# WILLIAM PATERSON UNIVERSITY

# OVERLOOK NORTH & SOUTH

**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: 278005298 | | | |
| Customer ID No: 42-001-822-03 (Account #) | | | |
| Third Party Utility Provider: | | | |
| TPS Meter / Acct No: | | | |
| **MONTH OF USE** | **CONSUMPTION KWH** | **DEMAND** | **TOTAL BILL** |
| May-11 | 177,600 | 404.0 | $25,792 |
| Jun-11 | 82,800 | 284.0 | $14,867 |
| Jul-11 | 66,400 | 152.0 | $11,125 |
| Aug-11 | 68,800 | 356.0 | $12,979 |
| Sep-11 | 238,400 | 468.0 | $35,027 |
| Oct-11 | 182,800 | 528.0 | $24,561 |
| Nov-11 | 169,600 | 484.0 | $22,848 |
| Dec-11 | 185,600 | 308.0 | $24,234 |
| Jan-12 | 136,400 | 288.0 | $18,177 |
| Feb-12 | 178,400 | 300.0 | $23,795 |
| Mar-12 | 160,400 | 292.0 | $21,387 |
| Apr-12 | 154,800 | 476.0 | $21,331 |
| **Totals** | **1,802,000** | **528.0 Max** | **$256,122** |
| **AVERAGE DEMAND** | | **361.7 KW average** | |
| **AVERAGE RATE** | | **$0.142 $/kWh** | |

**Figure 1**
**Electricity Usage Profile**

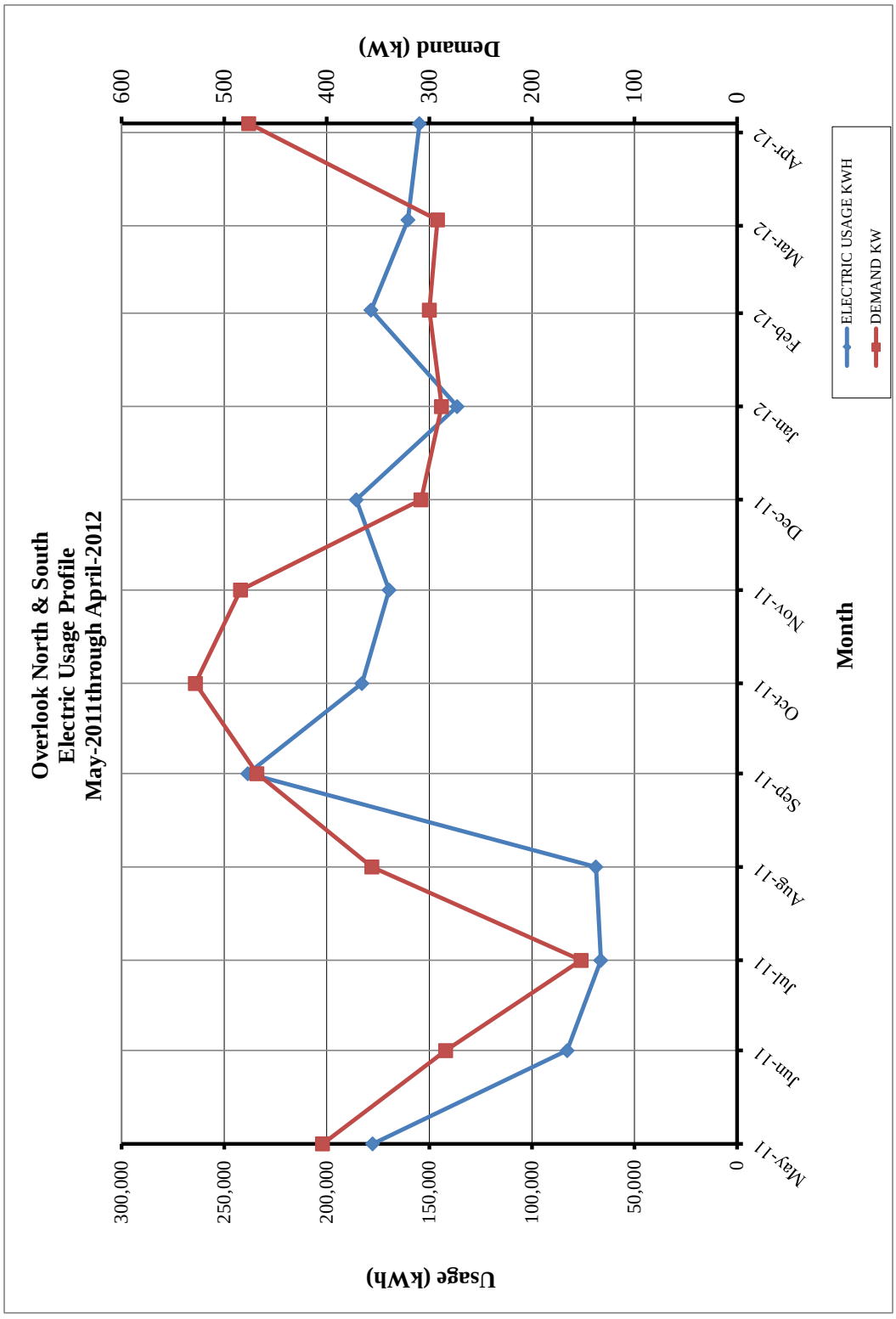
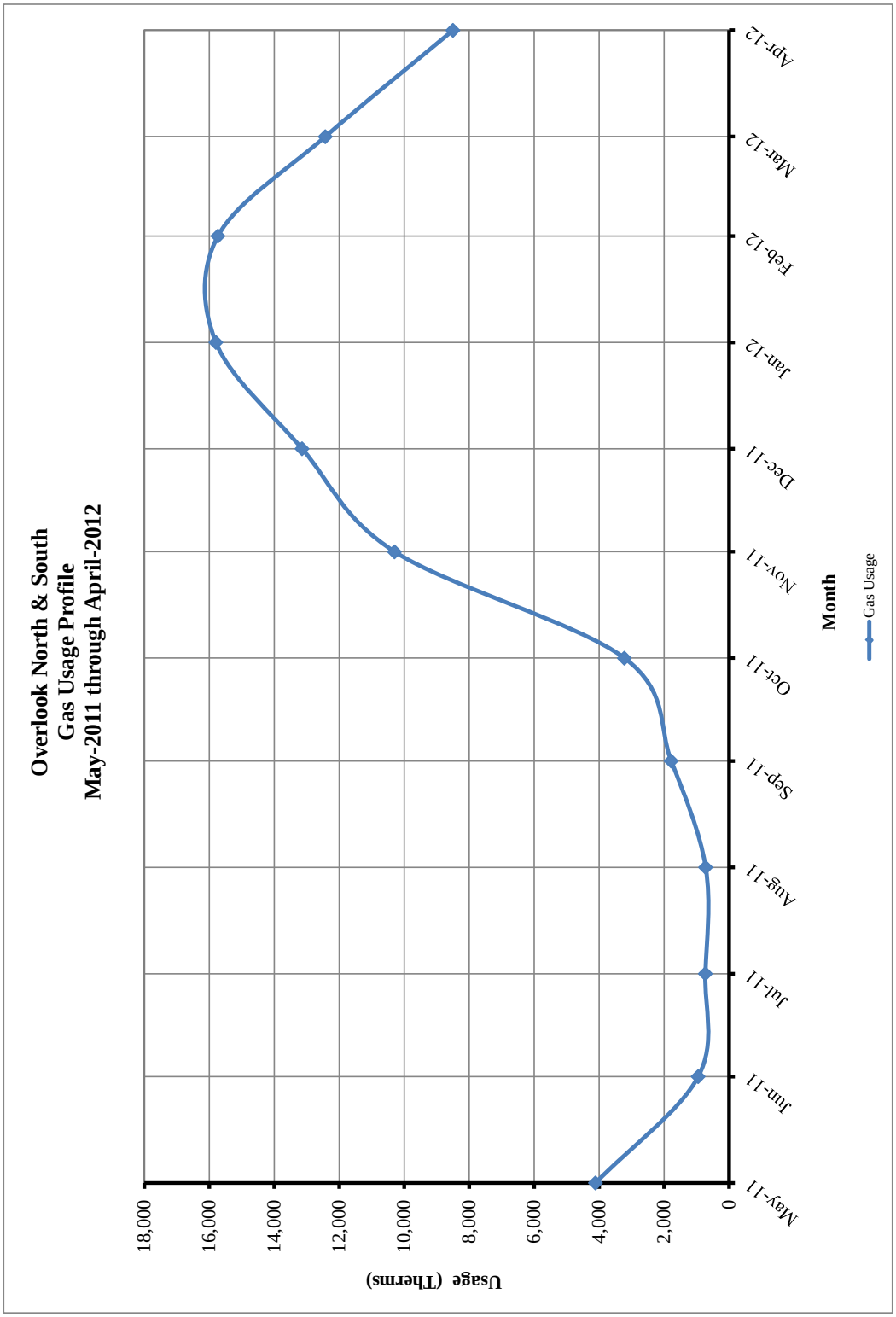


**Table 2**
**Natural Gas Billing Data**

| NATURAL GAS USAGE SUMMARY | | |
|---|---|---|
| Utility Provider: | PSE&G | |
| Rate: | GSG (General Service Gas) | |
| Meter No: | 3164347 | |
| Point of Delivery ID: | 42-001-822-03 (ACC. #) | |
| Third Party Utility Provider: | | |
| TPS Meter No: | | |
| **MONTH OF USE** | **CONSUMPTION (THERMS)** | **TOTAL BILL** |
| May-11 | 4,108.08 | $3,778.96 |
| Jun-11 | 948.52 | $979.19 |
| Jul-11 | 728.54 | $774.81 |
| Aug-11 | 719.82 | $770.59 |
| Sep-11 | 1,780.12 | $1,724.16 |
| Oct-11 | 3,219.16 | $3,000.93 |
| Nov-11 | 10,295.19 | $12,917.64 |
| Dec-11 | 13,141.05 | $15,679.53 |
| Jan-12 | 15,796.26 | $18,244.99 |
| Feb-12 | 15,733.52 | $17,518.72 |
| Mar-12 | 12,427.23 | $14,004.77 |
| Mar-12 | 8,496.06 | $7,649.03 |
| **TOTALS** | **87,393.56** | **$97,043.32** |
| **AVERAGE RATE:** | **$1.11** | **$/THERM** |

**Figure 2**
**Natural Gas Usage Profile**



## II. FACILITY DESCRIPTION

The Overlook North & South Facility is located on Mills Drive in Wayne Township, New Jersey. The 151,415 SF Facility was built in 1982 with no renovations. The North and South towers are twins of one another and are connected together via the Pavillion building which also houses the central heating and cooling plant. The building is five story facility comprised of dormitory space for students, office space, mechanical room, and Laundry spaces.

Occupancy Profile

The typical hours of operation for this facility are continuous throughout the academic year September to May for residents. During the summer the facility is occupied minimally with staff utilizing office space on the first level, that are typically there from 9:00 AM to 5:00 PM.

Building Envelope

Exterior walls for the Dormitory are brick faced with a concrete block construction. The amount of insulation within the walls is approximately ¾" foam insulation. The windows throughout the Dormitory are in good condition and appear to be maintained. Typical windows throughout the Facility are single and double panels, operable, ¼" clear glass with aluminum frames. The roof is a flat, built up rubber roof where some HVAC equipment resides. The amount of insulation below the roofing ranges from 2" to 5" depending on the location of the roof.

HVAC Systems

The Facility central systems consists of six (6) hot water boilers, two (2) Water Chiller units with a Cooling Tower and two (2) makeup air units located on the roof. The dormitories are conditioned by two-pipe console type fan coil units located on the outside wall. These units either receive hot or chilled water based on the systems mode of operation.

The boilers are gas-fired condensing hot water boiler, with an input of 2,000 MBH and an output of 1,706 MBH. Manufactured by Aerco and having a boiler efficiency of 85.3%. These boilers provide heating hot water to both towers and domestic hot water via two heat exchangers. Hot water is distributed via six pumps, two dedicated to the North Tower and two to the South Tower, one to the Pavillion, and one spare.

The chiller is a Carrier model 19XRV Series rated at 350 tons located in Level 1 MER and was installed in 2010. The BAC cooling tower is located on the roof of the Pavillion and was not replaced with the chiller. Chilled water is distributed by two pumps rated at 25 horsepower, with one dedicated to each tower. Condenser water is pumped by two 20 horsepower pumps. All the pumps are under constant flow; therefore, it is highly recommended to install VFD to control the flow of the fluid.

The rooftop units (AHU-1 & 2) are the main source for fresh air distribution and appear to be well past there ASHRAE life expectancy but in operable condition. These units have hot and chilled water coils and typically operate only September to May when the building is occupied.

Exhaust System

Air is exhausted from the toilet rooms in each dorm through risers that go to a total of twenty-four (24) mushroom type fans on each tower.

HVAC System Controls

The main heating and cooling plant has electronic controls that operated based on the main building management system located at the Facilities Management Buildings. The remaining systems are controlled by pneumatic operators that are not tied into a BMS system. The fan coil system has on board controls that allow for cool/heat and a fan speed setting.

Domestic Hot Water

Domestic hot water for the Facility is provided by two (2) Heat Exchanger hot water heaters. The DHWHs are located in the MER (lower level). The Heat Exchangers manufactured by Old Dominion Fabricators and are connected to a large storage tank.

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 | NEMA Premium Efficiency Motor | $71,716 | $8,263 | 8.7 | 107.4% |
| ECM #2 | Vending Miser Controls | $600 | $458 | 1.3 | 662.9% |
| ECM #3 | VFD HW Pumps | $60,000 | $4,913 | 12.2 | 22.8% |
| ECM #4 | VFD CHW Pumps | $47,000 | $9,739 | 4.8 | 210.8% |
| ECM #5 | Cooling Tower VFD | $22,800 | $6,884 | 3.3 | 352.9% |
| ECM #6 | Intelligent Thermostats | $348,000 | $35,916 | 9.7 | 54.8% |
| ECM #7 | Energy Recovery Units | $450,000 | $28,934 | 15.6 | 28.6% |
| ECM #8 | Lighting Upgrade | $45,243 | $6,344 | 7.1 | 110.3% |
| ECM #9 | Lighting Controls | $6,025 | $1,500 | 4.0 | 273.4% |
| **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 | NEMA Premium Efficiency Motor | 16.0 | 58,191 | 0 |
| ECM #2 | Vending Miser Controls | 0.0 | 3,224 | 0 |
| ECM #3 | VFD HW Pumps | 0.0 | 17,301 | 0 |
| ECM #4 | VFD CHW Pumps | 0.0 | 68,583 | 0 |
| ECM #5 | Cooling Tower VFD | 0.0 | 48,481 | 0 |
| ECM #6 | Intelligent Thermostats | 0.0 | 95,726 | 17,094 |
| ECM #7 | Energy Recovery Units | 0.0 | 31,590 | 22,025 |
| ECM #8 | Lighting Upgrade | 7.3 | 44,672 | 0 |
| ECM #9 | Lighting Controls | 0.0 | 10,568 | 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** |
| NEMA Premium Efficiency Motor | $8,263 | $73,546 | $1,830 | $71,716 | 8.7 |
| Vending Miser Controls | $458 | $600 | $0 | $600 | 1.3 |
| VFD HW Pumps | $4,913 | $60,000 | $0 | $60,000 | 12.2 |
| VFD CHW Pumps | $9,739 | $50,000 | $3,000 | $47,000 | 4.8 |
| Cooling Tower VFD | $6,884 | $24,600 | $1,800 | $22,800 | 3.3 |
| Intelligent Thermostats | $35,916 | $348,000 | $0 | $348,000 | 9.7 |
| Energy Recovery Units | $28,934 | $450,000 | $0 | $450,000 | 15.6 |
| Lighting Upgrade | $6,344 | $51,013 | $5,770 | $45,243 | 7.1 |
| Lighting Controls | $1,500 | $6,500 | $475 | $6,025 | 4.0 |
| *Design / Construction Extras (15%)* | | | | *$159,639* | |
| **Total Project** | **$102,951** | **$1,064,259** | **$6,630** | **$1,211,023** | **11.8** |

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:**

The two air handlers, and eleven chilled and hot water pumps have below NEMA Premium Efficiency Motors. Therefore, these units have 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 of 20 HP or greater. 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** |
| AHU-1 | Supply Fan | 50 | 6,000 | 84.0% | 94.5% |
| AHU-2 | Supply Fan | 50 | 6,000 | 85.5% | 94.5% |
| P-1 | Chiller Water Pump | 25 | 3,000 | 87.5% | 93.6% |
| P-2 | Chiller Water Pump | 25 | 3,000 | 87.5% | 93.6% |
| P-3 | Chiller Water Pump | 25 | 500 | 87.5% | 93.6% |
| P-4 | Condenser Pumps | 20 | 1,500 | 87.5% | 93.0% |
| P-5 | Condenser Pumps | 20 | 1,500 | 87.5% | 93.0% |
| P-6 | South Wing Pump | 20 | 2,000 | 87.5% | 93.0% |
| P-7 | South Wing Pump | 20 | 2,000 | 87.5% | 93.0% |
| P-8 | Central PAV Pump | 20 | 2,000 | 87.5% | 93.0% |
| P-9 | North Wing Pump | 20 | 2,000 | 87.5% | 93.0% |
| P-10 | North Wing Pump | 20 | 2,000 | 87.5% | 93.0% |
| P-11 | Standby Pump | 20 | 500 | 87.5% | 93.0% |

**Energy Savings Calculations:**
**Error! Bookmark not defined.**

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

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** |
| AHU-1 | 50 | 75% | 84.0% | 94.5% | 3.70 | 22,321 | $3,170 |
| AHU-2 | 50 | 75% | 85.5% | 94.5% | 3.12 | 18,797 | $2,669 |
| P-1 | 25 | 75% | 87.5% | 93.6% | 1.04 | 3,142 | $446 |
| P-2 | 25 | 75% | 87.5% | 93.6% | 1.04 | 3,142 | $446 |
| P-3 | 25 | 75% | 87.5% | 93.6% | 1.04 | 524 | $74 |
| P-4 | 20 | 75% | 87.5% | 93.0% | 0.76 | 1,141 | $162 |
| P-5 | 20 | 75% | 87.5% | 93.0% | 0.76 | 1,141 | $162 |
| P-6 | 20 | 75% | 87.5% | 93.0% | 0.76 | 1,521 | $216 |
| P-7 | 20 | 75% | 87.5% | 93.0% | 0.76 | 1,521 | $216 |
| P-8 | 20 | 75% | 87.5% | 93.0% | 0.76 | 1,521 | $216 |
| P-9 | 20 | 75% | 87.5% | 93.0% | 0.76 | 1,521 | $216 |
| P-10 | 20 | 75% | 87.5% | 93.0% | 0.76 | 1,521 | $216 |
| P-11 | 20 | 75% | 87.5% | 93.0% | 0.76 | 380 | $54 |
| **TOTAL** | | | | | **16.0** | **58,191** | **$8,263** |

**Energy Savings Summary:**

| ECM #1 - ENERGY SAVINGS SUMMARY | |
|---|---|
| **Installation Cost ($):** | $73,546 |
| **NJ Smart Start Equipment Incentive ($):** | $1,830 |
| **Net Installation Cost ($):** | $71,716 |
| **Maintenance Savings ($/Yr):** | $0 |
| **Energy Savings ($/Yr):** | $8,263 |
| **Total Yearly Savings ($/Yr):** | $8,263 |
| **Estimated ECM Lifetime (Yr):** | 18 |
| **Simple Payback** | 8.7 |
| **Simple Lifetime ROI** | 107.4% |
| **Simple Lifetime Maintenance Savings** | $0 |
| **Simple Lifetime Savings** | $148,734 |
| **Internal Rate of Return (IRR)** | 9% |
| **Net Present Value (NPV)** | $41,929.28 |

## ECM #2: Vending Miser Controls

**Description:**

The Overlook Towers currently has snack and cold beverage vending machines in reception areas for the North and South Towers which are typically in use for a minimal period 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 four (4) of these control systems, two (2) for the snack machines and two (2) 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 ($):** | $600 |
| **NJ Smart Start Equipment Incentive ($):** | $0 |
| **Net Installation Cost ($):** | $600 |
| **Maintenance Savings ($/Yr):** | $0 |
| **Energy Savings ($/Yr):** | $458 |
| **Total Yearly Savings ($/Yr):** | $458 |
| **Estimated ECM Lifetime (Yr):** | 10 |
| **Simple Payback** | 1.3 |
| **Simple Lifetime ROI** | 662.9% |
| **Simple Lifetime Maintenance Savings** | $0 |
| **Simple Lifetime Savings** | $4,578 |
| **Internal Rate of Return (IRR)** | 76% |
| **Net Present Value (NPV)** | $3,304.79 |

## ECM #3: Install VFD on Hot Water Pumps

**Description:**

The North and South Tower currently have 20 horsepower hot water pumps to distribute heating water to the fan coil units and make-up air units on the roof. The existing pumps operate at constant flow and ride the pump curve only.

This ECM includes the installation of Variable Frequency Drives on the four (4) 20 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 also includes replacement of the existing pump motors with inverter duty motors that meet NEMA Premium Efficiency Standard, which also helps to reduce energy consumption.

**Energy Savings Calculations:**

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

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

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

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

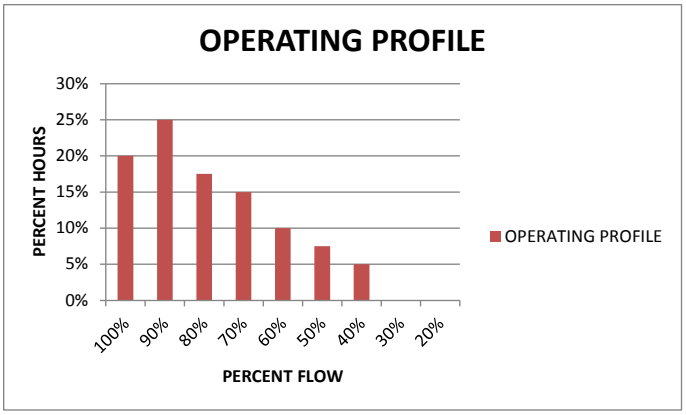
Affinity Laws are used in order to calculate energy savings by calculating the reduced power consumption requirement based a reduction in flow. Affinity laws, are as following:

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** | 20.0 | 20.0 | |
| **Flow* (GPM)** | 330 | 330 | - |
| **Head* (Ft)** | 125 | 125 | - |
| **Pump Efficiency (%)** | 75.0% | 75.0% | - |
| **Motor Efficiency (%)** | 89.5% | 91.5% | 2.0% |
| **Operating Hrs** | 4500 | 4500 | - |
| **Estimated Power (HP)** | 15.5 | 15.2 | 0.34 |
| **Elec Cost ($/kWh)** | 0.142 | 0.142 | - |
| **ENERGY SAVINGS CALCULATIONS** | | | |
| **ECM RESULTS** | **EXISTING** | **PROPOSED** | **SAVINGS** |
| **Electric Energy (kWh)** | 58,207 | 40,906 | 17,301 |
| **Electric Energy Cost ($)** | $8,265 | $5,809 | $2,457 |
| **COMMENTS:** | Estimated Flow and Head Pressure, Savings for One Pump, assumed two operate. | | |

Estimated Operating Profile with VFD



**Energy Savings Summary:**

| ECM #3 - ENERGY SAVINGS SUMMARY | |
|---|---|
| **Installation Cost ($):** | $60,000 |
| **NJ Smart Start Equipment Incentive ($):** | $0 |
| **Net Installation Cost ($):** | $60,000 |
| **Maintenance Savings ($/Yr):** | $0 |
| **Energy Savings ($/Yr):** | $4,913 |
| **Total Yearly Savings ($/Yr):** | $4,913 |
| **Estimated ECM Lifetime (Yr):** | 15 |
| **Simple Payback** | 12.2 |
| **Simple Lifetime ROI** | 22.8% |
| **Simple Lifetime Maintenance Savings** | $0 |
| **Simple Lifetime Savings** | $73,695 |
| **Internal Rate of Return (IRR)** | 3% |
| **Net Present Value (NPV)** | ($1,348.92) |

## ECM #4: Install VFD on Chilled Water Pumps

**Description:**

The chilled water pumps for Overlook North and South currently operate as a constant flow system. The existing system feeds two air handlers located on the tower roofs and 2-pipe fan coils in the dorm rooms. The fan-coils and air handlers are fitted with 2-way controls valves.

This ECM includes the installation of Variable Frequency Drives on the two (2) 25 horsepower existing chilled water pumps. 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 with inverter duty motors that meet NEMA Premium Efficiency Standard, which also helps to reduce energy consumption.

**Energy Savings Calculations:**

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

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

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

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

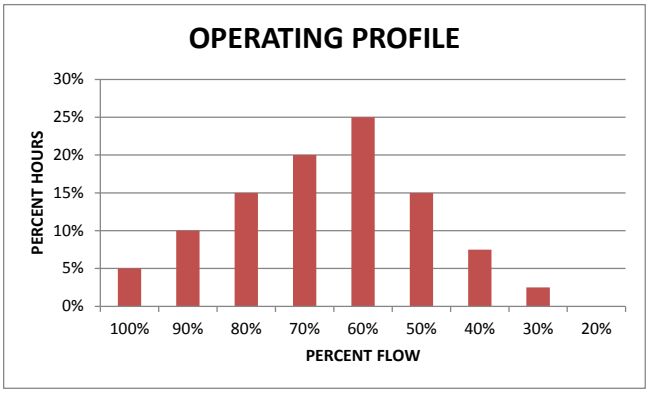
Affinity Laws are used in order to calculate energy savings by calculating the reduced power consumption requirement based a reduction in flow. Affinity laws, are as following:

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

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

| CHILLER PUMPS VFD CALULATION | | | |
|---|---|---|---|
| **ECM INPUTS** | **EXISTING** | **PROPOSED** | **SAVINGS** |
| **ECM INPUTS** | CV Pumps | VFD Pumps | |
| **Flow Control** | Throttle | VFD | - |
| **Motor Nameplate HP** | 25.0 | 25.0 | |
| **Flow* (GPM)** | 827 | 827 | - |
| **Head* (Ft)** | 75 | 75 | - |
| **Pump Efficiency (%)** | 75.0% | 75.0% | - |
| **Motor Efficiency (%)** | 91.0% | 91.0% | 0.0% |
| **Operating Hrs** | 2928 | 2928 | - |
| **Estimated Power (HP)** | 22.9 | 22.9 | 0.00 |
| **Elec Cost ($/kWh)** | 0.142 | 0.142 | - |
| **ENERGY SAVINGS CALCULATIONS** | | | |
| **ECM RESULTS** | **EXISTING** | **PROPOSED** | **SAVINGS** |
| **Electric Energy (kWh)** | 55,086 | 20,794 | 34,291 |
| **Electric Energy Cost ($)** | $7,822 | $2,953 | $4,869 |
| **COMMENTS:** | Savings for 1 Pump, it is assummed two operate. | | |

Estimated Operating Profile with VFD



**Energy Savings Summary:**

| ECM #4 - ENERGY SAVINGS SUMMARY | |
|---|---|
| **Installation Cost ($):** | $50,000 |
| **NJ Smart Start Equipment Incentive ($):** | $3,000 |
| **Net Installation Cost ($):** | $47,000 |
| **Maintenance Savings ($/Yr):** | $0 |
| **Energy Savings ($/Yr):** | $9,739 |
| **Total Yearly Savings ($/Yr):** | $9,739 |
| **Estimated ECM Lifetime (Yr):** | 15 |
| **Simple Payback** | 4.8 |
| **Simple Lifetime ROI** | 210.8% |
| **Simple Lifetime Maintenance Savings** | $0 |
| **Simple Lifetime Savings** | $146,085 |
| **Internal Rate of Return (IRR)** | 19% |
| **Net Present Value (NPV)** | $69,263.55 |

## ECM #5: Install VFD on Cooling Tower Fan

**Description:**

The Cooling Tower for the North and South Tower Chiller is an older BAC Tower with constant volume fans. The tower is a two cell which allows for a reduced flow setting by shutting off one of the cells. The installation of a VFD will allow the tower fan to modulate based on the required amount airflow needed to maintain the necessary condenser water temperature for the chiller.

This ECM includes the installation of a variable frequency drive and inverter duty premium efficiency motor on each tower fan along with the required tower controls to modulate the fan speed. It should be noted that the tower is past its useful life and while retrofitting the tower is more cost effective then replacing the entire tower, the University should consider replacement of the tower as an alternative option. A new tower should greatly reduce make up water consumption and improve chiller performance.

**Energy Savings Calculations:**

Load Factor = 75% (without VFD)

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

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

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

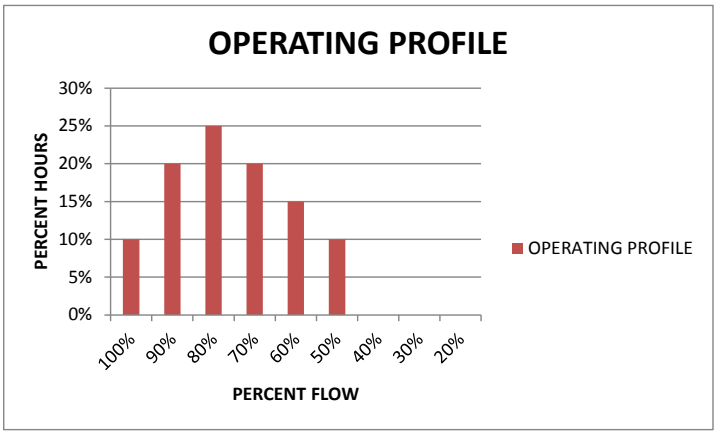
Affinity Laws are used in order to calculate energy savings by calculating the reduced power consumption requirement based a reduction in flow. Affinity laws, are as following:

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

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

| COOLING TOWER FAN VFD CALULATION | | | |
|---|---|---|---|
| **ECM INPUTS** | **EXISTING** | **PROPOSED** | **SAVINGS** |
| **ECM INPUTS** | Constant Fan | VFD Fan | |
| **Control** | On/Off | VFD | - |
| **Quantiy of Fans** | 2 | 2 | |
| **Motor Nameplate HP** | 15.0 | 15.0 | - |
| **Motor Efficiency (%)** | 89.5% | 92.4% | 2.9% |
| **Operating Hrs** | 3672 | 3672 | - |
| **Load Factor** | 75.0% | 75.0% | |
| **Elec Cost ($/kWh)** | 0.142 | 0.142 | - |
| **ENERGY SAVINGS CALCULATIONS** | | | |
| **ECM RESULTS** | **EXISTING** | **PROPOSED** | **SAVINGS** |
| **Electric Energy (kWh)** | 91,821 | 43,340 | 48,481 |
| **Electric Energy Cost ($)** | $13,039 | $6,154 | $6,884 |
| **COMMENTS:** | | | |

Estimated Operating Profile with VFD



**Energy Savings Summary:**

| ECM #5 - ENERGY SAVINGS SUMMARY | |
|---|---|
| **Installation Cost ($):** | $24,600 |
| **NJ Smart Start Equipment Incentive ($):** | $1,800 |
| **Net Installation Cost ($):** | $22,800 |
| **Maintenance Savings ($/Yr):** | $0 |
| **Energy Savings ($/Yr):** | $6,884 |
| **Total Yearly Savings ($/Yr):** | $6,884 |
| **Estimated ECM Lifetime (Yr):** | 15 |
| **Simple Payback** | 3.3 |
| **Simple Lifetime ROI** | 352.9% |
| **Simple Lifetime Maintenance Savings** | $0 |
| **Simple Lifetime Savings** | $103,260 |
| **Internal Rate of Return (IRR)** | 30% |
| **Net Present Value (NPV)** | $59,380.75 |

## ECM #6: Intelligent Thermostats

**Description:**

The fan coils in the dorm rooms currently have very limited control capability allowing for cool/heat with no real specific temperature set point or setback capability. The installation of INNCOM intelligent thermostats with occupancy controls could significantly reduce the heating, cooling, and fan power due to increase setback time and improved temperature control. The system will automatically detect whether or not an occupant is in the room resulting in the determination of an occupied or unoccupied temperature setting.

This ECM would install a battery powered wall mounted INNCOM thermostat standalone system with door switch and sensor eye to control the existing dorm room fan coil unit. The University should also consider installing a window switch sensor on rooms with operable windows to ensure the thermostat shuts the heating/chilled water valve if the window is open.

**Energy Savings Calculations:**

Savings calculations are based on Degree Days and existing heating and cooling system information. See **Appendix Intelligent Thermostat Analysis** for detailed calculations.

**Energy Savings Summary:**

| ECM #6 - ENERGY SAVINGS SUMMARY | |
|---|---|
| **Installation Cost ($):** | $348,000 |
| **NJ Smart Start Equipment Incentive ($):** | $0 |
| **Net Installation Cost ($):** | $348,000 |
| **Maintenance Savings ($/Yr):** | $0 |
| **Energy Savings ($/Yr):** | $35,916 |
| **Total Yearly Savings ($/Yr):** | $35,916 |
| **Estimated ECM Lifetime (Yr):** | 15 |
| **Simple Payback** | 9.7 |
| **Simple Lifetime ROI** | 54.8% |
| **Simple Lifetime Maintenance Savings** | 0 |
| **Simple Lifetime Savings** | $538,740 |
| **Internal Rate of Return (IRR)** | 6% |
| **Net Present Value (NPV)** | $80,762.88 |

## ECM #7: Energy Recovery Unit Retrofit

**Description:**

The Overlook North and South Tower currently have two rooftop units that serve as dedicated outside air units for the dorm rooms. These units are rated at approximately 15,000 CFM each and have chilled and hot water coils to condition the air. The installation of air to air energy recovery wheels will greatly reduce the cost to condition fresh air.

This ECM includes replacement of the existing rooftop units with new Energy Recovery Rooftop Units with recovery wheels. The existing roof exhaust fans will be removed and the exhaust air will ducted across the roof to the new ERU.

It is recommended to perform airflow measurements of the existing equipment to verify the O.A. quantities prior to implementation of this ECM. It is also recommended to have a professional engineer provide further review of the equipment selection and load analysis prior to implementing this ECM. The energy savings calculations are based on the follow input data:

| | |
|---|---|
| AHU Nominal Outside Airflow (CFM) | 30,000 |
| Energy Recovery Efficiency | 65% |

**Energy Savings Calculations:**

Heating Energy Savings:

Total heating capacity is calculated with the equation below.

$$\text{Heating Load}, \frac{\text{BTU}}{\text{Hr}} = 1.08 \times \text{Airflow (CFM)} \times \text{O.A.\%} \times (\text{Indoor °F} - \text{Outdoor °F})$$

$$\text{Occ Ventilation Heating Energy} = \frac{\text{Occ Heating Load}}{\Delta\text{T} \times \text{Eff} \times \text{V}} (\text{Occ. HDD}_{68°\text{F}} \times \text{NonSetback Hrs}) \times (1 - \text{Energy Rec. Eff.\%})$$

$$\text{Unocc Ventilation Heating Energy} = \frac{\text{Unocc Heating Load}}{\Delta\text{T} \times \text{Eff} \times \text{V}} (\text{Unocc. HDD}_{60°\text{F}} \times \text{Setback Hrs}) \times (1 - \text{Energy Rec. Eff.\%})$$

Where:

HDD = number of Heating Degree Days as Specified Base Temperature
ΔT= Design temperature difference, º F
Eff = Efficiency of Energy Utilization
V = Heating value of fuel

$$\text{Heating Cost Savings} = \text{Energy Savings (Therms)} \times \text{Cost of Gas}\left(\frac{\$}{\text{Therm}}\right)$$

Energy savings calculations are summarized in the table below.

| ENERGY RECOVERY HEATING ENERGY CALCULATIONS | | | |
|---|---|---|---|
| **ECM INPUTS** | **EXISTING** | **PROPOSED** | **SAVINGS** |
| **ECM INPUTS** | No O.A. Preconditioning | Total O.A. Energy Recovery Wheel | |
| **Total AHU Airflow (CFM)** | 30,000 | 30,000 | |
| **Occ. O.A. Percentage (%)** | 100.0% | 100.0% | |
| **Unocc. O.A. Percentage (%)** | 0% | 0% | |
| **Occ. Temp Diff (°F)** | 55 | 55 | |
| **Unocc. Temp Diff (°F)** | 65 | 65 | |
| **Heating Degree Days (68°F)** | 4,750 | 4,750 | |
| **Heating Degree Days (60°F)** | 3,704 | 3,704 | |
| **Hours of setback per day (ave)** | 0 | 0 | |
| **Heating System Efficiency (%)** | 85% | 85% | |
| **Heating Fuel Value** | 100,000 | 100,000 | |
| **Energy Recovery Sys Efficiency** | 0% | 65% | 65% |
| **Occ O.A. Heating Load (Btu/Hr)** | 1,782,000 | 623,700 | 1,158,300 |
| **Unocc O.A. Heating Load (Btu/Hr)** | 0 | 0 | |
| **Occ O.A. Heating Energy (Therms)** | 33,885 | 11,860 | 22,025 |
| **Unocc O.A. Heating Energy (Therms)** | 0 | 0 | |
| **Gas Cost ($/Therm)** | $1.11 | $1.11 | |
| **ENERGY SAVINGS CALCULATIONS** | | | |
| **ECM RESULTS** | **EXISTING** | **PROPOSED** | **SAVINGS** |
| **O.A. Heating Energy (Therms)** | 33,885 | 11,860 | 22,025 |
| **Heating Energy Cost ($)** | $37,612 | $13,164 | $24,448 |
| **COMMENTS:** | Degree Days based on Newark, NJ. | | |

Cooling Energy Savings:

Cooling Energy savings are based on the energy required to condition outside air during occupied hours only. The cooling energy required for minimal outside air at unoccupied hours are negligible and therefore not included in this calculation. Enthalpy difference is based on design cooling day (95°F DB, 78°F WB), and average room conditions (75°F, 50% RH).

$$\text{Cooling Load } \frac{\text{BTU}}{\text{Hr}} = 4.5 \times \text{Airflow (CFM)} \times \text{O. A. \%} \times \text{Enthalpy Diff}$$

$$\text{Cooling Energy kWh} = \text{Cooling Capacity, } \frac{\text{BTU}}{\text{Hr}} \times \left(\frac{1}{\text{EER}}\right) \times \frac{\text{Full Load Hrs}}{1000 \frac{\text{W}}{\text{kWh}}} \times (1 - \text{Energy Rec. Eff. \%})$$

$$\text{Cooling Cost Savings} = \text{Energy Savings, kWh} \times \text{Cost of Electricity} \left(\frac{\$}{\text{kWh}}\right)$$

| ENERGY RECOVERY COOLING ENERGY CALCULATIONS | | | |
|---|---|---|---|
| **ECM INPUTS** | **EXISTING** | **PROPOSED** | **SAVINGS** |
| **ECM INPUTS** | No O.A. Preconditioning | Total O.A. Energy Recovery Wheel | |
| **Total AHU Airflow (CFM)** | 30,000 | 30,000 | |
| **Occ. O.A. Percentage (%)** | 100% | 100% | |
| **Occ. Enthalpy Diff (°F)** | 14 | 14 | |
| **Unocc. Enthalpy Diff (°F)** | 0 | 0 | |
| **Full Load Cooling Hrs** | 400 | 400 | |
| **Cooling System Efficiency (EER)** | 15.0 | 15.0 | |
| **Energy Recovery Sys Efficiency** | 0% | 65% | |
| **O.A. Cooling Load (Btu/Hr)** | 1,822,500 | 637,875 | |
| **Elec Cost ($/kWh)** | $0.142 | $0.142 | |
| **ENERGY SAVINGS CALCULATIONS** | | | |
| **ECM RESULTS** | **EXISTING** | **PROPOSED** | **SAVINGS** |
| **O.A. Cooling Energy (kWh)** | 48,600 | 17,010 | 31,590 |
| **Cooling Energy Cost ($)** | $6,901 | $2,415 | $4,486 |
| **COMMENTS:** | | | |

**Energy Savings Summary:**

| ECM #7 - ENERGY SAVINGS SUMMARY | |
|---|---|
| **Installation Cost ($):** | $450,000 |
| **NJ Smart Start Equipment Incentive ($):** | $0 |
| **Net Installation Cost ($):** | $450,000 |
| **Maintenance Savings ($/Yr):** | $0 |
| **Energy Savings ($/Yr):** | $28,934 |
| **Total Yearly Savings ($/Yr):** | $28,934 |
| **Estimated ECM Lifetime (Yr):** | 20 |
| **Simple Payback** | 15.6 |
| **Simple Lifetime ROI** | 28.6% |
| **Simple Lifetime Maintenance Savings** | $0 |
| **Simple Lifetime Savings** | $578,680 |
| **Internal Rate of Return (IRR)** | 3% |
| **Net Present Value (NPV)** | ($19,535.14) |

## ECM #8: Lighting Upgrade

**Description:**

The majority of the interior lighting throughout Overlook North and South is provided with fluorescent fixtures with older generation, 700 series 32W T8 lamps and electronic ballasts. Although 700 series T8 lamps are considered fairly efficient, further energy savings can be achieved by replacing the existing T8 lamps with new generation, 800 series 28W T8 lamps without compromising light output. CEG recommends, re-lamping all of the fixtures with 28W T8 lamps and re-ballasting them with High Efficiency Electronic Ballasts.

This ECM includes re-lamping and re-ballasting of the existing fluorescent fixtures with 800 series, 28W T8 lamps.

**Energy Savings Calculations:**

The **Investment Grade Lighting Audit Appendix** outlines the hours of operation, proposed retrofits, costs, savings, and payback periods for each set of fixtures in the each building.

**Energy Savings Summary:**

| ECM #8 - ENERGY SAVINGS SUMMARY | |
|---|---|
| **Installation Cost ($):** | $51,013 |
| **NJ Smart Start Equipment Incentive ($):** | $5,770 |
| **Net Installation Cost ($):** | $45,243 |
| **Maintenance Savings ($/Yr):** | $0 |
| **Energy Savings ($/Yr):** | $6,344 |
| **Total Yearly Savings ($/Yr):** | $6,344 |
| **Estimated ECM Lifetime (Yr):** | 15 |
| **Simple Payback** | 7.1 |
| **Simple Lifetime ROI** | 110.3% |
| **Simple Lifetime Maintenance Savings** | $0 |
| **Simple Lifetime Savings** | $95,160 |
| **Internal Rate of Return (IRR)** | 11% |
| **Net Present Value (NPV)** | $30,491.26 |

## ECM #9: Lighting Controls

**Description:**

Most if not all of the lighting throughout Overlook North and South is controlled via lights switches. 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 many of the common spaces on each floor that are used intermittently. 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 #9 - ENERGY SAVINGS SUMMARY | |
|---|---|
| **Installation Cost ($):** | $6,500 |
| **NJ Smart Start Equipment Incentive ($):** | $475 |
| **Net Installation Cost ($):** | $6,025 |
| **Maintenance Savings ($/Yr):** | $0 |
| **Energy Savings ($/Yr):** | $1,500 |
| **Total Yearly Savings ($/Yr):** | $1,500 |
| **Estimated ECM Lifetime (Yr):** | 15 |
| **Simple Payback** | 4.0 |
| **Simple Lifetime ROI** | 273.4% |
| **Simple Lifetime Maintenance Savings** | $0 |
| **Simple Lifetime Savings** | $22,500 |
| **Internal Rate of Return (IRR)** | 24% |
| **Net Present Value (NPV)** | $11,881.90 |

## 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. A significant portion of the dormitory load is likely due to plug loads from the students such as microwaves, mini-fridges, lamps, and computers. In order to reduce the effect of these loads we recommend providing students with idle power draw killing power strips to reduce off time power draw, educating students on dormitory energy usage, and regulating appliances by providing them in rooms.

B. Chemically clean the condenser and evaporator coils periodically to optimize efficiency. Poorly maintained heat transfer surfaces can reduce efficiency 5-10%.

C. Maintain all weather stripping on windows and doors.

D. Clean all light fixtures to maximize light output.

E. Provide more frequent air filter changes to decrease overall system power usage and maintain better IAQ.

# APPENDIX A

# ECM COST & SAVINGS BREAKDOWN

CONCORD ENGINEERING GROUP

**WPU - Overlook North and South**

**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 | NEMA Premium Efficiency Motor | $37,636 | $35,910 | $1,830 | $71,716 | $8,263 | $0 | $8,263 | 18 | $148,734 | $0 | 107.4% | 8.7 | 9.13% | $41,929.28 |
| ECM #2 | Vending Miser Controls | $600 | $0 | $0 | $600 | $458 | $0 | $458 | 10 | $4,578 | $0 | 662.9% | 1.3 | 76.03% | $3,304.79 |
| ECM #3 | VFD HW Pumps | $35,000 | $25,000 | $0 | $60,000 | $4,913 | $0 | $4,913 | 15 | $73,695 | $0 | 22.8% | 12.2 | 2.69% | ($1,348.92) |
| ECM #4 | VFD CHW Pumps | $30,000 | $20,000 | $3,000 | $47,000 | $9,739 | $0 | $9,739 | 15 | $146,085 | $0 | 210.8% | 4.8 | 19.24% | $69,263.55 |
| ECM #5 | Cooling Tower VFD | $16,000 | $8,600 | $1,800 | $22,800 | $6,884 | $0 | $6,884 | 15 | $103,260 | $0 | 352.9% | 3.3 | 29.57% | $59,380.75 |
| ECM #6 | Intelligent Thermostats | $192,000 | $156,000 | $0 | $348,000 | $35,916 | $0 | $35,916 | 15 | $538,740 | $0 | 54.8% | 9.7 | 6.04% | $80,762.88 |
| ECM #7 | Energy Recovery Units | $200,000 | $250,000 | $0 | $450,000 | $28,934 | $0 | $28,934 | 20 | $578,680 | $0 | 28.6% | 15.6 | 2.52% | ($19,535.14) |
| ECM #8 | Lighting Upgrade | $19,563 | $31,450 | $5,770 | $45,243 | $6,344 | $0 | $6,344 | 15 | $95,160 | $0 | 110.3% | 7.1 | 11.15% | $30,491.26 |
| ECM #9 | Lighting Controls | $5,100 | $1,400 | $475 | $6,025 | $1,500 | $0 | $1,500 | 15 | $22,500 | $0 | 273.4% | 4.0 | 23.90% | $11,881.90 |

**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<br>$600 per ton, EER ≥ 18<br>$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<br>Existing Facility < 75 kw<br>Existing Facility > 75 kw | <br>$20 per fixture<br>$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<br>$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<br>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
# Overlook North & South

**Building ID:** 3254905
**For 12-month Period Ending:** April 30, 2012[1]
**Date SEP becomes ineligible:** N/A
**Date SEP Generated:** September 18, 2012

**Facility**
Overlook North & South
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:** 1982
**Gross Floor Area (ft²):** 151,415

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

**Site Energy Use Summary**[3]

| | |
|---|---|
| Electricity - Grid Purchase(kBtu) | 6,148,424 |
| Natural Gas (kBtu)[4] | 8,739,355 |
| Total Energy (kBtu) | 14,887,779 |

**Energy Intensity**[4]

| | |
|---|---|
| Site (kBtu/ft²/yr) | 98 |
| Source (kBtu/ft²/yr) | 196 |

**Emissions** (based on site energy use)

| | |
|---|---|
| Greenhouse Gas Emissions ($MtCO_2e$/year) | 1,336 |

**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 | -20% |
| 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** | Overlook North & South | 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. | | ☐ |
| Overlook North & South (Other) | | | | |
| **CRITERION** | **VALUE AS ENTERED IN PORTFOLIO MANAGER** | **VERIFICATION QUESTIONS** | **NOTES** | ☑ |
| **Gross Floor Area** | 151,415 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 #4200182203 (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 | 154,800.00 |
| 03/01/2012 | 03/31/2012 | 160,400.00 |
| 02/01/2012 | 02/29/2012 | 178,400.00 |
| 01/01/2012 | 01/31/2012 | 136,400.00 |
| 12/01/2011 | 12/31/2011 | 185,600.00 |
| 11/01/2011 | 11/30/2011 | 169,600.00 |
| 10/01/2011 | 10/31/2011 | 182,800.00 |
| 09/01/2011 | 09/30/2011 | 238,400.00 |
| 08/01/2011 | 08/31/2011 | 68,800.00 |
| 07/01/2011 | 07/31/2011 | 66,400.00 |
| 06/01/2011 | 06/30/2011 | 82,800.00 |
| 05/01/2011 | 05/31/2011 | 177,600.00 |
| **Electric #4200182203 Consumption (kWh (thousand Watt-hours))** | | **1,802,000.00** |
| **Electric #4200182203 Consumption (kBtu (thousand Btu))** | | **6,148,424.00** |
| **Total Electricity (Grid Purchase) Consumption (kBtu (thousand Btu))** | | **6,148,424.00** |
| **Is this the total Electricity (Grid Purchase) consumption at this building including all Electricity meters?** | | ☐ |

**Fuel Type: Natural Gas**

**Meter: Gas #4200182203 (therms)**
**Space(s):** Entire Facility

| Start Date | End Date | Energy Use (therms) |
|---|---|---|
| 04/01/2012 | 04/30/2012 | 8,496.06 |
| 03/01/2012 | 03/31/2012 | 12,427.23 |
| 02/01/2012 | 02/29/2012 | 15,733.52 |
| 01/01/2012 | 01/31/2012 | 15,796.26 |
| 12/01/2011 | 12/31/2011 | 13,141.05 |
| 11/01/2011 | 11/30/2011 | 10,295.19 |
| 10/01/2011 | 10/31/2011 | 3,219.16 |
| 09/01/2011 | 09/30/2011 | 1,780.12 |
| 08/01/2011 | 08/31/2011 | 719.82 |
| 07/01/2011 | 07/31/2011 | 728.54 |

| | | |
|---|---|---|
| 06/01/2011 | 06/30/2011 | 948.52 |
| 05/01/2011 | 05/31/2011 | 4,108.08 |
| **Gas #4200182203 Consumption (therms)** | | **87,393.55** |
| **Gas #4200182203 Consumption (kBtu (thousand Btu))** | | **8,739,355.00** |
| **Total Natural Gas Consumption (kBtu (thousand Btu))** | | **8,739,355.00** |
| **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**
Overlook North & South
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

| Overlook North & South | |
|---|---|
| Gross Floor Area Excluding Parking: ($ft^2$) | 151,415 |
| Year Built | 1982 |
| For 12-month Evaluation Period Ending Date: | April 30, 2012 |

## Facility Space Use Summary

| Overlook North & South | |
|---|---|
| Space Type | Other - College/University (Campus-Level) |
| Gross Floor Area ($ft^2$) | 151,415 |
| 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 ($kBtu/ft^2$)* | 98 | 98 | 0 | N/A | 104 |
| *Source ($kBtu/ft^2$)* | 196 | 196 | 0 | N/A | 244 |
| Energy Cost | | | | | |
| *$/year* | $ 353,166.32 | $ 353,166.32 | N/A | N/A | $ 373,568.93 |
| *$/$ft^2$/year* | $ 2.33 | $ 2.33 | N/A | N/A | $ 2.46 |
| Greenhouse Gas Emissions | | | | | |
| $MtCO_2e$/year | 1,336 | 1,336 | 0 | N/A | 1,413 |
| $kgCO_2e/ft^2$/year | 9 | 9 | 0 | N/A | 10 |

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 20% less 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

### Overlook North & South

## AHUs

| Tag | AHU-1 | AHU-2 | |
|---|---|---|---|
| **Unit Type** | Modular / Custom Style AHU | Modular / Custom Style AHU | |
| **Qty** | 1 | 1 | |
| **Location** | Overlook North Roof | Overlook South Roof | |
| **Area Served** | Dormitories | Dormitories | |
| **Manufacturer** | - | - | |
| **Model #** | - | - | |
| **Serial #** | - | - | |
| **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** | 30 | 30 | |
| **ASHRAE Service Life** | 15 | 15 | |
| **Remaining Life** | (15) | (15) | |
| **Comments** | OA Unit | OA Unit | |

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

# MAJOR EQUIPMENT LIST

## Concord Engineering Group

### Overlook North & South

## Boilers

| Tag | B-1- to 6 | | |
|---|---|---|---|
| Unit Type | Gas Fired Hot Water Boiler | | |
| Qty | 6 | | |
| Location | Level 1 MER | | |
| Area Served | HWR Loop | | |
| Manufacturer | Aerco | | |
| Model # | BMK 2.0 | | |
| Serial # | G-05-0455/56/57/58/59/60 | | |
| Input Capacity (Btu/Hr) | 2,000,000 | | |
| Rated Output Capacity (Btu/Hr) | 1,706,000 | | |
| Approx. Efficiency % | 85.3% | | |
| Fuel | Natural Gas | | |
| Approx Age | 7 | | |
| ASHRAE Service Life | 24 | | |
| Remaining Life | 17 | | |
| Comments | Provide DHW too | | |

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

# MAJOR EQUIPMENT LIST

## Concord Engineering Group

### Overlook North & South

## Chiller

| Tag | CH-1 | CH-2 | |
|---|---|---|---|
| **Unit Type** | Centrifugal | Centrifugal | |
| **Qty** | 1 | 1 | |
| **Location** | Level 1 MER | Level 1 MER | |
| **Area Served** | CHW Loop | CHW Loop | |
| **Manufacturer** | Carrier | York | |
| **Model #** | 19XRV3637265BHH64 | HTC3C1-BBB | |
| **Serial #** | 18550 | - | |
| **Refrigerant** | R-134A | 11 | |
| **Cooling Capacity (Tons)** | 350 | - | |
| **Cooling Efficiency (KW/Ton)** | 0.5 KW/TON | - | |
| **Volts / Phase / Hz** | 460/3/60 | 460/3/60 | |
| **Fuel** | Electrical | - | |
| **Chilled Water GPM / ΔT** | CHW IN 41.8 F, CHW OUT 39.4 F | - | |
| **Condenser Water GPM / ΔT** | CDW IN 67.4 F, CDW OUT 69.1 F | - | |
| **Approx Age** | 2 | 30 | |
| **ASHRAE Service Life** | 20 | 20 | |
| **Remaining Life** | 18 | (10) | |
| **Comments** | COMPRESSOR MODEL H, O2XR-265BHH64, S/N 16550 | Abandoned in Place No Longer in Use | |

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

# MAJOR EQUIPMENT LIST

## Concord Engineering Group

### Overlook North & South

## Cooling Tower

| Tag | CT-1 & 2 | | |
|---|---|---|---|
| **Unit Type** | Cell Units | | |
| **Qty** | 2 | | |
| **Location** | Pavillon Roof | | |
| **Area Served** | CHW System | | |
| **Manufacturer** | BAC | | |
| **Model #** | 1-33269-2 | | |
| **Serial #** | 97422371 | | |
| **Rated Flow GPM** | 530 | | |
| **EWT / LWT** | 85/75 | | |
| **Motor HP** | 15 | | |
| **Electrical** | 460/3/60 | | |
| **Approx Age** | 30 | | |
| **ASHRAE Service Life** | 20 | | |
| **Remaining Life** | (10) | | |
| **Comments** | | | |

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

# MAJOR EQUIPMENT LIST

## Concord Engineering Group

### Overlook North & South

## Pumps

| Tag | P-1 to 3 | P-4 & 5 | P-6 |
|---|---|---|---|
| **Unit Type** | Base Mtd. End Suction | Base Mtd. End Suction | Base Mtd. End Suction |
| **Qty** | 3 | 2 | 1 |
| **Location** | Level 1 MER | Level 1 MER | Level 1 MER |
| **Area Served** | Primary Chilled Water | Condenser Water | South Wing |
| **Manufacturer** | Weinmans | Weinmans | Weinmans |
| **Model #** | - | 4L2 | - |
| **Serial #** | - | - | - |
| **Horse Power** | 25 | 20 | 20 |
| **Flow** | 827 | 530 | - |
| **Motor Info** | Dayton M 3N664 | - | - |
| **Electrical Power** | 460/3/60 | 460/3/60 | 460/3/60 |
| **RPM** | 1750 | 1750 | 1750 |
| **Motor Efficiency %** | - | - | - |
| **Approx Age** | 30 | 30 | 30 |
| **ASHRAE Service Life** | 20 | 20 | 20 |
| **Remaining Life** | (10) | (10) | (10) |
| **Comments** | Constant Flow, P3 is dual purpose backup | Constant Flow | Constant Flow |

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

## Pumps

| Tag | P-7 | P-8 | P-9 |
|---|---|---|---|
| **Unit Type** | Base Mtd. End Suction | Base Mtd. End Suction | Base Mtd. End Suction |
| **Qty** | 1 | 1 | 1 |
| **Location** | Level 1 MER | Level 1 MER | Level 1 MER |
| **Area Served** | South Wing | Central PAV | North Wing |
| **Manufacturer** | Weinmans | Weinmans | Weinmans |
| **Model #** | - | - | - |
| **Serial #** | - | - | - |
| **Horse Power** | 20 | 20 | 20 |
| **Flow** | - | - | - |
| **Motor Info** | - | - | - |
| **Electrical Power** | 460/3/60 | 460/3/60 | 460/3/60 |
| **RPM** | 1750 | 1746 | 1745 |
| **Motor Efficiency %** | - | - | - |
| **Approx Age** | 30 | 30 | 30 |
| **ASHRAE Service Life** | 20 | 20 | 20 |
| **Remaining Life** | (10) | (10) | (10) |
| **Comments** | Constant Flow | Constant Flow | Constant Flow |

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

# Pumps

| Tag | P-10 | P-11 | |
|---|---|---|---|
| **Unit Type** | Base Mtd. End Suction | Base Mtd. End Suction | |
| **Qty** | 1 | 1 | |
| **Location** | Level 1 MER | Level 1 MER | |
| **Area Served** | North Wing | Stand By for P_6 to P-10 | |
| **Manufacturer** | Weinmans | Weinmans | |
| **Model #** | - | - | |
| **Serial #** | - | - | |
| **Horse Power** | 20 | 25 | |
| **Flow** | - | - | |
| **Motor Info** | - | - | |
| **Electrical Power** | 460/3/60 | 460/3/60 | |
| **RPM** | 1750 | 1780 | |
| **Motor Efficiency %** | - | 93.6% | |
| **Approx Age** | 30 | 30 | |
| **ASHRAE Service Life** | 20 | 20 | |
| **Remaining Life** | (10) | (10) | |
| **Comments** | Constant Flow | Constant Flow | |

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

# MAJOR EQUIPMENT LIST

## Concord Engineering Group

### Overlook North & South

## Domestic Water Heaters

| Tag | HX-1 & 2 | | |
|---|---|---|---|
| **Unit Type** | Heat Exchangers | | |
| **Qty** | 2 | | |
| **Location** | Level 1 MER | | |
| **Area Served** | Domestic Hot Water | | |
| **Manufacturer** | Old Dominion fabricators | | |
| **Model #** | - | | |
| **Serial #** | P5993-U-1 | | |
| **Size (Gallons)** | - | | |
| **Input Capacity (MBH/KW)** | - | | |
| **Recovery (Gal/Hr)** | - | | |
| **Efficiency %** | N/A | | |
| **Fuel** | N/A | | |
| **Approx Age** | 30 | | |
| **ASHRAE Service Life** | 12 | | |
| **Remaining Life** | (18) | | |
| **Comments** | Domestic Demand Satisified by main boilers | | |

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

# APPENDIX E

**CEG Project #:** 9C12007
**Facility Name:** Overlook Facility North
**Address:** Mills Drive
**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, $ |
| 227.21 | Floor F - Corridor | 6200 | 2x2, 2Lamp, 32W, 700 Series, T8, Elect. Ballast, Recessed Mnt., Prismatic Lens | 2 | 65 | 3 | 0.20 | 1,209 | Reballast and Relamp | HE Electronic Ballast & Sylvania Lamp FBO30/841XP/6//SS/ECO | 2 | 49 | 3 | 0.15 | 911 | 0.05 | 298 | $42 | $105.00 | $150.00 | $255.00 | $0.00 | 6.03 | 0 | No New Controls | 0 | 0.0% | 0 | $0 |
| 222.21 | Corridor | 6200 | 2x4, 2Lamp, 32W, 700 Series, T8, elect. Ballast, Recessed Mnt., prismatic Lens | 2 | 62 | 22 | 1.36 | 8,457 | Reballast and Relamp | HE Electronic Ballast & Sylvania Lamp FO28/841/SS/ECO | 2 | 50 | 22 | 1.10 | 6,820 | 0.26 | 1,637 | $232 | $550.00 | $1,100.00 | $1,650.00 | $220.00 | 6.15 | 0 | No New Controls | 0 | 0.0% | 0 | $0 |
| 221.11 | Lounge | 6200 | 1x4, 2 Lamp, 32W, 700 Series, T8, Elect.Ballast, Surface mnt., Prismatic Lens | 2 | 62 | 6 | 0.37 | 2,306 | Reballast and Relamp | HE Electronic Ballast & Sylvania Lamp FO28/841/SS/ECO | 2 | 50 | 6 | 0.30 | 1,860 | 0.07 | 446 | $63 | $204.00 | $300.00 | $504.00 | $60.00 | 7.00 | 5 | Dual Technology Occupancy Sensor - Switch Mnt. | 1 | 20.0% | 372 | $53 |
| 221.11 | Common Area | 6200 | 1x4, 2 Lamp, 32W, 700 Series, T8, Elect.Ballast, Surface mnt., Prismatic Lens | 2 | 62 | 10 | 0.62 | 3,844 | Reballast and Relamp | HE Electronic Ballast & Sylvania Lamp FO28/841/SS/ECO | 2 | 50 | 10 | 0.50 | 3,100 | 0.12 | 744 | $106 | $340.00 | $500.00 | $840.00 | $100.00 | 7.00 | 4 | Dual Technology Occupancy Sensor - Remote Mnt. | 1 | 20.0% | 620 | $88 |
| 211.11 | Lounge | 6200 | 1x4, 1Lamp, 32W, 700 Series, T8, elect. Ballast, Surface Mnt., Prismatic Lens | 1 | 33 | 6 | 0.20 | 1,228 | Reballast and Relamp | HE Electronic Ballast & Sylvania Lamp FO28/841/SS/ECO | 1 | 25 | 6 | 0.15 | 930 | 0.05 | 298 | $42 | $162.00 | $300.00 | $462.00 | $60.00 | 9.51 | 5 | Dual Technology Occupancy Sensor - Switch Mnt. | 1 | 20.0% | 186 | $26 |
| 227.21 | Floor E - Corridor | 6200 | 2x2, 2Lamp, 32W, 700 Series, T8, Elect. Ballast, Recessed Mnt., Prismatic Lens | 2 | 65 | 3 | 0.20 | 1,209 | Reballast and Relamp | HE Electronic Ballast & Sylvania Lamp FBO30/841XP/6//SS/ECO | 2 | 49 | 3 | 0.15 | 911 | 0.05 | 298 | $42 | $105.00 | $150.00 | $255.00 | $0.00 | 6.03 | 0 | No New Controls | 0 | 0.0% | 0 | $0 |
| 222.21 | Corridor | 6200 | 2x4, 2Lamp, 32W, 700 Series, T8, elect. Ballast, Recessed Mnt., prismatic Lens | 2 | 62 | 22 | 1.36 | 8,457 | Reballast and Relamp | HE Electronic Ballast & Sylvania Lamp FO28/841/SS/ECO | 2 | 50 | 22 | 1.10 | 6,820 | 0.26 | 1,637 | $232 | $550.00 | $1,100.00 | $1,650.00 | $220.00 | 6.15 | 0 | No New Controls | 0 | 0.0% | 0 | $0 |
| 221.11 | Lounge | 6200 | 1x4, 2 Lamp, 32W, 700 Series, T8, Elect.Ballast, Surface mnt., Prismatic Lens | 2 | 62 | 6 | 0.37 | 2,306 | Reballast and Relamp | HE Electronic Ballast & Sylvania Lamp FO28/841/SS/ECO | 2 | 50 | 6 | 0.30 | 1,860 | 0.07 | 446 | $63 | $204.00 | $300.00 | $504.00 | $60.00 | 7.00 | 5 | Dual Technology Occupancy Sensor - Switch Mnt. | 1 | 20.0% | 372 | $53 |
| 221.11 | Common Area | 6200 | 1x4, 2 Lamp, 32W, 700 Series, T8, Elect.Ballast, Surface mnt., Prismatic Lens | 2 | 62 | 10 | 0.62 | 3,844 | Reballast and Relamp | HE Electronic Ballast & Sylvania Lamp FO28/841/SS/ECO | 2 | 50 | 10 | 0.50 | 3,100 | 0.12 | 744 | $106 | $340.00 | $500.00 | $840.00 | $100.00 | 7.00 | 4 | Dual Technology Occupancy Sensor - Remote Mnt. | 1 | 20.0% | 620 | $88 |
| 211.11 | Lounge | 6200 | 1x4, 1Lamp, 32W, 700 Series, T8, elect. Ballast, Surface Mnt., Prismatic Lens | 1 | 33 | 6 | 0.20 | 1,228 | Reballast and Relamp | HE Electronic Ballast & Sylvania Lamp FO28/841/SS/ECO | 1 | 25 | 6 | 0.15 | 930 | 0.05 | 298 | $42 | $162.00 | $300.00 | $462.00 | $60.00 | 9.51 | 5 | Dual Technology Occupancy Sensor - Switch Mnt. | 1 | 20.0% | 186 | $26 |
| 227.21 | Floor D - Corridor | 6200 | 2x2, 2Lamp, 32W, 700 Series, T8, Elect. Ballast, Recessed Mnt., Prismatic Lens | 2 | 65 | 3 | 0.20 | 1,209 | Reballast and Relamp | HE Electronic Ballast & Sylvania Lamp FBO30/841XP/6//SS/ECO | 2 | 49 | 3 | 0.15 | 911 | 0.05 | 298 | $42 | $105.00 | $150.00 | $255.00 | $0.00 | 6.03 | 0 | No New Controls | 0 | 0.0% | 0 | $0 |
| 222.21 | Corridor | 6200 | 2x4, 2Lamp, 32W, 700 Series, T8, elect. Ballast, Recessed Mnt., prismatic Lens | 2 | 62 | 22 | 1.36 | 8,457 | Reballast and Relamp | HE Electronic Ballast & Sylvania Lamp FO28/841/SS/ECO | 2 | 50 | 22 | 1.10 | 6,820 | 0.26 | 1,637 | $232 | $550.00 | $1,100.00 | $1,650.00 | $220.00 | 6.15 | 0 | No New Controls | 0 | 0.0% | 0 | $0 |
| 221.11 | Lounge | 6200 | 1x4, 2 Lamp, 32W, 700 Series, T8, Elect.Ballast, Surface mnt., Prismatic Lens | 2 | 62 | 6 | 0.37 | 2,306 | Reballast and Relamp | HE Electronic Ballast & Sylvania Lamp FO28/841/SS/ECO | 2 | 50 | 6 | 0.30 | 1,860 | 0.07 | 446 | $63 | $204.00 | $300.00 | $504.00 | $60.00 | 7.00 | 5 | Dual Technology Occupancy Sensor - Switch Mnt. | 1 | 20.0% | 372 | $53 |
| 221.11 | Office | 2500 | 1x4, 2 Lamp, 32W, 700 Series, T8, Elect.Ballast, Surface mnt., Prismatic Lens | 2 | 62 | 16 | 0.99 | 2,480 | Reballast and Relamp | HE Electronic Ballast & Sylvania Lamp FO28/841/SS/ECO | 2 | 50 | 16 | 0.80 | 2,000 | 0.19 | 480 | $68 | $544.00 | $800.00 | $1,344.00 | $160.00 | 17.37 | 4 | Dual Technology Occupancy Sensor - Remote Mnt. | 1 | 20.0% | 400 | $57 |
| 211.11 | Lounge | 6200 | 1x4, 1Lamp, 32W, 700 Series, T8, elect. Ballast, Surface Mnt., Prismatic Lens | 1 | 33 | 6 | 0.20 | 1,228 | Reballast and Relamp | HE Electronic Ballast & Sylvania Lamp FO28/841/SS/ECO | 1 | 25 | 6 | 0.15 | 930 | 0.05 | 298 | $42 | $162.00 | $300.00 | $462.00 | $60.00 | 9.51 | 5 | Dual Technology Occupancy Sensor - Switch Mnt. | 1 | 20.0% | 186 | $26 |
| 227.21 | Floor C - Corridor | 6200 | 2x2, 2Lamp, 32W, 700 Series, T8, Elect. Ballast, Recessed Mnt., Prismatic Lens | 2 | 65 | 3 | 0.20 | 1,209 | Reballast and Relamp | HE Electronic Ballast & Sylvania Lamp FBO30/841XP/6//SS/ECO | 2 | 49 | 3 | 0.15 | 911 | 0.05 | 298 | $42 | $105.00 | $150.00 | $255.00 | $0.00 | 6.03 | 0 | No New Controls | 0 | 0.0% | 0 | $0 |
| 222.21 | Corridor | 6200 | 2x4, 2Lamp, 32W, 700 Series, T8, elect. Ballast, Recessed Mnt., prismatic Lens | 2 | 62 | 22 | 1.36 | 8,457 | Reballast and Relamp | HE Electronic Ballast & Sylvania Lamp FO28/841/SS/ECO | 2 | 50 | 22 | 1.10 | 6,820 | 0.26 | 1,637 | $232 | $550.00 | $1,100.00 | $1,650.00 | $220.00 | 6.15 | 0 | No New Controls | 0 | 0.0% | 0 | $0 |
| 221.11 | Lounge | 6200 | 1x4, 2 Lamp, 32W, 700 Series, T8, Elect.Ballast, Surface mnt., Prismatic Lens | 2 | 62 | 6 | 0.37 | 2,306 | Reballast and Relamp | HE Electronic Ballast & Sylvania Lamp FO28/841/SS/ECO | 2 | 50 | 6 | 0.30 | 1,860 | 0.07 | 446 | $63 | $204.00 | $300.00 | $504.00 | $60.00 | 7.00 | 5 | Dual Technology Occupancy Sensor - Switch Mnt. | 1 | 20.0% | 372 | $53 |
| 221.11 | Common Area | 6200 | 1x4, 2 Lamp, 32W, 700 Series, T8, Elect.Ballast, Surface mnt., Prismatic Lens | 2 | 62 | 10 | 0.62 | 3,844 | Reballast and Relamp | HE Electronic Ballast & Sylvania Lamp FO28/841/SS/ECO | 2 | 50 | 10 | 0.50 | 3,100 | 0.12 | 744 | $106 | $340.00 | $500.00 | $840.00 | $100.00 | 7.00 | 4 | Dual Technology Occupancy Sensor - Remote Mnt. | 1 | 20.0% | 620 | $88 |
| 211.11 | Lounge | 6200 | 1x4, 1Lamp, 32W, 700 Series, T8, elect. Ballast, Surface Mnt., Prismatic Lens | 1 | 33 | 6 | 0.20 | 1,228 | Reballast and Relamp | HE Electronic Ballast & Sylvania Lamp FO28/841/SS/ECO | 1 | 25 | 6 | 0.15 | 930 | 0.05 | 298 | $42 | $162.00 | $300.00 | $462.00 | $60.00 | 9.51 | 5 | Dual Technology Occupancy Sensor - Switch Mnt. | 1 | 20.0% | 186 | $26 |
| 227.21 | Floor B - Corridor | 6200 | 2x2, 2Lamp, 32W, 700 Series, T8, Elect. Ballast, Recessed Mnt., Prismatic Lens | 2 | 65 | 3 | 0.20 | 1,209 | Reballast and Relamp | HE Electronic Ballast & Sylvania Lamp FBO30/841XP/6//SS/ECO | 2 | 49 | 3 | 0.15 | 911 | 0.05 | 298 | $42 | $105.00 | $150.00 | $255.00 | $0.00 | 6.03 | 0 | No New Controls | 0 | 0.0% | 0 | $0 |
| 222.21 | Corridor | 6200 | 2x4, 2Lamp, 32W, 700 Series, T8, elect. Ballast, Recessed Mnt., prismatic Lens | 2 | 62 | 22 | 1.36 | 8,457 | Reballast and Relamp | HE Electronic Ballast & Sylvania Lamp FO28/841/SS/ECO | 2 | 50 | 22 | 1.10 | 6,820 | 0.26 | 1,637 | $232 | $550.00 | $1,100.00 | $1,650.00 | $220.00 | 6.15 | 0 | No New Controls | 0 | 0.0% | 0 | $0 |
| 221.11 | Lounge | 6200 | 1x4, 2 Lamp, 32W, 700 Series, T8, Elect.Ballast, Surface mnt., Prismatic Lens | 2 | 62 | 6 | 0.37 | 2,306 | Reballast and Relamp | HE Electronic Ballast & Sylvania Lamp FO28/841/SS/ECO | 2 | 50 | 6 | 0.30 | 1,860 | 0.07 | 446 | $63 | $204.00 | $300.00 | $504.00 | $60.00 | 7.00 | 5 | Dual Technology Occupancy Sensor - Switch Mnt. | 1 | 20.0% | 372 | $53 |
| 221.11 | Common Area | 6200 | 1x4, 2 Lamp, 32W, 700 Series, T8, Elect.Ballast, Surface mnt., Prismatic Lens | 2 | 62 | 10 | 0.62 | 3,844 | Reballast and Relamp | HE Electronic Ballast & Sylvania Lamp FO28/841/SS/ECO | 2 | 50 | 10 | 0.50 | 3,100 | 0.12 | 744 | $106 | $340.00 | $500.00 | $840.00 | $100.00 | 7.00 | 4 | Dual Technology Occupancy Sensor - Remote Mnt. | 1 | 20.0% | 620 | $88 |
| 211.11 | Lounge | 6200 | 1x4, 1Lamp, 32W, 700 Series, T8, elect. Ballast, Surface Mnt., Prismatic Lens | 1 | 33 | 6 | 0.20 | 1,228 | Reballast and Relamp | HE Electronic Ballast & Sylvania Lamp FO28/841/SS/ECO | 1 | 25 | 6 | 0.15 | 930 | 0.05 | 298 | $42 | $162.00 | $300.00 | $462.00 | $60.00 | 9.51 | 5 | Dual Technology Occupancy Sensor - Switch Mnt. | 1 | 20.0% | 186 | $26 |

| | | | 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, $ |
| 227.21 | Floor A - Corridor | 6200 | 2x2, 2Lamp, 32W, 700 Series, T8, Elect. Ballast, Recessed Mnt., Prismatic Lens | 2 | 65 | 3 | 0.20 | 1,209 | Reballast and Relamp | HE Electronic Ballast & Sylvania Lamp FBO30/841XP/6//SS/ECO | 2 | 49 | 3 | 0.15 | 911 | 0.05 | 298 | $42 | $105.00 | $150.00 | $255.00 | $0.00 | 6.03 | 0 | No New Controls | 0 | 0.0% | 0 | $0 |
| 222.21 | Corridor | 6200 | 2x4, 2Lamp, 32W, 700 Series, T8, elect. Ballast, Recessed Mnt., prismatic Lens | 2 | 62 | 22 | 1.36 | 8,457 | Reballast and Relamp | HE Electronic Ballast & Sylvania Lamp FO28/841/SS/ECO | 2 | 50 | 22 | 1.10 | 6,820 | 0.26 | 1,637 | $232 | $550.00 | $1,100.00 | $1,650.00 | $220.00 | 6.15 | 0 | No New Controls | 0 | 0.0% | 0 | $0 |
| 221.11 | Lounge | 6200 | 1x4, 2 Lamp, 32W, 700 Series, T8, Elect.Ballast, Surface mnt., Prismatic Lens | 2 | 62 | 6 | 0.37 | 2,306 | Reballast and Relamp | HE Electronic Ballast & Sylvania Lamp FO28/841/SS/ECO | 2 | 50 | 6 | 0.30 | 1,860 | 0.07 | 446 | $63 | $204.00 | $300.00 | $504.00 | $60.00 | 7.00 | 5 | Dual Technology Occupancy Sensor - Switch Mnt. | 1 | 20.0% | 372 | $53 |
| 221.11 | Common Area | 6200 | 1x4, 2 Lamp, 32W, 700 Series, T8, Elect.Ballast, Surface mnt., Prismatic Lens | 2 | 62 | 10 | 0.62 | 3,844 | Reballast and Relamp | HE Electronic Ballast & Sylvania Lamp FO28/841/SS/ECO | 2 | 50 | 10 | 0.50 | 3,100 | 0.12 | 744 | $106 | $340.00 | $500.00 | $840.00 | $100.00 | 7.00 | 4 | Dual Technology Occupancy Sensor - Remote Mnt. | 1 | 20.0% | 620 | $88 |
| 211.11 | Lounge | 6200 | 1x4, 1Lamp, 32W, 700 Series, T8, elect. Ballast, Surface Mnt., Prismatic Lens | 1 | 33 | 6 | 0.20 | 1,228 | Reballast and Relamp | HE Electronic Ballast & Sylvania Lamp FO28/841/SS/ECO | 1 | 25 | 6 | 0.15 | 930 | 0.05 | 298 | $42 | $162.00 | $300.00 | $462.00 | $60.00 | 9.51 | 5 | Dual Technology Occupancy Sensor - Switch Mnt. | 1 | 20.0% | 186 | $26 |
| 211.11 | Stairwell (3) | 8760 | 1x4, 1Lamp, 32W, 700 Series, T8, elect. Ballast, Surface Mnt., Prismatic Lens | 1 | 33 | 12 | 0.40 | 3,469 | Reballast and Relamp | HE Electronic Ballast & Sylvania Lamp FO28/841/SS/ECO | 1 | 25 | 12 | 0.30 | 2,628 | 0.10 | 841 | $119 | $324.00 | $600.00 | $924.00 | $120.00 | 6.73 | 0 | No New Controls | 0 | 0.0% | 0 | $0 |
| 211.11 | Compactor Room | 1500 | 1x4, 1Lamp, 32W, 700 Series, T8, elect. Ballast, Surface Mnt., Prismatic Lens | 1 | 33 | 2 | 0.07 | 99 | Reballast and Relamp | HE Electronic Ballast & Sylvania Lamp FO28/841/SS/ECO | 1 | 25 | 2 | 0.05 | 75 | 0.02 | 24 | $3 | $54.00 | $100.00 | $154.00 | $20.00 | 39.32 | 0 | No New Controls | 0 | 0.0% | 0 | $0 |
| 221.21 | Corridor | 6200 | 1x4, 2 Lamp, 32W, 700 Series, T8, Elect.Ballast, Surface mnt., Prismatic Lens | 2 | 62 | 13 | 0.81 | 4,997 | Reballast and Relamp | HE Electronic Ballast & Sylvania Lamp FO28/841/SS/ECO | 2 | 50 | 13 | 0.65 | 4,030 | 0.16 | 967 | $137 | $442.00 | $650.00 | $1,092.00 | $130.00 | 7.00 | 0 | No New Controls | 0 | 0.0% | 0 | $0 |
| 227.21 | Lounge | 6200 | 2x2, 2Lamp, 32W, 700 Series, T8, Elect. Ballast, Recessed Mnt., Prismatic Lens | 2 | 65 | 1 | 0.07 | 403 | Reballast and Relamp | HE Electronic Ballast & Sylvania Lamp FBO30/841XP/6//SS/ECO | 2 | 49 | 1 | 0.05 | 304 | 0.02 | 99 | $14 | $35.00 | $50.00 | $85.00 | $0.00 | 6.03 | 0 | No New Controls | 0 | 0.0% | 0 | $0 |
| 221.11 | Lounge | 6200 | 1x4, 2 Lamp, 32W, 700 Series, T8, Elect.Ballast, Surface mnt., Prismatic Lens | 2 | 62 | 6 | 0.37 | 2,306 | Reballast and Relamp | HE Electronic Ballast & Sylvania Lamp FO28/841/SS/ECO | 2 | 50 | 6 | 0.30 | 1,860 | 0.07 | 446 | $63 | $204.00 | $300.00 | $504.00 | $60.00 | 7.00 | 5 | Dual Technology Occupancy Sensor - Switch Mnt. | 1 | 20.0% | 372 | $53 |
| 227.21 | Lobby | 6200 | 2x2, 2Lamp, 32W, 700 Series, T8, Elect. Ballast, Recessed Mnt., Prismatic Lens | 2 | 65 | 8 | 0.52 | 3,224 | Reballast and Relamp | HE Electronic Ballast & Sylvania Lamp FBO30/841XP/6//SS/ECO | 2 | 49 | 8 | 0.39 | 2,430 | 0.13 | 794 | $113 | $280.00 | $400.00 | $680.00 | $0.00 | 6.03 | 0 | No New Controls | 0 | 0.0% | 0 | $0 |
| | **TOTAL** | | | | | **330** | **19** | **115,397** | | | | | **330** | **15** | **91,956** | 3.87 | 23,442 | $3,329 | $9,709.00 | $16,500.00 | $26,209.00 | $3,030.00 | | | | **19** | **4** | 7,220 | $1,025 |

**CEG Project #:** 9C12007
**Facility Name:** Overlook Facility South
**Address:** Mills Drives
**City, State, Zip** Wanye, 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, $ |
| 221.11 | Floor G - Common Area | 6200 | 1x4, 2 Lamp, 32W, 700 Series, T8, Elect.Ballast, Surface mnt., Prismatic Lens | 2 | 62 | 10 | 0.62 | 3,844 | Reballast and Relamp | HE Electronic Ballast & Sylvania Lamp FO28/841/SS/ECO | 2 | 50 | 10 | 0.50 | 3,100 | 0.12 | 744 | $106 | $340.00 | $500.00 | $840.00 | $100.00 | 7.00 | 0 | No New Controls | 0 | 0.0% | 0 | $0 |
| 221.21 | Corridor | 6200 | 1x4, 2Lamp, 32W, 700 Series, T8, elect. Ballast, Recessed Mnt., prismatic Lens | 2 | 62 | 20 | 1.24 | 7,688 | Reballast and Relamp | HE Electronic Ballast & Sylvania Lamp FO28/841/SS/ECO | 2 | 50 | 20 | 1.00 | 6,200 | 0.24 | 1,488 | $211 | $680.00 | $1,000.00 | $1,680.00 | $200.00 | 7.00 | 0 | No New Controls | 0 | 0.0% | 0 | $0 |
| 227.21 | Corridor | 6200 | 2x2, 2Lamp, 32W, 700 Series, T8, Elect. Ballast, Recessed Mnt., Prismatic Lens | 2 | 65 | 4 | 0.26 | 1,612 | Reballast and Relamp | HE Electronic Ballast & Sylvania Lamp FBO30/841XP/6//SS/ECO | 2 | 49 | 4 | 0.20 | 1,215 | 0.06 | 397 | $56 | $136.00 | $200.00 | $336.00 | $0.00 | 5.96 | 0 | No New Controls | 0 | 0.0% | 0 | $0 |
| 221.11 | Lounge | 6200 | 1x4, 2 Lamp, 32W, 700 Series, T8, Elect.Ballast, Surface mnt., Prismatic Lens | 2 | 62 | 6 | 0.37 | 2,306 | Reballast and Relamp | HE Electronic Ballast & Sylvania Lamp FO28/841/SS/ECO | 2 | 50 | 6 | 0.30 | 1,860 | 0.07 | 446 | $63 | $204.00 | $300.00 | $504.00 | $60.00 | 7.00 | 5 | Dual Technology Occupancy Sensor - Switch Mnt. | 1 | 20.0% | 372 | $53 |
| 221.11 | Lounge | 6200 | 1x4, 2 Lamp, 32W, 700 Series, T8, Elect.Ballast, Surface mnt., Prismatic Lens | 2 | 62 | 6 | 0.37 | 2,306 | Reballast and Relamp | HE Electronic Ballast & Sylvania Lamp FO28/841/SS/ECO | 2 | 50 | 6 | 0.30 | 1,860 | 0.07 | 446 | $63 | $204.00 | $300.00 | $504.00 | $60.00 | 7.00 | 5 | Dual Technology Occupancy Sensor - Switch Mnt. | 1 | 20.0% | 372 | $53 |
| 221.11 | Floor H - Common Area | 6200 | 1x4, 2 Lamp, 32W, 700 Series, T8, Elect.Ballast, Surface mnt., Prismatic Lens | 2 | 62 | 10 | 0.62 | 3,844 | Reballast and Relamp | HE Electronic Ballast & Sylvania Lamp FO28/841/SS/ECO | 2 | 50 | 10 | 0.50 | 3,100 | 0.12 | 744 | $106 | $340.00 | $500.00 | $840.00 | $100.00 | 7.00 | 0 | No New Controls | 0 | 0.0% | 0 | $0 |
| 221.21 | Corridor | 6200 | 1x4, 2Lamp, 32W, 700 Series, T8, elect. Ballast, Recessed Mnt., prismatic Lens | 2 | 62 | 20 | 1.24 | 7,688 | Reballast and Relamp | HE Electronic Ballast & Sylvania Lamp FO28/841/SS/ECO | 2 | 50 | 20 | 1.00 | 6,200 | 0.24 | 1,488 | $211 | $680.00 | $1,000.00 | $1,680.00 | $200.00 | 7.00 | 0 | No New Controls | 0 | 0.0% | 0 | $0 |
| 227.21 | Corridor | 6200 | 2x2, 2Lamp, 32W, 700 Series, T8, Elect. Ballast, Recessed Mnt., Prismatic Lens | 2 | 65 | 4 | 0.26 | 1,612 | Reballast and Relamp | HE Electronic Ballast & Sylvania Lamp FBO30/841XP/6//SS/ECO | 2 | 49 | 4 | 0.20 | 1,215 | 0.06 | 397 | $56 | $136.00 | $200.00 | $336.00 | $0.00 | 5.96 | 0 | No New Controls | 0 | 0.0% | 0 | $0 |
| 221.11 | Lounge | 6200 | 1x4, 2 Lamp, 32W, 700 Series, T8, Elect.Ballast, Surface mnt., Prismatic Lens | 2 | 62 | 6 | 0.37 | 2,306 | Reballast and Relamp | HE Electronic Ballast & Sylvania Lamp FO28/841/SS/ECO | 2 | 50 | 6 | 0.30 | 1,860 | 0.07 | 446 | $63 | $204.00 | $300.00 | $504.00 | $60.00 | 7.00 | 5 | Dual Technology Occupancy Sensor - Switch Mnt. | 1 | 20.0% | 372 | $53 |
| 221.11 | Lounge | 6200 | 1x4, 2 Lamp, 32W, 700 Series, T8, Elect.Ballast, Surface mnt., Prismatic Lens | 2 | 62 | 6 | 0.37 | 2,306 | Reballast and Relamp | HE Electronic Ballast & Sylvania Lamp FO28/841/SS/ECO | 2 | 50 | 6 | 0.30 | 1,860 | 0.07 | 446 | $63 | $204.00 | $300.00 | $504.00 | $60.00 | 7.00 | 5 | Dual Technology Occupancy Sensor - Switch Mnt. | 1 | 20.0% | 372 | $53 |
| 221.11 | Floor F - Common Area | 6200 | 1x4, 2 Lamp, 32W, 700 Series, T8, Elect.Ballast, Surface mnt., Prismatic Lens | 2 | 62 | 10 | 0.62 | 3,844 | Reballast and Relamp | HE Electronic Ballast & Sylvania Lamp FO28/841/SS/ECO | 2 | 50 | 10 | 0.50 | 3,100 | 0.12 | 744 | $106 | $340.00 | $500.00 | $840.00 | $100.00 | 7.00 | 0 | No New Controls | 0 | 0.0% | 0 | $0 |
| 221.21 | Corridor | 6200 | 1x4, 2Lamp, 32W, 700 Series, T8, elect. Ballast, Recessed Mnt., prismatic Lens | 2 | 62 | 20 | 1.24 | 7,688 | Reballast and Relamp | HE Electronic Ballast & Sylvania Lamp FO28/841/SS/ECO | 2 | 50 | 20 | 1.00 | 6,200 | 0.24 | 1,488 | $211 | $680.00 | $1,000.00 | $1,680.00 | $200.00 | 7.00 | 0 | No New Controls | 0 | 0.0% | 0 | $0 |
| 227.21 | Corridor | 6200 | 2x2, 2Lamp, 32W, 700 Series, T8, Elect. Ballast, Recessed Mnt., Prismatic Lens | 2 | 65 | 4 | 0.26 | 1,612 | Reballast and Relamp | HE Electronic Ballast & Sylvania Lamp FBO30/841XP/6//SS/ECO | 2 | 49 | 4 | 0.20 | 1,215 | 0.06 | 397 | $56 | $136.00 | $200.00 | $336.00 | $0.00 | 5.96 | 0 | No New Controls | 0 | 0.0% | 0 | $0 |
| 221.11 | Lounge | 6200 | 1x4, 2 Lamp, 32W, 700 Series, T8, Elect.Ballast, Surface mnt., Prismatic Lens | 2 | 62 | 6 | 0.37 | 2,306 | Reballast and Relamp | HE Electronic Ballast & Sylvania Lamp FO28/841/SS/ECO | 2 | 50 | 6 | 0.30 | 1,860 | 0.07 | 446 | $63 | $204.00 | $300.00 | $504.00 | $60.00 | 7.00 | 5 | Dual Technology Occupancy Sensor - Switch Mnt. | 1 | 20.0% | 372 | $53 |
| 221.11 | Lounge | 6200 | 1x4, 2 Lamp, 32W, 700 Series, T8, Elect.Ballast, Surface mnt., Prismatic Lens | 2 | 62 | 6 | 0.37 | 2,306 | Reballast and Relamp | HE Electronic Ballast & Sylvania Lamp FO28/841/SS/ECO | 2 | 50 | 6 | 0.30 | 1,860 | 0.07 | 446 | $63 | $204.00 | $300.00 | $504.00 | $60.00 | 7.00 | 5 | Dual Technology Occupancy Sensor - Switch Mnt. | 1 | 20.0% | 372 | $53 |
| 221.11 | Floor E - Common Area | 6200 | 1x4, 2 Lamp, 32W, 700 Series, T8, Elect.Ballast, Surface mnt., Prismatic Lens | 2 | 62 | 10 | 0.62 | 3,844 | Reballast and Relamp | HE Electronic Ballast & Sylvania Lamp FO28/841/SS/ECO | 2 | 50 | 10 | 0.50 | 3,100 | 0.12 | 744 | $106 | $340.00 | $500.00 | $840.00 | $100.00 | 7.00 | 0 | No New Controls | 0 | 0.0% | 0 | $0 |
| 221.21 | Corridor | 6200 | 1x4, 2Lamp, 32W, 700 Series, T8, elect. Ballast, Recessed Mnt., prismatic Lens | 2 | 62 | 20 | 1.24 | 7,688 | Reballast and Relamp | HE Electronic Ballast & Sylvania Lamp FO28/841/SS/ECO | 2 | 50 | 20 | 1.00 | 6,200 | 0.24 | 1,488 | $211 | $680.00 | $1,000.00 | $1,680.00 | $200.00 | 7.00 | 0 | No New Controls | 0 | 0.0% | 0 | $0 |
| 227.21 | Corridor | 6200 | 2x2, 2Lamp, 32W, 700 Series, T8, Elect. Ballast, Recessed Mnt., Prismatic Lens | 2 | 65 | 4 | 0.26 | 1,612 | Reballast and Relamp | HE Electronic Ballast & Sylvania Lamp FBO30/841XP/6//SS/ECO | 2 | 49 | 4 | 0.20 | 1,215 | 0.06 | 397 | $56 | $136.00 | $200.00 | $336.00 | $0.00 | 5.96 | 0 | No New Controls | 0 | 0.0% | 0 | $0 |
| 221.11 | Lounge | 6200 | 1x4, 2 Lamp, 32W, 700 Series, T8, Elect.Ballast, Surface mnt., Prismatic Lens | 2 | 62 | 6 | 0.37 | 2,306 | Reballast and Relamp | HE Electronic Ballast & Sylvania Lamp FO28/841/SS/ECO | 2 | 50 | 6 | 0.30 | 1,860 | 0.07 | 446 | $63 | $204.00 | $300.00 | $504.00 | $60.00 | 7.00 | 5 | Dual Technology Occupancy Sensor - Switch Mnt. | 1 | 20.0% | 372 | $53 |
| 311.43 | Floor D - Common Area | 6200 | 1x4, 1 Lamp, 54w T5HO Fixture, Wall Mount | 1 | 60 | 6 | 0.36 | 2,232 | Existing to remain | 0 | 1 | 60 | 0 | 0.36 | 2,232 | 0.00 | 0 | $0 | $0.00 | $0.00 | $0.00 | $0.00 | - | 0 | No New Controls | 0 | 0.0% | 0 | $0 |
| 221.21 | Corridor | 6200 | 1x4, 2Lamp, 32W, 700 Series, T8, elect. Ballast, Recessed Mnt., prismatic Lens | 2 | 62 | 20 | 1.24 | 7,688 | Reballast and Relamp | HE Electronic Ballast & Sylvania Lamp FO28/841/SS/ECO | 2 | 50 | 20 | 1.00 | 6,200 | 0.24 | 1,488 | $211 | $680.00 | $1,000.00 | $1,680.00 | $200.00 | 7.00 | 0 | No New Controls | 0 | 0.0% | 0 | $0 |
| 227.21 | Corridor | 6200 | 2x2, 2Lamp, 32W, 700 Series, T8, Elect. Ballast, Recessed Mnt., Prismatic Lens | 2 | 65 | 4 | 0.26 | 1,612 | Reballast and Relamp | HE Electronic Ballast & Sylvania Lamp FBO30/841XP/6//SS/ECO | 2 | 49 | 4 | 0.20 | 1,215 | 0.06 | 397 | $56 | $136.00 | $200.00 | $336.00 | $0.00 | 5.96 | 0 | No New Controls | 0 | 0.0% | 0 | $0 |
| 221.11 | Lounge | 6200 | 1x4, 2 Lamp, 32W, 700 Series, T8, Elect.Ballast, Surface mnt., Prismatic Lens | 2 | 62 | 6 | 0.37 | 2,306 | Reballast and Relamp | HE Electronic Ballast & Sylvania Lamp FO28/841/SS/ECO | 2 | 50 | 6 | 0.30 | 1,860 | 0.07 | 446 | $63 | $204.00 | $300.00 | $504.00 | $60.00 | 7.00 | 5 | Dual Technology Occupancy Sensor - Switch Mnt. | 1 | 20.0% | 372 | $53 |
| 221.11 | Lounge | 6200 | 1x4, 2 Lamp, 32W, 700 Series, T8, Elect.Ballast, Surface mnt., Prismatic Lens | 2 | 62 | 6 | 0.37 | 2,306 | Reballast and Relamp | HE Electronic Ballast & Sylvania Lamp FO28/841/SS/ECO | 2 | 50 | 6 | 0.30 | 1,860 | 0.07 | 446 | $63 | $204.00 | $300.00 | $504.00 | $60.00 | 7.00 | 5 | Dual Technology Occupancy Sensor - Switch Mnt. | 1 | 20.0% | 372 | $53 |

| | | | 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, $ |
| 211.41 | Stairwells (3) | 8760 | 1x4, 1Lamp, 32W, 700 Series, T8, elect. Ballast, Surface Mnt., Prismatic Lens | 0 | 34 | 36 | 1.22 | 10,722 | Reballast and Relamp | HE Electronic Ballast & Sylvania Lamp FO28/841/SS/ECO | 1 | 25 | 36 | 0.90 | 7,884 | 0.32 | 2,838 | $403 | $972.00 | $1,800.00 | $2,772.00 | $360.00 | 5.98 | 0 | No New Controls | 0 | 0.0% | 0 | $0 |
| 211.14 | Basement | 4000 | 1x4, 1Lamp, 32W, 700 Series, T8, elect. Ballast, Surface Mnt., Prismatic Lens | 0 | 34 | 12 | 0.41 | 1,632 | Reballast and Relamp | HE Electronic Ballast & Sylvania Lamp FO28/841/SS/ECO | 1 | 25 | 12 | 0.30 | 1,200 | 0.11 | 432 | $61 | $324.00 | $600.00 | $924.00 | $120.00 | 13.11 | 0 | No New Controls | 0 | 0.0% | 0 | $0 |
| 211.14 | Boiler Room | 4000 | 1x4, 1Lamp, 32W, 700 Series, T8, elect. Ballast, Surface Mnt., Prismatic Lens | 0 | 34 | 4 | 0.14 | 544 | Reballast and Relamp | HE Electronic Ballast & Sylvania Lamp FO28/841/SS/ECO | 1 | 25 | 4 | 0.10 | 400 | 0.04 | 144 | $20 | $108.00 | $200.00 | $308.00 | $40.00 | 13.11 | 0 | No New Controls | 0 | 0.0% | 0 | $0 |
| 221.34 | Boiler Room | 4000 | 1x4, 2Lamp, 32W, T8, elect. Ballast, Pendant Mnt., No Lens | 2 | 58 | 15 | 0.87 | 3,480 | Reballast and Relamp | HE Electronic Ballast & Sylvania Lamp FO28/841/SS/ECO | 2 | 50 | 15 | 0.75 | 3,000 | 0.12 | 480 | $68 | $510.00 | $750.00 | $1,260.00 | $150.00 | 16.29 | 0 | No New Controls | 0 | 0.0% | 0 | $0 |
| 128.34 | Boiler Room | 4000 | 8' Channel, 2Lamp, 75W, T12 , Mag. Ballast, Pendant Mnt., No Lens | 2 | 142 | 2 | 0.28 | 1,136 | Reballast and Relamp | (2) 8' Lamps to (4) 4' Lamps, 28W, T8, Elect. Ballast, retrofit | 4 | 100 | 2 | 0.20 | 800 | 0.08 | 336 | $48 | $196.00 | $150.00 | $346.00 | $0.00 | 7.25 | 0 | No New Controls | 0 | 0.0% | 0 | $0 |
| 651 | Storage | 1200 | "Industrial" Relector, 26w CFL | 1 | 26 | 4 | 0.10 | 125 | Existing to remain | 0 | 1 | 26 | 0 | 0.10 | 125 | 0.00 | 0 | $0 | $0.00 | $0.00 | $0.00 | $0.00 | - | 0 | No New Controls | 0 | 0.0% | 0 | $0 |
| 221.34 | Storage | 1200 | 1x4, 2Lamp, 32W, T8, elect. Ballast, Pendant Mnt., No Lens | 2 | 58 | 3 | 0.17 | 209 | Reballast and Relamp | HE Electronic Ballast & Sylvania Lamp FO28/841/SS/ECO | 2 | 50 | 3 | 0.15 | 180 | 0.02 | 29 | $4 | $102.00 | $150.00 | $252.00 | $30.00 | 54.28 | 0 | No New Controls | 0 | 0.0% | 0 | $0 |
| 221.34 | Switch Gear | 4000 | 1x4, 2Lamp, 32W, T8, elect. Ballast, Pendant Mnt., No Lens | 2 | 58 | 4 | 0.23 | 928 | Reballast and Relamp | HE Electronic Ballast & Sylvania Lamp FO28/841/SS/ECO | 2 | 50 | 4 | 0.20 | 800 | 0.03 | 128 | $18 | $136.00 | $200.00 | $336.00 | $40.00 | 16.29 | 0 | No New Controls | 0 | 0.0% | 0 | $0 |
| 242.21 | Server Room | 4000 | 2x2, 2Lamp, 32W, 700 Series, T8, Elect. Ballast, Recessed Mnt., Prismatic Lens | 2 | 65 | 2 | 0.13 | 520 | Reballast and Relamp | HE Electronic Ballast & Sylvania Lamp FBO30/841XP/6//SS/ECO | 2 | 49 | 2 | 0.10 | 392 | 0.03 | 128 | $18 | $68.00 | $100.00 | $168.00 | $0.00 | 9.24 | 0 | No New Controls | 0 | 0.0% | 0 | $0 |
| 211.11 | Laundry | 6200 | 1x4, 1Lamp, 32W, 700 Series, T8, elect. Ballast, Surface Mnt., Prismatic Lens | 1 | 33 | 6 | 0.20 | 1,228 | Reballast and Relamp | HE Electronic Ballast & Sylvania Lamp FO28/841/SS/ECO | 1 | 25 | 6 | 0.15 | 930 | 0.05 | 298 | $42 | $162.00 | $300.00 | $462.00 | $60.00 | 9.51 | 0 | No New Controls | 0 | 0.0% | 0 | $0 |
| | **TOTAL** | | | | | **308** | **17** | **105,389** | | | | | **298** | 13.99 | 84,159 | 3.46 | 21,230 | $3,015 | $9,854.00 | $14,950.00 | $24,804.00 | $2,740.00 | | | | 9 | | 3,348 | $475 |

# APPENDIX F

# Cold Drink and Snack Vending Machine Energy Conservation Project

**Energy Analysis Prepared For:**

**Overlook North & South**

| Input Variables | |
|---|---|
| Energy Costs ($0.000 per kwh) | $0.142 |
| Facility Occupied Hours per Week | 100 |
| Number of Cold Drink Vending Machines | 2 |
| 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 | $1,063.04 | $705.70 | Cost of Operation |
| | 7,486 | 4,970 | kWh |
| | | 34% | % Energy Savings |
| Snack Machines | $248.10 | $147.68 | Cost of Operation |
| | 1,747 | 1,040 | kWh |
| | | 40% | % Energy Savings |

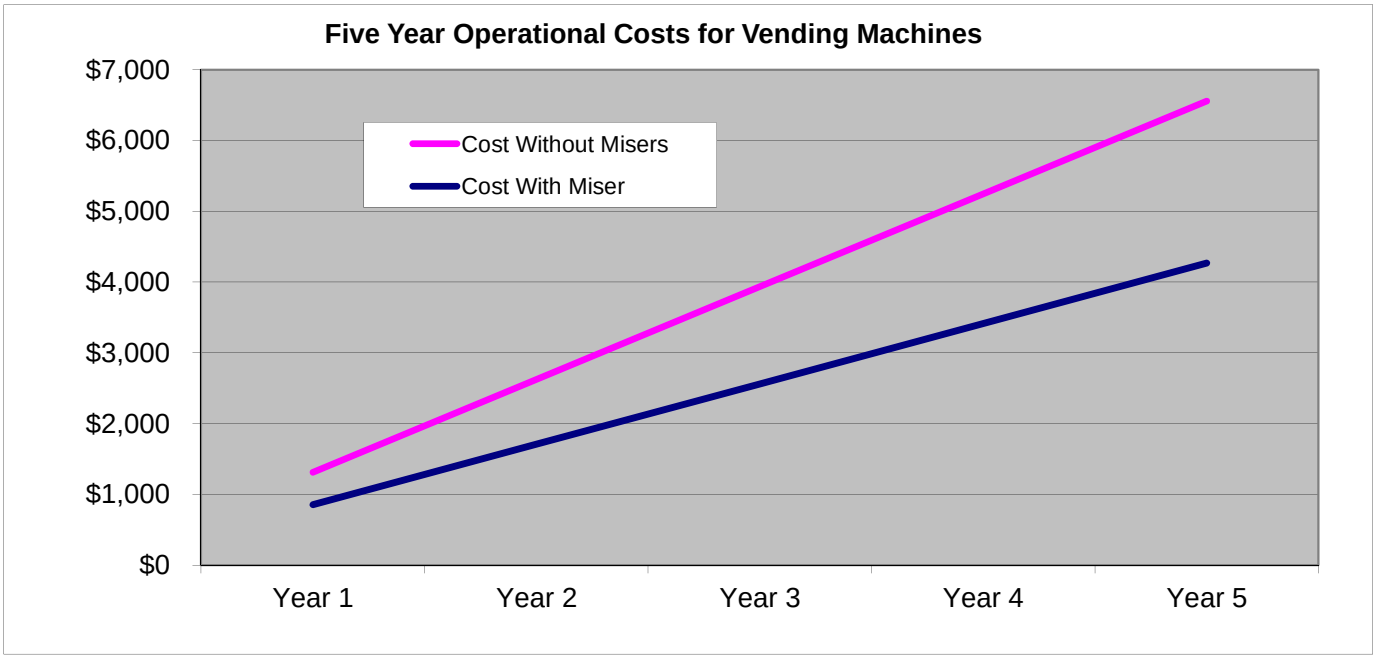
## Project Summary

| Present kWh | Projected kWh | kWh Savings per Year |
|---|---|---|
| 9,233 | 6,010 | 3,224 |

| Present Cost | Projected Costs | Annual Savings | Per Cent Savings | Total Project Cost | Break Even (Months) |
|---|---|---|---|---|---|
| $1,311.14 | $853.38 | $457.76 | 35% | $600.00 | 15.7 |

**Five Year Savings on 4 Machines = $2,288.79**

**Five Year Return on Investment = 281%**




Version 1.0

# APPENDIX G

**INNCOM Intelligent Dormitory Thermostat Controls**

Degree Day Data 5 yr Average

| Newark, New Jersey | | Jan | Feb | Mar | Apr | May | Jun | Jul | Aug | Sep | Oct | Nov | Dec | Total |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Heating | 1002 | 874 | 666 | 358 | | | | | | 250 | 510 | 863 | 4523 |
| | Cooling | 0 | 0 | 0 | 0 | 111 | 134 | 213.5 | 176.5 | 186 | 0 | 0 | 0 | 821 |
| | | | | | | Reduction | 50% | 50% | 50% | | | | | 5344 |
| | | | | | | | 268 | 427 | 353 | | | | | |

**CONSTANTS**

| | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Heat gain per degree difference outside/inside | 160.00 | Btuh/deg | 0.05 | kWh/deg | 170.6 | Btuh/deg | | | | | | | | |
| Cost of energy heating (Thermal Plant) | $13.06 | $/Mmbtu | $0.0131 | $/MBTU | | | | | | | | | | |
| Cost of energy cooling | $0.089 | $/ton-hr | $0.0075 | $/MBTU | | | | | | | | | | |
| Heating | 1,000,000 | Btuh | | | $0.0205 | | | | 0.630 | kW/ton | | $0.09 | $/tonh | |
| Cooling | 12,000 | Btuh | | | | | | | | | | | | |
| Electric Rate | $0.142 | $/kWh | | | | | | | | | | | | |
| Natural Gas Rate | $1.110 | $/therm | | | | | | | | | | | | |

**ASSUMPTIONS**

| | | |
|---|---|---|
| Room occupancy hours per day | 12 | Hours |
| Hotel Occupancy annual average | 100% | Occ Rate |
| Setback Rented Unoccupied Degree F | 5 | Degrees |
| Deep Setback Unrented | 0 | Degrees |
| Setback Night Rented Occupied | 3 | Degrees |
| Night Setback Hours | 6 | Hours |
| Temperature Overshoot, mechanical thermostat | 2 | Degrees |
| Temperature overshoot hours until corrected | 3 | Hours |
| Average time difference checkout to checkin | 0 | Hours |
| Average stay | 7 | Day |

**COMPUTED ENERGY COSTS**

| | |
|---|---|
| Heating Cost per degree-day w/o demand | $0.0501 |
| Cooling Cost per degree-day w/o demand | $0.0305 |
| Estimated other room energy consumption | $0.00 |
| Cost per room | $251.88 |
| Weighted Average cost per degree-day | $0.0471 |

| **SAVINGS CALCULATIONS** | **DAY** | **MONTH** | **YEAR** | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| Rented Unoccupied Room Setback Savings | $0.118 | $3.53 | $43.01 | | | | | | |
| Rented Unoccupied Room Setback MBTU Sav. | 9.698 | 290.93 | 3,539.66 | MBTU | | | | | |
| Deep Setback Savings-extended non-occupancy | $0.000 | $0.00 | $0.00 | | | | | | |
| Deep Setback MBTU Sav.-extended non-occ. | 0.00 | 0.00 | 0.00 | MBTU | | | | | |
| Rented Night Setback Savings | $0.035 | $1.06 | $31.81 | | | | | | |
| Rented Night Setback MBTU Sav. | 7.76 | 232.75 | 6,982.35 | MBTU | | | | | |
| DDC Precise Temperature Control | $0.000 | $0.00 | $0.00 | | | | | | |
| DDC Precise Temperature Control MBTU Sav. | 0.00 | 0.00 | 0.00 | MBTU | | | | | |
| Estimated HVAC Savings for Standalone System | $0.153 | $4.595 | $74.824 | | 30% | **63.33** | **4,849** | **48.494996** | **therms** |
| Est. HVAC MBTU Sav. for Standalone System | 17 | 524 | 10,522 | MBTU | | **11.50** | **128** | **80.952303** | **kWh** |

**Standalone Estimated Project Cost**

| | | |
|---|---|---|
| Equipment | $400.00 | Per Room |
| Estimated Labor | $250.00 | Per Room |
| PM/Commissioning | $75.00 | Per Room |
| Sub-Total | $725.00 | Per Room |

| **Project Summary (Standalone System)** | | |
|---|---|---|
| Total Rooms | 480 | rooms |
| Total Project Cost | $348,000 | |
| Total Est. Savings | $35,916 | |
| Simple Payback | 9.69 | years |