LEVEL II ENERGY AUDIT

SACRAMENTO CITY UNIFIED SCHOOL DISTRICT
5735 47th Avenue
Sacramento, California 95824

DLR GROUP
1050 20th Street, Suite 250
Sacramento, California 95906

PREPARED BY:
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EMG PROJECT #:

136988.19R000-005.268

DATE OF REPORT:

October 22, 2019

ONSITE DATE:

September 23, 2019

ZERO NET ENERGY ASHRAE LEVEL II AUDIT

CHARLES A. JONES CAREER & EDUCATION CENTER

5451 Lemon Hill Avenue

Sacramento, California 95824

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Certification

EMG has completed an Energy Audit of Charles A. Jones Career & Education Center located at 5451 Lemon Hill Avenue in Sacramento, California 95824. EMG visited the site on September 23, 2019.

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 95824. Since actual installed costs may vary widely for particular installation based on labor & 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: Galileo Atalig
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 Charles A. Jones Career & Education Center 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 & 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.

BUILDING #	STRUCTURES ASSESSED	BUILDING TYPE	EMG CALCULATED AREA (SF)	ESTIMATED OCCUPANCY
1	Building 00A	School Building	56,487	100-150
2	Building 00B	School Building	39,483	75-125
3	Building 00C	School Building	2,989	25-50
4	Building 00D	School Building	3,103	25-50
5	Building 00E	School Building	5,760	50-75
6	Portables	School Building	4,800	50-75

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 three 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)*	$ 122,263 *(In Current Dollars)*
Estimated Annual Cost Savings *(Current Dollars Only)*	$14,607 *(In Current Dollars)*
ECM Effective Payback	8.37 years
Estimated Annual Energy Savings	6%
Estimated Annual Energy Utility Cost Savings *(Excluding Water)*	8%
Estimated Annual Water Cost Saving	1%

Solar Photovoltaic (PV) Screening for CHARLES A. JONES CAREER & EDUCATION CENTER

SOLAR ROOFTOP PHOTOVOLTAIC ANALYSIS		
Estimated Number of Panels	67	
Estimated KW Rating	58	KW
Potential Annual kWh Produced	91,099	kWh
% of Current Electricity Uses	12%	
FINANCIAL SUMMARY		
Investment Cost	$203,000	
Estimated Energy Cost Savings	$14,576	
Payback without Incentives	13.9	Years
Incentive Payback but without SRECs	8.4	Years
Payback with All Incentives	8.4	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)	53 kBtu/ft^2
Post ECM Site Energy Use Intensity (EUI)	50 kBtu/ft^2
SOURCE ENERGY USE INTENSITY (EUI)	**RATING**
Current Source Energy Use Intensity (EUI)	129 kBtu/ft^2
Post ECM Source Energy Use Intensity (EUI)	119 kBtu/ft^2
BUILDING COST INTENSITY (BCI)	**RATING**
Current Building Cost Intensity	$1.74/ft^2
Post ECM Building Cost Intensity	$1.60/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	263 MMbtu
Total CO_2 Emissions Reduced	24.23 $MtCO_2$/Yr
Total Cars Off the Road (Equivalent)*	4
Total Acres of Pine Trees Planted (Equivalent)*	6

**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	4,328,851 kBtu
Total Annual Energy Savings for Non-Renewable Energy Measures	263,383 kBtu
Total Annual Energy Savings from Renewable Energy Measures	310,830 kBtu
Total Annual Energy Savings	574,213 kBtu
Net Energy Consumption from Grid Post Implementation	3,754,638 kBtu
% Energy Reduction (Annual Energy-Net Energy) / (Annual Energy)	13%

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 Charles A. Jones Career & Education Center

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: Apartment Bathrooms	$518	289	0	38	$631	$0	$631	0.82	10.40	$4,867	10.00
2	Retrofit Apartment Tank Toilets to Dual Flush Location:	$629	0	0	9	$66	$0	$66	9.52	1.56	$355	20.00
Totals for No/Low Cost Items		**$1,147**	**289**	**0**	**48**	**$697**	**$0**	**$697**	**1.65**			
Capital Cost Recommendations												
1	Upgrade Building Lighting to LED and Install Automatic Lighting Controls Location: Building Interior And Exterior	$105,168	0	77,302	0	$12,080	$3,453	$15,533	6.77	1.76	$80,259	15.00
Total For Capital Cost		**$105,168**	**0**	**77,302**	**0**	**$12,080**	**$3,453**	**$15,533**	**6.77**			
	Interactive Savings Discount @ 10%		-29	-7,730	-5	-$1,278	-$345	-$1,623				
	Total Contingency Expenses @ 15%	$15,947										
Total for Improvements		**$122,263**	**260**	**69,572**	**43**	**$11,500**	**$3,107**	**$14,607**	**8.37**			

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 Charles A. Jones Career & Education Center

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 Timers On Exhaust Fans Location:	$354	-895	-8,237	0	-$2,420	$0	-$2,420	-0.15	-81.62	-$29,240	15.00
2	Replace Existing Air Conditioners with Energy Star Air Conditioners Location:	$43,538	0	15,551	0	$2,430	$122	$2,552	17.06	0.70	-$13,076	15.00
3	Replace Existing Motors With High Efficiency Motors Location:	$5,261	0	920	0	$144	$7	$151	34.84	0.34	-$3,459	15.00
4	Install Low Flow Tankless Restroom Fixtures Location:	$70,087	0	0	83	$578	$0	$578	121.26	0.10	-$63,187	15.00
Total for Improvements		**$119,240**	**-895**	**8,235**	**83**	**$732**	**$129**	**$861**	**138.48**			

2. Introduction

The purpose of this Energy Audit is to provide Charles A. Jones Career & Education Center 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	40
Operational Weeks / Year	37
Estimated Facility Occupancy	252
% of Male Occupants	50%

POINT OF CONTACT	
Point of Contact Name	Desiree Albo
Point of Contact Title	Plant Manager
Point of Contact – Contact Number	916.296.1442

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

Description:

Heating and cooling is mainly provided by rooftop packaged units. There are also split system air conditioners and furnaces.

The Mechanical Equipment Schedule in Appendix E contains a summary of the HVAC Equipment at the property.

BUILDING CENTRAL HEATING SYSTEM	
Primary Heating System	Rooftop Packaged Units
Secondary Heating System	Forced Air Furnace
Hydronic Distribution System	Not Applicable
Primary Heating Fuel	Natural Gas
Heating Mode Set-point	69 °F
Heating Mode- Set-back Temperature	53 °F

BUILDING COOLING SYSTEM	
Primary Cooling System	Rooftop Packaged Units
Secondary Cooling System	Split Systems

BUILDING COOLING SYSTEM	
Hydronic Distribution System	Not Applicable
Cooling Mode Set-point	68 °F
Cooling Mode- Set-back Temperature	93 °F

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 High Intensity Discharge (HID) fixtures.

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
$0.16 /kWh	$1.27/therm	$ 6.98/kGal

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.

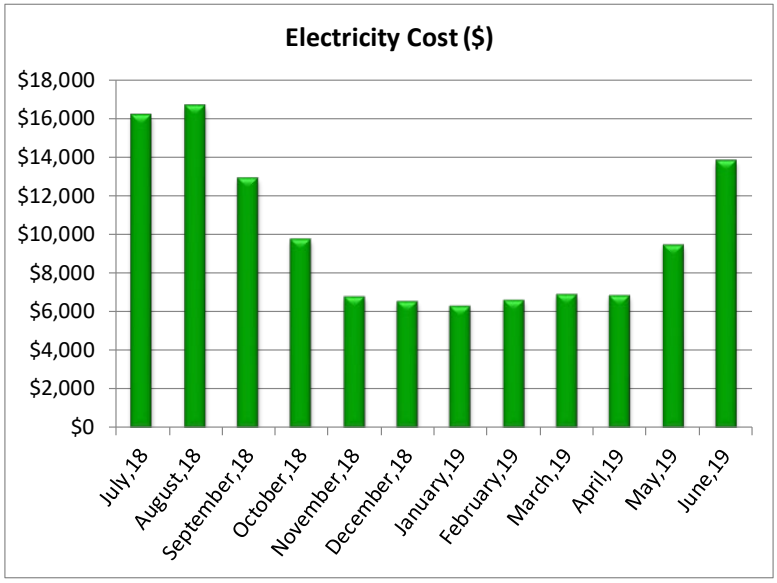
4.1. Electricity

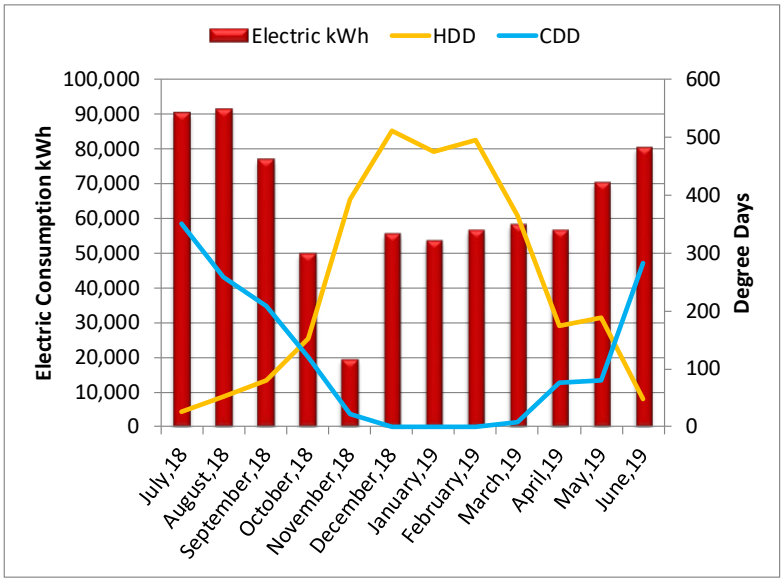
PGE satisfies the electricity requirements for the facility. The primary end uses for electric utility compromises of lighting, cooling, office/school equipment, and appliances in the break room.

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	90,240	$0.18	$16,181
August,18	91,238	$0.18	$16,644
September,18	77,051	$0.17	$12,887
October,18	49,967	$0.19	$9,706
November,18	19,344	$0.35	$6,771
December,18	55,451	$0.12	$6,500
January,19	53,440	$0.12	$6,279
February,19	56,514	$0.12	$6,576
March,19	58,090	$0.12	$6,886
April,19	56,383	$0.12	$6,811
May,19	70,103	$0.13	$9,406
June,19	80,106	$0.17	$13,797
Total/average	**757,928**	**$0.16**	**$118,442**


Electricity Cost ($)
$18,000
$16,000
$14,000
$12,000
$10,000
$8,000
$6,000
$4,000
$2,000
$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


Electric kWh
HDD
CDD
Electric Consumption kWh
Degree Days
100,000
90,000
80,000
70,000
60,000
50,000
40,000
30,000
20,000
10,000
0
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

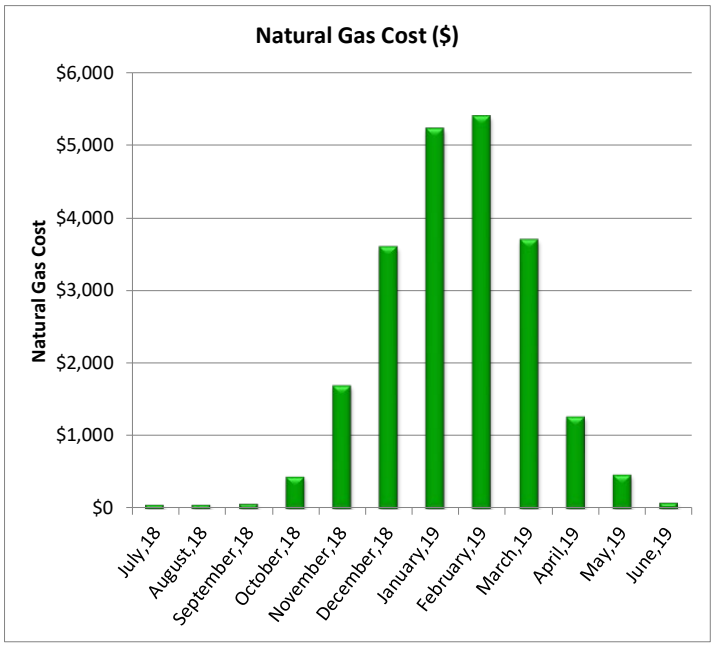
4.2. Natural Gas

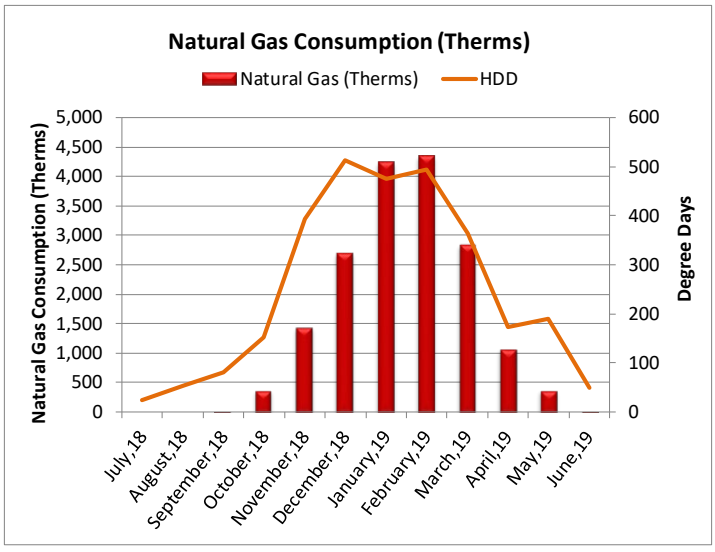
Spurr Gas satisfies the natural gas requirements of the facility. The primary end use of natural gas is for building heating, domestic water heating, and cooking in the cafeteria.

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	0	$0.00	$52
August,18	0	$0.00	$52
September,18	18	$3.80	$67
October,18	384	$1.16	$445
November,18	1,439	$1.17	$1,689
December,18	2,699	$1.34	$3,604
January,19	4,238	$1.23	$5,229
February,19	4,337	$1.24	$5,392
March,19	2,835	$1.31	$3,704
April,19	1,070	$1.18	$1,261
May,19	374	$1.27	$476
June,19	34	$2.44	$84
Total/average	**17,428**	**$1.27**	**$22,053**


Natural Gas Cost ($)
Natural Gas Cost
$6,000
$5,000
$4,000
$3,000
$2,000
$1,000
$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

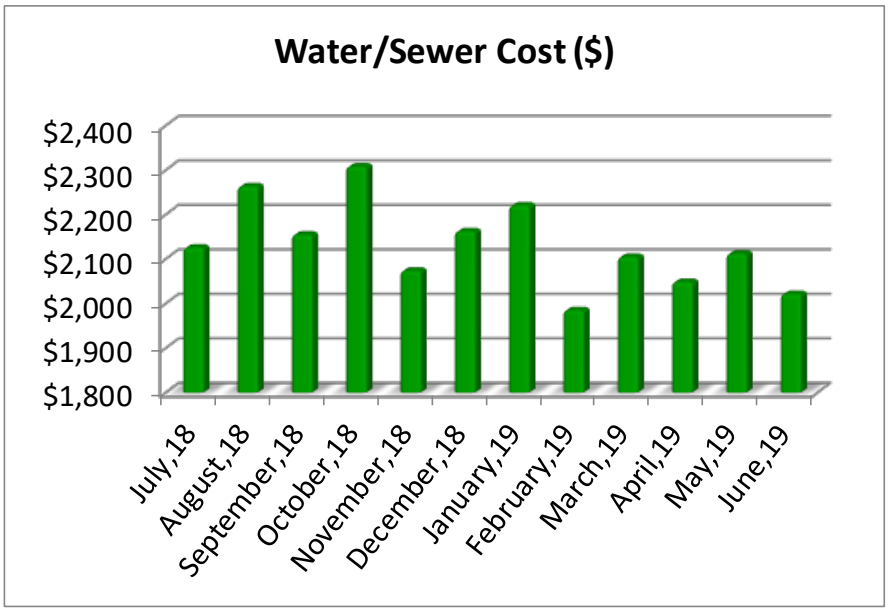

Natural Gas Consumption (Therms)
Natural Gas (Therms)
HDD
Natural Gas Consumption (Therms)
5,000
4,500
4,000
3,500
3,000
2,500
2,000
1,500
1,000
500
0
Degree Days
600
500
400
300
200
100
0
July,18
August,18
September,18
October,18
November,18
December,18
January,19
February,19
March,19
April,19
May,19
June,19

4.3. 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	307	$6.93	$2,126
August,18	353	$6.42	$2,264
September,18	330	$6.54	$2,155
October,18	359	$6.42	$2,309
November,18	268	$7.75	$2,075
December,18	283	$7.65	$2,163
January,19	285	$7.80	$2,221
February,19	279	$7.12	$1,986
March,19	308	$6.84	$2,106
April,19	290	$7.05	$2,049
May,19	321	$6.58	$2,113
June,19	282	$7.17	$2,022
Total/average	**3,664**	**$6.98**	**$25,588**


Water/Sewer Cost ($)
$2,400
$2,300
$2,200
$2,100
$2,000
$1,900
$1,800
July,18
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September,18
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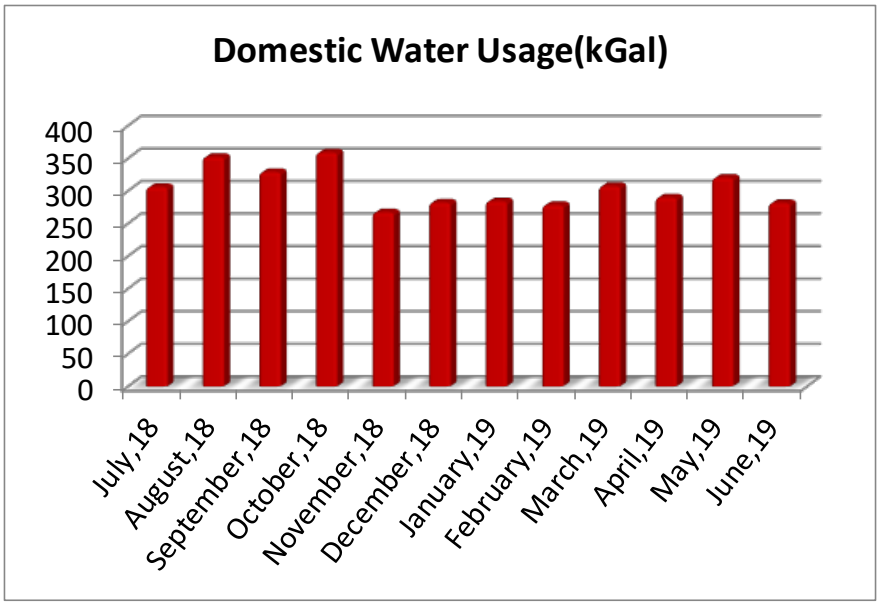
December,18
January,19
February,19
March,19
April,19
May,19
June,19


Domestic Water Usage(kGal)
400
350
300
250
200
150
100
50
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

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?	**Yes**
Is the property located in a state eligible for net metering?	**Yes**

A solar feasibility analysis of the Charles A. Jones Career & Education Center 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	67	
Estimated KW Rating	58	KW
Potential Annual kWh Produced	91,099	kWh
% of Current Electricity Uses	12%	
FINANCIAL SUMMARY		
Investment Cost	$203,000	
Estimated Energy Cost Savings	$14,576	
Payback without Incentives	13.9	Years
Incentive Payback but without SRECs	8.4	Years
Payback with All Incentives	8.4	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) Investment 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

Mechanical Inventory						
System	Make	Model	Serial Number	Input Capacity	Location	Location- Floor
Condensing Unit/Heat Pump	United Technologies Carrier	40QN8018300	4899V50118	1.5 TON	Charles A. Jones Career & Education Center / 00A - Building 100/200	Utility closet
Condensing Unit/Heat Pump	Ameristar	No tag/plate found	No tag/plate found	2 TON	Charles A. Jones Career & Education Center / 00B - Building 300	Building exterior
Condensing Unit/Heat Pump	Ameristar	No tag/plate found	No tag/plate found	2.5 TON	Charles A. Jones Career & Education Center / 00B - Building 300	Building exterior
Condensing Unit/Heat Pump	No tag/plate found	No tag/plate found	No tag/plate found	2.5 TON	Charles A. Jones Career & Education Center / 00B - Building 300	Building exterior
Condensing Unit/Heat Pump	United Technologies Carrier	400AB036320	2598V05563	3 TON	Charles A. Jones Career & Education Center / 00A - Building 100/200	Utility closet
Condensing Unit/Heat Pump	No tag/plate found	698ANO36-A	0694E02510	3 TON	Charles A. Jones Career & Education Center / 00B - Building 300	Building exterior
Condensing Unit/Heat Pump	Ameristar	38TXA042330	0605E25424	3.5 TON	Charles A. Jones Career & Education Center / 00B - Building 300	Building exterior
Condensing Unit/Heat Pump	Carrier	Illegible	Illegible	2 TON	Charles A. Jones Career & Education Center / 00B - Building 300	Roof

Condensing Unit/Heat Pump	Carrier	Illegible	Illegible	2 TON	Charles A. Jones Career & Education Center / 00B - Building 300	Roof
Condensing Unit/Heat Pump	Carrier	Illegible	Illegible	2 TON	Charles A. Jones Career & Education Center / 00B - Building 300	Roof
Condensing Unit/Heat Pump	Carrier	Illegible	Illegible	1.5 TON	Charles A. Jones Career & Education Center / 00B - Building 300	Roof
Condensing Unit/Heat Pump	United Technologies Carrier	Illegible	Illegible	1.5 TON	Charles A. Jones Career & Education Center / 00A - Building 100/200	Roof
Condensing Unit/Heat Pump	United Technologies Carrier	Illegible	Illegible	1.5 TON	Charles A. Jones Career & Education Center / 00A - Building 100/200	Roof
Condensing Unit/Heat Pump	United Technologies Carrier	Illegible	2598X54795	1.5 TON	Charles A. Jones Career & Education Center / 00A - Building 100/200	Roof
Condensing Unit/Heat Pump	United Technologies Carrier	40QNB024300	1998Y50631	550 CFM	Charles A. Jones Career & Education Center / 00C - Building 400	Electrical room
Condensing Unit/Heat Pump	United Technologies Carrier	Illegible	Illegible	1.5 TON	Charles A. Jones Career & Education Center / 00B - Building 300	Roof
Condensing Unit/Heat Pump	Carrier	Illegible	Illegible	1.5 TON	Charles A. Jones Career & Education Center / 00C - Building 400	Roof

Condensing Unit/Heat Pump	United Technologies Carrier	38HDC018341	1200X85382	1.5 TON	Charles A. Jones Career & Education Center / 00A - Building 100/200	Roof
Condensing Unit/Heat Pump	Fujitsu	AOU24CL1	GDN 012172	2 TON	Charles A. Jones Career & Education Center / 00A - Building 100/200	Roof
Domestic Boiler	Lochinvar	EWN150PM	H987600	150 MBH	Charles A. Jones Career & Education Center / 00B - Building 300	J001 - Utility closet
Evaporative Cooler	Adobe Air	Illegible	Illegible	18000 CFM	Charles A. Jones Career & Education Center / 00B - Building 300	Roof
Evaporative Cooler	Adobe Air	Illegible	E98002423	18000 CFM	Charles A. Jones Career & Education Center / 00B - Building 300	Roof
Evaporative Cooler	Adobe Air	Illegible	Illegible	18000 CFM	Charles A. Jones Career & Education Center / 00B - Building 300	Roof
Evaporative Cooler	Adobe Air	Illegible	E98002413	18000 CFM	Charles A. Jones Career & Education Center / 00B - Building 300	Roof
Evaporative Cooler	Adobe Air	Illegible	Illegible	18000 CFM	Charles A. Jones Career & Education Center / 00B - Building 300	Roof
Evaporative Cooler	Adobe Air	Illegible	Illegible	3000 CFM	Charles A. Jones Career & Education Center / 00C - Building 400	Roof

Evaporative Cooler	Adobe Air	Illegible	Illegible	18000 CFM	Charles A. Jones Career & Education Center / 00B - Building 300	Roof
Evaporative Cooler	Adobe Air	Illegible	Illegible	18000 CFM	Charles A. Jones Career & Education Center / 00B - Building 300	Roof
Evaporative Cooler	Adobe Air	Illegible	Illegible	18000 CFM	Charles A. Jones Career & Education Center / 00B - Building 300	Roof
Evaporative Cooler	Adobe Air	Illegible	Illegible	18000 CFM	Charles A. Jones Career & Education Center / 00B - Building 300	Roof
Evaporative Cooler	Adobe Air	Illegible	Illegible	18000 CFM	Charles A. Jones Career & Education Center / 00B - Building 300	Roof
Exhaust Fan	Inaccessible	Inaccessible	Inaccessible	2000 CFM	Charles A. Jones Career & Education Center / 00A - Building 100/200	Building exterior
Exhaust Fan	Cook	100C3B	20455352210000007011198	1250 CFM	Charles A. Jones Career & Education Center / 00A - Building 100/200	Roof
Exhaust Fan	Cook	120C3B	284S4980850000135010398	1500 CFM	Charles A. Jones Career & Education Center / 00B - Building 300	Roof
Exhaust Fan	Cook	150C6B	284S4980850000029010398	2900 CFM	Charles A. Jones Career & Education Center / 00B - Building 300	Roof

Exhaust Fan	Loren Cook Company	70C15DFD	284S52947900000070110 98	300 CFM	Charles A. Jones Career & Education Center / 00C - Building 400	Roof
Exhaust Fan	Loren Cook Company	180C5B	284S49808500000500103 98	3000 CFM	Charles A. Jones Career & Education Center / 00B - Building 300	Roof
Exhaust Fan	Loren Cook Company	180C5B	284S49808500000500203 98	3000 CFM	Charles A. Jones Career & Education Center / 00B - Building 300	Roof
Exhaust Fan	Loren Cook Company	180C5B	284S49808500000500303 98	3000 CFM	Charles A. Jones Career & Education Center / 00B - Building 300	Roof
Exhaust Fan	Loren Cook Company	180C5B	284S49808500000500403 98	3000 CFM	Charles A. Jones Career & Education Center / 00B - Building 300	Roof
Exhaust Fan	Cook	195CEB	281349803500000750103 98	3800 CFM	Charles A. Jones Career & Education Center / 00A - Building 100/200	Roof
Exhaust Fan	Loren Cook Company	225V1C3	284S49808500000970103 98	4800 CFM	Charles A. Jones Career & Education Center / 00A - Building 100/200	Roof
Exhaust Fan	Loren Cook Company	365 CPV	284049808502000070103 98	25000 CFM	Charles A. Jones Career & Education Center / 00B - Building 300	Roof
Exhaust Fan	Loren Cook Company	300R9B	284S49808500001110103 98	10500 CFM	Charles A. Jones Career & Education Center / 00B - Building 300	Roof

Exhaust Fan	Loren Cook Company	300R8B	284S49808500001230103 98	10500 CFM	Charles A. Jones Career & Education Center / 00B - Building 300	Roof
Exhaust Fan	Loren Cook Company	135 CPV	224049308502000260103 98	2100 CFM	Charles A. Jones Career & Education Center / 00B - Building 300	Roof
Exhaust Fan	Loren Cook Company	165 CPV	284049808502000430103 98	2500 CFM	Charles A. Jones Career & Education Center / 00B - Building 300	Roof
Exhaust Fan	Cook	120C3B	284S49808500001350103 98	1500 CFM	Charles A. Jones Career & Education Center / 00B - Building 300	Roof
Exhaust Fan	No tag/plate found	No tag/plate found	No tag/plate found	2250 CFM	Charles A. Jones Career & Education Center / 00B - Building 300	Roof
Exhaust Fan	Greenheck	CUBE-140-LMDG-QD	00C10621	2500 CFM	Charles A. Jones Career & Education Center / 00B - Building 300	Roof
Exhaust Fan	No tag/plate found	No tag/plate found	No tag/plate found	6000 CFM	Charles A. Jones Career & Education Center / 00B - Building 300	Roof
Furnace	Carrier	58MXB100-20	1207A05183	100 MBH	Charles A. Jones Career & Education Center / 00B - Building 300	O312 - Computer Bay
Furnace	Carrier	58MXB100-20	0907A05023	100 MBH	Charles A. Jones Career & Education Center / 00B - Building 300	O312 - Computer Bay

Furnace	Carrier	58MXB100-20	0907A05029	100 MBH	Charles A. Jones Career & Education Center / 00B - Building 300	O313 - Computer Lab
Furnace	Carrier	58MXB100-20	1207A05189	100 MBH	Charles A. Jones Career & Education Center / 00B - Building 300	O313 - Computer Lab
Heat Pump	Marvair	VAI40HPA05BII-2000 96	BL36991	3 TON	Charles A. Jones Career & Education Center / 00E - Building 500	Classrooms
Heat Pump	Inaccessible	Inaccessible	Inaccessible	3 TON	Charles A. Jones Career & Education Center / 00E - Building 500	Classrooms
Heat Pump	Marvair	VA140HPA05BII- 2000 96	BL36995	3 TON	Charles A. Jones Career & Education Center / 00E - Building 500	Classrooms
Heat Pump	Marvair	VAI40HPA05BII-2000 96	BL36994	3 TON	Charles A. Jones Career & Education Center / 00E - Building 500	Classrooms
Heat Pump	Marvair	Inaccessible	Inaccessible	3 TON	Charles A. Jones Career & Education Center / 00E - Building 500	Classrooms
Heat Pump	Inaccessible	Inaccessible	Inaccessible	3 TON	Charles A. Jones Career & Education Center / 00E - Building 500	Classrooms
Heat Pump	Marvair	Inaccessible	Illegible	3 TON	Charles A. Jones Career & Education Center / 00E - Building 500	Classrooms

Heat Pump	Bard	WH421-A00VP4	126H041929835-02	3.5 TON	Charles A. Jones Career & Education Center / Portables 400/500	Building exterior
Heat Pump	Bard	WH483-A00VP4	236D052026215-02	4 TON	Charles A. Jones Career & Education Center / Portables 400/500	Building exterior
Heat Pump	Bard	WH483-A00VP4	236D052023011-02	4 TON	Charles A. Jones Career & Education Center / Portables 400/500	Building exterior
Motor	Brainerd	06E7265310	69030	3 HP	Charles A. Jones Career & Education Center / 00A - Building 100/200	Roof
Motor	Brainerd	6E250TL 360-T	0811PE0175	3 HP	Charles A. Jones Career & Education Center / 00A - Building 100/200	Roof
Motor	Totaline	6E265TL-360-T	2211 PE1842	3 HP	Charles A. Jones Career & Education Center / 00A - Building 100/200	Roof
Motor	Totaline	06EA250310	2698JO0754	3 HP	Charles A. Jones Career & Education Center / 00A - Building 100/200	Roof
Packaged Unit (RTU)	Bard	WAG36D-A54XX	125D981225482-1	3 TON	Charles A. Jones Career & Education Center / 00D - Child Care	Building exterior
Packaged Unit (RTU)	Bard	WAG36D-A54XX	125H981246558-1		Charles A. Jones Career & Education Center / 00D - Child Care	Building exterior

Packaged Unit (RTU)	Bard	WAG36D-A54XX	125D981225473-1	3 TON	Charles A. Jones Career & Education Center / 00D - Child Care	Building exterior
Packaged Unit (RTU)	Carrier	48TJD028	2998F56424	25 TON	Charles A. Jones Career & Education Center / 00A - Building 100/200	Roof
Packaged Unit (RTU)	Carrier	48HJD006-631	2498G20605	5 TON	Charles A. Jones Career & Education Center / 00A - Building 100/200	Roof
Packaged Unit (RTU)	Carrier	48HJD005-631	2598G20337	4 TON	Charles A. Jones Career & Education Center / 00A - Building 100/200	Roof
Packaged Unit (RTU)	Carrier	48HJD005-631	2598G20333	4 TON	Charles A. Jones Career & Education Center / 00A - Building 100/200	Roof
Packaged Unit (RTU)	Carrier	48HJD008-631	2598G30311	7.5 TON	Charles A. Jones Career & Education Center / 00A - Building 100/200	Roof
Packaged Unit (RTU)	Carrier	48HJD008-631	2598G30308	7.5 TON	Charles A. Jones Career & Education Center / 00A - Building 100/200	Roof
Packaged Unit (RTU)	Carrier	48HJD008-631	2598G30306	7.5 TON	Charles A. Jones Career & Education Center / 00A - Building 100/200	Roof
Packaged Unit (RTU)	Carrier	48HJD008-631	2598G30304	7.5 TON	Charles A. Jones Career & Education Center / 00A - Building 100/200	Roof

Packaged Unit (RTU)	Carrier	48HJD008-631	0798G30319	7.5 TON	Charles A. Jones Career & Education Center / 00A - Building 100/200	Roof
Packaged Unit (RTU)	Carrier	48HJD017	3098F58223	15 TON	Charles A. Jones Career & Education Center / 00A - Building 100/200	Roof
Packaged Unit (RTU)	Carrier	48HJD005-631	2598G20341	4 TON	Charles A. Jones Career & Education Center / 00A - Building 100/200	Roof
Packaged Unit (RTU)	Carrier	48TJD028	2998F56422	25 TON	Charles A. Jones Career & Education Center / 00A - Building 100/200	Roof
Packaged Unit (RTU)	Carrier	48HJD005-631	2598G20340	4 TON	Charles A. Jones Career & Education Center / 00A - Building 100/200	Roof
Packaged Unit (RTU)	Carrier	48HJD014641	2598G30856	12.5 TON	Charles A. Jones Career & Education Center / 00A - Building 100/200	Roof
Packaged Unit (RTU)	Carrier	48HJD005---631--	2598G20345	4 TON	Charles A. Jones Career & Education Center / 00B - Building 300	Roof
Packaged Unit (RTU)	Carrier	48HJD006---631--	2498G20606	5 TON	Charles A. Jones Career & Education Center / 00B - Building 300	Roof
Packaged Unit (RTU)	Carrier	48HJD008---631--	2598G30307	7.5 TON	Charles A. Jones Career & Education Center / 00B - Building 300	Roof

Packaged Unit (RTU)	Carrier	48HJD008631	2598G30313	7.5 TON	Charles A. Jones Career & Education Center / 00B - Building 300	Roof
Packaged Unit (RTU)	Carrier	48HJE007---631--	2098G20586	6 TON	Charles A. Jones Career & Education Center / 00B - Building 300	Roof
Packaged Unit (RTU)	Carrier	48HJD007--631--	0898G20511	6 TON	Charles A. Jones Career & Education Center / 00C - Building 400	Roof
Packaged Unit (RTU)	Carrier	48EKD048	2898F55111	45 TON	Charles A. Jones Career & Education Center / 00A - Building 100/200	Roof
Packaged Unit (RTU)	Carrier	48EKD0486FA	2898F55113	45 TON	Charles A. Jones Career & Education Center / 00A - Building 100/200	Roof
Packaged Unit (RTU)	Carrier	48HJD006-631	2498G20604	5 TON	Charles A. Jones Career & Education Center / 00A - Building 100/200	Roof
Packaged Unit (RTU)	Carrier	48HJD007-631	0698G20583	6 TON	Charles A. Jones Career & Education Center / 00A - Building 100/200	Roof
Packaged Unit (RTU)	Carrier	48HJD012-651	2698G30766	10 TON	Charles A. Jones Career & Education Center / 00A - Building 100/200	Roof
Packaged Unit (RTU)	Carrier	48HJD012-651	2698G30765	10 TON	Charles A. Jones Career & Education Center / 00A - Building 100/200	Roof

Packaged Unit (RTU)	Carrier	48HJD014-641	2598G30863	12.5 TON	Charles A. Jones Career & Education Center / 00A - Building 100/200	Roof
Packaged Unit (RTU)	Carrier	48HJE004 631-	0899620184	3 TON	Charles A. Jones Career & Education Center / 00B - Building 300	Roof
Packaged Unit (RTU)	Carrier	48HJD005---631--	2099620279	4 TON	Charles A. Jones Career & Education Center / 00B - Building 300	Roof
Packaged Unit (RTU)	Carrier	48HJD009---631--	0599G30298	8.5 TON	Charles A. Jones Career & Education Center / 00B - Building 300	Roof
Unit Heater	Reznor	BE250	Inaccessible	250 MBH	Charles A. Jones Career & Education Center / 00B - Building 300	O307 - Auto Shop
Unit Heater	Reznor	BE250	AXF66Q3N15216	250 MBH	Charles A. Jones Career & Education Center / 00B - Building 300	O305 - HVAC Shop
Unit Heater	Reznor	BE250	Inaccessible	250 MBH	Charles A. Jones Career & Education Center / 00B - Building 300	O305 - HVAC Shop
Unit Heater	Reznor	BE250	Inaccessible	250 MBH	Charles A. Jones Career & Education Center / 00B - Building 300	O307 - Auto Shop
Unit Heater	Reznor	BE250	Inaccessible	250 MBH	Charles A. Jones Career & Education Center / 00B - Building 300	O305 - HVAC Shop

Unit Heater	Reznor	BE250	Inaccessible	250 MBH	Charles A. Jones Career & Education Center / 00B - Building 300	O305 - HVAC Shop
Unit Heater	Reznor	BE250	Inaccessible	250 MBH	Charles A. Jones Career & Education Center / 00B - Building 300	O307 - Auto Shop
Unit Heater	Reznor	Inaccessible	Inaccessible	201 - 300 MBH	Charles A. Jones Career & Education Center / 00B - Building 300	O307 - Auto Shop
Unit Heater	Reznor	BE250	Inaccessible	250 MBH	Charles A. Jones Career & Education Center / 00B - Building 300	O305 - HVAC Shop
Variable Air Volume (VAV) Unit				1000 CFM	Charles A. Jones Career & Education Center / 00A - Building 100/200	Throughout building
Water Heater	State Industries, Inc.	PR630NORT2	G00211086	30 GAL	Charles A. Jones Career & Education Center / 00D - Child Care	J001 - Utility Closet
Water Heater	A. O. Smith	DSF10-6	SG98-74231	5 - 15 GAL	Charles A. Jones Career & Education Center / 00C - Building 400	Building interior
Water Heater	A. O. Smith	DSE20 3	SG98-74275		Charles A. Jones Career & Education Center / 00A - Building 100/200	S108 - Kitchenette
Water Storage Tank	No tag/plate found	No tag/plate found	No tag/plate found	150 GAL	Charles A. Jones Career & Education Center / 00B - Building 300	J001 - Utility closet

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	Charles A Jones	Interior		OFFICE	S103		80	2	Light Switch	Linear Fluorescent	T8	4' 32W T8	6	2x4 Prism Troffer	3	0	8	1,480	284
2	Charles A Jones	Interior		OFFICE	S103		80	2	Light Switch	Linear Fluorescent	T8	4' 32W T8	10	2x4 Prism Troffer	5	0	8	1,480	474
3	Charles A Jones	Interior		LIBRARY	O101	2L 6 6F	170	6	Light Switch	Linear Fluorescent	T8	4' 32W T8	36	2x4 Prism Troffer	18	0	8	1,480	1,705
4	Charles A Jones	Interior		LIBRARY	O101	2L 6 6F	170	6	Light Switch	Linear Fluorescent	T8	4' 32W T8	36	2x4 Prism Troffer	18	0	8	1,480	1,705
5	Charles A Jones	Interior		STORAGE	S100	2L 1F	-	23	Light Switch	Linear Fluorescent	T8	4' 32W T8	46	1x4 Prism Troffer	23	0	8	703	1,035
6	Charles A Jones	Interior		CLASSROOM	O109	2L 6 8F	-	4	Light Switch	Linear Fluorescent	T8	4' 32W T8	32	2x4 Prism Troffer	16	0	8	1,480	1,516
7	Charles A Jones	Interior		CLASSROOM	O109	2L 6 8F	-	4	Light Switch	Linear Fluorescent	T8	4' 32W T8	24	2x4 Prism Troffer	12	0	8	1,480	1,137
8	Charles A Jones	Interior		OFFICE	O107	2L 2 2F	-	6	Light Switch	Linear Fluorescent	T8	4' 32W T8	12	2x4 Prism Troffer	6	0	8	1,480	568
9	Charles A Jones	Interior		OFFICE	O107	2L 2 2F	-	6	Light Switch	Linear Fluorescent	T8	4' 32W T8	12	2x4 Prism Troffer	6	0	8	1,480	568
10	Charles A Jones	Interior		STORAGE	S117	2L 1 1F	-	4	Light Switch	Linear Fluorescent	T8	4' 32W T8	4	2x4 Prism Troffer	2	0	8	703	90
11	Charles A Jones	Interior		STORAGE	S117	2L 1 1F	-	4	Light Switch	Linear Fluorescent	T8	4' 32W T8	4	2x4 Prism Troffer	2	0	8	703	90
12	Charles A Jones	Interior		CLASSROOM	015B	2L 3 6F	-	4	Light Switch	Linear Fluorescent	T8	4' 32W T8	24	2x4 Prism Troffer	12	0	8	1,480	1,137
13	Charles A Jones	Interior		CLASSROOM	015B	2L 3 6F	-	4	Light Switch	Linear Fluorescent	T8	4' 32W T8	12	2x4 Prism Troffer	6	0	8	1,480	568
14	Charles A Jones	Interior		CLASSROOM	C15C	2L 10 11F	-	2	Light Switch	Linear Fluorescent	T8	4' 32W T8	22	2x4 Prism Troffer	11	0	8	1,480	1,042
15	Charles A Jones	Interior		CLASSROOM	C15C	2L 10 11F	-	2	Light Switch	Linear Fluorescent	T8	4' 32W T8	20	2x4 Prism Troffer	10	0	8	1,480	947
16	Charles A Jones	Interior		CLASSROOM	O106		-	2	Light Switch	Linear Fluorescent	T8	4' 32W T8	26	2x4 Prism Troffer	13	0	8	1,480	1,231
17	Charles A Jones	Interior		CLASSROOM	O106		-	2	Light Switch	Linear Fluorescent	T8	4' 32W T8	26	2x4 Prism Troffer	13	0	8	1,480	1,231
18	Charles A Jones	Interior		OPEN OFFICE	0108	2L 6 5F	-	2	Light Switch	Linear Fluorescent	T8	4' 32W T8	10	2x4 Prism Troffer	5	0	8	1,480	474
19	Charles A Jones	Interior		OPEN OFFICE	0108	2L 6 5F	-	2	Light Switch	Linear Fluorescent	T8	4' 32W T8	12	2x4 Prism Troffer	6	0	8	1,480	568
20	Charles A Jones	Interior		OPEN OFFICE	O104		-	2	Light Switch	Linear Fluorescent	T8	4' 32W T8	6	2x4 Prism Troffer	3	0	8	1,480	284
21	Charles A Jones	Interior		OPEN OFFICE	O104		-	2	Light Switch	Linear Fluorescent	T8	4' 32W T8	6	2x4 Prism Troffer	3	0	8	1,480	284
22	Charles A Jones	Interior		OPEN OFFICE	C100		-	2	Light Switch	Linear Fluorescent	T8	4' 32W T8	28	2x4 Prism Troffer	14	0	8	1,480	1,326
23	Charles A Jones	Interior		OPEN OFFICE	C100		-	2	Light Switch	Linear Fluorescent	T8	4' 32W T8	26	2x4 Prism Troffer	13	0	8	1,480	1,231
24	Charles A Jones	Interior		STORAGE	S104	2L 1 1F	-	3	Light Switch	Linear Fluorescent	T8	4' 32W T8	6	2x4 Prism Troffer	3	0	8	703	135
25	Charles A Jones	Interior		STORAGE	S104	2L 1 1F	-	3	Light Switch	Linear Fluorescent	T8	4' 32W T8	6	2x4 Prism Troffer	3	0	8	703	135
26	Charles A Jones	Interior		OPEN OFFICE	0121		-	2	Light Switch	Linear Fluorescent	T8	4' 32W T8	10	2x4 Prism Troffer	5	0	8	1,480	474
27	Charles A Jones	Interior		OPEN OFFICE	0121		-	2	Light Switch	Linear Fluorescent	T8	4' 32W T8	12	2x4 Prism Troffer	6	0	8	1,480	568
28	Charles A Jones	Interior		MECHANICAL	S101		-	1	Light Switch	Linear Fluorescent	T8	4' 32W T8	6	2x4 Prism Troffer	3	0	8	1,480	284
29	Charles A Jones	Interior		STORAGE	S10B	2L 2 2F	-	6	Light Switch	Linear Fluorescent	T8	4' 32W T8	12	2x4 Prism Troffer	6	0	8	703	270
30	Charles A Jones	Interior		STORAGE	S10B	2L 2 2F	-	6	Light Switch	Linear Fluorescent	T8	4' 32W T8	12	2x4 Prism Troffer	6	0	8	703	270
31	Charles A Jones	Interior		OPEN OFFICE	C120		-	2	Light Switch	Linear Fluorescent	T8	4' 32W T8	6	2x4 Prism Troffer	3	0	8	1,480	284
32	Charles A Jones	Interior		OPEN OFFICE	C120		-	2	Light Switch	Linear Fluorescent	T8	4' 32W T8	10	2x4 Prism Troffer	5	0	8	1,480	474
33	Charles A Jones	Interior		STORAGE	S108		-	2	Light Switch	Linear Fluorescent	T8	4' 32W T8	2	2x4 Prism Troffer	1	0	8	703	45
34	Charles A Jones	Interior		STORAGE	S108		-	2	Light Switch	Linear Fluorescent	T8	4' 32W T8	2	2x4 Prism Troffer	1	0	8	703	45
35	Charles A Jones	Interior		OFFICE	C12B	2L 2 2B	-	2	Light Switch	Linear Fluorescent	T8	4' 32W T8	4	2x4 Prism Troffer	2	0	8	1,480	189
36	Charles A Jones	Interior		OFFICE	C12B	2L 2 2B	-	2	Light Switch	Linear Fluorescent	T8	4' 32W T8	4	2x4 Prism Troffer	2	0	8	1,480	189
37	Charles A Jones	Interior		RESTROOM	T101		-	2	Light Switch	Linear Fluorescent	T8	4' 32W T8	4	2x4 Prism Troffer	2	0	8	1,480	189
38	Charles A Jones	Interior		OPEN OFFICE	Conference	2L 3 3F	-	2	Light Switch	Linear Fluorescent	T8	4' 32W T8	6	2x4 Prism Troffer	3	0	8	1,480	284
39	Charles A Jones	Interior		OPEN OFFICE	Conference	2L 3 3F	-	2	Light Switch	Linear Fluorescent	T8	4' 32W T8	6	2x4 Prism Troffer	3	0	8	1,480	284
40	Charles A Jones	Interior		CAFETERIA	U104		-	5	Light Switch	Linear Fluorescent	T8	4' 32W T8	54	2x4 Prism Troffer	18	0	8	1,480	2,557
41	Charles A Jones	Interior		CAFETERIA	U104		-	5	Light Switch	Linear Fluorescent	T8	4' 32W T8	27	2x4 Prism Troffer	9	0	8	1,480	1,279
42	Charles A Jones	Interior		CAFETERIA	U104		-	5	Light Switch	Linear Fluorescent	T8	4' 32W T8	54	2x4 Prism Troffer	18	0	8	1,480	2,557
43	Charles A Jones	Interior		CAFETERIA	U104		-	5	Light Switch	Linear Fluorescent	T8	4' 32W T8	54	2x4 Prism Troffer	18	0	8	1,480	2,557
44	Charles A Jones	Interior		CAFETERIA	U104		-	5	Light Switch	Linear Fluorescent	T8	4' 32W T8	54	2x4 Prism Troffer	18	0	8	1,480	2,557
45	Charles A Jones	Interior		KITCHEN	K1		-	2	Light Switch	Linear Fluorescent	T8	4' 32W T8	8	2x4 Prism Troffer	4	0	8	1,480	379
46	Charles A Jones	Interior		KITCHEN	K1		-	2	Light Switch	Linear Fluorescent	T8	4' 32W T8	12	2x4 Prism Troffer	6	0	8	1,480	568
47	Charles A Jones	Interior		STORAGE	S111	2L 2F	-	2	Light Switch	Linear Fluorescent	T8	4' 32W T8	8	1x4 Prism Troffer	4	0	8	703	180
48	Charles A Jones	Interior		CLASSROOM	Ext		-	1	Timer	HID	HPS	HPS70	45	Wallpack-Horizontal	45	0	8	1,480	4,662
49	Charles A Jones	Interior		OFFICE	C1	4L 2F	-	1	Light Switch	Linear Fluorescent	T8	4' 32W T8	8	2x4 Prism Troffer	2	0	8	1,480	379
50	Charles A Jones	Interior		CLASSROOM	Y2	4L 10 bi	-	2	Light Switch	Linear Fluorescent	T8	4' 32W T8	80	2x4 Prism Troffer	20	0	8	1,480	3,789
51	Charles A Jones	Interior		RESTROOM	T2		-	2	Light Switch	Linear Fluorescent	T8	4' 32W T8	8	2x4 Prism Troffer	2	0	8	1,480	379
52	Charles A Jones	Interior		OPEN OFFICE	1		-	1	Light Switch	Linear Fluorescent	T8	4' 32W T8	12	2x4 Prism Troffer	3	0	8	1,480	568
53	Charles A Jones	Interior		HALLWAY	H1		-	1	Light Switch	Linear Fluorescent	T8	4' 32W T8	4	2x4 Prism Troffer	1	0	8	1,480	189
54	Charles A Jones	Interior		RESTROOM	T3		-	1	Light Switch	Linear Fluorescent	T8	4' 32W T8	4	2x4 Prism Troffer	1	0	8	1,480	189
55	Charles A Jones	Interior		CLASSROOM	O202	3L 6 6 F para	-	2	Light Switch	Linear Fluorescent	T8	4' 32W T8	18	2x4 Parabolic Troffer	6	0	8	1,480	852
56	Charles A Jones	Interior		CLASSROOM	O202	3L 6 6 F para	-	2	Light Switch	Linear Fluorescent	T8	4' 32W T8	18	2x4 Parabolic Troffer	6	0	8	1,480	852
57	Charles A Jones	Interior		CLASSROOM	020A	2L 6 6F prism	-	4	Light Switch	Linear Fluorescent	T8	4' 32W T8	24	2x4 Prism Troffer	12	0	8	1,480	1,137
58	Charles A Jones	Interior		CLASSROOM	020A	2L 6 6F prism	-	4	Light Switch	Linear Fluorescent	T8	4' 32W T8	24	2x4 Prism Troffer	12	0	8	1,480	1,137
59	Charles A Jones	Interior		CLASSROOM	O200		-	2	Light Switch	Linear Fluorescent	T8 U	U 32W T8	10	2x2 Prism Troffer	5	0	8	1,480	474
60	Charles A Jones	Interior		CLASSROOM	O200		-	2	Light Switch	Linear Fluorescent	T8	4' 32W T8	30	2x4 Prism Troffer	15	0	8	1,480	1,421
61	Charles A Jones	Interior		CLASSROOM	O200		-	2	Light Switch	Linear Fluorescent	T8	4' 32W T8	30	2x4 Prism Troffer	15	0	8	1,480	1,421
62	Charles A Jones	Interior		CLASSROOM	020B	2L 3 3F	-	6	Light Switch	Linear Fluorescent	T8	4' 32W T8	18	2x4 Prism Troffer	9	0	8	1,480	852
63	Charles A Jones	Interior		CLASSROOM	020B	2L 3 3F	-	6	Light Switch	Linear Fluorescent	T8	4' 32W T8	18	2x4 Prism Troffer	9	0	8	1,480	852
64	Charles A Jones	Interior		STORAGE	S206	2L 2 1F	-	2	Light Switch	Linear Fluorescent	T8	4' 32W T8	2	2x4 Prism Troffer	1	0	8	703	45

65	Charles A Jones	Interior		STORAGE	S206	2L 2 1F	-	2	Light Switch	Linear Fluorescent	T8	4' 32W T8	4	2x4 Prism Troffer	2	0	8	703	90
66	Charles A Jones	Interior		CLASSROOM	020D	2L 4 4F	-	2	Light Switch	Linear Fluorescent	T8	4' 32W T8	8	2x4 Prism Troffer	4	0	8	1,480	379
67	Charles A Jones	Interior		CLASSROOM	020D	2L 4 4F	-	2	Light Switch	Linear Fluorescent	T8	4' 32W T8	8	2x4 Prism Troffer	4	0	8	1,480	379
68	Charles A Jones	Interior		CLASSROOM	0203	2L 8 8 F	-	4	Light Switch	Linear Fluorescent	T8	4' 32W T8	32	2x4 Prism Troffer	16	0	8	1,480	1,516
69	Charles A Jones	Interior		CLASSROOM	0203	2L 8 8 F	-	4	Light Switch	Linear Fluorescent	T8	4' 32W T8	32	2x4 Prism Troffer	16	0	8	1,480	1,516
70	Charles A Jones	Interior		CLASSROOM	0201	3L 4 7F para	-	2	Light Switch	Linear Fluorescent	T8	4' 32W T8	21	2x4 Parabolic Troffer	7	0	8	1,480	995
71	Charles A Jones	Interior		CLASSROOM	0201	3L 4 7F para	-	2	Light Switch	Linear Fluorescent	T8	4' 32W T8	12	2x4 Parabolic Troffer	4	0	8	1,480	568
72	Charles A Jones	Interior		CLASSROOM	0205	3L 8 8F ref	-	2	Light Switch	Linear Fluorescent	T8	4' 32W T8	24	2x4 Parabolic Troffer	8	0	8	1,480	1,137
73	Charles A Jones	Interior		CLASSROOM	0205	3L 8 8F ref	-	2	Light Switch	Linear Fluorescent	T8	4' 32W T8	24	2x4 Parabolic Troffer	8	0	8	1,480	1,137
74	Charles A Jones	Interior		CLASSROOM	0207	3L 88F para	-	2	Light Switch	Linear Fluorescent	T8	4' 32W T8	24	2x4 Parabolic Troffer	8	0	8	1,480	1,137
75	Charles A Jones	Interior		CLASSROOM	0207	3L 88F para	-	2	Light Switch	Linear Fluorescent	T8	4' 32W T8	24	2x4 Parabolic Troffer	8	0	8	1,480	1,137
76	Charles A Jones	Interior		CLASSROOM	0209	3L 87F para	-	4	Light Switch	Linear Fluorescent	T8	4' 32W T8	42	2x4 Parabolic Troffer	14	0	8	1,480	1,989
77	Charles A Jones	Interior		CLASSROOM	0209	3L 87F para	-	4	Light Switch	Linear Fluorescent	T8	4' 32W T8	48	2x4 Parabolic Troffer	16	0	8	1,480	2,273
78	Charles A Jones	Interior		CLASSROOM	0206		-	2	Light Switch	Linear Fluorescent	T8	4' 32W T8	16	2x4 Prism Troffer	8	0	8	1,480	758
79	Charles A Jones	Interior		CLASSROOM	0206		-	2	Light Switch	Linear Fluorescent	T8	4' 32W T8	16	2x4 Prism Troffer	8	0	8	1,480	758
80	Charles A Jones	Interior		CLASSROOM	0211	3L 66F para	-	2	Light Switch	Linear Fluorescent	T8	4' 32W T8	18	2x4 Parabolic Troffer	6	0	8	1,480	852
81	Charles A Jones	Interior		CLASSROOM	0211	3L 66F para	-	2	Light Switch	Linear Fluorescent	T8	4' 32W T8	18	2x4 Parabolic Troffer	6	0	8	1,480	852
82	Charles A Jones	Interior		CLASSROOM	0213	3L 11 11F para	-	2	Light Switch	Linear Fluorescent	T8	4' 32W T8	33	2x4 Parabolic Troffer	11	0	8	1,480	1,563
83	Charles A Jones	Interior		CLASSROOM	0213	3L 11 11F para	-	2	Light Switch	Linear Fluorescent	T8	4' 32W T8	33	2x4 Parabolic Troffer	11	0	8	1,480	1,563
84	Charles A Jones	Interior		RESTROOM	T200		-	1	Light Switch	Linear Fluorescent	T8	4' 32W T8	12	1x4 Prism Troffer	6	0	8	1,480	568
85	Charles A Jones	Interior		RESTROOM	T201		-	1	Light Switch	Linear Fluorescent	T8	4' 32W T8	10	1x4 Prism Troffer	5	0	8	1,480	474
86	Charles A Jones	Interior		ESTROOM - PRIVAT	T202		-	2	Light Switch	Linear Fluorescent	T8	4' 32W T8	2	Strip Fixture	2	0	8	925	59
87	Charles A Jones	Interior		HALLWAY	H1		-	1	Timer	Linear Fluorescent	T8	4' 32W T8	4	Surface Mount w Lense	4	0	8	1,480	189
88	Charles A Jones	Interior		HALLWAY	H1		-	1	Timer	Linear Fluorescent	T8	4' 32W T8	4	2x4 Prism Troffer	2	0	8	1,480	189
89	Charles A Jones	Interior		HALLWAY	H1		-	1	Timer	Linear Fluorescent	T8	4' 32W T8	26	Vanity-Indirect	13	0	8	1,480	1,231
90	Charles A Jones	Interior		RESTROOM	T102	Women	-	2	Light Switch	Linear Fluorescent	T8	4' 32W T8	16	1x4 Prism Troffer	8	0	8	1,480	758
91	Charles A Jones	Interior		RESTROOM	T103	Men	-	2	Light Switch	Linear Fluorescent	T8	4' 32W T8	20	1x4 Prism Troffer	10	0	8	1,480	947
92	Charles A Jones	Interior		CLASSROOM	0300	2L 88F	-	2	Light Switch	Linear Fluorescent	T8	4' 32W T8	16	2x4 Prism Troffer	8	0	8	1,480	758
93	Charles A Jones	Interior		CLASSROOM	0300	2L 88F	-	2	Light Switch	Linear Fluorescent	T8	4' 32W T8	16	2x4 Prism Troffer	8	0	8	1,480	758
94	Charles A Jones	Interior		CLASSROOM	0301	3L 66F ind	-	4	Light Switch	Linear Fluorescent	T8	4' 32W T8	36	Industrial	12	0	8	1,480	1,705
95	Charles A Jones	Interior		CLASSROOM	0301	3L 66F ind	-	4	Light Switch	Linear Fluorescent	T8	4' 32W T8	36	Industrial	12	0	8	1,480	1,705
96	Charles A Jones	Interior		CLASSROOM	0302	2L 55F	-	4	Light Switch	Linear Fluorescent	T8	4' 32W T8	20	2x4 Prism Troffer	10	0	8	1,480	947
97	Charles A Jones	Interior		CLASSROOM	0302	2L 55F	-	4	Light Switch	Linear Fluorescent	T8	4' 32W T8	20	2x4 Prism Troffer	10	0	8	1,480	947
98	Charles A Jones	Interior		CLASSROOM	0305		-	3	Light Switch	Linear Fluorescent	T8	4' 32W T8	90	Industrial	30	0	8	1,480	4,262
99	Charles A Jones	Interior		CLASSROOM	0305		-	3	Light Switch	Linear Fluorescent	T8	4' 32W T8	90	Industrial	30	0	8	1,480	4,262
100	Charles A Jones	Interior		CLASSROOM	0305		-	3	Light Switch	Linear Fluorescent	T8	4' 32W T8	90	Industrial	30	0	8	1,480	4,262
101	Charles A Jones	Interior		CLASSROOM	L1		-	2	Light Switch	Linear Fluorescent	T8	4' 32W T8	8	1x4 Prism Troffer	4	0	8	1,480	379
102	Charles A Jones	Interior		CLASSROOM	L1		-	2	Light Switch	Linear Fluorescent	T8	4' 32W T8	6	1x4 Prism Troffer	3	0	8	1,480	284
103	Charles A Jones	Interior		CLASSROOM	0308		-	3	Light Switch	Linear Fluorescent	T8	4' 32W T8	105	Industrial	35	0	8	1,480	4,973
104	Charles A Jones	Interior		CLASSROOM	0308		-	3	Light Switch	Linear Fluorescent	T8	4' 32W T8	90	Industrial	30	0	8	1,480	4,262
105	Charles A Jones	Interior		CLASSROOM	0308		-	3	Light Switch	Linear Fluorescent	T8	4' 32W T8	90	Industrial	30	0	8	1,480	4,262
106	Charles A Jones	Interior		CLASSROOM	Z1		-	2	Light Switch	Linear Fluorescent	T8	4' 32W T8	6	Surface Mount w Lense	6	0	8	1,480	284
107	Charles A Jones	Interior		CLASSROOM	Z1		-	2	Light Switch	Linear Fluorescent	T8	4' 32W T8	2	Surface Mount w Lense	2	0	8	1,480	95
108	Charles A Jones	Interior		CLASSROOM	N1		-	1	Light Switch	Linear Fluorescent	T8	4' 32W T8	20	Surface Mount w Lense	20	0	8	1,480	947
109	Charles A Jones	Interior		CLASSROOM	0310	3L 7 14F	-	8	Light Switch	Linear Fluorescent	T8	4' 32W T8	84	Industrial	28	0	8	1,480	3,978
110	Charles A Jones	Interior		CLASSROOM	0310	3L 7 14F	-	8	Light Switch	Linear Fluorescent	T8	4' 32W T8	168	Industrial	56	0	8	1,480	7,956
111	Charles A Jones	Interior		CLASSROOM	C314	3L 66F	-	4	Light Switch	Linear Fluorescent	T8	4' 32W T8	36	Industrial	12	0	8	1,480	1,705
112	Charles A Jones	Interior		CLASSROOM	C314	3L 66F	-	4	Light Switch	Linear Fluorescent	T8	4' 32W T8	36	Industrial	12	0	8	1,480	1,705
113	Charles A Jones	Interior		CLASSROOM	0314		-	4	Light Switch	Linear Fluorescent	T8	4' 32W T8	60	Industrial	20	0	8	1,480	2,842
114	Charles A Jones	Interior		CLASSROOM	0314		-	4	Light Switch	Linear Fluorescent	T8	4' 32W T8	72	Industrial	24	0	8	1,480	3,410
115	Charles A Jones	Interior		CLASSROOM	S5		-	2	Light Switch	Linear Fluorescent	T8	4' 32W T8	6	Industrial	2	0	8	1,480	284
116	Charles A Jones	Interior		HALLWAY	H1		-	1	Light Switch	Linear Fluorescent	T8	4' 32W T8	10	1x4 Prism Troffer	5	0	8	1,480	474
117	Charles A Jones	Interior		STORAGE	S6		-	1	Timer	Linear Fluorescent	T8	4' 32W T8	6	1x4 Prism Troffer	3	0	8	703	135
118	Charles A Jones	Interior		CLASSROOM	0316		-	2	Light Switch	Linear Fluorescent	T8	4' 32W T8	72	Industrial	24	0	8	1,480	3,410
119	Charles A Jones	Interior		CLASSROOM	0316		-	2	Light Switch	Linear Fluorescent	T8	4' 32W T8	72	Industrial	24	0	8	1,480	3,410
120	Charles A Jones	Interior		CLASSROOM	0401	3L 18Fbi	-	5	Light Switch	Linear Fluorescent	T8	4' 32W T8	270	2x4 Prism Troffer	90	0	8	1,480	12,787
121	Charles A Jones	Interior		CLASSROOM	0400	2L 77F	-	2	Light Switch	Linear Fluorescent	T8	4' 32W T8	14	2x4 Prism Troffer	7	0	8	1,480	663
122	Charles A Jones	Interior		CLASSROOM	0400	2L 77F	-	2	Light Switch	Linear Fluorescent	T8	4' 32W T8	14	2x4 Prism Troffer	7	0	8	1,480	663
123	Charles A Jones	Interior		CLASSROOM	0401	2L 44F	-	2	Light Switch	Linear Fluorescent	T8	4' 32W T8	8	1x4 Prism Troffer	4	0	8	1,480	379
124	Charles A Jones	Interior		CLASSROOM	0401	2L 44F	-	2	Light Switch	Linear Fluorescent	T8	4' 32W T8	8	1x4 Prism Troffer	4	0	8	1,480	379
125	Charles A Jones	Interior		CLASSROOM	0502	4L 12F bi	-	2	Light Switch	Linear Fluorescent	T8	4' 32W T8	96	2x4 Prism Troffer	24	0	8	1,480	4,547
126	Charles A Jones	Interior		CLASSROOM	T2	2L 3F	-	2	Light Switch	Linear Fluorescent	T8	4' 32W T8	12	2x4 Prism Troffer	6	0	8	1,480	568
127	Charles A Jones	Interior		CLASSROOM	Ext		-	1	Timer	CFL	CFL - 2 Pin	CFL18	20	Wallpack-Vertical	10	0	8	1,480	533
	Totals												3,508		1,390			177,304	165,385

									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	Charles A Jones	Interior		OFFICE	S103		Light Switch	2	Linear Fluorescent	T8	4' 32W T8; 2x4 Prism Troffer	3	6	8	1,480	284	ECM	RB - Replace Bulb	Retain Existing Controls	4' 17W LED T8	1,480	151	133
2	Charles A Jones	Interior		OFFICE	S103		Light Switch	2	Linear Fluorescent	T8	4' 32W T8; 2x4 Prism Troffer	5	10	8	1,480	474	ECM	RB - Replace Bulb	Retain Existing Controls	4' 17W LED T8	1,480	252	222
3	Charles A Jones	Interior		LIBRARY	O101	2L 6 6F	Light Switch	6	Linear Fluorescent	T8	4' 32W T8; 2x4 Prism Troffer	18	36	8	1,480	1,705	ECM	RB - Replace Bulb	Retain Existing Controls	4' 17W LED T8	1,480	906	799
4	Charles A Jones	Interior		LIBRARY	O101	2L 6 6F	Light Switch	6	Linear Fluorescent	T8	4' 32W T8; 2x4 Prism Troffer	18	36	8	1,480	1,705	ECM	RB - Replace Bulb	Retain Existing Controls	4' 17W LED T8	1,480	906	799
5	Charles A Jones	Interior		STORAGE	S100	2L 1F	Light Switch	23	Linear Fluorescent	T8	4' 32W T8; 1x4 Prism Troffer	23	46	8	703	1,035	ECM	RB - Replace Bulb	Wall Mounted	4' 17W LED T8	703	550	485
6	Charles A Jones	Interior		CLASSROOM	O109	2L 6 8F	Light Switch	4	Linear Fluorescent	T8	4' 32W T8; 2x4 Prism Troffer	16	32	8	1,480	1,516	ECM	RB - Replace Bulb	Ceiling Mounted	4' 17W LED T8	1,480	805	710
7	Charles A Jones	Interior		CLASSROOM	O109	2L 6 8F	Light Switch	4	Linear Fluorescent	T8	4' 32W T8; 2x4 Prism Troffer	12	24	8	1,480	1,137	ECM	RB - Replace Bulb	Ceiling Mounted	4' 17W LED T8	1,480	604	533
8	Charles A Jones	Interior		OFFICE	O107	2L 2 2F	Light Switch	6	Linear Fluorescent	T8	4' 32W T8; 2x4 Prism Troffer	6	12	8	1,480	568	ECM	RB - Replace Bulb	Ceiling Mounted	4' 17W LED T8	1,480	302	266
9	Charles A Jones	Interior		OFFICE	O107	2L 2 2F	Light Switch	6	Linear Fluorescent	T8	4' 32W T8; 2x4 Prism Troffer	6	12	8	1,480	568	ECM	RB - Replace Bulb	Ceiling Mounted	4' 17W LED T8	1,480	302	266
10	Charles A Jones	Interior		STORAGE	S117	2L 1 1F	Light Switch	4	Linear Fluorescent	T8	4' 32W T8; 2x4 Prism Troffer	2	4	8	703	90	ECM	RB - Replace Bulb	Ceiling Mounted	4' 17W LED T8	703	48	42
11	Charles A Jones	Interior		STORAGE	S117	2L 1 1F	Light Switch	4	Linear Fluorescent	T8	4' 32W T8; 2x4 Prism Troffer	2	4	8	703	90	ECM	RB - Replace Bulb	Ceiling Mounted	4' 17W LED T8	703	48	42
13	Charles A Jones	Interior		CLASSROOM	015B	2L 3 6F	Light Switch	4	Linear Fluorescent	T8	4' 32W T8; 2x4 Prism Troffer	6	12	8	1,480	568	ECM	RB - Replace Bulb	Ceiling Mounted	4' 17W LED T8	1,480	302	266
15	Charles A Jones	Interior		CLASSROOM	C15C	2L 10 11F	Light Switch	2	Linear Fluorescent	T8	4' 32W T8; 2x4 Prism Troffer	10	20	8	1,480	947	ECM	RB - Replace Bulb	Ceiling Mounted	4' 17W LED T8	1,480	503	444
17	Charles A Jones	Interior		CLASSROOM	O106		Light Switch	2	Linear Fluorescent	T8	4' 32W T8; 2x4 Prism Troffer	13	26	8	1,480	1,231	ECM	RB - Replace Bulb	Ceiling Mounted	4' 17W LED T8	1,480	654	577
19	Charles A Jones	Interior		OPEN OFFICE	0108	2L 6 5F	Light Switch	2	Linear Fluorescent	T8	4' 32W T8; 2x4 Prism Troffer	6	12	8	1,480	568	ECM	RB - Replace Bulb	Ceiling Mounted	4' 17W LED T8	1,480	302	266
21	Charles A Jones	Interior		OPEN OFFICE	O104		Light Switch	2	Linear Fluorescent	T8	4' 32W T8; 2x4 Prism Troffer	3	6	8	1,480	284	ECM	RB - Replace Bulb	Ceiling Mounted	4' 17W LED T8	1,480	151	133
22	Charles A Jones	Interior		OPEN OFFICE	C100		Light Switch	2	Linear Fluorescent	T8	4' 32W T8; 2x4 Prism Troffer	14	28	8	1,480	1,326	ECM	RB - Replace Bulb	Ceiling Mounted	4' 17W LED T8	1,480	704	622
24	Charles A Jones	Interior		STORAGE	S104	2L 1 1F	Light Switch	3	Linear Fluorescent	T8	4' 32W T8; 2x4 Prism Troffer	3	6	8	703	135	ECM	RB - Replace Bulb	Ceiling Mounted	4' 17W LED T8	703	72	63
25	Charles A Jones	Interior		STORAGE	S104	2L 1 1F	Light Switch	3	Linear Fluorescent	T8	4' 32W T8; 2x4 Prism Troffer	3	6	8	703	135	ECM	RB - Replace Bulb	Ceiling Mounted	4' 17W LED T8	703	72	63
26	Charles A Jones	Interior		OPEN OFFICE	0121		Light Switch	2	Linear Fluorescent	T8	4' 32W T8; 2x4 Prism Troffer	5	10	8	1,480	474	ECM	RB - Replace Bulb	Ceiling Mounted	4' 17W LED T8	1,480	252	222
27	Charles A Jones	Interior		OPEN OFFICE	0121		Light Switch	2	Linear Fluorescent	T8	4' 32W T8; 2x4 Prism Troffer	6	12	8	1,480	568	ECM	RB - Replace Bulb	Ceiling Mounted	4' 17W LED T8	1,480	302	266
28	Charles A Jones	Interior		MECHANICAL	S101		Light Switch	1	Linear Fluorescent	T8	4' 32W T8; 2x4 Prism Troffer	3	6	8	1,480	284	ECM	RB - Replace Bulb	Ceiling Mounted	4' 17W LED T8	1,480	151	133
32	Charles A Jones	Interior		OPEN OFFICE	C120		Light Switch	2	Linear Fluorescent	T8	4' 32W T8; 2x4 Prism Troffer	5	10	8	1,480	474	ECM	RB - Replace Bulb	Ceiling Mounted	4' 17W LED T8	1,480	252	222
33	Charles A Jones	Interior		STORAGE	S108		Light Switch	2	Linear Fluorescent	T8	4' 32W T8; 2x4 Prism Troffer	1	2	8	703	45	ECM	RB - Replace Bulb	Ceiling Mounted	4' 17W LED T8	703	24	21
34	Charles A Jones	Interior		STORAGE	S108		Light Switch	2	Linear Fluorescent	T8	4' 32W T8; 2x4 Prism Troffer	1	2	8	703	45	ECM	RB - Replace Bulb	Ceiling Mounted	4' 17W LED T8	703	24	21
35	Charles A Jones	Interior		OFFICE	C12B	2L 2 2B	Light Switch	2	Linear Fluorescent	T8	4' 32W T8; 2x4 Prism Troffer	2	4	8	1,480	189	ECM	RB - Replace Bulb	Ceiling Mounted	4' 17W LED T8	1,480	101	89
36	Charles A Jones	Interior		OFFICE	C12B	2L 2 2B	Light Switch	2	Linear Fluorescent	T8	4' 32W T8; 2x4 Prism Troffer	2	4	8	1,480	189	ECM	RB - Replace Bulb	Ceiling Mounted	4' 17W LED T8	1,480	101	89
37	Charles A Jones	Interior		RESTROOM	T101		Light Switch	2	Linear Fluorescent	T8	4' 32W T8; 2x4 Prism Troffer	2	4	8	1,480	189	ECM	RB - Replace Bulb	Ceiling Mounted	4' 17W LED T8	1,480	101	89
38	Charles A Jones	Interior		OPEN OFFICE	Conference	2L 3 3F	Light Switch	2	Linear Fluorescent	T8	4' 32W T8; 2x4 Prism Troffer	3	6	8	1,480	284	ECM	RB - Replace Bulb	Ceiling Mounted	4' 17W LED T8	1,480	151	133
39	Charles A Jones	Interior		OPEN OFFICE	Conference	2L 3 3F	Light Switch	2	Linear Fluorescent	T8	4' 32W T8; 2x4 Prism Troffer	3	6	8	1,480	284	ECM	RB - Replace Bulb	Ceiling Mounted	4' 17W LED T8	1,480	151	133
40	Charles A Jones	Interior		CAFETERIA	U104		Light Switch	5	Linear Fluorescent	T8	4' 32W T8; 2x4 Prism Troffer	18	54	8	1,480	2,557	ECM	RB - Replace Bulb	Ceiling Mounted	4' 17W LED T8	1,480	1,359	1,199
41	Charles A Jones	Interior		CAFETERIA	U104		Light Switch	5	Linear Fluorescent	T8	4' 32W T8; 2x4 Prism Troffer	9	27	8	1,480	1,279	ECM	RB - Replace Bulb	Ceiling Mounted	4' 17W LED T8	1,480	679	599
42	Charles A Jones	Interior		CAFETERIA	U104		Light Switch	5	Linear Fluorescent	T8	4' 32W T8; 2x4 Prism Troffer	18	54	8	1,480	2,557	ECM	RB - Replace Bulb	Ceiling Mounted	4' 17W LED T8	1,480	1,359	1,199
45	Charles A Jones	Interior		KITCHEN	K1		Light Switch	2	Linear Fluorescent	T8	4' 32W T8; 2x4 Prism Troffer	4	8	8	1,480	379	ECM	RB - Replace Bulb	Ceiling Mounted	4' 17W LED T8	1,480	201	178
48	Charles A Jones	Interior		CLASSROOM	Ext		Timer	1	HID	HPS	HPS70; Wallpack-Horizontal	45	45	8	1,480	4,662	ECM	RF - Replace Entire Fixture	Retain Existing Controls	37W LED Wall Pack	1,480	2,464	2,198
49	Charles A Jones	Interior		OFFICE	C1	4L 2F	Light Switch	1	Linear Fluorescent	T8	4' 32W T8; 2x4 Prism Troffer	2	8	8	1,480	379	ECM	RB - Replace Bulb	Ceiling Mounted	4' 17W LED T8	1,480	201	178
50	Charles A Jones	Interior		CLASSROOM	Y2	4L 10 bi	Light Switch	2	Linear Fluorescent	T8	4' 32W T8; 2x4 Prism Troffer	20	80	8	1,480	3,789	ECM	RB - Replace Bulb	Ceiling Mounted	4' 17W LED T8	1,480	2,013	1,776
51	Charles A Jones	Interior		RESTROOM	T2		Light Switch	2	Linear Fluorescent	T8	4' 32W T8; 2x4 Prism Troffer	2	8	8	1,480	379	ECM	RB - Replace Bulb	Ceiling Mounted	4' 17W LED T8	1,480	201	178
52	Charles A Jones	Interior		OPEN OFFICE	1		Light Switch	1	Linear Fluorescent	T8	4' 32W T8; 2x4 Prism Troffer	3	12	8	1,480	568	ECM	RB - Replace Bulb	Ceiling Mounted	4' 17W LED T8	1,480	302	266
53	Charles A Jones	Interior		HALLWAY	H1		Light Switch	1	Linear Fluorescent	T8	4' 32W T8; 2x4 Prism Troffer	1	4	8	1,480	189	ECM	RB - Replace Bulb	Ceiling Mounted	4' 17W LED T8	1,480	101	89
54	Charles A Jones	Interior		RESTROOM	T3		Light Switch	1	Linear Fluorescent	T8	4' 32W T8; 2x4 Prism Troffer	1	4	8	1,480	189	ECM	RB - Replace Bulb	Ceiling Mounted	4' 17W LED T8	1,480	101	89
55	Charles A Jones	Interior		CLASSROOM	O202	3L 6 6 F para	Light Switch	2	Linear Fluorescent	T8	4' 32W T8; 2x4 Parabolic Troffer	6	18	8	1,480	852	ECM	RB - Replace Bulb	Retain Existing Controls	4' 17W LED T8	1,480	453	400
56	Charles A Jones	Interior		CLASSROOM	O202	3L 6 6 F para	Light Switch	2	Linear Fluorescent	T8	4' 32W T8; 2x4 Parabolic Troffer	6	18	8	1,480	852	ECM	RB - Replace Bulb	Retain Existing Controls	4' 17W LED T8	1,480	453	400
58	Charles A Jones	Interior		CLASSROOM	O20A	2L 6 6F prism	Light Switch	4	Linear Fluorescent	T8	4' 32W T8; 2x4 Prism Troffer	12	24	8	1,480	1,137	ECM	RB - Replace Bulb	Retain Existing Controls	4' 17W LED T8	1,480	604	533
60	Charles A Jones	Interior		CLASSROOM	O200		Light Switch	2	Linear Fluorescent	T8	4' 32W T8; 2x4 Prism Troffer	15	30	8	1,480	1,421	ECM	RB - Replace Bulb	Retain Existing Controls	4' 17W LED T8	1,480	755	666
62	Charles A Jones	Interior		CLASSROOM	020B	2L 3 3F	Light Switch	6	Linear Fluorescent	T8	4' 32W T8; 2x4 Prism Troffer	9	18	8	1,480	852	ECM	RB - Replace Bulb	Retain Existing Controls	4' 17W LED T8	1,480	453	400
64	Charles A Jones	Interior		STORAGE	S206	2L 2 1F	Light Switch	2	Linear Fluorescent	T8	4' 32W T8; 2x4 Prism Troffer	1	2	8	703	45	ECM	RB - Replace Bulb	Retain Existing Controls	4' 17W LED T8	703	24	21
65	Charles A Jones	Interior		STORAGE	S206	2L 2 1F	Light Switch	2	Linear Fluorescent	T8	4' 32W T8; 2x4 Prism Troffer	2	4	8	703	90	ECM	RB - Replace Bulb	Retain Existing Controls	4' 17W LED T8	703	48	42
66	Charles A Jones	Interior		CLASSROOM	020D	2L 4 4F	Light Switch	2	Linear Fluorescent	T8	4' 32W T8; 2x4 Prism Troffer	4	8	8	1,480	379	ECM	RB - Replace Bulb	Retain Existing Controls	4' 17W LED T8	1,480	201	178
67	Charles A Jones	Interior		CLASSROOM	020D	2L 4 4F	Light Switch	2	Linear Fluorescent	T8	4' 32W T8; 2x4 Prism Troffer	4	8	8	1,480	379	ECM	RB - Replace Bulb	Retain Existing Controls	4' 17W LED T8	1,480	201	178
68	Charles A Jones	Interior		CLASSROOM	0203	2L 8 8 F	Light Switch	4	Linear Fluorescent	T8	4' 32W T8; 2x4 Prism Troffer	16	32	8	1,480	1,516	ECM	RB - Replace Bulb	Retain Existing Controls	4' 17W LED T8	1,480	805	710
69	Charles A Jones	Interior		CLASSROOM	0203	2L 8 8 F	Light Switch	4	Linear Fluorescent	T8	4' 32W T8; 2x4 Prism Troffer	16	32	8	1,480	1,516	ECM	RB - Replace Bulb	Retain Existing Controls	4' 17W LED T8	1,480	805	710
70	Charles A Jones	Interior		CLASSROOM	0201	3L 4 7F para	Light Switch	2	Linear Fluorescent	T8	4' 32W T8; 2x4 Parabolic Troffer	7	21	8	1,480	995	ECM	RB - Replace Bulb	Retain Existing Controls	4' 17W LED T8	1,480	528	466
72	Charles A Jones	Interior		CLASSROOM	0205	3L 8 8F ref	Light Switch	2	Linear Fluorescent	T8	4' 32W T8; 2x4 Parabolic Troffer	8	24	8	1,480	1,137	ECM	RB - Replace Bulb	Retain Existing Controls	4' 17W LED T8	1,480	604	533
73	Charles A Jones	Interior		CLASSROOM	0205	3L 8 8F ref	Light Switch	2	Linear Fluorescent	T8	4' 32W T8; 2x4 Parabolic Troffer	8	24	8	1,480	1,137	ECM	RB - Replace Bulb	Retain Existing Controls	4' 17W LED T8	1,480	604	533
74	Charles A Jones	Interior		CLASSROOM	0207	3L 88F para	Light Switch	2	Linear Fluorescent	T8	4' 32W T8; 2x4 Parabolic Troffer	8	24	8	1,480	1,137	ECM	RB - Replace Bulb	Retain Existing Controls	4' 17W LED T8	1,480	604	533
76	Charles A Jones	Interior		CLASSROOM	0209	3L 87F para	Light Switch	4	Linear Fluorescent	T8	4' 32W T8; 2x4 Parabolic Troffer	14	42	8	1,480	1,989	ECM	RB - Replace Bulb	Retain Existing Controls	4' 17W LED T8	1,480	1,057	932
78	Charles A Jones	Interior		CLASSROOM	0206		Light Switch	2	Linear Fluorescent	T8	4' 32W T8; 2x4 Prism Troffer	8	16	8	1,480	758	ECM	RB - Replace Bulb	Retain Existing Controls	4' 17W LED T8	1,480	403	355
79	Charles A Jones	Interior		CLASSROOM	0206		Light Switch	2	Linear Fluorescent	T8	4' 32W T8; 2x4 Prism Troffer	8	16	8	1,480	758	ECM	RB - Replace Bulb	Retain Existing Controls	4' 17W LED T8	1,480	403	355
80	Charles A Jones	Interior		CLASSROOM	0211	3L 66F para	Light Switch	2	Linear Fluorescent	T8	4' 32W T8; 2x4 Parabolic Troffer	6	18	8	1,480	852	ECM	RB - Replace Bulb	Retain Existing Controls	4' 17W LED T8	1,480	453	400
81	Charles A Jones	Interior		CLASSROOM	0211	3L 66F para	Light Switch	2	Linear Fluorescent	T8	4' 32W T8; 2x4 Parabolic Troffer	6	18	8	1,480	852	ECM	RB - Replace Bulb	Retain Existing Controls	4' 17W LED T8	1,480	453	400
82	Charles A Jones	Interior		CLASSROOM	0213	3L 11 11F para	Light Switch	2	Linear Fluorescent	T8	4' 32W T8; 2x4 Parabolic Troffer	11	33	8	1,480	1,563	ECM	RB - Replace Bulb	Retain Existing Controls	4' 17W LED T8	1,480	830	733
85	Charles A Jones	Interior		RESTROOM	T201		Light Switch	1	Linear Fluorescent	T8	4' 32W T8; 1x4 Prism Troffer	5	10	8	1,480	474	ECM	RB - Replace Bulb	Retain Existing Controls	4' 17W LED T8	1,480	252	222
87	Charles A Jones	Interior		HALLWAY	H1		Timer	1	Linear Fluorescent	T8	4' 32W T8; Surface Mount w Lense	4	4	8	1,480	189	ECM	RB - Replace Bulb	Retain Existing Controls	4' 17W LED T8	1,480	101	89
91	Charles A Jones	Interior		RESTROOM	T103	Men	Light Switch	2	Linear Fluorescent	T8	4' 32W T8; 1x4 Prism Troffer	10	20	8	1,480	947	ECM	RB - Replace Bulb	Retain Existing Controls	4' 17W LED T8	1,480	503	444
92	Charles A Jones	Interior		CLASSROOM	0300	2L 88F	Light Switch	2	Linear Fluorescent	T8	4' 32W T8; 2x4 Prism Troffer	8	16	8	1,480	758	ECM	RB - Replace Bulb	Retain Existing Controls	4' 17W LED T8	1,480	403	355
93	Charles A Jones	Interior		CLASSROOM	0300	2L 88F	Light Switch	2	Linear Fluorescent	T8	4' 32W T8; 2x4 Prism Troffer	8	16	8	1,480	758	ECM	RB - Replace Bulb	Retain Existing Controls	4' 17W LED T8	1,480	403	355
94	Charles A Jones	Interior		CLASSROOM	0301	3L 66F ind	Light Switch	4	Linear Fluorescent	T8	4' 32W T8; Industrial	12	36	8	1,480	1,705	ECM	RB - Replace Bulb	Retain Existing Controls	4' 17W LED T8	1,480	906	799
95	Charles A Jones	Interior		CLASSROOM	0301	3L 66F ind	Light Switch	4	Linear Fluorescent	T8	4' 32W T8; Industrial	12	36	8	1,480	1,705	ECM	RB - Replace Bulb	Retain Existing Controls	4' 17W LED T8	1,480	906	799
97	Charles A Jones	Interior		CLASSROOM	0302	2L 55F	Light Switch	4	Linear Fluorescent	T8	4' 32W T8; 2x4 Prism Troffer	10	20	8	1,480	947	ECM	RB - Replace Bulb	Retain Existing Controls	4' 17W LED T8	1,480	503	444
98	Charles A Jones	Interior		CLASSROOM	0305		Light Switch	3	Linear Fluorescent	T8	4' 32W T8; Industrial	30	90	8	1,480	4,262	ECM	RB - Replace Bulb	Retain Existing Controls	4' 17W LED T8	1,480	2,264	1,998
99	Charles A Jones	Interior		CLASSROOM	0305		Light Switch	3	Linear Fluorescent	T8	4' 32W T8; Industrial	30	90	8	1,480	4,262	ECM	RB - Replace Bulb	Retain Existing Controls	4' 17W LED T8	1,480	2,264	1,998
104	Charles A Jones	Interior		CLASSROOM	0308		Light Switch	3	Linear Fluorescent	T8	4' 32W T8; Industrial	30	90	8	1,480	4,262	ECM	RB - Replace Bulb	Retain Existing Controls	4' 17W LED T8	1,480	2,264	1,998
106	Charles A Jones	Interior		CLASSROOM	Z1		Light Switch	2	Linear Fluorescent	T8	4' 32W T8; Surface Mount w Lense	6	6	8	1,480	284	ECM	RB - Replace Bulb	Retain Existing Controls	4' 17W LED T8	1,480	151	133
109	Charles A Jones	Interior		CLASSROOM	0310	3L 7 14F	Light Switch	8	Linear Fluorescent	T8	4' 32W T8; Industrial	28	84	8	1,480	3,978	ECM	RB - Replace Bulb	Retain Existing Controls	4' 17W LED T8	1,480	2,113	1,865
	Totals												3,508									87,551	77,302

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**: Apartment bathrooms

Property Type:	Commercial	Estimated No. of Operational Weeks	37
		Number of Occupied Days/Week (Max 7)	5

KITCHEN FAUCETS			BATHROOM FAUCETS		
Number of Occupants Affected By Retrofit	0		Number of Occupants Affected by Retrofit	252	
Do You Want To Replace Kitchen Faucets Aerators	No	*(Select)*	Do You Want To Replace Bathroom Faucets Aerators	Yes	*(Select)*
Total Number of Faucet Aerators To Be Replaced	0		Total Number of Faucet Aerators To Be Replaced	34	
Total Number of Faucets To Be Replaced:	0		Total Number of Faucets To Be Replaced:	0	
GPM of Existing Faucet Aerators	-	GPM	GPM of Existing Faucet Aerators	2.2	GPM
GPM of Proposed Faucet Aerator	-	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: 38.04 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:	0.56	EF	Heating Fuel Tariff	$1.27	$/Therm
Hot Water Discharge Temperature at Faucet	110.00	°F	Water Tariff ($/1000 Gal)	$6.98	$/kGal
Equivalent Heating Fuel Savings: *Savings Discounted by 15% to Account For Cold Water Use*	289	Therms	Annual Cost Savings In Form of Water	$266	$
Annual Water Savings	38.04	kGal	Annual Energy Savings From Water Heater	$366	$

COST BENEFIT ANALYSIS					
Estimated Total Annual Cost Savings	$631	$$	Estimated Total Installation Cost	$518	$$
Simple Payback Period	0.82	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: $518 Estimated Annual Cost Savings: $631 Simple Payback Period (Yrs): 0.82

UIC	Retrofit Apartment Tank Toilets to Dual Flush
EAP3	Location:

EXISTING CONDITION

Total Occupants:	50	
Number of Water Closets To Be Replaced	4	
Number of Occupied Days Per Week (Max 7)	5	
Number of Occupied Weeks/Year (Max 52)	37	
Estimated Restroom Usage/Individual/Day *5.05 flushes/person/day@American Water Works Association (AWWA)*	4	(Select)

PROPOSED RETROFIT/REPLACEMENT

Existing Gallons Per Flush Ratings For Water Closet Flushes		1.60	GPF
Replace or Retrofit Toilets With Dual Flush Toilets		Retrofit	
Replace			
Proposed Toilet	0.8GPF -Floor Mount, 10" Rough-In		
GPF of Proposed New Low Flow Water Closet Fixture*		0.80	GPF
Retrofit			
Dual Flush - Retrofit Setup Valve for Flush Tank Toilet	*Solid Waste(20%)*	1.60	GPF
**(Federal Law Requires All Flushes Not To Exceed 1.6 GPF)*	*Liquid Waste(80%)*	1.28	GPF

Water & Cost Saving Calculations

Water Savings By The Use of Low Flow Water Closet Flush Valves/Day	51.20	gal
Total Annual Water Savings in gallons	9.47	kgal
Cost Savings Calculations		
Enter Water Tariff Rate ($/1000Gal)	$6.98	$$
Estimated Cost Savings From Water	$66	$$
Estimated Cost of Retrofit		
Estimated Total Cost For Retrofit	$629	$$
Simple Pay Back Period	9.52	Yrs
Type of Recommendation	No/Low 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.

Existing toilets can be retrofitted with pressure-assisted flush technology to reduce the flush rate to 1.0 GPF or less. Though water efficient these toilets make considerable amount of noise as this involves release of pressurized air during the course of flushing. Thus making them unpopular among residential properties.

Thus EMG recommends replacing the existing high flow toilets with new low flow 1.28GPF rated flush tank toilets, which are comparatively more water efficient at the same time considerably quiter as compared to the pressure assisted technology retrofitted toilets.

Summary:

Initial Investment: $629

Simple Payback: 9.52 Years

Annual Cost Savings: $66

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	1,380	3,488	77,302	$12,368.30	$3,452.58

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	1	45	45	2,198	$352	$502
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	124	1,330	1,330	74,867	$11,979	$2,943
Linear Fluorescent	T12	0	0	0	0	$0	$0
Linear Fluorescent	T8 U	1	5	5	237	$38	$7
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	152
Wall Mounted	23		

Initial Investment			**Equipment Rentals**	
Material Cost	$39,347.30		Scissor Lift 26' - Interior Spaces	$0.00
Labor Cost	$65,820.65		Bucket Truck - Exterior Spaces	$0.00
Local Electric Rate:	$0.16	$/kWh	Estimated Annual Energy Savings:	77,302
Hourly Labor Rate For Electrician:	$72.40		Estimated Annual Energy Cost Savings:	$12,368
Budgeted Initial Investment:	$105,168		Estimated Annual O&M Cost Savings:	$3,453
Estimated Return on Investment:	6.65	Years	Estimated Annual Cost Savings:	$15,821

(Including O&M Savings)

UIC	Install Timers On Exhaust Fans
EAC7A	Location:

Type of Exhaust Fan: Rooftop Exhaust Fans

EXISTING CONDITION

No. of Timers to Be Installed:	1	Qty	HP of Individual Fan Motor:	0.19	HP
No. of Exhaust Fans:	25		Total kW:	3.54	kW
Existing Daily Hours of Operation/Exhaust Fan:	8.00	Hrs/Day	Annual kWh For All Fans:	10,347	kWh

PROPOSED CONDITION

New Daily Hours With Timers/Exhaust Fan:	12.00	Hrs/Day	New Annual kWh For All Fans:	15,521	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	90	CFM	No. of Water Closets In Building	46	
(For bathrooms<100Sqft)			No. of Urinals In Building	32	
Total Exhuast CFM From All Fans	2,250	CFM	Total CFM for All Restroom Exhaust	3,900	CFM
Annual Heating Energy Savings	0	kbtu	Annual Heating Energy Savings	-67,392	kbtu
Annual Cooling Energy Savings	0	kbtu	Annual Cooling Energy Savings	-33,696	kbtu

Energy & Cost Savings

Estimated Annual Heating Plant Efficiency	75.30	%	Estimated Annual Cooling Plant Efficiency	11.00	EER
Annual Heating Energy Savings	-895	Therms	Annual Cooling Energy Savings	-3,063	kWh
Annual Electric Fan Motor Savings	-5,174	kWh			

COST ANALYSIS

Electric Rate:	**$0.16**	$/kWh	Total Annual Electric Savings	-8,237	kWh
Material Cost For Timers:	$169	$	Total Annual Non Electric Savings	-895	Therms
Total Cost for Installing Timers	$354	$	Annual Cost savings:	-$2,420	$
Simple Payback:	-0.15	Yrs			

Type of Recommendation No/Low 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: $169
Energy Cost Savings: -$2,420
Simple Payback: -0.15 Years

UIC	Replace Existing Air Conditioners with Energy Star Air Conditioners
EAH3	Location:

Electric Rate: $0.16 $/kWh

Number of Existing Air Conditioners	8	Qty	2	Qty	3	Qty		Qty
Insert Cooling Capacity of Existing Air-Conditioner	18,000	Btuh	24,000	Btuh	24,000	Btuh		Btuh
Please Input The Existing EER of The Air-Conditioner:	7.53	EER	7.53	EER	7.53	EER		EER
Estimated Annual Operating Hours:	976	Hrs	976	Hrs	976	Hrs		Hrs
Select Proposed Air Conditioner Type:	Ductless System-18000		Ductless System-24000		Split System-24000		-	
Estimated New Annual Operating Hours:	976	Hrs	976	Hrs	976	Hrs		Hrs
Please Input The Btu/Hr of The New Air-Conditioner:	18,000	Btuh	24,000	Btuh	24,000	Btuh	-	Btuh
EER of Proposed Air-Conditioning System:	13.39	EER	14.88	EER	14.00	EER	-	EER
Total Energy Consumption For Existing Air conditioner:	18,665	kWh	6,222	kWh	9,332	kWh	0	kWh
Total Energy Consumption For Proposed Air conditioner:	10,498	kWh	3,149	kWh	5,019	kWh	0	kWh
Annual kWh savings for all Air conditioner:	8,166	kWh	3,072	kWh	4,313	kWh	0	kWh
Estimated Annual Energy Cost Savings:	$1,276		$480		$674		$0	
Estimated Annual O&M Savings:	$64		$24		$34		$0	
Total Annual Cost Savings:	$1,340		$504		$708		$0	
Estimated Installed Cost For All Air conditioner:	$28,056		$8,446		$7,035		$0	

Total Initial Investment:	$43,538	Total Annual Electric Savings:	15,551	kWh
Total Annual Cost Savings:	$2,552	Simple Payback:	17.06	Yrs
Type of Recommendation	Capital Cost ECM Recommendation			

ECM DESCRIPTION:

Advances in compressor and condenser technology have allowed for the development of more efficient air conditioning systems. As a result cooling can be provided at the same rate, with a lower energy input. Energy efficiency ratio (EER) is the ratio of cooling output to power input. Seasonal energy efficiency ratio (SEER) is an adjusted figure based on the length of the cooling season. A higher EER or SEER indicates a more efficient unit which can provide the same cooling capacity while consuming less energy. The minimum standard for air conditioner performance in most areas is currently 13 SEER as required by the 2006 International Energy Conservation Code. Units

EMG recommends replacing all the identified air conditioners with the new proposed high efficiency air conditioners as mentioned above.

Summary:

Initial Investment: $43,538 Simple Payback: 17.06 Yrs

Energy Cost Savings: $2,552

UIC	Replace Existing Motors With High Efficiency Motors			
EAM1	Location:			
Enter The Number of Existing Motors	4			
Enter Horse Power of Existing Motor:	3 hp	hp	hp	hp
Enter Existing Annual Hours of Operation:	1,480 Hrs	Hrs	0 Hrs	0 Hrs
Enter Existing Name Plate Efficiency:	80.0%			
Type of Current Supplied	Three Phase			
Enter The Number of Proposed Motors	4		0	0
Enter Horse Power of Proposed Motor:	3 hp	hp	hp	hp
Enter Proposed Annual Hours of Operation:	1,480 Hrs	0 Hrs	0 Hrs	0 Hrs
No. of Poles of the Proposed Motor:	4 Pole (1800 RPM)			
Select Type of Motor:	Open Drip Proof Motor			
Efficiency of Proposed Motor :	90.2%	0.0%	0.0%	0.0%
Estimated annual cost savings:	$151	$0	$0	$0
Estimated cost to replace *one* motor: *(Material And Installation Cost)*	$881	$0	$0	$0
Total Replacement Cost	$5,261	$0	$0	$0
Simple Payback:	34.84 Yrs	#DIV/0! Yrs	#DIV/0! Yrs	#DIV/0! Yrs

Total Initial Investment:	$5,261	Total Annual Cost Savings:	$151	Simple Payback:	34.84 Yrs
Type of Recommendation			Capital Cost ECM Recommendation		

ECM DESCRIPTION:

High-efficiency motors will perform the same function as standard motors, but will improve efficiency by reducing losses in the conversion of electrical to mechanical energy. For example, magnetic losses are reduced by using thinner, higher quality steel lamination in the stator and rotor core. The air gap between rotor and stator is minimized by manufacturing to higher tolerances. More copper is used in the stator windings to reduce resistive losses. On motors with fans, smaller and more efficient fans are used.

The best applications are generally those in which the motor operates at least eight hours or more per day (NCEL 1983a). In some cases, the savings in electrical energy consumption justifies immediate replacement. However, high-efficiency motors are not cost-effective when their premium cost cannot be recovered during the normal life of the motor because of limited hours of operation.

Summary:

Initial Investment: $5,261 Energy Cost Savings: $151 Simple Payback: 34.84 Yrs

UIC	Install Low Flow Tankless Restroom Fixtures
EAP4	Location:

ECM FOR DETERMINING WATER SAVINGS IN COMMERCIAL PROPERTIES

Number of Males	126	
Number of Females	126	
Number of Occupied Days Per Week (Max 7)	5	
Number of Occupied Weeks/Year (Max 52)	37	
Number of Urinals To Be Retrofitted	32	
Number of Water Closets To Be Retrofitted	46	
No. of Water Closets With Separate Flush Tank *(Typical Residential Type)*	0	
Estimated Restroom Usage/Individual/Day *Default is 4 Uses/Day For Residential/Office*	2	(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 -Wall 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	32.63	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)*	No	
No. of Tankless Water Closets		46	
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%)	0.48	GPF
Estimated Annual Water Savings From Male Users		8.35	kGal
Estimated Annual Water Savings From Female Users		41.77	kGal
Total Water Savings From Water Closets		50.13	kGal

Water & Cost Saving Calculations

Water Savings Calculation

Water Savings By The Use of Low Flow Water Closet Flush Valves/Yr	50.13	kgal
Water Savings By The Use of Low Flow Urinal Flush Valves/ Yr	32.63	kgal
Total Annual Water Savings in kgal	82.76	kgal

Cost Savings Calculations

Enter Water Tariff Rate ($/1000Gal)	$6.98	$$
Estimated Cost Savings From Water	$578	$$

Estimated Cost of Retrofit

Cost For Replacing Existing Urinal Fixture With A Low Flow Fixture	$41,611 *(Includes Labor)*	$$
Cost For Replacing Existing Flush Valves With Low Flow - Dual Flush Valves ($80 Per Unit) *(Up For Liquid Waste And Down For Solid Waste)*	$28,476 *(Includes Labor)*	$$
Estimated Total Cost For Retrofit	$70,087	$$
Simple Pay Back Period	121.26	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:	$70,087	Simple Payback Period:	121.26 Yrs
Annual Cost Savings:	$578		

APPENDIX F:
Solar PV

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

Select State: Northern California **Electric Rate:** $0.16 $/KWH Annual Electric Consumption: 757,928 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	20.70	21	66	32,513	32,513	$5,202	$72,450	13.9	$0	$21,735	$715	$0	8.4
2	Building 1 part 2	1	23	23	1	35,340	35,340	$5,654	$78,750	13.9	$0	$23,625	$777	$0	8.4
3	Building 1 part 3	1	15	15	1	23,246	23,246	$3,719	$51,800	13.9	$0	$15,540	$511	$0	8.4
4				0	0		0	$0	$0		$0	$0	$0	$0	
5				0	0		0	$0	$0		$0	$0	$0	$0	
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	
		3		**58**	**67**	**91,099.0**	**91,099**	**$14,576**	**$203,000**	**13.93**	**$0**	**$60,900**	**$2,004**	**$0**	**8.37**

Solar Rooftop Photovoltaic Analysis		
Total Number of Roofs	3	
Estimated Number of Panels	67	
Estimated KW Rating	58	KW
Potential Annual KWh Produced	91,099	KWh
% of Current Electricity Load	12.0%	

Financial Analysis		
Investment Cost	$203,000	
Estimated Energy Cost Savings	$14,576	
Potential Rebates	$60,900	
Potential Annual Incentives	$2,004	
Payback without Incentives	13.9	years
Incentive Payback but without SRECS	8.4	years
Payback with All Incentives	8.4	years