WILLIAM PATERSON UNIVERSITY

BEN SHAHN CENTER

300 POMPTON ROAD
WAYNE, NJ 07470

FACILITY ENERGY REPORT

TABLE OF CONTENTS

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: 778015352
Customer ID No: 4200858800 (Account #)
Third Party Utility Provider:
TPS Meter / Acct No:

MONTH OF USE	CONSUMPTION KWH	DEMAND	TOTAL BILL
May-11	68,400	224.0	$10,400
Jun-11	104,400	296.0	$17,929
Jul-11	114,800	324.0	$19,666
Aug-11	102,400	348.0	$16,990
Sep-11	103,200	328.0	$16,858
Oct-11	70,000	304.0	$9,997
Nov-11	57,200	140.0	$7,880
Dec-11	63,600	108.0	$8,566
Jan-12	56,000	104.0	$7,640
Feb-12	60,400	116.0	$8,361
Mar-12	55,600	116.0	$7,716
Apr-12	54,800	120.0	$7,630
Totals	**910,800**	**348.0 Max**	**$139,634**

AVERAGE DEMAND **210.7 KW average**
AVERAGE RATE **$0.153** **$/kWh**

Figure 1
Electricity Usage Profile

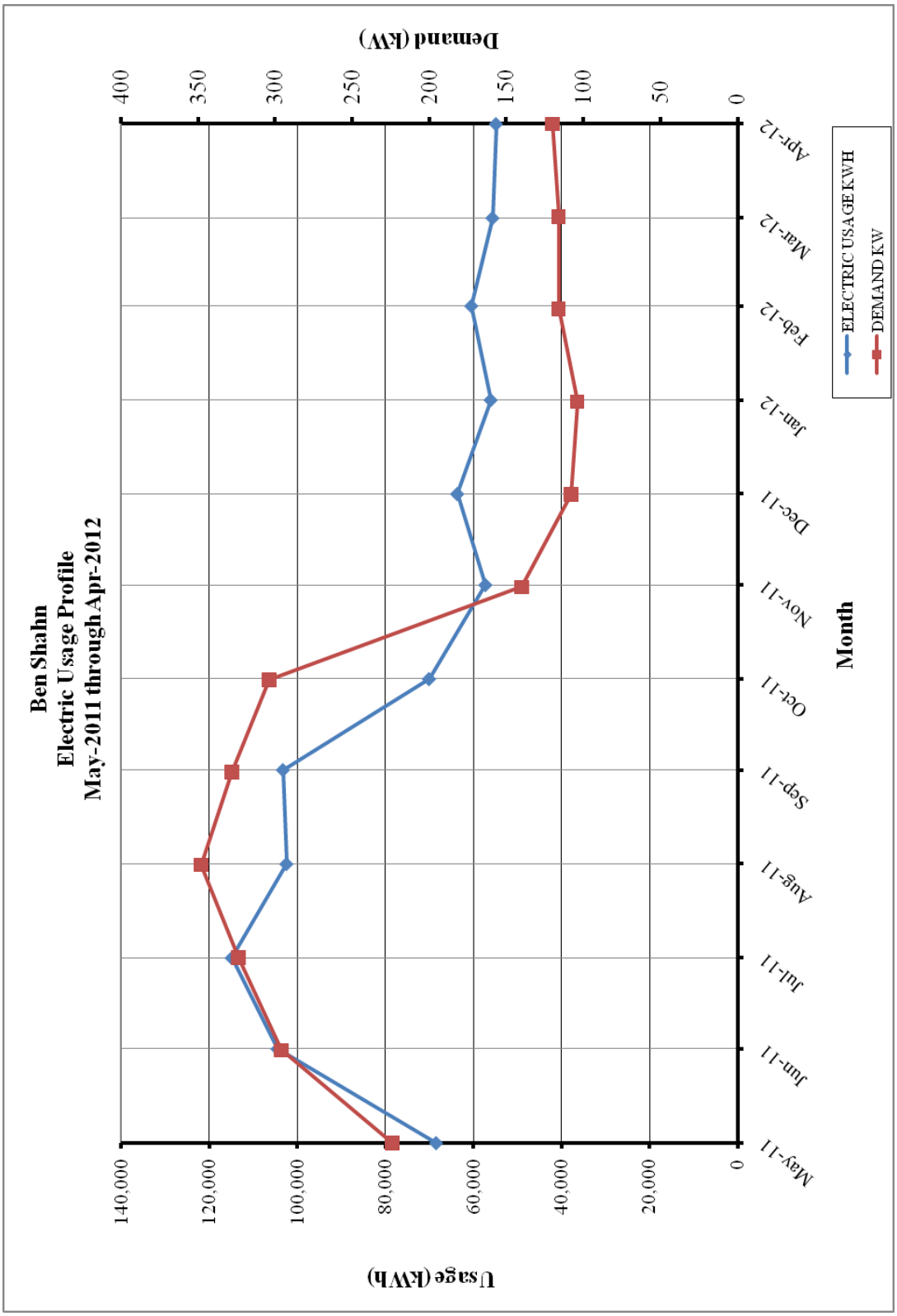
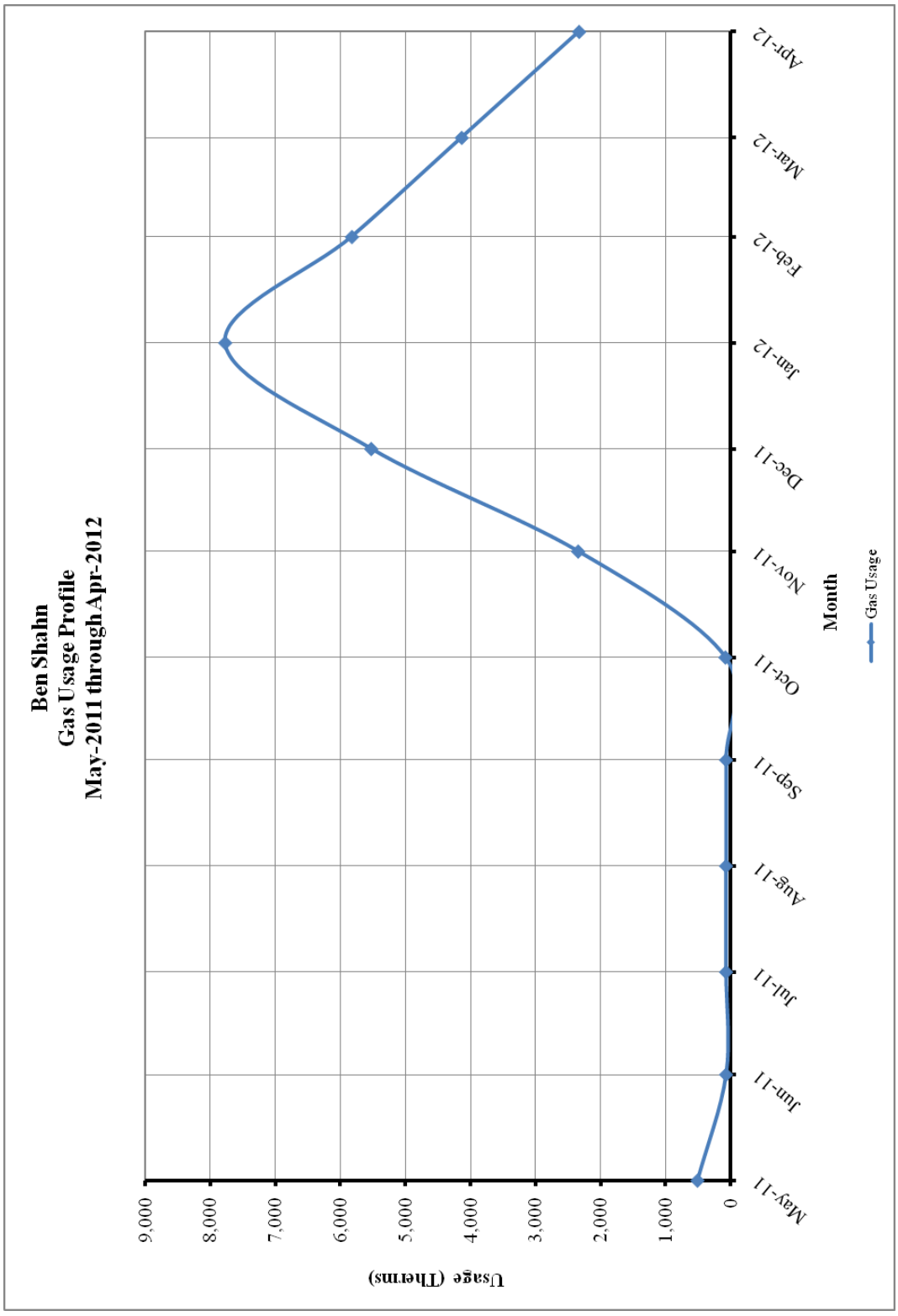


Table 2
Natural Gas Billing Data

NATURAL GAS USAGE SUMMARY		
Utility Provider:	South Jersey Gas	
Rate:	GSG (General Service Gas)	
Meter No:		
Point of Delivery ID:		
Third Party Utility Provider:		
TPS Meter No:		
MONTH OF USE	**CONSUMPTION (THERMS)**	**TOTAL BILL**
May-11	513.98	$575.06
Jun-11	74.04	$166.11
Jul-11	73.89	$166.03
Aug-11	73.89	$168.28
Sep-11	74.04	$168.53
Oct-11	83.64	$177.52
Nov-11	2,348.23	$3,524.06
Dec-11	5,530.82	$6,632.65
Jan-12	7,776.59	$8,809.33
Feb-12	5,827.23	$6,723.03
Mar-12	4,139.09	$5,078.15
Apr-12	2,333.50	$2,205.64
TOTALS	**28,848.94**	**$34,394.39**
AVERAGE RATE:	**$1.19**	**$/THERM**

Figure 2
Natural Gas Usage Profile



II. FACILITY DESCRIPTION

The William Paterson University Ben Shahn Facility is a 50,625 SF academic building built in 1969 with no renovations. The building is a two story facility with a basement comprised of student activity spaces, classrooms, art gallery, common areas, mechanical room and administration offices.

Occupancy Profile

The typical hours of operation for the Ben Shahn Facility are Monday through Thursday between 8:00 am and 6:00 pm, Friday and Saturday between 9:00 am and 5:00 pm. The Ben Shan Facility's occupancy can vary during the day although the occupancy is greater during the evening. This specific Facility employs 82 people although employees are present in multiple shifts for custodial and other maintenance functions.

Building Envelope

The exterior walls for the Ben Shahn Facility are concrete block construction. The amount of insulation within the walls is approximately ¾" foam insulation. The windows throughout the Ben Shahn Facility are in good condition and appear to be maintained. Typical windows throughout the Shahn Facility are single panel with aluminum frames. The roof is a flat, built up rubber roof where a large skylight is giving natural illumination to the interior. The amount of insulation below the roofing ranges from 2" to 5" depending on the location of the roof.

HVAC Systems

The Ben Shahn Facility system consists of four (4) hot water boilers, two (2) Central air conditioners and two (2) Air Pak Central stations.

The boilers are four (4) gas-fired condensing hot water boilers with an input of 2,000 MBH and an output of 1,706 MBH. These boilers are manufactured by Aerco and have a boiler efficiency of 85%. These boilers serve the baseboard heat which is run throughout the building, as well as hot water coils within the air handling equipment.

The hot water is circulated throughout the hot water loop via base mounted end suction pumps. The pump has 7-1/2 HP motors and is in good conditions. The pump is under the ASHRAE recommended service life and it is with the proper insulation to reduce heat loss.

The chiller is an Air Cooled Chiller, with a cooling capacity of 250 tons. It is manufactured by York and serving the cooling coils within the Central Air conditioners located on the roof and the MER. The chiller was installed 6 years ago and is under ASHRAE recommended service life in good conditions.

Chilled water is circulated throughout the chilled water loop via base mounted end suction pump. The pump has a 25 HP motor and is in good conditions.

The South office space is being served by two (2) Central Air conditioners located on the Roof as well as the MER. These units are manufactured by Trane (Model L-63) and York (Model M11937330). These units are beyond the ASHRAE standard recommended service life and the new generation will improve their operating efficiency.

The North office space is being served by two (2) Air Park Central Stations located (AP series) on the MER-019. These units are fitted chilled water cooling coils and hot water heating coils.

Exhaust System

Air is exhausted from the toilet rooms through the roof exhausters.

HVAC System Controls

The HVAC systems within the Ben Shahn Facility are controlled through non-programmable thermostats. A time clock controls which thermostat is utilized based on the occupancy schedule. Currently, the Ben Shahn Facility 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 8:00 am to 6:00 pm from Monday to Thursday and 6:00 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 hardware used to control the units is manufactured by Andover. The equipment controlled by BMS have their controller provided by the manufacturer such Aerco, York and McQuay. The controllers use twisted pair cable to communicate between their sensors and their controller. Equipment controlled by the BMS is for instance boilers, chillers, AHUs and Central Air Conditioners.

Domestic Hot Water

Domestic hot water for the Plumbing system is provided by a 130 gallons A.O. Smith (BTH 300A 100) with an input capacity of 300 MBH. The DHWH is located in the MER and has a recovery rate of 349.09 Gal/Hr with an operating efficiency of 96%. The domestic hot water heater is 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	Premium Efficiency Motor	$5,330	$232	23.0	-21.7%
ECM #2	Vending Miser Controls	$300	$247	1.2	722.0%
ECM #3	VFD HW Pump	$10,000	$1,783	5.6	167.5%
ECM #4	DDC Controls Expansion	$200,000	$12,198	16.4	-8.5%
ECM #5	Lighting Upgrade	$1,810	$1,484	1.2	719.9%
ECM #6	Lighting Controls	$6,135	$1,140	5.4	85.8%
Notes:	A. Cost takes into consideration applicable NJ Smart StartTM 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	Premium Efficiency Motor	0.4	1,514	0
ECM #2	Vending Miser Controls	0	1,612	0
ECM #3	VFD HW Pump	0.0	12,213	0
ECM #4	DDC Controls Expansion	0.0	58,000	2,793
ECM #5	Lighting Upgrade	4.1	9,701	0
ECM #6	Lighting Controls	0.0	7,453	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**
Premium Efficiency Motor	$232	$5,580	$250	$5,330	23.0
Vending Miser Controls	$247	$300	$0	$300	1.2
VFD HW Pump	$1,783	$10,000	$0	$10,000	5.6
DDC Controls Expansion	$12,198	$200,000	$0	$200,000	16.4
Lighting Upgrade	$1,484	$1,810	$0	$1,810	1.2
Lighting Controls	$1,140	$6,350	$215	$6,135	5.4
Design / Construction Extras (15%)		$33,606		*$33,606*	
Total Project	**$17,084**	**$257,646**	**$465**	**$257,181**	**15.1**

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: Install NEMA Premium® Efficiency Motors

Description:

Two (2) indoor air handling units and hot water heating pump have standard efficiency motors that 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**
HWP-2	Hot Water Pump	7.5	4,000	88.5%	91.7%
AHU-1	Supply Fan	10	3,391	89.5%	92.4%
AHU-2	Supply Fan	3	2,745	86.5%	89.5%

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

$$\text{Electric Usage Savings, kWh} = \text{Electric Usage}_{\text{Existing}} - \text{Electric Usage}_{\text{Proposed}}$$

$$\text{Electric Usage Savings, kWh} = \text{Electric Usage}_{\text{Existing}} - \text{Electric Usage}_{\text{Proposed}}$$

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

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
HWP-2	7.5	75%	88.5%	91.7%	0.17	665	$102
AHU-1	10	75%	89.5%	92.4%	0.20	669	$102
AHU-2	3	75%	86.5%	89.5%	0.07	180	$27
TOTAL					**0.4**	**1,514**	**$232**

Energy Savings Summary:

ECM #1 - ENERGY SAVINGS SUMMARY	
Installation Cost ($):	$5,580
NJ Smart Start Equipment Incentive ($):	$250
Net Installation Cost ($):	$5,330
Maintenance Savings ($/Yr):	$0
Energy Savings ($/Yr):	$232
Total Yearly Savings ($/Yr):	$232
Estimated ECM Lifetime (Yr):	18
Simple Payback	23.0
Simple Lifetime ROI	-21.7%
Simple Lifetime Maintenance Savings	$0
Simple Lifetime Savings	$4,176
Internal Rate of Return (IRR)	-2%
Net Present Value (NPV)	($2,139.18)

ECM #2: Vending Miser Controls

Description:

The Ben Shahn Center currently has snack and beverage machines located in its facility. These machines are used intermittently by staff and students however operate continuously. The installation of controls on these devices will allow for the machines to sense the level of activity and setback during periods of low activity.

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 two (2) of these control systems, one (1) 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 #2 - ENERGY SAVINGS SUMMARY	
Installation Cost ($):	$300
NJ Smart Start Equipment Incentive ($):	$0
Net Installation Cost ($):	$300
Maintenance Savings ($/Yr):	$0
Energy Savings ($/Yr):	$247
Total Yearly Savings ($/Yr):	$247
Estimated ECM Lifetime (Yr):	10
Simple Payback	1.2
Simple Lifetime ROI	722.0%
Simple Lifetime Maintenance Savings	$0
Simple Lifetime Savings	$2,466
Internal Rate of Return (IRR)	82%
Net Present Value (NPV)	$1,803.63

ECM #3: Install VFD on Hot Water Pumps

Description:

The Ben Shahn Center has one 7.5 HP hot water pump with a standard efficiency motor, but operates at constant flow and rides the pump curve only. These pumps feed hot water baseboard, reheat coils, and air handling equipment.

This ECM includes the installation of Variable Frequency Drives on the one (1) 7.5 horsepower existing hot water pump. The VFD control is based on a differential pressure sensor in the water loop to measure demand for water. This ECM also includes replacement of the existing pump motors to a premium efficiency style inverter duty motor.

Energy Savings Calculations:

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

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

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

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

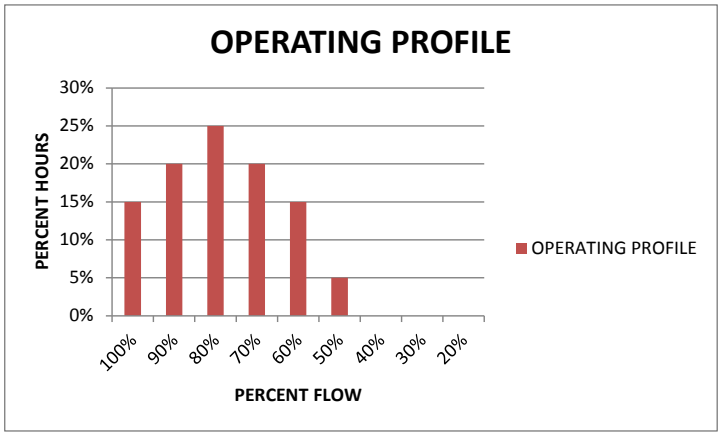
Affinity Laws are used in order to calculate energy savings by calculating the reduced power consumption requirement based a reduction in flow. Affinity laws, are as following:

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

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

HW PUMPS VFD CALULATION			
ECM INPUTS	**EXISTING**	**PROPOSED**	**SAVINGS**
ECM INPUTS	CV Pumps	VFD Pumps	
Flow Control	Throttle	VFD	-
Motor Nameplate HP	7.5	7.5	
Flow* (GPM)	200	200	-
Head* (Ft)	95	95	-
Pump Efficiency (%)	75.0%	75.0%	-
Motor Efficiency (%)	85.5%	85.5%	0.0%
Operating Hrs	4000	4000	-
Estimated Power (HP)	7.5	7.5	0.00
Elec Cost ($/kWh)	0.146	0.146	-
ENERGY SAVINGS CALCULATIONS			
ECM RESULTS	**EXISTING**	**PROPOSED**	**SAVINGS**
Electric Energy (kWh)	26,113	13,900	12,213
Electric Energy Cost ($)	$3,813	$2,029	$1,783
COMMENTS:	Estimated GPM and Pressure		

Estimated Operating Profile with VFD



Energy Savings Summary:

ECM #3 - ENERGY SAVINGS SUMMARY	
Installation Cost ($):	$10,000
NJ Smart Start Equipment Incentive ($):	$0
Net Installation Cost ($):	$10,000
Maintenance Savings ($/Yr):	$0
Energy Savings ($/Yr):	$1,783
Total Yearly Savings ($/Yr):	$1,783
Estimated ECM Lifetime (Yr):	15
Simple Payback	5.6
Simple Lifetime ROI	167.5%
Simple Lifetime Maintenance Savings	$0
Simple Lifetime Savings	$26,745
Internal Rate of Return (IRR)	16%
Net Present Value (NPV)	$11,285.34

ECM #4: Digital Energy Management System (DDC EMS)

Description:

The boiler systems and chillers within the facility are controlled via a building Management System with DDC controls, manufactured by Automated Logics. The remaining HVAC systems in the facility are controlled via a central pneumatic system.

CE recommends expanding the DDC system to control remaining HVAC systems in the facility including the air handling units, terminal boxes, baseboard, and thermostats.

This ECM includes expansion of the existing Building Automation system to include control of the rest of the HVAC equipment in the facility. The system will include new temperature sensors and new local thermostats with limited over-ride capability, main controller that can integrate back to the main Andover System. With the communication between the control devices and the front end computer interface, the facility manager will be able to take advantage of scheduling for occupied and unoccupied periods based on the actual occupancy of each space in the facility. Due to the fact that the building may have diverse hours of occupancy, including evening and weekend activities, having supervisory control over all of the equipment makes sense. The DDC system will also aid in the response time to service / maintenance issues when the facility is not under normal maintenance supervision, i.e. after-hours.

The new DDC system has the potential to provide significant savings by controlling the HVAC systems as a whole and provide operating schedules and features such as space averaging, night set-back, temperature override control, etc. 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 referenced report:

- Energy Management and Control System Savings: 5%-15%.

Savings resulting from the implementation of this ECM for energy management controls are estimated to be 10% of the electricity and 10% for the gas utility in this building.

The basis for the DDC system expansion is the Automated Logic Energy Management System or similar.

Energy Savings Calculations:

The specific HVAC related consumptions for natural gas and electric were estimated based on gathered facility data.

Energy savings for each utility is calculated with the equation below.

$$\text{Energy Savings (Utility)} = \text{Current Energy Consumption} \times \text{Estimated Savings, \%}$$

Following table summarizes energy savings for this facility via implementation of an Energy Management System:

DDC ENERGY MANAGEMENT SYSYEM CALCULATIONS			
ECM INPUTS	**EXISTING**	**PROPOSED**	**SAVINGS**
ECM INPUTS	Existing Controls w/ Local Thermostats	DDC Controls	
Existing Nat Gas Usage for Heat (Therms)	27,930	-	
Existing Electricity Usage for HVAC (kWh)	580,000	-	
Energy Savings, Nat. Gas	-	10%	
Energy Savings, Electricity	-	10%	
Gas Cost ($/Therm)	*$1.19*	$1.19	
Electricity Cost ($/kWh)	*$0.153*	$0.153	
ENERGY SAVINGS CALCULATIONS			
ECM RESULTS	**EXISTING**	**PROPOSED**	**SAVINGS**
Natural Gas Usage (Therms)	27,930	25,137	2,793
Electricity Usage (kWh)	580,000	522,000	58,000
Natural Gas Cost ($)	$33,237	$29,913	$3,324
Electricity Cost ($)	$88,740	$79,866	$8,874
Energy Cost ($)	$121,977	$109,779	$12,198
COMMENTS:			

Currently, there are no prequalified NJ SmartSmart Incentives for installation of the DDC system.

Energy Savings Summary:

ECM #4 - ENERGY SAVINGS SUMMARY	
Installation Cost ($):	$200,000
NJ Smart Start Equipment Incentive ($):	$0
Net Installation Cost ($):	$200,000
Maintenance Savings ($/Yr):	$0
Energy Savings ($/Yr):	$12,198
Total Yearly Savings ($/Yr):	$12,198
Estimated ECM Lifetime (Yr):	15
Simple Payback	16.4
Simple Lifetime ROI	-8.5%
Simple Lifetime Maintenance Savings	$0
Simple Lifetime Savings	$182,970
Internal Rate of Return (IRR)	-1%
Net Present Value (NPV)	($54,381.07)

ECM #5: Lighting Upgrade

Description:

There are still areas with Ben Shahn that utilize incandescent style lamps for general lighting purposes. These lights could be upgraded to newer compact fluorescent technology significantly lower in input wattage and increase its lamp life.

This ECM includes replacement of all incandescent lamps to compact fluorescent lamps. The energy usage of an incandescent compared to a compact fluorescent approximately 3 to 4 times greater. In addition to the energy savings, compact fluorescent fixtures burn-hours are 8 to 15 times longer than incandescent fixtures ranging from 6,000 to 15,000 burn-hours compared to incandescent fixtures ranging from 750 to 1000 burn-hours.

Energy Savings Calculations:

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

Energy Savings Summary:

ECM #5 - ENERGY SAVINGS SUMMARY	
Installation Cost ($):	$1,810
NJ Smart Start Equipment Incentive ($):	$0
Net Installation Cost ($):	$1,810
Maintenance Savings ($/Yr):	$0
Energy Savings ($/Yr):	$1,484
Total Yearly Savings ($/Yr):	$1,484
Estimated ECM Lifetime (Yr):	10
Simple Payback	1.2
Simple Lifetime ROI	719.9%
Simple Lifetime Maintenance Savings	$0
Simple Lifetime Savings	$14,840
Internal Rate of Return (IRR)	82%
Net Present Value (NPV)	$10,848.82

ECM #6: Lighting Controls

Description:

While some 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 faculty lounge, offices, and daylight sensors in the 2nd Floor Corridor. 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:

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

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

Energy Savings Summary:

ECM #6 - ENERGY SAVINGS SUMMARY	
Installation Cost ($):	$6,350
NJ Smart Start Equipment Incentive ($):	$215
Net Installation Cost ($):	$6,135
Maintenance Savings ($/Yr):	$0
Energy Savings ($/Yr):	$1,140
Total Yearly Savings ($/Yr):	$1,140
Estimated ECM Lifetime (Yr):	10
Simple Payback	5.4
Simple Lifetime ROI	85.8%
Simple Lifetime Maintenance Savings	0
Simple Lifetime Savings	$11,400
Internal Rate of Return (IRR)	13%
Net Present Value (NPV)	$3,589.43

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.

F. Ensure outside air dampers are functioning properly and only open during occupied mode.

APPENDIX A

ECM COST & SAVINGS BREAKDOWN

CONCORD ENGINEERING GROUP

WPU - Ben Shahn Center

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 (IRR)	NET PRESENT VALUE (NPV)
		MATERIAL	LABOR	REBATES, INCENTIVES	NET INSTALLATION COST	ENERGY	MAINT. / SREC	TOTAL		(Yearly Saving * ECM Lifetime)	(Yearly Maint Svaing * 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)	($/Yr)	(Yr)	($)	($)	(%)	(Yr)	($)	($)
ECM #1	Premium Efficiency Motor	$3,243	$2,337	$250	$5,330	$232	$0	$232	18	$4,176	$0	-21.7%	23.0	-2.45%	($2,139.18)
ECM #2	Vending Miser Controls	$300	$0	$0	$300	$247	$0	$247	10	$2,466	$0	722.0%	1.2	82.00%	$1,803.63
ECM #3	VFD HW Pump	$6,000	$4,000	$0	$10,000	$1,783	$0	$1,783	15	$26,745	$0	167.5%	5.6	15.87%	$11,285.34
ECM #4	DDC Controls Expansion	$150,000	$50,000	$0	$200,000	$12,198	$0	$12,198	15	$182,970	$0	-8.5%	16.4	-1.09%	($54,381.07)
ECM #5	Lighting Upgrade	$1,000	$810	$0	$1,810	$1,484	$0	$1,484	10	$14,840	$0	719.9%	1.2	81.78%	$10,848.82
ECM #6	Lighting Controls	$5,100	$1,250	$215	$6,135	$1,140	$0	$1,140	10	$11,400	$0	85.8%	5.4	13.21%	$3,589.43

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 ≥ 16 $600 per ton, EER ≥ 18 $750 per ton, EER ≥ 20

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 ≥ 10 hp	$60 per VFD rated hp

Natural Gas Water Heating

Gas Water Heaters ≤ 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 ≥ 100w Retrofit with induction lamp, power coupler and generator (must be 30% less watts/fixture than HID system)	$50 per fixture
HID ≥ 100w Replacement with new HID ≥ 100w	$70 per fixture

Prescriptive Lighting - LED

LED New Exit Sign Fixture Existing Facility < 75 kw Existing Facility > 75 kw	 $20 per fixture $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

OMB No. 2060-0347

STATEMENT OF ENERGY PERFORMANCE
Ben Shahn

Building ID: 3254941
For 12-month Period Ending: April 30, 2012[1]
Date SEP becomes ineligible: N/A
Date SEP Generated: September 18, 2012

Facility
Ben Shahn
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: 1969
Gross Floor Area (ft²): 50,625

Energy Performance Rating[2] (1-100) N/A

Site Energy Use Summary[3]

Electricity - Grid Purchase(kBtu)	3,107,650
Natural Gas (kBtu)[4]	2,884,894
Total Energy (kBtu)	5,992,544

Energy Intensity[4]

Site (kBtu/ft²/yr)	118
Source (kBtu/ft²/yr)	265

Emissions (based on site energy use)

Greenhouse Gas Emissions ($MtCO_2e$/year)	594

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	9%
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.

Certifying Professional
N/A

Meets Industry Standards[5] **for Indoor Environmental Conditions:**

Ventilation for Acceptable Indoor Air Quality	**N/A**
Acceptable Thermal Environmental Conditions	**N/A**
Adequate Illumination	**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	Ben Shahn	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.		☐
Ben Shahn (Other)				
CRITERION	**VALUE AS ENTERED IN PORTFOLIO MANAGER**	**VERIFICATION QUESTIONS**	**NOTES**	☑
Gross Floor Area	50,625 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 #4200858800 (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	54,800.00
03/01/2012	03/31/2012	55,600.00
02/01/2012	02/29/2012	60,400.00
01/01/2012	01/31/2012	56,000.00
12/01/2011	12/31/2011	63,600.00
11/01/2011	11/30/2011	57,200.00
10/01/2011	10/31/2011	70,000.00
09/01/2011	09/30/2011	103,200.00
08/01/2011	08/31/2011	102,400.00
07/01/2011	07/31/2011	114,800.00
06/01/2011	06/30/2011	104,400.00
05/01/2011	05/31/2011	68,400.00
Electric #4200858800 Consumption (kWh (thousand Watt-hours))		**910,800.00**
Electric #4200858800 Consumption (kBtu (thousand Btu))		**3,107,649.60**
Total Electricity (Grid Purchase) Consumption (kBtu (thousand Btu))		**3,107,649.60**
Is this the total Electricity (Grid Purchase) consumption at this building including all Electricity meters?		☐

Fuel Type: Natural Gas

Meter: Gas #4200858800 (therms)
Space(s): Entire Facility

Start Date	End Date	Energy Use (therms)
04/01/2012	04/30/2012	2,333.50
03/01/2012	03/31/2012	4,139.09
02/01/2012	02/29/2012	5,827.23
01/01/2012	01/31/2012	7,776.59
12/01/2011	12/31/2011	5,530.82
11/01/2011	11/30/2011	2,348.23
10/01/2011	10/31/2011	83.64
09/01/2011	09/30/2011	74.04
08/01/2011	08/31/2011	73.89
07/01/2011	07/31/2011	73.89

06/01/2011	06/30/2011	74.04
05/01/2011	05/31/2011	513.98
Gas #4200858800 Consumption (therms)		**28,848.94**
Gas #4200858800 Consumption (kBtu (thousand Btu))		**2,884,894.00**
Total Natural Gas Consumption (kBtu (thousand Btu))		**2,884,894.00**
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
Ben Shahn
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

Ben Shahn	
Gross Floor Area Excluding Parking: (ft^2)	50,625
Year Built	1969
For 12-month Evaluation Period Ending Date:	April 30, 2012

Facility Space Use Summary

Ben Shahn	
Space Type	Other - College/University (Campus-Level)
Gross Floor Area (ft^2)	50,625
Number of PCs °	N/A
Weekly operating hours °	N/A
Workers on Main Shift °	N/A

Energy Performance Comparison

	Evaluation Periods		Comparisons		
Performance Metrics	**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 ($kBtu/ft^2$)	118	118	0	N/A	104
Source ($kBtu/ft^2$)	265	265	0	N/A	244
Energy Cost					
$/year	$ 174,027.39	$ 174,027.39	N/A	N/A	$ 152,900.64
$/$ft^2$/year	$ 3.44	$ 3.44	N/A	N/A	$ 3.02
Greenhouse Gas Emissions					
$MtCO_2e$/year	594	594	0	N/A	522
$kgCO_2e/ft^2$/year	12	12	0	N/A	11

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 9% 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

Ben Shahn Facility

AC Units

Tag	AC-1	AC-3	
Unit Type	Central Air Conditioners	Central Air Conditioners	
Qty	1	1	
Location	MER	Roof	
Area Served	Office Space	Office Space	
Manufacturer	TRANE	York	
Model #	L-63	M11937330	
Serial #	K159732	14ORGRSRSn	
Cooling Type	Chilled Water Coil	Chilled Water Coil	
Cooling Capacity (Tons)	-	-	
Cooling Efficiency (SEER/EER)	N/A	N/A	
Heating Type	Hot Water Coil	Hot Water Coil	
Heating Input (MBH)	-	-	
Efficiency	N/A	N/A	
Fuel	N/A	N/A	
Approx Age	17	17	
ASHRAE Service Life	15	15	
Remaining Life	(2)	(2)	
Comments	AMPS: 69-70. Volts: 208. Hz: 60,. Phase: 3	AMPS: 69-70. Volts: 208. Hz: 60,. Phase: 3	

Note:
"N/A" = Not Applicable.
"-" = Info Not Available

MAJOR EQUIPMENT LIST

Concord Engineering Group

Ben Shahn Facility

AHUs

Tag	AHU-1	AHU-2	
Unit Type	CHW/HW Air Handler	CHW/HW Air Handler	
Qty	1	1	
Location	MER - 019	MER - 019	
Area Served	Facility	Facility	
Manufacturer	York	York	
Model #	AP215-FS-VC-MA	AP80 FS-VC-MA	
Serial #	CEJM 04950D	CEJM 04951D	
Cooling Type	Chilled Water Coil	Chilled Water Coil	
Cooling Capacity (Tons)	-	-	
Cooling Efficiency (SEER/EER)	-	-	
Heating Type	Hot Water Coil	Hot Water Coil	
Heating Input (MBH)	-	-	
Efficiency	N/A	N/A	
Fuel	N/A	N/A	
Approx Age	12	12	
ASHRAE Service Life	15	15	
Remaining Life	3	3	
Comments	38.1 GPM Heat. Supply Fan. FC: 20X20. FLA: 29.7. HP: 10.0	Supply Fan. FC: 10X10. FLA: 9.8. HP: 3.0	

Note:
"N/A" = Not Applicable.
"-" = Info Not Available

MAJOR EQUIPMENT LIST

Concord Engineering Group

Ben Shahn Facility

Boilers

Tag	BOILER A TO D		
Unit Type	Gas Fired Hot Water Boiler		
Qty	4		
Location	MER		
Area Served	HW Loop		
Manufacturer	Aerco		
Model #	BMK 2.0		
Serial #	G-09-1010/G-09-1006		
Input Capacity (Btu/Hr)	2,000,000		
Rated Output Capacity (Btu/Hr)	1,706,000		
Approx. Efficiency %	85.3%		
Fuel	Natural Gas		
Approx Age	4		
ASHRAE Service Life	24		
Remaining Life	20		
Comments			

Note:
"N/A" = Not Applicable.
"-" = Info Not Available

MAJOR EQUIPMENT LIST

Concord Engineering Group

Ben Shahn Facility

Cooling Tower

Tag	CH-1		
Unit Type	Air Cooled Chiller		
Qty	1		
Location	On grade		
Area Served	CHW Loop		
Manufacturer	York		
Model #	-		
Serial #	-		
Refrigerant	-		
Cooling Capacity (Tons)	250		
Cooling Efficiency (KW/Ton)	-		
Volts / Phase / Hz	460/3/60		
Fuel	electrical		
Chilled Water GPM / ΔT	-		
Condenser Water GPM / ΔT	-		
Approx Age	6		
ASHRAE Service Life	20		
Remaining Life	14		
Comments			

Note:
"N/A" = Not Applicable.
"-" = Info Not Available

MAJOR EQUIPMENT LIST

Concord Engineering Group

Ben Shahn Facility

Domestic Water Heaters

Tag	HWH		
Unit Type	Tank Water Heater		
Qty	1		
Location	Level 1 MER		
Area Served	Domestic Hot Water Loop		
Manufacturer	A.O. Smith		
Model #	BTH 300A 100		
Serial #	0926M000127		
Size (Gallons)	130		
Input Capacity (MBH/KW)	300		
Recovery (Gal/Hr)	349.09		
Efficiency %	96%		
Fuel	Natural Gas		
Approx Age	3		
ASHRAE Service Life	12		
Remaining Life	9		
Comments	Electrical Power required: 120/60/5		

Note:
"N/A" = Not Applicable.
"-" = Info Not Available

MAJOR EQUIPMENT LIST

Concord Engineering Group

Ben Shahn Facility

Pumps

Tag	CHWP-1	HWP-2	
Unit Type	Base Mtd. End Suction	Base Mtd. End Suction	
Qty	1	1	
Location	MER	MER	
Area Served	CHW Loop	HW Loop	
Manufacturer	Bell & Gossett	Bell & Gossett	
Model #	-	-	
Serial #	-	-	
Horse Power	25	7.5	
Flow	-	-	
Motor Info	Baldor Super E Model: EM2532T	Baldor Reliance. JMM3311T	
Electrical Power	230/460/3/60	230/460/3/60	
RPM	1760	1750	
Motor Efficiency %	93.6%	88.5%	
Approx Age	6	6	
ASHRAE Service Life	20	20	
Remaining Life	14	14	
Comments	Amp: 58/29	Amp: 21.7-20/10	

Note:
"N/A" = Not Applicable.
"-" = Info Not Available

APPENDIX E

CEG Project #: 9C12007
Facility Name: Ben Shahn
Address: East Road
City, State, Zip Wayne, NJ

			Existing Fixtures						Proposed Fixtures Retrofit						Retrofit Energy Savings			Lighting Retrofit Costs					Proposed Lighting Controls					
Fixture Reference #	Location	Average Burn Hours	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	Simple Payback	Control Ref #	Controls Description	Qty of Controls	Hour Reduction %	Energy Savings, kWh	Energy Savings, $
237.22	B220	2600	2x2, 3 Lamp, 31w T8 Ulamp, Elect. Ballast, Recessed Mnt., Prismatic Lens	3	92	16	1.47	3,827	Existing to Remain	0	3	92	0	1.47	3,827	0.00	0	$0	$0.00	$0.00	$0.00	$0.00	-	0	No New Controls	0	0.0%	0	$0
558	B220	2600	Recessed Down Light, 100w R30 Lamp	1	100	34	3.40	8,840	Relamp	Energy Star Rated, Dimmable 26w CFL Lamp	1	26	34	0.88	2,298	2.52	6,542	$1,001	$680.00	$510.00	$1,190.00	$0.00	1.19	0	No New Controls	0	0.0%	0	$0
221.31	019 Mechanical room	1200	1x4, 2Lamp, 32W, 700 Series, T8, Elect. Ballast, Pendant Mnt., Prismatic Lens	2	62	4	0.25	298	Existing to Remain	0	2	62	0	0.25	298	0.00	0	$0	$0.00	$0.00	$0.00	$0.00	-	0	No New Controls	0	0.0%	0	$0
227.21	2nd Floor Corridor	3000	2x2, 2Lamp, 32W, 700 Series, T8, elect. Ballast, Recessed Mnt., Prismatic Lens	2	65	38	2.47	7,410	Existing to Remain	0	2	65	0	2.47	7,410	0.00	0	$0	$0.00	$0.00	$0.00	$0.00	-	2	Daylight Sensor (Sensorswitch PP-20 & CM-PC or equal)	4	40.0%	2,964	$453
211.31	Classroom 206	2600	1x4, 1Lamp, 32W, 700 Series, T8, Elect. Ballast, Pendant Mnt., Prismatic Lens	1	33	31	1.02	2,660	Existing to Remain	0	1	33	0	1.02	2,660	0.00	0	$0	$0.00	$0.00	$0.00	$0.00	-	0	No New Controls	0	0.0%	0	$0
211.31	Classroom 205	2600	1x4, 1Lamp, 32W, 700 Series, T8, Elect. Ballast, Pendant Mnt., Prismatic Lens	1	33	18	0.59	1,544	Existing to Remain	0	1	33	0	0.59	1,544	0.00	0	$0	$0.00	$0.00	$0.00	$0.00	-	0	No New Controls	0	0.0%	0	$0
211.31	Classroom 204	2600	1x4, 1Lamp, 32W, 700 Series, T8, Elect. Ballast, Pendant Mnt., Prismatic Lens	1	33	24	0.79	2,059	Existing to Remain	0	1	33	0	0.79	2,059	0.00	0	$0	$0.00	$0.00	$0.00	$0.00	-	0	No New Controls	0	0.0%	0	$0
211.31	Classroom 201	2600	1x4, 1Lamp, 32W, 700 Series, T8, Elect. Ballast, Pendant Mnt., Prismatic Lens	1	33	24	0.79	2,059	Existing to Remain	0	1	33	0	0.79	2,059	0.00	0	$0	$0.00	$0.00	$0.00	$0.00	-	0	No New Controls	0	0.0%	0	$0
211.31	Classroom 225	2600	1x4, 1Lamp, 32W, 700 Series, T8, Elect. Ballast, Pendant Mnt., Prismatic Lens	1	33	18	0.59	1,544	Existing to Remain	0	1	33	0	0.59	1,544	0.00	0	$0	$0.00	$0.00	$0.00	$0.00	-	0	No New Controls	0	0.0%	0	$0
211.31	Classroom 222	2600	1x4, 1Lamp, 32W, 700 Series, T8, Elect. Ballast, Pendant Mnt., Prismatic Lens	1	33	24	0.79	2,059	Existing to Remain	0	1	33	0	0.79	2,059	0.00	0	$0	$0.00	$0.00	$0.00	$0.00	-	0	No New Controls	0	0.0%	0	$0
211.31	Classroom 220	2600	1x4, 1Lamp, 32W, 700 Series, T8, Elect. Ballast, Pendant Mnt., Prismatic Lens	1	33	14	0.46	1,201	Existing to Remain	0	1	33	0	0.46	1,201	0.00	0	$0	$0.00	$0.00	$0.00	$0.00	-	0	No New Controls	0	0.0%	0	$0
211.31	Classroom 216	2600	1x4, 1Lamp, 32W, 700 Series, T8, Elect. Ballast, Pendant Mnt., Prismatic Lens	1	33	37	1.22	3,175	Existing to Remain	0	1	33	0	1.22	3,175	0.00	0	$0	$0.00	$0.00	$0.00	$0.00	-	0	No New Controls	0	0.0%	0	$0
211.31	Classroom 215	2600	1x4, 1Lamp, 32W, 700 Series, T8, Elect. Ballast, Pendant Mnt., Prismatic Lens	1	33	30	0.99	2,574	Existing to Remain	0	1	33	0	0.99	2,574	0.00	0	$0	$0.00	$0.00	$0.00	$0.00	-	0	No New Controls	0	0.0%	0	$0
221.11	215 Prep Room	2600	1x4, 1Lamp, 32W, 700 Series, T8, Elect. Ballast, Pendant Mnt., Prismatic Lens	1	33	3	0.10	257	Existing to Remain	0	1	33	0	0.10	257	0.00	0	$0	$0.00	$0.00	$0.00	$0.00	-	0	No New Controls	0	0.0%	0	$0
211.11	215 Restroom	2600	1x4, 1Lamp, 32W, 700 Series, T8, Elect. Ballast, Surface Mnt., Prismatic Lens	1	33	1	0.03	86	Existing to Remain	0	1	33	0	0.03	86	0.00	0	$0	$0.00	$0.00	$0.00	$0.00	-	0	No New Controls	0	0.0%	0	$0
652	216 Prep	2600	"Industrial" Relector, 200w CFL	1	200	3	0.60	1,560	Relamp	42w CFL	1	42	3	0.13	328	0.47	1,232	$189	$60.00	$45.00	$105.00	$0.00	0.56	0	No New Controls	0	0.0%	0	$0
211.31	Classroom 213	2600	1x4, 1Lamp, 32W, 700 Series, T8, Elect. Ballast, Pendant Mnt., Prismatic Lens	1	33	24	0.79	2,059	Existing to Remain	0	1	33	0	0.79	2,059	0.00	0	$0	$0.00	$0.00	$0.00	$0.00	-	0	No New Controls	0	0.0%	0	$0
211.11	Women's Restroom	2600	1x4, 1Lamp, 32W, 700 Series, T8, Elect. Ballast, Surface Mnt., Prismatic Lens	1	33	3	0.10	257	Existing to Remain	0	1	33	0	0.10	257	0.00	0	$0	$0.00	$0.00	$0.00	$0.00	-	0	No New Controls	0	0.0%	0	$0
211.11	Men's Restroom	2600	1x4, 1Lamp, 32W, 700 Series, T8, Elect. Ballast, Surface Mnt., Prismatic Lens	1	33	3	0.10	257	Existing to Remain	0	1	33	0	0.10	257	0.00	0	$0	$0.00	$0.00	$0.00	$0.00	-	0	No New Controls	0	0.0%	0	$0
611	South Gallery	3000	Track Head, 65w PAR38 Lamp	1	65	70	4.55	13,650	Existing to Remain	0	1	65	0	4.55	13,650	0.00	0	$0	$0.00	$0.00	$0.00	$0.00	-	0	No New Controls	0	0.0%	0	$0
242.21	South Gallery Office	2600	2x4, 4 Lamp, 32W, 700 Series, T8, Elect. Ballast, Recessed Mnt., Prismatic Lens	4	107	4	0.43	1,113	Existing to Remain	0	4	107	0	0.43	1,113	0.00	0	$0	$0.00	$0.00	$0.00	$0.00	-	0	No New Controls	0	0.0%	0	$0
242.21	South Gallery Storage	1200	2x4, 4 Lamp, 32W, 700 Series, T8, Elect. Ballast, Recessed Mnt., Prismatic Lens	4	107	2	0.21	257	Existing to Remain	0	4	107	0	0.21	257	0.00	0	$0	$0.00	$0.00	$0.00	$0.00	-	0	No New Controls	0	0.0%	0	$0
611	East Gallery	3000	Track Head, 65w PAR38 Lamp	1	65	12	0.78	2,340	Existing to Remain	0	1	65	0	0.78	2,340	0.00	0	$0	$0.00	$0.00	$0.00	$0.00	-	0	No New Controls	0	0.0%	0	$0
211.11	Art Offices Hall	3000	1x4, 1Lamp, 32W, 700 Series, T8, Elect. Ballast, Surface Mnt., Prismatic Lens	1	33	9	0.30	891	Existing to Remain	0	1	33	0	0.30	891	0.00	0	$0	$0.00	$0.00	$0.00	$0.00	-	0	No New Controls	0	0.0%	0	$0

			Existing Fixtures						Proposed Fixtures Retrofit							Retrofit Energy Savings			Lighting Retrofit Costs						Proposed Lighting Controls					
Fixture Reference #	Location	Average Burn Hours	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	Simple Payback	Control Ref #	Controls Description	Qty of Controls	Hour Reduction %	Energy Savings, kWh	Energy Savings, $
3520	Art Offices Restrooms	2600	Ceiling Mount White Globe, (2) 26w CFL Lamp	2	52	6	0.31	811	Existing to Remain	0	2	52	0	0.31	811	0.00	0	$0	$0.00	$0.00	$0.00	$0.00	-	0	No New Controls	0	0.0%	0	$0
221.11	Side Offices (22)	2600	1x4, 1Lamp, 32W, 700 Series, T8, Elect. Ballast, Pendant Mnt., Prismatic Lens	1	33	44	1.45	3,775	Existing to Remain	0	1	33	0	1.45	3,775	0.00	0	$0	$0.00	$0.00	$0.00	$0.00	-	0	No New Controls	0	0.0%	0	$0
211.11	Side Offices (14)	2600	1x4, 1Lamp, 32W, 700 Series, T8, Elect. Ballast, Surface Mnt., Prismatic Lens	1	33	28	0.92	2,402	Existing to Remain	0	1	33	0	0.92	2,402	0.00	0	$0	$0.00	$0.00	$0.00	$0.00	-	0	No New Controls	0	0.0%	0	$0
610	Faculty Lounge	2600	Track Head, 65w BR30 Lamp	1	65	9	0.59	1,521	Relamp	Energy Star Rated, Dimmable 13w CFL Lamp	1	13	9	0.12	304	0.47	1,217	$186	$180.00	$135.00	$315.00	$0.00	1.69	4	Dual Technology Occupancy Sensor - Remote Mnt.	1	20.0%	61	$9
227.21	002 Athletic Department	2600	2x2, 2Lamp, 32W, 700 Series, T8, elect. Ballast, Recessed Mnt., Prismatic Lens	2	65	16	1.04	2,704	Existing to Remain	0	2	65	0	1.04	2,704	0.00	0	$0	$0.00	$0.00	$0.00	$0.00	-	4	Dual Technology Occupancy Sensor - Remote Mnt.	1	20.0%	541	$83
227.21	002 Athletic Department Offices (4)	2600	2x2, 2Lamp, 32W, 700 Series, T8, elect. Ballast, Recessed Mnt., Prismatic Lens	2	65	20	1.30	3,380	Existing to Remain	0	2	65	0	1.30	3,380	0.00	0	$0	$0.00	$0.00	$0.00	$0.00	-	5	Dual Technology Occupancy Sensor - Switch Mnt.	4	20.0%	676	$103
227.21	032 Athletic Department	2600	2x2, 2Lamp, 32W, 700 Series, T8, elect. Ballast, Recessed Mnt., Prismatic Lens	2	65	24	1.56	4,056	Existing to Remain	0	2	65	0	1.56	4,056	0.00	0	$0	$0.00	$0.00	$0.00	$0.00	-	4	Dual Technology Occupancy Sensor - Remote Mnt.	1	20.0%	811	$124
227.21	032 Athletic Department Offices (12)	2600	2x2, 2Lamp, 32W, 700 Series, T8, elect. Ballast, Recessed Mnt., Prismatic Lens	2	65	54	3.51	9,126	Existing to Remain	0	2	65	0	3.51	9,126	0.00	0	$0	$0.00	$0.00	$0.00	$0.00	-	5	Dual Technology Occupancy Sensor - Switch Mnt.	12	20.0%	1,825	$279
227.21	018 Conference Room	2600	2x2, 2Lamp, 32W, 700 Series, T8, elect. Ballast, Recessed Mnt., Prismatic Lens	2	65	9	0.59	1,521	Existing to Remain	0	2	65	0	0.59	1,521	0.00	0	$0	$0.00	$0.00	$0.00	$0.00	-	4	Dual Technology Occupancy Sensor - Remote Mnt.	1	20.0%	304	$47
612	Mechanical Room	1200	Pendant Mnt., 100W A19 Lamp	1	100	8	0.80	960	Relamp	26W CFL Lamp	1	26	8	0.21	250	0.59	710	$109	$80.00	$120.00	$200.00	$0.00	1.84	0	No New Controls	0	0.0%	0	$0
221.31	Mechanical Room	1200	1x4, 2Lamp, 32W, 700 Series, T8, Elect. Ballast, Pendant Mnt., Prismatic Lens	2	62	1	0.06	74	Existing to Remain	0	2	62	0	0.06	74	0.00	0	$0	$0.00	$0.00	$0.00	$0.00	-	0	No New Controls	0	0.0%	0	$0
227.21	Basement Corridor	3000	2x2, 2Lamp, 32W, 700 Series, T8, elect. Ballast, Recessed Mnt., Prismatic Lens	2	65	36	2.34	7,020	Existing to Remain	0	2	65	0	2.34	7,020	0.00	0	$0	$0.00	$0.00	$0.00	$0.00	-	0	No New Controls	0	0.0%	0	$0
563	Basement Corridor	3000	Recessed Down Light, (2)26w Quad CFL Lamp	2	52	18	0.94	2,808	Existing to Remain	0	2	52	0	0.94	2,808	0.00	0	$0	$0.00	$0.00	$0.00	$0.00	-	0	No New Controls	0	0.0%	0	$0
563	011 Offices	2600	Recessed Down Light, (2)26w Quad CFL Lamp	2	52	10	0.52	1,352	Existing to Remain	0	2	52	0	0.52	1,352	0.00	0	$0	$0.00	$0.00	$0.00	$0.00	-	4	Dual Technology Occupancy Sensor - Remote Mnt.	1	20.0%	270	$41
227.22	Restrooms	2600	2x2, 2Lamp, 32W, T8, Elact. Ballast, Recessed Mnt., Parabolic Lens	2	65	10	0.65	1,690	Existing to Remain	0	2	65	0	0.65	1,690	0.00	0	$0	$0.00	$0.00	$0.00	$0.00	-	0	No New Controls	0	0.0%	0	$0
211.11	Stairwells (2)	8760	1x4, 1Lamp, 32W, 700 Series, T8, Elect. Ballast, Surface Mnt., Prismatic Lens	1	33	16	0.53	4,625	Existing to Remain	0	1	33	0	0.53	4,625	0.00	0	$0	$0.00	$0.00	$0.00	$0.00	-	0	No New Controls	0	0.0%	0	$0
	TOTAL					**755**	**40**	**109,805**					**54**	35.90	100,104	4.05	9,701	$1,484	$1,000.00	$810.00	$1,810.00	**0**				**25**	**2**	7,453	$1,140

APPENDIX F

Cold Drink and Snack Vending Machine Energy Conservation Project

Energy Analysis Prepared For:

Ben Shahn

www.VendingMiserStore.com

Input Variables	
Energy Costs ($0.000 per kwh)	$0.153
Facility Occupied Hours per Week	100
Number of Cold Drink Vending Machines	1
Number of Uncooled Snack Machines	1
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	$572.69	$380.18	Cost of Operation
	3,743	2,485	kWh
		34%	% Energy Savings
Snack Machines	$133.66	$79.56	Cost of Operation
	874	520	kWh
		40%	% Energy Savings

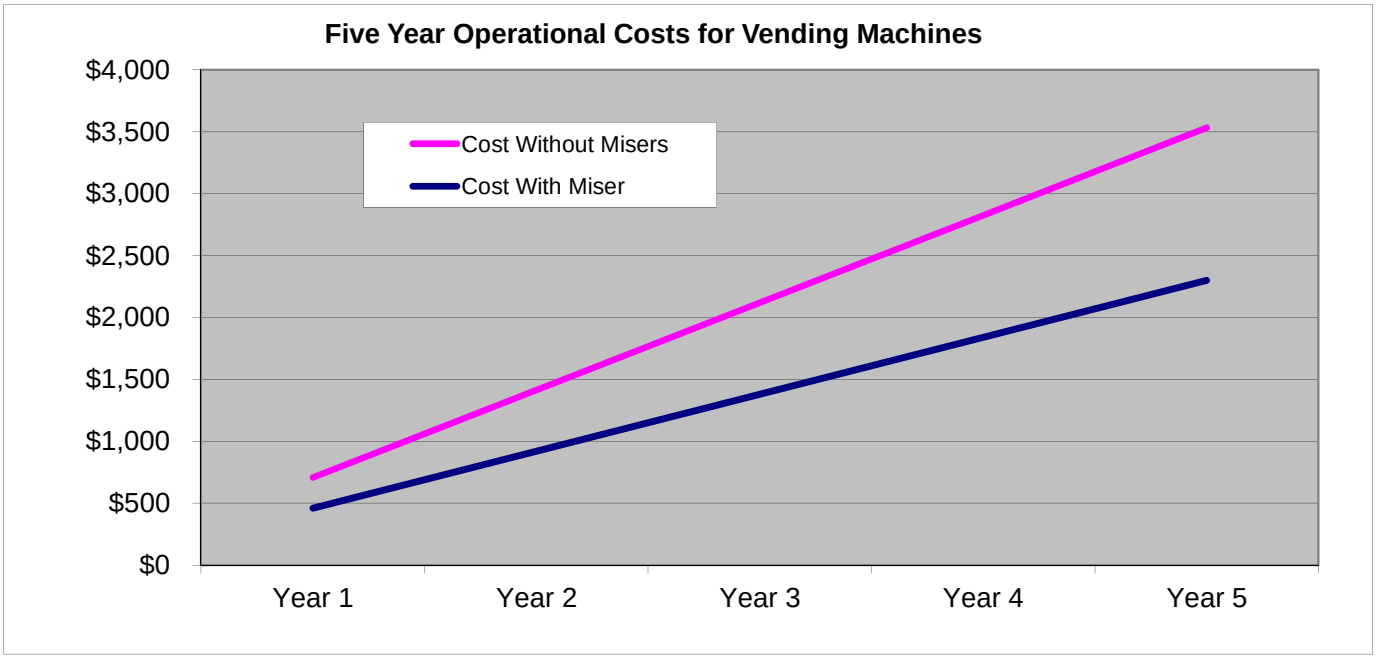
Project Summary

Present kWh	Projected kWh	kWh Savings per Year
4,617	3,005	1,612

Present Cost	Projected Costs	Annual Savings	Per Cent Savings	Total Project Cost	Break Even (Months)
$706.35	$459.74	$246.61	35%	$300.00	14.6

Five Year Savings on 2 Machines = $1,233.05

Five Year Return on Investment = 311%



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