District Offices
Alternative Energy Concept Plan

San Bernardino Community College District

FINAL REPORT

January 7, 2011

Prepared by:

P2S Engineering, Inc.
5000 East Spring Street, Eighth Floor
Long Beach, CA 90815

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1.0 Executive Summary

1.1 Background and Scope

P2S Engineering, Inc. was retained by San Bernardino Community College District (SBCCD) to conduct an energy efficiency study for Professional Development Center (PDC) & Administration Offices, Applied Technology and Training center (ATTC), and Annex buildings located in San Bernardino, CA. The goal of the efficiency study is to identify potential energy savings associated with mechanical and electrical systems currently serving the buildings.

The objective of this study is to:

- Maximize energy efficiencies to reduce both electrical consumption and peak demand
- Reduce operational and maintenance costs
- Promote renewable power sources for offsetting facilities peak demand and reducing greenhouse gas emissions
- Minimize the operating fiscal impact from electrical rate escalation in the future
- Reducing the facilities exposure to future carbon emission charges
- To reduce water consumption by promoting water efficient fixtures.

The scope of this study involves:

- Evaluating existing mechanical systems and their related control configurations
- Evaluating existing lighting systems and their controls
- Identifying potential energy conservation measures for lighting and mechanical systems
- Evaluating sites for providing photovoltaic panels to generate solar power
- Identifying water conservation measures to reduce water consumption in buildings
- Establishing rough order of magnitude construction cost estimates for the identified potential energy conservation measures
- Estimating simple energy paybacks

1.2 Methodology

The following methodology was adopted in identifying potential energy savings measures:

1. Review drawings and perform field investigation. The following information was gathered from the drawings and field investigation:
   a. Configurations of installed equipment
   b. Equipment operation, level of control and strategies
   c. Nameplate data for HVAC components including AHU units, pumps, chillers, cooling towers, and boilers
   d. System control schematic diagrams
   e. Apparent system deficiencies
2. Identify opportunities and options for system modifications and upgrades to optimize and minimize energy usage. This task included:

- Establishing proposed lighting modifications and upgrades
- Identifying potential alternate cooling plant configurations and control strategies
- Identifying alternative airside distribution system configurations
- Identifying potential control system modifications
- Identifying water reduction measures

5. Perform economic savings analysis and calculate rough order magnitude costs/payback for alternatives described herein.
6. Present recommendations for implementation.

1.3 Report Overview

A summary of energy conservation measures for both mechanical and electrical systems along with associated paybacks follows this section.

The plumbing systems review concentrated on reducing water consumption at the facility and the efficiencies of domestic hot water equipment.

A detailed description of the existing mechanical, plumbing, and lighting systems currently serving the buildings and our identified energy conservation measures to reduce energy consumption follows this section.

This report also provides recommendations on provision of photovoltaic systems at the facility along with associated costs and simple payback analysis.

1.4 Summary of ECMs (Energy Conservation Measures)

Table 1 List of ECMs Analyzed for District Office, PDC and ATTC

ECM #	ECM Description	Cost	Savings ($/Yr)	Rebate	Payback (Yrs)	Notes
1	PV Panels at District Offices	$600,000	$28,821	$196,000	14.0	Note1
2	High SEER CU for Server Rooms	$10,000	$1,082	$1,768	7.6	Note-2
3(b)	Replace Electric DHW Heaters with Energy Star Tankless Gas Water Heater	$8,900	$1,783	$3,383	3.1	
5	Low Flush Male Urinals	$4,000	$696	$-	5.8	Note-3
7	Lighting	$6,772	$2,497	$4,079	1.1	
Energy Conservation Measures (∑)		**$629,672**	**$34,878**	**$205,230**	**10.5**	

See Table 3 for Notes

Table 2 List of ECMs Analyzed for Annex

ECM #	ECM Description	Cost	Savings ($/Yr)	Rebate	Payback (Yrs)	Notes
3(b)	Replace Electric DHW Heaters with Energy Star Tankless Gas Water Heater	$4,450	$855	$1,501	3.4	
7	Lighting	$15,670	$6,433	$7,719	1.2	
Energy Conservation Measures (∑)		**$23,120**	**$7,705**	**$9,619**	**1.8**	

See Table 3 for Notes

Table 3 Notes for Table-1

#	Note
1	See ECM for detailed Calculations. Net Metering for Campuses, Annex & DO Bldgs is recommended. This is Simple period. Discounted Payback period is 13 Years.
2	2500 Hrs/yr of Operation is Assumed
3	No water department savings are applicable or available at this time. However, this will change in the future and applicable incentives if available should be applied.

2.0 Existing Conditions

An estimate of installed equipment capacities for heating, cooling, lighting and domestic hot water loads is summarized below for the three buildings being analyzed for energy conservation.

Table 4 Summaries of Installed Capacities of Existing Equipment

Bldg	Bldg Name	Conditioned Area, ft^2	Lighting Watts	Heating	MBtuh	Cooling	Tons	DHW
PDC & Admin	Professional Development Center & Administration Offices	20,798	34,410	RTU Furnace	687	Packaged RTU	67	4.5 kW; 60 Gallon Storage, Recirculation Pump
ATTC	Applied Technology and Training Center	9,632	11,579	RTU Furnace	629	Packaged RTU	35	32 MBTUH, with 30 Gallon Storage
Annex	Annex Office & Printing Services	8,900	16,000	RTU Furnace	283	Packaged RTU	30	2 kW; 6 Gallon Storage

Detailed discussions of installed capacities, observations on energy utilization, methods and/or calculation to derive capacities are discussed on individual building's existing conditions in this chapter. None of the buildings have sub-metering for Natural Gas and Electricity.

There is no sub-metering on the individual buildings at district offices to help study energy consumption by end use. No data logging was undertaken, nor was any energy modeling done to establish energy baselines. Energy consuming equipment was studied and reviewed for energy utilization performance in each of the buildings. Conservation measures are developed based on reasonable assumptions clearly establishing baseline, to compute savings. Data used as inputs and assumptions made in calculations are documented upfront in each and every energy conservation method (ECM) documented in Section 4.

2.1 Professional Development Center and Administration Office Building

2.1.1 Background

This building has north south orientation with rectangular geometrical configuration, with north side being used as PDC (Professional Development Center) and south wing being used as Administration offices. The conditioned space of this single level building is 20,798 ft^2. The building is mostly used as office space. The building has significant amount of plug load in terms of kitchen equipment, soda coolers, office computers and printers. The building has electricity service connection from SCE and gas connection from The Gas Company. The glazing was verified as clear double pane.

2.1.2 Heating, Cooling and Ventilation

The building has packaged roof top units (RTUs) for cooling. RTUs have 82% efficient furnaces. Cooling equipment has 10.1 to 10.3 SEER ratings. RTUs supply ventilation air with fixed mixing of outside air. There are three exhaust fans for the building located in restrooms and janitors closet. The envelope is maintained at positive pressure. It is practically not possible to recover heat from exhaust air due to scattered equipment locations. All RTUs operate as Constant Air volume (CAV) systems. The RTUs operate on a time schedule from 5 AM to 6 PM.

2.1.3 Lighting

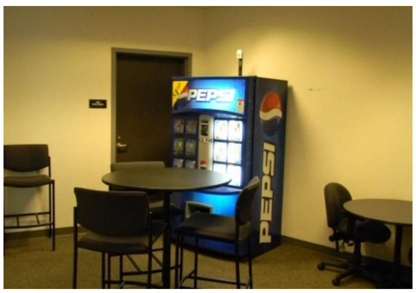
Hallways and reception area have daylight provisions through roof mounted skylights and building windows. The building has luminaries with first generation T8 lamps in 2' x 4' fluorescent lighting fixtures. The building classrooms have pendant fluorescent fixtures. There are 1' x 4' fluorescent lighting fixtures and CFLS with total lighting of 34,410 watts. This does not include task lights found on most of the desks. Many lights in hallways are not operated due to diligence of building operations. The fixtures are manually switched on/off in occupied areas.

2.1.4 Plumbing

The building has one male restroom with two urinals and a water closet and the women's restroom is equipped with two water closets. The building also has two break rooms, janitors closet service sink and kitchen sinks in break rooms, where water is used.

Domestic Hot Water (DHW) is heated by 4.5 kW electric heater with 50 gallon tank. The DHW heater has a re-circulating pump which operates round the clock with no setback controls.

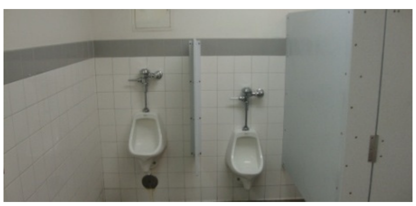
2.1.5 Schedule and Controls



The building mechanical and lighting systems operate from 5 AM to 6 PM for approximately 250 days in year.

The RTUs are controlled by thermostats. Setpoints for thermostats are remotely provided by EMS system in the ATTC (Applied Technology and Training Center) building.

There is a lighting control panel located in Electric Room 114 on the PDC side which has been bypassed. It was connected to the interior lighting in the District Office.



2.1.6 Other Observations

The break room kitchen has equipment with significant plug loads. The office areas have computers, LCD monitors and printers which also contribute significantly to the plug loads. The building envelope has two soda coolers in them.

Roof area is available for installation of PV (Photovoltaic) systems, and solar collectors for DHW heating systems.

2.2 Applied Technology and Training Center (ATTC)

2.2.1 Background

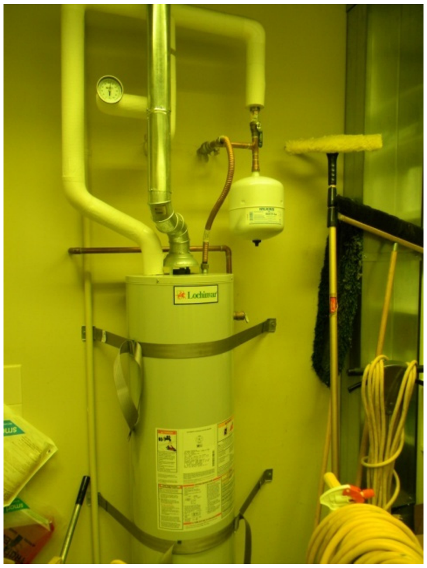
This building has square geometrical configuration, with no windows on north facade. The offices on south facade and the entrance on the east facade have dual pane low-E glazing. The conditioned space of this single level building is 9,632 ft^2. The building is mostly used as classrooms, laboratory and office space. The building has significant amount of plug load in terms of lab equipment, kitchen equipment, soda coolers, office computers and printers. The building is an add-on to the Admin and District Offices building and it gets electric and gas feeds from same service connection. The building is reported as four year old. The glazing was verified as clear double pane with Low-E coating.

2.2.2 Heating, Cooling and Ventilation

The building has eight packaged roof top units (RTUs) for cooling. RTUs have 82% AFUE efficient furnaces. Most RTUs have Energy Star rating at the time they were installed. Cooling equipment has 12 to 13 SEER ratings. RTUs supply ventilation air with fixed mixing of outside air. There are three exhaust fans for the building located in restrooms and janitors closet. It is not practical to recover heat from exhaust air due to scattered equipment locations. All the RTUs operate as CAV (Constant Air Volume) systems. The RTUs operate on a time schedule of 5 AM till 6 PM.

2.2.3 Lighting

Hallway area has skylights. Building entrance has MR 16 type of down lights and accent lighting which is not used. The building has luminaries with first generation T8 lamps in 2' x 4' fluorescent lighting fixtures and 1' x 4' fluorescent lighting fixtures with total lighting of 11,579 watts. This does not include task lights found on most of the office desks. The fixtures are manually switched on/off. Classrooms have occupancy sensors with back up timer. The control on backup timer was verified as having issues and needs to be commissioned.



2.2.4 Plumbing

The building has one male restroom with two urinals and a water closet and the women's restroom is equipped with two water closets. The building has one break room with a kitchen sink, and janitors closet service sink, where water is used besides restrooms.

DHW (Domestic Hot Water) is heated by 32,000 Btu/hr gas fired water heater with 30 gallon tank. The DHW heater does not have re-circulating pump, and water efficiency is degraded as more water is wasted at fixtures waiting for hot water.

2.1.5 Schedule and Controls

The building mechanical and lighting systems operate from 5 AM to 6 PM for 250 days in year.

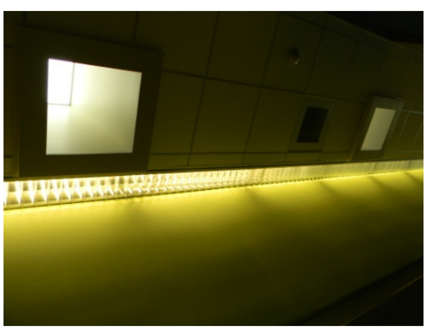
The RTUs are controlled by thermostats. Set points for thermostats are remotely provided by EMS system in the ATTC (Applied Technology and Training Center) building.

Lights are switched on/off manually. Some classrooms, conference rooms and common areas had occupancy sensors in this building.

2.1.6 Other Observations

The break room kitchen has equipment with significant plug loads. The office areas have computers, LCD monitors and printers which also contribute significantly to the plug loads. The building envelope has one soda cooler with SCE Energy Miser controls.

There is ample roof area for installation of PV (Photovoltaic) systems on this building, and solar collectors for DHW heating systems.



2.3 Annex

2.3.1 Background

This building has north south orientation with rectangular geometrical configuration, with north side being used as offices and south wing being used as printing area. The conditioned space of this single level building is 8,900 ft^2. The building has plug loads in terms of kitchen equipment, soda coolers, office computers and printers, over and above the process load of printing equipment. The building has electricity service connection from SCE and gas connection from the Gas Company. The glazing was verified as double pane with reflecting tint. The building is reported as forty year old building.

2.3.2 Heating, Cooling and Ventilation

The building has eight packaged roof top units (RTUs) for cooling. Newer RTUs have 82% efficient furnaces. Cooling equipment has 8 to 13 SEER ratings. RTUs supply ventilation air with fixed mixing of outside air. The exhaust fans for the building located in restrooms and janitors closet, and break room. All the RTUs operate as CAV (Constant Air Volume) systems. The RTUs operate on a time schedule of 6 AM till 9 PM. Three old RTUs are assumed to have 8 SEER rating and are found operational with general observation of five units replaced at catastrophic failures. Replacement units were Trane and York.

2.3.3 Lighting

The building has luminaries with first generation T12 lamps in 2' x 4' fluorescent lighting fixtures. The building is estimated to have installed lighting of 16,000 watts. The fixtures are manually switched on/off. The lighting fixtures are Troffer's with prismatic lenses. They have four lamp fixtures with two (2), lamp ballasts. The lamps are 34W T12 Econ-0-watt by Philips. The lights have manual "A/B" control, allowing half of lamps to be turned on one ballast. There are no lighting control panels.

2.3.4 Plumbing

The building has one male restroom with a urinal and a water closet and a women's restroom with a water closet. The building also has two break rooms, water closets (tank type) in restrooms, janitors closet service sink, and kitchen sinks in break rooms, where water is used.

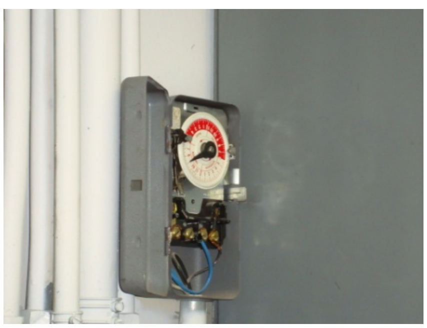
DHW (Domestic Hot Water) is heated by 2 kW electric heater with 6 gallon tank. The DHW heater does not have a re-circulating pump.

2.3.5 Schedule and Controls

The building mechanical and lighting systems operate from 6 AM to 9 PM for 250 days in year.

The RTUs are controlled by thermostats. Setpoints for programmable thermostats control roof top units.

Lights are switched on/off manually.



2.3.6 Other Observations

There is process load of printing press equipment. Some printing equipment is being upgraded with energy efficient equipment. The break room kitchen has equipment with plug loads. The office areas have computers, CRT/LCD monitors and printers which also contribute to the plug loads. The building has one soda cooler with SCE Energy Miser controls.

There is ample roof area for installation of PV (Photovoltaic) systems on this building, and solar collectors for DHW heating systems.

2.3.7 Process Equipment

The following type of process equipment was found in Annex

- Colored printers
- Paper cutting machines
- Laminating machine
- Punching machines
- Sorting and binding machines
- Automatic colored printing machine

3.0 Cost of Energy & Baseline Energy Consumption

This section establishes current electricity and natural gas consumption at district office buildings and Annex. Blended cost of electricity and natural gas are computed based on monthly bills at both facilities.

3.1 District Offices

District Offices has electrical energy connection of General Service (GS-2) from SCE with monthly statistics tabulated in Table-4. Blended cost of electricity is averaged at $0.1469 per kWh.

Natural gas is purchased from The Gas Company with consumption and monthly bills statistics in Table-6. Blended cost of Natural gas is $1.17 per therm.

3.1.1 Electricity

Peak monthly demand of 158 kW is observed in summer (August). Minimum winter electrical demand is observed as 98 kW (December). A cursory analysis to breakdown the monthly demand was attempted based on data in Figure-1, and is summarized in Table 4.

Table 5 Baseline Electricity Consumption & Monthly Costs at District Offices

Service Connection Type			GS-2
Service Account Number			3-019-1559-93
End Date	kW	kWh	$/Mo
4/8/2009	146	30,800	$4,056.81
5/8/2009	133	34,560	$4,934.22
6/10/2009	142	32,800	$4,982.11
7/10/2009	158	42,400	$8,309.18
8/10/2009	155	41,040	$8,106.58
9/9/2009	146	36,160	$6,783.65
10/7/2009	138	35,200	$4,251.63
11/9/2009	103	28,960	$3,406.45
12/10/2009	98	26,320	$3,106.54
1/11/2010	100	27,440	$3,101.54
2/8/2010	109	29,600	$3,448.02
3/10/2010	111	31,280	$3,777.18
Totals, kWh, $/Mo		**396,560**	**$58,264**
Blended Cost of Electricity, $/kWh			**0.1469**

Since the winter demand is averaged at 100 kW, the load for cooling with packaged RTU (Roof Top Units) is visible as 55 kW. Table 2 attempts to estimate the plug load in range of 41.5 kW to 44 kW, which represents 25% of peak demand and 40% of winter demand. This translates to approximately 2 Watts /ft^2, for 20,798 ft^2 building.

Appliances, computers and printers are the major contributors of plug load.

Table 6 Estimation of Electrical Energy Consuming Constituents

Load Type	Winter	Summer
Lighting	34.5	30
Ventilation	20	25
DHW Htg	4	2
Cooling	0	55
Plug Loads	41.5	43
Total Demand	**100**	**155**

No metering was done to generate data in Table 5 and it represents the judgmental values of energy consumption.

Figure 1 Monthly Electrical Demand at District Offices

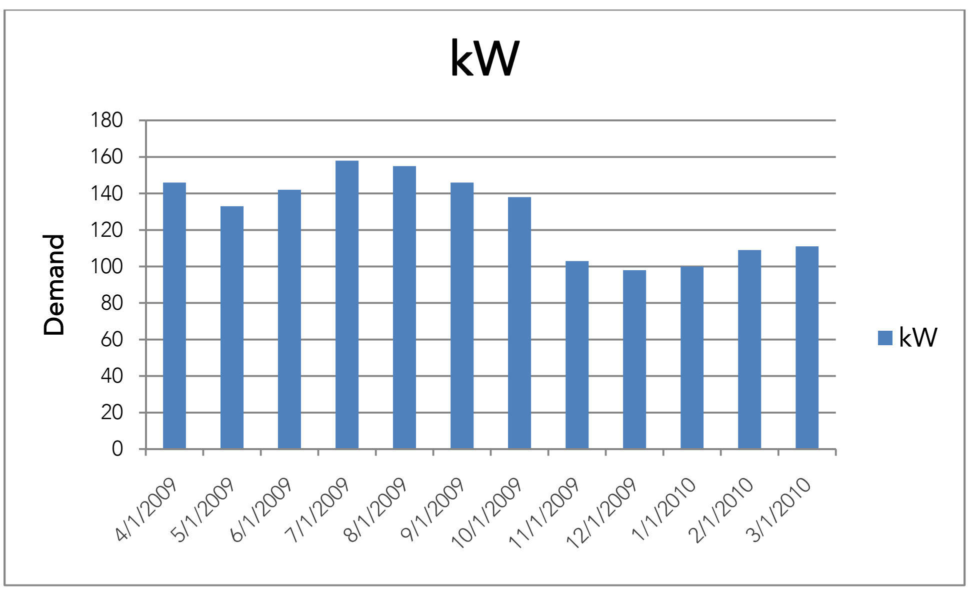


Figure 2 Monthly Electrical Energy Consumption at District Offices

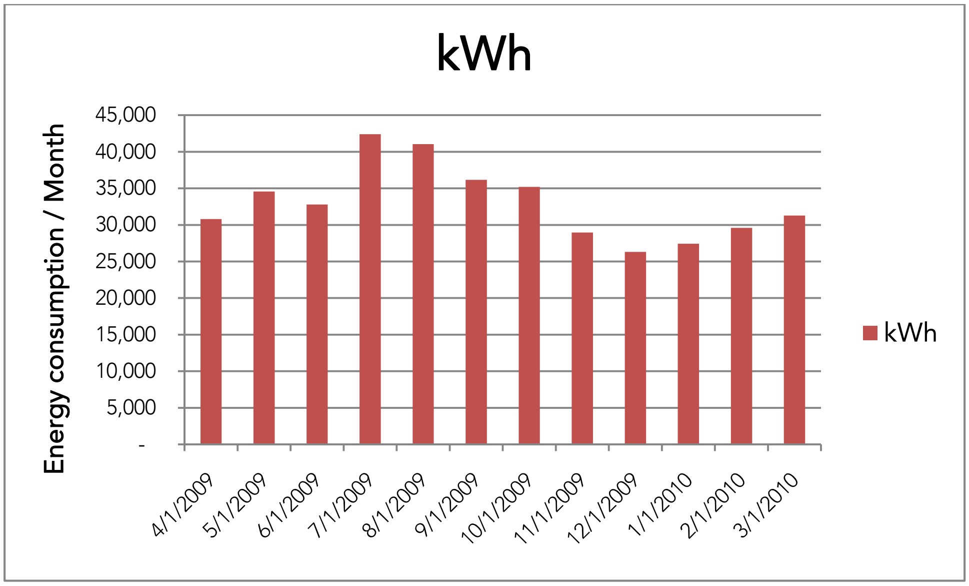
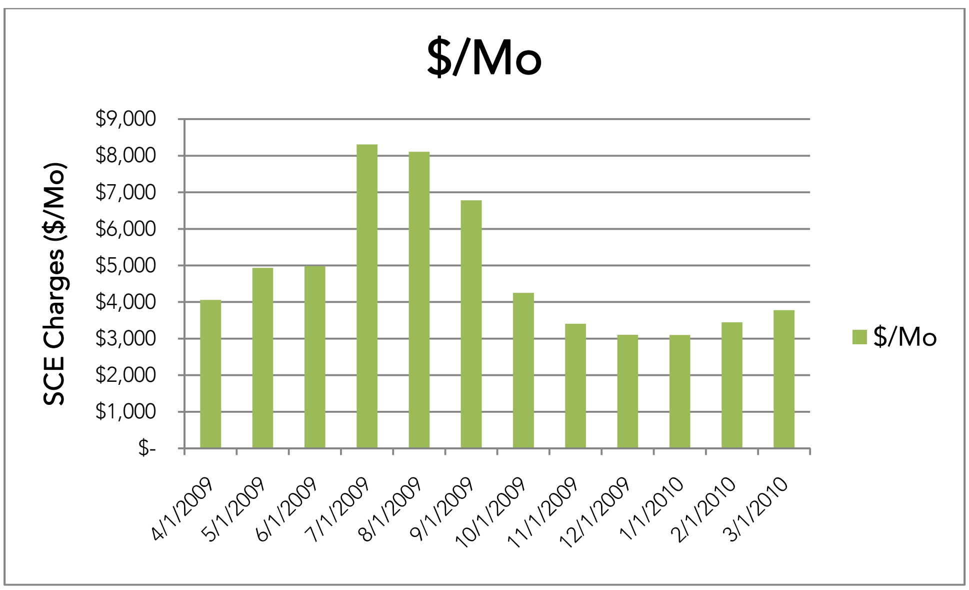


Figure 3 Monthly Electrical Energy Charges at District Offices



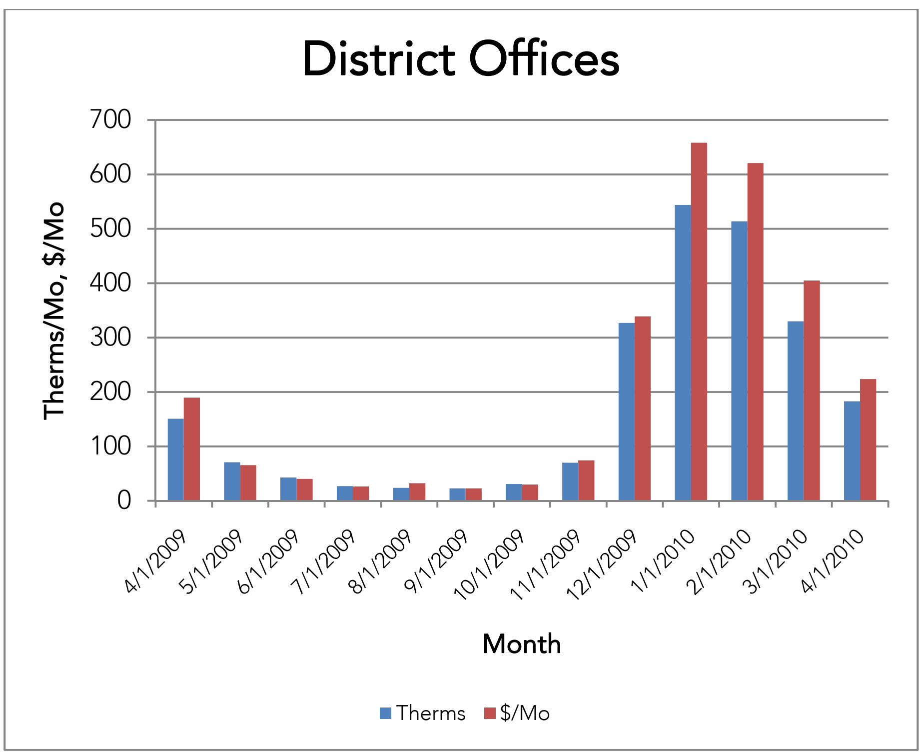
3.1.2 Gas

Since the PDC and Administration Offices have electrical domestic water heater, the summer month gas consumption is for ATTC DHW (Domestic Hot Water) heater. The 82% AFUE furnace on packaged RTUs consume significant amount of gas for space heating. Figure 3.4 summarizes baseline consumption and associated energy cost for natural gas.

Table 7 Baseline Consumption and Monthly Bills for Natural Gas at District Offices

Start	End	Therms	$/Mo
3/17/2009	4/15/2009	151	$190
4/15/2009	5/14/2009	71	$66
5/14/2009	6/12/2009	43	$40
6/12/2009	7/13/2009	27	$27
7/13/2009	8/11/2009	24	$32
8/11/2009	9/11/2009	23	$23
9/11/2009	10/9/2009	31	$30
10/9/2009	11/9/2009	70	$75
11/9/2009	12/11/2009	327	$339
12/11/2009	1/19/2010	544	$658
1/19/2010	2/16/2010	514	$621
2/16/2010	3/16/2010	330	$405
3/16/2010	4/15/2010	183	$224
Totals		**2,338**	**$2,730**
Blended Cost of Natural Gas, $/Therm			**$1.17/therm**

Figure 4 Monthly Bills and Consumption of Natural Gas at District Offices



3.2 Annex

Electricity consumption and monthly costs of electrical energy are summarized in Table 3-4. Blended cost of electricity at Annex is $0.20 per kWh.

Natural Gas consumption at Annex and its associated monthly costs are summarized in Table 8. Blended cost of Natural gas is computed as $1.38 per therm at Annex.

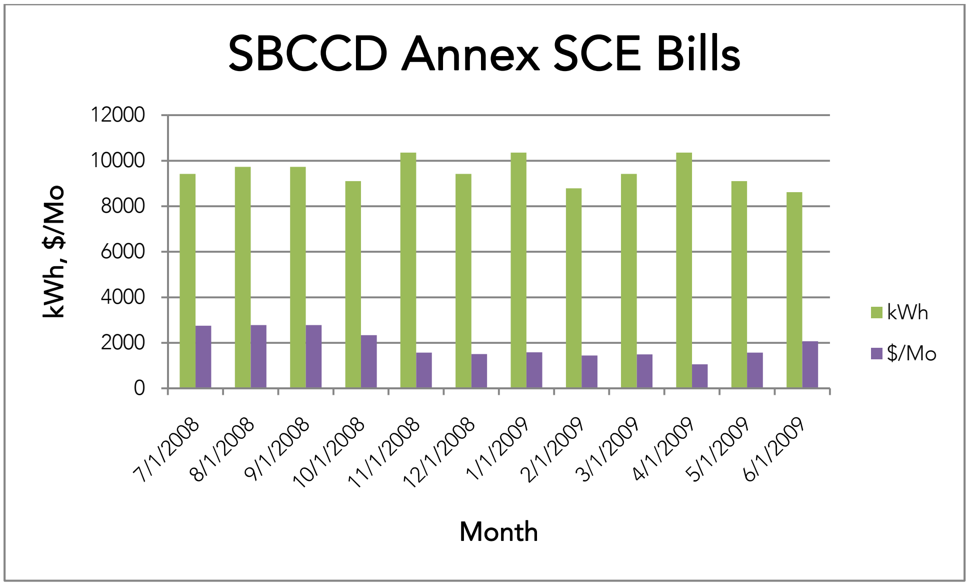
3.2.1 Electricity

Electricity is mainly used for lighting, cooling, printing equipment and plug loads. Kitchen equipment in break room, computers, office printers and printing equipment comprise of plug loads. Plug loads vary based on season, printing demand and work schedules. Table 9 attempts to estimate plug loads from 18 to 39 kW respectively (2-4 Watts/ft^2). This is judgmental approximation and no metering was undertaken to validate this data.

Table 8 Baseline Consumption and Monthly Charges for Electricity at Annex

Service Connection Type			GS-2	
Service Account Number			2-31-568-8879	
Billing Date	# of Days	kW	kWh	$/Mo
6/15/2009	32	59.4	8,620	$2,070.40
5/14/2009	29	59.4	9,104	$1,568.88
4/15/2009	33	59.4	10,359	$1,058.70
3/13/2009	30	59.4	9,418	$1,490.66
2/11/2009	28	59.4	8,790	$1,444.03
1/14/2009	33	59.4	10,359	$1,580.75
12/12/2008	30	59.4	9,418	$1,509.59
11/12/2008	33	59.4	10,359	$1,570.32
10/10/2008	29	59.4	9,104	$2,338.57
9/11/2008	31	59.4	9,732	$2,778.87
8/11/2008	31	59.4	9,732	$2,777.73
7/11/2008	30	59.4	9,418	$2,748.32
Totals, kWh, $/Mo			**114,413**	**$22,936.82**
Blended Cost of Electricity, $/kWh				**$0.20**

Figure 5 Electrical Energy Demand and Monthly Charges



3.2.2 Gas

Gas is used for space heating only in Annex building by RTU furnaces. Figure 3.6 outlines the baseline consumption and gas costs at Annex.

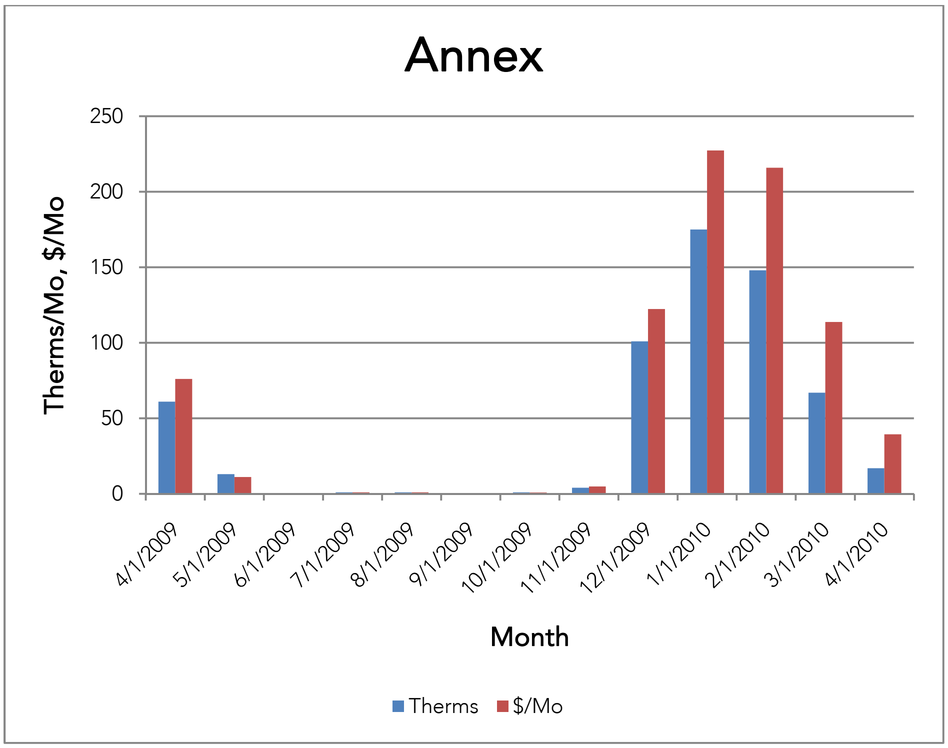
Table 9 Annex Natural Gas Consumption and Monthly Charges at Annex

Annex Start	End	Therms	$/Mo
3/17/2009	4/15/2009	61	$76
4/15/2009	5/14/2009	13	$11
5/14/2009	6/12/2009	0	$-
6/12/2009	7/13/2009	1	$0.9
7/13/2009	8/11/2009	1	$0.9
8/11/2009	9/11/2009	0	$-
9/11/2009	10/9/2009	1	$0.9
10/9/2009	11/9/2009	4	$4.8
11/9/2009	12/11/2009	101	$122
12/11/2009	1/19/2010	175	$227
1/19/2010	2/16/2010	148	$215
2/16/2010	3/16/2010	67	$113
3/16/2010	4/15/2010	17	$39
Totals		**589**	**$813**
Blended Cost of Natural Gas, ($/Therm)			**$1.38/therm**

Table 10 Seasonal Demand Estimation for Annex

Load Type	Winter	Summer
Lighting	12	10
Ventilation	6	10
DHW Htg	2	1
Cooling	-	20
Plug Loads	39	18
Total Demand	**59**	**59**

Figure 6 Monthly Charges and Gas Consumption at Annex



4.0 Energy Conservation Measures (ECMs)

After reviewing the technical information appearing on building drawings and conducting two site visits to observe the installed equipment consuming energy, this report documents seven ECMs outlined in Table 10.

No M&V (Metering and Verification) was done to establish the energy consumption baselines. Reasonable assumptions, conservative in nature were made and they are documented in each of ECMs.

Table 11 Summary of District Offices, PDC, ATTC ECMs

ECM #	ECM Description	Cost	Savings ($/Yr)	Rebate	Payback (Yrs)
1	PV Panels at District Offices	$600,000	$28,821	$255,015	12.0
2	High SEER CU for Data Center	$10,000	$1,082	$1,768	7.6
3(b)	Replace Electric DHW Heaters with Energy Star Tankless Gas Water Heater	$8,900	$1,783	$3,383	3.1
5	Low Flush Male Urinals	$4,000	$696	$-	5.8
7	Lighting	$6,772	$2,497	$4,079	1.1

Table 12 Summary of Annex ECMs

ECM #	ECM Description	Cost	Savings ($/Yr)	Rebate	Payback (Yrs)
3(b)	Replace Electric DHW Heaters with Energy Star Tankless Gas Water Heater	$4,450	$855	$1,501	3.4
7	Lighting	$15,670	$6,433	$7,719	1.2

4.1 ECM 01 Photovoltaic (PV) Panels (Self Generation)

4.1.1 PV for District Offices

Figure 7 SBCCD Offices

This ECM (Energy Conservation Method) is generated in line with California Solar Initiative utilizing the online calculator available at HTTP://GOSOLARCALIFORNIA.CLEANPOWERESTIMATOR.COM/GOSOLARCALIFORNIA.HTM. Based on the available data and billing information for the buildings at District Office in Table-11, it is estimated that a PV system of 100 kW AC will produce 49% of last year's energy utilization (kWh). Implementation of the energy conservation measures recommended at the district office buildings will increase the percentage to over 60%. The summary of PV system at district office buildings is tabulated in Table-2.

It is a fair judgment to use $6,000/kW as cost parameter for PV systems. A detailed study needs to be taken by solar contractor to install all the PV panels on roof of Admin and District Offices building to minimize the electrical (inverter) costs on two buildings. Polycrystalline PV panels should be preferred over mono-crystalline.

Table 13 Existing Energy Usage Summary

Service Connection Type			GS-2
Service Account Number			3-019-1559-93
End Date	kW	kWh	$/Mo
4/8/2009	146	30,800	$4,057
5/8/2009	133	34,560	$4,934
6/10/2009	142	32,800	$4,982
7/10/2009	158	42,400	$8,309
8/10/2009	155	41,040	$8,107
9/9/2009	146	36,160	$6,784
10/7/2009	138	35,200	$4,252
11/9/2009	103	28,960	$3,406
12/10/2009	98	26,320	$3,107
1/11/2010	100	27,440	$3,102
2/8/2010	109	29,600	$3,448
3/10/2010	111	31,280	$3,777
Totals		**396,560**	**$58,264**
$/kWh			**$0.1469**

Table 14 District Offices System Summary

Parameter	Value	Units
Size	100	kW AC
Roof Area Required	6400	ft^2
Cost	$6,000	$/kW
Tilt	30	° South
PV Output Adjustment	-10%	%
O&M Cost	$500.00	$/Yr
Escalation	2.5%	%
Net system cost after all incentives:	$395,988	
PV system electricity production:	196,165	kWh/year
Internal rate of return	9%	%
Net present value	$21,046.00	$
Discounted Payback	13	Yrs
Tax Status	Exempt	Yrs
Rebates	$255,015	$
Capital Required	$600,000	
Simple Payback	11.97	Yrs

Table 15 Environmental Benefits

Each Year Prevent	
217,190	Lbs of CO_2
229.51	Lbs of SO_2
318.18	Lbs of NO_X
Equivalent to	
260,627	Miles of Car Driving Per Year
16.8	Acres of Trees

Table 13 summarizes the environmental benefits of the PV system at district office.

Table 16 Self-Generation (Monthly Analysis)

Month	Produced by PV system (kWh)	kWh Purchased in last Year
January	13,578	30,800
February	14,469	34,560
March	17,475	32,800
April	19,193	42,400
May	18,258	41,040
June	18,191	36,160
July	17,635	35,200
August	17,529	28,960
September	17,284	26,320
October	16,042	27,440
November	13,839	29,600
December	12,672	31,280
Total	**196,165**	**396,560**

Figure 8 Current Energy Consumption & PV Production

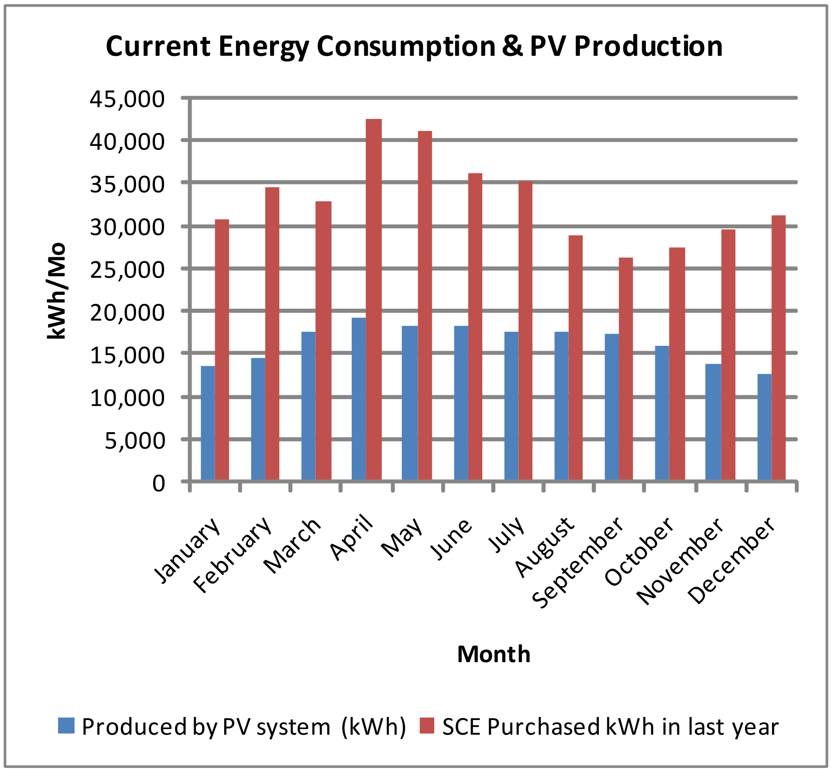


Table 14 and Figure 8 highlight the past year's energy consumption v/s proposed PV self generation. It is important to note that with other ECMs in this report being implemented, the demand for energy (kW and kWh/yr) will be reduced.

Table 15 documents the cash flows involved in the PV system under the assumptions and inputs listed in Table 12.

Table 17 Cash Flow Analysis for PV System on District Office Buildings

Year	Cash Payment	Net Incentives	Annual Elec. Bill Savings	O and M Cost	Total Net Cash Flow
2010	$(600,000)	$51,003	$27,108	$(500)	$(522,389)
2011		$51,003	$27,786	$(500)	$78,289
2012		$51,003	$28,480	$(500)	$78,983
2013		$51,003	$29,192	$(500)	$79,695
2014		$51,003	$29,922	$(500)	$80,425
2015			$30,670	$(500)	$30,170
2016			$31,437	$(500)	$30,937
2017			$32,223	$(500)	$31,723
2018			$33,028	$(500)	$32,528
2019			$33,854	$(500)	$33,354
2020			$34,701	$(500)	$34,201
2021			$35,568	$(500)	$35,068
2022			$36,457	$(500)	$35,957
2023			$37,369	$(500)	$36,869
2024			$38,303	$(500)	$37,803
2025			$39,260	$(500)	$38,760
2026			$40,242	$(500)	$39,742
2027			$41,248	$(500)	$40,748
2028			$42,279	$(500)	$41,779
2029			$43,336	$(500)	$42,836
2030			$44,420	$(500)	$43,920
2031			$45,530	$(500)	$45,030
2032			$46,668	$(500)	$46,168
2033			$47,835	$(500)	$47,335
2034			$49,031	$(500)	$48,531
2035			$50,257	$(500)	$49,757
2036			$51,513	$(500)	$51,013
2037			$52,801	$(500)	$52,301
2038			$54,121	$(500)	$53,621
2039			$55,474	$(500)	$54,974

4.2 ECM-02 High SEER Condensing Units

4.2.1 Background

SBCCD has five split system condensing units with SEER ratings in range of 10.3 to 13 on the three buildings being analyzed for energy conservation. Cooling capacities of these condensing units vary from 12000 Btu/h (1 Ton) to 24000 Btu/h (2 Tons). Some of the units are relatively new. For smaller capacities the newer technology allows 21 SEER condensing units that generate room for energy conservation by energy efficient retrofit. Using of Energy Star rated condensing units when choosing a retrofit will provide rebates and reliable energy efficiency. Some units are used for data centers and computer rooms and have EER ratings. This ECM targets split system condensing units only, used for cooling the server rooms.

Generally speaking, the rebates pay for the difference in price for 13 SEER (current Title-24 requirement) and the state of the art 21 SEER equipment, if it operates more than 1000 hours.

Implementation of this ECM will allow SBCCD to eliminate CFC based refrigerants from the subject buildings. The proposed refrigeration in the high SEER/EER condensing units is Puron™.

Figure 9 Few Installations of Condensing Units at SBCCD

4.2.2 Assumptions

Table 18 Assumptions for Retrofit

#	Parameter	Value	Comments
1	Blended cost of electricity ($/kWh)	$0.15	From SCE Bills
2	Data Center Cooling Hrs/Yr @ full capacity	2500	Needs to be Validated
3	Rebate rate, if available for 2010 ($/kWh)	$0.24	CCC-IOU Rebate

Condensing units have on/off controls and operate on full capacity only.

4.2.3 Savings

Table 19 Energy Efficiency Improvement Calculations

					Existing		Proposed			
ID#	Bldg	Mfr	Model #	BTU/h	SEER	Operating Cost $/Yr	SEER	Operating Cost $/Yr	kWh/Yr Savings	Savings. $/yr
CU-1	ATTC	Mitsubishi	PU24EK	24000	10.3	$856	21	$420	2,968	$436
CU-1	ATTC	Mitsubishi	PU24EK	24000	10.3	$856	21	$420	2,968	$436
HP-1	PDC	Carrier	38BK-009	12000	10.5	$420	21	$210	1,429	$210
Totals						**$2,131**		**$1,049**	**7,365**	**$1,082**

4.2.4 Cost Estimate

Table 20 Capital Cost Estimate

ID#	Bldg	BTUh	Total Installed Cost, $	Reference
CU-1	ATTC	24,000	$3,500	Carrier Verbal Quote
CU-2	ATTC	24,000	$3,500	Carrier Verbal Quote
HP-1	PDC	12,000	$3,000	Carrier Verbal Quote
Total Cost			**$10,000**	

Actual costs vary from manufacturer to manufacturer.

4.2.5 Payback Analysis

Table 21 Cost, Rebate and Payback Analysis

ID#	Bldg	BTUh	Total Installed Cost, $	kWH/Yr Savings	Savings. $/yr	Rebate, $	Simple Payback (Yrs), without Rebate	Simple Payback (Yrs), with Rebate
CU-1	7	18000	$3,500	2,968	$436	$712	8.0	6.4
CU-1	9B	18000	$3,500	2,968	$436	$712	8.0	6.4
CU-2	9B	12000	$3,000	1,429	$210	$343	14.3	12.7
			$10,000	**7,365**	**$1,082**	**$1,768**	**9.2**	**7.6**

4.3 ECM-03 Tankless DHW Heating

Figure 10 Existing DHW Heaters

4.3.1 Background

Domestic Hot Water (DHW) is currently heated with electric heaters in PDC+DO (Professional Development Center and District Offices) building, and Annex buildings respectively. The DHW system in PDC+DO have re-circulating pump with no set-back controls, lowering its energy factor. DHW system in Annex does not have recirculation system. DHW system in ATTC (Applied Technology Training Center) comprises of gas fired tank (30 gallons storage) water heater. None of the boilers have set-back controls and the DHW systems operate round the clock.

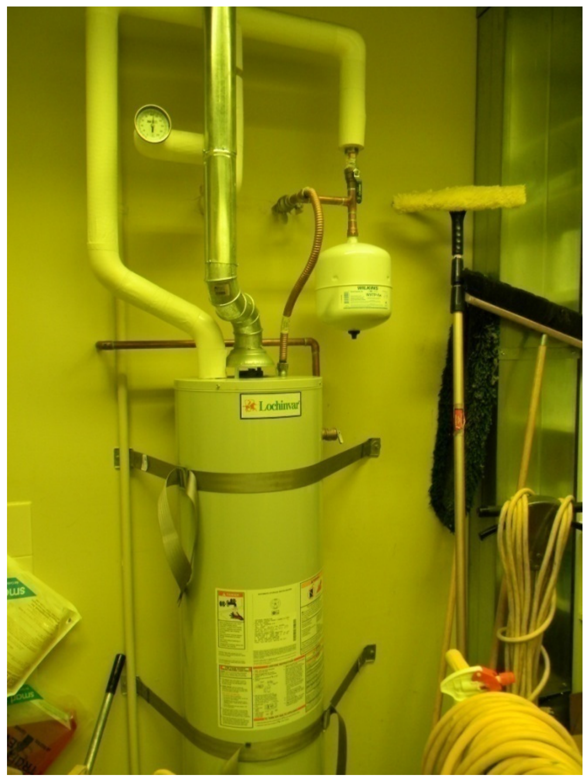
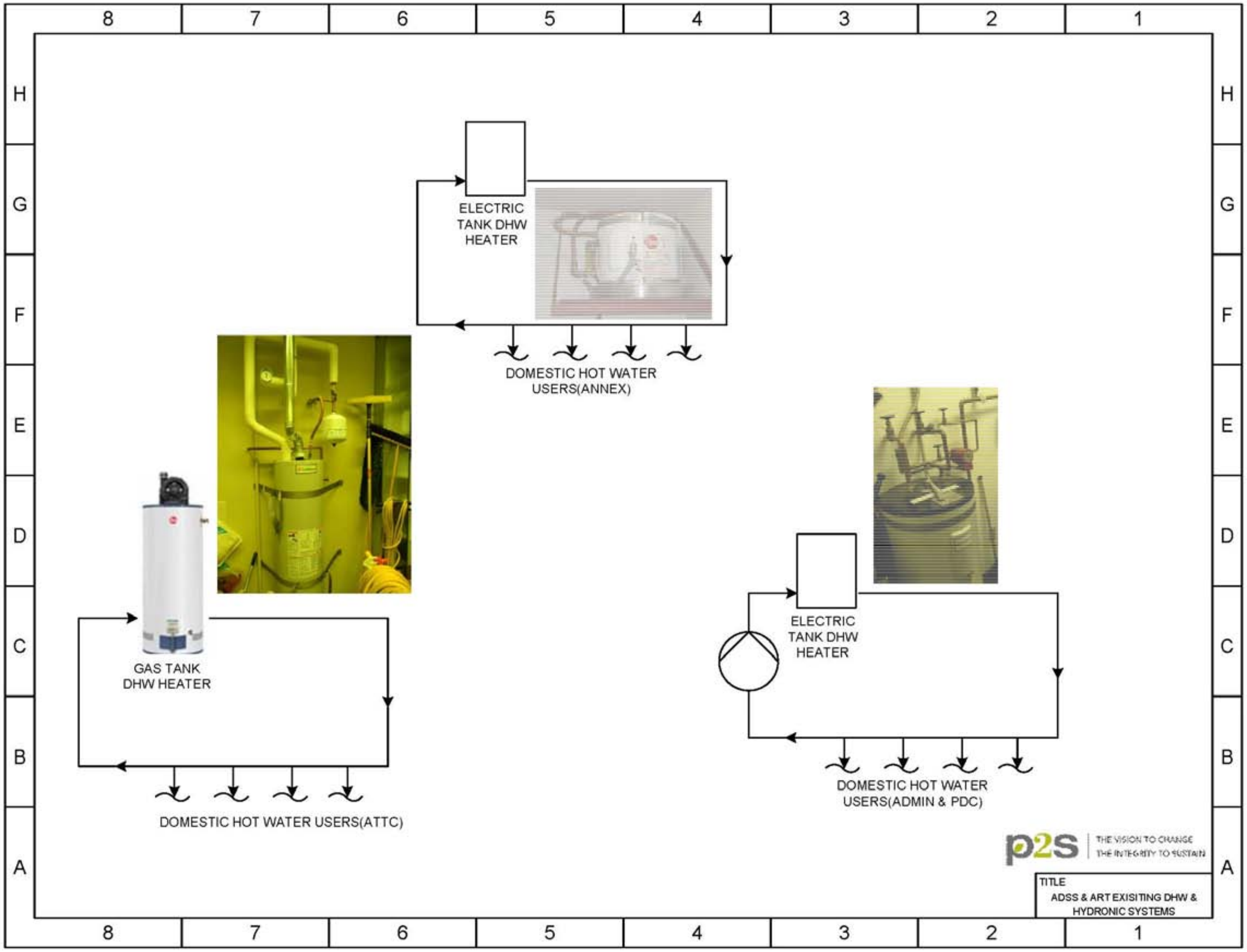


Figure 11 Existing DHW Systems



4.3.2 Assumptions

Table 22 Assumptions for ECM-3

#	Parameter	Value	Comments
1	Blended cost of electricity ($/kWh)	$0.15	From SCE Bills
2	Rebate for Gas Savings	$1.00	CCC-IOU Rebate
3	Rebate ($/kWh)	$0.24	CCC-IOU Rebate
4	DHW Usage	1.60	GPD Per Person
5	Occupant Density	100.00	ft^2/Occupant
6	Heating ΔT	60.00	˚F
7	Gas Water Heater Combustion Efficiency	85%	Assumption
8	Energy Factor of Gas Water Heater	0.65	DOE Published Data
9	Energy Factor of Electric Water Heater w/ recirculation pump	0.90	DOE Published Data for systems with recirculation Pump
10	Annual Days of Operation	250	Days/Yr
11	Cost of Gas	$1.17	$/Therm
12	98% Condensing Tankless DHW Heater	98%	Navien Tankeless
13	DHW Heating Load shifted to Solar	75%	Design Criteria for Solar Htrs

This data is proposed to be verified by data logging (M&V: Metering and Validation), to ascertain the system sizing, savings and capital costs.

4.3.3 Cost Estimate

Table 23 Cost Estimate for a Unit Tankless Condensing Boiler

#	CBS Description	Unit Cost	Qty	Units	Item Cost	Notes/Comments
1	Heater	$1,950.00	1	Ea	$1,950	
2	Piping	$22.00	30	LF	$660	Means 23.1200
3	Insulation	$5.30	30	LF	$159	
4	Electrical Conduit, 1"	$22.00	10	Ea	$220	
5	Flue Duct	$4.44	25	LF	$111	Means 16.5420
6	Duct Accessories	$450.00	1	LOT	$450	
7	Demolition	$500.00	1	Ea	$500	
8	Contingency				$400	
	Total Installed Cost of Installation				**$4,450**	

Capital cost of replacing the electric heaters with tankless condensing water heaters (Energy Star Rated) estimated in the table above.

4.3.4 Savings

Table 24 Calculations for Savings of ECM-3

#	Parameter	Value	Units	Comments
1	ATTC Bldg Area	9632	ft^2	From T-24 Sheets
2	DHW Usage ATTC	154.11	GPD	
3	PDC & Admin Offices Area	20798	ft^2	From T-24 Sheet E3.1
4	DHW Usage PDC & Admin	332.77	GPD	
5	Annex Bldg Area	9,600	ft^2	
6	DHW Usage in Annex	153.60	GPD	
7	ATTC DHW Energy Usage	348.95	Therms/yr	Calculated
8	PDC & Admin Offices DHW Energy Usage	13,552.52	kWh/yr	Calculated
9	Annex DHW Baseline Energy Usage	6,256	kWh/yr	Calculated
10	ATTC Baseline Cost	$408.27	$/Yr	
11	PDC and Admin Baseline Cost	$1,990.87	$/Yr	
12	Annex DHW Baseline Operating Cost	$918.95	$/Yr	
13	ATTC Proposed Annual Energy with Tankless DHW Heater	218.59	Therms/yr	$218.59
14	PDC & Admin Proposed Annual Energy with Tankless DHW Heater	471.99	Therms/yr	$471.99
15	Annex Proposed Gas Heating Energy Usage	204.24	Therms/yr	$204.24
16	ATTC Proposed Annual Operating Cost with 75% Load shifted to Solar Panels	$63.94	$/yr	
17	PDC & Admin Proposed Annual Operating Cost with 75% Load shifted to Solar Panels	$138.06	$/Yr	
18	Annex Proposed Annual Operating Costs with 75% load shifted to Solar Panels	$63.72	$/Yr	
19	Total Savings	$3052.37	$/yr	
20	Rebate for PDC & Admin	$3,252.60	$	Savings of electric Heating
21	Rebate for Annex	$1,501.35	$	
22	Rebate for ATTC	$344.33	$	
23	Total Rebate	$5,098.28	$	Annex+ATTC+Admin+PDC

4.3.5 Simple Payback

Table 25 Payback Analysis for ECM-3

Bldg	Cost	Savings	Rebate	Payback
ATTC	$4,450.00	$345	$130	12.54
DO+PDC	$4,450.00	$1,439	$3,253	0.83
Annex	$4,450.00	$855	$1,501	3.45
Totals	**$13,350.00**	**$2,638.41**	**$4,884.31**	**3.21**

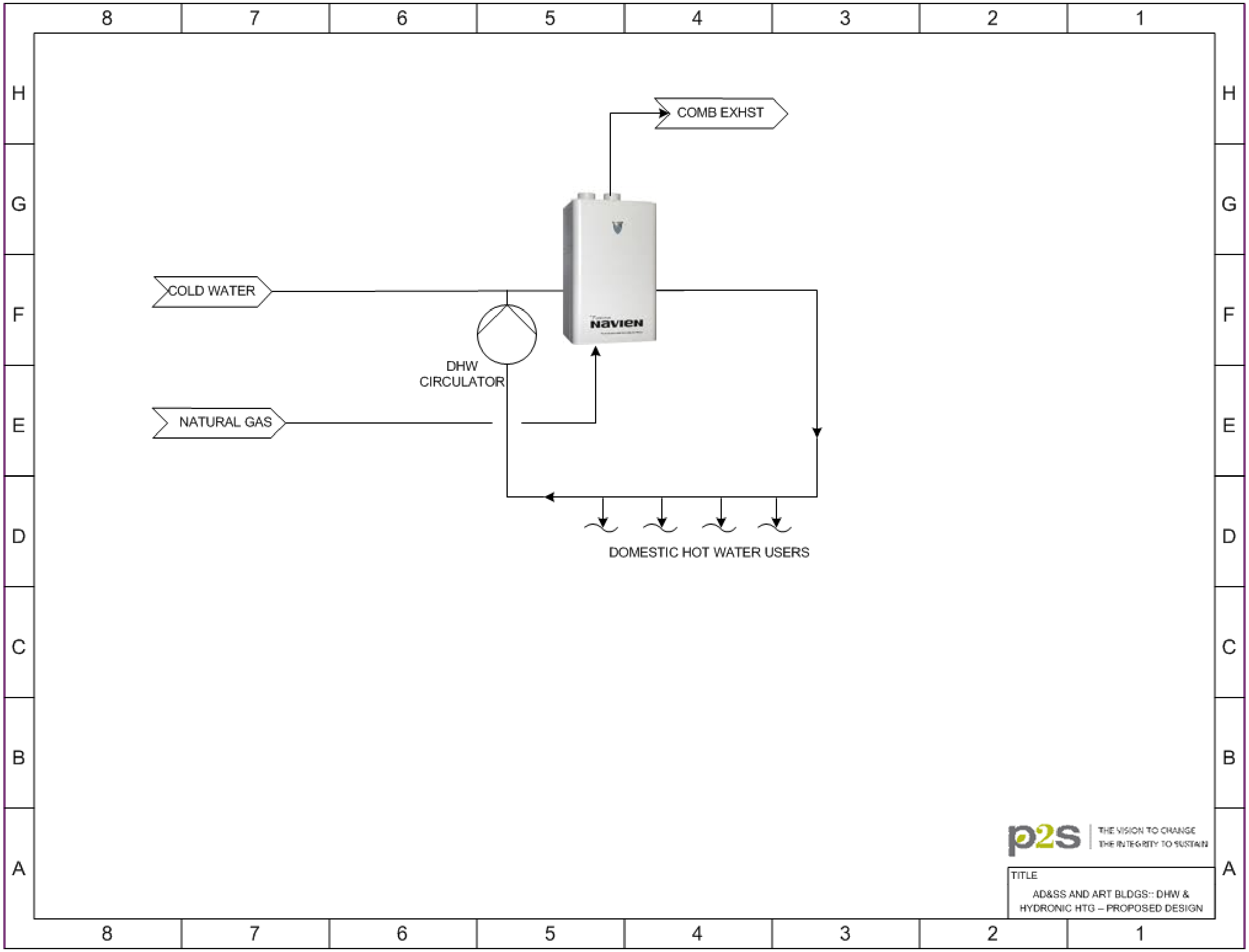
4.3.6 Comments and Observations

It is further recommended to implement this project as a green project by reusing every linear feet of copper pipe in the buildings, without disturbing them significantly. This will minimize the capital costs and reduce load on resources (copper pipes, insulation, conduits, cables etc). Use of DC pump circulators from roof mounted PV systems is encouraged.

It is also recommended to install set-back controls on the DHW systems (pumps and heaters) to achieve even further savings. Aquastats with timers are recommended for the retrofitted DHW systems.

If only DHW heaters are replaced from electric heaters to tankless gas water heaters, the following cost and payback statistics are observed

Figure 12 Proposed System Design



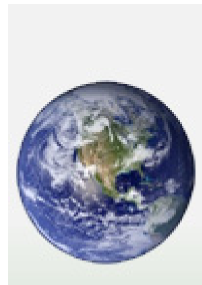
4.4 Not Used

4.5 ECM-05 Low Flush Urinals

4.5.1 Background

Low flush urinals contribute to water efficiency and help conserve water and energy.



This analysis is for all 5 Male Urinals of three buildings at SBCCD.

Figure 13 Installations of Flushed Male Urinals at SBCCD

This ECM reduces electrical energy associated with water pumping and sewage treatment included in savings. This is eco-friendly in nature reducing the carbon footprint of SBCCD.

4.5.2 Assumption

Table 26 Assumptions for ECM-5 Calculations

#	Parameter	Value	Comments
1	Cost of Water & Sewer ($/1000 Gallons)	$4.00	Reasonable Assumption
2	Male Urinals	5	From Plumbing Plans
3	Urinal's Flush Rate	1.6	Gallons/flush
4	Male Population of Buildings	200	50% of 300 Occupants @ 100 ft^2/occupant density
5	Flushes/day/Occupant	3	From ASPE Handbook
6	Academic days/Yr	250	Reasonable Assumption
7	Rebate	$-	No 2010 Rebates Available
8	Cartridges/Urinal/Yr	2.68	
9	Cost of Cartridges	$29	Manufacturer's Quote
10	New Reduced Flush Rate	0.125	1/8th Gallon Flush

4.5.3 Capital Cost

Table 27 Capital Cost Estimate

#	Parameter	Unit Cost	Qty	Item Cost	Notes/Comments
1	Installation cost per Waterfree urinal	750	5	$1,175	www.plumbingsupply.com
2	Waterfree Urinal cost	250	5	$1,250	CSI # 224213303140
3	**Total Installed Cost/Ea**	**$1,000**		**$5,000**	

4.5.4 Savings

Table 28 Savings for Zero Flush Urinals

#	Parameter	Value	Notes/Comments
1	Flushes/Day	600	=Assumption 4 * Assumption 5
2	Days/Yr	250	Assumption-6
3	Flushes/Yr	149,993	=flushes/day * Days/yr
4	Annual Water Usage (MG)	239.99	=Flushes -/Yr * Assumption-3 / 1000
5	Cost of Water & Sewer	$4.00	Assumption-1
6	Cost of Male Urinals ($/Yr)	$959	Operating Costs
7	Cost of Cartridges ($/Yr)	$469	
8	Net Savings	$490	
9	Water Savings with Pint Flush	217.37	MG/yr=flushes/yr*(Assumption 3-Assumption 10)/1000
10	Cost Savings with Pint Flush	$869.47	Savings per Year

4.5.5 Payback Analysis

Table 29 Payback Analysis for ECM-5

#	Parameter	DO+PDC+ATTC	ANNEX	Notes/Comments
1	Capital Cost	$1,000.00	$4,000	Prorated by Quantity
2	Rebates		$-	None
2	Savings $/ Yr	$173.89	$696	
5	Simple Payback(Yrs)	5.75	5.75	=(Capital costs-Rebates)/Savings

4.6 Not Used

4.7 ECM-07: Lighting Energy Conservation Measures

4.7.1 Background:

This ECM analyzes the Lighting in the three buildings being analyzed for energy conservation. LECM (Lighting Energy Conservation Measures) are defined in this ECM. LECMs provide general understanding of the equipment involved and the purpose of the measure. Some retrofits may make more economic sense when major tenant improvements or building modernizations are implemented.

The recommended foot-candle lighting levels per the Illuminating Engineering Society (IES) at 30" above finished floor are shown below:

Classrooms	50
Corridors/Foyers/Entry	10-20
Stairways	10-20
Dining	5-10
Kitchen	50
Offices	20-50
Toilets	10-20

Our recommendations are made to hold the foot-candle levels shown above.

The San Bernardino Community College District has implemented some lighting Energy Conservation measures. These include:

1. Energy saver lamps (34W T12) have been installed in the lighting fixtures at the Annex
2. LED exit signs have been installed.

The following item were identified during our surveying of the Applied Technology Training Center and require further attention.

There are three (3) rooms, Lecture Hall 1, Lecture Hall 2 and Executive Training with ceiling mounted occupancy sensors which were not operating correctly. We were in Lecture Hall 2 at 12 noon on May 27th 2010. The room was unoccupied. We returned at 1:00PM and the lights had not turned off from the occupancy sensor. We suggest these three (3) rooms sensors be checked by an electrician for proper installation, mounting and settings of the device and inspected by a commissioning agent to ensure proper operation. The current usage lighting is rated 5,208 watts. The potential savings is 2,614 kWh/yr with the occupancy sensors operating properly. We suggest setting the time delay to 5 minutes to shutoff lights after being unoccupied. The current T24 lighting code (California Code of Regulations - Title 24 states that lights should be shutoff in 30 minutes or less when not occupied. Additionally, the occupancy sensor is to have a visible status signal that indicates that is operating properly or has failed.

Table 30 Lighting Energy Conservation Measures-Annex

San Bernardino Community College – Annex Lighting Audit																						
	Existing Conditions								Post-Retrofit Conditions									Cost, Rebate & Payback Analysis				
Item #	Building	Location	Type	Fixture	Fixture Qty	Watts per fixture	Total kWatts	Total kWh	Replacement Fixture	ECM#	New Watts/fixture	Total kW	kW Demand Reduction	Total kW Demand Reduction	Operating Hours	kWh saved (kWh)/yr	Annual Cost Savings ($)	Installation Cost/fixture	Total Installed Cost ($)	Rebate	Simple Payback (Yrs)	Comments
1	Annex	Misc	Fluor	Troffer	118	151	17.8	69,490	Retrofit with 1-3 lamp electronic program start ballast and 3 - 28W - T8 lamps	1	97	11.5	0.1	6.3	3,900	24,759	$4,952	$70	$8,260	$5,942	0.5	2 ballasts in existing fixture with 4 34W T12 lamps. 4 lamp 2300 mean lumens average with .9 ballast factor or 8280 lumens. Go to 3 lamp 5th generation T8, 28W Sylvania 800 series lamps type F028XP/SS with Quicktronic High Efficieincy T8 ProStart Ballast for 3 lamps, QHE 3x32T8/UHV-PSH-HT, 8835 mean system lumens with 1.15 ballast factor or 10160 mean lumens. Also change reflector to a three lamp single ballast fixture. Suggest provide fixture number to Precision Lighting in Yorba Linda to make the custom reflector.
2	Annex	Misc	Fluor	Troffer	118	118	13.9	54,304		3					3,900	6,990	$1,398	$1,890	$7,080	$1,678	3.9	Deemed savings of 502kWh per kW.
3	Annex	Restrooms	Fluor	Surface Wrap	6	60	0.4	1,404	Retrofit with 2-28W T8	1	50	0.3	0.0	0.1	3,900	415	$83	$55	$330	$100	2.8	Hard lid ceiling. The on/off switch currently controls the exhaust fan and will need to be maintained. Existing fixtures are 2 lamp, T12 with 34W lamps, electronic ballast.
4	Annex	Restrooms	Fluor	Surface Wrap	6	50	0.3	1,170		3					3,900	151	$30		$126	$36	3.0	
							Total Savings:									49,309	$8,959		$22,568	$11,834	1.20	

Table 31 Lighting Energy Conservation Measures-Annex

San Bernardino Community College - Applied Technology Training Center, District Office and Professional Development Center - Lighting Audit																						
Item #				Existing Conditions								Post-Retrofit Conditions						Cost, Rebate & Payback Analysis				
	Building	Location	Type	Fixture	Fixture Qty	Watts per fixture	Total kWatts	Total kWh	Replacement Fixture	ECM#	New Watts/ fixture	Total kW	kW Demand Reduction	Total kW Demand Reduction	Operating Hours	kWh saved (kWh)/yr	Annual Cost Savings ($)	Installation Cost/fixture	Total Installed Cost ($)	Rebate	Simple Payback (Yrs)	Comments
1	ATTC	Foyer	Fluor	Recessed	17	32	0.5	1,697		7					3,120	1,188	$175		$500	$285	1.2	The ceiling tiles are non-removable type. Install wireless photocell control for the fixtures. We have assumed that 70% of the time the lights can be off. Need to separate the switching of the foyer from the adjoining hallway. Lights currently controlled by lighting control panel.
2	ATTC	Hallway	Fluor	Recessed	12	32	0.4	1,198		3					3,120	134	$20		$250	$32	11.0	Install photocell control to shutoff alternate fixture based on daylighting level. We measured 20-30 footcandles at the floor with every other fixture off. Need to separate the switching of the this hallway and the foyer 1x4 fixtures. This is a joint project with the Foyer. Lights currently controlled by lighting control panel.
3	ATTC	Restrooms	Fluor	Recessed 1x4 Deep Cell With Asymetric Reflector	15	58	0.9	2,714		15					3,120	1,357	$199	$25	$375	$326	0.2	Eliminate one lamp in two lamp fixture. Hard lid type ceiling.
4	ATTC	Reception	Fluor	Recessed	12	58	0.7	2,172		3					3,120	349	$51		$126	$84	0.8	Currently 3 way switched.
5	PDC	Classrooms and restrooms	Fluor	Pendant	133	62	8.2	29,158		3					3,536	4,139	$608		$1,008	$993	0.02	Assumes 2 ceiling mounted occupancy sensors per room. Layin ceiling in classrooms and hard lid in restroom. Could go to wireless in restroom but installation cost impact.
6	PDC	Offices/Corri dors	Fluor	DeepCell Parabolics	17	92	1.6	5,530		3					3,536	785	$115		$630	$188	3.8	Layin ceiling.
7	PDC	Board Room	CFL	RecessedCans	57	92	5.2	18,543		3					3,536	2,632	$387		$700	$632	0.2	Hard lid ceiling at 12'2".
8	District Offices	Lounge/Offic es/ Hallway	Deep Cell Para- bolics	DeepCell Parabolics	127	92	11.7	41,315		3					3,536	5,865	$862		$2,457	$1,408	1.2	
9	Distict Offices	Men /Womens Restrooms	Fluor	Recessed	4	62	0.2	877		3					3,536	124	$18		$126	$30	5.3	
10	District Offices	Daylighted Hallways	Fluor	Wall Mount	18	62	1.1	4,002							3,586	419	$62		$600	$100	8.1	Savings combined with item 15. Separate photocell in skylight are in center, one photocell for all three skylights. Assume 50% reduction of energy after the occupancy sensors are installed.
11	District Offices	Daylighted Hallways	Fluor	CeilingMtg	6	92	0.6	1,979							3,586							Combined with line item 14. Separate photocell in center part of corridor with 2x4.
Total Savings:																16,995	$2,497		$6,772	$4,079	1.08	

4.7.2 LECM -1: Replace magnetic ballast and T12 lamps in existing fixtures with electronic Ballast and T8 lamps.

4.7.2.1 T8 Lamp with Electronic Ballast

Replacing magnetically ballasted T12 linear fluorescent lamps with electronically ballasted fourth generation 25W T8 lamps reduces lighting energy consumption by over 25%. The T8 lamps are approximately 40% more efficient than the T12 lamps and deliver more lumens when installed in the same fixture due to limited light loss between lamps. In addition, they generally last 20% longer than the older T12s.

This combination not only provides energy savings, but also reduces operations and maintenance costs. It also makes a T12 to T8 retrofit one of the most cost effective upgrades; two-year payback is typical and payback in a year is common for facilities with long hours of operation.

4.7.2.2 Electronic Fluorescent Ballasts

In conjunction with the T8 lamps, new electronic ballasts are much more efficient than older magnetic ballasts for fluorescent lighting. Magnetic ballasts convert more of their input energy into heat, which creates two problems: extra energy consumption and extra heat for the HVAC system to handle.

There are two additional benefits to replacing magnetic ballasts with electronic units. Magnetic ballasts also produce noise due to the vibrations of the transformers and light flickering, which is especially noticeable when using a computer monitor. Electronic units eliminate the noise and the flicker.

Dimming ballasts allow the lighting levels to be adjusted, either with photocell, manual, or automatic controls. This control provides the perfect amount of lighting near windows and reduces energy wasted on excess lighting levels. Standard ballasts are not dimmable, but still provide all the other benefits described.

4.7.2.3 LECM -3: Control Interior Light Fixtures with Occupancy Sensors

Occupancy sensors react to motion/sound using passive infrared and ultrasonic technologies. The application determines what type to use and some require dual or both of the technologies. Generally sensors are ceiling mounted to maximize the coverage areas. Time delays are also used to limit on/off operations of lights which can be obtrusive. The ballast type must be selected to coincide with the anticipated on/off operations.

4.7.4 LECM-7: Install day lighting controls for a group of fixtures with astronomical time clock and photocells

A time clock can be used to automatically program when equipment turns on and off. This reduces energy waste and ultimately saves money.

Different times of the year have different amounts of daylight, thus it is important that a time clock adjusts for this; an astronomic time clock is suggested for these applications. This type of time clock compensates for daylight savings time and is programmed for a specific geographic location. Even through astronomic time clocks are more expensive we recommend these be used to minimize maintenance department's time in adjusting standard time clocks throughout the year.

A photocell is another device used to automatically turn equipment on and off. The difference is that a photocell is activated by the presence and absence of daylight. Generally you want lights not operating when natural daylight is present. This too reduces energy waste and ultimately saves money.

A time clock is often used in conjunction with a photocell and vice versa.

4.7.5 LECM-15: Reduce number of lamps in a fixture.

There are downward trends in levels of light recommended by Illuminating Engineering Society practices. This means that older buildings are sometimes over lit. It is possible to reduce some fixtures by simply removing one of the lamps in each fixture. Other fixtures require re-ballasting to remove a lamp. Additionally, some fixtures require reflector changes to reposition the lamp and ballast to provide optimum light from the fixture.

4.8 Not Used

5.0 Action Items & Closure

After multiple walkthroughs and observing major energy consuming equipment at SBCCD, seven ECMS are recommended in this report. Some ECMs are more promising than others and other ECMs require more accurate data collection (M&V) to accurately quantify the savings and payback analysis than others.

The list below in this final section of the report attempts to provide opportunities for further evaluation and some good housekeeping practices. These items were observed during the site visits of the energy conservation study.

5.1 PDC and Administration Offices

5.1.1 Exhaust fan set-back controls in EMS

5.1.2 Reduce Plug Loads. Investigate in detail the plug load components and have a plug load management plan. Replace appliances like Computers, Monitors, and Refrigerators with Energy Star rating.

5.1.3 Turn off desk top computers at night and while not on desk.

5.2 ATTC

5.2.1 Reduce plug loads

5.2.2 Reduce Plug Loads. Investigate in detail the plug load components and have a plug load management plan. Replace appliances like Computers, Monitors, and Refrigerators with Energy Star rating.

5.3 Annex

5.3.1 Some task lights have incandescent lamps, which need to be replaced with CFLs

5.3.2 Replaced printing machinery should be energy efficiency and preferably have Energy Star rating on it.

5.3.3 Reduce Plug Loads. Investigate in detail the plug load components and have a plug load management plan. Replace appliances like computers, monitors, and refrigerators with Energy Star rating.

5.4 Plug Load Reduction

5.4.1 Background:

Plug load is defined as load which is served by plugs. These plugs can provide power to any device with a cord and are generally not controlled. Design drawings for new buildings provide plugs at convenient locations or to tie to locations of portable equipment or task related items. Plugs are generally not used for general lighting or HVAC.

5.4.2 District Offices

Based on the Baseline Energy Consumption Analysis of Section 3,, the estimated plug load is in the range of 41.5 kW to 44 kW.

Appliances, Computers and Printers are the significant part of plug load. There are forty (40) networked computers in the District Office and forty two (42) in the Applied Technology Training Center.

5.4.3 Annex

Based on the Baseline Energy Consumption Analysis of Section 3, the estimated plug load is in the range of 18 kW to 39 kW range.

Kitchen equipment in break room, computers, office printers and printing equipment comprise of plug loads. Plug loads vary based on season, printing demand and work schedules.

5.4.4 Manual Methods to Control Plug Load

The lowest cost way to reduce electrical use is by turning off equipment when not in use. Many Energy Star products have automatic means of turning of devices such as monitors which are properly set to go into sleep mode or to actually turn off after a period of time.

5.4.5 Automated Methods to Control Plug Load

The biggest culprit of energy waste is the small power supplies that stay on even when a piece of equipment is turned off. Therefore to truly turn of the power you need to turn off the power supply feeding that equipment. A few of these are shown and are common with printers, cell phones, faxes, etc.

This can be done using motion sensors at desks to shutdown all the loads at the desk such as task lighting, heaters, printers, monitors, computers, etc. Another means is to have a power strip with a controlling outlet and other controlled outlets. When the controlling outlet is turned off or at reduced power the controlled outlets are automatically turned off. Specifications and technical information for such products are attached below through the www (World Wide Web) links.

- HTTP://WWW.SMARTHOMEUSA.COM/SHOP/SMART-ENERGY/SMART-STRIP/
- HTTP://WWW.WATTSTOPPER.COM/GETDOC/1105/11907_ISOLE_12-2009.PDF

5.4.6 Further Study

We suggest further study including doing an inventory of the plug load, how it is controlled currently and looking at various manual an automated methods to control costs. We have attempted to draw your attention through pictures in this section about the plug loads and even documented an ECM for energy star Soda cooler. We found CRT (Cathode Ray Tube) computer monitors and clunker refrigerators, operational incandescent lamps for task lighting and electric heaters for unoccupied office space.

5.4.5 Energy Star Policy

SBCCD can embrace a policy to buy all the equipment that is rated with energy star logo, at its minimum. This includes refrigerators, soda coolers, fluorescent lamps being replaced, water dispensing machines, printers, monitors, fax machines, microwaves, toasters, window glazing etc. A wealth of information is available for free at WWW.ENERGYSTAR.GOV regarding the products and energy management plans for commercial buildings, which guides the building operators on how to engage the building users for energy utilization consciousness. In particular, we draw your attention to resources for higher education facilities available at HTTP://WWW.ENERGYSTAR.GOV/INDEX.CFM?C=HIGHER_ED.BUS_HIGHEREDUCATION.