ENERGY AUDIT – FINAL REPORT
JANUARY 6, 2010

UNION COUNTY COLLEGE
ELIZABETH CAMPUS
LESSNER BUILDING

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ELIZABETH, NJ 07201
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REPORT DISCLAIMER

I. EXECUTIVE SUMMARY

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

Union County College – Elizabeth Campus
Lessner Building
12 West Jersey Street
Elizabeth, NJ 07201

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

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	$ 347,350
Natural Gas	$ 120,790
Total	$ 468,140

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 Upgrade	$8,124	$4,971	1.6	817.8%
ECM #2	Domestic HW Decentralization	$8,423	$7,761	1.1	821.4%
ECM #3	Chiller Replacement	$155,000	$14,587	10.6	135.3%
ECM #4	HVAC System Controls	$409,984	$14,620	28.0	-46.5%
ECM #5	RTU-1 & 2 Replacement	$35,520	$1,197	29.7	-49.5%
ECM #6	Demand Control Ventilation	$222,144	$14,620	15.2	-1.3%
ECM #7	Chilled Water Pump VFDs	$8,900	$3,023	2.9	477.4%

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 is shown below in Table 2. The descriptions in this table correspond to the ECM'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 Upgrade	5.2	32,899	0
ECM #2	Domestic HW Decentralization	7.5	26,856	2,400
ECM #3	Chiller Replacement	142.9	99,914	0
ECM #4	HVAC System Controls	0.0	45,177	5,015
ECM #5	RTU-1 & 2 Replacement	10.2	8,201	0
ECM #6	Demand Control Ventilation	0.0	45,177	5,015
ECM #7	Chilled Water Pump VFDs	0.0	21,000	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 Upgrade
- **ECM #2:** Domestic Hot Water Decentralization
- **ECM #7:** Chilled Water pump VFDs

Although ECM #3 does not provide a payback less than 10 years, it is recommended to implement the installation of an efficient chiller as suggested in ECM #3 when the need to replace the existing chiller is required. This option should be considered as a viable option for the facility since the IRR of this ECM is 8.05%. A positive value for any ECM IRR represents the current rate of return of an investment in today's dollars. If the IRR rate is greater than the rate of return on an alternative form of investment, it should be strongly considered.

Campus level facilities such as the Lessner building have a wide range of uses which makes it difficult to compare. The Lessner building energy use is 22% higher than average per square foot based on the US Department of Energy bin data. The long operating hours provide opportunity for significant energy savings since any reduction in usage is multiplied by the long use.

The proposed lighting retrofit is primarily replacing incandescent fixtures throughout the facility with compact fluorescent bulbs. The T-12 fixtures can be replaced with T-8 fixtures to save approximately 40% on energy use with the added benefit of improved lighting quality. This

ECM is a quick and easy retrofit that pays for itself in less than 2 years, which is strongly recommended.

The domestic hot water heater is indirectly a significant user of natural gas energy. The efficiency of the central boiler plant which serves the domestic hot water heater is decreased in the summertime operation because of the standby losses. Operation of the central boiler system keeps piping hot and boiler pumps running all summer to supply heat to the domestic hot water tank. The implementation of a high efficiency independent hot water heater allows the boiler system to be turned off and eliminates the standby losses and pumping energy. The savings as a result of the implementation of this system pays for itself in approximately one year. This change to decentralize the domestic hot water heaters is also recommended.

The chilled water system includes chilled water pumps which currently do not have variable speed control. ECM #7 includes installation of VFDs which slow the pumps down on an as needed basis. The load profile for this facility is estimated to vary throughout the cooling season however the current operation has the chilled water pumps running at full flow 100% of the time. VFDs are becoming the standard for new installations and very competitive on a first cost basis. This ECM is would save approximately $3000 per year and provide a simple payback on the installation cost within 3 years.

Due to the age of the building, many system components and set points have likely drifted from its original set points and operating conditions. It is expected that implementing Retro-Commissioning would be extremely beneficial for this facility. Retro-Commissioning is a means to verify your current equipment is operating at its designed efficiency, capacity, airflow, and overall performance. Retro-Commissioning provides valuable insight into systems or components not performing correctly or out of balance. This is especially valuable for buildings with extensive air side systems such as this facility. Retro-Commissioning is highly recommended for this facility.

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. Doors that operate more frequently are prone to having the weather stripping wear out and become of little value.
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.

Incentives provide financial motivation and much needed support for the implementation of energy conservation measures. Along with the NJ Smart Start program, the Pay for Performance Program incentives, sponsored by NJ Clean Energy Program, are applicable for this facility. The existing average operating demand above 200 KW and high energy consumption qualifies for the Pay for Performance Program. The incentive based on a 15% electrical energy reduction for this facility would qualify for an additional $64,114 in the pay for performance program. This option is one to consider for a whole-building approach to energy reduction. The Pay for Performance Program represents a significant commitment to energy reduction of a facility. This option should be reviewed in more detail with a Pay for Performance Program partner.

II. INTRODUCTION

The comprehensive energy audit covers the 102,496 square foot, seven stories Lessner Building, which includes the following spaces: administration area, offices, classrooms, theater, cafeteria and bookstore.

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 (also known as Energy Use Intensity) 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:

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

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

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

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

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

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

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 LPLS 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. The facility receives their natural gas supply via two means; commodity and delivery. Woodruff Energy and Pepco Energy Services are both Third Party Suppliers (TPS) that the Owner has contracted with two provide the commodity side of the natural gas supply; Pepco Energy Services is the Owner's current TPS for this facility. Elizabethtown Gas provides natural gas delivery to the facility under the AMR rate structure. Woodruff Energy and Pepco have both serviced the commodity side of the natural gas utility as third party suppliers (TPS). 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 overall cost for utilities is calculated by dividing the total cost by the total usage. Based on the utility history provided, the average cost for utilities at this facility is as follows:

Description	Average
Electricity	14.6¢ / kWh
Natural Gas	$1.60 / Therm

Table 3
Electricity Billing Data

ELECTRIC USAGE SUMMARY

Utility Provider: PSE&G
Rate: Rate - LPLS
Account No: 67 076 193 06 & 71 800 839 2
Customer ID No: PE000009878647871450
Third Party Utility Provider: N/A
TPS Meter / Acct No: N/A

MONTH OF USE	CONSUMPTION KWH	DEMAND		TOTAL BILL
Jan-09	153,155	304.4		$21,077
Feb-09	160,376	409.3		$23,540
Mar-09	190,336	394.3		$26,087
Apr-09	192,848	601.1		$26,987
May-08	204,844	440.9		$24,160
Jun-08	229,645	435.8		$36,849
Jul-08	243,649	435.3		$39,589
Aug-08	232,342	415.3		$38,819
Sep-08	241,735	476.1		$39,871
Oct-08	221,176	450.2		$29,273
Nov-08	151,950	292.4		$20,442
Dec-08	152,553	296.6		$20,654
Totals	**2,374,609**	**601.1**	**Max**	**$347,350**

AVERAGE DEMAND **412.6 KW average**

AVERAGE RATE **$0.146 $/kWh**

Figure 1
Electricity Usage Profile

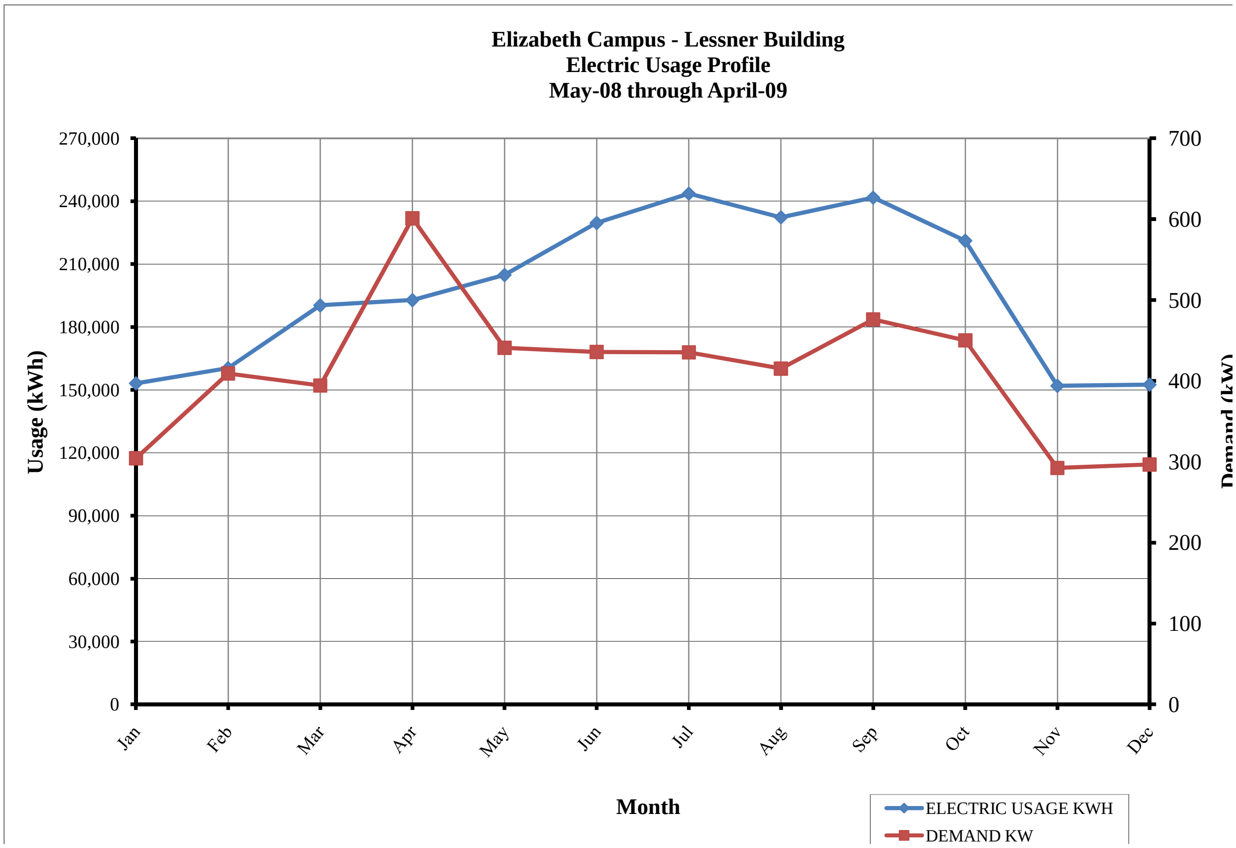


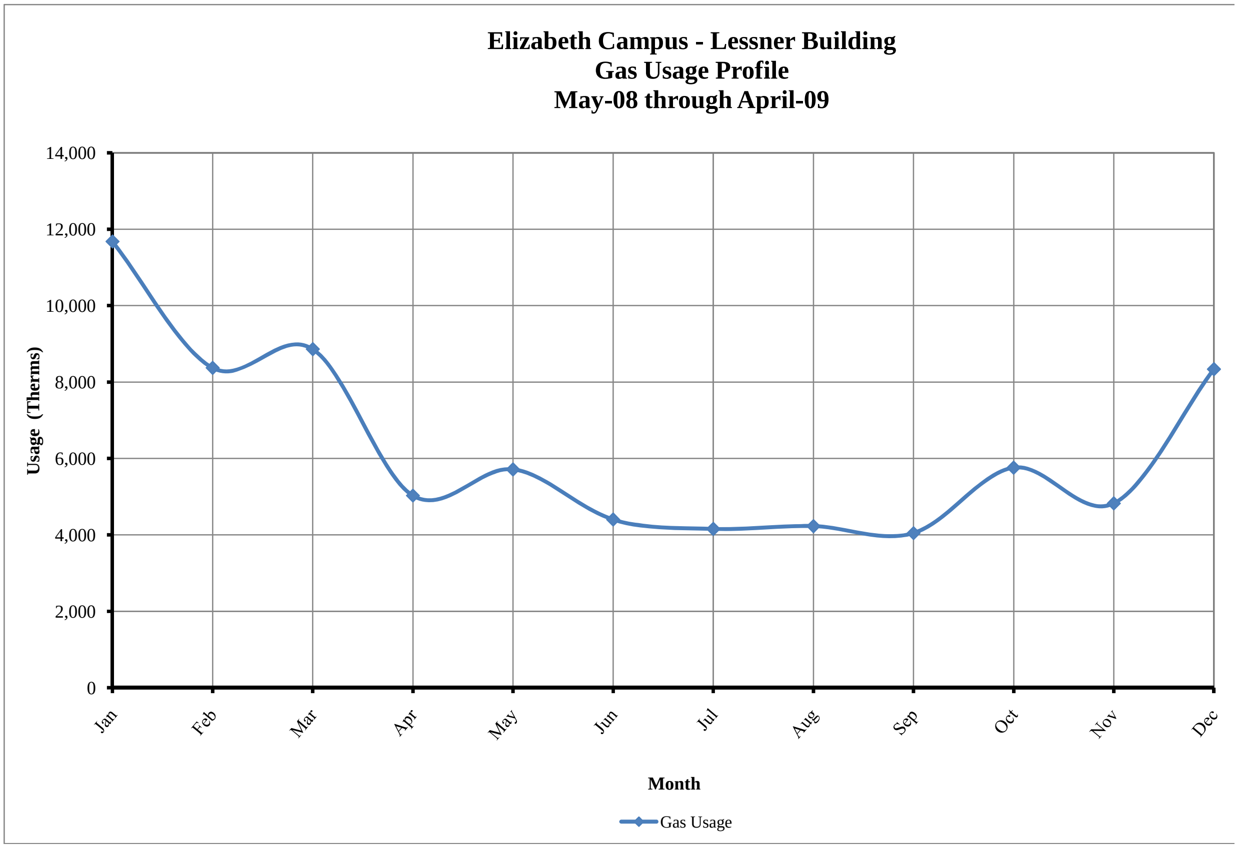
Table 4
Natural Gas Billing Data

NATURAL GAS USAGE SUMMARY

Utility Provider:	Elizabethtown Gas
Rate:	Rate - AMR aft
Meter No:	4374825531
Point of Delivery ID:	N/A
Third Party Utility Provider:	PEPCO
TPS Meter No:	N/A

MONTH OF USE	CONSUMPTION (THERMS)	TOTAL BILL
Jan-09	11,677.80	$16,137.88
Feb-09	8,372.00	$11,496.06
Mar-09	8,861.50	$12,128.91
Apr-09	5,029.50	$8,273.14
May-08	5,714.80	$10,344.99
Jun-08	4,402.20	$8,407.18
Jul-08	4,156.30	$8,505.89
Aug-08	4,230.10	$7,911.66
Sep-08	4,046.20	$7,598.50
Oct-08	5,760.00	$9,376.77
Nov-08	4,824.70	$7,836.07
Dec-08	8,338.20	$12,772.98
TOTALS	**75,413.30**	**$120,790.03**
AVERAGE RATE:	**$1.602**	**$/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. There are many databases of information available to determine how a building's energy use compares with similar facilities throughout the U.S. and in a specific region or state. When comparing, it is important to compare the correct type of energy. Typically, the two energy types compared are site energy and source energy.

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:

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

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

Refer to **Table 5** below for the calculation of Site and Source EUI for this facility.

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	2374608.8			8,106,914	3.340	27,077,094
NATURAL GAS		75413.3		7,541,330	1.047	7,895,773
FUEL OIL			0.0	0	1.010	0
PROPANE			0.0	0	1.010	0
TOTAL				15,648,244		34,972,867
*Site - Source Ratio data is provided by the Energy Star Performance Rating Methodology for Incorporating Source Energy Use document issued Dec 2007.						
BUILDING AREA	102,496	SQUARE FEET				
BUILDING SITE EUI	*152.67*	kBtu/SF/YR				
BUILDING SOURCE EUI	*341.21*	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 facility, as compared to the national average the energy usage is approximately 22% higher 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: "Union County"

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**
Lessner Building	NA	NA

The energy performance rating is unavailable because the facility does not fall within the acceptable categories defined by Energy Star. See the **Statement of Energy Performance Appendix** for the detailed energy summary.

V. FACILITY DESCRIPTION

The 102,496 SF Lessner Building is a seven story facility comprised of administration areas, open and enclosed office areas, classrooms, laboratories, theater, cafeteria and bookstore. The building was constructed in 1965 for the Elizabethtown Gas Company and was renovated in 1991 for use by Union County College. The typical hours of operation for this facility have been noted as eighty-four (84) hours per week full occupied and forty-five (45) hours per week occupied by the cleaning staff only. The facility is utilized for educational purposes year round, but utilizes a summer schedule of Monday through Thursday occupancy. Exterior walls for the facility are constructed typically of curtain wall with film on the glazing. There is also block construction with face brick present in areas of the exterior wall construction. The roof on the facility is split between a lower flat roof and an upper flat roof. The lower flat roof construction consists of built-up EPDM roof with white finish. The upper flat roof which was recently redone is of same construction. Overall, the building envelope appeared to be in decent condition and maintained by the Owner.

<u>HVAC Systems</u>

The base HVAC systems within the Lessner Building are fed via a hot water plant and a chilled water plant located in the top floor penthouse. The hot and chilled water from these two plants feed various hot water heating and chilled water cooling coils within the penthouse and throughout the building. The following is a brief description of each plant:

- *Hot Water Plant*: The hot water plant consists of two (2) Weil McLain "88" gas-fired hot water boilers rated at 2,724 MBH output each. Each boiler is outfitted with a Powerflame natural gas burner that provides approximately 80% combustion efficiency. The boilers were manufactured in 1991 and have an estimated remaining useful life of 18 years according to 2007 ASHRAE Applications Handbook. There are two (2) base-mounted hot water pumps, labeled P-3 and P-4, manufactured by Taco with Baldor motors that are 85.5% NEMA efficient. These pumps operate as constant volume and were installed when the boilers were installed. The nameplate data on the motors suggest a manufacture date for each pump motor around 1990, therefore these pump motors have an estimate 10 years remaining useful life according to 2007 ASHRAE Applications Handbook.

- *Chilled Water Plant*: The chilled water plant consists of two (2) Carrier hermetic screw chillers operating on R-134a refrigerant. Each chiller has a cooling capacity of 350 tons and a full load efficiency of 0.653 KW/Ton. At the time of the survey the Owner advised our team that Chiller #1 had the oil recently changed and Chiller #2 is having refrigerant oil problems. The chillers were manufactured in 1998 and have an estimated 12 years remaining useful life based on 2007 ASHRAE Applications Handbook, however based on operational issues the Owner could see a replacement for one (1) or both chillers in the upcoming years. The replacement of the chillers will be a cost demolition measure because of their location and size. There are two (2) base-mounted chilled water pumps, labeled P-1 and P-2, manufactured by Taco. Pump P-1 has a Magnetek motor that is 93.6% NEMA efficiency and pump P-2 with a Baldor motor that is 88% NEMA efficient.

These pumps operate as constant volume and were installed when the chillers were installed. The nameplate data on the motors suggest a manufacture date for each pump motor around 1991, therefore these pump motors have an estimate 9 years remaining useful life according to 2007 ASHRAE Applications Handbook.

- *Condenser Water Plant*: The condenser water plant consists of a 2-cell Evapco cooling tower that was recently installed in 2008. The cooling tower is located on the low roof adjacent to the Penthouse. Based on its recent installation the tower's remaining useful life is approximately 20 years as noted in 2007 ASHRAE Applications Handbook. During the audit survey it was noted by our team that a cleaning of the intake filters on the cooling tower is required. This will aid in more efficient heat transfer. In addition to the installation of the new cooling tower, three (3) base-mounted condenser water pumps were also installed. The pumps, labeled P-5, P-6 and P-7, are manufactured by Taco and contain Baldor 93% NEMA efficient motors. The condenser water pumps are operated via Square D S-Flex variable frequency drives and have an estimated remaining useful life of approximately 20 years. Another part of the condenser water system is the plate-and-frame heat exchangers that connect the condenser water side of the chiller to the cooling tower and pumps. The two (2) heat exchangers as manufactured by Alfa Laval are original to the installation of the chillers in 1991. Each plate-and-frame heat exchanger has a 528.9 SF surface area and 205 plates. The exchangers require annual maintenance for cleaning and based on discussion with the Owner is appears that the exchangers have not been flushed in some time.

In addition to the main heating and cooling plant noted above there are multiple single zone air-handling systems that serve various areas throughout the building. The respective air-handling units, their make, location, type and zone served are as follows:

- *AHU-1*: Located in Penthouse and serves floors 2 through 7 ventilation air. Unit is an indoor air-handling unit that contains supply fan, chilled water coil, hot water coil and a freeze protection pump.

- *AHU-2*: Located in Penthouse and serves the laboratory rooms 701, 702 and 703. Unit is an indoor air-handling unit that contains supply fan, chilled water coil, hot water coil and a freeze protection pump.

- *AHU-3*: Located in Lower Level Electrical Service Room and serves the Theater. Unit is an indoor air-handling unit that contains supply fan, chilled water coil and hot water coil.

- *AHU-4*: Located in Lower Level Electrical Service Room and serves the Multi-Purpose Room. Unit is an indoor air-handling unit that contains supply fan, chilled water coil and hot water coil.

- *AHU-5*: Located in Lower Level Maintenance Room and serves the Library. Unit is an indoor air-handling unit that contains supply fan, chilled water coil and hot water coil.

- *AHU-6*: Located in Lower Level Maintenance Room and serves the Ground Floor Lobby. Unit is an indoor air-handling unit that contains supply fan, chilled water coil and hot water coil.

- *AHU-7*: Located in Lower Level Maintenance Room and serves the Bookstore. Unit is an indoor air-handling unit that contains supply fan, chilled water coil and hot water coil.

The above-listed air-handling units all have respective inline fans that work as return/relief fans for the zones that they serve.

Additionally, there are three packaged rooftop units located on the facility's low roof area that also provide conditioning to the college's cafeteria/lounge area and the current offices of Elizabethtown Gas. The rooftop units are detailed as follows:

- *RTU-1*: 20-ton cooling capacity unit utilizing R-22 refrigerant that serves the support area. Manufactured in 1991 and has an approximated EER of 8.7 based on manufacturer's data. This unit is approximately 3 years passed its estimated service life as outlined by 2007 ASHRAE Applications Handbook.

- *RTU-2*: 10-ton cooling capacity unit utilizing R-22 refrigerant that serves the cafeteria. Manufactured in 1991 and has an approximated EER of 9.6 based on manufacturer's data. This unit is approximately 3 years passed its estimated service life as outlined by 2007 ASHRAE Applications Handbook. There are hot water coils located in the duct distribution system that provide heating to the spaces served by this unit.

- *RTU-3*: 5-ton cooling capacity unit utilizing R-22 refrigerant that serves the Elizabethtown Gas Company's area. Manufactured in 2004 and has an approximated EER of 8.7 based on manufacturer's data. This unit has approximately 10 years remaining service life as outlined by 2007 ASHRAE Applications Handbook. This unit contains a 6.8 kW electric heating coil.

Storage / mechanical rooms where required are heated via hot water unit heaters. There is one (1) electric unit heater located in the small garage in the rear of the facility.

Exhaust System

Ventilation air is removed from the building via the return/relief fans noted in the above descriptions. In addition, there are roof exhaust fans that provide required exhaust rates as needed. There is a single grease exhaust fan on the low roof that provides the exhaust requirements for the grease hood within the cafeteria area.

HVAC System Controls

The HVAC systems within the facility are controlled via direct digital controls that are capable of being adjusted remotely via a desktop computer located in the maintenance office within the Penthouse. The hot water boilers, chillers and associated pumps are controlled via Barber

Coleman Network 8000™ controllers while the new condenser water pumps and cooling tower are controlled via Invensys I/A Series controllers.

Domestic Hot Water

Domestic hot water for the facility is provided by a Patterson Kelly hot water generator located in the basement mechanical room of the facility. The generator was installed in 1991 and acts as a storage tank and heat exchanger. The heat exchanger portion of the hot water generator requires the hot water boiler plant to provide the heating hot water to heat the domestic loop. This requires the hot water boilers and hot water pumps to continuously run throughout the year whether heating season or not. This utilizes excess pumping and thermal energy.

Lighting

Typical lighting throughout building is fluorescent tube lay-in fixtures with T-8 lamps and electronic ballasts. There were some rooms that contained T-12 fixtures that have not been retro-fitted as of yet. The Owner made the lighting retrofit a high priority and has completed the retro-fit in 98% of the building. Both standard switching and occupancy sensors are utilized for lighting control. Electronic time-clocks are utilized for all lighting that is not controlled via switch or sensor.

Refer to **Investment Grade Lighting Audit Appendix** for a detailed inventory of all fixtures within the Lessner Building.

VI. MAJOR EQUIPMENT LIST

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

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

VII. ENERGY CONSERVATION MEASURES

ECM #1: Lighting Upgrade

Description:

The lighting in the Lessner Building is almost entirely made up of fluorescent fixtures with T-8 lamps and electronic ballasts, however there are a few storage rooms and closets with incandescent and halogen lighting as well as a few T-12 fixtures with magnetic ballasts.

This ECM includes replacement of the existing fixtures containing T12 lamps and magnetic ballasts with fixtures containing T8 lamps and electronic ballasts. The new energy efficient, T8 fixtures will provide adequate lighting and will save the owner on electrical costs due to the better performance of the lamp and ballasts. This ECM will also provide maintenance savings through the reduced number of lamps replaced per year. The expected lamp life of a T8 lamp is approximately 30,000 burn-hours, in comparison to the existing T12 lamps which is approximately 20,000 burn-hours. The facility will need 33% less lamps replaced per year.

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

Hours of Operation:

Classrooms and Student Occupied Areas:

84 Hrs per week + 45 Hrs per week, 39 weeks per year – 5031 Hrs per year.
67.2 Hrs per week + 36 Hrs per week, 13 weeks per year – 1341.6 Hrs per year.
Total – 6372.6 Hrs per year.

Storage rooms and Mechanical rooms:

25% of normal hours (above) – 1593 Hrs per year.

Outdoor Lighting:

10 Hrs per day, 7 days per week, 52 weeks per year – 3640 Hrs per year.

Energy Savings Calculations:

The **Investment Grade Lighting Audit Appendix** outlines the proposed retrofits, costs, savings, and payback periods.

NJ Smart Start® Program Incentives are calculated as follows:

From the **Smart Start Incentive Appendix**, the replacement of a T-12 fixture to a T-5 or T-8 fixture warrants the following incentive: T-5 or T-8 (1-2 lamp) = $10 per fixture; T-5 or T-8 (3-4 lamp) = $20 per fixture.

$$\text{Smart Start® } Incentive = (\#\ of\ 1-2\ lamp\ \ fixtures \times \ \$10) + (\#\ of\ \ 3-4\ lamp\ \ fixtures \times \ \$20)$$

$$\text{Smart Start® } Incentive = (43 \times \ \$10) + (22 \times \ \$20) = \underline{\$870}$$

Replacement and Maintenance Savings are calculated as follows:

$$Savings = (reduction\ in\ lamps\ replaced\ \ per\ \ year) \times (repacment\ \$\ per\ lamp + Labor\ \$\ per\ lamp)$$

$$Savings = (24\ lamps\ \ per\ \ year) \times (\$2.00 + \$5.00) = \underline{\$168}$$

Energy Savings Summary:

ECM #1 - ENERGY SAVINGS SUMMARY	
Installation Cost ($):	$8,994
NJ Smart Start Equipment Incentive ($):	$870
Net Installation Cost ($):	$8,124
Maintenance Savings ($/Yr):	$168
Energy Savings ($/Yr):	$4,803
Total Yearly Savings ($/Yr):	$4,971
Estimated ECM Lifetime (Yr):	15
Simple Payback	1.6
Simple Lifetime ROI	817.8%
Simple Lifetime Maintenance Savings	$2,520
Simple Lifetime Savings	$74,565
Internal Rate of Return (IRR)	61%
Net Present Value (NPV)	$51,219.48

ECM #2: Domestic HW Decentralization

Description:

The domestic hot water heater is centrally located in the lower level mechanical room. The central domestic hot water heater is a large storage tank with integral boiler water heat exchanger inside the tank. The boiler is required to run and distribute heating water from the penthouse down to the lower level mechanical room year round to provide domestic hot water to the building. The losses due to keeping the boiler hot and circulating boiler water for domestic hot water production are significant. The efficiency of the heating system when operating only to support domestic hot water production drop far below the efficiency of a dedicated hot water heater. The overall energy loss due to the boilers and boiler water piping are compounded by the added cooling load resulting from the added heat to the space.

This ECM includes installing a dedicated domestic hot water heater for the building. This installation would eliminate boiler operation in the summer. Savings from the implementation of this ECM will be achieved through reduced gas consumption from reduced heating energy as well as reduced electric consumption from reduced air conditioning energy. Estimations for domestic hot water use are based on the LEED rating system version 2.2.

The ECM calculations are based on AO Smith hot water heaters model number BTH-150 or equal. The installation cost of a dedicated hot water heater, plumbing work, and associated wiring is $8,821 ($6,276 Materials)

Summer Boiler Pump Operating Hrs	= 3600
Boiler Efficiency	= 80%
Boiler Jacket and piping loss	= 10%
Proposed Hot Water Heater Efficiency	= 96%
Average Cost of Gas	= $1.60/Therm
Average Cooling Equipment EER	= 8.0 EER
Average Cost of Electricity	= $0.146/kWh
Full Time Equivalent Occupants (FTE)	= 2660
Sink Dom. HW usage (0.25 Min per FTE per day)	= 2.5 GPM
Lavatory Faucet (0.75 Min per FTE per day)	= 2.5 GPM

Energy Savings Calculations:

<u>Domestic Hot Water Usage Calculations</u>

$$DHW\ Usage = FTE \times Flowrate\left(\frac{Gal}{Min}\right) \times Duration\left(\frac{Min}{Day}\right) \times Duration\left(\frac{Day}{Wk}\right) \times Duration\left(\frac{Wk}{Yr}\right)$$

$$DHW\ Usage = 2660\ FTE \times 2.5\left(\frac{Gal}{Min}\right) \times (0.25 + 0.75)\left(\frac{Min}{Day}\right) \times 5\left(\frac{Day}{Wk}\right) \times 52\left(\frac{Wk}{Yr}\right) = 1{,}729{,}000(Gal)$$

$$DHW\ Gas\ Use = \frac{DHW\ Usage\left(\frac{Gal}{Yr}\right) \times 8.33\left(\frac{Lbs}{Gal}\right) \times TempRise(°F) \times 1\left(\frac{Btu}{Lb\,°F}\right)}{\Pr oposed\ DHW\ Eff \times HeatValue\left(\frac{Btu}{kWh}\right)}$$

$$DHW\ Gas\ Use = \frac{1{,}729{,}000\left(\frac{Gal}{Yr}\right) \times 8.33\left(\frac{Lbs}{Gal}\right) \times (120(°F) - 50(°F)) \times 1\left(\frac{Btu}{Lb\,°F}\right)}{80\% \times 100{,}000\left(\frac{Btu}{Therm}\right)} = 12{,}602(Therms)$$

Existing Boiler Gas Usage

$$DHW\ Gas\ Use = \frac{DHW\ Usage\left(\frac{Gal}{Yr}\right) \times 8.33\left(\frac{Lbs}{Gal}\right) \times TempRise(°F) \times 1\left(\frac{Btu}{Lb\,°F}\right)}{\Pr oposed\ DHW\ Eff \times HeatValue\left(\frac{Btu}{kWh}\right)}$$

$$DHW\ Gas\ Use = \frac{1{,}729{,}000\left(\frac{Gal}{Yr}\right) \times 8.33\left(\frac{Lbs}{Gal}\right) \times (120(°F) - 50(°F)) \times 1\left(\frac{Btu}{Lb\,°F}\right)}{70\% \times 100{,}000\left(\frac{Btu}{Therm}\right)} = 14{,}403(Therms)$$

Proposed HWH Gas Usage

$$DHW\ Gas\ Use = \frac{DHW\ Usage\left(\frac{Gal}{Yr}\right) \times 8.33\left(\frac{Lbs}{Gal}\right) \times TempRise(°F) \times 1\left(\frac{Btu}{Lb\,°F}\right)}{\Pr oposed\ DHW\ Eff \times HeatValue\left(\frac{Btu}{kWh}\right)}$$

$$DHW\ Gas\ Use = \frac{1{,}729{,}000\left(\frac{Gal}{Yr}\right) \times 8.33\left(\frac{Lbs}{Gal}\right) \times (120(°F) - 50(°F)) \times 1\left(\frac{Btu}{Lb\,°F}\right)}{96\% \times 100{,}000\left(\frac{Btu}{Therm}\right)} = 12{,}003(Therms)$$

<u>Boiler Water Pump Electrical Savings</u>

$$Elec\,Usage = PumpPower\ (HP) \times .746\left(\frac{KW}{HP}\right) \times Operation(Hrs)$$

$$Elec\,Usage = 10\ (HP) \times .746\left(\frac{KW}{HP}\right) \times 3600(Hrs) = 26{,}856\ (kWh)$$

<u>Cost Savings Calculations</u>

$$Demand\ \ Savings = \frac{Elec\,Usage(kWh)}{Operation(Hrs)}$$

$$Demand\ \ Savings = \frac{26{,}856(kWh)}{3600(Hrs)} = 7.46(KW)$$

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

$$Electric\ Cost\ Savings = 26{,}856(kWh) \times .146\left(\frac{\$}{kWh}\right) = \$3{,}921$$

$$GasSavings. = (Existing\ Gas\ Use(Therms) - \Pr oposed\ \ Gas\ Use(Therms)) \times Ave\ Gas\ Cost\left(\frac{\$}{Therm}\right)$$

$$GasSavings. = (14{,}403(Therms) - 12{,}003(Therms)) \times 1.60\left(\frac{\$}{Therm}\right) = \$3{,}840$$

$$Total\ \ Savings. = \$3{,}921 + \$3{,}840 = \$7{,}761$$

From the **NJ Smart Start® Program Appendix**, the unit falls under the category "Gas Water Heating" and warrants an incentive based on efficiency above 85%. The program incentives are calculated as follows:

$$\text{Smart Start® } Incentive = (MBH\ \ Input \times\ \ \$2.0 / MBH\ \ Input)$$
$$= (199\ MBH\ \times \$2.0 / MBH) = \$398$$

Energy Savings Summary:

ECM #2 - ENERGY SAVINGS SUMMARY	
Installation Cost ($):	$8,821
NJ Smart Start Equipment Incentive ($):	$398
Net Installation Cost ($):	$8,423
Maintenance Savings ($/Yr):	$0
Energy Savings ($/Yr):	$7,761
Total Yearly Savings ($/Yr):	$7,761
Estimated ECM Lifetime (Yr):	10
Simple Payback	1.1
Simple Lifetime ROI	821.4%
Simple Lifetime Maintenance Savings	$0
Simple Lifetime Savings	$77,610
Internal Rate of Return (IRR)	92%
Net Present Value (NPV)	$57,779.90

ECM #3: Chiller Replacement

Description:

The Lessner Building is cooled by two 200 ton water cooled chillers. The chillers are not past its expected life, however one unit has been difficult to keep running due to refrigerant oil issues. The units are inefficient compared to a single larger centrifugal chiller. The existing chiller efficiency is 0.653 KW/Ton base on manufacturer's data.

This ECM includes installation of a new 400 ton centrifugal chiller. The proposed centrifugal chiller's efficiency is 0.35 KW/Ton. This ECM is based on a 400 ton Carrier water cooled centrifugal chiller model number 23SRV4242NRVAA5 or equal.

Full Load Cooling Hrs.	= 800 hrs/yr.
Average Cost of Electricity	= $0.146/kWh
Cooling Capacity	= 400 Tons
Existing Unit Eff.	= 0.653 KW/Ton (18.4 EER)
New Unit Eff.	= 0.34 KW/Ton (35.3 EER)

Energy Savings Calculations:

<u>Cooling Savings:</u>

$$EnergySavings = \frac{Cooling(Tons) \times 12{,}000\left(\frac{Btu}{Ton\ hr}\right)}{1000\left(\frac{Wh}{kWh}\right)} \times \left(\frac{1}{EER_{OLD}} - \frac{1}{EER_{NEW}}\right) \times Full\ Load\ Hrs.$$

$$EnergySavings = \frac{400\ (Tons) \times 12{,}000\left(\frac{Btu}{Ton\ hr}\right)}{1000\left(\frac{Wh}{kWh}\right)} \times \left(\frac{1}{18.4\left(\frac{Btu}{W}\right)} - \frac{1}{35.3\left(\frac{Btu}{W}\right)}\right) \times 800\ hours$$

$$= 99{,}914\ kWh$$

$$Demand\ Savings = \frac{Energy\ Savings\ (kWh)}{Hrs\ of\ Cooling}$$

$$Demand\ Savings = \frac{99{,}914(kWh)}{800\ Hrs.} = 142.9\ KW$$

$$Cooling\ Cost\ Savings = 99{,}914(kWh) \times 0.146\left(\frac{\$}{kWh}\right) = \$14{,}587$$

Installation cost for the water cooled chiller is estimated to be $195,000 ($140,000 Materials).

From the **NJ Smart Start® Program Appendix**, the unit falls under the category "Electric Chiller" and warrants an incentive based on efficiency (KW/Ton) at 0.35 KW/Ton. The program incentives are calculated as follows:

$$\text{Smart Start® } Incentive = (Cooling\ Tons \times \ \$/Ton\ Incentive)$$
$$= (400\ Tons \times \$100/Ton) = \$40{,}000$$

Energy Savings Summary:

ECM #3 - ENERGY SAVINGS SUMMARY	
Installation Cost ($):	$195,000
NJ Smart Start Equipment Incentive ($):	$40,000
Net Installation Cost ($):	$155,000
Maintenance Savings ($/Yr):	$0
Energy Savings ($/Yr):	$14,587
Total Yearly Savings ($/Yr):	$14,587
Estimated ECM Lifetime (Yr):	25
Simple Payback	10.6
Simple Lifetime ROI	135.3%
Simple Lifetime Maintenance Savings	$0
Simple Lifetime Savings	$364,675
Internal Rate of Return (IRR)	8%
Net Present Value (NPV)	$99,005.59

ECM #4: HVAC System Controls

Description:

The existing HVAC control system is a combination of new and old direct digital control (DDC) components. A front end computer is located in the Penthouse and has the ability to make certain changes to the major mechanical systems operating parameters. Based on the limitations of the existing control system, CEG recommends the Owner review the possibility of upgrading the entire control system in order to obtain the optimum control of the HVAC systems within the Lessner building. Modern DDC systems are capable of being accessed over the internet, can be programmed to trend system operation, and have advanced scheduling capabilities. Furthermore, modern control systems have the capability of saving significant energy as well as improve occupant comfort.

This ECM includes installing a Building Automation system through Direct Digital Controls (DDC) wired through an Ethernet backbone and front end controller. The system will include new thermostat controllers for terminal unit ventilators, baseboard zones, air handling units, and packaged AC equipment wired back to a front end controller with computer interface. The front end device will provide communication between the devices as well as the main boilers. The system will respond to the overall building's needs and operating schedules as defined by the building operator. The DDC system will provide features such as space averaging, temperature override control, night set-back, morning warm-up mode, heating water loop temperature re-set, etc.

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

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

Energy savings achieved for "Energy Management and Control Systems," average 5%-15%. Savings resulting from the implementation of this ECM for energy management controls are estimated to be 10% of the total HVAC energy cost for the facility.

The cost of a full DDC system with new field devices, controllers, computer, software, programming, etc. is approximately $4.00 per SF (per recent contractor pricing.) Savings from the implementation of this ECM will be achieved through reduced oil consumption from reduced heating energy as well as reduced electric consumption from reduced air conditioning energy.

Cost of complete DDC System = ($4.00/SF x 102,496 SF) = $409,984.

Total Gas Usage	= 75,413 Therms
Estimated non-Heat gas usage (Dom HW)	= 2,105 Therms*

(*50% of Gas usage averaged from Jun, Jul, Aug & Sept. gas usage)
Average Cost of Gas = $1.60/Therm

Total Cooling Capacity = 400 tons
(total from equipment list)
Cooling Season Full Load Cooling Hrs. = 800 hrs/yr.
Average Cooling Equipment EER = 8.5 EER
(Est. based on all equipment)
Average Cost of Electricity = $0.146/kWh

Energy Savings Calculations:

Heating Savings Calculations

$$Gas\ Heat\ Usage = Total\ Cons.\left(Therms\right) - \left(Est.\ Dom.\ HW\ Use\left(\frac{Therms}{Month}\right) \times Use\left(\frac{Months}{Yr}\right)\right)$$

$$Gas\ Heat\ Usage = 75{,}413\left(Therms\right) - \left(2{,}105\left(\frac{Therms}{Month}\right) \times 12\left(\frac{Months}{Yr}\right)\right) = 50{,}153\left(Therms\right)$$

$$Savings. = Heating\ Input\left(Gallons\right) \times 10\%\ Savings \times Ave\ Oil\ Cost\left(\$/Therm\right)$$

$$Savings. = 50{,}153\left(Therms\right) \times 10\% \times 1.60\left(\$/Therm\right) = \$8{,}024$$

Cooling Savings Calculations

$$Est\ Cool\ Cons. = \frac{Cool\ Load\left(Tons\right) \times 12{,}000\left(\frac{Btu}{Ton\ Hr}\right) \times Full\ Load\ Cooling\ Hrs.}{Ave\ Energy\ Efficiency\ Ratio\left(\frac{Btu}{Wh}\right) \times 1000\left(\frac{Wh}{kWh}\right)}$$

$$Est\ Cool\ Cons. = \frac{400\left(Tons\right) \times 12{,}000\left(\frac{Btu}{Ton\ Hr}\right) \times 800\ Hrs.}{8.5\left(\frac{Btu}{Wh}\right) \times 1000\left(\frac{Wh}{kWh}\right)} = 451{,}765\left(kWh\right)$$

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

$$Savings. = 451{,}765\,(kWh) \times 10\% \times 0.146\left(\frac{\$}{kWh}\right) = \$6{,}596$$

$$Total\ ECM\ \ Savings = \$8{,}024 + \$6{,}596 = \$14{,}620$$

Energy Savings Summary:

ECM #4 - ENERGY SAVINGS SUMMARY	
Installation Cost ($):	$409,984
NJ Smart Start Equipment Incentive ($):	$0
Net Installation Cost ($):	$409,984
Maintenance Savings ($/Yr):	$0
Energy Savings ($/Yr):	$14,620
Total Yearly Savings ($/Yr):	$14,620
Estimated ECM Lifetime (Yr):	15
Simple Payback	28.0
Simple Lifetime ROI	-46.5%
Simple Lifetime Maintenance Savings	$0
Simple Lifetime Savings	$219,300
Internal Rate of Return (IRR)	-7%
Net Present Value (NPV)	($235,451.39)

ECM #5: Rooftop Units Replacement

Description:

The Support Space and Cafeteria is heated and cooled by dedicated packaged rooftop units for each space. The unit's cooling efficiencies are as shown below. The existing units are in poor condition and in need of replacement due to age. The efficiencies of the existing units are below today's standards for cooling efficiency. The proposed units are one for one replacement of the existing units. The Owner should have a professional engineer verify heating and cooling loads prior to moving forward with this ECM.

This ECM includes installation of two high efficient cooling / heating rooftop units. Heating is provided by integral hot water coils from the central heating water loop. The proposed support space unit is a packaged 20 ton DX unit with hot water heating coil. The proposed cafeteria unit is a packaged 10 ton DX unit with hot water heating coil. The ECM calculations are based on McQuay Packaged Rooftop Units model #MPS010B and MP020B or equivalent.

Full Load Cooling Hrs.	= 800 hrs/yr.
Average Cost of Electricity	= $0.146/kWh
Support Space Capacity (RTU-1)	= 20 Tons
Cafeteria Capacity (RTU-2)	= 10.0 Tons
Existing Unit Eff. (RTU-1)	= 8.7 EER
Existing Unit Eff. (RTU-2)	= 8.0 EER
Proposed Unit Eff. (RTU-1)	= 11.1 EER
Proposed Unit Eff. (RTU-2)	= 11.2 EER

Energy Savings Calculations:

<u>Cooling Savings:</u>

$$EnergySavings = \frac{Cooling(Tons) \times 12{,}000\left(\frac{Btu}{Ton\ hr}\right)}{1000\left(\frac{Wh}{kWh}\right)} \times \left(\frac{1}{EER_{OLD}} - \frac{1}{EER_{NEW}}\right) \times Full\ Load\ Hrs.$$

$$RTU-1\ EnergySavings = \frac{20\ (Tons) \times 12{,}000\left(\frac{Btu}{Ton\ hr}\right)}{1000\left(\frac{Wh}{kWh}\right)} \times \left(\frac{1}{8.7\left(\frac{Btu}{W}\right)} - \frac{1}{11.1\left(\frac{Btu}{W}\right)}\right) \times 800\ hours$$

$$= 4{,}772\ kWh$$

$$RTU-2\ EnergySavings = \frac{10\,(Tons)\times 12{,}000\left(\frac{Btu}{Ton\ hr}\right)}{1000\left(\frac{Wh}{kWh}\right)} \times \left(\frac{1}{8.0\left(\frac{Btu}{W}\right)} - \frac{1}{11.2\left(\frac{Btu}{W}\right)}\right)\times 800\ hours$$

$$= 3{,}429\ kWh$$

$$Demand\ \ Savings = \frac{Energy\ Savings\ (kWh)}{Hrs\ of\ \ Cooling}$$

$$Demand\ \ Savings = \frac{4{,}772\ (kWh) + 3{,}429(kWh)}{800\ Hrs.} = 10.2\ KW$$

$$Cooling\ Cost\ Savings = (4{,}772\ (kWh) + 3{,}429(kWh))\times 0.146\left(\frac{\$}{kWh}\right) = \$1{,}197$$

Installation cost for the 2 Rooftop units is estimated at $37,100.

From the **NJ Smart Start® Program Appendix**, the packaged unit’s replacement falls under the category “Unitary AC” and warrants an incentive for the 20 ton unit based on efficiency (EER) at or above 10.5. The program incentives are calculated as follows:

$$\text{Smart Start® } Incentive = (Cooling\,Tons \times\ \$/Ton\ Incentive)$$
$$= (20\,Tons \times \$79/Ton) = \$1{,}580$$

Energy Savings Summary:

ECM #5 - ENERGY SAVINGS SUMMARY	
Installation Cost ($):	$37,100
NJ Smart Start Equipment Incentive ($):	$1,580
Net Installation Cost ($):	$35,520
Maintenance Savings ($/Yr):	$0
Energy Savings ($/Yr):	$1,197
Total Yearly Savings ($/Yr):	$1,197
Estimated ECM Lifetime (Yr):	15
Simple Payback	29.7
Simple Lifetime ROI	-49.5%
Simple Lifetime Maintenance Savings	$0
Simple Lifetime Savings	$17,955
Internal Rate of Return (IRR)	-8%
Net Present Value (NPV)	($21,230.29)

ECM #6: Demand Control Ventilation

Description:

The existing HVAC air handling units provide outside air to the space through mixing of the outside air with return air. The outside air is set to a minimum damper position to provide outside air to the space whenever the supply fan is set to run (in occupied mode). Unoccupied mode the outside air dampers shut. This operation is typical for the majority of the systems throughout the building. The exception is the laboratory with fume exhaust hoods, which requires more outside air than the other systems. The outside air volume is typically based on the maximum occupancy of the space conditioned. In the situation where the space is not fully occupied the outside air quantity delivered to the space is over the amount needed for adequate ventilation.

This ECM includes the installation of CO_2 sensors integrated into a demand control ventilation system. This system allows the air handling unit to respond to changes in occupancy and therefore reduce the amount of outside air that has to be conditioned. Outside air accounts for a large portion of the energy consumption in the HVAC system, especially in high occupancy spaces. 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:

- Demand Control Ventilation - 10%-15%.

Energy savings achieved for "Demand Control Ventilation" average 10%-15%. Savings resulting from the implementation of this ECM for energy management controls are estimated to be 10% of the total HVAC energy cost for the facility.

The components included to install a demand control ventilation system include controllers, software programming, and CO_2 sensors. Each occupied zone would require a CO_2 sensor installed to monitor occupancy levels. This ECM is based on wireless sensors to minimize on installation cost. Savings from the implementation of this ECM will be achieved through reduced gas consumption from reduced heating energy as well as reduced electric consumption from reduced air conditioning energy.

Cost of Demand Control Ventilation System Controls = ($1.50/SF x 102,496 SF) = $153,744.
Cost of CO2 Sensors for all spaces = ($450/Sensor x 152 Sensors) = $68,400
Total = $222,144

Total Gas Usage = 75,413 Therms
Estimated non-Heat gas usage (Dom HW) = 2,105 Therms*
(*50% of Gas usage averaged from Jun, Jul, Aug & Sept. gas usage)
Average Cost of Gas = $1.60/Therm

Total Cooling Capacity (total from equipment list)	= 400 tons
Cooling Season Full Load Cooling Hrs.	= 800 hrs/yr.
Average Cooling Equipment EER (Est. based on all equipment)	= 8.5 EER
Average Cost of Electricity	= $0.146/kWh

Energy Savings Calculations:

<u>Heating Savings Calculations</u>

$$Gas\ Heat\ Usage = Total\ Cons.\left(Therms\right) - \left(Est.\ Dom.\ HW\ Use\left(\frac{Therms}{Month}\right) \times Use\left(\frac{Months}{Yr}\right)\right)$$

$$Gas\ Heat\ Usage = 75{,}413\left(Therms\right) - \left(2{,}105\left(\frac{Therms}{Month}\right) \times 12\left(\frac{Months}{Yr}\right)\right) = 50{,}153\left(Therms\right)$$

$$Savings. = Heating\ Input\left(Gallons\right) \times 10\%\ Savings \times Ave\ Oil\ Cost\left(\$/Therm\right)$$

$$Savings. = 50{,}153\left(Therms\right) \times 10\% \times 1.60\left(\$/Therm\right) = \$8{,}024$$

<u>Cooling Savings Calculations</u>

$$Est\ Cool\ Cons. = \frac{Cool\ Load\left(Tons\right) \times 12{,}000\left(\frac{Btu}{Ton\ Hr}\right) \times Full\ Load\ Cooling\ Hrs.}{Ave\ Energy\ Efficiency\ Ratio\left(\frac{Btu}{Wh}\right) \times 1000\left(\frac{Wh}{kWh}\right)}$$

$$Est\ Cool\ Cons. = \frac{400\left(Tons\right) \times 12{,}000\left(\frac{Btu}{Ton\ Hr}\right) \times 800\ Hrs.}{8.5\left(\frac{Btu}{Wh}\right) \times 1000\left(\frac{Wh}{kWh}\right)} = 451{,}765\left(kWh\right)$$

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

$$Savings. = 451{,}765\left(kWh\right) \times 10\% \times 0.146\left(\frac{\$}{kWh}\right) = \$6{,}596$$

$$Total\ ECM\ Savings = \$8{,}024 + \$6{,}596 = \$14{,}620$$

Energy Savings Summary:

ECM #6 - ENERGY SAVINGS SUMMARY	
Installation Cost ($):	$222,144
NJ Smart Start Equipment Incentive ($):	$0
Net Installation Cost ($):	$222,144
Maintenance Savings ($/Yr):	$0
Energy Savings ($/Yr):	$14,620
Total Yearly Savings ($/Yr):	$14,620
Estimated ECM Lifetime (Yr):	15
Simple Payback	15.2
Simple Lifetime ROI	-1.3%
Simple Lifetime Maintenance Savings	0
Simple Lifetime Savings	$219,300
Internal Rate of Return (IRR)	0%
Net Present Value (NPV)	($47,611.39)

ECM #7: Chilled Water Pump VFD

Description:

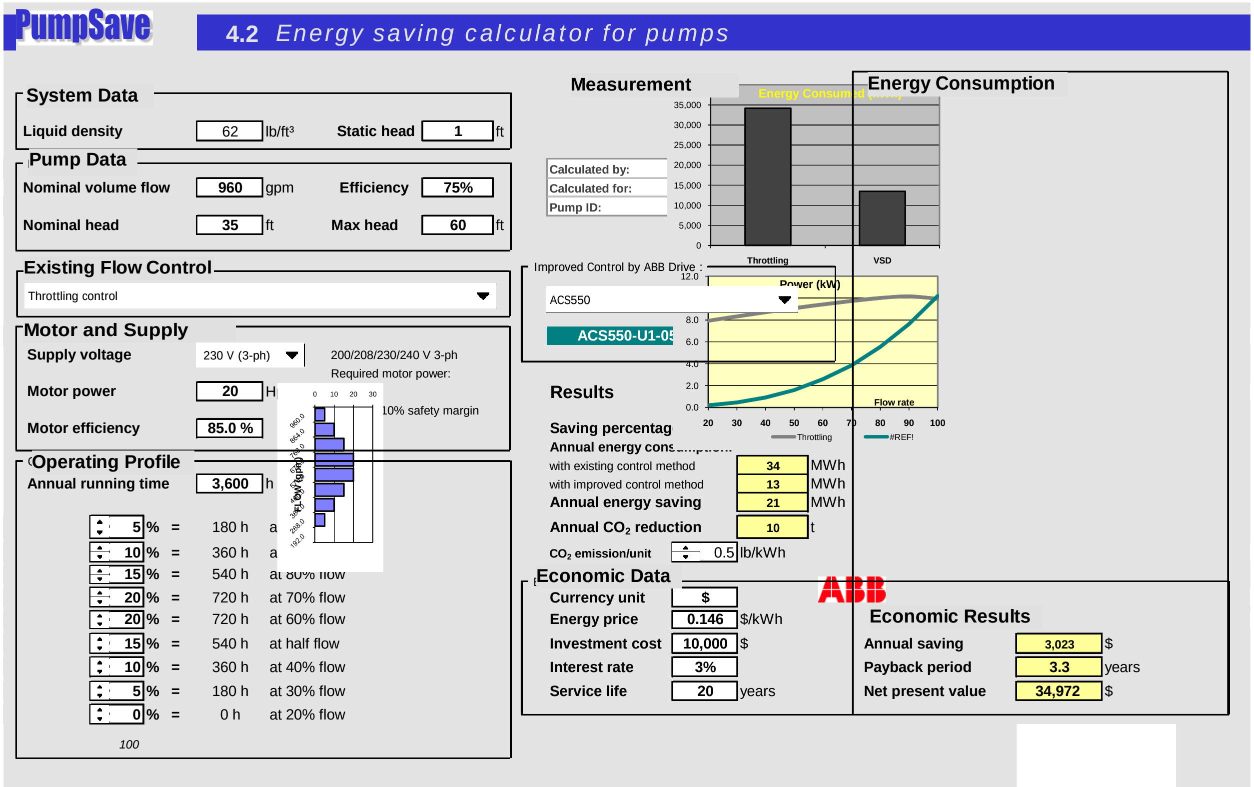
The Lessner Building is cooled by a 400 ton air water cooled chiller. The distribution of the chilled water throughout the facility is through two 20HP pumps. The chilled water is distributed to the building AHU's cooling coils and modulated with each unit's control valve. The total required chilled water flow is determined by the flow of the control valves simultaneously. The AHUs do not require full flow for the majority of the hours of operation; however, the existing pumps do not have variable speed control. The pumping energy of the existing system stays relatively constant throughout the cooling season.

This ECM includes the installation of two new variable frequency drives (VFDs) for the two chilled water pumps. The reduction in chilled water flow reduces the pumping energy by a significant quantity. As the control valve on the AHUs modulate, the VFDs slow the pump motor to match the building's load. This ECM is based on two ABB VFDs model number ACS550, as well as a differential pressure sensor installed in the chilled water piping. This ECM also includes converting the existing 3-way control valves to 2-way operation by installing an isolation valve in the bypass pipe to the each of the AHU's.

Energy and cost savings calculations are based on calculation software "PumpSave v4.2," provided by ABB.

Cooling Season Run Hrs.	= 3600 hrs/yr.
Average Cost of Electricity	= $0.146/kWh
Motor HP (EA.)	= 20 HP
Total GPM	= 960 GPM
Nominal Piping System Head	= 35 Ft Head
Motor Efficiency	= 85%
Pump Efficiency	= 75%

Energy Savings Calculations:



Installation cost for the two VFDs and bypass valve installation is estimated to be $10,100 ($6,900 Materials).

From the **NJ Smart Start® Program Appendix**, the unit falls under the category "Variable Frequency Drive" and warrants an incentive based on horsepower. The program incentives are calculated as follows:

$$\text{Smart Start® } Incentive = (HoresePower \times \ \$/HP)$$
$$= (20\ HP \times \$60/HP) = \$1{,}200$$

Energy Savings Summary:

ECM #7 - ENERGY SAVINGS SUMMARY	
Installation Cost ($):	$10,100
NJ Smart Start Equipment Incentive ($):	$1,200
Net Installation Cost ($):	$8,900
Maintenance Savings ($/Yr):	$0
Energy Savings ($/Yr):	$3,023
Total Yearly Savings ($/Yr):	$3,023
Estimated ECM Lifetime (Yr):	17
Simple Payback	2.9
Simple Lifetime ROI	477.4%
Simple Lifetime Maintenance Savings	$0
Simple Lifetime Savings	$51,391
Internal Rate of Return (IRR)	34%
Net Present Value (NPV)	$30,901.18

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 little potential for solar energy generation due to the lack of roof space and shading surrounding the facility.

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 or stable, at the site. Therefore, wind energy is not a viable option to implement.

Combined heat and power is another option available to the facility to reduce the electric demand drawn from the electric grid. In addition a CHP provides waste heat as a byproduct to be used for the buildings heat loads. CHP is typically utilized in facilities with adequate base line heating load and significant and steady electric demand. Although CHP systems are more frequently implemented in very large facilities, small systems such as micro turbines and natural gas internal combustion engines are available for smaller facilities. After initial review of the utility bills, the Lessner building is suited for a CHP system size of approximately 150 KW. Tecogen offers a small internal combustion engine with output of 75 KW. This facility shows potential as a candidate for a CHP system comprised of two 75 KW engines with heat recovery. However, based on the lack of space within the lower level mechanical room and the Penthouse, CEG does not see the feasibility for the installation of the system at the Elizabeth campus.

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.

<u>Electricity:</u>

The Electric Usage Profile for this facility is fairly typical for a building of this type. The profile demonstrates a fairly flat load shape throughout the year. This is typical and expected for college buildings, which are based on occupancy throughout the year, and are measured by the hours of operation for full occupancy and cleaning staff each and every week. The steady load profile is supported by the activities intrinsic to an institution of higher learning. This is exemplified not only by an elevated load throughout the year, but by the strong summer load. The summer load escalates slightly (April – September) and is consistent with a cooling (air conditioner) load. The main source of cooling in this facility is supplied by a Chilled Water Plant and Condenser Water Plant. The Chilled Water Plant consists of two (2) Carrier hermetic screw chillers. Each chiller has a capacity of 350 tons. The Condenser Water Plant consists of a 2-cell Evapco cooling tower. There is also the presence of (3) base - mounted condenser water pumps. In addition to these main systems, there are multiple single zone air-handling systems that serve various areas of the building. These are Air Handling Units (AHU) 1 – 7. These AHU's contain chilled water coils that add to the cooling load of the building. In addition to these (7), units there are (3) packaged rooftop units that provide conditioning to cafeteria/lounge and the offices of Elizabethtown Gas Company. These units are RTU (Roof Top Unit), 1-3. There is also one electric unit heater present, adding to the cooling and electric load. This facility receives electric Delivery service and Commodity service from PSE&G (Public Service Electric & Gas Company). A flatter load profile will allow for more competitive energy prices when shopping for alternative energy suppliers.

<u>Natural Gas:</u>

The Natural Gas Usage Profile demonstrates a fairly typical heating load profile with an escalation in load usage seen in the heating season, October through March. However, the variance to the summer (April-September) is not as extreme as was expected. In fact, the summer natural gas load is consistent, but elevated to about 4,000 therm's monthly. Heating and natural gas consumption has its main consumption from the Hot Water Plant. The plant consists of (2) gas-fired hot water boilers. They utilize two (2) hot-water pumps to distribute hot water throughout the building. In addition to the Hot Water Plant, the same AHU (Air Handling Units) mentioned above, contribute to the hot water load via their integral hot water coils. Furthermore, domestic hot-water is provided by a Patterson Kelly hot water generator. The heat exchanger portion of the hot water generator requires the hot water plant to provide the heating hot water to heat the domestic loop. This requires the hot water boilers and the hot water pumps to run continuously throughout the year, whether heating season or not. This is the reason for excess summer energy use. While this facility utilizes Elizabethtown Gas Company for the natural gas Delivery Service, it is PEPCO Energy Services that provides the Commodity Service. A flatter load profile will allow for more competitive energy prices when shopping for alternative energy sources.

Tariffs:

Electricity:

This facility receives electrical service through the utility Public Service Electric and Gas Company (PSE&G) on a LPLS (Large Power and Lighting Service) rate schedule classification. The Delivery Service and Commodity Service is provided by PSE&G. The LPLS Delivery Service is a for general purposes at secondary distribution voltages where the customer's measured peak demand exceeds 150 kilowatts in any month and also at primary distribution voltages. Customers may either purchase electric supply from a TPS or from PSE&G's Basic Generation Service default service as detailed in the rate schedule. Delivery Charges include the following: Service Charge, Distribution Charges, Societal Benefits Charge, Non-utility Generation Charge and Securitization 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 Lessner Building procures the energy supply from PSE&G.

Natural Gas:

This facility receives utility Delivery service through Elizabethtown Gas Company (E'town) on a General Delivery Service (GDS) Delivery rate schedule. General Delivery Service is utilized where Gas Company's facilities are suitable and the quantity of gas is available for service. The character of service is continuous, however customers may either purchase gas form a Third Party Supplier (TPS) or the Company's Rider "A", Basic Gas Supply Service. Charges in the rate schedule include: Service Charge, Demand Charge, Distribution Charge and Commodity Charge (TPS). Special Provisions: For customers receiving gas supply from a TPS, Automatic Meter Reading (AMR) equipment will be provided for consumption with a DCQ of 500 therms or more. Currently this facility receives natural gas supply from PEPCO Energy Services the TPS.

Recommendations:

CEG recommends a global approach that will be consistent for all Union County College campuses. Good potential savings can be seen in the electric costs and the 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 $.1180 / kWh (this is the fixed "price to compare" when shopping for energy procurement alternatives). The fixed weighted average price per decatherm for natural gas service in this facility from the information provided by PEPCO Energy Services is, $12.35 / Dth (dekatherm is the common unit of measure for natural gas). Again, this is the "price to compare."

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 19 % or over $60,000 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.

CEG's secondary recommendation coincides with the natural gas costs. Based on the current alternative market pricing, supplied by PEPCO Energy Services, CEG feels that the Lessner facility could see an improvement of up to 27 % or up to $25,000 in its natural gas costs. CEG recommends the College receive further advisement on these prices through an energy advisor. The College should also consider having that 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 providers to review their utility charges and current tariff structures for electricity and natural gas. This meeting would provide insight regarding alternative procurement options that are currently available. Through its meeting with the Local Distribution Company (LDC), the municipality can learn more about the competitive supply process. The county 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.

In addition to the recommendations above, implementing Retro-Commissioning would be beneficial for this facility. Retro-Commissioning is a means to verify your current equipment is operating at its designed efficiency, capacity, airflow, and overall performance. Retro-Commissioning provides valuable insight into systems or components not performing correctly or efficiently. The commissioning process defines the original system design parameters and recommends revisions to the current system operating characteristics.

ECM COST & SAVINGS BREAKDOWN

CONCORD ENGINEERING GROUP

Union County College Lessner 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)
ECM ENERGY AND FINANCIAL COSTS AND SAVINGS SUMMARY															
		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 Upgrade	$8,994	$0	$870	$8,124	$4,803	$168	$4,971	15	$74,565	$2,520	817.8%	1.6	61.14%	$51,219.48
ECM #2	Domestic HW Decentralization	$6,276	$2,546	$398	$8,423	$7,761	$0	$7,761	10	$77,610	$0	821.4%	1.1	92.01%	$57,779.90
ECM #3	Chiller Replacement	$140,000	$55,000	$40,000	$155,000	$14,587	$0	$14,587	25	$364,675	$0	135.3%	10.6	8.05%	$99,005.59
ECM #4	HVAC System Controls	$204,992	$204,992	$0	$409,984	$14,620	$0	$14,620	15	$219,300	$0	-46.5%	28.0	-6.96%	($235,451.39)
ECM #5	RTU-1 & 2 Replacement	$28,400	$8,700	$1,580	$35,520	$1,197	$0	$1,197	15	$17,955	$0	-49.5%	29.7	-7.52%	($21,230.29)
ECM #6	Demand Control Ventilation	$68,400	$153,744	$0	$222,144	$14,620	$0	$14,620	15	$219,300	$0	-1.3%	15.2	-0.16%	($47,611.39)
ECM #7	Chilled Water Pump VFDs	$6,900	$3,200	$1,200	$8,900	$3,023	$0	$3,023	17	$51,391	$0	477.4%	2.9	33.72%	$30,901.18
ECM #8	Not Applicable	$0	$0	$0	$0	$0	$0	$0	15	$0	$0	#DIV/0!	#DIV/0!	#NUM!	$0.00
ECM #9	Not Applicable	$0	$0	$0	$0	$0	$0	$0	15	$0	$0	#DIV/0!	#DIV/0!	#NUM!	$0.00
ECM #10	Not Applicable	$0	$0	$0	$0	$0	$0	$0	15	$0	$0	#DIV/0!	#DIV/0!	#NUM!	$0.00
REM RENEWABLE ENERGY AND FINANCIAL COSTS AND SAVINGS SUMMARY															
REM #1	Not Applicable	$0	$0	$0	$0	$0	$0	$0	15	$0	$0	#DIV/0!	#DIV/0!	#NUM!	$0.00
REM #2	Not Applicable	$0	$0	$0	$0	$0	$0	$0	15	$0	$0	#DIV/0!	#DIV/0!	#NUM!	$0.00

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
Lessner

Building ID: 1906947
For 12-month Period Ending: April 30, 2009[1]
Date SEP becomes ineligible: N/A

Date SEP Generated: October 22, 2009

Facility
Lessner
12 West Jersey St.
Elizabeth, NJ 07201

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: 1964
Gross Floor Area (ft^2): 102,496

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

Site Energy Use Summary[3]	
Electricity - Grid Purchase(kBtu)	8,102,166
Natural Gas (kBtu)[4]	7,541,330
Total Energy (kBtu)	15,643,496

Energy Intensity[5]	
Site (kBtu/ft^2/yr)	153
Source (kBtu/ft^2/yr)	341

Emissions (based on site energy use)	
Greenhouse Gas Emissions ($MtCO_2e$/year)	1,635

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	22%
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	Lessner	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	12 West Jersey St., Elizabeth, NJ 07201	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		☐

Lessner Building (Other)

CRITERION	VALUE AS ENTERED IN PORTFOLIO MANAGER	VERIFICATION QUESTIONS	NOTES	☑
Gross Floor Area	102,496 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: Combined 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	192,848.00
03/01/2009	03/31/2009	190,336.00
02/01/2009	02/28/2009	160,376.00
01/01/2009	01/31/2009	153,155.00
12/01/2008	12/31/2008	152,553.00
11/01/2008	11/30/2008	151,950.00
10/01/2008	10/31/2008	221,176.00
09/01/2008	09/30/2008	241,735.00
08/01/2008	08/31/2008	232,342.00
07/01/2008	07/31/2008	243,649.00
06/01/2008	06/30/2008	229,645.00
05/01/2008	05/31/2008	204,844.00
Combined Electric Meter Consumption (kWh (thousand Watt-hours))		**2,374,609.00**
Combined Electric Meter Consumption (kBtu (thousand Btu))		**8,102,165.91**
Total Electricity (Grid Purchase) Consumption (kBtu (thousand Btu))		**8,102,165.91**
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	5,029.50
03/01/2009	03/31/2009	8,861.50
02/01/2009	02/28/2009	8,372.00
01/01/2009	01/31/2009	11,677.80
12/01/2008	12/31/2008	8,338.20
11/01/2008	11/30/2008	4,824.70
10/01/2008	10/31/2008	5,760.00
09/01/2008	09/30/2008	4,046.20
08/01/2008	08/31/2008	4,230.10
07/01/2008	07/31/2008	4,156.30

06/01/2008	06/30/2008	4,402.20
05/01/2008	05/31/2008	5,714.80
Natural Gas Meter Consumption (therms)		**75,413.30**
Natural Gas Meter Consumption (kBtu (thousand Btu))		**7,541,330.00**
Total Natural Gas Consumption (kBtu (thousand Btu))		**7,541,330.00**
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
Lessner
12 West Jersey St.
Elizabeth, NJ 07201

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

Lessner	
Gross Floor Area Excluding Parking: (ft^2)	102,496
Year Built	1964
For 12-month Evaluation Period Ending Date:	April 30, 2009

Facility Space Use Summary

Lessner Building	
Space Type	Other - College/University (Campus-Level)
Gross Floor Area(ft^2)	102,496
Number of PCs°	N/A
Weekly operating hours°	N/A
Workers on Main Shift°	N/A

Energy Performance Comparison

	Evaluation Periods		Comparisons		
Performance Metrics	**Current** (Ending Date 04/30/2009)	**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/ft²)	153	153	0	N/A	120
Source (kBtu/ft²)	341	341	0	N/A	280
Energy Cost					
$/year	$ 468,138.03	$ 468,138.03	N/A	N/A	$ 368,057.16
$/ft²/year	$ 4.57	$ 4.57	N/A	N/A	$ 3.59
Greenhouse Gas Emissions					
$MtCO_2e$/year	1,635	1,635	0	N/A	1,285
$kgCO_2e/ft^2$/year	16	16	0	N/A	13

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

"Lessner"

Boiler

Location	Area Served	Manufacturer	Qty.	Model #	Serial #	Input (MBh)	Output (MBh)	Efficiency (%)	Fuel	Approx. Age	ASHRAE Service Life	Remaining Life	Notes
Penthouse		Weil-McLain	2	1188		3392	2724	80%	Natural Gas	18	25	7	

Boiler - Burner

Location	Area Served	Manufacturer	Qty.	Model #	Serial #	Input (MBh)	Efficiency (%)	Fuel	Approx. Age	ASHRAE Service Life	Remaining Life	Notes
Penthouse		PowerFlame	2	WCR3-G-20	5915425E	3753		Natural Gas	18	21	3	

Boiler - Pumps

Location	Area Served	Manufacturer	Qty.	Model #	Serial #	HP	Volts	Amps	Approx. Age	ASHRAE Service Life	Remaining Life	Notes
Penthouse		Taco	1	FM 3008	-	10	-	-	20	20	0	Attached to Baldor 10 HP Motor
Penthouse		Taco	1	FM 3008	-	10	-	-	19	20	1	Attached to Baldor 10 HP Motor

Domestic Hot Water Heater

Location	Area Served	Manufacturer	Qty	Model #	Serial #	Input (MBh)	Recovery (gal/h)	Capacity (gal)	Efficiency (%)	Fuel	Approx. Age	ASHRAE Service Life	Remaining Life	Notes
Basement Mech Room		Patterson Kelley	1		CO701-30						18	10	-8	Wat Board # 58261

Chilled Water - Pumps

Location	Area Served	Manufacturer	Qty.	Model #	Serial #	HP	RPM	GPM	Ft. Hd	Frame Size	Volts	Phase	Approx. Age	ASHRAE Service Life	Remaining Life	Notes
Penthouse		Taco	2	FM3010	-	15	1750	-	-	H	-	-	18	20	2	Baldor M2515T 20Hp Motor attached and Magneter M0GB 20Hp Motor attached

Condenser - Pumps

Location	Area Served	Manufacturer	Qty.	Model #	Serial #	HP	Volts	Amps	Approx. Age	ASHRAE Service Life	Remaining Life	Notes
Penthouse		Taco	3	F14009E	-	15	-	-	1	20	19	Attached Baldor Motor EM2513T 15Hp

Air Handling Units

Location	Area Served	Manufacturer	Qty	Model #	Serial #	Cooling Coil	Cooling Eff. (EER)	Cooling Capacity	Heating Type	Input (MBh)	Output (MBh)	Heating Eff. (%)	Fuel	Volts	Phase	Amps	Approx. Age	ASHRAE Service Life	Remaining Life	Notes
Penthouse	Fl 2-7	McQuay	1																	
Penthouse	Labs	McQuay	1	CS1111	3WF00068-06															
	Theater	McQuay	1	LSL117DH	3WF00069-04															
	Lower Level	McQuay	1	LSL106CH	3KF00070-06															
	Library	McQuay	1	LSL111CH	3WF00071-06															
	Ground Lobby	McQuay	1	LSL117DH	3WF00072-06															
	Bookstore/ Financial Aid	McQuay	1	LSL117DH	3WF00073-04															

AC Condensers

Location	Area Served	Manufacturer	Qty.	Model #	Serial #	Cooling Capacity	Eff.	Refrigerant	Volts	Phase	Approx. Age	ASHRAE Service Life	Remaining Life	Notes
Low Roof	Support	McQuay	1	CUR201ETYC	5WF83815	20 Ton	8.7 EER	R-22	460	3	18	15	-3	
Low Roof	Café	McQuay	1	CUR100FYYY	5WF84015-01	9.3 Ton	8.0 EER	R-22	460	3	18	15	-3	
Low Roof	Gas Company	York	1	D4CE060A46A	NHLM086945	5 Tons		R-22	460	3	6	15	9	

Air Compressor

Location	Area Served	Manufacturer	Qty.	Model #	Serial #	HP	Pressure	Capacity	Volts	Phase	FLA	Approx. Age	ASHRAE Service Life	Remaining Life	Notes
		Quincy	1	QE-10								18	8	-10	

Water Cooled Chiller

									Evaporator				Condenser				Compress		Electrical						
Location	Area Served	Manufacturer	Qty.	Model #	Serial #	Symbol	Service	Nominal Capacity (Tons)	EWT	LWT	GPM	Max PD (Ft)	EWT	LWT	GPM	Max PD (Ft)	QTY	HP	V/PH/Hz	MCA	MOCP	Approx. Age	ASHRAE Service Life	Remaining Life	Notes
Penthouse		Carrier	1	10XB44002401	576954	-	oil recently changed	200	49.3	44.1	-	-	80.8	87.3	-	-			460/3/60			11	25	14	Water temperatures were observed at 12pm.
		Carrier	1	10XB44002402	576944	-	refrig oil problems	200	49.7	49.9	-	-	81	81	-	-			460/3/60			11	25	14	

Heat Exchanger

									Hot Side				Cold Side							
Location	Area Served	Manufacturer	Qty.	Model #	Serial #	Symbol	Service	Capacity (Gal)	EWT	LWT	GPM	Water PD (Ft)	EWT	LWT	GPM	Water PD (Ft)	Approx. Age	ASHRAE Service Life	Remaining Life	Notes
Penthouse		Alfa Laval	2	M10-BFM	30101-66212	HX-1/HX-2	-	32.8	-	-	-	-	-	-	-		18	24	6	528.9 Surface area, 205 Plates, 0.4mm thick

Cooling Tower

													Electric Basin Heaters				Fan Motor							
Location	Area Served	Manufacturer	Qty.	Model #	Serial #	Symbol	Service	Nominal Capacity	GPM	Ambient Air WB	EWT	LWT	QTY	Kw	V/Ph/Hz	FLA	QTY	Kw	V/Ph/Hz	FLA	Approx. Age	ASHRAE Service	Remaining Life	Notes
Low Roof		Evapco	1	AT 29-918	8-332846		Needs Cleaning										2				1	22	21	2 Cell Tower, Belt # 4B-158

INVESTMENT GRADE LIGHTING AUDIT

CONCORD ENERGY SERVICES

CEG Job #: 9C08144
Project: Union County Community College
Address: 12 W Jersey St
City: Elizabeth, NJ
Building SF: 102,000

"Lessner Lower Level"

DATE: 10/27/2009
KWH COST: $0.146

EXISTING LIGHTING										PROPOSED LIGHTING								SAVINGS			
Line No.	PC's	Fixture Location	No. eFixts	Fixture eType	Yearly Usage	Watts Used	Total kW	kWh/Yr Fixtures	Yearly $ Cost	No. rFixts	Retro-Unit rDescription	Watts Used	Total kW	kWh/Yr Fixtures	Yearly $ Cost	Unit Cost (INSTALLED)	Total Cost	kW Savings	kWh/Yr Savings	Yearly $ Savings	Yearly Payback
1		Ground Floor Lobby	2	2'X2' 2-Lamp T-8 U-Tube Recessed Parabolic Lens 32W	6708	73	0.15	979.368	$142.99	2	No Change Required (NCR)	73	0.15	979.368	$142.99	$0.00	$0.00	0.00	0	$0.00	0.00
2			32	2-Lamp Twin Tube CFL Recessed 13W	6708	30	0.96	6439.68	$940.19	32	NCR	30	0.96	6439.68	$940.19	$0.00	$0.00	0.00	0	$0.00	0.00
3			6	6" Diameter Downlights	6708	58	0.35	2334.384	$340.82	6		58	0.35	2334.38	$340.82		$0.00	0.00	0	$0.00	0.00
4			3	Track Light Flood Lights	6708	75	0.23	1509.3	$220.36	3		75	0.23	1509.3	$220.36		$0.00	0.00	0	$0.00	0.00
5	2	Library Office	3	4' 3-Lamp T-8 Parabolic Lens 32W	6708	82	0.25	1650.168	$240.92	3	NCR	82	0.25	1650.17	$240.92	$0.00	$0.00	0.00	0	$0.00	0.00
6	14	L48 (Library)	25	4' 3-Lamp T-8 Prismatic Lens 32W	6708	82	2.05	13751.4	$2,007.70	25	NCR	82	2.05	13751.4	$2,007.70	$0.00	$0.00	0.00	0	$0.00	0.00
7			8	2-Lamp Twin Tube CFL Recessed 13W	6708	71	0.57	3810.144	$556.28	8	NCR	71	0.57	3810.14	$556.28	$0.00	$0.00	0.00	0	$0.00	0.00
8			19	8' 2-Lamp T-12 Pendant Fixture 34W	6708	158	3.00	20137.416	$2,940.06	38	4' - 2-Lamp 32W T-8 Industrial Strip w/ Elect Ballast; Metalux M/N SNF232	73	2.77	18608	$2,716.77	$123.00	$4,674.00	0.23	1529.424	$223.30	20.93
9			10	8' 4-Lamp T-12 Pendant Fixture 34W	6708	316	3.16	21197.28	$3,094.80	20	4' - 3-Lamp 32W T-8 Industrial Strip w/ Elect Ballast; Metalux M/N DIM	82	1.64	11001.1	$1,606.16	$150.00	$3,000.00	1.52	10196.16	$1,488.64	2.02
10	1	Maintenance	10	4' 2-Lamp T-8 Industrial With Reflector	6708	58	0.58	3890.64	$568.03	10	NCR	58	0.58	3890.64	$568.03	$0.00	$0.00	0.00	0	$0.00	0.00
11	17	L04	6	2'X2' 2-Lamp T-8 U-Tube Recessed Parabolic Lens 32W	6708	73	0.44	2938.104	$428.96	6	NCR	73	0.44	2938.1	$428.96	$0.00	$0.00	0.00	0	$0.00	0.00
12			4	2'X4' 3-Lamp T-8 Recessed Parabolic 32W	6708	82	0.33	2200.224	$321.23	4	NCR	82	0.33	2200.22	$321.23	$0.00	$0.00	0.00	0	$0.00	0.00
13	4	L04A	6	2'X4' 3-Lamp T-8 Recessed Parabolic 32W	6708	82	0.49	3300.336	$481.85	6	NCR	82	0.49	3300.34	$481.85	$0.00	$0.00	0.00	0	$0.00	0.00
14			2	1'X4' 4-Lamp T-12 Prismatic Wraparound 34W	6708	160	0.32	2146.56	$313.40	2	4' - 3-Lamp 32W T-8 Industrial Strip w/ Elect Ballast; Metalux M/N DIM	82	0.16	1100.11	$160.62	$150.00	$300.00	0.16	1046.448	$152.78	1.96
15		L04B	6	2'X4' 3-Lamp T-8 Recessed Parabolic 32W	6708	82	0.49	3300.336	$481.85	6	NCR	82	0.49	3300.34	$481.85	$0.00	$0.00	0.00	0	$0.00	0.00
16		Electrical Service	5	4' 2-Lamp T-8 Industrial With Reflector 32W	1593	58	0.29	461.97	$67.45	5	NCR	58	0.29	461.97	$67.45	$0.00	$0.00	0.00	0	$0.00	0.00

17		Corridor	13	2'X2' 2-Lamp T-8 U-Tube Recessed Parabolic Lens 32W	6708	73	0.95	6365.892	$929.42	13	NCR	73	0.95	6365.89	$929.42	$0.00	$0.00	0.00	0	$0.00	0.00
18		L05	4	4' 3-Lamp T-8 Parabolic Lens 32W	6708	82	0.33	2200.224	$321.23	4	NCR	82	0.33	2200.22	$321.23	$0.00	$0.00	0.00	0	$0.00	0.00
19		L08	2	4' 3-Lamp T-8 Parabolic Lens 32W	6708	82	0.16	1100.112	$160.62	2	NCR	82	0.16	1100.11	$160.62	$0.00	$0.00	0.00	0	$0.00	0.00
20		L08A	1	1'X4' 2-Lamp T-8 Industrial With Reflector 32W	6708	28	0.03	187.824	$27.42	1	NCR	28	0.03	187.824	$27.42	$0.00	$0.00	0.00	0	$0.00	0.00
21		L10	1	13W CFL	6708	13	0.01	87.204	$12.73	1	NCR	13	0.01	87.204	$12.73	$0.00	$0.00	0.00	0	$0.00	0.00
22	3	L11	2	4' 2-Lamp T-8 Recessed Prismatic Lens 32 W	6708	58	0.12	778.128	$113.61	2	NCR	58	0.12	778.128	$113.61	$0.00	$0.00	0.00	0	$0.00	0.00
23			2	4' 3-Lamps T-8 Recessed Parabolic Lens 32W	6708	82	0.16	1100.112	$160.62	2	NCR	82	0.16	1100.11	$160.62	$0.00	$0.00	0.00	0	$0.00	0.00
24		L12	2	4' 2-Lamp T-8 Industrial With Reflector 32W	6708	58	0.12	778.128	$113.61	2	NCR	58	0.12	778.128	$113.61	$0.00	$0.00	0.00	0	$0.00	0.00
25		L13	1	1'X4' 3-Lamp T-8 Industrial With Reflector 32W	6708	82	0.08	550.056	$80.31	1	NCR	82	0.08	550.056	$80.31	$0.00	$0.00	0.00	0	$0.00	0.00
26		L14	2	1'X4' 2-Lamp T-8 Industrial With Reflector 32W	6708	58	0.12	778.128	$113.61	2	NCR	58	0.12	778.128	$113.61	$0.00	$0.00	0.00	0	$0.00	0.00
27		L15	1	Tri-Tube CFL Wall Mounted with Cage	6708	71	0.07	476.268	$69.54	1	NCR	71	0.07	476.268	$69.54	$0.00	$0.00	0.00	0	$0.00	0.00
28		Ejection Pump Room	1	75W Incandescent	1593	75	0.08	119.475	$17.44	1	18 W CFL Lamp	18	0.02	28.674	$4.19	$5.75	$5.75	0.06	90.801	$13.26	0.43
29		Closet	1	100W Incandescent	1593	100	0.10	159.3	$23.26	1	18 W CFL Lamp	18	0.02	28.674	$4.19	$5.75	$5.75	0.08	130.626	$19.07	0.30
30		Theater	17	Par 75W Flood 8" Can	6708	75	1.28	8552.7	$1,248.69	17	18 W CFL Lamp	18	0.31	2052.65	$299.69	$5.75	$97.75	0.97	6500.052	$949.01	0.10
31			3	400W Metal Halide	6708	450	1.35	9055.8	$1,322.15	3	NCR	450	1.35	9055.8	$1,322.15	$0.00	$0.00	0.00	0	$0.00	0.00
32			12	100W Incandescent 6" Can	6708	100	1.20	8049.6	$1,175.24	12	18 W CFL Lamp	18	0.22	1448.93	$211.54	$5.75	$69.00	0.98	6600.672	$963.70	0.07
33			4	100W Incandescent 6" Can	6708	100	0.40	2683.2	$391.75	4	18 W CFL Lamp	18	0.07	482.976	$70.51	$5.75	$23.00	0.33	2200.224	$321.23	0.07
34		Theater Storage	2	1'X4' 2-Lamp T-12 Industrial With Reflector 34W	1593	80	0.16	254.88	$37.21	2	4' - 2-Lamp 32W T-8 Industrial Strip w/ Elect Ballast; Metalux M/N SNF232	73	0.15	232.578	$33.96	$123.00	$246.00	0.01	22.302	$3.26	75.55
35		Theater Closet	1	1'X4' 2-Lamp T-8 Industrial With Reflector 32W	1593	80	0.08	127.44	$18.61	1	NCR	80	0.08	127.44	$18.61	$0.00	$0.00	0.00	0	$0.00	0.00
36		Theater Closet	1	1'X4' 2-Lamp T-12 Industrial With Reflector 34W	1593	80	0.08	127.44	$18.61	1	4' - 2-Lamp 32W T-8 Industrial Strip w/ Elect Ballast; Metalux M/N SNF232	73	0.07	116.289	$16.98	$123.00	$123.00	0.01	11.151	$1.63	75.55
37		Theater Control Room	5	2-Lamp 13W Twin Tube CFL 10" Can Recessed	1593	30	0.15	238.95	$34.89	5	NCR	30	0.15	238.95	$34.89	$0.00	$0.00	0.00	0	$0.00	0.00
38		Student Study Lounge	4	10" Can	6708	100	0.40	2683.2	$391.75	4		100	0.40	2683.2	$391.75		$0.00	0.00	0	$0.00	0.00

39		L01	1	60W Incandescent	6708	60	0.06	402.48	$58.76	1	13 W CFL Lamp	13	0.01	87.204	$12.73	$5.00	$5.00	0.05	315.276	$46.03	0.11
40			1	10" Can	6708	100	0.10	670.8	$97.94	1		100	0.10	670.8	$97.94		$0.00	0.00	0	$0.00	0.00
41		L02	2	2'X2' 2-Lamp T-8 U-Tube Recessed Parabolic Lens 32W	6708	73	0.15	979.368	$142.99	2	NCR	73	0.15	979.368	$142.99	$0.00	$0.00	0.00	0	$0.00	0.00
42		Mens Bathroom	2	2'X2' 2-Lamp T-8 U-Tube Recessed Parabolic Lens 32W	6708	73	0.15	979.368	$142.99	2	NCR	73	0.15	979.368	$142.99	$0.00	$0.00	0.00	0	$0.00	0.00
43			2	1-Lamp T-8 Vanity Fixture	6708	28	0.06	375.648	$54.84	2	NCR	28	0.06	375.648	$54.84	$0.00	$0.00	0.00	0	$0.00	0.00
44		Womens Bathroom	2	2'X2' 2-Lamp T-8 U-Tube Recessed Parabolic Lens 32W	6708	73	0.15	979.368	$142.99	2	NCR	73	0.15	979.368	$142.99	$0.00	$0.00	0.00	0	$0.00	0.00
45			2	1-Lamp T-8 Vanity Fixture	6708	28	0.06	375.648	$54.84	2	NCR	28	0.06	375.648	$54.84	$0.00	$0.00	0.00	0	$0.00	0.00
46		Storage Room	1	1'X4' 1-Lamp T-12 Wall Mounted 34 W	1593	50	0.05	79.65	$11.63	1	4' 1-Lamp T-8 32W wall Mtd.Metalux BC132	28	0.03	44.604	$6.51	$166.00	$166.00	0.02	35.046	$5.12	32.44
PC's	41	**Totals**	242				21.82	141343.70	20636.18	271			17.41	#######	16449.17		$8,715.25	4.41	28,678.18	$4,187.01	2.08

INVESTMENT GRADE LIGHTING AUDIT

CONCORD ENERGY SERVICES

CEG Job #: 9C08144
Project: Union County Community College
Address: 12 W Jersey St
City: Elizabeth, NJ
Building SF: 102,000

"Lessner Ground Floor"

DATE: 10/27/2009
KWH COST: $0.146

EXISTING LIGHTING										PROPOSED LIGHTING								SAVINGS			
Line No.	PC's	Fixture Location	No. eFixts	Fixture eType	Yearly Usage	Watts Used	Total kW	kWh/Yr Fixtures	Yearly $ Cost	No. rFixts	Retro-Unit rDescription	Watts Used	Total kW	kWh/Yr Fixtures	Yearly $ Cost	Unit Cost (INSTALLED)	Total Cost	kW Savings	kWh/Yr Savings	Yearly $ Savings	Yearly Payback
1		Dining	15	2'X4' 3-Lamp T-8 Recessed Parabolic Lens 32W	6708	82	1.23	8250.84	$1,204.62	15	No Change Required (NCR)	82	1.23	8250.84	$1,204.62	$0.00	$0.00	0.00	0	$0.00	0.00
2			2	LED Exit Signs	8760	4	0.01	70.08	$10.23	2	NCR	4	0.01	70.08	$10.23	$0.00	$0.00	0.00	0	$0.00	0.00
3		Lobby	31	Metal Halide	6708		0.00	0	$0.00	31	NCR	0	0.00	0	$0.00		$0.00	0.00	0	$0.00	0.00
4	6		13	2-Lamp 13W CFL PL Type Recessed 10" Can	6708	26	0.34	2267.3	$331.03	13	NCR	26	0.34	2267.3	$331.03	$0.00	$0.00	0.00	0	$0.00	0.00
5			1	2'X2' 2-Lamp T-8 U-Tube Recessed Parabolic Lens 32W	6708	73	0.07	489.684	$71.49	1	NCR	73	0.07	489.684	$71.49	$0.00	$0.00	0.00	0	$0.00	0.00
6			4	LED Exit Signs	8760	4	0.02	140.16	$20.46	4	NCR	4	0.02	140.16	$20.46	$0.00	$0.00	0.00	0	$0.00	0.00
7	3	Book Store	12	2'X4' 3-Lamp T-8 Recessed Parabolic Lens 32W	6708	82	0.98	6600.67	$963.70	12	NCR	82	0.98	6600.67	$963.70	$0.00	$0.00	0.00	0	$0.00	0.00
8			1	2'X2' 2-Lamp T-8 U-Tube Recessed Parabolic Lens 32W	6708	73	0.07	489.684	$71.49	1	NCR	73	0.07	489.684	$71.49	$0.00	$0.00	0.00	0	$0.00	0.00
9	1	105	3	4' 1-Lamp T-8 Clear Lens Pendant 32W	6708	28	0.08	563.472	$82.27	3	NCR	28	0.08	563.472	$82.27	$0.00	$0.00	0.00	0	$0.00	0.00
10	1	106	3	4' 1-Lamp T-8 Clear Lens Pendant 32W	6708	28	0.08	563.472	$82.27	3	NCR	28	0.08	563.472	$82.27	$0.00	$0.00	0.00	0	$0.00	0.00
11	1	107	3	4' 1-Lamp T-8 Clear Lens Pendant 32W	6708	28	0.08	563.472	$82.27	3	NCR	28	0.08	563.472	$82.27	$0.00	$0.00	0.00	0	$0.00	0.00
12		Back Lobby	24	Metal Halide	6708		0.00	0	$0.00	24	NCR	0	0.00	0	$0.00		$0.00	0.00	0	$0.00	0.00
13		113	1	65W Incandescent	6708	65	0.07	436.02	$63.66	1	13 W CFL Lamp	13	0.01	87.204	$12.73	$5.00	$5.00	0.05	348.816	$50.93	0.10
14	3	114	6	2'X4' 3-Lamp T-8 Recessed Parabolic Lens 32W	6708	82	0.49	3300.34	$481.85	6	NCR	82	0.49	3300.34	$481.85	$0.00	$0.00	0.00	0	$0.00	0.00
15	1	115	2	2'X4' 3-Lamp T-8 Recessed Parabolic Lens 32W	6708	82	0.16	1100.11	$160.62	2	NCR	82	0.16	1100.11	$160.62	$0.00	$0.00	0.00	0	$0.00	0.00
16	3	116	3	2'X4' 3-Lamp T-8 Recessed Parabolic Lens 32W	6708	82	0.25	1650.17	$240.92	3	NCR	82	0.25	1650.17	$240.92	$0.00	$0.00	0.00	0	$0.00	0.00

17	1	116A	1	2'X4' 3-Lamp T-8 Recessed Parabolic Lens 32W	6708	82	0.08	550.056	$80.31	1	NCR	82	0.08	550.056	$80.31	$0.00	$0.00	0.00	0	$0.00	0.00
18	1	116B	1	2'X4' 3-Lamp T-8 Recessed Parabolic Lens 32W	6708	82	0.08	550.056	$80.31	1	NCR	82	0.08	550.056	$80.31	$0.00	$0.00	0.00	0	$0.00	0.00
19	6	117	12	2'X4' 3-Lamp T-8 Recessed Parabolic Lens 32W	6708	82	0.98	6600.67	$963.70	12	NCR	82	0.98	6600.67	$963.70	$0.00	$0.00	0.00	0	$0.00	0.00
20	1	117A	1	2'X4' 3-Lamp T-8 Recessed Parabolic Lens 32W	6708	82	0.08	550.056	$80.31	1	NCR	82	0.08	550.056	$80.31	$0.00	$0.00	0.00	0	$0.00	0.00
21	1	117B	1	2'X4' 3-Lamp T-8 Recessed Parabolic Lens 32W	6708	82	0.08	550.056	$80.31	1	NCR	82	0.08	550.056	$80.31	$0.00	$0.00	0.00	0	$0.00	0.00
22		Hallway	3	2'X4' 3-Lamp T-8 Recessed Parabolic Lens 32W	6708	82	0.25	1650.17	$240.92	3	NCR	82	0.25	1650.17	$240.92	$0.00	$0.00	0.00	0	$0.00	0.00
23		Electrical Closet	1	65W Incandescent	1593	65	0.07	103.545	$15.12	1	13 W CFL Lamp	13	0.01	20.709	$3.02	$5.00	$5.00	0.05	82.836	$12.09	0.41
24		130	7	2'X2' 2-Lamp T-8 U-Tube Recessed Parabolic Lens 32W	6708	73	0.51	3427.79	$500.46	7	NCR	73	0.51	3427.79	$500.46	$0.00	$0.00	0.00	0	$0.00	0.00
25		131	12	2'X2' 2-Lamp T-8 U-Tube Recessed Parabolic Lens 32W	6708	73	0.88	5876.21	$857.93	12	NCR	73	0.88	5876.21	$857.93	$0.00	$0.00	0.00	0	$0.00	0.00
26	3	132	7	2'X2' 2-Lamp T-8 U-Tube Recessed Parabolic Lens 32W	6708	73	0.511	3427.79	500.457048	7	NCR	73	0.51	3427.79	$500.46	$0.00	0	0	0	0	0.00
27	1	132A	4	2'X2' 2-Lamp T-8 U-Tube Recessed Parabolic Lens 32W	6708	73	0.29	1958.74	$285.98	4	NCR	73	0.29	1958.74	$285.98	$0.00	$0.00	0.00	0	$0.00	0.00
28	1	132B	4	2'X2' 2-Lamp T-8 U-Tube Recessed Parabolic Lens 32W	6708	73	0.29	1958.74	$285.98	4	NCR	73	0.29	1958.74	$285.98	$0.00	$0.00	0.00	0	$0.00	0.00
29	1	132C	4	2'X2' 2-Lamp T-8 U-Tube Recessed Parabolic Lens 32W	6708	73	0.29	1958.74	$285.98	4	NCR	73	0.29	1958.74	$285.98	$0.00	$0.00	0.00	0	$0.00	0.00
30	3	132D	7	2'X2' 2-Lamp T-8 U-Tube Recessed Parabolic Lens 32W	6708	73	0.51	3427.79	$500.46	7	NCR	73	0.51	3427.79	$500.46	$0.00	$0.00	0.00	0	$0.00	0.00
31	1	Kitchen	4	2'X2' 2-Lamp T-8 U-Tube Recessed Parabolic Lens 32W	6708	73	0.29	1958.74	$285.98	4	NCR	73	0.29	1958.74	$285.98	$0.00	$0.00	0.00	0	$0.00	0.00
32			6	1'X4' 3-Lamp T-8 Recessed Parabolic 32W	6708	82	0.49	3300.34	$481.85	6	NCR	82	0.49	3300.34	$481.85	$0.00	$0.00	0.00	0	$0.00	0.00
33			4	65W Halogen	6708	65	0.26	1744.08	$254.64	4	13 W CFL Lamp	13	0.05	348.816	$50.93	$5.00	$20.00	0.21	1395.26	$203.71	0.10
34			3	65W Incandescent	6708	65	0.20	1308.06	$190.98	3	13 W CFL Lamp	13	0.04	261.612	$38.20	$5.00	$15.00	0.16	1046.45	$152.78	0.10
35		Hallway	3	2'X2' 2-Lamp T-8 U-Tube Recessed Parabolic Lens 32W	6708	73	0.22	1469.05	$214.48	3	NCR	73	0.22	1469.05	$214.48	$0.00	$0.00	0.00	0	$0.00	0.00
36			1	LED Exit Signs	8760	4	0.00	35.04	$5.12	1	NCR	4	0.00	35.04	$5.12	$0.00	$0.00	0.00	0	$0.00	0.00
PC's	39	**Totals**	210				10.31	68891.2	$10,058.11	210			9.84	66017.8	$9,638.60		$45.00	0.47	2873.36	$419.51	0.11

INVESTMENT GRADE LIGHTING AUDIT

CONCORD ENERGY SERVICES

CEG Job #: 9C08144
Project: Union County Community College
Address: 12 W Jersey St
City: Elizabeth, NJ
Building SF: 102,000

"Lessner 2nd Floor"

DATE: 10/27/2009
KWH COST: $0.146

EXISTING LIGHTING										PROPOSED LIGHTING								SAVINGS			
Line No.		Fixture Location	No. eFixts	Fixture eType	Yearly Usage	Watts Used	Total kW	kWh/Yr Fixtures	Yearly $ Cost	No. rFixts	Retro-Unit rDescription	Watts Used	Total kW	kWh/Yr Fixtures	Yearly $ Cost	Unit Cost (INSTALLED)	Total Cost	kW Savings	kWh/Yr Savings	Yearly $ Savings	Yearly Payback
1		200	14	1'X4' 1-Lamp T-8 Recessed Parabolic 32W	6373	28	0.39	2498.06	$364.72	14	No Change Required (NCR)	28	0.39	2498.06	$364.72	$0.00	$0.00	0.00	0	$0.00	0.00
2	3	201	6	1'X4' 1-Lamp T-8 Recessed Parabolic 32W	6373	28	0.17	1070.6	$156.31	6	NCR	28	0.17	1070.6	$156.31	$0.00	$0.00	0.00	0	$0.00	0.00
3		201A	6	1'X4' 1-Lamp T-8 Recessed Parabolic 32W	6373	28	0.17	1070.6	$156.31	6	NCR	28	0.17	1070.6	$156.31	$0.00	$0.00	0.00	0	$0.00	0.00
4		202	30	1'X4' 1-Lamp T-8 Recessed Parabolic 32W	6373	28	0.84	5352.98	$781.54	30	NCR	28	0.84	5352.98	$781.54	$0.00	$0.00	0.00	0	$0.00	0.00
5	10	203	20	1'X4' 1-Lamp T-8 Recessed Parabolic 32W	6373	28	0.56	3568.66	$521.02	20	NCR	28	0.56	3568.66	$521.02	$0.00	$0.00	0.00	0	$0.00	0.00
6		204	3	2'X2' 2-Lamp T-8 U-Tube Recessed Parabolic 32W	6373	73	0.22	1395.6	$203.76	3	NCR	73	0.22	1395.6	$203.76	$0.00	$0.00	0.00	0	$0.00	0.00
7			1	Vanity	6373		0.00	0	$0.00	1		0	0.00	0	$0.00		$0.00	0.00	0	$0.00	0.00
8	2	205	6	1'X4' 1-Lamp T-8 Recessed Parabolic 32W	6373	28	0.17	1070.6	$156.31	6	NCR	28	0.17	1070.6	$156.31	$0.00	$0.00	0.00	0	$0.00	0.00
9	2	206	6	1'X4' 1-Lamp T-8 Recessed Parabolic 32W	6373	28	0.17	1070.6	$156.31	6	NCR	28	0.17	1070.6	$156.31	$0.00	$0.00	0.00	0	$0.00	0.00
10		208	1	13W CFL Wall Mounted with Cage	6373	13	0.01	82.8438	$12.10	1	NCR	13	0.01	82.8438	$12.10	$0.00	$0.00	0.00	0	$0.00	0.00
11	20	209	20	1'X4' 1-Lamp T-8 Recessed Parabolic 32W	6373	28	0.56	3568.66	$521.02	20	NCR	28	0.56	3568.66	$521.02	$0.00	$0.00	0.00	0	$0.00	0.00
12	20	210	20	1'X4' 1-Lamp T-8 Recessed Parabolic 32W	6373	28	0.56	3568.66	$521.02	20	NCR	28	0.56	3568.66	$521.02	$0.00	$0.00	0.00	0	$0.00	0.00
13		211	6	1'X4' 1-Lamp T-8 Recessed Parabolic 32W	6373	28	0.17	1070.6	$156.31	6	NCR	28	0.17	1070.6	$156.31	$0.00	$0.00	0.00	0	$0.00	0.00
14	16	212	20	1'X4' 1-Lamp T-8 Recessed Parabolic 32W	6373	28	0.56	3568.66	$521.02	20	NCR	28	0.56	3568.66	$521.02	$0.00	$0.00	0.00	0	$0.00	0.00

15	16	214	20	1'X4' 1-Lamp T-8 Recessed Parabolic 32W	6373	28	0.56	3568.66	$521.02	20	NCR	28	0.56	3568.66	$521.02	$0.00	$0.00	0.00	0	$0.00	0.00
16		215	1	2'X2' 2-Lamp T-8 U-Tube Recessed Parabolic 32W	6373	73	0.07	465.2	$67.92	1	NCR	73	0.07	465.2	$67.92	$0.00	$0.00	0.00	0	$0.00	0.00
17		216	1	2'X2' 2-Lamp T-8 U-Tube Recessed Parabolic 32W	6373	73	0.07	465.2	$67.92	1	NCR	73	0.07	465.2	$67.92	$0.00	$0.00	0.00	0	$0.00	0.00
18		217	1	13W CFL Wall Mounted with Cage	6373	13	0.01	82.8438	$12.10	1	NCR	13	0.01	82.8438	$12.10	$0.00	$0.00	0.00	0	$0.00	0.00
19		218	15	1'X4' 1-Lamp T-8 Recessed Parabolic 32W	6373	28	0.42	2676.49	$390.77	15	NCR	28	0.42	2676.49	$390.77	$0.00	$0.00	0.00	0	$0.00	0.00
20		221	3	2'X2' 2-Lamp T-8 U-Tube Recessed Parabolic 32W	6373	73	0.22	1395.6	$203.76	3	NCR	73	0.22	1395.6	$203.76	$0.00	$0.00	0.00	0	$0.00	0.00
21			1	Vanity	6373		0.00	0	$0.00	1		0	0.00	0	$0.00		$0.00	0.00	0	$0.00	0.00
22	16	222	20	1'X4' 1-Lamp T-8 Recessed Parabolic 32W	6373	28	0.56	3568.66	$521.02	20	NCR	28	0.56	3568.66	$521.02	$0.00	$0.00	0.00	0	$0.00	0.00
23	6	222A	6	1'X4' 1-Lamp T-8 Recessed Parabolic 32W	6373	28	0.17	1070.6	$156.31	6	NCR	28	0.17	1070.6	$156.31	$0.00	$0.00	0.00	0	$0.00	0.00
24	28	224	40	1'X4' 1-Lamp T-8 Recessed Parabolic 32W	6373	28	1.12	7137.31	$1,042.05	40	NCR	28	1.12	7137.31	$1,042.05	$0.00	$0.00	0.00	0	$0.00	0.00
25		Hallways	14	2-Lamp 13W CFL Recessed 10" Can	6373	26	0.36	2319.63	$338.67	14	NCR	26	0.36	2319.63	$338.67	$0.00	$0.00	0.00	0	$0.00	0.00
26			18	2'X2' 2-Lamp T-8 U-Tube Recessed Parabolic 32W	6373	73	1.31	8373.6	$1,222.55	18	NCR	73	1.31	8373.6	$1,222.55	$0.00	$0.00	0.00	0	$0.00	0.00
27			6	1'X4' 1-Lamp T-8 Recessed Parabolic 32W	6373	28	0.17	1070.6	$156.31	6	NCR	28	0.17	1070.6	$156.31	$0.00	$0.00	0.00	0	$0.00	0.00
28			9	LED Exit Sign	8760	4	0.04	315.36	$46.04	9	NCR	4	0.04	315.36	$46.04	$0.00	$0.00	0.00	0	$0.00	0.00
PC's	139	**Totals**	314				9.63	61466.8	$8,974.16	314			9.63	61466.8	$8,974.16		$0.00	0.00	0	$0.00	0.00

INVESTMENT GRADE LIGHTING AUDIT

CONCORD ENERGY SERVICES

CEG Job #: 9C08144
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Address: 12 W Jersey St
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"Lessner 2nd Floor"

DATE: 10/27/2009
KWH COST: $0.146

EXISTING LIGHTING										PROPOSED LIGHTING								SAVINGS			
Line No.		Fixture Location	No. eFixts	Fixture eType	Yearly Usage	Watts Used	Total kW	kWh/Yr Fixtures	Yearly $ Cost	No. rFixts	Retro-Unit rDescription	Watts Used	Total kW	kWh/Yr Fixtures	Yearly $ Cost	Unit Cost (INSTALLED)	Total Cost	kW Savings	kWh/Yr Savings	Yearly $ Savings	Yearly Payback
	PC's																				
1		319	1	18W CFL	6373	18	0.02	114.707	$16.75	1	No Change Required (NCR)	18	0.02	114.707	$16.75	$0.00	$0.00	0.00	0	$0.00	0.00
2	23	318	21	1'X4' 1-Lamp T-8 Recessed Parabolic w/ Oc Sensor 32W	6373	28	0.59	3747.09	$547.07	21	NCR	28	0.59	3747.09	$547.07	$0.00	$0.00	0.00	0	$0.00	0.00
3	22	316	20	1'X4' 1-Lamp T-8 Recessed Parabolic w/ Oc Sensor 32W	6373	28	0.56	3568.66	$521.02	20	NCR	28	0.56	3568.66	$521.02	$0.00	$0.00	0.00	0	$0.00	0.00
4	23	322	23	1'X4' 1-Lamp T-8 Recessed Parabolic w/ Oc Sensor 32W	6373	28	0.64	4103.95	$599.18	23	NCR	28	0.64	4103.95	$599.18	$0.00	$0.00	0.00	0	$0.00	0.00
5	1	323	19	1'X4' 1-Lamp T-8 Recessed Parabolic 32W	6373	28	0.53	3390.22	$494.97	19	NCR	28	0.53	3390.22	$494.97	$0.00	$0.00	0.00	0	$0.00	0.00
6		324	19	1'X4' 1-Lamp T-8 Recessed Parabolic w/ Oc Sensor 32W	6373	28	0.53	3390.22	$494.97	19	NCR	28	0.53	3390.22	$494.97	$0.00	$0.00	0.00	0	$0.00	0.00
7		300	15	1'X4' 1-Lamp T-8 Recessed Parabolic w/ Oc Sensor 32W	6373	28	0.42	2676.49	$390.77	15	NCR	28	0.42	2676.49	$390.77	$0.00	$0.00	0.00	0	$0.00	0.00
8		301	19	1'X4' 1-Lamp T-8 Recessed Parabolic w/ Oc Sensor 32W	6373	28	0.53	3390.22	$494.97	19	NCR	28	0.53	3390.22	$494.97	$0.00	$0.00	0.00	0	$0.00	0.00
9		302	20	1'X4' 1-Lamp T-8 Recessed Parabolic w/ Oc Sensor 32W	6373	28	0.56	3568.66	$521.02	20	NCR	28	0.56	3568.66	$521.02	$0.00	$0.00	0.00	0	$0.00	0.00
10		303	15	1'X4' 1-Lamp T-8 Recessed Parabolic w/ Oc Sensor 32W	6373	28	0.42	2676.49	$390.77	15	NCR	28	0.42	2676.49	$390.77	$0.00	$0.00	0.00	0	$0.00	0.00
11		304	1	2'X2' 2-Lamp T-8 U-Tube Recessed Parabolic 32W	6373	73	0.07	465.2	$67.92	1	NCR	73	0.07	465.2	$67.92	$0.00	$0.00	0.00	0	$0.00	0.00

12		305	1	2'X2' 2-Lamp T-8 U-Tube Recessed Parabolic 32W	6373	73	0.07	465.2	$67.92	1	NCR	73	0.07	465.2	$67.92	$0.00	$0.00	0.00	0	$0.00	0.00
13	3	307	8	1'X4' 1-Lamp T-8 Recessed Parabolic 32W	6373	28	0.22	1427.46	$208.41	8	NCR	28	0.22	1427.46	$208.41	$0.00	$0.00	0.00	0	$0.00	0.00
14		309	1	18W CFL	6373	18	0.02	114.707	$16.75	1	NCR	18	0.02	114.707	$16.75	$0.00	$0.00	0.00	0	$0.00	0.00
15	28	310	28	1'X4' 1-Lamp T-8 Recessed Parabolic 32W	6373	28	0.78	4996.12	$729.43	28	NCR	28	0.78	4996.12	$729.43	$0.00	$0.00	0.00	0	$0.00	0.00
16	1	313	4	1'X4' 1-Lamp T-8 Recessed Parabolic 32W	6373	28	0.11	713.731	$104.20	4	NCR	28	0.11	713.731	$104.20	$0.00	$0.00	0.00	0	$0.00	0.00
17	2	314	6	1'X4' 1-Lamp T-8 Recessed Parabolic 32W	6373	28	0.17	1070.6	$156.31	6	NCR	28	0.17	1070.6	$156.31	$0.00	$0.00	0.00	0	$0.00	0.00
18	1	315	4	1'X4' 1-Lamp T-8 Recessed Parabolic 32W	6373	28	0.11	713.731	$104.20	4	NCR	28	0.11	713.731	$104.20	$0.00	$0.00	0.00	0	$0.00	0.00
19	1	312	62	1'X4' 1-Lamp T-8 Recessed Parabolic 32W	6373	28	1.74	11062.8	$1,615.17	62	NCR	28	1.74	11062.8	$1,615.17	$0.00	$0.00	0.00	0	$0.00	0.00
20		306	3	2'X2' 2-Lamp T-8 U-Tube Recessed Parabolic 32W	6373	73	0.22	1395.6	$203.76	3	NCR	73	0.22	1395.6	$203.76	$0.00	$0.00	0.00	0	$0.00	0.00
21			1	4' 2 Lamp T-8 32W Vanity	6373	58	0.06	369.611	$53.96	1	NCR	58	0.06	369.611	$53.96	$0.00	$0.00	0.00	0	$0.00	0.00
22		321	3	2'X2' 2-Lamp T-8 U-Tube Recessed Parabolic 32W	6373	73	0.22	1395.6	$203.76	3	NCR	73	0.22	1395.6	$203.76	$0.00	$0.00	0.00	0	$0.00	0.00
23			1	4' 2 Lamp T-8 32W Vanity	6373	58	0.06	369.611	$53.96	1	NCR	58	0.06	369.611	$53.96	$0.00	$0.00	0.00	0	$0.00	0.00
24		Hallway	13	2'X2' 2-Lamp T-8 U-Tube Recessed Parabolic 32W	6373	73	0.95	6047.6	$882.95	13	NCR	73	0.95	6047.6	$882.95	$0.00	$0.00	0.00	0	$0.00	0.00
25			12	2-Lamp 13W PL Type CFL Recessed 10" Cans	6373	30	0.36	2294.14	$334.94	12	NCR	30	0.36	2294.14	$334.94	$0.00	$0.00	0.00	0	$0.00	0.00
26			6	LED Exit Signs	8760	4	0.02	210.24	$30.70	6	NCR	4	0.02	210.24	$30.70	$0.00	$0.00	0.00	0	$0.00	0.00
PC's	105	**Totals**	326				9.99	63738.7	$9,305.85	326			9.99	63738.7	$9,305.85		$0.00	0.00	0	$0.00	0.00

INVESTMENT GRADE LIGHTING AUDIT

CONCORD ENERGY SERVICES

CEG Job #: 9C08144
Project: Union County Community College
Address: 12 W Jersey St
City: Elizabeth, NJ
Building SF: 102,000

"Lessner 4th Floor"

DATE: 10/27/2009
KWH COST: $0.146

EXISTING LIGHTING										PROPOSED LIGHTING								SAVINGS			
Line No.	PC's	Fixture Location	No. eFixts	Fixture eType	Yearly Usage	Watts Used	Total kW	kWh/Yr Fixtures	Yearly $ Cost	No. rFixts	Retro-Unit rDescription	Watts Used	Total kW	kWh/Yr Fixtures	Yearly $ Cost	Unit Cost (INSTALLED)	Total Cost	kW Savings	kWh/Yr Savings	Yearly $ Savings	Yearly Payback
1		400	15	1'X4' 1-Lamp T-8 Recessed Parabolic w/ Oc Sensor 32W	6373	28	0.42	2676.49	$390.77	15	No Change Required (NCR)	28	0.42	2676.49	$390.77	$0.00	$0.00	0.00	0	$0.00	0.00
2		401	19	1'X4' 1-Lamp T-8 Recessed Parabolic w/ Oc Sensor 32W	6373	28	0.53	3390.22	$494.97	19	NCR	28	0.53	3390.22	$494.97	$0.00	$0.00	0.00	0	$0.00	0.00
3		402	20	1'X4' 1-Lamp T-8 Recessed Parabolic w/ Oc Sensor 32W	6373	28	0.56	3568.66	$521.02	20	NCR	28	0.56	3568.66	$521.02	$0.00	$0.00	0.00	0	$0.00	0.00
4	1	403	19	1'X4' 1-Lamp T-8 Recessed Parabolic w/ Oc Sensor 32W	6373	28	0.53	3390.22	$494.97	19	NCR	28	0.53	3390.22	$494.97	$0.00	$0.00	0.00	0	$0.00	0.00
5	2	405	6	1'X4' 1-Lamp T-8 Recessed Parabolic 32W	6373	28	0.17	1070.6	$156.31	6	NCR	28	0.17	1070.6	$156.31	$0.00	$0.00	0.00	0	$0.00	0.00
6	2	406	6	1'X4' 1-Lamp T-8 Recessed Parabolic 32W	6373	28	0.17	1070.6	$156.31	6	NCR	28	0.17	1070.6	$156.31	$0.00	$0.00	0.00	0	$0.00	0.00
7		411	15	1'X4' 1-Lamp T-8 Recessed Parabolic w/ Oc Sensor 32W	6373	28	0.42	2676.49	$390.77	15	NCR	28	0.42	2676.49	$390.77	$0.00	$0.00	0.00	0	$0.00	0.00
8	1	412	25	1'X4' 1-Lamp T-8 Recessed Parabolic w/ Oc Sensor 32W	6373	28	0.70	4460.82	$651.28	25	NCR	28	0.70	4460.82	$651.28	$0.00	$0.00	0.00	0	$0.00	0.00
9	3	414	15	1'X4' 1-Lamp T-8 Recessed Parabolic 32W	6373	28	0.42	2676.49	$390.77	15	NCR	28	0.42	2676.49	$390.77	$0.00	$0.00	0.00	0	$0.00	0.00
10	2	414A	9	1'X4' 1-Lamp T-8 Recessed Parabolic 32W	6373	28	0.25	1605.9	$234.46	9	NCR	28	0.25	1605.9	$234.46	$0.00	$0.00	0.00	0	$0.00	0.00
11		414B	9	1'X4' 1-Lamp T-8 Recessed Parabolic 32W	6373	28	0.25	1605.9	$234.46	9	NCR	28	0.25	1605.9	$234.46	$0.00	$0.00	0.00	0	$0.00	0.00

12	1	414C	6	1'X4' 1-Lamp T-8 Recessed Parabolic 32W	6373	28	0.17	1070.6	$156.31	6	NCR	28	0.17	1070.6	$156.31	$0.00	$0.00	0.00	0	$0.00	0.00
13		414D	6	1'X4' 1-Lamp T-8 Recessed Parabolic 32W	6373	28	0.17	1070.6	$156.31	6	NCR	28	0.17	1070.6	$156.31	$0.00	$0.00	0.00	0	$0.00	0.00
14	1	415	25	1'X4' 1-Lamp T-8 Recessed Parabolic w/ Oc Sensor 32W	6373	28	0.70	4460.82	$651.28	25	NCR	28	0.70	4460.82	$651.28	$0.00	$0.00	0.00	0	$0.00	0.00
15	2	416	6	1'X4' 1-Lamp T-8 Recessed Parabolic 32W	6373	28	0.17	1070.6	$156.31	6	NCR	28	0.17	1070.6	$156.31	$0.00	$0.00	0.00	0	$0.00	0.00
16	4	417	12	1'X4' 1-Lamp T-8 Recessed Parabolic 32W	6373	28	0.34	2141.19	$312.61	12	NCR	28	0.34	2141.19	$312.61	$0.00	$0.00	0.00	0	$0.00	0.00
17	4	418	9	1'X4' 1-Lamp T-8 Recessed Parabolic 32W	6373	28	0.25	1605.9	$234.46	9	NCR	28	0.25	1605.9	$234.46	$0.00	$0.00	0.00	0	$0.00	0.00
18		422	18	1'X4' 1-Lamp T-8 Recessed Parabolic w/ Oc Sensor 32W	6373	28	0.50	3211.79	$468.92	18	NCR	28	0.50	3211.79	$468.92	$0.00	$0.00	0.00	0	$0.00	0.00
19		423		1'X4' 1-Lamp T-8 Recessed Parabolic w/ Oc Sensor 32W	6373	28	0.00	0	$0.00	0	NCR	28	0.00	0	$0.00	$0.00	$0.00	0.00	0	$0.00	0.00
20		Mens Bathroom	3	2'X2' 2-Lamp T-8 U-Tube Recessed Parabolic 32W	6373	73	0.22	1395.6	$203.76	3	NCR	73	0.22	1395.6	$203.76	$0.00	$0.00	0.00	0	$0.00	0.00
21			1	2-Lamp T-8 Wall Mounted Vanity 32W	6373	58	0.06	369.611	$53.96	1	NCR	58	0.06	369.611	$53.96	$0.00	$0.00	0.00	0	$0.00	0.00
22		Womens Bathroom	3	2'X2' 2-Lamp T-8 U-Tube Recessed Parabolic 32W	6373	73	0.22	1395.6	$203.76	3	NCR	73	0.22	1395.6	$203.76	$0.00	$0.00	0.00	0	$0.00	0.00
23			1	2-Lamp T-8 Wall Mounted Vanity 32W	6373	2	0.00	12.7452	$1.86	1	NCR	2	0.00	12.7452	$1.86	$0.00	$0.00	0.00	0	$0.00	0.00
24		Hallway	18	2'X2' 2-Lamp T-8 U-Tube Recessed Parabolic 32W	6373	73	1.31	8373.6	$1,222.55	18	NCR	73	1.31	8373.6	$1,222.55	$0.00	$0.00	0.00	0	$0.00	0.00
25			26	2-Lamp 13W PL Type CFL Recessed 10" Cans	6373	30	0.78	4970.63	$725.71	26	NCR	30	0.78	4970.63	$725.71	$0.00	$0.00	0.00	0	$0.00	0.00
26			8	LED Exit Signs	8760	4	0.03	280.32	$40.93	8	NCR	4	0.03	280.32	$40.93	$0.00	$0.00	0.00	0	$0.00	0.00

27		IT Closet	1	65W Incandescent	1593	65	0.07	103.545	$15.12	1	13 W CFL Lamp	13	0.01	20.709	$3.02	$5.00	$5.00	0.05	82.836	$12.09	0.41
28		Electrical Closet	1	18W CFL	1593	18	0.02	28.674	$4.19	1	NCR	18	0.02	28.674	$4.19	$0.00	$0.00	0.00	0	$0.00	0.00
PC's	23	**Totals**	302				9.43	59754.2	$8,724.11	302			9.38	59671.4	$8,712.02		$5.00	0.05	82.836	$12.09	0.41

INVESTMENT GRADE LIGHTING AUDIT

CONCORD ENERGY SERVICES

CEG Job #: 9C08144
Project: Union County Community College
Address: 12 W Jersey St
City: Elizabeth, NJ
Building SF: 102,000

"Lessner 5th Floor"

DATE: 10/27/2009
KWH COST: $0.146

EXISTING LIGHTING										PROPOSED LIGHTING								SAVINGS			
Line No.	PC's	Fixture Location	No. eFixts	Fixture eType	Yearly Usage	Watts Used	Total kW	kWh/Yr Fixtures	Yearly $ Cost	No. rFixts	Retro-Unit rDescription	Watts Used	Total kW	kWh/Yr Fixtures	Yearly $ Cost	Unit Cost (INSTALLED)	Total Cost	kW Savings	kWh/Yr Savings	Yearly $ Savings	Yearly Payback
1	5	500	15	1'X4'1-Lamp T-8 Recessed Parabolic 32W	6373	28	0.42	2676.49	$390.77	15	No Change Required (NCR)	28	0.42	2676.49	$390.77	$0.00	$0.00	0.00	0	$0.00	0.00
2		501	19	1'X4'1-Lamp T-8 Recessed Parabolic w/ Oc Sensor 32W	6373	28	0.53	3390.22	$494.97	19	NCR	28	0.53	3390.22	$494.97	$0.00	$0.00	0.00	0	$0.00	0.00
3		502	19	1'X4'1-Lamp T-8 Recessed Parabolic w/ Oc Sensor 32W	6373	28	0.53	3390.22	$494.97	19	NCR	28	0.53	3390.22	$494.97	$0.00	$0.00	0.00	0	$0.00	0.00
4		503	19	1'X4'1-Lamp T-8 Recessed Parabolic w/ Oc Sensor 32W	6373	28	0.53	3390.22	$494.97	19	NCR	28	0.53	3390.22	$494.97	$0.00	$0.00	0.00	0	$0.00	0.00
5	2	505	6	1'X4'1-Lamp T-8 Recessed Parabolic 32W	6373	28	0.17	1070.6	$156.31	6	NCR	28	0.17	1070.6	$156.31	$0.00	$0.00	0.00	0	$0.00	0.00
6	1	506	6	1'X4'1-Lamp T-8 Recessed Parabolic 32W	6373	28	0.17	1070.6	$156.31	6	NCR	28	0.17	1070.6	$156.31	$0.00	$0.00	0.00	0	$0.00	0.00
7		508	3	1'X4'1-Lamp T-8 Recessed Parabolic 32W	6373	28	0.08	535.298	$78.15	3	NCR	28	0.08	535.298	$78.15	$0.00	$0.00	0.00	0	$0.00	0.00
8	1	510	6	1'X4'1-Lamp T-8 Recessed Parabolic 32W	6373	28	0.17	1070.6	$156.31	6	NCR	28	0.17	1070.6	$156.31	$0.00	$0.00	0.00	0	$0.00	0.00
9		509	1	13W CFL	6373	13	0.01	82.8438	$12.10	1	NCR	13	0.01	82.8438	$12.10	$0.00	$0.00	0.00	0	$0.00	0.00
10	1	511	9	1'X4'1-Lamp T-8 Recessed Parabolic w/ Oc Sensor 32W	6373	28	0.25	1605.9	$234.46	9	NCR	28	0.25	1605.9	$234.46	$0.00	$0.00	0.00	0	$0.00	0.00
11	6	512	20	1'X4'1-Lamp T-8 Recessed Parabolic 32W	6373	28	0.56	3568.66	$521.02	20	NCR	28	0.56	3568.66	$521.02	$0.00	$0.00	0.00	0	$0.00	0.00

12		513A	20	1'X4'1-Lamp T-8 Recessed Parabolic w/ Oc Sensor 32W	6373	28	0.56	3568.66	$521.02	20	NCR	28	0.56	3568.66	$521.02	$0.00	$0.00	0.00	0	$0.00	0.00
13	14	513B	20	1'X4'1-Lamp T-8 Recessed Parabolic w/ Oc Sensor 32W	6373	28	0.56	3568.66	$521.02	20	NCR	28	0.56	3568.66	$521.02	$0.00	$0.00	0.00	0	$0.00	0.00
14	1	514	31	1'X4'1-Lamp T-8 Recessed Parabolic w/ Oc Sensor 32W	6373	28	0.87	5531.42	$807.59	31	NCR	28	0.87	5531.42	$807.59	$0.00	$0.00	0.00	0	$0.00	0.00
15		515	16	1'X4'1-Lamp T-8 Recessed Parabolic w/ Oc Sensor 32W	6373	28	0.45	2854.92	$416.82	16	NCR	28	0.45	2854.92	$416.82	$0.00	$0.00	0.00	0	$0.00	0.00
16		516	1	60W Incandescent	6373	60	0.06	382.356	$55.82	1	13 W CFL Lamp	13	0.01	82.8438	$12.10	$5.00	$5.00	0.05	299.512	$43.73	0.11
17	2	518	6	1'X4'1-Lamp T-8 Recessed Parabolic 32W	6373	28	0.17	1070.6	$156.31	6	NCR	28	0.17	1070.6	$156.31	$0.00	$0.00	0.00	0	$0.00	0.00
18	3	519	6	1'X4'1-Lamp T-8 Recessed Parabolic 32W	6373	28	0.17	1070.6	$156.31	6	NCR	28	0.17	1070.6	$156.31	$0.00	$0.00	0.00	0	$0.00	0.00
19		521	20	1'X4'1-Lamp T-8 Recessed Parabolic w/ Oc Sensor 32W	6373	28	0.56	3568.66	$521.02	20	NCR	28	0.56	3568.66	$521.02	$0.00	$0.00	0.00	0	$0.00	0.00
20	1	522		1'X4'1-Lamp T-8 Recessed Parabolic w/ Oc Sensor 32W	6373	28	0.00	0	$0.00	0	NCR	28	0.00	0	$0.00	$0.00	$0.00	0.00	0	$0.00	0.00
21		504 Mens Bathroom	3	2'X2' 2-Lamp T-8 U-Tube Recessed Parabolic 32W	6373	73	0.22	1395.6	$203.76	3	NCR	73	0.22	1395.6	$203.76	$0.00	$0.00	0.00	0	$0.00	0.00
22			2	4' 2-Lamp T-8 Wall Mounted Vanity 32W	6373	58	0.12	739.222	$107.93	2	NCR	58	0.12	739.222	$107.93	$0.00	$0.00	0.00	0	$0.00	0.00
23		521 Womens Bathroom	3	2'X2' 2-Lamp T-8 U-Tube Recessed Parabolic 32W	6373	73	0.22	1395.6	$203.76	3	NCR	73	0.22	1395.6	$203.76	$0.00	$0.00	0.00	0	$0.00	0.00
24			2	4' 2-Lamp T-8 Wall Mounted Vanity 32W	6373	58	0.12	739.222	$107.93	2	NCR	58	0.12	739.222	$107.93	$0.00	$0.00	0.00	0	$0.00	0.00
25			18	2'X2' 2-Lamp T-8 U-Tube Recessed Parabolic 32W	6373	73	1.31	8373.6	$1,222.55	18	NCR	73	1.31	8373.6	$1,222.55	$0.00	$0.00	0.00	0	$0.00	0.00

26		Hallway	25	2-Lamp 13W PL Type CFL Recessed 10" Cans	6373	30	0.75	4779.45	$697.80	25	NCR	30	0.75	4779.45	$697.80	$0.00	$0.00	0.00	0	$0.00	0.00
27			8	LED Exit Signs	8760	4	0.03	280.32	$40.93	8	NCR	4	0.03	280.32	$40.93	$0.00	$0.00	0.00	0	$0.00	0.00
PC's	37	**Totals**	304				9.59	61170.5	$8,930.89	304			9.54	60871	$8,887.17		$5.00	0.05	299.512	$43.73	0.11

INVESTMENT GRADE LIGHTING AUDIT

CONCORD ENERGY SERVICES

CEG Job #: 9C08144
Project: Union County Community College
Address: 12 W Jersey St
City: Elizabeth, NJ
Building SF: 102,000

"Lessner 6th Floor"

DATE: 10/27/2009
KWH COST: $0.146

EXISTING LIGHTING										PROPOSED LIGHTING								SAVINGS			
Line No.		Fixture Location	No. eFixts	Fixture eType	Yearly Usage	Watts Used	Total kW	kWh/Yr Fixtures	Yearly $ Cost	No. rFixts	Retro-Unit rDescription	Watts Used	Total kW	kWh/Yr Fixtures	Yearly $ Cost	Unit Cost (INSTALLED)	Total Cost	kW Savings	kWh/Yr Savings	Yearly $ Savings	Yearly Payback
1	4	600	12	1'X4' 1-Lamp T-8 Recessed Parabolic 32W	6373	28	0.34	2141.19	$312.61	12	No Change Required (NCR)	28	0.34	2141.19	$312.61	$0.00	$0.00	0.00	0	$0.00	0.00
2		601	8	1'X4' 1-Lamp T-8 Recessed Parabolic w/ Oc Sensor 32W	6373	28	0.22	1427.46	$208.41	8	NCR	28	0.22	1427.46	$208.41	$0.00	$0.00	0.00	0	$0.00	0.00
3		602	22	1'X4' 1-Lamp T-8 Recessed Parabolic w/ Oc Sensor 32W	6373	28	0.62	3925.52	$573.13	22	NCR	28	0.62	3925.52	$573.13	$0.00	$0.00	0.00	0	$0.00	0.00
4		603	16	1'X4' 1-Lamp T-8 Recessed Parabolic w/ Oc Sensor 32W	6373	28	0.45	2854.92	$416.82	16	NCR	28	0.45	2854.92	$416.82	$0.00	$0.00	0.00	0	$0.00	0.00
5	2	605	6	1'X4' 1-Lamp T-8 Recessed Parabolic 32W	6373	28	0.17	1070.6	$156.31	6	NCR	28	0.17	1070.6	$156.31	$0.00	$0.00	0.00	0	$0.00	0.00
6	2	606	6	1'X4' 1-Lamp T-8 Recessed Parabolic 32W	6373	28	0.17	1070.6	$156.31	6	NCR	28	0.17	1070.6	$156.31	$0.00	$0.00	0.00	0	$0.00	0.00
7		608	6	2'X2' 2-Lamp T-8 U-Tube Recessed Parabolic 32W	6373	73	0.44	2791.2	$407.52	6	NCR	73	0.44	2791.2	$407.52	$0.00	$0.00	0.00	0	$0.00	0.00
8		610	1	2'X2' 2-Lamp T-12 U-Tube Recessed Parabolic 34W	6373	73	0.07	465.2	$67.92	1	2'x2' 2-Lamp T-8, Prism Lens Electronic Ballast, Architectural surface or Recessed static METALUX 2AC-217-UNV-EB81-U	34	0.03	216.668	$31.63	$204.00	$204.00	0.04	248.531	$36.29	5.62
9		609	1	13W CFL Surface Wall w/ Cage	6373	18	0.02	114.707	$16.75	1	NCR	18	0.02	114.707	$16.75	$0.00	$0.00	0.00	0	$0.00	0.00
10		611	15	1'X4' 1-Lamp T-8 Recessed Parabolic w/ Oc Sensor 32W	6373	28	0.42	2676.49	$390.77	15	NCR	28	0.42	2676.49	$390.77	$0.00	$0.00	0.00	0	$0.00	0.00

11		612	15	1'X4' 1-Lamp T-8 Recessed Parabolic w/ Oc Sensor 32W	6373	28	0.42	2676.49	$390.77	15	NCR	28	0.42	2676.49	$390.77	$0.00	$0.00	0.00	0	$0.00	0.00
12		614	19	1'X4' 1-Lamp T-8 Recessed Parabolic w/ Oc Sensor 32W	6373	28	0.53	3390.22	$494.97	19	NCR	28	0.53	3390.22	$494.97	$0.00	$0.00	0.00	0	$0.00	0.00
13	4	615	15	1'X4' 1-Lamp T-8 Recessed Parabolic w/ Oc Sensor 32W	6373	28	0.42	2676.49	$390.77	15	NCR	28	0.42	2676.49	$390.77	$0.00	$0.00	0.00	0	$0.00	0.00
14	1	615A	6	1'X4' 1-Lamp T-8 Recessed Parabolic w/ Oc Sensor 32W	6373	28	0.17	1070.6	$156.31	6	NCR	28	0.17	1070.6	$156.31	$0.00	$0.00	0.00	0	$0.00	0.00
15	1	615B	9	1'X4' 1-Lamp T-8 Recessed Parabolic w/ Oc Sensor 32W	6373	28	0.25	1605.9	$234.46	9	NCR	28	0.25	1605.9	$234.46	$0.00	$0.00	0.00	0	$0.00	0.00
16	25	616	28	1'X4' 1-Lamp T-8 Recessed Parabolic w/ Oc Sensor 32W	6373	28	0.78	4996.12	$729.43	28	NCR	28	0.78	4996.12	$729.43	$0.00	$0.00	0.00	0	$0.00	0.00
17	17	617	15	1'X4' 1-Lamp T-8 Recessed Parabolic w/ Oc Sensor 32W	6373	28	0.42	2676.49	$390.77	15	NCR	28	0.42	2676.49	$390.77	$0.00	$0.00	0.00	0	$0.00	0.00
18		618	1	60W Incandescent	6373	60	0.06	382.356	$55.82	1	13 W CFL Lamp	13	0.01	82.8438	$12.10	$5.00	$5.00	0.05	299.512	$43.73	0.11
19	2	620	6	1'X4' 1-Lamp T-8 Recessed Parabolic 32W	6373	28	0.17	1070.6	$156.31	6	NCR	28	0.17	1070.6	$156.31	$0.00	$0.00	0.00	0	$0.00	0.00
20	3	621	6	1'X4' 1-Lamp T-8 Recessed Parabolic 32W	6373	28	0.17	1070.6	$156.31	6	NCR	28	0.17	1070.6	$156.31	$0.00	$0.00	0.00	0	$0.00	0.00
21		623	20	1'X4' 1-Lamp T-8 Recessed Parabolic w/ Oc Sensor 32W	6373	28	0.56	3568.66	$521.02	20	NCR	28	0.56	3568.66	$521.02	$0.00	$0.00	0.00	0	$0.00	0.00
22	26	624	36	1'X4' 1-Lamp T-8 Recessed Parabolic w/ Oc Sensor 32W	6373	28	1.01	6423.58	$937.84	36	NCR	28	1.01	6423.58	$937.84	$0.00	$0.00	0.00	0	$0.00	0.00
23		604 Mens Bathroom	4	2'X2' 2-Lamp T-8 U-Tube Recessed Parabolic 32W	6373	73	0.29	1860.8	$271.68	4	NCR	73	0.29	1860.8	$271.68	$0.00	$0.00	0.00	0	$0.00	0.00
24			2	4' 2-Lamp T-8 Wall Mounted Vanity 32W	6373	58	0.12	739.222	$107.93	2	NCR	58	0.12	739.222	$107.93	$0.00	$0.00	0.00	0	$0.00	0.00
25		622 Womens	4	2'X2' 2-Lamp T-8 U-Tube Recessed Parabolic 32W	6373	73	0.29	1860.8	$271.68	4	NCR	73	0.29	1860.8	$271.68	$0.00	$0.00	0.00	0	$0.00	0.00

26		Bathroom	2	4' 2-Lamp T-8 Wall Mounted Vanity 32W	6373	58	0.12	739.222	$107.93	2	NCR	58	0.12	739.222	$107.93	$0.00	$0.00	0.00	0	$0.00	0.00
27		Cust Closet	1	Tri-Tube CFL	1593	71	0.07	113.103	$16.51	1	NCR	71	0.07	113.103	$16.51	$0.00	$0.00	0.00	0	$0.00	0.00
28		Hallway	18	2'X2' 2-Lamp T-8 U-Tube Recessed Parabolic 32W	6373	73	1.31	8373.6	$1,222.55	18	NCR	73	1.31	8373.6	$1,222.55	$0.00	$0.00	0.00	0	$0.00	0.00
29			22	2-Lamp13W PL Type CFL Recessed 10" Cans	6373	30	0.66	4205.92	$614.06	22	NCR	30	0.66	4205.92	$614.06	$0.00	$0.00	0.00	0	$0.00	0.00
30			8	LED Exit Signs	8760	4	0.03	280.32	$40.93	8	NCR	4	0.03	280.32	$40.93	$0.00	$0.00	0.00	0	$0.00	0.00
PC's	87	**Totals**	330				10.76	68319	$9,974.57	330			10.68	67770.9	$9,894.55		$209.00	0.09	548.044	$80.01	2.61

INVESTMENT GRADE LIGHTING AUDIT

CONCORD ENERGY SERVICES

CEG Job #: 9C08144
Project: Union County Community College
Address: 12 W Jersey St
City: Elizabeth, NJ
Building SF: 102,000

"Lessner 7th Floor & Penthouse"

DATE: 10/27/2009
KWH COST: $0.146

EXISTING LIGHTING										PROPOSED LIGHTING								SAVINGS			
Line No.	PC's	Fixture Location	No. eFixts	Fixture eType	Yearly Usage	Watts Used	Total kW	kWh/Yr Fixtures	Yearly $ Cost	No. rFixts	Retro-Unit rDescription	Watts Used	Total kW	kWh/Yr Fixtures	Yearly $ Cost	Unit Cost (INSTALLED)	Total Cost	kW Savings	kWh/Yr Savings	Yearly $ Savings	Yearly Payback
1		701	45	1'X4' 1-Lamp T-8 Recessed Parabolic w/ Oc Sensor 32W	6373	28	1.26	8029.48	$1,172.30	45	No Change Required (NCR)	28	1.26	8029.48	$1,172.30	$0.00	$0.00	0.00	0	$0.00	0.00
2			2	2'X2' 2-Lamp T-8 U-Tube Recessed Parabolic 32W	6373	73	0.15	930.4	$135.84	2	NCR	73	0.15	930.4	$135.84	$0.00	$0.00	0.00	0	$0.00	0.00
3			4	1'X4' 1-Lamp T-8 Surface Mounted 32W	6373	28	0.11	713.731	$104.20	4	NCR	28	0.11	713.731	$104.20	$0.00	$0.00	0.00	0	$0.00	0.00
4	1	702	11	1'X4'1-Lamp T-8 Recessed Parabolic 32W	6373	28	0.31	1962.76	$286.56	11	NCR	28	0.31	1962.76	$286.56	$0.00	$0.00	0.00	0	$0.00	0.00
5		702A	4	1'X4'1-Lamp T-8 Recessed Parabolic 32W	6373	28	0.11	713.731	$104.20	4	NCR	28	0.11	713.731	$104.20	$0.00	$0.00	0.00	0	$0.00	0.00
6		703	10	1'X4'1-Lamp T-8 Recessed Parabolic 32W	6373	28	0.28	1784.33	$260.51	10	NCR	28	0.28	1784.33	$260.51	$0.00	$0.00	0.00	0	$0.00	0.00
7	1	703A	8	1'X4'1-Lamp T-8 Recessed Parabolic 32W	6373	28	0.22	1427.46	$208.41	8	NCR	28	0.22	1427.46	$208.41	$0.00	$0.00	0.00	0	$0.00	0.00
8		705	6	1'X4'1-Lamp T-8 Recessed Parabolic 32W	6373	28	0.17	1070.6	$156.31	6	NCR	28	0.17	1070.6	$156.31	$0.00	$0.00	0.00	0	$0.00	0.00
9		706	6	1'X4'1-Lamp T-8 Recessed Parabolic 32W	6373	28	0.17	1070.6	$156.31	6	NCR	28	0.17	1070.6	$156.31	$0.00	$0.00	0.00	0	$0.00	0.00
10		709	16	1'X4' 1-Lamp T-8 Recessed Parabolic w/ Oc Sensor 32W	6373	28	0.45	2854.92	$416.82	16	NCR	28	0.45	2854.92	$416.82	$0.00	$0.00	0.00	0	$0.00	0.00
11		708	1	13W CFL	6373	18	0.02	114.707	$16.75	1	NCR	18	0.02	114.707	$16.75	$0.00	$0.00	0.00	0	$0.00	0.00
12		714 (Stairwell)	19	1'X2' 1-Lamp T-8 Wall Mounted 17W	6373	20	0.38	2421.59	$353.55	19	NCR	20	0.38	2421.59	$353.55	$0.00	$0.00	0.00	0	$0.00	0.00

13		710	34	1'X4'1-Lamp T-8 Recessed Parabolic 32W	6373	28	0.95	6066.72	$885.74	34	NCR	28	0.95	6066.72	$885.74	$0.00	$0.00	0.00	0	$0.00	0.00
14	14	711	54	1'X4'1-Lamp T-8 Recessed Parabolic 32W	6373	28	1.51	9635.37	$1,406.76	54	NCR	28	1.51	9635.37	$1,406.76	$0.00	$0.00	0.00	0	$0.00	0.00
15	1	711A	8	1'X4'1-Lamp T-8 Recessed Parabolic 32W	6373	28	0.22	1427.46	$208.41	8	NCR	28	0.22	1427.46	$208.41	$0.00	$0.00	0.00	0	$0.00	0.00
16		712	16	1'X4'1-Lamp T-8 Recessed Parabolic 32W	6373	28	0.45	2854.92	$416.82	16	NCR	28	0.45	2854.92	$416.82	$0.00	$0.00	0.00	0	$0.00	0.00
17		713	1	13W CFL	6373	18	0.02	114.707	$16.75	1	NCR	18	0.02	114.707	$16.75	$0.00	$0.00	0.00	0	$0.00	0.00
18		707 (Stairwell)	19	1'X2' 1-Lamp T-8 Wall Mounted 17W	6373	20	0.38	2421.59	$353.55	19	NCR	20	0.38	2421.59	$353.55	$0.00	$0.00	0.00	0	$0.00	0.00
19		704 (Mens Bathroom)	4	2'X2' 2-Lamp T-8 U-Tube Recessed Parabolic 32W	6373	73	0.29	1860.8	$271.68	4	NCR	73	0.29	1860.8	$271.68	$0.00	$0.00	0.00	0	$0.00	0.00
20			2	2' 2-Lamp T-8 Wall Mounted Vanity 17W	6373	34	0.07	433.337	$63.27	2	NCR	34	0.07	433.337	$63.27	$0.00	$0.00	0.00	0	$0.00	0.00
21		717 (Women's Bathroom)	4	2'X2' 2-Lamp T-8 U-Tube Recessed Parabolic 32W	6373	73	0.29	1860.8	$271.68	4	NCR	73	0.29	1860.8	$271.68	$0.00	$0.00	0.00	0	$0.00	0.00
22			2	2' 2-Lamp T-8 Wall Mounted Vanity 17W	6373	34	0.07	433.337	$63.27	2	NCR	34	0.07	433.337	$63.27	$0.00	$0.00	0.00	0	$0.00	0.00
23	1	715	4	1'X4'1-Lamp T-8 Recessed Parabolic 13 Cell Typ 32W	6373	28	0.11	713.731	$104.20	4	NCR	28	0.11	713.731	$104.20	$0.00	$0.00	0.00	0	$0.00	0.00
24		715A	2	1'X4'1-Lamp T-8 Recessed Parabolic 13 Cell Typ 32W	6373	28	0.06	356.866	$52.10	2	NCR	28	0.06	356.866	$52.10	$0.00	$0.00	0.00	0	$0.00	0.00
25	2	716	6	1'X4'1-Lamp T-8 Recessed Parabolic 13 Cell Typ 32W	6373	28	0.17	1070.6	$156.31	6	NCR	28	0.17	1070.6	$156.31	$0.00	$0.00	0.00	0	$0.00	0.00
26	3	718A	8	1'X4'1-Lamp T-8 Recessed Parabolic 13 Cell Typ 32W	6373	28	0.22	1427.46	$208.41	8	NCR	28	0.22	1427.46	$208.41	$0.00	$0.00	0.00	0	$0.00	0.00
27			32	1'X4'1-Lamp T-8 Recessed Parabolic 32W	6373	28	0.90	5709.85	$833.64	32	NCR	28	0.90	5709.85	$833.64	$0.00	$0.00	0.00	0	$0.00	0.00
28		718	3	2'X2' 2-Lamp T-8 U-Tube Recessed Parabolic 32W	6373	73	0.22	1395.6	$203.76	3	NCR	73	0.22	1395.6	$203.76	$0.00	$0.00	0.00	0	$0.00	0.00
29			15	2'X2' 2-Lamp T-8 U-Tube Recessed Parabolic 32W	6373	73	1.10	6978	$1,018.79	15	NCR	73	1.10	6978	$1,018.79	$0.00	$0.00	0.00	0	$0.00	0.00

30		Hallway	16	2-Lamp 13W PL Type CFL Recessed 10" Cans	6373	30	0.48	3058.85	$446.59	16	NCR	30	0.48	3058.85	$446.59	$0.00	$0.00	0.00	0	$0.00	0.00
31			6	LED Exit Signs	8760	4	0.02	210.24	$30.70	6	NCR	4	0.02	210.24	$30.70	$0.00	$0.00	0.00	0	$0.00	0.00
32		Penthouse	27	1'X4' 2-Lamp T-8 Industril with Reflectors 32W	6373	58	1.57	9979.49	$1,457.01	27	NCR	58	1.57	9979.49	$1,457.01	$0.00	$0.00	0.00	0	$0.00	0.00
33		Cold Water Pump Room	4	1'X4' 2-Lamp T-8 Industril with Reflectors 32W	1593	58	0.23	369.576	$53.96	4	NCR	58	0.23	369.576	$53.96	$0.00	$0.00	0.00	0	$0.00	0.00
34		Storage Room	1	60W Incandescent	1593	60	0.06	95.58	$13.95	1	13 W CFL Lamp	13	0.01	20.709	$3.02	$5.00	$5.00	0.05	74.871	$10.93	0.46
35	1	Building Operator Office	4	2'X4' 4-Lamp T-8 Recessed Prismatic 32W	6373	109	0.44	2778.45	$405.65	4	NCR	109	0.44	2778.45	$405.65	$0.00	$0.00	0.00	0	$0.00	0.00
36		Elevator Equipment Room	5	2'X4' 2-Lamp T-8 Industrial with Reflectors 32W	1593	58	0.29	461.97	$67.45	5	NCR	58	0.29	461.97	$67.45	$0.00	$0.00	0.00	0	$0.00	0.00
PC's	24	**Totals**	409				13.74	84809.6	$12,382.20	409			13.69	84734.7	$12,371.27		$5.00	0.05	74.871	$10.93	0.46

INVESTMENT GRADE LIGHTING AUDIT

CONCORD ENERGY SERVICES

CEG Job #: 9C08144
Project: Union County Community College
Address: 12 W Jersey St
City: Elizabeth, NJ
Building SF: 102,000

"Lessner Exterior Lighting"

DATE: 10/27/2009
KWH COST: $0.146

EXISTING LIGHTING										PROPOSED LIGHTING								SAVINGS			
Line No.		Fixture Location	No. eFixts	Fixture eType	Yearly Usage	Watts Used	Total kW	kWh/Yr Fixtures	Yearly $ Cost	No. rFixts	Retro-Unit rDescription	Watts Used	Total kW	kWh/Yr Fixtures	Yearly $ Cost	Unit Cost (INSTALLED)	Total Cost	kW Savings	kWh/Yr Savings	Yearly $ Savings	Yearly Payback
1		Outside Lobby	10	Metal Halide 8" Can	3640		0.00	0	$0.00	10	NCR	0	0.00	0	$0.00	$0.00	$0.00	0.00	0	$0.00	0.00
2			20	Metal Halide 12" Can	3640		0.00	0	$0.00	20	NCR	0	0.00	0	$0.00	$0.00	$0.00	0.00	0	$0.00	0.00
3			16	90 Par 38 Metal Halide 90W Halogen	3640		0.00	0	$0.00	16	NCR	0	0.00	0	$0.00	$0.00	$0.00	0.00	0	$0.00	0.00
4		Cooling Towers	2	60W Incandescents	3640	60	0.12	436.8	$63.77	2	13 W CFL Lamp	13	0.03	94.64	$13.82	$5.00	$10.00	0.09	342.16	$49.96	0.20
5		Perimeter Roofing	6	13W CFL Twin Tube Wall Mounted	3640		0.00	0	$0.00	6	NCR	0	0.00	0	$0.00	$0.00	$0.00	0.00	0	$0.00	0.00
6		Parking Lot	4	250W MH Pole Fixture Shoe Box Type	3640		0.00	0	$0.00	4	NCR	0	0.00	0	$0.00	$0.00	$0.00	0.00	0	$0.00	0.00
		Totals	58				0.12	436.8	$63.77	58			0.03	94.64	$13.82		$10.00	0.09	342.16	$49.96	0.20

INVESTMENT GRADE LIGHTING AUDIT

CONCORD ENERGY SERVICES

CEG Job #: 9C08144
Project: Union County Community College
Address: 12 W Jersey St
City: Elizabeth, NJ
Building SF: 102,000

"Lessner Total All Floors"

DATE: 10/27/2009
KWH COST: $0.146

EXISTING LIGHTING										**PROPOSED LIGHTING**								**SAVINGS**			
Floor No.		Fixture Location	No. eFixts	Fixture eType	Yearly Usage	Watts Used	Total kW	kWh/Yr Fixtures	Yearly $ Cost	No. rFixts	Retro-Unit rDescription	Watts Used	Total kW	kWh/Yr Fixtures	Yearly $ Cost	Unit Cost (INSTALLED)	Total Cost	kW Savings	kWh/Yr Savings	Yearly $ Savings	Yearly Payback
LL	Total		242				21.822	141343.701	20636.18035	271			17.408	112666	16449.16577		8715.25	4.414	28678.182	$4,187.01	2.08
G			210				10.311	68891.169	10058.11067	210			9.843	66017.8	9638.59953		45	0.468	2873.364	$419.51	0.11
2nd			314				9.632	61466.8296	8974.157122	314			9.632	61466.8	8974.157122		0	0	0	$0.00	0.00
3rd			326				9.993	63738.6894	9305.848652	326			9.993	63738.7	9305.848652		0	0	0	$0.00	0.00
4th			302				9.427	59754.1902	8724.111769	302			9.375	59671.4	8712.017713		5	0.052	82.836	$12.09	0.41
5th			304				9.587	61170.513	8930.894898	304			9.54	60871	8887.166117		5	0.047	299.5122	$43.73	0.11
6th			330				10.762	68318.9664	9974.569094	330			10.676	67770.9	9894.554729		209	0.086	548.0436	$80.01	2.61
7th			409				13.736	84809.604	12382.20218	409			13.689	84734.7	12371.27102		5	0.047	74.871	$10.93	0.46
Ext.			58				0.12	436.8	63.7728	58			0.026	94.64	13.81744		10	0.094	342.16	$49.96	0.20
		Totals	1698				95.39	609930	89049.85	2524			90.18	577031	$84,246.60		$8,994.25	5.21	32898.9688	$4,803.25	1.87