LEVEL II ENERGY AUDIT

A Bureau Veritas Group Company

Sacramento City Unified School District
5735 47th Avenue
Sacramento, California 95824

DLR Group
1050 20th Street, Suite 250
Sacramento, California 95969

ALICE BIRNEY PUBLIC WALDORF

6251 13th Street
Sacramento, California 95831

PREPARED BY:
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EMG PROJECT #:

136988.19R000-069.268

DATE OF REPORT:

October 24, 2019

ONSITE DATE:

September 23, 2019

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Certification

EMG has completed an Energy Audit of Alice Birney Public Waldorf located at 6251 13th Street in Sacramento, California. EMG visited the site on September 23, 2019, located 6251 13th Street, Sacramento, California 95831

The assessment was performed at the Client's request using methods and procedures consistent with ASHRAE Level II Energy Audit and using methods and procedures as outlined in EMG's Proposal.

This report has been prepared for and is exclusively for the use and benefit of the Client identified on the cover page of this report. The purpose for which this report shall be used shall be limited to the use as stated in the contract between the client and EMG.

This report, or any of the information contained therein, is not for the use or benefit of, nor may it be relied upon by any other person or entity, for any purpose without the advance written consent of EMG. Any reuse or distribution without such consent shall be at the client's or recipient's sole risk, without liability to EMG.

Estimated installation costs are based on EMG's experience on similar projects and industry standard cost estimating tools including *RS Means and Whitestone CostLab*. In developing the installed costs, EMG also considered the area correction factors for labor rates for Sacramento, California. Since actual installed costs may vary widely for particular installation based on labor and material rates at time of installation, EMG does not guarantee installed cost estimates and shall in no event be liable should actual installed costs vary from the estimated costs herein. We strongly encourage the owner to confirm these cost estimates independently. EMG does not guarantee the costs savings estimated in this report. EMG shall in no event be liable should the actual energy savings vary from the savings estimated herein.

EMG certifies that EMG has no undisclosed interest in the subject property and that EMG's employment and compensation are not contingent upon the findings or estimated costs to remedy any deficiencies due to deferred maintenance and any noted component or system replacements.

Any questions regarding this report should be directed to Kaustubh Anil Chabukswar at 800.733.0660, ext. 7512.

Prepared by: Rashad Alnial
Energy Auditor
Project Manager

Reviewed by:

Al Diefert
Technical Report Reviewer
For
Kaustubh Anil Chabukswar, CEM CRM
Program Manager

1. Executive Summary

The purpose of this Energy Audit is to provide Sacramento City Unified School District and Alice Birney Public Waldorf with a baseline of energy usage and the relative energy efficiency of the facility and specific recommendations for Energy Conservation Measures. Information obtained from these analyses may be used to support a future application to an Energy Conservation Program, Federal and Utility grants towards energy conservation, support performance contracting, justify a municipal bond funded improvement program, or as a basis for replacement of equipment or systems.

BLDG #	STRUCTURES ASSESSED	BUILDING TYPE	EMG CALCULATED AREA (SF)	ESTIMATED OCCUPANCY
1	Offices and Kindergarten -001	Office and Classroom	5046	88
2	Multi Purpose- 002	Cafeteria and Kitchen	5503	97
3	Classrooms 3 to 7- 003	Classroom	6464	113
4	Library and classrooms 9 TO 12	Classroom	6145	108
5	Storage-005	Storage	800	1
6	Portable Classrooms 13 to 15-P01	Classroom	2880	50
7	Portable Classrooms 16 to 18-P02-P03-P04	Classroom	2880	50
8	Portable Classroom 20 to 23-P07 and P 08	Classroom	960	17
9	Portable Classroom 20 to 23-P07 and P 08	Classroom	4320	76

The study included a review of the building's construction features, historical energy and water consumption and costs, review of the building envelope, HVAC equipment, heat distribution systems, lighting, and the building's operational and maintenance practices.

1.1. Energy Conservation Measures

EMG has identified Five Energy Conservation Measures (ECMs) for this property. The savings for each measure is calculated using standard engineering methods followed in the industry, and detailed calculations for ECM are provided in Appendix for reference. A 10% discount in energy savings was applied to account for the interactive effects amongst the ECMs. In addition to the consideration of the interactive effects, EMG has applied a 15% contingency to the implementation costs to account for potential cost overruns during the implementation of the ECMs.

The following table summarizes the recommended ECMs in terms of description, investment cost, energy consumption reduction, and cost savings.

Summary of Financial Information for Recommended Non-Renewable Energy Conservation Measures

ITEM	ESTIMATE
Net Initial ECM Investment *(Current Dollars Only)*	$ 59,009 *(In Current Dollars)*
Estimated Annual Cost Savings *(Current Dollars Only)*	$10,949 *(In Current Dollars)*
ECM Effective Payback	5.39 years
Estimated Annual Energy Savings	33.64%

ITEM	ESTIMATE
Estimated Annual Energy Utility Cost Savings *(Excluding Water)*	20.17%
Estimated Annual Water Cost Saving	6.83%

Solar Photovoltaic (PV) Screening for Alice Birney Public Waldorf

SOLAR ROOFTOP PHOTOVOLTAIC ANALYSIS	
Estimated Number of Panels	369
Estimated KW Rating	116 KW
Potential Annual kWh Produced	178,430 kWh
% of Current Electricity Uses	86.7%
FINANCIAL SUMMARY	
Investment Cost	$406,700
Estimated Energy Cost Savings	$30,333
Payback without Incentives	13.4 Years
Incentive Payback but without SRECs	8.1 Years
Payback with All Incentives	8.1 Years

Key Metrics to Benchmark the Subject Property's Energy Usage Profile

- Building Site Energy Use Intensity - The sum of the total site energy use in thousands of Btu per unit of gross building area. Site energy accounts for all energy consumed at the building location only not the energy consumed during generation and transmission of the energy to the site.
- Building Source Energy Use Intensity – The sum of the total source energy use in thousands of Btu per unit of gross building area. Source energy is the energy consumed during generation and transmission in supplying the energy to your site.
- Building Cost Intensity - This metric is the sum of all energy use costs in dollars per unit of gross building area.
- Greenhouse Gas Emissions - Although there are numerous gases that are classified as contributors to the total for Greenhouse Emissions, the scope of this energy audit focuses on carbon dioxide (CO_2). Carbon dioxide enters the atmosphere through the burning of fossil fuels (oil, natural gas, and coal), solid waste, trees and wood products, and also as a result of other chemical reactions (e.g., manufacture of cement).

SITE ENERGY USE INTENSITY (EUI)	RATING
Current Site Energy Use Intensity (EUI)	33 kBtu/ft^2
Post ECM Site Energy Use Intensity (EUI)	22 kBtu/ft^2
SOURCE ENERGY USE INTENSITY (EUI)	**RATING**
Current Source Energy Use Intensity (EUI)	80 kBtu/ft^2
Post ECM Source Energy Use Intensity (EUI)	63 kBtu/ft^2
BUILDING COST INTENSITY (BCI)	**RATING**
Current Building Cost Intensity	$1.15/ft^2

BUILDING COST INTENSITY (BCI)	RATING
Post ECM Building Cost Intensity	$0.92/ft^2

Summary of the Greenhouse Gas Reductions from Recommended Non-Renewable Energy Conservation Measures

The following table provides a summary of the projected Greenhouse Gas Emissions reductions as a result of the recommended Energy Conservation Measures:

GREENHOUSE GAS EMISSIONS REDUCTION	
Estimated Annual Thermal Energy Reduction	386 MMbtu
Total CO_2 Emissions Reduced	24.19 MtCO_2/Yr
Total Cars Off the Road (Equivalent)*	4
Total Acres of Pine Trees Planted (Equivalent)*	5

**Equivalent reductions per DOE emissions calculation algorithms*

Zero Net Energy Analysis for Renewable and Non-Renewable Recommended Measures

ZERO NET ENERGY ANALYSIS	
Building Annual Net Energy Consumption	1,148,124 kBtu
Total Annual Energy Savings for Non-Renewable Energy Measures	455,206 kBtu
Total Annual Energy Savings from Renewable Energy Measures	608,803 kBtu
Net Energy Consumption from Grid Post Implementation	84,115 kBtu
% Energy Reduction (Renewable + Non- Renewable)	93%

Energy Conservation Measures Screening:

EMG screens ECMs using two financial methodologies. ECMs which are considered financially viable must meet both criteria.

1. Simple Payback Period –The number of years required for the cumulative value of energy or water cost savings less future non-fuel or non-water costs to equal the investment costs of the building energy or water system, without consideration of discount rates. ECMs with a payback period greater than the Expected Useful Life (EUL) of the project are not typically recommended, as the cost of the project will not be recovered during the lifespan of the equipment. These ECMs are recommended for implementation during future system replacement. At that time, replacement may be evaluated based on the premium cost of installing energy efficient equipment.

$$Simple\ Payback = \frac{Initial\ Cost}{Annual\ Savings}$$

2. Savings-to-Investment Ratio (SIR) – The savings-to-investment ratio is the ratio of the present value savings to the present value costs of an energy or water conservation measure. The numerator of the ratio is the present value over the estimated useful life (EUL) of net savings in energy or water and non-fuel or non-water operation and maintenance costs attributable to the proposed energy or water conservation measure. The denominator of the ratio is the present value of the net increase in investment and replacement costs less salvage value attributable to the proposed energy or water conservation measure. It is recommended that energy efficiency recommendations should be based on a calculated SIR, with larger SIRs receiving a higher priority. A project is typically only recommended if SIR is greater than or equal to 1.0, unless other factors outweigh the financial benefit.

$$SIR = \frac{Present\ Value\ (Annual\ Savings, i\%, EUL)}{Initial\ Cost}$$

List of Recommended Energy Conservation Measures For Alice Birney Public Waldorf

ECM #	Description of ECM	Projected Initial Investment	Estimated Annual Energy Savings		Estimated Annual Water Savings	Estimated Cost Savings	Estimated Annual O&M Savings	Total Estimated Annual Cost Savings	Simple Payback	S.I.R.	Life Cycle Savings	Expected Useful Life (EUL)
			Natural Gas	Electricity								
		$	Therms	kWh	kgal	$	$	$	Years		$	Years
No/Low Cost Recommendations												
1	Install Low Flow Faucet Aerators Location: Throughout	$746	3,173	0	321	$5,822	$0	$5,822	0.13	66.53	$48,913	10.00
Totals for No/Low Cost Items		**$746**	**3,173**	**0**	**321**	**$5,822**	**$0**	**$5,822**	**0.13**			
Capital Cost Recommendations												
1	Install Timers On Exhaust Fans Location:Throughout	$1,416	113	657	0	$257	$0	$257	5.51	2.17	$1,650	15.00
2	Replace Existing Water Heater With New Energy Efficient Units Location:Throughout	$4,608	54	3,448	0	$646	$0	$646	7.13	1.93	$4,279	18.00
3	Upgrade Building Lighting to LED and Install Automatic Lighting Controls Location: Building Interior And Exterior	$44,543	0	23,783	0	$3,972	$1,470	$5,441	8.19	1.46	$20,417	15.00
Total For Capital Cost		**$50,566**	**167**	**27,888**	**0**	**$4,875**	**$1,470**	**$6,344**	**7.97**			
	Interactive Savings Discount @ 10%		-334	-2,789	-32	-$1,070	-$147	-$1,217				
	Total Contingency Expenses @ 15%	$7,697										
Total for Improvements		**$59,009**	**3,006**	**25,099**	**289**	**$9,627**	**$1,323**	**$10,949**	**5.39**			

In addition to the above measures, EMG has identified the following measure(s) but has not recommended as they fail to meet the above-mentioned financial criteria of SIR>1.0. Thus, EMG has classified the measure(s) as recommended for consideration.

List of Recommended For Consideration Energy Conservation Measures For Alice Birney Public Waldorf

ECM #	Description of ECM	Initial Investment	Annual Energy Savings		Annual Water Savings	Cost Savings	Estimated Annual O&M Savings	Total Estimated Annual Cost Savings	Payback	S.I.R.	Life Cycle Savings	Expected Useful Life (EUL)
		$	Natural Gas	Electricity	kgal	$	$	$	Years		$	Years
1	Install Low Flow Tankless Restroom Fixtures Location: Througout	$38,075	0	0	411	$2,173	$0	$2,173	17.52	0.68	-$12,134	15.00
Total for Improvements		**$38,075**	**0**	**0**	**411**	**$2,173**	**$0**	**$2,173**	**17.52**			

2. Introduction

The purpose of this Energy Audit is to provide Alice Birney Public Waldorf and Sacramento City Unified School District with a baseline of energy usage, the relative energy efficiency of the facility, and specific recommendations for Energy Conservation Measures. Information obtained from these analyses may be used to support a future application to an Energy Conservation Program, Federal and Utility grants towards energy conservation, as well as support performance contracting, justify a municipal bond-funded improvement program, or as a basis for replacement of equipment or systems.

The energy audit consisted of an onsite visual assessment to determine current conditions, itemize the energy consuming equipment (i.e. Boilers, Make-Up Air Units, DWH equipment); review lighting systems both exterior and interior; and review efficiency of all such equipment. The study also included interviews and consultation with operational and maintenance personnel. The following is a summary of the tasks and reporting that make up the Energy Audit portion of the report.

The following is a summary of the tasks and reporting that make up the Energy Audit portion of the report.

ENERGY AND WATER USING EQUIPMENT

- EMG has surveyed the common areas, office areas, rooms, maintenance facilities and mechanical rooms to document utility-related equipment, including heating systems, cooling systems, air handling systems and lighting systems.

BUILDING ENVELOPE

- EMG has reviewed the characteristics and conditions of the building envelope, checking insulation values and conditions. This review also includes an inspection of the condition of walls, windows, doors, roof areas, insulation and special use areas

RECOMMENDATIONS FOR ENERGY SAVINGS OPPORTUNITIES

- Based on the information gathered during the on site assessment, the utility rates, as well as recent consumption data and engineering analysis, EMG has identified opportunities to save energy and provide probable construction costs, projected energy/utility savings and provide a simple payback analysis.

ANALYSIS OF ENERGY CONSUMPTION

- Based on the information gathered during the on-site assessment, EMG has conducted an analysis of the energy usage of all equipment, and identified which equipment is using the most energy and what equipment upgrades may be necessary. As a result, equipment upgrades, or replacements are identified that may provide a reasonable return on the investment and improve maintenance reliability.

ENERGY AUDIT PROCESS

- Interviewing staff and review plans and past upgrades
- Performing an energy audit for each use type
- Performing a preliminary evaluation of the utility system
- Analyzing findings, utilizing ECM cost-benefit worksheets
- Making preliminary recommendations for system energy improvements and measures
- Estimating initial cost and changes in operating and maintenance costs based on implementation of energy efficiency measures
- Ranking recommended cost measures, based on the criticality of the project and the largest payback

REPORTING

The EMG Energy Audit Report includes:

- A comprehensive study identifying all applicable Energy Conservation Measures (ECMs) and priorities, based on initial cost and payback
- A narrative discussion of building systems/components considered and a discussion of energy improvement options;
- A summary of ECMs including initial costs and simple paybacks, based on current utility rates and expected annual savings.

3. Facility Overview and Existing Conditions

3.1. Building Occupancy and Point of Contact

FACILITY SCHEDULE	
Hours of Operations / Week	35
Operational Weeks / Year	37
Estimated Facility Occupancy	600
% of Male Occupants	Assuming 50% Male Occupants

POINT OF CONTACT	
Point of Contact Name	Ralph (Mike) Cinciripino
Point of Contact Title	Plant manager
Point of Contact – Contact Number	916-694-8926

3.2. Building Heating, Ventilating and Air-Conditioning (HVAC)

Description:

Heating and cooling are mainly provided by two rooftop packaged units, Heat Pumps and Ductless Split Systems. The Mechanical Equipment Schedule in Appendix E contains a summary of the HVAC Equipment at the property.

BUILDING CENTRAL HEATING SYSTEM	
Primary Heating System	Heatpump System
Secondary Heating System	-
Hydronic Distribution System	Not Applicable
Primary Heating Fuel	Natural Gas
Heating Mode Set-point	69
Heating Mode- Set-back Temperature	53

BUILDING COOLING SYSTEM	
Primary Cooling System	Package Units
Secondary Cooling System	None
Hydronic Distribution System	-

BUILDING COOLING SYSTEM	
Cooling Mode Set-point	68
Cooling Mode- Set-back Temperature	93

AIR DISTRIBUTION SYSTEM	
Building Ventilation	Roof Top Exhaust Fans
On-Demand Ventilation System in Use?	No
Energy Recovery Wheel / Enthalpy Wheel Exhaust Fans	No

DOMESTIC HOT WATER SYSTEM	
Primary Domestic Water Fuel	Natural Gas

3.3. Lighting

Description:

The lighting in the school building primarily consists of T8 linear fluorescent lamp fixtures in classrooms and hallways. The fixtures were observed to be operating on bi-level mode in the classrooms. The exterior lights were primarily Linear Fluorescent and High Intensity Discharge (HID)

The detailed lighting schedule and the proposed LED alternative is provided in Appendix D

4. Utility Analysis

Establishing the energy baseline begins with an analysis of the utility cost and consumption of the building. Utilizing the historical energy data and local weather information, we evaluate the existing utility consumption and assign it to the various end-uses throughout the buildings. The Historical Data Analysis breaks down utilities by consumption, cost and annual profile.

This data is analyzed, using standard engineering assumptions and practices. The analysis serves the following functions:

- Allows our engineers to benchmark the energy and water consumption of the facilities against consumption of efficient buildings of similar construction, use and occupancy.
- Generates the historical and current unit costs for energy and water
- Provides an indication of how well changes in energy consumption correlate to changes in weather.
- Reveals potential opportunities for energy consumption and/or cost reduction. For example, the analysis may indicate that there is excessive, simultaneous heating and cooling, which may mean that there is an opportunity to improve the control of the heating and cooling systems.

By performing this analysis and leveraging our experience, our engineers prioritize buildings and pinpoint systems for additional investigation during the site visit, thereby maximizing the benefit of their time spent on-site and minimizing time and effort by the customer's personnel.

Based upon the utility information provided about the Sacramento City Unified School District, the following energy rates are utilized in determining existing and proposed energy costs.

Utility Rates used for Cost Analysis

ELECTRICITY (BLENDED RATE)	NATURAL GAS	WATER / SEWER
$0.17 /kWh	$1.3/therm	$ 5.29kGal

The data analyzed provides the following information: 1) breakdown of utilities by consumption, 2) cost and annual profile, 3) baseline consumption in terms of energy/utility at the facility, 4) the Energy Use Index, or Btu/sq ft, and cost/sq ft. For multiple water meters, the utility data is combined to illustrate annual consumption for each utility type.

4.1. Electricity

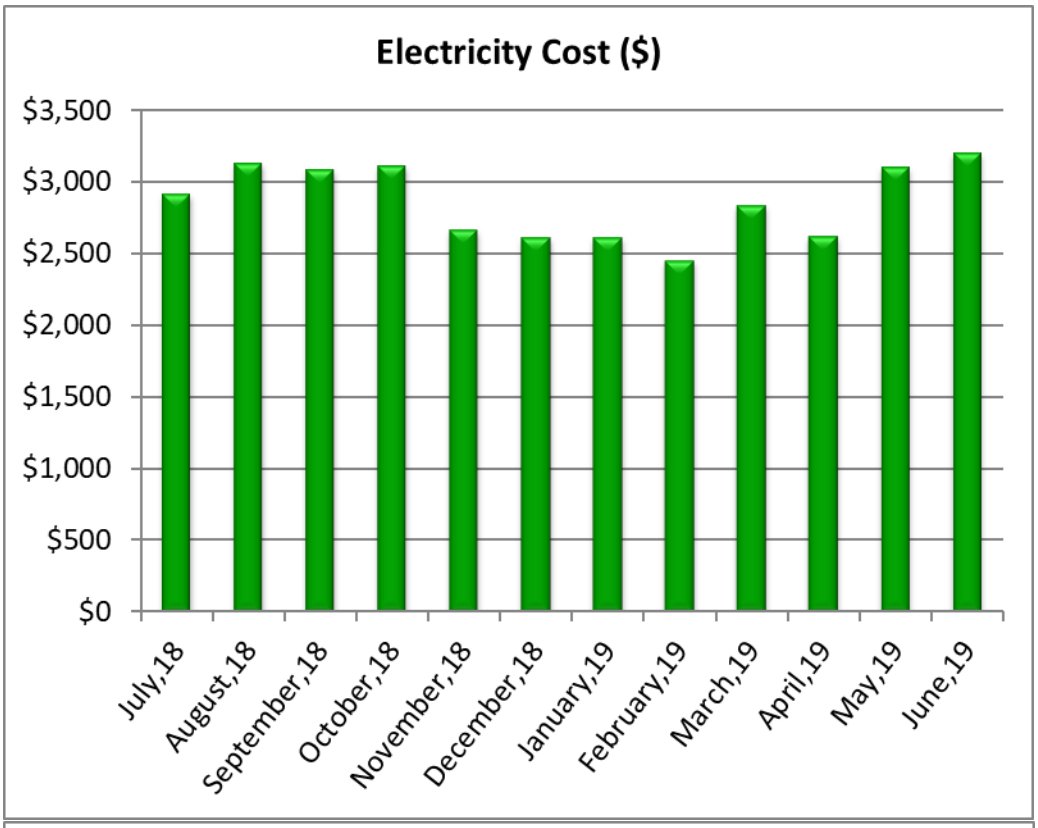
PGE satisfies the electricity requirements for the facility. The primary end uses for electric utility compromises of lighting, cooling, office/school equipment, and appliances in the break room.

The table below provides the electric use for the period of twelve continuous months.

Electric Consumption and Cost Data

BILLING MONTH	CONSUMPTION (KWH)	UNIT COST/KWH	TOTAL COST
July,18	15,303	$0.19	$2,917
August,18	18,027	$0.17	$3,136
September,18	19,449	$0.16	$3,086
October,18	19,483	$0.16	$3,113
November,18	16,506	$0.16	$2,666
December,18	16,051	$0.16	$2,615
January,19	15,812	$0.17	$2,618

BILLING MONTH	CONSUMPTION (KWH)	UNIT COST/KWH	TOTAL COST
February,19	15,153	$0.16	$2,455
March,19	16,909	$0.17	$2,835
April,19	15,463	$0.17	$2,625
May,19	19,191	$0.16	$3,104
June,19	18,463	$0.17	$3,203
Total/average	**205,810**	**$0.17**	**$34,372**


Electricity Cost ($)
$3,500
$3,000
$2,500
$2,000
$1,500
$1,000
$500
$0
July,18
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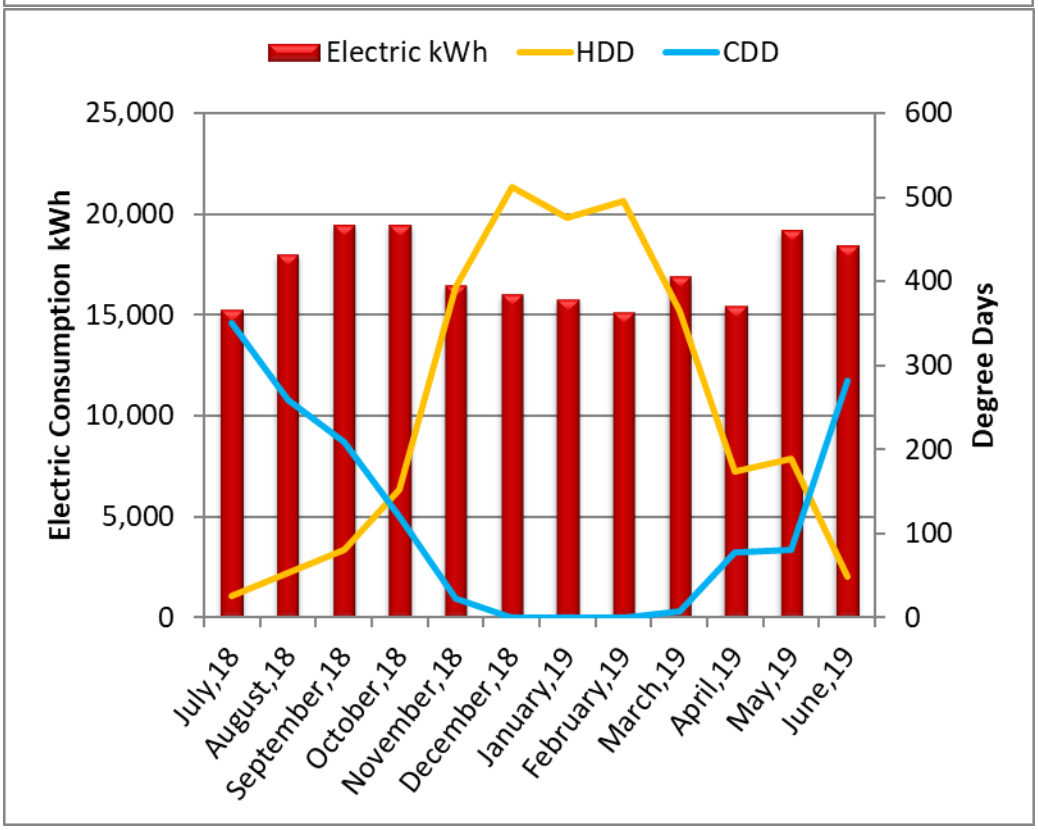
September,18
October,18
November,18
December,18
January,19
February,19
March,19
April,19
May,19
June,19


Electric kWh
HDD
CDD
Electric Consumption kWh
25,000
20,000
15,000
10,000
5,000
0
Degree Days
600
500
400
300
200
100
0
July,18
August,18
September,18
October,18
November,18
December,18
January,19
February,19
March,19
April,19
May,19
June,19

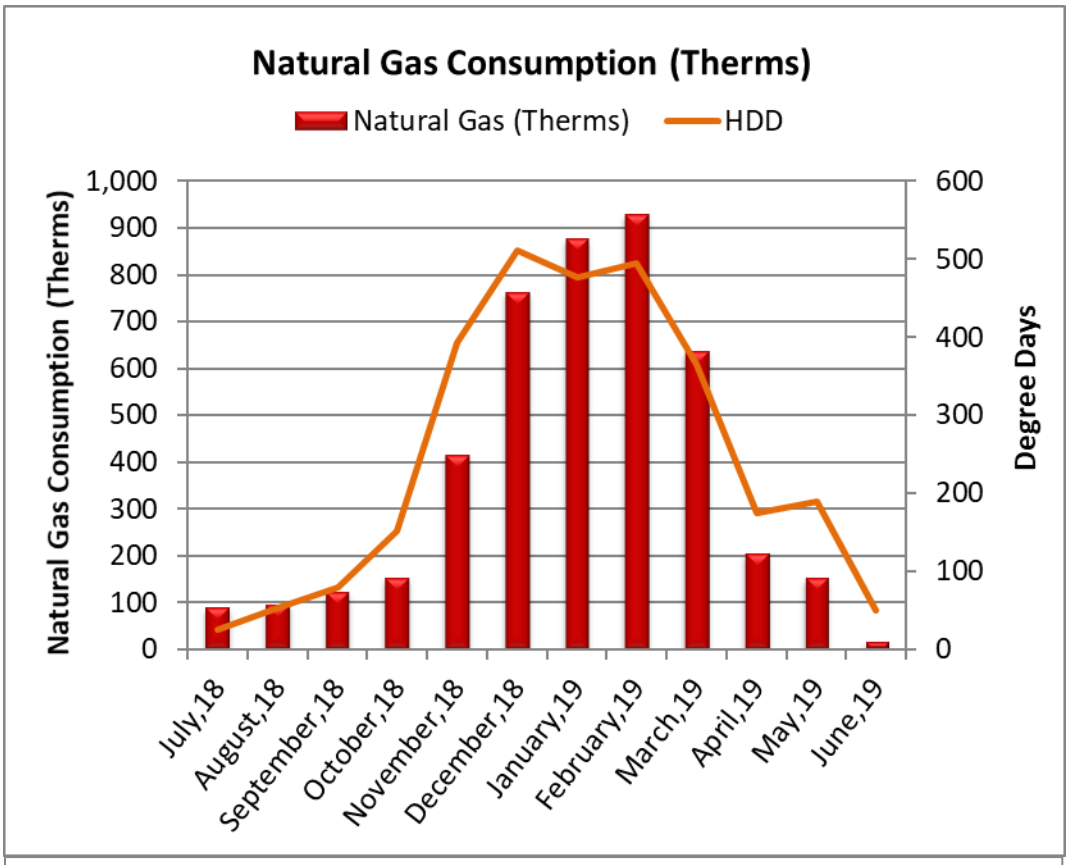
4.2. Natural Gas

Spurr Gas satisfies the natural gas requirements of the facility. The primary end use of natural gas is for building heating, domestic water heating, and cooking in the cafeteria.

The analysis of the 12 months of consumption is provided below.

Natural Gas Consumption and Cost Data

BILLING MONTH	CONSUMPTION (THERMS)	UNIT COST/THERM	TOTAL COST
July,18	**90**	**$1.40**	**$127**
August,18	**96**	**$1.31**	**$126**
September,18	**123**	**$1.26**	**$155**
October,18	**153**	**$1.20**	**$184**
November,18	**416**	**$1.24**	**$515**
December,18	**762**	**$1.35**	**$1,031**
January,19	**878**	**$1.30**	**$1,138**
February,19	**931**	**$1.31**	**$1,216**
March,19	**638**	**$1.32**	**$842**
April,19	**204**	**$1.24**	**$253**
May,19	**153**	**$1.26**	**$194**
June,19	**15**	**$1.28**	**$19**
Total/average	4,459	$1.30	$5,798


Natural Gas Consumption (Therms)
Natural Gas (Therms)
HDD
Natural Gas Consumption (Therms)
Degree Days
1,000
900
800
700
600
500
400
300
200
100
0
600
500
400
300
200
100
0
July,18
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November,18
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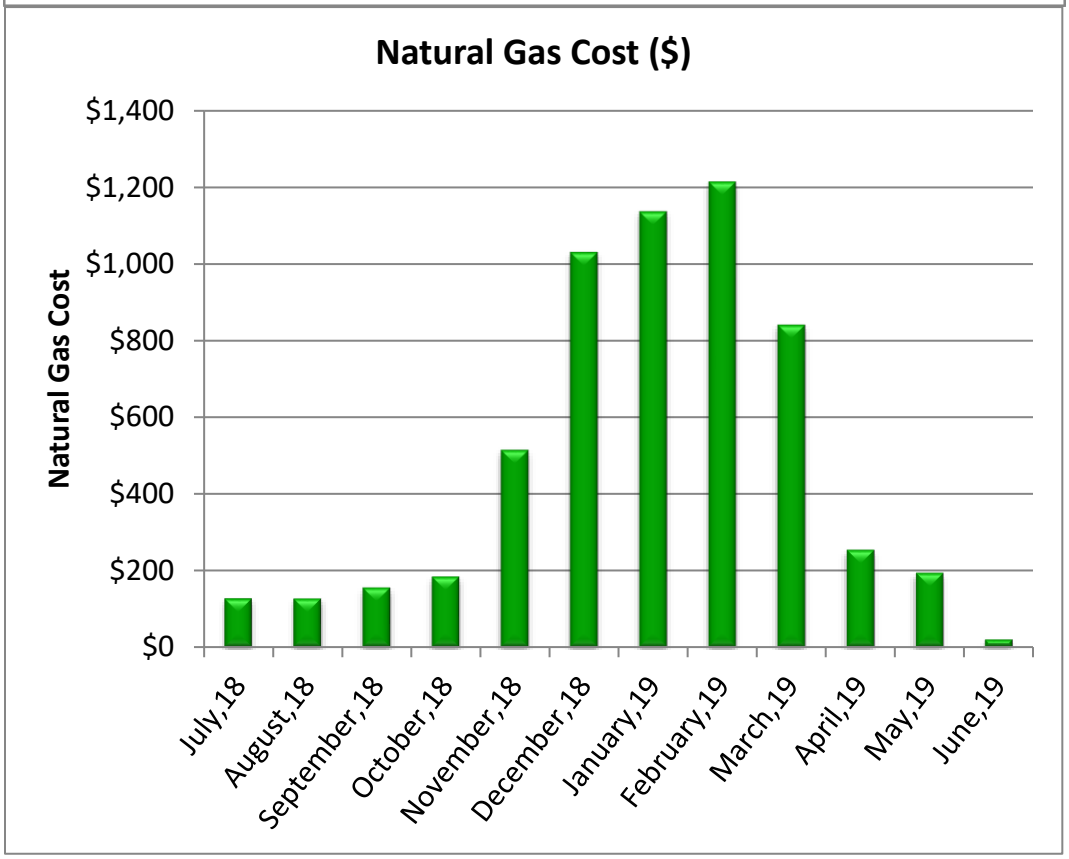
January,19
February,19
March,19
April,19
May,19
June,19

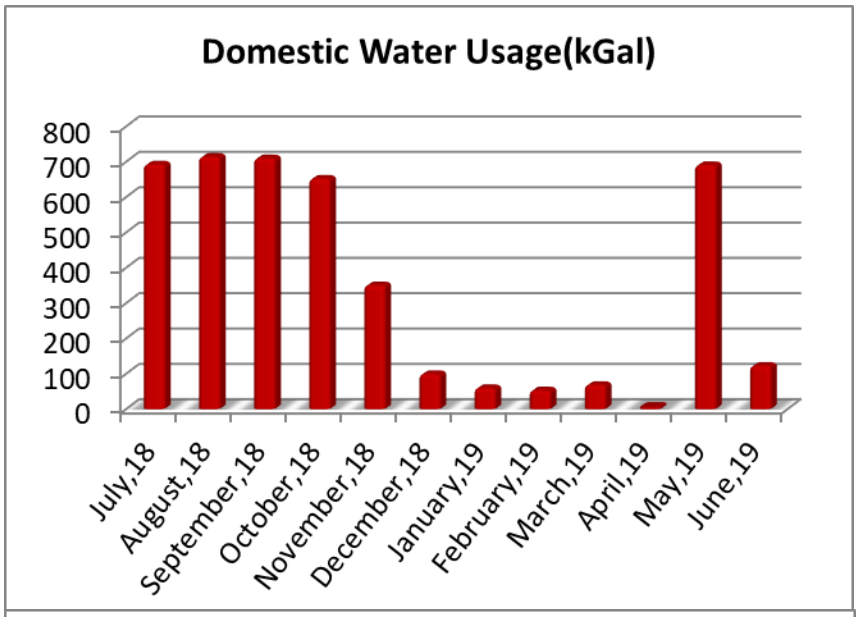

Natural Gas Cost ($)
Natural Gas Cost
$1,400
$1,200
$1,000
$800
$600
$400
$200
$0
July,18
August,18
September,18
October,18
November,18
December,18
January,19
February,19
March,19
April,19
May,19
June,19

4.3. Water and Sewer

The City of Sacramento satisfies the water requirements for the facility. The primary end use of water is the plumbing fixtures such as staff showers, water closets, and lavatories. The table below provides the twelve continuous months' worth of consumption and cost for water in kGal for the facility.

Water and Sewer Consumption and Cost Data

BILLING MONTH	CONSUMPTION (KGAL)	UNIT COST/KGAL	TOTAL COST
July,18	693	$4.74	$3,288
August,18	715	$4.38	$3,128
September,18	711	$4.42	$3,138
October,18	653	$4.59	$2,993
November,18	351	$5.37	$1,885
December,18	100	$11.82	$1,182
January,19	60	$18.16	$1,097
February,19	54	$15.69	$845
March,19	69	$15.31	$1,059
April,19	7	$32.96	$233
May,19	691	$4.16	$2,872
June,19	123	$5.05	$623
Total/average	**4,227**	**$5.29**	**$22,341**


Domestic Water Usage(kGal)
800
700
600
500
400
300
200
100
0
July,18
August,18
September,18
October,18
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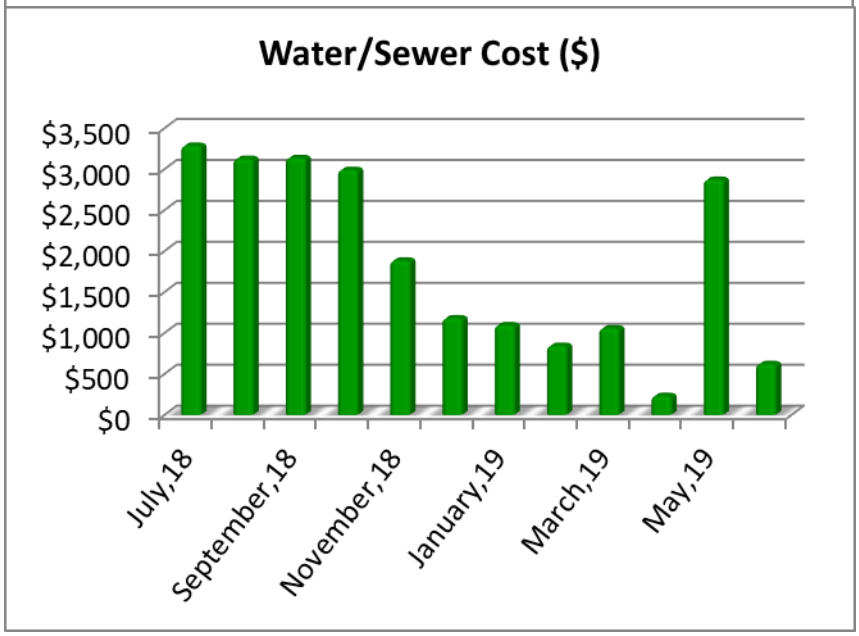
January,19
February,19
March,19
April,19
May,19
June,19


Water/Sewer Cost ($)
$3,500
$3,000
$2,500
$2,000
$1,500
$1,000
$500
$0
July,18
September,18
November,18
January,19
March,19
May,19

5. Renewable Energy Discussions

5.1. Rooftop Solar Photovoltaic Feasibility

Solar Energy Feasibility

A photovoltaic array is a linked collection of photovoltaic modules, which are in turn made of multiple interconnected solar cells. The cells convert solar energy into direct current electricity via the photovoltaic effect. The power that one module can produce is seldom enough to meet requirements of a home or a business, so the modules are linked together to form an array. Most PV arrays use an inverter to convert the DC power produced by the modules into alternating current that can plug into the existing infrastructure to power lights, motors, and other loads. The modules in a PV array are usually first connected in series to obtain the desired voltage; the individual strings are then connected in parallel to allow the system to produce more current. Solar arrays are typically measured by the peak electrical power they produce, in watts, kilowatts, or even megawatts.

When determining if a site is suitable for a solar application, two basic considerations must be evaluated:

- At minimum, the sun should shine upon the solar collectors from 9 AM to 3 PM. If less, the application may still be worthwhile, but the benefit will be less.
- The array should face south and be free of any shading from buildings, trees, rooftop equipment, etc. If the array is not facing directly south, there will be a penalty in transfer efficiency, reducing the overall efficiency of the system.

SOLAR PV QUESTIONNAIRE	RESPONSE
Does the property have a south, east, or west facing roof or available land of more than 250 square feet per required Solar Array Panel?	**Yes**
Is the area free from any shading such as trees, buildings, equipment etc throughout the whole day?	**Yes**
Can the panels be mounted at an incline of roughly 25-45 degrees? (equal to latitude of property)	**Yes**
Is the property in an area with acceptable average monthly sunlight levels?	**Yes**
Has the roofing been replaced within the past 3-5 years?	**No**
Is the roof structure sufficient to hold solar panels?	**Additional Study Needed**
Is the property located in a state eligible for net metering?	**Yes**

A solar feasibility analysis of the Alice Birney Public Waldorf site has resulted in the building containing more than sufficient amount of roof area for solar electricity generation. The analysis through the use of National Renewable Energy Laboratory's solar photovoltaic software assisted in calculating the potential electricity generated from the allocated land and roof area set for solar photovoltaic installment. The allocated roof area was through looking at the roof and surrounding areas at a bird's eye view. Also detailed in the report are incentives and rebates that can potentially bring down the installation cost of the ECMs and result in a higher return on investment and quicker payback period.

The approach taken in the solar photovoltaic (PV) roof analysis begins with surveying the roof and determine areas on the roof where solar PV panels can potentially be installed.

1) Conducting a preliminary sizing of solar PV panels on the roofs and on the ground and its potential electricity production for its first year of installment using the National Renewable Energy Laboratory (NREL) PV WATTS Version 2 Software.

2) Calculate energy and cost savings for the site as a sole proprietor of the system capable of collecting state, local, and federal tax credits and incentives and interconnecting and selling the renewable energy electrical production to the building.

SOLAR ROOFTOP PHOTOVOLTAIC ANALYSIS	
Estimated Number of Panels	369
Estimated KW Rating	116 KW
Potential Annual kWh Produced	178,430 kWh

SOLAR ROOFTOP PHOTOVOLTAIC ANALYSIS	
% of Current Electricity Uses	86.7%
FINANCIAL SUMMARY	
Investment Cost	$406,700
Estimated Energy Cost Savings	$30,333
Payback without Incentives	13.4 Years
Incentive Payback but without SRECs	8.1 Years
Payback with All Incentives	8.1 Years

A photovoltaic array is a linked collection of photovoltaic modules, which are in turn made of multiple interconnected solar cells. The cells convert solar energy into direct current. Modules of cells are linked together to form an array. Most PV arrays use an inverter to convert the DC power produced by the modules into alternating current that can connect to existing AC infrastructure to power lights, motors, and other loads.

Cost of production has fallen years with increasing demand and through production and technological advances. The cost dropped from $8–10/watt in 1996 to $4–7/watt in 2006. The market is diversifying with new types of panels suited to unique installation methods including stick on sheets and PV spray coating. The solar PV cost used in the analysis was set at $7.0/Watt which includes design, construction, administration, and installation and maintenance cost throughout the life of the solar panels.

One breakthrough for PV is “Net Metering”. When more PV electric power is generated than is consumed on site, the electric service meter reverses to “sell” the excess power directly back onto the power grid. The economics of PV for commercial industrial installations become attractive when coupled with incentives from Federal and state agencies, as well utility companies.

A kilowatt-hour costing $0.15 might be valued at $0.30 when produced by PV and sent to the grid. The economics of PV for commercial industrial installations become attractive when coupled with incentives from Federal and state agencies, as well utility companies.

The low payback period is highly dependent on the marketing potential of selling Solar Renewable Certificates to electricity generated providers who are under state regulations to contain a certain percentage of their electricity generation derived from renewable energy such as wind and solar.

Solar facilities are encouraged to sell their SRECs on the market (either spot market or through long-term contracts). Utilities may use SRECs for compliance under the state RPS for the year in which they are generated. Utilities may purchase up to 10% more SRECs than they require for compliance and "bank" those surplus SRECs for compliance during the following two years. Any SRECs pricing can range from $300 - $450/MWh and can be sold across state borders to other utility providers looking to purchase SRECs. EMG has selected to use the market value of $300/MWh minus 5% administrative fee in the analysis.

A number of states and corresponding electrical utility supplier are required under regulation to have a certain percentage of its electricity be produced by solar energy. To offset that they allow other utility companies to buy Renewable Energy Credits (REC) credit off their customers and facilities that produce their own solar energy. Typically, the national market, the utility market is $400 per MWh to Utility Suppliers for not meeting this standard percentage so these REC credits are sold for $350 per MWH. (1 REC credit = 1 MWH).

State charges these utility companies to meet their state compliance of 0.2% of the entire electricity consumption from solar energy by 2022 (from.005% in 2008 aggregated up to 0.2% by 2022). The REC credits correspond to these percentages as they aggregate each year.

6. Operations and Maintenance Plan

The quality of the maintenance and the operation of the facility's energy systems have a direct effect on its overall energy efficiency. Energy-efficiency needs to be a consideration when implementing facility modifications, equipment replacements, and general corrective actions. The following is a list of activities that should be performed as part of the routine maintenance program for the property.

Building Envelope

- ✓ Ensure that the building envelope has proper caulking and weather stripping.
- ✓ Patch holes in the building envelope with foam insulation and fire rated caulk around combustion vents
- ✓ Inspect building vents semiannually for bird infestation
- ✓ Inspect windows monthly for damaged panes and failed thermal seals
- ✓ Repair and adjust automatic door closing mechanisms as needed.

Heating and Cooling

- ✓ Pilots lights on furnaces and boilers be turned off in summer
- ✓ All preventive maintenance should be performed on all furnaces and boilers, which would include cleaning of burners and heat exchanger tubes.
- ✓ Ensure that the combustion vents exhaust outside the conditioned space and the vent dampers are functional
- ✓ Ensure that the control valves are functioning properly before start of every season
- ✗ Ensure steam traps are functional before start of each heating season
- ✗ Ensure use of chemical treatment for boiler make up water
- ✗ Ensure boiler outside temperature re-set is set to 55F
- ✗ Ensure use of chemical treatment for Colling tower water to prevent corrosion
- ✓ Ensure the duct work in unconditioned space is un-compromised and well insulated
- ✓ Duct cleaning is recommended every 10 years. This should include sealing of ducts using products similar to 'aero-seal'
- ✓ Ensure use of economizer mode is functional and used
- ✓ Ensure that the outside air dampers actuators are operating correctly
- ✓ Ensure air coils in the AHU and FCA's are pressure washed annually
- ✓ Return vents should remain un-obstructed and be located centrally
- ✓ Temperature settings reduced in unoccupied areas and set points seasonally adjusted.
- ✓ Evaporator coils and condenser coils should be regularly cleaned to improve heat transfer
- ✓ Refrigerant pipes should be insulated with a minimum of ¾" thick Elastomeric Rubber Pipe Insulation
- ✓ Ensure refrigerant pressure is maintained in the condensers
- ✓ Change air filters on return vents seasonally. Use only filters with 'Minimum Efficiency Rating Value'(MERV) of 8

Central Domestic Hot Water Heater

- ✓ Never place gas fired water heaters adjacent to return vents so as to prevent flame roll outs
- ✓ Ensure the circulation system is on timer to reduce the losses through re-circulation
- ✓ Ensure all hot water pipes are insulated with fiberglass insulation at all times
- ✓ Replacement water heater should have Energy Factor (EF)>0.9
- ✓ Tank-type water heaters flushed monthly

Lighting Improvements

- ✓ Utilize bi-level lighting controls in stairwells and hallways.
- ✓ Use LED replacement lamps
- ✓ Clean lighting fixture reflective surfaces and translucent covers.
- ✓ Ensure that timers and/or photocells are operating correctly on exterior lighting
- ✓ Use occupancy sensors for offices and other rooms with infrequent occupancy

Existing Equipment and Replacements

- ✓ Ensure that refrigerator and freezer doors close and seal correctly
- ✓ Ensure kitchen and bathroom exhaust outside the building and the internal damper operates properly
- ✓ Ensure that bathroom vents exhaust out
- ✓ Office/ computer equipment either in the “sleep” or “off” mode when not used

7. Appendices

APPENDIX A: Glossary of Terms

APPENDIX B: Mechanical Equipment Inventory

APPENDIX C: Lighting System Schedule

APPENDIX D: ECM Checklist

APPENDIX E: ECM Calculations

APPENDIX F: Solar PV

APPENDIX A:
Glossary of Terms

Glossary of Terms and Acronyms

ECM – Energy Conservation Measures are projects recommended to reduce energy consumption. These can be No/Low cost items implemented as part of routine maintenance or Capital Cost items to be implemented as a capital improvement project.

Initial Investment – The estimated cost of implementing an ECM project. Estimates typically are based on R.S. Means Construction cost data and Industry Standards.

Annual Energy Savings – The reduction in energy consumption attributable to the implementation of a particular ECM. These savings values do not include the interactive effects of other ECMs.

Cost Savings – The expected reduction in utility or energy costs achieved through the corresponding reduction in energy consumption by implementation of an ECM.

Simple Payback Period –The number of years required for the cumulative value of energy or water cost savings less future non-fuel or non-water costs to equal the investment costs of the building energy or water system, without consideration of discount rates.

EUL – Expected Useful Life is the estimated lifespan of a typical piece of equipment based on industry accepted standards.

RUL – Remaining Useful Life is the EUL minus the effective age of the equipment and reflects the estimated number of operating years remaining for the item.

SIR - The savings-to-investment ratio is the ratio of the present value savings to the present value costs of an energy or water conservation measure. The numerator of the ratio is the present value of net savings in energy or water and non-fuel or non-water operation and maintenance costs attributable to the proposed energy or water conservation measure. The denominator of the ratio is the present value of the net increase in investment and replacement costs less salvage value attributable to the proposed energy or water conservation measure. It is recommended that energy-efficiency recommendations be based on a calculated SIR, with larger SIRs receiving a higher priority. A project typically is recommended only if the SIR is greater than or equal to 1.0, unless other factors outweigh the financial benefit.

Life Cycle Cost - The sum of the present values of (a) **I**nvestment costs, less salvage values at the end of the study period; (b) Non-fuel operation and maintenance costs: (c) Replacement costs less salvage costs of replaced building systems; and (d) Energy and/or water costs.

Life Cycle Savings – The sum of the estimated annual cost savings over the EUL of the recommended ECM, expressed in present value dollars.

Building Site Energy Use Intensity - The sum of the total site energy use in thousands of Btu per unit of gross building area. Site energy accounts for all energy consumed at the building location only not the energy consumed during generation and transmission of the energy to the site.

Building Source Energy Use Intensity – The sum of the total source energy use in thousands of Btu per unit of gross building area. Source energy is the energy consumed during generation and transmission in supplying the energy to your site.

Building Cost Intensity - This metric is the sum of all energy use costs in dollars per unit of gross building area.

Greenhouse Gas Emissions - Although there are numerous gases that are classified as contributors to the total for Greenhouse Emissions, the scope of this energy audit focuses on carbon dioxide (CO_2). Carbon dioxide enters the atmosphere through the burning of fossil fuels (oil, natural gas, and coal), solid waste, trees and wood products, and also as a result of other chemical reactions (e.g., manufacture of cement).

APPENDIX B:
Mechanical Equipment Inventory

D10 CONVEYING

Index	ID	UFCode	Component	Capacity	Building	Location Detail	Manufacturer	Model	Serial	Dataplate Yr	Barcode	Qty
1	1448297	D1013	**Wheelchair Lift**	750 LBS	Alice Birney Public Waldorf / 002 Multipurpose	Cafeteria - U001	National Wheel-O-Vator Company	BC42	79559	2003	77481	

D20 PLUMBING

Index	ID	UFCode	Component	Capacity	Building	Location Detail	Manufacturer	Model	Serial	Dataplate Yr	Barcode	Qty
1	1448231	D2021	**Backflow Preventer**	3 INCH	Alice Birney Public Waldorf / Site	Site					00255760	
2	1448438	D2021	**Backflow Preventer**	3 INCH	Alice Birney Public Waldorf / Site	Site					00262084	
3	1448367	D2023	**Domestic Circulation/Booster Pump**	10 HP	Alice Birney Public Waldorf / Site	Site	Berkeley Pump	2-1/2TP1S	H02540		00262098	
4	1454185	D2023	**Water Heater** [EWH-1]	80 GAL	Alice Birney Public Waldorf / 002 Multipurpose	Boiler-B004	A. O. Smith	DVE 80 927	MF01-1036984-917	2001	00262081	
5	1454186	D2023	**Water Heater**	40 GAL	Alice Birney Public Waldorf / 001 Office and Kindergarten	Boiler-B001	State	GS8640Y0CTG	0925J006302	2009	00264310	

D30 HVAC

Index	ID	UFCode	Component	Capacity	Building	Location Detail	Manufacturer	Model	Serial	Dataplate Yr	Barcode	Qty
1	1448306	D3032	**Condensing Unit/Heat Pump** [CU-1]	4 TON	Alice Birney Public Waldorf / P07-P08 Portable Classrooms 20 to 23	Building exterior	Carrier	ZI24ABC648A0031010	S2313E04078	2013	00262369	
2	1448481	D3032	**Condensing Unit/Heat Pump** [CU-1]	5 TON	Alice Birney Public Waldorf / 004 Library and Classrooms 9 to 12	Classroom - O012	Carrier	38TXA060320	2601E04585	2001	00257886	
3	1448244	D3032	**Condensing Unit/Heat Pump** [CU-10]	5 TON	Alice Birney Public Waldorf / 003 Classrooms 3 to 7	Classroom - O003	Carrier	38TXA060320	2501E13981	2001	00262364	
4	1448488	D3032	**Condensing Unit/Heat Pump** [CU-11]	5 TON	Alice Birney Public Waldorf / 001 Office and Kindergarten	Classroom - Y002	Carrier	38TXA060320	2501E18320	2001	00262361	
5	1448332	D3032	**Condensing Unit/Heat Pump** [CU-12]	5 TON	Alice Birney Public Waldorf / 001 Office and Kindergarten	Classroom - Y001	Carrier	38TXA060320	2501E13999	2001	00262360	
6	1448470	D3032	**Condensing Unit/Heat Pump** [CU-2]	4 TON	Alice Birney Public Waldorf / P07-P08 Portable Classrooms 20 to 23	Building exterior	Carrier	ZI24ABC648A0031010	S2613E03926	2013	00262368	
7	1448309	D3032	**Condensing Unit/Heat Pump** [CU-2]	5 TON	Alice Birney Public Waldorf / 004 Library and Classrooms 9 to 12	Classroom - O011	Carrier	38TXA060320	2501E18???	2001	00257885	
8	1448376	D3032	**Condensing Unit/Heat Pump** [CU-3]	4 TON	Alice Birney Public Waldorf / P07-P08 Portable Classrooms 20 to 23	Building exterior	Carrier	ZI24ABC648A0031010	S2313E04088	2013	00262366	
9	1448272	D3032	**Condensing Unit/Heat Pump** [CU-3]	5 TON	Alice Birney Public Waldorf / 004 Library and Classrooms 9 to 12	Classroom - O010	Carrier	38TXA060320	2601E04570	2001	00257884	
10	1448413	D3032	**Condensing Unit/Heat Pump** [CU-4]	4 TON	Alice Birney Public Waldorf / P07-P08 Portable Classrooms 20 to 23	Building exterior	Carrier	ZI24ABC648A0031010	S2613E03932	2013	00262367	
11	1448396	D3032	**Condensing Unit/Heat Pump** [CU-4]	5 TON	Alice Birney Public Waldorf / 004 Library and Classrooms 9 to 12	Classroom - O009	Carrier	38TXA060320	2501E13992	2001	00262354	
12	1448294	D3032	**Condensing Unit/Heat Pump** [CU-5]	5 TON	Alice Birney Public Waldorf / 004 Library and Classrooms 9 to 12	Library - O008	Carrier	38TXA060320	2601E04586	2001	00262355	
13	1448225	D3032	**Condensing Unit/Heat Pump** [CU-6]	5 TON	Alice Birney Public Waldorf / 003 Classrooms 3 to 7	Classroom - O007	Carrier	38TXA060320	2501E13??9	2001	00262353	
14	1448316	D3032	**Condensing Unit/Heat Pump** [CU-7]	5 TON	Alice Birney Public Waldorf / 003 Classrooms 3 to 7	Classroom - O006	Carrier	38TXA060320	2501E18328	2001	00262352	
15	1448269	D3032	**Condensing Unit/Heat Pump** [CU-8]	5 TON	Alice Birney Public Waldorf / 003 Classrooms 3 to 7	Classroom - O005	Carrier	38TXA060320	2601E04587	2001	00262351	
16	1448427	D3032	**Condensing Unit/Heat Pump** [CU-9]	5 TON	Alice Birney Public Waldorf / 003 Classrooms 3 to 7	Classroom - O004	Carrier	38TXA060320	2501E18309	2001	00262365	
17	1448283	D3032	**Heat Pump**	4 TON	Alice Birney Public Waldorf / P06 Portable Classroom 19	Classroom - O019	Mitsubishi	PUMY-P48NHMU	25U02762C	2012	00262099	
18	1448326	D3041	**Fan Coil Unit**	4 TON	Alice Birney Public Waldorf / P06 Portable Classroom 19	Classroom - O019	Mitsubishi	PVFY-P4BE00A	R0524120226	2012	00262067	
19	1448363	D3042	**Exhaust Fan**	800 CFM	Alice Birney Public Waldorf / 002 Multipurpose	Roof						4
20	1448328	D3042	**Exhaust Fan**	800 CFM	Alice Birney Public Waldorf / 003 Classrooms 3 to 7	Roof						2
21	1448245	D3042	**Exhaust Fan**	2000 CFM	Alice Birney Public Waldorf / 002 Multipurpose	Roof	Penn Ventilator Company	RB452	No tag/plate found		00262359	
22	1448259	D3042	**Exhaust Fan**	500 CFM	Alice Birney Public Waldorf / 001 Office and Kindergarten	Roof	Penn Ventilator Company	RB452	No tag/plate found			4
23	1448291	D3051	**Air Conditioner**	2 TON	Alice Birney Public Waldorf / P01 Portable Classrooms 13 to 15	Classroom - O013	Comfort-Aire	WA-323	CN 923886 0681		00263617	
24	1448456	D3051	**Air Conditioner**	2 TON	Alice Birney Public Waldorf / P01 Portable Classrooms 13 to 15	Classroom - O015	Comfort-Aire	WA-323	No tag/plate found		00263615	
25	1448490	D3051	**Air Conditioner**	2 TON	Alice Birney Public Waldorf / P01 Portable Classrooms 13 to 15	Classroom - O014	Comfort-Aire	WA-323	CN 923758 0681		00263616	
26	1448483	D3051	**Furnace** [F-1]	100 MBH	Alice Birney Public Waldorf / P07-P08 Portable Classrooms 20 to 23	Classroom - O020	Carrier	ZI59TP5A100E211120	S2413A52910	2013	00262100	
27	1448264	D3051	**Furnace** [F-1]	100 MBH	Alice Birney Public Waldorf / 004 Library and Classrooms 9 to 12	Classroom - O012	Carrier	58MXA100-F-120	2401A14444	2001	00263618	
28	1448441	D3051	**Furnace** [F-10]	100 MBH	Alice Birney Public Waldorf / 003 Classrooms 3 to 7	Classroom - O003	Carrier	58MXA100-F-120	2401A14423	2013	00263613	
29	1448343	D3051	**Furnace** [F-11]	100 MBH	Alice Birney Public Waldorf / 001 Office and Kindergarten	Classroom - Y002	Carrier	58MXA100-F-120	2401A12448	2001	00263612	
30	1448256	D3051	**Furnace** [F-12]	100 MBH	Alice Birney Public Waldorf / 001 Office and Kindergarten	Classroom - Y001	Carrier	58MXA100-F-120	2401A1244	2013	00263611	
31	1448380	D3051	**Furnace** [F-2]	100 MBH	Alice Birney Public Waldorf / P07-P08 Portable Classrooms 20 to 23	Classroom - O021	Carrier	ZI59TP5A100E211120	S5012A54254	2013	00262038	
32	1448487	D3051	**Furnace** [F-2]	100 MBH	Alice Birney Public Waldorf / 004 Library and Classrooms 9 to 12	Classroom - O011	Carrier	58MXA100-F-120	2401A14437	2013	00263614	
33	1448398	D3051	**Furnace** [F-3]	100 MBH	Alice Birney Public Waldorf / 004 Library and Classrooms 9 to 12	Classroom - O010	Carrier	58MXA100-F-120	2401A12441	2013	00263619	
34	1448338	D3051	**Furnace** [F-3]	100 MBH	Alice Birney Public Waldorf / P07-P08 Portable Classrooms 20 to 23	Classroom - O022	Carrier	ZI59TP5A100E211120	Inaccessible	2013		
35	1448493	D3051	**Furnace** [F4]	100 MBH	Alice Birney Public Waldorf / P07-P08 Portable Classrooms 20 to 23	Classroom - O023	Carrier	ZI59TP5A100E211120	S2413A52833	2013	00262066	
36	1448432	D3051	**Furnace** [F-4]	100 MBH	Alice Birney Public Waldorf / 004 Library and Classrooms 9 to 12	Classroom - O009	Carrier	58MXA100-F-120	2401A14431	2013	00263620	
37	1448394	D3051	**Furnace** [F-5]	100 MBH	Alice Birney Public Waldorf / 004 Library and Classrooms 9 to 12	Library - O008	Carrier	58MXA100-F-120	2401A14427	2013	00263621	
38	1448350	D3051	**Furnace** [F-6]	100 MBH	Alice Birney Public Waldorf / 003 Classrooms 3 to 7	Classroom - O007	Carrier	58MXA100-F-120	2401A14444	2013	00263625	
39	1448379	D3051	**Furnace** [F-7]	100 MBH	Alice Birney Public Waldorf / 003 Classrooms 3 to 7	Classroom - O006	Carrier	58MXA100-F-120	2501A12415	2013	00263624	
40	1448263	D3051	**Furnace** [F-8]	100 MBH	Alice Birney Public Waldorf / 003 Classrooms 3 to 7	Classroom - O005	Carrier	58MXA100-F-120	2401A12438	2013	00263623	
41	1448219	D3051	**Furnace** [F-9]	100 MBH	Alice Birney Public Waldorf / 003 Classrooms 3 to 7	Classroom - O004	Carrier	58MXA100-F-120	2401A12449	2013	00263622	
42	1448468	D3051	**Furnace**	80 MBH	Alice Birney Public Waldorf / P01 Portable Classrooms 13 to 15	Classroom - O013	Tuckaire	USB2780	No tag/plate found		00264309	
43	1448411	D3051	**Furnace**	80 MBH	Alice Birney Public Waldorf / P01 Portable Classrooms 13 to 15	Classroom - O014	Tuckaire	USB2780	No tag/plate found		00264308	
44	1448433	D3051	**Furnace**	80000 MBH	Alice Birney Public Waldorf / P01 Portable Classrooms 13 to 15	Classroom - O015	Tuckaire	USB2780	No tag/plate found		00264306	
45	1448460	D3051	**Unit Heater**	80 MBH	Alice Birney Public Waldorf / 005 Storage	Throughout building	Reznor	Inaccessible	Inaccessible			
46	1448428	D3052	**Heat Pump** [2]	3 TON	Alice Birney Public Waldorf / P02-P03-P04 Portable Classrooms 16-18	Classroom - O017	Bard	36WH7-A05C	058D900645789	1999	00264304	
47	1448356	D3052	**Heat Pump** [3]	3 TON	Alice Birney Public Waldorf / P02-P03-P04 Portable Classrooms 16-18	Classroom - O018	Bard	36WH7-A05C	058F900648778	1999	00264303	
48	1448230	D3052	**Heat Pump**	3 TON	Alice Birney Public Waldorf / P02-P03-P04 Portable Classrooms 16-18	Classroom - O016	Bard	36WH7-A05C	No tag/plate found	1999	00264305	
49	1448381	D3052	**Packaged Unit (RTU)** [AC-1]	5 TON	Alice Birney Public Waldorf / 002 Multipurpose	Kitchen - K001	Carrier	48HJD006G531	2501G3499	2001	00262358	
50	1448401	D3052	**Packaged Unit (RTU)** [AC-2]	15 TON	Alice Birney Public Waldorf / 002 Multipurpose	Cafeteria	Carrier	48HJD016A	2301F88658	2001	00262357	
51	1448506	D3052	**Packaged Unit (RTU)** [AC-3]	3.5 TON	Alice Birney Public Waldorf / 001 Office and Kindergarten	Office	Carrier	48HJE004G531	2501G23654	2001	00262363	
52	1448277	D3052	**Packaged Unit (RTU)** [AC-4]	3.5 TON	Alice Birney Public Waldorf / 001 Office and Kindergarten	Office	Carrier	48HJE004G531	2501G23653	2001	00262362	
53	1448243	D3052	**Packaged Unit (RTU)** [AC-5]	3.5 TON	Alice Birney Public Waldorf / 001 Office and Kindergarten	Office	Carrier	48HJE004G531	2501G23657	2001	00262356	

D40 FIRE PROTECTION

Index	ID	UFCode	Component	Capacity	Building	Location Detail	Manufacturer	Model	Serial	Dataplate Yr	Barcode	Qty
1	1448254	D4031	**Fire Extinguisher**		Alice Birney Public Waldorf / 004 Library and Classrooms 9 to 12	Throughout building						6
2	1448260	D4031	**Fire Extinguisher**		Alice Birney Public Waldorf / 001 Office and Kindergarten	Throughout building						6
3	1448423	D4031	**Fire Extinguisher**		Alice Birney Public Waldorf / 002 Multipurpose	Throughout building						5
4	1448250	D4031	**Fire Extinguisher**		Alice Birney Public Waldorf / 003 Classrooms 3 to 7	Throughout building						6
5	1448255	D4031	**Fire Extinguisher**		Alice Birney Public Waldorf / P07-P08 Portable Classrooms 20 to 23	Throughout building						4
6	1448387	D4031	**Fire Extinguisher**		Alice Birney Public Waldorf / P01 Portable Classrooms 13 to 15	Throughout building						3
7	1448419	D4031	**Fire Extinguisher**		Alice Birney Public Waldorf / P02-P03-P04 Portable Classrooms 16-18	Throughout building						3

8	1448319	D4031	**Fire Extinguisher**		Alice Birney Public Waldorf / 005 Storage	Throughout building						
9	1448289	D4031	**Fire Extinguisher**		Alice Birney Public Waldorf / P06 Portable Classroom 19	Throughout building						
10	1448330	D4099	**Fire Shutter**		Alice Birney Public Waldorf / 002 Multipurpose	Kitchen						3

D50 ELECTRICAL

Index	ID	UFCode	Component	Capacity	Building	Location Detail	Manufacturer	Model	Serial	Dataplate Yr	Barcode	Qty
1	1448405	D5012	**Building/Main Switchboard** [Main switchboard]	2000 AMP	Alice Birney Public Waldorf / Site	Site	Cutler-Hammer	No tag/plate found	HSF67958	1998	00262082	
2	1480869	D5012	**Main Distribution Panel**		Alice Birney Public Waldorf / P02-P03-P04 Portable Classrooms 16-18							
3	1448310	D5012	**Main Distribution Panel** [DPB]	400 AMP	Alice Birney Public Waldorf / P07-P08 Portable Classrooms 20 to 23	Building exterior	Inaccessible	Inaccessible	Inaccessible	2013	00262037	
4	1454183	D5012	**Main Distribution Panel**	400 AMP	Alice Birney Public Waldorf / 002 Multipurpose	Kitchen-K001	Cutler-Hammer	PRL-3A	SC991644AB	2001	00250862	
5	1448508	D5012	**Main Distribution Panel** [Panel DOS]	600 AMP	Alice Birney Public Waldorf / 003 Classrooms 3 to 7	Science room - B003	Cutler-Hammer	PRL-3A	SC991644AB	2001	00262370	
6	1454190	D5012	**Main Distribution Panel** [Panel LD]	400 AMP	Alice Birney Public Waldorf / 001 Office and Kindergarten	Boiler-B001	Cutler-Hammer	PRL-1A	SC991644AB	2001	00255754	
7	1448472	D5012	**Main Distribution Panel** [Panel LG]	400 AMP	Alice Birney Public Waldorf / 003 Classrooms 3 to 7	Kiln - B002	Cutler-Hammer	PRL-1A	SC991644AB	2001	00262101	
8	1448258	D5012	**Main Distribution Panel** [Panel LQP]	100 AMP	Alice Birney Public Waldorf / 005 Storage	Building exterior	No tag/plate found	No tag/plate found	No tag/plate found		00262083	
9	1448349	D5012	**Secondary Transformer** [DOB XFMR]	150 kVA	Alice Birney Public Waldorf / P07-P08 Portable Classrooms 20 to 23	Building exterior	Eaton	V60M28T49EE	J13G51270B	2013	00262036	
10	1448279	D5012	**Secondary Transformer** [DPB XFMR]	150 kVA	Alice Birney Public Waldorf / Site	Site	Eaton	V29R60T49EE	J13G01011B	2013	00262097	
11	1448446	D5022	**Light Fixture**	100 WATT	Alice Birney Public Waldorf / P06 Portable Classroom 19	Building exterior						6
12	1448372	D5022	**Light Fixture**	100 WATT	Alice Birney Public Waldorf / P02-P03-P04 Portable Classrooms 16-18	Building exterior						6
13	1448290	D5022	**Light Fixture**		Alice Birney Public Waldorf / P06 Portable Classroom 19	Building exterior				2003		2
14	1448287	D5022	**Light Fixture**		Alice Birney Public Waldorf / P07-P08 Portable Classrooms 20 to 23	Building exterior				2013		12
15	1448315	D5022	**Light Fixture**		Alice Birney Public Waldorf / P02-P03-P04 Portable Classrooms 16-18	Building exterior						5
16	1454197	D5037	**Fire Alarm Control Panel**		Alice Birney Public Waldorf / 001 Office and Kindergarten	Boiler-B001	Fire-Lite	MS-9600	No tag/plate found	2001	00255756	
17	1448449	D5092	**Exit Sign Light Fixture**		Alice Birney Public Waldorf / P07-P08 Portable Classrooms 20 to 23	Building exterior						6
18	1448480	D5092	**Exit Sign Light Fixture**		Alice Birney Public Waldorf / 001 Office and Kindergarten	Throughout building						2
19	1448320	D5092	**Exit Sign Light Fixture**		Alice Birney Public Waldorf / 002 Multipurpose	Throughout building						8

E10 EQUIPMENT

Index	ID	UFCode	Component	Capacity	Building	Location Detail	Manufacturer	Model	Serial	Dataplate Yr	Barcode	Qty
1	1454198	E1093	**Commercial 6 LF**	6 LF	Alice Birney Public Waldorf / 002 Multipurpose	Kitchen-K001	No tag/plate found	No tag/plate found	No tag/plate found		00162774	
2	1454184	E1093	**Commercial Convection Oven, Double**		Alice Birney Public Waldorf / 002 Multipurpose	Kitchen-K001	Southbend	SLGS/22SC	15B11187	2015	00162775	
3	1454200	E1093	**Commercial Dairy Cooler/Wells**		Alice Birney Public Waldorf / 002 Multipurpose	Kitchen-K001	Beverage-Air Corporation	SM58N-W	9610405		00162770	
4	1454191	E1093	**Commercial Food Warmer**		Alice Birney Public Waldorf / 002 Multipurpose	Kitchen-K001	Cres Cor	H137PUA12CMS	EBA-J232055-1177	2013	00250861	
5	1454193	E1093	**Commercial Food Warmer**		Alice Birney Public Waldorf / 002 Multipurpose	Kitchen-K001	Cres Cor	H137UA12C	FBA-J233179-571	2013	00250853	
6	1454203	E1093	**Commercial Freezer, 2-Door Reach-In**		Alice Birney Public Waldorf / 002 Multipurpose	Kitchen-K001	True Manufacturing Co	1-4341644	TS-49F	2006	00250859	
7	1454182	E1093	**Commercial Freezer, 2-Door Reach-In**		Alice Birney Public Waldorf / 002 Multipurpose	Kitchen-K001	True Manufacturing Co	TS-49F	6929393	2010	00250860	
8	1454202	E1093	**Commercial Range/Oven, 6-Burner w/ Griddle**		Alice Birney Public Waldorf / 002 Multipurpose	Kitchen-K001	U.S. Range	No tag/plate found	No tag/plate found		00162773	
9	1454196	E1093	**Commercial Walk-In Refrigerator**		Alice Birney Public Waldorf / 002 Multipurpose	Kitchen-K001	No tag/plate found	No tag/plate found	No tag/plate found		00250854	
10	1454181	E1093	**Commercial Walk-In Refrigerator/Freezer, Condenser**		Alice Birney Public Waldorf / 002 Multipurpose	Kitchen-K001	Emerson	KAAB007ACAV800	15H64702R	2015	00250855	
11	1454194	E1093	**Commercial Walk-In Refrigerator/Freezer, Evaporator**		Alice Birney Public Waldorf / 002 Multipurpose	Kitchen-K001	Russell	AL-26-56	H8481268-1		00250854	
12	1448497	E1094	**Residential Range, Electric**		Alice Birney Public Waldorf / 001 Office and Kindergarten	Lounge - I002					00262069	
13	1454195	E1094	**Residential Clothes Washer/Dryer Combo Unit**		Alice Birney Public Waldorf / 002 Multipurpose	Kitchen-K001	Kenmore	11022932100	CL 3018273		00250856	
14	1448313	E1094	**Residential Refrigerator, 14-18 CF**		Alice Birney Public Waldorf / 001 Office and Kindergarten	Lounge - I002	LG	LBC22518WW	612MRZL10533	2006	00262068	

APPENDIX C:
Lighting System Schedule

										Lamp Details				Fixture Details				Existing Consumption	
Line No.	Building Name	Interior/ Exterior	Floor	Space Type	Room No.	Additional Area Description	LUX	Control Quantity	Existing Control	Technology	Sub-Technology	Lamp Type	Total Lamps	Fixture Type	Fixture Quantity	24x7 Fixture Count	Fixture Height	Annual Hours	Existing Annual kWh
1	001	Interior		RESTROOM	T004		-	4	Light Switch	Linear Fluorescent	T8	4' 32W T8	8	2x4 Prism Troffer	4	0	8	1,295	332
2	002	Interior		RESTROOM	T003		-	2	Light Switch	Linear Fluorescent	T8	4' 32W T8	4	2x4 Prism Troffer	2	0	8	1,295	166
3	004	Interior		RESTROOM	T001		-	3	Light Switch	Linear Fluorescent	T8	4' 32W T8	24	2x4 Prism Troffer	12	0	8	1,295	995
4	003	Interior		RESTROOM	T001		-	2	Light Switch	Linear Fluorescent	T8	4' 32W T8	16	2x4 Prism Troffer	8	0	8	1,295	663
5	001	Interior		RESTROOM	T001		-	3	Light Switch	Linear Fluorescent	T8	4' 32W T8	6	2x4 Prism Troffer	3	0	8	1,295	249
6	002	Interior		AuDITORIUM	Stage		-	1	Light Switch	Linear Fluorescent	T8	4' 32W T8	12	2x4 Prism Troffer	6	0	8	1,295	497
7	001	Interior		STORAGE	S003		-	1	Light Switch	Incan/H/MR	Incan	I100-Globe	1	Jelly Jar-hor	1	0	8	1,295	130
8	001	Interior		STORAGE	S003		-	1	Timer	HID	HPS	HPS150	4	Wallpack-Horizontal	4	0	8	1,295	777
9	002	Interior		STORAGE	S001		-	2	Light Switch	Linear Fluorescent	T8	4' 32W T8	8	2x4 Prism Troffer	4	0	8	1,295	332
10	001	Interior		OFFICE	Office hallway		-	2	Light Switch	Linear Fluorescent	T8	4' 32W T8	44	2x4 Prism Troffer	11	0	8	1,295	1,823
11	001	Interior		OFFICE	Office		-	2	Light Switch	Linear Fluorescent	T8	4' 32W T8	4	2x4 Prism Troffer	2	0	8	1,295	166
12	002	Interior		CAFETERIA	Multipurpose		-	8	Light Switch	Linear Fluorescent	T8	4' 32W T8	128	2x4 Prism Troffer	32	0	16	1,295	5,304
13	002	Interior		KiTCHEN	K001		-	2	Light Switch	Linear Fluorescent	T8	4' 32W T8	27	2x4 Prism Troffer	9	0	8	1,295	1,119
14	002	Interior		KiTCHEN	K001		-	2	Light Switch	Linear Fluorescent	T8	4' 32W T8	6	2x4 Prism Troffer	3	0	8	1,295	249
15	002	Interior		JANITORIAL	J001		-	4	Light Switch	Incan/H/MR	Incan	I100-Globe	4	Jelly Jar-hor	4	0	8	1,295	518
16	001	Interior		CAFETERIA	I001		-	3	Light Switch	Linear Fluorescent	T8	4' 32W T8	12	2x4 Prism Troffer	3	0	8	1,295	497
17	001	Interior		CAFETERIA	I001		-	3	Light Switch	Linear Fluorescent	T8	4' 32W T8	4	1x4 Prism Troffer	2	0	8	1,295	166
18	001	Interior		CAFETERIA	I001		-	3	Light Switch	Linear Fluorescent	T8	4' 32W T8	2	1x4 Prism Troffer	2	0	8	1,295	83
19	001	Interior		CAFETERIA	I001		-	3	Light Switch	Linear Fluorescent	T8	4' 32W T8	2	1x4 Prism Troffer	2	0	8	1,295	83
20	P05	Exterior		OFFICE	Exterior		-	1	Timer	CFL	CFL - 4 Pin	CFL42	2	Wallpack-Vertical	2	0	8	1,295	109
21	P08	Exterior		HALLWAY	Exterior		-	1	Timer	CFL	CFL - 4 Pin	CFL42	6	Wallpack-Horizontal	6	0	8	1,295	326
22	P07	Exterior		HALLWAY	Exterior		-	0	Timer	CFL	CFL - 4 Pin	CFL42	7	Wallpack-Horizontal	7	0	8	1,295	381
23	P019	Exterior		HALLWAY	Exterior		-	0	Timer	CFL	CFL - 4 Pin	CFL42	1	Wallpack-Vertical	1	0	8	1,295	54
24	P01	Exterior		HALLWAY	Exterior		-	0	Timer	HID	HPS	HPS250	1	Wallpack-Horizontal	1	0	8	1,295	324
25	P01	Exterior		HALLWAY	Exterior		-	0	Light Switch	CFL	CFL - 2 Pin	CFL13	6	Wallpack-Horizontal	3	0	8	1,295	101
26	004	Interior		HALLWAY	Exterior		-	0	Timer	CFL	CFL - 4 Pin	CFL42	11	Surface Mount Can	11	0	8	1,295	598
27	004	Interior		HALLWAY	Exterior		-	0	Timer	HID	HPS	HPS150	2	Wallpack-Horizontal	2	0	8	1,295	389
28	003	Interior		HALLWAY	Exterior		-	0	Timer	CFL	CFL - 4 Pin	CFL42	6	Surface Mount Can	6	0	8	1,295	326
29	003	Interior		HALLWAY	Exterior		-	0	Timer	HID	HPS	HPS150	1	Wallpack-Horizontal	1	0	8	1,295	194
30	001	Exterior		HALLWAY	Exterior		-	0	Timer	CFL	CFL - 4 Pin	CFL42	8	Surface Mount Can	8	0	8	1,295	435
31	002	Exterior		HaLLWAY	Exterior		-	0	Light Switch	CFL	CFL - 4 Pin	CFL42	8	Wallpack-Vertical	4	0	8	1,295	435
32	002	Exterior		HaLLWAY	Exterior		-	0	Timer	HID	HPS	HPS150	4	Wallpack-Horizontal	4	0	8	1,295	777
33	002	Exterior		HaLLWAY	Exterior		-	0	Timer	CFL	CFL - 4 Pin	CFL42	2	Surface Mount Can	2	0	8	1,295	109
34	P02	Exterior		CLASSROOM	Exterior		-	0	Timer	HID	HPS	HPS150	2	Wallpack-Horizontal	2	0	8	1,295	389
35	P02	Exterior		CLASSROOM	Exterior		-	0	Timer	CFL	CFL - 4 Pin	CFL42	4	Surface Mount Can	4	0	8	1,295	218
36	001	Interior		OFFICE	C007		-	1	Light Switch	Linear Fluorescent	T8	4' 32W T8	8	2x4 Prism Troffer	4	0	8	1,295	332
37	001	Interior		OFFICE	C005		-	2	Light Switch	Linear Fluorescent	T8	4' 32W T8	8	2x4 Prism Troffer	4	0	8	1,295	332
38	001	Interior		OFFICE	C004		-	1	Light Switch	Linear Fluorescent	T8	4' 32W T8	6	2x4 Prism Troffer	3	0	8	1,295	249
39	P07	Interior		RESTROOM	Boys		-	3	Light Switch	Linear Fluorescent	T8	4' 32W T8	12	2x4 Prism Troffer	6	0	8	1,295	497
40	003	Interior		MECHANICAL	B002		-	2	Light Switch	Linear Fluorescent	T8	4' 32W T8	8	2x4 Prism Troffer	4	0	8	1,295	332
41	004	Interior		MECHANICAL	B001		-	2	Light Switch	Linear Fluorescent	T8	4' 32W T8	4	2x4 Prism Troffer	2	0	8	1,295	166
42	001	Interior		JANITORIAL	B001		-	2	Light Switch	Linear Fluorescent	T8	4' 32W T8	8	2x4 Prism Troffer	4	0	8	1,295	332
43	004	Interior		CLASSROOM	8		-	2	Light Switch	Linear Fluorescent	T8	4' 32W T8	60	2x4 Prism Troffer	15	0	8	1,295	2,486
44	003	Interior		ClASSROOM	7		-	10	Light Switch	Linear Fluorescent	T8	4' 32W T8	180	2x4 Prism Troffer	45	0	8	1,295	7,459
45	P05	Interior		OFFICE	4th r		-	2	Light Switch	Linear Fluorescent	T8	4' 32W T8	24	2x4 Prism Troffer	12	0	8	1,295	995
46	P08	Interior		ClASSROOM	23		-	2	Light Switch	Linear Fluorescent	T8	4' 32W T8	48	2x4 Prism Troffer	24	0	8	1,295	1,989
47	P07	Interior		CLASSROOM	21		-	2	Light Switch	Linear Fluorescent	T8	4' 32W T8	48	2x4 Prism Troffer	24	0	8	1,295	1,989
48	P019	Interior		ClASSROOM	19		-	3	Light Switch	Linear Fluorescent	T8	4' 32W T8	24	2x4 Prism Troffer	12	0	8	1,295	995
49	P02	Interior		ClASSROOM	18		-	6	Light Switch	Linear Fluorescent	T8	4' 32W T8	90	2x4 Prism Troffer	45	0	8	1,295	3,730
50	P01	Interior		CLASSROOM	13		-	9	Light Switch	Linear Fluorescent	T8	8' 86W T8	54	Industrial	27	0	8	1,295	6,014
51	004	Interior		CLASSROOM	12		-	8	Light Switch	Linear Fluorescent	T8	4' 32W T8	144	2x4 Prism Troffer	36	0	8	1,295	5,967
52	001	Interior		CLASSROOM	1		-	6	Light Switch	Linear Fluorescent	T8	4' 32W T8	104	2x4 Prism Troffer	26	0	8	1,295	4,310
53	005	Interior		STORAGE	005		-	1	Light Switch	Linear Fluorescent	T8	4' 32W T8	24	Industrial	12	0	8	1,295	995
	Totals												1,241		483			68,635	58,477

									Fixture Details						Existing Consumption				Proposed- Post Retrofit				
Line No.	Building Name	Interior/ Exterior	Floor	Space Type	Room No.	Additional Area Description	Existing Control	Control Quantity	Technology	Sub-Technology	Lamp- Fixture	Fixture Quantity	Total Lamps	Fixture Height	Annual Hours	Existing Annual kWh	ECM	ECM Type	Recommended Sensor	LED Lamp Retrofit	Annual Hours of Operation	Proposed Annual kWh	Annual Savings From LED Retrofit
																							kWh
1	001	Interior		RESTROOM	T004		Light Switch	4	Linear Fluorescent	T8	4' 32W T8; 2x4 Prism Troffer	4	8	8	1,295	332	ECM		Wall Mounted	4' 17W LED T8	1,295	176	155
2	002	Interior		RESTROOM	T003		Light Switch	2	Linear Fluorescent	T8	4' 32W T8; 2x4 Prism Troffer	2	4	8	1,295	166	ECM	RB - Replace Bulb	Wall Mounted	4' 17W LED T8	1,295	88	78
3	004	Interior		RESTROOM	T001		Light Switch	3	Linear Fluorescent	T8	4' 32W T8; 2x4 Prism Troffer	12	24	8	1,295	995	ECM	RB - Replace Bulb	Ceiling Mounted	4' 17W LED T8	1,295	528	466
4	003	Interior		RESTROOM	T001		Light Switch	2	Linear Fluorescent	T8	4' 32W T8; 2x4 Prism Troffer	8	16	8	1,295	663	ECM	RB - Replace Bulb	Ceiling Mounted	4' 17W LED T8	1,295	352	311
5	001	Interior		RESTROOM	T001		Light Switch	3	Linear Fluorescent	T8	4' 32W T8; 2x4 Prism Troffer	3	6	8	1,295	249	ECM	RB - Replace Bulb	Wall Mounted	4' 17W LED T8	1,295	132	117
6	002	Interior		AuDITORIUM	Stage		Light Switch	1	Linear Fluorescent	T8	4' 32W T8; 2x4 Prism Troffer	6	12	8	1,295	497	ECM	RB - Replace Bulb	Wall Mounted	4' 17W LED T8	1,295	264	233
7	001	Interior		STORAGE	S003		Light Switch	1	Incan/H/MR	Incan	I100-Globe; Jelly Jar-hor	1	1	8	1,295	130		RB - Replace Bulb	Wall Mounted				
8	001	Interior		STORAGE	S003		Timer	1	HID	HPS	HPS150; Wallpack-Horizontal	4	4	8	1,295	777	ECM	RB - Replace Bulb	Wall Mounted	30W LED Wall Pack	1,295	155	622
9	002	Interior		STORAGE	S001		Light Switch	2	Linear Fluorescent	T8	4' 32W T8; 2x4 Prism Troffer	4	8	8	1,295	332	ECM	RB - Replace Bulb	Wall Mounted	4' 17W LED T8	1,295	176	155
10	001	Interior		OFFICE	Office hallway		Light Switch	2	Linear Fluorescent	T8	4' 32W T8; 2x4 Prism Troffer	11	44	8	1,295	1,823	ECM	RB - Replace Bulb	Wall Mounted	4' 17W LED T8	1,295	969	855
11	001	Interior		OFFICE	Office		Light Switch	2	Linear Fluorescent	T8	4' 32W T8; 2x4 Prism Troffer	2	4	8	1,295	166	ECM	RB - Replace Bulb	Wall Mounted	4' 17W LED T8	1,295	88	78
13	002	Interior		KiTCHEN	K001		Light Switch	2	Linear Fluorescent	T8	4' 32W T8; 2x4 Prism Troffer	9	27	8	1,295	1,119	ECM	RB - Replace Bulb	Ceiling Mounted	4' 17W LED T8	1,295	594	524
15	002	Interior		JANITORIAL	J001		Light Switch	4	Incan/H/MR	Incan	I100-Globe; Jelly Jar-hor	4	4	8	1,295	518		RB - Replace Bulb	Wall Mounted				
17	001	Interior		CAFETERIA	I001		Light Switch	3	Linear Fluorescent	T8	4' 32W T8; 1x4 Prism Troffer	2	4	8	1,295	166	ECM	RB - Replace Bulb	Wall Mounted	4' 17W LED T8	1,295	88	78
19	001	Interior		CAFETERIA	I001		Light Switch	3	Linear Fluorescent	T8	4' 32W T8; 1x4 Prism Troffer	2	2	8	1,295	83	ECM	RB - Replace Bulb	Wall Mounted	4' 17W LED T8	1,295	44	39
21	P08	Exterior		HALLWAY	Exterior		Timer	1	CFL	CFL - 4 Pin	CFL42; Wallpack-Horizontal	6	6	8	1,295	326		RF - Replace Entire Fixture	Photo Sensor				
22	P07	Exterior		HALLWAY	Exterior		Timer	0	CFL	CFL - 4 Pin	CFL42; Wallpack-Horizontal	7	7	8	1,295	381		RF - Replace Entire Fixture	Photo Sensor				
24	P01	Exterior		HALLWAY	Exterior		Timer	0	HID	HPS	HPS250; Wallpack-Horizontal	1	1	8	1,295	324	ECM	RF - Replace Entire Fixture	Photo Sensor	50W LED Flood	1,295	65	259
25	P01	Exterior		HALLWAY	Exterior		Light Switch	0	CFL	CFL - 2 Pin	CFL13; Wallpack-Horizontal	3	6	8	1,295	101	No ECM	RF - Replace Entire Fixture	Photo Sensor	6W LED A19	1,295	85	16
26	004	Interior		HALLWAY	Exterior		Timer	0	CFL	CFL - 4 Pin	CFL42; Surface Mount Can	11	11	8	1,295	598		RF - Replace Entire Fixture	Photo Sensor				
27	004	Interior		HALLWAY	Exterior		Timer	0	HID	HPS	HPS150; Wallpack-Horizontal	2	2	8	1,295	389	ECM	RF - Replace Entire Fixture	Photo Sensor	30W LED Wall Pack	1,295	78	311
28	003	Interior		HALLWAY	Exterior		Timer	0	CFL	CFL - 4 Pin	CFL42; Surface Mount Can	6	6	8	1,295	326		RF - Replace Entire Fixture	Photo Sensor				
32	002	Exterior		HaLLWAY	Exterior		Timer	0	HID	HPS	HPS150; Wallpack-Horizontal	4	4	8	1,295	777	ECM	RF - Replace Entire Fixture	Photo Sensor	30W LED Wall Pack	1,295	155	622
33	002	Exterior		HaLLWAY	Exterior		Timer	0	CFL	CFL - 4 Pin	CFL42; Surface Mount Can	2	2	8	1,295	109		RF - Replace Entire Fixture	Photo Sensor				
34	P02	Exterior		CLASSROOM	Exterior		Timer	0	HID	HPS	HPS150; Wallpack-Horizontal	2	2	8	1,295	389	ECM	RF - Replace Entire Fixture	Photo Sensor	30W LED Wall Pack	1,295	78	311
35	P02	Exterior		CLASSROOM	Exterior		Timer	0	CFL	CFL - 4 Pin	CFL42; Surface Mount Can	4	4	8	1,295	218		RF - Replace Entire Fixture	Photo Sensor				
36	001	Interior		OFFICE	C007		Light Switch	1	Linear Fluorescent	T8	4' 32W T8; 2x4 Prism Troffer	4	8	8	1,295	332	ECM	RB - Replace Bulb	Wall Mounted	4' 17W LED T8	1,295	176	155
37	001	Interior		OFFICE	C005		Light Switch	2	Linear Fluorescent	T8	4' 32W T8; 2x4 Prism Troffer	4	8	8	1,295	332	ECM	RB - Replace Bulb	Wall Mounted	4' 17W LED T8	1,295	176	155
38	001	Interior		OFFICE	C004		Light Switch	1	Linear Fluorescent	T8	4' 32W T8; 2x4 Prism Troffer	3	6	8	1,295	249	ECM	RB - Replace Bulb	Wall Mounted	4' 17W LED T8	1,295	132	117
39	P07	Interior		RESTROOM	Boys		Light Switch	3	Linear Fluorescent	T8	4' 32W T8; 2x4 Prism Troffer	6	12	8	1,295	497	ECM	RB - Replace Bulb	Ceiling Mounted	4' 17W LED T8	1,295	264	233
40	003	Interior		MECHANICAL	B002		Light Switch	2	Linear Fluorescent	T8	4' 32W T8; 2x4 Prism Troffer	4	8	8	1,295	332	ECM	RB - Replace Bulb	Ceiling Mounted	4' 17W LED T8	1,295	176	155
41	004	Interior		MECHANICAL	B001		Light Switch	2	Linear Fluorescent	T8	4' 32W T8; 2x4 Prism Troffer	2	4	8	1,295	166	ECM	RB - Replace Bulb	Ceiling Mounted	4' 17W LED T8	1,295	88	78
42	001	Interior		JANITORIAL	B001		Light Switch	2	Linear Fluorescent	T8	4' 32W T8; 2x4 Prism Troffer	4	8	8	1,295	332	ECM	RB - Replace Bulb	Wall Mounted	4' 17W LED T8	1,295	176	155
45	P05	Interior		OFFICE	4th r		Light Switch	2	Linear Fluorescent	T8	4' 32W T8; 2x4 Prism Troffer	12	24	8	1,295	995	ECM	RB - Replace Bulb	Ceiling Mounted	4' 17W LED T8	1,295	528	466
48	P019	Interior		CIASSROOM	19		Light Switch	3	Linear Fluorescent	T8	4' 32W T8; 2x4 Prism Troffer	12	24	8	1,295	995	ECM	RB - Replace Bulb	Ceiling Mounted	4' 17W LED T8	1,295	528	466
49	P02	Interior		CIASSROOM	18		Light Switch	6	Linear Fluorescent	T8	4' 32W T8; 2x4 Prism Troffer	45	90	8	1,295	3,730	ECM	RB - Replace Bulb	Wall Mounted	4' 17W LED T8	1,295	1,981	1,748
50	P01	Interior		CLASSROOM	13		Light Switch	9	Linear Fluorescent	T8	8' 86W T8; Industrial	27	54	8	1,295	6,014		RB - Replace Bulb	Ceiling Mounted				
52	001	Interior		CLASSROOM	1		Light Switch	6	Linear Fluorescent	T8	4' 32W T8; 2x4 Prism Troffer	26	104	8	1,295	4,310	ECM	RB - Replace Bulb	Ceiling Mounted	4' 17W LED T8	1,295	2,290	2,020
53	005	Interior		STORAGE	005		Light Switch	1	Linear Fluorescent	T8	4' 32W T8; Industrial	12	24	8	1,295	995	ECM	RB - Replace Bulb	Wall Mounted	4' 17W LED T8	1,295	528	466
51	004	Interior		CLASSROOM	12		Light Switch	8	Linear Fluorescent	T8	4' 32W T8; 2x4 Prism Troffer	36	144	8	1,295	5,967	ECM	RB - Replace Bulb	Ceiling Mounted	4' 17W LED T8	1,295	3,170	2,797
	Totals												1,241									25,026	23,798

APPENDIX D:
ECM Checklist

NA	In Place	Evaluate	ECM Description
✓			Add Reflective Coating To Exterior Windows
	✓		Replace External Windows
	✓		Upgrade Insulation
✓			Control External Air Leakage In Commercial Buildings
✓			Install Reflective Insulation Between Radiators And External Wall
✓			Replace Existing Motors With High Efficiency Motors
✓			Install On-Demand Ventilation on Air Handlers
✓			Reduce HVAC Hours of Operation
✓			Install Variable Frequency Drives (VFD)
✓			Install Outside Air Temperature Reset Controls For Hot Water Boilers
✓			Install Chilled Water Reset Control
✓			Install Timers On Exhaust Fans
✓			Install Energy Savers on Vending, Snack Machines
✓			Install Building Energy Management System and Replace Terminal Units
✓			Re-Commission The Building & Its Control Systems
✓			Replace Inefficient Heating Plant
✓			Replace Inefficient Cooling Plant
✓			Replace Existing Air Conditioners with Energy Star Air Conditioners
✓			Replace Unit Electric Heaters with Natural Gas Fired Unit Heaters
	✓		Convert From Gas Pilot to Electronic Ignition for Boilers
✓			Insulate Hot Water Pipes
	✓		Insulate Refrigerant Lines
	✓		Insulate Hot Surfaces And Tanks
	✓		Insulate Air Ducts
✓			Replace Defective Steam Traps
✓			Upgrade Electric Heating System To Heat Pumps
	✓		Replace Inefficient Furnace System
✓			Replace Rooftop Package Unit
	✓		Install Energy Recovery Wheel on Air Handling Unit
		✓	Replace Existing Water Heater With New Energy Efficient Units
		✓	Replace Incandescent/Halogen Lamps With Energy Efficient Lamps
		✓	Upgrade Inefficient Linear Fluorescent Lamps And Fixtures
	✓		Upgrade EXIT SIGNS With LED EXIT Signs
✓			Bilevel and Tandem Linear Fluorescent Lighting ECM
		✓	Replace High Intensity Discharge (HID) Lamps With Energy Efficienct Lamps
✓			Replace Existing Refrigerator(s) With Energy Star Certified Refrigerator(s)
✓			Replace Existing Freezers With High Efficiency Freezers
✓			Install Low Flow Shower Heads
		✓	Install Low Flow Faucet Aerators
✓			Install Low Flow Restroom Flush Tank Toilets
		✓	Install Low Flow Tankless Restroom Fixtures

APPENDIX E:
ECM Calculations

UIC	Install Low Flow Faucet Aerators
EAP2-b	**Location**: Throughout

Property Type:	Commercial	Estimated No. of Operational Weeks	52
		Number of Occupied Days/Week (Max 7)	7

KITCHEN FAUCETS			BATHROOM FAUCETS		
Number of Occupants Affected By Retrofit	600		Number of Occupants Affected by Retrofit	600	
Do You Want To Replace Kitchen Faucets Aerators	Yes	*(Select)*	Do You Want To Replace Bathroom Faucets Aerators	Yes	*(Select)*
Total Number of Faucet Aerators To Be Replaced	26		Total Number of Faucet Aerators To Be Replaced	23	
Total Number of Faucets To Be Replaced:	0		Total Number of Faucets To Be Replaced:	0	
GPM of Existing Faucet Aerators	2.2	GPM	GPM of Existing Faucet Aerators	2.2	GPM
GPM of Proposed Faucet Aerator	0.5	GPM	GPM of Proposed Faucet Aerator	0.5	GPM
Estimated Number of Uses Per Day	4		Estimated Number of Uses Per Day	5	

Annual Water Savings From Installing Low Flow Aerators: 320.79 kGal

WATER & ENERGY SAVING CALCULATION			COST SAVING CALCULATION		
Select Type of Water Heater Fuel:	Natural Gas	(Select)	Property Location in United States	North Central Localities	
Energy Factor of Domestic Hot Water Heater:	0.43	EF	Heating Fuel Tariff	$1.30	$/Therm
Hot Water Discharge Temperature at Faucet	110.00	°F	Water Tariff ($/1000 Gal)	$5.29	$/kGal
Equivalent Heating Fuel Savings: *Savings Discounted by 15% to Account For Cold Water Use*	3,173	Therms	Annual Cost Savings In Form of Water	$1,695	$
Annual Water Savings	320.79	kGal	Annual Energy Savings From Water Heater	$4,126	$

COST BENEFIT ANALYSIS					
Estimated Total Annual Cost Savings	$5,822	$$	Estimated Total Installation Cost	$746	$$
Simple Payback Period	0.13	Years	*Type of Recommendation*	No/Low Cost ECM Recommendation	

ECM EXPLANATION:

By reducing the flow of water coming from the restroom faucets, aerators can generate energy savings at low cost and with easy installation. The savings generated would be in the form of reduced water and sewer costs and at the same time aerators would save energy by reducing the demand for hot water. The average faucet has a flow rate of about 2 to 4 GPM. Adding a screw-in faucet aerator reduces the flow to 0.5 to 1.5 GPM in the bathroom and 2.2 GPM in the kitchen. In addition to saving energy and water, the "foamier" water that comes from faucet aerators wets objects better than water from a faucet with no aerator, which tends to bounce off the object rather than thoroughly wetting it.

EMG recommends replacing the proposed faucet aerators with new low flow aerators as mentioned above. The proposed ECM shall also result in an annual energy saving in form of reduction in water heating bills.

Summary:

Initial Investment: $746 Estimated Annual Cost Savings: $5,822 Simple Payback Period (Yrs): 0.13

UIC	Install Timers On Exhaust Fans
EAC7A	Location:Throughout

Type of Exhaust Fan: Rooftop Exhaust Fans

EXISTING CONDITION

No. of Timers to Be Installed:	4	Qty	HP of Individual Fan Motor:	0.17	HP
No. of Exhaust Fans:	4		Total kW:	0.51	kW
Existing Daily Hours of Operation/Exhaust Fan:	2.00	Hrs/Day	Annual kWh For All Fans:	370	kWh

PROPOSED CONDITION

New Daily Hours With Timers/Exhaust Fan:	0.94	Hrs/Day	New Annual kWh For All Fans:	174	kWh
Type of Heating Fuel:	Natural Gas		Is The Property Cooled?	Yes	

Only For Apt. Bathroom Exhaust Fans			Only For Roof Top Exhaust Fans- Commerical Spaces		
CFM for Individual Bathroom Exhaust Fans *(For bathrooms<100Sqft)*	90	CFM	No. of Water Closets In Building	28	
			No. of Urinals In Building	11	
Total Exhuast CFM From All Fans	360	CFM	Total CFM for All Restroom Exhaust	1,950	CFM
Annual Heating Energy Savings	0	kbtu	Annual Heating Energy Savings	8,941	kbtu
Annual Cooling Energy Savings	0	kbtu	Annual Cooling Energy Savings	4,471	kbtu

Energy & Cost Savings

Estimated Annual Heating Plant Efficiency	79.05	%	Estimated Annual Cooling Plant Efficiency	9.71	EER
Annual Heating Energy Savings	113	Therms	Annual Cooling Energy Savings	460	kWh
Annual Electric Fan Motor Savings	197	kWh			

COST ANALYSIS

Electric Rate:	**$0.17**	$/kWh	Total Annual Electric Savings	657	kWh
Material Cost For Timers:	$677	$	Total Annual Non Electric Savings	113	Therms
Total Cost for Installing Timers	$1,416	$	Annual Cost savings:	$257	$
Simple Payback:	5.51	Yrs			

Type of Recommendation Capital Cost ECM Recommendation

ECM DESCRIPTION:

Exhaust fans are generally used in areas with high concentrations of pollutants generated from occupants' activities. These exhaust requirements are rarely continuous, and the fans should operate only as needed. Continuous operations of bathroom exhaust fans results in exhausting conditioned air out. This causes low pressures in the conditioned space, which is filled up by infiltrated air from unconditioned spaces. Air infiltration leads to increase loads on heating and cooling system increasing the energy consumed to condition the space. In addition to this the fan motor is also consumes energy to operate, though insignificant as compared to the HVAC losses. In case of the residential properties with individual exhaust fans in the bathrooms, EMG recommends installing timer switches on each bathroom fan to control the fan operations. Bathroom fans are essential to exhaust out the excess humidity and odor control. The timer switch will limit the operation time to 20 mins.

In case of central exhaust systems that have roof top or side wall mounted exhaust fans, EMG recommends a single electronic timer control to restrict the exhaust fan operations to typical building occupancy hours +/- 2 hrs. A single electronic timer would be able to control all the exhaust fans.

Summary:

Initial Investment:	$677	Simple Payback:	5.51	Years
Energy Cost Savings:	$257			

UIC	**Upgrade Building Lighting to LED and Install Automatic Lighting Controls**
EAL10	**Location: Building Interior and Exterior**

	No. of ECMs	No. of Fixtures	No. of Lamps	KWh Saved	Energy Cost Saving	O & M Savings
Upgrade Lighting to LED	296	397	1,121	23,783	$4,043.05	$1,469.50

Existing Technology	**Sub-Technology**	No. of ECMs	No. of Fixtures	No. of Lamps	KWh Saved	Energy Cost Saving	O & M Savings
CFL	CFL - 2 Pin	0	0	0	0	$0	$0
CFL	CFL - 4 Pin	0	0	0	0	$0	$0
CFL	CFL - Screw-in	0	0	0	0	$0	$0
Circiline	T9	0	0	0	0	$0	$0
Incan/H/MR	H	0	0	0	0	$0	$0
Incan/H/MR	Incan	0	0	0	0	$0	$0
Incan/H/MR	MR	0	0	0	0	$0	$0
HID	HPS	6	14	14	2,279	$387	$352
HID	MH	0	0	0	0	$0	$0
HID	MV	0	0	0	0	$0	$0
HID	QL	0	0	0	0	$0	$0
Linear Fluorescent	T8	33	383	383	21,503	$3,656	$1,117
Linear Fluorescent	T12	0	0	0	0	$0	$0
Linear Fluorescent	T8 U	0	0	0	0	$0	$0
Linear Fluorescent	T12 U	0	0	0	0	$0	$0
Linear Fluorescent	T5	0	0	0	0	$0	$0
Linear Fluorescent	T6	0	0	0	0	$0	$0
Linear Fluorescent	T10	0	0	0	0	$0	$0

Proposed Controls	**No. of Controls**		**No. of Controls**
Photo Sensor	0	Ceiling Mounted	51
Wall Mounted	50		

Initial Investment			**Equipment Rentals**	
Material Cost	$15,286.00		Scissor Lift 26' - Interior Spaces	$185.00
Labor Cost	$29,071.87		Bucket Truck - Exterior Spaces	$0.00
Local Electric Rate:	$0.17	$/kWh	Estimated Annual Energy Savings:	23,783
Hourly Labor Rate For Electrician:	$82.45		Estimated Annual Energy Cost Savings:	$4,043
Budgeted Initial Investment:	$44,543		Estimated Annual O&M Cost Savings:	$1,470
Estimated Return on Investment:	8.08	Years	Estimated Annual Cost Savings:	$5,513
(Including O&M Savings)				

UIC	Install Low Flow Tankless Restroom Fixtures
EAP4	Location:Througout

ECM FOR DETERMINING WATER SAVINGS IN COMMERCIAL PROPERTIES

Number of Males	300	
Number of Females	300	
Number of Occupied Days Per Week (Max 7)	5	
Number of Occupied Weeks/Year (Max 52)	37	
Number of Urinals To Be Retrofitted	9	
Number of Water Closets To Be Retrofitted	28	
No. of Water Closets With Separate Flush Tank (Typical Residential Type)	4	
Estimated Restroom Usage/Individual/Day (Default is 4 Uses/Day For Residential/Office)	4	(Select)

Urinal Water Savings

Do you Want To Make Any Changes To The Urinals?	Yes	
Estimated Existing Use of Urinal/Day/Man	80%	
Existing Gallons Per Flush Ratings For Urinal Flushes	1.00	GPF
Proposed Urinal	0.125 GPF -Floor Mount	
GPF of Proposed Urinal Flush Valve** (**(1992 EpACT Energy Act Mandates 1.0GPF Max on Urinals)	0.125	GPF
Estimated Annual Water Savings From Urinal	155.40	kGal

Water Closet Water Savings

Tankless Water Closets

Do The Water Closet Need To Be Retrofitted?	(Select)	Yes	
Existing Gallons Per Flush Ratings For Water Closet Flushes		1.60	GPF
Are The Existing Water Closet Being Replaced? (if No; Then Only The Flush Valve Would Be Replaced With Dual Flush Retrofit Kit)	(Select)	Yes	
No. of Tankless Water Closets		24	
GPF of Proposed Dual Flush- Water Closet Valve* (*Federal Law Requires All Flushes Not To Exceed 1.6 GPF)	Solid Waste(20%)	1.60	GPF
	Liquid Waste(80%)	0.40	GPF
Estimated Annual Water Savings From Male Users		42.62	kGal
Estimated Annual Water Savings From Female Users		213.12	kGal
Total Water Savings From Water Closets		255.74	kGal

Water & Cost Saving Calculations

Water Savings Calculation

Water Savings By The Use of Low Flow Water Closet Flush Valves/Yr	255.74	kgal
Water Savings By The Use of Low Flow Urinal Flush Valves/ Yr	155.40	kgal
Total Annual Water Savings in kgal	411.14	kgal

Cost Savings Calculations

Enter Water Tariff Rate ($/1000Gal)	$5.29	$$
Estimated Cost Savings From Water	$2,173	$$

Estimated Cost of Retrofit

Cost For Replacing Existing Urinal Fixture With A Low Flow Fixture	$11,781 (Includes Labor)	$$
Cost For Replacing Existing Water Closet With A New Water Closet And- Dual Flush Valves (Up For Liquid Waste And Down For Solid Waste)	$26,293 (Includes Labor)	$$
Estimated Total Cost For Retrofit	$38,075	$$
Simple Pay Back Period	17.52	Yrs
Type of Recommendation	Capital Cost ECM Recommendation	

ECM EXPLANATION:

The highest water utilization at any home/office occurs in the restrooms. It is estimated that on an average a normal human being uses the restroom at least four times a day. Keeping with the global water conservation objectives, federal law prohibits use of any new water closet flushes over 1.6 GPF. At the same time the '1992 EpACT' mandates all new Urinals to have a maximum 1.0 GPF flush valves on urinals.

EMG recommends replacing all urinals above 1.0 GPF with a new 0.5 GPF or lesser urinals. At the same time EMG also recommends replacing all the water closets having a GPF rating of 1.6 and over with low flow water closet fixtures equipped with dual flush valves.

In case the property doesn't wish to replace the entire water closet fixtures, EMG recommends retrofitting all the tankless water closet flush fixtures with new dual flush fixtures that would result in a 30% water savings per flush for liquid wastes, while retaining the same flush rate for solid wastes.

SUMMARY:

Initial Investment:	$38,075	Simple Payback Period:	17.52 Yrs
Annual Cost Savings:	$2,173		

APPENDIX F:
Solar PV

UIC	Install Fixed Tilt Solar Photovoltaic System
EAR-2	Details:Roof

Select State: Northern California **Electric Rate:** **$0.17** $/KWH Annual Electric Consumption: 205,810 KWh

Roof No.	Description	Number of Roofs	DC System Size Per Roof	PV System Sizing For All Roofs	Estimated Number of 315 Watt PV Panels:	Total Estimated Annual Electricity Generated/ Roof	Total Estimated Electricity Generated (All Roofs)	Total Cost Savings	Installation Cost: ($3.5/Watt)	Simple Pay Back Period without Incentives	One Time Potential Utility or State Incentives	One Time Potential Federal Incentives	Annual Potential Incentives and Rebates		Simple Pay Back Period with All Incentives
			kW	kW		kWh	kWh			Yrs		Dept. of Treasury Renewable Grant (30%)	Federal REPI Incentive	Solar Renewable Certificates (SRECS)-(~$0/MWH)	Years
												30%	$0.02	$0	
1	Building 1	1	25.80	26	82	39,617	39,617	$6,735	$90,300	13.4	$0	$27,090	$872	$0	8.1
2	Building 2	1	28	28	89	42,842	42,842	$7,283	$97,650	13.4	$0	$29,295	$943	$0	8.1
3	Building 3	1	24	24	76	36,546	36,546	$6,213	$83,300	13.4	$0	$24,990	$804	$0	8.1
4	Building 4	1	19	19	60	29,175	29,175	$4,960	$66,500	13.4	$0	$19,950	$642	$0	8.1
5	Building 5	1	20	20	63	30,250	30,250	$5,143	$68,950	13.4	$0	$20,685	$666	$0	8.1
6				0	0		0	$0	$0		$0	$0	$0	$0	
7				0	0		0	$0	$0		$0	$0	$0	$0	
8				0	0		0	$0	$0		$0	$0	$0	$0	
9				0	0		0	$0	$0		$0	$0	$0	$0	
10				0	0		0	$0	$0		$0	$0	$0	$0	
		5		**116**	**369**	**178,430.0**	**178,430**	**$30,333**	**$406,700**	**13.41**	**$0**	**$122,010**	**$3,925**	**$0**	**8.09**

Solar Rooftop Photovoltaic Analysis		
Total Number of Roofs	5	
Estimated Number of Panels	369	
Estimated KW Rating	116	KW
Potential Annual KWh Produced	178,430	KWh
% of Current Electricity Load	86.7%	

Financial Analysis		
Investment Cost	$406,700	
Estimated Energy Cost Savings	$30,333	
Potential Rebates	$122,010	
Potential Annual Incentives	$3,925	
Payback without Incentives	13.4	years
Incentive Payback but without SRECS	8.1	years
Payback with All Incentives	8.1	years