Energy Opportunity Survey Report

Rancho Cucamonga High School

Rancho Cucamonga, California

Eskinder Berhanu & Associates (EBA)
alex@ebaenergy.com

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CCC ENERGY CORPS INITIATIVE: PARTNERSHIP BETWEEN CCC AND UC DAVIS

From the beginning of the Clean Energy Jobs Act and Senate Bill 73 (California Proposition 39), the California Conservation Corps (CCC) and the Energy Efficiency Center (EEC) at the University of California, Davis (UC Davis) have been partnered in conducting Energy Opportunity Surveys (ASHRAE compliant energy audits), training, and developing reports and recommendations for K-12 schools throughout California, with the shared goal of increasing energy efficiency in California schools and reducing energy related operating costs, while providing workforce development education and developing pathways for employment for CCC Corpsmembers.

The CCC deploys their Energy Corps crews to conduct ASHRAE level 1+ Energy Opportunity Surveys at schools across the state. For each school energy audit, the CCC performs observations and measurements, records a detailed data set, and provides the data to the UC Davis team for use in analysis and developing the audit reports. During their site visit, the CCC Energy Corps crews collect and create a detailed inventory of all equipment and appliances that use electricity, natural gas, and other fuels. They also record each school's site layout and individual building characteristics, as well as observable operations and maintenance (O&M) issues. The data collected is then transcribed and sent to the UC Davis Energy EEC for compilation, analysis, and report generation.

Within the framework of the California Energy Commission's (CEC's) Proposition 39 Guidelines and recommendations, UC Davis determines and recommends the appropriate energy conservation measures (ECMs), costs of the ECMs, and compiles an audit report to be presented to the school to which it pertains. Each Energy Opportunity Survey report contains the details of each school's energy consumption (electricity and natural gas) and their annual costs. These data are inserted into a benchmarking calculator provided by the CEC to determine the school's energy use intensity (EUI) and show comparisons of their energy habits with national averages.

All participating schools will receive the following documents:

- An energy audit report compiled by the UC Davis EEC
- A draft of the CEC's Energy Savings Calculator
- Spreadsheet inventories of the schools' appliances, lights, and HVAC systems
- Sketches from the field audit compiled in a (PDF) report by the CCC
- CCC Energy Opportunity Survey Recommended Whole Building "Best Practices"

The ultimate goal of this report is to provide each school with their current energy performance and a straightforward guideline of recommendations for achieving energy efficiency and cost savings on their campus.

ACKNOWLEDGEMENTS AND CONTACT

This Energy Opportunity Survey report was compiled by EBA staff. EBA has utilized extensively the sample study and methodologies of UC Davis Energy Efficiency Center. We would like to acknowledge the following EBA staff involved in developing this report.

Key EBA Staff Contacts
Eskinder "Alex" Berhanu, Program Manager

Special thanks also goes to the staff and Corpsmembers of the California Conservation Corps; we would like to thank the Pomona Crew/Team for their hard work and dedication to the Energy Corps Initiative and completing the site's energy survey. We would like to thank **Bill McNamara, Director of the Energy Corps** at the CCC for his invaluable contributions toward the content and structure of this report. We would also like to thank **Scott Linton, Prop 39 Manager; Kimberley Phan, Contract Manager; Juan Muy Prop 39 Coordinator**, and the team for their painstaking efforts toward ensuring the in-field logistics and data quality for the surveys conducted throughout California by the CCC as well in the project coordination and support.

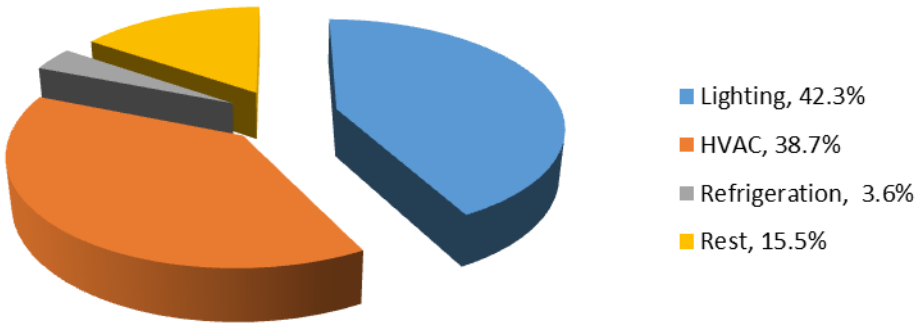
For any further questions about this report, please contact us at **alex@ebaenergy.com**

EXECUTIVE SUMMARY

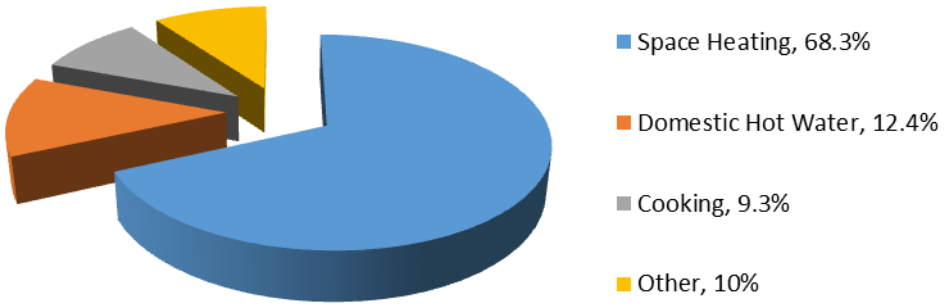
The CCC conducted an on-site Energy Opportunity Survey of Rancho Cucamonga High School facility on 11/03/2014. The CCC crew surveyed a total of 24 buildings that in total have 282 rooms on the site and catalogued nearly all of the electricity and natural gas-using equipment. Based on the School's estimated calendar, runtimes for the equipment provided during the CCC survey and industry accepted assumptions, we developed estimates on how energy is used at your facility. The figure below breaks down the energy use by end uses.

Figure 1: Electricity End Use Percentages

According to our estimates, HVAC which is represented by water source heat pumps (WSHP), packaged/split units, air and hydronic systems as well as condensers accounts for 39% of all electrical energy use, while lighting accounts for 42% and refrigeration 4%. The "rest" category that includes plug loads, electric kitchen appliances and domestic hot water systems in addition to any other process/specialty loads that the survey may not have included accounts 16%. Based on the 2006 study by Itron Inc., the typical California school uses 30% of all electricity use on HVAC and 48% on lighting.



According to our estimates[1], space heating accounts for 68% of all natural gas energy use, while the Domestic Hot Water (DHW) system and cooking account for 12% and 10% accordingly. Based on the CEUS study, the typical California school uses 63% of all natural gas use on space heating, 29% on water heating, and 6% on cooking.



[1] Based on our survey data, the school Swimming Pool is heated using propane -fired system/s.

Energy Conservation Measures (ECMs) and associated cost savings

The energy conservation measures (ECMs) are the recommendations for reducing energy usage. It is **very important to note that the recommended measures in this report were "chosen from and limited to" the 21 recommendations listed by the California Energy Commission in its Prop 39 Guidelines**. Based on the survey data and communication with the site's staff we picked a total of **14 ECMs for the evaluation of which 10 were selected**, refer to Table 1. More information on the ECMs is provided in Section 4 of the report.

Table 1: Summary of Recommended Energy Conservation Measures (ECMs)

The table on the next page shows a summary of each of the recommended energy saving measures. Included in this table is the total annual cost savings for each measure, as well as the project implementation, simple payback and estimated SIR values, generated by the CEC Calculator of the evaluated 14 ECMs.

Table 1: Summary of Recommended Energy Conservation Measures (ECMs)

ECMs	CEC Recommended Measures	Cost Savings	Project Cost	Simple Payback (years)	SIR Value
	Lighting Energy Efficiency Measures				
ECM 1	Replace incandescent light with compact fluorescent light	$ 47	$ 50	0.9	4.95
ECM 2	Replace incandescent light with LED light	$ 30	$ 147	4.7	3.26
ECM 5&6	Convert T12 fluorescent to T8 with electronic ballast or LED Lamps	$ 19,040	$ 91,362	4.6	3.32
ECM 7	Replace 32 Watt T8 lamps with 28 Watt T8 Lamps	$ 4,971	$ 33,617	6.6	0.68
ECM 8&9	Replace exterior mercury vapor/HPS with LED/Induction lights	$ 14,480	$402,892	27.6	0.76
ECM 10	Install occupancy control for intermittenly occupied rooms	$ 10,537	$ 60,976	5.6	1.55
	HVAC Measures				
ECM 11	Replace old packaged/split HVAC unit with high efficiency HVAC	$ 11,588	$190,914	16	1.14
ECM 13A	Replace boiler with high efficiency condensing boiler	$ 675	$ 39,788	57.4	0.64
ECM 13B	Replace furnace with high efficiency condensing furnace	$ 1,451	$ 78,635	52.7	0.52
ECM 15	Install variable speed drive for pumps and fans	$ 1,082	$ 17,180	15.5	1.17
ECM 17	Replace old motor with premium efficiency motor	$ 398	$ 3,576	8.5	1.93
ECM 18	Replace storage water heater with gas-fired tankless water heater	$ 107	$ 2,946	21.9	1.16
	Plug-Load Efficiency Measures				
ECM 19	Install smart strip/PC management to control computers/printers	$ 5,193	$ 13,440	2	2.16
ECM 20	Install vending machine occupancy control	$ 3,514	$ 2,391	0.7	7.32
Total		**$ 73,114**	**$937,913**	**12.5**	**1.15**

Potential Cost Savings based on the ECMs

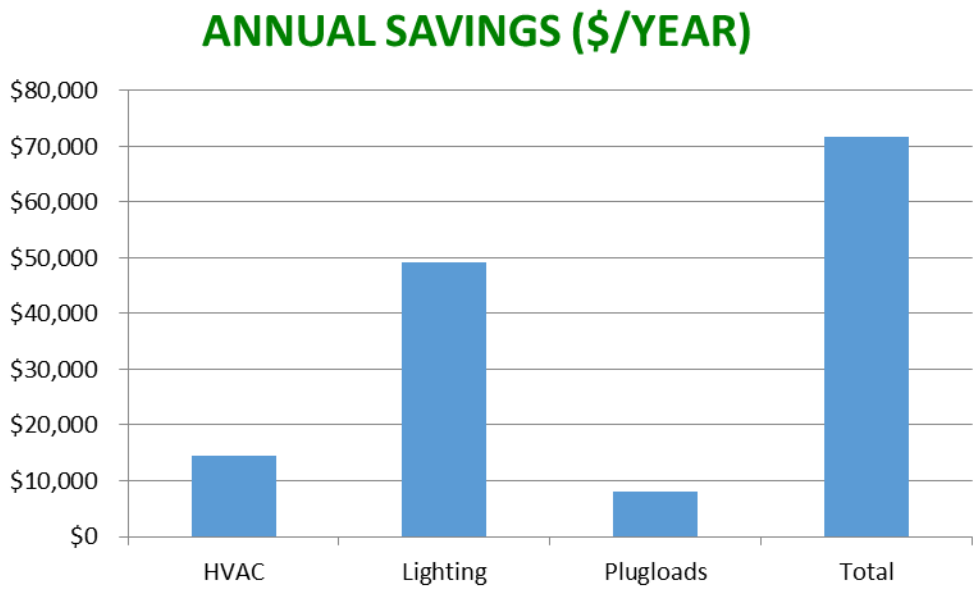
Potential savings and other associated econometrics for each ECM are captured in the preceding table. These savings estimates were generated using the Prop 39 calculator that was made available by the California Energy Commission (CEC). **It is very important to note that the savings estimated by the CEC's calculator are not completely specific to the site. While the inputs to the calculator take into account the school's inventory, the calculator does not base the savings on the equipment runtimes or climate conditions specific to the school.**

Rather, the savings are based on savings data reported on projects completed by Utilities across the state. Hence the savings estimated for a specific ECM is only a good ball park value and should not be considered accurate.

The following chart shows the total potential energy (electric and gas) cost savings as well as savings by category for the three major end use categories: HVAC, lighting, and plug loads.

Figure 2: Potential Energy Cost Savings by End Use

The graph shows the cost savings if all ECMs under consideration were to be implemented.

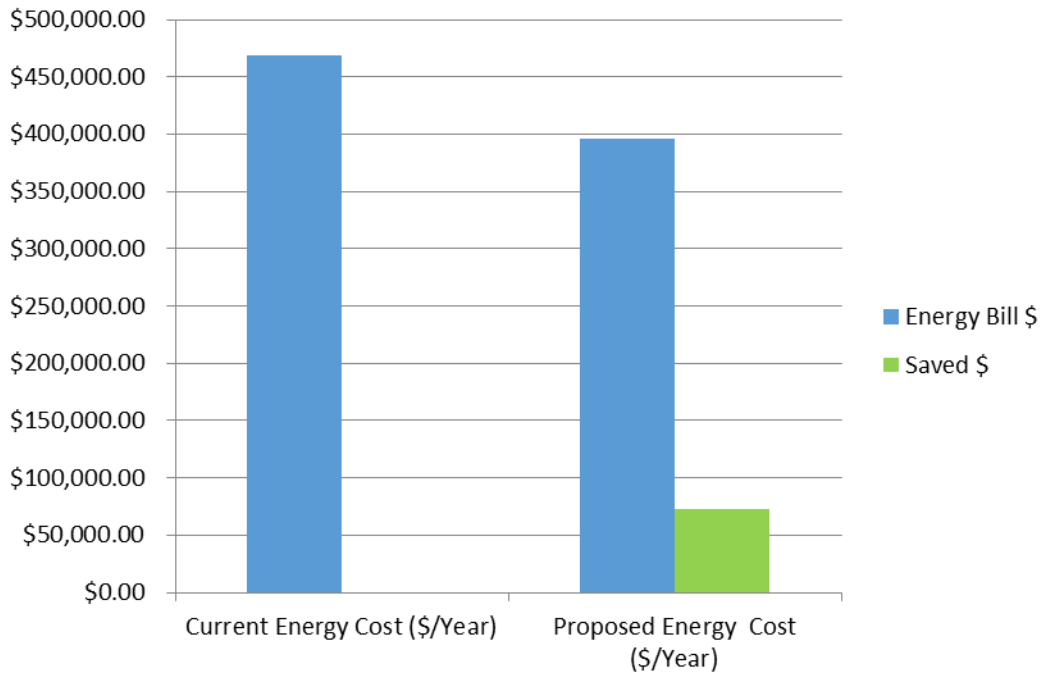


Current Energy Costs and Potential Savings

For the calendar year under consideration the total cost of energy (electric and natural gas) for the buildings surveyed is estimated to be $468,707.

Figure 3: Current Annual Energy Costs and Potential Savings

If all ECMs under consideration were implemented it would reduce the current energy cost by $73,113. This translates to a reduction in energy costs by **15.6%.**



1. OVERVIEW OF THE REPORT: FOCUS AND LIMITATIONS

This document is an energy efficiency assessment report that was prepared for 24 Rancho Cucamonga High School buildings located in Southern California. This report was prepared by Eskinder Berhanu and Associates (EBA). Note that consistent with the CEC's 'loading order' of energy efficiency first, identifying renewable energy opportunities are not within the intended scope of this report.

The on-site Energy Opportunity Survey observations, measurements, and data collection for each of the surveyed buildings was completed 'on site' by the California Conservation Corps (CCC) crew from Pomona, CA on 11/03/2014. During the Energy Opportunity Survey, the CCC crew collected valuable information regarding the energy use of Rancho Cucamonga High School buildings and developed a detailed inventory of electrical and gas using equipment and appliances that are in use at the site. The inventory developed for the site facility includes the following key areas:

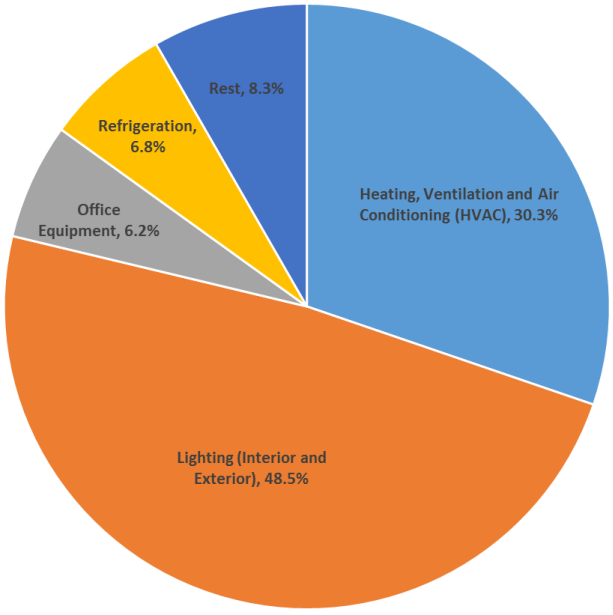
- Building Envelope
- Interior and exterior lighting
- Heating, ventilating and air-conditioning (HVAC) systems
- Plug loads, such as computers, printers, vending machines, microwaves etc.
- Fenestration, which includes windows, doors and skylights and how they are oriented
- Domestic hot-water systems used for bathrooms and food preparation
- And other miscellaneous equipment such as kitchen appliances, freezers etc.

Overview of Energy Use in California Schools

Figures 4 and 5 show the average distribution of electric and natural gas energy use for California schools based on a Commercial End Use Survey (CEUS) published by Itron, Inc. in 2006.

Figure 4: Typical electric energy usage distribution at a CA school

Nearly 50% of electrical energy use at California schools is attributed to interior and exterior lighting. Space conditioning (HVAC) accounts for another 30% of the total school electricity usage.



Based on this vital information, the efforts of the CCC's Energy Opportunity Survey are primarily focused toward lighting and HVAC, which together account for nearly 80% of total electricity use at schools. Similarly for gas usage, Energy Opportunity Survey efforts were primarily focused on space heating and domestic hot water, which together account for over 90% of gas energy usage at a typical school. This focus is also reflected in the energy conservation measures (ECMs) recommended by the California Energy Commission (CEC) in their final Proposition 39 Guidelines, which are substantially focused on lighting and HVAC.

Energy Opportunity Survey Data Limitations and Completeness

The data required for developing this report has been collected primarily by the CCC via different processes starting from the application that the schools submitted to the CCC requesting the Energy Opportunity Survey, to the actual on-site Energy Opportunity Survey itself, and interviews with the school's operations and maintenance (O&M) staff. Another critical aspect of the data collected is the utility bills which are requested from the utility service provider. This data has also been augmented by visiting the school website in some cases.

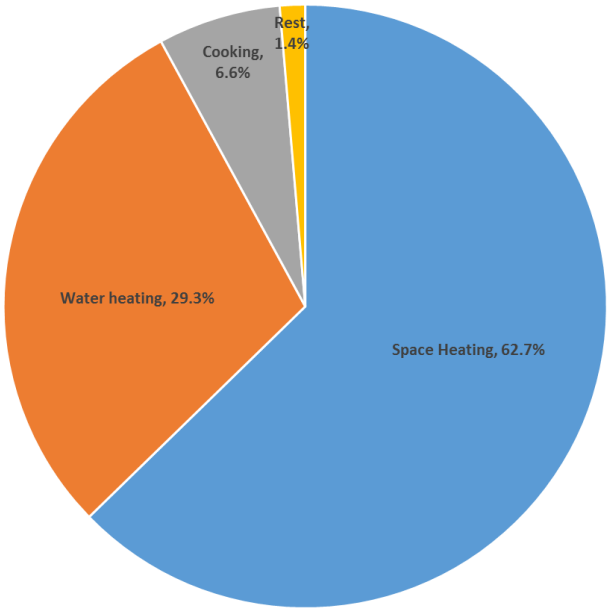
The scope of data collected by the CCC during the on-site Energy Opportunity Survey was focused primarily on addressing the 21 recommendations or energy conservation measures (ECMs) listed by the California Energy.

In addition to developing the inventory of equipment and appliances listed above, the CCC interviewed school O&M staff to gather the schedules and operating hours for the school and equipment. Lastly, the energy audit questionnaire and database tool is designed for the CCC crew to document observed maintenance issues while on site considering the ASHRAE O&M standards.

California Energy Commission (CEC), in the Proposition 39 guidelines, encompasses the great majority of all potential energy saving opportunities.

Figure 5: Gas usage distribution at a typical CA school

Natural gas use is predominately space heating and water heating, accounting for 62.7% and 29.3% of total gas use, respectively.



The data collected during the site surveys might be limited by accessibility of certain equipment such as exterior pole lights and air conditioning units on roofs considered unsafe for the Corpsmembers (CMs) to reach. CMs rely on the nameplates of appliances and equipment to obtain critical information regarding their energy use. In cases where this was unavailable, the CMs rely on information from O&M staff at the school. It must be noted that while the CMs make every effort to obtain this information, there are typically some instances where specific information required for a more accurate and thorough analysis is unavailable. In such cases the analysis is based on industry averages and practices.

Finally, while schools often have multiple utility accounts for electric and gas, for the purposes of this report we are limited to the meter(s) serving the school buildings receiving the Energy Opportunity Surveys. Utility meters serving athletic stadiums, etc. are outside the scope of this report.

2. SITE DETAILS AND ENERGY OVERVIEW

The following section provides an overview of the overall energy performance of the site by establishing the necessary benchmarking metrics and summarizing the electrical and gas usage data for the calendar year of 2013.

2.1 Site Details and Naming Convention

One of the first tasks for the CCC Energy Opportunity Survey crew is to create a site map and assign building 'IDs' to all of the buildings for the purpose of the surveys and analysis. Figure 6 that shows the top view of the site is the campus map of the site that was provided to us by the LEA. For this school the CCC crew surveyed a total of 24 buildings on site.

Figures 6: Top View Diagrams of Buildings (Next Page)

Figures 6: Top View Diagrams of Buildings

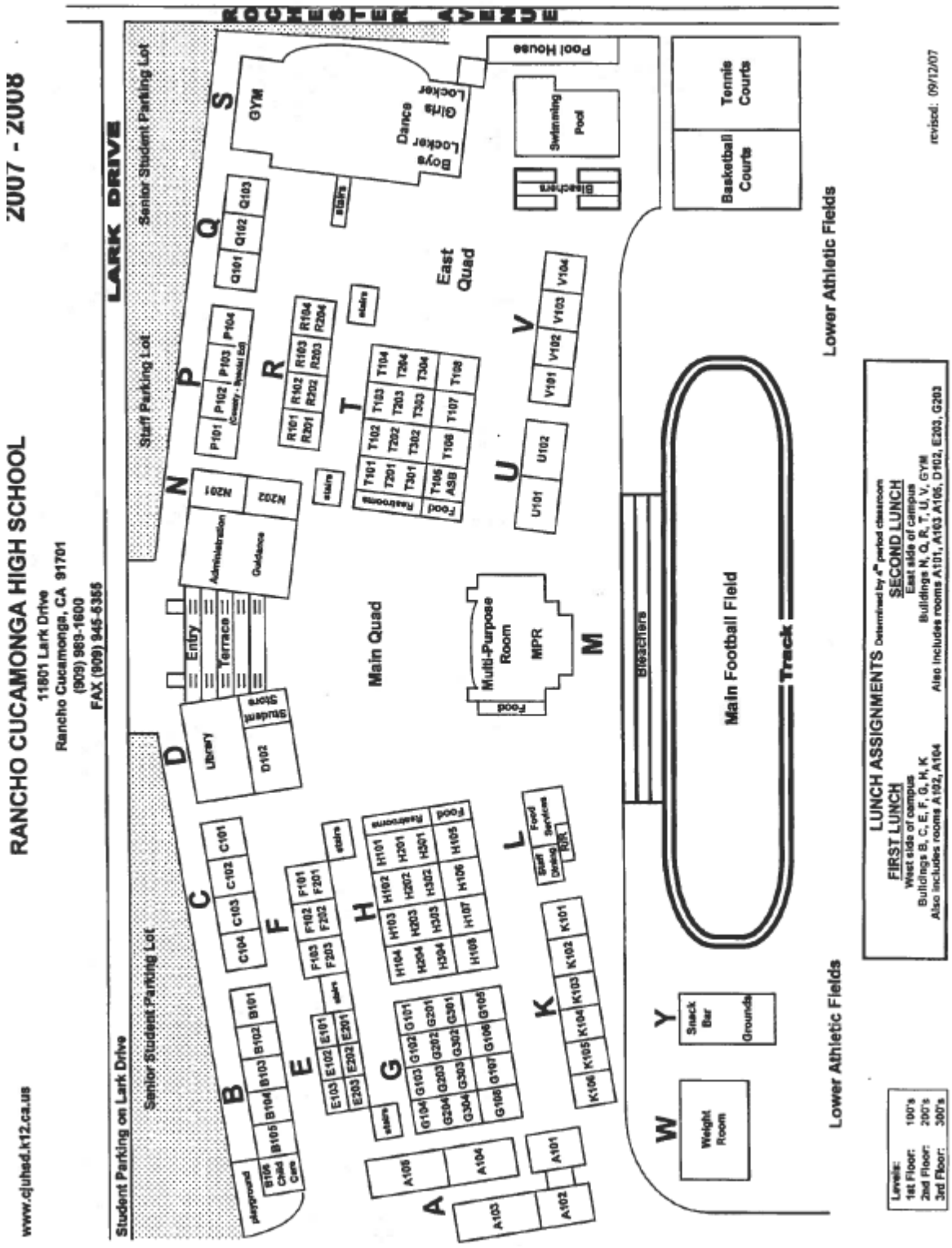


Table 2: Site Level Basic Information

The tables below (Table 2.a and Table 2.b) provide the age, gross square footage, and description of the buildings primary 'end use'. The combined square footage of the buildings surveyed is estimated to be 208,552 sq-ft.

Table 2.a

Building ID	Year Built	Building Type	Gross Total Area (sq-ft)	# of stories
B1	1990	ADMIN	10,665	2
B2	1990	CLASSES	3,118	1
B3	1990	CLASSES	2,668	1
B4	1990	GYM	31,434	2
B5	1990	POOL HOUSE	1,962	1
B6	1990	CLASSES	3,596	1
B7	1990	MPR	4,587	1
B8	1990	KITCHEN	14,179	1
B9	1990	CLASSES	5,532	1
B10	1990	GROUNDS	5,208	1
B11	1990	WEIGHT ROOM	3,539	1
B12	1990	CLASSES	4,432	1
B13	1990	CLASSES	5,803	1
B14	1990	CLASSES	5,394	1
B15	1990	LIBRARY	3,600	1
B16	1990	CLASSES	14,211	2
B17	1990	CLASSES	19,225	2
B18	1990	CLASSES	7,440	2
B19	1990	CLASSES	9,720	2
B20	1990	CLASSES	6,334	2
B21	1990	CLASSES	19,314	3
B22	1990	CLASSES	22,301	3
B23	1990	CLASSES	4,065	1
B24	1990	GYMS	225	1

Table 2.b (Next Page)

Table 2.b

Building & Room ID	Gross Area (sq-ft)	Room Type	Height (ft)	Floor #
B1-R1	323	OFFICE	9	1
B1-R2	713	LOBBY	10	1
B1-R3	342	CONFERENCE	9	1
B1-R4	700	LOBBY	10	1
B1-R5	252	HALLWAY	10	1
B1-R6	144	RESTROOM	8	1
B1-R7	180	RESTROOM	8	1
B1-R8	144	DATAROOM	14	1
B1-R9	28	ELEVATOR	7	1
B1-R10	99	COPY ROOM	8	1
B1-R11	117	MAILROOM	8	1
B1-R12	1,014	COMPUTER LAB	10	1
B1-R13	1,000	CLASSROOM	10	1
B1-R14	190	MAITENCE	14	1
B1-R15	130	OFFICE	9	1
B1-R16	324	STAIRWAY	17	1
B1-R17	260	OFFICE	8	1
B1-R18	736	LOBBY	10	1
B1-R19	720	OFFICE	8	1
B1-R20	720	OFFICE	10	1
B1-R21	264	HALLWAY	10	1
B1-R22	198	OFFICE	9	1
B1-R23	198	BREAKROOM	7	1
B1-R24	88	RESTROOM	8	1
B1-R25	42	OFFICE	8	1
B1-R26	209	ELEVATOR SHAFT	17	1
B1-R27	56	HALLWAY	10	1
B1-R28	108	OFFICE	8	1
B1-R29	150	OFFICE	10	1
B1-R30	135	OFFICE	10	1
B1-R31	437	OFFICE	10	1
B1-R32	68	HALLWAY	8	1
B1-R33	96	OFFICE	10	1

Table 2.b Continues

Building & Room ID	Gross Area (sq-ft)	Room Type	Height (ft)	Floor #
B1-R34	60	HALLWAY	8	1
B1-R35	180	OFFICE	10	1
B1-R36	240	OFFICE	10	1
B2-R1	899	CLASSROOM	10	1
B2-R2	899	STORAGE	10	1
B2-R3	450	STORAGE	10	1
B2-R4	870	CLASSROOM	10	1
B3-R1	870	CLASSROOM	10	1
B3-R2	899	CLASSROOM	10	1
B3-R3	899	CLASSROOM	10	1
B4-R1	28	ELEVATOR	7	1
B4-R2	54	MECHANICAL	10	1
B4-R3	1008	HALLWAY	10	1
B4-R4	270	STORAGE	14	1
B4-R5	616	DANCE ROOM	13	1
B4-R6	1148	CLASSROOM	13	1
B4-R7	756	TRAINING ROOM	13	1
B4-R8	126	HALLWAY	11	1
B4-R9	455	HALLWAY	11	1
B4-R10	126	HALLWAY	11	1
B4-R11	360	STAIRWAY	22	1
B4-R12	195	ELECTRICAL	14	1
B4-R13	150	BOILER ROOM	14	1
B4-R14	392	LOCKER	14	1
B4-R15	336	OFFICE	11	1
B4-R16	3420	LOCKERS	15	1
B4-R17	437	STORAGE	15	1
B4-R18	112	OFFICE	10	1
B4-R19	36	OFFICE	10	1
B4-R20	315	OFFICE	10	1
B4-R21	1067	HALLWAY	10	1
B4-R22	28	ELEVATOR SHAFT	18	1
B4-R23	54	STORAGE	14	1

Table 2.b Continues

Building & Room ID	Gross Area (sq-ft)	Room Type	Height (ft)	Floor #
B4-R24	1872	HALLWAY	11	1
B4-R25	56	SNACK BAR	9	1
B4-R26	15600	GYM	26	1
B4-R27	846	HALLWAY	10	1
B4-R28	66	OFFICE	10	1
B4-R29	580	RESTROOM	10	1
B4-R30	870	RESTROOM	10	1
B4-R31	55	STORAGE	14	1
B5-R1	420	RESTROOM	10	1
B5-R2	420	RESTROOM	10	1
B5-R3	340	OFFICE	10	1
B5-R4	782	STORAGE	10	1
B6-R1	899	CLASSROOM	10	1
B6-R2	899	CLASSROOM	10	1
B6-R3	899	CLASSROOM	10	1
B6-R4	899	CLASSROOM	10	1
B7-R1	1410	BANDROOM	11	1
B7-R2	352	ELECTRICAL	14	1
B7-R3	168	STORAGE	13	1
B7-R4	414	OFFICE	10	1
B7-R5	357	STORAGE	13	1
B7-R6	1886	BANDROOM	14	1
B8-R1	1625	Unknown	10	1
B8-R2	209	STORAGE	13	1
B8-R3	7938	AUTO ROOM	13	1
B8-R4	132	HALLWAY	10	1
B8-R5	45	SNACK BAR	10	1
B8-R6	54	STORAGE	10	1
B8-R7	437	RESTROOM	10	1
B8-R8	406	RESTROOM	10	1
B8-R9	1050	STAGE	10	1
B8-R10	406	RESTROOM	10	1
B8-R11	437	RESTROOM	10	1

Table 2.b Continues

Building & Room ID	Gross Area (sq-ft)	Room Type	Height (ft)	Floor #
B8-R12	270	STORAGE	10	1
B8-R13	1170	SNACKBAR	10	1
B9-R1	184	STORAGE	10	1
B9-R2	152	HALLWAY	10	1
B9-R3	100	Unknown	0	1
B9-R4	90	OFFICE	9	1
B9-R5	2397	KITCHEN	10	1
B9-R6	115	HALLWAY	10	1
B9-R7	40	STORAGE	9	1
B9-R8	40	STORAGE	9	1
B9-R9	40	DOMESTIC HOT	9	1
B9-R10	2262	CAFETERIA	14	1
B9-R11	56	RESTROOM	8	1
B9-R12	56	RESTROOM	8	1
B10-R1	868	CLASSROOM	10	1
B10-R2	868	CLASSROOM	10	1
B10-R3	868	CLASSROOM	10	1
B10-R4	868	CLASSROOM	10	1
B10-R5	868	CLASSROOM	10	1
B10-R6	868	CLASSROOM	10	1
B11-R1	418	RESTROOM	10	1
B11-R2	418	RESTROOM	10	1
B11-R3	90	DOMESTIC HOT	15	1
B11-R4	1773	FIELD STORAGE	15	1
B11-R5	840	SNACK BAR	15	1
B12-R1	4312	WIEGHT ROOM	21	1
B12-R2	120	OFFICE	10	1
B13-R1	1540	COMPUTER LAB	10	1
B13-R2	165	OFFICE	10	1
B13-R3	120	OFFICE	10	1
B13-R4	187	OFFICE	10	1
B13-R5	64	OFFICE	10	1
B13-R6	672	CLASSROOM	10	1

Table 2.b Continues

Building & Room ID	Gross Area (sq-ft)	Room Type	Height (ft)	Floor #
B13-R7	748	CLASSROOM	10	1
B13-R8	2065	CLASSROOM	10	1
B13-R9	242	STORAGE	14	1
B14-R1	899	CLASSROOM	10	1
B14-R2	899	CLASSROOM	10	1
B14-R3	899	CLASSROOM	10	1
B14-R4	899	CLASSROOM	10	1
B14-R5	899	CLASSROOM	10	1
B14-R6	899	CLASSROOM	10	1
B15-R1	900	CLASSROOM	10	1
B15-R2	900	CLASSROOM	10	1
B15-R3	900	CLASSROOM	10	1
B15-R4	900	CLASSROOM	10	1
B16-R1	170	ELECTRICAL	15	1
B16-R2	432	LIBRARY	10	1
B16-R3	217	HALLWAY	10	1
B16-R4	49	RESTROOM	8	1
B16-R5	255	OFFICE	10	1
B16-R6	153	WORKROOM	10	1
B16-R7	646	COMPUTER LAB	10	1
B16-R8	153	OFFICE	10	1
B16-R9	255	FRONT DESK	10	1
B16-R10	28	ELEVATOR	8	1
B16-R11	56	HALLWAY	9	1
B16-R12	56	HALLWAY	9	1
B16-R13	680	LIBRARY	11	1
B16-R14	476	LIBRARY	11	1
B16-R15	2146	LIBRARY	26	1
B16-R16	378	LIBRARY	10	1
B16-R17	1200	LIBRARY	10	1
B16-R18	936	WORK ROOM	10	1
B16-R19	1610	STORAGE	14	1
B16-R20	432	HALLWAY	10	1

Table 2.b Continues

Building & Room ID	Gross Area (sq-ft)	Room Type	Height (ft)	Floor #
B16-R21	42	STORAGE	7	1
B16-R22	28	ELEVATOR SHAFT	23	1
B16-R23	2397	COMPUTER LAB	14	1
B16-R24	1326	STUDENT STORE	10	1
B16-R25	90	STORAGE	14	1
B17-R1	1170	CLASSROOM	10	1
B17-R2	1170	CLASSROOM	10	1
B17-R3	1170	COMPUTER LAB	10	1
B17-R4	1170	COMPUTER LAB	10	1
B17-R5	28	ELEVATOR	7	1
B17-R6	72	MECHANICAL	14	1
B17-R7	396	RESTROOM	10	1
B17-R8	396	RESTROOM	10	1
B17-R9	81	ROOF ACCESS	14	1
B17-R10	702	SNACK BAR	9	1
B17-R11	1200	CLASSROOM	9	1
B17-R12	600	CLASSROOM	10	1
B17-R13	600	CLASSROOM	10	1
B17-R14	600	CLASSROOM	10	1
B17-R15	380	ELECTRICAL	14	1
B17-R16	150	HALLWAY	11	1
B17-R17	360	STORAGE	14	1
B17-R18	1230	CLASSROOM	10	1
B17-R19	1230	CLASSROOM	10	1
B17-R20	1230	CLASSROOM	10	1
B17-R21	1230	CLASSROOM	10	1
B17-R22	297	RESTROOM	10	1
B17-R23	66	CUSTODIAN	14	1
B17-R24	297	RESTROOM	10	1
B17-R25	40	ELEVATOR SHAFT	3	1
B17-R26	840	CLASSROOM	10	1
B17-R27	840	CLASSROOM	10	1
B17-R28	840	CLASSROOM	10	1

Table 2.b Continues

Building & Room ID	Gross Area (sq-ft)	Room Type	Height (ft)	Floor #
B17-R29	840	CLASSROOM	10	1
B18-R1	930	CLASSROOM	10	1
B18-R2	930	CLASSROOM	10	1
B18-R3	930	CLASSROOM	10	1
B18-R4	930	CLASSROOM	10	1
B18-R5	930	CLASSROOM	10	1
B18-R6	930	CLASSROOM	10	1
B18-R7	930	CLASSROOM	10	1
B18-R8	930	CLASSROOM	10	1
B19-R1	1620	CLASSROOM	10	1
B19-R2	1620	CLASSROOM	10	1
B19-R3	1620	CLASSROOM	10	1
B19-R4	1620	CLASSROOM	10	1
B19-R5	1620	CLASSROOM	10	1
B19-R6	1620	CLASSROOM	10	1
B20-R1	900	CLASSROOM	10	1
B20-R2	900	CLASSROOM	10	1
B20-R3	900	CLASSROOM	10	1
B20-R4	390	CLASSROOM	10	1
B20-R5	544	WORKROOM	27	1
B20-R6	900	CLASSROOM	10	1
B20-R7	900	CLASSROOM	10	1
B20-R8	900	CLASSROOM	10	1
B21-R1	1110	CLASSROOM	10	1
B21-R2	1110	CLASSROOM	10	1
B21-R3	1110	CLASSROOM	10	1
B21-R4	1110	CLASSROOM	10	1
B21-R5	28	ELEVATOR	8	1
B21-R6	72	STORAGE	14	1
B21-R7	396	RESTROOM	10	1
B21-R8	396	RESTROOM	10	1
B21-R9	72	STORAGE	14	1
B21-R10	702	SNACK BAR	10	1

Table 2.b Continues

Building & Room ID	Gross Area (sq-ft)	Room Type	Height (ft)	Floor #
B21-R11	1200	CLASSROOM	10	1
B21-R12	900	CLASSROOM	10	1
B21-R13	900	CLASSROOM	10	1
B21-R14	900	CLASSROOM	10	1
B21-R15	770	HALLWAY	10	1
B21-R16	900	CLASSROOM	10	1
B21-R17	900	CLASSROOM	10	1
B21-R18	300	WORKROOM	10	1
B21-R19	900	CLASSROOM	10	1
B21-R20	1200	CLASSROOM	10	1
B21-R21	297	RESTROOM	10	1
B21-R22	60	DOMESTIC HOT	14	1
B21-R23	297	RESTROOM	10	1
B21-R24	28	ELEVATOR SHAFT	20	1
B21-R25	900	CLASSROOM	10	1
B21-R26	900	CLASSROOM	10	1
B21-R27	900	CLASSROOM	10	1
B21-R28	900	CLASSROOM	10	1
B21-R29	56	ELEVATOR SHAFT	30	1
B22-R1	1200	CLASSROOM	10	1
B22-R2	1200	CLASSROOM	10	1
B22-R3	1200	CLASSROOM	10	1
B22-R4	1200	CLASSROOM	10	1
B22-R5	468	STORAGE	10	1
B22-R6	198	RESTROOM	10	1
B22-R7	198	RESTROOM	10	1
B22-R8	456	ELECTRICAL	14	1
B22-R9	1200	CLASSROOM	10	1
B22-R10	1200	CLASSROOM	10	1
B22-R11	1200	CLASSROOM	10	1
B22-R12	1200	CLASSROOM	10	1
B22-R13	990	HALLWAY	10	1
B22-R14	1230	CLASSROOM	10	1
B22-R15	154	WORKROOM	10	1

Table 2.b Continues

Building & Room ID	Gross Area (sq-ft)	Room Type	Height (ft)	Floor #
B22-R16	900	CLASSROOM	10	1
B22-R17	480	WORKROOM	10	1
B22-R18	900	CLASSROOM	10	1
B22-R19	1230	CLASSROOM	10	1
B22-R20	297	RESTROOM	10	1
B22-R21	70	CUSTODIAN	14	1
B22-R22	330	RESTROOM	10	1
B22-R23	1200	CLASSROOM	10	1
B22-R24	1200	CLASSROOM	10	1
B22-R25	1200	CLASSROOM	10	1
B22-R26	1200	CLASSROOM	10	1
B23-R1	1395	CLASSROOM	18	1
B23-R2	2380	WOODSHOP	18	1
B23-R3	130	STORAGE	18	1
B23-R4	80	STORAGE	18	1
B23-R5	80	STORAGE	18	1
B24-R1	225	STORAGE	16	1

- All unavailable and non-applicable input fields are left as “0”, per CEC’s direction. Estimated data points are highlighted.

2.1.1 Runtime Approximations

One of the key variables in estimating the energy use of specific electric- and gas-using equipment and appliances is the normal operating hours. Based on 1) the estimated general operating hours, 2) data estimated regarding the operating schedules during the analysis and 3) in some cases data based on industry averages by climate zone, the operating hours for lighting and HVAC equipment were approximated.

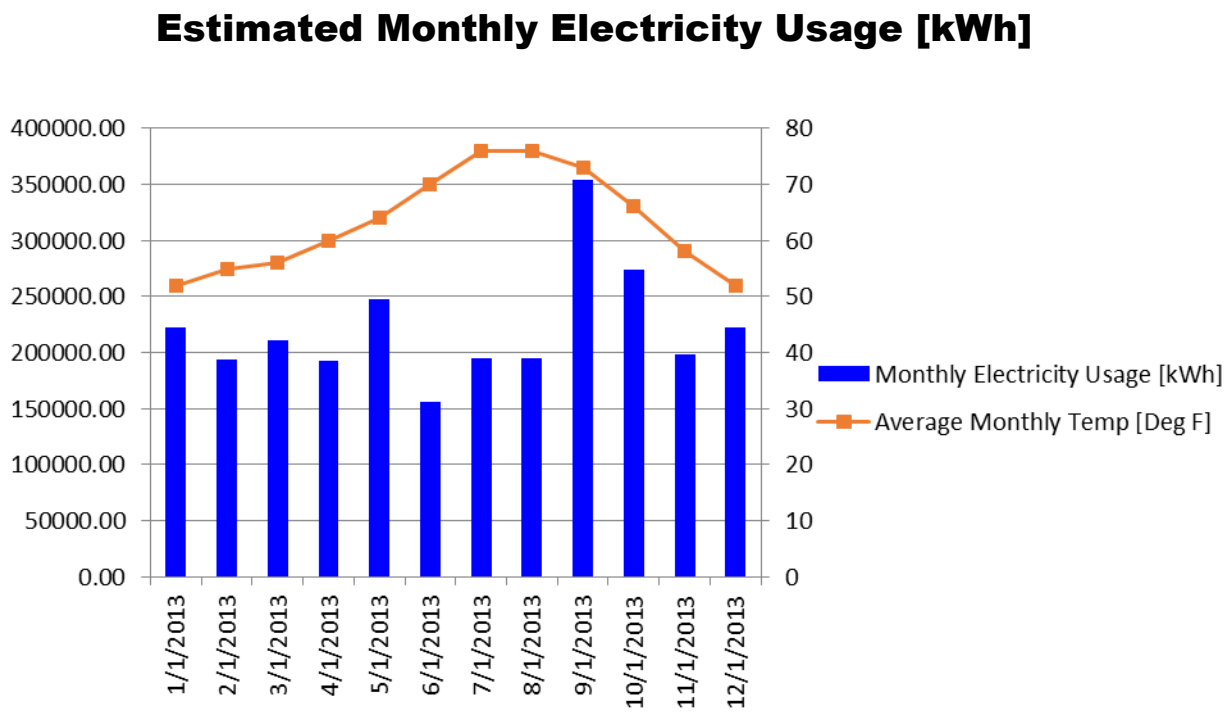
2.2 Electric and Gas Usage at the Site

For the calendar year under consideration it is estimated that the site used a total of 2,662,672 kWh of electricity and 41,490 therms of natural gas, which cost Rancho Cucamonga High School $441,341 and $27,366 respectively.

The following two figures show the normalized total monthly electricity and gas usage of the site plotted along with average monthly air temperatures. This visualization is extremely useful to identify any abnormal trends in monthly electric and gas usages.

Figure 7: Estimated Monthly Electricity Usage

As expected, the monthly electricity usage fluctuates alongside changes in school operation and monthly air temperature. Typically, more electricity is used during hotter months when the demand for air conditioning is greater; however, in this school due to the low operation in June, July and August high energy usages are observed only in summer month of September as well as in the early and late summer months of May and October. The typical winter months, January and December, electric heating usage is also illustrated to be higher than the mild months of April and November.

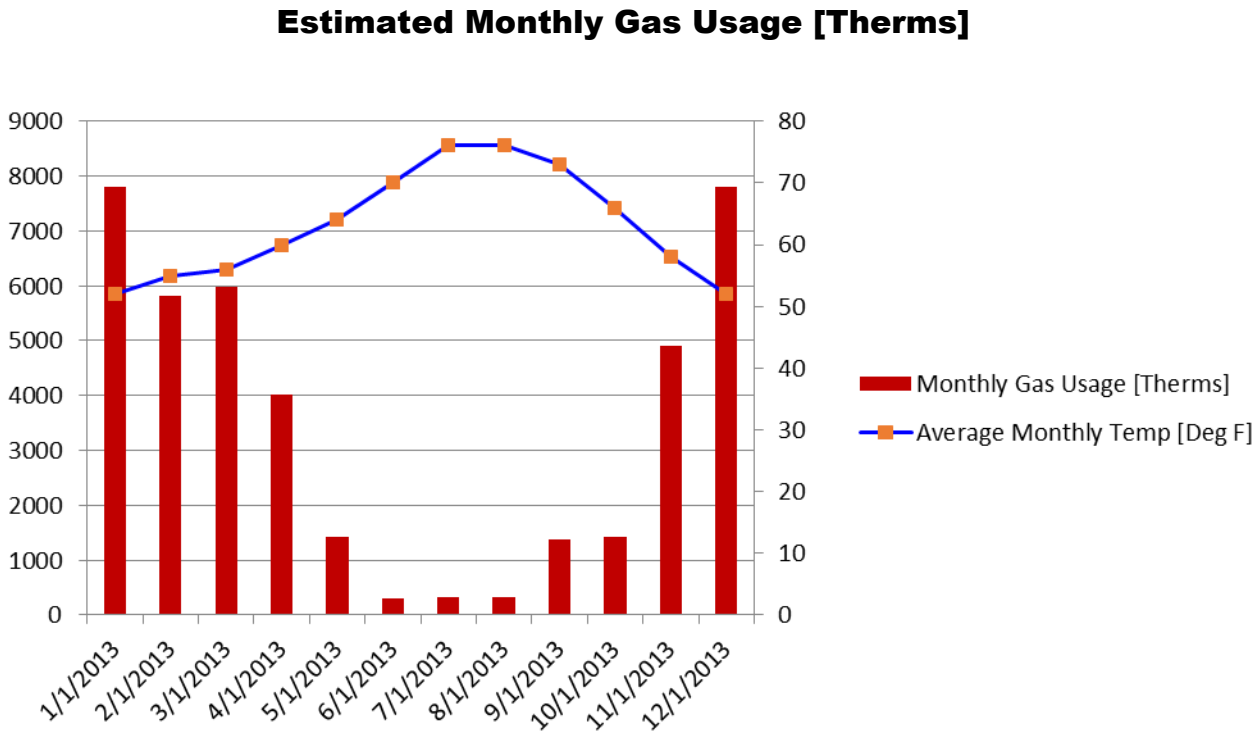


Potential operations and maintenance issues:

June, July and August are the lowest months in terms of electricity usage. This means the school should operate at or near this level during all non-operating months. All the energy usage during non-operating months might be attributed to the administration office, exterior lighting, school occupation for special programs and summer school, or end of the year office work. In any case, attention need to be paid toward this in order to ensure that all unnecessary HVAC systems, lighting, and plug loads are turned off during the school's summer season.

Figure 8: Monthly natural gas usage and average air temperature

As expected Natural gas usage of this facility increased during the winter months when there is a greater demand for space heating.



2.3 CEC Benchmarking Metrics

Benchmarking allows schools of different sizes to compare their energy performance, expressed in terms of annual energy use per sq-ft. The benchmarking metrics are calculated for the school using the CEC calculator.

Table 3: CEC Benchmarking Calculator

This table shows the inputs for the CEC Benchmarking Calculator based on the information collected. Please note the following:

Electricity		
	Average Maximum Demand (kW):	527
	Total Annual Electric Use (kWh):	2,662,672
	Total Annual Electric Charges ($)	441,341
Natural Gas		
	Total Annual Natural Gas Use (therms):	41,490
	Total Annual Gas Charges ($):	27,366
Other Fuels (if applicable)		
	Total Annual Propane Use(gals):	0.0
	Total Annual Propane Charges($):	0.00
	Total Annual Fuel Oil Use(gals):	0
	Total Annual Fuel Oil Costs($):	0

- All unavailable and non-applicable input fields are left as "0", per CEC's direction. Estimated data points are highlighted.

Table 4: CEC Energy Use Intensity (EUI) Calculator

The Electric Energy Use Intensity (EUI) of the school is 12.77 kWh/sf/year. This figure is significantly higher than the California average EUI based on the CEUS data, which is 7.46 kWh/sf/year.

The fact that the main energy source for space heating and domestic hot water is electricity in addition to a higher outdoor and indoor lighting usage coupled with enhanced operation have contributed for the EUI of this school in being higher than the California average. Installing the recommended measures of this study will help in lowering the school's current EUI.

Energy Use Intensity (EUI) Calculator					
Electricity		**Natural Gas**		**Other Fuels**	
2.52	W/SF	0.20	*Therms/SF/Yr*	-	Propane gal/SF/Yr
12.77	*kWh/SF/Yr*	$0.13	*Gas Cost/SF/Yr*	-	Fuel Oil gal/SF/Yr
$2.12	*Cost/SF/Yr*			-	Fuel Cost/SF/Yr
Energy Costs/SF/Year:	$2.25		Energy EUI(Kbtu)/SF/Year:	156.7	

Table 5: Average Unit Energy Cost

The table lists the average unit cost of various fuels. These costs are used to calculate all baseline estimates.

Average Cost (if applicable)		
Electricity	0.166	$/kWh
Natural Gas	0.6595760	$/therm
Propane	-	$/gal
Fuel Oil	-	$/gal

3. INVENTORY CHARACTERISTICS AND OBSERVATIONS AND LIMITATIONS

This section summarizes the inventory of electric and gas end usage of Rancho Cucamonga High School buildings that was collected by the CCC during the Energy Opportunity Survey. The information is calculated and provided for each individual building, as identified in the table. This section also provides estimates for the total energy used by each energy end use category, as well as the operating costs for each of them. The estimates provided are based on best available data, approximations, and simple engineering calculations.

The section is divided into five sub sections:
1. Electric End Use Characteristics
2. Gas End Use Characteristics
3. Building Envelope Characteristics
4. Specialty and Miscellaneous loads and Characteristics
5. Observed O&M issues

3.1 Electric End Use Characteristics

The main areas of focus in the electric end use section are Lighting and HVAC, which together account for over 80% of electric energy use at a typical CA school. Other electric usage data is summarized as available. The cost estimates for electric usage throughout the document are calculated using the blended cost of electricity of $0.166 per kWh established in "Table 5: Average Unit Energy Cost" of the previous section. **Note that the perceived discrepancies in totals at the end of tables when compared with the sum of all individual entries is due to rounding the numbers and, in fact, is consistent and correct.**

3.1.1 Lighting Characteristics

The following two tables are summaries of interior and exterior lighting of this facility. Cells highlighted in yellow, if any, signify assumptions that were made due to suspect or missing data. The total energy used in each row of the tables was calculated using an approximate reported annual operating hours of 2,346 for all the interior lights (also considering a usage factor) and 4,004 for the exterior lights.

Table 6: Building Interior Lighting Inventory (Next Page)

Table 6: Building Interior Lighting Inventory

Building & Room ID	Space Type	Lamp Type	Lamp Wattage (W)	Lamps per Fixture	Number of Fixtures	Total Power (kW)	Total Annual Energy Use (kWh)	Total Annual Operating Cost ($)
B1-R1	OFFICE	T12	34	3	4	0.41	958	$159
B1-R2	LOBBY	T12	34	2	12	0.82	1,916	$318
B1-R3	CONFERENCE	T12	34	3	4	0.41	958	$159
B1-R4	LOBBY	T12	34	2	11	0.75	1,756	$291
B1-R5	HALLWAY	T12	34	2	3	0.20	479	$79
B1-R6	RESTROOM	T12	34	1	2	0.07	160	$26
B1-R7	RESTROOM	T12	34	1	2	0.07	160	$26
B1-R8	DATAROOM	T12	34	1	2	0.07	160	$26
B1-R9	ELEVATOR	T12	34	1	1	0.03	80	$13
B1-R10	COPY ROOM	T12	34	3	2	0.20	479	$79
B1-R11	MAILROOM	T12	34	3	2	0.20	479	$79
B1-R12	COMPUTER LAB	T12	34	3	14	1.43	3,353	$556
B1-R13	CLASSROOM	T12	34	3	14	1.43	3,353	$556
B1-R14	MAITENCE	T12	34	1	2	0.07	160	$26
B1-R15	OFFICE	T12	34	3	2	0.20	479	$79
B1-R16	STAIRWAY	UNKNOWN	80	1	8	0.64	1,503	$249
B1-R17	OFFICE	T12	34	3	4	0.41	958	$159
B1-R18	LOBBY	T12	34	2	12	0.82	1,916	$318
B1-R19	OFFICE	T12	34	2	8	0.54	1,277	$212
B1-R19	OFFICE	T12	34	2	12	0.82	1,916	$318
B1-R20	OFFICE	T12	34	2	1	0.07	160	$26
B1-R20	OFFICE	T12	34	2	9	0.61	1,437	$238
B1-R21	HALLWAY	T12	34	2	3	0.20	479	$79
B1-R22	OFFICE	T12	34	2	2	0.14	319	$53
B1-R22	OFFICE	T12	34	2	2	0.14	319	$53
B1-R23	BREAKROOM	T12	34	2	1	0.07	160	$26
B1-R24	RESTROOM	T12	34	2	1	0.07	160	$26
B1-R25	OFFICE	T12	34	2	3	0.20	479	$79
B1-R26	ELEVATOR SHAFT	T12	34	2	2	0.14	319	$53
B1-R27	HALLWAY	T12	34	2	2	0.14	319	$53

Table 6: Building Interior Lighting Inventory Continues

Building & Room ID	Space Type	Lamp Type	Lamp Wattage (W)	Lamps per Fixture	Number of Fixtures	Total Power (kW)	Total Annual Energy Use (kWh)	Total Annual Operating Cost ($)
B1-R28	OFFICE	T12	34	2	2	0.14	319	$53
B1-R29	OFFICE	T12	34	3	2	0.20	479	$79
B1-R30	OFFICE	T12	34	3	2	0.20	479	$79
B1-R31	OFFICE	T12	34	3	6	0.61	1,437	$238
B1-R32	HALLWAY	T12	34	2	2	0.14	319	$53
B1-R33	OFFICE	T8	32	2	2	0.13	301	$50
B1-R34	HALLWAY	T12	34	2	3	0.20	479	$79
B1-R35	OFFICE	T8	32	2	5	0.32	751	$125
B1-R36	OFFICE	T8	32	2	5	0.32	751	$125
B2-R1	CLASSROOM	T12	34	2	18	1.22	2,874	$476
B2-R2	STORAGE	T12	34	2	14	0.95	2,235	$370
B2-R2	STORAGE	T12	34	2	3	0.20	479	$79
B2-R3	STORAGE	T12	34	2	3	0.20	479	$79
B2-R3	STORAGE	T12	34	2	14	0.95	2,235	$370
B2-R4	CLASSROOM	T12	34	2	18	1.22	2,874	$476
B3-R1	CLASSROOM	T12	34	2	18	1.22	2,874	$476
B3-R2	CLASSROOM	T12	34	2	18	1.22	2,874	$476
B3-R2	CLASSROOM	CFL	26	1	2	0.05	122	$20
B3-R3	CLASSROOM	T12	34	4	18	2.45	5,748	$953
B4-R1	ELEVATOR	T12	34	3	1	0.10	239	$40
B4-R2	MECHANICAL	T12	34	2	1	0.07	160	$26
B4-R3	HALLWAY	T12	34	2	14	0.95	2,235	$370
B4-R4	STORAGE	T12	34	2	2	0.14	319	$53
B4-R5	DANCE ROOM	HID	250	1	10	2.95	6,926	$1,148
B4-R5	DANCE ROOM	HAL	50	2	5	0.50	1,174	$195
B4-R6	CLASSROOM	T8	32	4	14	1.79	4,207	$697
B4-R6	CLASSROOM	HAL	50	2	2	0.20	470	$78
B4-R7	TRAINING ROOM	T12	34	2	10	0.68	1,597	$265
B4-R8	HALLWAY	T12	34	2	2	0.14	319	$53
B4-R8	HALLWAY	LED	1	1	1	0.00	2	$0

Table 6: Building Interior Lighting Inventory Continues

Building & Room ID	Space Type	Lamp Type	Lamp Wattage (W)	Lamps per Fixture	Number of Fixtures	Total Power (kW)	Total Annual Energy Use (kWh)	Total Annual Operating Cost ($)
B4-R9	HALLWAY	T12	34	2	8	0.54	1,277	$212
B4-R10	HALLWAY	T12	34	2	2	0.14	319	$53
B4-R10	HALLWAY	LED	1	1	1	0.00	2	$0
B4-R11	STAIRWAY	HID	250	1	4	1.18	2,770	$459
B4-R11	STAIRWAY	HAL	50	2	1	0.10	235	$39
B4-R12	ELECTRICAL	T12	34	2	4	0.27	639	$106
B4-R13	BOILER ROOM	T12	34	2	2	0.14	319	$53
B4-R14	LOCKER	T8	32	2	6	0.38	902	$149
B4-R15	OFFICE	T12	34	3	6	0.61	1,437	$238
B4-R16	LOCKERS	T12	34	2	65	4.42	10,378	$1,720
B4-R16	LOCKERS	LED	1	1	2	0.00	5	$1
B4-R17	STORAGE	T12	34	2	22	1.50	3,512	$582
B4-R17	STORAGE	LED	1	1	1	0.00	2	$0
B4-R18	OFFICE	T12	34	2	2	0.14	319	$53
B4-R19	OFFICE	T12	34	3	2	0.20	479	$79
B4-R20	OFFICE	T12	34	3	6	0.61	1,437	$238
B4-R21	HALLWAY	T12	34	2	14	0.95	2,235	$370
B4-R21	HALLWAY	LED	1	1	1	0.00	2	$0
B4-R22	ELEVATOR SHAFT	T12	34	2	1	0.07	160	$26
B4-R23	STORAGE	T12	34	2	1	0.07	160	$26
B4-R24	HALLWAY	T12	34	2	19	1.29	3,033	$503
B4-R24	HALLWAY	T12	34	2	2	0.14	319	$53
B4-R24	HALLWAY	T8	32	2	1	0.06	150	$25
B4-R25	SNACK BAR	T12	34	3	1	0.10	239	$40
B4-R26	GYM	HID	400	1	45	19.17	45,008	$7,460
B4-R26	GYM	LED	1	1	10	0.01	23	$4
B4-R26	GYM	T8	32	2	4	0.26	601	$100
B4-R27	HALLWAY	T12	34	2	10	0.68	1,597	$265
B4-R27	HALLWAY	HAL	50	1	3	0.15	352	$58
B4-R27	HALLWAY	LED	1	1	2	0.00	5	$1

Table 6: Building Interior Lighting Inventory Continues

Building & Room ID	Space Type	Lamp Type	Lamp Wattage (W)	Lamps per Fixture	Number of Fixtures	Total Power (kW)	Total Annual Energy Use (kWh)	Total Annual Operating Cost ($)
B4-R28	OFFICE	T12	34	3	1	0.10	239	$40
B4-R29	RESTROOM	T12	34	2	13	0.88	2,076	$344
B4-R30	RESTROOM	T12	34	2	13	0.88	2,076	$344
B4-R31	STORAGE	T12	34	2	1	0.07	160	$26
B5-R1	RESTROOM	T12	34	2	7	0.48	1,118	$185
B5-R2	RESTROOM	T12	34	2	7	0.48	1,118	$185
B5-R3	OFFICE	T12	34	2	6	0.41	958	$159
B5-R4	STORAGE	T12	34	2	12	0.82	1,916	$318
B6-R1	CLASSROOM	T8	32	2	18	1.15	2,705	$448
B6-R2	CLASSROOM	T8	32	2	18	1.15	2,705	$448
B6-R3	CLASSROOM	T8	32	2	18	1.15	2,705	$448
B6-R4	CLASSROOM	T8	32	2	18	1.15	2,705	$448
B7-R1	BANDROOM	T12	34	3	24	2.45	5,748	$953
B7-R2	ELECTRICAL	T12	34	4	4	0.54	1,277	$212
B7-R3	STORAGE	T12	34	2	3	0.20	479	$79
B7-R4	OFFICE	T12	34	2	6	0.41	958	$159
B7-R5	STORAGE	T12	34	2	4	0.27	639	$106
B7-R6	BANDROOM	T12	34	2	30	2.04	4,790	$794
B8-R1	Unknown	T12	34	2	2	0.14	319	$53
B8-R2	STORAGE	T12	34	2	2	0.14	319	$53
B8-R3	AUTO ROOM	T8	32	2	55	3.52	8,264	$1,370
B8-R3	AUTO ROOM	HAL	50	1	40	2.00	4,696	$778
B8-R3	AUTO ROOM	HAL	250	1	29	7.25	17,022	$2,821
B8-R3	AUTO ROOM	CFL	18	8	4	0.58	1,352	$224
B8-R3	AUTO ROOM	UNKNOWN	12	1	4	0.05	113	$19
B8-R4	HALLWAY	INC	40	1	2	0.08	188	$31
B8-R5	SNACK BAR	T12	34	3	2	0.20	479	$79
B8-R6	STORAGE	T12	34	3	2	0.20	479	$79
B8-R7	RESTROOM	T12	34	1	1	0.03	80	$13
B8-R8	RESTROOM	T12	34	3	3	0.31	718	$119

Table 6: Building Interior Lighting Inventory Continues

Building & Room ID	Space Type	Lamp Type	Lamp Wattage (W)	Lamps per Fixture	Number of Fixtures	Total Power (kW)	Total Annual Energy Use (kWh)	Total Annual Operating Cost ($)
B8-R9	STAGE	HAL	50	1	16	0.80	1,878	$311
B8-R10	RESTROOM	HAL	50	1	4	0.20	470	$78
B8-R10	RESTROOM	T12	34	2	12	0.82	1,916	$318
B8-R11	STORAGE	T12	34	2	4	0.27	639	$106
B8-R12	SNACKBAR	T12	34	2	15	1.02	2,395	$397
B8-R13	STORAGE	T12	34	2	3	0.20	479	$79
B9-R1	HALLWAY	T12	34	2	2	0.14	319	$53
B9-R2	Unknown	T12	34	2	1	0.07	160	$26
B9-R3	OFFICE	T12	34	2	2	0.14	319	$53
B9-R4	KITCHEN	T12	34	2	31	2.11	4,949	$820
B9-R5	HALLWAY	T12	34	2	3	0.20	479	$79
B9-R6	STORAGE	T12	34	1	1	0.03	80	$13
B9-R7	STORAGE	T12	34	1	1	0.03	80	$13
B9-R8	DOMESTIC HOT	T12	34	2	1	0.07	160	$26
B9-R9	CAFETERIA	T12	34	3	9	0.92	2,155	$357
B9-R10	RESTROOM	T12	34	2	1	0.07	160	$26
B9-R11	RESTROOM	T12	34	2	1	0.07	160	$26
B9-R12	CLASSROOM	T8	32	2	18	1.15	2,705	$448
B10-R1	CLASSROOM	T8	32	2	18	1.15	2,705	$448
B10-R2	CLASSROOM	T8	32	2	18	1.15	2,705	$448
B10-R3	CLASSROOM	T8	32	2	18	1.15	2,705	$448
B10-R4	CLASSROOM	T8	32	2	18	1.15	2,705	$448
B10-R5	CLASSROOM	T8	32	2	18	1.15	2,705	$448
B10-R6	RESTROOM	T12	34	2	10	0.68	1,597	$265
B11-R1	RESTROOM	T12	34	2	10	0.68	1,597	$265
B11-R2	DOMESTIC HOT	T12	34	2	1	0.07	160	$26
B11-R3	FIELD STORAGE	T12	34	2	16	1.09	2,554	$423
B11-R4	SNACK BAR	T12	34	2	8	0.54	1,277	$212
B11-R5	WIEGHT ROOM	T12	34	2	23	1.56	3,672	$609
B12-R1	OFFICE	T12	34	3	2	0.20	479	$79

Table 6: Building Interior Lighting Inventory Continues

Building & Room ID	Space Type	Lamp Type	Lamp Wattage (W)	Lamps per Fixture	Number of Fixtures	Total Power (kW)	Total Annual Energy Use (kWh)	Total Annual Operating Cost ($)
B12-R2	OFFICE	T12	34	3	2	0.20	479	$79
B13-R1	COMPUTER LAB	T12	34	3	20	2.04	4,790	$794
B13-R2	OFFICE	T12	34	3	2	0.20	479	$79
B13-R3	OFFICE	T12	34	3	2	0.20	479	$79
B13-R4	OFFICE	T12	34	3	2	0.20	479	$79
B13-R5	OFFICE	T12	34	3	2	0.20	479	$79
B13-R6	CLASSROOM	T12	34	3	10	1.02	2,395	$397
B13-R7	CLASSROOM	T12	34	3	10	1.02	2,395	$397
B13-R8	CLASSROOM	T12	34	2	32	2.18	5,109	$847
B13-R9	STORAGE	T12	34	2	3	0.20	479	$79
B14-R1	CLASSROOM	T8	32	2	15	0.96	2,254	$374
B14-R1	CLASSROOM	T12	34	1	3	0.10	239	$40
B14-R2	CLASSROOM	T8	32	2	18	1.15	2,705	$448
B14-R3	CLASSROOM	T8	32	2	18	1.15	2,705	$448
B14-R4	CLASSROOM	T8	32	2	18	1.15	2,705	$448
B14-R5	CLASSROOM	T8	32	2	18	1.15	2,705	$448
B14-R6	CLASSROOM	T8	32	2	18	1.15	2,705	$448
B15-R1	CLASSROOM	T12	34	2	18	1.22	2,874	$476
B15-R2	CLASSROOM	T12	34	2	18	1.22	2,874	$476
B15-R3	CLASSROOM	T12	34	2	18	1.22	2,874	$476
B15-R4	CLASSROOM	T12	34	2	18	1.22	2,874	$476
B16-R1	ELECTRICAL	T12	34	1	2	0.07	160	$26
B16-R2	LIBRARY	T12	34	3	3	0.31	718	$119
B16-R3	HALLWAY	T12	34	2	3	0.20	479	$79
B16-R3	HALLWAY	UNKNOWN	34	1	1	0.03	80	$13
B16-R4	RESTROOM	T12	34	2	1	0.07	160	$26
B16-R5	OFFICE	T12	34	3	4	0.41	958	$159
B16-R6	WORKROOM	T12	34	3	2	0.20	479	$79
B16-R7	COMPUTER LAB	T12	34	3	10	1.02	2,395	$397
B16-R8	OFFICE	T12	34	3	3	0.31	718	$119

Table 6: Building Interior Lighting Inventory Continues

Building & Room ID	Space Type	Lamp Type	Lamp Wattage (W)	Lamps per Fixture	Number of Fixtures	Total Power (kW)	Total Annual Energy Use (kWh)	Total Annual Operating Cost ($)
B16-R9	FRONT DESK	T12	34	2	6	0.41	958	$159
B16-R10	ELEVATOR	T12	34	2	1	0.07	160	$26
B16-R11	HALLWAY	T12	34	2	1	0.07	160	$26
B16-R12	HALLWAY	T12	34	2	1	0.07	160	$26
B16-R13	LIBRARY	T12	34	2	16	1.09	2,554	$423
B16-R14	LIBRARY	T12	34	2	15	1.02	2,395	$397
B16-R15	LIBRARY	HAL	250	1	7	1.75	4,109	$681
B16-R16	LIBRARY	T12	34	1	14	0.48	1,118	$185
B16-R17	LIBRARY	T12	34	2	18	1.22	2,874	$476
B16-R18	WORK ROOM	T12	34	3	9	0.92	2,155	$357
B16-R19	STORAGE	T12	34	3	16	1.63	3,832	$635
B16-R20	HALLWAY	T12	34	2	6	0.41	958	$159
B16-R21	STORAGE	T12	34	1	1	0.03	80	$13
B16-R22	ELEVATOR SHAFT	T12	34	2	1	0.07	160	$26
B16-R23	COMPUTER LAB	T12	34	3	32	3.26	7,663	$1,270
B16-R24	STUDENT STORE	T12	34	3	12	1.22	2,874	$476
B16-R25	STORAGE	T8	32	1	1	0.03	75	$12
B17-R1	CLASSROOM	T8	32	2	17	1.09	2,554	$423
B17-R1	CLASSROOM	T8	32	2	5	0.32	751	$125
B17-R2	CLASSROOM	T8	32	2	18	1.15	2,705	$448
B17-R2	CLASSROOM	T8	32	2	5	0.32	751	$125
B17-R3	COMPUTER LAB	T8	32	2	18	1.15	2,705	$448
B17-R3	COMPUTER LAB	T8	32	2	5	0.32	751	$125
B17-R4	COMPUTER LAB	T8	32	2	18	1.15	2,705	$448
B17-R4	COMPUTER LAB	T8	32	2	5	0.32	751	$125
B17-R5	ELEVATOR	T12	34	2	1	0.07	160	$26
B17-R6	MECHANICAL	T12	34	1	1	0.03	80	$13
B17-R7	RESTROOM	T12	34	1	8	0.27	639	$106
B17-R8	RESTROOM	T12	34	1	8	0.27	639	$106
B17-R9	ROOF ACCESS	T12	34	2	1	0.07	160	$26

Table 6: Building Interior Lighting Inventory Continues

Building & Room ID	Space Type	Lamp Type	Lamp Wattage (W)	Lamps per Fixture	Number of Fixtures	Total Power (kW)	Total Annual Energy Use (kWh)	Total Annual Operating Cost ($)
B17-R10	SNACK BAR	T12	34	2	14	0.95	2,235	$370
B17-R11	CLASSROOM	T8	32	2	16	1.02	2,404	$399
B17-R11	CLASSROOM	T8	32	2	4	0.26	601	$100
B17-R11	CLASSROOM	T12	34	2	2	0.14	319	$53
B17-R12	CLASSROOM	T8	32	2	14	0.90	2,104	$349
B17-R12	CLASSROOM	T8	32	2	4	0.26	601	$100
B17-R13	CLASSROOM	T8	32	2	14	0.90	2,104	$349
B17-R13	CLASSROOM	T8	32	2	4	0.26	601	$100
B17-R14	CLASSROOM	T8	32	2	14	0.90	2,104	$349
B17-R14	CLASSROOM	T8	32	2	4	0.26	601	$100
B17-R15	ELECTRICAL	T12	34	2	4	0.27	639	$106
B17-R16	HALLWAY	T12	34	2	4	0.27	639	$106
B17-R17	STORAGE	T12	34	3	4	0.41	958	$159
B17-R18	CLASSROOM	T8	32	2	14	0.90	2,104	$349
B17-R18	CLASSROOM	T8	32	2	4	0.26	601	$100
B17-R18	CLASSROOM	INC	100	1	1	0.10	235	$39
B17-R19	CLASSROOM	T8	32	2	14	0.90	2,104	$349
B17-R19	CLASSROOM	T8	32	2	14	0.90	2,104	$349
B17-R20	CLASSROOM	T8	32	2	14	0.90	2,104	$349
B17-R20	CLASSROOM	T8	32	2	4	0.26	601	$100
B17-R21	CLASSROOM	T8	32	2	22	1.41	3,306	$548
B17-R22	RESTROOM	T12	34	2	5	0.34	798	$132
B17-R23	CUSTODIAN	T12	34	2	1	0.07	160	$26
B17-R24	RESTROOM	T12	34	2	5	0.34	798	$132
B17-R25	ELEVATOR SHAFT	T12	34	2	1	0.07	160	$26
B17-R26	CLASSROOM	T12	34	2	18	1.22	2,874	$476
B17-R27	CLASSROOM	T12	34	2	18	1.22	2,874	$476
B17-R28	CLASSROOM	T12	34	2	18	1.22	2,874	$476
B17-R29	CLASSROOM	T12	34	2	18	1.22	2,874	$476
B18-R1	CLASSROOM	T8	32	2	4	0.26	601	$100

Table 6: Building Interior Lighting Inventory Continues

Building & Room ID	Space Type	Lamp Type	Lamp Wattage (W)	Lamps per Fixture	Number of Fixtures	Total Power (kW)	Total Annual Energy Use (kWh)	Total Annual Operating Cost ($)
B18-R1	CLASSROOM	T12	34	2	14	0.95	2,235	$370
B18-R2	CLASSROOM	T8	32	2	4	0.26	601	$100
B18-R2	CLASSROOM	T12	34	2	14	0.95	2,235	$370
B18-R3	CLASSROOM	T8	32	2	4	0.26	601	$100
B18-R3	CLASSROOM	T12	34	2	14	0.95	2,235	$370
B18-R4	CLASSROOM	T8	32	2	4	0.26	601	$100
B18-R4	CLASSROOM	T12	34	2	14	0.95	2,235	$370
B18-R5	CLASSROOM	T8	32	2	4	0.26	601	$100
B18-R5	CLASSROOM	T8	32	2	14	0.90	2,104	$349
B18-R6	CLASSROOM	T8	32	2	4	0.26	601	$100
B18-R6	CLASSROOM	T8	32	2	14	0.90	2,104	$349
B18-R7	CLASSROOM	T8	32	2	4	0.26	601	$100
B18-R7	CLASSROOM	T8	32	2	14	0.90	2,104	$349
B18-R8	CLASSROOM	T8	32	2	4	0.26	601	$100
B18-R8	CLASSROOM	T8	32	2	14	0.90	2,104	$349
B19-R1	CLASSROOM	T12	34	2	14	0.95	2,235	$370
B19-R1	CLASSROOM	T8	32	2	4	0.26	601	$100
B19-R2	CLASSROOM	T12	34	2	14	0.95	2,235	$370
B19-R2	CLASSROOM	T8	32	2	4	0.26	601	$100
B19-R3	CLASSROOM	T8	32	2	14	0.90	2,104	$349
B19-R3	CLASSROOM	T8	32	2	4	0.26	601	$100
B19-R4	CLASSROOM	T12	34	2	14	0.95	2,235	$370
B19-R4	CLASSROOM	T8	32	2	4	0.26	601	$100
B19-R5	CLASSROOM	T12	34	2	14	0.95	2,235	$370
B19-R5	CLASSROOM	T8	32	2	4	0.26	601	$100
B19-R6	CLASSROOM	T8	32	2	14	0.90	2,104	$349
B19-R6	CLASSROOM	T8	32	2	4	0.26	601	$100
B20-R1	CLASSROOM	T12	34	2	14	0.95	2,235	$370
B20-R1	CLASSROOM	T8	32	2	4	0.26	601	$100
B20-R2	CLASSROOM	T12	34	2	14	0.95	2,235	$370

Table 6: Building Interior Lighting Inventory Continues

Building & Room ID	Space Type	Lamp Type	Lamp Wattage (W)	Lamps per Fixture	Number of Fixtures	Total Power (kW)	Total Annual Energy Use (kWh)	Total Annual Operating Cost ($)
B20-R2	CLASSROOM	T8	32	2	4	0.26	601	$100
B20-R3	CLASSROOM	T8	32	2	13	0.83	1,953	$324
B20-R3	CLASSROOM	T8	32	2	4	0.26	601	$100
B20-R3	CLASSROOM	T12	34	2	1	0.07	160	$26
B20-R4	CLASSROOM	T12	34	3	3	0.31	718	$119
B20-R5	WORKROOM	T12	34	3	4	0.41	958	$159
B20-R5	WORKROOM	T8	32	2	4	0.26	601	$100
B20-R5	WORKROOM	HAL	50	2	2	0.20	470	$78
B20-R6	CLASSROOM	T8	32	2	14	0.90	2,104	$349
B20-R6	CLASSROOM	T8	32	2	4	0.26	601	$100
B20-R7	CLASSROOM	T12	34	2	14	0.95	2,235	$370
B20-R7	CLASSROOM	T8	32	2	4	0.26	601	$100
B20-R8	CLASSROOM	T12	34	2	14	0.95	2,235	$370
B20-R8	CLASSROOM	T8	32	2	4	0.26	601	$100
B21-R1	CLASSROOM	T12	34	2	23	1.56	3,672	$609
B21-R2	CLASSROOM	T12	34	2	23	1.56	3,672	$609
B21-R3	CLASSROOM	T8	32	2	23	1.47	3,456	$573
B21-R4	CLASSROOM	T8	32	2	24	1.54	3,606	$598
B21-R5	ELEVATOR	T12	34	2	1	0.07	160	$26
B21-R6	STORAGE	T12	34	2	1	0.07	160	$26
B21-R7	RESTROOM	T12	34	2	8	0.54	1,277	$212
B21-R8	RESTROOM	T12	34	2	8	0.54	1,277	$212
B21-R9	STORAGE	T12	34	2	1	0.07	160	$26
B21-R10	SNACK BAR	T12	34	2	14	0.95	2,235	$370
B21-R11	CLASSROOM	T12	34	2	18	1.22	2,874	$476
B21-R12	CLASSROOM	T8	32	2	16	1.02	2,404	$399
B21-R13	CLASSROOM	T8	32	2	18	1.15	2,705	$448
B21-R14	CLASSROOM	T8	32	2	18	1.15	2,705	$448
B21-R15	HALLWAY	T8	32	3	12	1.15	2,705	$448
B21-R16	CLASSROOM	T8	32	2	18	1.15	2,705	$448

Table 6: Building Interior Lighting Inventory Continues

Building & Room ID	Space Type	Lamp Type	Lamp Wattage (W)	Lamps per Fixture	Number of Fixtures	Total Power (kW)	Total Annual Energy Use (kWh)	Total Annual Operating Cost ($)
B21-R17	CLASSROOM	T8	32	2	18	1.15	2,705	$448
B21-R18	WORKROOM	T12	34	2	6	0.41	958	$159
B21-R19	CLASSROOM	T12	34	2	18	1.22	2,874	$476
B21-R20[1]	CLASSROOM	HAL	750	1	6	4.50	2,113	$350
B21-R20[1]	CLASSROOM	HAL	750	1	4	3.00	1,409	$233
B21-R20	CLASSROOM	T8	32	2	19	1.22	2,855	$473
B21-R21	RESTROOM	T12	34	2	5	0.34	798	$132
B21-R22	DOMESTIC HOT	T12	34	2	1	0.07	160	$26
B21-R23	RESTROOM	T12	34	2	5	0.34	798	$132
B21-R24	ELEVATOR SHAFT	T12	34	2	1	0.07	160	$26
B21-R25	CLASSROOM	T12	34	2	18	1.22	2,874	$476
B21-R26	CLASSROOM	T8	32	2	18	1.15	2,705	$448
B21-R27	CLASSROOM	T8	32	2	18	1.15	2,705	$448
B21-R28	CLASSROOM	T8	32	2	18	1.15	2,705	$448
B21-R29	ELEVATOR SHAFT	T8	32	2	1	0.06	150	$25
B22-R1	CLASSROOM	T8	32	2	18	1.15	2,705	$448
B22-R1	CLASSROOM	T8	32	2	5	0.32	751	$125
B22-R2	CLASSROOM	T8	32	2	18	1.15	2,705	$448
B22-R2	CLASSROOM	T8	32	2	5	0.32	751	$125
B22-R3	CLASSROOM	T8	32	2	18	1.15	2,705	$448
B22-R3	CLASSROOM	T8	32	2	5	0.32	751	$125
B22-R4	CLASSROOM	T8	32	2	18	1.15	2,705	$448
B22-R4	CLASSROOM	T8	32	2	5	0.32	751	$125
B22-R4	CLASSROOM	CFL	7	1	1	0.01	16	$3
B22-R5	STORAGE	T8	32	2	6	0.38	902	$149
B22-R6	RESTROOM	T8	32	2	1	0.06	150	$25
B22-R6	RESTROOM	T12	34	2	2	0.14	319	$53
B22-R7	RESTROOM	T12	34	2	3	0.20	479	$79
B22-R8	ELECTRICAL	T12	34	2	4	0.27	639	$106
B22-R9	CLASSROOM	T8	32	2	18	1.15	2,705	$448

Table 6: Building Interior Lighting Inventory Continues

Building & Room ID	Space Type	Lamp Type	Lamp Wattage (W)	Lamps per Fixture	Number of Fixtures	Total Power (kW)	Total Annual Energy Use (kWh)	Total Annual Operating Cost ($)
B22-R9	CLASSROOM	T8	32	2	5	0.32	751	$125
B22-R9	CLASSROOM	T8	15	2	2	0.06	141	$23
B22-R10	CLASSROOM	T8	32	2	14	0.90	2,104	$349
B22-R10	CLASSROOM	T8	32	2	4	0.26	601	$100
B22-R11	CLASSROOM	T8	32	2	14	0.90	2,104	$349
B22-R11	CLASSROOM	T8	32	2	4	0.26	601	$100
B22-R12	CLASSROOM	T8	32	2	14	0.90	2,104	$349
B22-R12	CLASSROOM	T8	32	2	4	0.26	601	$100
B22-R13	HALLWAY	T8	32	2	10	0.64	1,503	$249
B22-R13	HALLWAY	CFL	7	1	1	0.01	16	$3
B22-R14	CLASSROOM	T8	32	2	14	0.90	2,104	$349
B22-R14	CLASSROOM	T8	32	2	4	0.26	601	$100
B22-R15	WORKROOM	T12	34	2	1	0.07	160	$26
B22-R16	CLASSROOM	T8	32	2	14	0.90	2,104	$349
B22-R16	CLASSROOM	T8	32	2	3	0.19	451	$75
B22-R17	WORKROOM	T12	34	2	5	0.34	798	$132
B22-R18	CLASSROOM	T8	32	2	14	0.90	2,104	$349
B22-R18	CLASSROOM	T8	32	2	3	0.19	451	$75
B22-R19	CLASSROOM	T12	34	2	18	1.22	2,874	$476
B22-R19	CLASSROOM	T8	32	2	4	0.26	601	$100
B22-R20	RESTROOM	T12	34	2	5	0.34	798	$132
B22-R21	CUSTODIAN	T8	32	2	1	0.06	150	$25
B22-R22	RESTROOM	T12	34	2	5	0.34	798	$132
B22-R23	CLASSROOM	T8	32	2	14	0.90	2,104	$349
B22-R23	CLASSROOM	T8	32	2	4	0.26	601	$100
B22-R24	CLASSROOM	T12	34	2	13	0.88	2,076	$344
B22-R24	CLASSROOM	T8	32	2	4	0.26	601	$100
B22-R24	CLASSROOM	T8	32	2	1	0.06	150	$25
B22-R25	CLASSROOM	T12	34	2	14	0.95	2,235	$370
B22-R25	CLASSROOM	T8	32	2	4	0.26	601	$100

Table 6: Building Interior Lighting Inventory Continues

Building & Room ID	Space Type	Lamp Type	Lamp Wattage (W)	Lamps per Fixture	Number of Fixtures	Total Power (kW)	Total Annual Energy Use (kWh)	Total Annual Operating Cost ($)
B22-R26	CLASSROOM	T12	34	2	14	0.95	2,235	$370
B22-R26	CLASSROOM	T8	32	2	4	0.26	601	$100
B23-R1	CLASSROOM	T12	34	2	32	2.18	5,109	$847
B23-R2	WOODSHOP	T12	34	2	27	1.84	4,311	$714
B23-R2	WOODSHOP	CFL	15	1	2	0.03	70	$12
B23-R3	STORAGE	CFL	15	1	2	0.03	70	$12
B23-R4	STORAGE	CFL	15	1	2	0.03	70	$12
B23-R5	STORAGE	CFL	15	1	2	0.03	70	$12
B24-R1	STORAGE	T12	34	2	1	0.07	160	$26
Total							**588,960**	**$97,621**

- All unavailable and non-applicable input fields are left as "0", per CEC's direction. Estimated data points are highlighted.
- [1]Have reduced lighting system/s operation by a factor of 5 for two (2) HAL fixtures listed under Building 21, Rm 20.

Figure 9: Interior Lighting Distribution by Lamp Type

This chart shows a breakdown of interior and exterior lighting energy usage by lamp type. The significant majority of the indoor lights are 4 feet Fluorescent fixtures.

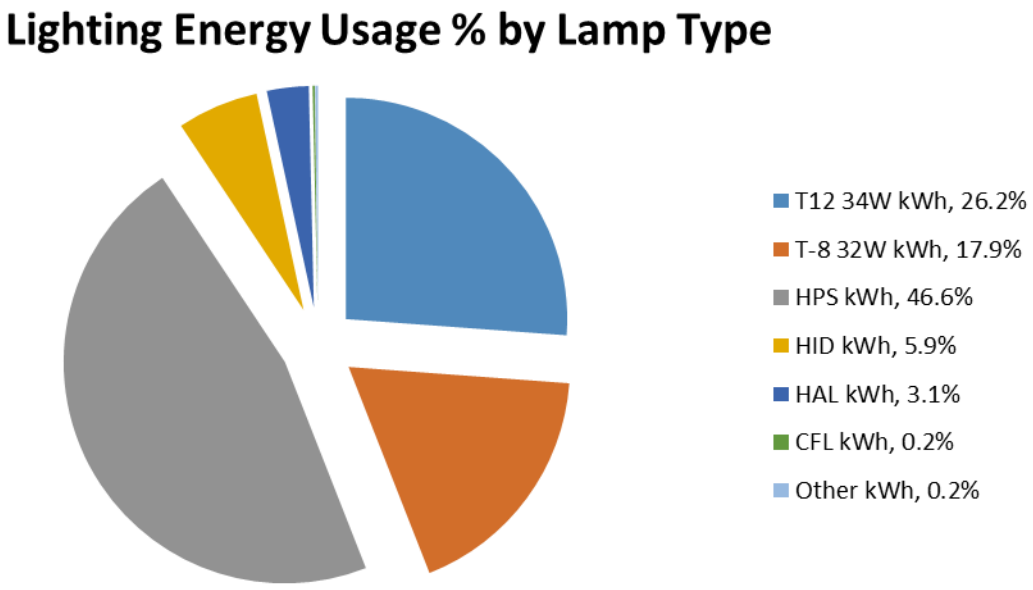
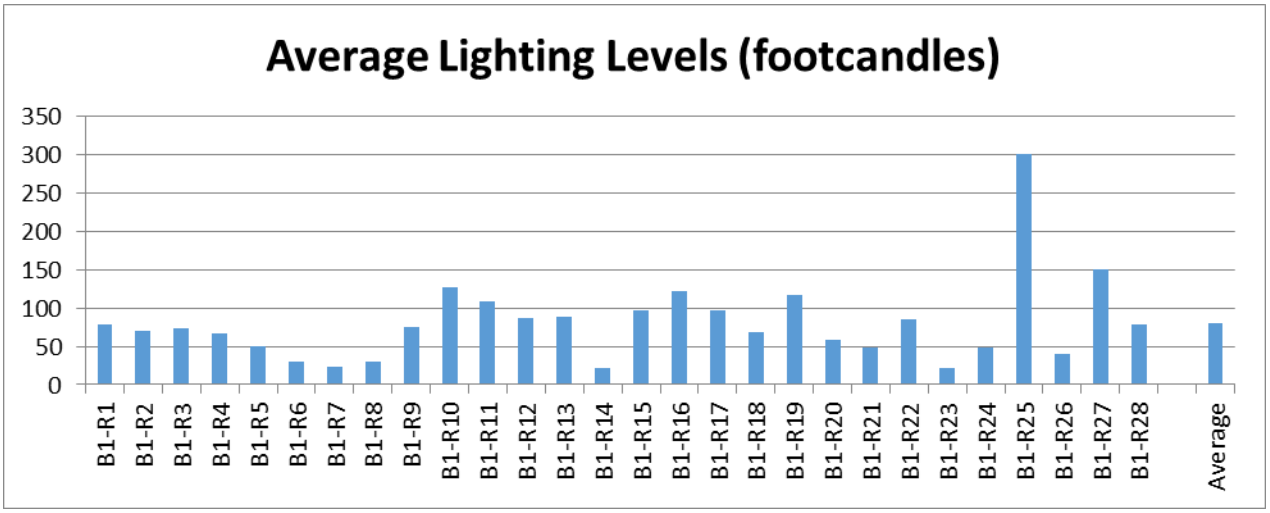


Figure 9 Reference Table: Interior and Exterior Lighting Energy Usage % and kWh by Lamp Type

Lamp Type & Usage %	kWh
T12 34W kWh, 26.2%	294,642.0
T-8 32W kWh, 17.9%	201,126.8
HPS kWh, 46.6%	524,780.3
HID kWh, 5.9%	66,717.1
HAL kWh, 3.1%	34,396.1
CFL kWh, 0.2%	1,789.1
Other kWh, 0.2%	2,300.9
Total	1,125,752.2

Figure 10: Average Illuminance for Each Room

This figures shows the average illumination levels of each building, assuming all documented lights in each room are turned on during operating hours and ignoring natural light.



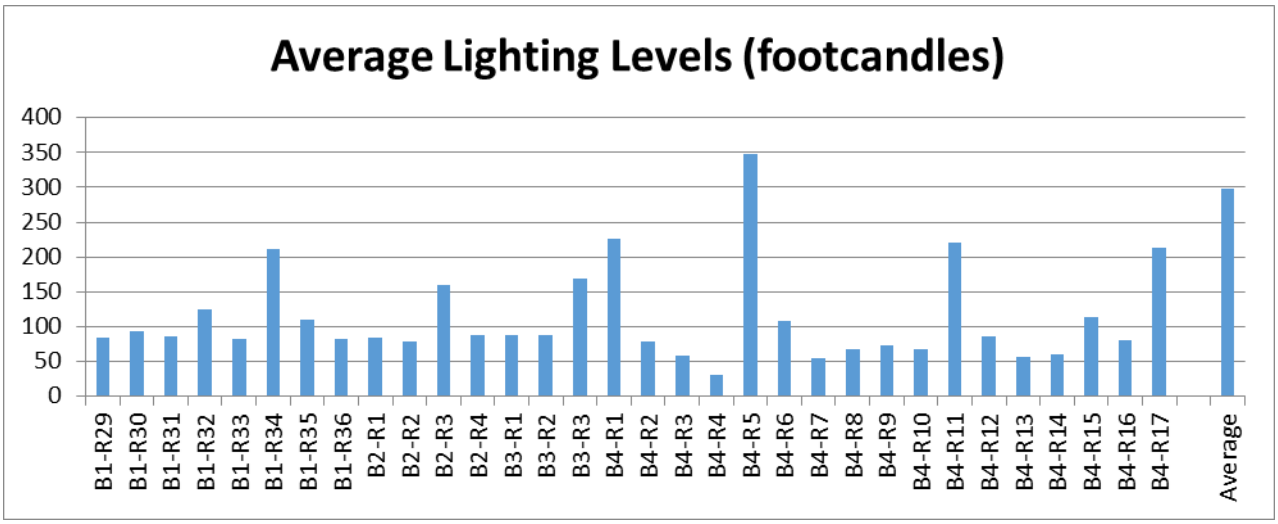
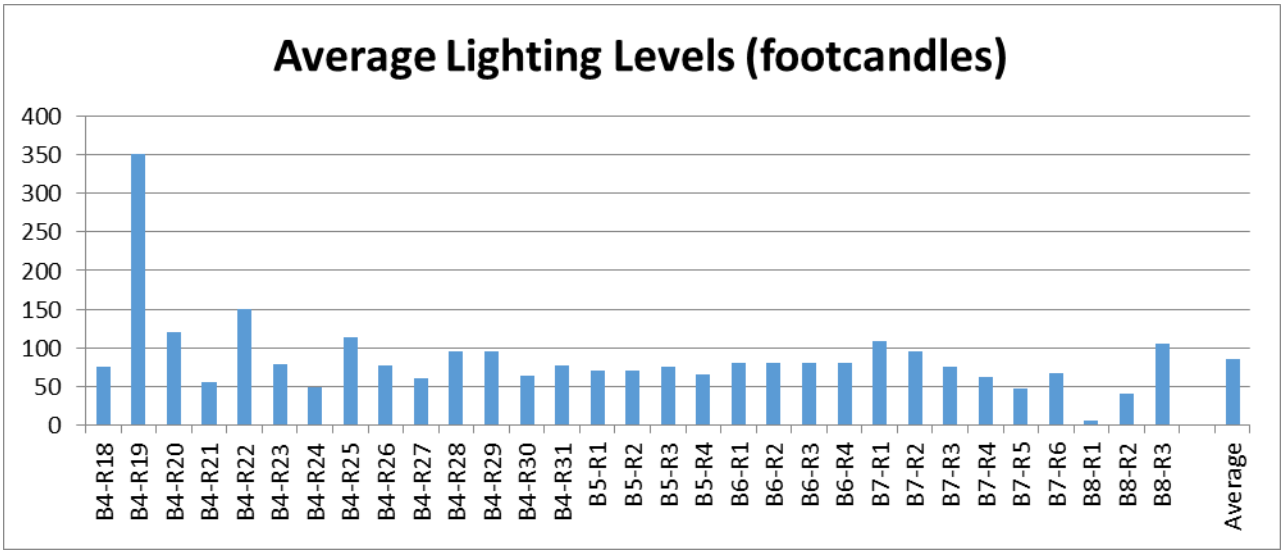


Figure 10: Average Illuminance for Each Room Continues



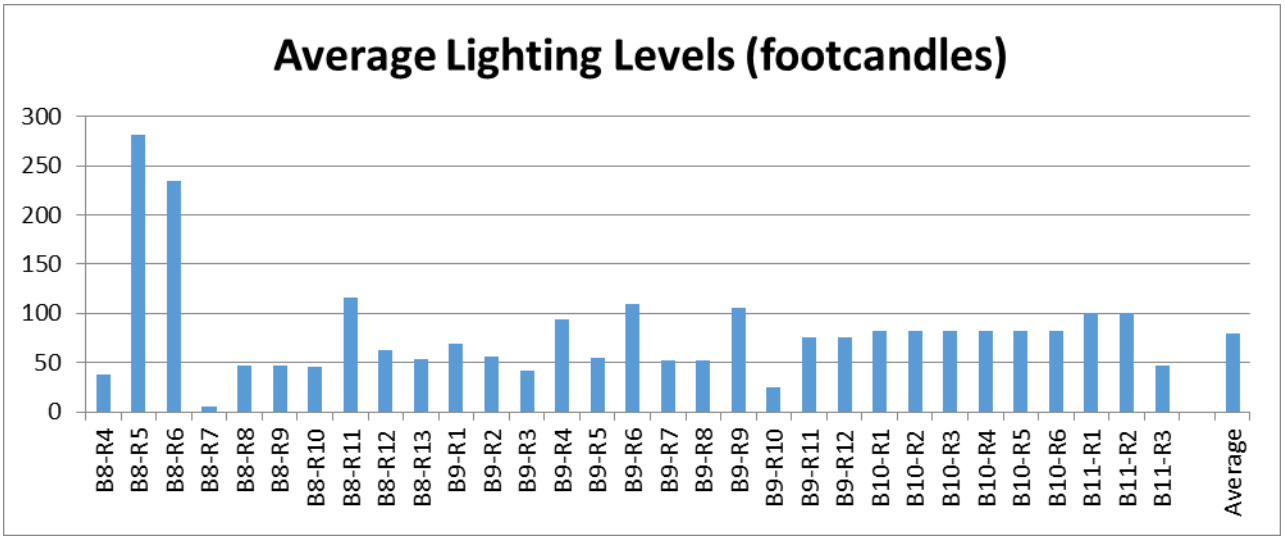
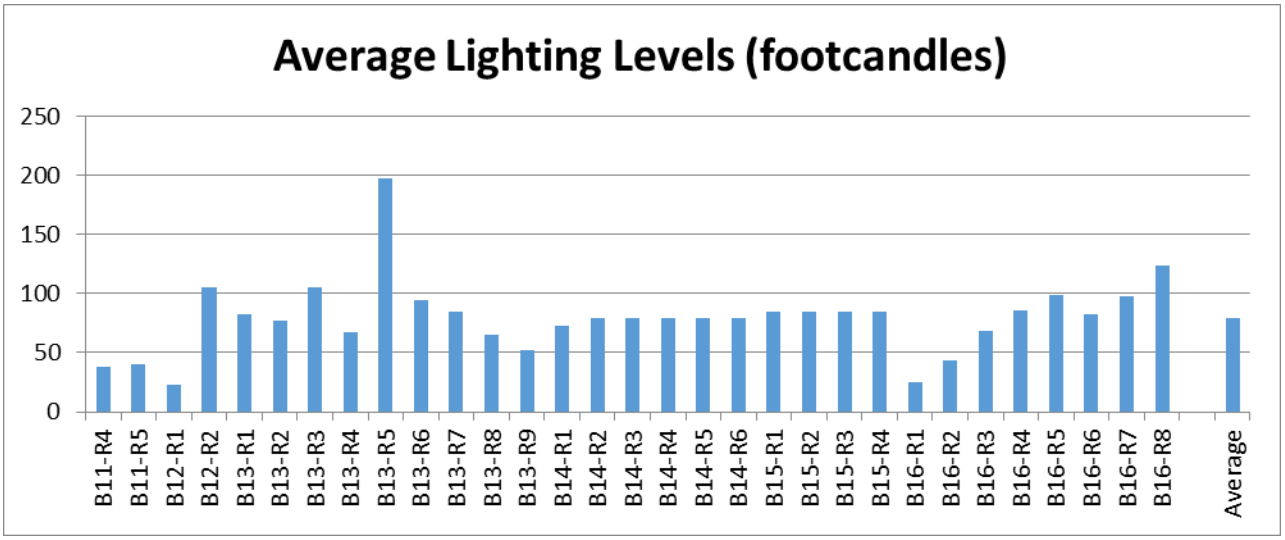


Figure 10: Average Illuminance for Each Room Continues



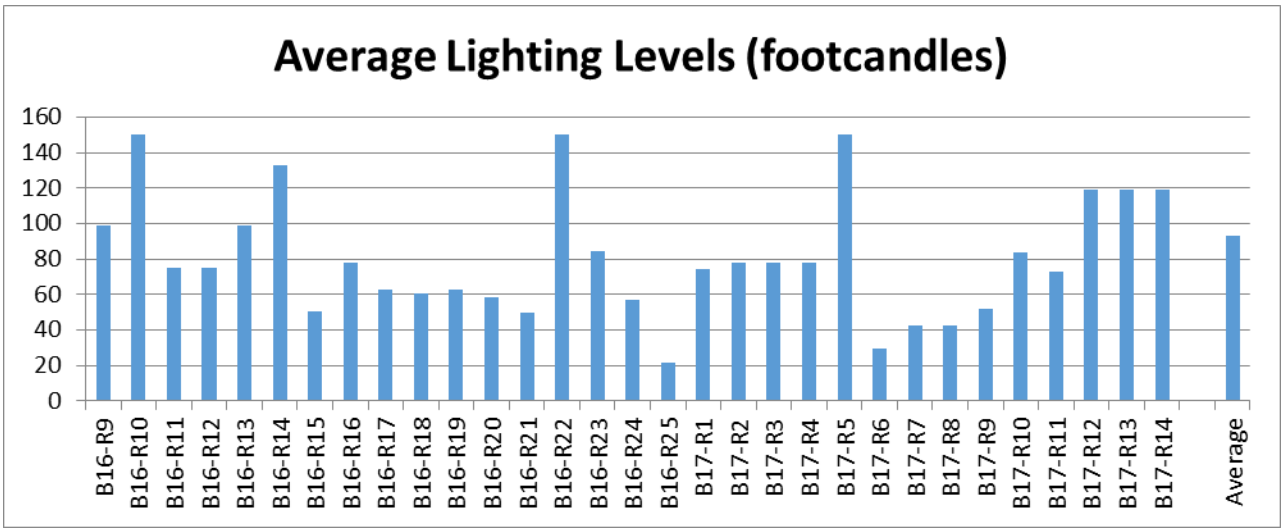
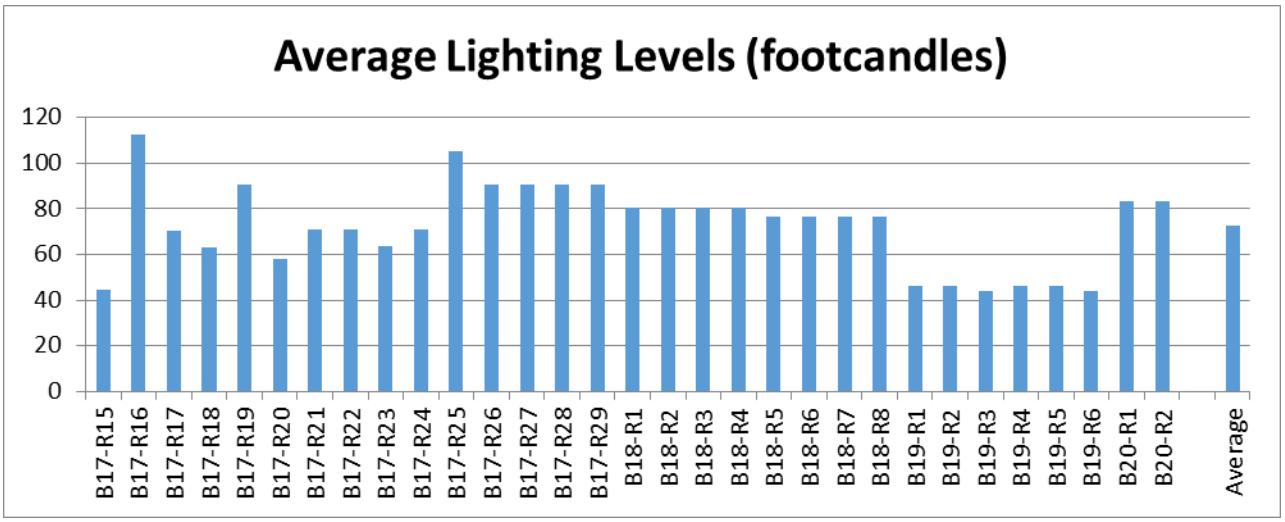


Figure 10: Average Illuminance for Each Room Continues



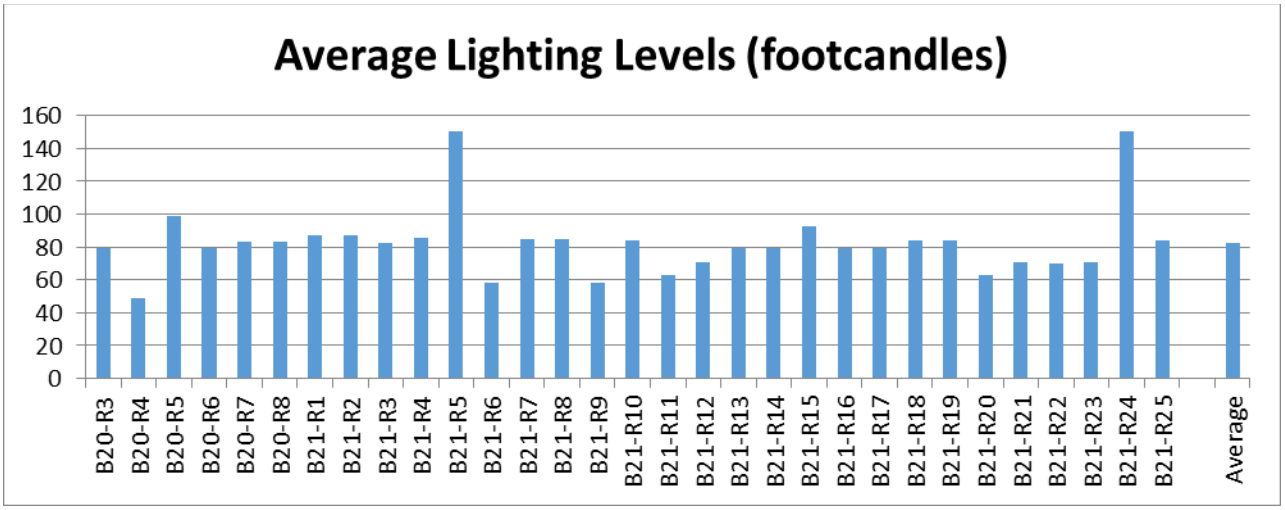
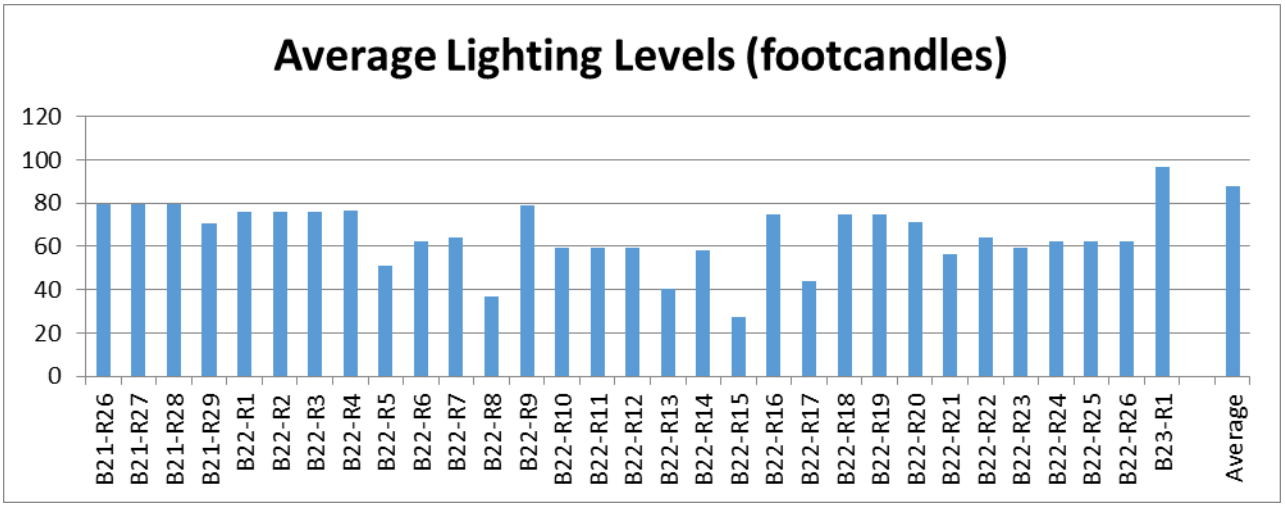
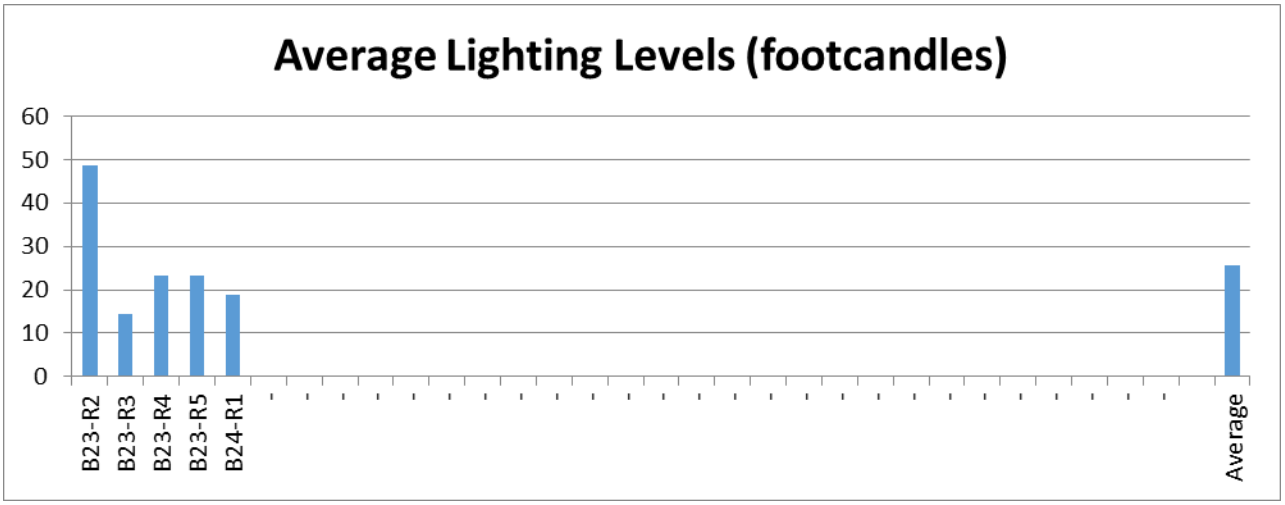


Figure 10: Average Illuminance for Each Room Continues





The Illuminating Engineering Society of North America (IESNA Handbook, 9th Edition) recommends lighting levels in classrooms to be between 30-50 foot-candles. Special attention should be given to buildings with levels above 50 foot-candles, as there may be opportunities to leave some lights turned off or lamps removed. Reducing lighting levels in these areas will reduce electricity use and lower energy costs.

There are several spaces throughout the buildings that have shown higher lighting levels. Further investigation is necessary to identify energy saving measures in lighting for these spaces followed by the remaining rooms of the buildings.

- The tabulated FC of Room 20 located in Building 21 did not account the 750 Watt HPS lightings not typically used during standard operation to avoid unrealistically high FC for the room.

Table 7: Building Exterior Lighting Inventory

Based on these calculations, approximately **30.1% of all electrical energy is used for indoor lighting and 5.4% is used for exterior lighting** at the facility (it does not with include the football field outdoor lighting systems). Some data presentation has been rounded or compressed for presentation purposes.

Table 7: Building Exterior Lighting Inventory

Building ID or Mount Type	Fixture Use	Lamp Type	Lamp Wattage (W)	Number of Fixtures	Lamps per Fixture	Total Power (kW)	Total Annual Energy Usage (kWh)	Total Annual Operating
B1	Building Facade	HPS	400	18	1	6.19	24,792.77	$4,109
B1	Building Facade	HPS	400	5	1	1.72	6,886.88	$1,142
B2	Building Facade	HPS	400	4	1	1.38	5,509.50	$913
B3	Building Facade	HPS	400	3	1	1.03	4,132.13	$685
B4	Building Facade	HPS	400	12	1	4.13	16,528.51	$2,740
B5	Building Facade	HPS	400	5	1	1.72	6,886.88	$1,142
B5	Building Facade	HPS	400	5	1	1.72	6,886.88	$1,142
B5	Building Facade	HPS	400	2	1	0.69	2,754.75	$457
B6	Building Facade	HPS	400	4	1	1.38	5,509.50	$913
B7	Building Facade	HPS	400	5	1	1.72	6,886.88	$1,142
B8	Building Facade	HPS	400	20	1	6.88	27,547.52	$4,566
B9	Building Facade	HPS	400	5	1	1.72	6,886.88	$1,142
B10	Building Facade	HPS	400	6	1	2.06	8,264.26	$1,370
B11	Building Facade	HPS	400	7	1	2.41	9,641.63	$1,598
B12	Building Facade	HPS	400	4	1	1.38	5,509.50	$913
B13	Building Facade	HPS	400	6	1	2.06	8,264.26	$1,370
B13	Building Facade	HPS	400	5	1	1.72	6,886.88	$1,142
B14	Building Facade	HPS	400	6	1	2.06	8,264.26	$1,370
B15	Building Facade	HPS	400	4	1	1.38	5,509.50	$913
B16	Building Facade	HPS	400	4	1	1.38	5,509.50	$913
B16	Building Facade	HPS	400	10	1	3.44	13,773.76	$2,283
B17	Building Facade	HPS	400	26	1	8.94	35,811.78	$5,936
B17	Building Facade	HPS	400	5	1	1.72	6,886.88	$1,142
B17	Building Facade	HPS	400	1	1	0.34	1,377.38	$228
B18	Building Facade	HPS	400	5	1	1.72	6,886.88	$1,142
B18	Building Facade	HPS	400	4	1	1.38	5,509.50	$913

Table 7: Building Exterior Lighting Inventory Continues

Building ID or Mount Type	Fixture Use	Lamp Type	Lamp Wattage (W)	Number of Fixtures	Lamps per Fixture	Total Power (kW)	Total Annual Energy Usage (kWh)	Total Annual Operating
B19	Building Facade	HPS	400	5	1	1.72	6,886.88	$1,142
B19	Building Facade	HPS	400	7	1	2.41	9,641.63	$1,598
B20	Building Facade	HPS	400	5	1	1.72	6,886.88	$1,142
B20	Building Facade	HPS	400	8	1	2.75	11,019.01	$1,826
B21	Building Facade	HPS	400	27	1	9.29	37,189.15	$6,164
B21	Building Facade	HPS	400	7	1	2.41	9,641.63	$1,598
B21	Building Facade	HPS	400	1	1	0.34	1,377.38	$228
B22	Building Facade	HPS	400	27	1	9.29	37,189.15	$6,164
B22	Building Facade	HPS	400	4	1	1.38	5,509.50	$913
B22	Building Facade	HPS	400	1	1	0.34	1,377.38	$228
B23	Building Facade	HPS	400	10	1	3.44	13,773.76	$2,283
B24	Building Facade	HPS	400	2	1	0.69	2,754.75	$457
B24	Building Facade	HPS	400	3	1	1.03	4,132.13	$685
Pole	Landscape	HPS	400	8	1	2.75	11,019.01	$1,826
Ground	Landscape	HPS	400	39	1	13.42	53,717.66	$8,904
Pole	Parking Lot	HPS	400	2	3	2.06	8,264.26	$1,370
Pole	Security	HPS	400	28	1	9.63	38,566.53	$6,392
Pole	Parking Lot	HPS	400	6	2	4.13	16,528.51	$2,740
Pole	Parking Lot	MH	150	20	1	3.00	12,012.00	$1,991
TOTAL							**536,792.26**	**$88,974**

Cells highlighted, if any, signify assumptions that were made due to inaccurate or missing data.

3.1.2 HVAC Characteristics

Heating, ventilation, and air conditioning (HVAC) equipment is responsible for maintaining comfortable spaces in the building. Typically cooling and ventilation are accomplished using electricity and heating is accomplished using natural gas. However, many California schools have window or wall-mounted heat pumps that use electricity to heat the spaces. This section of HVAC addresses electric heating, cooling and ventilation only. Heating provided by gas equipment can be found in section 3.2.2 of this report. Following table is a summary of the major electricity using HVAC equipment. Note that any swamp coolers and mini splits that are used to cool server rooms are not included in the table. Without real-time monitoring or smart meter data, operating hours of HVAC equipment must be approximated. Following table shows annual electricity use of HVAC equipment using ASHRAE's estimated heating and cooling operating hours most applicable for a school's climate zone. Cells highlighted in green signify assumptions that were made due to suspect or missing data.

Based on the calculations approximately 38% of all electrical energy is used air distribution and electric heating. The cooling system energy usage is relatively negligible.

Refer to Table 8 that is on the next page for further details. The assumed HVAC equipment inventory data are highlighted.

Table 8: HVAC Systems Zones and Building Level HVAC Equipment Inventory

Table 8.a HVAC System Zones

HVAC Zone #	Building ID	HVAC System #	Rooms Served
1	B1	HVAC_1	R1-R2-R3-R4-R5
2	B1	HVAC_2	R9-R10-R11-R12
3	B1	HVAC_3	R13-R14-R15
4	B1	HVAC_4	R16-R17-R18-R19-R20-R21-R22-R23
5	B1	HVAC_5	R25-R26-R27-R28-R29-R30-R31-R32-R33-R34-R35-R36
6	B1	HVAC_6	R8
7	B2	HVAC_1	R1
8	B2	HVAC_2	R2-R3
9	B2	HVAC_3	R4
10	B3	HVAC_1	R1
11	B3	HVAC_2	R2
12	B3	HVAC_3	R3
13	B4	HVAC_1	R3-R5-R6-R7-R8-R9-R10-R14
14	B4	HVAC_2	R15-R16-R17-R18-R19-R20-R21
15	B4	HVAC_3	R26-R22-R23-R24-R25-R27-R28-R29-R30-R31
16	B4	HVAC_4	R26-R22-R23-R24-R25-R27-R28-R29-R30-R31
17	B4	HVAC_5	R26-R22-R23-R24-R25-R27-R28-R29-R30-R31
18	B4	HVAC_6	R3-R5-R6-R7-R8-R9-R10-R14
19	B4	HVAC_7	R15-R16-R17
20	B4	HVAC_8	R18-R19-R20-R21
21	B4	HVAC_9	R26-R22-R23-R24-R25-R27-R28-R29-R30-R31
22	B4	HVAC_10	R26-R22-R23-R24-R25-R27-R28-R29-R30-R31
23	B4	HVAC_11	R26-R22-R23-R24-R25-R27-R28-R29-R30-R31
24	B6	HVAC_1	R1
25	B6	HVAC_2	R2
26	B6	HVAC_3	R3
27	B6	HVAC_4	R4
28	B7	HVAC_1	R1-R4
29	B7	HVAC_2	R6

Table 8.a HVAC System Zones Continues

HVAC Zone #	Building ID	HVAC System #	Rooms Served
30	B8	HVAC_1	R1-R3-R13
31	B8	HVAC_2	R1-R3-R13
32	B9	HVAC_1	R1-R2-R3-R5
33	B9	HVAC_2	R10
34	B9	HVAC_3	R4-R5
35	B10	HVAC_1	R1
36	B10	HVAC_2	R2
37	B10	HVAC_3	R3
38	B10	HVAC_4	R4
39	B10	HVAC_5	R5
40	B10	HVAC_6	R6
41	B12	HVAC_1	R1
42	B12	HVAC_2	R1
43	B13	HVAC_1	R1-R2-R3
44	B13	HVAC_2	R4-R5
45	B13	HVAC_3	R6-R7
46	B13	HVAC_4	R8
47	B13	HVAC_5	R8
48	B14	HVAC_1	R1
49	B14	HVAC_2	R2
50	B14	HVAC_3	R3
51	B14	HVAC_4	R4
52	B14	HVAC_5	R5
53	B14	HVAC_6	R6
54	B15	HVAC_1	R1
55	B15	HVAC_2	R2
56	B15	HVAC_3	R3
57	B15	HVAC_4	R4
58	B16	HVAC_1	R18-R23-R24
59	B16	HVAC_2	R8-R9-R11-R12-R13-R14-R15-R16-R17
60	B16	HVAC_3	R2-R5-R6-R7
61	B17	HVAC_1	R1
62	B17	HVAC_2	R2
63	B17	HVAC_3	R3

Table 8.a HVAC System Zones Continues

HVAC Zone #	Building ID	HVAC System #	Rooms Served
64	B17	HVAC_4	R4
65	B17	HVAC_5	R10
66	B17	HVAC_6	R11
67	B17	HVAC_7	R12
68	B17	HVAC_8	R13
69	B17	HVAC_9	R14
70	B17	HVAC_10	R17
71	B17	HVAC_11	R18
72	B17	HVAC_12	R19
73	B17	HVAC_13	R20
74	B17	HVAC_14	R21
75	B17	HVAC_15	R26
76	B17	HVAC_16	R27
77	B17	HVAC_17	R28
78	B17	HVAC_18	R29
79	B18	HVAC_1	R1
80	B18	HVAC_2	R2
81	B18	HVAC_3	R3
82	B18	HVAC_4	R4
83	B18	HVAC_5	R5
84	B18	HVAC_6	R6
85	B18	HVAC_7	R7
86	B18	HVAC_1	R8
87	B19	HVAC_1	R1
88	B19	HVAC_2	R2
89	B19	HVAC_3	R3
90	B19	HVAC_4	R4
91	B19	HVAC_5	R5
92	B19	HVAC_6	R6
93	B20	HVAC_1	R1
94	B20	HVAC_2	R2
95	B20	HVAC_3	R3
96	B20	HVAC_4	R5
97	B20	HVAC_5	R6

Table 8.a HVAC System Zones Continues

HVAC Zone #	Building ID	HVAC System #	Rooms Served
98	B20	HVAC_6	R7
99	B20	HVAC_7	R8
100	B21	HVAC_1	R1
101	B21	HVAC_2	R2
102	B21	HVAC_3	R3
103	B21	HVAC_4	R4
104	B21	HVAC_5	R10
105	B21	HVAC_6	R11
106	B21	HVAC_7	R12
107	B21	HVAC_8	R13
108	B21	HVAC_9	R14
109	B21	HVAC_10	R16
110	B21	HVAC_11	R17-R18
111	B21	HVAC_12	R19
112	B21	HVAC_13	R20
113	B21	HVAC_14	R25
114	B21	HVAC_15	R26
115	B21	HVAC_16	R27
116	B21	HVAC_17	R28
117	B22	HVAC_1	R1
118	B22	HVAC_2	R2
119	B22	HVAC_3	R3
120	B22	HVAC_4	R4
121	B22	HVAC_5	R9
122	B22	HVAC_6	R10
123	B22	HVAC_7	R11
124	B22	HVAC_8	R12
125	B22	HVAC_9	R14
126	B22	HVAC_10	R15-R16-R17
127	B22	HVAC_11	R18
128	B22	HVAC_12	R19-R21
129	B22	HVAC_13	R23
130	B22	HVAC_14	R24
131	B22	HVAC_15	R25

Table 8.a HVAC System Zones Continues

HVAC Zone #	Building ID	HVAC System #	Rooms Served
132	B22	HVAC_16	R26
133	B23	HVAC_1	R1
134	B23	HVAC_2	R2-R3-R4-R5

Table 8b: Building Level HVAC Equipment Inventory

Building & HVAC ID	Room No	Unit Type	Unit Capacity * (Ton)	Annual Cooling Energy Use (kWh)	Annual Heating Energy Use (kWh)	Annual Air System Energy (kWh)	Total Annual Energy Use (kWh)	Total Annual Operating Cost ($)
B1_HVAC1	R1-R2-R3-R4-R5	WSHP	4	2896	1209	1548	5653	$937.0
B1_HVAC2	R9-R10-R11-R12	WSHP	4	2896	1209	1548	5653	$937.0
B1_HVAC3	R13-R14-R15	WSHP	4	2896	1209	1548	5653	$937.0
B1_HVAC4	R16-R17-R18-R19-R20-R21-R22-R23	WSHP	4	2896	1209	1548	5653	$937.0
B1_HVAC5	R11	WSHP	4	3521	1459	1548	6529	$1,082.1
B1_HVAC6	R8	SS	2	1126	0	668	1794	$297.3
B2_HVAC1	R1	WSHP	4	3521	1459	1548	6529	$1,082.1
B2_HVAC2	R2-R3	WSHP	4	3521	1459	1548	6529	$1,082.1
B2_HVAC3	R4	WSHP	4	3521	1459	1548	6529	$1,082.1
B3_HVAC1	R1	WSHP	4	2896	1209	1548	5653	$937.0
B3_HVAC2	R2	WSHP	4	2896	1209	1548	5653	$937.0
B3_HVAC3	R3	WSHP	4	2896	1209	1548	5653	$937.0
B4_HVAC1	R3-R5-R6-R7-R8-R9-R10-R14	SS	15	16992	0	5161	22153	$3,671.9
B4_HVAC2	R15-R16-R17-R18-R19-R20-R21	SS	15	16992	0	5161	22153	$3,671.9
B4_HVAC3	R26-R22-R23-R24-R25-R27-R28-R29-R30-R31	SS	15	16992	0	5161	22153	$3,671.9
B4_HVAC4	R26-R22-R23-R24-R25-R27-R28-R29-R30-R31	SS	15	16992	0	5161	22153	$3,671.9
B4_HVAC5	R26-R22-R23-R24-R25-R27-R28-R29-R30-R31	SS	15	16992	0	5161	22153	$3,671.9
B4_HVAC6	R3-R5-R6-R7-R8-R9-R10-R14	FUR FAN	0	0	0	2190	2190	$363.0
B4_HVAC7	R15-R16-R17	FUR FAN	0	0	0	2190	2190	$363.0
B4_HVAC8	R18-R19-R20-R21	FUR FAN	0	0	0	2190	2190	$363.0
B4_HVAC9	R26-R22-R23-R24-R25-R27-R28-R29-R30-R31	FUR FAN	0	0	0	2190	2190	$363.0
B4_HVAC10	R26-R22-R23-R24-R25-R27-R28-R29-R30-R31	FUR FAN	0	0	0	2190	2190	$363.0
B4_HVAC11	R26-R22-R23-R24-R25-R27-R28-R29-R30-R31	FUR FAN	0	0	0	2190	2190	$363.0
B6_HVAC1	R1	WSHP	4	3521	1459	1548	6529	$1,082.1
B6_HVAC2	R2	WSHP	4	3521	1459	1548	6529	$1,082.1
B6_HVAC3	R3	WSHP	4	3521	1459	1548	6529	$1,082.1
B6_HVAC4	R4	WSHP	4	3521	1459	1548	6529	$1,082.1
B7_HVAC1	R1-R4	WSHP	4	3521	1459	1548	6529	$1,082.1
B7_HVAC2	R6	WSHP	4	3521	1459	1548	6529	$1,082.1
B8_HVAC1	R1-R3-R13	FUR FAN	0	0	0	2190	2190	$363.0
B8_HVAC2	R1-R3-R13	FUR FAN	0	0	0	2190	2190	$363.0
B9_HVAC1	R1-R2-R3-R5	WSHP	5	4250	1769	1822	7841	$1,299.6

Building & HVAC ID	Room No	Unit Type	Unit Capacity * (Ton)	Annual Cooling Energy Use (kWh)	Annual Heating Energy Use (kWh)	Annual Air System Energy (kWh)	Total Annual Energy Use (kWh)	Total Annual Operating Cost ($)
B9_HVAC2	R10	WSHP	5	4250	1769	1822	7841	$1,299.6
B9_HVAC3	R4-R5	FUR FAN	0	0	0	249	249	$41.2
B10_HVAC1	R1	WSHP	4	3521	1459	1548	6529	$1,082.1
B10_HVAC2	R2	WSHP	4	3521	1459	1548	6529	$1,082.1
B10_HVAC3	R3	WSHP	4	3521	1459	1548	6529	$1,082.1
B10_HVAC4	R4	WSHP	4	3521	1459	1548	6529	$1,082.1
B10_HVAC5	R5	WSHP	4	3521	1459	1548	6529	$1,082.1
B10_HVAC6	R6	WSHP	4	3521	1459	1548	6529	$1,082.1
B12_HVAC1	R1	FUR FAN	0	0	0	120	120	$19.9
B12_HVAC2	R1	FUR FAN	0	0	0	120	120	$19.9
B13_HVAC1	R1-R2-R3	WSHP	5	4216	1754	1822	7792	$1,291.5
B13_HVAC2	R4-R5	HP	2	1261	506	716	2483	$411.6
B13_HVAC3	R6-R7	WSHP	4	2872	1199	1548	5620	$931.4
B13_HVAC4	R8	PACKAGE	10	11191	0	3441	14632	$2,425.3
B13_HVAC5	R8	PACKAGE	1	917	0	340	1257	$208.4
B14_HVAC1	R1	WSHP	4	3521	1459	1548	6529	$1,082.1
B14_HVAC2	R2	WSHP	4	3521	1459	1548	6529	$1,082.1
B14_HVAC3	R3	WSHP	4	3521	1459	1548	6529	$1,082.1
B14_HVAC4	R4	WSHP	4	3521	1459	1548	6529	$1,082.1
B14_HVAC5	R5	WSHP	4	3521	1459	1548	6529	$1,082.1
B14_HVAC6	R6	WSHP	4	3521	1459	1548	6529	$1,082.1
B15_HVAC1	R1	WSHP	4	3521	1459	1548	6529	$1,082.1
B15_HVAC2	R2	WSHP	4	3521	1459	1548	6529	$1,082.1
B15_HVAC3	R3	WSHP	4	3521	1459	1548	6529	$1,082.1
B15_HVAC4	R4	WSHP	4	3521	1459	1548	6529	$1,082.1
B16_HVAC1	R18-R23-R24	PACKAGE	15	17098	0	5161	22259	$3,689.5
B16_HVAC2	R8-R9-R11-R12-R13-R14-R15-R16-R17	PACKAGE	15	17098	0	5161	22259	$3,689.5
B16_HVAC3	R2-R5-R6-R7	PACKAGE	5	5699	0	1700	7399	$1,226.5
B17_HVAC1	R1	WSHP	5	4250	1769	1822	7841	$1,299.6
B17_HVAC2	R2	WSHP	5	4250	1769	1822	7841	$1,299.6
B17_HVAC3	R3	WSHP	5	4250	1769	1822	7841	$1,299.6
B17_HVAC4	R4	WSHP	5	4250	1769	1822	7841	$1,299.6
B17_HVAC5	R10	WSHP	5	4250	1769	1822	7841	$1,299.6

Table 8b: Building Level HVAC Equipment Inventory Continues

Building & HVAC ID	Room No	Unit Type	Unit Capacity * (Ton)	Annual Cooling Energy Use (kWh)	Annual Heating Energy Use (kWh)	Annual Air System Energy (kWh)	Total Annual Energy Use (kWh)	Total Annual Operating Cost ($)
B17_HVAC6	R11	WSHP	5	4250	1769	1822	7841	$1,299.6
B17_HVAC7	R12	WSHP	5	4250	1769	1822	7841	$1,299.6
B17_HVAC8	R13	WSHP	5	4250	1769	1822	7841	$1,299.6
B17_HVAC9	R14	WSHP	5	4250	1769	1822	7841	$1,299.6
B17_HVAC10	R17	WSHP	5	4250	1769	1822	7841	$1,299.6
B17_HVAC11	R18	WSHP	5	4250	1769	1822	7841	$1,299.6
B17_HVAC12	R19	WSHP	5	4250	1769	1822	7841	$1,299.6
B17_HVAC13	R20	WSHP	5	4250	1769	1822	7841	$1,299.6
B17_HVAC14	R21	WSHP	5	4250	1769	1822	7841	$1,299.6
B17_HVAC15	R26	WSHP	5	4250	1769	1822	7841	$1,299.6
B17_HVAC16	R27	WSHP	5	4250	1769	1822	7841	$1,299.6
B17_HVAC17	R28	WSHP	5	4250	1769	1822	7841	$1,299.6
B17_HVAC18	R29	WSHP	5	4250	1769	1822	7841	$1,299.6
B18_HVAC1	R1	WSHP	4	3521	1459	1548	6529	$1,082.1
B18_HVAC2	R2	WSHP	4	3521	1459	1548	6529	$1,082.1
B18_HVAC3	R3	WSHP	4	3521	1459	1548	6529	$1,082.1
B18_HVAC4	R4	WSHP	4	3521	1459	1548	6529	$1,082.1
B18_HVAC5	R5	WSHP	4	3521	1459	1548	6529	$1,082.1
B18_HVAC6	R6	WSHP	4	3521	1459	1548	6529	$1,082.1
B18_HVAC7	R7	WSHP	4	3521	1459	1548	6529	$1,082.1
B19_HVAC1	R8	WSHP	4	3521	1459	1548	6529	$1,082.1
B19_HVAC1	R1	WSHP	4	3521	1459	1548	6529	$1,082.1
B19_HVAC2	R2	WSHP	4	3521	1459	1548	6529	$1,082.1
B19_HVAC3	R3	WSHP	4	3521	1459	1548	6529	$1,082.1
B19_HVAC4	R4	WSHP	4	3521	1459	1548	6529	$1,082.1
B19_HVAC5	R5	WSHP	4	3521	1459	1548	6529	$1,082.1
B19_HVAC6	R6	WSHP	4	3521	1459	1548	6529	$1,082.1
B20_HVAC1	R1	WSHP	4	3521	1459	1548	6529	$1,082.1
B20_HVAC2	R2	WSHP	4	3521	1459	1548	6529	$1,082.1
B20_HVAC3	R3	WSHP	4	3521	1459	1548	6529	$1,082.1
B20_HVAC4	R5	WSHP	4	3521	1459	1548	6529	$1,082.1

Table 8b: Building Level HVAC Equipment Inventory Continues

Building & HVAC ID	Room No	Unit Type	Unit Capacity * (Ton)	Annual Cooling Energy Use (kWh)	Annual Heating Energy Use (kWh)	Annual Air System Energy (kWh)	Total Annual Energy Use (kWh)	Total Annual Operating Cost ($)
B20_HVAC5	R6	WSHP	4	3521	1459	1548	6529	$1,082.1
B20_HVAC6	R7	WSHP	4	3521	1459	1548	6529	$1,082.1
B20_HVAC7	R8	WSHP	4	3521	1459	1548	6529	$1,082.1
B21_HVAC1	R1	WSHP	4	3521	1459	1548	6529	$1,082.1
B21_HVAC2	R2	WSHP	4	3521	1459	1548	6529	$1,082.1
B21_HVAC3	R3	WSHP	4	3521	1459	1548	6529	$1,082.1
B21_HVAC4	R4	WSHP	4	3521	1459	1548	6529	$1,082.1
B21_HVAC5	R10	WSHP	4	3521	1459	1548	6529	$1,082.1
B21_HVAC6	R11	WSHP	4	3521	1459	1548	6529	$1,082.1
B21_HVAC7	R12	WSHP	4	3521	1459	1548	6529	$1,082.1
B21_HVAC8	R13	WSHP	4	3521	1459	1548	6529	$1,082.1
B21_HVAC9	R14	WSHP	4	3521	1459	1548	6529	$1,082.1
B21_HVAC10	R16	WSHP	4	3521	1459	1548	6529	$1,082.1
B21_HVAC11	R17-R18	WSHP	4	3521	1459	1548	6529	$1,082.1
B21_HVAC12	R19	WSHP	4	3521	1459	1548	6529	$1,082.1
B21_HVAC13	R20	WSHP	4	3521	1459	1548	6529	$1,082.1
B21_HVAC14	R25	WSHP	4	3521	1459	1548	6529	$1,082.1
B21_HVAC15	R26	WSHP	4	3521	1459	1548	6529	$1,082.1
B21_HVAC16	R27	WSHP	4	3521	1459	1548	6529	$1,082.1
B21_HVAC17	R28	WSHP	4	3521	1459	1548	6529	$1,082.1
B22_HVAC1	R1	WSHP	4	3521	1459	1548	6529	$1,082.1
B22_HVAC2	R2	WSHP	4	3521	1459	1548	6529	$1,082.1
B22_HVAC3	R3	WSHP	4	3521	1459	1548	6529	$1,082.1
B22_HVAC4	R4	WSHP	4	3521	1459	1548	6529	$1,082.1
B22_HVAC5	R9	WSHP	4	3521	1459	1548	6529	$1,082.1
B22_HVAC6	R10	WSHP	4	3521	1459	1548	6529	$1,082.1
B22_HVAC7	R11	WSHP	4	3521	1459	1548	6529	$1,082.1
B22_HVAC8	R12	WSHP	4	3521	1459	1548	6529	$1,082.1
B22_HVAC9	R14	WSHP	4	3521	1459	1548	6529	$1,082.1
B22_HVAC10	R15-R16-R17	WSHP	4	3521	1459	1548	6529	$1,082.1
B22_HVAC11	R18	WSHP	4	3521	1459	1548	6529	$1,082.1

Table 8b: Building Level HVAC Equipment Inventory Continues

Building & HVAC ID	Room No	Unit Type	Unit Capacity * (Ton)	Annual Cooling Energy Use (kWh)	Annual Heating Energy Use (kWh)	Annual Air System Energy (kWh)	Total Annual Energy Use (kWh)	Total Annual Operating Cost ($)
B22_HVAC12	R19-R21	WSHP	4	3521	1459	1548	6529	$1,082.1
B22_HVAC13	R23	WSHP	4	3521	1459	1548	6529	$1,082.1
B22_HVAC14	R24	WSHP	4	3521	1459	1548	6529	$1,082.1
B22_HVAC15	R25	WSHP	4	3521	1459	1548	6529	$1,082.1
B22_HVAC16	R26	WSHP	4	3521	1459	1548	6529	$1,082.1
B23_HVAC1	R1	PACKAGE	10	11283	0	3441	14724	$2,440.5
B23_HVAC2	R2-R3-R4-R5	Portable	5	6206	0	1700	7906	$1,310.4
TOTAL				**550,888**	**164,048**	**240,650**	**955,586**	**$158,390**

Location	System	Systems Served	Enduse Item	HP	Annual Heating Energy Use (kWh)	Total Annual Operating Cost ($)
Mech Room	Water Loop Circulation	WSHP	Waterloop-Pump-1	15.0	20162.2	$3,341.90
Mech Room	Water Loop Circulation	WSHP	Waterloop-Pump-2	15.0	20162.2	$3,341.90
Outdoor	Water Loop Condenser	WSHP	Tower Fan	20.0	26792.4	$4,440.87
Outdoor	Water Loop Condenser	WSHP	Tower Pump	5.0	7113.2	$1,179.03
Total					**74229.9**	**$12,303.70**

- Cells highlighted, if any, signify assumptions that were made due to inaccurate or missing data.

3.1.3 Plug Loads

Plug loads, such as computers, copiers, and other office equipment; represent over 6% of all electricity use in a typical California school. Without real-time monitoring or smart meter data, operating hours of plug load equipment using statistical means is not always reliable. The table below provides a summary of all plug loads in the site.

Table 9: Plug Load Summary

Location Bldg & Rm ID	Load Source	Qty	Total Power (kW)
B1-R1	COMPUTER	1	0.32
B1-R1	COOLER	1	0.40
B1-R1	PRINTER	1	0.20
B1-R2	PRINTER	2	0.40
B1-R2	COMPUTER	2	0.64
B1-R2	MINI FRIDGE	1	0.50
B1-R2	MICROWAVE	1	1.20
B1-R2	TOASTER OVEN	1	1.40
B1-R2	RADIO	1	0.10
B1-R2	SPACE HEATER	1	0.80
B1-R2	FAN	1	0.10
B1-R3	PLASMA	1	0.50
B1-R3	TV	1	0.13
B1-R3	COMPUTER	1	0.32
B1-R3	PRINTER	1	0.20
B1-R3	LAMINATOR	1	0.48
B1-R4	COMPUTER	1	0.32
B1-R4	PLASMA	1	0.50
B1-R4	PRINTER	2	0.40
B1-R4	SPACE HEATER	1	1.50
B1-R8	COMPUTER	1	0.32
B1-R8	DATA SERVER	3	9.60
B1-R10	COPY MACHINE	4	3.60
B1-R12	COMPUTER	38	12.16
B1-R12	MICROWAVE	1	1.20
B1-R12	MINI FRIDGE	1	0.50
B1-R12	PRINTER	2	0.40
B1-R12	PROJECTOR	1	0.40
B1-R12	TV	1	0.15
B1-R13	TV	1	0.15
B1-R13	MICROWAVE	1	1.20
B1-R13	COMPUTER	1	0.32
B1-R13	PRINTER	1	0.20
B1-R13	PROJECTOR	1	0.40
B1-R15	COMPUTER	1	0.32
B1-R15	PRINTER	1	0.20
B1-R15	SPACE HEATER	1	1.50
B1-R17	COMPUTER	2	0.64
B1-R17	PRINTER	3	0.60
B1-R17	FAN	1	0.10
B1-R18	COMPUTER	3	0.96
B1-R18	SHARPERNER	1	0.24
B1-R19	COMPUTER	6	1.92
B1-R19	SPACE HEATER	3	4.50
B1-R19	MINI FRIDGE	3	1.50
B1-R19	PRINTER	6	1.20
B1-R19	MICROWAVE	1	1.50
B1-R20	COMPUTER	2	0.64
B1-R20	PRINTER	3	0.60
B1-R16	PRINTER	2	1.80
B1-R16	COMPUTER	1	0.32
B1-R22	COMPUTER	2	0.64
B1-R22	PRINTER	2	0.40
B1-R23	FRIDGE	1	0.90
B1-R23	COFFEE MAKER	1	0.90
B1-R23	TOASTER	1	0.90
B1-R23	MICROWAVE	1	1.50
B1-R25	COFFEE MAKER	1	0.90

Table 9: Plug Load Summary Continues

Location Bldg & Rm ID	Load Source	Qty	Total Power (kW)
B1-R25	COMPUTER	2	0.64
B1-R25	PRINTER	2	0.40
B1-R25	MINI FRIDGE	2	1.00
B1-R28	COMPUTER	1	0.32
B1-R28	PRINTER	1	0.20
B1-R28	SHREDDER	1	0.40
B1-R29	COMPUTER	1	0.32
B1-R29	PRINTER	1	0.20
B1-R30	PRINTER	1	0.20
B1-R30	COMPUTER	1	0.32
B1-R31	COMPUTER	2	0.64
B1-R31	PRINTER	2	0.40
B1-R31	PLASMA	2	3.00
B1-R31	FRIDGE	1	0.90
B1-R31	COFFEE MAKER	1	0.90
B1-R31	MICROWAVE	3	4.50
B1-R31	TOASTER OVEN	1	1.40
B1-R33	COMPUTER	1	0.32
B1-R33	PRINTER	1	0.20
B1-R35	COMPUTER	1	0.32
B2-R1	TV	1	0.15
B2-R1	PRINTER	1	0.20
B2-R2	PRINTER	1	0.20
B2-R2	MICROWAVE	1	1.50
B2-R2	LAMINATOR	1	0.40
B2-R2	EMERGENCY RECLYNER	1	0.35
B2-R3	FRIDGE	1	0.90
B2-R3	WASHER	1	1.43
B2-R3	DRYER	1	1.60
B2-R3	STOVE	1	0.80
B2-R3	DISHWASHER	1	0.60
B2-R3	PRINTER	1	0.20
B2-R4	COMPUTER	2	0.64
B2-R4	PRINTER	2	0.40
B2-R4	PROJECTOR	1	0.28
B2-R4	MICROWAVE	1	1.50
B2-R26	COMPUTER	1	0.33

Location Bldg & Rm ID	Load Source	Qty	Total Power (kW)
B2-R26	TV	1	0.15
B2-R26	PRINTER	1	0.21
B2-R26	PROJECTOR	1	0.42
B3-R1	TV	1	0.15
B3-R1	MICROWAVE	1	1.50
B3-R1	COMPUTER	1	0.32
B3-R1	PROJECTOR	1	0.38
B3-R1	MINI FRIDGE	1	0.50
B3-R1	PRINTER	1	0.20
B3-R2	PROJECTOR	1	0.38
B3-R2	COMPUTER	1	0.32
B3-R2	PRINTER	1	0.20
B3-R2	TV	1	0.15
B3-R3	COMPUTER	1	0.32
B3-R3	PROJECTOR	1	0.38
B3-R3	PRINTER	1	0.20
B3-R3	TV	1	0.15
B3-R3	MICROWAVE	1	1.50
B4-R5	TV	1	0.15
B4-R5	DATA SERVER	1	1.30
B4-R5	SPEAKERS	2	0.64
B4-R6	TV	2	0.30
B4-R6	COMPUTER	1	0.34
B4-R6	PRINTER	1	0.20
B4-R6	PROJECTOR	1	0.39
B4-R6	MICROWAVE	1	1.60
B4-R6	MINI FRIDGE	1	0.50
B4-R7	FAN	1	0.24
B4-R7	MINI FRIDGE	3	2.25
B4-R7	COMPUTER	1	0.42
B4-R7	PRINTER	1	0.32
B4-R7	HEART MACHINE	1	1.20
B4-R7	ICE MACHINE	1	0.92
B4-R7	TREAD MILL	1	1.50
B4-R14	WASHER	1	1.02
B4-R14	DRYER	1	1.20
B4-R15	COMPUTER	4	1.60

Table 9: Plug Load Summary Continues

Location Bldg & Rm ID	Load Source	Qty	Total Power (kW)
B4-R15	PRINTER	5	1.60
B4-R15	COFFEE MAKER	1	1.20
B4-R15	MICROWAVE	1	1.60
B4-R15	MINI FRIDGE	1	6.60
B4-R15	TOASTER	1	0.90
B4-R15	AIR COMPRESSER	1	0.08
B4-R15	FAN	1	0.12
B4-R15	SPACE HEATER	1	3.00
B4-R18	COMPUTER	1	0.30
B4-R19	PRINTER	1	0.20
B4-R19	MICROWAVE	1	1.50
B4-R19	MINI FRIDGE	1	0.50
B4-R19	COMPUTER	1	0.32
B4-R20	COMPUTER	4	1.40
B4-R20	MINI FRIDGE	1	0.50
B4-R20	COFFEE MAKER	1	1.20
B4-R20	TOASTER	1	1.30
B4-R20	PRINTER	4	0.80
B4-R20	MICROWAVE	1	1.30
B4-R20	TOASTER	1	1.40
B4-R23	R.A. SYSTEM	1	3.12
B4-R26	SCOREBOARD	1	1.20
B4-R26	SPEAKERS	18	9.90
B4-R26	PROJECTOR	2	1.50
B4-R28	FRIDGE	1	0.95
B4-R28	SHARPERNER	1	0.24
B4-R29	HAND DRYER	1	0.92
B4-R30	HAND DRYER	1	0.92
B5-R1	HAND DRYER	2	0.50
B5-R2	HAND DRYER	2	0.50
B5-R3	REFRIGERATOR	1	0.35
B5-R3	MICROWAVE	1	1.00
B5-R3	COFFEE MAKER	1	0.50
B6-R1	COMPUTER	1	0.32
B6-R1	PRINTER	1	0.20
B6-R1	PROJECTOR	1	0.38
B6-R1	MICROWAVE	1	1.50

Location Bldg & Rm ID	Load Source	Qty	Total Power (kW)
B4-R26	PROJECTOR	2	1.50
B4-R28	FRIDGE	1	0.95
B4-R28	SHARPERNER	1	0.24
B4-R29	HAND DRYER	1	0.92
B4-R30	HAND DRYER	1	0.92
B5-R1	HAND DRYER	2	0.50
B5-R2	HAND DRYER	2	0.50
B5-R3	REFRIGERATOR	1	0.35
B5-R3	MICROWAVE	1	1.00
B5-R3	COFFEE MAKER	1	0.50
B6-R1	COMPUTER	1	0.32
B6-R1	PRINTER	1	0.20
B6-R1	PROJECTOR	1	0.38
B6-R1	MICROWAVE	1	1.50
B6-R1	MINI FRIDGE	1	0.50
B6-R2	MICROWAVE	1	1.50
B6-R2	MINI FRIDGE	1	0.50
B6-R2	COMPUTER	1	0.32
B6-R2	PRINTER	1	0.20
B6-R2	TV	1	0.15
B6-R2	SHARPERNER	1	0.24
B6-R3	PROJECTOR	1	0.38
B6-R3	TV	1	0.15
B6-R3	COMPUTER	1	0.32
B6-R3	TV	1	0.15
B6-R3	COMPUTER	1	0.32
B7-R4	COMPUTER	2	0.64
B7-R4	MINI FRIDGE	1	0.50
B7-R5	PROJECTOR	1	0.20
B7-R5	TV	1	0.15
B8-R5	CASHIER	1	0.15
B8-R5	MINI FRIDGE	1	0.30
B8-R5	OVEN WARMER	1	0.30
B8-R13	ICE MAKER	1	0.20
B8-R13	CASHIER	1	0.10
B8-R13	SUSHI MAKER	1	0.20
B9-R4	COMPUTER	1	1.61

Table 9: Plug Load Summary Continues

Location Bldg & Rm ID	Load Source	Qty	Total Power (kW)
B9-R4	PRINTER	1	1.00
B9-R4	PHONE	1	2.80
B9-R5	ICE MAKER	1	1.44
B9-R5	PRETZEL MACHINE	1	0.32
B9-R5	WARMER	1	0.20
B9-R5	WARMER	1	0.12
B9-R10	MICROWAVE	3	4.50
B9-R10	VENDING MACHINE	1	0.70
B9-R10	FRIDGE	1	0.80
B10-R1	COMPUTER	1	0.32
B10-R1	PRINTER	1	0.20
B10-R1	PROJECTOR	1	0.38
B10-R1	MINI FRIDGE	1	0.50
B10-R1	MICROWAVE	1	1.50
B10-R1	TV	1	0.15
B10-R2	TV	1	0.15
B10-R2	COFFEE MAKER	1	0.76
B10-R2	COMPUTER	1	0.32
B10-R2	PRINTER	1	0.20
B10-R2	PROJECTOR	1	0.38
B10-R3	MINI FRIDGE	1	0.50
B10-R3	COMPUTER	1	0.32
B10-R3	PRINTER	1	0.20
B10-R3	TV	1	0.15
B10-R3	PROJECTOR	1	0.38
B10-R4	TV	1	0.15
B10-R4	COMPUTER	1	0.32
B10-R4	PRINTER	1	0.20
B10-R4	PROJECTOR	1	0.38
B10-R5	COMPUTER	23	7.36
B10-R5	PRINTER	2	0.40
B10-R5	TV	1	0.15
B10-R5	DATA SERVER	1	1.20
B10-R5	PROJECTOR	1	0.38
B10-R6	TV	1	0.15
B10-R6	PROJECTOR	1	0.38
B10-R6	COMPUTER	1	0.32
B10-R6	PRINTER	1	0.20
B10-R6	MINI FRIDGE	1	0.50
B10-R6	MICROWAVE	1	1.50
B11-R4	MICROWAVE	1	1.00
B11-R4	REFRIGERATOR	1	0.35
B12-R2	MINI FRIDGE	1	0.30
B13-R1	COMPUTER	40	12.80
B13-R1	PRINTER	1	0.20
B13-R1	PROJECTOR	1	0.38
B13-R1	TV	1	0.15
B13-R2	MINI FRIDGE	1	0.50
B13-R2	MICROWAVE	1	1.50
B13-R2	PRINTER	6	3.60
B13-R2	COMPUTER	1	0.32
B13-R3	COMPUTER	1	0.32
B13-R3	PRINTER	1	0.20
B13-R4	COMPUTER	3	0.96
B13-R4	PRINTER	3	1.20
B13-R4	MINI FRIDGE	2	1.00
B13-R4	MICROWAVE	1	1.50
B13-R4	TOASTER	1	0.90
B13-R5	COMPUTER	1	0.32
B13-R5	PRINTER	1	0.20
B13-R6	COMPUTER	2	0.64
B13-R6	PRINTER	2	0.40
B13-R6	TV	1	0.15
B13-R7	COMPUTER	9	2.88
B13-R7	PRINTER	2	0.40
B13-R7	MINI FRIDGE	2	1.00
B13-R7	PROJECTOR	1	0.38
B13-R8	COMPUTER	40	12.80
B13-R8	PRINTER	4	1.20
B13-R8	MINI FRIDGE	2	1.00
B13-R8	MICROWAVE	1	1.50
B13-R8	PROJECTOR	1	0.38
B13-R8	TV	1	0.15
B14-R1	COMPUTER	2	0.64

Table 9: Plug Load Summary Continues

Location Bldg & Rm ID	Load Source	Qty	Total Power (kW)
B14-R2	COMPUTER	2	0.64
B14-R2	PRINTER	2	0.44
B14-R2	MICROWAVE	1	1.50
B14-R2	MINI FRIDGE	1	0.50
B14-R2	PROJECTOR	1	0.70
B14-R3	COMPUTER	1	0.32
B14-R3	PRINTER	1	0.24
B14-R3	TV	1	0.15
B14-R3	PROJECTOR	1	0.73
B14-R3	MICROWAVE	1	1.30
B14-R3	MINI FRIDGE	1	0.50
B14-R4	COMPUTER	2	0.70
B14-R4	PRINTER	1	0.28
B14-R4	MINI FRIDGE	2	1.00
B14-R4	MICROWAVE	1	1.50
B14-R4	PROJECTOR	1	0.66
B14-R4	TV	1	0.15
B14-R5	MINI FRIDGE	1	0.50
B14-R5	COMPUTER	2	0.64
B14-R5	TV	2	0.30
B14-R5	PROJECTOR	1	0.66
B14-R5	PRINTER	1	0.20
B14-R5	MICRO	1	1.50
B15-R1	COMPUTER	13	1.95
B15-R1	PRINTER	2	0.44
B15-R1	MICRO	1	1.00
B15-R1	TV	1	0.10
B15-R1	PROJECTOR	1	0.20
B15-R2	COMPUTER	1	0.15
B15-R2	PRINTER	1	0.22
B15-R3	MINI FRIDGE	1	0.35
B15-R3	PROJECTOR	1	0.20
B15-R3	TV	1	0.10
B15-R3	COMPUTER	1	0.15
B15-R4	COMPUTER	1	0.15
B15-R4	PROJECTOR	1	0.20
B15-R4	TV	1	0.10

Location Bldg & Rm ID	Load Source	Qty	Total Power (kW)
B15-R4	MICROWAVE	1	1.00
B15-R4	MINI FRIDGE	1	0.35
B16-R2	DATA SERVER	1	3.00
B16-R5	COMPUTER	1	0.15
B16-R5	LAPTOP CHARGER	1	2.00
B16-R5	PRINTER	1	0.15
B16-R6	MICROWAVE	1	1.00
B16-R6	REFRIGERATOR	1	0.50
B16-R6	COFFEE MAKER	1	0.30
B16-R7	COMPUTER	34	5.10
B16-R7	TV	2	0.20
B16-R8	PRINTER	1	0.15
B16-R8	COMPUTER	1	0.10
B16-R9	COMPUTER	2	0.30
B16-R9	PRINTER	2	0.30
B16-R13	COMPUTER	1	0.15
B16-R14	PROJECTOR	1	0.15
B16-R15	COMPUTER	1	0.15
B16-R15	PROJECTOR	1	0.15
B16-R16	PRINTER	1	0.72
B16-R16	COMPUTER	13	1.95
B16-R18	MICROWAVE	1	1.00
B16-R18	MINI FRIDGE	1	0.35
B16-R18	COMPUTER	3	0.45
B16-R19	COMPUTER	7	1.05
B16-R19	PRINTER	2	0.44
B16-R23	COMPUTER	42	6.30
B16-R23	PRINTER	1	0.22
B16-R23	TV	8	0.80
B16-R23	REFRIGERATOR	4	2.00
B16-R24	REFRIGERATOR	5	2.50
B16-R24	COMPUTER	3	0.45
B16-R24	PRINTER	2	0.44
B17-R1	COMPUTER	1	0.32
B17-R1	PRINTER	1	0.20
B17-R1	TV	1	0.15
B17-R1	PROJECTOR	1	0.38

Table 9: Plug Load Summary Continues

Location Bldg & Rm ID	Load Source	Qty	Total Power (kW)
B17-R1	MINI FRIDGE	1	0.50
B17-R2	COMPUTER	1	0.32
B17-R2	PRINTER	1	0.20
B17-R2	PROJECTOR	1	0.38
B17-R2	TV	1	0.18
B17-R3	COMPUTER	38	12.16
B17-R3	PRINTER	1	0.20
B17-R3	MICROWAVE	1	1.50
B17-R3	MINI FRIDGE	1	0.50
B17-R3	PROJECTOR	1	0.38
B17-R3	TV	1	0.15
B17-R4	COMPUTER	37	11.84
B17-R4	PRINTER	1	0.20
B17-R4	PROJECTOR	1	0.38
B17-R4	TV	1	0.15
B17-R10	ICE MAKER	1	1.00
B17-R10	SLUSHIE MACHINE	1	1.44
B17-R10	PRETZEL MACHINE	1	1.00
B17-R10	AIR COMPRESSER	3	3.00
B17-R10	FOOD WARMER	2	7.20
B17-R10	FREEZER	2	1.44
B17-R10	BAR ROOD WARMER	2	2.52
B17-R10	FRIDGE	4	2.88
B17-R11	COMPUTER	1	0.32
B17-R11	PRINTER	2	0.40
B17-R11	TV	1	0.15
B17-R11	FRIDGE	1	0.90
B17-R11	MICROWAVE	1	1.50
B17-R12	COMPUTER	1	0.32
B17-R12	PRINTER	1	0.20
B17-R12	TV	1	0.15
B17-R12	PROJECTOR	1	0.38
B17-R13	TV	2	0.30
B17-R13	PROJECTOR	1	0.30
B17-R13	COMPUTER	1	0.32
B17-R13	PRINTER	1	0.20
B17-R13	MINI FRIDGE	1	0.50

Location Bldg & Rm ID	Load Source	Qty	Total Power (kW)
B17-R14	TV	1	0.15
B17-R14	LAPTOP CHARGER	2	1.92
B17-R14	COMPUTER	1	0.32
B17-R14	PRINTER	1	0.20
B17-R14	PROJECTOR	1	0.30
B17-R16	COMPUTER	8	2.56
B17-R16	PRINTER	1	0.90
B17-R16	SHARPERNER	1	0.24
B17-R18	MICROWAVE	1	1.50
B17-R18	MINI FRIDGE	1	0.50
B17-R18	COMPUTER	1	0.32
B17-R18	PRINTER	1	0.20
B17-R18	TV	1	0.15
B17-R19	COMPUTER	1	0.32
B17-R19	MICROWAVE	1	1.50
B17-R19	PRINTER	1	0.20
B17-R19	TV	1	0.15
B17-R19	PROJECTOR	1	0.38
B17-R19	MINI FRIDGE	2	1.00
B17-R20	COMPUTER	3	0.96
B17-R20	PRINTER	2	0.40
B17-R20	MICROWAVE	1	1.50
B17-R20	MINI FRIDGE	1	0.50
B17-R20	TV	1	0.15
B17-R20	PROJECTOR	2	0.76
B17-R20	PORTA TRACE	3	0.24
B17-R21	MICROWAVE	1	1.50
B17-R21	COMPUTER	2	0.64
B17-R21	PRINTER	1	0.20
B17-R21	PROJECTER	1	0.38
B17-R21	TV	1	0.15
B17-R21	SHARPERNER	1	0.24
B17-R22	HAND DRYER	1	0.24
B17-R24	HAND DRYER	1	0.24
B17-R26	COMPUTER	1	0.32
B17-R26	PRINTER	1	0.20
B17-R26	PROJECTER	1	0.38

Table 9: Plug Load Summary Continues

Location Bldg & Rm ID	Load Source	Qty	Total Power (kW)
B17-R26	MICROWAVE	1	1.50
B17-R26	TOASTER	1	0.80
B17-R26	MINI FRIDGE	1	0.50
B17-R27	PROJECTOR	1	0.30
B17-R27	COMPUTER	1	0.32
B17-R27	PRINTER	1	0.20
B17-R28	COMPUTER	1	0.32
B17-R28	PRINTER	1	0.20
B17-R28	MICROWAVE	1	1.50
B17-R28	MINI FRIDGE	1	0.50
B17-R28	PROJECTOR	1	0.38
B17-R28	SHARPERNER	1	0.20
B17-R29	COMPUTER	1	0.32
B17-R29	PRINTER	1	0.20
B17-R29	TV	1	0.15
B17-R29	PROJECTER	1	0.38
B17-R29	MINI FRIDGE	1	0.50
B18-R1	COMPUTER	1	0.32
B18-R1	PRINTER	1	0.20
B18-R1	TV	1	0.15
B18-R1	MICROWAVE	1	1.50
B18-R1	MINI FRIDE	1	0.50
B18-R2	RADIO	1	0.12
B18-R2	PRINTER	1	0.20
B18-R2	COMPUTER	1	0.32
B18-R2	MINI FRIDGE	1	0.50
B18-R2	TV	1	0.15
B18-R2	PROJECTER	1	0.38
B18-R3	TV	1	0.15
B18-R3	COMPUTER	1	0.32
B18-R3	PRINTER	1	0.20
B18-R3	PROJECTER	1	0.38
B18-R4	TV	1	0.15
B18-R4	PROJECTER	1	0.38
B18-R4	COMPUTER	1	0.32
B18-R4	PRINTER	1	0.20
B18-R4	MICROWAVE	1	1.50

Location Bldg & Rm ID	Load Source	Qty	Total Power (kW)
B18-R3	COMPUTER	1	0.32
B18-R3	PRINTER	1	0.20
B18-R3	PROJECTER	1	0.38
B18-R4	TV	1	0.15
B18-R4	PROJECTER	1	0.38
B18-R4	COMPUTER	1	0.32
B18-R4	PRINTER	1	0.20
B18-R4	MICROWAVE	1	1.50
B18-R4	MINI FRIDE	1	0.50
B18-R5	TV	1	0.15
B18-R5	MICROWAVE	1	1.50
B18-R5	MINI FRIDGE	1	0.50
B18-R5	PLASMA	1	1.00
B18-R5	COFFEE MAKER	1	0.90
B18-R5	COMPUTER	1	0.32
B18-R5	PRINTER	1	0.20
B18-R6	MICROWAVE	1	1.50
B18-R6	MINI FRIDGE	1	0.50
B18-R6	TV	1	0.15
B18-R6	COMPUTER	1	0.32
B18-R6	PRINTER	1	0.20
B18-R6	PROJECTER	1	0.38
B18-R7	COMPUTER	1	0.32
B18-R7	PRINTER	1	0.20
B18-R7	PROJECTER	1	0.38
B18-R7	TV	1	0.15
B18-R8	TV	1	0.15
B18-R8	COMPUTER	1	0.32
B18-R8	PRINTER	1	0.20
B18-R8	PROJECTER	1	0.38
B18-R8	DATASERVER	1	3.20
B19-R1	COMPUTER	1	0.33
B19-R2	PRINTER	1	0.22
B19-R2	TV	1	0.15
B19-R2	PROJECTER	1	0.39
B19-R2	MINI FRIDGE	1	0.55
B19-R3	TV	1	0.15

Table 9: Plug Load Summary Continues

Location Bldg & Rm ID	Load Source	Qty	Total Power (kW)
B19-R3	PROJECTER	1	0.38
B19-R3	COMPUTER	1	0.32
B19-R3	PRINTER	1	0.20
B19-R3	MICROWAVE	1	1.30
B19-R4	COMPUTER	1	0.66
B19-R4	PRINTER	2	0.64
B19-R4	PROJECTER	2	1.60
B19-R4	TV	2	0.30
B19-R4	SHARPERNER	2	0.48
B19-R5	MICROWAVE	1	1.30
B19-R5	MINI FRIDGE	1	0.55
B19-R5	TV	1	0.15
B19-R5	COMPUTER	1	0.35
B19-R5	PRINTER	1	0.22
B19-R6	MINI FRIDGE	1	0.55
B19-R6	PRINTER	1	0.30
B19-R6	COMPUTER	1	0.40
B19-R6	COFFEE MAKER	1	1.60
B19-R6	PROJECTER	1	0.30
B19-R6	TV	1	0.15
B20-R1	PROJECTER	1	0.38
B20-R1	COMPUTER	1	0.35
B20-R1	PRINTER	1	0.20
B20-R1	TV	1	0.15
B20-R1	MINI FRIDGE	1	0.55
B20-R1	LAVA LAMP	1	0.24
B20-R2	COMPUTER	1	0.32
B20-R2	TV	1	0.15
B20-R2	PROJECTER	1	0.45
B20-R2	PRINTER	1	0.25
B20-R3	COMPUTER	1	0.35
B20-R3	PRINTER	1	0.22
B20-R3	TV	1	0.15
B20-R3	FRIDGE	1	0.85
B20-R3	PROJECTER	1	1.20
B20-R4	DATA SERVER	2	2.60
B20-R5	PRINTER	4	3.20

Location Bldg & Rm ID	Load Source	Qty	Total Power (kW)
B20-R5	COMPUTER	5	1.60
B20-R5	FRIDGE	1	0.80
B20-R6	PRINTER	1	0.22
B20-R6	COMPUTER	1	0.35
B20-R6	TV	1	0.15
B20-R6	MINI FRIDGE	1	0.55
B20-R6	PROJECTER	1	0.42
B20-R7	COMPUTER	11	3.74
B20-R7	MINI FRIDGE	1	0.60
B20-R7	PRINTER	1	0.22
B20-R7	PROJECTER	1	0.70
B20-R7	TV	1	0.24
B20-R8	COMPUTER	11	3.74
B20-R8	TV	1	0.15
B20-R8	PROJECTER	1	0.84
B20-R8	PRINTER	1	0.22
B21-R1	AQUAIRIUM	3	0.90
B21-R1	MICROWAVE	1	1.50
B21-R1	TV	1	0.15
B21-R1	COMPUTER	1	0.32
B21-R1	PRINTER	1	0.20
B21-R1	PROJECTER	1	0.38
B21-R1	MINI FRIDGE	1	0.50
B21-R1	TOASTER	1	0.90
B21-R2	COMPUTER	1	0.32
B21-R2	PRINTER	1	0.20
B21-R2	PROJECTER	1	0.38
B21-R2	TV	1	0.15
B21-R3	COMPUTER	3	1.14
B21-R3	PRINTER	1	0.20
B21-R3	TV	1	0.15
B21-R3	PROJECTOR	1	0.38
B21-R4	COMPUTER	1	0.32
B21-R4	PRINTER	1	0.20
B21-R4	PROJECTER	1	0.38
B21-R4	TV	1	0.15
B21-R4	MINI FRIDGE	1	0.50

Table 9: Plug Load Summary Continues

Location Bldg & Rm ID	Load Source	Qty	Total Power (kW)
B21-R8	HAND DRYER	1	0.24
B21-R9	HAND DRYER	1	0.24
B21-R10	ICE MAKER	1	1.00
B21-R10	COOLER	1	1.00
B21-R10	SLUSHEE	1	1.44
B21-R10	FOOD WARMER	1	3.60
B21-R10	FRIDGE	4	1.20
B21-R10	FREEZER	2	1.44
B21-R10	AIR DOOR	3	1.80
B21-R11	COMPUTER	1	0.32
B21-R11	PRINTER	1	0.20
B21-R11	TV	1	0.15
B21-R11	PROJECTER	1	0.38
B21-R12	COMPUTER	1	0.32
B21-R12	PRINTER	1	0.20
B21-R12	MINI FRIDGE	1	0.50
B21-R12	PROJECTER	1	0.38
B21-R12	TV	1	0.15
B21-R12	MICROWAVE	1	1.50
B21-R13	PROJECTOR	1	0.38
B21-R13	PRINTER	1	0.20
B21-R13	COMPUTER	1	0.32
B21-R13	TV	1	0.15
B21-R14	COMPUTER	1	0.32
B21-R14	PRINTER	1	0.20
B21-R14	MICROWAVE	1	1.50
B21-R14	PROJECTOR	1	0.38
B21-R14	MINI FRIDGE	1	0.50
B21-R14	TV	1	0.15
B21-R15	COPY MACHINE	2	0.80
B21-R15	COMPUTER	4	1.28
B21-R15	FRIDGE	1	0.80
B21-R16	COMPUTOR	4	1.28
B21-R16	PRINTER	2	0.40
B21-R16	LIGHT SWITCH	1	0.40
B21-R16	TV	1	0.15
B21-R16	PROJECTOR	1	0.38

Location Bldg & Rm ID	Load Source	Qty	Total Power (kW)
B21-R16	MICROWAVE	1	1.50
B21-R16	MINI FRIDGE	1	0.50
B21-R17	PROJECTOR	1	0.38
B21-R17	TV	1	0.15
B21-R17	COMPUTER	1	0.32
B21-R17	PRINTER	1	0.20
B21-R18	MINI FRIDGE	1	0.50
B21-R18	MICROWAVE	1	1.50
B21-R19	COMPUTER	3	0.96
B21-R19	PRINTER	2	0.40
B21-R19	TV	1	0.15
B21-R19	PROJECTOR	1	0.38
B21-R20	TV	2	0.30
B21-R20	PROJECTOR	1	0.38
B21-R20	COMPUTER	1	0.32
B21-R20	PRINTER	1	0.20
B21-R21	HAND DRYER	1	0.24
B21-R23	HAND DRYER	1	0.24
B21-R25	COMPUTER	1	0.32
B21-R25	TV	1	0.15
B21-R25	PRINTER	1	0.20
B21-R25	PROJECTOR	1	0.38
B21-R26	COMPUTER	1	0.32
B21-R26	PRINTER	1	0.20
B21-R26	TV	1	0.15
B21-R26	MICROWAVE	1	1.50
B21-R26	MINI FRIDGE	1	0.50
B21-R27	MICROWAVE	1	1.50
B21-R27	MINI FRIDGE	1	0.50
B21-R27	PRINTER	1	0.20
B21-R27	PROJECTOR	1	0.38
B21-R27	TV	1	0.15
B21-R27	COMPUTER	1	0.32
B21-R28	COMPUTER	1	0.32
B21-R28	PRINTER	1	0.20
B21-R28	PROJECTOR	1	0.38
B21-R28	TV	1	0.15

Table 9: Plug Load Summary Continues

Location Bldg & Rm ID	Load Source	Qty	Total Power (kW)
B21-R28	MINI FRIDGE	1	0.50
B22-R1	HEATING LAMP	1	0.11
B22-R1	PROJECTOR	1	0.38
B22-R1	TV	1	0.15
B22-R1	PRINTER	1	0.30
B22-R1	COMPUTER	1	0.32
B22-R1	MICROWAVE	1	1.50
B22-R2	PROJECTOR	1	0.38
B22-R2	TV	1	0.15
B22-R2	COMPUTER	1	0.32
B22-R2	PRINTER	1	0.20
B22-R2	LAB OVEN	1	0.75
B22-R3	TV	1	0.15
B22-R3	MICROWAVE	1	1.50
B22-R3	PROJECTOR	1	0.38
B22-R3	COMPUTER	1	0.32
B22-R3	PRINTER	1	0.20
B22-R4	TV	1	0.15
B22-R4	PROJECTOR	1	0.38
B22-R4	PRINTER	1	0.20
B22-R4	COMPUTER	1	0.32
B22-R4	AQUA CHILLER	1	0.24
B22-R5	COMPUTER	2	0.64
B22-R5	PRINTER	1	0.20
B22-R5	TV	1	0.15
B22-R6	HAND DRYER	1	0.24
B22-R7	HAND DRYER	1	0.24
B22-R9	AQUARIUM	1	0.12
B22-R9	MINI FRIDGE	1	0.50
B22-R9	PROJECTOR	1	0.30
B22-R9	MICROWAVE	1	1.50
B22-R9	COMPUTER	1	0.32
B22-R9	PRINTER	1	0.20
B22-R10	COMPUTER	1	0.32
B22-R10	MINI FRIDGE	1	0.50
B22-R10	TV	1	0.15

Location Bldg & Rm ID	Load Source	Qty	Total Power (kW)
B22-R10	PROJECTOR	1	0.38
B22-R11	TV	1	0.15
B22-R11	COMPUTER	1	0.32
B22-R11	PRINTER	1	0.20
B22-R11	PROJECTOR	1	0.38
B22-R12	COFFEE MAKER	1	1.00
B22-R12	MICROWAVE	1	1.50
B22-R12	MINI FRIDGE	1	0.50
B22-R12	TV	2	0.30
B22-R12	COMPUTER	1	0.32
B22-R12	PRINTER	1	0.30
B22-R12	PROJECTOR	1	0.50
B22-R13	MICROWAVE	2	3.00
B22-R13	FRIDGE	1	0.90
B22-R13	COMPUTER	1	0.32
B22-R13	DISHWASHER	1	1.32
B22-R13	PROJECTOR	1	0.00
B22-R14	PROJECTOR	1	0.38
B22-R14	TV	1	0.15
B22-R14	COMPUTER	1	0.32
B22-R14	PRINTER	2	0.40
B22-R15	MINI FRIDGE	1	0.50
B22-R15	MICROWAVE	1	1.50
B22-R15	COFFEE MAKER	1	1.00
B22-R16	COMPUTER	10	3.50
B22-R16	PRINTER	2	0.40
B22-R16	PROJECTOR	1	0.38
B22-R16	TV	1	0.15
B22-R17	MICROWAVE	2	3.00
B22-R17	WASHER	1	0.80
B22-R17	DRYER	1	1.20
B22-R17	FRIDGE	4	3.20
B22-R18	COMPUTER	1	0.40
B22-R18	PRINTER	1	0.20
B22-R18	TV	1	0.15
B22-R19	PROJECTOR	1	0.70

Table 9: Plug Load Summary Continues

Location Bldg & Rm ID	Load Source	Qty	Total Power (kW)
B22-R19	TV	2	0.30
B22-R19	MICROWAVE	2	3.00
B22-R19	TOASTER	1	0.90
B22-R19	COMPUTER	6	2.10
B22-R19	PROJECTOR	1	0.39
B22-R20	HAND DRYER	1	0.24
B22-R22	HAND DRYER	1	0.24
B22-R23	COMPUTER	4	1.60
B22-R23	TV	2	0.30
B22-R23	PROJECTOR	2	1.00
B22-R23	PRINTER	2	0.60
B22-R23	MICROWAVE	1	1.50
B22-R24	COMPUTER	1	0.34
B22-R24	PROJECTOR	1	0.40
B22-R24	MINI FRIDGE	2	1.00
B22-R24	PRINTER	1	0.22
B22-R24	TV	1	0.15
B22-R25	COMPUTER	1	0.33
B22-R25	PRINTER	1	0.22
B22-R25	TV	1	0.15
B22-R25	PROJECTOR	1	0.39
B23-R1	TV	1	0.15
B23-R1	PROJECTER	1	0.38
B23-R1	COMPUTER	1	0.32
B23-R1	PRINTER	1	0.20
B23-R1	MINI FRIDGE	1	0.50
B23-R1	MICROWAVE	1	1.50
B23-R1	COFFEE MAKER	1	0.80
B23-R1	BLENDER	1	0.24
B23-R2	WOOD THINNER	3	4.50
B23-R2	TABLE SAW	3	8.28
B23-R2	SAW MACHINE	3	4.50
B23-R2	COMPUTER	6	1.92
B23-R2	PRINTER	2	0.40
B23-R2	TV	1	0.15
B23-R2	MINI FRIDGE	2	1.00
B23-R2	MICROWAVE	1	1.30
B23-R2	DRILL MACHINE	2	1.84
B23-R2	BUZZ SAW	2	1.60
B23-R2	WOOD THINNER	2	1.50

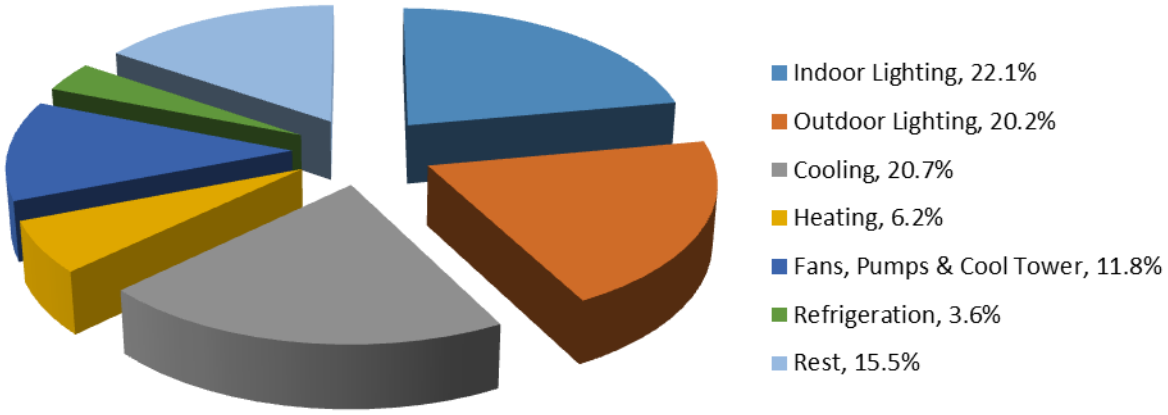
The easiest way to reduce electricity use in plug loads is by turning off equipment when it is not in use.

3.1.4 Electricity End Use Summary

A pie chart of the electric usage by end use categories: Interior lighting, exterior lighting, space cooling, space heating, air distribution, refrigeration and rest.

Figure 11: Summary of the Electrical End Use Percentages

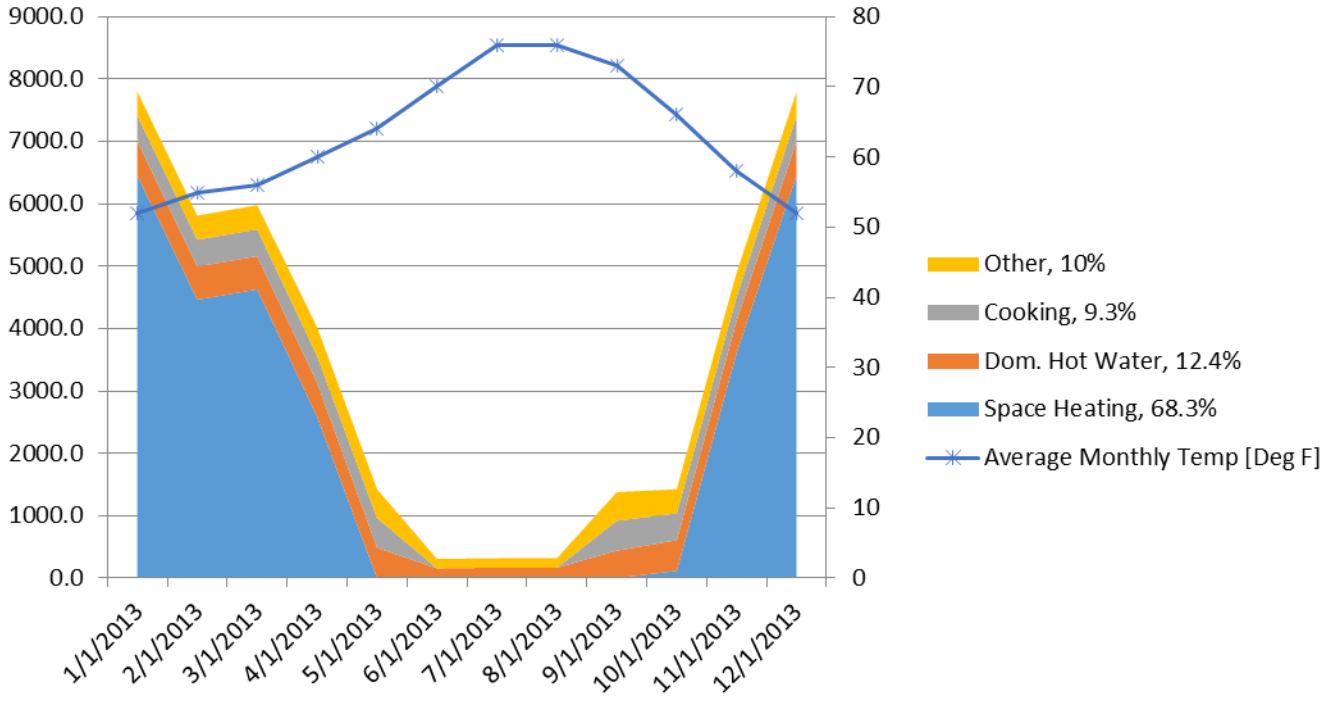
According to our estimates, HVAC accounts for 39% of all electrical energy use, while lighting and refrigeration account for 42% and 4% respectively. The "rest" category which is estimated to be 16% of the site usage includes the plug loads, electric kitchen appliances, electric domestic water heating systems and other process/specialty loads that the survey did not include. The cooling energy portion of the HVAC system and electric heating are 20.7% and 6.2% respectively, while air systems, hydronic systems and the condenser together consume 11.8%. Based on the 2006 study by Itron Inc., the typical California school uses 30% of all electricity use on HVAC and 48% on lighting.



3.2 Gas End Use Characteristics & Domestic Hot Water

Natural gas is primarily used in schools for space heating, water heating, and cooking. These three (3) end-uses amount to nearly 98% of gas usage in a typical California school. In order to estimate the natural gas usage by end use, the relationship between monthly usages, the site operating schedule and local temperature has been statistically examined. The stacked area graph shown below represents how gas is used over a year.

Figure 12: Estimated Seasonal Gas Use by End Use Profiles



Based on the estimated results obtained from our analysis, approximately 68.3% of the annual natural gas usage is spent on space heating, which amounts to 28,333 therms and 12.4% on domestic hot water consuming 5,133 therms. Another 3,875 therms, or 9.3% of the total natural gas use, is assumed for cooking and the remaining 4,149 therms which amount to 10% for other miscellaneous/process natural gas systems.

3.2.1 Space Heating Using Natural Gas

Based on the results of our energy analysis, annually a total of 28,333 therms, or 68% of the total natural gas usage, goes towards space heating. All of the gas-based heating except the swimming pool is accomplished using natural gas-fired furnaces and boilers (that support the water source heat pumps). The school swimming pool is heated by propane-fired system/s.

Table 10: Natural Gas Space Heating Systems Inventory Table

Building & HVAC ID	Room ID	Unit Type	Unit Heating Capacity* (Btuh in)	Annual Heating Energy Use (Therms)	Total Annual Operating Cost ($)
B4_HVAC6	R3-R5-R6-R7-R8-R9-R10-R14	Furnace	300,000	1,141	$752.6
B4_HVAC7	R15-R16-R17	Furnace	300,000	1,141	$752.6
B4_HVAC8	R18-R19-R20-R21	Furnace	300,000	1,141	$752.6
B4_HVAC9	R29-R30-R31	Furnace	300,000	1,141	$752.6
B4_HVAC10	R29-R30-R31	Furnace	300,000	1,141	$752.6
B4_HVAC11	R29-R30-R31	Furnace	300,000	1,141	$752.6
B8_HVAC1	R1-R3-R13	Furnace	300,000	1,141	$752.6
B8_HVAC2	R1-R3-R13	Furnace	300,000	1,141	$752.6
B9_HVAC3	R4-R5	Furnace	45,000	171	$112.9
B12_HVAC1	R1	Furnace	45,000	171	$112.9
B12_HVAC2	R1	Furnace	45,000	171	$112.9
B13_HVAC4	R8	Package	180,000	702	$462.8
B13_HVAC5	R8	Package	11,500	45	$29.6
B16_HVAC1	R18-R23-R24	Package	260,000	1,014	$668.5
B16_HVAC2	R16-R17	Package	260,000	1,014	$668.5
B16_HVAC3	R2-R5-R6-R7	Package	60,000	234	$154.3
B23_HVAC1	R1	Package	130,000	355	$233.8
Total				**13,004**	**$8,577.0**

System ID	Type	Age	Location	No. of Units	Fuel type	Total Annual Energy Use (Therms)	Total Annual Operating Cost ($)
B1	Hot Water Boiler	< 25 yrs	Mechancial Room	1	Natural Gas	7664.6	$5,055.36
B2	Hot Water Boiler	< 25 yrs	Mechancial Room	1	Natural Gas	7664.6	$5,055.36
TOTAL						**15,329**	**$10,110.72**

- Cells highlighted, if any, signify assumptions that were made due to inaccurate or missing data.

3.2.2 Domestic Hot Water

The table below lists the electric based domestic hot water tanks located during the survey.

Table 10.a: Domestic Hot Water Inventory Table

Building ID	Type	Total Storage (gal)	Location	No. of Units	Fuel type
B4	Storage	85	R13	1	Natural Gas
B9	Storage	85	R9	1	Electric
B9	Instantaneous (Tankless)		R9	1	Electric
B11	Storage	30	R3	1	Electric
B16	Instantaneous (Tankless)		R4	1	Electric
B17	Storage	30	R9	1	Electric
B21	Storage	40	R22	1	Electric
B22	Storage	75	R5	1	Natural Gas

Cells highlighted, if any, signify assumptions that were made due to inaccurate or missing data.

Table 10.b Monthly Average, Ground Water Temperature

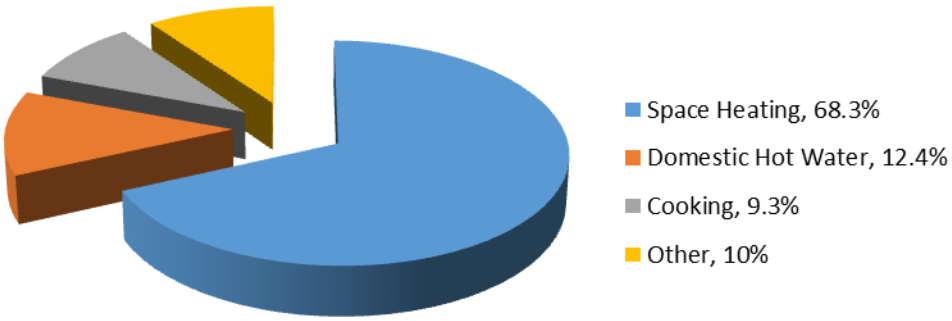
Month	Temp [F]
January	56
February	55
March	55
April	57
May	62
June	66
July	69
August	71
September	70
October	67
November	63
December	59

3.2.3 Gas End Use summary

Breaking down total energy use into end use categories helps to identify where energy efficiency efforts should be focused.

Figure 13: Natural Gas Energy Use Breakdown by End Use

According to our estimates, space heating accounts for 68.3% of all natural gas energy use, while water heating/process and cooking account for 12.4% and 9.3% respectively. Based on the CEUS study, the typical California school uses 63% of all natural gas use on space heating, 29% on domestic hot water heating, and 6% on cooking.



3.3 Building Envelope Characteristics

This section provides a brief summary of the observed building envelope characteristics. These observations will not necessarily contribute to the savings calculations, but this information can be used to inform energy saving measures.

Table 11: Calculated Solar Heat Gain through Windows

This table shows the annual solar heat gain through single pane windows based on the site's location.

Solar Heat Gain(Btu/ft2) Estimate								
N	NE	E	SE	S	SW	W	NW	Horiz
78500	137600	258000	342000	357000	342000	258000	137600	313
Peak Irradiance (Btu/h-ft2), Diffuse and Direct								Btu/h-ft2
N	NE	E	SE	S	SW	W	NW	Horz/DN
62	190	236	181	100	181	236	190	69.6/75.2

** Horiz/DN, Horiz = Average Horizontal Solar Radiation and DN = Average Direct Normal Solar radiation. The data for both is the 2014 version that has reduced by 4% and 16% respectively from the 2011 data of DEER for the applicable climate zone of this facility.

All the windows of the 24 buildings in the school have been identified as single pane with no coating. The values on Table 12 (next page) are to be used if the facility decides to implement measures for windows.

Table 12: Total Solar Heat Gain Area for Each Building

The table summarizes the amount of heat potentially entering into the conditioned space.

Bld & Rm	Solar heat gain through each direction (kBTU)							
ID, Flr.	N	NE	E	SE	S	SW	W	NW
B1-R1	0	0	0	0	4284	0	0	0
B1-R2	0	0	0	0	4284	0	3096	0
B1-R3	0	0	0	0	0	0	10320	0
B1-R4	10284	0	0	0	0	0	45150	0
B1-R5	0	0	0	0	0	0	0	0
B1-R6	0	0	0	0	0	0	0	0
B1-R7	0	0	0	0	0	0	0	0
B1-R8	0	0	0	0	0	0	0	0
B1-R9	0	0	0	0	0	0	0	0
B1-R10	0	0	0	0	0	0	0	0
B1-R11	0	0	0	0	0	0	0	0
B1-R12	0	0	7998	0	2856	0	0	0
B1-R13	942	0	3096	0	6783	0	0	0
B1-R14	0	0	0	0	0	0	0	0
B1-R15	0	0	0	0	1428	0	0	0
B1-R16	0	0	0	0	0	0	0	0
B1-R17	0	0	0	0	1428	0	0	0
B1-R18	0	0	0	0	14280	0	1032	0
B1-R19	0	0	0	0	0	0	0	0
B1-R20	0	0	0	0	0	0	0	0
B1-R21	0	0	0	0	0	0	0	0
B1-R22	0	0	0	0	0	0	0	0
B1-R23	0	0	0	0	0	0	0	0
B1-R24	0	0	0	0	0	0	0	0
B1-R25	0	0	0	0	0	0	0	0
B1-R26	0	0	0	0	0	0	0	0
B1-R27	0	0	0	0	0	0	0	0
B1-R28	0	0	0	0	0	0	0	0
B1-R29	0	0	0	0	0	0	0	0
B1-R30	0	0	0	0	0	0	0	0
B1-R31	0	0	0	0	0	0	0	0
B1-R32	0	0	0	0	0	0	0	0

Table 12: Total Solar Heat Gain Area for Each Building Continues

Bld & Rm	Solar heat gain through each direction (kBTU)							
ID, Flr.	N	NE	E	SE	S	SW	W	NW
B1-R33	0	0	0	0	0	0	0	0
B1-R34	0	0	0	0	0	0	0	0
B1-R35	0	0	0	0	0	0	0	0
B1-R36	0	0	2064	0	2142	0	0	0
B2-R1	1413	0	0	6498	9996	0	0	0
B2-R2	1413	0	0	0	16779	0	0	0
B2-R3	1413	0	0	16074	0	0	0	0
B2-R4	1413	0	0	0	0	16074	0	0
B3-R1	1413	0	0	0	9996	6498	0	0
B3-R2	1413	0	0	6498	9996	0	0	0
B3-R3	1413	0	0	0	9996	6498	0	0
B4-R1	0	0	0	0	0	0	0	0
B4-R2	0	0	0	0	0	0	0	0
B4-R3	0	0	0	0	0	0	0	0
B4-R4	0	0	0	0	0	0	0	0
B4-R5	0	0	0	0	0	0	0	0
B4-R6	0	0	0	0	0	0	0	0
B4-R7	0	0	0	0	0	0	0	0
B4-R8	0	0	0	0	0	0	0	0
B4-R9	0	0	0	0	0	0	0	0
B4-R10	0	0	0	0	0	0	0	0
B4-R11	0	0	3870	0	0	0	0	0
B4-R12	0	0	0	0	0	0	0	0
B4-R13	0	0	0	0	0	0	0	0
B4-R14	0	0	0	0	0	0	0	0
B4-R15	0	0	0	0	0	0	0	0
B4-R16	0	0	0	0	0	0	0	0
B4-R17	0	0	0	0	0	0	0	0
B4-R18	0	0	0	0	0	0	0	0
B4-R19	0	0	0	0	0	0	0	0
B4-R20	0	0	0	0	0	0	0	0
B4-R21	0	0	0	0	0	0	0	0
B4-R22	0	0	0	0	0	0	0	0
B4-R23	0	0	0	0	0	0	0	0

Table 12: Total Solar Heat Gain Area for Each Building Continues

Bld & Rm	Solar heat gain through each direction (kBTU)							
ID, Flr.	N	NE	E	SE	S	SW	W	NW
B4-R24	0	0	0	0	0	0	16254	0
B4-R25	707	0	0	0	0	0	0	0
B4-R26	471	0	14190	0	2142	0	13158	0
B4-R27	0	0	0	0	0	0	0	0
B4-R28	707	0	0	0	0	0	0	0
B4-R29	0	0	0	0	0	0	0	0
B4-R30	0	0	0	0	0	0	0	0
B4-R31	0	0	0	0	0	0	0	0
B5-R1	0	0	0	0	0	0	0	0
B5-R2	0	0	0	0	0	0	0	0
B5-R3	3140	0	3096	0	0	0	0	0
B5-R4	0	0	0	0	0	0	0	0
B6-R1	1727	0	0	0	2856	0	0	0
B6-R2	1727	0	0	0	2856	0	0	0
B6-R3	3140	0	0	0	2856	0	0	0
B6-R4	1727	0	0	0	2856	0	0	0
B7-R1	9891	0	774	0	2142	0	1548	0
B7-R2	0	0	0	0	0	0	0	0
B7-R3	0	0	0	0	0	0	0	0
B7-R4	0	0	0	0	0	0	0	0
B7-R5	0	0	0	0	0	0	0	0
B7-R6	0	0	0	0	0	0	0	0
B8-R1	0	0	0	0	0	0	0	0
B8-R2	0	0	0	0	0	0	0	0
B8-R3	0	0	0	0	0	0	0	0
B8-R4	0	0	2322	0	0	0	0	0
B8-R5	707	0	0	0	0	0	0	0
B8-R6	707	0	0	0	0	0	0	0
B8-R7	0	0	0	0	0	0	0	0
B8-R8	0	0	0	0	0	0	0	0
B8-R9	0	0	0	0	0	0	0	0
B8-R10	0	0	0	0	0	0	0	0
B8-R11	0	0	0	0	0	0	0	0
B8-R12	0	0	0	0	0	0	0	0

Table 12: Total Solar Heat Gain Area for Each Building Continues

Bld & Rm	Solar heat gain through each direction (kBTU)							
ID, Flr.	N	NE	E	SE	S	SW	W	NW
B8-R13	0	0	0	0	0	0	1548	0
B9-R1	0	0	0	0	0	0	0	0
B9-R2	0	0	0	0	0	0	0	0
B9-R3	0	0	0	0	0	0	0	0
B9-R4	0	0	0	0	0	0	0	0
B9-R5	0	0	0	0	0	0	0	0
B9-R6	0	0	0	0	0	0	0	0
B9-R7	0	0	0	0	0	0	0	0
B9-R8	0	0	0	0	0	0	0	0
B9-R9	0	0	0	0	0	0	0	0
B9-R10	4710	0	0	0	34272	0	41280	0
B9-R11	0	0	0	0	0	0	0	0
B9-R12	0	0	0	0	0	0	0	0
B10-R1	2826	0	0	0	2856	0	0	0
B10-R2	2826	0	0	0	2856	0	0	0
B10-R3	2826	0	0	0	2856	0	0	0
B10-R4	2826	0	0	0	2856	0	0	0
B10-R5	2826	0	0	0	2856	0	0	0
B10-R6	2826	0	0	0	2856	0	0	0
B11-R1	0	0	0	0	0	0	0	0
B11-R2	0	0	0	0	0	0	0	0
B11-R3	0	0	0	0	0	0	0	0
B11-R4	0	0	0	0	0	0	0	0
B11-R5	0	0	15480	0	0	0	0	0
B12-R1	0	0	0	0	0	0	0	0
B12-R2	0	0	0	0	3213	0	3096	0
B13-R1	314	0	0	0	3213	0	774	0
B13-R2	0	0	0	0	0	0	6192	0
B13-R3	0	0	3870	0	0	0	0	0
B13-R4	0	0	0	0	0	0	6192	0
B13-R5	0	0	3870	0	0	0	0	0
B13-R6	157	0	0	0	1071	0	774	0
B13-R7	314	0	0	0	1071	0	0	0
B13-R8	1649	0	1548	0	0	0	774	0

Table 12: Total Solar Heat Gain Area for Each Building Continues

Bld & Rm	Solar heat gain through each direction (kBTU)							
ID, Flr.	N	NE	E	SE	S	SW	W	NW
B14-R1	2198	0	0	0	17136	0	0	0
B14-R2	2669	0	0	0	12852	0	0	0
B14-R3	2669	0	0	0	12852	0	0	0
B14-R4	1884	0	0	0	17136	0	0	0
B14-R5	1884	0	0	0	17136	0	0	0
B14-R6	1884	0	0	0	17136	0	0	0
B15-R1	942	0	0	0	12495	0	0	0
B15-R2	942	0	0	0	12495	0	0	0
B15-R3	471	0	0	0	12495	0	0	0
B15-R4	942	0	0	0	12495	0	0	0
B16-R1	0	0	0	0	0	0	0	0
B16-R2	0	0	0	0	11424	0	0	0
B16-R3	0	0	0	0	0	0	0	0
B16-R4	0	0	0	0	0	0	0	0
B16-R5	0	0	0	0	0	0	0	0
B16-R6	0	0	0	0	0	0	0	0
B16-R7	1884	0	0	0	0	0	0	0
B16-R8	0	0	0	0	0	0	0	0
B16-R9	0	0	0	0	0	0	0	0
B16-R10	0	0	0	0	0	0	0	0
B16-R11	0	0	0	0	0	0	0	0
B16-R12	0	0	0	0	0	0	0	0
B16-R13	0	0	0	0	4284	0	0	0
B16-R14	0	0	0	0	12852	0	0	0
B16-R15	2826	0	10836	0	12852	0	10836	0
B16-R16	157	0	0	0	6426	0	0	0
B16-R17	3297	0	27090	0	0	0	0	0
B16-R18	0	0	0	0	0	0	0	0
B16-R19	0	0	0	0	0	0	0	0
B16-R20	0	0	0	0	13566	0	0	0
B16-R21	0	0	6966	0	0	0	0	0
B16-R22	0	0	0	0	0	0	0	0
B16-R23	0	0	0	0	0	0	0	0
B16-R24	0	0	0	0	0	0	0	0

Table 12: Total Solar Heat Gain Area for Each Building Continues

Bld & Rm	Solar heat gain through each direction (kBTU)							
ID, Flr.	N	NE	E	SE	S	SW	W	NW
B16-R25	0	0	0	0	0	0	0	0
B17-R1	3140	0	0	0	0	0	0	2614
B17-R2	3140	2614	0	0	0	0	0	0
B17-R3	3140	0	0	0	0	0	0	2614
B17-R4	3140	2614	0	0	0	0	0	0
B17-R5	0	0	0	0	0	0	0	0
B17-R6	0	0	0	0	0	0	0	0
B17-R7	0	0	0	0	0	0	0	0
B17-R8	0	0	0	0	0	0	0	0
B17-R9	0	0	0	0	0	0	0	0
B17-R10	0	0	0	0	38913	0	774	0
B17-R11	0	0	0	6498	0	0	0	0
B17-R12	0	0	0	0	14280	6498	0	0
B17-R13	0	0	0	6498	14280	0	0	0
B17-R14	0	0	0	0	0	6498	0	0
B17-R15	0	0	0	0	0	0	0	0
B17-R16	0	0	0	0	14280	0	0	0
B17-R17	0	0	0	0	0	0	774	0
B17-R18	2434	0	0	0	19992	0	1548	2614
B17-R19	4396	3578	0	0	9996	0	0	0
B17-R20	2826	0	0	0	4998	0	0	4266
B17-R21	3690	0	0	0	17136	0	0	0
B17-R22	0	0	0	0	0	0	0	0
B17-R23	0	0	0	0	0	0	0	0
B17-R24	0	0	0	0	0	0	0	0
B17-R25	2826	0	0	0	17136	0	0	0
B17-R26	0	0	0	0	0	0	0	0
B17-R27	2826	0	0	0	17136	0	0	0
B17-R28	2826	0	0	0	17136	0	0	0
B17-R29	2826	0	0	0	17136	0	0	0
B18-R1	1413	0	0	0	14994	0	0	2614
B18-R2	4710	3715	0	0	0	0	0	0
B18-R3	0	0	0	0	14994	0	0	2202
B18-R4	1413	2614	0	0	14994	0	0	0

Table 12: Total Solar Heat Gain Area for Each Building Continues

Bld & Rm	Solar heat gain through each direction (kBTU)							
ID, Flr.	N	NE	E	SE	S	SW	W	NW
B18-R4	1413	2614	0	0	14994	0	0	0
B18-R5	0	0	0	6498	6426	0	0	0
B18-R6	0	0	0	0	6426	6498	0	0
B18-R7	0	0	0	6498	6426	0	0	0
B18-R8	0	0	0	0	6426	6498	0	0
B19-R1	0	0	0	0	13923	0	0	0
B19-R2	0	0	0	0	13923	0	0	0
B19-R3	0	0	0	0	13923	0	0	0
B19-R4	5888	0	0	0	0	0	0	0
B19-R5	3062	0	0	0	3213	0	0	0
B19-R6	3062	0	0	0	12852	0	0	0
B20-R1	0	0	0	0	13923	0	0	0
B20-R2	0	0	0	0	13923	0	0	0
B20-R3	0	0	0	0	13923	0	0	0
B20-R4	0	0	0	0	0	0	0	0
B20-R5	0	0	0	0	0	0	0	0
B20-R6	5888	0	0	0	0	0	0	0
B20-R7	3062	0	0	0	12852	0	0	0
B20-R8	3062	0	0	0	12852	0	0	0
B21-R1	3140	0	0	0	0	0	0	0
B21-R2	3140	0	0	0	0	0	0	0
B21-R3	3140	0	0	0	0	0	0	0
B21-R4	3140	0	0	0	0	0	0	0
B21-R5	0	0	0	0	0	0	0	0
B21-R6	0	0	0	0	0	0	0	0
B21-R7	0	0	0	0	0	0	0	0
B21-R8	0	0	0	0	0	0	0	0
B21-R9	0	0	0	0	0	0	0	0
B21-R10	0	0	1806	0	12852	0	0	0
B21-R11	0	0	0	0	14280	0	0	0
B21-R12	0	0	0	0	14280	0	0	0
B21-R13	0	0	0	0	14280	0	0	0
B21-R14	0	0	0	0	14280	0	0	0
B21-R15	0	0	0	0	1071	0	0	0

Table 12: Total Solar Heat Gain Area for Each Building Continues

Bld & Rm	Solar heat gain through each direction (kBTU)							
ID, Flr.	N	NE	E	SE	S	SW	W	NW
B21-R16	1178	0	0	0	17136	0	0	0
B21-R17	2826	0	0	0	0	0	0	0
B21-R18	0	0	0	0	19992	0	0	0
B21-R19	942	0	0	0	17136	0	0	0
B21-R20	3376	0	0	0	17136	0	0	0
B21-R21	0	0	0	0	0	0	0	0
B21-R22	0	0	0	0	0	0	0	0
B21-R23	0	0	0	0	0	0	0	0
B21-R24	0	0	0	0	0	0	0	0
B21-R25	2826	0	0	0	23562	0	0	0
B21-R26	3533	0	0	0	17136	0	0	0
B21-R27	0	0	0	0	0	0	0	0
B21-R28	0	0	0	0	0	0	0	0
B21-R29	0	0	0	0	0	0	0	0
B22-R1	5574	0	0	0	0	0	0	0
B22-R2	5574	0	0	0	0	0	0	0
B22-R3	3690	0	0	0	0	0	0	0
B22-R4	8400	0	0	0	0	0	0	0
B22-R5	0	0	0	0	0	0	0	0
B22-R6	0	0	0	0	0	0	0	0
B22-R7	0	0	0	0	0	0	0	0
B22-R8	0	0	0	0	0	0	0	0
B22-R9	0	0	0	0	16779	0	0	0
B22-R10	0	0	0	0	25347	0	0	0
B22-R11	0	0	0	0	25347	0	0	0
B22-R12	0	0	0	0	25347	0	0	0
B22-R13	0	0	774	0	0	0	0	0
B22-R14	8400	0	0	0	10710	0	0	0
B22-R15	0	0	0	0	17850	0	0	0
B22-R16	5574	0	0	0	0	0	0	0
B22-R17	7850	0	0	0	17850	0	0	0
B22-R18	3768	0	0	0	0	0	0	0
B22-R19	5495	0	0	0	35700	0	0	0
B22-R20	0	0	0	0	0	0	0	0

Table 12: Total Solar Heat Gain Area for Each Building Continues

Bld & Rm	Solar heat gain through each direction (kBTU)							
ID, Flr.	N	NE	E	SE	S	SW	W	NW
B22-R21	0	0	0	0	0	0	0	0
B22-R22	0	0	0	0	0	0	0	0
B22-R23	5574	0	0	0	35700	0	0	0
B22-R24	5574	0	0	0	35700	0	0	0
B22-R25	5574	0	0	0	35700	0	0	0
B22-R26	5574	0	0	0	35700	0	0	0
B23-R1	0	0	774	0	0	0	774	0
B23-R2	0	0	1290	0	0	0	774	0
B23-R3	0	0	0	0	0	0	0	0
B23-R4	0	0	0	0	0	0	0	0
B23-R5	0	0	0	0	0	0	0	0
B24-R1	0	0	0	0	0	0	0	0

3.4 Specialty and Miscellaneous Loads and Characteristics

This section provides characteristics and suggest ECMs (retrofits) based on specialty and miscellaneous loads information from the Energy Opportunity Survey that include kitchen appliances and other energy loads, such as air curtains, swimming pools, etc.

No information on these types of loads is applicable or available for your facility.

3.5 Observed O&M issues

This section provides a list of O&M issues that were observed during the Energy Opportunity Survey.

No information regarding observed O&M issues is available for your facility.

Please refer to Appendix E for information on resources that your facility can use to investigate further O&M and Energy Efficiency measures.

4. CEC RECOMMENDED MEASURES AND COST EFFECTIVENESS

The scope of the energy efficiency measures and recommendations contained in this report are limited to the 21 ECMs outlined in the CEC Proposition 39 final guidelines. Based on the depth of information collected during the Energy Opportunity Surveys, a subset of these 21 recommendations was recommended for this site. This section also summarizes the cost-effectiveness of the selected measure(s) using the Proposition 39 calculators that the CEC published at the end of April 2014. Recommendations for any further measures, and their associated cost effectiveness calculations, would need further analysis, and in many cases would need a more detailed energy audit (ASHRAE Level 2 or above).

4.1 Selected Measures Based on the Energy Opportunity Survey

Table 13: List of ECM recommendations for Schools by CEC

The table provides the list of the ECM recommendations by CEC and points to which amongst them are applicable for the site based on the survey data. The ECMs highlighted green have been selected.

CEC Recommended Measures		Measure Applicable ?	Comments
Lighting Energy Efficiency Measures:			
ECM 1	Replace incandescent light with compact fluorescent light	**Yes**	We have proposed to replace three (3) units of incandescent light with compact fluorescent light.
ECM 2	Replace incandescent light with LED light	**No**	ECM1 was found to be more cost effective per CEC calculator.
ECM 3&4	Convert incandescent/CFL exit sign to LED exit sign	**No**	No Incandescent exit signs were collected at the site.
ECM 5&6	Convert T12 fluorescent to T8 with electronic ballast or LED Lamps	**Yes**	There are 3,691units of T12 34 Watt fluorescent lamps we proposed to covert to T8 with electronic ballast.
ECM 7	Replace 32 Watt T8 lamps with 28 Watt T8 Lamps	**Yes**	There are 2,677 units of T8 32 Watt lamps with a total wattage of 85,664.
ECM 8&9	Replace exterior mercury vapor/HPS with LED/Induction lights	**No**	It is determined that ECM 9 is not cost effective per CEC savings calculator.
ECM 10	Install occupancy control for intermittently occupied rooms	**Yes**	We have proposed 262 units of occupancy controls for the site.

HVAC Measures:			
ECM11	Replace old packaged/split HVAC unit with high-efficiency HVAC	**Yes**	We have proposed to replace 10 packaged/split with a total capacity of 120 tons with high-efficiency units of SEER 14.
ECM12	Replace old heat pump with high-efficiency heat pump	**No**	The currently installed water source heat pump systems and one (1) small heat pump are energy efficient.
ECM13A	Replace boiler with high efficiency condensing boiler	**No**	The measure is determined to be not cost effective per CEC calculator.
ECM13B	Replace furnace with high efficiency condensing furnace	**No**	The measure is determined to be not cost effective per CEC calculator.
ECM14	Seal existing leaky duct	**No**	Duct leaks were not visually observed, sealing leaky duct is a very good idea.
ECM15	Install variable speed drive for pumps and fans	**Yes**	We have proposed to install variable speed drive for the water loop pumps and condenser fans.
ECM16	Install new programmable/set back thermostat	**No**	The installed thermostats are programmable.
ECM17	Install premium efficiency motors	**Yes**	We have proposed to install premium efficiency motors for the water loop pumps and condenser fans.
ECM18	Replace storage water heater with instantaneous water heater	**Yes**	We have proposed to replace two (2) storage water heater units with instantaneous water heaters.
Plug-Load Efficiency Measures:			
ECM19	Install smart strip/PC management to control computers/printers	**Yes**	We have proposed a total of 267 units. The quantity is tabulated based on desktop counts per room. The control units are shared up to 3 units per controller if there is more than one (1) desktop per room.
ECM20	Install vending machine occupancy control.	**Yes**	Estimated 16 units, further investigation is recommended.
Simple PV Self-Generation Project:			
ECM21		**No**	Information unavailable or not sure

4.2 Inputs for the CEC calculator

Based on the measures selected, the inputs for the CEC calculator were created. A 'prefilled' electronic version of CEC calculator with all the required inputs is provided to the school along with the report. Some of the inputs are placeholders and the school needs to adjust the numbers based on the 'hard bids' received and rebates that are applicable.

4.3 Assumed costs and rebates

The assumed costs and rebates for calculating the cost effectiveness of the measures were based on engineering estimates. The engineering estimates provide a good 'ball park' value, but prior to submitting the Form B, the schools need to acquire actual 'bid values' on the measures. The rebates included, were based on general custom rebate values for PG&E. Further information is available on the utility websites that provide energy to this site, and are subject to change. We highly encourage checking for the most recent values. The assumed costs and rebates are included in Appendix "C".

4.4 Results of Recommended Energy Conservation Measures

This section shows the potential energy savings of each recommended energy conservation measure (ECM) based on the CEC Calculator.

ECM1: Replace Incandescent Lights with Compact Fluorescent (CFL)

The CCC survey shows there are three (3) incandescent lamps with a total wattage of 180 in the site. According to the CEC calculator, replacing this lamp with CFL would save an estimated **$47.4 per year** in electricity costs with a simple payback of **0.9 years**.

Table 14: ECM1 CEC Calculator Energy Savings Summary

Energy Savings Summary				
This measure saves		**0.03**	**kW peak demand**	
	and	**293**	**kWh energy use.**	
	and	-1.8	therms natural gas	
	or	0.0	gallons of	NA
	or	**$ 47.4**	**energy cost annually.**	
Simple Payback is		**0.9**	**years.**	
Saving to Investment Ratio		4.95		

ECM2: Replace Incandescent Lights with LED light

The CCC survey shows there are three (3) incandescent lamps with a total wattage of 180 in the site. According to the CEC calculator, replacing this lamp with LED lamp would save an estimated **$30.1 per year** in electricity costs with a simple payback of **4.7 years**.

Table 15: ECM2 CEC Calculator Energy Savings Summary

Energy Savings Summary				
This measure saves		**0.02**	**kW peak demand**	
	and	**186**	**kWh energy use.**	
	and	-1.1	therms natural gas	
	or	0.0	gallons of	NA
	or	**$ 30.1**	**energy cost annually.**	
Simple Payback is		**4.7**	**years.**	
Saving to Investment Ratio		3.26		

Table 16: Location of Incandescent Lamp/s

Building & Room ID	Space Type	Lamp Type	Lamp Watt (W)	Total # of Lamp	Interior/ Exterior	OS Ctrl Measure
B8-R4	HALLWAY	INC	40	2	Interior	No
B17-R18	CLASSROOM	INC	100	1	Interior	No

ECM5: Convert T12 fluorescent to T8 with electronic ballast or LED Lamps

The CCC survey shows there are a total of 3,691 units of 4-feet T12s located at the school. According to the CEC calculator, replacing these with 28-watt T8s with electronic ballasts would save an estimated **$19,040.3 per year** in electricity costs with a simple payback of **4.6 years**. The table below provides more savings details of the ECM and is the output of the CEC calculator.

Table 17: ECM5 CEC Calculator Energy Savings Summary

Energy Savings Summary				
This measure saves		13.32	**kW peak demand**	
	and	117651	**kWh energy use.**	
	and	-698.0	therms natural gas	
	or	0.0	gallons of	NA
	or	**$ 19,040.3**	**energy cost annually.**	
Simple Payback is		**4.6**	**years.**	
Saving to Investment Ratio		3.32		

Table 18 (next page) provides information on the location and wattage of the T12 fluorescent lamps to assist in the implementation of ECM5.

Table 18: Location of T12 Fluorescent Lamps

Building & Room ID	Space Type	Lamp Type	Lamp Watt (W)	Total # of Lamp	Ballast Type	# of Ballasts Per Fixture	Interior or Exterior	OS Ctrl Measure
B1-R1	OFFICE	T12	34	12	Magnetic	2	Interior	Yes
B1-R2	LOBBY	T12	34	24	Magnetic	1	Interior	Yes
B1-R3	CONFERENCE	T12	34	12	Magnetic	2	Interior	Yes
B1-R4	LOBBY	T12	34	22	Magnetic	1	Interior	Yes
B1-R5	HALLWAY	T12	34	6	Magnetic	1	Interior	No
B1-R6	RESTROOM	T12	34	2	Magnetic	1	Interior	Yes
B1-R7	RESTROOM	T12	34	2	Magnetic	1	Interior	Yes
B1-R8	DATAROOM	T12	34	2	Magnetic	1	Interior	Yes
B1-R9	ELEVATOR	T12	34	1	Magnetic	1	Interior	Yes
B1-R10	COPY ROOM	T12	34	6	Magnetic	2	Interior	Yes
B1-R11	MAILROOM	T12	34	6	Magnetic	2	Interior	Yes
B1-R12	COMPUTER LAB	T12	34	42	Magnetic	2	Interior	Yes
B1-R13	CLASSROOM	T12	34	42	Magnetic	2	Interior	Yes
B1-R14	MAITENCE	T12	34	2	Magnetic	1	Interior	Yes
B1-R15	OFFICE	T12	34	6	Magnetic	2	Interior	Yes
B1-R17	OFFICE	T12	34	12	Magnetic	2	Interior	Yes
B1-R18	LOBBY	T12	34	24	Magnetic	1	Interior	Yes
B1-R19	OFFICE	T12	34	16	Magnetic	1	Interior	Yes
B1-R19	OFFICE	T12	34	24	Magnetic	1	Interior	No
B1-R20	OFFICE	T12	34	2	Magnetic	1	Interior	Yes
B1-R20	OFFICE	T12	34	18	Magnetic	1	Interior	No
B1-R21	HALLWAY	T12	34	6	Magnetic	1	Interior	No
B1-R22	OFFICE	T12	34	4	Magnetic	1	Interior	Yes
B1-R22	OFFICE	T12	34	4	Magnetic	1	Interior	No
B1-R23	BREAKROOM	T12	34	2	Magnetic	1	Interior	Yes
B1-R24	RESTROOM	T12	34	2	Magnetic	1	Interior	Yes
B1-R25	OFFICE	T12	34	6	Magnetic	1	Interior	Yes
B1-R26	ELEVATOR SHAFT	T12	34	4	Magnetic	1	Interior	Yes
B1-R27	HALLWAY	T12	34	4	Magnetic	1	Interior	No
B1-R28	OFFICE	T12	34	4	Magnetic	1	Interior	Yes
B1-R29	OFFICE	T12	34	6	Magnetic	2	Interior	Yes
B1-R30	OFFICE	T12	34	6	Magnetic	2	Interior	Yes

Table 18: Location of T12 Fluorescent Lamps Continues

Building & Room ID	Space Type	Lamp Type	Lamp Watt (W)	Total # of Lamp	Interior/Exterior	OS Ctrl Measure
B1-R1	OFFICE	T12	34	12	Interior	Yes
B1-R2	LOBBY	T12	34	24	Interior	Yes
B1-R3	CONFERENCE	T12	34	12	Interior	Yes
B1-R4	LOBBY	T12	34	22	Interior	Yes
B1-R5	HALLWAY	T12	34	6	Interior	No
B1-R6	RESTROOM	T12	34	2	Interior	Yes
B1-R7	RESTROOM	T12	34	2	Interior	Yes
B1-R8	DATAROOM	T12	34	2	Interior	Yes
B1-R9	ELEVATOR	T12	34	1	Interior	Yes
B1-R10	COPY ROOM	T12	34	6	Interior	Yes
B1-R11	MAILROOM	T12	34	6	Interior	Yes
B1-R12	COMPUTER LAB	T12	34	42	Interior	Yes
B1-R13	CLASSROOM	T12	34	42	Interior	Yes
B1-R14	MAITENCE	T12	34	2	Interior	Yes
B1-R15	OFFICE	T12	34	6	Interior	Yes
B1-R17	OFFICE	T12	34	12	Interior	Yes
B1-R18	LOBBY	T12	34	24	Interior	Yes
B1-R19	OFFICE	T12	34	16	Interior	Yes
B1-R19	OFFICE	T12	34	24	Interior	No
B1-R20	OFFICE	T12	34	2	Interior	Yes
B1-R20	OFFICE	T12	34	18	Interior	No
B1-R21	HALLWAY	T12	34	6	Interior	No
B1-R22	OFFICE	T12	34	4	Interior	Yes
B1-R22	OFFICE	T12	34	4	Interior	No
B1-R23	BREAKROOM	T12	34	2	Interior	Yes
B1-R24	RESTROOM	T12	34	2	Interior	Yes
B1-R25	OFFICE	T12	34	6	Interior	Yes
B1-R26	ELEVATOR SHAFT	T12	34	4	Interior	Yes
B1-R27	HALLWAY	T12	34	4	Interior	No
B1-R28	OFFICE	T12	34	4	Interior	Yes
B1-R29	OFFICE	T12	34	6	Interior	Yes
B1-R30	OFFICE	T12	34	6	Interior	Yes
B1-R31	OFFICE	T12	34	18	Interior	Yes
B1-R32	HALLWAY	T12	34	4	Interior	No

Table 18: Location of T12 Fluorescent Lamps Continues

Building & Room ID	Space Type	Lamp Type	Lamp Watt (W)	Total # of Lamp	Interior/Exterior	OS Ctrl Measure
B1-R34	HALLWAY	T12	34	6	Interior	No
B2-R1	CLASSROOM	T12	34	36	Interior	Yes
B2-R2	STORAGE	T12	34	28	Interior	Yes
B2-R2	STORAGE	T12	34	6	Interior	No
B2-R3	STORAGE	T12	34	6	Interior	Yes
B2-R3	STORAGE	T12	34	28	Interior	No
B2-R4	CLASSROOM	T12	34	36	Interior	Yes
B3-R1	CLASSROOM	T12	34	36	Interior	Yes
B3-R2	CLASSROOM	T12	34	36	Interior	Yes
B3-R3	CLASSROOM	T12	34	72	Interior	Yes
B4-R1	ELEVATOR	T12	34	3	Interior	Yes
B4-R2	MECHANICAL	T12	34	2	Interior	Yes
B4-R3	HALLWAY	T12	34	28	Interior	No
B4-R4	STORAGE	T12	34	4	Interior	Yes
B4-R7	TRAINING ROOM	T12	34	20	Interior	Yes
B4-R8	HALLWAY	T12	34	4	Interior	No
B4-R9	HALLWAY	T12	34	16	Interior	No
B4-R10	HALLWAY	T12	34	4	Interior	No
B4-R12	ELECTRICAL	T12	34	8	Interior	Yes
B4-R13	BOILER ROOM	T12	34	4	Interior	Yes
B4-R15	OFFICE	T12	34	18	Interior	Yes
B4-R16	LOCKERS	T12	34	130	Interior	No
B4-R17	STORAGE	T12	34	44	Interior	Yes
B4-R18	OFFICE	T12	34	4	Interior	Yes
B4-R19	OFFICE	T12	34	6	Interior	Yes
B4-R20	OFFICE	T12	34	18	Interior	Yes
B4-R21	HALLWAY	T12	34	28	Interior	No
B4-R22	ELEVATOR SHAFT	T12	34	2	Interior	Yes
B4-R23	STORAGE	T12	34	2	Interior	Yes
B4-R24	HALLWAY	T12	34	38	Interior	No
B4-R24	HALLWAY	T12	34	4	Interior	No
B4-R25	SNACK BAR	T12	34	3	Interior	Yes
B4-R27	HALLWAY	T12	34	20	Interior	No
B4-R28	OFFICE	T12	34	3	Interior	Yes

Table 18: Location of T12 Fluorescent Lamps Continues

Building & Room ID	Space Type	Lamp Type	Lamp Watt (W)	Total # of Lamp	Interior/Exterior	OS Ctrl Measure
B4-R29	RESTROOM	T12	34	26	Interior	Yes
B4-R30	RESTROOM	T12	34	26	Interior	Yes
B4-R31	STORAGE	T12	34	2	Interior	Yes
B5-R1	RESTROOM	T12	34	14	Interior	Yes
B5-R2	RESTROOM	T12	34	14	Interior	Yes
B5-R3	OFFICE	T12	34	12	Interior	Yes
B5-R4	STORAGE	T12	34	24	Interior	Yes
B7-R1	BANDROOM	T12	34	72	Interior	Yes
B7-R2	ELECTRICAL	T12	34	16	Interior	Yes
B7-R3	STORAGE	T12	34	6	Interior	Yes
B7-R4	OFFICE	T12	34	12	Interior	Yes
B7-R5	STORAGE	T12	34	8	Interior	Yes
B7-R6	BANDROOM	T12	34	60	Interior	Yes
B8-R1	Unknown	T12	34	4	Interior	Yes
B8-R2	STORAGE	T12	34	4	Interior	Yes
B8-R5	SNACK BAR	T12	34	6	Interior	Yes
B8-R6	STORAGE	T12	34	6	Interior	Yes
B8-R7	RESTROOM	T12	34	1	Interior	Yes
B8-R8	RESTROOM	T12	34	9	Interior	Yes
B8-R10	RESTROOM	T12	34	3	Interior	Yes
B8-R11	RESTROOM	T12	34	24	Interior	Yes
B8-R12	STORAGE	T12	34	8	Interior	Yes
B8-R13	SNACKBAR	T12	34	30	Interior	Yes
B9-R1	STORAGE	T12	34	6	Interior	Yes
B9-R2	HALLWAY	T12	34	4	Interior	No
B9-R3	Unknown	T12	34	2	Interior	Yes
B9-R4	OFFICE	T12	34	4	Interior	Yes
B9-R5	KITCHEN	T12	34	62	Interior	No
B9-R6	HALLWAY	T12	34	6	Interior	No
B9-R7	STORAGE	T12	34	1	Interior	Yes
B9-R8	STORAGE	T12	34	1	Interior	Yes
B9-R9	DOMESTIC HOT	T12	34	2	Interior	Yes
B9-R10	CAFETERIA	T12	34	27	Interior	Yes
B9-R11	RESTROOM	T12	34	2	Interior	Yes

Table 18: Location of T12 Fluorescent Lamps Continues

Building & Room ID	Space Type	Lamp Type	Lamp Watt (W)	Total # of Lamp	Interior/Exterior	OS Ctrl Measure
B9-R12	RESTROOM	T12	34	2	Interior	Yes
B11-R1	RESTROOM	T12	34	20	Interior	Yes
B11-R2	RESTROOM	T12	34	20	Interior	Yes
B11-R3	DOMESTIC HOT	T12	34	2	Interior	Yes
B11-R4	FIELD STORAGE	T12	34	32	Interior	Yes
B11-R5	SNACK BAR	T12	34	16	Interior	Yes
B12-R1	WIEGHT ROOM	T12	34	46	Interior	Yes
B12-R2	OFFICE	T12	34	6	Interior	Yes
B13-R1	COMPUTER LAB	T12	34	60	Interior	Yes
B13-R2	OFFICE	T12	34	6	Interior	Yes
B13-R3	OFFICE	T12	34	6	Interior	Yes
B13-R4	OFFICE	T12	34	6	Interior	Yes
B13-R5	OFFICE	T12	34	6	Interior	Yes
B13-R6	CLASSROOM	T12	34	30	Interior	Yes
B13-R7	CLASSROOM	T12	34	30	Interior	Yes
B13-R8	CLASSROOM	T12	34	64	Interior	Yes
B13-R9	STORAGE	T12	34	6	Interior	Yes
B14-R1	CLASSROOM	T12	34	3	Interior	No
B15-R1	CLASSROOM	T12	34	36	Interior	Yes
B15-R2	CLASSROOM	T12	34	36	Interior	Yes
B15-R3	CLASSROOM	T12	34	36	Interior	Yes
B15-R4	CLASSROOM	T12	34	36	Interior	Yes
B16-R1	ELECTRICAL	T12	34	2	Interior	Yes
B16-R2	LIBRARY	T12	34	9	Interior	Yes
B16-R3	HALLWAY	T12	34	6	Interior	No
B16-R3	HALLWAY	NKNOW	34	1	Interior	No
B16-R4	RESTROOM	T12	34	2	Interior	Yes
B16-R5	OFFICE	T12	34	12	Interior	Yes
B16-R6	WORKROOM	T12	34	6	Interior	Yes
B16-R7	COMPUTER LAB	T12	34	30	Interior	Yes
B16-R8	OFFICE	T12	34	9	Interior	Yes
B16-R9	FRONT DESK	T12	34	12	Interior	Yes
B16-R10	ELEVATOR	T12	34	2	Interior	Yes
B16-R11	HALLWAY	T12	34	2	Interior	No

Table 18: Location of T12 Fluorescent Lamps Continues

Building & Room ID	Space Type	Lamp Type	Lamp Watt (W)	Total # of Lamp	Interior/Exterior	OS Ctrl Measure
B16-R12	HALLWAY	T12	34	2	Interior	No
B16-R13	LIBRARY	T12	34	32	Interior	Yes
B16-R14	LIBRARY	T12	34	30	Interior	Yes
B16-R16	LIBRARY	T12	34	14	Interior	Yes
B16-R17	LIBRARY	T12	34	36	Interior	Yes
B16-R18	WORK ROOM	T12	34	27	Interior	Yes
B16-R19	STORAGE	T12	34	48	Interior	Yes
B16-R20	HALLWAY	T12	34	12	Interior	No
B16-R21	STORAGE	T12	34	1	Interior	Yes
B16-R22	ELEVATOR SHAFT	T12	34	2	Interior	Yes
B16-R23	COMPUTER LAB	T12	34	96	Interior	No
B16-R24	STUDENT STORE	T12	34	36	Interior	Yes
B17-R5	ELEVATOR	T12	34	2	Interior	Yes
B17-R6	MECHANICAL	T12	34	1	Interior	Yes
B17-R7	RESTROOM	T12	34	8	Interior	Yes
B17-R8	RESTROOM	T12	34	8	Interior	Yes
B17-R9	ROOF ACCESS	T12	34	2	Interior	Yes
B17-R10	SNACK BAR	T12	34	28	Interior	Yes
B17-R11	CLASSROOM	T12	34	4	Interior	No
B17-R15	ELECTRICAL	T12	34	8	Interior	Yes
B17-R16	HALLWAY	T12	34	8	Interior	No
B17-R17	STORAGE	T12	34	12	Interior	Yes
B17-R22	RESTROOM	T12	34	10	Interior	Yes
B17-R23	CUSTODIAN	T12	34	2	Interior	Yes
B17-R24	RESTROOM	T12	34	10	Interior	Yes
B17-R25	ELEVATOR SHAFT	T12	34	2	Interior	Yes
B17-R26	CLASSROOM	T12	34	36	Interior	Yes
B17-R27	CLASSROOM	T12	34	36	Interior	Yes
B17-R28	CLASSROOM	T12	34	36	Interior	Yes
B17-R29	CLASSROOM	T12	34	36	Interior	Yes
B18-R1	CLASSROOM	T12	34	28	Interior	No
B18-R2	CLASSROOM	T12	34	28	Interior	No
B18-R3	CLASSROOM	T12	34	28	Interior	No
B18-R4	CLASSROOM	T12	34	28	Interior	No

Table 18: Location of T12 Fluorescent Lamps Continues

Building & Room ID	Space Type	Lamp Type	Lamp Watt (W)	Total # of Lamp	Interior/Exterior	OS Ctrl Measure
B19-R1	CLASSROOM	T12	34	28	Interior	Yes
B19-R2	CLASSROOM	T12	34	28	Interior	Yes
B19-R4	CLASSROOM	T12	34	28	Interior	Yes
B19-R5	CLASSROOM	T12	34	28	Interior	Yes
B20-R1	CLASSROOM	T12	34	28	Interior	Yes
B20-R2	CLASSROOM	T12	34	28	Interior	Yes
B20-R3	CLASSROOM	T12	34	2	Interior	No
B20-R4	CLASSROOM	T12	34	9	Interior	Yes
B20-R5	WORKROOM	T12	34	12	Interior	Yes
B20-R7	CLASSROOM	T12	34	28	Interior	Yes
B20-R8	CLASSROOM	T12	34	28	Interior	Yes
B21-R1	CLASSROOM	T12	34	46	Interior	Yes
B21-R2	CLASSROOM	T12	34	46	Interior	Yes
B21-R5	ELEVATOR	T12	34	2	Interior	Yes
B21-R6	STORAGE	T12	34	2	Interior	Yes
B21-R7	RESTROOM	T12	34	16	Interior	Yes
B21-R8	RESTROOM	T12	34	16	Interior	Yes
B21-R9	STORAGE	T12	34	2	Interior	Yes
B21-R10	SNACK BAR	T12	34	28	Interior	Yes
B21-R11	CLASSROOM	T12	34	36	Interior	Yes
B21-R18	WORKROOM	T12	34	12	Interior	Yes
B21-R19	CLASSROOM	T12	34	36	Interior	Yes
B21-R21	RESTROOM	T12	34	10	Interior	Yes
B21-R22	DOMESTIC HOT	T12	34	2	Interior	Yes
B21-R23	RESTROOM	T12	34	10	Interior	Yes
B21-R24	ELEVATOR SHAFT	T12	34	2	Interior	Yes
B21-R25	CLASSROOM	T12	34	36	Interior	Yes
B22-R6	RESTROOM	T12	34	4	Interior	No
B22-R7	RESTROOM	T12	34	6	Interior	Yes
B22-R8	ELECTRICAL	T12	34	8	Interior	Yes
B22-R15	WORKROOM	T12	34	2	Interior	Yes
B22-R17	WORKROOM	T12	34	10	Interior	Yes
B22-R19	CLASSROOM	T12	34	36	Interior	Yes
B22-R20	RESTROOM	T12	34	10	Interior	Yes

Table 18: Location of T12 Fluorescent Lamps Continues

Building & Room ID	Space Type	Lamp Type	Lamp Watt (W)	Total # of Lamp	Interior/Exterior	OS Ctrl Measure
B22-R22	RESTROOM	T12	34	10	Interior	Yes
B22-R24	CLASSROOM	T12	34	26	Interior	Yes
B22-R25	CLASSROOM	T12	34	28	Interior	Yes
B22-R26	CLASSROOM	T12	34	28	Interior	Yes
B23-R1	CLASSROOM	T12	34	64	Interior	Yes
B23-R2	WOODSHOP	T12	34	54	Interior	Yes
B24-R1	STORAGE	T12	34	2	Interior	Yes

ECM7: Replace 32 Watt T8 Lamps with 28 Watt T8 Lamps

The CCC survey shows there are a total of 2,677 units of 32-watt T8s located at the school. According to the CEC calculator, replacing these with 28-watt T8s would save an estimated **$4,971.4 per year** in electricity costs with a simple payback of **6.6 years**. The table below provides more savings details of the ECM and is the output of the CEC calculator.

Table 19: ECM7 CEC Calculator Energy Savings Summary

Energy Savings Summary				
This measure saves		**3.48**	**kW peak demand**	
	and	**30,719**	**kWh energy use.**	
	and	-182.3	therms natural gas	
	or	0.0	gallons of	NA
	or	**$ 4,971.4**	**energy cost annually.**	
Simple Payback is		**6.6**	**years.**	
Saving to Investment Ratio		0.68		

Table 20 that is on the next page provides information on the location and wattage of the fluorescent lamps to assist in the implementation of ECM 7.

Table 20: Location of 32 Watt T8 Fluorescent Lamps

Building & Room ID	Space Type	Lamp Type	Lamp Watt (W)	Total # of Lamp	Interior/Exterior	OS Ctrl Measure
B1-R33	OFFICE	T8	32	4	Interior	Yes
B1-R35	OFFICE	T8	32	10	Interior	Yes
B1-R36	OFFICE	T8	32	10	Interior	Yes
B4-R6	CLASSROOM	T8	32	56	Interior	Yes
B4-R14	LOCKER	T8	32	12	Interior	Yes
B4-R24	HALLWAY	T8	32	2	Interior	No
B4-R26	GYM	T8	32	8	Interior	No
B6-R1	CLASSROOM	T8	32	36	Interior	Yes
B6-R2	CLASSROOM	T8	32	36	Interior	Yes
B6-R3	CLASSROOM	T8	32	36	Interior	Yes
B6-R4	CLASSROOM	T8	32	36	Interior	Yes
B8-R3	AUTO ROOM	T8	32	110	Interior	No
B10-R1	CLASSROOM	T8	32	36	Interior	Yes
B10-R2	CLASSROOM	T8	32	36	Interior	Yes
B10-R3	CLASSROOM	T8	32	36	Interior	Yes
B10-R4	CLASSROOM	T8	32	36	Interior	Yes
B10-R5	CLASSROOM	T8	32	36	Interior	Yes
B10-R6	CLASSROOM	T8	32	36	Interior	Yes
B14-R1	CLASSROOM	T8	32	30	Interior	Yes
B14-R2	CLASSROOM	T8	32	36	Interior	Yes
B14-R3	CLASSROOM	T8	32	36	Interior	Yes
B14-R4	CLASSROOM	T8	32	36	Interior	Yes
B14-R5	CLASSROOM	T8	32	36	Interior	Yes
B14-R6	CLASSROOM	T8	32	36	Interior	Yes
B16-R25	STORAGE	T8	32	1	Interior	Yes
B17-R1	CLASSROOM	T8	32	34	Interior	Yes
B17-R1	CLASSROOM	T8	32	10	Interior	No
B17-R2	CLASSROOM	T8	32	36	Interior	Yes
B17-R2	CLASSROOM	T8	32	10	Interior	No
B17-R3	COMPUTER LAB	T8	32	36	Interior	Yes
B17-R3	COMPUTER LAB	T8	32	10	Interior	No
B17-R4	COMPUTER LAB	T8	32	36	Interior	Yes
B17-R4	COMPUTER LAB	T8	32	10	Interior	No

Table 20: Location of 32 Watt T8 Fluorescent Lamps

Building & Room ID	Space Type	Lamp Type	Lamp Watt (W)	Total # of Lamp	Interior/Exterior	OS Ctrl Measure
B17-R11	CLASSROOM	T8	32	8	Interior	No
B17-R12	CLASSROOM	T8	32	28	Interior	Yes
B17-R12	CLASSROOM	T8	32	8	Interior	No
B17-R13	CLASSROOM	T8	32	28	Interior	Yes
B17-R13	CLASSROOM	T8	32	8	Interior	No
B17-R14	CLASSROOM	T8	32	28	Interior	Yes
B17-R14	CLASSROOM	T8	32	8	Interior	No
B17-R18	CLASSROOM	T8	32	28	Interior	Yes
B17-R18	CLASSROOM	T8	32	8	Interior	No
B17-R19	CLASSROOM	T8	32	28	Interior	Yes
B17-R19	CLASSROOM	T8	32	28	Interior	No
B17-R20	CLASSROOM	T8	32	28	Interior	Yes
B17-R20	CLASSROOM	T8	32	8	Interior	No
B17-R21	CLASSROOM	T8	32	44	Interior	Yes
B18-R1	CLASSROOM	T8	32	8	Interior	Yes
B18-R2	CLASSROOM	T8	32	8	Interior	Yes
B18-R3	CLASSROOM	T8	32	8	Interior	Yes
B18-R4	CLASSROOM	T8	32	8	Interior	Yes
B18-R5	CLASSROOM	T8	32	8	Interior	Yes
B18-R5	CLASSROOM	T8	32	28	Interior	No
B18-R6	CLASSROOM	T8	32	8	Interior	Yes
B18-R6	CLASSROOM	T8	32	28	Interior	No
B18-R7	CLASSROOM	T8	32	8	Interior	Yes
B18-R7	CLASSROOM	T8	32	28	Interior	No
B18-R8	CLASSROOM	T8	32	8	Interior	Yes
B18-R8	CLASSROOM	T8	32	28	Interior	No
B19-R1	CLASSROOM	T8	32	8	Interior	No
B19-R2	CLASSROOM	T8	32	8	Interior	No
B19-R3	CLASSROOM	T8	32	28	Interior	Yes
B19-R3	CLASSROOM	T8	32	8	Interior	No
B19-R4	CLASSROOM	T8	32	8	Interior	No
B19-R5	CLASSROOM	T8	32	8	Interior	No
B19-R6	CLASSROOM	T8	32	28	Interior	Yes
B19-R6	CLASSROOM	T8	32	8	Interior	No

Table 20: Location of 32 Watt T8 Fluorescent Lamps

Building & Room ID	Space Type	Lamp Type	Lamp Watt (W)	Total # of Lamp	Interior/Exterior	OS Ctrl Measure
B20-R1	CLASSROOM	T8	32	8	Interior	No
B20-R2	CLASSROOM	T8	32	8	Interior	No
B20-R3	CLASSROOM	T8	32	26	Interior	Yes
B20-R3	CLASSROOM	T8	32	8	Interior	No
B20-R5	WORKROOM	T8	32	8	Interior	No
B20-R6	CLASSROOM	T8	32	28	Interior	Yes
B20-R6	CLASSROOM	T8	32	8	Interior	No
B20-R7	CLASSROOM	T8	32	8	Interior	No
B20-R8	CLASSROOM	T8	32	8	Interior	No
B21-R3	CLASSROOM	T8	32	46	Interior	Yes
B21-R4	CLASSROOM	T8	32	48	Interior	Yes
B21-R12	CLASSROOM	T8	32	32	Interior	Yes
B21-R13	CLASSROOM	T8	32	36	Interior	Yes
B21-R14	CLASSROOM	T8	32	36	Interior	Yes
B21-R15	HALLWAY	T8	32	36	Interior	No
B21-R16	CLASSROOM	T8	32	36	Interior	Yes
B21-R17	CLASSROOM	T8	32	36	Interior	Yes
B21-R20	CLASSROOM	T8	32	38	Interior	No
B21-R26	CLASSROOM	T8	32	36	Interior	Yes
B21-R27	CLASSROOM	T8	32	36	Interior	Yes
B21-R28	CLASSROOM	T8	32	36	Interior	Yes
B21-R29	ELEVATOR SHAFT	T8	32	2	Interior	Yes
B22-R1	CLASSROOM	T8	32	36	Interior	Yes
B22-R1	CLASSROOM	T8	32	10	Interior	No
B22-R2	CLASSROOM	T8	32	36	Interior	Yes
B22-R2	CLASSROOM	T8	32	10	Interior	No
B22-R3	CLASSROOM	T8	32	36	Interior	Yes
B22-R3	CLASSROOM	T8	32	10	Interior	No
B22-R4	CLASSROOM	T8	32	36	Interior	Yes
B22-R4	CLASSROOM	T8	32	10	Interior	No
B22-R5	STORAGE	T8	32	12	Interior	Yes
B22-R6	RESTROOM	T8	32	2	Interior	Yes
B22-R9	CLASSROOM	T8	32	36	Interior	Yes
B22-R9	CLASSROOM	T8	32	10	Interior	No

Table 20: Location of 32 Watt T8 Fluorescent Lamps

Building & Room ID	Space Type	Lamp Type	Lamp Watt (W)	Total # of Lamp	Interior/Exterior	OS Ctrl Measure
B22-R10	CLASSROOM	T8	32	28	Interior	Yes
B22-R10	CLASSROOM	T8	32	8	Interior	No
B22-R11	CLASSROOM	T8	32	28	Interior	Yes
B22-R11	CLASSROOM	T8	32	8	Interior	No
B22-R12	CLASSROOM	T8	32	28	Interior	Yes
B22-R12	CLASSROOM	T8	32	8	Interior	No
B22-R13	HALLWAY	T8	32	20	Interior	No
B22-R14	CLASSROOM	T8	32	28	Interior	Yes
B22-R14	CLASSROOM	T8	32	8	Interior	No
B22-R16	CLASSROOM	T8	32	28	Interior	Yes
B22-R16	CLASSROOM	T8	32	6	Interior	No
B22-R18	CLASSROOM	T8	32	28	Interior	Yes
B22-R18	CLASSROOM	T8	32	6	Interior	No
B22-R19	CLASSROOM	T8	32	8	Interior	No
B22-R21	CUSTODIAN	T8	32	2	Interior	Yes
B22-R23	CLASSROOM	T8	32	28	Interior	Yes
B22-R23	CLASSROOM	T8	32	8	Interior	No
B22-R24	CLASSROOM	T8	32	8	Interior	No
B22-R24	CLASSROOM	T8	32	2	Interior	No
B22-R25	CLASSROOM	T8	32	8	Interior	No
B22-R26	CLASSROOM	T8	32	8	Interior	No

ECM9: Replace exterior HPS with LED/Induction lights

The CCC survey shows there are 371 units of High Pressure Sodium (HPS) lamps with wattage of 400 each (without including the ballast) located at the school. According to the CEC calculator, replacing these exterior HPS lamps with LEDs would save an estimated **$14.479.8 per year** in electricity costs and has a **payback of 27.6 years**. The table below provides more savings details of the ECM and is the output of the CEC calculator. The measure was dropped since the payback period is very high.

Table 21: ECM7 CEC Calculator Energy Savings Summary

Energy Savings Summary				
This measure saves		**0**	**kW peak demand**	
	and	**109199**	**kWh energy use.**	
	and	0.0	therms natural gas	
	or	0.0	gallons of	NA
	or	**$ 14,479.8**	**energy cost annually.**	
Simple Payback is		**27.6**	**years.**	
Saving to Investment Ratio		0.76		

Table 22 (next page) provides information on the location and wattage of the fluorescent lamps to assist in the implementation when the running hours of the lamps approach towards the end of life (EOL).

Table 22: Location of HPS /MV Lamps

Building ID or Mount Type	Fixture Use	Lamp Type	Lamp Wattage (W)	Number of Fixtures	Lamps per Fixture	Interior/ exterior
B1	Building Facade	HPS	400	18	1	Exterior
B1	Building Facade	HPS	400	5	1	Exterior
B2	Building Facade	HPS	400	4	1	Exterior
B3	Building Facade	HPS	400	3	1	Exterior
B4	Building Facade	HPS	400	12	1	Exterior
B5	Building Facade	HPS	400	5	1	Exterior
B5	Building Facade	HPS	400	5	1	Exterior
B5	Building Facade	HPS	400	2	1	Exterior
B6	Building Facade	HPS	400	4	1	Exterior
B7	Building Facade	HPS	400	5	1	Exterior
B8	Building Facade	HPS	400	20	1	Exterior
B9	Building Facade	HPS	400	5	1	Exterior
B10	Building Facade	HPS	400	6	1	Exterior
B11	Building Facade	HPS	400	7	1	Exterior
B12	Building Facade	HPS	400	4	1	Exterior
B13	Building Facade	HPS	400	6	1	Exterior
B13	Building Facade	HPS	400	5	1	Exterior
B14	Building Facade	HPS	400	6	1	Exterior
B15	Building Facade	HPS	400	4	1	Exterior
B16	Building Facade	HPS	400	4	1	Exterior
B16	Building Facade	HPS	400	10	1	Exterior
B17	Building Facade	HPS	400	26	1	Exterior
B17	Building Facade	HPS	400	5	1	Exterior
B17	Building Facade	HPS	400	1	1	Exterior
B18	Building Facade	HPS	400	5	1	Exterior
B18	Building Facade	HPS	400	4	1	Exterior

Table 22: Location of HPS /MV Lamps Continues

Building ID or Mount Type	Fixture Use	Lamp Type	Lamp Wattage (W)	Number of Fixtures	Lamps per Fixture	Interior/ exterior
B19	Building Facade	HPS	400	5	1	Exterior
B19	Building Facade	HPS	400	7	1	Exterior
B20	Building Facade	HPS	400	5	1	Exterior
B20	Building Facade	HPS	400	8	1	Exterior
B21	Building Facade	HPS	400	27	1	Exterior
B21	Building Facade	HPS	400	7	1	Exterior
B21	Building Facade	HPS	400	1	1	Exterior
B22	Building Facade	HPS	400	27	1	Exterior
B22	Building Facade	HPS	400	4	1	Exterior
B22	Building Facade	HPS	400	1	1	Exterior
B23	Building Facade	HPS	400	10	1	Exterior
B24	Building Facade	HPS	400	2	1	Exterior
B24	Building Facade	HPS	400	3	1	Exterior
Pole	Landscape	HPS	400	8	1	Exterior
Ground	Landscape	HPS	400	39	1	Exterior
Pole	Parking Lot	HPS	400	2	3	Exterior
Pole	Security	HPS	400	28	1	Exterior
Pole	Parking Lot	HPS	400	6	2	Exterior

ECM10: Install Occupancy Control for Intermittently Occupied Rooms

The CCC survey shows there are a total of 262 locations that can install occupancy sensors. According to the CEC calculator, installing these sensors would save an estimated **$10,537.4 per year** in electricity costs and has a **payback of 5.6 years**. The table below provides more savings details of the ECM and is the output of the CEC calculator.

Table 23: ECM10 CEC Calculator Energy Savings Summary

Energy Savings Summary				
This measure saves		**16.07**	**kW peak demand**	
	and	**82150**	**kWh energy use.**	
	and	-539.4	therms natural gas	
	or	0.0	gallons of	NA
	or	**$ 10,537.4**	**energy cost annually.**	
Simple Payback is		**5.6**	**years.**	
Saving to Investment Ratio		1.55		

Table 16, 18 & 20 (previous pages) provide information on the location of the rooms to install the occupancy sensors to assist in the implementation of ECM 10.

Table 24: Location of Rooms for Proposed Occupancy Sensor

Table 24 is skipped since all the fixtures that have Occupancy Sensor measure specified are covered by Table 16, 18 and 20.

ECM11: Replace old packaged/split HVAC unit with high efficiency HVAC

Based on our assessment of the school survey data, 10 package/split AC units with a total estimated capacity of 130 tons have been identified for this measure. Estimation was made in the units' capacity and efficiency since the model number of the unit was not recorded as our field team was not able to get access to the systems during the time of the survey or due to worn out nameplates. According to the CEC calculator, replacing the existing system with high efficiency unit of SEER 14 would save an estimated **$11,588.3 per year** in energy costs with a simple payback of **16 years**.

Table 25: ECM11 CEC Calculator Energy Savings Summary

Energy Savings Summary				
This project saves		25.66	kW peak demand	
	and	71,998	kWh electricity use.	
	and	-523.9	therms natural gas	
	or	0.0	gallons of	Fuel Oil
	or	**$ 11,588.3**	**energy cost annually.**	
Simple Payback is		**16.0**	**years.**	
Saving to Investment Ratio		1.14		

Table 26: Location and information on the Packaged/Split Units

Table 26 (next page) provides information on the location, buildings and rooms served including the estimated capacity of the Packaged/Split unit/s to assist with ECM11.

Table 26: Location and information on the Packaged/Split Units

Building & HVAC ID	Room No	Unit Type	Unit Capacity* (Ton)
B4_HVAC1	R3-R5-R6-R7-R8-R9-R10-R14	SS	15
B4_HVAC2	R15-R16-R17-R18-R19-R20-R21	SS	15
B4_HVAC3	R26-R22-R23-R24-R25-R27-R28-R29-R30-R31	SS	15
B4_HVAC4	R26-R22-R23-R24-R25-R27-R28-R29-R30-R31	SS	15
B4_HVAC5	R26-R22-R23-R24-R25-R27-R28-R29-R30-R31	SS	15
B13_HVAC4	R8	Package	10
B16_HVAC1	R18-R23-R24	Package	15
B16_HVAC2	R8-R9-R11-R12-R13-R14-R15-R16-R17	Package	15
B16_HVAC3	R2-R5-R6-R7	Package	5
B23_HVAC1	R1	Package	10

- Cells highlighted, if any, signify assumptions that were made due to inaccurate or missing data.

ECM13a: Replace boiler with high efficiency condensing boiler

The CCC survey data was limited in terms of the boiler systems and did not have the exact count as well as the capacity of the existing boilers. According to the CEC calculator, replacing these old units with high efficiency condensing boiler units of AFUE 95-97 would save an estimated **$675.4 per year** in energy costs with a simple payback of **57.4 years**.

Table 27: ECM13a CEC Calculator Energy Savings Summary

Energy Savings Summary				
This project saves		1024.0	**therms natural gas**	
		0.0	gallons of	Fuel Oil
	or	**$ 675.4**	**energy cost annually.**	
Simple Payback is		**57.4**	**years.**	
Saving to Investment Ratio		0.64		

Table 28: Location and information on the Boiler Units

The following table provides information on the location; buildings served and estimated capacity of the Boilers units to assist with ECM13a.

System ID	Type	Age	Location	No. of Units	Fuel type
B1	Hot Water Boiler	> 20 yrs	Mechancial Room	1	Natural Gas
B2	Hot Water Boiler	> 20 yrs	Mechancial Room	1	Natural Gas

Estimated and assumed information has been highlighted

ECM13b: Replace furnace with high efficiency condensing furnace

Based on the CCC survey and inventory, there 17 gas-fired furnaces or unit heaters with total capacity of 3,437 MBH that can get replaced by high efficiency condensing furnaces. According to the CEC calculator, replacing these heating systems with high efficiency condensing furnaces would save an **estimated $1,450.7 per year** in energy costs with a simple payback of **52.7 years**.

The table below provides more savings details of the ECM and is the output of the CEC calculator.

Table 29: ECM18 CEC Calculator Energy Savings Summary

Energy Savings Summary					
This project saves		2199.4	**therms natural gas**		
		0.0	gallons of	Fuel Oil	
	or	**$ 1,450.7**	**energy cost annually.**		
Simple Payback is		**52.7**	**years.**		
Saving to Investment Ratio		0.52			

Table 30: Location of gas-fired furnace/unit heaters

The following table (next page) provides information on the location of the condensing furnaces to assist with ECM13b.

Table 30: Location of gas-fired furnace/unit heaters

Building & HVAC ID	Room No	Unit Type	Unit Input Capacity (MBH)
B4_HVAC6	R3-R5-R6-R7-R8-R9-R10-R14	Furnace	300
B4_HVAC7	R15-R16-R17	Furnace	300
B4_HVAC8	R18-R19-R20-R21	Furnace	300
B4_HVAC9	R26-R22-R23-R24-R25-R27-R28-R29-R30-R31	Furnace	300
B4_HVAC10	R26-R22-R23-R24-R25-R27-R28-R29-R30-R31	Furnace	300
B4_HVAC11	R26-R22-R23-R24-R25-R27-R28-R29-R30-R31	Furnace	300
B8_HVAC1	R1-R3-R13	Furnace	300
B8_HVAC2	R1-R3-R13	Furnace	300
B9_HVAC3	R4-R5	Furnace	45
B12_HVAC1	R1	Furnace	45
B12_HVAC2	R1	Furnace	45
B13_HVAC4	R8	Package	180
B13_HVAC5	R8	Package	11.5
B16_HVAC1	R18-R23-R24	Package	260
B16_HVAC2	R8-R9-R11-R12-R13-R14-R15-R16-R17	Package	260
B16_HVAC3	R2-R5-R6-R7	Package	60
B23_HVAC1	R1	Package	130

- Cells highlighted, if any, signify assumptions that were made due to inaccurate or missing data.

ECM15: Install variable speed drive for pumps and fans

Since the CCC survey data information on the size of the motors and efficiency as well as the capacity and count of the air handler units and heating hot water pumping systems was limited, the study has estimated the motor sizes. A total of three (3) motors serving the heat pumps and tower fan of the water loop system with a total estimated capacity of 50 HP have been selected for this measure. According to the CEC calculator, installing VSD drive to the motors would save an estimated **$1,081.7 per year** in energy costs with a simple payback of **15.5 years**.

Table 31: ECM15 CEC Calculator Energy Savings Summary

Energy Savings Summary				
This measure saves		**4.40**	**kW peak demand**	
	and	**5,573**	**kWh energy use.**	
	and	**239.6**	therms natural gas	
	or	**0.0**	**gallons of**	**NA**
	or	**$ 1,081.7**	**energy cost annually.**	
Simple Payback is		**15.5**	**years.**	
Saving to Investment Ratio		1.17		

Table 32: Location and information on the Motor Units

The following table provides information on the location; buildings served and estimated capacity of the Motor units to assist with ECM15.

Location	System	Systems Served	Enduse Item	HP
Mech Room	Water Loop Circulation	WSHP	Waterloop-Pump-1	15.0
Mech Room	Water Loop Circulation	WSHP	Waterloop-Pump-2	15.0
Outdoor	Water Loop Condenser	WSHP	Tower Fan	20.0

Estimated and assumed information has been highlighted.

ECM17: Replace old motor with premium efficiency motor

Since the CCC survey data information on the size of the motors and efficiency as well as the capacity and count of the air handler units and heating hot water pumping systems was limited, the study has estimated the motor sizes. A total of three (3) motors serving the heat pumps and tower fan of the water loop system with a total estimated capacity of 50 HP have been selected for this measure. According to the CEC calculator, replacing the old unit/s with premium efficiency motors would save an estimated **$398.1 per year** in energy costs with a simple payback of **8.5 years**.

Table 33: ECM17 CEC Calculator Energy Savings Summary

Energy Savings Summary				
This measure saves		**5.39**	**kW peak demand**	
	and	**2,486**	**kWh energy use.**	
	and	**-21.2**	therms natural gas	
	or	**0.0**	**gallons of**	**NA**
	or	**$ 398.1**	**energy cost annually.**	
Simple Payback is		**8.5**	**years.**	
Saving to Investment Ratio		1.93		

Table 34: Location and information on the Motor Units

The following table provides information on the location and estimated size of the Motor units to assist with ECM17.

Location	System	Systems Served	Enduse Item	HP
Mech Room	Water Loop Circulation	WSHP	Waterloop-Pump-1	15.0
Mech Room	Water Loop Circulation	WSHP	Waterloop-Pump-2	15.0
Outdoor	Water Loop Condenser	WSHP	Tower Fan	20.0

Estimated and assumed information has been highlighted.

ECM18: Replace storage water heater with gas-fired tankless water heater

Based on the CCC survey and inventory of domestic hotwater heaters, there is at least two (2) gas-fired storage water heater units with a 160 gallon total capacity that can get replaced by tankless water heater. According to the CEC calculator, replacing these storage water heater systems with high efficiency condensing furnaces would save an **estimated $107.0 per year** in energy costs with a simple payback of **21.9 years**.

The table below provides more savings details of the ECM and is the output of the CEC calculator.

Table 27: ECM18 CEC Calculator Energy Savings Summary

Energy Savings Summary				
This measure saves		0	**kW peak demand**	
	and	0	**kWh energy use.**	
	and	**162.2**	therms natural gas	
	or	**0.0**	**gallons of**	**NA**
	or	**$ 107.0**	**energy cost annually.**	
Simple Payback is		**21.9**	**years.**	
Saving to Investment Ratio		1.16		

Table 28: Location of gas-fired storage water heaters

The following table provides information on the location of the storage water heater to assist with ECM18.

Building ID	Type	Total Storage (gal)	Location	No. of Units	Fuel type
B4	Storage	85	R13	1	Natural Gas
B22	Storage	75	R5	1	Natural Gas

Cells highlighted, if any, signify assumptions that were made due to inaccurate or missing data.

ECM19: Install Smart Strip/PC Management to Control Computers/Printers

Based on the CCC survey and inventory of plug loads and computers, we have proposed 267 smart strip controllers. According to the CEC calculator, installing one smart strip per each of these plugloads would save an estimated **$5,192.6 per year** in energy costs with a simple payback of **2.0 years**.

The table below provides more savings details of the ECM and is the output of the CEC calculator.

Table 29: ECM19 CEC Calculator Energy Savings Summary

Energy Savings Summary				
This measure saves		**0**	**kW peak demand**	
	and	**41,178**	**kWh energy use.**	
	and	-602.5	therms natural gas	
	or	0.0	gallons of	NA
	or	**$ 5,192.6**	**energy cost annually.**	
Simple Payback is		**2.0**	**years.**	
Saving to Investment Ratio		2.16		

ECM20: Install vending machine occupancy control

We have estimated 16 vending machine units (further investigation is recommended) that qualify for this measure. According to the CEC calculator, installing vending machine occupancy control for each vending system would save an estimated **$3,514 per year** in energy costs with a simple payback of **0.7 years**.

The table below provides more savings details of the ECM and is the output of the CEC calculator.

Table 30: ECM20 CEC Calculator Energy Savings Summary Energy Savings Summary

Energy Savings Summary				
This measure saves		**0**	**kW peak demand**	
	and	**22,509**	**kWh energy use.**	
	and	-329.3	therms natural gas	
	or	0.0	gallons of	NA
	or	**$3,514**	**energy cost annually.**	
Simple Payback is		**0.7**	**years.**	
Saving to Investment Ratio		7.32		

School Information	
School Name	RANCHO CUCAMONGA HIGH SCHOOL
School CDS Code	PO2AAH008
Mailing Address	11801 LARK DRIVE , RANCHO CUCAMONGA CA 91701

Energy Efficiency Measure Savings Summary

ECM	Energy Efficiency Project	Demand Savings	kWh Savings	Therm Savings	Propane Savings	Fuel Oil Savings	Cost Savings	Project Cost	Utility Rebate	Simple Payback	SIR
		kW	kWh	Therms	Gallons	Gallons	$	$	$	Years	
ECM 1	Replace incandescent light with compact fluorescent light	0.03	293	(1.8)	-	-	$ 47	$ 50	$ 9	0.9	4.67
ECM 2	Replace incandescent light with LED light	0.00	-	-	-	-	$ -	$ -	$ -	-	-
ECM 3&4	Convert incandescent/CFL exit sign to LED exit sign	0.00	-	-	-	-	$ -	$ -	$ -	-	-
ECM 5&6	Convert T12 fluorescent to T8 with electronic ballast or LED Lamps	13.32	117,651	(698.0)	-	-	$ 19,040	$ 91,362	$ 3,530	4.6	3.32
ECM 7	Replace 32 Watt T8 lamps with 28 Watt T8 Lamps	3.48	30,719	(182.3)	-	-	$ 4,971	$ 33,617	$ 922	6.6	0.68
ECM 8&9	Replace exterior mercury vapor/HPS with LED/Induction lights	0.00	-	-	-	-	$ -	$ -	$ -	-	-
ECM 10	Install occupancy control for intermittenly occupied rooms	16.07	82,150	(539.4)	-	-	$ 10,537	$ 60,976	$ 2,465	5.6	1.55
ECM 11	Replace old packaged/split HVAC unit with high efficiency HVAC	25.66	71,998	(523.9)	-	-	$ 11,588	$ 190,914	$ 5,760	16.0	1.14
ECM 12	Replace old heat pump with high efficiency heat pump	0.00	-	-	-	-	$ -	$ -	$ -	-	-
ECM 13A	Replace boiler with high efficiency condensing boiler	0.00	-	-	-	-	$ -	$ -	$ -	-	-
ECM 13B	Replace furnace with high efficiency condensing furnace	0.00	-	-	-	-	$ -	$ -	$ -	-	-
ECM 14	Seal existing HVAC leaky duct	0.00	-	-	-	-	$ -	$ -	$ -	-	-
ECM 15	Install variable speed drive for pumps and fans	4.40	5,573	239.6	-	-	$ 1,082	$ 17,180	$ 446	15.5	1.17
ECM 16	Replace manual thermostat with programmable/smart thermostat	0.00	-	-	-	-	$ -	$ -	$ -	-	-
ECM 17	Replace old motor with premium efficiency motor	5.39	2,486	(21.2)	-	-	$ 398	$ 3,576	$ 199	8.5	1.93
ECM 18	Replace storage water heater with gas-fired tankless water heater	0.00	-	162.2	-	-	$ 107	$ 2,946	$ 600	21.9	1.16
ECM 19	Install smart strip/PC management to control computers/printers	0.00	41,178	(602.5)	-	-	$ 5,193	$ 13,440	$ 3,294	2.0	2.16
ECM 20	Install vending machine occupancy control	0.00	22,509	(329.3)	-	-	$ 3,514	$ 2,391	$ -	0.7	7.32
ECM 21	Install photovoltaic system	0.00	-	-	-	-	$ -	$ -	$ -	-	-
	Total	68.35	374,557	(2,496.5)	-	-	$ 56,478	$ 416,451	$ 17,223	7.1	1.71

Appendix A: Brief overview of CEC suggested Energy Conservation Measures (ECMs)

This appendix provides a brief discussion regarding the different measures recommended by the CEC. The section is provided to familiarize schools with context of each of the recommended measures.

Lighting Measures

ECM 1: Replace incandescent bulbs with compact fluorescent lamps (CFLs)

Replacing traditional incandescent light bulbs with modern compact fluorescent lamp (CFL) style bulb will allow for the same output with less wattage, and less electricity consumption. A 23-watt CFL bulb will deliver the same performance in lumens as a 100-watt incandescent light bulb, while using approximately 75% less energy. 1

Left to right: LED, CFL, Incandescent
Source:
http://www.energy.ca.gov/lightbulbs/lightbulb_faqs.html

ECM 2: Replace incandescent bulbs with light-emitting diode (LED) lamps

Replacing traditional incandescent lights with light-emitting diode (LED) lights provides the same performance while consuming significantly less electricity. A 12-watt LED bulb will deliver the same performance as a 60-watt incandescent bulb, using between 75-80% less energy. 2

ECM 3 & 4: Convert incandescent/CFL exit sign to LED exit sign

Converting your building's emergency exit sign's bulbs from incandescent or compact fluorescent lamps (CFL) to light-emitting diode (LED) bulbs will provide the same performance while using much less electricity. Incandescent and CFL powered exit signs use 350 kWh and 140 kWh per year, respectively. An exit sign using LED bulbs only uses 44 kWh annually, have a service life for over 10 years, and shine brighter than incandescent or CFL bulbs. [3]

Source:
http://www.utopialighting.com/home.php?cat=33

[1] *http://blog.insofast.com/tag/federal-energy-tax-credits/*

[2] *http://energy.gov/energysaver/articles/how-energy-efficient-light-bulbs-compare-traditional-incandescents*

[3] *https://www.energystar.gov/ia/business/small_business/led_exitsigns_techsheet.pdf*

ECM 5 & 6: Convert T12 fluorescent to T8 with electronic ballast or LED lamps

Converting T12 fluorescent lights to T8 lights with electronic ballasts yields energy savings. The following table presents how much electricity is saved by replacing T12 lights with T8 lights of certain wattages.

Old T12 Light	New T8 Light	Annual Savings
34 watts	32 watts	66 kWh
34 watts	28 watts	78 kWh
40 watts	32 watts	82 kWh
40 watts	28 watts	93 kWh

T12 and T8 fixtures

T12 lights can also be replaced with light-emitting diode (LED) lights. The following table (based on CEC Calculator) shows annual electricity savings for various T12 wattages replaced by a 15-watt LED light:

Old T12 Light	LED Light	Annual Savings
34 watts	15 watts	46 kWh
40 watts	15 watts	61 kWh

LED fixtures
Source (both pictures):
http://www.hoveyelectric.com/hovey-electric-power-blog/bid/73754/T5-vs-T8-vs-LED-The-Best-Options-For-Replacing-Aging-T-12-Fixtures

ECM 7: Replace 32 watt T8 lamps with 28 watt T8 lamps

Upgrading to a low-wattage T8 lamp will yield annual savings. According to the CEC Calculator, replacing a 32-watt T8 lamp with a 28-watt T8 lamp will reduce electricity consumption by 11 kWh per year.

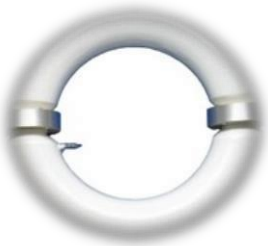
ECM 8 & 9: Replace exterior mercury vapor/HPS with LED/induction lights

For a site exterior lighting system, replacing traditional high pressure sodium (HPS) lights with LED lights provides a chemically safe, and energy efficient alternative. LED lights do not contain mercury, lead, or other hazardous chemicals. Furthermore, a 183-watt HPS system's efficacy is 61 lumens per watt, while a 153-watt LED system's efficacy is 67 lumens per watt. [4]

[4] http://apps1.eere.energy.gov/buildings/publications/pdfs/alliances/outdoor_area_lighting.pdf

Mercury vapor lamp
Source:
http://www.1000bulbs.com/product/1821/MV0400-0001E.html

High pressure sodium lamp
Source:
http://www.hiwtc.com/products/high-pressure-sodium-lamp-197655-9233.htm



Induction lamp
Source:
http://www.lightsoftherockies.net/Induction_Main.html

ECM 10: Install occupancy control for intermittently occupied rooms

Installing occupancy control systems, such as motion sensors, can reduce a building's energy demand should certain rooms be used intermittently. These systems can detect activity, turn on the lights when the room is in use, and turn them off when the room is vacant. A study done by the California Energy Commission estimated 25-50% energy savings in commercial buildings.[5]

Occupancy Sensors[6]

[5] *http://www.lrc.rpi.edu/resources/pdf/dorene1.pdf*
[6] http://www.leviton.com/OA_HTML/SectionDisplay.jsp?section=62870&minisite=10251

ECM 11: Replace old packaged/split HVAC unit (up to 65KBtu) with high-efficiency HVAC

Replacing old (10 or more years old) packaged/split HVAC units with new high-efficiency models can save 20% to 50% in energy costs. The table below (based on CEC Calculator) presents the savings per ton of specific SEER models once replaced with high-efficiency HVAC systems.[7]

SEER	Electricity	Fuel Oil
13	384 kWh	1.3 gal
14	468 kWh	2.4 gal

Old HVAC (left) and Efficient New HVAC (right)
Sources:
http://www.hvacmechanicalsystems.com/files/hvac_old_unit_remove_22.JPG;
http://climatetech.biz/images/products/packaged_units/GPC13_crossection.jpg

ECM 12: Replace old heat pump (up to 65 kBtu) with high-efficiency heat pump

Old heat pumps should be replaced with high-efficiency heat pumps. High efficiency heat pumps are better dehumidifiers than older pumps, which reduces energy usage. The following table (based on CEC Calculator) presents the annual savings per ton of specific SEER models once replaced with high-efficiency heat pumps:

SEER	Electricity
13	707 kWh
14	846 kWh
15	916 kWh

Old heat pump (left) and efficient heat pump (right)
Sources: http://www.leinbachservices.com/do-i-really-need-a-supertune-on-my-air-conditioner/new-2-ac-install-4-30-13-2/; http://detectenergy.com/tag/heat-pump/

[7] *http://energy.gov/energysaver/articles/central-air-conditioning*

ECM 13A: Replace ECM 13A: Replace boiler with high- efficiency condensing boiler

ECM 13B: Replace furnace with high-efficiency condensing furnace

Old furnaces and boilers should be replaced with new, high-efficiency condensing furnaces and boilers. Candidates for replacement are coal burners which were changed to oil or gas, and gas furnaces with pilot lights. The AFUE rating of a condensing furnace or boiler can be over 10% higher than a non-condensing model.[8] The following table (based on CEC Calculator) presents the savings on boilers and furnaces based on AFUE ratings:

AFUE Percentage Rating	Fuel Oil
AFUE92-94	3.53 gal/KBTU/hr
AFUE95-97	4.17 gal/KBTU/hr

High Efficiency Condensing Boiler & Furnace
Sources: http://www.pexsupply.com/High-Efficiency-Gas-Boilers-1735000; http://www.alliantgas.com/why-propane/home-heating-systems/

ECM 14: Seal existing leaky ducts

A significant amount of air used by ducts is lost due to leaks, which can lead to higher utility bills and insufficient heating or cooling. Sealing duct leaks could greatly reduce costs. According to the CEC calculator, when ducts are properly sealed, 24 kWh of energy use and 3.6 gallons of fuel oil are saved per ton of AC.[9]

Leaky Air Duct vs. Tightly Sealed Air Duct
Sources: http://www.energystar.gov/index.cfm?c=behind_the_walls.btw_ducts; http://www.alliedcompletefurnace.com/insulation.html

[8] http://energy.gov/energysaver/articles/furnaces-and-boilers

[9] http://www.energystar.gov/index.cfm?c=home_improvement.hm_improvement_ducts

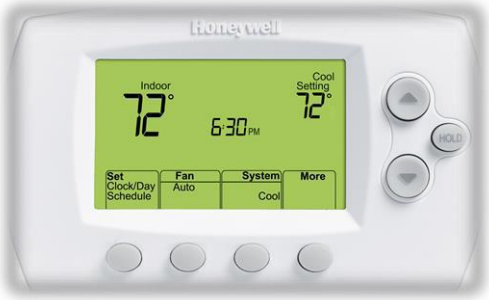
ECM 15: Install variable speed drive for pumps and fans

Replacing single-speed drive for a fan or pump with a variable-speed drive would reduce costs, as lower speeds can be used when sufficient. A 10% reduction in speed reduces the device's electrical usage by around 25%. According to the CEC calculator, installing variable speed drives can result in savings of 101 kWh and 3.1 gallons of fuel oil per horsepower.[10]

Right: Variable Speed Drive
Source: http://www.pandsautomation.com/variable-speed-drives

ECM 16: Replace manual thermostat with programmable thermostat

Replacing manual thermostats with programmable thermostats can result in energy savings. According to the CEC calculator, by replacing a building's thermostat to a programmable one, 740 kWh of energy use and 88.1 gallons of fuel oil can be saved.



Manual thermostat vs. programmable thermostat
Sources: http://www.honeywellstore.com/store/products/honeywell-yct87k1003-the-round-heat-only-manual-thermostat.htm;

[10] https://www.energystar.gov/index.cfm?c=power_mgt.datacenter_efficiency_vsds

ECM 17: Replace old motor with premium efficiency motor

Replacing standard motors with premium efficiency motors saves 3105 kWh and $250 per year for 10 horsepower motors, 5160 kWh and $410 per year for 25 horsepower motors, 8630 kWh and $690 per year for 50 horsepower motors, 15680 kWh and $1255 per year for 100 horsepower motors, and 29350 kWh and $2350 per year for 200 horsepower motors.[11]

Right: Premium efficiency motor
Source: http://www.baltimoreaircoil.com/english/parts-services/bac-parts/fans-and-drives/premium-efficiantinverter-duty-motors

ECM 18: Replace storage water heater with gas- fired 'tankless' water heater

Storage water heaters continuously consume energy, even when water is not being used. Gas-fired tankless water-heaters only heat water as it is being used, so replacing storage water heaters with tankless greatly cuts down on energy usage.[12]

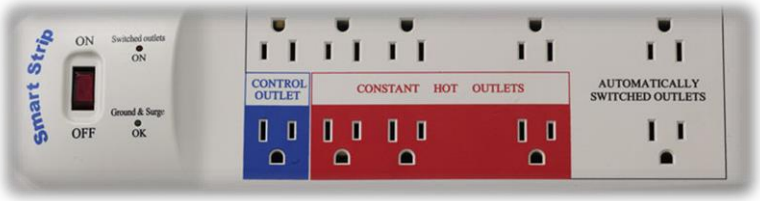
Storage Heater vs. Tankless Heater
Sources: http://ronaldtcurtisplumbing.com/1253/new-water-heater-for-sun-city-lincoln-home-owner/; http://atozleakdetection.com/tankless-water-heaters/

[11] http://www1.eere.energy.gov/manufacturing/tech_assistance/pdfs/whentopurchase_nema_motor_systemts1.pdf
[12] http://www.energystar.gov/certified-products/detail/water_heater_whole_home_gas_tankless

Plug - Load Efficiency Measures:

ECM 19: Install smart strip/PC management to control computers/printers

Computers and other electronic appliances running on standby mode waste energy. By installing a smart strip or other type of management system, energy can be saved. According to the CEC Calculator, one smart strip can save 154 kWh each year, with $4.60 saved annually.



Smart Strip
Source: http://www.lafcpug.org/reviews/review_bits_limited.html

ECM 20: Install vending machine occupancy control

Installing occupancy control systems in existing vending machines can result in energy savings. According to the CEC Calculator, in a snack vending machine, an occupancy control system saves 293 kWh and a beverage vending will save 1,407 kWh.

CoolerMiser occupancy sensor control system
Source:http://store.usatech.com/coolermiserccm150wallmountedwsensor.aspx

Simple Photovoltaic (PV) Self- Generation Project

ECM 21: Install PV System

Installing photovoltaic (PV) systems on site can be a fruitful long-term project that allows the user to generate their own electricity directly from sunlight. However, the installation does pose very high initial costs, with long term ROI. The average cost of a system under 10 kW is $5.82/watt in California. Government rebates are also available to offset these costs. As the CEC's Proposition 39 Guidelines suggest, PV systems should only be considered once all other feasible and applicable ECMs are implemented. [13]

Onsite PV system
Source:http://stateenergyreport.com/2012/11/07/power-purchase-agreements-expand-solar-development/

[13] *http://www.californiasolarstatistics.ca.gov/*

Appendix B: Prior UC Davis Research on Best Practices in Schools

During July-September 2012, the UC Davis Energy Efficiency Center undertook case study research examining energy efficiency programs in k-12 schools and utility programs.

Specific focus areas for the study included:

- Understanding institutional structures and decision-making for energy-related upgrades at schools
- Determining best practices utilized by school districts and/or utilities
- Understanding how large school districts have overcome institutional barriers to implementing energy efficiency
- Researching potential behavior-based programs to include "end-users" at schools
- Distilling lessons learned from other large campus-based entities that might apply to schools

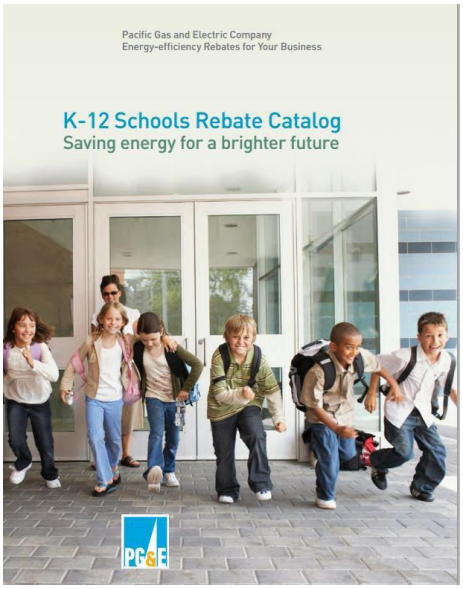
The study reinforced many of the important lessons of energy efficiency programs such as commissioning, retro-commissioning, and facility upgrades. Perhaps more interestingly, however, the study has shown the vast opportunity that exists for behavior-based approaches. Key recommendations of this study include:

- The potential opportunity is enormous—with more than $3 billion annually spent on school's energy needs, even a small reduction in energy usage produces millions of dollars in savings which can be used to more directly benefit students.
- Schools have a captive, mutually reinforcing audience—use it to promote and leverage behavior change.
- Develop strong utility/school district relationships.
- Consider behavior-based programs focusing on operations and maintenance as well as programs focusing on building occupants
- Consider a robust role for third-party administrators.
- Consider strong on-bill financing programs.
- Consider partnerships with NGOs who can help leverage work with schools.
- Empower and develop great leaders to create charismatic political and operational leadership focusing on energy efficiency.
- Learn from the successes of others.

The full publication, which elaborates on all of these recommendations, is available here:
http://eec.ucdavis.edu/files/03-21-2013-Approaches-to-Finding-Savings-Efficiency-in-Schools-1.pdf

Appendix C: Cost and Rebate Estimates

The section includes a summary of available rebates offered by the utility serving the school. Specific rebates change periodically and need to be verified with the utility. Current rebate catalog for PG&E specific to K-12 schools can be downloaded at the following link:
http://www.pge.com/includes/docs/pdfs/mybusiness/energysavingsrebates/rebatesincentives/schools_catalog.pdf



Non-residential rebate summary for PG&E

This section reproduces the summary of electric and gas rebates for PG&E compiled by DSIRE[14].

Overall non-residential sector Electric Rebates Summary for PG&E:

- Custom Lighting: $0.05/kWh saved
- Custom Air Conditioning and Refrigeration: $0.09 - $0.15/kWh saved
- Business Computing: $15/Sensor or Power Management Software
- Electric Food Service Equipment: $50 - $1,250/unit
- Refrigeration Equipment: $25 - $1,000/unit
- Night Cover for Display Cases: $3.50/linear ft. Insulation for Bare Suction Lines: $2/linear ft. Package Terminal Air Conditioner & Heat Pumps: $100/unit
- Variable Frequency Drives (VFDs) for HVAC Fans: $80/hp
- Variable Speed Motor Air Handler System: $50/unit
- Efficient Lighting Upgrades: $17 - $200/fixture
- Lamps: $1 - $20
- Occupancy Sensors: $15 - $55/sensor
- LED Exit Sign: $15 - $27
- Time Clocks: $36/unit
- Greenhouse Heat Curtain: $0.20/sq. ft.

[14] Established in 1995, DSIRE is currently operated and funded by the N.C. Solar Center at N.C. State University, with support from the Interstate Renewable Energy Council, Inc. DSIRE is funded in part by the U.S. Department of Energy. http://dsireusa.org/about/

- Infrared Film for Greenhouses: $0.05/sq. ft.
- Equipment Insulation: $2 - $4/ln. or sq. ft.
- Attic Insulation: $0.15
- Wall Insulation: $0.50
- Window Film: $1.35/sq. ft.
- Room AC: $50
- Electric Storage Water Heater: $30
- Heat Pump Water Heater: $500/unit
- Clothes Washer: $50
- Refrigerator: $75

Overall non-residential sector Gas Rebates Summary for PG&E:

- Equipment Insulation: $2 - $4/sq. ft.
- Pipe Insulation: $2 - $3/linear ft.
- Steam Traps: $50 - $290/unit
- Pool Heating: $2/Mbtuh
- Attic/Roof/Ceiling Insulation: $0.15/sq. ft.
- Domestic Hot Water Boiler: $1.50/MBtu/h
- Natural Gas Storage Water Heaters: $200/unit Steam/Water Process Boiler: $2.00/MBtu/h
- Steam/Water Boiler for Space Heating: $0.25-$2.00/MBtu/h
- Direct Contact Water Heater: $2/MBtu/h Furnaces: $150 - $300/unit
- Ozone Laundry System: $39/lb
- Cooking Equipment: $125 - $2,000/unit
- Custom Natural Gas: $1/therm saved

Appendix D: California Lighting Technology Center – Lighting Best Practices Guide

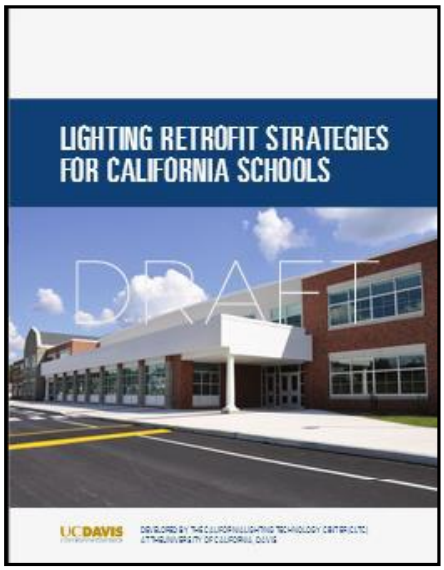
CALIFORNIA LIGHTING TECHNOLOGY CENTER

The California Lighting Technology Center (CLTC) is a not-for-profit RD&D facility dedicated to advancing energy-efficient lighting and daylighting technologies. Part of the Department of Design at the University of California, Davis, the CLTC includes full-scale laboratories for research and development, and it provides instruction to both undergraduate and graduate students of lighting design.

Working in partnership with designers, manufacturers, end users, utilities, government agencies, and others, CLTC conducts prototype and product testing, technology demonstrations and case studies. CLTC also provides resources for applying best practices to lighting design and installation. The center's faculty and staff provide curriculum and instruction for education and training courses, in addition to conducting workshops, seminars and outreach activities.

In response to the Proposition 39 efforts, the CLTC has developed a ***"Lighting Retrofit Strategies for California Schools guide"***. This is a 'living' document that will be continually updated. The latest version of the guide can be downloaded here: https://ucdavis.box.com/s/aqgpm7i6faeowsa39wda

The CLTC will produce this both in hard copy and maintain an electronic document available 'on-line' with frequent updates.



Appendix E: Washington State University's Checklist

Washington State University's Energy program has developed an industry accepted and widely used O&M and Energy Efficiency Measures Checklist to assist energy auditors. A part of that document has been reproduced, edited, and adapted into a simplified format for use by schools.

The Purpose of this document is to provide California School Districts and other LEAs that request and receive Energy Opportunity Surveys from the California Conservation Corps (CCC) with a detailed 'checklist' perspective and approach to further energy efficiency opportunities that may currently exist within their buildings for a wide range of energy efficiency 'Best Practices' and 'Energy Efficiency Measures'. The scope of the recommended energy efficiency 'Best Practices' and 'Energy Efficiency Measures' contained in this document is intentionally broader than the scope of the "Proposition 39 Guidelines" published by the California Energy Commission (CEC).

Below is the URL to Washington State University checklist:

http://www.energy.wsu.edu/documents/omchecklists.pdf

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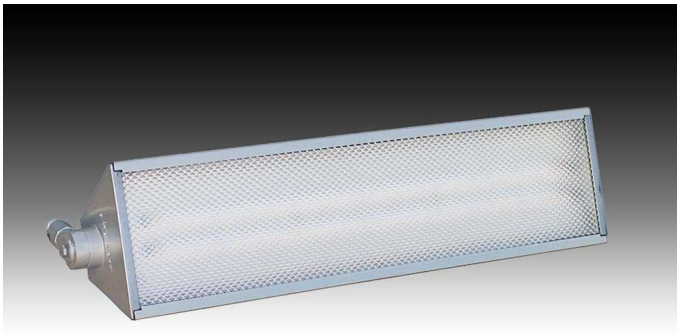


WLED-48 FLOODLIGHT

APPLICATIONS:

Security Lighting
Sign Lighting
Building-Accent Lighting
Parking Area/Garage Lighting

Specifications

Certification/Listings: CSA International certified for wet-location use. LM80 certified by independent laboratory testing.

Housing: Ultra-sustainable anodized aluminum, with injection-molded aluminum end castings and locking swivels. Male 1/2"- NPT thread. Castings use 1,000-hour salt-spray tested anti-corrosion pre-treatment with 5,000-hour tested finish coat. Luminaire is CSA listed for use in Wet Locations.

Units are designed for new installations and as upgrades to earlier Magnaray units, allowing for gradual replacement without re-wiring or relocation required. Retrofit kits available.

Lens/Optics: Diamond acrylic, clear or white lens, never yellows or becomes brittle. Provides maximum light distribution, high lighting uniformity, low exit luminance (glare), using linear LED strips.

Finish: Clear anodized aluminum. Optional powder coat colors available: Black, White, Dark Bronze, Green.

Dimensions/Weight: 27 3/4"L x 6-1/2"W x 5"H (705mm x 165mm x127mm);
8 pounds (3.62874kg)

Warranty: 5-year limited factory warranty.

Thermal Management: All-aluminum construction provides maximum effective heat management of LEDs and driver. All strips are Conformal coated.

LEDs/Driver: ULT strips and driver or other CSA approved components, 120 through 277 vac, 50/60 HZ.

2242 Whitfield Park Loop • Sarasota, FL 34243 • Phone: 941.755.2111 • Fax: 941.751.5483 • www.magnaray.com

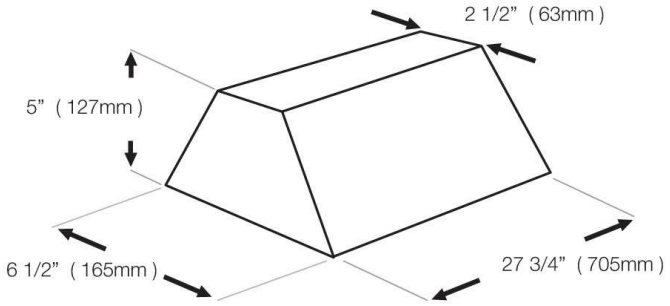
WLED-48 FLOODLIGHT

LED Information:

# LEDs	Initial Lumens	Total Watts	LED Type	CRI	K/CCT Range	Color	OP Current	LPW
192	7060	50	Samsung 2323	80–85	2700–4000	White	700 ma	110

** or other approved

Model	Volts	Dimming	Color
☐ WLED-48	☐ 120–127	☐	☐ AA Anodized Alum
			☐ BK Black
			☐ DB Dark Bronze
			☐ GR Green
			☐ WH White

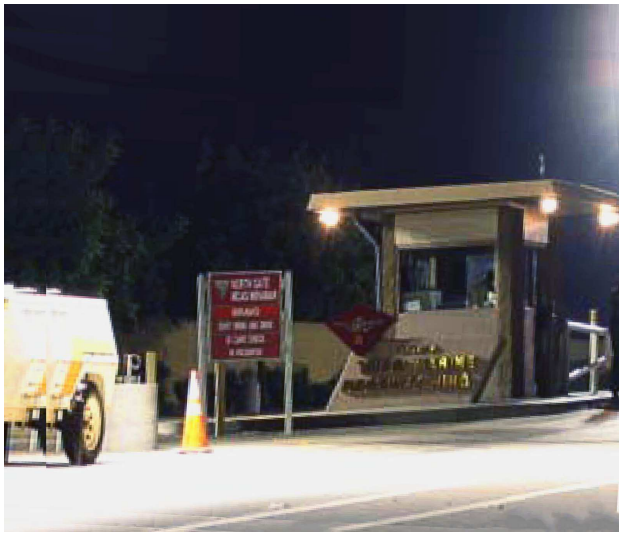


C US "Wet Location"

RoHS

Visually and Energy Efficient Lighting Product

Typical WLED-48 Applications



Security Lighting - Before

Security Lighting – After

MAGNARAY®
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A DIVISION OF WORLD INSTITUTE OF LIGHTING AND DEVELOPMENT CORP.

WLED-96 FLOODLIGHT

APPLICATIONS:

Security Lighting • Sign Lighting • Building-Accent Lighting

Specifications

Certification/Listings: CSA International certified for wet-location use. LM80 certified by independent laboratory testing.

Housing: Ultra-sustainable anodized aluminum, with injection-molded aluminum end castings and locking swivels. Male 1/2"- NPT thread. Castings use 1,000-hour salt-spray tested anti-corrosion pre-treatment with 5,000-hour tested finish coat. Light engine and driver are IP67

Units are designed for new installations and as upgrades to earlier Magnaray units, allowing for gradual replacement without re-wiring or relocation required. Retrofit kits available.

Lens/Optics: Diamond acrylic lens, never yellows or becomes brittle. Provides maximum light distribution, high lighting uniformity, low exit luminance (glare), using linear LED strips.

Finish: Clear anodized aluminum. Optional powder coat colors available: Black, White, Dark Bronze, Green.

Dimensions/Weight: 51 3/4"L x 6-1/2"W x 5"H (1314mm x 165mm x127mm);
12 pounds (5.44311kg)

Warranty: 5-year limited factory warranty.

Thermal Management: All-aluminum construction provides maximum effective heat management of LEDs and driver. All strips are Conformal coated.

LEDs/Driver: ULT strips and driver, 120 through 277 vac, 50/60 HZ.

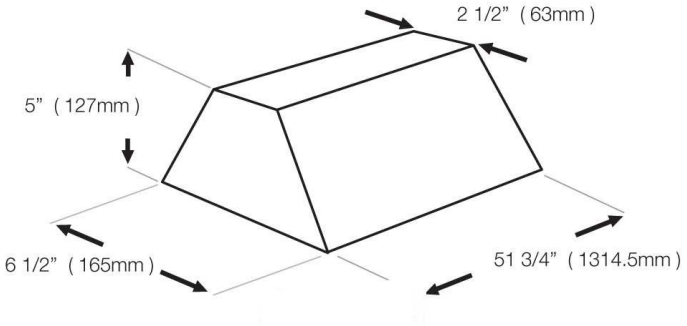
2242 Whitfield Park Loop • Sarasota, FL 34243 • Phone: 941.755.2111 • Fax: 941.751.5483 • www.magnaray.com

WLED-96 FLOODLIGHT

LED Information:

# LEDs	Initial Lumens	Total Watts	LED Type	CRI	K/CCT Range	Color	OP Current	LPW
384	14120	100	Pansonic	80–85	2700–4000	White	700 ma	108

Model	Volts	Dimming	Color
☐ WLED-96	☐ 120–127	☐	☐ AA Anodized Alum
			☐ BK Black
			☐ DB Dark Bronze
			☐ GR Green
			☐ WH White



C SP US "Wet Location"

RoHS

Visually and Energy Efficient Lighting Product

Typical WLED-96 Applications

Sign Lighting

Security Lighting