0	325	815	0.02	0.00	29	0	0.19	0.04	960	952
147	0.17	0.05	0.01	252	250	328	824	8	0	325	815	0.01	0.00	8	0	0.05	0.01	260	257
148	0.12	0.02	0.02	190	190	308	882	5	0	307	880	0.00	0.00	5	0	0.03	0.02	196	195
149	0.03	0.00	0.00	31	30	220	626	1	0	219	624	0.00	0.00	1	0	0.00	0.00	32	31
150	0.27	0.03	0.02	360	358	251	730	10	0	250	727	0.00	0.00	10	0	0.03	0.02	370	368
151	0.18	0.00	0.00	5	5	5	13	0	0	5	13	0.00	0.00	0	0	0.00	0.00	5	5
152	1.55	0.44	0.10	2,372	2,351	328	824	74	0	325	815	0.05	0.00	73	0	0.50	0.10	2,446	2,424
153	0.03	0.01	0.00	47	46	328	824	1	0	325	815	0.00	0.00	1	0	0.01	0.00	48	48
154	1.28	0.36	0.08	1,956	1,938	328	824	61	0	325	815	0.04	0.00	60	0	0.41	0.08	2,016	1,998
155	0.03	0.01	0.00	50	50	328	824	2	0	325	815	0.00	0.00	2	0	0.01	0.00	52	51
156	0.03	0.01	0.00	41	41	328	824	1	0	325	815	0.00	0.00	1	0	0.01	0.00	42	42
157	0.03	0.01	0.00	50	50	328	824	2	0	325	815	0.00	0.00	2	0	0.01	0.00	52	51
158	0.03	0.01	0.00	47	46	328	824	1	0	325	815	0.00	0.00	1	0	0.01	0.00	48	48
159	0.06	0.00	0.00	2	2	5	13	0	0	5	13	0.00	0.00	0	0	0.00	0.00	2	2
160	1.37	0.39	0.09	2,090	2,071	328	824	65	0	325	815	0.05	0.00	64	0	0.44	0.09	2,155	2,136
161	0.03	0.01	0.00	22	22	165	374	1	0	161	366	0.00	0.00	1	0	0.01	0.00	23	22
162	0.27	0.03	0.02	360	358	251	730	10	0	250	727	0.00	0.00	10	0	0.03	0.02	370	368
163	1.11	0.00	0.00	43	40	12	15	2	0	12	14	0.00	0.00	2	0	0.00	0.00	45	42
164	0.08	0.00	0.00	3	3	12	15	0	0	12	14	0.00	0.00	0	0	0.00	0.00	3	3
165	0.18	0.02	0.01	240	239	251	730	7	0	250	727	0.00	0.00	7	0	0.02	0.01	246	245
166	0.50	0.18	0.15	1,296	1,081	458	1,095	33	0	452	1,076	0.02	0.00	32	0	0.20	0.15	1,329	1,113
167	0.31	0.31	0.31	2,698	1,242	1,336	2,225	60	0	920	1,520	0.04	0.00	41	0	0.35	0.31	2,758	1,283
168	0.16	0.16	0.16	1,358	625	1,336	2,225	30	0	920	1,520	0.02	0.00	21	0	0.17	0.16	1,388	646
169	0.06	0.02	0.02	146	122	458	1,095	4	0	452	1,076	0.00	0.00	4	0	0.02	0.02	150	126
170	0.55	0.07	0.04	640	618	220	626	17	0	219	624	0.01	0.00	17	0	0.08	0.04	657	636
171	0.55	0.16	0.04	838	831	328	824	26	0	325	815	0.02	0.00	26	0	0.17	0.04	864	856
172	0.18	0.00	0.00	5	5	5	13	0	0	5	13	0.00	0.00	0	0	0.00	0.00	5	5
173	0.03	0.00	0.00	1	1	5	13	0	0	5	13	0.00	0.00	0	0	0.00	0.00	1	1
174	0.55	0.16	0.04	838	831	328	824	26	0	325	815	0.02	0.00	26	0	0.17	0.04	864	856
175	1.10	0.13	0.01	1,033	997	258	490	41	0	253	474	0.02	0.00	40	0	0.14	0.01	1,074	1,037
176	0.55	0.07	0.04	640	618	220	626	17	0	219	624	0.01	0.00	17	0	0.08	0.04	657	636
177	1.10	0.13	0.01	1,033	997	258	490	41	0	253	474	0.02	0.00	40	0	0.14	0.01	1,074	1,037
178	0.03	0.00	0.00	1	1	5	13	0	0	5	13	0.00	0.00	0	0	0.00	0.00	1	1
179	1.01	0.37	0.30	2,634	2,196	458	1,095	67	0	452	1,076	0.04	0.00	66	0	0.41	0.30	2,701	2,262
180	0.11	0.11	0.11	981	452	1,336	2,225	22	0	920	1,520	0.01	0.00	15	0	0.13	0.11	1,003	466
181	0.43	0.16	0.13	1,134	945	458	1,095	29	0	452	1,076	0.02	0.00	28	0	0.18	0.13	1,163	974
182	0.36	0.36	0.36	3,189	1,468	1,336	2,225	70	0	920	1,520	0.05	0.00	48	0	0.41	0.36	3,259	1,516
183	2.30	2.30	2.30	20,113	9,257	1,336	2,225	444	0	920	1,520	0.29	0.00	306	0	2.58	2.30	20,557	9,563
184	0.16	0.16	0.16	1,358	625	1,336	2,225	30	0	920	1,520	0.02	0.00	21	0	0.17	0.16	1,388	646
185	0.03	0.01	0.00	22	22	165	374	1	0	161	366	0.00	0.00	1	0	0.01	0.00	23	22
186	0.03	0.01	0.00	22	22	165	374	1	0	161	366	0.00	0.00	1	0	0.01	0.00	23	22
187	0.12	0.00	0.02	139	132	169	581	3	0	165	570	0.00	0.00	3	0	0.00	0.02	142	135
188	0.03	0.00	0.00	31	29	169	581	1	0	165	570	0.00	0.00	1	0	0.00	0.00	31	30
189	0.02	0.00	0.00	1	1	12	15	0	0	12	14	0.00	0.00	0	0	0.00	0.00	1	1
190	0.85	0.13	0.02	1,393	1,180	280	772	35	0	279	767	0.01	0.00	34	0	0.15	0.02	1,428	1,215
191	0.03	0.01	0.00	22	22	165	374	1	0	161	366	0.00	0.00	1	0	0.01	0.00	23	22
192	0.03	0.01	0.00	60	50	476	1,047	0	0	381	893	0.00	0.00	0	0	0.01	0.00	60	50
193	0.12	0.03	0.00	89	87	165	374	3	0	161	366	0.00	0.00	3	0	0.03	0.00	92	89
194	0.12	0.02	0.02	190	190	308	882	5	0	307	880	0.00	0.00	5	0	0.03	0.02	196	195
195	0.15	0.06	0.12	447	416	446	1,223	10	0	444	1,214	0.01	0.00	10	0	0.07	0.12	457	425
196	0.15	0.06	0.12	447	416	446	1,223	10	0	444	1,214	0.01	0.00	10	0	0.07	0.12	457	425
197	0.03	0.02	0.00	69	67	620	1,161	3	0	607	1,122	0.00	0.00	3	0	0.02	0.00	71	69
198	0.03	0.02	0.00	69	67	620	1,161	3	0	607	1,122	0.00	0.00	3	0	0.02	0.00	71	69
199	0.03	0.01	0.00	22	22	165	374	1	0	161	366	0.00	0.00	1	0	0.01	0.00	23	22
200	0.03	0.00	0.00	40	40	251	730	1	0	250	727	0.00	0.00	1	0	0.00	0.00	41	41
201	0.03	0.00	0.00	23	23	145	410	1	0	144	408	0.00	0.00	1	0	0.00	0.00	24	23
202	0.09	0.01	0.01	120	119	251	730	3	0	250	727	0.00	0.00	3	0	0.01	0.01	123	123
203	0.03	0.01	0.00	22	22	165	374	1	0	161	366	0.00	0.00	1	0	0.01	0.00	23	22
204	0.15	0.02	0.01	200	199	251	730	6	0	250	727	0.00	0.00	6	0	0.02	0.01	205	205
205	0.15	0.02	0.01	200	199	251	730	6	0	250	727	0.00	0.00	6	0	0.02	0.01	205	205
206	0.05	0.01	0.00	71	70	251	730	2	0	250	727	0.00	0.00	2	0	0.01	0.00	73	72
207	0.12	0.02	0.02	190	190	308	882	5	0	307	880	0.00	0.00	5	0	0.03	0.02	196	195
208	0.11	0.02	0.02	169	168	308	882	5	0	307	880	0.00	0.00	5	0	0.02	0.02	173	173
209	0.08	0.05	0.01	182	177	620	1,161	7	0	607	1,122	0.01	0.00	7	0	0.06	0.01	189	184
210	0.06	0.04	0.01	137	133	620	1,161	5	0	607	1,122	0.01	0.00	5	0	0.05	0.01	142	139

Post-Retrofit Demand and Energy Consumption

Fixture ID	Lighting Demand and Energy Consumption (am) Connected kW	(an) FCM Diversified kW Summer	(ao) FCM Diversified kW Winter	(ap) Annual kWh	(aq) Peak kWh	Interactive Hours (ar) Cooling Hours	(as) Heating Hours	Interactive Energy Consumption (at) Cooling kWh	(au) Heating kWh	On-Peak Interactive Hours (av) Cooling Hours	(aw) Heating Hours	On-Peak Interactive Demand and Energy Consumption (ax) FCM Diversified kW Summer	(ay) FCM Diversified kW Winter	(az) Cooling kWh	(ba) Heating kWh	Lighting and Interactive Demand and Energy Consumption (bb) FCM Diversified kW Summer	(bc) FCM Diversified kW Winter	(bd) Annual kWh	(be) Peak kWh
211	0.03	0.02	0.00	69	67	620	1,161	3	0	607	1,122	0.00	0.00	3	0	0.02	0.00	71	69
212	0.03	0.00	0.00	0	0	0	0	0	0	0	0	0.00	0.00	0	0	0.00	0.00	0	0
213	0.03	0.01	0.00	22	22	165	374	1	0	161	366	0.00	0.00	1	0	0.01	0.00	23	22
214	0.03	0.01	0.00	22	22	165	374	1	0	161	366	0.00	0.00	1	0	0.01	0.00	23	22
215	1.46	0.37	0.33	2,674	2,501	358	887	143	0	355	876	0.08	0.00	141	0	0.44	0.33	2,816	2,643
216	2.99	0.75	0.69	5,481	5,128	358	887	292	0	355	876	0.16	0.00	290	0	0.91	0.69	5,773	5,418
217	0.89	0.22	0.20	1,634	1,529	358	887	87	0	355	876	0.05	0.00	86	0	0.27	0.20	1,721	1,615
218	0.55	0.06	0.04	719	717	251	730	20	0	250	727	0.01	0.00	20	0	0.07	0.04	739	736
219	0.05	0.01	0.00	71	70	251	730	2	0	250	727	0.00	0.00	2	0	0.01	0.00	73	72
220	0.06	0.01	0.00	80	80	251	730	2	0	250	727	0.00	0.00	2	0	0.01	0.00	82	82
221	0.03	0.00	0.00	36	34	220	626	1	0	219	624	0.00	0.00	1	0	0.00	0.00	37	35
222	0.03	0.00	0.00	36	34	220	626	1	0	219	624	0.00	0.00	1	0	0.00	0.00	37	35
223	0.04	0.00	0.00	1	1	12	15	0	0	12	14	0.00	0.00	0	0	0.00	0.00	2	1
224	0.34	0.12	0.10	891	743	458	1,095	23	0	452	1,076	0.01	0.00	22	0	0.14	0.10	914	765
225	0.28	0.28	0.28	2,453	1,129	1,336	2,225	54	0	920	1,520	0.04	0.00	37	0	0.32	0.28	2,507	1,166
226	0.12	0.12	0.12	1,086	500	1,336	2,225	24	0	920	1,520	0.02	0.00	17	0	0.14	0.12	1,110	516
227	0.06	0.02	0.02	146	122	458	1,095	4	0	452	1,076	0.00	0.00	4	0	0.02	0.02	150	126
228	0.28	0.10	0.08	729	608	458	1,095	18	0	452	1,076	0.01	0.00	18	0	0.11	0.08	748	626
229	0.03	0.03	0.03	245	113	1,336	2,225	5	0	920	1,520	0.00	0.00	4	0	0.03	0.03	251	117
230	0.55	0.07	0.04	640	618	220	626	17	0	219	624	0.01	0.00	17	0	0.08	0.04	657	636
231	0.06	0.01	0.01	46	45	145	410	1	0	144	408	0.00	0.00	1	0	0.01	0.01	47	46
232	0.55	0.07	0.04	640	618	220	626	17	0	219	624	0.01	0.00	17	0	0.08	0.04	657	636
233	0.27	0.06	0.05	428	427	308	882	12	0	307	880	0.01	0.00	12	0	0.06	0.05	441	440
234	0.55	0.07	0.04	640	618	220	626	17	0	219	624	0.01	0.00	17	0	0.08	0.04	657	636
235	0.55	0.07	0.04	640	618	220	626	17	0	219	624	0.01	0.00	17	0	0.08	0.04	657	636
236	0.03	0.00	0.00	38	37	220	626	1	0	219	624	0.00	0.00	1	0	0.00	0.00	40	38
237	0.15	0.03	0.03	238	237	308	882	7	0	307	880	0.00	0.00	7	0	0.03	0.03	245	244
238	0.03	0.00	0.00	1	1	5	13	0	0	5	13	0.00	0.00	0	0	0.00	0.00	1	1
239	0.09	0.02	0.02	178	161	322	947	4	0	322	947	0.00	0.00	4	0	0.02	0.02	182	165
240	0.55	0.07	0.04	640	618	220	626	17	0	219	624	0.01	0.00	17	0	0.08	0.04	657	636
241	0.09	0.04	0.07	281	261	446	1,223	6	0	444	1,214	0.00	0.00	6	0	0.04	0.07	287	267
242	0.03	0.01	0.02	85	79	446	1,223	2	0	444	1,214	0.00	0.00	2	0	0.01	0.02	86	80
243	0.55	0.07	0.04	640	618	220	626	17	0	219	624	0.01	0.00	17	0	0.08	0.04	657	636
244	0.09	0.04	0.07	281	261	446	1,223	6	0	444	1,214	0.00	0.00	6	0	0.04	0.07	287	267
245	0.03	0.01	0.02	85	79	446	1,223	2	0	444	1,214	0.00	0.00	2	0	0.01	0.02	86	80
246	0.55	0.07	0.04	640	618	220	626	17	0	219	624	0.01	0.00	17	0	0.08	0.04	657	636
247	0.55	0.07	0.04	640	618	220	626	17	0	219	624	0.01	0.00	17	0	0.08	0.04	657	636
248	0.49	0.06	0.04	569	550	220	626	16	0	219	624	0.01	0.00	15	0	0.07	0.04	584	565
249	0.03	0.00	0.00	38	37	220	626	1	0	219	624	0.00	0.00	1	0	0.00	0.00	40	38
250	0.55	0.07	0.04	640	618	220	626	17	0	219	624	0.01	0.00	17	0	0.08	0.04	657	636
251	0.49	0.06	0.04	569	550	220	626	16	0	219	624	0.01	0.00	15	0	0.07	0.04	584	565
252	0.03	0.00	0.00	38	37	220	626	1	0	219	624	0.00	0.00	1	0	0.00	0.00	40	38
253	0.55	0.07	0.04	640	618	220	626	17	0	219	624	0.01	0.00	17	0	0.08	0.04	657	636
254	0.49	0.06	0.04	569	550	220	626	16	0	219	624	0.01	0.00	15	0	0.07	0.04	584	565
255	0.03	0.00	0.00	38	37	220	626	1	0	219	624	0.00	0.00	1	0	0.00	0.00	40	38
256	0.55	0.07	0.04	640	618	220	626	17	0	219	624	0.01	0.00	17	0	0.08	0.04	657	636
257	0.49	0.06	0.04	569	550	220	626	16	0	219	624	0.01	0.00	15	0	0.07	0.04	584	565
258	0.03	0.00	0.00	38	37	220	626	1	0	219	624	0.00	0.00	1	0	0.00	0.00	40	38
259	0.19	0.19	0.19	1,629	750	1,336	2,225	36	0	920	1,520	0.02	0.00	25	0	0.21	0.19	1,665	775
260	0.42	0.42	0.42	3,679	1,693	1,336	2,225	81	0	920	1,520	0.05	0.00	56	0	0.47	0.42	3,760	1,749
261	0.56	0.20	0.17	1,458	1,216	458	1,095	37	0	452	1,076	0.02	0.00	37	0	0.23	0.17	1,495	1,252
262	0.08	0.03	0.03	220	183	458	1,095	6	0	452	1,076	0.00	0.00	5	0	0.03	0.03	225	188
263	0.22	0.08	0.07	567	473	458	1,095	14	0	452	1,076	0.01	0.00	14	0	0.09	0.07	581	487
264	0.03	0.03	0.03	245	113	1,336	2,225	5	0	920	1,520	0.00	0.00	4	0	0.03	0.03	251	117
265	1.10	0.13	0.01	1,033	997	258	490	41	0	253	474	0.02	0.00	40	0	0.14	0.01	1,074	1,037
266	0.55	0.07	0.04	640	618	220	626	17	0	219	624	0.01	0.00	17	0	0.08	0.04	657	636
267	0.37	0.05	0.03	427	412	220	626	12	0	219	624	0.00	0.00	12	0	0.05	0.03	438	424
268	0.55	0.07	0.04	640	618	220	626	17	0	219	624	0.01	0.00	17	0	0.08	0.04	657	636
269	0.31	0.06	0.05	476	475	308	882	14	0	307	880	0.01	0.00	14	0	0.07	0.05	490	488
270	0.03	0.01	0.00	42	42	308	882	1	0	307	880	0.00	0.00	1	0	0.01	0.00	43	43
271	0.03	0.01	0.01	48	47	308	882	1	0	307	880	0.00	0.00	1	0	0.01	0.01	49	49
272	0.15	0.00	0.00	4	4	5	13	0	0	5	13	0.00	0.00	0	0	0.00	0.00	4	4
273	1.34	0.16	0.02	1,263	1,219	258	490	50	0	253	474	0.02	0.00	49	0	0.18	0.02	1,313	1,268
274	0.07	0.01	0.00	62	60	258	490	2	0	253	474	0.00	0.00	2	0	0.01	0.00	65	62
275	0.13	0.03	0.03	256	232	322	947	6	0	322	947	0.00	0.00	6	0	0.04	0.03	263	238
276	0.06	0.00	0.00	2	2	5	13	0	0	5	13	0.00	0.00	0	0	0.00	0.00	2	2
277	0.13	0.00	0.00	3	3	5	13	0	0	5	13	0.00	0.00	0	0	0.00	0.00	4	4
278	0.09	0.01	0.01	107	103	220	626	3	0	219	624	0.00	0.00	3	0	0.01	0.01	110	106
279	0.55	0.07	0.04	640	618	220	626	17	0	219	624	0.01	0.00	17	0	0.08	0.04	657	636
280	0.55	0.07	0.04	640	618	220	626	17	0	219	624	0.01	0.00	17	0	0.08	0.04	657	636

Post-Retrofit Demand and Energy Consumption

Fixture ID	Lighting Demand and Energy Consumption (am) Connected kW	(an) FCM Diversified kW Summer	(ao) FCM Diversified kW Winter	(ap) Annual kWh	(aq) Peak kWh	Interactive Hours (ar) Cooling Hours	(as) Heating Hours	Interactive Energy Consumption (at) Cooling kWh	(au) Heating kWh	On-Peak Interactive Hours (av) Cooling Hours	(aw) Heating Hours	On-Peak Interactive Demand and Energy Consumption (ax) FCM Diversified kW Summer	(ay) FCM Diversified kW Winter	(az) Cooling kWh	(ba) Heating kWh	Lighting and Interactive Demand and Energy Consumption (bb) FCM Diversified kW Summer	(bc) FCM Diversified kW Winter	(bd) Annual kWh	(be) Peak kWh
281	0.55	0.07	0.04	640	618	220	626	17	0	219	624	0.01	0.00	17	0	0.08	0.04	657	636
282	0.49	0.06	0.04	569	550	220	626	16	0	219	624	0.01	0.00	15	0	0.07	0.04	584	565
283	0.03	0.00	0.00	38	37	220	626	1	0	219	624	0.00	0.00	1	0	0.00	0.00	40	38
284	0.55	0.07	0.04	640	618	220	626	17	0	219	624	0.01	0.00	17	0	0.08	0.04	657	636
285	0.49	0.06	0.04	569	550	220	626	16	0	219	624	0.01	0.00	15	0	0.07	0.04	584	565
286	0.03	0.00	0.00	38	37	220	626	1	0	219	624	0.00	0.00	1	0	0.00	0.00	40	38
287	0.55	0.07	0.04	640	618	220	626	17	0	219	624	0.01	0.00	17	0	0.08	0.04	657	636
288	0.49	0.06	0.04	569	550	220	626	16	0	219	624	0.01	0.00	15	0	0.07	0.04	584	565
289	0.03	0.00	0.00	38	37	220	626	1	0	219	624	0.00	0.00	1	0	0.00	0.00	40	38
290	0.55	0.07	0.04	640	618	220	626	17	0	219	624	0.01	0.00	17	0	0.08	0.04	657	636
291	0.49	0.06	0.04	569	550	220	626	16	0	219	624	0.01	0.00	15	0	0.07	0.04	584	565
292	0.03	0.00	0.00	38	37	220	626	1	0	219	624	0.00	0.00	1	0	0.00	0.00	40	38
293	0.08	0.03	0.03	220	183	458	1,095	6	0	452	1,076	0.00	0.00	5	0	0.03	0.03	225	188
294	0.27	0.01	0.04	312	297	169	581	13	0	165	570	0.00	0.00	12	0	0.01	0.04	325	309
295	0.11	0.00	0.02	121	115	169	581	5	0	165	570	0.00	0.00	5	0	0.00	0.02	125	119
296	0.84	0.03	0.13	952	904	169	581	39	0	165	570	0.00	0.00	38	0	0.03	0.13	991	942
297	2.30	0.08	0.34	2,617	2,486	169	581	106	0	165	570	0.01	0.00	104	0	0.09	0.34	2,723	2,590
298	0.85	0.29	0.06	1,666	1,404	476	1,047	0	0	381	893	0.00	0.00	0	0	0.29	0.06	1,666	1,404
299	0.06	0.02	0.00	121	102	476	1,047	0	0	381	893	0.00	0.00	0	0	0.02	0.00	121	102
300	0.29	0.00	0.00	11	10	12	15	0	0	12	14	0.00	0.00	0	0	0.00	0.00	12	11
301	0.03	0.00	0.00	1	1	5	13	0	0	5	13	0.00	0.00	0	0	0.00	0.00	1	1
302	1.28	0.14	0.09	1,678	1,672	251	730	46	0	250	727	0.01	0.00	46	0	0.15	0.09	1,725	1,718
303	0.22	0.08	0.07	567	473	458	1,095	14	0	452	1,076	0.01	0.00	14	0	0.09	0.07	581	487
304	0.06	0.02	0.00	119	100	476	1,047	4	0	381	893	0.00	0.00	3	0	0.02	0.00	123	104
305	0.03	0.00	0.00	1	1	5	13	0	0	5	13	0.00	0.00	0	0	0.00	0.00	1	1
306	0.49	0.02	0.07	555	527	169	581	12	0	165	570	0.00	0.00	12	0	0.02	0.07	567	539
307	0.03	0.00	0.00	31	29	169	581	1	0	165	570	0.00	0.00	1	0	0.00	0.00	31	30
308	0.02	0.00	0.00	1	1	12	15	0	0	12	14	0.00	0.00	0	0	0.00	0.00	1	1
309	0.06	0.00	0.00	2	2	12	15	0	0	12	14	0.00	0.00	0	0	0.00	0.00	2	2
310	0.31	0.11	0.09	810	675	458	1,095	21	0	452	1,076	0.01	0.00	20	0	0.13	0.09	831	696
311	0.08	0.08	0.08	736	339	1,336	2,225	16	0	920	1,520	0.01	0.00	11	0	0.09	0.08	752	350
312	0.03	0.03	0.03	272	125	1,336	2,225	6	0	920	1,520	0.00	0.00	4	0	0.03	0.03	278	129
313	0.10	0.10	0.10	867	399	1,336	2,225	19	0	920	1,520	0.01	0.00	13	0	0.11	0.10	886	412
314	8.42	3.18	2.49	19,404	14,834	498	1,079	0	0	384	904	0.00	0.00	0	0	3.18	2.49	19,404	14,834
315	0.24	0.24	0.24	2,137	984	1,336	2,225	0	0	920	1,520	0.00	0.00	0	0	0.24	0.24	2,137	984
316	5.11	0.54	0.42	3,653	3,152	119	321	0	0	114	312	0.00	0.00	0	0	0.54	0.42	3,653	3,152
317	0.11	0.03	0.07	293	241	441	1,158	7	0	387	1,076	0.00	0.00	6	0	0.04	0.07	300	248
318	1.33	0.40	0.90	3,522	2,900	441	1,158	85	0	387	1,076	0.04	0.00	75	0	0.44	0.90	3,608	2,975
319	0.12	0.01	0.02	57	53	78	194	1	0	67	175	0.00	0.00	1	0	0.01	0.02	58	54
320	0.37	0.03	0.07	170	158	78	194	4	0	67	175	0.00	0.00	4	0	0.04	0.07	175	161
321	0.04	0.00	0.00	1	1	12	15	0	0	12	14	0.00	0.00	0	0	0.00	0.00	2	1
322	0.02	0.00	0.00	1	1	12	15	0	0	12	14	0.00	0.00	0	0	0.00	0.00	1	1
323	0.04	0.00	0.00	1	1	12	15	0	0	12	14	0.00	0.00	0	0	0.00	0.00	2	1
324	0.02	0.00	0.00	1	1	12	15	0	0	12	14	0.00	0.00	0	0	0.00	0.00	1	1
325	0.02	0.00	0.00	1	1	12	15	0	0	12	14	0.00	0.00	0	0	0.00	0.00	1	1
326	0.04	0.00	0.00	28	27	145	410	1	0	144	408	0.00	0.00	1	0	0.00	0.00	29	28
327	0.04	0.00	0.00	1	1	12	15	0	0	12	14	0.00	0.00	0	0	0.00	0.00	2	1
328	0.02	0.00	0.00	1	1	12	15	0	0	12	14	0.00	0.00	0	0	0.00	0.00	1	1
329	0.02	0.00	0.00	1	1	12	15	0	0	12	14	0.00	0.00	0	0	0.00	0.00	1	1
330	0.02	0.00	0.00	1	1	12	15	0	0	12	14	0.00	0.00	0	0	0.00	0.00	1	1
331	0.02	0.00	0.00	1	1	12	15	0	0	12	14	0.00	0.00	0	0	0.00	0.00	1	1
332	0.31	0.31	0.31	2,716	1,250	1,336	2,225	60	0	920	1,520	0.04	0.00	41	0	0.35	0.31	2,776	1,291
333	0.40	0.40	0.40	3,530	1,625	1,336	2,225	78	0	920	1,520	0.05	0.00	54	0	0.45	0.40	3,608	1,679
334	0.53	0.19	0.16	1,377	1,148	458	1,095	35	0	452	1,076	0.02	0.00	34	0	0.22	0.16	1,412	1,183
335	0.16	0.16	0.16	1,358	625	1,336	2,225	30	0	920	1,520	0.02	0.00	21	0	0.17	0.16	1,388	646
336	0.09	0.09	0.09	815	375	1,336	2,225	18	0	920	1,520	0.01	0.00	12	0	0.10	0.09	833	387
337	0.09	0.09	0.09	815	375	1,336	2,225	18	0	920	1,520	0.01	0.00	12	0	0.10	0.09	833	387
338	0.07	0.01	0.01	116	115	308	882	3	0	307	880	0.00	0.00	3	0	0.02	0.01	119	119
339	0.04	0.01	0.01	58	58	308	882	2	0	307	880	0.00	0.00	2	0	0.01	0.01	59	59
340	0.06	0.02	0.00	119	100	476	1,047	4	0	381	893	0.00	0.00	3	0	0.02	0.00	123	104
341	0.06	0.02	0.00	119	100	476	1,047	4	0	381	893	0.00	0.00	3	0	0.02	0.00	123	104
342	0.07	0.01	0.01	56	55	145	410	2	0	144	408	0.00	0.00	2	0	0.01	0.01	57	56
343	0.22	0.08	0.02	433	365	476	1,047	0	0	381	893	0.00	0.00	0	0	0.08	0.02	433	365
344	0.11	0.01	0.01	129	125	220	626	4	0	219	624	0.00	0.00	4	0	0.02	0.01	133	129
345	0.55	0.07	0.04	640	618	220	626	17	0	219	624	0.01	0.00	17	0	0.08	0.04	657	636
346	0.92	0.11	0.07	1,066	1,031	220	626	29	0	219	624	0.01	0.00	29	0	0.13	0.07	1,096	1,060
347	0.92	0.11	0.07	1,066	1,031	220	626	29	0	219	624	0.01	0.00	29	0	0.13	0.07	1,096	1,060
348	0.92	0.11	0.07	1,066	1,031	220	626	29	0	219	624	0.01	0.00	29	0	0.13	0.07	1,096	1,060
349	0.06	0.01	0.00	44	43	165	374	1	0	161	366	0.00	0.00	1	0	0.02	0.00	46	45
Totals	116.97	29.85	24.64	237,917	178,204			5,669	0			3.13	0.00	5,049	0	32.98	24.64	243,586	183,253

Total Savings Summary	Energy kWh	Summer kW	Winter kW	Connected kW
Annual Lighting Only	261,086	33.13	27.16	128.60
Annual Interactive	6,065	3.37	0.00	N/A
Annual Lighting and Interactive	267,151	36.50	27.16	128.60
On-Peak Lighting Only	200,056			
On-Peak Interactive	5,440			
On-Peak Lighting and Interactive	205,496			

	MMBTU
Annual Non-Electric Heating Savings	(387)

Savings Adjustment Factors						
Parameter	Annual KWH	Difference %	Summer kW	Difference %	Winter kW	Difference %
Gross (TRACKING) Savings	279,561	N/A	42.33	N/A	63.50	N/A
Adjustment - Documentation Change	-115	0%	-0.02	0%	-0.02	0%
Adjustment - Technology Change	383	0%	0.17	0%	0.17	0%
Adjustment - Quantity Change	3,095	1%	1.41	3%	1.41	2%
Adjustment - Operation Change	-21,839	-8%	N/A	N/A	N/A	N/A
Adjustment - Coincident Change	N/A	N/A	-10.76	-25%	-37.89	-60%
Adjustment - Heating Interaction	0	0%	N/A	N/A	0.00	0%
Adjustment - Cooling Interaction	6,065	2%	3.37	8%	N/A	N/A
Adjustment - TOTAL	-12,410	-4%	-5.83	-14%	-36.34	-57%
Adjusted Gross (ONSITE) Savings	267,151	96%	36.50	86%	27.16	43%

Table 72: Summary of On-Site Energy and Demand Savings

Hour Ending	Average kW Reduction
1	12.6
2	12.6
3	12.7
4	11.6
5	11.4
6	13.4
7	23.3
8	44.3
9	47.7
10	48.4
11	49.9
12	49.9
13	48.0
14	46.8
15	42.6
16	29.6
17	26.9
18	24.0
19	19.5
20	17.9
21	16.3
22	13.7
23	13.4
24	12.7

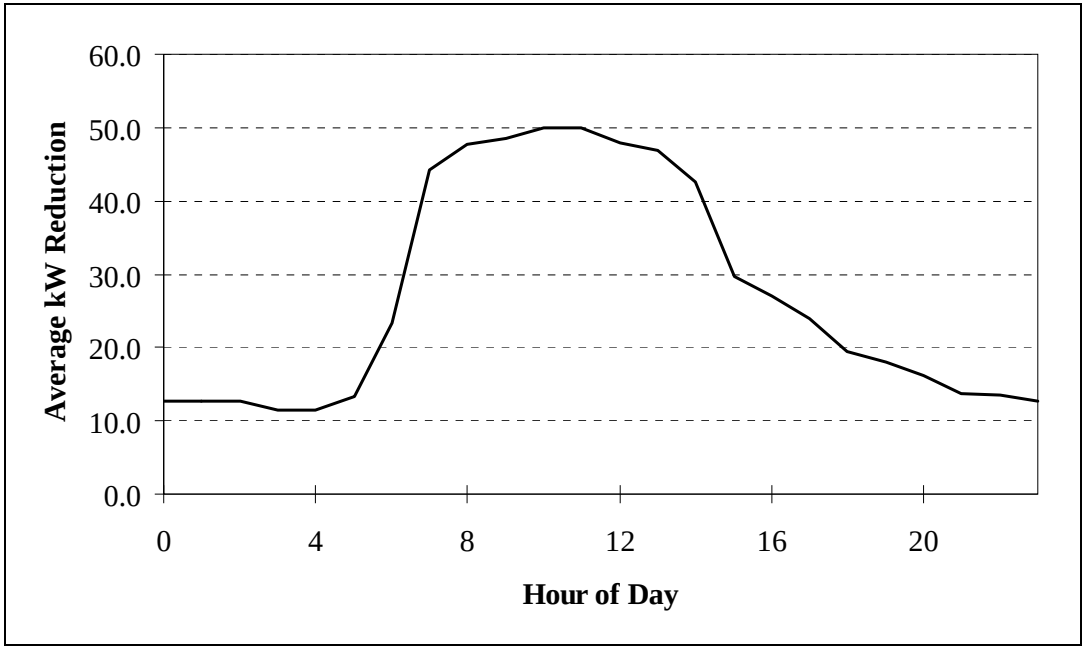

Table 73: Average Summer Weekday kW Reduction

Hour Ending	Average kW Reduction
1	14.1
2	14.7
3	14.7
4	13.1
5	12.4
6	18.4
7	34.4
8	82.0
9	85.2
10	84.1
11	84.9
12	83.7
13	79.9
14	80.3
15	69.2
16	42.7
17	36.3
18	27.9
19	26.4
20	24.6
21	20.2
22	14.1
23	13.3
24	14.3

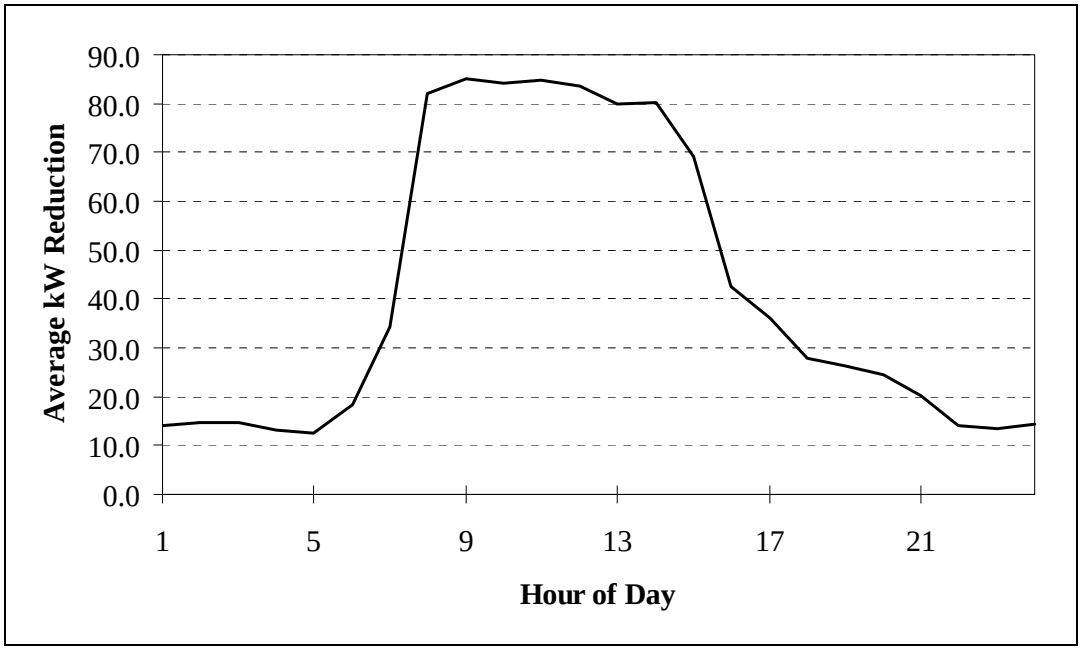

Table 74: Average Winter Weekday kW Reduction

Column Definitions for Lighting Calculations		
(a) Brief description of area where lighting is installed		

Pre-retrofit Lighting			Post-retrofit Lighting		
(b) Description of fixture type			(i) Description of fixture type		
(c) Fixture quantity from application documentation			(j) Fixture quantity from on-site inspection		
(d) Fixture wattage from application documentation			(k) Fixture wattage from application documentation		
(e) Annual hours of use	TMY2 Query	Eq. 1.1	(l) Annual hours of use	TMY2 Query	Eq. 1.1
(f) On-peak hours of use	TMY2 Query	Eq. 1.2	(m) On-peak hours of use	TMY2 Query	Eq. 1.2
(g) FCM Summer peak demand diversity factor	TMY2 Query	Eq. 1.3	(n) FCM Summer peak demand diversity factor	TMY2 Query	Eq. 1.3
(h) FCM Winter peak demand diversity factor	TMY2 Query	Eq. 1.4	(o) FCM Winter peak demand diversity factor	TMY2 Query	Eq. 1.4

HVAC Interaction Inputs	
(p) Electric cooling coefficient of performance	(r) Percent of space that is cooled
(q) Electric heating coefficient of performance	(s) Percent of space that is heated

Pre-retrofit Lighting Demand and Energy Consumption			Post-retrofit Lighting Demand and Energy Consumption		
(t) Connected lighting Demand	(t) = (c) x (d) / 1,000	Eq. 2.1	(am) Connected lighting Demand	(am) = (j) x (k) / 1,000	Eq. 3.1
(u) Summer diversified peak lighting demand (FCM)	(u) = (t) x (g)	Eq. 2.2	(an) Summer diversified peak lighting demand (FCM)	(an) = (am) x (n)	Eq. 3.2
(v) Winter diversified peak lighting demand (FCM)	(v) = (t) x (h)	Eq. 2.3	(ao) Winter diversified peak lighting demand (FCM)	(ao) = (am) x (o)	Eq. 3.3
(w) Annual energy consumption	(w) = (t) x (e)	Eq. 2.4	(ap) Annual energy consumption	(ap) = (am) x (l)	Eq. 3.4
(x) Annual On-peak energy consumption	(x) = (t) x (f)	Eq. 2.5	(aq) Annual On-peak energy consumption	(aq) = (am) x (m)	Eq. 3.5
(y) Annual cooling hours	TMY2 Qyery	Eq. 2.6	(ar) Annual cooling hours	TMY2 Query	Eq. 3.6
(z) Annual heating hours	TMY2 Qyery	Eq. 2.7	(as) Annual heating hours	TMY2 Query	Eq. 3.7
(aa) Electric cooling interactive energy effects	(aa) = (t) x (y) x (r) x 0.8 / (p)	Eq. 2.8	(at) Electric cooling interactive energy effects	(at) = (am) x (aq) x (r) x 0.8 / (p)	Eq. 3.8
(ab) Electric heating interactive energy effects	(ab) = -(t) x (z) x (s) x 0.8 / (q)	Eq. 2.9	(au) Electric heating interactive energy effects	(au) = -(am) x (as) x (s) x 0.8 / (q)	Eq. 3.9
(ac) Annual On-peak cooling hours	TMY2 Qyery	Eq. 2.10	(av) Annual On-peak cooling hours	TMY2 Query	Eq. 3.10
(ad) Annual On-peak heating hours	TMY2 Qyery	Eq. 2.11	(aw) Annual On-peak heating hours	TMY2 Query	Eq. 3.11
(ae) On-peak interactive cooling demand (FCM)	(ae) = (u) x (r) x 0.8 / (p)	Eq. 2.12	(ax) On-peak interactive cooling demand (FCM)	(ax) = (an) x (r) x 0.8 / (p)	Eq. 3.12
(af) On-peak interactive heating demand (FCM)	(af) = -(v) x (s) x 0.8 / (q)	Eq. 2.13	(ay) On-peak interactive heating demand (FCM)	(ay) = (ao) x (s) x 0.8 / (q)	Eq. 3.13
(ag) On-peak interactive electric cooling energy	(ag) = (t) x (ac) x (r) x 0.8 / (p)	Eq. 2.14	(az) On-peak interactive electric cooling energy	(az) = (am) x (av) x (r) x 0.8 / (p)	Eq. 3.14
(ah) On-peak interactive electric heating energy	(ah) = -(t) x (ad) x (s) x 0.8 / (q)	Eq. 2.15	(ba) On-peak interactive electric heating energy	(ba) = -(am) x (aw) x (s) x 0.8 / (q)	Eq. 3.15
(ai) Lighting and interactive summer demand (FCM)	(ai) = (u) + (ae)	Eq. 2.16	(bb) Lighting and interactive summer demand (FCM)	(bb) = (an) + (ax)	Eq. 3.16
(aj) Lighting and interactive winter demand (FCM)	(aj) = (v) + (af)	Eq. 2.17	(bc) Lighting and interactive winter demand (FCM)	(bc) = (ao) + (ay)	Eq. 3.17
(ak) Annual lighting and interactive energy consumption	(ak) = (w) + (aa) + (ab)	Eq. 2.18	(bd) Annual lighting and interactive energy consumption	(bd) = (ap) + (at) + (au)	Eq. 3.18
(al) Annual on-peak lighting and interactive energy consumption	(al) = (x) + (ag) + (ah)	Eq. 2.19	(be) Annual on-peak lighting and interactive energy consumption	(be) = (aq) + (az) + (ba)	Eq. 3.19

Total Savings Summary					
Annual Lighting Only Energy Consumption	Σ (w) - Σ (ap)	Eq. 4.1	Annual Lighting and Interactive Energy Consumption	Σ (ak) - Σ (bd)	Eq. 4.8
Annual Lighting Only Summer Demand (FCM)	Σ (u) - Σ (an)	Eq. 4.2	Annual Lighting and Interactive Summer Demand (FCM)	Σ (ai) - Σ (bb)	Eq. 4.9
Annual Lighting Only Winter Demand (FCM)	Σ (v) - Σ (ao)	Eq. 4.3	Annual Lighting and Interactive Winter Demand (FCM)	Σ (aj) - Σ (bc)	Eq. 4.10
Annual Lighting Only Connected Demand	Σ (t) - Σ (am)	Eq. 4.4	On-Peak Lighting Only Energy Consumption	Σ (x) - Σ (aq)	Eq. 4.11
Annual Interactive Energy Consumption	[Σ (aa) - Σ (at)] + [Σ (ab) - Σ (au)]	Eq. 4.5	On-Peak Interactive Energy Consumption	[Σ (ag) - Σ (az)] + [Σ (ah) - Σ (ba)]	Eq. 4.12
Annual Interactive Summer Demand (FCM)	Σ (ae) - Σ (ax)	Eq. 4.6			
Annual Interactive Winter Demand (FCM)	Σ (af) - Σ (ay)	Eq. 4.7			

Site 9, Application ID: 529332

Facility Type: Parking Garage

Summary

New lighting was installed in a parking garage under the Design 2000 program. The new fixtures included (335) two lamp F32/T8 fixtures. The baseline system included (112) 250 watt metal halide fixtures. The tracking savings estimated that (268) two lamp fixtures could be shut off during the day using controls. These fixtures were estimated to operate 4,460 hours per year. The remaining fixtures were estimated to operate 8,760 hours per year.

Evaluators found (322) two lamp F32/T8 fixtures during the site visit. It was also determined from site inspection that (128) of these fixtures are controlled to go off during the day rather than (268) fixtures as proposed in the tracking estimate.

Table 75 presents the summary of the tracking and on-site savings results.

Savings Quantity	Tracking Estimate	On-site Savings	Evaluated/ Tracking
Annual Energy (kWh)	177,593	124,934	70%
% Energy Savings On-Peak	64%	50%	79%
Summer Peak Diversified kW	28.50	17.56	62%
Winter Peak Diversified kW	12.40	11.62	94%

Table 75: Summary of Tracking and On-site Savings Results

The overall on-site savings estimate is 30% lower than predicted in the tracking estimate. The on-site estimates of summer and winter peak diversified kW was lower than the tracking values. The following factors influenced the difference between the tracking and on-site estimates of energy and demand savings:

- There was a decrease in savings resulting from fewer fixtures being installed than proposed in the tracking estimate. The tracking estimate proposed the installation of (335) two lamp F32/T8 fixtures. Evaluators found (322) two lamp F32/T8 fixtures installed in the parking garage during the site visit. The evaluation adjusted the baseline to account for the reduced number of fixtures installed by assuming the same ratio of

baseline to installed fixtures as the tracking estimate. The decreased quantity resulted in a reduction in energy savings equal to 5,869 kWh per year.

- The majority of the decrease in savings was the result of fewer fixtures being controlled and the hours of use of these controlled fixtures being higher than proposed. The tracking savings estimated 80% of the installed fixtures, or (268) of (335), could be shut off during the day for a total of 4,300 hours per year. During the site visit, evaluators counted all of the fixtures in the parking garage and recorded how many were on and how many were off. It was found that (128) fixtures were off during this daytime visit. The remaining (194) fixtures were operating during this time, meaning that they are always on. Lighting logger data revealed that the reduction in operating hours for the fixtures that are controlled was equal to 3,012 hours per year. The combination of fewer fixtures being controlled and higher operating hours of these fixtures that are controlled resulted in a decrease of energy savings equal to 46,789 kWh per year.

- The on-peak kWh savings was estimated to be 50% of the annual on-site kWh savings. The tracking estimate for on-peak kWh savings was calculated to be 64%. The on-peak period defined by National Grid is non-holiday weekdays between 6 am and 10 pm. The reason for the difference in on-peak kWh savings is because the majority of the controls savings that were lost would have occurred during the on-peak period.

- The summer diversified kW reduction was 17.56 kW or 38% lower than predicted in the tracking estimate. The decrease is due to the combination of the quantity reduction and the reduced number of fixtures controlled as described above. The winter diversified kW reduction was 11.62 kW or 6% lower than the tracking estimate. The reason for this decrease is because of the difference in total quantity of fixtures installed. The reason why the winter kW reduction is closer to the tracking than the summer kW reduction is because the controls portion of this measure is not a factor during the winter peak period. This is because these lights are typically on 100% of the time during the winter peak period.

Project Description

This project was completed under the Design 2000 program. Table 76 presents a summary of the baseline system as outlined in the customer application.

Baseline Case				
Space	**Fixture Type**	**Wattage**	**Quantity**	**Annual Hours**
Ground Level	250 Watt Metal Halide	290	16	8,760
Level 1	250 Watt Metal Halide	290	21	8,760
Level 2	250 Watt Metal Halide	290	21	8,760
Level 3	250 Watt Metal Halide	290	21	8,760
Level 4	250 Watt Metal Halide	290	21	8,760
Level 5	250 Watt Metal Halide	290	2	8,760
Ramps	250 Watt Metal Halide	290	10	8,760
	Total	32,480	112	NA

Table 76: Baseline Lighting System

Table 77 presents the installed fixtures and quantities as proposed in the customer application.

Installed Case				
Space	**Fixture Type**	**Wattage**	**Quantity**	**Annual Hours**
Ground Level	Two Lamp F32/T8	60	40	4,460
Ground Level	Two Lamp F32/T8	60	10	8,760
Level 1	Two Lamp F32/T8	60	50	4,460
Level 1	Two Lamp F32/T8	60	12	8,760
Level 2	Two Lamp F32/T8	60	50	4,460
Level 2	Two Lamp F32/T8	60	12	8,760
Level 3	Two Lamp F32/T8	60	50	4,460
Level 3	Two Lamp F32/T8	60	12	8,760
Level 4	Two Lamp F32/T8	60	50	4,460
Level 4	Two Lamp F32/T8	60	12	8,760
Level 5	Two Lamp F32/T8	60	4	4,460
Level 5	Two Lamp F32/T8	60	1	8,760
Ramps	Two Lamp F32/T8	60	24	4,460
Ramps	Two Lamp F32/T8	60	8	8,760
	Total	20,100	335	NA

Table 77: Installed Lighting System

Evaluation Methodology

Tracking Estimates

The tracking estimates of energy use were calculated based on the full load of the existing and proposed fixtures. The spaces being controlled by the energy management system (EMS) were reported to reduce operating hours by an average of 4,300 hours per year. The energy savings were calculated as the difference in the pre and post installation energy use. The controls savings accounted for approximately 39% of the total tracking savings.

Evaluation Approach

The evaluation included a verification of installed fixtures, on-site monitoring and interview. Some fixtures are controlled by an EMS, while the remaining fixtures operate 8,760 hours per year.

The base case used in the evaluation of the lighting savings was developed from information contained in the customer application. Evaluators visited the facility to verify the installed fixtures and install monitoring equipment to quantify the hours of use of the different spaces. Evaluators surveyed facility personnel to obtain information on the lighting usage throughout the year. They also inquired about any HVAC equipment serving the space.

To determine the hours of use for the new fixtures, field evaluators installed seven time-of-use lighting loggers throughout the garage. Five loggers were installed on lights that operate 8,760 hours per year and two loggers were installed on fixtures that are controlled by the EMS. Evaluators determined the number of fixtures that were being controlled by identifying those that were off during the daytime site visit. Evaluators were unable to verify this through the EMS because facility staff did not know how to access the information. According to them, the EMS has not been accessed or reprogrammed by anyone since it has been installed. Evaluators assumed that the two loggers used to monitor the controlled fixtures were representative of all of the controlled fixtures. Table 78 presents the fixtures monitored by the evaluation engineers.

Logger #	Equipment Monitored	Parameter Measured	Test Equip. Make & Model	Measurement Type	Installation Method	Frequency of Observations	Monitoring Duration
940629-265	1st Floor 8,760 hour 2F32T8	On/Off Operation	PS&T TOU Lighting Logger	Event Logger	Proximity	Based on Schedule	3/31/09 - 4/28/09
940824-006	5th Floor 8,760 hour 2F32/T8	On/Off Operation	PS&T TOU Lighting Logger	Event Logger	Proximity	Based on Schedule	3/31/09 - 4/28/09
940824-043	2nd Floor Controlled 2F32/T8	On/Off Operation	PS&T TOU Lighting Logger	Event Logger	Proximity	Based on Schedule	3/31/09 - 4/28/09
940824-044	3rd Floor Ramp 8,760 hour 2F32/T8	On/Off Operation	PS&T TOU Lighting Logger	Event Logger	Proximity	Based on Schedule	3/31/09 - 4/28/09
940824-051	Ground Floor 8,760 hour 2F32/T8	On/Off Operation	PS&T TOU Lighting Logger	Event Logger	Proximity	Based on Schedule	3/31/09 - 4/28/09
940824-059	Ground Floor 8,760 hour 2F32/T8	On/Off Operation	PS&T TOU Lighting Logger	Event Logger	Proximity	Based on Schedule	3/31/09 - 4/28/09
940824-249	4th Floor Controlled 2F32/T8	On/Off Operation	PS&T TOU Lighting Logger	Event Logger	Proximity	Based on Schedule	3/31/09 - 4/28/09

Table 78: Spaces Monitored

Verification of Equipment and Operating Parameters

This was a new construction project that included the installation of two lamp F32/T8 lighting in a parking garage in place of 250 watt metal halide fixtures. The tracking savings estimated a total of (335) two lamp F32/T8 fixtures were to be installed. A count of the entire parking garage by evaluators found there to be (322) two lamp F32/T8 fixtures.

In addition, controls were supposed to be added to shut off a certain number of fixtures during the day when the ambient light is sufficient to offset these fixtures. The tracking savings estimated that 80%, or (268) of these fixtures could be shut off during the day. Evaluators found that (128) fixtures were off during the time of the site visit. According to facility personnel, these are the fixtures that are controlled by an EMS. All remaining fixtures operate 24/7.

This is a parking garage that serves a public transportation facility. This facility operates 24 hours a day, seven days a week. There are no observed holidays at this location. Table 79 presents the values obtained from the monitored data including annual operation, summer and winter diversity factors, and on-peak hours of use.

Schedule ID	Logger #	Description	Annual Hours	Summer Diversity	Winter Diversity	On-Peak Hours
1	940629-265	1st Floor 8,760 hour 2F32T8	8,719	100%	100%	4,008
2	940824-006	5th Floor 8,760 hour 2F32/T8	8,760	100%	100%	4,032
3	940824-043	2nd Floor Controlled 2F32/T8	5,473	23%	100%	1,763
4	940824-044	3rd Floor Ramp 8,760 hour 2F32/T8	8,760	100%	100%	4,032
5	940824-051	Ground Floor 8,760 hour 2F32/T8	8,374	95%	94%	3,820
6	940824-059	Ground Floor 8,760 hour 2F32/T8	8,760	100%	100%	4,032
7	940824-249	4th Floor Controlled 2F32/T8	5,475	23%	100%	1,764
8	NA	Average Controlled Fixture	5,748	23%	100%	1,949
9	NA	Average Ground Floor Fixtures	8,567	97%	97%	3,926

Table 79: Annual Hours of Use and Diversity Factors of Monitored Data

Schedule 8 represents the average controlled fixture and was generated in two steps. The first step was to average the two loggers that monitored the controlled fixtures (Schedules 3 and 7). Both loggers showed near identical daily operation of approximately 4 pm to 7 am. The second step was to adjust the daytime operation to account for daylight savings time. According to the vendor who installed the computer system that controls the lights, the operating schedules are programmed only to adjust for daylight savings time. This adjustment occurs twice a year, resulting in a summer schedule (March through October) and a winter schedule (November through February). The monitoring period occurred in April, which for this report is considered the summer schedule because it occurs after the daylight savings time shift in March.

To adjust the logger data for winter time, evaluators compared the logger data from April to the average percent darkness for March. The logger data were compared to the average darkness for March because this is the most extreme month of darkness between March and October, and the summer operating schedule is assumed to be programmed to accommodate the months with the most darkness between March and October. It was found that the logger data includes more hours of operation than actual darkness in March. This is likely because it is a parking structure that is partially enclosed. It appears that the operation of the lights is scheduled to account for this “lag” in daylight. To estimate the winter usage from November through February, evaluators adjusted the logger data to correspond with the average percent darkness for December, which is the most extreme month for darkness during the winter. Evaluators also applied a similar lag to the data to account for the effect the structure has on how much natural light it lets in. Table 80 presents the data used to estimate the winter operation of the controlled lights.

Hour Ending	Average % Darkness[4]		April (Summer) Logger Data	Estimated Winter % Operation
	March	December		
1	100%	100%	100%	100%
2	100%	100%	100%	100%
3	100%	100%	100%	100%
4	100%	100%	100%	100%
5	100%	100%	100%	100%
6	86%	100%	100%	100%
7	8%	100%	100%	100%
8	0%	15%	9%	100%
9	0%	0%	0%	15%
10	0%	0%	0%	0%
11	0%	0%	0%	0%
12	0%	0%	0%	0%
13	0%	0%	0%	0%
14	0%	0%	0%	0%
15	0%	0%	0%	0%
16	0%	0%	0%	100%
17	0%	71%	91%	100%
18	12%	100%	100%	100%
19	96%	100%	100%	100%
20	100%	100%	100%	100%
21	100%	100%	100%	100%
22	100%	100%	100%	100%
23	100%	100%	100%	100%
24	100%	100%	100%	100%

Table 80: Summer (Logged) and Winter (Estimated) Operation of Controlled Fixtures

[4] *Average monthly percent darkness for Worcester, MA was obtained from the US Naval Observatory. Data retrieved May 2009 from http://aa.usno.navy.mil/data/docs/RS_OneYear.php.*

Schedule 9 was calculated to represent the fixtures that operate 24/7 on the ground floor. The reason this was done was because one of the loggers installed on this floor was off for a small period of time during the monitoring period. It is unclear why this light went off, but the remaining data suggests that this fixture operates 24/7. Schedule 9 was created as the average of Schedules 5 and 6 because evaluators assumed that the ground floor fixtures would operate based on some combination of these two loggers. It is unclear how many lights would have been affected by this short period of "off" time, so evaluators assumed a straight average of the two lighting loggers on this level.

To estimate annual energy and demand savings, a spreadsheet method was employed. The summary of this spreadsheet is presented in Table 81. Annual hours and diversity factors from Table 79 are used with wattages from Table 81 to calculate energy and demand savings. The schedule ID's from Table 79 are presented in Table 81 to show which schedule was used with each fixture ID. The final on-site savings estimates are presented in Table 81.

The facility is neither heated nor cooled. Therefore, there are no interactive effects associated with the new lighting and any HVAC systems.

The average daily lighting profiles for the all the monitored spaces are presented in Figure 155 through Figure 161. This includes the average weekday, weekend day and holiday. The x-axis represents one full day and the y-axis is the percentage that the lights are on for each hour. Schedules 8 and 9 are also presented graphically in Figure 162 and Figure 163.

An hourly summary of the site kW savings for an average summer (June through August), non-holiday, weekday is presented in Table 82. This summary is provided so that the summer diversified peak kW can be estimated across any range of hours in the event that the FCM definition for summer peak changes in the future. The same summary was also provided for the average winter (December and January), non-holiday, weekday in Table 83.

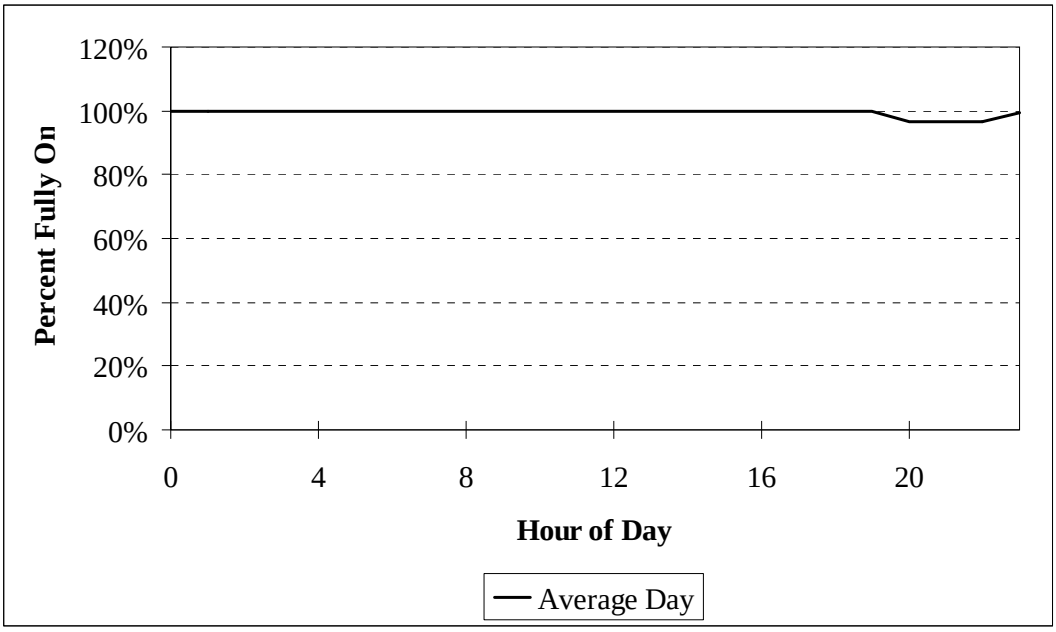

Figure 155: Average Daily Lighting Profile for Schedule 1 (1st Floor, 24/7 Fixture) from 3/31/09 to 4/28/09

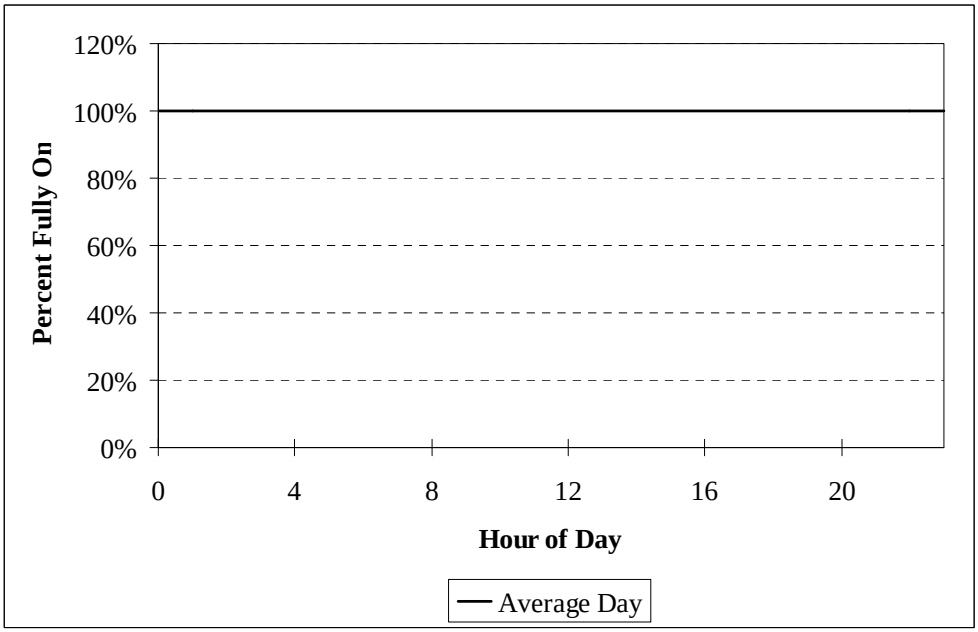

Figure 156: Average Daily Profile for Schedule 2 (5th Floor, 24/7 Fixture) from 3/31/09 to 4/28/09

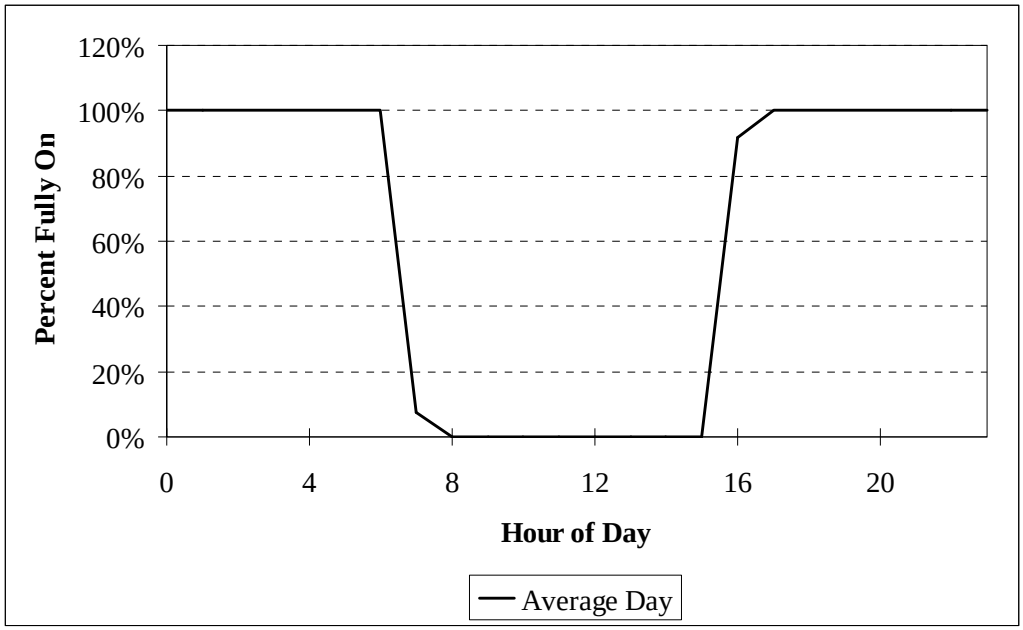

Figure 157: Average Daily Lighting Profile for Schedule 3 (2nd Floor, Controlled Fixture) from 3/31/09 to 4/28/09

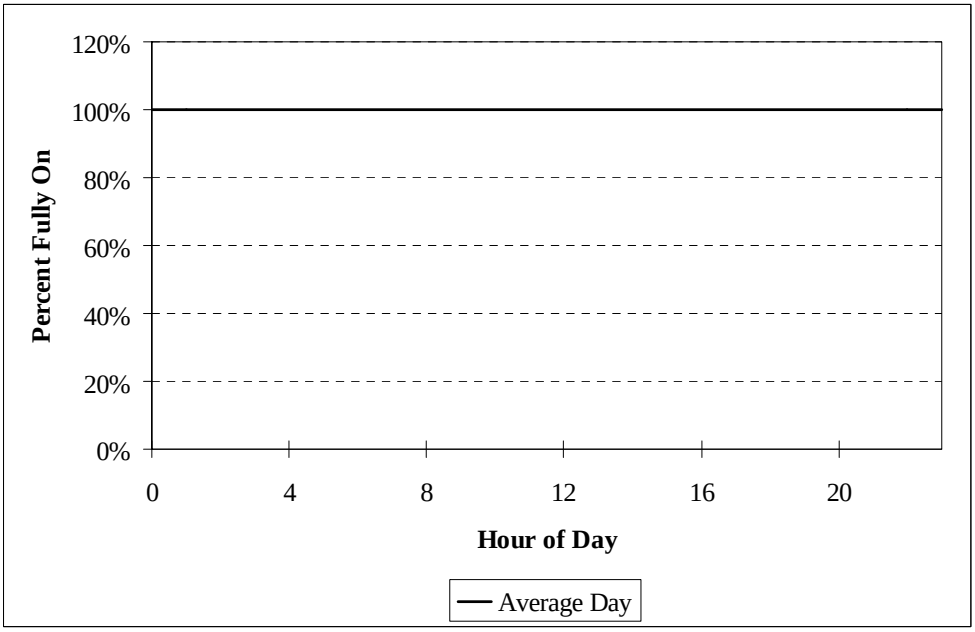

Figure 158: Average Daily Lighting Profile for Schedule 4 (3rd Floor, 24/7 Fixture) from 3/31/09 to 4/28/09

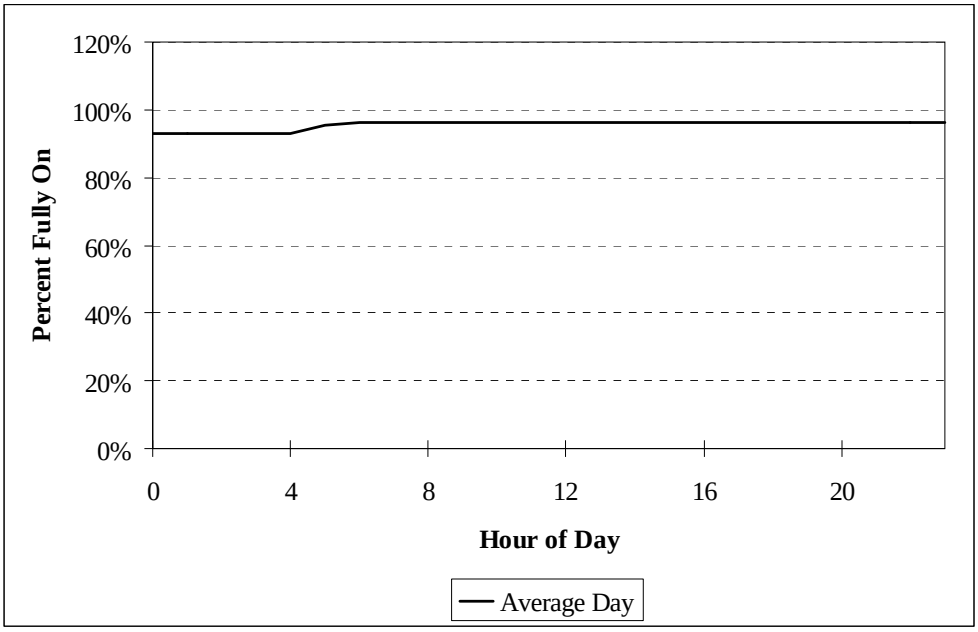

Figure 159: Average Daily Lighting Profile for Schedule 5 (Ground Floor, 24/7 Fixture) from 3/31/09 to 4/28/09

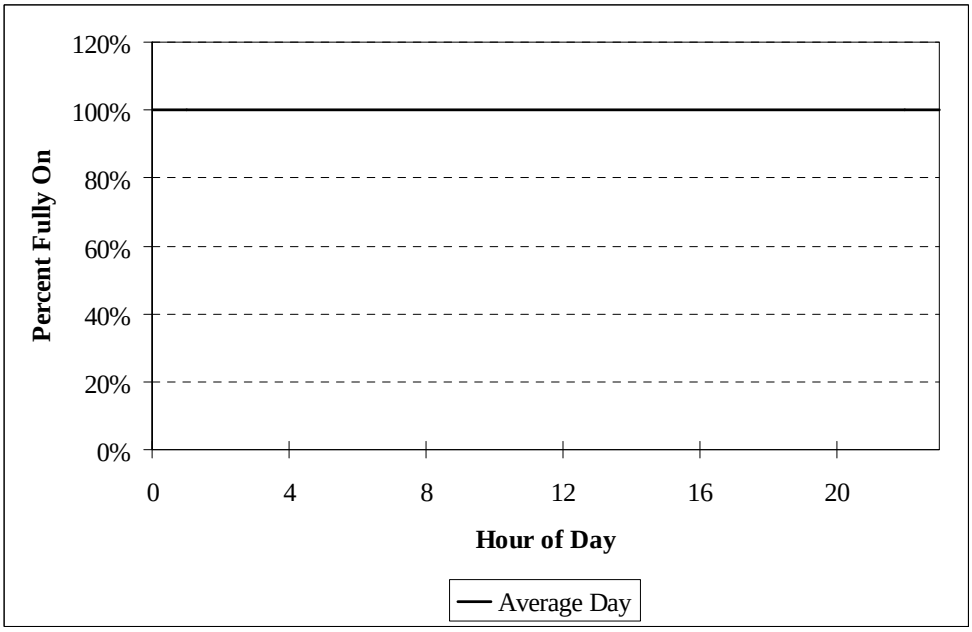

Figure 160: Average Daily Lighting Profile for Schedule 6 (Ground Floor, 24/7 Fixture) from 3/31/09 to 4/28/09

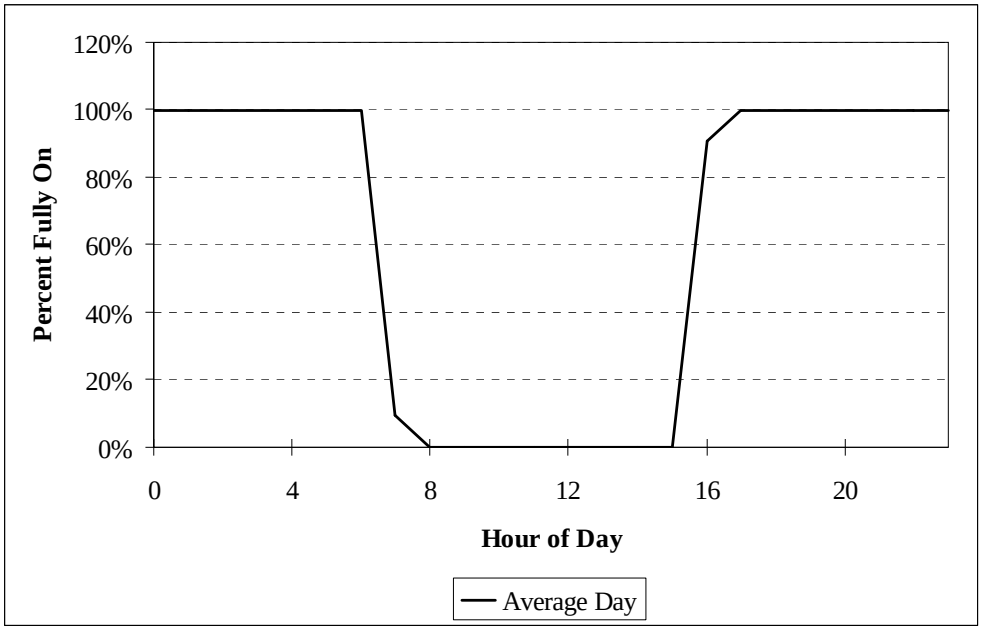

Figure 161: Average Daily Lighting Profile for Schedule 7 (4th Floor, Controlled Fixture) from 3/31/09 to 4/28/09

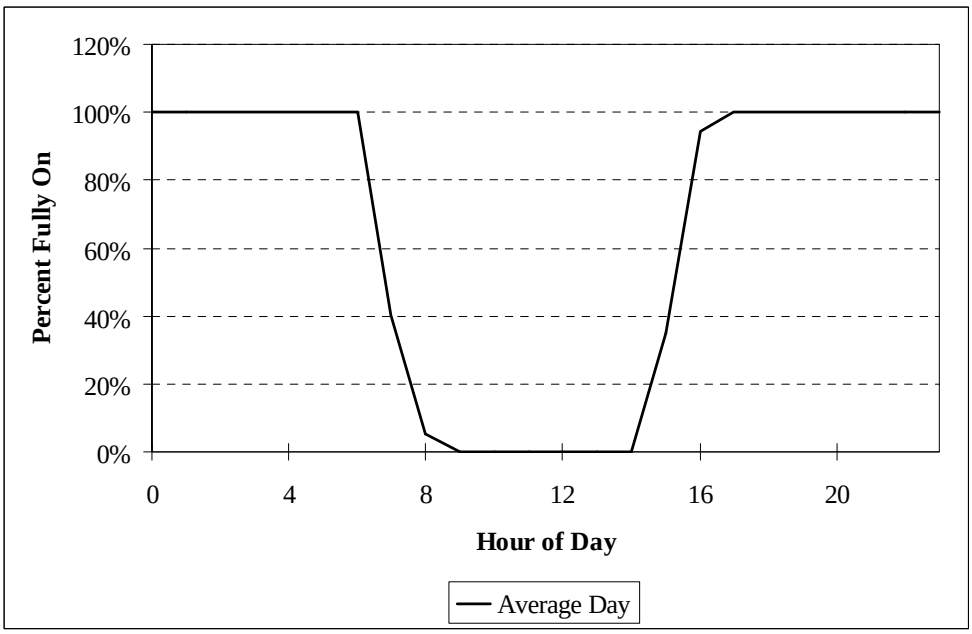

Figure 162: Average Daily Lighting Profile for Schedule 8 (Average Controlled Fixture)

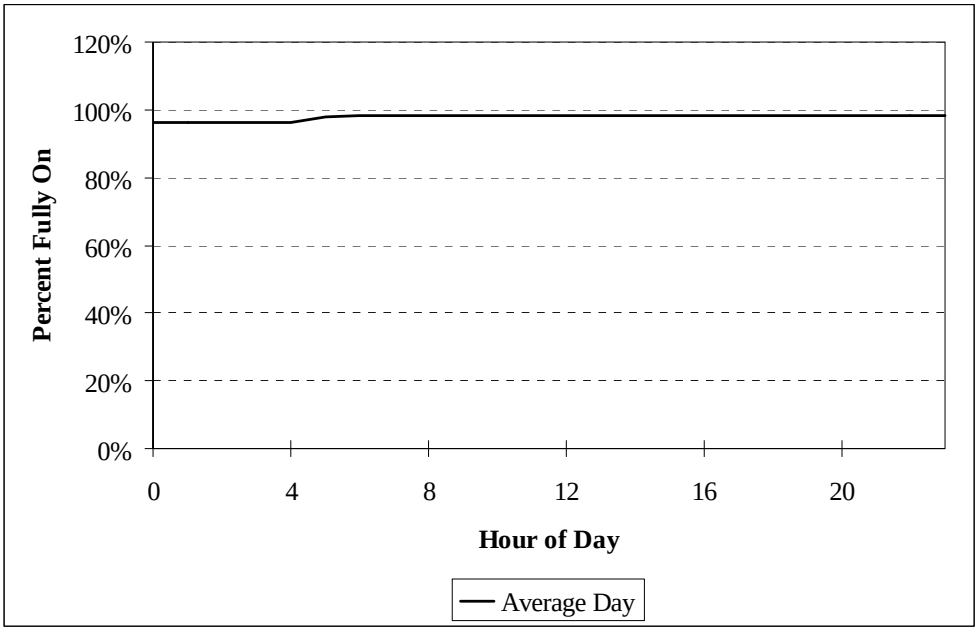

Figure 163: Average Daily Lighting Profile for Schedule 9 (Average Ground Floor 24/7 Fixture)

Facility Type: Parking Garage
Application ID: 529332

Fixture Information

Fixture ID	(a) Space Type	Pre-retrofit Lighting (b) Fixture Type	(c) Fixture Quantity	(d) Fixture Wattage	(e) Hours of Use Annual	(f) Hours of Use Peak	(g) FCM Diversity Factor Summer	(h) FCM Diversity Factor Winter	Post-retrofit Lighting (i) Fixture Type	(j) Fixture Quantity	(k) Fixture Wattage	(l) Hours of Use Annual	(m) Hours of Use Peak	(n) FCM Diversity Factor Summer	(o) FCM Diversity Factor Winter	HVAC (p) COP Cooling	(q) COP Heating	(r) % Space Cooled	(s) % Space Heated	Schedule ID from Table 5 Pre Retrofit	Post Retrofit
1	Ground Level	250W METAL HALIDE	7	290	8,567	3,926	97%	97%	2L4' T8/ELIG	23	60	8,567	3,926	97%	97%	NA	NA	0%	0%	9	9
2	Ground Level	250W METAL HALIDE	9	290	8,567	3,926	97%	97%	2L4' T8/ELIG	25	60	5,748	1,949	23%	100%	NA	NA	0%	0%	9	8
3	Level 1	250W METAL HALIDE	12	290	8,719	4,008	100%	100%	2L4' T8/ELIG	35	60	8,719	4,008	100%	100%	NA	NA	0%	0%	1	1
4	Level 1	250W METAL HALIDE	8	290	8,719	4,008	100%	100%	2L4' T8/ELIG	25	60	5,748	1,949	23%	100%	NA	NA	0%	0%	1	8
5	Level 2	250W METAL HALIDE	12	290	8,760	4,032	100%	100%	2L4' T8/ELIG	35	60	8,760	4,032	100%	100%	NA	NA	0%	0%	2	2
6	Level 2	250W METAL HALIDE	8	290	8,760	4,032	100%	100%	2L4' T8/ELIG	25	60	5,748	1,949	23%	100%	NA	NA	0%	0%	2	8
7	Level 3	250W METAL HALIDE	12	290	8,760	4,032	100%	100%	2L4' T8/ELIG	35	60	8,760	4,032	100%	100%	NA	NA	0%	0%	2	2
8	Level 3	250W METAL HALIDE	8	290	8,760	4,032	100%	100%	2L4' T8/ELIG	25	60	5,748	1,949	23%	100%	NA	NA	0%	0%	2	8
9	Level 4	250W METAL HALIDE	11	290	8,760	4,032	100%	100%	2L4' T8/ELIG	32	60	8,760	4,032	100%	100%	NA	NA	0%	0%	2	2
10	Level 4	250W METAL HALIDE	9	290	8,760	4,032	100%	100%	2L4' T8/ELIG	28	60	5,748	1,949	23%	100%	NA	NA	0%	0%	2	8
11	Level 5	250W METAL HALIDE	1	290	8,760	4,032	100%	100%	2L4' T8/ELIG	4	60	8,760	4,032	100%	100%	NA	NA	0%	0%	2	2
12	Level 5	250W METAL HALIDE	0	290	0		0%	0%	2L4' T8/ELIG	0	60	0		0%	0%	NA	NA	0%	0%	0	0
13	Ramps	250W METAL HALIDE	10	290	8,760	4,032	100%	100%	2L4' T8/ELIG	30	60	8,760	4,032	100%	100%	NA	NA	0%	0%	4	4
14	Ramps	250W METAL HALIDE	0	290	0		0%	0%	2L4' T8/ELIG	0	60	0		0%	0%	NA	NA	0%	0%	0	0
		Totals	107	31,030					Totals	322	19,320										

Pre-Retrofit Demand and Energy Consumption

Fixture ID	Lighting Demand and Energy Consumption (t) Connected kW	(u) FCM Diversified kW Summer	(v) FCM Diversified kW Winter	(w) Annual kWh	(x) Peak kWh	Interactive Hours (y) Cooling Hours	(z) Heating Hours	Interactive Energy Consumption (aa) Cooling kWh	(ab) Heating kWh	On-Peak Interactive Hours (ac) Cooling Hours	(ad) Heating Hours	On-Peak Interactive Demand and Energy Consumption (ae) FCM Diversified kW Summer	(af) FCM Diversified kW Winter	(ag) Cooling kWh	(ah) Heating kWh	Lighting and Interactive Demand and Energy Consumption (ai) FCM Diversified kW Summer	(aj) FCM Diversified kW Winter	(ak) Annual kWh	(al) Peak kWh
1	2.03	1.98	1.97	17,391	7,970	0	0	0	0	0	0	0.00	0.00	0	0	1.98	1.97	17,391	7,970
2	2.61	2.54	2.54	22,360	10,247	0	0	0	0	0	0	0.00	0.00	0	0	2.54	2.54	22,360	10,247
3	3.48	3.48	3.48	30,343	13,947	0	0	0	0	0	0	0.00	0.00	0	0	3.48	3.48	30,343	13,947
4	2.32	2.32	2.32	20,229	9,298	0	0	0	0	0	0	0.00	0.00	0	0	2.32	2.32	20,229	9,298
5	3.48	3.48	3.48	30,485	14,031	0	0	0	0	0	0	0.00	0.00	0	0	3.48	3.48	30,485	14,031
6	2.32	2.32	2.32	20,323	9,354	0	0	0	0	0	0	0.00	0.00	0	0	2.32	2.32	20,323	9,354
7	3.48	3.48	3.48	30,485	14,031	0	0	0	0	0	0	0.00	0.00	0	0	3.48	3.48	30,485	14,031
8	2.32	2.32	2.32	20,323	9,354	0	0	0	0	0	0	0.00	0.00	0	0	2.32	2.32	20,323	9,354
9	3.19	3.19	3.19	27,944	12,862	0	0	0	0	0	0	0.00	0.00	0	0	3.19	3.19	27,944	12,862
10	2.61	2.61	2.61	22,863	10,523	0	0	0	0	0	0	0.00	0.00	0	0	2.61	2.61	22,863	10,523
11	0.29	0.29	0.29	2,540	1,169	0	0	0	0	0	0	0.00	0.00	0	0	0.29	0.29	2,540	1,169
12	0.00	0.00	0.00	0				0	0			0.00	0.00			0.00	0.00	0	
13	2.90	2.90	2.90	25,404	11,693	0	0	0	0	0	0	0.00	0.00	0	0	2.90	2.90	25,404	11,693
14	0.00	0.00	0.00	0				0	0			0.00	0.00			0.00	0.00	0	
Totals	31.03	30.91	30.90	270,691	124,480			0	0			0.00	0.00	0	0	30.91	30.90	270,691	124,480

Post-Retrofit Demand and Energy Consumption

Fixture ID	Lighting Demand and Energy Consumption (am) Connected kW	(an) FCM Diversified kW Summer	(ao) FCM Diversified kW Winter	(ap) Annual kWh	(aq) Peak kWh	Interactive Hours (ar) Cooling Hours	(as) Heating Hours	Interactive Energy Consumption (at) Cooling kWh	(au) Heating kWh	On-Peak Interactive Hours (av) Cooling Hours	(aw) Heating Hours	On-Peak Interactive Demand and Energy Consumption (ax) FCM Diversified kW Summer	(ay) FCM Diversified kW Winter	(az) Cooling kWh	(ba) Heating kWh	Lighting and Interactive Demand and Energy Consumption (bb) FCM Diversified kW Summer	(bc) FCM Diversified kW Winter	(bd) Annual kWh	(be) Peak kWh
1	1.38	1.34	1.34	11,823	5,418	0	0	0	0	0	0	0.00	0.00	0	0	1.34	1.34	11,823	5,418
2	1.50	0.34	1.50	8,622	2,923	0	0	0	0	0	0	0.00	0.00	0	0	0.34	1.50	8,622	2,923
3	2.10	2.10	2.10	18,311	8,416	0	0	0	0	0	0	0.00	0.00	0	0	2.10	2.10	18,311	8,416
4	1.50	0.34	1.50	8,622	2,923	0	0	0	0	0	0	0.00	0.00	0	0	0.34	1.50	8,622	2,923
5	2.10	2.10	2.10	18,396	8,467	0	0	0	0	0	0	0.00	0.00	0	0	2.10	2.10	18,396	8,467
6	1.50	0.34	1.50	8,622	2,923	0	0	0	0	0	0	0.00	0.00	0	0	0.34	1.50	8,622	2,923
7	2.10	2.10	2.10	18,396	8,467	0	0	0	0	0	0	0.00	0.00	0	0	2.10	2.10	18,396	8,467
8	1.50	0.34	1.50	8,622	2,923	0	0	0	0	0	0	0.00	0.00	0	0	0.34	1.50	8,622	2,923
9	1.92	1.92	1.92	16,819	7,741	0	0	0	0	0	0	0.00	0.00	0	0	1.92	1.92	16,819	7,741
10	1.68	0.38	1.68	9,656	3,274	0	0	0	0	0	0	0.00	0.00	0	0	0.38	1.68	9,656	3,274
11	0.24	0.24	0.24	2,102	968	0	0	0	0	0	0	0.00	0.00	0	0	0.24	0.24	2,102	968
12	0.00	0.00	0.00	0				0	0			0.00	0.00			0.00	0.00	0	
13	1.80	1.80	1.80	15,768	7,258	0	0	0	0	0	0	0.00	0.00	0	0	1.80	1.80	15,768	7,258
14	0.00	0.00	0.00	0				0	0			0.00	0.00			0.00	0.00	0	
Totals	19.32	13.36	19.28	145,757	61,701			0	0			0.00	0.00	0	0	13.36	19.28	145,757	61,701

Total Savings Summary	Energy kWh	Summer kW	Winter kW	Connected kW
Annual Lighting Only	124,934	17.56	11.62	11.71
Annual Interactive	0	0.00	0.00	N/A
Annual Lighting and Interactive	124,934	17.56	11.62	11.71
On-Peak Lighting Only	62,779			
On-Peak Interactive	0			
On-Peak Lighting and Interactive	62,779			

	MMBTU
Annual Non-Electric Heating Savings	0

Savings Adjustment Factors						
Parameter	Annual KWH	Difference %	Summer kW	Difference %	Winter kW	Difference %
Gross (TRACKING) Savings	177,593	N/A	28.50	N/A	12.40	N/A
Adjustment - Documentation Change	0	0%	0.00	0%	0.00	0%
Adjustment - Technology Change	0	0%	0.00	0%	0.00	0%
Adjustment - Quantity Change	-5,869	-3%	-0.67	-2%	-0.67	-5%
Adjustment - Operation Change	-46,789	-26%	N/A	N/A	N/A	N/A
Adjustment - Coincident Change	N/A	N/A	-10.27	-36%	-0.11	-1%
Adjustment - Heating Interaction	0	0%	N/A	N/A	0.00	0%
Adjustment - Cooling Interaction	0	0%	0.00	0%	N/A	N/A
Adjustment - TOTAL	-52,659	-30%	-10.94	-38%	-0.78	-6%
Adjusted Gross (ONSITE) Savings	124,934	70%	17.56	62%	11.62	94%

Table 81: Summary of On-Site Energy and Demand Savings

Hour Ending	Average kW Reduction
1	11.5
2	11.5
3	11.5
4	11.5
5	11.5
6	11.6
7	11.6
8	18.7
9	19.3
10	19.3
11	19.3
12	19.3
13	19.3
14	19.3
15	19.3
16	19.3
17	12.3
18	11.6
19	11.6
20	11.6
21	11.4
22	11.4
23	11.4
24	11.6

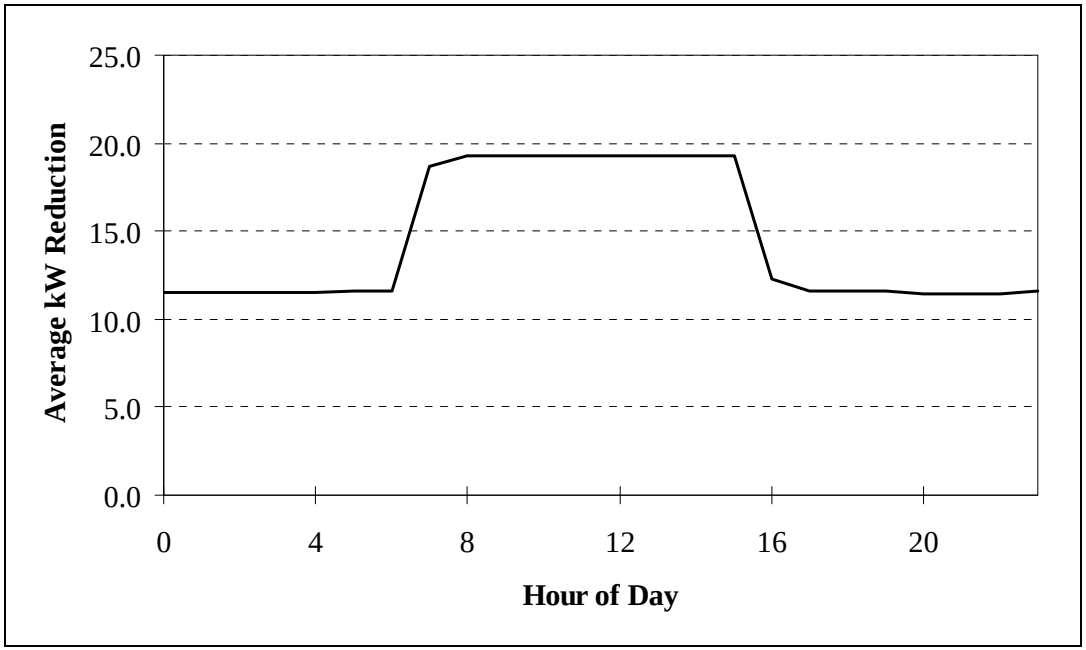

Table 82: Average Summer Weekday kW Reduction

Hour Ending	Average kW Reduction
1	11.5
2	11.5
3	11.5
4	11.5
5	11.5
6	11.6
7	11.6
8	11.6
9	18.1
10	19.3
11	19.3
12	19.3
13	19.3
14	19.3
15	19.3
16	11.6
17	11.6
18	11.6
19	11.6
20	11.6
21	11.4
22	11.4
23	11.4
24	11.6

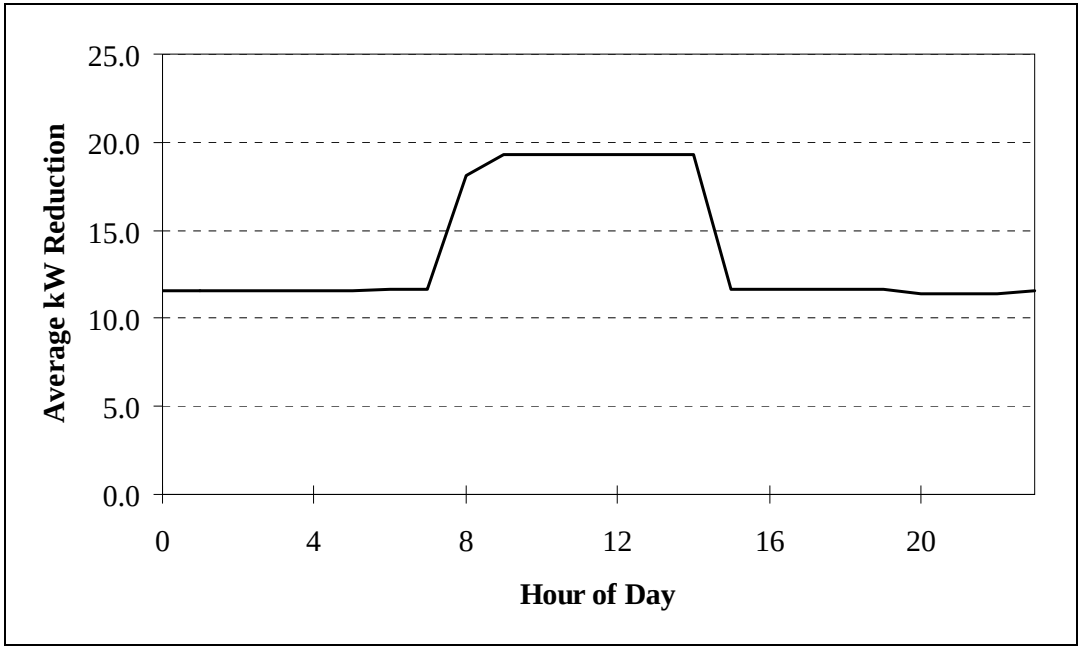

Table 83: Average Winter Weekday kW Reduction

Column Definitions for Lighting Calculations
(a) Brief description of area where lighting is installed

Pre-retrofit Lighting			Post-retrofit Lighting		
(b) Description of fixture type			(i) Description of fixture type		
(c) Fixture quantity from application documentation			(j) Fixture quantity from on-site inspection		
(d) Fixture wattage from application documentation			(k) Fixture wattage from application documentation		
(e) Annual hours of use	TMY2 Query	Eq. 1.1	(l) Annual hours of use	TMY2 Query	Eq. 1.1
(f) On-peak hours of use	TMY2 Query	Eq. 1.2	(m) On-peak hours of use	TMY2 Query	Eq. 1.2
(g) FCM Summer peak demand diversity factor	TMY2 Query	Eq. 1.3	(n) FCM Summer peak demand diversity factor	TMY2 Query	Eq. 1.3
(h) FCM Winter peak demand diversity factor	TMY2 Query	Eq. 1.4	(o) FCM Winter peak demand diversity factor	TMY2 Query	Eq. 1.4

HVAC Interaction Inputs	
(p) Electric cooling coefficient of performance	(r) Percent of space that is cooled
(q) Electric heating coefficient of performance	(s) Percent of space that is heated

Pre-retrofit Lighting Demand and Energy Consumption			Post-retrofit Lighting Demand and Energy Consumption		
(t) Connected lighting Demand	(t) = (c) x (d) / 1,000	Eq. 2.1	(am) Connected lighting Demand	(am) = (j) x (k) / 1,000	Eq. 3.1
(u) Summer diversified peak lighting demand (FCM)	(u) = (t) x (g)	Eq. 2.2	(an) Summer diversified peak lighting demand (FCM)	(an) = (am) x (n)	Eq. 3.2
(v) Winter diversified peak lighting demand (FCM)	(v) = (t) x (h)	Eq. 2.3	(ao) Winter diversified peak lighting demand (FCM)	(ao) = (am) x (o)	Eq. 3.3
(w) Annual energy consumption	(w) = (t) x (e)	Eq. 2.4	(ap) Annual energy consumption	(ap) = (am) x (l)	Eq. 3.4
(x) Annual On-peak energy consumption	(x) = (t) x (f)	Eq. 2.5	(aq) Annual On-peak energy consumption	(aq) = (am) x (m)	Eq. 3.5
(y) Annual cooling hours	TMY2 Qyery	Eq. 2.6	(ar) Annual cooling hours	TMY2 Query	Eq. 3.6
(z) Annual heating hours	TMY2 Qyery	Eq. 2.7	(as) Annual heating hours	TMY2 Query	Eq. 3.7
(aa) Electric cooling interactive energy effects	(aa) = (t) x (y) x (r) x 0.8 / (p)	Eq. 2.8	(at) Electric cooling interactive energy effects	(at) = (am) x (aq) x (r) x 0.8 / (p)	Eq. 3.8
(ab) Electric heating interactive energy effects	(ab) = -(t) x (z) x (s) x 0.8 / (q)	Eq. 2.9	(au) Electric heating interactive energy effects	(au) = -(am) x (as) x (s) x 0.8 / (q)	Eq. 3.9
(ac) Annual On-peak cooling hours	TMY2 Qyery	Eq. 2.10	(av) Annual On-peak cooling hours	TMY2 Query	Eq. 3.10
(ad) Annual On-peak heating hours	TMY2 Qyery	Eq. 2.11	(aw) Annual On-peak heating hours	TMY2 Query	Eq. 3.11
(ae) On-peak interactive cooling demand (FCM)	(ae) = (u) x (r) x 0.8 / (p)	Eq. 2.12	(ax) On-peak interactive cooling demand (FCM)	(ax) = (an) x (r) x 0.8 / (p)	Eq. 3.12
(af) On-peak interactive heating demand (FCM)	(af) = -(v) x (s) x 0.8 / (q)	Eq. 2.13	(ay) On-peak interactive heating demand (FCM)	(ay) = (ao) x (s) x 0.8 / (q)	Eq. 3.13
(ag) On-peak interactive electric cooling energy	(ag) = (t) x (ac) x (r) x 0.8 / (p)	Eq. 2.14	(az) On-peak interactive electric cooling energy	(az) = (am) x (av) x (r) x 0.8 / (p)	Eq. 3.14
(ah) On-peak interactive electric heating energy	(ah) = -(t) x (ad) x (s) x 0.8 / (q)	Eq. 2.15	(ba) On-peak interactive electric heating energy	(ba) = -(am) x (aw) x (s) x 0.8 / (q)	Eq. 3.15
(ai) Lighting and interactive summer demand (FCM)	(ai) = (u) + (ae)	Eq. 2.16	(bb) Lighting and interactive summer demand (FCM)	(bb) = (an) + (ax)	Eq. 3.16
(aj) Lighting and interactive winter demand (FCM)	(aj) = (v) + (af)	Eq. 2.17	(bc) Lighting and interactive winter demand (FCM)	(bc) = (ao) + (ay)	Eq. 3.17
(ak) Annual lighting and interactive energy consumption	(ak) = (w) + (aa) + (ab)	Eq. 2.18	(bd) Annual lighting and interactive energy consumption	(bd) = (ap) + (at) + (au)	Eq. 3.18
(al) Annual on-peak lighting and interactive energy consumption	(al) = (x) + (ag) + (ah)	Eq. 2.19	(be) Annual on-peak lighting and interactive energy consumption	(be) = (aq) + (az) + (ba)	Eq. 3.19

Total Savings Summary					
Annual Lighting Only Energy Consumption	Σ (w) - Σ (ap)	Eq. 4.1	Annual Lighting and Interactive Energy Consumption	Σ (ak) - Σ (bd)	Eq. 4.8
Annual Lighting Only Summer Demand (FCM)	Σ (u) - Σ (an)	Eq. 4.2	Annual Lighting and Interactive Summer Demand (FCM)	Σ (ai) - Σ (bb)	Eq. 4.9
Annual Lighting Only Winter Demand (FCM)	Σ (v) - Σ (ao)	Eq. 4.3	Annual Lighting and Interactive Winter Demand (FCM)	Σ (aj) - Σ (bc)	Eq. 4.10
Annual Lighting Only Connected Demand	Σ (t) - Σ (am)	Eq. 4.4	On-Peak Lighting Only Energy Consumption	Σ (x) - Σ (aq)	Eq. 4.11
Annual Interactive Energy Consumption	[Σ (aa) - Σ (at)] + [Σ (ab) - Σ (au)]	Eq. 4.5	On-Peak Interactive Energy Consumption	[Σ (ag) - Σ (az)] + [Σ (ah) - Σ (ba)]	Eq. 4.12
Annual Interactive Summer Demand (FCM)	Σ (ae) - Σ (ax)	Eq. 4.6			
Annual Interactive Winter Demand (FCM)	Σ (af) - Σ (ay)	Eq. 4.7			

Site 10, Application ID: 532719

Facility Type: Manufacturing

Summary

A lighting retrofit of a manufacturing facility was done to replace older inefficient lighting fixtures with new more efficient fixtures. Included in the retrofit are labs, offices and manufacturing space. A total of (697) older technology lighting fixtures were replaced with new high efficiency fixtures. The existing fixtures were replaced by various size high efficiency T8 lamps and ballasts.

Also included in this project were (17) occupancy sensors that were to be installed mostly in private offices. The total connected load of the rooms that had occupancy sensors installed was 4.1 kW out of a total connected load of 50.5 kW. The occupancy sensors accounted for approximately 10% of the total tracking savings.

A count of fixtures taken during the on-site visit revealed that installed quantities and types of lighting fixtures closely matched the proposed quantities and fixture types.

Table 84 presents the summary of the tracking and on-site savings results.

Savings Quantity	Tracking Estimate	On-site Savings	Evaluated/ Tracking
Annual Energy (kWh)	120,638	171,118	142%
% Energy Savings On-Peak	60%	61%	101%
Summer Peak Diversified kW	26.41	31.81	120%
Winter Peak Diversified kW	26.41	21.87	83%

Table 84: Summary of Tracking and On-site Savings Results

The overall on-site savings estimate is 42% higher than predicted in the tracking estimate. The on-site estimate of summer peak diversified kW was higher than the tracking value and the on-site estimate of winter peak diversified kW was lower than the tracking value. The following factors influenced the difference between the tracking and on-site estimates of energy and demand savings:

- The majority of the increase in savings was the result of higher annual hours of use. The tracking estimate of savings estimated a weighted average of the operating hours of

all the installed fixtures to be 4,284 hours per year prior to the installation of occupancy sensors. The monitoring data combined with reported operating schedules reveal that the weighted average of the post-installation operating hours are 5,653 hours per year without occupancy sensors. This increase in annual operating hours results in the annual savings being increased by 42,155 kWh.

- There was also an increase in savings resulting from the interaction between the new lighting and the facility's HVAC systems. The entire facility is air-conditioned using several rooftop packaged DX units. The decrease in lighting wattage resulting from this efficiency measure results in less heat going into the air-conditioned space. Therefore, additional savings are realized from the reduced cooling requirements of the building. It is estimated that the added benefit is equal to 11,302 kWh per year.

- There was a decrease in savings equal to approximately 2% of the tracking savings resulting from a smaller reduction of operating hours associated with the installed occupancy sensors. Evaluators identified all of the occupancy sensors that were proposed to be installed in the tracking savings. However, the evaluation found that the total annual hours of use reduced was lower than the tracking estimate. The tracking savings estimated the weighted average reduction of annual hours to be 231 hours per year while the evaluation found this reduction in operating hours to be 192 hours per year. The result is an annual decrease in savings equal to 2,024 kWh per year.

- There were some minor discrepancies between the tracking and on-site estimates related to quantities and technologies of fixtures installed. Specifically, the on-site visit found (3) fewer two lamp F59/T8/HO fixtures than proposed in the tracking estimate of savings and one more of each of the two lamp F59/T8 fixtures, two lamp F32/T8/LP fixtures and three lamp F32/T8/LP fixtures. Additionally, the evaluation found (2) two lamp F59/T8 fixtures in a room that was proposed to have (2) three lamp F32/T8/LP fixtures and (1) two lamp F32/T8/LP fixture in a room that was proposed to have a one lamp F32/T8/LP fixture. These small discrepancies resulted in a reduction in savings equal to 953 kWh per year.

- The on-peak kWh savings was estimated to be 61% of the annual on-site kWh savings. This value is consistent with the tracking estimate for on-peak kWh savings of 60%. The on-peak period defined by National Grid is non-holiday weekdays between 6 am and 10 pm.

- The summer diversified kW reduction was 31.81 kW or 20% higher than predicted in the tracking estimate. The increase is due to the interactive effects of the new lighting on the facility's HVAC system as described above. The savings associated with reduced cooling loads is equal to 6.09 kW. The winter diversified kW reduction was 21.87 kW or 17% lower than the tracking estimate. The reason for this decrease is that the tracking savings estimated the lights to operate 100% of the time during the defined winter peak period. The monitoring data shows that the weighted average winter diversity factor is 75%. Though most of the facility operates three shifts, the office areas usually shut down around 5 pm each day. Therefore, this section of the building does not contribute to the winter peak kW reduction.

Project Description

This project was completed under the Energy Initiative program. Table 85 presents a summary of the existing system as outlined in the customer application.

Existing Case				
Space	**Fixture Type**	**Wattage**	**Quantity**	**Annual Hours**
Cafeteria	Two Lamp F40/T12	80	17	8,760
Conference Rm	Two Lamp F40/T12	80	6	1,200
Conference Rm	Four Lamp F40/T12	160	3	1,200
Facilities Office	Two Lamp F40/T12	80	8	3,640
Facilities Office	Three Lamp F32/T8	88	5	3,640
Laboratory	Two Lamp F40/T12	80	7	3,640
Laboratory	Three Lamp F32/T8	88	12	3,640
Laboratory	Four Lamp F40/T12	160	2	3,640
Lobby/Reception	Two Lamp F32/T8	60	4	8,760
Manufacturing/Production	Two Lamp F40/T12	80	138	4,795
Manufacturing/Production	Two Lamp F32/T8	60	9	5,700
Manufacturing/Production	Two Lamp F96/T12	138	68	7,218
Manufacturing/Production	Two Lamp F96/T12/HO	227	46	3,367
Manufacturing/Production	Three Lamp F32/T8	88	49	4,930
Manufacturing/Production	Four Lamp F32/T8	112	28	3,640
Manufacturing/Production	Four Lamp F40/T12	160	17	4,160
Open Office	Two Lamp F40/T12	80	51	3,640
Open Office	Two Lamp F32/T8	60	1	3,640
Open Office	Four Lamp F40/T12	160	31	3,640
Private Office	Two Lamp F40/T12	80	45	2,271
Private Office	Three Lamp F32/T8	88	3	2,600
Private Office	Four Lamp F40/T12	160	2	2,600
Pump Room	Two Lamp F40/T12	80	10	3,453
Pump Room	Two Lamp F96/T12	138	3	3,640
Pump Room	Two Lamp F96/T12/HO	227	11	3,640
Pump Room	Three Lamp F32/T8	88	46	4,680
Pump Room	Four Lamp F32/T8	112	2	4,680
Pump Room	Four Lamp F40/T12	160	15	3,500
Restroom	Two Lamp F40/T12	80	4	8,760
Restroom	Two Lamp F32/T8	60	31	8,760
Storage	Two Lamp F40/T12	80	8	1,333
Storage	Two Lamp F96/T12	138	2	1,000
Storage	Two Lamp F96/T12/HO	227	13	1,667
	Total	76,864	697	NA

Table 85: Existing Lighting System

Table 86 presents the installed fixtures and quantities as proposed in the customer application.

Installed Case				
Space	**Fixture Type**	**Wattage**	**Quantity**	**Annual Hours**
Cafeteria	Two Lamp F32/T8/LP	45	17	3,000
Conference Rm	Two Lamp F32/T8/LP	45	6	1,200
Conference Rm	Four Lamp F32/T8/LP	89	3	1,200
Facilities Office	Two Lamp F32/T8/LP	45	8	3,640
Facilities Office	Three Lamp F32/T8/LP	68	5	3,640
Laboratory	Two Lamp F32/T8/LP	45	7	3,640
Laboratory	Three Lamp F32/T8/LP	68	12	3,640
Laboratory	Four Lamp F32/T8/LP	89	2	3,640
Lobby/Reception	Two Lamp F32/T8/LP	45	4	8,760
Manufacturing/Production	Two Lamp F32/T8/LP	45	10	5,440
Manufacturing/Production	Two Lamp F32/T8/LP	45	137	4,436
Manufacturing/Production	Two Lamp F59/T8	100	68	7,218
Manufacturing/Production	Two Lamp F59/T8/HO	160	46	3,367
Manufacturing/Production	Three Lamp F32/T8/LP	68	49	4,930
Manufacturing/Production	Four Lamp F32/T8/LP	89	45	4,056
Open Office	Two Lamp F32/T8/LP	45	14	3,640
Open Office	Two Lamp F32/T8/LP	45	38	3,640
Open Office	Four Lamp F32/T8/LP	89	31	3,640
Private Office	Two Lamp F32/T8/LP	45	12	1,133
Private Office	Two Lamp F32/T8/LP	45	33	1,636
Private Office	Three Lamp F32/T8/LP	68	3	1,400
Private Office	Four Lamp F32/T8/LP	89	2	1,400
Pump Room	Two Lamp F32/T8/LP	45	4	4,680
Pump Room	Two Lamp F32/T8/LP	45	6	1,000
Pump Room	Two Lamp F59/T8	100	3	3,640
Pump Room	Two Lamp F59/T8/HO	160	11	1,945
Pump Room	Three Lamp F32/T8/LP	68	46	4,680
Pump Room	Four Lamp F32/T8/LP	89	17	3,058
Restroom	One Lamp F32/T8/LP	24	1	8,760
Restroom	Two Lamp F32/T8/LP	45	29	8,760
Restroom	Two Lamp F32/T8/LP	45	5	8,760
Storage	Two Lamp F32/T8/LP	45	8	1,333
Storage	Two Lamp F59/T8	100	2	1,000
Storage	Two Lamp F59/T8/HO	160	13	1,667
	Total	50,454	697	NA

Table 86: Installed Lighting System

Evaluation Methodology

Tracking Estimates

The tracking estimates of energy use were calculated based on the full load of the existing and proposed fixtures. The spaces with occupancy sensors were reported to reduce operating hours by an average of 231 hours per year. The energy savings were calculated as the difference in the pre and post installation energy use. The occupancy sensors accounted for approximately 10% of the total tracking savings.

Evaluation Approach

The evaluation included a verification of installed fixtures, on-site monitoring and interview. All fixtures are controlled by wall switches with the exception of all of the private offices, server room, phone room and a pump room, which had occupancy sensors installed.

The base case used in the evaluation of the lighting savings was developed from information contained in the customer application. The pre-existing fixture types were confirmed while on-site with the facility contact. Evaluators visited the facility to verify the installed fixtures and install monitoring equipment to quantify the hours of use of the different spaces. Evaluators surveyed facility personnel to obtain information on the lighting usage throughout the year. They also inquired about any HVAC equipment serving the space.

To determine the hours of use for the new fixtures, field evaluators installed nineteen time-of-use lighting loggers throughout the building. Six loggers were installed in manufacturing or production type areas, three in private offices, three in open offices, two in pump rooms and several other space types received one logger. Table 87 presents the fixtures monitored by the evaluation engineers.

Logger #	Equipment Monitored	Parameter Measured	Test Equip. Make & Model	Measurement Type	Installation Method	Frequency of Observations	Monitoring Duration
940629-234	Two Lamp F59/T8/HO	On/Off Operation	PS&T TOU Lighting Logger	Event Logger	Proximity	Based on Schedule	4/1/09 - 4/28/09
940629-239	Four Lamp F32/T8/LP	On/Off Operation	PS&T TOU Lighting Logger	Event Logger	Proximity	Based on Schedule	4/1/09 - 4/28/09
940629-240	Three Lamp F32/T8/LP	On/Off Operation	PS&T TOU Lighting Logger	Event Logger	Proximity	Based on Schedule	4/1/09 - 4/28/09
940629-241	Two Lamp F32/T8/LP	On/Off Operation	PS&T TOU Lighting Logger	Event Logger	Proximity	Based on Schedule	4/1/09 - 4/28/09
940629-258	Two Lamp F32/T8/LP	On/Off Operation	PS&T TOU Lighting Logger	Event Logger	Proximity	Based on Schedule	4/1/09 - 4/28/09
940629-259	Four Lamp F32/T8/LP	On/Off Operation	PS&T TOU Lighting Logger	Event Logger	Proximity	Based on Schedule	4/1/09 - 4/28/09
940629-260	Four Lamp F32/T8/LP	On/Off Operation	PS&T TOU Lighting Logger	Event Logger	Proximity	Based on Schedule	4/1/09 - 4/28/09
940629-297	Two Lamp F32/T8/LP	On/Off Operation	PS&T TOU Lighting Logger	Event Logger	Proximity	Based on Schedule	4/1/09 - 4/28/09
940629-362	Three Lamp F32/T8/LP	On/Off Operation	PS&T TOU Lighting Logger	Event Logger	Proximity	Based on Schedule	4/1/09 - 4/28/09
940629-372	Two Lamp F32/T8/LP	On/Off Operation	PS&T TOU Lighting Logger	Event Logger	Proximity	Based on Schedule	4/1/09 - 4/28/09
940824-008	Two Lamp F32/T8/LP	On/Off Operation	PS&T TOU Lighting Logger	Event Logger	Proximity	Based on Schedule	4/1/09 - 4/28/09
940824-033	Four Lamp F32/T8/LP	On/Off Operation	PS&T TOU Lighting Logger	Event Logger	Proximity	Based on Schedule	4/1/09 - 4/28/09
940824-036	Two Lamp F32/T8/LP	On/Off Operation	PS&T TOU Lighting Logger	Event Logger	Proximity	Based on Schedule	4/1/09 - 4/28/09
940824-062	Two Lamp F32/T8/LP	On/Off Operation	PS&T TOU Lighting Logger	Event Logger	Proximity	Based on Schedule	4/1/09 - 4/28/09
940824-063	Two Lamp F32/T8/LP	On/Off Operation	PS&T TOU Lighting Logger	Event Logger	Proximity	Based on Schedule	4/1/09 - 4/28/09
940824-064	Two Lamp F32/T8/LP	On/Off Operation	PS&T TOU Lighting Logger	Event Logger	Proximity	Based on Schedule	4/1/09 - 4/28/09
940824-074	Four Lamp F32/T8/LP	On/Off Operation	PS&T TOU Lighting Logger	Event Logger	Proximity	Based on Schedule	4/1/09 - 4/28/09
940824-094	Two Lamp F32/T8/LP	On/Off Operation	PS&T TOU Lighting Logger	Event Logger	Proximity	Based on Schedule	4/1/09 - 4/28/09
940824-100	Two Lamp F32/T8/LP	On/Off Operation	PS&T TOU Lighting Logger	Event Logger	Proximity	Based on Schedule	4/1/09 - 4/28/09

Table 87: Spaces Monitored

Verification of Equipment and Operating Parameters

The entire facility was retrofit with new low power T8 lighting. There were two, three and four lamp T12 fixtures that were replaced with two, three and four lamp low power T8 fixtures. This included both four and eight foot fixtures. Additionally, there were some existing standard efficiency T8 lamps and ballasts that were also replaced with low power T8 fixtures. Evaluators found that the quantities and fixture types closely matched those that were proposed in the tracking savings estimate. There were some minor discrepancies found which led to a reduction in savings of less than 1%. Table 88 presents the comparison between the tracking and evaluation fixture counts.

	Fixture Quantity	
Fixture Type	**Tracking**	**Evaluation**
One Lamp F59/T8/HO	0	1
Two Lamp F32/T8/LP	339	340
Two Lamp F59/T8	75	76
Two Lamp F59/T8/HO	70	67
Three Lamp F32/T8/LP	113	114
Four Lamp F32/T8/LP	100	100
Total	**697**	**698**

Table 88: Tracking vs. Evaluation Fixture Quantities

Evaluators found all of the occupancy sensors that were to be installed. These were identified mostly in private offices and some other types of rooms such as the server room and pump room.

The majority of the building operates three shifts year round. This includes most of the manufacturing and production areas. The operating hours begin Sunday at 9 pm and end Friday at midnight. The office areas operate Monday through Friday between 8 am and 5 pm. The facility observes eight holidays in which most of the building remains unoccupied. These include New Year's Day, Washington's Birthday, Memorial Day, Independence Day, Labor Day, Thanksgiving Day, Thanksgiving Friday and Christmas Day. The monitoring period did not cover any of the facility holidays. Therefore, evaluators assumed that each holiday would operate the same as a Sunday.

Table 89 presents the values obtained from the monitored data including annual operation, summer and winter diversity factors, and on-peak hours of use.

Schedule 20 represents the average private office schedule and was calculated as the average of Schedules 3, 4 and 15 or all the private office schedules. This schedule was used to calculate the energy savings for all the private offices. Each of these offices had an occupancy sensor in them. These were either installed as part of the program or were existing occupancy sensors. Schedule 21 was created to represent the baseline operation for private offices that had occupancy sensors installed as part of this program. All other private offices that had existing occupancy sensors used Schedule 20 for the pre- and post-installation hours of use.

Evaluators were unable to use a proxy schedule from a private office in the building that didn't have an occupancy sensor to use as the baseline profile for the offices that had occupancy sensors installed under this project because no such room fit this description at the site. Therefore, evaluators estimated that the baseline operation of the private office with occupancy sensors would operate during the same hours that were monitored, but the room would have the lights on 90% of the time between these hours. This assumes that the most of the private offices would have had their lights on for the duration of the work day without significant "off" time. This was the method used to develop Schedule 21.

Likewise, Schedule 6 represents the pump room that had an occupancy sensor installed. This schedule was used for the installed case while Schedule 19, which was a pump room without an occupancy sensor, was used as the baseline case for this and other similar spaces with occupancy sensors.

Schedule ID	Logger #	Description	Annual Hours	Summer Diversity	Winter Diversity	On-Peak Hours
1	940629-234	Measurement/Test Area	3,391	94%	61%	3,039
2	940629-239	Optics Lab	6,706	100%	100%	3,960
3	940629-240	Private Office w/ Occupancy Sensor	2,002	75%	1%	1,981
4	940629-241	Private Office w/ Occupancy Sensor	1,222	52%	5%	1,202
5	940629-258	Reception/Lobby	5,944	100%	100%	4,010
6	940629-259	Pump Room #4 w/ Occupancy Sensor	535	13%	1%	519
7	940629-260	Conference Room A	284	5%	1%	254
8	940629-297	Facilities Office	3,101	94%	33%	2,863
9	940629-362	Chamber Area #2	8,754	99%	100%	4,026
10	940629-372	Men's Restroom	8,701	100%	100%	4,032
11	940824-008	Chamber Area #1	7,568	100%	100%	4,024
12	940824-033	Cubicle Area	5,950	100%	100%	4,008
13	940824-036	Assembly Room Cubicles	7,042	100%	100%	4,022
14	940824-062	QC Aisle	7,042	100%	100%	4,022
15	940824-063	Private Office w/ Occupancy Sensor	678	30%	4%	672
16	940824-064	Assembly Area	7,040	100%	100%	4,019
17	940824-074	Lamination Room	8,280	100%	100%	4,028
18	940824-094	Cafeteria	5,272	100%	77%	3,600
19	940824-100	Pump Room #1	7,568	100%	100%	4,024
20	Average Private Office (OS)	Average Private Office (OS) - Avg Sched IDs 3,4 & 15	1,301	52%	4%	1,285
21	Average Private Office (Baseline)	Average Private Office (Baseline)	2,221	90%	4%	2,199

Table 89: Annual Hours of Use and Diversity Factors of Monitored Data

To estimate annual energy and demand savings, a spreadsheet method was employed. The summary of this spreadsheet is presented in Table 90. Annual hours and diversity factors from Table 89 are used with wattages from Table 90 to calculate energy and demand savings. The schedule ID's from Table 89 are presented in Table 90 to show which schedule was used with each fixture ID. The final on-site savings estimates are presented in Table 90.

The facility's heat is provided by natural gas which has no electrical interaction with the new lighting. However, because of the reduced heat going into the space due to the installation of more efficient lighting, there will be a need for additional heat from the facility's forced air system. It was estimated that this heating penalty is equal to approximately 308 MMBTU's per year. This was calculated using a heating efficiency of 74% for the forced air system. Likewise, the entire building is air-conditioned using rooftop packaged DX units. Evaluators calculated additional energy savings resulting from reduced cooling loads on the system. Evaluators assumed an efficiency rating of 1.2 kW/ton for the air-conditioning system.

The average daily lighting profiles for the all the monitored spaces are presented in Figure 164 through Figure 184. This includes the average weekday, weekend day and holiday. The x-axis represents one full day and the y-axis is the percentage that the lights are on for each hour.

An hourly summary of the site kW savings for an average summer (June through August), non-holiday, weekday is presented in Table 91. This summary is provided so that the summer diversified peak kW can be estimated across any range of hours in the event that the FCM definition for summer peak changes in the future. The same summary was also provided for the average winter (December and January), non-holiday, weekday in Table 92.

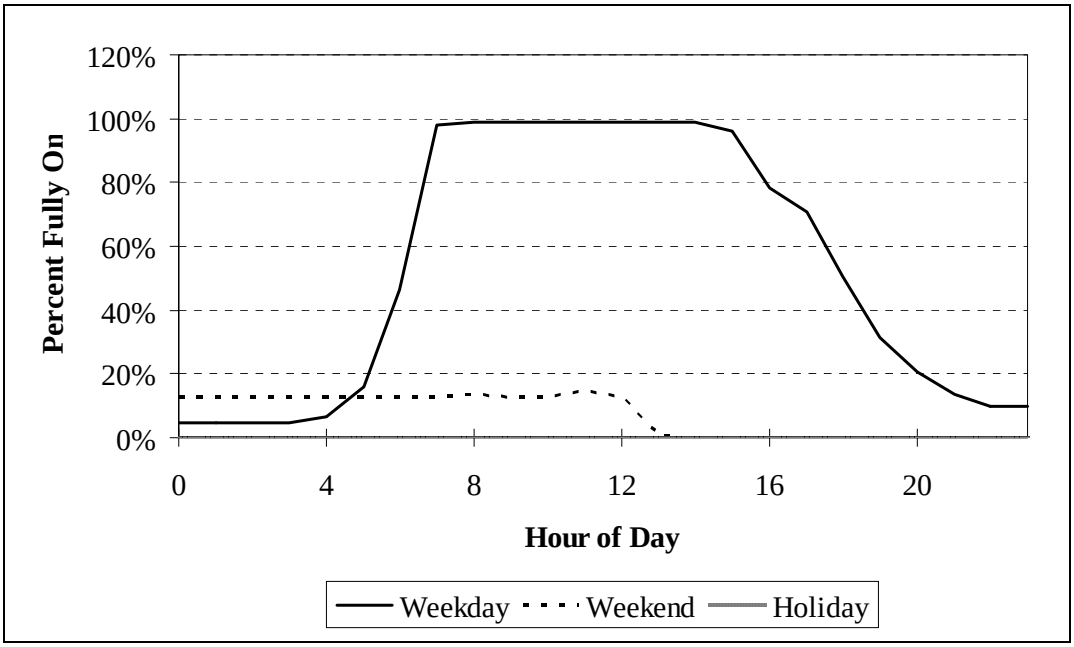

Figure 164: Average Daily Lighting Profile for Schedule 1 (Measurement/Test Area) from 4/1/09 to 4/28/09

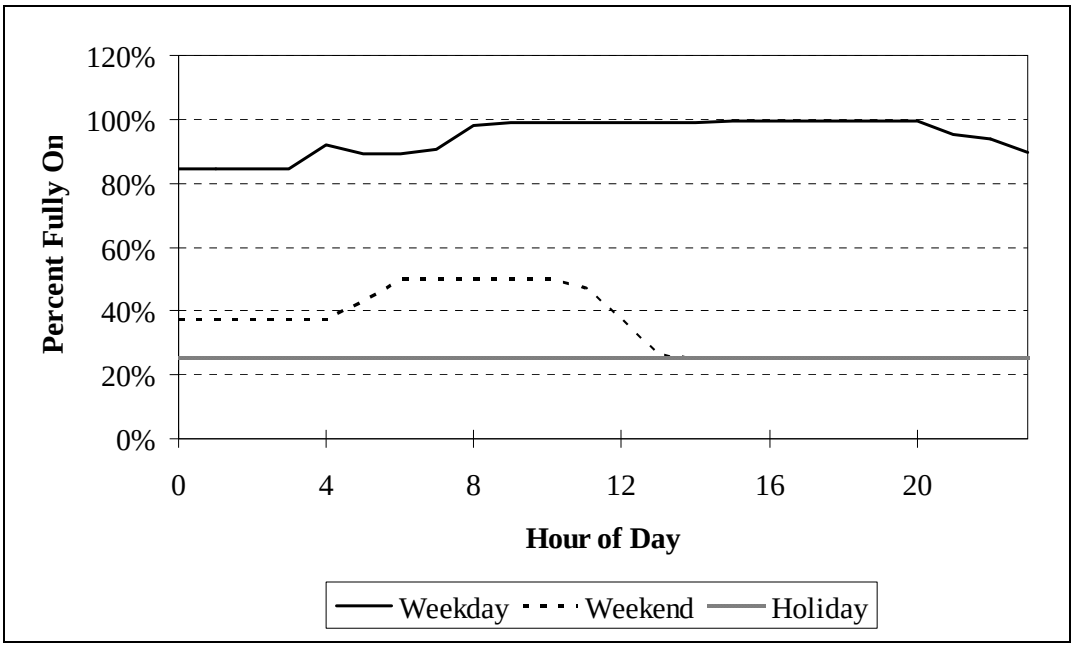

Figure 165: Average Daily Profile for Schedule 2 (Optics Lab) from 4/1/09 to 4/28/09

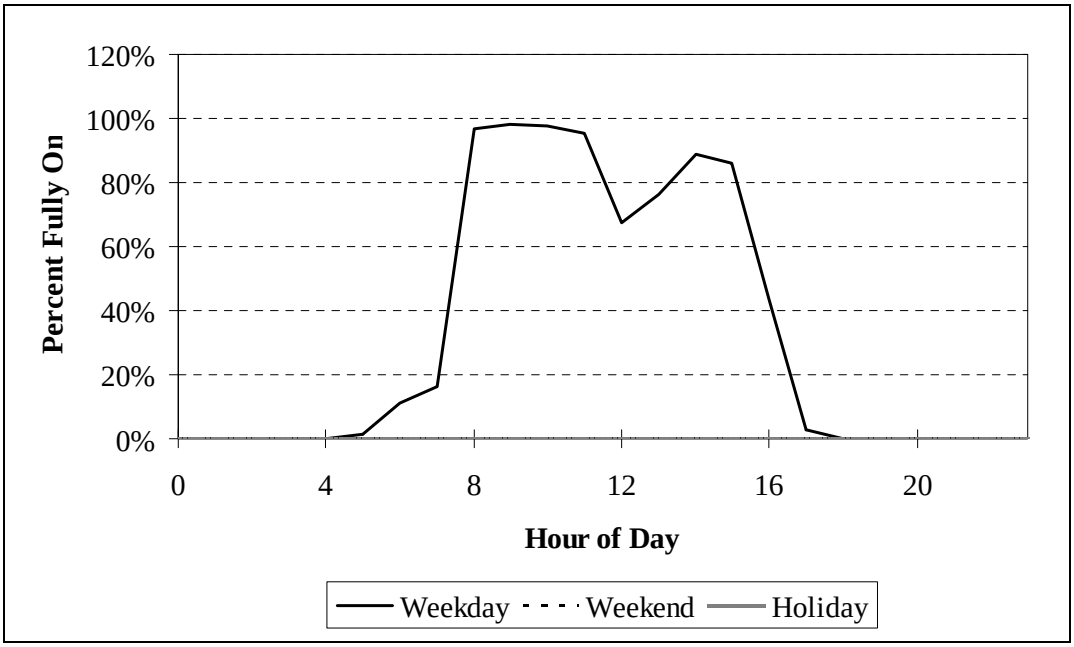

Figure 166: Average Daily Lighting Profile for Schedule 3 (Private Office w/ OS) from 4/1/09 to 4/28/09

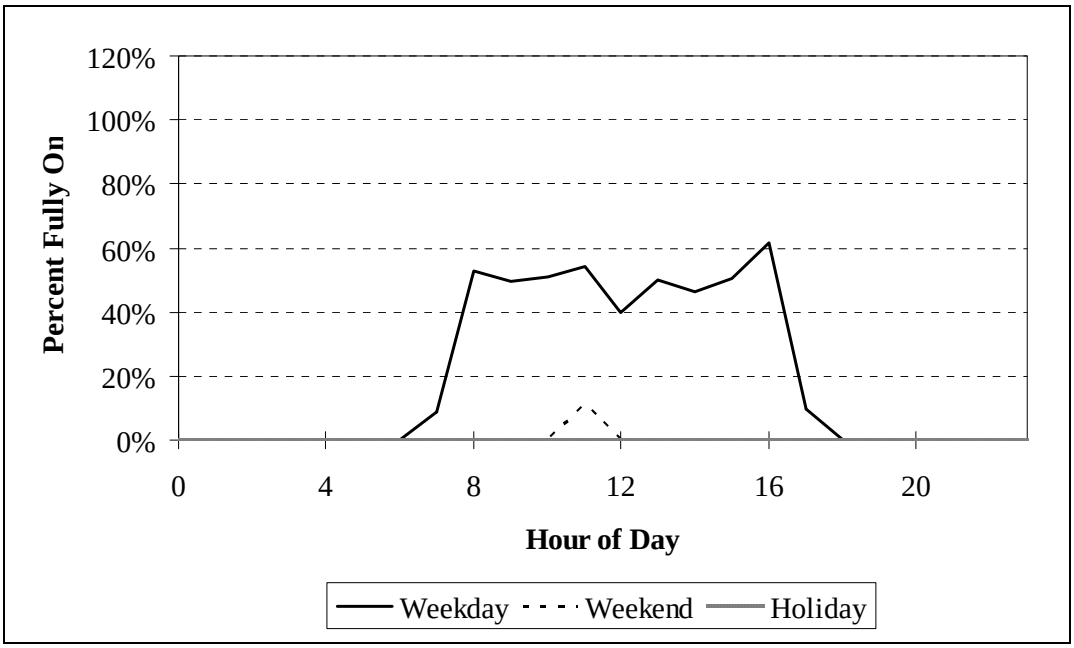

Figure 167: Average Daily Lighting Profile for Schedule 4 (Private Office w/ OS) from 4/1/09 to 4/28/09

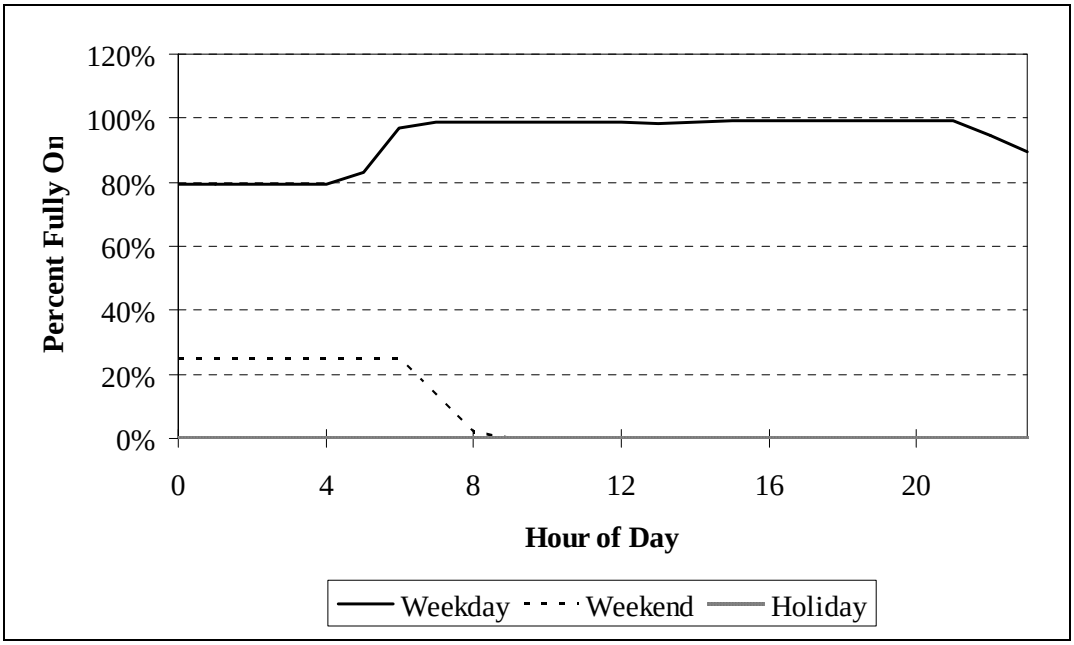

Figure 168: Average Daily Lighting Profile for Schedule 5 (Reception/Lobby) from 4/1/09 to 4/28/09

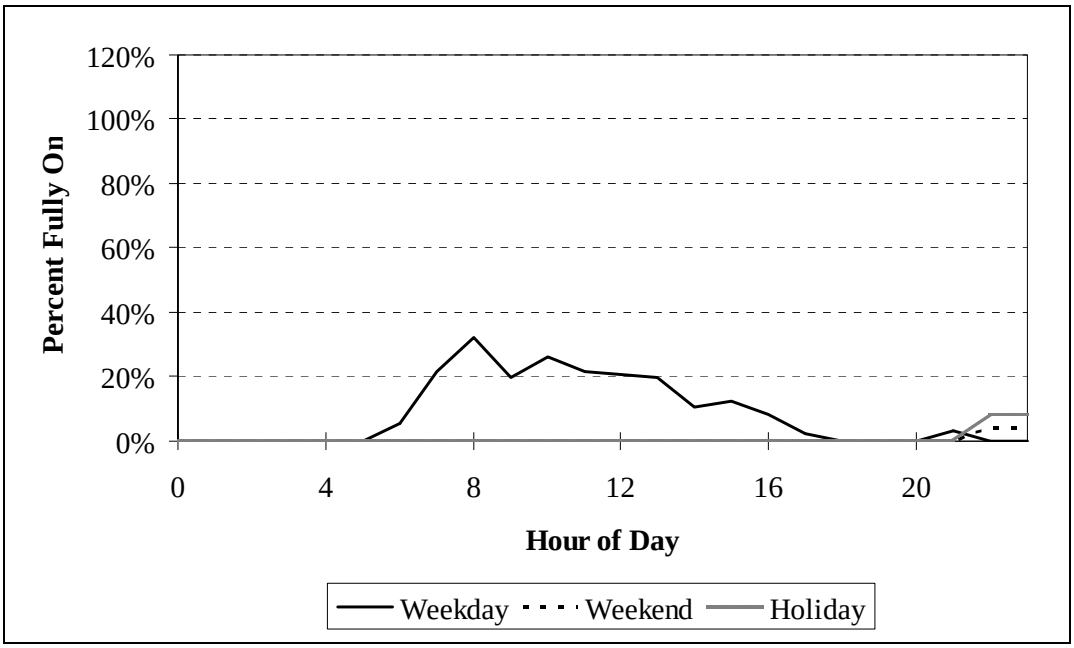

Figure 169: Average Daily Lighting Profile for Schedule 6 (Pump Room #4) from 4/1/09 to 4/28/09

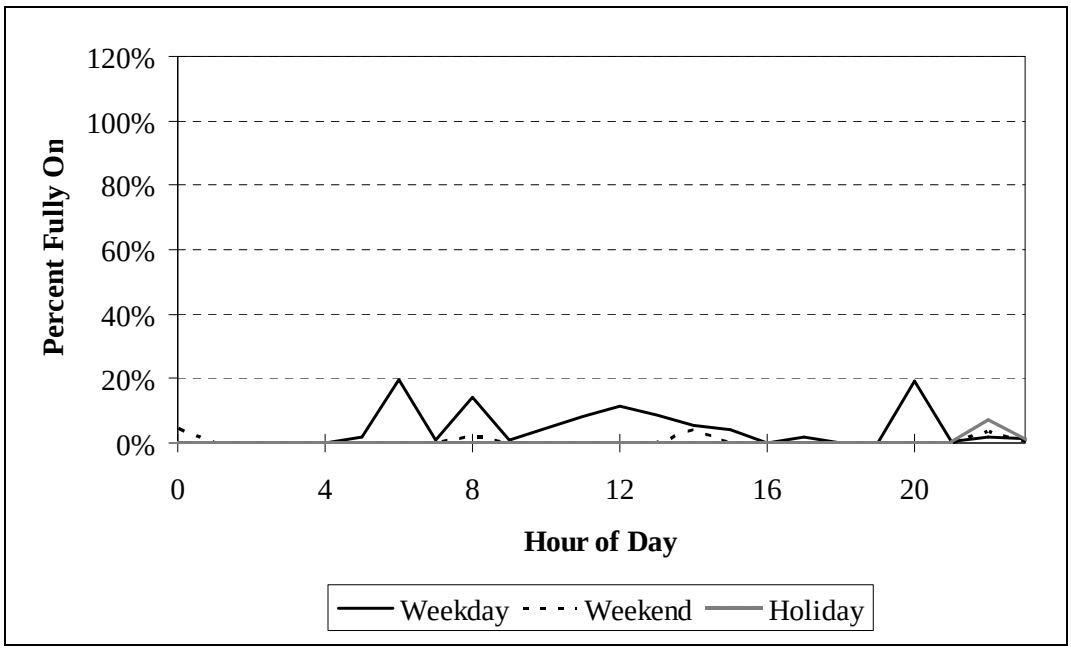

Figure 170: Average Daily Lighting Profile for Schedule 7 (Conference Room A) from 4/1/09 to 4/28/09

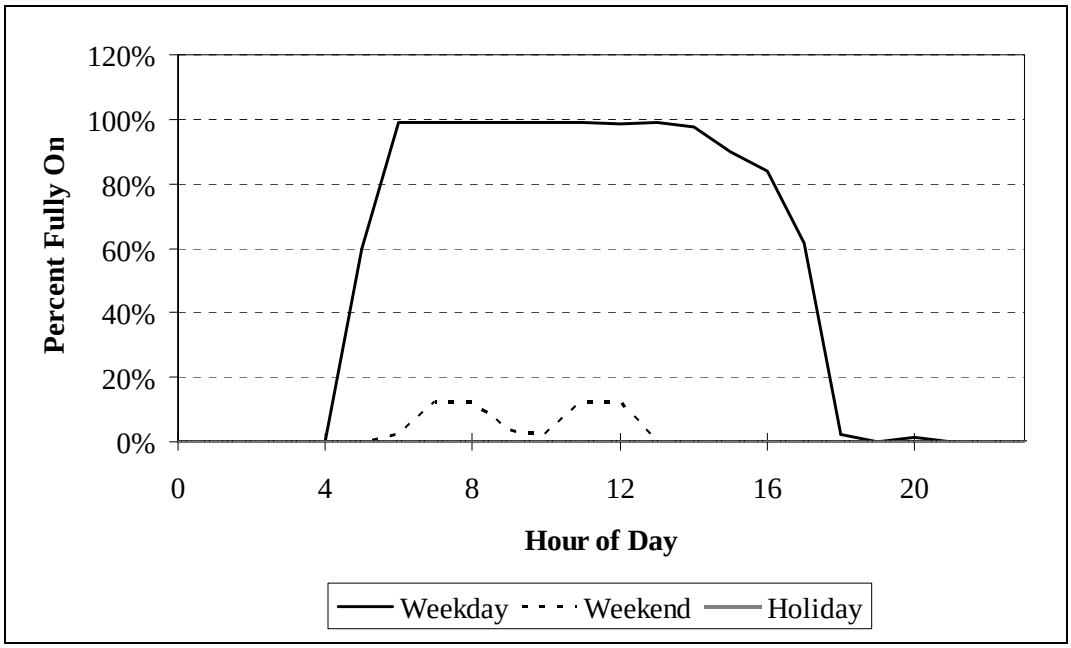

Figure 171: Average Daily Lighting Profile for Schedule 8 (Facilities Office) from 4/1/09 to 4/28/09

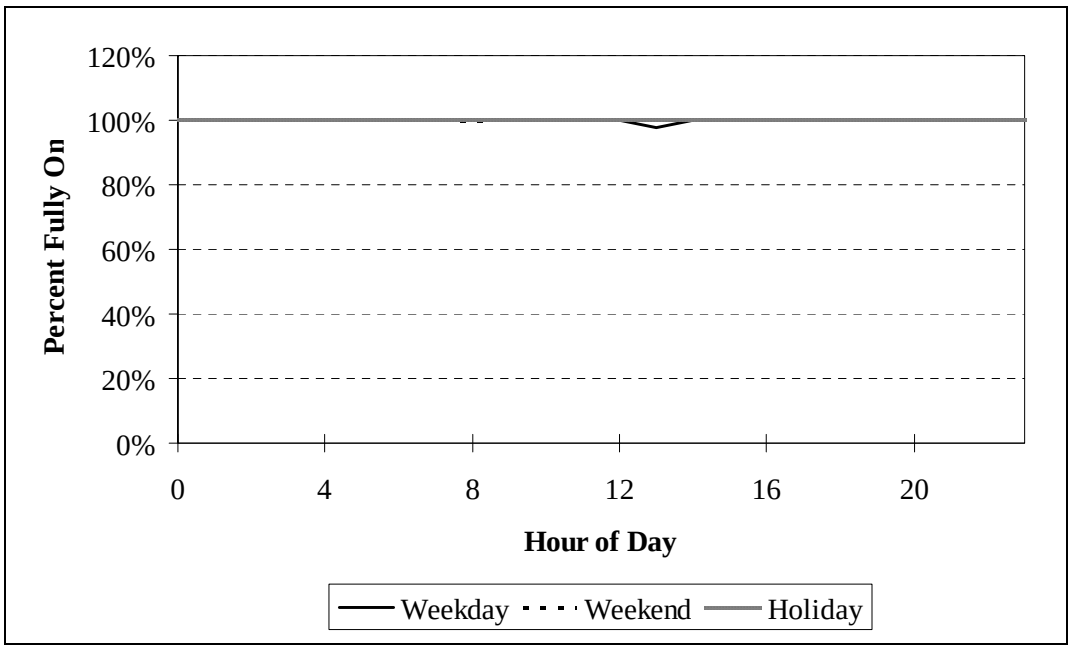

Figure 172: Average Daily Lighting Profile for Schedule 9 (Chamber Area #2) from 4/1/09 to 4/28/09

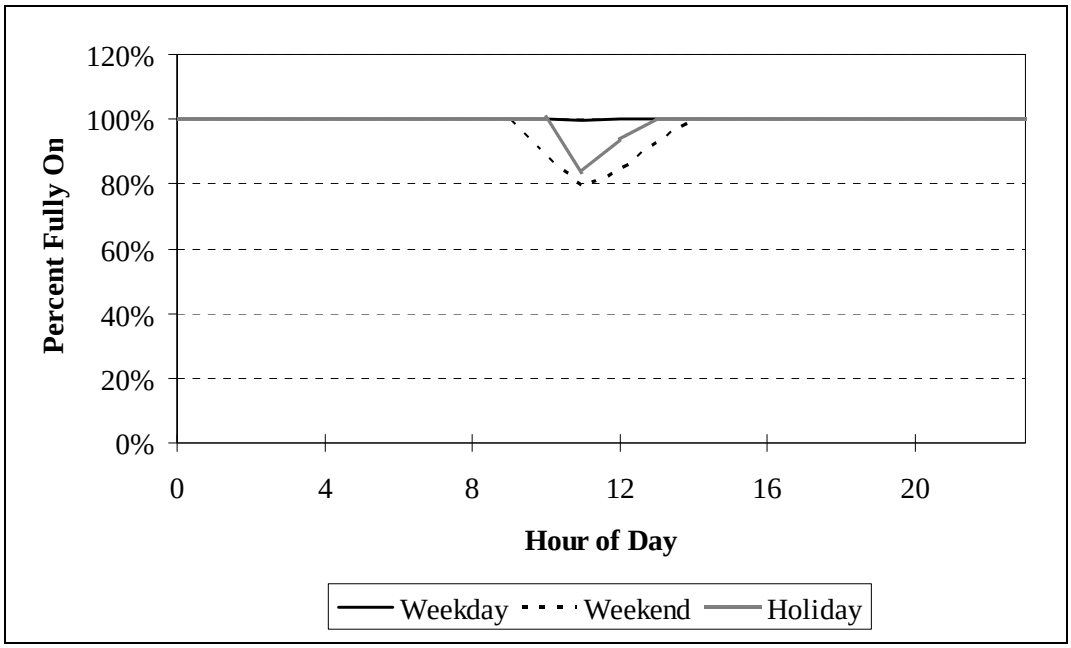

Figure 173: Average Daily Lighting Profile for Schedule 10 (Men's Restroom) from 4/1/09 to 4/28/09

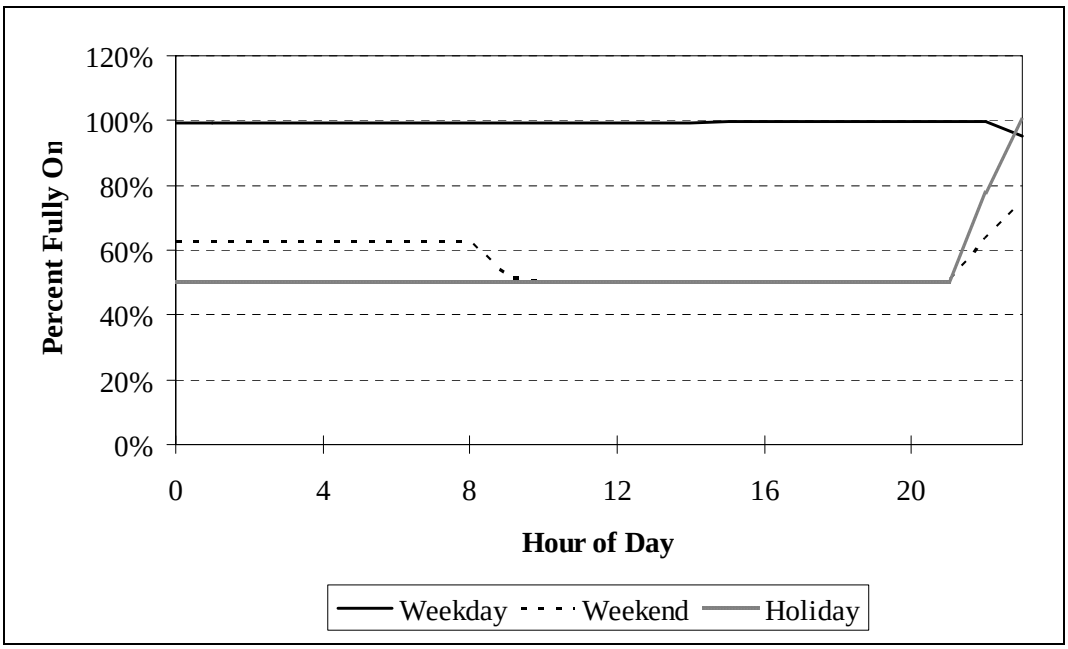

Figure 174: Average Daily Lighting Profile for Schedule 11 (Chamber Area #1) from 4/1/09 to 4/28/09

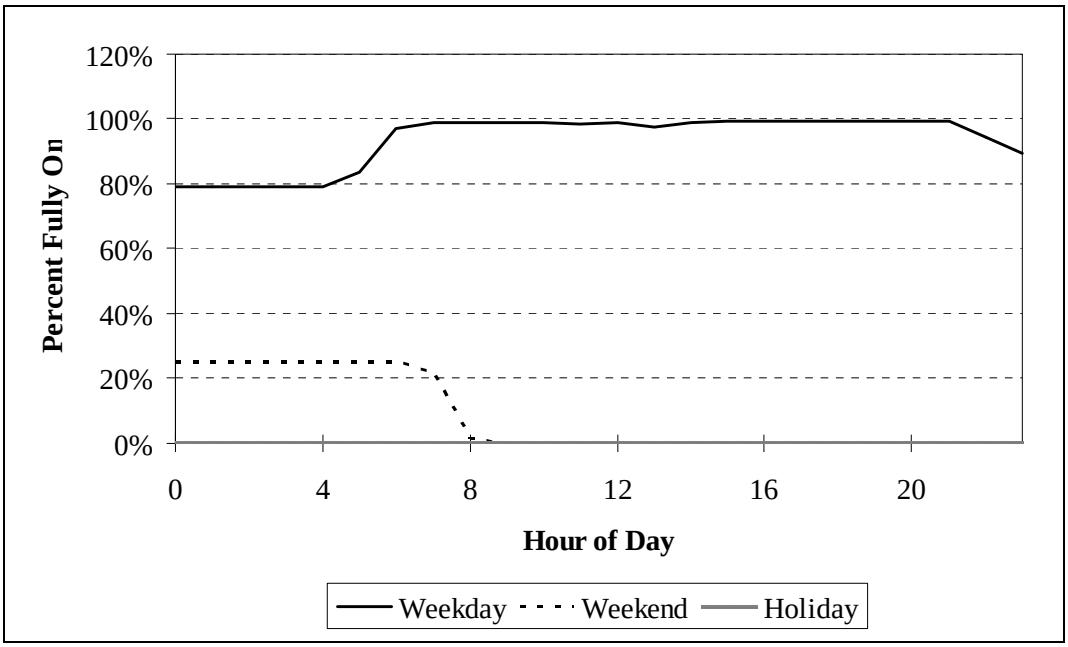

Figure 175: Average Daily Lighting Profile for Schedule 12 (Cubicle Area) from 4/1/09 to 4/28/09

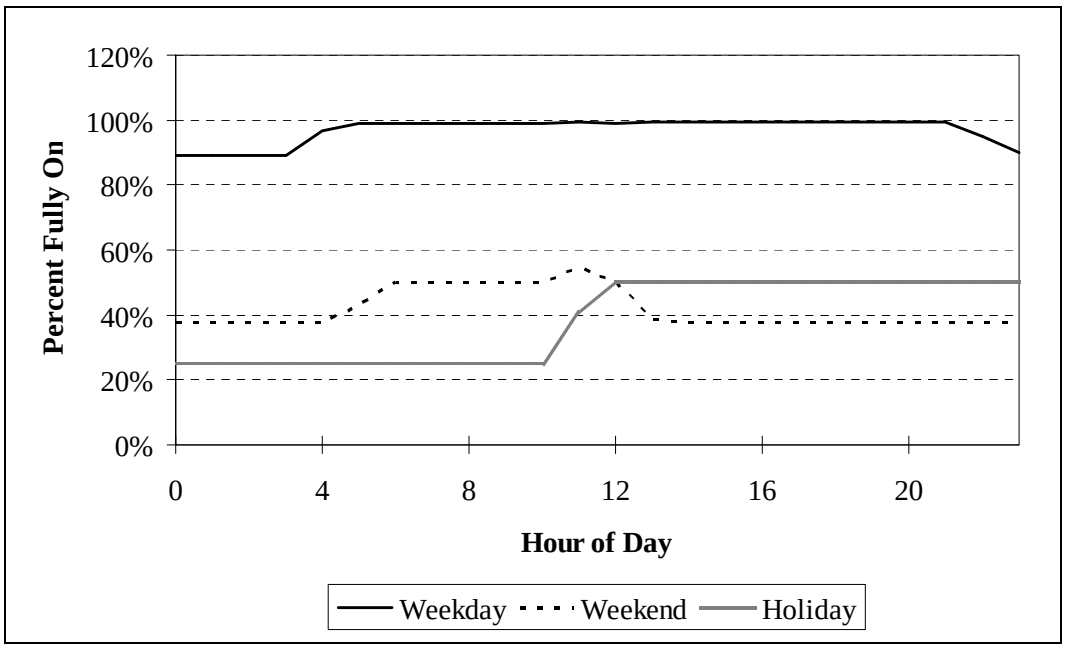

Figure 176: Average Daily Lighting Profile for Schedule 13 (Assembly Room Cubicles) from 4/1/09 to 4/28/09

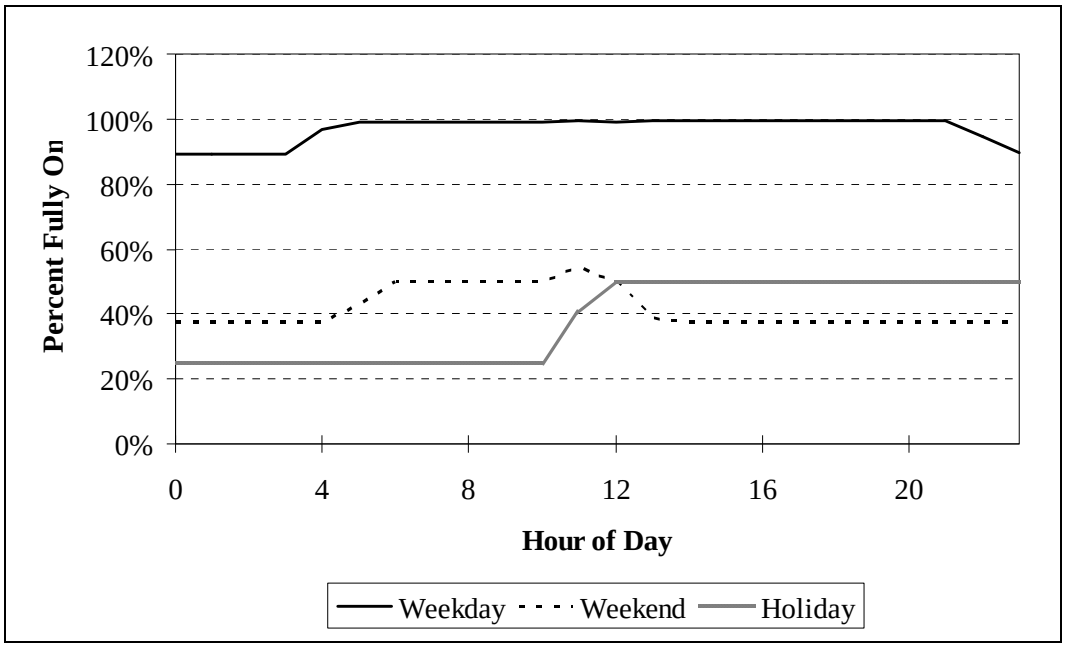

Figure 177: Average Daily Lighting Profile for Schedule 14 (QC Aisle) from 4/1/09 to 4/28/09

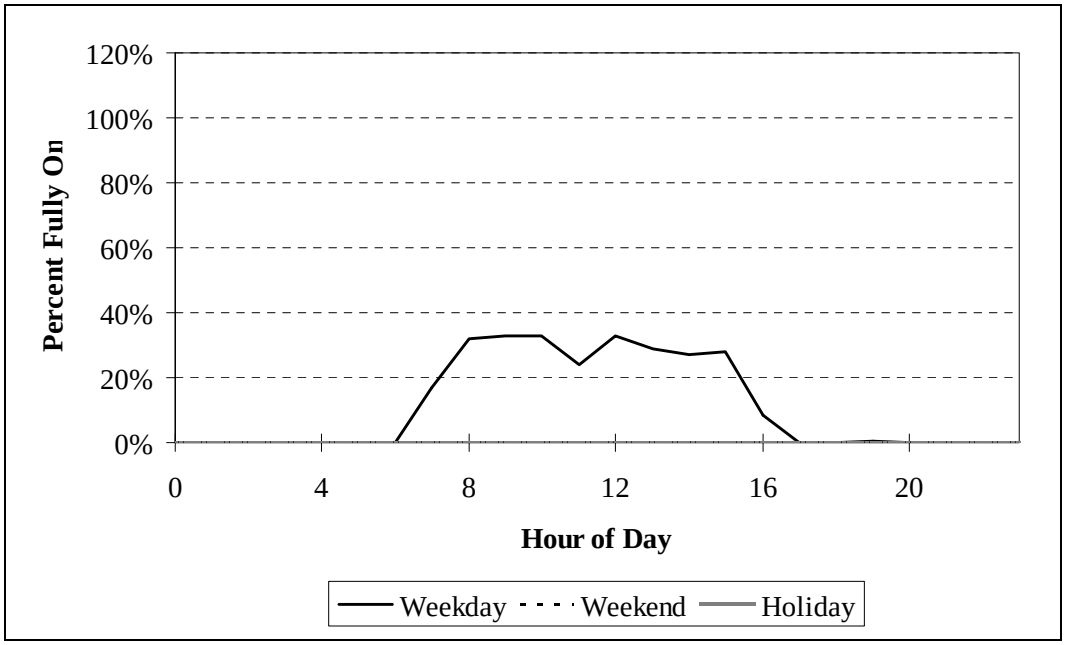

Figure 178: Average Daily Lighting Profile for Schedule 15 (Private Office w/ OS) from 4/1/09 to 4/28/09

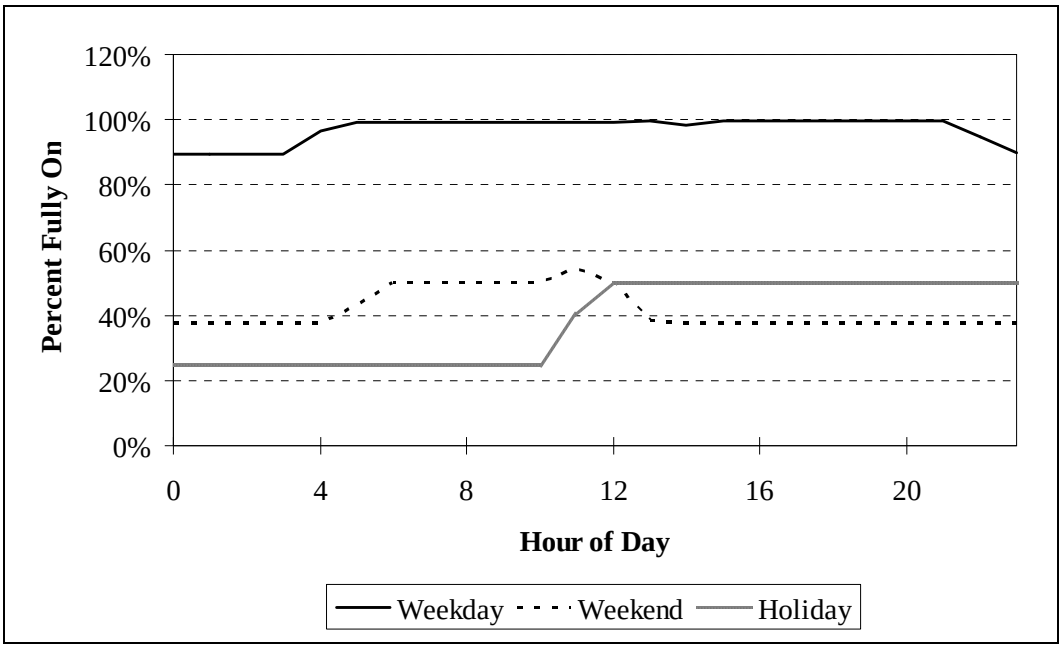

Figure 179: Average Daily Lighting Profile for Schedule 16 (Assembly Area) from 4/1/09 to 4/28/09

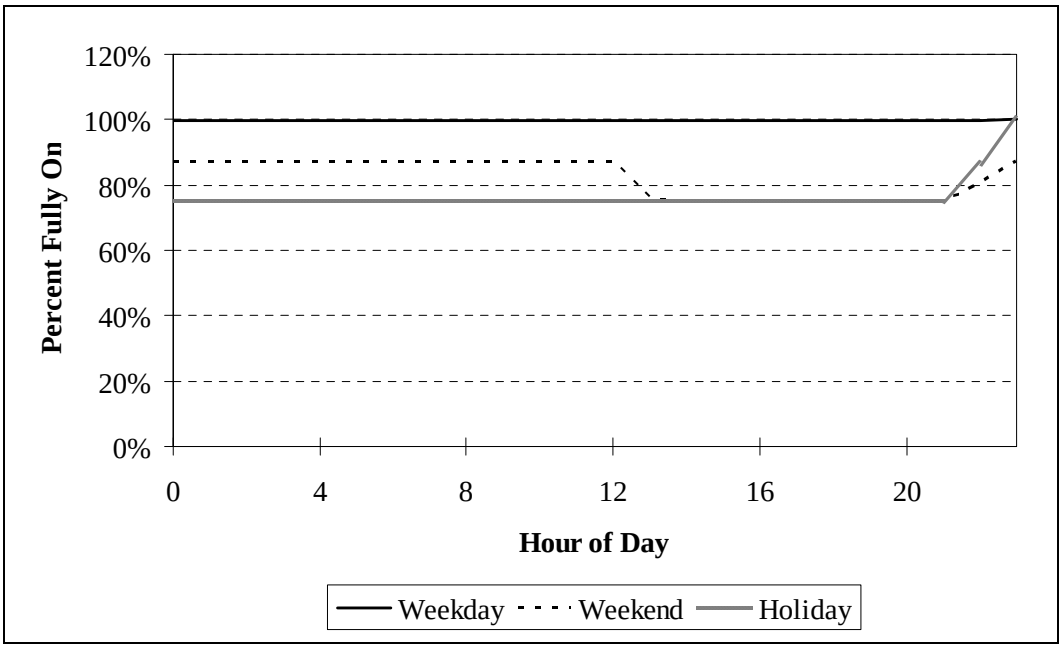

Figure 180: Average Daily Lighting Profile for Schedule 17 (Lamination Room) from 4/1/09 to 4/28/09

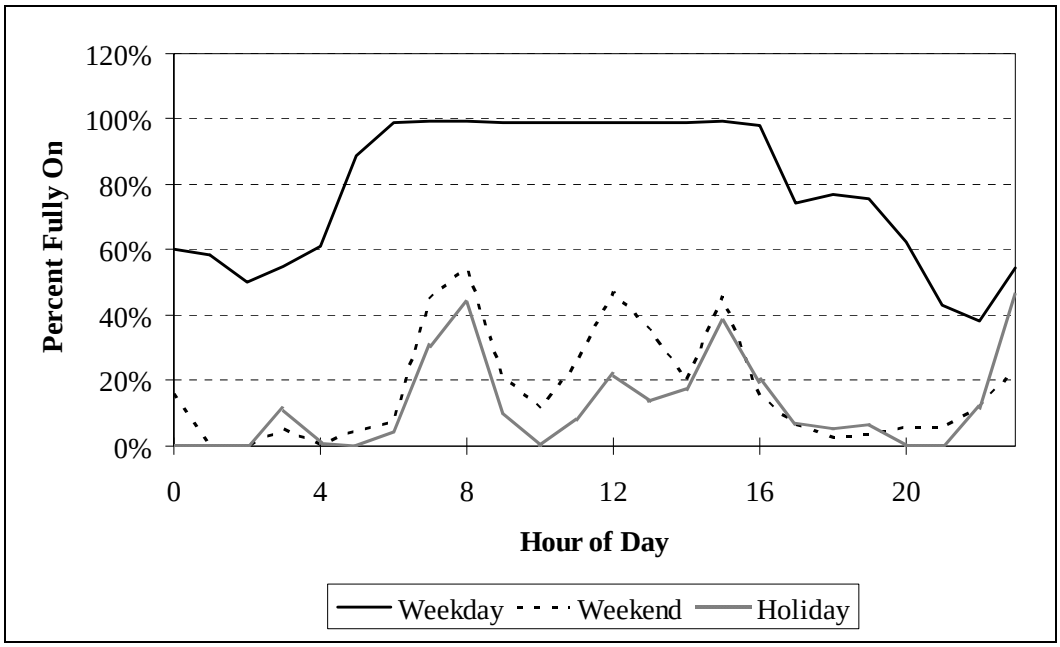

Figure 181: Average Daily Lighting Profile for Schedule 18 (Cafeteria) from 4/1/09 to 4/28/09

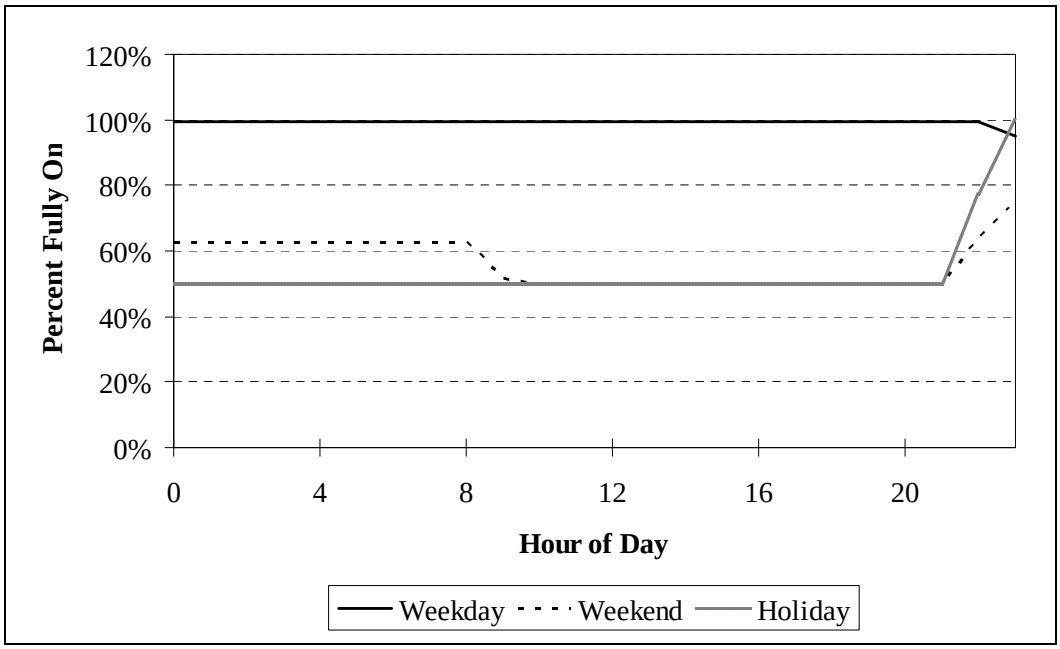

Figure 182: Average Daily Lighting Profile for Schedule 19 (Pump Room #1) from 4/1/09 to 4/28/09

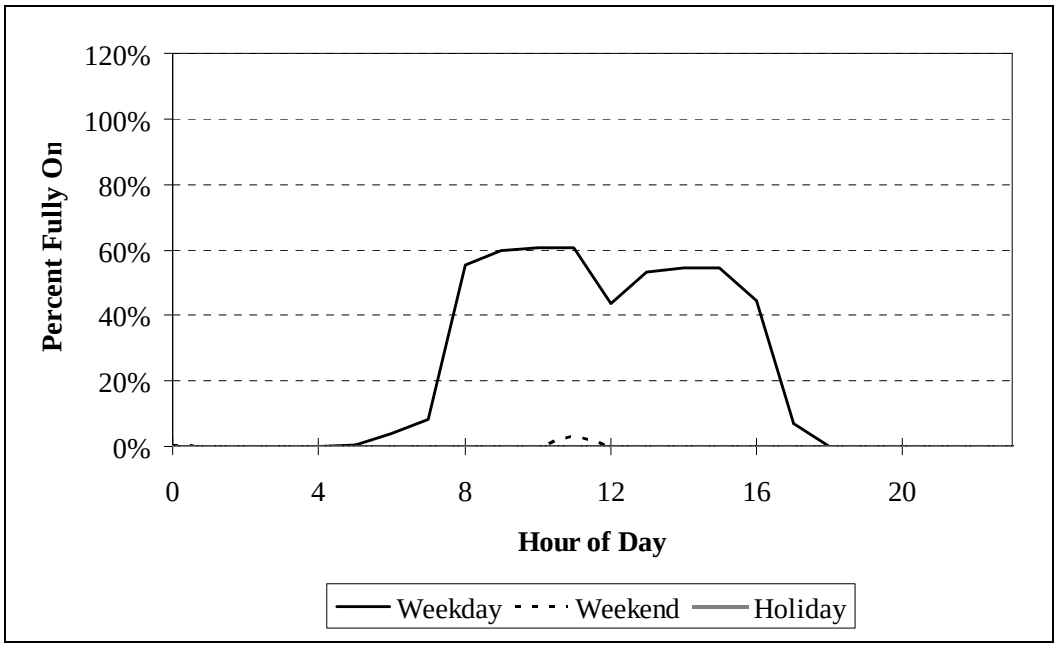

Figure 183: Average Daily Lighting Profile for Schedule 20 (Avg Private Office w/ OS) from 4/1/09 to 4/28/09

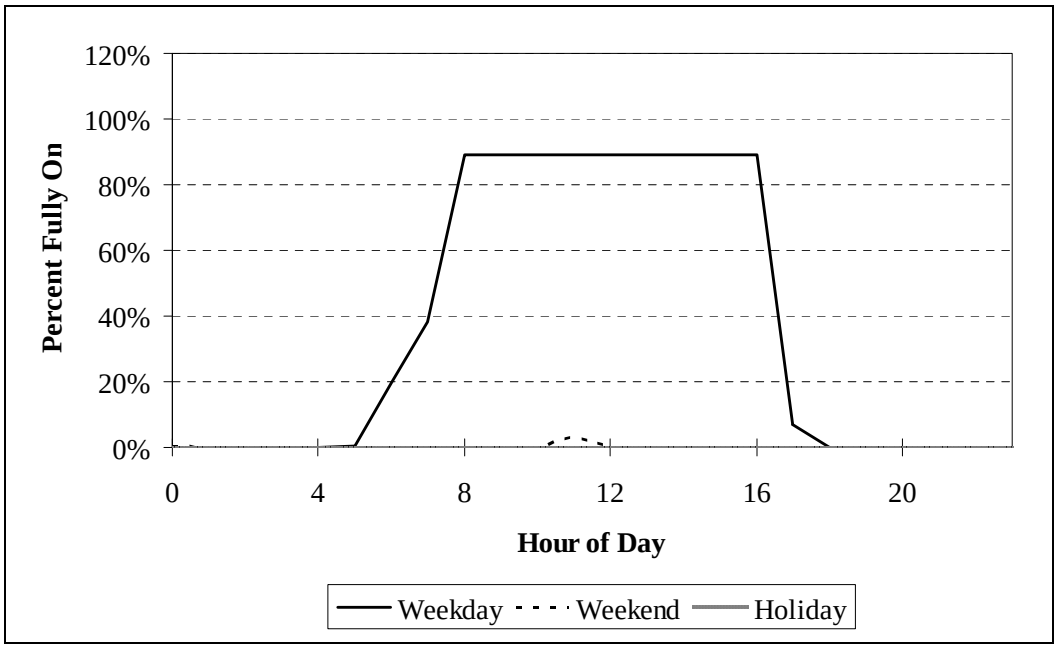

Figure 184: Average Daily Lighting Profile for Schedule 21 (Avg Private Office Baseline) from 4/1/09 to 4/28/09

Facility Type: Manufacturing
Application ID: 532719

Fixture Information

		Pre-retrofit Lighting							Post-retrofit Lighting							HVAC				Schedule ID from Table 6	
Fixture ID	(a) Space Type	(b) Fixture Type	(c) Fixture Quantity	(d) Fixture Wattage	(e) Hours of Use Annual	(f) Hours of Use Peak	(g) FCM Diversity Factor Summer	(h) FCM Diversity Factor Winter	(i) Fixture Type	(j) Fixture Quantity	(k) Fixture Wattage	(l) Hours of Use Annual	(m) Hours of Use Peak	(n) FCM Diversity Factor Summer	(o) FCM Diversity Factor Winter	(p) COP Cooling	(q) COP Heating	(r) % Space Cooled	(s) % Space Heated	Pre Retrofit	Post Retrofit
1	Lobby/Reception	2L4'T8	2	60	5,944	4,010	100%	100%	2L 4' SUPER T8 ULAMP	2	45	5,944	4,010	100%	100%	2.9	NA	100%	100%	5	5
2	Lobby/Reception	2L4'T8	2	60	5,944	4,010	100%	100%	2L 4' SUPER T8 ULAMP	2	45	5,944	4,010	100%	100%	2.9	NA	100%	100%	5	5
3	Private Office	2L4'EE/MAG	4	80	2,221	2,199	90%	4%	2L 4' SUPER T8 ULAMP	4	45	1,301	1,285	52%	4%	2.9	NA	100%	100%	21	20
4	Private Office	4L4'EE/MAG	2	160	2,221	2,199	90%	4%	4L 4' SUPER T8	2	89	1,301	1,285	52%	4%	2.9	NA	100%	100%	21	20
5	Open Office	4L4'EE/MAG	27	160	5,950	4,008	100%	100%	4L 4' SUPER T8	27	89	5,950	4,008	100%	100%	2.9	NA	100%	100%	12	12
6	Open Office	2L4'EE/MAG	13	80	5,950	4,008	100%	100%	2L 4' SUPER T8 ULAMP	13	45	5,950	4,008	100%	100%	2.9	NA	100%	100%	12	12
7	Open Office	2L4'EE/MAG	6	80	5,950	4,008	100%	100%	2L4' SUPER T8	6	45	5,950	4,008	100%	100%	2.9	NA	100%	100%	12	12
8	Conference Rm	4L4'EE/MAG	3	160	284	254	5%	1%	4L 4' SUPER T8	3	89	284	254	5%	1%	2.9	NA	100%	100%	7	7
9	Manufacturing/Production	2L4'EE/MAG	19	80	7,042	4,022	100%	100%	2L4' SUPER T8	19	45	7,042	4,022	100%	100%	2.9	NA	100%	100%	14	14
10	Manufacturing/Production	2L4'EE/MAG	6	80	7,042	4,022	100%	100%	2L4' SUPER T8	6	45	7,042	4,022	100%	100%	2.9	NA	100%	100%	14	14
11	Manufacturing/Production	4L4'EE/MAG	5	160	7,042	4,022	100%	100%	4L 4' SUPER T8	5	89	7,042	4,022	100%	100%	2.9	NA	100%	100%	14	14
12	Manufacturing/Production	2L4'EE/MAG	5	80	7,042	4,022	100%	100%	2L 4' SUPER T8 ULAMP	5	45	7,042	4,022	100%	100%	2.9	NA	100%	100%	14	14
13	Manufacturing/Production	3L4' T8	8	88	7,040	4,019	100%	100%	3L4'SUPER T8	8	68	7,040	4,019	100%	100%	2.9	NA	100%	100%	16	16
14	Manufacturing/Production	2L4'EE/MAG	33	80	7,040	4,019	100%	100%	2L4' SUPER T8	33	45	7,040	4,019	100%	100%	2.9	NA	100%	100%	16	16
15	Manufacturing/Production	2L4'EE/MAG	1	80	8,701	4,032	100%	100%	2L4' SUPER T8	1	45	8,701	4,032	100%	100%	2.9	NA	100%	100%	10	10
16	Manufacturing/Production	3L4' T8	2	88	8,701	4,032	100%	100%	3L4'SUPER T8	2	68	8,701	4,032	100%	100%	2.9	NA	100%	100%	10	10
17	Facilities Office	2L4'EE/MAG	8	80	3,101	2,863	94%	33%	2L4' SUPER T8	8	45	3,101	2,863	94%	33%	2.9	NA	100%	100%	8	8
18	Facilities Office	3L4' T8	5	88	3,101	2,863	94%	33%	3L4'SUPER T8	5	68	3,101	2,863	94%	33%	2.9	NA	100%	100%	8	8
19	Storage	2L4'EE/MAG	4	80	284	254	5%	1%	2L4' SUPER T8	4	45	284	254	5%	1%	2.9	NA	100%	100%	7	7
20	Open Office	2L4'EE/MAG	19	80	7,042	4,022	100%	100%	2L4' SUPER T8	19	45	7,042	4,022	100%	100%	2.9	NA	100%	100%	13	13
21	Open Office	4L4'EE/MAG	4	160	7,042	4,022	100%	100%	4L 4' SUPER T8	4	89	7,042	4,022	100%	100%	2.9	NA	100%	100%	13	13
22	Manufacturing/Production	2L4'EE/MAG	5	80	3,391	3,039	94%	61%	2L4' SUPER T8	5	45	3,391	3,039	94%	61%	2.9	NA	100%	100%	1	1
23	Private Office	2L4'EE/MAG	2	80	2,221	2,199	90%	4%	2L4' SUPER T8	2	45	1,301	1,285	52%	4%	2.9	NA	100%	100%	21	20
24	Private Office	2L4'EE/MAG	2	80	2,221	2,199	90%	4%	2L4' SUPER T8	2	45	1,301	1,285	52%	4%	2.9	NA	100%	100%	21	20
25	Private Office	3L4' T8	1	88	2,221	2,199	90%	4%	3L4'SUPER T8	1	68	1,301	1,285	52%	4%	2.9	NA	100%	100%	21	20
26	Private Office	2L4'EE/MAG	6	80	2,221	2,199	90%	4%	2L 4' SUPER T8 ULAMP	6	45	1,301	1,285	52%	4%	2.9	NA	100%	100%	21	20
27	Conference Rm	2L4'EE/MAG	6	80	284	254	5%	1%	2L 4' SUPER T8 ULAMP	6	45	284	254	5%	1%	2.9	NA	100%	100%	7	7
28	Private Office	2L4'EE/MAG	3	80	2,221	2,199	90%	4%	2L4' SUPER T8	3	45	1,301	1,285	52%	4%	2.9	NA	100%	100%	21	20
29	Private Office	3L4' T8	2	88	1,301	1,285	52%	4%	3L4'SUPER T8	2	68	1,301	1,285	52%	4%	2.9	NA	100%	100%	20	20
30	Manufacturing/Production	2L4'EE/MAG	3	80	8,701	4,032	100%	100%	2L 4' SUPER T8 ULAMP	3	45	8,701	4,032	100%	100%	2.9	NA	100%	100%	10	10
31	Private Office	2L4'EE/MAG	5	80	2,221	2,199	90%	4%	2L4' SUPER T8	5	45	1,301	1,285	52%	4%	2.9	NA	100%	100%	21	20
32	Private Office	2L4'EE/MAG	2	80	1,301	1,285	52%	4%	2L4' SUPER T8	2	45	1,301	1,285	52%	4%	2.9	NA	100%	100%	20	20
33	Private Office	2L4'EE/MAG	2	80	2,221	2,199	90%	4%	2L 4' SUPER T8 ULAMP	2	45	1,301	1,285	52%	4%	2.9	NA	100%	100%	21	20
34	Restroom	2L4'T8	9	60	8,701	4,032	100%	100%	2L 4' SUPER T8 ULAMP	9	45	8,701	4,032	100%	100%	2.9	NA	100%	100%	10	10
35	Restroom	2L4'T8	1	60	8,701	4,032	100%	100%	2L4' SUPER T8	1	45	8,701	4,032	100%	100%	2.9	NA	100%	100%	10	10
36	Restroom	2L4'T8	8	60	8,701	4,032	100%	100%	2L 4' SUPER T8 ULAMP	8	45	8,701	4,032	100%	100%	2.9	NA	100%	100%	10	10
37	Restroom	2L4'T8	1	60	8,701	4,032	100%	100%	2L4' SUPER T8	1	45	8,701	4,032	100%	100%	2.9	NA	100%	100%	10	10
38	Open Office	2L4'EE/MAG	13	80	5,950	4,008	100%	100%	2L4' SUPER T8	13	45	5,950	4,008	100%	100%	2.9	NA	100%	100%	12	12
39	Open Office	2L4'T8	1	60	5,950	4,008	100%	100%	2L 4' SUPER T8 ULAMP	1	45	5,950	4,008	100%	100%	2.9	NA	100%	100%	12	12
40	Private Office	2L4'EE/MAG	2	80	1,301	1,285	52%	4%	2L4' SUPER T8	2	45	1,301	1,285	52%	4%	2.9	NA	100%	100%	20	20
41	Private Office	2L4'EE/MAG	3	80	1,301	1,285	52%	4%	2L4' SUPER T8	3	45	1,301	1,285	52%	4%	2.9	NA	100%	100%	20	20
42	Private Office	2L4'EE/MAG	4	80	1,301	1,285	52%	4%	2L4' SUPER T8	4	45	1,301	1,285	52%	4%	2.9	NA	100%	100%	20	20
43	Private Office	2L4'EE/MAG	4	80	1,301	1,285	52%	4%	2L4' SUPER T8	4	45	1,301	1,285	52%	4%	2.9	NA	100%	100%	20	20
44	Cafeteria	2L4'EE/MAG	17	80	5,272	3,600	100%	77%	2L4' SUPER T8	17	45	5,272	3,600	100%	77%	2.9	NA	100%	100%	18	18
45	Manufacturing/Production	2L8' EE/MAG	5	138	8,701	4,032	100%	100%	2L8' T8	5	100	8,701	4,032	100%	100%	2.9	NA	100%	100%	10	10
46	Storage	2L8'HO	10	227	284	254	5%	1%	2L8'T8HO	10	160	284	254	5%	1%	2.9	NA	100%	100%	7	7
47	Storage	1L8' EE/MAG	0	83	284	254	5%	1%	1L8' T8	0	60	284	254	5%	1%	2.9	NA	100%	100%	7	7
48	Manufacturing/Production	2L8' EE/MAG	2	138	8,701	4,032	100%	100%	2L8' T8	2	100	8,701	4,032	100%	100%	2.9	NA	100%	100%	10	10
49	Manufacturing/Production	2L8'HO	15	227	3,391	3,039	94%	61%	2L8'T8HO	15	160	3,391	3,039	94%	61%	2.9	NA	100%	100%	1	1
50	Manufacturing/Production	2L8' EE/MAG	12	138	3,391	3,039	94%	61%	2L8' T8	12	100	3,391	3,039	94%	61%	2.9	NA	100%	100%	1	1
51	Manufacturing/Production	2L4'EE/MAG	1	80	3,391	3,039	94%	61%	2L4' SUPER T8	1	45	3,391	3,039	94%	61%	2.9	NA	100%	100%	1	1
52	Laboratory	3L4' T8	12	88	6,706	3,960	100%	100%	3L4'SUPER T8	12	68	6,706	3,960	100%	100%	2.9	NA	100%	100%	2	2
53	Laboratory	2L4'EE/MAG	2	80	6,706	3,960	100%	100%	2L4' SUPER T8	2	45	6,706	3,960	100%	100%	2.9	NA	100%	100%	2	2
54	Laboratory	4L4'EE/MAG	2	160	6,706	3,960	100%	100%	4L 4' SUPER T8	2	89	6,706	3,960	100%	100%	2.9	NA	100%	100%	2	2
55	Laboratory	2L4'EE/MAG	5	80	6,706	3,960	100%	100%	2L4' SUPER T8	5	45	6,706	3,960	100%	100%	2.9	NA	100%	100%	2	2
56	Private Office	2L4'EE/MAG	4	80	2,221	2,199	90%	4%	2L4' SUPER T8	4	45	1,301	1,285	52%	4%	2.9	NA	100%	100%	21	20
57	Manufacturing/Production	2L8' EE/MAG	6	138	8,701	4,032	100%	100%	2L8' T8	6	100	8,701	4,032	100%	100%	2.9	NA	100%	100%	10	10
58	Private Office	2L4'EE/MAG	2	80	2,221	2,199	90%	4%	2L4' SUPER T8	2	45	1,301	1,285	52%	4%	2.9	NA	100%	100%	21	20
59	Manufacturing/Production	4L4' T8\EL	28	112	3,391	3,039	94%	61%	4L 4' SUPER T8	28	89	3,391	3,039	94%	61%	2.9	NA	100%	100%	1	1
60	Manufacturing/Production	2L4'EE/MAG	1	80	3,391	3,039	94%	61%	2L4' SUPER T8	1	45	3,391	3,039	94%	61%	2.9	NA	100%	100%	1	1

Fixture Information

Fixture ID	(a) Space Type	Pre-retrofit Lighting (b) Fixture Type	(c) Fixture Quantity	(d) Fixture Wattage	(e) Hours of Use Annual	(f) Hours of Use Peak	(g) FCM Diversity Factor Summer	(h) FCM Diversity Factor Winter	Post-retrofit Lighting (i) Fixture Type	(j) Fixture Quantity	(k) Fixture Wattage	(l) Hours of Use Annual	(m) Hours of Use Peak	(n) FCM Diversity Factor Summer	(o) FCM Diversity Factor Winter	HVAC (p) COP Cooling	(q) COP Heating	(r) % Space Cooled	(s) % Space Heated	Schedule ID from Table 6 Pre Retrofit	Schedule ID from Table 6 Post Retrofit
61	Manufacturing/Production	1L4'EE\MAG	0	50	8,701	4,032	100%	100%	1L4'T8	0	24	8,701	4,032	100%	100%	2.9	NA	100%	100%	10	10
62	Manufacturing/Production	4L4'EE/MAG	1	160	3,391	3,039	94%	61%	4L 4' SUPER T8	1	89	3,391	3,039	94%	61%	2.9	NA	100%	100%	1	1
63	Manufacturing/Production	2L8' EE/MAG	1	138	8,701	4,032	100%	100%	2L8' T8	1	100	8,701	4,032	100%	100%	2.9	NA	100%	100%	10	10
64	Manufacturing/Production	2L8'HO	2	227	3,391	3,039	94%	61%	2L8'T8HO	2	160	3,391	3,039	94%	61%	2.9	NA	100%	100%	1	1
65	Manufacturing/Production	2L8'HO	4	227	3,391	3,039	94%	61%	2L8'T8HO	4	160	3,391	3,039	94%	61%	2.9	NA	100%	100%	1	1
66	Manufacturing/Production	3L4' T8	4	88	3,391	3,039	94%	61%	3L4'SUPER T8	4	68	3,391	3,039	94%	61%	2.9	NA	100%	100%	1	1
67	Manufacturing/Production	2L8'HO	10	227	3,391	3,039	94%	61%	2L8'T8HO	10	160	3,391	3,039	94%	61%	2.9	NA	100%	100%	1	1
68	Manufacturing/Production	2L4'EE/MAG	9	80	3,391	3,039	94%	61%	2L4' SUPER T8	9	45	3,391	3,039	94%	61%	2.9	NA	100%	100%	1	1
69	Manufacturing/Production	2L8' EE/MAG	2	138	8,701	4,032	100%	100%	2L8' T8	2	100	8,701	4,032	100%	100%	2.9	NA	100%	100%	10	10
70	Pump Room	2L8'HO	9	227	7,568	4,024	100%	100%	2L8'T8HO	9	160	7,568	4,024	100%	100%	2.9	NA	100%	100%	19	19
71	Manufacturing/Production	3L4' T8	16	88	8,754	4,026	99%	100%	3L4'SUPER T8	16	68	8,754	4,026	99%	100%	2.9	NA	100%	100%	9	9
72	Manufacturing/Production	2L4'EE/MAG	3	80	8,280	4,028	100%	100%	2L4' SUPER T8	3	45	8,280	4,028	100%	100%	2.9	NA	100%	100%	17	17
73	Manufacturing/Production	4L4'EE/MAG	9	160	8,280	4,028	100%	100%	4L 4' SUPER T8	9	89	8,280	4,028	100%	100%	2.9	NA	100%	100%	17	17
74	Manufacturing/Production	3L4' T8	6	88	8,280	4,028	100%	100%	3L4'SUPER T8	6	68	8,280	4,028	100%	100%	2.9	NA	100%	100%	17	17
75	Pump Room	4L4'EE/MAG	2	160	7,568	4,024	100%	100%	4L 4' SUPER T8	2	89	7,568	4,024	100%	100%	2.9	NA	100%	100%	19	19
76	Pump Room	2L4'EE/MAG	2	80	7,568	4,024	100%	100%	2L 4' SUPER T8 ULAMP	2	45	7,568	4,024	100%	100%	2.9	NA	100%	100%	19	19
77	Pump Room	4L4'EE/MAG	6	160	7,568	4,024	100%	100%	4L 4' SUPER T8	6	89	7,568	4,024	100%	100%	2.9	NA	100%	100%	19	19
78	Pump Room	3L4' T8	8	88	7,568	4,024	100%	100%	3L4'SUPER T8	8	68	7,568	4,024	100%	100%	2.9	NA	100%	100%	19	19
79	Pump Room	3L4' T8	39	88	7,568	4,024	100%	100%	3L4'SUPER T8	39	68	7,568	4,024	100%	100%	2.9	NA	100%	100%	19	19
80	Pump Room	4L4'EE/MAG	1	160	7,568	4,024	100%	100%	4L 4' SUPER T8	1	89	7,568	4,024	100%	100%	2.9	NA	100%	100%	19	19
81	Pump Room	2L4'EE/MAG	2	80	7,568	4,024	100%	100%	2L 4' SUPER T8 ULAMP	2	45	7,568	4,024	100%	100%	2.9	NA	100%	100%	19	19
82	Storage	2L8'HO	2	227	284	254	5%	1%	2L8'T8HO	2	160	284	254	5%	1%	2.9	NA	100%	100%	7	7
83	Storage	2L4'EE/MAG	2	80	284	254	5%	1%	2L4' SUPER T8	2	45	284	254	5%	1%	2.9	NA	100%	100%	7	7
84	Restroom	2L4'T8	6	60	8,701	4,032	100%	100%	2L 4' SUPER T8 ULAMP	6	45	8,701	4,032	100%	100%	2.9	NA	100%	100%	10	10
85	Restroom	2L4'EE/MAG	2	80	8,701	4,032	100%	100%	2L4' SUPER T8	2	45	8,701	4,032	100%	100%	2.9	NA	100%	100%	10	10
86	Restroom	2L4'T8	6	60	8,701	4,032	100%	100%	2L 4' SUPER T8 ULAMP	6	45	8,701	4,032	100%	100%	2.9	NA	100%	100%	10	10
87	Restroom	2L4'EE/MAG	2	80	8,701	4,032	100%	100%	2L4' SUPER T8	2	45	8,701	4,032	100%	100%	2.9	NA	100%	100%	10	10
88	Pump Room	4L4'EE/MAG	7	160	7,568	4,024	100%	100%	4L 4' SUPER T8	7	89	535	519	13%	1%	2.9	NA	100%	100%	19	6
89	Pump Room	2L8' EE/MAG	3	138	7,568	4,024	100%	100%	2L8' T8	3	100	535	519	13%	1%	2.9	NA	100%	100%	19	6
90	Pump Room	2L8'HO	1	227	7,568	4,024	100%	100%	2L8'T8HO	1	160	535	519	13%	1%	2.9	NA	100%	100%	19	6
91	Pump Room	2L8'HO	1	227	7,568	4,024	100%	100%	1L8'T8 HO	1	80	535	519	13%	1%	2.9	NA	100%	100%	19	6
92	Manufacturing/Production	2L4'EE/MAG	8	80	7,568	4,024	100%	100%	2L4' SUPER T8	8	45	7,568	4,024	100%	100%	2.9	NA	100%	100%	11	11
93	Manufacturing/Production	2L4'EE/MAG	6	80	7,568	4,024	100%	100%	2L4' SUPER T8	6	45	7,568	4,024	100%	100%	2.9	NA	100%	100%	11	11
94	Manufacturing/Production	2L4'EE/MAG	36	80	7,568	4,024	100%	100%	2L4' SUPER T8	36	45	7,568	4,024	100%	100%	2.9	NA	100%	100%	11	11
95	Manufacturing/Production	4L4'EE/MAG	2	160	7,568	4,024	100%	100%	4L 4' SUPER T8	2	89	7,568	4,024	100%	100%	2.9	NA	100%	100%	11	11
96	Manufacturing/Production	3L4' T8	2	88	7,568	4,024	100%	100%	2L8' T8	2	100	7,568	4,024	100%	100%	2.9	NA	100%	100%	11	11
97	Manufacturing/Production	2L8' EE/MAG	2	138	3,391	3,039	94%	61%	2L8' T8	2	100	3,391	3,039	94%	61%	2.9	NA	100%	100%	1	1
98	Storage	2L8' EE/MAG	2	138	284	254	5%	1%	2L8' T8	2	100	284	254	5%	1%	2.9	NA	100%	100%	7	7
99	Storage	2L8'HO	2	227	284	254	5%	1%	2L8'T8HO	2	160	284	254	5%	1%	2.9	NA	100%	100%	7	7
100	Storage	2L4'EE/MAG	2	80	284	254	5%	1%	2L4' SUPER T8	2	45	284	254	5%	1%	2.9	NA	100%	100%	7	7
101	Manufacturing/Production	3L4' T8	1	88	7,568	4,024	100%	100%	3L4'SUPER T8	1	68	7,568	4,024	100%	100%	2.9	NA	100%	100%	11	11
102	Manufacturing/Production	2L4'EE/MAG	1	80	7,568	4,024	100%	100%	2L4' SUPER T8	1	45	7,568	4,024	100%	100%	2.9	NA	100%	100%	11	11
103	Manufacturing/Production	2L4'T8	1	60	7,568	4,024	100%	100%	2L 4' SUPER T8 ULAMP	1	45	7,568	4,024	100%	100%	2.9	NA	100%	100%	11	11
104	Manufacturing/Production	2L8' EE/MAG	1	138	8,701	4,032	100%	100%	2L8' T8	1	100	8,701	4,032	100%	100%	2.9	NA	100%	100%	10	10
105	Pump Room	4L4'EE/MAG	1	160	7,568	4,024	100%	100%	4L 4' SUPER T8	1	89	7,568	4,024	100%	100%	2.9	NA	100%	100%	19	19
106	Pump Room	2L4'EE/MAG	7	80	7,568	4,024	100%	100%	2L4' SUPER T8	7	45	7,568	4,024	100%	100%	2.9	NA	100%	100%	19	19
107	Manufacturing/Production	2L8' EE/MAG	8	138	7,568	4,024	100%	100%	2L8' T8	8	100	7,568	4,024	100%	100%	2.9	NA	100%	100%	11	11
108	Manufacturing/Production	2L4'EE/MAG	1	80	7,568	4,024	100%	100%	2L4' SUPER T8	1	45	7,568	4,024	100%	100%	2.9	NA	100%	100%	11	11
109	Manufacturing/Production	2L4'T8	6	60	7,568	4,024	100%	100%	2L4' SUPER T8	6	45	7,568	4,024	100%	100%	2.9	NA	100%	100%	11	11
110	Manufacturing/Production	2L8' EE/MAG	24	138	3,391	3,039	94%	61%	2L8' T8	24	100	3,391	3,039	94%	61%	2.9	NA	100%	100%	1	1
111	Manufacturing/Production	2L8'HO	2	227	3,391	3,039	94%	61%	2L8'T8HO	2	160	3,391	3,039	94%	61%	2.9	NA	100%	100%	1	1
112	Manufacturing/Production	2L4'EE/MAG	1	80	3,391	3,039	94%	61%	2L4' SUPER T8	1	45	3,391	3,039	94%	61%	2.9	NA	100%	100%	1	1
113	Manufacturing/Production	3L4' T8	10	88	8,754	4,026	99%	100%	3L4'SUPER T8	10	68	8,754	4,026	99%	100%	2.9	NA	100%	100%	9	9
114	Manufacturing/Production	2L4'T8	1	60	8,754	4,026	99%	100%	2L 4' SUPER T8 ULAMP	1	45	8,754	4,026	99%	100%	2.9	NA	100%	100%	9	9
115	Manufacturing/Production	2L8'HO	10	227	8,754	4,026	99%	100%	2L8'T8HO	10	160	8,754	4,026	99%	100%	2.9	NA	100%	100%	9	9
116	Manufacturing/Production	2L8' EE/MAG	6	138	8,754	4,026	99%	100%	2L8' T8	6	100	8,754	4,026	99%	100%	2.9	NA	100%	100%	9	9
		Totals	698	76,832					Totals	698	50,352										

Pre-Retrofit Demand and Energy Consumption

Fixture ID	Lighting Demand and Energy Consumption (t) Connected kW	(u) FCM Diversified kW Summer	(v) FCM Diversified kW Winter	(w) Annual kWh	(x) Peak kWh	Interactive Hours (y) Cooling Hours	(z) Heating Hours	Interactive Energy Consumption (aa) Cooling kWh	(ab) Heating kWh	On-Peak Interactive Hours (ac) Cooling Hours	(ad) Heating Hours	On-Peak Interactive Demand and Energy Consumption (ae) FCM Diversified kW Summer	(af) FCM Diversified kW Winter	(ag) Cooling kWh	(ah) Heating kWh	Lighting and Interactive Demand and Energy Consumption (ai) FCM Diversified kW Summer	(aj) FCM Diversified kW Winter	(ak) Annual kWh	(al) Peak kWh
1	0.12	0.12	0.12	713	481	1,513	3,112	50	0	1,171	2,038	0.03	0.00	38	0	0.15	0.12	763	520
2	0.12	0.12	0.12	713	481	1,513	3,112	50	0	1,171	2,038	0.03	0.00	38	0	0.15	0.12	763	520
3	0.32	0.29	0.01	711	704	696	1,105	61	0	694	1,085	0.07	0.00	61	0	0.36	0.01	772	764
4	0.32	0.29	0.01	711	704	696	1,105	61	0	694	1,085	0.07	0.00	61	0	0.36	0.01	772	764
5	4.32	4.31	4.32	25,703	17,313	1,514	3,116	1,785	0	1,171	2,036	1.02	0.00	1,380	0	5.33	4.32	27,489	18,693
6	1.04	1.04	1.04	6,188	4,168	1,514	3,116	430	0	1,171	2,036	0.25	0.00	332	0	1.28	1.04	6,618	4,500
7	0.48	0.48	0.48	2,856	1,924	1,514	3,116	198	0	1,171	2,036	0.11	0.00	153	0	0.59	0.48	3,054	2,077
8	0.48	0.02	0.00	136	122	77	145	10	0	72	129	0.00	0.00	9	0	0.03	0.00	146	131
9	1.52	1.52	1.52	10,704	6,113	1,796	3,705	745	0	1,173	2,047	0.36	0.00	487	0	1.88	1.52	11,450	6,600
10	0.48	0.48	0.48	3,380	1,930	1,796	3,705	235	0	1,173	2,047	0.11	0.00	154	0	0.59	0.48	3,616	2,084
11	0.80	0.80	0.80	5,634	3,217	1,796	3,705	392	0	1,173	2,047	0.19	0.00	256	0	0.99	0.80	6,026	3,474
12	0.40	0.40	0.40	2,817	1,609	1,796	3,705	196	0	1,173	2,047	0.09	0.00	128	0	0.49	0.40	3,013	1,737
13	0.70	0.70	0.70	4,956	2,830	1,795	3,703	345	0	1,172	2,046	0.17	0.00	225	0	0.87	0.70	5,301	3,055
14	2.64	2.63	2.64	18,585	10,611	1,795	3,703	1,294	0	1,172	2,046	0.62	0.00	845	0	3.26	2.64	19,879	11,456
15	0.08	0.08	0.08	696	323	2,187	4,587	48	0	1,173	2,057	0.02	0.00	26	0	0.10	0.08	744	348
16	0.18	0.18	0.18	1,531	710	2,187	4,587	105	0	1,173	2,057	0.04	0.00	56	0	0.22	0.18	1,636	766
17	0.64	0.60	0.21	1,984	1,832	921	1,577	161	0	875	1,436	0.14	0.00	153	0	0.74	0.21	2,145	1,985
18	0.44	0.41	0.14	1,364	1,260	921	1,577	111	0	875	1,436	0.10	0.00	105	0	0.51	0.14	1,475	1,365
19	0.32	0.02	0.00	91	81	77	145	7	0	72	129	0.00	0.00	6	0	0.02	0.00	98	88
20	1.52	1.52	1.52	10,704	6,113	1,796	3,705	745	0	1,173	2,047	0.36	0.00	487	0	1.88	1.52	11,450	6,600
21	0.64	0.64	0.64	4,507	2,574	1,796	3,705	314	0	1,173	2,047	0.15	0.00	205	0	0.79	0.64	4,821	2,779
22	0.40	0.38	0.25	1,356	1,216	989	1,722	108	0	924	1,524	0.09	0.00	101	0	0.47	0.25	1,464	1,317
23	0.16	0.14	0.01	355	352	696	1,105	30	0	694	1,085	0.03	0.00	30	0	0.18	0.01	386	382
24	0.16	0.14	0.01	355	352	696	1,105	30	0	694	1,085	0.03	0.00	30	0	0.18	0.01	386	382
25	0.09	0.08	0.00	195	193	696	1,105	17	0	694	1,085	0.02	0.00	17	0	0.10	0.00	212	210
26	0.48	0.43	0.02	1,066	1,055	696	1,105	91	0	694	1,085	0.10	0.00	91	0	0.53	0.02	1,157	1,146
27	0.48	0.02	0.00	136	122	77	145	10	0	72	129	0.00	0.00	9	0	0.03	0.00	146	131
28	0.24	0.22	0.01	533	528	696	1,105	46	0	694	1,085	0.05	0.00	45	0	0.27	0.01	579	573
29	0.18	0.09	0.01	229	226	412	645	20	0	410	632	0.02	0.00	20	0	0.11	0.01	249	246
30	0.24	0.24	0.24	2,088	968	2,187	4,587	143	0	1,173	2,057	0.06	0.00	77	0	0.30	0.24	2,231	1,044
31	0.40	0.36	0.01	888	879	696	1,105	76	0	694	1,085	0.09	0.00	76	0	0.45	0.01	964	955
32	0.16	0.08	0.01	208	206	412	645	18	0	410	632	0.02	0.00	18	0	0.10	0.01	226	224
33	0.16	0.14	0.01	355	352	696	1,105	30	0	694	1,085	0.03	0.00	30	0	0.18	0.01	386	382
34	0.54	0.54	0.54	4,699	2,177	2,187	4,587	322	0	1,173	2,057	0.13	0.00	173	0	0.67	0.54	5,021	2,350
35	0.06	0.06	0.06	522	242	2,187	4,587	36	0	1,173	2,057	0.01	0.00	19	0	0.07	0.06	558	261
36	0.48	0.48	0.48	4,176	1,935	2,187	4,587	287	0	1,173	2,057	0.11	0.00	154	0	0.59	0.48	4,463	2,089
37	0.06	0.06	0.06	522	242	2,187	4,587	36	0	1,173	2,057	0.01	0.00	19	0	0.07	0.06	558	261
38	1.04	1.04	1.04	6,188	4,168	1,514	3,116	430	0	1,171	2,036	0.25	0.00	332	0	1.28	1.04	6,618	4,500
39	0.06	0.06	0.06	357	240	1,514	3,116	25	0	1,171	2,036	0.01	0.00	19	0	0.07	0.06	382	260
40	0.16	0.08	0.01	208	206	412	645	18	0	410	632	0.02	0.00	18	0	0.10	0.01	226	224
41	0.24	0.13	0.01	312	308	412	645	27	0	410	632	0.03	0.00	27	0	0.16	0.01	339	335
42	0.32	0.17	0.01	416	411	412	645	36	0	410	632	0.04	0.00	36	0	0.21	0.01	452	447
43	0.32	0.17	0.01	416	411	412	645	36	0	410	632	0.04	0.00	36	0	0.21	0.01	452	447
44	1.36	1.35	1.04	7,170	4,896	1,413	2,749	524	0	1,067	1,824	0.32	0.00	396	0	1.68	1.04	7,695	5,292
45	0.69	0.69	0.69	6,004	2,782	2,187	4,587	412	0	1,173	2,057	0.16	0.00	221	0	0.85	0.69	6,416	3,003
46	2.27	0.11	0.02	645	577	77	145	48	0	72	129	0.02	0.00	44	0	0.13	0.02	693	621
47	0.00	0.00	0.00	0	0	77	145	0	0	72	129	0.00	0.00	0	0	0.00	0.00	0	0
48	0.28	0.28	0.28	2,401	1,113	2,187	4,587	165	0	1,173	2,057	0.07	0.00	88	0	0.34	0.28	2,566	1,201
49	3.41	3.20	2.09	11,546	10,349	989	1,722	919	0	924	1,524	0.76	0.00	859	0	3.96	2.09	12,465	11,208
50	1.66	1.56	1.02	5,616	5,033	989	1,722	447	0	924	1,524	0.37	0.00	418	0	1.93	1.02	6,062	5,451
51	0.08	0.08	0.05	271	243	989	1,722	22	0	924	1,524	0.02	0.00	20	0	0.09	0.05	293	263
52	1.06	1.06	1.06	7,082	4,182	1,712	3,521	493	0	1,157	2,013	0.25	0.00	334	0	1.31	1.06	7,575	4,516
53	0.16	0.16	0.16	1,073	634	1,712	3,521	75	0	1,157	2,013	0.04	0.00	51	0	0.20	0.16	1,148	684
54	0.32	0.32	0.32	2,146	1,267	1,712	3,521	150	0	1,157	2,013	0.08	0.00	101	0	0.40	0.32	2,296	1,368
55	0.40	0.40	0.40	2,682	1,584	1,712	3,521	187	0	1,157	2,013	0.09	0.00	126	0	0.49	0.40	2,869	1,711
56	0.32	0.29	0.01	711	704	696	1,105	61	0	694	1,085	0.07	0.00	61	0	0.36	0.01	772	764
57	0.83	0.83	0.83	7,204	3,338	2,187	4,587	494	0	1,173	2,057	0.20	0.00	265	0	1.02	0.83	7,699	3,603
58	0.16	0.14	0.01	355	352	696	1,105	30	0	694	1,085	0.03	0.00	30	0	0.18	0.01	386	382
59	3.14	2.95	1.92	10,634	9,532	989	1,722	846	0	924	1,524	0.70	0.00	791	0	3.65	1.92	11,480	10,323
60	0.08	0.08	0.05	271	243	989	1,722	22	0	924	1,524	0.02	0.00	20	0	0.09	0.05	293	263

Pre-Retrofit Demand and Energy Consumption																			
	Lighting Demand and Energy Consumption					Interactive Hours		Interactive Energy Consumption		On-Peak Interactive Hours		On-Peak Interactive Demand and Energy Consumption				Lighting and Interactive Demand and Energy Consumption			
	(t)	(u)	(v)	(w)	(x)	(y)	(z)	(aa)	(ab)	(ac)	(ad)	(ae)	(af)	(ag)	(ah)	(ai)	(aj)	(ak)	(al)
Fixture	Connected	FCM Diversified kW		Annual	Peak	Cooling	Heating	Cooling	Heating	Cooling	Heating	FCM Diversified kW		Cooling	Heating	FCM Diversified kW		Annual	Peak
ID	kW	Summer	Winter	kWh	kWh	Hours	Hours	kWh	kWh	Hours	Hours	Summer	Winter	kWh	kWh	Summer	Winter	kWh	kWh
61	0.00	0.00	0.00	0	0	2,187	4,587	0	0	1,173	2,057	0.00	0.00	0	0	0.00	0.00	0	0
62	0.16	0.15	0.10	543	486	989	1,722	43	0	924	1,524	0.04	0.00	40	0	0.19	0.10	586	527
63	0.14	0.14	0.14	1,201	556	2,187	4,587	82	0	1,173	2,057	0.03	0.00	44	0	0.17	0.14	1,283	601
64	0.45	0.43	0.28	1,540	1,380	989	1,722	123	0	924	1,524	0.10	0.00	114	0	0.53	0.28	1,662	1,494
65	0.91	0.85	0.56	3,079	2,760	989	1,722	245	0	924	1,524	0.20	0.00	229	0	1.06	0.56	3,324	2,989
66	0.35	0.33	0.22	1,194	1,070	989	1,722	95	0	924	1,524	0.08	0.00	89	0	0.41	0.22	1,289	1,159
67	2.27	2.14	1.39	7,698	6,900	989	1,722	613	0	924	1,524	0.51	0.00	572	0	2.64	1.39	8,310	7,472
68	0.72	0.68	0.44	2,442	2,188	989	1,722	194	0	924	1,524	0.16	0.00	182	0	0.84	0.44	2,636	2,370
69	0.28	0.28	0.28	2,401	1,113	2,187	4,587	165	0	1,173	2,057	0.07	0.00	88	0	0.34	0.28	2,566	1,201
70	2.04	2.04	2.04	15,462	8,221	1,901	3,990	1,060	0	1,173	2,049	0.48	0.00	654	0	2.53	2.04	16,522	8,875
71	1.41	1.40	1.41	12,326	5,669	2,205	4,614	847	0	1,171	2,054	0.33	0.00	450	0	1.73	1.41	13,173	6,119
72	0.24	0.24	0.24	1,987	967	2,083	4,363	136	0	1,173	2,053	0.06	0.00	77	0	0.30	0.24	2,124	1,044
73	1.44	1.44	1.44	11,923	5,800	2,083	4,363	819	0	1,173	2,053	0.34	0.00	461	0	1.78	1.44	12,741	6,261
74	0.53	0.53	0.53	4,372	2,127	2,083	4,363	300	0	1,173	2,053	0.12	0.00	169	0	0.65	0.53	4,672	2,296
75	0.32	0.32	0.32	2,422	1,288	1,901	3,990	166	0	1,173	2,049	0.08	0.00	102	0	0.40	0.32	2,588	1,390
76	0.16	0.16	0.16	1,211	644	1,901	3,990	83	0	1,173	2,049	0.04	0.00	51	0	0.20	0.16	1,294	695
77	0.96	0.96	0.96	7,266	3,863	1,901	3,990	498	0	1,173	2,049	0.23	0.00	307	0	1.19	0.96	7,764	4,170
78	0.70	0.70	0.70	5,328	2,833	1,901	3,990	365	0	1,173	2,049	0.17	0.00	225	0	0.87	0.70	5,694	3,058
79	3.43	3.43	3.43	25,975	13,810	1,901	3,990	1,781	0	1,173	2,049	0.81	0.00	1,099	0	4.24	3.43	27,756	14,909
80	0.16	0.16	0.16	1,211	644	1,901	3,990	83	0	1,173	2,049	0.04	0.00	51	0	0.20	0.16	1,294	695
81	0.16	0.16	0.16	1,211	644	1,901	3,990	83	0	1,173	2,049	0.04	0.00	51	0	0.20	0.16	1,294	695
82	0.45	0.02	0.00	129	115	77	145	10	0	72	129	0.00	0.00	9	0	0.03	0.00	139	124
83	0.16	0.01	0.00	45	41	77	145	3	0	72	129	0.00	0.00	3	0	0.01	0.00	49	44
84	0.36	0.36	0.36	3,132	1,451	2,187	4,587	215	0	1,173	2,057	0.09	0.00	115	0	0.45	0.36	3,347	1,567
85	0.16	0.16	0.16	1,392	645	2,187	4,587	96	0	1,173	2,057	0.04	0.00	51	0	0.20	0.16	1,488	696
86	0.36	0.36	0.36	3,132	1,451	2,187	4,587	215	0	1,173	2,057	0.09	0.00	115	0	0.45	0.36	3,347	1,567
87	0.16	0.16	0.16	1,392	645	2,187	4,587	96	0	1,173	2,057	0.04	0.00	51	0	0.20	0.16	1,488	696
88	1.12	1.12	1.12	8,477	4,507	1,901	3,990	581	0	1,173	2,049	0.27	0.00	359	0	1.39	1.12	9,058	4,865
89	0.41	0.41	0.41	3,133	1,666	1,901	3,990	215	0	1,173	2,049	0.10	0.00	133	0	0.51	0.41	3,348	1,798
90	0.23	0.23	0.23	1,718	913	1,901	3,990	118	0	1,173	2,049	0.05	0.00	73	0	0.28	0.23	1,836	986
91	0.23	0.23	0.23	1,718	913	1,901	3,990	118	0	1,173	2,049	0.05	0.00	73	0	0.28	0.23	1,836	986
92	0.64	0.64	0.64	4,844	2,575	1,901	3,990	332	0	1,173	2,049	0.15	0.00	205	0	0.79	0.64	5,176	2,780
93	0.48	0.48	0.48	3,633	1,932	1,901	3,990	249	0	1,173	2,049	0.11	0.00	154	0	0.59	0.48	3,882	2,085
94	2.88	2.88	2.88	21,797	11,589	1,901	3,990	1,495	0	1,173	2,049	0.68	0.00	922	0	3.56	2.88	23,292	12,511
95	0.32	0.32	0.32	2,422	1,288	1,901	3,990	166	0	1,173	2,049	0.08	0.00	102	0	0.40	0.32	2,588	1,390
96	0.18	0.18	0.18	1,332	708	1,901	3,990	91	0	1,173	2,049	0.04	0.00	56	0	0.22	0.18	1,423	765
97	0.28	0.26	0.17	936	839	989	1,722	74	0	924	1,524	0.06	0.00	70	0	0.32	0.17	1,010	908
98	0.28	0.01	0.00	78	70	77	145	6	0	72	129	0.00	0.00	5	0	0.02	0.00	84	76
99	0.45	0.02	0.00	129	115	77	145	10	0	72	129	0.00	0.00	9	0	0.03	0.00	139	124
100	0.16	0.01	0.00	45	41	77	145	3	0	72	129	0.00	0.00	3	0	0.01	0.00	49	44
101	0.09	0.09	0.09	666	354	1,901	3,990	46	0	1,173	2,049	0.02	0.00	28	0	0.11	0.09	712	382
102	0.08	0.08	0.08	605	322	1,901	3,990	42	0	1,173	2,049	0.02	0.00	26	0	0.10	0.08	647	348
103	0.06	0.06	0.06	454	241	1,901	3,990	31	0	1,173	2,049	0.01	0.00	19	0	0.07	0.06	485	261
104	0.14	0.14	0.14	1,201	556	2,187	4,587	82	0	1,173	2,057	0.03	0.00	44	0	0.17	0.14	1,283	601
105	0.16	0.16	0.16	1,211	644	1,901	3,990	83	0	1,173	2,049	0.04	0.00	51	0	0.20	0.16	1,294	695
106	0.56	0.56	0.56	4,238	2,253	1,901	3,990	291	0	1,173	2,049	0.13	0.00	179	0	0.69	0.56	4,529	2,433
107	1.10	1.10	1.10	8,356	4,442	1,901	3,990	573	0	1,173	2,049	0.26	0.00	353	0	1.37	1.10	8,928	4,796
108	0.08	0.08	0.08	605	322	1,901	3,990	42	0	1,173	2,049	0.02	0.00	26	0	0.10	0.08	647	348
109	0.36	0.36	0.36	2,725	1,449	1,901	3,990	187	0	1,173	2,049	0.09	0.00	115	0	0.45	0.36	2,911	1,564
110	3.31	3.12	2.03	11,231	10,067	989	1,722	894	0	924	1,524	0.74	0.00	835	0	3.86	2.03	12,125	10,902
111	0.45	0.43	0.28	1,540	1,380	989	1,722	123	0	924	1,524	0.10	0.00	114	0	0.53	0.28	1,662	1,494
112	0.08	0.08	0.05	271	243	989	1,722	22	0	924	1,524	0.02	0.00	20	0	0.09	0.05	293	263
113	0.88	0.88	0.88	7,703	3,543	2,205	4,614	530	0	1,171	2,054	0.21	0.00	281	0	1.08	0.88	8,233	3,824
114	0.06	0.06	0.06	525	242	2,205	4,614	36	0	1,171	2,054	0.01	0.00	19	0	0.07	0.06	561	261
115	2.27	2.26	2.27	19,871	9,139	2,205	4,614	1,366	0	1,171	2,054	0.53	0.00	726	0	2.79	2.27	21,238	9,865
116	0.83	0.82	0.83	7,248	3,334	2,205	4,614	498	0	1,171	2,054	0.19	0.00	265	0	1.02	0.83	7,747	3,598
Totals	76.83	69.90	59.88	434,810	261,720			30,826	0			16.55	0.00	21,077	0	86.45	59.88	465,636	282,796

Post-Retrofit Demand and Energy Consumption

Fixture ID	Lighting Demand and Energy Consumption (am) Connected kW	(an) FCM Diversified kW Summer	(ao) FCM Diversified kW Winter	(ap) Annual kWh	(aq) Peak kWh	Interactive Hours (ar) Cooling Hours	(as) Heating Hours	Interactive Energy Consumption (at) Cooling kWh	(au) Heating kWh	On-Peak Interactive Hours (av) Cooling Hours	(aw) Heating Hours	On-Peak Interactive Demand and Energy Consumption (ax) FCM Diversified kW Summer	(ay) FCM Diversified kW Winter	(az) Cooling kWh	(ba) Heating kWh	Lighting and Interactive Demand and Energy Consumption (bb) FCM Diversified kW Summer	(bc) FCM Diversified kW Winter	(bd) Annual kWh	(be) Peak kWh
1	0.09	0.09	0.09	535	361	1,513	3,112	37	0	1,171	2,038	0.02	0.00	29	0	0.11	0.09	572	390
2	0.09	0.09	0.09	535	361	1,513	3,112	37	0	1,171	2,038	0.02	0.00	29	0	0.11	0.09	572	390
3	0.18	0.09	0.01	234	231	412	645	20	0	410	632	0.02	0.00	20	0	0.12	0.01	254	251
4	0.18	0.09	0.01	232	229	412	645	20	0	410	632	0.02	0.00	20	0	0.12	0.01	252	249
5	2.40	2.40	2.40	14,298	9,630	1,514	3,116	993	0	1,171	2,036	0.57	0.00	768	0	2.96	2.40	15,291	10,398
6	0.59	0.58	0.59	3,481	2,344	1,514	3,116	242	0	1,171	2,036	0.14	0.00	187	0	0.72	0.59	3,722	2,531
7	0.27	0.27	0.27	1,606	1,082	1,514	3,116	112	0	1,171	2,036	0.06	0.00	86	0	0.33	0.27	1,718	1,168
8	0.27	0.01	0.00	76	68	77	145	6	0	72	129	0.00	0.00	5	0	0.02	0.00	81	73
9	0.86	0.85	0.85	6,021	3,439	1,796	3,705	419	0	1,173	2,047	0.20	0.00	274	0	1.06	0.85	6,440	3,712
10	0.27	0.27	0.27	1,901	1,086	1,796	3,705	132	0	1,173	2,047	0.06	0.00	86	0	0.33	0.27	2,034	1,172
11	0.45	0.44	0.45	3,134	1,790	1,796	3,705	218	0	1,173	2,047	0.11	0.00	142	0	0.55	0.45	3,352	1,932
12	0.23	0.22	0.23	1,585	905	1,796	3,705	110	0	1,173	2,047	0.05	0.00	72	0	0.28	0.23	1,695	977
13	0.54	0.54	0.54	3,830	2,187	1,795	3,703	267	0	1,172	2,046	0.13	0.00	174	0	0.67	0.54	4,096	2,361
14	1.49	1.48	1.49	10,454	5,969	1,795	3,703	728	0	1,172	2,046	0.35	0.00	475	0	1.83	1.49	11,182	6,444
15	0.05	0.05	0.05	392	181	2,187	4,587	27	0	1,173	2,057	0.01	0.00	14	0	0.06	0.05	418	196
16	0.14	0.14	0.14	1,183	548	2,187	4,587	81	0	1,173	2,057	0.03	0.00	44	0	0.17	0.14	1,265	592
17	0.36	0.34	0.12	1,116	1,031	921	1,577	90	0	875	1,436	0.08	0.00	86	0	0.42	0.12	1,207	1,117
18	0.34	0.32	0.11	1,054	974	921	1,577	85	0	875	1,436	0.08	0.00	81	0	0.39	0.11	1,140	1,055
19	0.18	0.01	0.00	51	46	77	145	4	0	72	129	0.00	0.00	4	0	0.01	0.00	55	49
20	0.86	0.85	0.85	6,021	3,439	1,796	3,705	419	0	1,173	2,047	0.20	0.00	274	0	1.06	0.85	6,440	3,712
21	0.36	0.36	0.36	2,507	1,432	1,796	3,705	175	0	1,173	2,047	0.08	0.00	114	0	0.44	0.36	2,682	1,546
22	0.23	0.21	0.14	763	684	989	1,722	61	0	924	1,524	0.05	0.00	57	0	0.26	0.14	824	741
23	0.09	0.05	0.00	117	116	412	645	10	0	410	632	0.01	0.00	10	0	0.06	0.00	127	126
24	0.09	0.05	0.00	117	116	412	645	10	0	410	632	0.01	0.00	10	0	0.06	0.00	127	126
25	0.07	0.04	0.00	88	87	412	645	8	0	410	632	0.01	0.00	8	0	0.04	0.00	96	95
26	0.27	0.14	0.01	351	347	412	645	30	0	410	632	0.03	0.00	30	0	0.17	0.01	381	377
27	0.27	0.01	0.00	77	69	77	145	6	0	72	129	0.00	0.00	5	0	0.02	0.00	82	74
28	0.14	0.07	0.00	176	173	412	645	15	0	410	632	0.02	0.00	15	0	0.09	0.00	191	189
29	0.14	0.07	0.00	177	175	412	645	15	0	410	632	0.02	0.00	15	0	0.09	0.00	192	190
30	0.14	0.14	0.14	1,175	544	2,187	4,587	81	0	1,173	2,057	0.03	0.00	43	0	0.17	0.14	1,255	588
31	0.23	0.12	0.01	293	289	412	645	25	0	410	632	0.03	0.00	25	0	0.15	0.01	318	314
32	0.09	0.05	0.00	117	116	412	645	10	0	410	632	0.01	0.00	10	0	0.06	0.00	127	126
33	0.09	0.05	0.00	117	116	412	645	10	0	410	632	0.01	0.00	10	0	0.06	0.00	127	126
34	0.41	0.41	0.41	3,524	1,633	2,187	4,587	242	0	1,173	2,057	0.10	0.00	130	0	0.50	0.41	3,766	1,763
35	0.05	0.05	0.05	392	181	2,187	4,587	27	0	1,173	2,057	0.01	0.00	14	0	0.06	0.05	418	196
36	0.36	0.36	0.36	3,132	1,451	2,187	4,587	215	0	1,173	2,057	0.09	0.00	115	0	0.45	0.36	3,347	1,567
37	0.05	0.05	0.05	392	181	2,187	4,587	27	0	1,173	2,057	0.01	0.00	14	0	0.06	0.05	418	196
38	0.59	0.58	0.59	3,481	2,344	1,514	3,116	242	0	1,171	2,036	0.14	0.00	187	0	0.72	0.59	3,722	2,531
39	0.05	0.04	0.05	268	180	1,514	3,116	19	0	1,171	2,036	0.01	0.00	14	0	0.06	0.05	286	195
40	0.09	0.05	0.00	117	116	412	645	10	0	410	632	0.01	0.00	10	0	0.06	0.00	127	126
41	0.14	0.07	0.00	176	173	412	645	15	0	410	632	0.02	0.00	15	0	0.09	0.00	191	189
42	0.18	0.09	0.01	234	231	412	645	20	0	410	632	0.02	0.00	20	0	0.12	0.01	254	251
43	0.18	0.09	0.01	234	231	412	645	20	0	410	632	0.02	0.00	20	0	0.12	0.01	254	251
44	0.77	0.76	0.59	4,033	2,754	1,413	2,749	295	0	1,067	1,824	0.18	0.00	223	0	0.94	0.59	4,328	2,977
45	0.50	0.50	0.50	4,350	2,016	2,187	4,587	298	0	1,173	2,057	0.12	0.00	160	0	0.62	0.50	4,649	2,176
46	1.60	0.08	0.01	454	407	77	145	34	0	72	129	0.02	0.00	31	0	0.09	0.01	488	438
47	0.00	0.00	0.00	0	0	77	145	0	0	72	129	0.00	0.00	0	0	0.00	0.00	0	0
48	0.20	0.20	0.20	1,740	806	2,187	4,587	119	0	1,173	2,057	0.05	0.00	64	0	0.25	0.20	1,860	870
49	2.40	2.26	1.47	8,138	7,295	989	1,722	648	0	924	1,524	0.54	0.00	605	0	2.79	1.47	8,786	7,900
50	1.20	1.13	0.74	4,069	3,647	989	1,722	324	0	924	1,524	0.27	0.00	303	0	1.40	0.74	4,393	3,950
51	0.05	0.04	0.03	153	137	989	1,722	12	0	924	1,524	0.01	0.00	11	0	0.05	0.03	165	148
52	0.82	0.82	0.82	5,472	3,232	1,712	3,521	381	0	1,157	2,013	0.19	0.00	258	0	1.01	0.82	5,854	3,490
53	0.09	0.09	0.09	604	356	1,712	3,521	42	0	1,157	2,013	0.02	0.00	28	0	0.11	0.09	646	385
54	0.18	0.18	0.18	1,194	705	1,712	3,521	83	0	1,157	2,013	0.04	0.00	56	0	0.22	0.18	1,277	761
55	0.23	0.22	0.23	1,509	891	1,712	3,521	105	0	1,157	2,013	0.05	0.00	71	0	0.28	0.23	1,614	962
56	0.18	0.09	0.01	234	231	412	645	20	0	410	632	0.02	0.00	20	0	0.12	0.01	254	251
57	0.60	0.60	0.60	5,221	2,419	2,187	4,587	358	0	1,173	2,057	0.14	0.00	192	0	0.74	0.60	5,579	2,611
58	0.09	0.05	0.00	117	116	412	645	10	0	410	632	0.01	0.00	10	0	0.06	0.00	127	126
59	2.49	2.35	1.53	8,450	7,574	989	1,722	672	0	924	1,524	0.56	0.00	628	0	2.90	1.53	9,123	8,203
60	0.05	0.04	0.03	153	137	989	1,722	12	0	924	1,524	0.01	0.00	11	0	0.05	0.03	165	148

Post-Retrofit Demand and Energy Consumption																			
	Lighting Demand and Energy Consumption					Interactive Hours		Interactive Energy Consumption		On-Peak Interactive Hours		On-Peak Interactive Demand and Energy Consumption				Lighting and Interactive Demand and Energy Consumption			
	(am)	(an)	(ao)	(ap)	(aq)	(ar)	(as)	(at)	(au)	(av)	(aw)	(ax)	(ay)	(az)	(ba)	(bb)	(bc)	(bd)	(be)
Fixture	Connected	FCM Diversified kW		Annual	Peak	Cooling	Heating	Cooling	Heating	Cooling	Heating	FCM Diversified kW		Cooling	Heating	FCM Diversified kW		Annual	Peak
ID	kW	Summer	Winter	kWh	kWh	Hours	Hours	kWh	kWh	Hours	Hours	Summer	Winter	kWh	kWh	Summer	Winter	kWh	kWh
61	0.00	0.00	0.00	0	0	2,187	4,587	0	0	1,173	2,057	0.00	0.00	0	0	0.00	0.00	0	0
62	0.09	0.08	0.05	302	271	989	1,722	24	0	924	1,524	0.02	0.00	22	0	0.10	0.05	326	293
63	0.10	0.10	0.10	870	403	2,187	4,587	60	0	1,173	2,057	0.02	0.00	32	0	0.12	0.10	930	435
64	0.32	0.30	0.20	1,085	973	989	1,722	86	0	924	1,524	0.07	0.00	81	0	0.37	0.20	1,171	1,053
65	0.64	0.60	0.39	2,170	1,945	989	1,722	173	0	924	1,524	0.14	0.00	161	0	0.75	0.39	2,343	2,107
66	0.27	0.26	0.17	922	827	989	1,722	73	0	924	1,524	0.06	0.00	69	0	0.32	0.17	996	895
67	1.60	1.51	0.98	5,426	4,863	989	1,722	432	0	924	1,524	0.36	0.00	403	0	1.86	0.98	5,857	5,267
68	0.41	0.38	0.25	1,373	1,231	989	1,722	109	0	924	1,524	0.09	0.00	102	0	0.47	0.25	1,483	1,333
69	0.20	0.20	0.20	1,740	806	2,187	4,587	119	0	1,173	2,057	0.05	0.00	64	0	0.25	0.20	1,860	870
70	1.44	1.44	1.44	10,898	5,795	1,901	3,990	747	0	1,173	2,049	0.34	0.00	461	0	1.78	1.44	11,646	6,256
71	1.09	1.08	1.09	9,524	4,380	2,205	4,614	655	0	1,171	2,054	0.26	0.00	348	0	1.34	1.09	10,179	4,728
72	0.14	0.14	0.14	1,118	544	2,083	4,363	77	0	1,173	2,053	0.03	0.00	43	0	0.17	0.14	1,195	587
73	0.80	0.80	0.80	6,632	3,226	2,083	4,363	456	0	1,173	2,053	0.19	0.00	256	0	0.99	0.80	7,087	3,483
74	0.41	0.41	0.41	3,378	1,643	2,083	4,363	232	0	1,173	2,053	0.10	0.00	131	0	0.50	0.41	3,610	1,774
75	0.18	0.18	0.18	1,347	716	1,901	3,990	92	0	1,173	2,049	0.04	0.00	57	0	0.22	0.18	1,440	773
76	0.09	0.09	0.09	681	362	1,901	3,990	47	0	1,173	2,049	0.02	0.00	29	0	0.11	0.09	728	391
77	0.53	0.53	0.53	4,042	2,149	1,901	3,990	277	0	1,173	2,049	0.13	0.00	171	0	0.66	0.53	4,319	2,320
78	0.54	0.54	0.54	4,117	2,189	1,901	3,990	282	0	1,173	2,049	0.13	0.00	174	0	0.67	0.54	4,400	2,363
79	2.65	2.65	2.65	20,071	10,672	1,901	3,990	1,376	0	1,173	2,049	0.63	0.00	849	0	3.28	2.65	21,448	11,521
80	0.09	0.09	0.09	674	358	1,901	3,990	46	0	1,173	2,049	0.02	0.00	28	0	0.11	0.09	720	387
81	0.09	0.09	0.09	681	362	1,901	3,990	47	0	1,173	2,049	0.02	0.00	29	0	0.11	0.09	728	391
82	0.32	0.02	0.00	91	81	77	145	7	0	72	129	0.00	0.00	6	0	0.02	0.00	98	88
83	0.09	0.00	0.00	26	23	77	145	2	0	72	129	0.00	0.00	2	0	0.01	0.00	27	25
84	0.27	0.27	0.27	2,349	1,089	2,187	4,587	161	0	1,173	2,057	0.06	0.00	86	0	0.33	0.27	2,510	1,175
85	0.09	0.09	0.09	783	363	2,187	4,587	54	0	1,173	2,057	0.02	0.00	29	0	0.11	0.09	837	392
86	0.27	0.27	0.27	2,349	1,089	2,187	4,587	161	0	1,173	2,057	0.06	0.00	86	0	0.33	0.27	2,510	1,175
87	0.09	0.09	0.09	783	363	2,187	4,587	54	0	1,173	2,057	0.02	0.00	29	0	0.11	0.09	837	392
88	0.62	0.08	0.01	333	323	165	271	28	0	163	260	0.02	0.00	28	0	0.10	0.01	361	351
89	0.30	0.04	0.00	160	156	165	271	13	0	163	260	0.01	0.00	13	0	0.05	0.00	174	169
90	0.16	0.02	0.00	86	83	165	271	7	0	163	260	0.01	0.00	7	0	0.03	0.00	93	90
91	0.08	0.01	0.00	43	42	165	271	4	0	163	260	0.00	0.00	4	0	0.01	0.00	46	45
92	0.36	0.36	0.36	2,725	1,449	1,901	3,990	187	0	1,173	2,049	0.09	0.00	115	0	0.45	0.36	2,911	1,564
93	0.27	0.27	0.27	2,043	1,086	1,901	3,990	140	0	1,173	2,049	0.06	0.00	86	0	0.33	0.27	2,184	1,173
94	1.62	1.62	1.62	12,261	6,519	1,901	3,990	841	0	1,173	2,049	0.38	0.00	519	0	2.00	1.62	13,102	7,038
95	0.18	0.18	0.18	1,347	716	1,901	3,990	92	0	1,173	2,049	0.04	0.00	57	0	0.22	0.18	1,440	773
96	0.20	0.20	0.20	1,514	805	1,901	3,990	104	0	1,173	2,049	0.05	0.00	64	0	0.25	0.20	1,617	869
97	0.20	0.19	0.12	678	608	989	1,722	54	0	924	1,524	0.04	0.00	50	0	0.23	0.12	732	658
98	0.20	0.01	0.00	57	51	77	145	4	0	72	129	0.00	0.00	4	0	0.01	0.00	61	55
99	0.32	0.02	0.00	91	81	77	145	7	0	72	129	0.00	0.00	6	0	0.02	0.00	98	88
100	0.09	0.00	0.00	26	23	77	145	2	0	72	129	0.00	0.00	2	0	0.01	0.00	27	25
101	0.07	0.07	0.07	515	274	1,901	3,990	35	0	1,173	2,049	0.02	0.00	22	0	0.08	0.07	550	295
102	0.05	0.05	0.05	341	181	1,901	3,990	23	0	1,173	2,049	0.01	0.00	14	0	0.06	0.05	364	195
103	0.05	0.05	0.05	341	181	1,901	3,990	23	0	1,173	2,049	0.01	0.00	14	0	0.06	0.05	364	195
104	0.10	0.10	0.10	870	403	2,187	4,587	60	0	1,173	2,057	0.02	0.00	32	0	0.12	0.10	930	435
105	0.09	0.09	0.09	674	358	1,901	3,990	46	0	1,173	2,049	0.02	0.00	28	0	0.11	0.09	720	387
106	0.32	0.32	0.32	2,384	1,268	1,901	3,990	163	0	1,173	2,049	0.07	0.00	101	0	0.39	0.32	2,548	1,368
107	0.80	0.80	0.80	6,055	3,219	1,901	3,990	415	0	1,173	2,049	0.19	0.00	256	0	0.99	0.80	6,470	3,475
108	0.05	0.05	0.05	341	181	1,901	3,990	23	0	1,173	2,049	0.01	0.00	14	0	0.06	0.05	364	195
109	0.27	0.27	0.27	2,043	1,086	1,901	3,990	140	0	1,173	2,049	0.06	0.00	86	0	0.33	0.27	2,184	1,173
110	2.40	2.26	1.47	8,138	7,295	989	1,722	648	0	924	1,524	0.54	0.00	605	0	2.79	1.47	8,786	7,900
111	0.32	0.30	0.20	1,085	973	989	1,722	86	0	924	1,524	0.07	0.00	81	0	0.37	0.20	1,171	1,053
112	0.05	0.04	0.03	153	137	989	1,722	12	0	924	1,524	0.01	0.00	11	0	0.05	0.03	165	148
113	0.68	0.68	0.68	5,953	2,738	2,205	4,614	409	0	1,171	2,054	0.16	0.00	217	0	0.84	0.68	6,362	2,955
114	0.05	0.04	0.05	394	181	2,205	4,614	27	0	1,171	2,054	0.01	0.00	14	0	0.06	0.05	421	196
115	1.60	1.59	1.60	14,006	6,442	2,205	4,614	963	0	1,171	2,054	0.38	0.00	511	0	1.97	1.60	14,969	6,953
116	0.60	0.60	0.60	5,252	2,416	2,205	4,614	361	0	1,171	2,054	0.14	0.00	192	0	0.74	0.60	5,613	2,608
Totals	50.35	44.18	38.01	274,994	165,606			19,524	0			10.46	0.00	13,343	0	54.64	38.01	294,518	178,949

Total Savings Summary	Energy kWh	Summer kW	Winter kW	Connected kW
Annual Lighting Only	159,816	25.72	21.87	26.48
Annual Interactive	11,302	6.09	0.00	N/A
Annual Lighting and Interactive	171,118	31.81	21.87	26.48
On-Peak Lighting Only	96,113			
On-Peak Interactive	7,734			
On-Peak Lighting and Interactive	103,847			

	MMBTU
Annual Non-Electric Heating Savings	(308)

Savings Adjustment Factors						
Parameter	Annual KWH	Difference %	Summer kW	Difference %	Winter kW	Difference %
Gross (TRACKING) Savings	120,638	N/A	26.41	N/A	26.41	N/A
Adjustment - Documentation Change	0	0%	0.00	0%	0.00	0%
Adjustment - Technology Change	59	0%	0.03	0%	0.03	0%
Adjustment - Quantity Change	-1,013	-1%	0.04	0%	0.04	0%
Adjustment - Operation Change	40,131	33%	N/A	N/A	N/A	N/A
Adjustment - Coincident Change	N/A	N/A	-0.76	-3%	-4.61	-17%
Adjustment - Heating Interaction	0	0%	N/A	N/A	0.00	0%
Adjustment - Cooling Interaction	11,302	9%	6.09	23%	N/A	N/A
Adjustment - TOTAL	50,480	42%	5.40	20%	-4.54	-17%
Adjusted Gross (ONSITE) Savings	171,118	142%	31.81	120%	21.87	83%

Table 90: Summary of On-Site Energy and Demand Savings

Hour Ending	Average kW Reduction
1	22.4
2	22.4
3	22.4
4	22.4
5	23.0
6	24.4
7	28.2
8	31.6
9	33.0
10	32.9
11	32.9
12	33.0
13	33.3
14	33.1
15	33.2
16	32.9
17	31.8
18	28.7
19	27.0
20	25.7
21	25.3
22	24.2
23	23.6
24	22.8

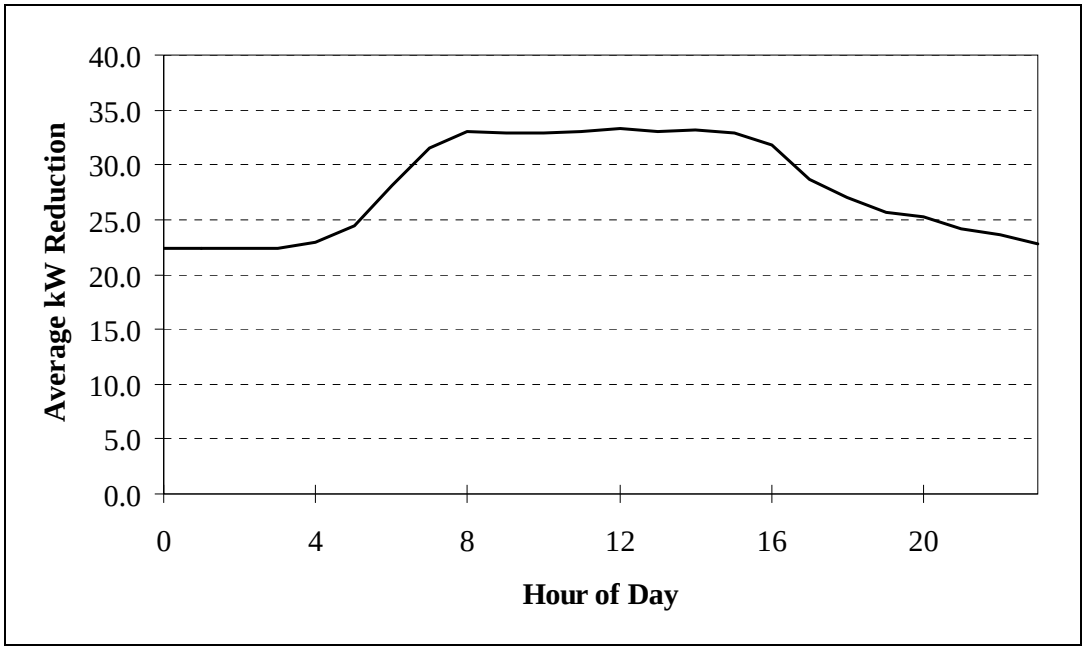

Table 91: Average Summer Weekday kW Reduction

Hour Ending	Average kW Reduction
1	17.6
2	17.6
3	17.5
4	17.6
5	18.0
6	19.1
7	22.0
8	24.8
9	26.0
10	25.8
11	25.8
12	25.9
13	26.2
14	26.0
15	26.1
16	25.8
17	25.0
18	22.6
19	21.2
20	20.2
21	19.9
22	19.0
23	18.5
24	17.9

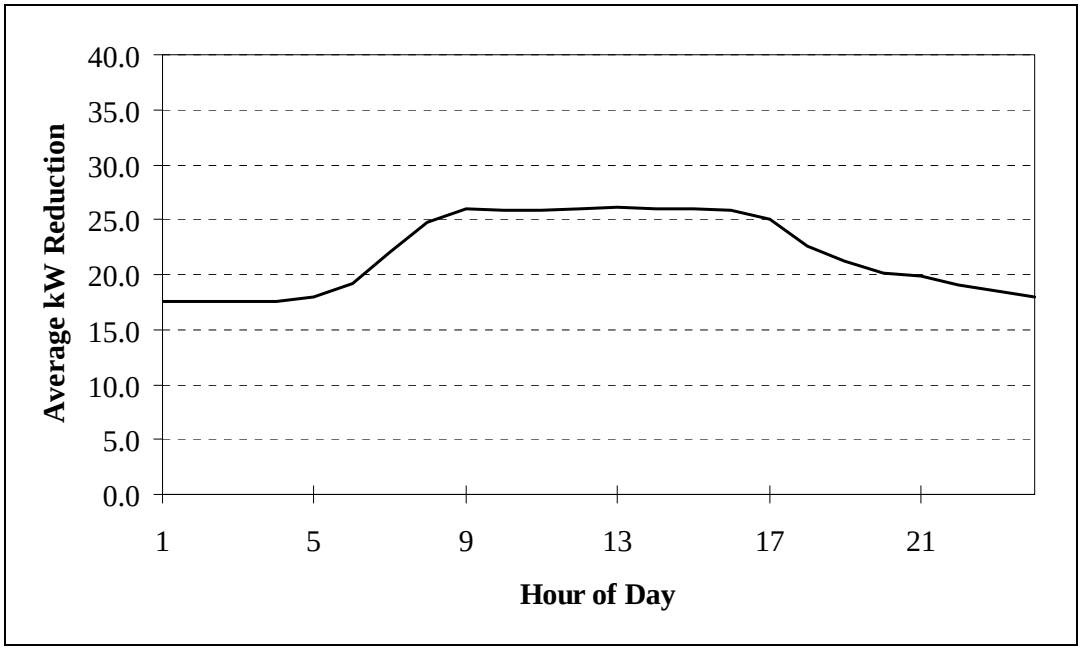

Table 92: Average Winter Weekday kW Reduction

Column Definitions for Lighting Calculations
(a) Brief description of area where lighting is installed

Pre-retrofit Lighting			Post-retrofit Lighting		
(b) Description of fixture type			(i) Description of fixture type		
(c) Fixture quantity from application documentation			(j) Fixture quantity from on-site inspection		
(d) Fixture wattage from application documentation			(k) Fixture wattage from application documentation		
(e) Annual hours of use	TMY2 Query	Eq. 1.1	(l) Annual hours of use	TMY2 Query	Eq. 1.1
(f) On-peak hours of use	TMY2 Query	Eq. 1.2	(m) On-peak hours of use	TMY2 Query	Eq. 1.2
(g) FCM Summer peak demand diversity factor	TMY2 Query	Eq. 1.3	(n) FCM Summer peak demand diversity factor	TMY2 Query	Eq. 1.3
(h) FCM Winter peak demand diversity factor	TMY2 Query	Eq. 1.4	(o) FCM Winter peak demand diversity factor	TMY2 Query	Eq. 1.4

HVAC Interaction Inputs	
(p) Electric cooling coefficient of performance	(r) Percent of space that is cooled
(q) Electric heating coefficient of performance	(s) Percent of space that is heated

Pre-retrofit Lighting Demand and Energy Consumption			Post-retrofit Lighting Demand and Energy Consumption		
(t) Connected lighting Demand	(t) = (c) x (d) / 1,000	Eq. 2.1	(am) Connected lighting Demand	(am) = (j) x (k) / 1,000	Eq. 3.1
(u) Summer diversified peak lighting demand (FCM)	(u) = (t) x (g)	Eq. 2.2	(an) Summer diversified peak lighting demand (FCM)	(an) = (am) x (n)	Eq. 3.2
(v) Winter diversified peak lighting demand (FCM)	(v) = (t) x (h)	Eq. 2.3	(ao) Winter diversified peak lighting demand (FCM)	(ao) = (am) x (o)	Eq. 3.3
(w) Annual energy consumption	(w) = (t) x (e)	Eq. 2.4	(ap) Annual energy consumption	(ap) = (am) x (l)	Eq. 3.4
(x) Annual On-peak energy consumption	(x) = (t) x (f)	Eq. 2.5	(aq) Annual On-peak energy consumption	(aq) = (am) x (m)	Eq. 3.5
(y) Annual cooling hours	TMY2 Qyery	Eq. 2.6	(ar) Annual cooling hours	TMY2 Query	Eq. 3.6
(z) Annual heating hours	TMY2 Qyery	Eq. 2.7	(as) Annual heating hours	TMY2 Query	Eq. 3.7
(aa) Electric cooling interactive energy effects	(aa) = (t) x (y) x (r) x 0.8 / (p)	Eq. 2.8	(at) Electric cooling interactive energy effects	(at) = (am) x (aq) x (r) x 0.8 / (p)	Eq. 3.8
(ab) Electric heating interactive energy effects	(ab) = -(t) x (z) x (s) x 0.8 / (q)	Eq. 2.9	(au) Electric heating interactive energy effects	(au) = -(am) x (as) x (s) x 0.8 / (q)	Eq. 3.9
(ac) Annual On-peak cooling hours	TMY2 Qyery	Eq. 2.10	(av) Annual On-peak cooling hours	TMY2 Query	Eq. 3.10
(ad) Annual On-peak heating hours	TMY2 Qyery	Eq. 2.11	(aw) Annual On-peak heating hours	TMY2 Query	Eq. 3.11
(ae) On-peak interactive cooling demand (FCM)	(ae) = (u) x (r) x 0.8 / (p)	Eq. 2.12	(ax) On-peak interactive cooling demand (FCM)	(ax) = (an) x (r) x 0.8 / (p)	Eq. 3.12
(af) On-peak interactive heating demand (FCM)	(af) = -(v) x (s) x 0.8 / (q)	Eq. 2.13	(ay) On-peak interactive heating demand (FCM)	(ay) = (ao) x (s) x 0.8 / (q)	Eq. 3.13
(ag) On-peak interactive electric cooling energy	(ag) = (t) x (ac) x (r) x 0.8 / (p)	Eq. 2.14	(az) On-peak interactive electric cooling energy	(az) = (am) x (av) x (r) x 0.8 / (p)	Eq. 3.14
(ah) On-peak interactive electric heating energy	(ah) = -(t) x (ad) x (s) x 0.8 / (q)	Eq. 2.15	(ba) On-peak interactive electric heating energy	(ba) = -(am) x (aw) x (s) x 0.8 / (q)	Eq. 3.15
(ai) Lighting and interactive summer demand (FCM)	(ai) = (u) + (ae)	Eq. 2.16	(bb) Lighting and interactive summer demand (FCM)	(bb) = (an) + (ax)	Eq. 3.16
(aj) Lighting and interactive winter demand (FCM)	(aj) = (v) + (af)	Eq. 2.17	(bc) Lighting and interactive winter demand (FCM)	(bc) = (ao) + (ay)	Eq. 3.17
(ak) Annual lighting and interactive energy consumption	(ak) = (w) + (aa) + (ab)	Eq. 2.18	(bd) Annual lighting and interactive energy consumption	(bd) = (ap) + (at) + (au)	Eq. 3.18
(al) Annual on-peak lighting and interactive energy consumption	(al) = (x) + (ag) + (ah)	Eq. 2.19	(be) Annual on-peak lighting and interactive energy consumption	(be) = (aq) + (az) + (ba)	Eq. 3.19

Total Savings Summary					
Annual Lighting Only Energy Consumption	Σ (w) - Σ (ap)	Eq. 4.1	Annual Lighting and Interactive Energy Consumption	Σ (ak) - Σ (bd)	Eq. 4.8
Annual Lighting Only Summer Demand (FCM)	Σ (u) - Σ (an)	Eq. 4.2	Annual Lighting and Interactive Summer Demand (FCM)	Σ (ai) - Σ (bb)	Eq. 4.9
Annual Lighting Only Winter Demand (FCM)	Σ (v) - Σ (ao)	Eq. 4.3	Annual Lighting and Interactive Winter Demand (FCM)	Σ (aj) - Σ (bc)	Eq. 4.10
Annual Lighting Only Connected Demand	Σ (t) - Σ (am)	Eq. 4.4	On-Peak Lighting Only Energy Consumption	Σ (x) - Σ (aq)	Eq. 4.11
Annual Interactive Energy Consumption	[Σ (aa) - Σ (at)] + [Σ (ab) - Σ (au)]	Eq. 4.5	On-Peak Interactive Energy Consumption	[Σ (ag) - Σ (az)] + [Σ (ah) - Σ (ba)]	Eq. 4.12
Annual Interactive Summer Demand (FCM)	Σ (ae) - Σ (ax)	Eq. 4.6			
Annual Interactive Winter Demand (FCM)	Σ (af) - Σ (ay)	Eq. 4.7			