ENERGY AUDIT – DRAFT REPORT
JANUARY 6, 2010

UNION COUNTY COLLEGE
PLAINFIELD CAMPUS
LOGOS BUILDING

232 EAST SECOND STREET
PLAINFIELD, NJ 07061
ATTN: MR. HENRY KEY,
DIRECTOR OF FACILITIES

CEG PROJECT NO. 9C08144

CONCORD ENGINEERING GROUP

520 SOUTH BURNT MILL ROAD
VOORHEES, NJ 08043
TELEPHONE: (856) 427-0200
FACSIMILE: (856) 427-6529
WWW.CEG-INC.NET

CONTACT: MICHAEL FISCHETTE PE, PRESIDENT
EMAIL: mfischette@ceg-inc.net

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I. EXECUTIVE SUMMARY

This report presents the findings of the energy audit conducted for:

Union County College – Plainfield Campus
Logos Building
232 East Second Street
Plainfield, NJ 07016

College Contact Person: Henry Key
Facility Contact Person: John Hone

This audit is performed in connection with the New Jersey Clean Energy - Local Government Energy Audit Program. The energy audit is conducted to promote the mission of the office of Clean Energy, which is to use innovation and technology to solve energy and environmental problems in a way that improves the State's economy. This can be achieved through the wiser and more efficient use of energy.

The annual energy costs at this facility are as follows:

Electricity	$52,362
Natural Gas	$22,402
Total	$74,764

The potential annual energy cost savings for each energy conservation measure (ECM) and renewable energy measure (REM) are shown below in Table 1. Be aware that the ECM's and REM' are not additive because of the interrelation of some of the measures. This audit is consistent with an ASHRAE level 2 audit. The cost and savings for each measure is ± 20%. The evaluations are based on engineering estimations and industry standard calculation methods. More detailed analyses would require engineering simulation models, hard equipment specifications, and contractor bid pricing.

Table 1
Financial Summary Table

ENERGY CONSERVATION MEASURES (ECM's)					
ECM NO.	DESCRIPTION	NET INSTALLATION COST[A]	ANNUAL SAVINGS[B]	SIMPLE PAYBACK (Yrs)	SIMPLE LIFETIME ROI
ECM #1	Lighting Controls	$2,160	$1,250	1.7	768.1%
ECM #2	HW Boiler Replacement & Controls	$80,050	$6,690	12.0	108.9%
ECM #3	OA Reset Controls on (E) Boilers	$14,000	$1,065	13.1	14.1%
ECM #4	HVAC Replacement - RTU 2	$21,453	$1,309	16.4	-8.5%
RENEWABLE ENERGY MEASURES (REM's)					
ECM NO.	DESCRIPTION	NET INSTALLATION COST	ANNUAL SAVINGS	SIMPLE PAYBACK (Yrs)	SIMPLE LIFETIME ROI
REM #1	Photovoltaic System	$710,010	$42,829	16.6	50.8%

Notes: A. Cost takes into consideration applicable NJ Smart StartTM incentives.
B. Savings takes into consideration applicable maintenance savings.

The estimated demand and energy savings for each ECM and REM is shown below in Table 2. The descriptions in this table correspond to the ECM's and REM's listed in Table 1.

Table 2
Estimated Energy Savings Summary Table

ENERGY CONSERVATION MEASURES (ECM's)				
ECM NO.	DESCRIPTION	ANNUAL UTILITY REDUCTION		
		ELECTRIC DEMAND (KW)	ELECTRIC CONSUMPTION (KWH)	NATURAL GAS (THERMS)
ECM #1	Lighting Controls	0.0	7,529	0.0
ECM #2	HW Boiler Replacement & Controls	0.0	0	4,451.4
ECM #3	OA Reset Controls on (E) Boilers	0.0	0	723.0
ECM #4	HVAC Replacement - RTU 2	3.6	6,502	154.2
RENEWABLE ENERGY MEASURES (REM's)				
ECM NO.	DESCRIPTION	ANNUAL UTILITY REDUCTION		
		ELECTRIC DEMAND (KW)	ELECTRIC CONSUMPTION (KWH)	NATURAL GAS (THERMS)
REM #1	Photovoltaic System	0.0	83,002	0.0

Concord Engineering Group (CEG) recommends proceeding with the implementation of all ECM's that provide a calculated simple payback at or under ten (10) years. The following Energy Conservation Measures are recommended for the facility:

- **ECM #1:** Lighting Controls

ECM #1 is a lighting controls installation that will provide energy savings to the Owner by ensuring that lighting fixtures are off when the spaces are not occupied. This ECM is simple to implement and will provide great savings for the College.

Although ECM #2 and ECM #4 do not provide a simple payback less than 10 years, CEG still recommends the Owner move forward with the implementation of these energy conservation measures as there are significant energy savings that could be realized by the College. With the current issues and complaints by the Owner in regards to the existing boiler operation having a simple payback (12.0 years) less than half of the expected equipment life of the new equipment (25 years) should provide the Owner with adequate financial security in realizing this ECM will save in the long run. In addition, the expected maintenance savings, which could not be

summarized at this time, would more than likely bring the simple payback below the standard 10 year threshold. In regards to ECM #4, the Lecture Hall rooftop unit replacement should be executed but only when the existing unit becomes a nuisance with continuous maintenance problems. The energy saved and the 16.4 year simple payback (does not include maintenance savings) proves the ECM to be of value however, as with all capital expenditures they need to be completed when the Owner sees fit.

ECM #3 is not recommended for implementation as it would be included in the installation of ECM #2. If the Owner does not plan to move forward with the boiler replacement recommended in ECM #2, then CEG proposes the Owner at a minimum install an outside air reset controller on the existing boilers to gain the estimated energy savings noted within this report.

In addition to the ECMs, there are maintenance and operational measures that can provide significant energy savings and provide immediate benefit. The ECMs listed above represent investments that can be made to the facility which are justified by the savings seen overtime. However, the maintenance items and small operational improvements below are typically achievable with on site staff or maintenance contractors and in turn have the potential to provide substantial operational savings compared to the costs associated. The following are recommendations which should be considered a priority in achieving an energy efficient building:

1. Chemically clean the condenser and evaporator coils periodically to optimize efficiency. Poorly maintained heat transfer surfaces can reduce efficiency 5-10%.
2. Maintain all weather stripping on entrance doors.
3. Clean all light fixtures to maximize light output.
4. Provide more frequent air filter changes to decrease overall system power usage and maintain better IAQ.

Renewable Energy Measures (REMs) were also reviewed for implementation at the Plainfield Campus. CEG utilized a covered parking strategy for the solar array as there was not enough room on either roof structures at the Logos Building or the Annex Building to house a substantial PV system. The recommended 78.9 kW PV system will produce approximately 83,002 kWh of electricity annually and will reduce the campus electrical consumption from the grid by 26%. The system's calculated simple payback of 16.6 years is past the standard 10 year simple payback threshold; however, with alternative funding this payback could be lessened. CEG recommends the Owner review all funding options before deciding to not implement this renewable energy measure.

II. INTRODUCTION

The comprehensive energy audit covers the 28,314 square foot Logos Building, which includes the following spaces: lecture halls, classrooms, library, and administration offices.

Electrical and natural gas utility information is collected and analyzed for one full year's energy use of the building. The utility information allows for analysis of the building's operational characteristics; calculate energy benchmarks for comparison to industry averages, estimated savings potential, and baseline usage/cost to monitor the effectiveness of implemented measures. A computer spreadsheet is used to calculate benchmarks and to graph utility information (see the utility profiles below).

The Energy Use Index (EUI) is established for the building. Energy Use Index (EUI) is expressed in British Thermal Units/square foot/year (BTU/ft^2/yr), which is used to compare energy consumption to similar building types or to track consumption from year to year in the same building. The EUI is calculated by converting the annual consumption of all energy sources to BTU's and dividing by the area (gross square footage) of the building. Blueprints (where available) are utilized to verify the gross area of the facility. The EUI is a good indicator of the relative potential for energy savings. A low EUI indicates less potential for energy savings, while a high EUI indicates poor building performance therefore a high potential for energy savings.

Existing building architectural and engineering drawings (where available) are utilized for additional background information. The building envelope, lighting systems, HVAC equipment, and controls information gathered from building drawings allow for a more accurate and detailed review of the building. The information is compared to the energy usage profiles developed from utility data. Through the review of the architectural and engineering drawings a building profile can be defined that documents building age, type, usage, major energy consuming equipment or systems, etc.

The preliminary audit information is gathered in preparation for the site survey. The site survey provides critical information in deciphering where energy is spent and opportunities exist within a facility. The entire site is surveyed to inventory the following to gain an understanding of how each facility operates:

- Building envelope (roof, windows, etc.)
- Heating, ventilation, and air conditioning equipment (HVAC)
- Lighting systems and controls
- Facility-specific equipment

The building site visit is performed to survey all major building components and systems. The site visit includes detailed inspection of energy consuming components. Summary of building occupancy schedules, operating and maintenance practices, and energy management programs provided by the building manager are collected along with the system and components to determine a more accurate impact on energy consumption.

III. METHOD OF ANALYSIS

Post site visit work includes evaluation of the information gathered, researching possible conservation opportunities, organizing the audit into a comprehensive report, and making recommendations on HVAC, lighting and building envelope improvements. Data collected is processed using energy engineering calculations to anticipate energy usage for each of the proposed energy conservation measures (ECMs). The actual building's energy usage is entered directly from the utility bills provided by the owner. The anticipated energy usage is compared to the historical data to determine energy savings for the proposed ECMs.

It is pertinent to note, that the savings noted in this report are not additive. The savings for each recommendation is calculated as standalone energy conservation measures. Implementation of more than one ECM may in some cases affect the savings of each ECM. The savings may in some cases be relatively higher if an individual ECM is implemented in lieu of multiple recommended ECMs. For example implementing reduced operating schedules for inefficient lighting will result in a greater relative savings. Implementing reduced operating schedules for newly installed efficient lighting will result in a lower relative savings, because there is less energy to be saved. If multiple ECM's are recommended to be implemented, the combined savings is calculated and identified appropriately.

ECMs are determined by identifying the building's unique properties and deciphering the most beneficial energy saving measures available that meet the specific needs of the facility. The building construction type, function, operational schedule, existing conditions, and foreseen future plans are critical in the evaluation and final recommendations. Energy savings are calculated base on industry standard methods and engineering estimations. Energy consumption is calculated based on manufacturer's cataloged information when new equipment is proposed.

Cost savings are calculated based on the actual historical energy costs for the facility. Installation costs include labor and equipment costs to estimate the full up-front investment required to implement a change. Costs are derived from Means Cost Data, industry publications, and local contractors and equipment suppliers. The NJ Smart Start Building® program incentives savings (where applicable) are included for the appropriate ECM's and subtracted from the installed cost. Maintenance savings are calculated where applicable and added to the energy savings for each ECM. The life-time for each ECM is estimated based on the typical life of the equipment being replaced or altered. The costs and savings are applied and a simple payback, simple lifetime savings, and simple return on investment are calculated. See below for calculation methods:

ECM Calculation Equations:

$$Simple\ Payback = \left(\frac{Net\ Cost}{Yearly\ Savings} \right)$$

$$Simple\ Lifetime\ Savings = \left(Yearly\ Savings \times ECM\ Lifetime \right)$$

$$Simple\ Lifetime\ ROI = \frac{(Simple\ Lifetime\ Savings - Net\ Cost)}{Net\ Cost}$$

$$Lifetime\ Ma\,\mathrm{int}\,enance\ Savings = \left(Yearly\ Ma\,\mathrm{int}\,enance\ Savings \times ECM\ Lifetime \right)$$

$$Internal\ Rate\ of\ \mathrm{Re}\,turn = \sum_{n=0}^{N} \left(\frac{Cash\ Flow\ of\ Period}{(1 + IRR)^n} \right)$$

$$Net\ \mathrm{Pr}\,esent\ Value = \sum_{n=0}^{N} \left(\frac{Cash\ Flow\ of\ Period}{(1 + DR)^n} \right)$$

Net Present Value calculations based on Interest Rate of 3%.

IV. HISTORIC ENERGY CONSUMPTION/COST

A. ENERGY USAGE / TARIFFS

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.

The electric usage profile represents the actual electrical usage for the facility. Public Service Electric and Gas (PSE&G) provides electricity to the facility under their General Lighting and Power (GLP) rate structure. 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 shows the actual natural gas energy usage for the facility. Public Service Electric and Gas (PSE&G) provides natural gas to the facility under the Large Volume Gas (LVG) rate structure. 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.

The third party commodity provider PEPCO Energy Service, Co is responsible for providing the commodity of Natural Gas to the campus. Commodity and delivery is billed separately for the natural gas utility service.

Description	Average
Electricity	16.6¢ / kWh
Natural Gas	$1.473 / Therm

Table 3
Electricity Billing Data

ELECTRIC USAGE SUMMARY

Utility Provider: PSE & G
Rate: Rate - GLP
Account No: 1165356
Customer ID No: PE000011633076571
Third Party Utility N/A
TPS Meter / Acct No: N/A

MONTH OF USE	CONSUMPTION KWH	DEMAND	TOTAL BILL
Jan-09	15,480	52.2	$2,297
Feb-09	21,433	97.2	$3,288
Mar-09	22,307	59.4	$3,422
Apr-09	27,180	61.2	$3,953
May-08	32,400	79.2	$4,003
Jun-08	31,680	75.6	$5,168
Jul-08	42,840	120.6	$7,938
Aug-08	26,640	97.2	$5,487
Sep-08	24,840	97.2	$5,236
Oct-08	26,460	81.0	$4,197
Nov-08	24,840	64.8	$3,592
Dec-08	20,160	61.2	$3,781
Totals	**316,260**	**120.6 Max**	**$52,362**

AVERAGE DEMAND 78.9 KW average

AVERAGE RATE $0.166 $/kWh

Figure 1
Electricity Usage Profile

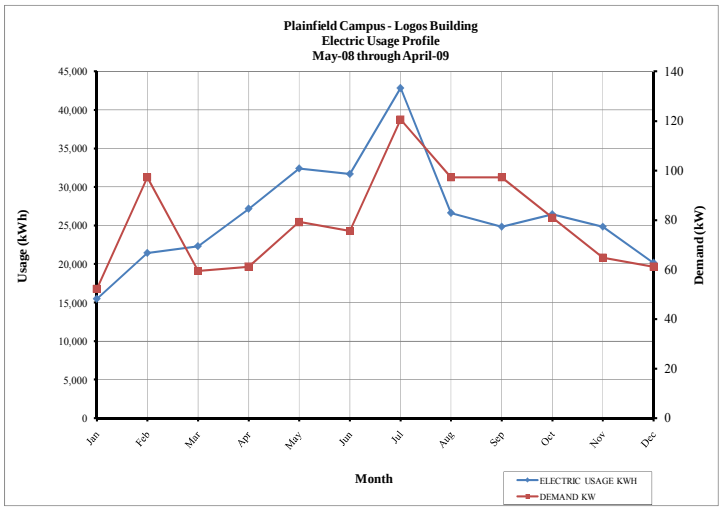
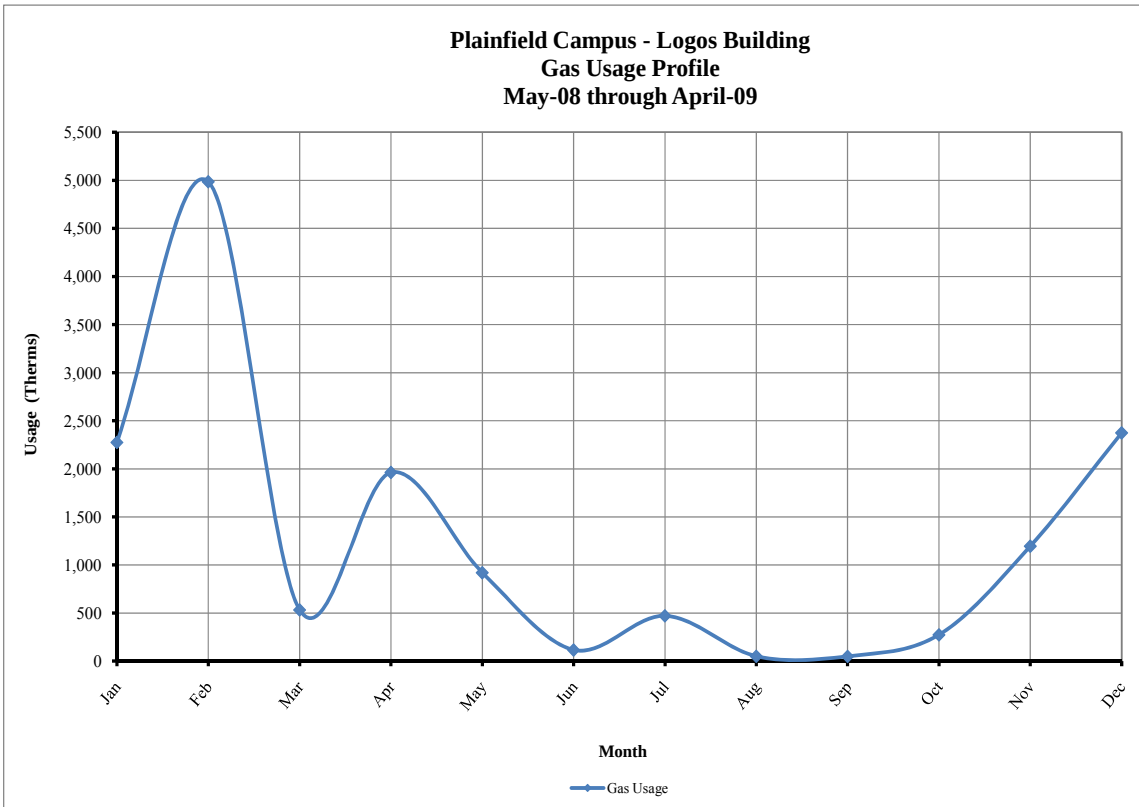


Table 4
Natural Gas Billing Data

NATURAL GAS USAGE SUMMARY		
Utility Provider:	PSE & G	
Rate:	Rate - LVG	
Account No:	2414676 55	
Point of Delivery ID:	PG0000111461752/1348	
Third Party Utility Provider:	PEPCO	
TPS Meter No:	N/A	
MONTH OF USE	**CONSUMPTION (THERMS)**	**TOTAL BILL**
Jan-09	2,274.67	$3,469.96
Feb-09	4,985.49	$6,592.02
Mar-09	533.14	$1,080.19
Apr-09	1,963.25	$2,278.71
May-08	920.25	$1,335.55
Jun-08	116.74	$270.58
Jul-08	471.60	$845.85
Aug-08	51.27	$180.39
Sep-08	50.28	$170.26
Oct-08	274.16	$519.21
Nov-08	1,195.93	$2,194.62
Dec-08	2,374.09	$3,464.73
TOTALS	**15,210.89**	**$22,402.07**
AVERAGE RATE:	**$1.473**	**$/THERM**

Figure 2
Natural Gas Usage Profile



B. ENERGY USE INDEX (EUI)

Energy Use Index (EUI) is a measure of a building's annual energy utilization per square foot of building. This calculation is completed by converting all utility usage consumed by a building for one year, to British Thermal Units (BTU) and dividing this number by the building square footage. EUI is a good measure of a building's energy use and is utilized regularly for comparison of energy performance for similar building types. The Oak Ridge National Laboratory (ORNL) Buildings Technology Center under a contract with the U.S. Department of Energy maintains a Benchmarking Building Energy Performance Program. The ORNL website determines how a building's energy use compares with similar facilities throughout the U.S. and in a specific region or state.

Source use differs from site usage when comparing a building's energy consumption with the national average. Site energy use is the energy consumed by the building at the building site only. Source energy use includes the site energy use as well as all of the losses to create and distribute the energy to the building. Source energy represents the total amount of raw fuel that is required to operate the building. It incorporates all transmission, delivery, and production losses, which allows for a complete assessment of energy efficiency in a building. The type of utility purchased has a substantial impact on the source energy use of a building. The EPA has determined that source energy is the most comparable unit for evaluation purposes and overall global impact. Both the site and source EUI ratings for the building are provided to understand and compare the differences in energy use.

The site and source EUI for this facility is calculated as follows:

$$Building\ Site\ EUI = \frac{(Electric\ Usage\ in\ kBtu + Gas\ Usage\ in\ kBtu)}{Building\ Square\ Footage}$$

$$Building\ Source\ EUI = \frac{(Electric\ Usage\ in\ kBtu\ X\ SS\ Ratio + Gas\ Usage\ in\ kBtu\ X\ SS\ Ratio)}{Building\ Square\ Footage}$$

Table 5
Facility Energy Use Index (EUI) Calculation

ENERGY USE INTENSITY CALCULATION						
ENERGY TYPE	**BUILDING USE**			**SITE ENERGY**	**SITE-SOURCE RATIO**	**SOURCE ENERGY**
	kWh	**Therms**	**Gallons**	**kBtu**		**kBtu**
ELECTRIC	316260.0			1,079,712	3.340	3,606,237
NATURAL GAS		15210.9		1,521,089	1.047	1,592,580
FUEL OIL			0.0	0	1.010	0
PROPANE			0.0	0	1.010	0
TOTAL				2,600,801		5,198,817
*Site - Source Ratio data is provided by the Energy Star Performance Rating Methodology for Incorporating Source Energy Use document issued Dec 2007.						
BUILDING AREA		28,314	SQUARE FEET			
BUILDING SITE EUI		*91.86*	kBtu/SF/YR			
BUILDING SOURCE EUI		*183.61*	kBtu/SF/YR			

As a comparison, data has been gathered by the US Department of Energy (DOE) for various facilities cataloguing the standard site and source energy utilization. This data has been published in the 2003 Commercial Building Energy Consumption Survey and is noted as follows for facilities of this type:

- Education – College/University (Campus Level):
  120 kBtu/SF Site Energy, 280 kBtu/SF Source Energy.

Based on the information compiled for the studied campus, as compared to the national average the energy usage is approximately 23% lower than the baseline data.

C. EPA ENERGY BENCHMARKING SYSTEM

The United States Environmental Protection Agency (EPA) in an effort to promote energy management has created a system for benchmarking energy use amongst various end users. The benchmarking tool utilized for this analysis is entitled Portfolio Manager. The Portfolio Manager tool allows tracking and assessment of energy consumption via the template forms located on the ENERGY STAR website (www.energystar.gov). The importance of benchmarking for local government municipalities is becoming more important as utility costs continue to increase and emphasis is being placed on carbon reduction, greenhouse gas emissions and other environmental impacts.

Based on information gathered from the ENERGY STAR website, Government agencies spend more than $10 billion a year on energy to provide public services and meet constituent needs. Furthermore, energy use in commercial buildings and industrial facilities is responsible for more than 50 percent of U.S. carbon dioxide emissions. It is vital that local government municipalities assess facility energy usage, benchmark energy usage utilizing Portfolio Manager, set priorities and goals to lessen energy usage and move forward with priorities and goals.

In accordance with the Local Government Energy Audit Program, CEG has created an ENERGY STAR account for the municipality to access and monitoring the facility's yearly energy usage as it compares to facilities of similar type. The login page for the account can be accessed at the following web address; the username and password are also listed below:

https://www.energystar.gov/istar/pmpam/index.cfm?fuseaction=login.login

User Name: unioncountycollege
Password: lgeaceg2009

Security Question: What city were you born in?
Security Answer: "cranford"

The utility bills and other information gathered during the energy audit process are entered into the Portfolio Manager. The following is a summary of the results for the facility:

Table 6
ENERGY STAR Performance Rating

ENERGY STAR PERFORMANCE RATING		
FACILITY DESCRIPTION	**ENERGY PERFORMANCE RATING**	**NATIONAL AVERAGE**
Logos Building	N/A	N/A

Refer to **Statement of Energy Performance Appendix** for the detailed energy summary.

An Energy Performance Rating cannot be established for the Logos building. The Energy Star program does not have enough bin data available to establish an Energy Performance Rating for a college at this time.

V. FACILITY DESCRIPTION

The 28,314 SF Logos Building is three story facility that contains instructional spaces, enclosed offices, library, student services, restrooms and mechanical rooms. The building was constructed in 1925 for use by Union County College and received alterations in 1992. The typical hours of operation for this facility have been noted as ninety-three (93) hours per week full occupied and ten (10) hours per week occupied by the cleaning staff only. Exterior walls for the facility are constructed typically of block and with brick face. The roof construction consists primarily of built-up roofing with stone cover. There is a pitched roof area that is constructed of a white PVC roofing material. The windows in the facility are double-pane and are typically inoperable throughout the rooms. Interior blinds are utilized where applicable.

HVAC Systems

The Logos Building is provided heating and cooling primarily from rooftop air-handling units containing packaged DX systems for cooling and ducted variable air volume (VAV) boxes containing heating coils for heating. There are two (2) sections of boilers located in Mechanical Room L01 that provide heating hot water to the VAV box heating coils. The boilers are both Hydrotherm MR Series with a total output of 1250 MBH input, 1000 MBH output equaling 80% efficiency. The boilers are approximately 25 years old and are at the end of their service life. The Owner believes the boilers are operating at approximately 60% efficiency at this time.

The air-handling systems for the facility vary in type and zoning. A summary of the equipment is as follows:

- *Entire Facility*: Heating and cooling for the Logos Building is provided by a packaged rooftop unit, tagged RTU-1, containing fans and packaged DX cooling system. The unit has a cooling capacity of 60 tons with average energy efficiency of 9.4 EER. Heating is provided by the VAV boxes' heating coils located throughout the facility. The unit was manufactured in 2008 and has a remaining service life of 14 years as outlined in 2007 ASHRAE Applications Handbook.

- *Lecture Hall 210*: Heating and cooling for Lecture Hall 210 is provided by a packaged rooftop unit, tagged RTU-2, containing supply fan and packaged DX cooling system. The unit has a cooling capacity of 8.5 tons with average energy efficiency of 10.1 EER. Heating is provided by the hot water heating plant. The unit was manufactured in 1992 and has past its service life of 15 years as outlined in 2007 ASHRAE Applications Handbook. However, the unit appears to be in working condition and could be replaced if the unit becomes a maintenance nuisance to the Owner.

Exhaust System

Exhaust air for the Logos Building is removed via rooftop exhaust fans located atop the facility. The fans operate either on an interlock control scheme with their respective air-handling equipment or on a time schedule based on facility occupancy.

HVAC System Controls

The HVAC systems within the Logos Building are controlled via a direct digital control (DDC) system that was recently installed in the building. The system is manufactured by Trane and provides the Owner with supervisory control over the major HVAC systems in the building.

Domestic Hot Water

Domestic hot water for the Logos Building is provided by a residential-style, natural gas-fired AO Smith M/N GCV with 40 MBH input, 78% efficiency and approximately 50 gallons of storage. The domestic hot water heater is approximately 3 years old and has an estimated 9 years remaining service life.

Lighting

Typical lighting throughout the building is fluorescent tube fixtures with T-8 lamps and electronic ballasts. Standard switching is utilized throughout the facility.

Refer to the **Investment Grade Lighting Audit Appendix** for a detailed inventory of all lamps, fixtures, etc., within the Logos Building.

VI. MAJOR EQUIPMENT LIST

The equipment list is considered major energy consuming equipment and through 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.

VII. ENERGY CONSERVATION MEASURES

ECM #1: Lighting Controls

Description:

In some areas the lighting is left on unnecessarily. In many cases the lights are left on because of the inconvenience to manually switch lights off when a room is left or on when a room is first occupied. This is common in storage 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 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. Photocell control senses light levels and turn off or reduce lights when there is adequate daylight. Photocells are mostly used outside, but are becoming more popular in energy-efficient interior lighting designs as well.

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 achieved for "Occupancy Sensors for Lighting Control" average 20%-28%. 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.

This ECM includes replacement of standard wall switches with occupancy sensor wall switches for individual classrooms and offices and the use of ceiling mounted occupancy sensors for open areas. Sensors shall be manufactured by Sensorswitch, Watt Stopper or equivalent.

The **Investment Grade Lighting Audit Appendix** of this report includes a summary of the rooms recommended for lighting controls implementation as calculated in this ECM.

Light Energy = 37,645.9 kWh/Yr. occupancy sensor controlled lighting

Energy Savings Calculations:

$$Energy\ Savings = 20\% \times Occuapancy\ Sensored\ Light\ Energy\ (kWh/Yr)$$

$$Energy\ Savings = 20\% \times 37{,}645.9\ (kWh) = 7{,}529.2\ (kWh)$$

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

$$Savings. = 7{,}529.2\ (kWh) \times 0.166\left(\frac{\$}{kWh}\right) = \$1{,}250$$

Installation cost per dual-technology sensor (Basis: Sensor switch or equivalent) is $110/unit including material and labor.

Installation Cost = $110 x 24 occupancy sensors = $2,640

NJ Smart Start® Program Incentives are calculated as follows:

From the **NJ Smart Start® Program Incentives Appendix**, the installation of a lighting control device warrants the following incentive: occupancy = $20 per sensor.

$$\text{Smart Start®}\ Incentive = (\#\ of\ \ wall\ mount\ devices \times\ \$\ 20) = (24 \times \$20) = \$480$$

Energy Savings Summary:

ECM #1 - ENERGY SAVINGS SUMMARY	
Installation Cost ($):	$2,640
NJ Smart Start Equipment Incentive ($):	$480
Net Installation Cost ($):	$2,160
Maintenance Savings ($/Yr):	$0
Energy Savings ($/Yr):	$1,250
Total Yearly Savings ($/Yr):	$1,250
Estimated ECM Lifetime (Yr):	15
Simple Payback	1.7
Simple Lifetime ROI	768.1%
Simple Lifetime Maintenance Savings	$0
Simple Lifetime Savings	$18,750
Internal Rate of Return (IRR)	58%
Net Present Value (NPV)	$12,762.42

ECM #2: Hot Water Boiler Replacement & Controls

Description:

Heating for the facility is provided by two (2) sections of modular boilers located in Mechanical Room L01. The boilers are both Hydrotherm MR Series with a total output of 1250 MBH input, 1000 MBH output equaling 80% efficiency (original). The boilers are approximately 25 years old and are at the end of their service life. The Owner believes the boilers are operating at approximately 60% efficiency at this time.

This energy conservation measure will replace the gas fired boilers serving the facility with a new boiler to handle the full load and a redundant boiler for backup. Calculation is based on the following equipment: Aerco, Benchmark BMK-1.5LN condensing boiler or equivalent replacing the hot water boiler. The existing units will be replaced with high energy efficient units with capacities typical of the existing units.

Energy Savings Calculations:

Existing Gas Fired Hot Water Boilers, Typical for (2) Hydrotherm:

Rated Capacity = 1,200 MBh Input, 1,000 MBh Output (Natural Gas)

Combustion Efficiency = 80%
Age & Radiation Losses = 20%
Thermal Efficiency = 60%

Replacement Gas Fired Hot Water Boilers, Typical for (2) Aerco Benchmark:

High-Efficiency Gas Fired Boiler

Rated Capacity = 2,000 MBh Input, 1,720 MBh Output (Natural Gas)

Combustion Efficiency = 88%
Radiation Losses = 0.5%
Thermal Efficiency = 87.5%

Replacement Gas Fired Boiler (Hot Water):

Heating Season Fuel Consumption = 14,450 Therms of natural (based on natural gas billing data and the square footage of the facility).

$$Heating\ Energy\ Savings = Fuel\ Consumption \times \frac{(New\ Furnace\ Efficiency - Old\ Furnace\ Efficiency)}{New\ Furnace\ Efficiency}$$

Heating Energy Savings = 14,450 Therms x ((87.5% - 60%)/87.5%) = 4,541.4 Therms per year

Savings:

Total Energy Savings = 4,451.4 Therms per year

Heating Energy Cost Savings = Annual Energy Savings x $/Therm

Heating Energy Cost Savings = 4,451.4 Therms x $1.473/Therm = $6,690 per year

Installed cost of two (2) new gas fired Aerco Benchmark 1.5 boilers and a new sequencing panel with associated sensors including demolition of existing boiler plant is approximated at $85,300.

NJ Smart Start® Program Incentives are calculated as follows:

From the **NJ Smart Start® Program Incentives Appendix**, Smart Start Equipment Incentive = $2.00/MBh for boilers < 300 MBh and $1.75/MBh for boilers ≥ 300 MBh.

Total Smart Start Equipment Incentive = ($1.75/MBh x 1,500 MBh x 2)

Total Smart Start Equipment Incentive = $5,250

Energy Savings Summary:

ECM #2 - ENERGY SAVINGS SUMMARY	
Installation Cost ($):	$85,300
NJ Smart Start Equipment Incentive ($):	$5,250
Net Installation Cost ($):	$80,050
Maintenance Savings ($/Yr):	$0
Energy Savings ($/Yr):	$6,690
Total Yearly Savings ($/Yr):	$6,690
Estimated ECM Lifetime (Yr):	25
Simple Payback	12.0
Simple Lifetime ROI	108.9%
Simple Lifetime Maintenance Savings	$0
Simple Lifetime Savings	$167,250
Internal Rate of Return (IRR)	7%
Net Present Value (NPV)	$36,443.96

ECM #3: OA Controls on Existing Hot Water Boilers

Description:

The existing boilers are gas-fired modular, sectioned boilers as manufactured by Hydrotherm. The boilers are operating inefficiently as noted above, however better control utilizing outside air reset on the supply water temperature could aid the boilers in operating more efficient. Currently, the boilers are controlled via aqua stats and maintain a set temperature when operating. New boiler controls have more precise control of the burner fire-rate, cycling, on/off temperature settings, and modulation. New temperature controls provide improvement on combustion efficiency and thermal efficiency by reducing the number of burner cycles and optimizing boiler supply water temperature based on outdoor temperature. The controls provide an estimated efficiency increase equal to 2.5% for combustion efficiency, and 2.5% for building loop temperature control. Overall fuel to hot water annual boiler efficiency increase is estimated to be 5%.

This ECM includes installation of new boiler controls for the existing boilers. The energy savings is applied to the facility heating load minus the small percentage of use for domestic hot water. This ECM is based on a basic boiler controller/sequencer with outside air reset that could be provided by any boiler manufacturer or control vendor. The total installation cost for the boiler controller is estimated to be $14,000 based on RS Means Cost Data.

Energy Savings Calculations:

Heating Season Fuel Consumption = 14,450 Therms of natural (based on natural gas billing data and the square footage of the facility).

Heating Energy Savings = Heating Season Fuel Consumption x 5% Reduction

Heating Energy Savings = 14,450 Therms x 5% = 723 Therms per year

Savings:

Total Energy Savings = 723 Therms per year

Heating Energy Cost Savings = Annual Energy Savings x $/Therm

Heating Energy Cost Savings = 723 Therms x $1.473/Therm = $1,065 per year

There are no available NJ Smart Start® Program Incentives at this time for the addition of boiler controls.

Energy Savings Summary:

ECM #3 - ENERGY SAVINGS SUMMARY	
Installation Cost ($):	$14,000
NJ Smart Start Equipment Incentive ($):	$0
Net Installation Cost ($):	$14,000
Maintenance Savings ($/Yr):	$0
Energy Savings ($/Yr):	$1,065
Total Yearly Savings ($/Yr):	$1,065
Estimated ECM Lifetime (Yr):	15
Simple Payback	13.1
Simple Lifetime ROI	14.1%
Simple Lifetime Maintenance Savings	$0
Simple Lifetime Savings	$15,975
Internal Rate of Return (IRR)	2%
Net Present Value (NPV)	($1,286.10)

ECM #4: HVAC Replacement – RTU 2

Description:

Heating and cooling for Lecture Hall 210 is provided by a packaged rooftop unit, tagged RTU-2, containing supply fan and packaged DX cooling system. The unit has a cooling capacity of 8.5 tons with average energy efficiency of 10.1 EER. Heating is provided by the hot water heating plant. The unit was manufactured in 1992 and has past its service life of 15 years as outlined in 2007 ASHRAE Applications Handbook.

This ECM would replace the existing roof top unit with a unit as manufactured by AAON (or equivalent) equipped with packaged DX cooling and CO2 demand control ventilation. The existing duct distribution and hot water heating piping will remain intact. Efficiency change will be strictly on cooling and CO2. The heating efficiency will not be changed.

Energy Savings Calculations:

Heating Assumptions:

Total Heating Capacity ($H_{L)}$	= 150 MBH
Average Unit Efficiency	= 80% Efficiency
Average Cost of Electricity	= $0.166/kWh
Average Cost of Gas	= $1.473/Therm

Cooling Assumptions:

Total Cooling Capacity	= 8.5 Tons
Cooling Season Full Load Cooling Hrs.	= 1,800 hrs/yr.
Existing Cooling Equipment EER	= 10.1 EER; 9.1 EER Age Correction
New Cooling Equipment EER	= 11.7 EER

Heating Savings Calculations

$$Heating\ \ Energy\ Used = \frac{H_L \times HDD \times Hrs}{\Delta t \times Eff}$$

Where:

HDD = number of Heating Degree Days as Specified Base Temperature
(Warm Air $HDD_{60^\circ F}$ = 4,800, Newark International Airport, NJ)

Hrs = Hours per Day

Δt = Design temperature difference, º F (Warm Air = 70 º F)

Eff = Efficiency of Energy Utilization

Estimated Energy Consumption of Air-Handling Unit:

$$Heating\ Energy\ Used = \frac{(150{,}000 Btu/h)\times(4{,}800°F)\times 12h}{70°F\times 80\%\times 100{,}000\frac{Btu}{Therm}} = 1{,}542\ Therms\ per\ year$$

$$Cost\ for\ Gas\ Heating. = Heating\ Input\ (Therms)\times Ave\ Cost\ (\$/Therm)$$

$$Cost\ for\ Gas\ Heating. = 1{,}542\ (Therms)\times 1.473\ (\$/Therm) = \$2{,}271\ per\ year$$

Cooling Usage Calculations

$$Cooling\ \ Energy\ \ Savings\ = \frac{[CoolingTon\ s\times 12{,}000\ Btu/ton]}{[1000\ W/kW]}\times\left(\frac{1}{EER_{OLD}}-\frac{1}{EER_{NEW}}\right)\times Hrs.ofCooling$$

$$Cooling\ \ Energy\ \ Savings\ = \frac{[8.5\times 12{,}000\ Btu/ton]}{[1000\ W/kW]}\times\left(\frac{1}{9.1}-\frac{1}{11.7}\right)\times 1{,}800\ = 4{,}484\ kwh\times \$0.166/kWh\ = \underline{\$744}$$

Electric Demand Savings = kWh saved / Hrs of Operation = 4,484 kWh / 1,800h = 2.5 kW

CO2 Demand Control Ventilation Savings

$$Cooling\ Savings. = Cool\ Cons.(kWh)\times 10\%\ Savings\times Ave\ Elec\ Cost\left(\frac{\$}{kWh}\right)$$

$$Cooling\ Savings. = 20{,}175\ (kWh)\times 10\%\times 0.166\left(\frac{\$}{kWh}\right) = \$335\ per\ year$$

Electric Demand Savings = kWh saved / Hrs of Operation = 2,017.5 kWh / 1,800h = 1.1 kW

$$Heating\ Savings. = Heating\ Input\ (Therms)\times Ave\ Cost\ (\$/Therm)$$

$$Heating\ Savings. = 1{,}542\ (Therms)\times 10\%\times 1.473\ (\$/Therm) = \$230\ per\ year$$

Total CO2 Control Savings = (Cooling Savings + Heating Savings)

Total CO2 Control Savings = $335 + $230 = $565 per year

Total Demand Savings = 3.6 kW

Total ECM Savings = $744 + $565 = $1,309 per year

Material and installation cost for the RTU replacement is estimated at $22,125. It is pertinent to note that this estimate includes the demolition of the existing unit and curb modifications (if required).

NJ Smart Start® Program Incentives are calculated as follows:

From **NJ Smart Start® Program Incentives Appendix**, the rooftop unit replacement falls under the category "Unitary HVAC" and warrants an incentive based on efficiency (EER) at a certain cooling tonnage.

$$\text{Smart Start® } Incentive\,(RTU) = (Cooling\,Tons \times \ RTU\ Incentive)$$
$$= (8.5\,Tons \times \$79\,/\,Ton) = \underline{\$672}$$

Energy Savings Summary:

ECM #4 - ENERGY SAVINGS SUMMARY	
Installation Cost ($):	$22,125
NJ Smart Start Equipment Incentive ($):	$672
Net Installation Cost ($):	$21,453
Maintenance Savings ($/Yr):	$0
Energy Savings ($/Yr):	$1,309
Total Yearly Savings ($/Yr):	$1,309
Estimated ECM Lifetime (Yr):	15
Simple Payback	16.4
Simple Lifetime ROI	-8.5%
Simple Lifetime Maintenance Savings	$0
Simple Lifetime Savings	$19,635
Internal Rate of Return (IRR)	-1%
Net Present Value (NPV)	($5,826.24)

VIII. RENEWABLE/DISTRIBUTED ENERGY MEASURES

Globally, renewable energy has become a priority affecting international and domestic energy policy. The State of New Jersey has taken a proactive approach, and has recently adopted in its Energy Master Plan a goal of 30% renewable energy by 2020. To help reach this goal New Jersey created the Office of Clean Energy under the direction of the Board of Public Utilities and instituted a Renewable Energy Incentive Program to provide additional funding to private and public entities for installing qualified renewable technologies. A renewable energy source can greatly reduce a building's operating expenses while producing clean environmentally friendly energy. CEG has assessed the feasibility of installing renewable energy measures (REM) for the municipality utilizing renewable technologies and concluded that there is potential for solar energy generation. The solar photovoltaic system calculation summary will be concluded as **REM#1** within this report.

Solar energy produces clean energy and reduces a building's carbon footprint. This is accomplished via photovoltaic panels which will be mounted on all south and southwestern facades of the building. Flat roof, as well as sloped areas can be utilized; flat areas will have the panels turned to an optimum solar absorbing angle. (A structural survey of the roof would be necessary before the installation of PV panels is considered). The state of NJ has instituted a program in which one Solar Renewable Energy Certificate (SREC) is given to the Owner for every 1000 kWh of generation. SREC's can be sold anytime on the market at their current market value. The value of the credit varies upon the current need of the power companies. The average value per credit is around $350, this value was used in our financial calculations. This equates to $0.35 per kWh generated.

CEG has reviewed the Logos Building roof area and believes that a parking lot canopy system would be more appropriate given the lack of roof area available for a solar array. The proposed arrays will be installed in the rear parking lot. The new parking lot arrays should be directly tied into the main distribution panel in the Logos Building. A depiction of the proposed area layouts is shown in **Renewable / Distributed Energy Measures Calculation Appendix**. Based on measurements of the parking lot it was determined that a system size of 78.9 kilowatts for could be installed; this is equal to the approximate average demand for the Logos Building. The total system has an estimated kilowatt hour production of 83,002 kWh annually, reducing the overall electric consumption by approximately 26%.

The proposed photovoltaic array layout is designed based on the specifications for the Sun Power SPR-230 panel. This panel has a "DC" rated full load output of 230 watts, and has a total panel conversion efficiency of 18%. Although panels rated at higher wattages are available through Sun Power and other various manufacturers, in general most manufacturers who produce commercially available solar panels produce a similar panel in the 200 to 250 watt range. This provides more manufacturer options to the public entity if they wish to pursue the proposed solar recommendation without losing significant system capacity.

The array system capacity was sized on available property area. Estimated solar array generation was then calculated based on the National Renewable Energy Laboratory PVWatts Version 1.0 Calculator. In order to calculate the array generation an appropriate location with solar data on

file must be selected. In addition the system DC rated kilowatt (kW) capacity must be inputted, a DC to AC de-rate factor, panel tilt angle, and array azimuth angle. The DC to AC de-rate factor is based on the panel nameplate DC rating, inverter and transformer efficiencies (95%), mismatch factor (98%), diodes and connections (100%), dc and ac wiring(98%, 99%), soiling, (95%), system availability (95%), shading (if applicable), and age(new/100%). The overall DC to AC de-rate factor has been calculated at an overall rating of 81%. The PVWatts Calculator program then calculates estimated system generation based on average monthly solar irradiance and user provided inputs. The monthly energy generation and offset electric costs from the PVWatts calculator is shown in the **Renewable/Distributed Energy Measures Calculation Appendix**.

The proposed solar array is qualified by the New Jersey Board of Public Utilities Net Metering Guidelines as a Class I Renewable Energy Source. These guidelines allow onsite customer generation using renewable energy sources such as solar and wind with a capacity of 2 megawatts (MW) or less. This limits a customer system design capacity to being a net user and not a net generator of electricity on an annual basis. Although these guidelines state that if a customer does net generate (produce more electricity than they use), the customer will be credited those kilowatt-hours generated to be carried over for future usage on a month to month basis. Then, on an annual basis if the customer is a net generator the customer will then be compensated by the utility the average annual PJM Grid LMP price per kilowatt-hour for the over generation. Due to the aforementioned legislation, the customer is at limited risk if they generate more than they use at times throughout the year. With the inefficiency of today's energy storage systems, such as batteries, the added cost of storage systems is not warranted and was not considered in the proposed design.

Direct purchase involves the college paying for 100% of the total project cost upfront via one of the methods noted in the Installation Funding Options section below. Calculations include a utility inflation rate as well as the degradation of the solar panels over time. Based on our calculations the following is the payback period:

FINANCIAL SUMMARY - PHOTOVOLTAIC SYSTEM				
PAYMENT TYPE	**SIMPLE PAYBACK**	**SIMPLE ROI**	**NET PRESENT VALUE**	**INTERNAL RATE OF RETURN**
Direct Purchase	16.6 Years	6.0%	$459,935	4.1 %

*The solar energy measure is shown for reference in the executive summary REM table as REM#1.

Given the large amount of capital required by the College to invest in a solar system through a Direct Purchase CEG does not recommend the College pursue this route. It would be more advantageous for the college to solicit Power Purchase Agreement (PPA) Providers who will own, operate, and maintain the system for a period of 15 years. During this time the PPA Provider would sell all of the electric generated by Solar Arrays to the College at a reduced rate compared to their existing electric rate.

In addition to the Solar Analysis, CEG also conducted a review of the applicability of wind energy for the facility. Wind energy production is another option available through the Renewable Energy Incentive Program. Wind turbines of various types can be utilized to produce clean energy on a per building basis. Cash incentives are available per kWh of electric usage. Based on CEG's review of the applicability of wind energy for the facility, it was determined that the average wind speed is not adequate, and the kilowatt demand for the building is below the threshold (200 kW) for purchase of a commercial wind turbine. Therefore, wind energy is not a viable option to implement.

IX. ENERGY PURCHASING AND PROCUREMENT STRATEGY

Load Profile:

Load Profile analysis was performed to determine the seasonal energy usage of the facility. Irregularities in the load profile will indicate potential problems within the facility. Consequently based on the profile a recommendation will be made to remedy the irregularity in energy usage. For this report, the facility's energy consumption data was gathered in table format and plotted in graph form to create the load profile. Refer to the Electric and Natural Gas Usage Profiles included within this report to reference the respective electricity and natural gas usage load profiles.

Electricity:

The Electric Usage Profile for this facility is a relatively scattered; there is not a typical load usage throughout the year. Based on the data received, in the month of July the electrical peak is set. Typically, the summer has elevated usage patterns due to increased cooling (air conditioning) use. The period March through July has a generally increased profile. Air conditioning in this facility is provided by two (2) packaged DX rooftop units in addition to two (2) split-system air-conditioners. The winter months (November – March) have a relatively consistent yet elevated, usage pattern.

This facility receives electric delivery service and commodity service from PSE&G (Public Service Electric & Gas Company) on a rate GLP. A flatter load profile, will allow for more competitive energy prices when shopping for alternative energy suppliers.

Natural Gas:

The Natural Gas Usage Profile demonstrates an atypical load profile. Typically, in a winter heating pattern, there would be a steep increase in natural gas usage beginning in November, peaking in February, and like a bell curve, gradually decrease into the spring (March). This load profile demonstrates an increase in November with a sharp peak in February, a sharp drop off in March and a slight bump in April to a flat, non-use in the summer. The winter peaks are usually associated with natural gas usage for heat. In this facility heating is provided by gas-fired hot water boilers that serve reheat boxes fed from the rooftop units. In addition, there is a gas-fired domestic hot water heater.

This facility receives natural gas delivery service from PSE&G (Public Service Electric & Gas Company) on a LVG (General Service) rate schedule. This facility utilizes a Third Party Supplier (TPS), for its commodity (supply) service.

Tariffs:

Electricity:

This facility receives electrical service through the utility Public Service Electric and Gas Company (PSE&G) on a GLP (General Lighting and Power Service) rate schedule. The Delivery Service and Commodity Service's are provided by PSE&G. The GLP Delivery Service is for general purposes at secondary distribution voltages. Customers may either purchase electric supply for a Third Party Supplier (TPS) or from PSE&G's Basic Generation Service default service as detailed in the rate schedule. Delivery Charges include: Service Charge, Distribution Charges, Societal Benefits Charge, Non-utility Generation Charge, Securitization and Transition Charges. System Control Charge, Customer Account Services Charge, CIEP Standby Fee, Base-rate Adjustment Charge, Solar Pilot Recovery Charge, RGGI Recovery Charge and Capital Adjustment Charge. Currently the Sperry facility utilizes full electric service from PSE&G.

Natural Gas:

This facility received its Delivery Service from PSE&G (Public Service Electric & Gas) and its Commodity supply from PEPCO Energy Services (TPS). This facility receives natural gas Delivery service from PSE&G on a LVG (Large Volume Gas Service) rate schedule. This rate schedule is for "firm" Delivery service for general purposes. Customers may either purchase natural gas supply room a Third Party Supplier or from Public Services Basic Gas Supply Service default service as detailed in the rate schedule. PSE&G Delivery Charges include the following: Service Charge, Demand Charge, Distribution Charges, Balancing Charge, Societal Benefits Charge, Realignment Charge, Margin Adjustment Charge, RGGI Recovery Charge, Capital Adjustment Charge and Customer Account Services Charge. The customer can buy supply from a Third Party Supplier or from PSE&G under Basic Gas Supply Service. Note: Should the TPS not deliver, PSE&G may supply Emergency Sales Service. This service typically comes at a great cost to the customer and is perceived as a penalty. It is therefore essential to choose an experience Regional natural gas supplier when considering Third Party Supply. CEG recommends the use of any energy advisor when considering alternative supply sources.

Please see CEG recommendations below.

Recommendations:

CEG recommends a global approach that will be consistent with all facilities. Potential savings can be seen in the electric costs and natural gas costs. The average price per kWh (kilowatt hour) for this facility based on a historical 1-year weighted average fixed price from PSE&G (based on information provided) is $.138 / kWh (this is the "price to compare" when shopping for energy procurement alternatives). The average price per Dth (dekatherm, basic unit of measure), for this facility based on a historical 1-year weighed average fixed price from PEPCO Energy Solutions (TPS) is $11.12 / Dth.

The "price to compare" is the netted cost of the energy (including other costs), that the customer will use to compare to Third Party Supply sources when shopping for alternative suppliers. For

electricity this cost would not include the utility transmission and distribution chargers. For natural gas the cost would not include the utility distribution charges and is said to be delivered to the utility's city-gate.

Energy commodities are among the most volatile of all commodities, however at this point and time, energy is extremely competitive. This facility could see improvement in its energy costs if it were to take advantage of these current market prices quickly, before energy prices increase. Based on electric supply from PSE&G and utilizing the historical consumption data provided (May 2008 through April 2009) and current electric rates, this facility could see an improvement in its electric costs of up to 23 % or over $12,000 annually. (Note: Savings were calculated using Average Annual Consumption and a variance to a Fixed Average One-Year commodity contract). CEG recommends aggregating the entire electric load to gain the most optimal energy costs. CEG recommends advisory services to review these energy costs.

Based on the natural gas supply from PEPCO Energy Services, and utilizing the historical consumption data provided, and current natural gas rates, this facility could see an improvement in its natural gas costs of up to 14% or over $3,000 annually.

CEG recommends the College receive further advisement on TPS prices through an energy advisor. They should also consider having an energy advisor write an RFP (Request for Proposal) for energy procurement now, while energy costs are deflated.

CEG also recommends scheduling a meeting with the current utility provider to review their utility charges and current tariff structures for electricity. This meeting would provide insight regarding alternative procurement options that are currently available. Through its meeting with the Local Distribution Company (LDC), the College can learn more about the competitive supply process. The College can acquire a list of approved Third Party Suppliers from the New Jersey Board of Public Utilities website at www.nj.gov/bpu. They should also consider using a billing-auditing service to further analyze the utility invoices, manage the data and use the information for ongoing demand-side management projects. Furthermore, special attention should be given to credit mechanisms, imbalances, balancing charges and commodity charges when meeting with the utility representative. The College should ask the utility representative about alternative billing options, such as consolidated billing when utilizing the service of a Third Party Supplier. Finally, if the supplier for energy (natural gas) is changed, closely monitor balancing, particularly when the contract is close to termination. This could be performed with the aid of an "energy advisor."

X. INSTALLATION FUNDING OPTIONS

CEG has reviewed various funding options for the facility owner to utilize in subsidizing the costs for installing the energy conservation measures noted within this report. Below are a few alternative funding methods:

i. *Energy Savings Improvement Program (ESIP)* – Public Law 2009, Chapter 4 authorizes government entities to make energy related improvements to their facilities and par for the costs using the value of energy savings that result from the improvements. The "Energy Savings Improvement Program (ESIP)" law provides a flexible approach that can allow all government agencies in New Jersey to improve and reduce energy usage with minimal expenditure of new financial resources.

ii. *Municipal Bonds* – Municipal bonds are a bond issued by a city or other local government, or their agencies. Potential issuers of municipal bonds include cities, counties, redevelopment agencies, school districts, publicly owned airports and seaports, and any other governmental entity (or group of governments) below the state level. Municipal bonds may be general obligations of the issuer or secured by specified revenues. Interest income received by holders of municipal bonds is often exempt from the federal income tax and from the income tax of the state in which they are issued, although municipal bonds issued for certain purposes may not be tax exempt.

iii. *Power Purchase Agreement* – Public Law 2008, Chapter 3 authorizes contractor of up to fifteen (15) years for contracts commonly known as "power purchase agreements." These are programs where the contracting unit (Owner) procures a contract for, in most cases, a third party to install, maintain, and own a renewable energy system. These renewable energy systems are typically solar panels, windmills or other systems that create renewable energy. In exchange for the third party's work of installing, maintaining and owning the renewable energy system, the contracting unit (Owner) agrees to purchase the power generated by the renewable energy system from the third party at agreed upon energy rates.

iv. *Pay For Performance – The New Jersey Smart Start Pay for Performance program includes incentives based on savings resulted from implemented ECMs. The program is available for all buildings with average demand loads above 200 KW. The facility's participation in the program is assisted by an approved program partner. An "Energy Reduction Plan" is created with the facility and approved partner to shown at least 15% reduction in the building's current energy use. Multiple energy conservation measures implemented together are applicable toward the total savings of at least 15%. No more than 50% of the total energy savings can result from lighting upgrades / changes.*

Total incentive is capped at 50% of the project cost. The program savings is broken down into three benchmarks; Energy Reduction Plan, Project

Implementation, and Measurement and Verification. Each step provides additional incentives as the energy reduction project continues. The benchmark incentives are as follows:

1. *Energy Reduction Plan – Upon completion of an energy reduction plan by an approved program partner, the incentive will grant $0.10 per square foot between $5,000 and $50,000, and not to exceed 50% of the facility's annual energy expense. (Benchmark #1 is not provided in addition to the local government energy audit program incentive.)*

2. *Project Implementation – Upon installation of the recommended measures along with the "Substantial Completion Construction Report," the incentive will grant savings per KWH or Therm based on the program's rates. Minimum saving must be 15%. (Example $0.11 / kWh for 15% savings, $0.12/ kWh for 17% savings, … and $1.10 / Therm for 15% savings, $1.20 / Therm for 17% saving, …) Increased incentives result from projected savings above 15%.*

3. *Measurement and Verification – Upon verification 12 months after implementation of all recommended measures, that actual savings have been achieved, based on a completed verification report, the incentive will grant additional savings per kWh or Therm based on the program's rates. Minimum savings must be 15%. (Example $0.07 / kWh for 15% savings, $0.08/ kWh for 17% savings, … and $0.70 / Therm for 15% savings, $0.80 / Therm for 17% saving, …) Increased incentives result from verified savings above 15%.*

CEG recommends the Owner review the use of the above-listed funding options in addition to utilizing their standard method of financing for facilities upgrades in order to fund the proposed energy conservation measures.

XI. ADDITIONAL RECOMMENDATIONS

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

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

B. Maintain all weather stripping on windows and doors.

C. Clean all light fixtures to maximize light output.

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

E. Confirm that outside air economizers on the rooftop units are functioning properly to take advantage of free cooling and avoid excess outside air during occupied periods.

ECM COST & SAVINGS BREAKDOWN

CONCORD ENGINEERING GROUP

Plainfield Campus - Logos Building

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	Lighting Controls	$1,320	$1,320	$480	$2,160	$1,250	$0	$1,250	15	$18,750	$0	768.1%	1.7	57.81%	$12,762.42
ECM #2	HW Boiler Replacement & Controls	$66,300	$19,000	$5,250	$80,050	$6,690	$0	$6,690	25	$167,250	$0	108.9%	12.0	6.71%	$36,443.96
ECM #3	OA Reset Controls on (E) Boilers	$8,400	$5,600	$0	$14,000	$1,065	$0	$1,065	15	$15,975	$0	14.1%	13.1	1.70%	($1,286.10)
ECM #4	HVAC Replacement - RTU 2	$15,250	$6,875	$672	$21,453	$1,309	$0	$1,309	15	$19,635	$0	-8.5%	16.4	-1.09%	($5,826.24)
REM RENEWABLE ENERGY AND FINANCIAL COSTS AND SAVINGS SUMMARY															
REM #1	Photovoltaic System	$710,010	$0	$0	$710,010	$13,778	$29,051	$42,829	25	$1,070,725	$726,275	50.8%	16.6	3.45%	$35,777.70

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* .

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 January, 2009:

Electric Chillers

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

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 - $93 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

Ground Source Heat Pumps

Closed Loop & Open Loop	$370 per ton

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

Variable Frequency Drives

Variable Air Volume	$65 - $155 per hp
Chilled-Water Pumps	$60 per hp
Compressors	$5,250 to $12,500 per drive

Natural Gas Water Heating

Gas Water Heaters ≤ 50 gallons	$50 per unit
Gas-Fired Water Heaters >50 gallons	$1.00 - $2.00 per MBH
Gas-Fired Booster Water Heaters	$17 - $35 per MBH

Premium Motors

Three-Phase Motors	$45 - $700 per motor

Prescriptive Lighting

T-5 and T-8 Lamps w/Electronic Ballast in Existing Facilities	$10 - $30 per fixture, (depending on quantity)
Hard-Wired Compact Fluorescent	$25 - $30 per fixture
Metal Halide w/Pulse Start	$25 per fixture
LED Exit Signs	$10 - $20 per fixture
T-5 and T-8 High Bay Fixtures	$16 - $284 per fixture

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

Other Equipment Incentives

Performance Lighting	$1.00 per watt per SF below program incentive threshold, currently 5% more energy efficient than ASHRAE 90.1-2004 for New Construction and Complete Renovation
Custom Electric and Gas Equipment Incentives	not prescriptive

OMB No. 2060-0347

STATEMENT OF ENERGY PERFORMANCE
Logos

Building ID: 1906950
For 12-month Period Ending: April 30, 2009[1]
Date SEP becomes ineligible: N/A

Date SEP Generated: October 22, 2009

Facility
Logos
246 East Second St.
Plainfield, NJ 07061

Facility Owner
Union County College
232 East Second Street
Plainfield, NJ 07060

Primary Contact for this Facility
John Hone
232 East Second Street
Plainfield, NJ 07060

Year Built: 1941
Gross Floor Area (ft²): 28,314

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

Site Energy Use Summary[3]

Electricity - Grid Purchase(kBtu)	1,079,079
Natural Gas (kBtu)[4]	1,521,087
Total Energy (kBtu)	2,600,166

Energy Intensity[5]

Site (kBtu/ft²/yr)	92
Source (kBtu/ft²/yr)	184

Emissions (based on site energy use)

Greenhouse Gas Emissions ($MtCO_2e$/year)	245

Electric Distribution Utility
PSE&G - Public Service Elec & Gas Co

National Average Comparison

National Average Site EUI	120
National Average Source EUI	280
% Difference from National Average Source EUI	-34%
Building Type	College/University (Campus-Level)

Stamp of Certifying Professional

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

Meets Industry Standards[6] **for Indoor Environmental Conditions:**

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

Certifying Professional
Raymond Johnson
520 South Burnt Mill Rd.
Voorhees, NJ 08043

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. Natural Gas values in units of volume (e.g. cubic feet) are converted to kBtu with adjustments made for elevation based on Facility zip code.
5. Values represent energy intensity, annualized to a 12-month period.
6. 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) 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 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	Logos	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	246 East Second St., Plainfield, NJ 07061	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 acute care or children's hospitals) nor can they be submitted as representing only a portion of a building		☐
Logos Building (Other)				
CRITERION	**VALUE AS ENTERED IN PORTFOLIO MANAGER**	**VERIFICATION QUESTIONS**	**NOTES**	☑
Gross Floor Area	28,314 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: PSE&G - Public Service Elec & Gas Co

Fuel Type: Electricity

Meter: Electric Meter (kWh (thousand Watt-hours))
Space(s): Entire Facility
Generation Method: Grid Purchase

Start Date	End Date	Energy Use (kWh (thousand Watt-hours))
04/01/2009	04/30/2009	27,180.00
03/01/2009	03/31/2009	22,307.00
02/01/2009	02/28/2009	21,433.00
01/01/2009	01/31/2009	15,480.00
12/01/2008	12/31/2008	20,160.00
11/01/2008	11/30/2008	24,840.00
10/01/2008	10/31/2008	26,460.00
09/01/2008	09/30/2008	24,840.00
08/01/2008	08/31/2008	26,640.00
07/01/2008	07/31/2008	42,840.00
06/01/2008	06/30/2008	31,680.00
05/01/2008	05/31/2008	32,400.00
Electric Meter Consumption (kWh (thousand Watt-hours))		**316,260.00**
Electric Meter Consumption (kBtu (thousand Btu))		**1,079,079.12**
Total Electricity (Grid Purchase) Consumption (kBtu (thousand Btu))		**1,079,079.12**
Is this the total Electricity (Grid Purchase) consumption at this building including all Electricity meters?		☐

Fuel Type: Natural Gas

Meter: Natural Gas Meter (therms)
Space(s): Entire Facility

Start Date	End Date	Energy Use (therms)
04/01/2009	04/30/2009	1,963.25
03/01/2009	03/31/2009	533.14
02/01/2009	02/28/2009	4,985.49
01/01/2009	01/31/2009	2,274.67
12/01/2008	12/31/2008	2,374.09
11/01/2008	11/30/2008	1,195.93
10/01/2008	10/31/2008	274.16
09/01/2008	09/30/2008	50.28
08/01/2008	08/31/2008	51.27
07/01/2008	07/31/2008	471.60

06/01/2008	06/30/2008	116.74
05/01/2008	05/31/2008	920.25
Natural Gas Meter Consumption (therms)		**15,210.87**
Natural Gas Meter Consumption (kBtu (thousand Btu))		**1,521,087.00**
Total Natural Gas Consumption (kBtu (thousand Btu))		**1,521,087.00**
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 as the PE 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
Logos
246 East Second St.
Plainfield, NJ 07061

Facility Owner
Union County College
232 East Second Street
Plainfield, NJ 07060

Primary Contact for this Facility
John Hone
232 East Second Street
Plainfield, NJ 07060

General Information

Logos	
Gross Floor Area Excluding Parking: (ft^2)	28,314
Year Built	1941
For 12-month Evaluation Period Ending Date:	April 30, 2009

Facility Space Use Summary

Logos Building	
Space Type	Other - College/University (Campus-Level)
Gross Floor Area(ft^2)	28,314
Number of PCs[o]	N/A
Weekly operating hours[o]	N/A
Workers on Main Shift[o]	N/A

Energy Performance Comparison

	Evaluation Periods		Comparisons		
Performance Metrics	**Current** (Ending Date 04/30/2009)	**Baseline** (Ending Date 04/30/2009)	**Rating of 75**	**Target**	**National Average**
Energy Performance Rating	N/A	N/A	75	N/A	N/A
Energy Intensity					
Site (kBtu/ft^2)	92	92	0	N/A	120
Source (kBtu/ft^2)	184	184	0	N/A	280
Energy Cost					
$/year	$ 74,764.07	$ 74,764.07	N/A	N/A	$ 97,698.88
$/$ft^2$/year	$ 2.64	$ 2.64	N/A	N/A	$ 3.45
Greenhouse Gas Emissions					
$MtCO_2e$/year	245	245	0	N/A	320
$kgCO_2e/ft^2$/year	9	9	0	N/A	12

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

Notes:
o - This attribute is optional.
d - A default value has been supplied by Portfolio Manager.

MAJOR EQUIPMENT LIST

Concord Engineering Group

"Logos Building"

Heating Hot Water Boilers

EQUIPT TAG	LOCATION	AREA SERVED	MANUFACTURER	MODEL NUMBER	SERIAL NUMBER	ELECTRICAL DATA				HEATING DATA				SERVICE LIFE			REMARKS
						V/PH/HZ	FLA	MCA	MOP	TYPE	MBH INPUT	MBH OUTPUT	EFF. (%)	APPROXAGE	ASHRAE SERVICE LIFE	REMAINING LIFE	
B-1	L-01	Entire Facility	Hydrotherm	MR-500C	MXG-1036	120/1/60	-	-	15	Nat. Gas	500	400	80%	25	25	0	*Estimated Age: (2) Sections
B-2	L-01	Entire Facility	Hydrotherm	MR-750C	MCJ10.20JD	120/1/60	-	-	15	Nat. Gas	750	600	80%	25	25	0	*Estimated Age: (3) Sections

Domestic Hot Water Heaters

EQUIPT TAG	LOCATION	AREA SERVED	MANUFACTURER	MODEL NUMBER	SERIAL NUMBER	ELECTRICAL DATA				HEATING DATA					SERVICE LIFE			REMARKS
						V/PH/HZ	FLA	MCA	MOP	FUEL	MBH INPUT	RECOVERY (GAL/H)	CAPACITY (GAL)	EFF. (%)	APPROX AGE	ASHRAE SERVICE LIFE	REMAINING LIFE	
DHW-1	L-01	Entire Facility	AO Smith	ProMax QCV	G06A050409	120/1/60	-	-	15	Nat. Gas	40	41	50	79%	3	15	12	

Packaged Rooftop Units

EQUIPT TAG	LOCATION	AREA SERVED	MANUFACTURER	MODEL NUMBER	SERIAL NUMBER	ELECTRICAL DATA				COOLING DATA			HEATING DATA				MOTOR DATA													SERVICE LIFE			REMARKS
						V/PH/HZ	FLA	MCA	MOP	TYPE	CAPACITY (TONS)	EFF. (EER)	TYPE	MBH INPUT	MBH OUTPUT	EFF. (%)	EVAPORATOR FAN				CONDENSER FAN				COMPRESSOR				APPROX AGE	ASHRAE SERVICE LIFE	REMAINING LIFE	
																	QTY	HP	V/PH/Hz	FLA	QTY	HP	V/PH/Hz	FLA	QTY	HP	V/PH/Hz	FLA				
RTU-1	Roof	Entire Facility	Trane	YSH/FF90E	000D03193	208-230/3/60	-	-	-	DX R-22	60	9.4	-	-	-	-	1	-	208-230/3/60	-	6	1	208-230/1/60	24.6	4	-	208-230/3/60	62.8 ea	1	15	14	-
RTU-2	Roof	Lecture Hall 2.10	Trane	TCD1.025E0108A	G211.42650 D	208-230/3/60	-	40	60	DX R-22	8.5	10.1	-	-	-	-	1	3	208-230/3/60	0.6	1	3/4	208-230/1/60	-	2	-	208-230/3/60	-	17	15	(2)	-

Note: Equipment Tags have been created by Auditor for clarification.

CEG Job #: 9C08144
Project: Union County College - Plainfield Campus
Address: 232 East Second Street, Plainfield, NJ 07061

"Plainfield Campus - Logos Building"

KWH COST: $0.166

Building SF: 28314

Investment Grade Lighting Audit

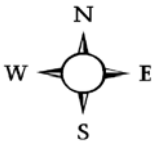
EXISTING LIGHTING										PROPOSED LIGHTING									SAVINGS			
CEG Type	Fixture Location	Yearly Usage	No. Fixts	No. Lamps	Fixture Type	Fixt Watts	Total kW	kWh/Yr Fixtures	Yearly $ Cost	No. Fixts	No. Lamps	Retro-Unit Description	Watts Used	Total kW	kWh/Yr Fixtures	Yearly $ Cost	Unit Cost (INSTALLED)	Total Cost	kW Savings	kWh/Yr Savings	Yearly $ Savings	Yearly Simple Payback
821	210 Lecture Hall	3120	19	3	2x2 3 Lamp, 17w T8, Elect. Ballast, Recessed, Prismatic Lens	47	0.89	2,786.2	$462.50	19	0	No Change	47	0.89	2786.16	$462.50	$0.00	$0.00	0.00	0	$0.00	0.00
321	211 Classroom	3120	6	3	2x4 3 Lamp, 32w T8, Elect. Ballast, Recessed, Prismatic Lens	82	0.49	1,535.0	$254.82	6	0	No Change	82	0.49	1535.04	$254.82	$0.00	$0.00	0.00	0	$0.00	0.00
321	212 Science Lab	3120	8	3	2x4 3 Lamp, 32w T8, Elect. Ballast, Recessed, Prismatic Lens	82	0.66	2,046.7	$339.76	8	0	No Change	82	0.66	2046.72	$339.76	$0.00	$0.00	0.00	0	$0.00	0.00
221	213 Lab Prep	3120	3	2	2x4 2 Lamp, 32w T8, Elect. Ballast, Recessed, Prismatic Lens	58	0.17	542.9	$90.12	3	0	No Change	58	0.17	542.88	$90.12	$0.00	$0.00	0.00	0	$0.00	0.00
221	Storage/Stairs	3120	1	2	2x4 2 Lamp, 32w T8, Elect. Ballast, Recessed, Prismatic Lens	58	0.06	181.0	$30.04	1	0	No Change	58	0.06	180.96	$30.04	$0.00	$0.00	0.00	0	$0.00	0.00
821	Corridor	3120	21	3	2x2 3 Lamp, 17w T8, Elect. Ballast, Recessed, Prismatic Lens	47	0.99	3,079.4	$511.19	21	0	No Change	47	0.99	3079.44	$511.19	$0.00	$0.00	0.00	0	$0.00	0.00
321	208 Classroom	3120	6	3	2x4 3 Lamp, 32w T8, Elect. Ballast, Recessed, Prismatic Lens	82	0.49	1,535.0	$254.82	6	0	No Change	82	0.49	1535.04	$254.82	$0.00	$0.00	0.00	0	$0.00	0.00
221	207 Classroom	3120	10	2	2x4 2 Lamp, 32w T8, Elect. Ballast, Recessed, Prismatic Lens	58	0.58	1,809.6	$300.39	10	0	No Change	58	0.58	1809.6	$300.39	$0.00	$0.00	0.00	0	$0.00	0.00
221	206 Classroom	3120	6	2	2x4 2 Lamp, 32w T8, Elect. Ballast, Recessed, Prismatic Lens	58	0.35	1,085.8	$180.24	6	0	No Change	58	0.35	1085.76	$180.24	$0.00	$0.00	0.00	0	$0.00	0.00
221	205 Classroom	3120	6	2	2x4 2 Lamp, 32w T8, Elect. Ballast, Recessed, Prismatic Lens	58	0.35	1,085.8	$180.24	6	0	No Change	58	0.35	1085.76	$180.24	$0.00	$0.00	0.00	0	$0.00	0.00
221	204 Classroom	3120	6	2	2x4 2 Lamp, 32w T8, Elect. Ballast, Recessed, Prismatic Lens	58	0.35	1,085.8	$180.24	6	0	No Change	58	0.35	1085.76	$180.24	$0.00	$0.00	0.00	0	$0.00	0.00
821	Men's Restroom	3120	3	3	2x2 3 Lamp, 17w T8, Elect. Ballast, Recessed, Prismatic Lens	47	0.14	439.9	$73.03	3	0	No Change	47	0.14	439.92	$73.03	$0.00	$0.00	0.00	0	$0.00	0.00
121		3120	1	2	1x4 2 Lamp, 32w T8, Elect. Ballast, Recessed, Prismatic Lens	58	0.06	181.0	$30.04	1	0	No Change	58	0.06	180.96	$30.04	$0.00	$0.00	0.00	0	$0.00	0.00
121	Custodial Closet	780	1	2	1x4 2 Lamp, 32w T8, Elect. Ballast, Recessed, Prismatic Lens	58	0.06	45.2	$7.51	1	0	No Change	58	0.06	45.24	$7.51	$0.00	$0.00	0.00	0	$0.00	0.00
821	Women's Restroom	3120	3	3	2x2 3 Lamp, 17w T8, Elect. Ballast, Recessed, Prismatic Lens	47	0.14	439.9	$73.03	3	0	No Change	47	0.14	439.92	$73.03	$0.00	$0.00	0.00	0	$0.00	0.00
321	201 Lockers	3120	2	3	2x4 3 Lamp, 32w T8, Elect. Ballast, Recessed, Prismatic Lens	82	0.16	511.7	$84.94	2	0	No Change	82	0.16	511.68	$84.94	$0.00	$0.00	0.00	0	$0.00	0.00
134	201 Data	3120	2	2	1x4 2 Lamp, 32w T8, Elect. Ballast, Pendant Mnt., No Lens	58	0.12	361.9	$60.08	2	0	No Change	58	0.12	361.92	$60.08	$0.00	$0.00	0.00	0	$0.00	0.00
600	Stairway	3120	3	2	1x4 2 Lamp, 32w T8, Elect. Ballast, Wall Mnt., Prismatic Lens	58	0.17	542.9	$90.12	3	0	No Change	58	0.17	542.88	$90.12	$0.00	$0.00	0.00	0	$0.00	0.00
821		3120	4	3	2x2 3 Lamp, 17w T8, Elect. Ballast, Recessed, Prismatic Lens	47	0.19	586.6	$97.37	4	0	No Change	47	0.19	586.56	$97.37	$0.00	$0.00	0.00	0	$0.00	0.00
821	105 Office	3120	4	3	2x2 3 Lamp, 17w T8, Elect. Ballast, Recessed, Prismatic Lens	47	0.19	586.6	$97.37	4	0	No Change	47	0.19	586.56	$97.37	$0.00	$0.00	0.00	0	$0.00	0.00
821	106 Office	3120	4	3	2x2 3 Lamp, 17w T8, Elect. Ballast, Recessed, Prismatic Lens	47	0.19	586.6	$97.37	4	0	No Change	47	0.19	586.56	$97.37	$0.00	$0.00	0.00	0	$0.00	0.00
821	107 Office	3120	6	3	2x2 3 Lamp, 17w T8, Elect. Ballast, Recessed, Prismatic Lens	47	0.28	879.8	$146.05	6	0	No Change	47	0.28	879.84	$146.05	$0.00	$0.00	0.00	0	$0.00	0.00

821	108 Office	3120	4	3	2x2 3 Lamp, 17w T8, Elect. Ballast, Recessed, Prismatic Lens	47	0.19	586.6	$97.37	4	0	No Change	47	0.19	586.56	$97.37	$0.00	$0.00	0.00	0	$0.00	0.00
821	108A Reception	3120	6	3	2x2 3 Lamp, 17w T8, Elect. Ballast, Recessed, Prismatic Lens	47	0.28	879.8	$146.05	6	0	No Change	47	0.28	879.84	$146.05	$0.00	$0.00	0.00	0	$0.00	0.00
821	108B Admissions	3120	9	3	2x2 3 Lamp, 17w T8, Elect. Ballast, Recessed, Prismatic Lens	47	0.42	1,319.8	$219.08	9	0	No Change	47	0.42	1319.76	$219.08	$0.00	$0.00	0.00	0	$0.00	0.00
821	109 Office	3120	6	3	2x2 3 Lamp, 17w T8, Elect. Ballast, Recessed, Prismatic Lens	47	0.28	879.8	$146.05	6	0	No Change	47	0.28	879.84	$146.05	$0.00	$0.00	0.00	0	$0.00	0.00
221	110 Classroom	3120	6	2	2x4 2 Lamp, 32w T8, Elect. Ballast, Recessed, Prismatic Lens	58	0.35	1,085.8	$180.24	6	0	No Change	58	0.35	1085.76	$180.24	$0.00	$0.00	0.00	0	$0.00	0.00
221	111 Classroom	3120	9	2	2x4 2 Lamp, 32w T8, Elect. Ballast, Recessed, Prismatic Lens	58	0.52	1,628.6	$270.35	9	0	No Change	58	0.52	1628.64	$270.35	$0.00	$0.00	0.00	0	$0.00	0.00
221	112 Comp. Lab	3120	8	2	2x4 2 Lamp, 32w T8, Elect. Ballast, Recessed, Prismatic Lens	58	0.46	1,447.7	$240.31	8	0	No Change	58	0.46	1447.68	$240.31	$0.00	$0.00	0.00	0	$0.00	0.00
221	113 Office Systems Lab	3120	6	2	2x4 2 Lamp, 32w T8, Elect. Ballast, Recessed, Prismatic Lens	58	0.35	1,085.8	$180.24	6	0	No Change	58	0.35	1085.76	$180.24	$0.00	$0.00	0.00	0	$0.00	0.00
221	114 Comp. Lab	3120	9	2	2x4 2 Lamp, 32w T8, Elect. Ballast, Recessed, Prismatic Lens	58	0.52	1,628.6	$270.35	9	0	No Change	58	0.52	1628.64	$270.35	$0.00	$0.00	0.00	0	$0.00	0.00
221	117 Classroom	3120	9	2	2x4 2 Lamp, 32w T8, Elect. Ballast, Recessed, Prismatic Lens	58	0.52	1,628.6	$270.35	9	0	No Change	58	0.52	1628.64	$270.35	$0.00	$0.00	0.00	0	$0.00	0.00
221	118 Classroom	3120	6	2	2x4 2 Lamp, 32w T8, Elect. Ballast, Recessed, Prismatic Lens	58	0.35	1,085.8	$180.24	6	0	No Change	58	0.35	1085.76	$180.24	$0.00	$0.00	0.00	0	$0.00	0.00
221	119 Classroom	3120	9	2	2x4 2 Lamp, 32w T8, Elect. Ballast, Recessed, Prismatic Lens	58	0.52	1,628.6	$270.35	9	0	No Change	58	0.52	1628.64	$270.35	$0.00	$0.00	0.00	0	$0.00	0.00
500	Lobby	3120	8	1	Wall Sconce, (1) 27w CFL	30	0.24	748.8	$124.30	8	0	No Change	30	0.24	748.8	$124.30	$0.00	$0.00	0.00	0	$0.00	0.00
1000		3120	6	1	Recessed Down Light, (1) 27w CFL	30	0.18	561.6	$93.23	6	0	No Change	30	0.18	561.6	$93.23	$0.00	$0.00	0.00	0	$0.00	0.00
500	Coridors	3120	4	1	Wall Sconce, (1) 27w CFL	30	0.12	374.4	$62.15	4	0	No Change	30	0.12	374.4	$62.15	$0.00	$0.00	0.00	0	$0.00	0.00
821		3120	22	3	2x2 3 Lamp, 17w T8, Elect. Ballast, Recessed, Prismatic Lens	47	1.03	3,226.1	$535.53	22	0	No Change	47	1.03	3226.08	$535.53	$0.00	$0.00	0.00	0	$0.00	0.00
821	120 Men's Restroom	3120	3	3	2x2 3 Lamp, 17w T8, Elect. Ballast, Recessed, Prismatic Lens	47	0.14	439.9	$73.03	3	0	No Change	47	0.14	439.92	$73.03	$0.00	$0.00	0.00	0	$0.00	0.00
821	Custodial Closet	780	1	3	2x2 3 Lamp, 17w T8, Elect. Ballast, Recessed, Prismatic Lens	47	0.05	36.7	$6.09	1	0	No Change	47	0.05	36.66	$6.09	$0.00	$0.00	0.00	0	$0.00	0.00
821	122 Women's Restroom	3120	3	3	2x2 3 Lamp, 17w T8, Elect. Ballast, Recessed, Prismatic Lens	47	0.14	439.9	$73.03	3	0	No Change	47	0.14	439.92	$73.03	$0.00	$0.00	0.00	0	$0.00	0.00
500	Lobby	3120	4	1	Wall Sconce, (1) 27w CFL	30	0.12	374.4	$62.15	4	0	No Change	30	0.12	374.4	$62.15	$0.00	$0.00	0.00	0	$0.00	0.00
821	Security Desk	3120	2	3	2x2 3 Lamp, 17w T8, Elect. Ballast, Recessed, Prismatic Lens	47	0.09	293.3	$48.68	2	0	No Change	47	0.09	293.28	$48.68	$0.00	$0.00	0.00	0	$0.00	0.00
821	Security Monitoring	3120	3	3	2x2 3 Lamp, 17w T8, Elect. Ballast, Recessed, Prismatic Lens	47	0.14	439.9	$73.03	3	0	No Change	47	0.14	439.92	$73.03	$0.00	$0.00	0.00	0	$0.00	0.00
600	Stairway	3120	5	2	1x4 2 Lamp, 32w T8, Elect. Ballast, Wall Mnt., Prismatic Lens	58	0.29	904.8	$150.20	5	0	No Change	58	0.29	904.8	$150.20	$0.00	$0.00	0.00	0	$0.00	0.00
134	L01 Mech. Rm.	780	3	2	1x4 2 Lamp, 32w T8, Elect. Ballast, Pendant Mnt., No Lens	58	0.17	135.7	$22.53	3	0	No Change	58	0.17	135.72	$22.53	$0.00	$0.00	0.00	0	$0.00	0.00
821	L04 Faculty Office	3120	3	3	2x2 3 Lamp, 17w T8, Elect. Ballast, Recessed, Prismatic Lens	47	0.14	439.9	$73.03	3	0	No Change	47	0.14	439.92	$73.03	$0.00	$0.00	0.00	0	$0.00	0.00
221	Elevator Mech. Rm	780	1	2	2x4 2 Lamp, 32w T8, Elect. Ballast, Recessed, Prismatic Lens	58	0.06	45.2	$7.51	1	0	No Change	58	0.06	45.24	$7.51	$0.00	$0.00	0.00	0	$0.00	0.00
821	Women's restroom	3120	3	3	2x2 3 Lamp, 17w T8, Elect. Ballast, Recessed, Prismatic Lens	47	0.14	439.9	$73.03	3	0	No Change	47	0.14	439.92	$73.03	$0.00	$0.00	0.00	0	$0.00	0.00

821	Custodial Closet	780	1	3	2x2 3 Lamp, 17w T8, Elect. Ballast, Recessed, Prismatic Lens	47	0.05	36.7	$6.09	1	0	No Change	47	0.05	36.66	$6.09	$0.00	$0.00	0.00	0	$0.00	0.00
821	Men's Restroom	3120	3	3	2x2 3 Lamp, 17w T8, Elect. Ballast, Recessed, Prismatic Lens	47	0.14	439.9	$73.03	3	0	No Change	47	0.14	439.92	$73.03	$0.00	$0.00	0.00	0	$0.00	0.00
221	L08 Classroom	3120	4	2	2x4 2 Lamp, 32w T8, Elect. Ballast, Recessed, Prismatic Lens	58	0.23	723.8	$120.16	4	0	No Change	58	0.23	723.84	$120.16	$0.00	$0.00	0.00	0	$0.00	0.00
421	L09 Electrolysis Lab	3120	6	4	2x4 4 Lamp, 32w T8, Elect. Ballast, Recessed, Prismatic Lens	112	0.67	2,096.6	$348.04	6	0	No Change	112	0.67	2096.64	$348.04	$0.00	$0.00	0.00	0	$0.00	0.00
221	L10 Storage	780	3	2	2x4 2 Lamp, 32w T8, Elect. Ballast, Recessed, Prismatic Lens	58	0.17	135.7	$22.53	3	0	No Change	58	0.17	135.72	$22.53	$0.00	$0.00	0.00	0	$0.00	0.00
221	L11	3120	6	2	2x4 2 Lamp, 32w T8, Elect. Ballast, Recessed, Prismatic Lens	58	0.35	1,085.8	$180.24	6	0	No Change	58	0.35	1085.76	$180.24	$0.00	$0.00	0.00	0	$0.00	0.00
221	L12 Physical Therapy	3120	7	2	2x4 2 Lamp, 32w T8, Elect. Ballast, Recessed, Prismatic Lens	58	0.41	1,266.7	$210.28	7	0	No Change	58	0.41	1266.72	$210.28	$0.00	$0.00	0.00	0	$0.00	0.00
821	Corridors	3120	14	3	2x2 3 Lamp, 17w T8, Elect. Ballast, Recessed, Prismatic Lens	47	0.66	2,053.0	$340.79	14	0	No Change	47	0.66	2052.96	$340.79	$0.00	$0.00	0.00	0	$0.00	0.00
821	Library Office	3120	8	3	2x2 3 Lamp, 17w T8, Elect. Ballast, Recessed, Prismatic Lens	47	0.38	1,173.1	$194.74	8	0	No Change	47	0.38	1173.12	$194.74	$0.00	$0.00	0.00	0	$0.00	0.00
821	L17 Learning Center	3120	14	3	2x2 3 Lamp, 17w T8, Elect. Ballast, Recessed, Prismatic Lens	47	0.66	2,053.0	$340.79	14	0	No Change	47	0.66	2052.96	$340.79	$0.00	$0.00	0.00	0	$0.00	0.00
221		3120	5	2	2x4 2 Lamp, 32w T8, Elect. Ballast, Recessed, Prismatic Lens	58	0.29	904.8	$150.20	5	0	No Change	58	0.29	904.8	$150.20	$0.00	$0.00	0.00	0	$0.00	0.00
500		3120	10	1	Wall Sconce, (1) 27w CFL	30	0.30	936.0	$155.38	10	0	No Change	30	0.30	936	$155.38	$0.00	$0.00	0.00	0	$0.00	0.00
821	L15 Reading Room	3120	4	3	2x2 3 Lamp, 17w T8, Elect. Ballast, Recessed, Prismatic Lens	47	0.19	586.6	$97.37	4	0	No Change	47	0.19	586.56	$97.37	$0.00	$0.00	0.00	0	$0.00	0.00
221		3120	14	2	2x4 2 Lamp, 32w T8, Elect. Ballast, Recessed, Prismatic Lens	58	0.81	2,533.4	$420.55	14	0	No Change	58	0.81	2533.44	$420.55	$0.00	$0.00	0.00	0	$0.00	0.00
731		3120	8	2	6"x4 2 Lamp, 32w T8, Elect. Ballast, Pendant Mnt., Prismatic Lens	58	0.46	1,447.7	$240.31	8	0	No Change	58	0.46	1447.68	$240.31	$0.00	$0.00	0.00	0	$0.00	0.00
711	L15A Stacks	3120	14	2	6"x4 2 Lamp, 32w T8, Elect. Ballast, Surface Mnt., Prismatic Lens	58	0.81	2,533.4	$420.55	14	0	No Change	58	0.81	2533.44	$420.55	$0.00	$0.00	0.00	0	$0.00	0.00
134	Electrical Room	3120	3	2	1x4 2 Lamp, 32w T8, Elect. Ballast, Pendant Mnt., No Lens	58	0.17	542.9	$90.12	3	0	No Change	58	0.17	542.88	$90.12	$0.00	$0.00	0.00	0	$0.00	0.00
711	Stock	3120	1	2	6"x4 2 Lamp, 32w T8, Elect. Ballast, Surface Mnt., Prismatic Lens	58	0.06	181.0	$30.04	1	0	No Change	58	0.06	180.96	$30.04	$0.00	$0.00	0.00	0	$0.00	0.00
211	Storage	780	2	2	1x4 2 Lamp, 32w T8, Elect. Ballast, Pendant Mnt., No Lens	58	0.12	90.5	$15.02	2	0	No Change	58	0.12	90.48	$15.02	$0.00	$0.00	0.00	0	$0.00	0.00
711	Storage	780	1	2	6"x4 2 Lamp, 32w T8, Elect. Ballast, Surface Mnt., Prismatic Lens	58	0.06	45.2	$7.51	1	0	No Change	58	0.06	45.24	$7.51	$0.00	$0.00	0.00	0	$0.00	0.00
	Totals		261	97			13.64	40,986	$6,803.66	261	0			13.64	40,986	$6,803.66		$0.00	0.00	0	$0.00	0.00

NOTES: 1. Simple Payback noted in this spreadsheet does not include Maintenance Savings and NJ Smart Start Incentives.
-Indicates Rooms that should be outfitted with dual technology occupancy sensors; refer to **ECM#1**.

Building	Total Area (sq ft)	Panel	Qty	Panel Sq Ft	Panel Total Sq Ft	Total KW_{DC}	Total Annual kWh	Panel Weight (33 lbs)	W/SQFT
Logos Parking Lot Arrays	5600	Sunpower SPR230	343	14.7	5,044	78.89	83,002	11,319	15.64



PVWatts *** AC Energy & Cost Savings

Cautions for Interpreting the Results

Station Identification	
City:	Newark
State:	New_Jersey
Latitude:	40.70° N
Longitude:	74.17° W
Elevation:	9 m
PV System Specifications	
DC Rating:	78.9 kW
DC to AC Derate Factor:	0.810
AC Rating:	63.9 kW
Array Type:	Fixed Tilt
Array Tilt:	10.0°
Array Azimuth:	270.0°
Energy Specifications	
Cost of Electricity:	0.2 ¢/kWh

Results			
Month	Sclar Radiation (kWh/m²/day)	AC Energy (kWh)	Energy Value ($)
1	1.97	3692	6.28
2	2.72	4797	8.15
3	3.58	7182	12.21
4	4.57	8421	14.32
5	5.53	10259	17.44
6	5.81	10149	17.25
7	5.55	10073	17.12
8	5.13	9052	15.39
9	4.26	7457	12.69
10	3.13	5670	9.64
11	1.92	3333	5.67
12	1.52	2907	4.94
Year	3.84	83002	141.10

Notes: =Proposed PV Layout

1. Estimated kWH based on the National Renewable Energy Laboratory PVWatts Version 1 Calculator Program.

Project Name: LGEA Solar PV Project - Logos Building
Location: Plainfield, NJ
Description: Photovoltaic System - Direct Purchase

Simple Payback Analysis

	Photovoltaic System - Direct Purchase
Total Construction Cost	$710,010
Annual kWh Production	83,002
Annual Energy Cost Reduction	$13,778
Annual SREC Revenue	$29,051
First Cost Premium	**$710,010**
Simple Payback:	**16.58** **Years**

Life Cycle Cost Analysis

Analysis Period (years):	25	Financing %:	0%
Financing Term (mths):	0	Maintenance Escalation Rate:	3.0%
Average Energy Cost ($/kWh)	**$0.166**	Energy Cost Escalation Rate:	3.0%
Financing Rate:	0.00%	SREC Value ($/kWh)	$0.350

Period	Additional Cash Outlay	Energy kWh Production	Energy Cost Savings	Additional Maint Costs	SREC Revenue	Net Cash Flow	Cumulative Cash Flow
0	$710,010	0	0	0	$0	(710,010)	0
1	$0	83,002	$13,778	$0	$29,051	$42,829	($667,181)
2	$0	82,587	$14,192	$0	$28,905	$43,097	($624,084)
3	$0	82,174	$14,617	$0	$28,761	$43,378	($580,705)
4	$0	81,763	$15,056	$0	$28,617	$43,673	($537,032)
5	$0	81,354	$15,508	$838	$28,474	$43,144	($493,889)
6	$0	80,948	$15,973	$834	$28,332	$43,471	($450,418)
7	$0	80,543	$16,452	$830	$28,190	$43,812	($406,605)
8	$0	80,140	$16,946	$825	$28,049	$44,169	($362,436)
9	$0	79,739	$17,454	$821	$27,909	$44,541	($317,895)
10	$0	79,341	$17,978	$817	$27,769	$44,930	($272,965)
11	$0	78,944	$18,517	$813	$27,630	$45,334	($227,631)
12	$0	78,549	$19,072	$809	$27,492	$45,756	($181,875)
13	$0	78,157	$19,645	$805	$27,355	$46,194	($135,681)
14	$0	77,766	$20,234	$801	$27,218	$46,651	($89,030)
15	$0	77,377	$20,841	$797	$27,082	$47,126	($41,904)
16	$0	76,990	$21,466	$793	$26,947	$47,620	$5,716
17	$0	76,605	$22,110	$789	$26,812	$48,133	$53,849
18	$0	76,222	$22,773	$785	$26,678	$48,666	$102,515
19	$0	75,841	$23,457	$781	$26,544	$49,220	$151,735
20	$0	75,462	$24,160	$777	$26,412	$49,795	$201,529
21	$1	75,084	$24,885	$773	$26,280	$50,391	$251,921
22	$2	74,709	$25,632	$770	$26,148	$51,010	$302,931
23	$3	74,336	$26,401	$766	$26,017	$51,652	$354,584
24	$4	73,964	$27,193	$762	$25,887	$52,318	$406,902
25	$5	73,594	$28,009	$758	$25,758	$53,008	$459,910
	Totals:	1,583,504	$370,229	$12,916	$554,226	$1,169,920	$911,539
				Net Present Value (NPV)		**$459,935**	
				Internal Rate of Return (IRR)		**4.1%**	