

WILLIAM PATERSON UNIVERSITY

COLLEGE HALL

**300 POMPTON ROAD
WAYNE, NJ 07470**

FACILITY ENERGY REPORT

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I. HISTORIC ENERGY CONSUMPTION/COST

The energy usage for the facility has been tabulated and plotted in graph form as depicted within this section. Each energy source has been identified and monthly consumption and cost noted per the information provided by the Owner.

Electric Utility Provider:	Public Service Electric & Gas
Electric Utility Rate Structure:	General Lighting & Power (GLP)
Third Party Supplier:	Hess

Natural Gas Utility Provider:	Public Service Electric & Gas
Utility Rate Structure:	General Service Gas (GSG)
Third Party Supplier:	Hess

The electric usage profile represents the actual electrical usage for the facility. The electric utility measures consumption in kilowatt-hours (KWH) and maximum demand in kilowatts (KW). One KWH usage is equivalent to 1000 watts running for one hour. One KW of electric demand is equivalent to 1000 watts running at any given time. The basic usage charges are shown as generation service and delivery charges along with several non-utility generation charges. Rates used in this report reflect the historical data received for the facility.

The gas usage profile within each facility report shows the actual natural gas energy usage for the facility. The gas utility measures consumption in cubic feet x 100 (CCF), and converts the quantity into Therms of energy. One Therm is equivalent to 100,000 BTUs of energy.

Table 1
Electricity Billing Data

ELECTRIC USAGE SUMMARY			
Utility Provider: PSE&G Rate: GLP (General Power and Lighting Service) Meter No: 778012901 Customer ID No: 42-012-008-09 (Account #) Third Party Utility Provider: TPS Meter / Acct No:			
MONTH OF USE	CONSUMPTION KWH	DEMAND	TOTAL BILL
May-11	150,911	308.8	\$21,855
Jun-11	205,170	374.5	\$32,472
Jul-11	209,349	380.5	\$33,119
Aug-11	157,303	349.3	\$23,713
Sep-11	163,696	314.6	\$24,092
Oct-11	145,965	306.4	\$19,288
Nov-11	135,467	270.8	\$17,924
Dec-11	147,340	261.8	\$19,378
Jan-12	140,804	245.3	\$18,570
Feb-12	137,972	260.9	\$18,591
Mar-12	137,015	335.2	\$18,624
Apr-12	144,083	313.1	\$19,427
Totals	1,875,075	380.5 Max	\$267,051
AVERAGE DEMAND 310.1 KW average AVERAGE RATE \$0.142 \$/kWh			

Figure 1
Electricity Usage Profile

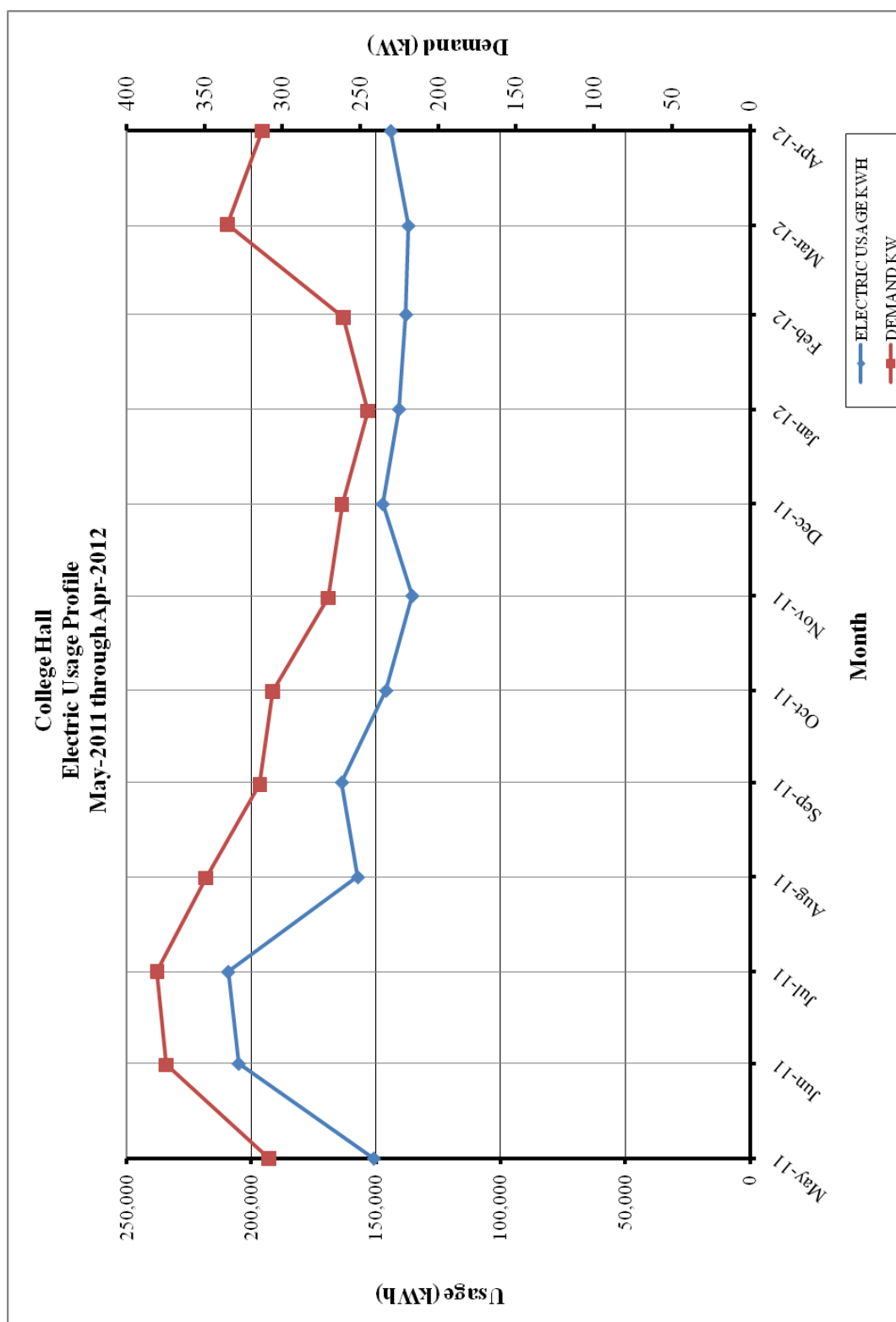
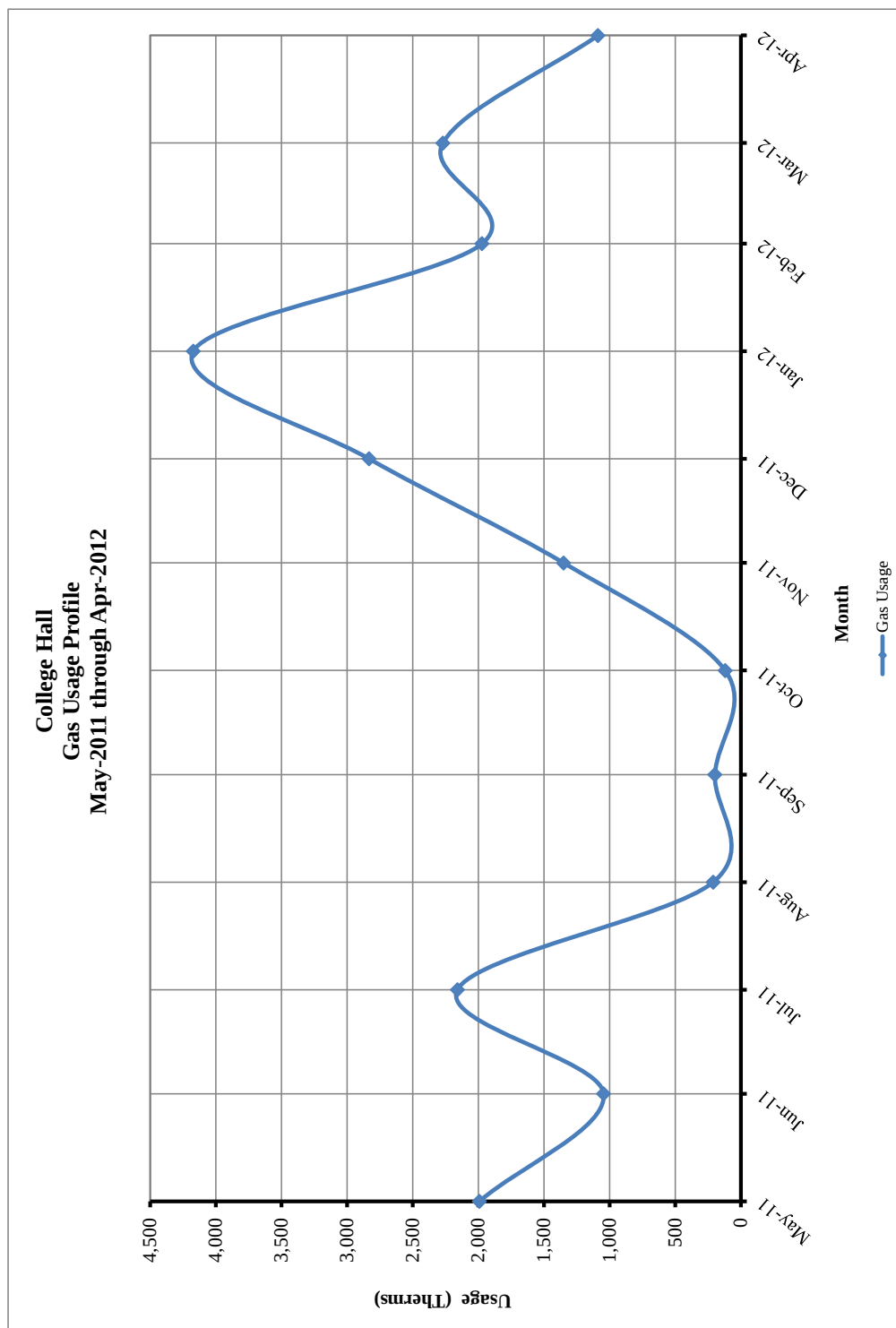


Table 2
Natural Gas Billing Data

NATURAL GAS USAGE SUMMARY		
Utility Provider: PSE&G Rate: GSG (General Service Gas) Meter No: 912599797 Point of Delivery ID: 42-012-008-09 (Account #) Third Party Utility Provider: Hess TPS Meter No:		
MONTH OF USE	CONSUMPTION (THERMS)	TOTAL BILL
May-11	1,992.20	\$1,794.69
Jun-11	1,045.70	\$1,009.31
Jul-11	2,158.90	\$1,933.49
Aug-11	210.80	\$154.24
Sep-11	197.70	\$272.82
Oct-11	119.80	\$204.52
Nov-11	1,350.90	\$988.45
Dec-11	2,832.50	\$2,072.54
Jan-12	4,171.00	\$3,051.92
Feb-12	1,971.60	\$5,146.02
Mar-12	2,270.30	\$2,338.05
Apr-12	1,088.40	\$1,045.64
TOTALS	19,409.80	\$20,011.69
AVERAGE RATE:	\$1.03	\$/THERM

The Peak Natural Gas usage is shown according to the utility data.

Figure 2
Natural Gas Usage Profile



II. FACILITY DESCRIPTION

The Wayne Township College Hall is located on College Road in Wayne, New Jersey. The 44,785 SF College Hall was built in 1993 with a renovation in 1995. The Administrative Building is a three story facility with a ground floor comprised of office space, mechanical room, common areas, and computer lab.

Occupancy Profile

The typical hours of operation for the College Hall Facility are Monday through Thursday between 9:00 am and 6:00 pm, Friday and Saturday between 9:00 am and 5:00 pm. The College Hall Facility's occupancy can vary during the day and this specific Facility employs 113 people.

Building Envelope

The exterior walls for the College Hall facility are brick faced with a concrete block construction. The amount of insulation within the walls is approximately $\frac{3}{4}$ " foam insulation. The windows throughout the College Hall are in good condition and appear to be maintained. Typical windows throughout are single panel, operable, $\frac{1}{4}$ " clear glass with aluminum frames. Blinds are utilized through the office area of the facility per occupant comfort. The blinds are useful to reduce the transmission of the solar radiation. The roof is a flat, built up rubber roof. The amount of insulation below the roofing ranges from 2" to 5" depending on the location of the roof.

HVAC Systems

The College Hall system consists of two (2) Gas Fired hot water boilers, four (4) packaged air conditioning units and a split system for the server room.

The boiler is a gas-fired hot water boiler with an input of 2,310 MBH and an output of 1,752 MBH. The boilers were manufactured by Hydrotherm and have a boiler efficiency of 75.8%. These boilers serve the baseboard heat which is run throughout the perimeter of the building and hot water reheat coils for the VAV terminal boxes. These boilers were also installed 18 years ago (based on model and condition) and they are within the ASHRAE recommended useful life.

Hot water is circulated throughout the building via two (2) Inline End Suctions for the HWS system and two (2) Inline End Suctions for the HWR system. These pumps are manufactured by Taco and have a $\frac{3}{4}$ and 5 HP motors manufactured by A.O. Smith. These pumps are in good condition and are within the recommended ASHRAE useful life.

The four (4) Carrier models 50DK are 40 and 50 ton packaged AC units located on the roof. These four units distribute conditioned air to variable air volume terminal boxes located throughout the building. These units are fitted with supply fans with inlet guide vanes, return/exhaust fans, and economizer controls.

The CPU room is served by two (2) Air Cooled Condenser Systems manufactured by Compu-Aire. The cooling capacity of these units is 8 Tons per unit and were installed three years ago. These units provide only cooling and are in good condition.

Exhaust System

Air is exhausted from the toilet rooms through the roof exhausters. The small toilet rooms are controlled by the light switch.

HVAC System Controls

The HVAC systems within the College Hall are controlled through direct digital control system. The DDC system is manufactured by Andover and use Bus Terminations to control the main equipment such as boilers, supply fan, and primary and secondary pumps. Currently, College Hall is one of the buildings controlled via the building management system in the Facility Management Building. Occupied modes are set for the same hours of operation in that 9:00 am to 6:00 pm from Monday to Thursday and 9:00 am to 5:00 pm on Friday and Saturday. The temperature set-points are approximately 72°F for cooling and 70°F for heating in occupied with roughly a 10 degree setback during unoccupied. The outside air is shut during unoccupied periods.

Domestic Hot Water

Domestic hot water for the restrooms is provided by fourth (4) Electric hot water heaters, manufactured by A.O Smith and Rheem. Each unit is approximately 2,000 watts and have approximately 20 gallons of storage. The HWHs are located close to the point of use and serve the lavatories within the bathrooms in every floor. These units are under the useful life as recommended by ASHRAE standards and are in good conditions.

Lighting

Refer to the Investment Grade lighting Audit Appendix for a detailed list of the lighting throughout the facility and estimated operating hours per space.

III. MAJOR EQUIPMENT LIST

The equipment list contains major energy consuming equipment that through implementation of energy conservation measures could yield substantial energy savings. The list shows the major equipment in the facility and all pertinent information utilized in energy savings calculations. An approximate age was assigned to the equipment in some cases if a manufactures date was not shown on the equipment's nameplate. The ASHRAE service life for the equipment along with the remaining useful life is also shown in the Appendix.

Refer to the **Major Equipment List Appendix** for this facility.

IV. ENERGY CONSERVATION MEASURES

Energy Conservation Measures are developed specifically for this facility. The energy savings and calculations are highly dependent on the information received from the site survey and interviews with operations personnel. The assumptions and calculations should be reviewed by the owner to ensure accurate representation of this facility. The following ECMs were analyzed:

Table 1
ECM Financial Summary

ENERGY CONSERVATION MEASURES (ECM's)					
ECM NO.	DESCRIPTION	NET INSTALLATION COST^A	ANNUAL SAVINGS^B	SIMPLE PAYBACK (Yrs)	SIMPLE LIFETIME ROI
ECM #1	Vending Miser Controls	\$400	\$382	1.0	855.0%
ECM #2	Premium Efficiency Motors	\$24,704	\$1,735	14.2	26.4%
ECM #3	VFD Hot Water Pumps	\$21,000	\$1,186	17.7	-15.3%
ECM #4	Condensing Boilers	\$148,500	\$3,520	42.2	-40.7%
ECM #5	VFD Air Handler Fan	\$32,000	\$5,345	6.0	150.5%
ECM #6	Lighting Upgrade	\$5,350	\$2,112	2.5	492.1%
ECM #7	Lighting Controls	\$2,790	\$803	3.5	331.7%
Notes:	A. Cost takes into consideration applicable NJ Smart Start TM incentives.				
	B. Savings takes into consideration applicable maintenance savings.				

Table 2
ECM Energy Summary

ENERGY CONSERVATION MEASURES (ECM's)				
ECM NO.	DESCRIPTION	ANNUAL UTILITY REDUCTION		
		ELECTRIC DEMAND (KW)	ELECTRIC CONSUMPTION (KWH)	NATURAL GAS (THERMS)
ECM #1	Vending Miser Controls	0.0	2,688	0
ECM #2	Premium Efficiency Motors	3.6	12,215	0
ECM #3	VFD Hot Water Pumps	0.0	8,349	0
ECM #4	Condensing Boilers	0.0	0	3,418
ECM #5	VFD Air Handler Fan	12.2	37,644	0
ECM #6	Lighting Upgrade	3.3	14,874	0
ECM #7	Lighting Controls	0.0	5,658	0

Table 3
Facility Project Summary

ENERGY SAVINGS IMPROVEMENT PROGRAM - POTENTIAL PROJECT					
ENERGY CONSERVATION MEASURES	ANNUAL ENERGY SAVINGS (\$)	PROJECT COST (\$)	SMART START INCENTIVES	CUSTOMER COST	SIMPLE PAYBACK
Vending Miser Controls	\$382	\$400	\$0	\$400	1.0
Premium Efficiency Motors	\$1,735	\$25,734	\$1,030	\$24,704	14.2
VFD Hot Water Pumps	\$1,186	\$21,000	\$0	\$21,000	17.7
Condensing Boilers	\$3,520	\$152,000	\$3,500	\$148,500	42.2
VFD Air Handler Fan	\$5,345	\$38,000	\$6,000	\$32,000	6.0
Lighting Upgrade	\$2,112	\$5,350	\$0	\$5,350	2.5
Lighting Controls	\$803	\$3,100	\$310	\$2,790	3.5
<i>Design / Construction Extras (15%)</i>		\$36,838		\$36,838	
Total Project	\$15,083	\$282,422	\$10,840	\$271,582	18.0

Design / Construction Extras is shown as an additional cost for the facility project summary. This cost is included to estimate the costs associated with construction management fees for a larger combined project.

ECM #1: Vending Miser Controls

Description:

The College Hall currently utilizes vending machines in the third floor, which typically are used for a limited time during the day. The installation of the Vending Miser system will help reduce the operating hours of vending machines.

Cold beverage machines regularly operate inefficiently trying to maintain a constant cool temperature within the machine and snack machines with no cooling usually have lights that operate 24/7. The VendingMiser® system incorporates innovative energy-saving technology into a small plug-and-play device that in conjunction with a passive infrared sensor regulate the operation of the cold beverage and snack machines based on occupancy and room temperature. This ECM approximates the installation of three (3) of these control systems, two (2) for the snack machines and one (1) for the cold beverage machines.

Energy Savings Calculations:

See **Vending Miser Appendix** for calculation methods and analysis.

Energy Savings Summary:

ECM #1 - ENERGY SAVINGS SUMMARY	
Installation Cost (\$):	\$400
NJ Smart Start Equipment Incentive (\$):	\$0
Net Installation Cost (\$):	\$400
Maintenance Savings (\$/Yr):	\$0
Energy Savings (\$/Yr):	\$382
Total Yearly Savings (\$/Yr):	\$382
Estimated ECM Lifetime (Yr):	10
Simple Payback	1.0
Simple Lifetime ROI	855.0%
Simple Lifetime Maintenance Savings	\$0
Simple Lifetime Savings	\$3,820
Internal Rate of Return (IRR)	95%
Net Present Value (NPV)	\$2,858.54

ECM #2: Install NEMA Premium® Efficiency Motors

Description:

The four air handling units have supply and return/power exhaust fan motors, and hot water heating pumps have motors that are old and inefficient. These units can be replaced with improved efficiency of the NEMA Premium® efficient motors due to better designs with use of better materials to reduce losses. Surprisingly, the electricity used to power a motor represents 95 % of its total lifetime operating cost. Because many motors operate continuously 24 hours a day, even small increases in efficiency can yield substantial energy and dollar savings.

This energy conservation measure replaces existing inefficient electric motors with NEMA Premium® efficiency motors. NEMA Premium® is the most efficient motor designation in the marketplace today.

IMPLEMENTATION SUMMARY					
EQMT ID	FUNCTION	MOTOR HP	HOURS OF OPERATION	EXISTING EFFICIENCY	NEMA PREMIUM EFFICIENCY
AC-1	AC-1 Supply Fan	10	3,391	85.6%	92.4%
AC-2	AC-2 Supply Fan	10	3,391	85.6%	92.4%
AC-3	AC-3 Supply Fan	15	3,391	84.5%	92.4%
AC-4	AC-4 Supply Fan	15	3,391	84.5%	92.4%
AC-1	AC-1 Return/Power	3	2,745	86.5%	89.5%
AC-1	AC-1 Return/Power	3	2,745	86.5%	89.5%
AC-2	AC-2 Return/Power	3	2,745	86.5%	89.5%
AC-2	AC-2 Return/Power	3	2,745	86.5%	89.5%
AC-3	AC-3 Return/Power	5	2,745	87.5%	90.2%
AC-3	AC-3 Return/Power	5	2,745	87.5%	90.2%
AC-4	AC-4 Return/Power	5	2,745	87.5%	90.2%
AC-4	AC-4 Return/Power	5	2,745	87.5%	90.2%
P-1	Hot Water Pump	5	4,000	85.5%	90.2%
P-2	Hot Water Pump	5	4,000	85.5%	90.2%

Energy Savings Calculations:

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$$\text{Electric usage, kWh} = \frac{\text{HP} \times \text{LF} \times 0.746 \times \text{Hours of Operation}}{\text{Motor Efficiency}}$$

where, HP = Motor Nameplate Horsepower Rating

LF = Load Factor

Motor Efficiency = Motor Nameplate Efficiency

Electric Usage Savings, kWh = Electric Usage_{Existing} – Electric Usage_{Proposed}

Electric cost savings = Electric Usage Savings × Electric Rate $\left(\frac{\$}{\text{kWh}} \right)$

The calculations were carried out and the results are tabulated in the table below:

PREMIUM EFFICIENCY MOTOR CALCULATIONS							
EQMT ID	MOTOR HP	LOAD FACTOR	EXISTING EFFICIENCY	NEMA PREMIUM EFFICIENCY	POWER SAVINGS kW	ENERGY SAVINGS kWh	COST SAVINGS
AC-1	10	75%	85.6%	92.4%	0.48	1,640	\$233
AC-2	10	75%	85.6%	92.4%	0.48	1,640	\$233
AC-3	15	75%	84.5%	92.4%	0.85	2,895	\$411
AC-4	15	75%	84.5%	92.4%	0.85	2,895	\$411
AC-1	3	75%	86.5%	89.5%	0.07	180	\$25
AC-1	3	75%	86.5%	89.5%	0.07	180	\$25
AC-2	3	75%	86.5%	89.5%	0.07	180	\$25
AC-2	3	75%	86.5%	89.5%	0.07	180	\$25
AC-3	5	75%	87.5%	90.2%	0.10	264	\$38
AC-3	5	75%	87.5%	90.2%	0.10	264	\$38
AC-4	5	75%	87.5%	90.2%	0.10	264	\$38
AC-4	5	75%	87.5%	90.2%	0.10	264	\$38
P-1	5	75%	85.5%	90.2%	0.17	686	\$97
P-2	5	75%	85.5%	90.2%	0.17	686	\$97
TOTAL					3.6	12,215	\$1,735

Energy Savings Summary:

ECM #2 - ENERGY SAVINGS SUMMARY	
Installation Cost (\$):	\$25,734
NJ Smart Start Equipment Incentive (\$):	\$1,030
Net Installation Cost (\$):	\$24,704
Maintenance Savings (\$/Yr):	\$0
Energy Savings (\$/Yr):	\$1,735
Total Yearly Savings (\$/Yr):	\$1,735
Estimated ECM Lifetime (Yr):	18
Simple Payback	14.2
Simple Lifetime ROI	26.4%
Simple Lifetime Maintenance Savings	\$0
Simple Lifetime Savings	\$31,222
Internal Rate of Return (IRR)	3%
Net Present Value (NPV)	(\$847.43)

ECM #3: Install VFD on Hot Water Pumps

Description:

The College Hall has two 5 HP hot water pumps with premium efficiency motors, but operate at constant flow and ride the pump curve only. These pumps feed hot water baseboard and reheat coils.

This ECM includes the installation of Variable Frequency Drives on the two (2) 5 horsepower existing hot water pumps. The VFD control is based on a differential pressure sensor in the water loop to measure demand for water. This ECM includes replacement of the existing pump motors with premium efficiency style inverter duty motors.

Energy Savings Calculations:

$$\text{Pump Power HP} = \frac{\text{Flow}_{\text{GPM}} \times \text{Head}_{\text{ft-hd.}}}{3650 \times \eta_{\text{pump}} \times \eta_{\text{motor}}}$$

$$\text{Energy Consumption (kWh)} = \text{Motor HP} \times 0.746 \frac{\text{kW}}{\text{HP}} \times \text{Hours of operation (Hr)} \times \frac{1}{\eta_{\text{motor}}}$$

$$\text{Total Energy Consumption (kWh)} = \sum \text{Energy Consumption of Each Motor}$$

$$\text{Energy Cost (\$)} = \text{Total Consumption (kWh)} \times \text{Average Cost of Electric} \left(\frac{\$}{\text{kWh}} \right)$$

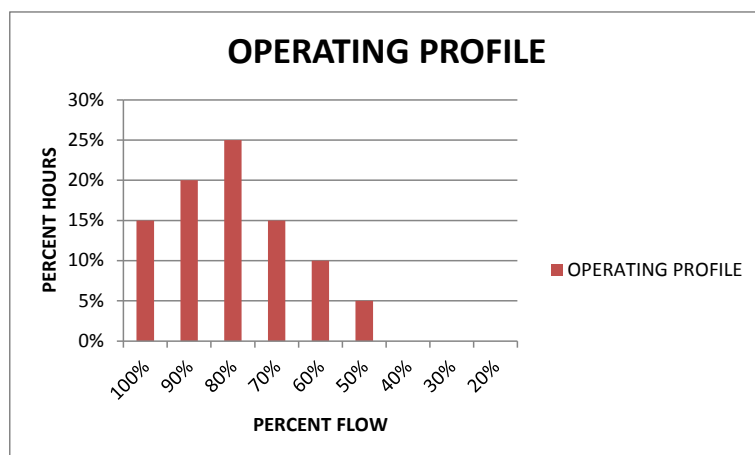
Affinity Laws are used in order to calculate energy savings by calculating the reduced power consumption requirement based a reduction in flow. Affinity laws, are as following:

Q = Flow, n = RPM, p = total pressure

$$\frac{Q_2}{Q_1} = \frac{n_2}{n_1} \quad \frac{p_2}{p_1} = \left(\frac{n_2}{n_1} \right)^2 \quad \frac{HP_2}{HP_1} = \left(\frac{n_2}{n_1} \right)^3$$

HW PUMPS VFD CALCULATION			
ECM INPUTS	EXISTING	PROPOSED	SAVINGS
ECM INPUTS	CV Pumps	VFD Pumps	
Flow Control	Throttle	VFD	-
Motor Nameplate HP	5.0	5.0	
Flow* (GPM)	180	180	-
Head* (Ft)	75	75	-
Pump Efficiency (%)	75.0%	75.0%	-
Motor Efficiency (%)	90.2%	90.2%	0.0%
Operating Hrs	4000	4000	-
Estimated Power (HP)	5.0	5.0	0.00
Elec Cost (\$/kWh)	0.142	0.142	-
ENERGY SAVINGS CALCULATIONS			
ECM RESULTS	EXISTING	PROPOSED	SAVINGS
Electric Energy (kWh)	16,671	8,322	8,349
Electric Energy Cost (\$)	\$2,367	\$1,182	\$1,186
COMMENTS:	Estimated Flow and Head		

Estimated Operating Profile with VFD



Energy Savings Summary:

ECM #3 - ENERGY SAVINGS SUMMARY	
Installation Cost (\$):	\$21,000
NJ Smart Start Equipment Incentive (\$):	\$0
Net Installation Cost (\$):	\$21,000
Maintenance Savings (\$/Yr):	\$0
Energy Savings (\$/Yr):	\$1,186
Total Yearly Savings (\$/Yr):	\$1,186
Estimated ECM Lifetime (Yr):	15
Simple Payback	17.7
Simple Lifetime ROI	-15.3%
Simple Lifetime Maintenance Savings	\$0
Simple Lifetime Savings	\$17,790
Internal Rate of Return (IRR)	-2%
Net Present Value (NPV)	(\$6,841.61)

ECM #4: Condensing Boiler Installation

Description:

The existing cast iron boilers are used as the primary source of heat for the building. These boilers are nearing the end of their useful life and with the increased efficiency of the condensing boilers, the savings can be substantial.

New condensing boilers could substantially improve the operating efficiency of the heating system of the building. Condensing boiler's peak efficiency tops out at 99% depending on return water temperature. Due to the operating conditions of the building, the annual average operating efficiency of the proposed condensing boiler is expected to be 92%. The existing boiler's efficiency is approximately 76%, which makes the condensing boilers an 16% increase in efficiency. This ECM is based on variable supply water temperature adjusted based on outdoor temperature.

This ECM includes installation of two condensing gas fired boilers to replace the existing cast iron boilers. The basis for this ECM is AERCO Benchmark 2.0. The boiler installation is based on a one for one replacement based on capacity of the existing boiler.

Energy Savings Calculations:

$$\text{Bldg Heat Required} = \text{Existing Nat Gas (Therms)} \times \text{Heating Eff.}(\%) \times \text{Fuel Heat Value} \left(\frac{\text{BTU}}{\text{Therm}} \right)$$

$$\text{Proposed Heating Gas Usage} = \frac{\text{Bldg Heat Required (BTU)}}{\text{Heating Eff.}(\%) \times \text{Fuel Heat Value} \left(\frac{\text{BTU}}{\text{Therm}} \right)}$$

$$\text{Energy Cost} = \text{Heating Gas Usage(Therms)} \times \text{Ave Fuel Cost} \left(\frac{\$}{\text{Therm}} \right)$$

CONDENSING BOILER CALCULATIONS			
ECM INPUTS	EXISTING	PROPOSED	SAVINGS
ECM INPUTS	Existing Cast Iron Boilers	New Condensing Boilers	
Existing Nat Gas (Therms)	19,410	0	
Boiler Efficiency (%)	76%	92%	16%
Nat Gas Heat Value (BTU/Therm)	100,000	100,000	
Equivalent Building Heat Usage (MMBTUs)	1,471	1,471	
Gas Cost (\$/Therm)	1.03	1.03	
ENERGY SAVINGS CALCULATIONS			
ECM RESULTS	EXISTING	PROPOSED	SAVINGS
Natural Gas Usage (Therms)	19,410	15,992	3,418
Energy Cost (\$)	\$19,992	\$16,472	\$3,520
COMMENTS:			

Energy Savings Summary:

ECM #4 - ENERGY SAVINGS SUMMARY	
Installation Cost (\$):	\$152,000
NJ Smart Start Equipment Incentive (\$):	\$3,500
Net Installation Cost (\$):	\$148,500
Maintenance Savings (\$/Yr):	\$0
Energy Savings (\$/Yr):	\$3,520
Total Yearly Savings (\$/Yr):	\$3,520
Estimated ECM Lifetime (Yr):	25
Simple Payback	42.2
Simple Lifetime ROI	-40.7%
Simple Lifetime Maintenance Savings	\$0
Simple Lifetime Savings	\$88,000
Internal Rate of Return (IRR)	-4%
Net Present Value (NPV)	(\$87,205.72)

ECM #6: Variable Speed Drive for Air Handling Units

Description:

The existing variable air volume rooftop units are fitted with inlet guide vanes to adjust the airflow as the terminal boxes reduce flow based on load. While inlet guide vanes properly control flow through mechanical linkages, they require a significant amount of maintenance to retain optimal performance. In many instances, while regular maintenance is performed, the vanes become rusted over time and get stuck in a single position. The installation of variable frequency drives allows for the direct turndown of the motor and fan without the need for mechanical linkages.

This ECM would install four variable frequency drives on AC-1, 2, 3, and 4 each rated for the respective supply fan motors. The existing inlet guide vanes shall be removed and disposed of. In addition the motors will be required to be replaced with inverter duty compatible motor.

Energy Savings Calculations:

Energy Savings were calculated based on New Jersey Board of Public Utilities Protocols to measure resource savings.

Energy Consumption (kWh)

$$= \text{Motor HP} \times 0.746 \frac{\text{kW}}{\text{HP}} \times \text{Hours of operation (Hr)} \times \frac{1}{\eta_{\text{motor}}} \times \text{Load Factor}$$

$$\text{Demand (kW)} = \text{Motor HP} \times 0.746 \frac{\text{kW}}{\text{HP}} \times \frac{1}{\eta_{\text{motor}}} \times \text{Load Factor}$$

$$\text{Energy Savings} = \text{Energy Consumption (kWh)} \times \text{Energy Savings Factor}$$

$$\text{Demand Savings} = \text{Demand (kW)} \times \text{Demand Savings Factor}$$

$$\text{Total Energy Consumption (kWh)} = \sum \text{Energy Consumption of Each Motor}$$

$$\text{Energy Cost (\$)} = \text{Total Consumption (kWh)} \times \text{Average Cost of Electric} \left(\frac{\$}{\text{kWh}} \right)$$

SUPPLY FAN VFD CALCULATION			
ECM INPUTS	EXISTING	PROPOSED	SAVINGS
Fan Control	Inlet Vanes	VFD	-
Motor Nameplate HP	10.0	10.0	
Motor Efficiency (%)	92.4%	92.4%	-
Hours of Operation	3,391	3,391	-
Demand Savings Factor	-	0.448	-
Energy Savings Factor	-	0.475	
Elec Cost (\$/kWh)	0.142	0.142	-
ENERGY SAVINGS CALCULATIONS			
ECM RESULTS	EXISTING	PROPOSED	SAVINGS
Electric Demand (kW)	6.1	3.6	2.4
Electric Energy (kWh)	20,533	13,004	7,529
Electric Energy Cost (\$)	\$2,916	\$1,847	\$1,069
COMMENTS:	75% Load Factor on Inlet Guide Vanes; Savings are x2 for AC-1 & 2		

SUPPLY FAN VFD CALCULATION			
ECM INPUTS	EXISTING	PROPOSED	SAVINGS
Fan Control	Inlet Vanes	VFD	-
Motor Nameplate HP	15.0	15.0	
Motor Efficiency (%)	92.4%	92.4%	-
Hours of Operation	3,391	3,391	-
Demand Savings Factor	-	0.448	-
Energy Savings Factor	-	0.475	
Elec Cost (\$/kWh)	0.142	0.142	-
ENERGY SAVINGS CALCULATIONS			
ECM RESULTS	EXISTING	PROPOSED	SAVINGS
Electric Demand (kW)	9.1	5.4	3.7
Electric Energy (kWh)	30,800	19,507	11,293
Electric Energy Cost (\$)	\$4,374	\$2,770	\$1,604
COMMENTS:	75% Load Factor on Inlet Guide Vanes; Savings are x2 for AC-3 & 4		

Energy Savings Summary:

ECM #5 - ENERGY SAVINGS SUMMARY	
Installation Cost (\$):	\$31,000
NJ Smart Start Equipment Incentive (\$):	\$0
Net Installation Cost (\$):	\$31,000
Maintenance Savings (\$/Yr):	\$0
Energy Savings (\$/Yr):	\$5,345
Total Yearly Savings (\$/Yr):	\$5,345
Estimated ECM Lifetime (Yr):	15
Simple Payback	5.8
Simple Lifetime ROI	158.6%
Simple Lifetime Maintenance Savings	\$0
Simple Lifetime Savings	\$80,175
Internal Rate of Return (IRR)	15%
Net Present Value (NPV)	\$32,808.26

ECM #6: Lighting Upgrade

Description:

In the conference rooms and board rooms many of the recessed can fixtures still you incandescent style flood lamps. By replacing these lamps with equivalent compact fluorescent lamps, a significant reduction in wattage and extension in lamp life can be realized. These lamps are easy to replace and in most instances utilize standard medium screw in base type lamps.

Energy Savings Calculations:

The **Investment Grade Lighting Audit Appendix** for detailed room by room calculations and retrofit strategies.

Energy Savings Summary:

ECM #6 - ENERGY SAVINGS SUMMARY	
Installation Cost (\$):	\$5,350
NJ Smart Start Equipment Incentive (\$):	\$0
Net Installation Cost (\$):	\$5,350
Maintenance Savings (\$/Yr):	\$0
Energy Savings (\$/Yr):	\$2,112
Total Yearly Savings (\$/Yr):	\$2,112
Estimated ECM Lifetime (Yr):	15
Simple Payback	2.5
Simple Lifetime ROI	492.1%
Simple Lifetime Maintenance Savings	0
Simple Lifetime Savings	\$31,680
Internal Rate of Return (IRR)	39%
Net Present Value (NPV)	\$19,862.92

ECM #7: Lighting Controls

Description:

While many of the areas of the facility utilize occupancy sensors to control the operation of lights, some of the lights in the building are left on unnecessarily. In many cases the lights are left on because of the inconvenience to manually switch lights off when a room is left or on when a room is first occupied. This is common in rooms that are occupied for only short periods and only a few times per day. In some instances lights are left on due to the misconception that it is better to keep the lights on rather than to continuously switch lights on and off. Although increased switching reduces lamp life, the energy savings outweigh the lamp replacement costs. The payback timeframe for when to turn the lights off is approximately two minutes. If the lights are expected to be off for at least a two minute interval, then it pays to shut them off.

Lighting controls come in many forms. Sometimes an additional switch is adequate to provide reduced lighting levels when full light output is not needed. Occupancy sensors detect motion and will switch the lights on when the room is occupied. Occupancy sensors can either be mounted in place of a current wall switch, or on the ceiling to cover large areas.

The U.S. Department of Energy sponsored a study to analyze energy savings achieved through various types of building system controls. The referenced savings is based on the “Advanced Sensors and Controls for Building Applications: Market Assessment and Potential R&D Pathways,” document posted for public use April 2005. The study has found that commercial buildings have the potential to achieve significant energy savings through the use of building controls. The average energy savings are as follows based on the report:

- Occupancy Sensors for Lighting Control 20% - 28% energy savings.

Savings resulting from the implementation of this ECM for energy management controls are estimated to be 20% of the total light energy controlled by occupancy sensors and daylight sensors.

This ECM includes installation of ceiling or switch mount sensors for the dining room, conference spaces, and individual offices. Sensors shall be manufactured by Sensorswitch, Watt Stopper or equivalent. The **Investment Grade Lighting Audit Appendix** of this report includes the summary of lighting controls implemented in this ECM and outlines the proposed controls, costs, savings, and payback periods. The calculations adjust the lighting power usage by the applicable percent savings for each area that includes lighting controls.

Energy Savings Calculations:

$$\text{Energy Savings} = (\% \text{ Savings} \times \text{Controlled Light Energy (kWh/Yr)})$$

$$\text{Savings.} = \text{Energy Savings (kWh)} \times \text{Ave Elec Cost} \left(\frac{\$}{\text{kWh}} \right)$$

Energy Savings Summary:

ECM #7 - ENERGY SAVINGS SUMMARY	
Installation Cost (\$):	\$3,100
NJ Smart Start Equipment Incentive (\$):	\$310
Net Installation Cost (\$):	\$2,790
Maintenance Savings (\$/Yr):	\$0
Energy Savings (\$/Yr):	\$803
Total Yearly Savings (\$/Yr):	\$803
Estimated ECM Lifetime (Yr):	15
Simple Payback	3.5
Simple Lifetime ROI	331.7%
Simple Lifetime Maintenance Savings	\$0
Simple Lifetime Savings	\$12,045
Internal Rate of Return (IRR)	28%
Net Present Value (NPV)	\$6,796.16

V. ADDITIONAL RECOMMENDATIONS

The following recommendations include no cost/low cost measures, Operation & Maintenance (O&M) items, and water conservation measures with attractive paybacks. These measures are not eligible for the Smart Start Buildings incentives from the office of Clean Energy but save energy none the less.

- A. Chemically clean the condenser and evaporator coils periodically to optimize efficiency. Poorly maintained heat transfer surfaces can reduce efficiency 5-10%.
- B. Maintain all weather stripping on windows and doors.
- C. Clean all light fixtures to maximize light output.
- D. Provide more frequent air filter changes to decrease overall system power usage and maintain better IAQ.
- E. Turn off computers when not in use. Ensure computers are not running in screen saver mode which saves the monitor screen not energy.
- F. Ensure outside air dampers are functioning properly and only open during occupied mode.

APPENDIX A

ECM COST & SAVINGS BREAKDOWN
CONCORD ENGINEERING GROUP

WPU - College Hall

ECM ENERGY AND FINANCIAL COSTS AND SAVINGS SUMMARY															
ECM NO.	DESCRIPTION	INSTALLATION COST				YEARLY SAVINGS			ECM LIFETIME	LIFETIME ENERGY SAVINGS	LIFETIME MAINTENANCE SAVINGS	LIFETIME ROI	SIMPLE PAYBACK	INTERNAL RATE OF RETURN	NET PRESENT VALUE (NPV)
		MATERIAL	LABOR	REBATES, INCENTIVES	NET INSTALLATION COST	ENERGY	MAINT. / SREC	TOTAL		(Yearly Saving * ECM Lifetime)	(Yearly Maint Saving * ECM Lifetime)	(Lifetime Savings - Net Cost) / (Net Cost)	(Net cost / Yearly Savings)	$\sum_{n=0}^N \frac{C_n}{(1 + IRR)^n}$	$\sum_{n=0}^N \frac{C_n}{(1 + DR)^n}$
		(\$)	(\$)	(\$)	(\$)	(\$/Yr)	(\$/Yr)	(\$/Yr)		(\$)	(\$)	(%)	(Yr)	(\$)	(\$)
ECM #1	Vending Miser Controls	\$400	\$0	\$0	\$400	\$382	\$0	\$382	10	\$3,820	\$0	855.0%	1.0	95.38%	\$2,858.54
ECM #2	Premium Efficiency Motors	\$15,246	\$10,488	\$1,030	\$24,704	\$1,735	\$0	\$1,735	18	\$31,222	\$0	26.4%	14.2	2.59%	(\$847.43)
ECM #3	VFD Hot Water Pumps	\$12,000	\$9,000	\$0	\$21,000	\$1,186	\$0	\$1,186	15	\$17,790	\$0	-15.3%	17.7	-2.01%	(\$6,841.61)
ECM #4	Condensing Boilers	\$87,000	\$65,000	\$3,500	\$148,500	\$3,520	\$0	\$3,520	25	\$88,000	\$0	-40.7%	42.2	-3.68%	(\$87,205.72)
ECM #5	VFD Air Handler Fan	\$20,000	\$18,000	\$6,000	\$32,000	\$5,345	\$0	\$5,345	15	\$80,175	\$0	150.5%	6.0	14.52%	\$31,808.26
ECM #6	Lighting Upgrade	\$3,460	\$1,890	\$0	\$5,350	\$2,112	\$0	\$2,112	15	\$31,680	\$0	492.1%	2.5	39.20%	\$19,862.92
ECM #7	Lighting Controls	\$2,400	\$700	\$310	\$2,790	\$803	\$0	\$803	15	\$12,045	\$0	331.7%	3.5	28.08%	\$6,796.16

Notes: 1) The variable Cn in the formulas for Internal Rate of Return and Net Present Value stands for the cash flow during each period.
2) The variable DR in the NPV equation stands for Discount Rate
3) For NPV and IRR calculations: From n=0 to N periods where N is the lifetime of ECM and Cn is the cash flow during each period .

APPENDIX B

Concord Engineering Group, Inc.

520 BURNT MILL ROAD
VOORHEES, NEW JERSEY 08043
PHONE: (856) 427-0200
FAX: (856) 427-6508



SmartStart Building Incentives

The NJ SmartStart Buildings Program offers financial incentives on a wide variety of building system equipment. The incentives were developed to help offset the initial cost of energy-efficient equipment. The following tables show the current available incentives as of February 15, 2011:

Electric Chillers

Water-Cooled Chillers	\$12 - \$170 per ton
Air-Cooled Chillers	\$8 - \$52 per ton

Energy Efficiency must comply with ASHRAE 90.1-2007

Gas Cooling

Gas Absorption Chillers	\$185 - \$400 per ton
Gas Engine-Driven Chillers	Calculated through custom measure path)

Desiccant Systems

\$1.00 per cfm – gas or electric

Electric Unitary HVAC

Unitary AC and Split Systems	\$73 - \$92 per ton
Air-to-Air Heat Pumps	\$73 - \$92 per ton
Water-Source Heat Pumps	\$81 per ton
Packaged Terminal AC & HP	\$65 per ton
Central DX AC Systems	\$40- \$72 per ton
Dual Enthalpy Economizer Controls	\$250
Occupancy Controlled Thermostat (Hospitality & Institutional Facility)	\$75 per thermostat

Energy Efficiency must comply with ASHRAE 90.1-2007

Gas Heating

Gas Fired Boilers < 300 MBH	\$300 per unit
Gas Fired Boilers ≥ 300 - 1500 MBH	\$1.75 per MBH
Gas Fired Boilers ≥1500 - ≤ 4000 MBH	\$1.00 per MBH
Gas Fired Boilers > 4000 MBH	(Calculated through Custom Measure Path)
Gas Furnaces	\$300 - \$400 per unit, AFUE ≥ 92%

Ground Source Heat Pumps

Closed Loop	\$450 per ton, EER $\geq$ 16 \$600 per ton, EER $\geq$ 18 \$750 per ton, EER $\geq$ 20
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Energy Efficiency must comply with ASHRAE 90.1-2007

Variable Frequency Drives

Variable Air Volume	\$65 - \$155 per hp
Chilled-Water Pumps	\$60 per VFD rated hp
Compressors	\$5,250 to \$12,500 per drive
Cooling Towers $\geq$ 10 hp	\$60 per VFD rated hp

Natural Gas Water Heating

Gas Water Heaters $\leq$ 50 gallons, 0.67 energy factor or better	\$50 per unit
Gas-Fired Water Heaters $>$ 50 gallons	\$1.00 - \$2.00 per MBH
Gas-Fired Booster Water Heaters	\$17 - \$35 per MBH
Gas Fired Tankless Water Heaters	\$300 per unit

Prescriptive Lighting

Retro fit of T12 to T-5 or T-8 Lamps w/Electronic Ballast in Existing Facilities	\$10 per fixture (1-4 lamps)
Replacement of T12 with new T-5 or T-8 Lamps w/Electronic Ballast in Existing Facilities	\$25 per fixture (1-4 lamps)
Replacement of incandescent with screw-in PAR 38 or PAR 30 (CFL) bulb	\$7 per bulb
T-8 reduced Wattage (28w/25w 4', 1-4 lamps) Lamp & ballast replacement	\$10 per fixture
Hard-Wired Compact Fluorescent	\$25 - \$30 per fixture
Metal Halide w/Pulse Start Including Parking Lot	\$25 per fixture
T-5 and T-8 High Bay Fixtures	\$16 - \$200 per fixture
HID $\geq$ 100w Retrofit with induction lamp, power coupler and generator (must be 30% less watts/fixture than HID system)	\$50 per fixture
HID $\geq$ 100w Replacement with new HID $\geq$ 100w	\$70 per fixture

Prescriptive Lighting - LED

LED New Exit Sign Fixture	
Existing Facility < 75 kw	\$20 per fixture
Existing Facility > 75 kw	\$10 per fixture
LED Display Case Lighting	\$30 per display case
LED Shelf-Mtd. Display & Task Lights	\$15 per linear foot
LED Portable Desk Lamp	\$20 per fixture
LED Wall-wash Lights	\$30 per fixture
LED Recessed Down Lights	\$35 per fixture
LED Outdoor Pole/Arm-Mounted Area and Roadway Luminaries	\$175 per fixture
LED Outdoor Pole/Arm-Mounted Decorative Luminaries	\$175 per fixture
LED Outdoor Wall-Mounted Area Luminaries	\$100 per fixture
LED Parking Garage Luminaries	\$100 per fixture
LED Track or Mono-Point Directional Lighting Fixtures	\$50 per fixture
LED High-Bay and Low-Bay Fixtures for Commercial & Industrial Bldgs.	\$150 per fixture
LED High-Bay-Aisle Lighting	\$150 per fixture
LED Bollard Fixtures	\$50 per fixture
LED Linear Panels (2x2 Troffers only)	\$100 per fixture
LED Fuel Pump Canopy	\$100 per fixture
LED Refrigerator/Freezer case lighting replacement of fluorescent in medium and low temperature display case	\$42 per 5 foot \$65 per 6 foot

Lighting Controls – Occupancy Sensors

Wall Mounted	\$20 per control
Remote Mounted	\$35 per control
Daylight Dimmers	\$25 per fixture
Occupancy Controlled hi-low Fluorescent Controls	\$25 per fixture controlled

Lighting Controls – HID or Fluorescent Hi-Bay Controls

Occupancy hi-low	\$75 per fixture controlled
Daylight Dimming	\$75 per fixture controlled
Daylight Dimming - office	\$50 per fixture controlled

Premium Motors

Three-Phase Motors	\$45 - \$700 per motor
Fractional HP Motors Electronic Communicated Motors (replacing shaded pole motors in refrigerator/freezer cases)	\$40 per electronic communicated motor

Other Equipment Incentives

Performance Lighting	\$1.00 per watt per SF below program incentive threshold, currently 5% more energy efficient than ASHRAE 90.1- 2007 for New Construction and Complete Renovation
Custom Electric and Gas Equipment Incentives	not prescriptive
Custom Measures	\$0.16 KWh and \$1.60/Therm of 1st year savings, or a buy down to a 1 year payback on estimated savings. Minimum required savings of 75,000 KWh or 1,500 Therms and a IRR of at least 10%.
Multi Measures Bonus	15%

APPENDIX C



STATEMENT OF ENERGY PERFORMANCE

College Hall

Building ID: 3254946

For 12-month Period Ending: April 30, 2012¹

Date SEP becomes ineligible: N/A

Date SEP Generated: September 18, 2012

Facility

College Hall
300 Pompton Road
Wayne, NJ 07470

Facility Owner

William Paterson University
300 Pompton Road
Wayne, NJ 07470

Primary Contact for this Facility

N/A

Year Built: 1993**Gross Floor Area (ft²):** 44,785**Energy Performance Rating²** (1-100) N/A**Site Energy Use Summary³**

Electricity - Grid Purchase(kBtu)	6,397,756
Natural Gas (kBtu) ⁴	1,910,293
Total Energy (kBtu)	8,308,049

Energy Intensity⁴

Site (kBtu/ft ² /yr)	186
Source (kBtu/ft ² /yr)	522

Emissions (based on site energy use)

Greenhouse Gas Emissions (MtCO ₂ e/year)	1,008
---	-------

Electric Distribution Utility

Public Service Electric & Gas Co

National Median Comparison

National Median Site EUI	104
National Median Source EUI	244
% Difference from National Median Source EUI	114%
Building Type	College/University (Campus-Level)

Stamp of Certifying Professional

Based on the conditions observed at the time of my visit to this building, I certify that the information contained within this statement is accurate.

Meets Industry Standards⁵ for Indoor Environmental Conditions:

Ventilation for Acceptable Indoor Air Quality	N/A
Acceptable Thermal Environmental Conditions	N/A
Adequate Illumination	N/A

Certifying Professional

N/A

Notes:

1. Application for the ENERGY STAR must be submitted to EPA within 4 months of the Period Ending date. Award of the ENERGY STAR is not final until approval is received from EPA.
2. The EPA Energy Performance Rating is based on total source energy. A rating of 75 is the minimum to be eligible for the ENERGY STAR.
3. Values represent energy consumption, annualized to a 12-month period.
4. Values represent energy intensity, annualized to a 12-month period.
5. Based on Meeting ASHRAE Standard 62 for ventilation for acceptable indoor air quality, ASHRAE Standard 55 for thermal comfort, and IESNA Lighting Handbook for lighting quality.

ENERGY STAR® Data Checklist for Commercial Buildings

In order for a building to qualify for the ENERGY STAR, a Professional Engineer (PE) or a Registered Architect (RA) must validate the accuracy of the data underlying the building's energy performance rating. This checklist is designed to provide an at-a-glance summary of a property's physical and operating characteristics, as well as its total energy consumption, to assist the PE or RA in double-checking the information that the building owner or operator has entered into Portfolio Manager.

Please complete and sign this checklist and include it with the stamped, signed Statement of Energy Performance.

NOTE: You must check each box to indicate that each value is correct, OR include a note.

CRITERION	VALUE AS ENTERED IN PORTFOLIO MANAGER	VERIFICATION QUESTIONS	NOTES	☒
Building Name	College Hall	Is this the official building name to be displayed in the ENERGY STAR Registry of Labeled Buildings?		☐
Type	College/University (Campus-Level)	Is this an accurate description of the space in question?		☐
Location	300 Pompton Road, Wayne, NJ 07470	Is this address accurate and complete? Correct weather normalization requires an accurate zip code.		☐
Single Structure	Single Facility	Does this SEP represent a single structure? SEPs cannot be submitted for multiple-building campuses (with the exception of a hospital, k-12 school, hotel and senior care facility) nor can they be submitted as representing only a portion of a building.		☐
College Hall (Other)				
CRITERION	VALUE AS ENTERED IN PORTFOLIO MANAGER	VERIFICATION QUESTIONS	NOTES	☒
Gross Floor Area	44,785 Sq. Ft.	Does this square footage include all supporting functions such as kitchens and break rooms used by staff, storage areas, administrative areas, elevators, stairwells, atria, vent shafts, etc. Also note that existing atriums should only include the base floor area that it occupies. Interstitial (plenum) space between floors should not be included in the total. Finally gross floor area is not the same as leasable space. Leasable space is a subset of gross floor area.		☐
Number of PCs	N/A(Optional)	Is this the number of personal computers in the space?		☐
Weekly operating hours	N/A(Optional)	Is this the total number of hours per week that the space is 75% occupied? This number should exclude hours when the facility is occupied only by maintenance, security, or other support personnel. For facilities with a schedule that varies during the year, "operating hours/week" refers to the total weekly hours for the schedule most often followed.		☐
Workers on Main Shift	N/A(Optional)	Is this the number of employees present during the main shift? Note this is not the total number of employees or visitors who are in a building during an entire 24 hour period. For example, if there are two daily 8 hour shifts of 100 workers each, the Workers on Main Shift value is 100.		☐

ENERGY STAR® Data Checklist for Commercial Buildings

Energy Consumption

Power Generation Plant or Distribution Utility: Public Service Electric & Gas Co

Fuel Type: Electricity		
Meter: Electric #4201200809 (kWh (thousand Watt-hours)) Space(s): Entire Facility Generation Method: Grid Purchase		
Start Date	End Date	Energy Use (kWh (thousand Watt-hours))
04/01/2012	04/30/2012	144,083.00
03/01/2012	03/31/2012	137,015.00
02/01/2012	02/29/2012	137,972.00
01/01/2012	01/31/2012	140,804.00
12/01/2011	12/31/2011	147,340.00
11/01/2011	11/30/2011	135,467.00
10/01/2011	10/31/2011	145,965.00
09/01/2011	09/30/2011	163,696.00
08/01/2011	08/31/2011	157,303.00
07/01/2011	07/31/2011	209,349.00
06/01/2011	06/30/2011	205,170.00
05/01/2011	05/31/2011	150,911.00
Electric #4201200809 Consumption (kWh (thousand Watt-hours))		1,875,075.00
Electric #4201200809 Consumption (kBtu (thousand Btu))		6,397,755.90
Total Electricity (Grid Purchase) Consumption (kBtu (thousand Btu))		6,397,755.90
Is this the total Electricity (Grid Purchase) consumption at this building including all Electricity meters?		☐
Fuel Type: Natural Gas		
Meter: Gas #4201200809 (therms) Space(s): Entire Facility		
Start Date	End Date	Energy Use (therms)
04/01/2012	04/30/2012	1,083.03
03/01/2012	03/31/2012	2,258.90
02/01/2012	02/29/2012	10,274.27
01/01/2012	01/31/2012	0.00
12/01/2011	12/31/2011	0.00
11/01/2011	11/30/2011	0.00
10/01/2011	10/31/2011	119.17
09/01/2011	09/30/2011	196.70
08/01/2011	08/31/2011	0.00
07/01/2011	07/31/2011	2,148.13

06/01/2011	06/30/2011	1,040.45
05/01/2011	05/31/2011	1,982.28
Gas #4201200809 Consumption (therms)		19,102.93
Gas #4201200809 Consumption (kBtu (thousand Btu))		1,910,293.00
Total Natural Gas Consumption (kBtu (thousand Btu))		1,910,293.00
Is this the total Natural Gas consumption at this building including all Natural Gas meters?		☐

Additional Fuels

Do the fuel consumption totals shown above represent the total energy use of this building?
Please confirm there are no additional fuels (district energy, generator fuel oil) used in this facility.

☐

On-Site Solar and Wind Energy

Do the fuel consumption totals shown above include all on-site solar and/or wind power located at your facility? Please confirm that no on-site solar or wind installations have been omitted from this list. All on-site systems must be reported.

☐

Certifying Professional

(When applying for the ENERGY STAR, the Certifying Professional must be the same PE or RA that signed and stamped the SEP.)

Name: _____ Date: _____

Signature: _____

Signature is required when applying for the ENERGY STAR.

FOR YOUR RECORDS ONLY. DO NOT SUBMIT TO EPA.

Please keep this Facility Summary for your own records; do not submit it to EPA. Only the Statement of Energy Performance (SEP), Data Checklist and Letter of Agreement need to be submitted to EPA when applying for the ENERGY STAR.

Facility
College Hall
300 Pompton Road
Wayne, NJ 07470

Facility Owner
William Paterson University
300 Pompton Road
Wayne, NJ 07470

Primary Contact for this Facility
N/A

General Information

College Hall	
Gross Floor Area Excluding Parking: (ft ²)	44,785
Year Built	1993
For 12-month Evaluation Period Ending Date:	April 30, 2012

Facility Space Use Summary

College Hall	
Space Type	Other - College/University (Campus-Level)
Gross Floor Area (ft ²)	44,785
Number of PCs °	N/A
Weekly operating hours °	N/A
Workers on Main Shift °	N/A

Energy Performance Comparison

Performance Metrics	Evaluation Periods		Comparisons		
	Current (Ending Date 04/30/2012)	Baseline (Ending Date 04/30/2012)	Rating of 75	Target	National Median
Energy Performance Rating	N/A	N/A	75	N/A	N/A
Energy Intensity					
Site (kBtu/ft ²)	186	186	0	N/A	104
Source (kBtu/ft ²)	522	522	0	N/A	244
Energy Cost					
\$/year	\$ 402,188.12	\$ 402,188.12	N/A	N/A	\$ 225,473.37
\$/ft ² /year	\$ 8.98	\$ 8.98	N/A	N/A	\$ 5.03
Greenhouse Gas Emissions					
MtCO ₂ e/year	1,008	1,008	0	N/A	565
kgCO ₂ e/ft ² /year	22	22	0	N/A	12

More than 50% of your building is defined as College/University (Campus-Level). This building is currently ineligible for a rating. Please note the National Median column represents the CBECS national median data for College/University (Campus-Level). This building uses 114% more energy per square foot than the CBECS national median for College/University (Campus-Level).

Notes:

o - This attribute is optional.

d - A default value has been supplied by Portfolio Manager.

APPENDIX D

MAJOR EQUIPMENT LIST

Concord Engineering Group

College Hall

AC Units

Tag	AC-1	AC-2	AC-3
Unit Type	Combination Cooling/Heating Units	Combination Cooling/Heating Units	Combination Cooling/Heating Units
Qty	1	1	1
Location	Roof	Roof	Roof
Area Served	Classrooms	Classrooms	Classrooms
Manufacturer	CARRIER	CARRIER	CARRIER
Model #	50DK-044-A500NJ	50DK-044-A500NJ	50DK-054-A500PR
Serial #	4894F24072	4894F24073	4894F24078
Cooling Type	DX (R22)	DX (R22)	DX (R22)
Cooling Capacity (Tons)	40	40	50
Cooling Efficiency (SEER/EER)	9.2	9.2	8.9
Heating Type	N/A	N/A	N/A
Heating Input (MBH)	N/A	N/A	N/A
Efficiency	N/A	N/A	N/A
Fuel	N/A	N/A	N/A
Approx Age	18	18	18
ASHRAE Service Life	15	15	15
Remaining Life	(3)	(3)	(3)
Comments	VAV Inlet Vanes, 10 HP SF, 85.6%, x2 3HP Power EF Econo	VAV Inlet Vanes, 10 HP SF, 85.6%, x2 3HP Power EF Econo	VAV Inlet Vanes, 15 HP SF, 84.5%, x2 5HP Power EF Econo

Note:

"N/A" = Not Applicable.

"-" = Info Not Available

AC Units

Tag	AC-4	ACC-1 & 2	
Unit Type	Combination Cooling/Heating Units	Air Cooled Condenser Systems	
Qty	1	2	
Location	Roof	Outdoor on Grade	
Area Served	Classrooms	CPU Rooms	
Manufacturer	CARRIER	COMPU-AIRE	
Model #	50DK-054-A500PR	ACC-2832	
Serial #	4894F24079	82005Y0906-5303C/5304C	
Cooling Type	DX (R22)	R22	
Cooling Capacity (Tons)	50	8	
Cooling Efficiency (SEER/EER)	8.9	8.6	
Heating Type	N/A	N/A	
Heating Input (MBH)	N/A	N/A	
Efficiency	N/A	N/A	
Fuel	N/A	N/A	
Approx Age	18	3	
ASHRAE Service Life	15	15	
Remaining Life	(3)	12	
Comments	VAV Inlet Vanes, 15 HP SF, 84.5%, x2 5HP Power EF Econo	Amps: 16.9. Condenser Motor: 3/4 HP. Electric Reheat. Steam generating	

Note:

"N/A" = Not Applicable.

"-" = Info Not Available

MAJOR EQUIPMENT LIST

Concord Engineering Group

College Hall

Boilers

Tag	B-1 & 2		
Unit Type	Gas Fired Hot Water Boiler		
Qty	2		
Location	MER-302		
Area Served	VAV HW Service and Baseboard HW		
Manufacturer	Hydrotherm Multitemp		
Model #	MOP2310		
Serial #	DPF1129		
Input Capacity (Btu/Hr)	2,310,000		
Rated Output Capacity (Btu/Hr)	1,752,000		
Approx. Efficiency %	75.8%		
Fuel	Natural Gas		
Approx Age	18		
ASHRAE Service Life	24		
Remaining Life	6		
Comments			

Note:

"N/A" = Not Applicable.

"-" = Info Not Available

MAJOR EQUIPMENT LIST

Concord Engineering Group

College Hall

Domestic Water Heaters

Tag	DHWH-1, 2	DHWH-3, 4	
Unit Type	Electrical Water Heaters	Electrical Water Heaters	
Qty	2	2	
Location	Housekeeping Closet 106, 304	Housekeeping Closet 006, 208	
Area Served	Domestic Hot Water	Domestic Hot Water	
Manufacturer	Rheem Ruud	AO Smith	
Model #	EGPS520	-	
Serial #	RR 0907601342	-	
Size (Gallons)	20	-	
Input Capacity (MBH/KW)	2 kW	2 kW (Est.)	
Recovery (Gal/Hr)	-	-	
Efficiency %	98%	98%	
Fuel	Electric	Electric	
Approx Age	5	-	
ASHRAE Service Life	12	12	
Remaining Life	7	-	
Comments	277 V 1P		

Note:

"N/A" = Not Applicable.

"-" = Info Not Available

MAJOR EQUIPMENT LIST

Concord Engineering Group

College Hall

Pumps

Tag	RP-1 & 2	HWP-1 & 2	
Unit Type	Inline End Suctions	Inline End Suctions	
Qty	2	2	
Location	MER-302	MER-302	
Area Served	VAV HWR Loop. Baseboards HWR Loop	VAV HWS Loop. Baseboards HWS Loop	
Manufacturer	TACO	TACO	
Model #	1614C3N2	V1250	
Serial #	-	-	
Horse Power	3/4	5	
Flow	-	-	
Motor Info	A.O. Smith. Model H582V1	U.S. Motors. Model B075A	
Electrical Power	230/460/3/60	230/460/3/60	
RPM	1725	1750	
Motor Efficiency %	85.5%	85.5%	
Approx Age	18	18	
ASHRAE Service Life	20	20	
Remaining Life	2	16	
Comments		CV, 3-way control valves	

Note:

"N/A" = Not Applicable.

"-" = Info Not Available

APPENDIX E

CEG Project #: 9C12007
Facility Name: College Hall
Address: College Road
City, State, Zip: Wayne, NJ 07470

Fixture Reference #	Location	Average Burn Hours	Existing Fixtures						Proposed Fixtures Retrofit						Retrofit Energy Savings				Lighting Retrofit Costs				Simple Payback	Control Ref #	Proposed Lighting Controls				
			Description	Lamps per Fixture	Watts per Fixture	Qty of Fixtures	Total kW	Usage kWh/Yr	Work Description	Equipment Description	Lamps per Fixture	Watts per Fixture	Qty of Fixtures	Total kW	Usage kWh/Yr	Energy Savings, kW	Energy Savings, kWh	Energy Savings, \$	Material	Total Labor	Total All	Rebate Estimate			Controls Description	Qty of Controls	Hour Reduction %	Energy Savings, kWh	Energy Savings, \$
12	Elevator Car (2)	8760	20w R12 Incandescent Lamp	1	20	60	1.20	10,512	Relamp	Halco 2.6w LED R12	1	3	60	0.18	1,577	1.02	8,935	\$1,269	\$3,000.00	\$1,200.00	\$4,200.00	\$0.00	3.31	0	No New Controls	0	0.0%	0	\$0
221.22	Dining Room	2600	1x4, 2 Lamp, 32w TR, Elect. Ballast, Recessed Mnt., Parabolic Lens	2	58	61	3.54	9,199	Existing to Remain	-	2	58	0	3.54	9,199	0.00	0	\$0	\$0.00	\$0.00	\$0.00	-	4	Dual Technology Occupancy Sensor - Remote Mnt.	1	20.0%	1,840	\$261	
227.21	Vending	3000	2x2, 2 Lamp, 32w TR, Elect. Ballast, Recessed Mnt., Prismatic Lens	2	73	3	0.22	657	Existing to Remain	-	2	73	0	0.22	657	0.00	0	\$0	\$0.00	\$0.00	\$0.00	-	0	No New Controls	0	0.0%	0	\$0	
221.22	312 conference Room	2600	1x4, 2 Lamp, 32w TR, Elect. Ballast, Recessed Mnt., Parabolic Lens	2	58	8	0.46	1,206	Existing to Remain	-	2	58	0	0.46	1,206	0.00	0	\$0	\$0.00	\$0.00	\$0.00	-	0	No New Controls	0	0.0%	0	\$0	
555	312 Conference Room	2600	Recessed Down Light, 65w BR30 Lamp	1	65	8	0.52	1,352	Relamp	26w CFL Flood Lamp	1	26	8	0.21	541	0.31	811	\$115	\$80.00	\$120.00	\$200.00	\$0.00	1.74	0	No New Controls	0	0.0%	0	\$0
227.21	320 Offices	2600	2x2, 2 Lamp, 32w TR, Elect. Ballast, Recessed Mnt., Prismatic Lens	2	73	132	9.64	25,054	Existing to Remain	-	2	73	0	9.64	25,054	0.00	0	\$0	\$0.00	\$0.00	\$0.00	-	0	No New Controls	0	0.0%	0	\$0	
227.21	320 Side Offices (7)	2600	2x2, 2 Lamp, 32w TR, Elect. Ballast, Recessed Mnt., Prismatic Lens	2	73	28	2.04	5,314	Existing to Remain	-	2	73	0	2.04	5,314	0.00	0	\$0	\$0.00	\$0.00	\$0.00	-	0	No New Controls	0	0.0%	0	\$0	
227.21	322 Kitchenette	2600	2x2, 2 Lamp, 32w TR, Elect. Ballast, Recessed Mnt., Prismatic Lens	2	73	2	0.15	380	Existing to Remain	-	2	73	0	0.15	380	0.00	0	\$0	\$0.00	\$0.00	\$0.00	-	0	No New Controls	0	0.0%	0	\$0	
227.21	323 Files	2600	2x2, 2 Lamp, 32w TR, Elect. Ballast, Recessed Mnt., Prismatic Lens	2	73	6	0.44	1,139	Existing to Remain	-	2	73	0	0.44	1,139	0.00	0	\$0	\$0.00	\$0.00	\$0.00	-	0	No New Controls	0	0.0%	0	\$0	
227.21	324 Office	2600	2x2, 2 Lamp, 32w TR, Elect. Ballast, Recessed Mnt., Prismatic Lens	2	73	2	0.15	380	Existing to Remain	-	2	73	0	0.15	380	0.00	0	\$0	\$0.00	\$0.00	\$0.00	-	0	No New Controls	0	0.0%	0	\$0	
227.21	326 Office	2600	2x2, 2 Lamp, 32w TR, Elect. Ballast, Recessed Mnt., Prismatic Lens	2	73	6	0.44	1,139	Existing to Remain	-	2	73	0	0.44	1,139	0.00	0	\$0	\$0.00	\$0.00	\$0.00	-	0	No New Controls	0	0.0%	0	\$0	
227.21	333 Office	2600	2x2, 2 Lamp, 32w TR, Elect. Ballast, Recessed Mnt., Prismatic Lens	2	73	4	0.29	759	Existing to Remain	-	2	73	0	0.29	759	0.00	0	\$0	\$0.00	\$0.00	\$0.00	-	0	No New Controls	0	0.0%	0	\$0	
227.21	335 Copy	2600	2x2, 2 Lamp, 32w TR, Elect. Ballast, Recessed Mnt., Prismatic Lens	2	73	2	0.15	380	Existing to Remain	-	2	73	0	0.15	380	0.00	0	\$0	\$0.00	\$0.00	\$0.00	-	0	No New Controls	0	0.0%	0	\$0	
227.21	226 Kitchenette	2600	2x2, 2 Lamp, 32w TR, Elect. Ballast, Recessed Mnt., Prismatic Lens	2	73	2	0.15	380	Existing to Remain	-	2	73	0	0.15	380	0.00	0	\$0	\$0.00	\$0.00	\$0.00	-	0	No New Controls	0	0.0%	0	\$0	
227.21	337 Office	2600	2x2, 2 Lamp, 32w TR, Elect. Ballast, Recessed Mnt., Prismatic Lens	2	73	6	0.44	1,139	Existing to Remain	-	2	73	0	0.44	1,139	0.00	0	\$0	\$0.00	\$0.00	\$0.00	-	5	Dual Technology Occupancy Sensor - Switch Mnt.	1	20.0%	228	\$32	
227.21	305 Conference Room	2600	2x2, 2 Lamp, 32w TR, Elect. Ballast, Recessed Mnt., Prismatic Lens	2	73	6	0.44	1,139	Existing to Remain	-	2	73	0	0.44	1,139	0.00	0	\$0	\$0.00	\$0.00	\$0.00	-	5	Dual Technology Occupancy Sensor - Switch Mnt.	1	20.0%	228	\$32	
555	305 Conference Room	2600	Recessed Down Light, 65w BR30 Lamp	1	65	6	0.39	1,014	Relamp	26w CFL Flood Lamp	1	26	6	0.16	406	0.23	608	\$86	\$60.00	\$90.00	\$150.00	\$0.00	1.74	0	No New Controls	0	0.0%	0	\$0
227.21	338 Office	2600	2x2, 2 Lamp, 32w TR, Elect. Ballast, Recessed Mnt., Prismatic Lens	2	73	2	0.15	380	Existing to Remain	-	2	73	0	0.15	380	0.00	0	\$0	\$0.00	\$0.00	\$0.00	-	0	No New Controls	0	0.0%	0	\$0	
227.21	File Area and Hall	2600	2x2, 2 Lamp, 32w TR, Elect. Ballast, Recessed Mnt., Prismatic Lens	2	73	13	0.95	2,467	Existing to Remain	-	2	73	0	0.95	2,467	0.00	0	\$0	\$0.00	\$0.00	\$0.00	-	0	No New Controls	0	0.0%	0	\$0	
227.21	350 Offices	2600	2x2, 2 Lamp, 32w TR, Elect. Ballast, Recessed Mnt., Prismatic Lens	2	73	11	0.80	2,088	Existing to Remain	-	2	73	0	0.80	2,088	0.00	0	\$0	\$0.00	\$0.00	\$0.00	-	0	No New Controls	0	0.0%	0	\$0	
227.21	Side Offices (2)	2600	2x2, 2 Lamp, 32w TR, Elect. Ballast, Recessed Mnt., Prismatic Lens	2	73	8	0.58	1,518	Existing to Remain	-	2	73	0	0.58	1,518	0.00	0	\$0	\$0.00	\$0.00	\$0.00	-	0	No New Controls	0	0.0%	0	\$0	
650	Hall	3000	Wall Sconce, (2) 18w PL Lamp	2	36	9	0.32	972	Existing to Remain	-	2	36	0	0.32	972	0.00	0	\$0	\$0.00	\$0.00	\$0.00	-	0	No New Controls	0	0.0%	0	\$0	
563	Hall	3000	Recessed Down Light, (2)26w Quad CFL Lamp	2	52	10	0.52	1,560	Existing to Remain	-	2	52	0	0.52	1,560	0.00	0	\$0	\$0.00	\$0.00	\$0.00	-	0	No New Controls	0	0.0%	0	\$0	
282.14	302 Mechanical Room	1200	2x4, 4 Lamp, 32w TR, Elect. Ballast, Recessed Mnt., Parabolic Lens	4	107	1	0.11	128	Existing to Remain	-	4	107	0	0.11	128	0.00	0	\$0	\$0.00	\$0.00	\$0.00	-	0	No New Controls	0	0.0%	0	\$0	

Fixture Reference #	Location	Average Room Hours	Existing Fixtures						Proposed Fixtures Retrofit						Retrofit Energy Savings			Lighting Retrofit Costs				Simple Payback	Control Ref #	Proposed Lighting Controls					
			Description	Lamps per Fixture	Watts per Fixture	Qty of Fixtures	Total kW	Usage kWh/Yr	Work Description	Equipment Description	Lamps per Fixture	Watts per Fixture	Qty of Fixtures	Total kW	Usage kWh/Yr	Energy Savings, kW	Energy Savings, kWh	Energy Savings, \$	Material	Total Labor	Total AB			Rebate Estimate	Controls Description	Qty of Controls	Hour Reduction %	Energy Savings, kWh	Energy Savings, \$
227.21	Stairwell #1	3000	2x2, 2 Lamp, 32w TR, Elect. Ballast, Recessed Mnt., Prismatic Lens	2	73	6	0.44	1,314	Existing to Remain	-	2	73	0	0.44	1,314	0.00	0	\$0	\$0.00	\$0.00	\$0.00	-	0	No New Controls	0	0.0%	0	\$0	
221.22	Board Room	2600	1x4, 2 Lamp, 32w TR, Elect. Ballast, Recessed Mnt., Parabolic Lens	2	58	36	2.09	5,429	Existing to Remain	-	2	58	0	2.09	5,429	0.00	0	\$0	\$0.00	\$0.00	\$0.00	-	0	No New Controls	0	0.0%	0	\$0	
555	Board Room	2600	Recessed Down Light, 65w BR30 Lamp	1	65	12	0.78	2,028	Relamp	26w CFL Flood Lamp	1	26	12	0.31	811	0.47	1,217	\$173	\$120.00	\$180.00	\$300.00	\$0.00	1.74	0	No New Controls	0	0.0%	0	\$0
551	Board Room	2600	Recessed Down Light, 100w A Lamp	1	100	14	1.40	3,640	Relamp	26w CFL Lamp	1	26	14	0.36	946	1.04	2,694	\$382	\$140.00	\$210.00	\$350.00	\$0.00	0.92	0	No New Controls	0	0.0%	0	\$0
227.21	Conference room 203	2600	2x2, 2 Lamp, 32w TR, Elect. Ballast, Recessed Mnt., Prismatic Lens	2	73	4	0.29	759	Existing to Remain	-	2	73	0	0.29	759	0.00	0	\$0	\$0.00	\$0.00	\$0.00	-	0	No New Controls	0	0.0%	0	\$0	
227.21	Training Room	2600	2x2, 2 Lamp, 32w TR, Elect. Ballast, Recessed Mnt., Prismatic Lens	2	73	12	0.88	2,278	Existing to Remain	-	2	73	0	0.88	2,278	0.00	0	\$0	\$0.00	\$0.00	\$0.00	-	0	No New Controls	0	0.0%	0	\$0	
237.22	220 Office	2600	2x2, 3 Lamp, 31w T8 U/lamp, Elect. Ballast, Recessed Mnt., Prismatic Lens	3	92	115	10.58	27,508	Existing to Remain	-	3	92	0	10.58	27,508	0.00	0	\$0	\$0.00	\$0.00	\$0.00	-	0	No New Controls	0	0.0%	0	\$0	
237.22	221 Office	2600	2x2, 3 Lamp, 31w T8 U/lamp, Elect. Ballast, Recessed Mnt., Prismatic Lens	3	92	4	0.37	957	Existing to Remain	-	3	92	0	0.37	957	0.00	0	\$0	\$0.00	\$0.00	\$0.00	-	0	No New Controls	0	0.0%	0	\$0	
237.22	IT	1200	2x2, 3 Lamp, 31w T8 U/lamp, Elect. Ballast, Recessed Mnt., Prismatic Lens	3	92	6	0.55	662	Existing to Remain	-	3	92	0	0.55	662	0.00	0	\$0	\$0.00	\$0.00	\$0.00	-	0	No New Controls	0	0.0%	0	\$0	
237.22	Copy Room	2600	2x2, 3 Lamp, 31w T8 U/lamp, Elect. Ballast, Recessed Mnt., Prismatic Lens	3	92	4	0.37	957	Existing to Remain	-	3	92	0	0.37	957	0.00	0	\$0	\$0.00	\$0.00	\$0.00	-	0	No New Controls	0	0.0%	0	\$0	
237.22	222 Office	2600	2x2, 3 Lamp, 31w T8 U/lamp, Elect. Ballast, Recessed Mnt., Prismatic Lens	3	92	4	0.37	957	Existing to Remain	-	3	92	0	0.37	957	0.00	0	\$0	\$0.00	\$0.00	\$0.00	-	5	Dual Technology Occupancy Sensor - Switch Mnt.	1	20.0%	191	\$27	
237.22	223 Office	2600	2x2, 3 Lamp, 31w T8 U/lamp, Elect. Ballast, Recessed Mnt., Prismatic Lens	3	92	4	0.37	957	Existing to Remain	-	3	92	0	0.37	957	0.00	0	\$0	\$0.00	\$0.00	\$0.00	-	5	Dual Technology Occupancy Sensor - Switch Mnt.	1	20.0%	191	\$27	
237.22	224 Office	2600	2x2, 3 Lamp, 31w T8 U/lamp, Elect. Ballast, Recessed Mnt., Prismatic Lens	3	92	2	0.18	478	Existing to Remain	-	3	92	0	0.18	478	0.00	0	\$0	\$0.00	\$0.00	\$0.00	-	0	No New Controls	0	0.0%	0	\$0	
237.22	242 Office	2600	2x2, 3 Lamp, 31w T8 U/lamp, Elect. Ballast, Recessed Mnt., Prismatic Lens	3	92	4	0.37	957	Existing to Remain	-	3	92	0	0.37	957	0.00	0	\$0	\$0.00	\$0.00	\$0.00	-	0	No New Controls	0	0.0%	0	\$0	
237.22	244 Office	2600	2x2, 3 Lamp, 31w T8 U/lamp, Elect. Ballast, Recessed Mnt., Prismatic Lens	3	92	4	0.37	957	Existing to Remain	-	3	92	0	0.37	957	0.00	0	\$0	\$0.00	\$0.00	\$0.00	-	5	Dual Technology Occupancy Sensor - Switch Mnt.	1	20.0%	191	\$27	
237.22	245 Office	2600	2x2, 3 Lamp, 31w T8 U/lamp, Elect. Ballast, Recessed Mnt., Prismatic Lens	3	92	4	0.37	957	Existing to Remain	-	3	92	0	0.37	957	0.00	0	\$0	\$0.00	\$0.00	\$0.00	-	5	Dual Technology Occupancy Sensor - Switch Mnt.	1	20.0%	191	\$27	
237.22	246 Office	2600	2x2, 3 Lamp, 31w T8 U/lamp, Elect. Ballast, Recessed Mnt., Prismatic Lens	3	92	4	0.37	957	Existing to Remain	-	3	92	0	0.37	957	0.00	0	\$0	\$0.00	\$0.00	\$0.00	-	0	No New Controls	0	0.0%	0	\$0	
237.22	247 Office	2600	2x2, 3 Lamp, 31w T8 U/lamp, Elect. Ballast, Recessed Mnt., Prismatic Lens	3	92	4	0.37	957	Existing to Remain	-	3	92	0	0.37	957	0.00	0	\$0	\$0.00	\$0.00	\$0.00	-	5	Dual Technology Occupancy Sensor - Switch Mnt.	1	20.0%	191	\$27	
237.21	248 Break Room	2600	2x4, 3 Lamp, 32w TR, Elect. Ballast, Recessed Mnt., Parabolic Lens	3	86	6	0.52	1,342	Existing to Remain	-	3	86	0	0.52	1,342	0.00	0	\$0	\$0.00	\$0.00	\$0.00	-	0	No New Controls	0	0.0%	0	\$0	
227.21	Conference Room 209	2600	2x2, 2 Lamp, 32w TR, Elect. Ballast, Recessed Mnt., Prismatic Lens	2	73	6	0.44	1,139	Existing to Remain	-	2	73	0	0.44	1,139	0.00	0	\$0	\$0.00	\$0.00	\$0.00	-	0	No New Controls	0	0.0%	0	\$0	
555	Conference Room 209	2600	Recessed Down Light, 65w BR30 Lamp	1	65	6	0.39	1,014	Relamp	26w CFL Flood Lamp	1	26	6	0.16	406	0.23	608	\$86	\$60.00	\$90.00	\$150.00	\$0.00	1.74	0	No New Controls	0	0.0%	0	\$0
227.21	Men's Restroom	2600	2x2, 2 Lamp, 32w TR, Elect. Ballast, Recessed Mnt., Prismatic Lens	2	73	1	0.07	190	Existing to Remain	-	2	73	0	0.07	190	0.00	0	\$0	\$0.00	\$0.00	\$0.00	-	0	No New Controls	0	0.0%	0	\$0	
227.41	Men's Restroom	2600	2x4, 2 Lamp, 32w TR, Elect. Ballast, Recessed Mnt., Prismatic Lens	2	62	2	0.12	322	Existing to Remain	-	2	62	0	0.12	322	0.00	0	\$0	\$0.00	\$0.00	\$0.00	-	0	No New Controls	0	0.0%	0	\$0	
227.21	Women's Restroom	2600	2x2, 2 Lamp, 32w TR, Elect. Ballast, Recessed Mnt., Prismatic Lens	2	73	1	0.07	190	Existing to Remain	-	2	73	0	0.07	190	0.00	0	\$0	\$0.00	\$0.00	\$0.00	-	0	No New Controls	0	0.0%	0	\$0	
227.41	Women's Restroom	2600	2x4, 2 Lamp, 32w TR, Elect. Ballast, Recessed Mnt., Prismatic Lens	2	62	2	0.12	322	Existing to Remain	-	2	62	0	0.12	322	0.00	0	\$0	\$0.00	\$0.00	\$0.00	-	0	No New Controls	0	0.0%	0	\$0	
650	Hall 2nd Floor	3000	Wall Sconce, (2) 15w PL Lamp	2	36	10	0.36	1,080	Existing to Remain	-	2	36	0	0.36	1,080	0.00	0	\$0	\$0.00	\$0.00	\$0.00	-	0	No New Controls	0	0.0%	0	\$0	

Fixture Reference #	Location	Average Burn Hours	Existing Fixtures						Proposed Fixtures Retrofit						Retrofit Energy Savings			Lighting Retrofit Costs				Simple Payback	Control Ref #	Proposed Lighting Controls				
			Description	Lamps per Fixture	Watts per Fixture	Qty of Fixtures	Total kW	Usage kWh/Yr	Work Description	Equipment Description	Lamps per Fixture	Watts per Fixture	Qty of Fixtures	Total kW	Usage kWh/Yr	Energy Savings, kW	Energy Savings, kWh	Energy Savings, \$	Material	Total Labor	Total AB			Rebate Estimate	Controls Description	Qty of Controls	Hour Reduction %	Energy Savings, kWh
563	Hall 2nd Floor	3000	Recessed Down Light, (2)30w Quad CFL Lamp	2	52	8	0.42	1,248	Existing to Remain	-	2	52	0	0.42	1,248	0.00	0	\$0	\$0.00	\$0.00	\$0.00	-	0	No New Controls	0	0.0%	0	\$0
227.21	Kitchenette	2600	2x2, 2 Lamp, 32w TR, Elect. Ballast, Recessed Mnt., Prismatic Lens	2	73	2	0.15	380	Existing to Remain	-	2	73	0	0.15	380	0.00	0	\$0	\$0.00	\$0.00	\$0.00	-	0	No New Controls	0	0.0%	0	\$0
237.22	Room 110	2600	2x2, 3 Lamp, 31w TR Ulamp, Elect. Ballast, Recessed Mnt., Prismatic Lens	3	92	37	3.40	8,850	Existing to Remain	-	3	92	0	3.40	8,850	0.00	0	\$0	\$0.00	\$0.00	\$0.00	-	0	No New Controls	0	0.0%	0	\$0
237.22	Office	2600	2x2, 3 Lamp, 31w TR Ulamp, Elect. Ballast, Recessed Mnt., Prismatic Lens	3	92	4	0.37	957	Existing to Remain	-	3	92	0	0.37	957	0.00	0	\$0	\$0.00	\$0.00	\$0.00	-	0	No New Controls	0	0.0%	0	\$0
237.22	Registrar Office	2600	2x2, 3 Lamp, 31w TR Ulamp, Elect. Ballast, Recessed Mnt., Prismatic Lens	3	92	40	3.68	9,568	Existing to Remain	-	3	92	0	3.68	9,568	0.00	0	\$0	\$0.00	\$0.00	\$0.00	-	0	No New Controls	0	0.0%	0	\$0
227.21	145 Files	2600	2x2, 2 Lamp, 32w TR, Elect. Ballast, Recessed Mnt., Prismatic Lens	2	73	6	0.44	1,139	Existing to Remain	-	2	73	0	0.44	1,139	0.00	0	\$0	\$0.00	\$0.00	\$0.00	-	0	No New Controls	0	0.0%	0	\$0
227.21	144 Office	2600	2x2, 2 Lamp, 32w TR, Elect. Ballast, Recessed Mnt., Prismatic Lens	2	73	4	0.29	759	Existing to Remain	-	2	73	0	0.29	759	0.00	0	\$0	\$0.00	\$0.00	\$0.00	-	5	Dual Technology Occupancy Sensor - Switch Mnt.	1	20.0%	152	\$22
227.21	143 Office	2600	2x2, 2 Lamp, 32w TR, Elect. Ballast, Recessed Mnt., Prismatic Lens	2	73	4	0.29	759	Existing to Remain	-	2	73	0	0.29	759	0.00	0	\$0	\$0.00	\$0.00	\$0.00	-	5	Dual Technology Occupancy Sensor - Switch Mnt.	1	20.0%	152	\$22
227.21	142 Office	2600	2x2, 2 Lamp, 32w TR, Elect. Ballast, Recessed Mnt., Prismatic Lens	2	73	6	0.44	1,139	Existing to Remain	-	2	73	0	0.44	1,139	0.00	0	\$0	\$0.00	\$0.00	\$0.00	-	5	Dual Technology Occupancy Sensor - Switch Mnt.	1	20.0%	228	\$32
237.22	150 Office	2600	2x2, 3 Lamp, 31w TR Ulamp, Elect. Ballast, Recessed Mnt., Prismatic Lens	3	92	28	2.58	6,698	Existing to Remain	-	3	92	0	2.58	6,698	0.00	0	\$0	\$0.00	\$0.00	\$0.00	-	4	Dual Technology Occupancy Sensor - Remote Mnt.	1	20.0%	1,340	\$190
237.22	152 Office	2600	2x2, 3 Lamp, 31w TR Ulamp, Elect. Ballast, Recessed Mnt., Prismatic Lens	3	92	8	0.74	1,914	Existing to Remain	-	3	92	0	0.74	1,914	0.00	0	\$0	\$0.00	\$0.00	\$0.00	-	5	Dual Technology Occupancy Sensor - Switch Mnt.	1	20.0%	383	\$54
227.21	154 Office	2600	2x2, 2 Lamp, 32w TR, Elect. Ballast, Recessed Mnt., Prismatic Lens	2	73	4	0.29	759	Existing to Remain	-	2	73	0	0.29	759	0.00	0	\$0	\$0.00	\$0.00	\$0.00	-	5	Dual Technology Occupancy Sensor - Switch Mnt.	1	20.0%	152	\$22
227.21	155 Office	2600	2x2, 2 Lamp, 32w TR, Elect. Ballast, Recessed Mnt., Prismatic Lens	2	73	4	0.29	759	Existing to Remain	-	2	73	0	0.29	759	0.00	0	\$0	\$0.00	\$0.00	\$0.00	-	0	No New Controls	0	0.0%	0	\$0
227.21	Hall	3000	2x2, 2 Lamp, 32w TR, Elect. Ballast, Recessed Mnt., Prismatic Lens	2	73	7	0.51	1,533	Existing to Remain	-	2	73	0	0.51	1,533	0.00	0	\$0	\$0.00	\$0.00	\$0.00	-	0	No New Controls	0	0.0%	0	\$0
227.21	156 Office	2600	2x2, 2 Lamp, 32w TR, Elect. Ballast, Recessed Mnt., Prismatic Lens	2	73	4	0.29	759	Existing to Remain	-	2	73	0	0.29	759	0.00	0	\$0	\$0.00	\$0.00	\$0.00	-	0	No New Controls	0	0.0%	0	\$0
227.21	108 Conference Room	2600	2x2, 2 Lamp, 32w TR, Elect. Ballast, Recessed Mnt., Prismatic Lens	2	73	6	0.44	1,139	Existing to Remain	-	2	73	0	0.44	1,139	0.00	0	\$0	\$0.00	\$0.00	\$0.00	-	0	No New Controls	0	0.0%	0	\$0
227.21	107 Storage	1200	2x2, 2 Lamp, 32w TR, Elect. Ballast, Recessed Mnt., Prismatic Lens	2	73	2	0.15	175	Existing to Remain	-	2	73	0	0.15	175	0.00	0	\$0	\$0.00	\$0.00	\$0.00	-	0	No New Controls	0	0.0%	0	\$0
227.21	157 Offices	2600	2x2, 2 Lamp, 32w TR, Elect. Ballast, Recessed Mnt., Prismatic Lens	2	73	4	0.29	759	Existing to Remain	-	2	73	0	0.29	759	0.00	0	\$0	\$0.00	\$0.00	\$0.00	-	0	No New Controls	0	0.0%	0	\$0
227.21	158 Offices	2600	2x2, 2 Lamp, 32w TR, Elect. Ballast, Recessed Mnt., Prismatic Lens	2	73	4	0.29	759	Existing to Remain	-	2	73	0	0.29	759	0.00	0	\$0	\$0.00	\$0.00	\$0.00	-	0	No New Controls	0	0.0%	0	\$0
227.21	159 Offices	2600	2x2, 2 Lamp, 32w TR, Elect. Ballast, Recessed Mnt., Prismatic Lens	2	73	3	0.22	569	Existing to Remain	-	2	73	0	0.22	569	0.00	0	\$0	\$0.00	\$0.00	\$0.00	-	0	No New Controls	0	0.0%	0	\$0
227.21	130 Payroll	2600	2x2, 2 Lamp, 32w TR, Elect. Ballast, Recessed Mnt., Prismatic Lens	2	73	20	1.46	3,796	Existing to Remain	-	2	73	0	1.46	3,796	0.00	0	\$0	\$0.00	\$0.00	\$0.00	-	0	No New Controls	0	0.0%	0	\$0
227.21	160 Payroll	2600	2x2, 2 Lamp, 32w TR, Elect. Ballast, Recessed Mnt., Prismatic Lens	2	73	4	0.29	759	Existing to Remain	-	2	73	0	0.29	759	0.00	0	\$0	\$0.00	\$0.00	\$0.00	-	0	No New Controls	0	0.0%	0	\$0
650	Hall 1st Floor	3000	Wall Sconce, (2) 18w PL Lamp	2	36	10	0.36	1,080	Existing to Remain	-	2	36	0	0.36	1,080	0.00	0	\$0	\$0.00	\$0.00	\$0.00	-	0	No New Controls	0	0.0%	0	\$0
563	Hall 1st Floor	3000	Recessed Down Light, (2)30w Quad CFL Lamp	2	52	8	0.42	1,248	Existing to Remain	-	2	52	0	0.42	1,248	0.00	0	\$0	\$0.00	\$0.00	\$0.00	-	0	No New Controls	0	0.0%	0	\$0
237.22	120 Office	2600	2x2, 3 Lamp, 31w TR Ulamp, Elect. Ballast, Recessed Mnt., Prismatic Lens	3	92	11	1.01	2,631	Existing to Remain	-	3	92	0	1.01	2,631	0.00	0	\$0	\$0.00	\$0.00	\$0.00	-	0	No New Controls	0	0.0%	0	\$0
227.21	Side Offices (3)	2600	2x2, 2 Lamp, 32w TR, Elect. Ballast, Recessed Mnt., Prismatic Lens	2	73	8	0.58	1,518	Existing to Remain	-	2	73	0	0.58	1,518	0.00	0	\$0	\$0.00	\$0.00	\$0.00	-	0	No New Controls	0	0.0%	0	\$0

Fixture Reference #	Location	Average Burn Hours	Existing Fixtures						Proposed Fixtures Retrofit						Retrofit Energy Savings			Lighting Retrofit Costs				Simple Payback	Control Ref #	Proposed Lighting Controls					
			Description	Lamps per Fixture	Watts per Fixture	Qty of Fixtures	Total kW	Usage kWh/Yr	Work Description	Equipment Description	Lamps per Fixture	Watts per Fixture	Qty of Fixtures	Total kW	Usage kWh/Yr	Energy Savings, kW	Energy Savings, kWh	Energy Savings, \$	Material	Total Labor	Total AB			Rebate Estimate	Controls Description	Qty of Controls	Hour Reduction %	Energy Savings, kWh	Energy Savings, \$
237.22	Conference Room	2600	2x2, 3 Lamp, 31w T8 U/Lamp, Elect. Ballast, Recessed Mnt., Prismatic Lens	3	92	5	0.46	1,196	Existing to Remain	-	3	92	0	0.46	1,196	0.00	0	\$0	\$0.00	\$0.00	\$0.00	-	0	No New Controls	0	0.0%	0	\$0	
227.21	Elevator Lobby	3000	2x2, 2 Lamp, 32w T8, Elect. Ballast, Recessed Mnt., Prismatic Lens	2	73	3	0.22	657	Existing to Remain	-	2	73	0	0.22	657	0.00	0	\$0	\$0.00	\$0.00	\$0.00	-	0	No New Controls	0	0.0%	0	\$0	
221.34	Elevator Equipment	600	1x4, 2 Lamp, 32w T8, Elect. Ballast, Pendant Mnt., No Lens	2	62	2	0.12	74	Existing to Remain	-	2	62	0	0.12	74	0.00	0	\$0	\$0.00	\$0.00	\$0.00	-	0	No New Controls	0	0.0%	0	\$0	
221.34	Custodial Closet 009	1200	1x4, 2 Lamp, 32w T8, Elect. Ballast, Pendant Mnt., No Lens	2	62	2	0.12	149	Existing to Remain	-	2	62	0	0.12	149	0.00	0	\$0	\$0.00	\$0.00	\$0.00	-	0	No New Controls	0	0.0%	0	\$0	
221.31	Main Computer	2600	1x4, 2 Lamp, 32w T8, Elect. Ballast, Recessed Mnt., Parabolic Lens	2	58	14	0.81	2,111	Existing to Remain	-	2	58	0	0.81	2,111	0.00	0	\$0	\$0.00	\$0.00	\$0.00	-	0	No New Controls	0	0.0%	0	\$0	
221.31	Servers	2600	1x4, 2 Lamp, 32w T8, Elect. Ballast, Recessed Mnt., Parabolic Lens	2	58	24	1.39	3,619	Existing to Remain	-	2	58	0	1.39	3,619	0.00	0	\$0	\$0.00	\$0.00	\$0.00	-	0	No New Controls	0	0.0%	0	\$0	
221.31	Servers Repair	2600	1x4, 2 Lamp, 32w T8, Elect. Ballast, Recessed Mnt., Parabolic Lens	2	58	12	0.70	1,810	Existing to Remain	-	2	58	0	0.70	1,810	0.00	0	\$0	\$0.00	\$0.00	\$0.00	-	0	No New Controls	0	0.0%	0	\$0	
281.34	Electrical Closet	1200	2x4, 4 Lamp, 32w T8, Elect. Ballast, Recessed Mnt., Parabolic Lens	4	107	2	0.21	257	Existing to Remain	-	4	107	0	0.21	257	0.00	0	\$0	\$0.00	\$0.00	\$0.00	-	0	No New Controls	0	0.0%	0	\$0	
TOTAL						983	70	190,089					106	67	175,216	3.30	14,874	\$2,112	\$3,460.00	\$1,890.00	\$5,350	\$0.00				14	3	5,658	\$803

APPENDIX F

Cold Drink and Snack Vending Machine Energy Conservation Project

Energy Analysis Prepared For:

College Hall

www.VendingMiserStore.com

Input Variables	
Energy Costs (\$0.000 per kwh)	\$0.142
Facility Occupied Hours per Week	75
Number of Cold Drink Vending Machines	1
Number of Uncooled Snack Machines	2
Power Requirements of Cold Drink Machine (avg watts)	427
Power Requirements of Snack Machine (avg watts)	100
VendingMiser Sale Price (for cold drink machines)	\$200.00
OfficeMiser Sale Price (for snack machines)	\$100.00

Savings Analysis

	Before	After	
Cold Drink Machines	\$531.52	\$287.16	Cost of Operation
	3,743	2,022	kWh
		46%	% Energy Savings

	Before	After	
Snack Machines	\$248.10	\$110.76	Cost of Operation
	1,747	780	kWh
		55%	% Energy Savings

Project Summary

Present kWh	Projected kWh	kWh Savings per Year
5,490	2,802	2,688

Present Cost	Projected Costs	Annual Savings	Per Cent Savings	Total Project Cost	Break Even (Months)
\$779.62	\$397.92	\$381.70	49%	\$400.00	12.6

Five Year Savings on 3 Machines = \$1,908.49

Five Year Return on Investment = 377%

