ENERGY STUDY
for the
OREGON STATE DEPARTMENT OF LANDS BUILDING

Located at
775 Summer
Salem, OR

BE 6374

Presented to:

Lockheed Martin
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Portland, OR

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May 2, 2009

MSE

TABLE OF CONTENTS

EXECUTIVE SUMMARY

Table 1

Energy Savings Summary

State of Oregon Lands Building

Revision 0

Energy Efficiency Measure	Annual Electricity Usage (kWh)	Annual Natural Gas Usage (Therms)	Total Annual Energy Usage (kBtu)	Annual Electric Energy Savings (kWh)	Annual Natural Gas Savings (Therms)	Total Annual Energy Savings (kBtu)	Annual Electric Cost Savings ($)	Annual Natural Gas Cost Savings ($)	Total Annual Energy Cost Savings ($)	Total Installed Cost ($)	Simple Payback (Years)
Baseline Energy Model	1,186,100	15,712	5,618,173								
EEM-1: Replace existing Weil McLain cast iron boiler with high efficiency condensing boiler	1,186,100	7,227	4,769,673	0	8,485	848,500	$0	$9,503	$9,503	$40,000	4.2
EEM-2: Install CO2 demand ventilation control	1,181,500	15,039	5,535,178	4,600	673	82,995	$391	$754	$1,145	$8,000	7.0
EEM-3: Install VSD's on AHU-1 supply and return fans	1,099,900	15,712	5,324,059	86,200	0	294,114	$7,327	$0	$7,327	$25,000	3.4
EEM-4: Install DDC system to replace pneumatic control system	1,085,100	11,283	4,830,661	101,000	4,429	787,512	$8,585	$4,960	$13,545	$90,000	6.6
EEM-5: Replace forced draft cooling tower with induced draft cooling tower	1,174,700	15,712	5,579,276	11,400	0	38,897	$969	$0	$969	$40,000	41.3
EEM-6: Replace existing reciprocating chiller with high efficiency centrifugal chiller	1,142,501	15,712	5,469,413	43,599	0	148,760	$3,706	$0	$3,706	$170,000	45.9
EEM-7: Install VSD on existing 15-hp cooling tower fan motor	1,166,782	15,712	5,552,261	19,318	0	65,912	$1,642	$0	$1,642	$10,000	6.1
EEM-8: Install VSD's on (2) chilled water pumps	1,183,600	15,712	5,609,643	2,500	0	8,530	$213	$0	$213	$7,500	35.3
EEM-9: Install VSD's on (2) hot water pumps	1,182,100	7,374	4,770,725	4,000	-147	-1,052	$340	($165)	$175	$5,500	31.4

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EXECUTIVE SUMMARY

Mechanical Systems Engineering (MSE) has completed the energy analysis of the Oregon State Department of Lands Building Located at 775 Summer in Salem and provides the following conclusions and recommendations for your review:

1. Table 1 provides a summary of the estimated energy savings that will result from installing the energy efficiency measures EEM-1 through EEM-9.
2. We recommend that the owner proceed with the installation of the EEMs shown in Table 1A.

Table 1A

Recommended Energy Efficiency Measures(EEM's)

EEM	Description
EEM-1	Replace existing Weil McLain cast iron boiler (Eff. < 75%) with high efficiency condensing boiler. (Eff. = 92%)
EEM-2	Install CO_2 demand ventilation control
EEM-3	Install VSD's on AHU-1 supply and return fans.
EEM-4	Install DDC system to replace pneumatic control system
EEM-6	Replace existing reciprocating chiller with high efficiency centrifugal chiller
EEM-7	Install VSD on existing 15-hp cooling tower fan motor.

3. The EEMs in Table 1A (except EEM-6) all have paybacks of less than 10 years. The simple payback of these EEMs will be significantly less than 10 years once the ETO and Business Energy Tax Credit (BETC) incentives are factored in.
4. Replacing the existing Weil McLain cast iron boiler with a high efficiency condensing boiler will reduce natural gas costs by about $9,503 per year.
5. Installing CO_2 controls will improve indoor air quality in the building in addition to conserving a natural gas and electrical energy. The annual energy cost savings will be about $1,145.
6. Installing variable speed drives (VSD's) on the supply and the return fans for AHU-1 will provide a more efficient form of fan control than the existing variable inlet vanes. The annual energy cost savings will be about $7,327.
7. Installation of a DDC control system will reduce annual operating costs by about $13,545 and will also improve tenant comfort conditions by more tightly controlling the temperature and relative humidity conditions in the building.
8. Replacing the reciprocating chiller with a high efficiency centrifugal chiller will have an annual energy cost savings of about $3,706, while also reducing the use of Ozone depleting compounds found in older systems.
9. Installation of a VSD on the 15hp cooling tower fan motor (CH-1) will reduce annual energy consumption. The annual energy cost savings is estimated to be about $969.

10. Oregon Business Energy Tax Credits (BETC) may be provided on this project. Typically the tax credit would be 25.9% (lump sum) of the installed cost of the project. The amount of the BETC is contingent on approval from ODOE and is therefore difficult to quantify the exact credit amount.
11. We do not currently know the amount of incentive that the Energy Trust of Oregon will be providing. However, any contribution made by the Trust will further reduce the net payback of the recommended upgrades.
12. It is recommended that the owner pursue the installation of the recommended. ETO and BETC funding is currently available. However, the continued availability of this funding is unpredictable from year to year and should be pursued at the owner's earliest opportunity.

Once you have reviewed this report, please don't hesitate to contact us regarding any questions you may have. We look forward to our continued discussions regarding improving the energy efficiency of the Executive Building.

DESCRIPTION OF EXISTING FACILITY

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The Oregon State Department of Lands Building is a 3-story, 72,000 square foot office Building located at 775 Summer in Salem.

Lighting Systems
The majority of the facility has T-8 fluorescent lighting with electronic ballasts. The overall lighting watt density of the facility is about 1.6 watts/square foot.

Miscellaneous Loads
Miscellaneous loads include personal computers, printer, copiers and small business machines. Miscellaneous loads are estimated to be 0.5 watts/sq. ft.

HVAC Systems

Central Plants
The central heating plant consists of (1) Weil McLain cast iron sectional boiler with a thermal efficiency of about 75% (estimated). A constant speed centrifugal pump serves the hot water distribution system.

Chilled water is provided to the building by a reciprocating chiller located in the mechanical room. The chiller does not have a VSD on the compressor. The water-cooled condenser is served by an induced draft cooling tower located on the roof. Constant speed centrifugal pumps serve both the chilled water and condenser water loops.

Heating and Cooling Distribution Systems
The air distribution system for the entire building is variable air volume. Several VAV terminal units are distributed throughout the building. All of the terminal units have Hydronic reheat coils. Each terminal unit has a pneumatic actuator and is pressure independent. Zone thermostats control the VAV dampers in response to zone dry bulb temperature. Supply air volume control is provided by variable inlet veins on the supply fan for AHU-1.

Table 2 provides a summary of the HVAC systems in the building.

Table 2
Executive Office Building HVAC Systems

Equipment Designation	Description
B-1	Weil McLain sectional cast iron boiler
CH-1	Reciprocating chiller (water cooled). Eff. < 0.70 kW/ton
CT-1	Forced draft cooling tower with 15=hp ODP motor
AHU-1	Built up air handling unit with VIV volume control on supply and return fan motors.
P-1 & 2	Hot water pumps (standard efficiency)
P-3 & 4	Chilled water pumps (standard efficiency)
VAV	Pressure independent VAV terminal units with Hydronic reheat coils.

<u>*HVAC Control System*</u>
The entire facility is served by a pneumatic control system. Pneumatic thermostats control pneumatic actuators on the VAV terminal units distributed throughout the building. Dampers and valves are also controlled by pneumatic actuators.

BASELINE BUILDING ANALYSIS

BASELINE BUILDING ANALYSIS

Mechanical Systems Engineering (MSE) has modeled the energy consumption of the Oregon State Department of Lands Building utilizing the eQuest Energy Analysis Program. This modeling software employs an hourly analysis energy simulation utilizing weather data for Portland, OR. Hourly temperatures are derived from US Weather Service data for average dry bulb and wet bulb temperatures for a 20 year period.

It is critical to develop a baseline simulation that closely models the actual energy consumption of the building. Once this baseline model is developed, various Energy Efficiency Measures (EEMs) can be superimposed into the baseline building model to determine the estimated energy savings that will result from each EEM. The best measure of the accuracy of the energy model is to compare simulated energy usage for the baseline building to actual building energy consumption over a 12 month period.

Table 3 shows the electricity and natural gas usage that the eQuest model predicts for the existing building. To test the accuracy of the model, Table 3 also shows actual monthly energy consumption for the Oregon State Department of Lands Building for a 12-month period. The graphical form of Table 3 is shown in Figures 1 and 1A.

Table 3
Modeled vs actual electricity and natural gas usage

	Electricity		*Natural Gas*	
Month	**Actual (kWh)**	**eQuest Simulation (kWh)**	**Actual (Therms)**	**eQuest Simulation (Therms)**
Jan	100,800	77,100	4,138	3,882
Feb	89,700	73,400	3,555	2,402
March	98,100	92,700	3,009	1,610
April	99,600	96,800	2,555	882
May	92,600	102,600	1,803	278
June	103,400	119,500	755	83
July	103,200	126,700	201	57
Aug	114,400	122,300	50	54
Sep	91,100	113,200	54	160
Oct	74,600	97,900	530	836
Nov	76,400	79,400	1,729	2,048
Dec	82,050	84,500	2,805	3,420
Total	1,125,950	1,186,100	21,182	15,712

Whereas it is very difficult to get simulated energy usage to exactly match actual consumption, the energy simulation has predicted energy usage that closely correlates to actual usage. This close approximation of actual energy usage indicates that our model accurately simulates actual building energy usage and can be used with confidence to predict the energy savings that will result from installing the various energy efficiency measures. Our model reflects the usage that would have occurred if the building were fully occupied.

Figure 1

Modeled vs. actual electricity usage

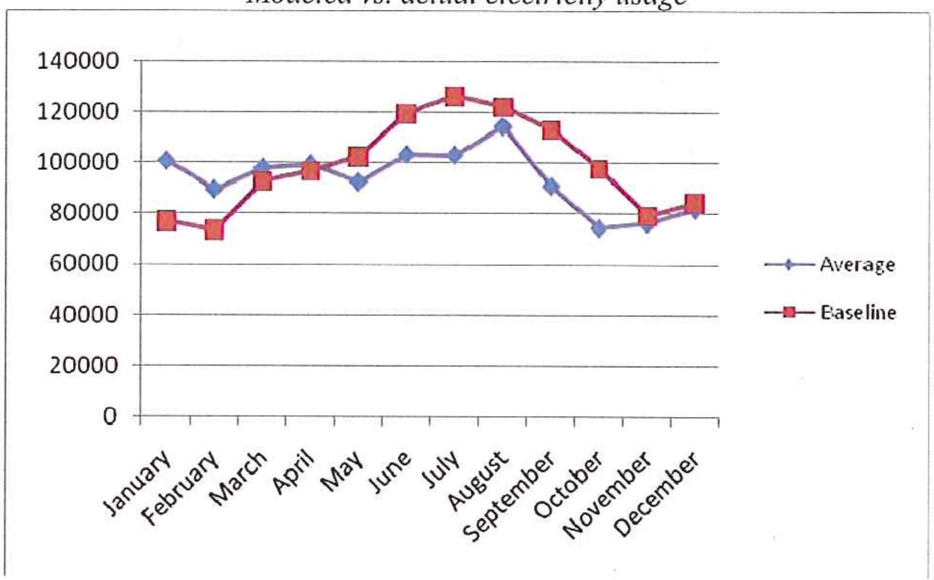
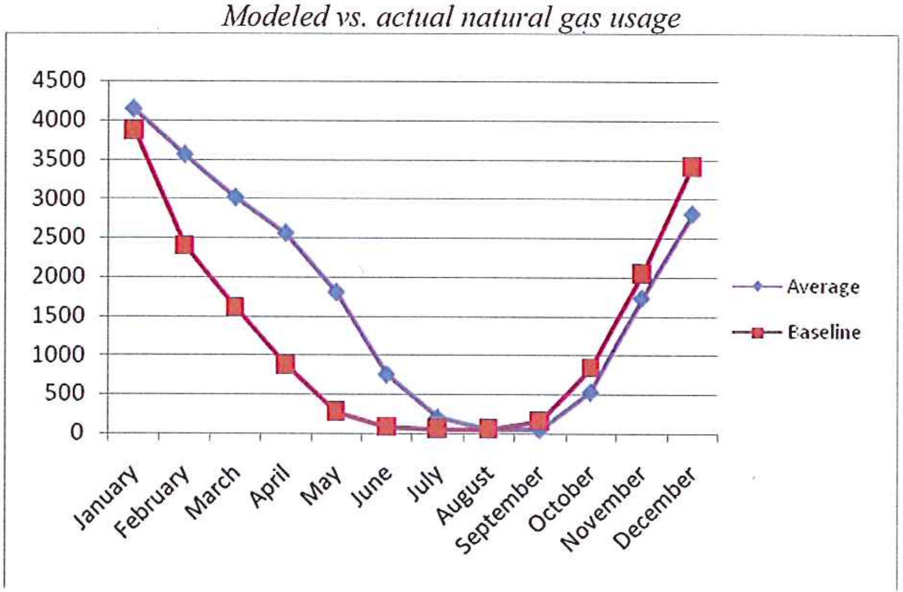


Figure 1A

Modeled vs. actual natural gas usage



The energy utilization index (EUI) for the facility is 82.8 kBtu/sq. ft./year. This corresponds to a EUI that we would expect for average commercial building. Our energy efficiency measure analysis indicates that the building EUI can be improved to 51.4 kBtu/sq. ft./year by installing EEM-1 thru EEM-4, EEM-5 and EEM-6. An EUI of 51.4 is representative of a very efficient building.

We have the following comments regarding the energy consumption patterns of the facility:

1. The existing cast iron boiler seems to be running very inefficiently. The building is using considerably more natural gas then a building of this size and usage should be using. This may be the result of poorly calibrated pneumatic controls or a problem with the boiler itself.
2. The existing pneumatic controls do not accurately control the building. Installation of a DDC control system will eliminate this inaccurate control that is characteristic of a pneumatic control system.

The next section discusses the Energy Efficiency Measures that we have evaluated for the building.

ENERGY EFFICIENCY MEASURES

ENERGY EFFICIENCY MEASURES

MSE has evaluated the following Energy Efficiency Measures (EEMs) for your review:

EEM-1: Replace existing cast iron boiler with high efficiency (Eff. = 92%) condensing boiler

This EEM evaluates the cost effectiveness of replacing the existing cast iron boiler with a high efficiency condensing boiler. Catalogue data on the existing boiler indicates that it had a full load efficiency of 80% when it was new. Our analysis assumes that the full load efficiency of the boiler has degraded to less than 50% due to poor burner calibration and scaling on the boiler heat exchange surfaces.

Our analysis assumes that a condensing boiler would replace the existing boiler. Catalogue data indicates that the boiler will have an efficiency of 92% with a return water temperature of less than 140F. Note that there are other manufacturers of condensing boilers that could be considered equal in performance and quality to the Aerco product line. Examples would include Camus and Fulton.

Our evaluation assumes that the existing centrifugal hot water pumps will be re-used with the new condensing boilers.

We recommend the owner proceed with the implementation of this EEM.

See Table 1 for a summary of energy savings and payback for this EEM.

EEM-2: Install CO_2 demand ventilation control

This EEM evaluates the cost effectiveness of installing demand ventilation control using CO_2 sensors. It is not possible to employ demand ventilation control without installing a DDC system. This EEM assumes that one CO_2 sensor would be installed in the common return plenum of the building. The sensor would provide a 4-20 mA or 0-10Vdc analogue signal to the DDC system and the DDC system would modulate the outside air intake dampers in order to maintain a maximum CO_2 level of 1,000 ppm (adjustable) in all parts of the building.

At the present time, a constant amount of ventilation air is provided to the building, regardless of the number of people present in the building at any given time. Therefore, excessive cooling and heating energy is being used to cool, heat and dehumidify outside air to satisfy "worst case" ventilation requirements. Installation of CO_2 sensors on each floor of the building will provide a feedback mechanism to the DDC system. If CO_2 levels are increasing, the DDC system will modulate the outside air dampers further open. Conversely, as CO_2 levels drop (indicating there are less people in the building), the DDC system will modulate the outside air dampers further closed, saving heating and cooling energy in the process.

We recommend the owner proceed with the implementation of this EEM.

See Table 1 for a summary of energy savings and payback for this EEM.

EEM-3: Replace VIV control AHU-1 Supply and Return fan motors

This EEM evaluates the cost effectiveness of installing variable speed drives (VSD's) on the supply and return fan motors. The new VSD's would be used for fan volume control. Variable inlet vanes that modulate in response to duct static pressure provide the existing fan volume control. Whereas this type of airflow control is effective at reducing static pressure it does very little to improve the energy efficiency of the fan at various load conditions. Installation of a VSD on each of the fans will reduce fan power requirements by the cube of the fan rpm and will therefore have a favorable impact on fan operating costs. The variable inlet vanes would be permanently set in the 100% open position.

We recommend the owner proceed with the implementation of this EEM.

See Table 1 for a summary of energy savings and payback for this EE

EEM-4: Install direct digital control (DDC) system to replace existing pneumatic control system to control HVAC systems

This EEM evaluates the cost effectiveness of replacing the existing pneumatic control system with a DDC system. This retrofit will include the replacement of the VAV terminal unit mounted controls with DDC actuators, pressure sensors and flow sensor.

This DDC system will reduce energy consumption through the following control mechanisms:

Night setback
Optimal start/stop
PID control
Static pressure reset
Discharge Temperature Reset
Time-of-day programming
VSD control

Table 3A provides the HVAC systems that would be controlled by the proposed DDC system.

Table 3A
HVAC systems controlled by DDC system

B-1 • On/off • HWS temp • HWR temp
CH-1 ▪ On/off
CT-1 ▪ On/off
VAV terminal units • PID control • Pressure independent control
P-1&2 (Hot water pumps) • On/off • Proof of flow
P-3 & 4 (Chilled water pumps) ▪ On/off ▪ Proof of flow
AHU-1 (supply fan) • On/off • Economizer control • Proof of airflow • VSD (or VIV) control
AHU-1 (Return fan) • On/off • Proof of airflow • VSD (or VIV) control
Floor/Reference pressure • Pressure sensor each floor • Lobby pressure (reference)

The existing pneumatic control system does a very poor job of controlling the VAV air distribution system and AHU-1. The existing control system is inefficient for the following reasons:

1. The pneumatic controls result in space temperatures that overshoot the set point for the space being controlled. The DDC proportional, integral and derivative (PID) control will eliminate this problem.

2. The pneumatic damper actuators on the VAV terminal units are old and most likely are not functioning correctly on many of the VAV terminal units. This results in poor temperature control for the zone. Installation of the DDC system will remedy this deficiency by replacing the pneumatic actuators with electronic actuators that will be controlled by the central control panel.
3. The HVAC system is turned on too early in the morning on most days. The DDC optimum start program will alleviate this tendency.
4. Energy consumption patterns in the building indicate that the HVAC systems operate a substantial number of additional hours each day than should be required to maintain comfort conditions in the building. Time-of-day programming and night setback programming will alleviate this problem.

We recommend the owner proceed with the implementation of this EEM.

See Table 1 for a summary of energy savings and payback for this EEM.

EEM-5: Replace existing forced draft cooling tower with induced draft cooling tower.

This EEM examines the cost effectiveness of replacing the forced draft cooling tower and 15HP motor with an induced draft cooling tower. Despite the large amount of energy savings that will result from the installation of this system, the cost effectiveness of this EEM is marginal due to the high installed cost of the system.

We recommend against the implementation of this EEM.

Table 1 provides a summary of the energy savings and installed cost for this system.

EEM-6: Replace existing 166-ton reciprocating chiller with high efficiency centrifugal chiller

This EEM evaluates the cost effectiveness of replacing the existing 166-ton water cooled reciprocating chiller with a high efficiency centrifugal chiller with the following full and part load efficiencies:

Percent of Full Load	Efficiency
100%	0.392 kW/ton
75%	0.480 kW/ton
50%	0.349 kW/ton
25%	0.323 kW/ton

The existing chiller has a full load efficiency of 0.698 kW/ton. Part load efficiency data is not available for this unit. Our analysis assumes that the part load efficiency remains constant at part and full load conditions.

The existing chiller was installed when the building was constructed 20 years ago and has experienced substantial maintenance problems over the past several years. Maintenance costs for the previous 12 months have been $51,430. The service contractor for the building indicates that service issues will continue to escalate on this unit and that it should be replaced as soon as is considered feasible.

The existing chiller uses a CFC based refrigerant, R-12. Any replacement chillers would have an environmentally friendly (approved by Montreal Protocol) refrigerant as CFC based refrigerants are no longer available in new chillers.

We recommend that the owner proceed with the installation of a new high efficiency chiller within the next 12-months.

Table 1 provides a summary of the energy savings and payback for this EEM.

EEM-7: Install VSD on existing cooling tower fan motor

This EEM examines the cost effectiveness of installing a VSD on the cooling tower that serves the building. Included in this EEM is the replacement of the existing 15 hp fan motor with a new, inverter rated motor of equal size.

The CT fan currently cycles in response to condenser supply water temperature. This is an ineffective means of temperature control for the following reasons:

1. Because the fan has only one speed, the supply condenser water temperature is constantly over and under shooting the temperature setpoint.
2. Fan energy is wasted since the fan is operating at full speed during those periods when the CT load requires substantially lower fan speeds.

We recommend the owner proceed with the implementation of this EEM.

See Table 1 for a summary of energy savings and payback for this EEM.

EEM-8: Install variable speed drives (VSD's) on existing 5-hp chilled water pumps

This EEM evaluates the cost effectiveness of installing VSD's on the (2) 10-hp centrifugal chilled water pumps that served the chilled water distribution system. Only one pump operates at a time. Only one centrifugal pump operates at a time.

This EEM assumes that the new high efficiency chiller recommended in EEM-6 will be installed. The new chiller would have the ability to operate with a variable chilled water flow. We would discourage the owner from implementing this EEM with the existing chiller as this vintage of chiller was not designed to work with a variable chilled water flow.

In order to implement this EEM, it will be necessary to replace the 3-way valve on the central air handling unit (AHU-1) chilled water coil with a 2-way valve. It is not possible to implement a variable flow chilled water system without this change.

We recommend against the implementation of this EEM due to the limited energy savings and long payback period.

Table 1 provides a summary of the energy savings and payback associated with this EEM.

<u>EEM-9: Install VSD's on (2) 5-hp hot water pumps</u>

This EEM evaluates the cost effectiveness of converting the existing constant flow hot water distribution system to a variable flow system. This retrofit would include the installation of VSD's on the (2) centrifugal hot water pumps that serve the hot water distribution system. In addition, it would be necessary to convert the existing 3-way valve at the VAV terminal units to 2-way valves. We estimate that there are about 20 VAV terminal units that would require a control valve retrofit.

Whereas the installed cost of the VSD's is relatively small, the cost to retrofit the hot water control valves at the VAV terminal units is quite high and makes this EEM quite expensive. Since the energy savings that results is relatively small to the installed cost of the retrofit, the payback is quite high. We therefore recommend against implementing this EEM.

Table 1 provides a summary of the energy savings and payback associated with this EEM.

CONCLUSIONS AND RECOMMENDATIONS

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Mechanical Systems Engineering (MSE) has completed the energy analysis of the Oregon State Department of Lands Building Located at 775 Summer in Salem and provides the following conclusions and recommendations for your review:

1. Table 1 provides a summary of the estimated energy savings that will result from installing the energy efficiency measures EEM-1 through EEM-9.
2. We recommend that the owner proceed with the installation of the EEMs shown in Table 4.

Table 4

Recommended Energy Efficiency Measures(EEM's)

EEM	Description
EEM-1	Replace existing Weil McLain cast iron boiler (Eff. < 75%) with high efficiency condensing boiler. (Eff. = 92%)
EEM-2	Install CO2 demand ventilation control
EEM-3	Install VSD's on AHU-1 supply and return fans.
EEM-4	Install DDC system to replace pneumatic control system
EEM-6	Replace existing reciprocating chiller with high efficiency centrifugal chiller
EEM-7	Install VSD on existing 15-hp cooling tower fan motor.

3. The EEMs in Table 1A all have paybacks of less than 10 years. The simple payback of these EEMs will be significantly less than 10 years once the ETO and Business Energy Tax Credit (BETC) incentives are factored in.
4. Replacing the existing Weil McLain cast iron boiler with a high efficiency condensing boiler will reduce natural gas costs by about $9,503 per year.
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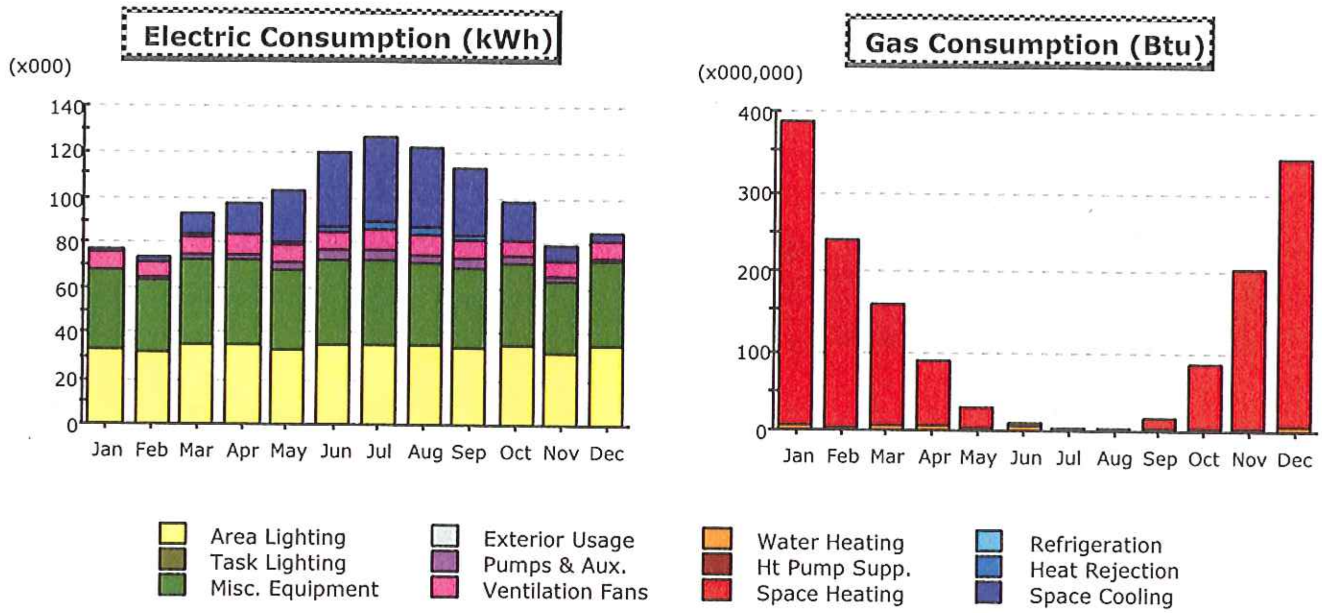
APPENDIX

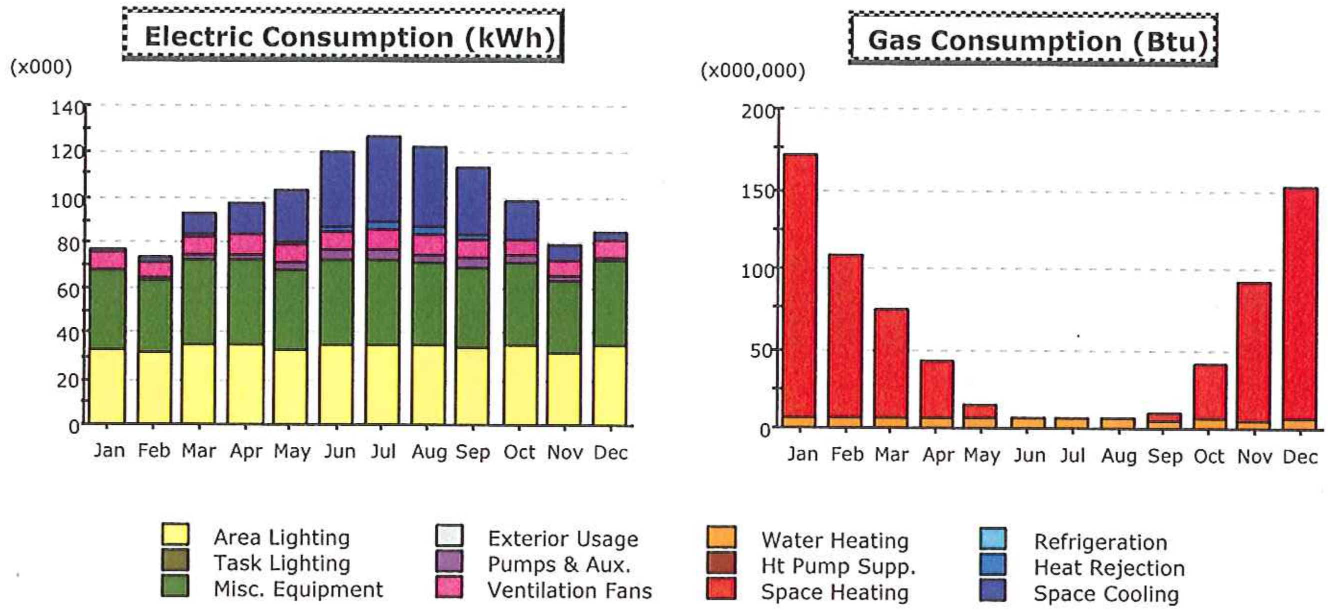


Electric Consumption (kWh x000)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
Space Cool	1.4	2.5	10.0	13.4	22.5	31.9	37.2	35.3	29.4	16.1	7.1	3.1	209.8
Heat Reject.	-	0.0	0.1	0.4	1.3	2.6	3.5	3.3	2.4	0.6	0.0	0.0	14.3
Refrigeration	-	-	-	-	-	-	-	-	-	-	-	-	-
Space Heat	0.1	0.1	0.1	0.0	0.0	0.0	-	-	0.0	0.0	0.1	0.1	0.5
HP Supp.	-	-	-	-	-	-	-	-	-	-	-	-	-
Hot Water	-	-	-	-	-	-	-	-	-	-	-	-	-
Vent. Fans	7.1	6.6	7.7	7.7	7.6	8.7	9.6	9.2	8.2	7.5	6.6	7.6	94.0
Pumps & Aux.	0.8	1.0	2.5	2.9	3.5	4.1	4.1	3.9	3.8	3.2	2.0	1.2	33.0
Ext. Usage	-	-	-	-	-	-	-	-	-	-	-	-	-
Misc. Equip.	34.6	32.3	36.9	36.8	34.6	36.7	36.9	36.0	35.3	36.0	32.5	36.9	425.6
Task Lights	-	-	-	-	-	-	-	-	-	-	-	-	-
Area Lights	33.0	31.0	35.5	35.5	33.0	35.5	35.5	34.5	34.0	34.5	31.1	35.5	408.8
Total	77.1	73.4	92.7	96.8	102.6	119.5	126.7	122.3	113.2	97.9	79.4	84.5	1,185.9

Gas Consumption (Btu x000,000)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
Space Cool	-	-	-	-	-	-	-	-	-	-	-	-	-
Heat Reject.	-	-	-	-	-	-	-	-	-	-	-	-	-
Refrigeration	-	-	-	-	-	-	-	-	-	-	-	-	-
Space Heat	382.1	234.5	154.4	81.6	22.0	2.3	-	-	10.7	78.1	199.5	335.7	1,501.0
HP Supp.	-	-	-	-	-	-	-	-	-	-	-	-	-
Hot Water	6.1	5.8	6.6	6.5	5.8	5.9	5.7	5.4	5.3	5.5	5.2	6.2	70.1
Vent. Fans	-	-	-	-	-	-	-	-	-	-	-	-	-
Pumps & Aux.	-	-	-	-	-	-	-	-	-	-	-	-	-
Ext. Usage	-	-	-	-	-	-	-	-	-	-	-	-	-
Misc. Equip.	-	-	-	-	-	-	-	-	-	-	-	-	-
Task Lights	-	-	-	-	-	-	-	-	-	-	-	-	-
Area Lights	-	-	-	-	-	-	-	-	-	-	-	-	-
Total	388.2	240.3	161.0	88.2	27.8	8.3	5.7	5.4	16.0	83.6	204.8	342.0	1,571.1

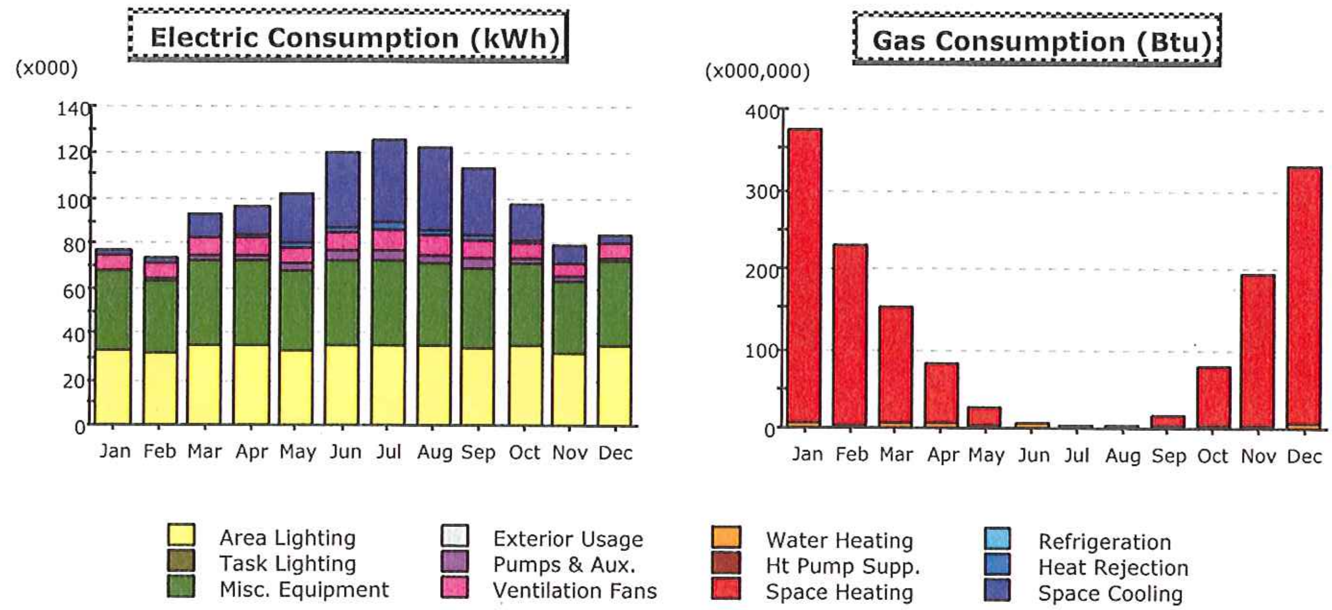


Electric Consumption (kWh x000)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
Space Cool	1.4	2.5	10.0	13.4	22.5	31.9	37.2	35.3	29.4	16.1	7.1	3.1	209.8
Heat Reject.	-	0.0	0.1	0.4	1.3	2.6	3.5	3.3	2.4	0.6	0.0	0.0	14.3
Refrigeration	-	-	-	-	-	-	-	-	-	-	-	-	-
Space Heat	0.1	0.1	0.1	0.0	0.0	0.0	-	-	0.0	0.0	0.1	0.1	0.5
HP Supp.	-	-	-	-	-	-	-	-	-	-	-	-	-
Hot Water	-	-	-	-	-	-	-	-	-	-	-	-	-
Vent. Fans	7.1	6.6	7.7	7.7	7.6	8.7	9.6	9.2	8.2	7.5	6.6	7.6	94.0
Pumps & Aux.	0.8	1.0	2.5	2.9	3.5	4.1	4.1	3.9	3.8	3.2	2.0	1.2	33.0
Ext. Usage	-	-	-	-	-	-	-	-	-	-	-	-	-
Misc. Equip.	34.6	32.3	36.9	36.8	34.6	36.7	36.9	36.0	35.3	36.0	32.5	36.9	425.6
Task Lights	-	-	-	-	-	-	-	-	-	-	-	-	-
Area Lights	33.0	31.0	35.5	35.5	33.0	35.5	35.5	34.5	34.0	34.5	31.1	35.5	408.8
Total	77.1	73.4	92.7	96.8	102.6	119.5	126.7	122.3	113.2	97.9	79.4	84.5	1,185.9

Gas Consumption (Btu x000,000)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
Space Cool	-	-	-	-	-	-	-	-	-	-	-	-	-
Heat Reject.	-	-	-	-	-	-	-	-	-	-	-	-	-
Refrigeration	-	-	-	-	-	-	-	-	-	-	-	-	-
Space Heat	166.14	101.94	67.11	35.50	9.57	1.01	-	-	4.66	33.95	86.76	145.98	652.62
HP Supp.	-	-	-	-	-	-	-	-	-	-	-	-	-
Hot Water	6.06	5.80	6.64	6.55	5.84	5.93	5.68	5.37	5.28	5.50	5.21	6.21	70.08
Vent. Fans	-	-	-	-	-	-	-	-	-	-	-	-	-
Pumps & Aux.	-	-	-	-	-	-	-	-	-	-	-	-	-
Ext. Usage	-	-	-	-	-	-	-	-	-	-	-	-	-
Misc. Equip.	-	-	-	-	-	-	-	-	-	-	-	-	-
Task Lights	-	-	-	-	-	-	-	-	-	-	-	-	-
Area Lights	-	-	-	-	-	-	-	-	-	-	-	-	-
Total	172.20	107.74	73.76	42.04	15.41	6.94	5.68	5.37	9.94	39.46	91.97	152.19	722.70

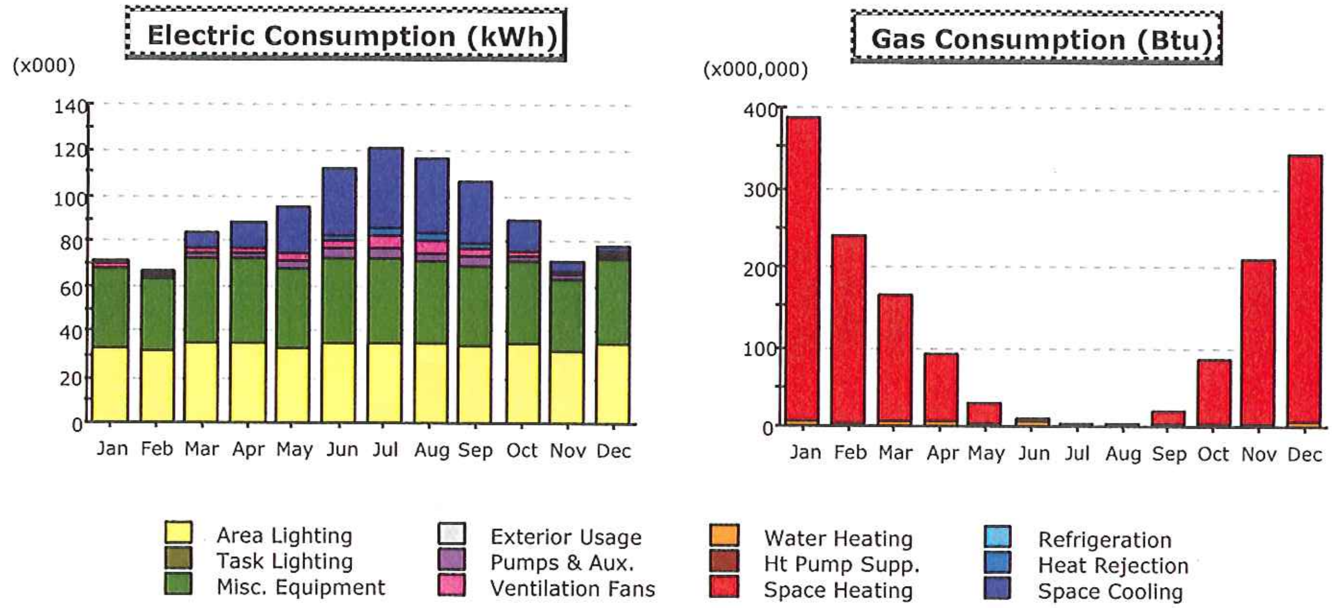


Electric Consumption (kWh x000)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
Space Cool	1.3	2.3	9.9	13.3	22.4	31.9	37.3	35.4	29.3	15.9	7.0	3.1	209.1
Heat Reject.	-	0.0	0.1	0.4	1.3	2.6	3.5	3.3	2.4	0.6	0.0	0.0	14.3
Refrigeration	-	-	-	-	-	-	-	-	-	-	-	-	-
Space Heat	0.1	0.1	0.1	0.0	0.0	0.0	-	-	0.0	0.0	0.1	0.1	0.5
HP Supp.	-	-	-	-	-	-	-	-	-	-	-	-	-
Hot Water	-	-	-	-	-	-	-	-	-	-	-	-	-
Vent. Fans	6.8	6.3	7.4	7.5	7.3	8.4	9.1	8.8	8.0	7.2	6.3	7.3	90.4
Pumps & Aux.	0.7	0.9	2.5	2.9	3.4	4.1	4.1	3.9	3.8	3.2	2.0	1.2	32.7
Ext. Usage	-	-	-	-	-	-	-	-	-	-	-	-	-
Misc. Equip.	34.6	32.3	36.9	36.8	34.6	36.7	36.9	36.0	35.3	36.0	32.5	36.9	425.6
Task Lights	-	-	-	-	-	-	-	-	-	-	-	-	-
Area Lights	33.0	31.0	35.5	35.5	33.0	35.5	35.5	34.5	34.0	34.5	31.1	35.5	408.8
Total	76.7	72.9	92.3	96.3	102.2	119.3	126.4	122.0	112.9	97.4	79.0	84.1	1,181.3

Gas Consumption (Btu x000,000)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
Space Cool	-	-	-	-	-	-	-	-	-	-	-	-	-
Heat Reject.	-	-	-	-	-	-	-	-	-	-	-	-	-
Refrigeration	-	-	-	-	-	-	-	-	-	-	-	-	-
Space Heat	368.8	224.0	146.3	75.5	20.5	2.0	-	-	10.2	72.8	190.8	322.9	1,433.7
HP Supp.	-	-	-	-	-	-	-	-	-	-	-	-	-
Hot Water	6.1	5.8	6.6	6.5	5.8	5.9	5.7	5.4	5.3	5.5	5.2	6.2	70.1
Vent. Fans	-	-	-	-	-	-	-	-	-	-	-	-	-
Pumps & Aux.	-	-	-	-	-	-	-	-	-	-	-	-	-
Ext. Usage	-	-	-	-	-	-	-	-	-	-	-	-	-
Misc. Equip.	-	-	-	-	-	-	-	-	-	-	-	-	-
Task Lights	-	-	-	-	-	-	-	-	-	-	-	-	-
Area Lights	-	-	-	-	-	-	-	-	-	-	-	-	-
Total	374.8	229.7	152.9	82.1	26.3	8.0	5.7	5.4	15.5	78.3	196.0	329.2	1,503.8

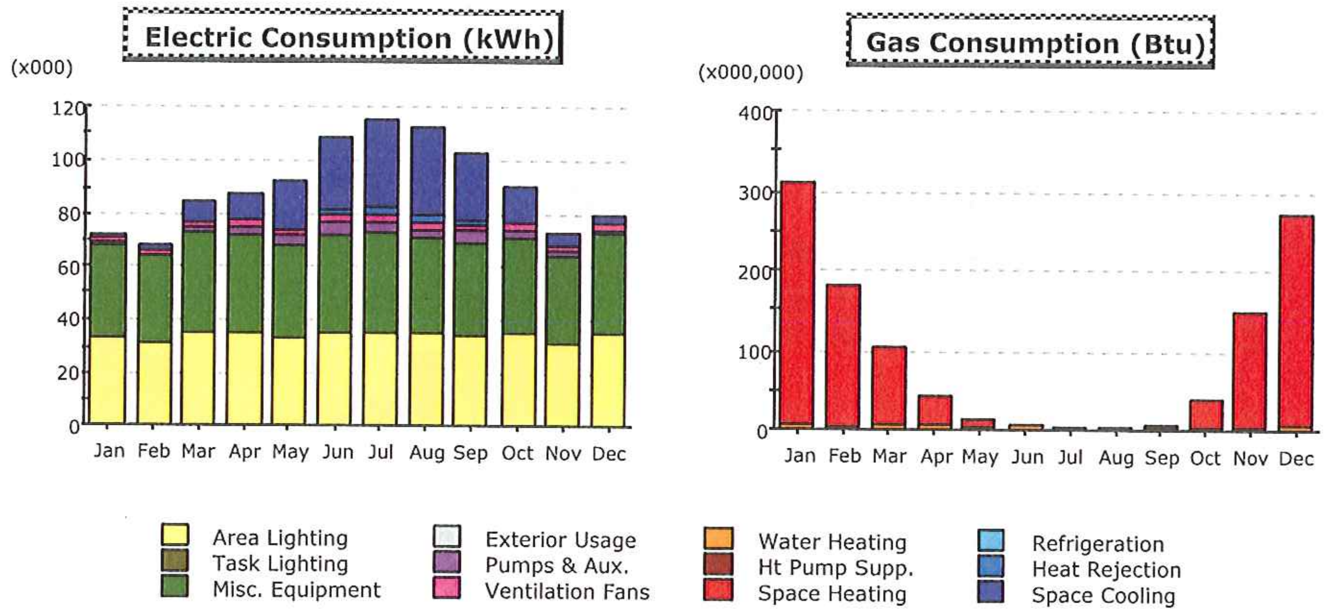


Electric Consumption (kWh x000)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
Space Cool	0.9	1.3	6.6	10.6	20.0	29.8	35.7	33.8	27.1	13.8	4.6	2.4	186.8
Heat Reject.	-	-	0.1	0.3	1.1	2.4	3.3	3.1	2.2	0.4	0.0	0.0	12.9
Refrigeration	-	-	-	-	-	-	-	-	-	-	-	-	-
Space Heat	0.1	0.1	0.1	0.0	0.0	0.0	-	-	0.0	0.0	0.1	0.1	0.5
HP Supp.	-	-	-	-	-	-	-	-	-	-	-	-	-
Hot Water	-	-	-	-	-	-	-	-	-	-	-	-	-
Vent. Fans	2.1	1.6	2.0	2.1	3.0	4.0	5.5	5.5	3.6	2.2	1.6	1.9	35.0
Pumps & Aux.	0.7	0.7	1.8	2.5	3.2	4.0	4.1	3.9	3.7	3.0	1.5	1.1	30.2
Ext. Usage	-	-	-	-	-	-	-	-	-	-	-	-	-
Misc. Equip.	34.6	32.3	36.9	36.8	34.6	36.7	36.9	36.0	35.3	36.0	32.5	36.9	425.6
Task Lights	-	-	-	-	-	-	-	-	-	-	-	-	-
Area Lights	33.0	31.0	35.5	35.5	33.0	35.5	35.5	34.5	34.0	34.5	31.1	35.5	408.8
Total	71.4	67.0	83.0	87.8	95.0	112.4	121.0	116.9	106.0	90.0	71.5	77.9	1,099.9

Gas Consumption (Btu x000,000)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
Space Cool	-	-	-	-	-	-	-	-	-	-	-	-	-
Heat Reject.	-	-	-	-	-	-	-	-	-	-	-	-	-
Refrigeration	-	-	-	-	-	-	-	-	-	-	-	-	-
Space Heat	382.1	235.2	159.0	83.5	23.3	4.5	-	-	12.8	79.7	203.2	335.8	1,519.0
HP Supp.	-	-	-	-	-	-	-	-	-	-	-	-	-
Hot Water	6.1	5.8	6.6	6.5	5.8	5.9	5.7	5.4	5.3	5.5	5.2	6.2	70.1
Vent. Fans	-	-	-	-	-	-	-	-	-	-	-	-	-
Pumps & Aux.	-	-	-	-	-	-	-	-	-	-	-	-	-
Ext. Usage	-	-	-	-	-	-	-	-	-	-	-	-	-
Misc. Equip.	-	-	-	-	-	-	-	-	-	-	-	-	-
Task Lights	-	-	-	-	-	-	-	-	-	-	-	-	-
Area Lights	-	-	-	-	-	-	-	-	-	-	-	-	-
Total	388.1	241.0	165.6	90.0	29.1	10.5	5.7	5.4	18.1	85.2	208.4	342.0	1,589.1

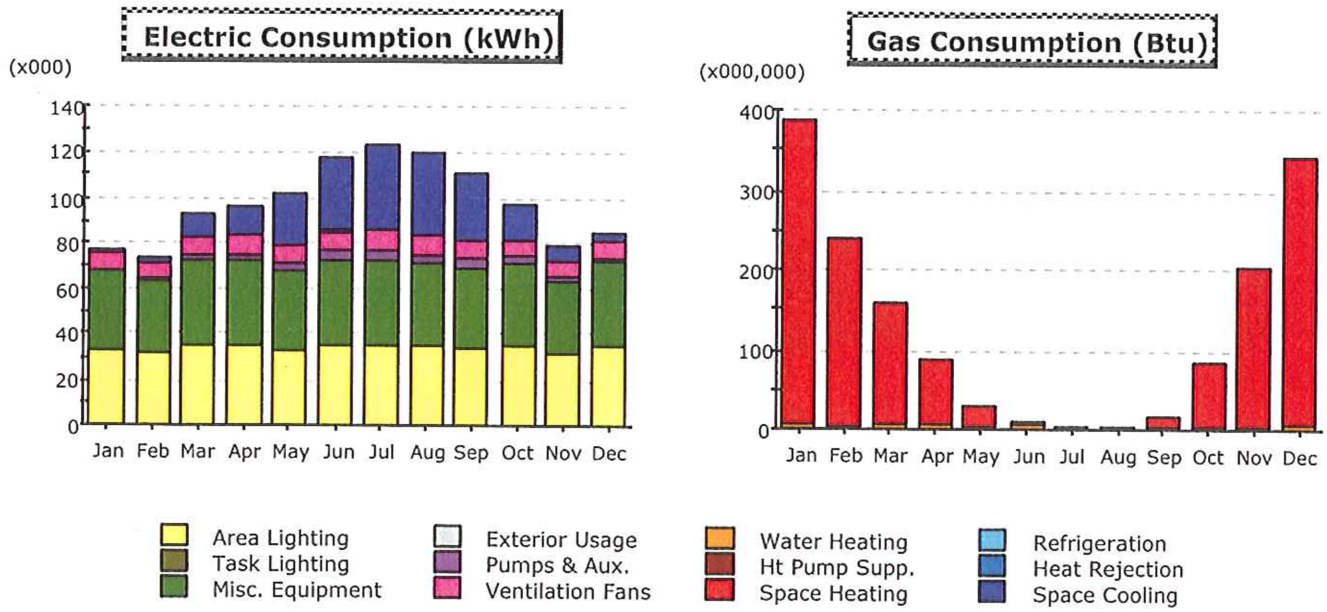


Electric Consumption (kWh x000)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
Space Cool	1.0	1.5	6.9	10.2	18.4	27.9	33.4	31.8	25.3	13.2	5.3	2.6	177.3
Heat Reject.	-	-	0.0	0.2	0.9	2.1	2.9	2.8	1.9	0.3	0.0	-	11.2
Refrigeration	-	-	-	-	-	-	-	-	-	-	-	-	-
Space Heat	0.1	0.1	0.0	0.0	0.0	-	-	-	0.0	0.0	0.1	0.1	0.4
HP Supp.	-	-	-	-	-	-	-	-	-	-	-	-	-
Hot Water	-	-	-	-	-	-	-	-	-	-	-	-	-
Vent. Fans	2.4	2.2	2.6	2.6	2.4	2.8	2.9	2.8	2.6	2.5	2.2	2.6	30.6
Pumps & Aux.	0.7	0.8	2.1	2.6	3.3	4.0	4.1	3.9	3.8	3.1	1.8	1.2	31.3
Ext. Usage	-	-	-	-	-	-	-	-	-	-	-	-	-
Misc. Equip.	34.6	32.3	36.9	36.8	34.6	36.7	36.9	36.0	35.3	36.0	32.5	36.9	425.6
Task Lights	-	-	-	-	-	-	-	-	-	-	-	-	-
Area Lights	33.0	31.0	35.5	35.5	33.0	35.5	35.5	34.5	34.0	34.5	31.1	35.5	408.8
Total	71.8	67.9	84.0	87.8	92.7	109.0	115.7	111.9	102.9	89.6	73.0	78.8	1,085.2

Gas Consumption (Btu x000,000)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
Space Cool	-	-	-	-	-	-	-	-	-	-	-	-	-
Heat Reject.	-	-	-	-	-	-	-	-	-	-	-	-	-
Refrigeration	-	-	-	-	-	-	-	-	-	-	-	-	-
Space Heat	304.3	174.8	98.0	35.2	5.3	-	-	-	2.1	32.6	141.9	264.1	1,058.3
HP Supp.	-	-	-	-	-	-	-	-	-	-	-	-	-
Hot Water	6.1	5.8	6.6	6.5	5.8	5.9	5.7	5.4	5.3	5.5	5.2	6.2	70.1
Vent. Fans	-	-	-	-	-	-	-	-	-	-	-	-	-
Pumps & Aux.	-	-	-	-	-	-	-	-	-	-	-	-	-
Ext. Usage	-	-	-	-	-	-	-	-	-	-	-	-	-
Misc. Equip.	-	-	-	-	-	-	-	-	-	-	-	-	-
Task Lights	-	-	-	-	-	-	-	-	-	-	-	-	-
Area Lights	-	-	-	-	-	-	-	-	-	-	-	-	-
Total	310.3	180.6	104.6	41.8	11.1	5.9	5.7	5.4	7.4	38.1	147.1	270.3	1,128.3



Electric Consumption (kWh x000)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
Space Cool	1.4	2.5	10.0	13.4	22.5	31.9	37.2	35.3	29.4	16.1	7.1	3.1	209.8
Heat Reject.	-	0.0	0.0	0.1	0.3	0.5	0.7	0.7	0.5	0.1	0.0	0.0	2.9
Refrigeration	-	-	-	-	-	-	-	-	-	-	-	-	-
Space Heat	0.1	0.1	0.1	0.0	0.0	0.0	-	-	0.0	0.0	0.1	0.1	0.5
HP Supp.	-	-	-	-	-	-	-	-	-	-	-	-	-
Hot Water	-	-	-	-	-	-	-	-	-	-	-	-	-
Vent. Fans	7.1	6.6	7.7	7.7	7.6	8.7	9.6	9.2	8.2	7.5	6.6	7.6	94.0
Pumps & Aux.	0.8	1.0	2.5	2.9	3.5	4.1	4.1	3.9	3.8	3.2	2.0	1.2	33.0
Ext. Usage	-	-	-	-	-	-	-	-	-	-	-	-	-
Misc. Equip.	34.6	32.3	36.9	36.8	34.6	36.7	36.9	36.0	35.3	36.0	32.5	36.9	425.6
Task Lights	-	-	-	-	-	-	-	-	-	-	-	-	-
Area Lights	33.0	31.0	35.5	35.5	33.0	35.5	35.5	34.5	34.0	34.5	31.1	35.5	408.8
Total	77.1	73.4	92.6	96.5	101.5	117.5	123.9	119.6	111.3	97.4	79.4	84.5	1,174.6

Gas Consumption (Btu x000,000)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
Space Cool	-	-	-	-	-	-	-	-	-	-	-	-	-
Heat Reject.	-	-	-	-	-	-	-	-	-	-	-	-	-
Refrigeration	-	-	-	-	-	-	-	-	-	-	-	-	-
Space Heat	382.1	234.5	154.4	81.6	22.0	2.3	-	-	10.7	78.1	199.5	335.7	1,501.0
HP Supp.	-	-	-	-	-	-	-	-	-	-	-	-	-
Hot Water	6.1	5.8	6.6	6.5	5.8	5.9	5.7	5.4	5.3	5.5	5.2	6.2	70.1
Vent. Fans	-	-	-	-	-	-	-	-	-	-	-	-	-
Pumps & Aux.	-	-	-	-	-	-	-	-	-	-	-	-	-
Ext. Usage	-	-	-	-	-	-	-	-	-	-	-	-	-
Misc. Equip.	-	-	-	-	-	-	-	-	-	-	-	-	-
Task Lights	-	-	-	-	-	-	-	-	-	-	-	-	-
Area Lights	-	-	-	-	-	-	-	-	-	-	-	-	-
Total	388.2	240.3	161.0	88.2	27.8	8.3	5.7	5.4	16.0	83.6	204.8	342.0	1,571.1

Energy Savings Summary

EEM-6: High Efficiency Chiller

OAT	Annual Operating Hours	Cooling Load (Tons)	Full Load %	Existing Chiller Power (kW)	Proposed Chiller Power (kW)	Power Savings (kW)	Annual Energy Savings (kWh)	Proposed Chiller Power (kW/Ton)
90	13	166	100%	115.9	65.1	50.8	660.3	0.392
88	12	159	96%	111.2	62.5	48.8	585.2	0.392
86	15	153	92%	106.6	59.9	46.7	701.1	0.392
84	24	146	88%	102.0	57.3	44.7	1,073.0	0.392
82	14	139	84%	97.4	54.7	42.7	597.5	0.392
80	43	133	80%	92.7	52.1	40.6	1,747.9	0.392
78	48	126	76%	88.1	49.5	38.6	1,853.8	0.392
76	29	120	72%	83.5	57.4	26.1	756.0	0.48
74	76	113	68%	78.8	54.2	24.6	1,871.3	0.48
72	140	106	64%	74.2	51.0	23.2	3,244.8	0.48
70	115	100	60%	69.6	47.8	21.7	2,499.1	0.48
68	105	93	56%	65.0	44.7	20.3	2,130.0	0.48
66	118	86	52%	60.3	41.5	18.8	2,223.1	0.48
64	100	80	48%	55.7	27.8	27.8	2,784.7	0.349
62	156	73	44%	51.1	25.5	25.5	3,983.0	0.349
60	170	67	40%	46.4	23.2	23.2	3,947.0	0.349
58	120	60	36%	41.8	20.9	20.9	2,508.4	0.349
56	168	53	32%	37.2	18.6	18.6	3,122.9	0.349
54	263	47	28%	32.5	16.3	16.3	4,280.2	0.349
52	202	40	24%	27.9	12.9	15.0	3,030.0	0.323
50	215							
48	185							
46	208							
44	194							
42	196							
40	95							
38	106							
36	109							
34	39							
32	40							
30	14							
28	14							
26	3							
24	9							
22	15							
20	6							
18	2							
Total Energy Savings							***43,599***	
Total Energy Cost Savings							***$4,360***	

Notes:

1. Existing chiller has full load power of 0.698 kW/ton.
2. Proposed chiller is McQuay centrifugal chiller with full and part load efficiencies as follows:
   - 100% 0.392 kW/ton
   - 75% 0.480 kW/ton
   - 50% 0.349 kW/ton
   - 25% 0.323 kW/ton
3. Building operation assumed to be 6 am to 6 pm, M thru F.
4. Electricity cost assumed to be a blended rate of $0.10/kWh.

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Portland, OR 97210
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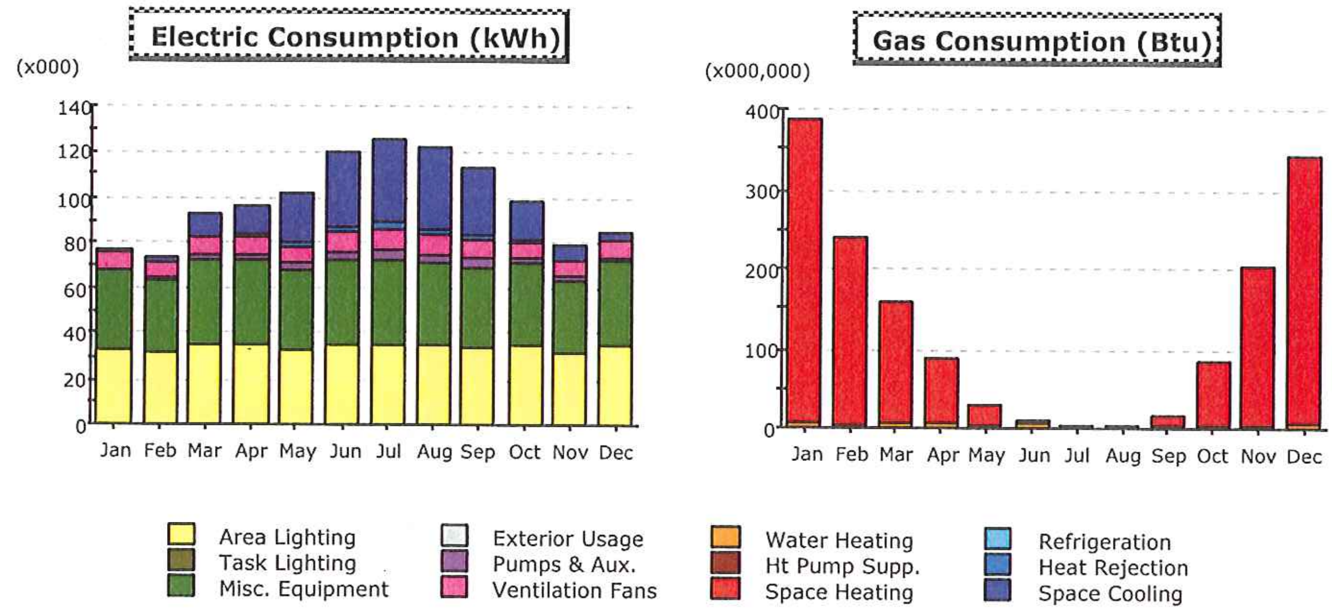
EEM-7: *VSD on cooling tower fan motor*

OAT	Annual Operating Hours	Cooling Load (Tons)	Fan Power w/o VSD (kW)	% of Full Load	Fan Power (kW)	Fan Power Savings (kW)	Total Fan Energy Savings (kWh)
90	13	166	11.19	1.00	11.19	0.00	0.00
88	12	159	11.19	0.95	9.67	1.52	18.19
86	15	153	11.19	0.91	8.30	2.89	43.33
84	24	146	11.19	0.86	7.07	4.12	98.99
82	14	139	11.19	0.81	5.96	5.23	73.24
80	43	133	11.19	0.76	4.97	6.22	267.30
78	48	126	11.19	0.72	4.10	7.09	340.14
76	29	120	11.19	0.67	3.34	7.85	227.60
74	76	113	11.19	0.62	2.68	8.51	646.72
72	140	106	11.19	0.57	2.11	9.08	1,270.81
70	115	100	11.19	0.53	1.63	9.56	1,099.24
68	105	93	11.19	0.48	1.23	9.96	1,045.86
66	118	86	11.19	0.43	0.90	10.29	1,214.28
64	100	80	11.19	0.38	0.63	10.56	1,055.53
62	156	73	11.19	0.34	0.43	10.76	1,678.92
60	170	67	11.19	0.29	0.27	10.92	1,856.16
58	120	60	11.19	0.24	0.16	11.03	1,323.74
56	168	53	11.19	0.19	0.08	11.11	1,866.04
54	263	47	11.19	0.15	0.04	11.15	2,933.55
52	202	40	11.19	0.10	0.01	11.18	2,258.12
50	215						
48	185						
46	208						
44	194						
42	196						
40	95						
38	106						
36	109						
34	39						
32	40						
30	14						
28	14						
26	3						
24	9						
22	15						
20	6						
18	2						
Total Savings							***19318***

Mechanical Systems Engineering
2882 NW Fairfax Terrace
Portland, OR 97210
503-888-0426

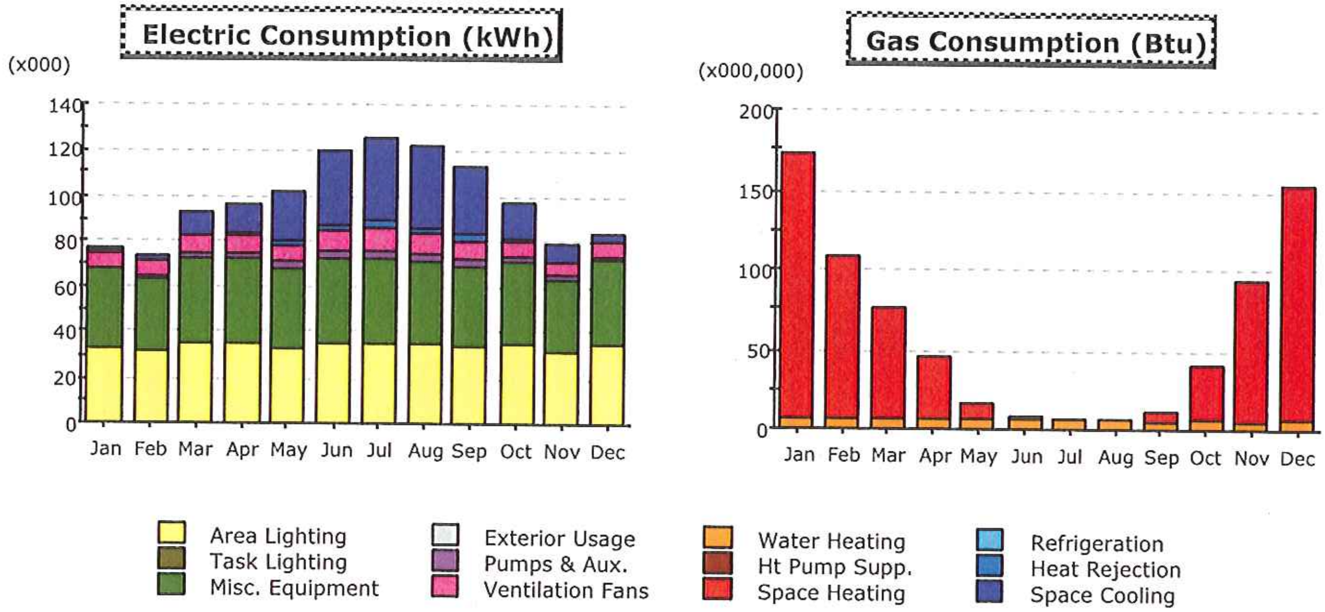


Electric Consumption (kWh x000)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
Space Cool	1.4	2.5	10.0	13.4	22.5	31.9	37.2	35.3	29.4	16.1	7.1	3.1	209.8
Heat Reject.	-	0.0	0.1	0.4	1.3	2.6	3.4	3.3	2.4	0.6	0.0	0.0	14.2
Refrigeration	-	-	-	-	-	-	-	-	-	-	-	-	-
Space Heat	0.1	0.1	0.1	0.0	0.0	0.0	-	-	0.0	0.0	0.1	0.1	0.5
HP Supp.	-	-	-	-	-	-	-	-	-	-	-	-	-
Hot Water	-	-	-	-	-	-	-	-	-	-	-	-	-
Vent. Fans	7.1	6.6	7.7	7.7	7.6	8.7	9.6	9.2	8.2	7.5	6.6	7.6	94.0
Pumps & Aux.	0.7	0.9	2.4	2.7	3.2	3.8	3.8	3.6	3.6	3.0	1.9	1.1	30.8
Ext. Usage	-	-	-	-	-	-	-	-	-	-	-	-	-
Misc. Equip.	34.6	32.3	36.9	36.8	34.6	36.7	36.9	36.0	35.3	36.0	32.5	36.9	425.6
Task Lights	-	-	-	-	-	-	-	-	-	-	-	-	-
Area Lights	33.0	31.0	35.5	35.5	33.0	35.5	35.5	34.5	34.0	34.5	31.1	35.5	408.8
Total	77.0	73.3	92.6	96.6	102.3	119.2	126.4	122.0	112.9	97.6	79.3	84.4	1,183.7

Gas Consumption (Btu x000,000)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
Space Cool	-	-	-	-	-	-	-	-	-	-	-	-	-
Heat Reject.	-	-	-	-	-	-	-	-	-	-	-	-	-
Refrigeration	-	-	-	-	-	-	-	-	-	-	-	-	-
Space Heat	382.1	234.5	154.4	81.6	22.0	2.3	-	-	10.7	78.1	199.5	335.7	1,501.0
HP Supp.	-	-	-	-	-	-	-	-	-	-	-	-	-
Hot Water	6.1	5.8	6.6	6.5	5.8	5.9	5.7	5.4	5.3	5.5	5.2	6.2	70.1
Vent. Fans	-	-	-	-	-	-	-	-	-	-	-	-	-
Pumps & Aux.	-	-	-	-	-	-	-	-	-	-	-	-	-
Ext. Usage	-	-	-	-	-	-	-	-	-	-	-	-	-
Misc. Equip.	-	-	-	-	-	-	-	-	-	-	-	-	-
Task Lights	-	-	-	-	-	-	-	-	-	-	-	-	-
Area Lights	-	-	-	-	-	-	-	-	-	-	-	-	-
Total	388.2	240.3	161.0	88.2	27.8	8.3	5.7	5.4	16.0	83.6	204.8	342.0	1,571.1



Electric Consumption (kWh x000)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
Space Cool	1.4	2.5	10.0	13.4	22.5	31.9	37.2	35.3	29.4	16.1	7.1	3.1	209.8
Heat Reject.	-	0.0	0.1	0.4	1.3	2.6	3.5	3.3	2.4	0.6	0.0	0.0	14.3
Refrigeration	-	-	-	-	-	-	-	-	-	-	-	-	-
Space Heat	0.1	0.1	0.1	0.0	0.0	0.0	-	0.0	0.0	0.0	0.1	0.1	0.6
HP Supp.	-	-	-	-	-	-	-	-	-	-	-	-	-
Hot Water	-	-	-	-	-	-	-	-	-	-	-	-	-
Vent. Fans	7.1	6.6	7.7	7.7	7.6	8.7	9.6	9.2	8.2	7.5	6.6	7.6	94.0
Pumps & Aux.	0.5	0.7	2.2	2.6	3.2	3.7	3.8	3.6	3.5	2.9	1.7	0.9	29.1
Ext. Usage	-	-	-	-	-	-	-	-	-	-	-	-	-
Misc. Equip.	34.6	32.3	36.9	36.8	34.6	36.7	36.9	36.0	35.3	36.0	32.5	36.9	425.6
Task Lights	-	-	-	-	-	-	-	-	-	-	-	-	-
Area Lights	33.0	31.0	35.5	35.5	33.0	35.5	35.5	34.5	34.0	34.5	31.1	35.5	408.8
Total	76.8	73.1	92.4	96.4	102.3	119.2	126.3	121.9	112.9	97.5	79.1	84.2	1,182.1

Gas Consumption (Btu x000,000)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
Space Cool	-	-	-	-	-	-	-	-	-	-	-	-	-
Heat Reject.	-	-	-	-	-	-	-	-	-	-	-	-	-
Refrigeration	-	-	-	-	-	-	-	-	-	-	-	-	-
Space Heat	166.94	102.78	69.49	37.84	10.60	2.72	-	0.57	6.23	35.59	87.61	146.92	667.29
HP Supp.	-	-	-	-	-	-	-	-	-	-	-	-	-
Hot Water	6.06	5.80	6.64	6.55	5.84	5.93	5.68	5.37	5.28	5.50	5.21	6.21	70.08
Vent. Fans	-	-	-	-	-	-	-	-	-	-	-	-	-
Pumps & Aux.	-	-	-	-	-	-	-	-	-	-	-	-	-
Ext. Usage	-	-	-	-	-	-	-	-	-	-	-	-	-
Misc. Equip.	-	-	-	-	-	-	-	-	-	-	-	-	-
Task Lights	-	-	-	-	-	-	-	-	-	-	-	-	-
Area Lights	-	-	-	-	-	-	-	-	-	-	-	-	-
Total	173.01	108.58	76.13	44.38	16.45	8.65	5.68	5.94	11.51	41.09	92.81	153.14	737.37