



ENERGY AUDIT – FINAL REPORT

**CITY OF PASSAIC
MUNICIPAL COMPLEX
330 PASSAIC STREET
PASSAIC, NJ 07055
ATTN: DORIS DUDEK
DIRECTOR OF PURCHASING
CEG PROJECT No. 9C09059**

CONCORD ENGINEERING GROUP



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

**CONTACT: RAYMOND JOHNSON, PRINCIPAL
EMAIL: rjohnson@ceg-inc.net**

Table of Contents

I. EXECUTIVE SUMMARY 3

II. INTRODUCTION 7

III. METHOD OF ANALYSIS..... 9

IV. HISTORIC ENERGY CONSUMPTION/COST..... 11

V. FACILITY DESCRIPTIONS 20

VI. MAJOR EQUIPMENT LIST 22

VII. ENERGY CONSERVATION MEASURES..... 23

VIII. RENEWABLE/DISTRIBUTED ENERGY MEASURES 44

IX. ENERGY PURCHASING AND PROCUREMENT STRATEGY 47

X. INSTALLATION FUNDING OPTIONS..... 50

XI. ADDITIONAL RECOMMENDATIONS 51

Appendix A – ECM Cost & Savings Breakdown

Appendix B – New Jersey Smart Start[®] Program Incentives

Appendix C – Major Equipment List

Appendix D – Portfolio Manager “Statement of Energy Performance”

Appendix E – Investment Grade Lighting Audit

Appendix F – Renewable / Distributed Energy Measures Calculations

REPORT DISCLAIMER

The information contained within this report, including any attachment(s), is intended solely for use by the named addressee(s). If you are not the intended recipient, or a person designated as responsible for delivering such messages to the intended recipient, you are not authorized to disclose, copy, distribute or retain this report, in whole or in part, without written authorization from Concord Engineering Group, Inc., 520 S. Burnt Mill Road, Voorhees, NJ 08043.

This report may contain proprietary, confidential or privileged information. If you have received this report in error, please notify the sender immediately. Thank you for your anticipated cooperation.

I. EXECUTIVE SUMMARY

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

City Of Passaic
Administration, Police, and Senior Center Buildings
330 Passaic Street
Passaic, NJ 07055

Municipal Contact Person: Glen Carter

This audit was performed in connection with the New Jersey Clean Energy Local Government Energy Audit Program. These energy audits are conducted to promote the office of Clean Energy's mission, 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	\$245,690
Natural Gas	\$40,541
Total	\$286,231

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 $\pm 20\%$. The evaluations are based on engineering estimations and industry standard calculation methods. More detailed analyses would require engineering simulation models, hard equipment specifications, and contractor bid pricing.

**Table 1
Financial Summary Table**

ENERGY CONSERVATION MEASURES (ECM's)					
ECM NO.	DESCRIPTION	NET INSTALLATION COST^A	ANNUAL SAVINGS^B	SIMPLE PAYBACK (Yrs)	SIMPLE LIFETIME ROI
ECM #1	Lighting Controls	\$7,205	\$8,379	0.9	1644.4%
ECM #2	Install Compact Fluorescents	\$1,200	\$9,905	0.1	12281.3%
ECM #3	HVAC Rooftop Replacements (TRANE)	\$528,953	\$39,674	13.3	12.5%
ECM #4	HVAC Rooftop Replacements (Aeon)	\$563,793	\$54,350	10.4	44.6%
ECM #5	Demand Control Ventilation	\$102,110	\$11,956	8.5	75.6%
ECM #6	HVAC System Controls	\$198,000	\$7,970	24.8	-39.6%
ECM #7	Boiler Replacement	\$140,687	\$2,031	69.3	-49.5%
RENEWABLE ENERGY MEASURES (REM's)					
ECM NO.	DESCRIPTION	NET INSTALLATION COST	ANNUAL SAVINGS	SIMPLE PAYBACK (Yrs)	SIMPLE LIFETIME ROI
REM #1	PV Solar System (Municipal Complex)	\$1,931,310	\$124,728	15.5	61.5%

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

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

Table 2
Estimated Energy Savings Summary Table

ENERGY CONSERVATION MEASURES (ECM's)				
ECM NO.	DESCRIPTION	ANNUAL UTILITY REDUCTION		
		ELECTRIC DEMAND (KW)	ELECTRIC CONSUMPTION (KWH)	NATURAL GAS (THERMS)
ECM #1	Lighting Controls	0	54,768	0
ECM #2	Install Compact Fluorescents	7.34	38,372	0
ECM #3	HVAC Rooftop Replacements (TRANE)	0	123,341	95
ECM #4	HVAC Rooftop Replacements (Aaon)	0	219,262	95
ECM #5	Demand Control Ventilation	0	320,160	23,451
ECM #6	HVAC System Controls	0	320,160	23,451
ECM #7	Boiler Replacement	0	0	1,551
RENEWABLE ENERGY MEASURES (REM's)				
ECM NO.	DESCRIPTION	ANNUAL UTILITY REDUCTION		
		ELECTRIC DEMAND (KW)	ELECTRIC CONSUMPTION	NATURAL GAS (THERMS)
REM #1	PV Solar System (Municipal Complex)	0	247,969	0

Recommendation:

Concord Engineering Group strongly recommends the implementation of all ECM's that provide a calculated simple payback at or under seven (7) years. The potential energy and cost savings from these ECM's are too great to pass upon. The following Energy Conservation Measures are recommended for Passaic Administration Building:

- **ECM #1: Lighting Controls**
- **ECM #2: Lighting Upgrade: Compact Fluorescent**

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

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

II. INTRODUCTION

This comprehensive energy audit covers the 49,500 square foot Passaic Municipal Complex which includes the Administration, Police, and Senior Center Buildings. The Administration building is comprised mostly of offices and common areas for the administrative personnel employed by the City of Passaic. The Police building houses the entire police force for the City of Passaic and is comprised of processing room, holding cells, dispatch communications room, offices, storage rooms and underground garage. Lastly, the Senior Center building acts as a daily activity center for the senior citizen community which includes a kitchen, cafeteria, recreation room, and offices.

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

The Energy Use Index (EUI) is established for the building. Energy Use Index (EUI) is expressed in British Thermal Units/square foot/year (BTU/ft²/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 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:

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

$$\text{Simple Lifetime Savings} = (\text{Yearly Savings} \times \text{ECM Lifetime})$$

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

$$\text{Lifetime Maintenance Savings} = (\text{Yearly Maintenance Savings} \times \text{ECM Lifetime})$$

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

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

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

IV. HISTORIC ENERGY CONSUMPTION/COST

A. Energy Usage / Tariffs

Electric

Table 3 and Figure 1 represent the electrical usage for the surveyed facility from April-08 to March-09. Public Service Enterprise Group (PSEG) provides electricity to the facility under the Large Power and Lighting Service (LPLS) Secondary rate. This electric rate has a component for consumption that is measured in kilowatt-hours (kWh). It is calculated by multiplying the wattage of the equipment times the hours that it operates. For example, a 1,000 Watt lamp operating for 5 hours would measure 5,000 Watt-hours. Since one kilowatt is equal to 1,000 Watts, the measured consumption would be 5 kWh. 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 most current rate structure available.

Natural Gas

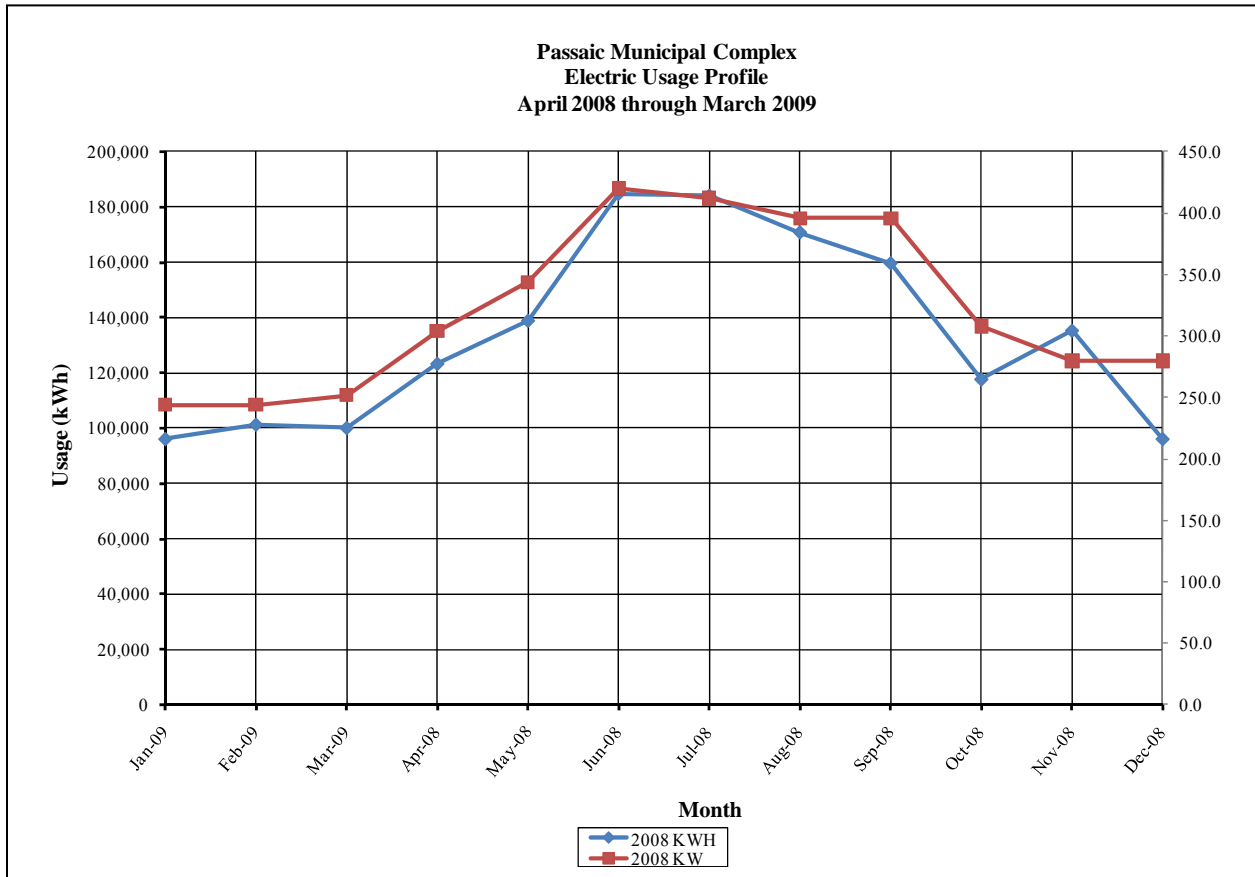
Table 4 and Figure 2 show the natural gas energy usage for the surveyed facility from April-08 to March-09. Public Service Enterprise Group (PSEG) supplies the natural gas for the facility under their Large Volume Gas (LVG) rate. The gas utility measures consumption in cubic feet x 100 (CCF), and converts the quantity into Therms of energy. One Therm is equivalent to 100,000 BTUs of energy.

<u>Description</u>	<u>Average</u>
Electricity	15.3¢ /kWh
Natural Gas	\$1.31 /Therm

**Table 3
Electricity Billing Data**

Electrical Billing Data			
Utility Provider: PSE&G, Large Power and Lighting Service (LPLS) Secondary			
Meter:	778014999		
MONTH OF USE	CONSUMPTION KWH	DEMAND	TOTAL BILL
Jan-09	96,000	244.0	\$14,133
Feb-09	101,200	244.0	\$15,304
Mar-09	100,000	252.0	\$15,141
Apr-08	123,200	304.0	\$14,766
May-08	138,800	344.0	\$16,998
Jun-08	184,800	420.0	\$30,882
Jul-08	184,000	412.0	\$30,853
Aug-08	170,800	396.0	\$30,498
Sep-08	159,600	396.0	\$27,786
Oct-08	117,600	308.0	\$16,943
Nov-08	135,200	280.0	\$18,355
Dec-08	96,000	280.0	\$14,030
Totals	1,607,200	420.0 Max	\$245,690
AVERAGE DEMAND 323.3 KW average AVERAGE RATE \$0.153 \$/kWh			

Figure 1
Electricity Usage Profile

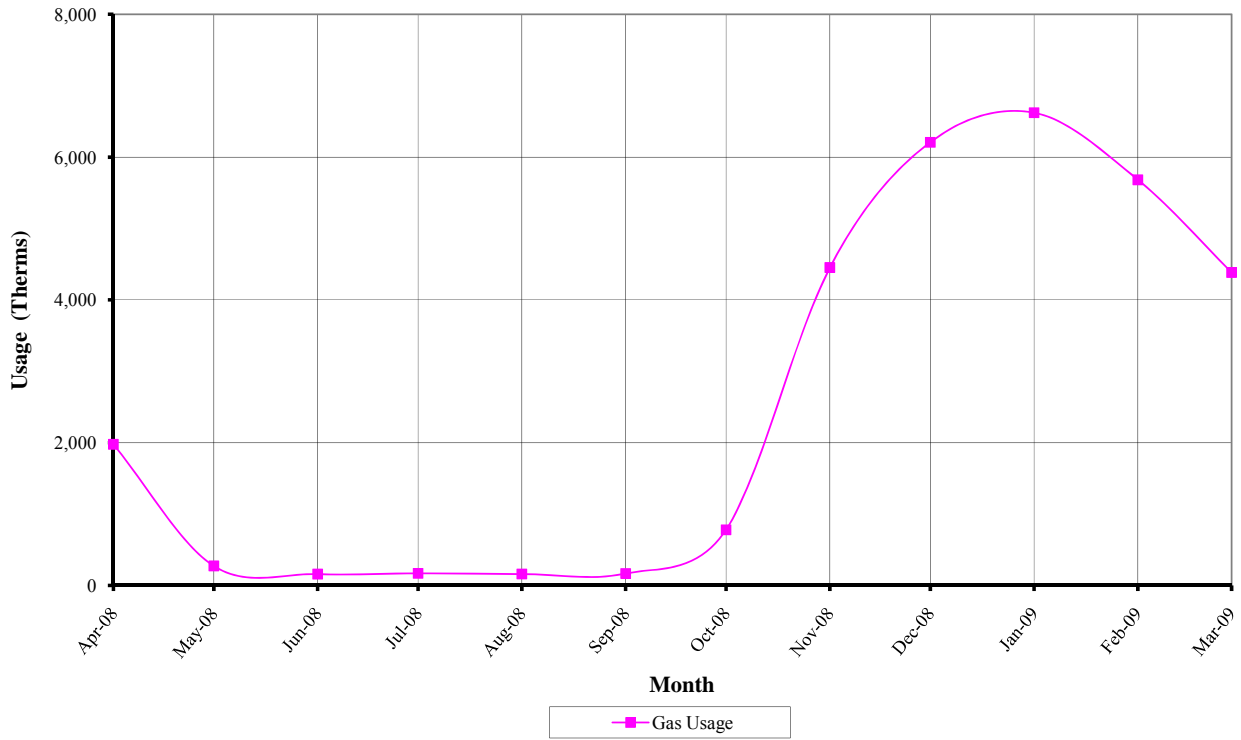


**Table 4
Natural Gas Billing Data**

Natural Gas Billing Data		
Utility Provider: PSE&G		
Rate LVG	Meter:	3166042
MONTH OF USE	CONSUMPTION (THERMS)	TOTAL BILL
Jan-09	6,620.50	\$8,529.26
Feb-09	5,681.37	\$6,616.46
Mar-09	4,383.98	\$4,912.43
Apr-08	1,977.45	\$2,841.58
May-08	273.24	\$527.25
Jun-08	159.90	\$357.85
Jul-08	171.03	\$400.99
Aug-08	160.91	\$312.58
Sep-08	167.99	\$305.89
Oct-08	781.26	\$1,001.14
Nov-08	4,453.81	\$6,321.30
Dec-08	6,207.61	\$8,414.69
TOTALS	31,039.05	\$40,541.42
AVERAGE RATE:	\$1.31	\$/THERM

Figure 2
Natural Gas Usage Profile

Passaic Municipal Complex
Gas Usage Profile
April 2008 through March 2009



B. Energy Use Index (EUI)

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

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

The site and source EUI for this facility is calculated as follows. (See Table 5 for details):

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

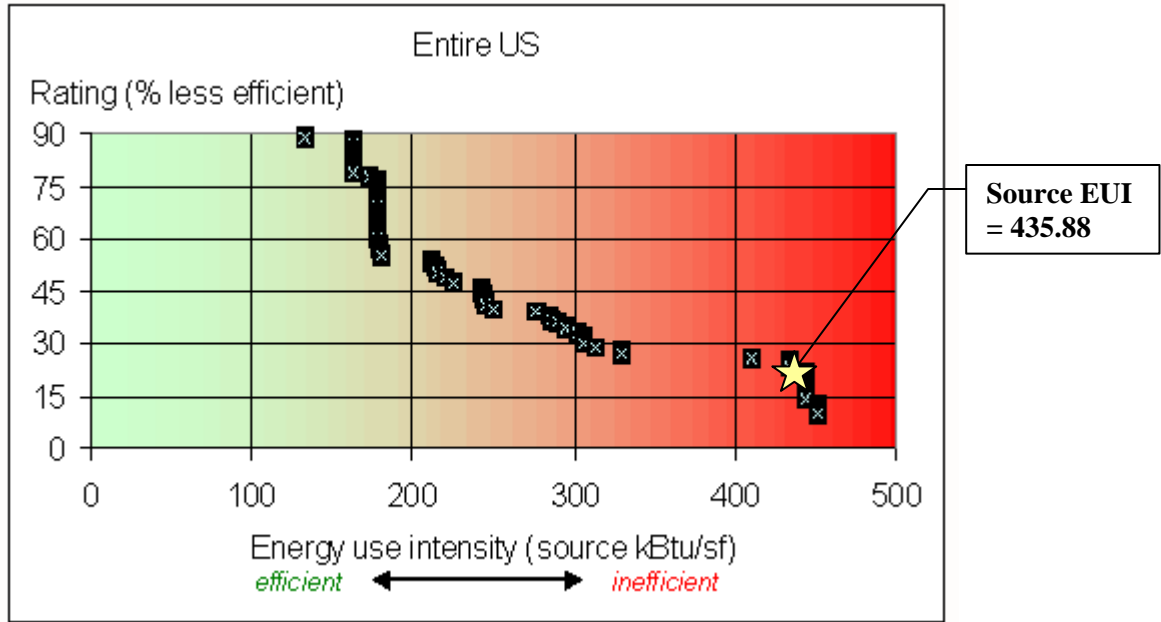
$$\text{Building Source EUI} = \frac{(\text{Electric Usage in kBtu} \times \text{SS Ratio} + \text{Gas Usage in kBtu} \times \text{SS Ratio})}{\text{Building Square Footage}}$$

Table 5
Passaic Municipal Complex EUI Calculations

EUI CALCULATOR						
ENERGY TYPE	BUILDING USE			SITE ENERGY	SITE-SOURCE	SOURCE ENERGY
	kWh	Therms	Gallons	kBtu	RATIO	kBtu
ELECTRIC	1,607,200			5,486,981	3.340	18,326,516
NATURAL GAS		31,039.05		3,103,905	1.047	3,249,789
FUEL OIL			0.00	0	1.010	0
TOTAL				8,590,886		21,576,304
*Site - Source Ratio data is provided by the Energy Star Performance Rating Methodology for Incorporating Source Energy Use document issued Dec 2007.						
BUILDING AREA	49,500			SQUARE FEET		
BUILDING SITE EUI	173.55			kBtu/SF/YR		
BUILDING SOURCE EUI	435.88			kBtu/SF/YR		

Figure 3 below depicts a national EUI grading for the source use of public order and safety buildings which include joint administration, police and other municipal facilities.

Figure 3
Source Energy Use Intensity Distributions: Public Order Buildings



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: passaiccity
 Password: lgeaceg2009

 Security Question: What city were you born in?
 Security Answer: “passaic”

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

FACILITY DESCRIPTION	ENERGY PERFORMANCE RATING	NATIONAL AVERAGE
Municipal Bldg Complex	N/A	50

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

As noted above, the Passaic Municipal Building Complex was given an energy performance rating of “N/A” due to the fact that the building serves as a multi-use facility and cannot be given a specific building type. Specific building types are detailed on the ENERGY STAR website. Non-typical buildings are covered by an “Other” category. The Passaic Municipal Building falls under this “Other” category. The “Other” category is used if your building type or a section of the building is not represented by one of the specific categories. An Energy Performance Rating cannot be calculated if more than 10% of a building is classified as “Other.” The majority of the Public Works Garage would be classified as “Other” and therefore cannot be given an Energy Performance Rating. Despite this, the Portfolio Manager calculates the building EUI. The EUI is an important tool that can be used to track the energy efficiency of the building. Baselines for improvement can be set that the municipality can strive to meet. CEG strongly urges the city of Passaic to keep their Portfolio Manager account up to date to monitor the performance of the building.

V. FACILITY DESCRIPTIONS

The City of Passaic's Municipal Complex is comprised of three (3) separate facilities; the Administration Building, the Police Building, and the Senior Center. The total facility square footage is approximately 49,500 SF. As a whole the buildings within this complex commonly share several characteristics. The outside facades are all brick face with concrete base construction. The roof is made up of a built-up Carlyle rubber roof material which spans across the entire roof. The window construction for these buildings is a typical double pane 1/4 inch window with tinted glass. Although the facility has many original features from its construction in 1978, the city has recently done a lighting retrofit and replaced all T12 lamps with new, energy efficient T8 fixtures.

The 25,000 SF Administration Building is a two story facility comprised of administration offices, local government agencies, and internal affairs department. The typical hours of operation for the Administration Building are between 9:00 am and 5:00 pm with meetings being held for 2 to 3 hours on certain evenings. This equates to an estimated usage of approximately 3,120 hours per year. The Administration Building was built in 1978 with no additions.

The 16,000 SF Police Building is a two story facility with administrative offices, court room, several different police agencies, and an underground parking garage. The Police Station is run 24 hours a day, 7 days a week, but the associated courtroom is usually on a daily schedule of 9:00 am to 5:00 pm. The courthouse also has sessions on several weekends throughout the month. The Police building was built in 1978 with no additions.

The 8,500 SF Senior Citizen Building is a single story facility with a cafeteria, kitchen, recreation office, and administrative office. The Senior Citizen Building operates from 9:00 am to 5:00 pm, Monday through Friday and sometimes holds functions on the weekends or at night making the total operating hours per year close to 2,080. The Senior Citizen Building was built in 1978 with no additions.

Heating System

A central boiler plant, located in the Administration Building, is the primary source of heating for all three buildings in the Municipal Complex. The boiler room contains two (2) Iron Fireman hot water boilers which serve the hot water coils in the baseboard radiators along the perimeter of the building. The boilers were converted from fuel oil to natural gas in 2003 and have a heating input of 1750 MBH. The Dunham Bush gas fired burners are vintage 1978 and have a heating capacity of 2100 MBH. The thirty-one (31) year old Iron Fireman boilers are in decent condition and are still working but due to their age, are becoming less efficient. And although these boilers do not exceed the ASHRAE service life of thirty-five (35) years, these units are viable options for replacement.

In addition to the HW heating in the radiators, the three buildings within the Municipal Complex also have Variable Air Volume (VAV) boxes with electric reheat that provide heat to areas via overhead diffusers.

Domestic Hot Water

Domestic hot water is fed to all three (3) buildings in the Municipal Complex via a 75 gallon Rheem gas fired water heater with a capacity of 70,000 Btu/h located in the central boiler plant in the Administration Building. A fractional horsepower Bell and Gossett circulator pump is used to circulate the domestic hot water through the building. Additionally there is also an A.O. Smith electric hot water heater which is currently not being used although it is still functional as a back-up source for the Rheem unit. Another small fractional horsepower pump is associated with the A.O. Smith unit but the name plate could not be read.

Cooling System

Cooling for the Municipal Complex is provided to each building through single zone rooftop units on the Police and Administration Building and a multi-zone unit on the Senior Citizen Building. The ages on most of these units are in excess of thirty (30) years old and should be replaced.

The Administration Building has three (3) rooftop air conditioning units, two (2) of which are manufactured by Seasons 4 and another by Comfort Temp. The Police Building has four (4) rooftop air conditioning units, three (3) of which are located on the top of the high roof of the building while the last is on top of the court room which connects the Administration Building to the Police Building. On top of the high roof are a 7.5 ton Comfort Temp unit which is not working, an 18.5 ton Seasons 4 unit, and a vintage rooftop unit which has missing nameplate data yet is still working. On the small roof between the Police and Administration Building there is a 17.5 ton Trane unit. Lastly on the Senior Citizen Building there is a single Seasons 4 rooftop unit.

Based on our survey, the majority of these packaged rooftop units are in need of replacement due to age, improper operation and continuing costly maintenance expenses incurred by the owner.

Controls System

Pneumatic controls located in the Administration Building's central boiler room are the primary means of control for all HVAC equipment in the Municipal Complex. The pneumatic system is vintage 1978 and has not been upgraded since the building has been built. There are local thermostats within most rooms of all the buildings that control VAV boxes, which are also controlled through pneumatics. Since these controls are very old and have passed their useful ASHRAE life expectancy, the replacement of this system would greatly help the organization and efficiency of the HVAC systems within the complex.

Lighting

Typical lighting throughout all three (3) of the buildings in the Municipal Complex is fluorescent tube lay-in fixtures with T-8 Lamps and electronic ballasts. Storage rooms and closets are lit with a mixture of incandescent lamps and surface mounted fluorescent T-8 fixtures. Outdoor lighting for the Municipal Complex consists of light poles and perimeter metal halide fixtures. The light pole fixtures are currently not in use for the facility as informed by maintenance staff.

VI. MAJOR EQUIPMENT LIST

Following the completion of the field survey a detailed equipment list was created. The equipment within this list is considered major energy consuming equipment whose replacement could yield substantial energy savings. Additionally, 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 if a manufactures date was not shown on the equipment's nameplate. The ASHRAE service life for the equipment along with the remaining useful life is also shown in the Appendix.

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

VII. ENERGY CONSERVATION MEASURES

ECM #1: Lighting Controls

Description:

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

Lighting controls come in many forms. Sometimes an additional switch is adequate to provide reduced lighting levels when full light output is not needed. Occupancy sensors detect motion and will switch the lights on when the room is occupied. Occupancy sensors can either be mounted in place of a current wall switch, or on the ceiling to cover large areas. Photocell control senses light levels and turn off or reduce lights when there is adequate daylight. Photocells are mostly used outside, but are becoming more popular in energy-efficient interior lighting designs as well.

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

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

The ECM includes replacement of standard wall switches for the whole municipal complex, with sensor wall switches for individual rooms and ceiling mount sensors for large office areas or restrooms. Sensors shall be manufactured by Sensorswitch, Watt Stopper or equivalent. See the “Investment Grade Lighting Audit” appendix for details.

The “Investment Grade Lighting Audit” appendix of this report includes the summary of lighting controls implemented in this ECM and outlines the proposed controls, costs, savings, and payback periods. The calculations adjust the lighting power usage by 20% for all areas that include occupancy sensor lighting.

Light Energy = 273,838 kWh/Yr. occupancy sensor controlled lighting

Energy Savings Calculations:

$$\text{Energy Savings} = 20\% \times \text{Occupancy Sensored Light Energy (kWh/Yr)}$$

$$\text{Energy Savings} = 20\% \times 273,838 \text{ (kWh)} = 54,768 \text{ (kWh)}$$

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

$$\text{Savings.} = 54,768 \text{ (kWh)} \times 0.153 \left(\frac{\$}{\text{kWh}} \right) = \$8,379$$

Installation cost per dual-technology sensor (Basis: Sensorswitch or equivalent) is \$75/unit including material and labor.

$$\text{Installation Cost} = \$75 \times 131 \text{ motion sensors} = \underline{\$9,825}$$

From the NJ Smart Start appendix, the installation of a lighting control device warrants the following incentive: occupancy = \$20 per fixture

$$\text{Smart Start}^\circledast \text{ Incentive} = (\# \text{ of wall mount devices} \times \$ 20) = (131 \times \$20) = \$2,620$$

Energy Savings Summary:

ECM #1 - ENERGY SAVINGS SUMMARY	
Installation Cost (\$):	\$9,825
NJ Smart Start Equipment Incentive (\$):	\$2,620
Net Installation Cost (\$):	\$7,205
Maintenance Savings (\$/Yr):	\$0
Energy Savings (\$/Yr):	\$8,379
Total Yearly Savings (\$/Yr):	\$8,379
Estimated ECM Lifetime (Yr):	15
Simple Payback	0.9
Simple Lifetime ROI	1644.4%
Simple Lifetime Maintenance Savings	\$0
Simple Lifetime Savings	\$125,685
Internal Rate of Return (IRR)	116%
Net Present Value (NPV)	\$92,822.96

ECM #2: Install Compact Fluorescent Lamps

Description:

Compact fluorescent lamps (CFL's) were created to be direct replacements for the standard incandescent lamps which are common to table lamps, spot lights, hi-hats, bathroom vanity lighting, etc. The light output of the CFL has been designed to resemble the incandescent lamp. The color rendering index (CRI) of the CFL is much higher than standard fluorescent lighting, and therefore provides a much "truer" light. The CFL is available in a myriad of shapes and sizes depending on the specific application. Typical replacements are: a 13-Watt CFL for a 40-Watt incandescent lamp, a 15-Watt CFL for a 60-Watt incandescent lamp, an 18-Watt CFL for a 75-Watt incandescent lamp, and a 23-Watt CFL for a 100-Watt incandescent lamp.

The CFL is also available for a number of "brightness colors" that is indicated by the Kelvin rating. A 2700K CFL is the "warmest" color available and is closest in color to the incandescent lamp. CFL's are also available in 3000K, 3500K, and 4100K. The 4100K would be the "brightest" or "coolest" output. A CFL can be chosen to screw right into your existing fixtures, or hardwired into your existing fixtures.

This ECM involves replacing all incandescent lamps in the facility with energy efficient compact fluorescent lamps.

Energy Savings Calculations:

There are forty (40) 60-Watt, sixty-four (64) 75-Watt, forty-nine (49) 100-Watt, and twenty-five (25) 150-Watt incandescent lamps in the facility that can be upgraded to 15, 18, 23 and 40 Watt CFL units respectively. The average operating hours for these lamps is estimated to be 5408.

Energy cost savings:

$[40 \text{ units} * (60\text{W} - 15\text{W}) + 64 \text{ units} * (75\text{W} - 18\text{W}) + 49 \text{ units} * (100\text{W} - 23\text{W}) + 25 \text{ units} * (150 - 40)] 5408 \text{ hours} * 1 \text{ kW}/1,000 \text{ W} * \$0.153/\text{kWh}] = \underline{\$9905.00/\text{yr}}$

The installed cost of twenty forty (40) 60-Watt, sixty-four (64) 75-Watt, forty-nine (49) 100-Watt, and twenty-five (25) 150-Watt CFL's is \$1200.

Energy Savings Summary:

ECM #2 - ENERGY SAVINGS SUMMARY	
Installation Cost (\$):	\$1,200
NJ Smart Start Equipment Incentive (\$):	\$0
Net Installation Cost (\$):	\$1,200
Maintenance Savings (\$/Yr):	\$0
Energy Savings (\$/Yr):	\$9,905
Total Yearly Savings (\$/Yr):	\$9,905
Estimated ECM Lifetime (Yr):	15
Simple Payback	0.1
Simple Lifetime ROI	12281.3%
Simple Lifetime Maintenance Savings	\$0
Simple Lifetime Savings	\$148,575
Internal Rate of Return (IRR)	825%
Net Present Value (NPV)	\$117,045.25

ECM #3: HVAC Rooftop Unit Replacements

Description:

There are seven (7) rooftop units in the Municipal Complex that serve various areas within the buildings. There is one (1) rooftop unit that is located atop the Police Building that we could not gather nameplate information off of. This unit is an ECS Model CZ that is believed to be approximately 35 tons based on information received from the Owner. CEG is utilizing 35 tons as the cooling tonnage for analysis but believes further calculations are required to verify required tonnage. The Administration Building and Senior Center rooftop units run approximately 800 hours a year at full load while the Police Building units run approximately 1800 hours a year at full load due to the Police Building's 24/7 operation. The majority of the rooftop units (typical for 6) are single-zone rooftop units with DX cooling that either have heating coils or VAV duct boxes with hot water coils that provide the heating. There is one (1) other unit located atop the Senior Center Building that is a multi-zone packaged rooftop unit. The Senior Center Building does not contain VAV boxes with reheat coils like the other two buildings, therefore the rooftop unit must provide both cooling and heating to the building.

All seven (7) roof-top units have surpassed or are close to surpassing their expected service life of fifteen (15) years as outlined in Chapter 36 of the 2007 ASHRAE Applications Handbook. These units were upgraded in 1994, and are excellent candidates for replacement. Due to escalating owning and maintenance costs, these units should be replaced.

This measure would replace all seven (7) rooftop units on a one-for-one basis with new energy efficient packaged rooftop units of same capacity. Trane SL series and Trane TF series or equivalent models were utilized as basis of design for the unit replacements. The following table shows the roof-top units recommended for replacement as well as their recommended upgrade, all electrical and fuel requirements are equivalent to the existing units.

Note: CEG recommends that a full HVAC cooling and heating calculation analysis be conducted by a professional engineer for the Administration Building, Police Building and Senior Center prior to moving forward with a rooftop unit replacement. Having this calculation and analysis will provide a more accurate heating and cooling design load for selecting the replacement units. Based on "rule-of-thumb" numbers for heating and cooling, it appears that many of the rooftop units are greatly oversized.

ROOFTOP UNIT REPLACEMENT PLAN												
Tag	Location	Area Served	Manufacturer	Model #	Cooling Coil	Cooling Eff. (EER)	Cooling Capacity (Tons)	Heating Type	Output (MBh)	Corrected Output (MBh)	Heating Eff. (%)	
A)	Roof	Admin	4 Seasons	6SZK40-0904-XXXXX 24SE	DX R-22	8	90	N/A	-	-	-	
	Roof	Admin	Trane	SLHJ0904	DX R-410A	9.6	90	N/A	-	-	-	
B)	Roof	Admin	4 Seasons	6SZK32-0802 XXXXX 24SE	DX R-22	8	70	N/A	-	-	-	
	Roof	Admin	Trane	SLHLF70	DX R-410A	10.2	70	N/A	-	-	-	
C)	Roof	Admin	Comfort Temp	CT-15	DX R-22	8	15	HW Coil	124	136	90%	
	Roof	Admin	Trane	TFD211	DX R-410A	12	15	HW Coil	180	-	-	
D)	Roof	Police Building	4 Seasons	6SZK40-0904-XXXXX-24SE	DX R-22	8	90	N/A	-	-	-	
	Roof	Faculty Dining	Trane	SLHJ0904	DX R-410A	9.6	90	N/A	-	-	-	
E)	Roof	Police Building	ECS	CZ	DX	8	35	-	-	-	-	
	Roof	Police Building	Trane	TCD420	DX R-410A	10.2	35	-	-	-	-	
F)	Roof	Court Room	Trane	TCD210B400DA	DX R-22	8	18.5	N/A	-	-	-	
	Roof	Court Room	Trane	TFD181	DX R-410A	12	18.5	N/A	-	-	-	
G)	Roof	Senior Center	Seasons 4	6MZG26-0322-HW5.0-1250	DX R-22	8	50	HW Coil	544	598	90%	
	Roof	Senior Center	Trane	SLHLF50	DX R-410A	10.2	50	HW Coil	603	-	-	

Recommended Replacement Units are noted in maroon font color.

Note: A heating efficiency degradation of 10% was taken into account to correctly represent equipment age and degradation due to plugging of the heat exchanger.

General Assumptions:

Heating Season Heating Degree Days = 4,888 HDD
 Average Cost of Gas = \$1.31/Therm

Cooling Season Full Load Cooling Hrs. = 800 hrs/yr. (Admin and Senior Ctr)
 = 1800 hrs/yr. (Police Building)

Average Cost of Electricity = \$0.153/kWh

Existing System Efficiency = 8.0 EER
 Heat loss for standard commercial building = 35 Btu/ Hr SF

Energy Savings Calculations:Cooling Savings Calculation:

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

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

$$Cooling\ Cost\ Savings = EnergySavings\ (kWh) \times AvgCostElectricity \left(\frac{\$}{kWh} \right)$$

Heating Savings Calculation:

Differential Energy Due to Inefficiencies of Old Heating Coils:

$$RTU-C = 124\ MBH - 112\ MBH = 12\ MBH$$

$$RTU-F = 544\ MBH - 490\ MBH = 54\ MBH$$

$$Total\ Differential\ Heat\ Load\ Saved = 12 + 54\ MBH = 66\ MBH\ Total$$

$$EnergySavings. = \frac{Heat\ Load \left(\frac{kBtu}{Hr} \right) \times Heat\ Deg\ Days \times 24\ Hrs \times Correction\ Factor}{Design\ Temp\ Difference(^{\circ}F) \times Fuel\ Heat\ Value \left(\frac{kBtu}{Therm} \right) \times Equipt\ Eff}$$

$$Savings. = Heat\ Cons.(Therms) \times Ave\ Gas\ Cost \left(\frac{\$}{Therm} \right)$$

$$Total\ ECM\ Savings. = \$Cooling + \$Heating$$

Savings for each of the rooftop unit replacements can be summarized in the table below:

ENERGY SAVINGS SUMMARY					
Tag	Cooling Savings (kWh)	Cooling Cost Savings	Heating Savings (therms)	Heating Cost Savings	Total Savings
A)	18,000	\$2,754	0	\$0	\$2,754
B)	18,118	\$2,772	0	\$0	\$2,772
C)	6,000	\$918	17.2	\$23	\$941
D)	40,500	\$6,197	0	\$0	\$6,197
E)	20,382	\$3,119	0	0	\$3,119
F)	7,400	\$1,132	0	\$0	\$1,132
G)	12,941	\$1,980	77.6	\$102	\$2,082
				Total Overall Savings =	\$18,995

Total installation cost for the seven (7) rooftop units is estimated at \$553,000. The pricing for each piece of equipment is based on budgetary numbers received from the manufacturer's representative. Installation costs were estimated utilizing RSMeans™ Cost Data.

Replacement of the seven (7) rooftop units will also reduce the cost of the annual maintenance. Concord Engineering has contacted the City of Passaic and gained yearly maintenance costs for all HVAC equipment. It can be estimated that 30% of these costs have gone towards rooftop unit maintenance. With 30% of the total bill being taken into account, the estimated yearly cost for maintaining seven (7) rooftop units is approximately \$27,679. Through contact with a private HVAC maintenance company, the yearly upkeep of a single rooftop unit is conservatively estimated to be \$1,000. Therefore, yearly maintenance for seven (7) rooftop units would approximately be \$7,000 and yield a differential maintenance savings of up to \$20,679.

From the NJ Smart Start® Program appendix, the rooftop unit replacement falls under the category "Unitary AC" and warrants an incentive based on efficiency (EER) at a certain cooling tonnage. The program incentives are calculated as follows:

\$79 / Ton for units between 11.25 tons and 20 tons

\$40 / Ton for units between 30 tons and 63 tons

\$72 / Ton for units greater than 63 tons

Smart Start® Incentive = (Cooling Tons × \$/Ton Incentive)

= (33.5 Tons × \$79 / Ton) = \$2,647

= (85 Tons × \$40 / Ton) = \$3,400

= (250 Tons × \$72 / Ton) = \$18,000

Total Smart Start incentives: \$2,647 + \$3,400 + \$18,000 = \$24,047

Energy Savings Summary:

ECM #3 - ENERGY SAVINGS SUMMARY	
Installation Cost (\$):	\$553,000
NJ Smart Start Equipment Incentive (\$):	\$24,047
Net Installation Cost (\$):	\$528,953
Maintenance Savings (\$/Yr):	\$20,679
Energy Savings (\$/Yr):	\$18,995
Total Yearly Savings (\$/Yr):	\$39,674
Estimated ECM Lifetime (Yr):	15
Simple Payback	13.3
Simple Lifetime ROI	-46.1%
Simple Lifetime Maintenance Savings	\$310,185
Simple Lifetime Savings	\$284,925
Internal Rate of Return (IRR)	2%
Net Present Value (NPV)	(\$55,327.36)

ECM #4: HVAC Rooftop Unit Replacements

Description:

ECM#4 is similar in scope to ECM #3; however, CEG is recommending the utilization of digital scroll compressors on the lead refrigerant circuit in order to save energy at part load conditions. A digital scroll compressor is controlled to vary capacity and load and unload the compressor in order to meet the actual load of the space rather than over-shooting the load as typically occurs in traditional refrigeration systems.

This measure would replace all seven (7) rooftop units on a one-for-one basis with new energy efficient packaged rooftop units of same capacity with variable capacity, digital scroll compressor. Aaon RN series or equivalent models were utilized as basis of design for the unit replacements. The following table shows the roof-top units recommended for replacement as well as their recommended upgrade, all electrical and fuel requirements are equivalent to the existing units. Energy savings are as calculated by the manufacturer’s energy analysis software for variable capacity compressors versus on-off or hot gas bypass controller compressors.

Note: CEG recommends that a full HVAC cooling and heating calculation analysis be conducted by a professional engineer for the Administration Building, Police Building and Senior Center prior to moving forward with a rooftop unit replacement. Having this calculation and analysis will provide a more accurate heating and cooling design load for selecting the replacement units. Based on “rule-of-thumb” numbers for heating and cooling, it appears that many of the rooftop units are greatly oversized.

ROOFTOP UNIT REPLACEMENT PLAN												
Tag	Location	Area Served	Manufacturer	Model #	Cooling Coil	Cooling Eff. (EER)	Cooling Capacity (Tons)	Heating Type	Output (MBh)	Corrected Output (MBh)	Heating Eff. (%)	
A)	Roof	Admin	4 Seasons	6SZK40-0904-XXXXX 24SE	DX R-22	8	90	N/A	-	-	-	
	Roof	Admin	Aaon	RN-070-3-0-EA09-000	DX R-410A	11.3	70	N/A	-	-	-	
B)	Roof	Admin	4 Seasons	6SZK32-0802 XXXXX 24SE	DX R-22	8	70	N/A	-	-	-	
	Roof	Admin	Aaon	RN-070-3-0-EA09-000	DX R-410A	11.3	70	N/A	-	-	-	
C)	Roof	Admin	Comfort Temp	CT-15	DX R-22	8	15	HW Coil	124	136	90%	
	Roof	Admin	Aaon	RN-015-3-0-EA09-EH1	DX R-410A	15.2	15	HW Coil	147	-	90%	
D)	Roof	Police Building	4 Seasons	6SZK40-0904-XXXXX-24SE	DX R-22	8	90	N/A	-	-	-	
	Roof	Faculty Dining	Aaon	RN-070-3-0-EA09-000	DX R-410A	11.3	70	N/A	-	-	-	
E)	Roof	Police Building	ECS	CZ	DX	8	35	N/A	-	-	-	
	Roof	Police Building	Aaon	RN-031-3-0-EA09-000	DX R-410A	15.2	31	N/A	-	-	-	
F)	Roof	Court Room	Trane	TCD210B400DA	DX R-22	8	18.5	N/A	-	-	-	
	Roof	Court Room	Aaon	RN-018-3-0-EA09-000	DX R-410A	15.2	18	N/A	-	-	-	
G)	Roof	Senior Center	Seasons 4	6MZG26-0322-HW5.0-1250	DX R-22	8	50	HW Coil	544	598	90%	
	Roof	Senior Center	Aaon	RN-031-3-0-EA09-3D9	DX R-410A	15.2	31	HW Coil	648	-	90%	

Recommended Replacement Units are noted in maroon font color.

Note: A heating efficiency degradation of 10% was taken into account to correctly represent equipment age and degradation due to plugging of the heat exchanger.

General Assumptions:

Heating Season Heating Degree Days	=4,888 HDD
Average Cost of Gas	= \$1.31/Therm
Cooling Season Full Load Cooling Hrs.	= 800 hrs/yr. (Admin and Senior Ctr) = 1800 hrs/yr. (Police Building)
Average Cost of Electricity	= \$0.153/kWh
Existing System Efficiency	= 8.0 EER
Heat loss for standard commercial building	= 35 Btu/ Hr SF

Energy Savings Calculations:

Cooling Savings Calculation:

The energy savings for cooling were calculated by the manufacturer utilizing their energy analysis software for variable capacity compressors versus on-off or hot gas bypass controller compressors. Refer to table below that summarizes the energy savings during cooling mode of operation.

Heating Savings Calculation:

Differential Energy Due to Inefficiencies of Old Heating Coils:

$$RTU-C = 124 \text{ MBH} - 112 \text{ MBH} = 12 \text{ MBH}$$

$$RTU-F = 544 \text{ MBH} - 490 \text{ MBH} = 54 \text{ MBH}$$

$$\text{Total Differential Heat Load Saved} = 12 + 54 \text{ MBH} = 66 \text{ MBH Total}$$

$$\text{Energy Savings.} = \frac{\text{Heat Load} \left(\frac{kBtu}{Hr} \right) \times \text{Heat Deg Days} \times 24 \text{ Hrs} \times \text{Correction Factor}}{\text{Design Temp Difference} (^{\circ}F) \times \text{Fuel Heat Value} \left(\frac{kBtu}{Therm} \right) \times \text{Equip Eff}}$$

$$\text{Savings.} = \text{Heat Cons. (Therms)} \times \text{Ave Gas Cost} \left(\frac{\$}{Therm} \right)$$

$$\text{Total ECM Savings.} = \$\text{Cooling} + \$\text{Heating}$$

Savings for each of the rooftop unit replacements can be summarized in the table below:

ENERGY SAVINGS SUMMARY					
Tag	Cooling Savings (kWh)	Cooling Cost Savings	Heating Savings (therms)	Heating Cost Savings	Total Savings
A)	31,540	\$4,826	0	\$0	\$4,826
B)	24,531	\$3,753	0	\$0	\$3,753
C)	8,526	\$1,305	17.2	\$23	\$1,327
D)	70,965	\$10,858	0	\$0	\$10,858
E)	44,763	\$6,849	0	0	\$6,849
F)	10,516	\$1,609	0	\$0	\$1,609
G)	28,421	\$4,348	77.6	\$102	\$4,450
				Total Overall Savings =	\$33,671

Total installation cost for the seven (7) rooftop units is estimated at \$584,000. The pricing for each piece of equipment is based on budgetary numbers received from the manufacturer's representative. Installation costs were estimated utilizing RSMeansTM Cost Data.

Replacement of the seven (7) rooftop units will also reduce the cost of the annual maintenance. Concord Engineering has contacted the City of Passaic and gained yearly maintenance costs for all HVAC equipment. It can be estimated that 30% of these costs have gone towards rooftop unit maintenance. With 30% of the total bill being taken into account, the estimated yearly cost for maintaining seven (7) rooftop units is approximately \$27,679. Through contact with a private HVAC maintenance company, the yearly upkeep of a single rooftop unit is conservatively estimated to be \$1,000. Therefore, yearly maintenance for seven (7) rooftop units would approximately be \$7,000 and yield a differential maintenance savings of up to \$20,679.

From the NJ Smart Start[®] Program appendix, the rooftop unit replacement falls under the category "Unitary AC" and warrants an incentive based on efficiency (EER) at a certain cooling tonnage. The program incentives are calculated as follows:

\$79 / Ton for units between 11.25 tons and 20 tons

\$40 / Ton for units between 30 tons and 63 tons

\$72 / Ton for units greater than 63 tons

Smart Start® Incentive = (Cooling Tons × \$/Ton Incentive)

= (33Tons × \$79/Ton) = \$2,607

= (62Tons × \$40/Ton) = \$2,480

= (210Tons × \$72/Ton) = \$15,120

Total Smart Start incentives: \$2,607 + \$2,480 + \$15,120 = \$20,207

Energy Savings Summary:

ECM #4 - ENERGY SAVINGS SUMMARY	
Installation Cost (\$):	\$584,000
NJ Smart Start Equipment Incentive (\$):	\$20,207
Net Installation Cost (\$):	\$563,793
Maintenance Savings (\$/Yr):	\$20,679
Energy Savings (\$/Yr):	\$33,671
Total Yearly Savings (\$/Yr):	\$54,350
Estimated ECM Lifetime (Yr):	15
Simple Payback	10.4
Simple Lifetime ROI	-10.4%
Simple Lifetime Maintenance Savings	\$310,185
Simple Lifetime Savings	\$505,065
Internal Rate of Return (IRR)	5%
Net Present Value (NPV)	\$85,033.77

ECM #5: Demand Controlled Ventilation

Description:

Currently the Passaic Municipal Complex outside air delivery is controlled with two-position, open or closed dampers on the outside air intakes of the rooftop units. This ECM will install demand controlled ventilation controls on the rooftop units at the Municipal Complex. The devices needed to operate a demand controlled ventilation system are as follows: ventilation controller, variable frequency drives for supply and/or return fans, CO2 sensors (zone and outdoor), actuators on outside air intake.

The Demand Controlled Ventilation system has the potential to provide substantial savings by controlling the introduction of ventilation air to the HVAC systems as required based on occupancy rather than a preset percentage. The U.S. Department of Energy sponsored a study to analyze energy savings achieved through various types of building system controls. The referenced savings are 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 demand controlled ventilation. The average energy savings are as follows based on the report:

- Demand Controlled Ventilation (DCV): 10%-15%.

Savings resulting from the implementation of this ECM for energy management controls are estimated to be 15% of the total energy cost for heating and cooling the facility.

The cost of a full DCV system with new devices, controllers, variable frequency drives, CO2 sensors, software, programming, etc. is approximately \$102,110; based on contractor pricing for projects of similar type and size and RS MeansTM Cost Data. Savings from the implementation of this ECM will be from the reduced electric energy currently used to cool the building as well as natural gas savings from the boiler not needing to temper such high amounts of outside air.

Cost of complete DCV System = \$102,110.

Heating Season Heating Degree Days	= 4,888 HDD
Average Cost of Gas	= \$1.31/Therm

Cooling Season Full Load Cooling Hrs.	= 800 hrs/yr.
Average Cost of Electricity	= \$0.153/kWh

Energy Savings Calculations:15% Savings on Heating Calculations

$$\text{Heat Load} = \frac{\text{Heat Loss} \left(\frac{\text{Btu}}{\text{Hr SF}} \right) \times \text{Area (SF)}}{1000 \left(\frac{\text{Btu}}{\text{kBtu}} \right)}$$

$$\text{Heat Load} = \frac{35 \left(\frac{\text{Btu}}{\text{Hr SF}} \right) \times 49,500 \text{ (SF)}}{1000 \left(\frac{\text{Btu}}{\text{kBtu}} \right)} = 1,732.5 \left(\frac{\text{kBtu}}{\text{Hr}} \right)$$

$$\text{Est Heat Cons.} = \frac{\text{Heat Load} \left(\frac{\text{kBtu}}{\text{Hr}} \right) \times \text{Heat Deg Days} \times 24 \text{ Hrs} \times \text{Correction Factor}}{\text{Design Temp Difference} (\text{°F}) \times \text{Efficiency} (\%) \times \text{Fuel Heat Value} \left(\frac{\text{kBtu}}{\text{Therm}} \right)}$$

$$\text{Est Heat Cons.} = \frac{1,732.5 \left(\frac{\text{kBtu}}{\text{Hr}} \right) \times 4,888 \text{ (HDD)} \times 24 \text{ Hrs} \times 0.6}{65 \text{ (°F)} \times 80\% \times 100 \left(\frac{\text{kBtu}}{\text{Therm}} \right)} = 23,451 \text{ (Therms)}$$

$$\text{Savings.} = \text{Heat Cons. (Therms)} \times 15\% \text{ Savings} \times \text{Ave Gas Cost} \left(\frac{\$}{\text{Therm}} \right)$$

$$\text{Savings.} = 23,451 \text{ (Therms)} \times 15\% \times 1.31 \left(\frac{\$}{\text{Therm}} \right) = \$4,608$$

15% Savings on Cooling Calculations:

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

$$Est\ Cool\ Cons. = \frac{333.5\ (Tons) \times 12,000\ \left(\frac{Btu}{Ton\ Hr}\right) \times 800\ Hrs.}{10.0\ \left(\frac{Btu}{Wh}\right) \times 1000\ \left(\frac{Wh}{kWh}\right)} = 320,160(kWh)$$

$$Savings. = Cool\ Cons.(kWh) \times 15\% \text{ Savings} \times Ave\ Elec\ Cost\ \left(\frac{\$}{kWh}\right)$$

$$Savings. = 320,160\ (kWh) \times 15\% \times 0.153\ \left(\frac{\$}{kWh}\right) = \$7,348$$

Total ECM Savings. = \$Cooling + \$Heating = \$11,956 per year

Simple Payback = \$102,110 / \$11,956 = 8.5 years

Energy Savings Summary:

ECM #5 - ENERGY SAVINGS SUMMARY	
Installation Cost (\$):	\$102,110
NJ Smart Start Equipment Incentive (\$):	\$0
Net Installation Cost (\$):	\$102,110
Maintenance Savings (\$/Yr):	\$0
Energy Savings (\$/Yr):	\$11,956
Total Yearly Savings (\$/Yr):	\$11,956
Estimated ECM Lifetime (Yr):	15
Simple Payback	8.5
Simple Lifetime ROI	75.6%
Simple Lifetime Maintenance Savings	\$0
Simple Lifetime Savings	\$179,340
Internal Rate of Return (IRR)	8%
Net Present Value (NPV)	\$40,619.95

ECM #6: HVAC System Controls

Description:

Currently the Passaic Municipal Complex is primarily controlled with a pneumatic control system. This ECM will install a Building Automation system with Direct Digital Controls (DDC) wired through an Ethernet backbone and front end controller. The system will include new thermostat controllers for all rooftop units, Variable Air Volume Boxes and baseboard heaters. The front end device will also communicate with the main rooftop units. Communication between the devices and the rooftops will minimize the necessary amount of outside air needed for each space.

The DDC system has the potential to provide substantial savings by controlling the HVAC systems as a whole and provide operating schedules and features such as space averaging, night set-back, temperature override control, etc. The U.S. Department of Energy sponsored a study to analyze energy savings achieved through various types of building system controls. The referenced savings are 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%.

Savings resulting from the implementation of this ECM for energy management controls are estimated to be 10% of the total energy cost for the facility.

The cost of a full DDC system with new devices, controllers, computer, software, programming, etc. is approximately \$4.00 per SF; based on contractor pricing for project of similar type and size. Savings from the implementation of this ECM will be from the reduced electric energy currently used to cool the building as well as natural gas savings from energy management through the DDC system.

Cost of complete DDC System = ($\$4.00/\text{SF} \times 49,500 \text{ SF}$) = \$198,000.

Heating Season Heating Degree Days = 4,888 HDD
Average Cost of Gas = \$1.31/Therm

Cooling Season Full Load Cooling Hrs. = 800 hrs/yr.
Average Cost of Electricity = \$0.153/kWh

Energy Savings Calculations:10% Savings on Heating Calculations

$$\text{Heat Load} = \frac{\text{Heat Loss} \left(\frac{\text{Btu}}{\text{Hr SF}} \right) \times \text{Area (SF)}}{1000 \left(\frac{\text{Btu}}{\text{kBtu}} \right)}$$

$$\text{Heat Load} = \frac{35 \left(\frac{\text{Btu}}{\text{Hr SF}} \right) \times 49,500 \text{ (SF)}}{1000 \left(\frac{\text{Btu}}{\text{kBtu}} \right)} = 1,732.5 \left(\frac{\text{kBtu}}{\text{Hr}} \right)$$

$$\text{Est Heat Cons.} = \frac{\text{Heat Load} \left(\frac{\text{kBtu}}{\text{Hr}} \right) \times \text{Heat Deg Days} \times 24 \text{ Hrs} \times \text{Correction Factor}}{\text{Design Temp Difference} (\text{°F}) \times \text{Efficiency} (\%) \times \text{Fuel Heat Value} \left(\frac{\text{kBtu}}{\text{Therm}} \right)}$$

$$\text{Est Heat Cons.} = \frac{1,732.5 \left(\frac{\text{kBtu}}{\text{Hr}} \right) \times 4,888 \text{ (HDD)} \times 24 \text{ Hrs} \times 0.6}{65 \text{ (°F)} \times 80\% \times 100 \left(\frac{\text{kBtu}}{\text{Therm}} \right)} = 23,451 \text{ (Therms)}$$

$$\text{Savings.} = \text{Heat Cons. (Therms)} \times 10\% \text{ Savings} \times \text{Ave Gas Cost} \left(\frac{\$}{\text{Therm}} \right)$$

$$\text{Savings.} = 23,451 \text{ (Therms)} \times 10\% \times 1.31 \left(\frac{\$}{\text{Therm}} \right) = \$3,072$$

10% Savings on Cooling Calculations:

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

$$Est\ Cool\ Cons. = \frac{333.5\ (Tons) \times 12,000\ \left(\frac{Btu}{Ton\ Hr}\right) \times 800\ Hrs.}{10.0\ \left(\frac{Btu}{Wh}\right) \times 1000\ \left(\frac{Wh}{kWh}\right)} = 320,160(kWh)$$

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

$$Savings. = 320,160\ (kWh) \times 10\% \times 0.153\ \left(\frac{\$}{kWh}\right) = \$4898$$

Energy Savings Summary:

ECM #6 - ENERGY SAVINGS SUMMARY	
Installation Cost (\$):	\$198,000
NJ Smart Start Equipment Incentive (\$):	\$0
Net Installation Cost (\$):	\$198,000
Maintenance Savings (\$/Yr):	\$0
Energy Savings (\$/Yr):	\$7,970
Total Yearly Savings (\$/Yr):	\$7,970
Estimated ECM Lifetime (Yr):	15
Simple Payback	24.8
Simple Lifetime ROI	-39.6%
Simple Lifetime Maintenance Savings	0
Simple Lifetime Savings	\$119,550
Internal Rate of Return (IRR)	-6%
Net Present Value (NPV)	(\$102,854.66)

ECM #7: Boiler Replacement

Description:

Heating is provided to the facilities by two (2) Iron Fireman gas fired boilers which are located in the central boiler plant within the Administration Building. The two (2) boilers serve all of the buildings in the municipal complex which covers the Police, Administration, and Senior Citizen Buildings. The existing units are inefficient with an estimated combustion efficiency of 80% for heating, when new. The estimated service life for this type of gas fired boiler is thirty-five (35) years; these hot water boilers are 31 years old and have not exceeded their ASHRAE service life but should be replaced due to their poor condition.

This energy conservation measure will replace the gas fired boilers serving the facility. Calculation is based on the following equipment: Aerco, Benchmark BMK-2.0GWB condensing boiler or equivalent replacing the hot water boiler. The existing units will be replaced with high energy efficient units with capacities typical of the existing units.

Energy Savings Calculations:

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

Rated Capacity = 1,750 MBh Input, 1,400 MBh Output (Natural Gas)

Combustion Efficiency = 80%
Age & Radiation Losses = 10%
Thermal Efficiency = 70%

Replacement Gas Fired Boiler (Hot water) (2 Aerco Benchmark):

High-Efficiency Gas Fired Boiler

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

Combustion Efficiency = 87.1%
Radiation Losses = 0.5%
Thermal Efficiency = 86.6%

Replacement Gas Fired Boiler (Hot Water):

Heating Season Fuel Consumption = 9,341 Therms of natural (based on natural gas billing data and the square footage of the facility).

Heating Energy Savings = Fuel Consumption × (New Furnace Efficiency – Old Furnace Efficiency)

Gas Heating Energy Savings = 9,341 Therms x (86.6% - 70%) = 1,550.6 Therms

Savings:

Total Energy Savings = 1,550.6 Therms

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

Heating Energy Cost Savings = 1,550.6 Therms x \$1.31/Therm = \$2,031/ yr.

Installed cost of a new gas fired heating plant \$146,812. Cost for asbestos abatement was not included in this estimate.

Equipment Incentives:

Heating Smart Start Equipment Incentive = \$2.00/MBh for boilers < 300 MBh and \$1.75/MBh for boilers ≥ 300 MBh.

Total Smart Start Equipment Incentive = (\$1.75/MBh x 3,500 MBh)

Total Smart Start Equipment Incentive = \$6,125

Energy Savings Summary:

ECM #7 - ENERGY SAVINGS SUMMARY	
Installation Cost (\$):	\$146,812
NJ Smart Start Equipment Incentive (\$):	\$6,125
Net Installation Cost (\$):	\$140,687
Maintenance Savings (\$/Yr):	\$0
Energy Savings (\$/Yr):	\$2,031
Total Yearly Savings (\$/Yr):	\$2,031
Estimated ECM Lifetime (Yr):	35
Simple Payback	69.3
Simple Lifetime ROI	-49.5%
Simple Lifetime Maintenance Savings	\$0
Simple Lifetime Savings	\$71,085
Internal Rate of Return (IRR)	-3%
Net Present Value (NPV)	(\$97,046.46)

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 technologies for Passaic, and concluded that there is potential for solar energy generation.

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

CEG has reviewed the existing roof area of the Municipal Complex which is comprised of three buildings; the Administration, Police and Senior Center Buildings. These buildings are being audited for the purposes of determining a potential for a roof mounted photovoltaic system. A total roof area of 13,700 S.F. can be utilized for a PV system on all the roofs. A depiction of the area utilized and an individual analysis of each separate roof area utilized is shown in Appendix F. Using the total square footage for the whole Municipal Complex it was determined that a system size of 214.59 kilowatts could be installed. A system of this size has an estimated kilowatt hour production of 247,969 KWh annually, reducing the overall utility bill for the whole Municipal Complex by 20.9% percent. A detailed financial analysis can be found in Appendix F. This analysis illustrates the payback of the system over a 25 year period. The eventual degradation of the solar panels and the price of accumulated SREC's are factored into the payback.

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

The array system capacity was sized on available roof space on the existing facility. Estimated solar array generation was then calculated based on the National Renewable Energy Laboratory

PVWatts Version 1.0 Calculator. In order to calculate the array generation an appropriate location with solar data on file must be selected. In addition the system DC rated kilowatt (kW) capacity must be inputted, a DC to AC de-rate factor, panel tilt angle, and array azimuth angle. The DC to AC de-rate factor is based on the panel nameplate DC rating, inverter and transformer efficiencies (95%), mismatch factor (98%), diodes and connections (100%), dc and ac wiring(98%, 99%), soiling, (95%), system availability (95%), shading (if applicable), and age(new/100%). The overall DC to AC de-rate factor has been calculated at an overall rating of 81%. The PVWatts Calculator program then calculates estimated system generation based on average monthly solar irradiance and user provided inputs. The monthly energy generation and offset electric costs from the PVWatts calculator is shown in the **Renewable/Distributed Energy Measures Calculation Appendix**.

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

CEG has reviewed financing options for the owner. Two options were studied and they are as follows: Self-financed and direct purchase without finance. Self-finance was calculated with 95% of the total project cost financed at a 7% interest rate over 25 years. Direct purchase involves the local government paying for 100% of the total project cost upfront. Both of these calculations include a utility inflation rate as well as the degradation of the solar panels over time. Based on our calculations the following are the payback periods for the respective method of payment:

PAYMENT TYPE	SIMPLE PAYBACK	INTERNAL RATE OF RETURN
Self-Finance	15.5 Years	-
Direct Purchase	15.5 Years	4.7%

The above information is concluded as Renewable Energy Measure (REM) #1 showing installation costs, energy savings and other pertinent summarized information in Section I of this report.

Wind energy production is another option available through the Renewable Energy Incentive Program. Small wind turbines can be utilized to produce clean energy on a per building basis. Cash incentives are available per kWh of electric usage. CEG has reviewed the applicability of wind energy for Passaic and has determined it is not a viable option. Low average wind speeds for the area are not adequate for wind turbine generation. Typical wind turbines start producing energy at 8 mph wind speeds. An average of 6 mph wind speeds making this application impractical. Additionally, the land requirement for such installation of wind turbines is insufficient for the Passaic area.

IX. ENERGY PURCHASING AND PROCUREMENT STRATEGY

Load Profile:

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

Electricity:

The Passaic Municipal Complex is comprised of (3) three separate facilities; The Administration Building, The Police Building and the Senior Center. The only building to run 24/7 is The Police Building. The consistent (flat) winter load is elevated due to the Police usage. There is an A.O. Smith, electric hot water heater that is not used but is available for back-up. The presence of VAV (variable air volume) boxes with electric reheat is observed in all buildings. This will add to the electric consumption as well.

The Electric Usage Profile demonstrates a typical load profile. There is increased consumption in the summer period (April-September) which is consistent with summer air conditioning usage (cooling load).

The *Administration Building* has (3) three rooftop units which provide cooling. *The Police Building* has (4) four, rooftop units. In the area between the Administration and Police Buildings is a 17.5 Trane unit. *The Senior Center* has a single-rooftop unit.

A flatter load profile of this type, will allow for more competitive energy prices when shopping for alternative suppliers.

Natural Gas:

The Natural Gas Usage Profile demonstrates a very typical natural gas (heat load) profile. The summer months (May – September) demonstrate extremely low consumption (complimenting the winter heating load). There is an increase in winter consumption (October – March). The increased winter load is caused by heating demand. The primary source of heat is from a centralized boiler, located in the Administration Building. The boiler room consists of (2) two, natural gas fired hot water boilers. Additionally, domestic hot water is supplied by a natural gas-fired hot-water heater. This hot water source supplies the rest rooms, lounges and kitchen areas.

Tariff Analysis:Electricity:

These facilities receive electrical service through Public Service Electric and Gas Company (PSE&G), on a LPLS (Large Power and Lighting Service) service rate. The LPLS utility tariff is for delivery service 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 charges. This rate schedule has a Delivery Charge, Societal Benefits Charge, Non-utility Generation Charge, Securitization Charge, System Control Charge, Customer Account Services Charge, Standby Fee, Base Rate Distribution Adjustment Charge, Solar Pilot Recovery Charge and RGGI Charge. The customer can elect to have the Commodity Charge serviced through the utility or by a Third Party Supplier (TPS). Currently the customer is receiving electric commodity service through the utility.

Natural Gas:

These facilities receive their Delivery charges and Commodity charges for natural gas service from Public Service Electric and Gas Company (PSE&G) on a LVG (Large Volume Service) service classification. This utility tariff is for firm delivery service for general purposes. This rate schedule has a Delivery Charge, Balancing Charge, Societal Benefits Charge, Realignment Adjustment Charge, Margin Adjustment Charge, RGGI Charge and Customer Account Service Charge. The customer can elect to have the Commodity Charge serviced through the utility or by a Third Party Supplier (TPS). Note: Should the customer elect to have commodity service provided by a TPS, and that TPS not deliver natural gas, the customer may receive service from PSE&G under Emergency Sales Service. Emergency Sales Service carries an extremely high penalty cost of service.

A "firm service" is a higher priority of delivery on the natural gas pipeline. Typically the firm users do not have the capability of being interrupted by the utility, so the utility must provide a higher level of service. Much like the telecom industry, the natural gas pipelines were deregulated and various levels of delivery service were created. The "firm service" was the most reliable because it is last on the pecking order for interruption.

Imbalances can occur when Third Party Suppliers are used to supply natural gas and when full delivery is not made, and when a new supplier is contracted or the customer returns to the utility. It is important when utilizing a Third Party Supplier, that an experienced regional supplier is used, otherwise, under delivery can occur, jeopardizing economics and scheduling.

Recommendations:

CEG recommends a global approach that will be consistent with all facilities within the city. The primary area for potential improvement is seen in the electric costs. This is due to price variance to the market and the large volume of electric consumption. The average price per kWh (kilowatt hour) for all buildings based on 1-year historical average price is \$.1279/kWh (this is the average "price to compare" if the client intends to shop for energy). The average price per decatherm for natural gas is \$ 9.79 / dth (dth, is the common unit of measure). Energy

commodities are among the most volatile of all commodities, however at this point and time, energy is extremely competitive. The city 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 annual historical consumption (January 2008 through December 2008) and current electric rates, the city could see an improvement in its electric costs of up to 18% annually, or over \$40,000. (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 advisement for alternative sourcing and supply of energy on a “managed approach”.

CEG’s secondary recommendation coincides with the natural gas costs. Based on the current market, the city could improve its natural gas costs by up to 16%. CEG recommends that the city receive further advisement on these prices through an energy advisor. They should also consider procuring energy (natural gas) through an alternative supply source.

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 city 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 city 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 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 pay 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.

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. Provide more frequent air filter changes to decrease overall fan horsepower requirements and maintain better IAQ.
- D. Recalibrate existing temperature sensors within the facility.
- E. Clean all light fixtures to maximize light output.
- F. Confirm that outside air economizers on the rooftop units are functioning properly to take advantage of free cooling.

ECM COST & SAVINGS BREAKDOWN
CONCORD ENGINEERING GROUP

Passaic Municipal Complex

ECM ENERGY AND FINANCIAL COSTS AND SAVINGS SUMMARY															
ECM NO.	DESCRIPTION	INSTALLATION COST				YEARLY SAVINGS			ECM LIFETIME (Yr)	LIFETIME ENERGY SAVINGS	LIFETIME MAINTENANCE SAVINGS	LIFETIME ROI	SIMPLE PAYBACK	INTERNAL RATE OF RETURN (IRR)	NET PRESENT VALUE (NPV)
		MATERIAL	LABOR	REBATES, INCENTIVES	NET INSTALLATION COST	ENERGY	MAINT. / SREC	TOTAL		(Yearly Saving * ECM Lifetime)	(Yearly Maint Saving * ECM Lifetime)	(Lifetime Savings - Net Cost) / (Net Cost)	(Net cost / Yearly Savings)	$\sum_{n=0}^N \frac{C_n}{(1+IRR)^n}$	$\sum_{n=0}^N \frac{C_n}{(1+DR)^n}$
		(\$)	(\$)	(\$)	(\$)	(\$/Yr)	(\$/Yr)	(\$/Yr)		(\$)	(\$)	(%)	(Yr)	(\$)	(\$)
ECM #1	Lighting Controls	\$9,825	\$0	\$2,620	\$7,205	\$8,379	\$0	\$8,379	15	\$125,685	\$0	1644.4%	0.9	116.29%	\$92,822.96
ECM #2	Install Compact Fluorescents	\$1,200	\$0	\$0	\$1,200	\$9,905	\$0	\$9,905	15	\$148,575	\$0	12281.3%	0.1	825.42%	\$117,045.25
ECM #3	HVAC Rooftop Replacements (TRANE)	\$553,000	\$0	\$24,047	\$528,953	\$18,995	\$20,679	\$39,674	15	\$595,110	\$310,185	12.5%	13.3	1.51%	(\$55,327.36)
ECM #4	HVAC Rooftop Replacements (Aeon)	\$584,000	\$0	\$20,207	\$563,793	\$33,671	\$20,679	\$54,350	15	\$815,250	\$310,185	44.6%	10.4	5.01%	\$85,033.77
ECM #5	Demand Control Ventilation	\$102,110	\$0	\$0	\$102,110	\$11,956	\$0	\$11,956	15	\$179,340	\$0	75.6%	8.5	8.04%	\$40,619.95
ECM #6	HVAC System Controls	\$198,000	\$0	\$0	\$198,000	\$7,970	\$0	\$7,970	15	\$119,550	\$0	-39.6%	24.8	-5.73%	(\$102,854.66)
ECM #7	Boiler Replacement	\$146,812	\$0	\$6,125	\$140,687	\$2,031	\$0	\$2,031	35	\$71,085	\$0	-49.5%	69.3	-3.40%	(\$97,046.46)
REM RENEWABLE ENERGY AND FINANCIAL COSTS AND SAVINGS SUMMARY															
REM #1	PV Solar System (Municipal Complex)	\$1,931,310	\$0	\$0	\$1,931,310	\$37,939	\$86,789	\$124,728	25	\$3,118,200	\$2,169,725	61.5%	15.5	4.08%	\$240,597.09

- 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



STATEMENT OF ENERGY PERFORMANCE

Municipal Complex

Building ID: 1830516

For 12-month Period Ending: March 31, 2009¹

Date SEP becomes ineligible: N/A

Date SEP Generated: September 03, 2009

Facility

Municipal Complex
330 Passaic Street
Passaic, NJ 07055

Facility Owner

City of Passaic
330 Passaic Street
Passaic, NJ 07055

Primary Contact for this Facility

Glenn Carter
330 Passaic Street
Passaic, NJ 07055

Year Built: 1978

Gross Floor Area (ft²): 49,500

Energy Performance Rating² (1-100) N/A

Site Energy Use Summary³

Electricity - Grid Purchase(kBtu)	5,483,766
Natural Gas (kBtu) ⁴	3,151,872
Total Energy (kBtu)	8,635,638

Energy Intensity⁵

Site (kBtu/ft ² /yr)	174
Source (kBtu/ft ² /yr)	437

Emissions (based on site energy use)

Greenhouse Gas Emissions (MtCO ₂ e/year)	1,003
---	-------

Electric Distribution Utility

PSE&G - Public Service Elec & Gas Co

National Average Comparison

National Average Site EUI	77
National Average Source EUI	182
% Difference from National Average Source EUI	140%
Building Type	Office

Meets Industry Standards⁶ for Indoor Environmental Conditions:

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

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

Certifying Professional

Ray Johnson
520 South Burnt Mill Road
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	<input checked="" type="checkbox"/>
Building Name	Municipal Complex	Is this the official building name to be displayed in the ENERGY STAR Registry of Labeled Buildings?		<input type="checkbox"/>
Type	Office	Is this an accurate description of the space in question?		<input type="checkbox"/>
Location	330 Passaic Street, Passaic, NJ 07055	Is this address accurate and complete? Correct weather normalization requires an accurate zip code.		<input type="checkbox"/>
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		<input type="checkbox"/>

Administration (Office)

CRITERION	VALUE AS ENTERED IN PORTFOLIO MANAGER	VERIFICATION QUESTIONS	NOTES	<input checked="" type="checkbox"/>
Gross Floor Area	25,000 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.		<input type="checkbox"/>
Weekly operating hours	168 Hours	Is this the total number of hours per week that the Office 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.		<input type="checkbox"/>
Workers on Main Shift	107	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. The normal worker density ranges between 0.3 and 10 workers per 1000 square feet (92.8 square meters)		<input type="checkbox"/>
Number of PCs	107	Is this the number of personal computers in the Office?		<input type="checkbox"/>
Percent Cooled	50% or more	Is this the percentage of the total floor space within the facility that is served by mechanical cooling equipment?		<input type="checkbox"/>
Percent Heated	50% or more	Is this the percentage of the total floor space within the facility that is served by mechanical heating equipment?		<input type="checkbox"/>

Police (Office)

CRITERION	VALUE AS ENTERED IN PORTFOLIO MANAGER	VERIFICATION QUESTIONS	NOTES	<input checked="" type="checkbox"/>
-----------	---------------------------------------	------------------------	-------	-------------------------------------

Gross Floor Area	16,000 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.	<input type="checkbox"/>
Weekly operating hours	168 Hours	Is this the total number of hours per week that the Office 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.	<input type="checkbox"/>
Workers on Main Shift	137	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. The normal worker density ranges between 0.3 and 10 workers per 1000 square feet (92.8 square meters)	<input type="checkbox"/>
Number of PCs	107	Is this the number of personal computers in the Office?	<input type="checkbox"/>
Percent Cooled	50% or more	Is this the percentage of the total floor space within the facility that is served by mechanical cooling equipment?	<input type="checkbox"/>
Percent Heated	50% or more	Is this the percentage of the total floor space within the facility that is served by mechanical heating equipment?	<input type="checkbox"/>

Sr. Center (Other)

CRITERION	VALUE AS ENTERED IN PORTFOLIO MANAGER	VERIFICATION QUESTIONS	NOTES	<input checked="" type="checkbox"/>
Gross Floor Area	8,500 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.		<input type="checkbox"/>
Number of PCs	5 (Optional)	Is this the number of personal computers in the space?		<input type="checkbox"/>
Weekly operating hours	168 Hours(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.		<input type="checkbox"/>
Workers on Main Shift	11 (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.		<input type="checkbox"/>

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: 778014999 (kWh (thousand Watt-hours)) Space(s): Entire Facility Generation Method: Grid Purchase		
Start Date	End Date	Energy Use (kWh (thousand Watt-hours))
03/01/2009	03/31/2009	100,000.00
02/01/2009	02/28/2009	101,200.00
01/01/2009	01/31/2009	96,000.00
12/01/2008	12/31/2008	96,000.00
11/01/2008	11/30/2008	135,200.00
10/01/2008	10/31/2008	117,600.00
09/01/2008	09/30/2008	159,600.00
08/01/2008	08/31/2008	170,800.00
07/01/2008	07/31/2008	184,000.00
06/01/2008	06/30/2008	184,800.00
05/01/2008	05/31/2008	138,800.00
04/01/2008	04/30/2008	123,200.00
778014999 Consumption (kWh (thousand Watt-hours))		1,607,200.00
778014999 Consumption (kBtu (thousand Btu))		5,483,766.40
Total Electricity (Grid Purchase) Consumption (kBtu (thousand Btu))		5,483,766.40
Is this the total Electricity (Grid Purchase) consumption at this building including all Electricity meters?		<input type="checkbox"/>
Fuel Type: Natural Gas		
Meter: 07055-5815 (therms) Space(s): Entire Facility		
Start Date	End Date	Energy Use (therms)
03/01/2009	03/31/2009	4,383.98
02/01/2009	02/28/2009	5,681.37
01/01/2009	01/31/2009	6,620.50
12/01/2008	12/31/2008	6,207.61
11/01/2008	11/30/2008	4,453.81
10/01/2008	10/31/2008	781.26
09/01/2008	09/30/2008	167.99
08/01/2008	08/31/2008	160.91
07/01/2008	07/31/2008	171.03
06/01/2008	06/30/2008	159.90

05/01/2008	05/31/2008	273.24
04/01/2008	04/30/2008	1,977.45
07055-5815 Consumption (therms)		31,039.05
07055-5815 Consumption (kBtu (thousand Btu))		3,103,905.00
Meter: Sr. Center Kitchen (therms) Space(s): Entire Facility		
Start Date	End Date	Energy Use (therms)
03/01/2009	03/31/2009	37.44
02/01/2009	02/28/2009	35.42
01/01/2009	01/31/2009	41.49
12/01/2008	12/31/2008	32.38
11/01/2008	11/30/2008	42.50
10/01/2008	10/31/2008	42.50
09/01/2008	09/30/2008	40.48
08/01/2008	08/31/2008	40.48
07/01/2008	07/31/2008	41.49
06/01/2008	06/30/2008	37.44
05/01/2008	05/31/2008	48.58
04/01/2008	04/30/2008	39.47
Sr. Center Kitchen Consumption (therms)		479.67
Sr. Center Kitchen Consumption (kBtu (thousand Btu))		47,967.00
Total Natural Gas Consumption (kBtu (thousand Btu))		3,151,872.00
Is this the total Natural Gas consumption at this building including all Natural Gas meters?		<input type="checkbox"/>

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.	<input type="checkbox"/>

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.	<input type="checkbox"/>

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

Municipal Complex
330 Passaic Street
Passaic, NJ 07055

Facility Owner

City of Passaic
330 Passaic Street
Passaic, NJ 07055

Primary Contact for this Facility

Glenn Carter
330 Passaic Street
Passaic, NJ 07055

General Information

Municipal Complex	
Gross Floor Area Excluding Parking: (ft ²)	49,500
Year Built	1978
For 12-month Evaluation Period Ending Date:	March 31, 2009

Facility Space Use Summary

Administration		Sr. Center	
Space Type	Office	Space Type	Other - Social/Meeting
Gross Floor Area(ft ²)	25,000	Gross Floor Area(ft ²)	8,500
Weekly operating hours	168	Number of PCs ^o	5
Workers on Main Shift	107	Weekly operating hours ^o	168
Number of PCs	107	Workers on Main Shift ^o	11
Percent Cooled	50% or more		
Percent Heated	50% or more		
Police			
Space Type	Office		
Gross Floor Area(ft ²)	16,000		
Weekly operating hours	168		
Workers on Main Shift	137		
Number of PCs	107		
Percent Cooled	50% or more		
Percent Heated	50% or more		

Energy Performance Comparison

Performance Metrics	Evaluation Periods		Comparisons		
	Current (Ending Date 03/31/2009)	Baseline (Ending Date 03/31/2009)	Rating of 75	Target	National Average
Energy Performance Rating	N/A	N/A	75	N/A	N/A
Energy Intensity					
<i>Site (kBtu/ft²)</i>	174	174	99	N/A	77
<i>Source (kBtu/ft²)</i>	437	437	247	N/A	182
Energy Cost					
<i>\$/year</i>	\$ 287,061.04	\$ 287,061.04	\$ 162,518.74	N/A	\$ 126,697.81
<i>\$/ft²/year</i>	\$ 5.80	\$ 5.80	\$ 3.28	N/A	\$ 2.56
Greenhouse Gas Emissions					
MtCO ₂ e/year	1,003	1,003	568	N/A	443
kgCO ₂ e/ft ² /year	20	20	11	N/A	9

More than 50% of your building is defined as Office. This building is currently ineligible for a rating. Please note the National Average column represents the CBECS national average data for Office. This building uses X% less energy per square foot than the CBECS national average for Office.

Notes:

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

MAJOR EQUIPMENT LIST

Concord Engineering Group
Administration Building

Boiler

Location	Area Served	Manufacturer	Qty.	Model #	Serial #	Input (MBh)	Output (MBh)	Efficiency (%)	Fuel	Approx. Age	ASHRAE Service Life	Remaining Life	Notes
Boiler Room	Complex	Iron Fireman	2	76-45-239	P9306	1780	-	-	NG	31	35	4	

Boiler - Burner

Location	Area Served	Manufacturer	Qty.	Model #	Serial #	Input (MBh)	Efficiency (%)	Fuel	Approx. Age	ASHRAE Service Life	Remaining Life	Notes
Boiler Room	Complex	Dunham Bush	2	G120-G-2.1	59872-09030104	2100	-	NG	31	31	-10	

Boiler - Pumps

Location	Area Served	Manufacturer	Qty.	Model #	Serial #	HP	RPM	GPM	Fl. Hd	Frame Size	Volts	Phase	Approx. Age	ASHRAE Service Life	Remaining Life	Notes
Boiler Room	Complex	B&G	2	8097B	218971199	7.5	1750	-	-	213M	208	3	10	20	10	

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
(B) Boiler Room	Complex	Rheem	1	ZZVR75-70N	RHLN0506110	-	130	75	-	Natural Gas	3	12	9	
(D) Boiler Room	Complex	AO Smith	1	KEN 80911	MFR3-26689	-	79	80	-	Electric	23	12	-11	Electric AO Smith Hot water heater is disconnected and not in service but can still be used for back up usage.

DHW - Pumps

Location	Area Served	Manufacturer	Qty.	Model #	Serial #	HP	Volts	Amps	Approx. Age	ASHRAE Service Life	Remaining Life	Notes
(A) Boiler Room	Complex	B&G	1	Series 100	M09181	1/12 HP	1725	1.75	3	10	7	Order B&G Domestic hot water pump is not currently in use due to the inactivity of the older electric DHWH.
(A) Boiler Room	Complex	B&G	1		A28 20R	1/6 HP	1725	1.9	23	10	-13	

Rooftop A/C Units

Location	Area Served	Manufacturer	Qty	Model #	Serial #	Cooling Coil	Cooling Eff. (EER)	Cooling Capacity	Heating Type	Input (MBh)	Output (RTU/b)	Heating Eff. (%)	Fuel	Volts	Phase	Amps	Approx. Age	ASHRAE Service Life	Remaining Life	Notes
Roof	Administration	4 Seasons	1	6SZK40-0904-XXXXX 24SE	4346-1095-485	DX	-	999.516 Btu/h	N/A	-	-	-	-	460	3	-	15	15	0	
Roof	Administration	4 Seasons	1	6SZK13-0802-XXXXX 24SE	4349-1095-486	DX	-	801.602 Btu/h	N/A	-	-	-	-	460	3	-	15	15	0	
Roof	Administration	Comfort Temp	1	CT-15	17-2067-01	DX	-	163,000 Btu/h	HW coil	-	124,500	-	-	460	3	-	31	15	-16	

Exhaust Fans

Location	Area Served	Manufacturer	Qty.	Model #	Serial #	Heating Coil	Capacity (Btu/h)	Fan HP	Fan RPM	Volts	Phase	Amps	Approx. Age	ASHRAE Service Life	Remaining Life	Notes
Roof	Administration	Cook	1	12UC1B	S-99515-A1178	-	-	1.6 HP	905	120	1	60	20	20	0	
Roof	Administration	Cook	1	12UC1B	S-99515-A1178	-	-	1.6 HP	994	120	1	60	20	20	0	
Roof	Administration	Cook	1	12UC1B	S-99515-A1178	-	-	1.6 HP	887	120	1	60	20	20	0	One (1) Exhaust fan has a broken belt and disconnected wires. This fan is currently not operating.
Roof	Administration	Cook	1	15UC1B	S-99515-A1178	-	-	1.6 HP	863	120	1	60	20	20	0	

MAJOR EQUIPMENT LIST

Concord Engineering Group
Police Building

Roof Top 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	Amps	Approx. Age	ASHRAE Service Life	Remaining Life	Notes
Roof	Police Dept Unit	Seasons-4	1	6SZK40-0904-XXXXX 24SE	43491095484	DX	-	999.516 Btu/h	N/A	-	-	-	-	460	60	15	15	0	
Roof	Police Dept	ECS	1	CZ	-	DX	-	-	N/A	-	-	-	-	460	60	31	15	-16	This unit had no tag and no information could be acquired.
Roof	Court	FRANE	1	TCD210B400DA	J24145392D	DX	8.8 @ ARI	17.5 Ton	N/A	-	-	-	-	460	60	15	15	0	

Heating and Ventilation Units

Location	Area Served	Manufacturer	Qty.	Model #	Serial #	Heating Coil	Capacity (Btu/h)	Fan HP	Fan RPM	Volts	Phase	Amps	Approx. Age	ASHRAE Service Life	Remaining Life	Notes
Roof	Police Station	-	1	URD	S-108276-379	N/A	N/A	1.6 HP	1075	115	1	60	30	20	-10	
Roof	Police Station	-	1	URD	S-108276-379	N/A	N/A	1.4 HP	865	115	1	60	30	20	-10	

MAJOR EQUIPMENT LIST

Concord Engineering Group
"Senior Citizen Building"

Rooftop A/C 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	Amps	Approx. Age	ASHRAE Service Life	Remaining Life	Notes
Roof	Senior Center	4 Seasons	1	6MZG26-0322-4W5.0-1250	2807-1191324	DX	-	400,000 Btu/h	HW coil	544.514 Btu/h	-	-	-	460	-	31	15	-16	

Heating and Ventilation Units

Location	Area Served	Manufacturer	Qty.	Model #	Serial #	Heating Coil	Capacity (Btu/h)	Fan HP	Fan RPM	Volts	Phase	Amps	Approx. Age	ASHRAE Service Life	Remaining Life	Notes
Roof	Senior Center	-	1	11CB	S-108276379	N/A	N/A	1.6 HP	780	115	1	60	30	20	-10	
Roof	Senior Center	Flo-Aire	1	NSA10	-	N/A	N/A	1/2 HP	-	115	1	60	3	20	17	
Roof	Senior Center	Flo-Aire	1	BDU15	-	N/A	N/A	1/2 HP	-	115	1	60	3	20	17	
Roof	Senior Center	Comfort Temp (OFF)	1	CTEA15-22 5-22	78-2190-04	N/A	N/A	1.8 HP	-	460	3	60	31	20	-11	Comfort Temp return air fan is not in use.

INVESTMENT GRADE LIGHTING AUDIT

CONCORD ENERGY SERVICES

CEG Job #: 9C09059
 Project: City of Passaic Energy Audit
 Address: 330 Passaic Street
 City: Passaic
 Building SF: 25,000

"Passaic Administration Building"

DATE: 10/12/2009
 KWH COST: **\$0.153**

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	Vestibule	6	4' 1L T8 32W Perimeter Cove Lighting	8736	28	0.17	1467.648	\$224.55	6	No Change Required	0	0.00	0	0	\$0.00	\$0.00	0.00	0	0	0.00
2		5	150W Incandescent High Hat	8736	150	0.75	6552	\$1,002.46	5	40W CFL Lamp	40	0.20	1747.2	\$267.32	\$9.60	\$48.00	0.55	4804.8	735.1344	0.07
3	1st Floor Lobby	13	150W Incandescent High Hat	8736	150	1.95	17035.2	\$2,606.39	13	40W CFL Lamp	40	0.52	4542.72	\$695.04	\$9.60	\$124.80	1.43	12492.48	1911.34944	0.07
4		16	60W CFL	8736	60	0.96	8386.56	\$1,283.14	16	18W CFL Lamp	18	0.29	2515.968	\$384.94	\$5.75	\$92.00	0.67	5870.592	898.200576	0.10
5		18	4' 1L T8 32W Perimeter Cove Lighting	8736	28	0.50	4402.944	\$673.65	18	No Change Required	0	0.00	0	\$0.00	\$0.00	\$0.00	0.00	0	0	0.00
6	1st Floor Hallway	16	2'x4' 2L T8 32W, Recessed, Electronic Ballast, Prismatic Lens	8736	58	0.93	8107.008	\$1,240.37	16	No Change Required	0	0.00	0	\$0.00	\$0.00	\$0.00	0.00	0	0	0.00
7		1	4' 1L T8 32W Perimeter Cove Lighting	8736	28	0.03	244.608	\$37.43	1	No Change Required	0	0.00	0	\$0.00	\$0.00	\$0.00	0.00	0	0	0.00
8		1	150W Incandescent High Hat	8736	150	0.15	1310.4	\$200.49	1	40W CFL Lamp	40	0.04	349.44	\$53.46	\$9.60	\$9.60	0.11	960.96	147.02688	0.07

9		Womens Room	1	4' 2L T8 32W Electronic Ballast, Egg Crate Wall Mount	2080	58	0.06	120.64	\$18.46	1	No Change Required	0	0.00	0	\$0.00	\$0.00	\$0.00	0.00	0	0	0.00
10		Mens Room	1	4' 2L T8 32W Electronic Ballast, Egg Crate Wall Mount	2080	58	0.06	120.64	\$18.46	1	No Change Required	0	0.00	0	\$0.00	\$0.00	\$0.00	0.00	0	0	0.00
11		Mail / Duplicating	6	2'x4' 2L T8 32W, Recessed, Electronic Ballast, Prismatic Lens	2080	58	0.35	723.84	\$110.75	6	No Change Required	0	0.00	0	\$0.00	\$0.00	\$0.00	0.00	0	0	0.00
12		Garage	12	4' 2L 32W T8 Vapor Proof, Acrylic Lens,	8736	58	0.70	6080.256	\$930.28	12	No Change Required	0	0.00	0	\$0.00	\$0.00	\$0.00	0.00	0	0	0.00
13		Boiler Room	12	4' 1L T8 32W Industrial	8736	28	0.34	2935.296	\$449.10	12	No Change Required	0	0.00	0	\$0.00	\$0.00	\$0.00	0.00	0	0	0.00
14		Tax Assessors Offices	40	2'x4' 2L T8 32W, Recessed, Electronic Ballast, Prismatic Lens	2080	58	2.32	4825.6	\$738.32	40	No Change Required	0	0.00	0	\$0.00	\$0.00	\$0.00	0.00	0	0	0.00
15			1	150W Incandescent High Hat	2080	150	0.15	312	\$47.74	1	40W CFL Lamp	40	0.04	83.2	\$12.73	\$9.60	\$9.60	0.11	228.8	35.0064	0.27
16		Tax Collector Offices	34	2'x4' 2L T8 32W, Recessed, Electronic Ballast, Prismatic Lens	2080	58	1.97	4101.76	\$627.57	34	No Change Required	0	0.00	0	\$0.00	\$0.00	\$0.00	0.00	0	0	0.00
17		Human Services	37	2'x4' 2L T8 32W, Recessed, Electronic Ballast, Prismatic Lens	2080	58	2.15	4463.68	\$682.94	37	No Change Required	0	0.00	0	\$0.00	\$0.00	\$0.00	0.00	0	0	0.00
18			2	1'x4' 2L T8 32W, Recessed, Electronic Ballast, Parabolic	2080	58	0.12	241.28	\$36.92	2	No Change Required	0	0.00	0	\$0.00	\$0.00	\$0.00	0.00	0	0	0.00
19		City Clerk	27	2'x4' 2L T8 32W, Recessed, Electronic Ballast, Prismatic Lens	2080	58	1.57	3257.28	\$498.36	27	No Change Required	0	0.00	0	\$0.00	\$0.00	\$0.00	0.00	0	0	0.00
20			2	4' 2L T8 32W Electronic Ballast, Ceiling mount, Prismatic Lens	2080	58	0.12	241.28	\$36.92	2	No Change Required	0	0.00	0	\$0.00	\$0.00	\$0.00	0.00	0	0	0.00
21			10	2'x4' 2L T8 32W, Ceiling mount, Prismatic Lens	2080	58	0.58	1206.4	\$184.58	10	No Change Required	0	0.00	0	\$0.00	\$0.00	\$0.00	0.00	0	0	0.00
22		Locker Room	2	4' 1L T8 32W Electronic Ballast, Ceiling Mount, Industrial	2080	28	0.06	116.48	\$17.82	2	No Change Required	0	0.00	0	\$0.00	\$0.00	\$0.00	0.00	0	0	0.00
23		Break Room	21	4' 1L T8 32W Electronic Ballast, Ceiling Mount, Industrial	2080	28	0.59	1223.04	\$187.13	21	No Change Required	0	0.00	0	\$0.00	\$0.00	\$0.00	0.00	0	0	0.00
24		Office	2	2'x4' 2L T8 32W, Recessed, Electronic Ballast, Prismatic Lens	2080	58	0.12	241.28	\$36.92	2	No Change Required	0	0.00	0	\$0.00	\$0.00	\$0.00	0.00	0	0	0.00
25		Office	9	2'x4' 2L T8 32W, Recessed, Electronic Ballast, Prismatic Lens	2080	58	0.52	1085.76	\$166.12	9	No Change Required	0	0.00	0	\$0.00	\$0.00	\$0.00	0.00	0	0	0.00

26		Storage	2	4' 1L T8 32W Industrial	2080	28	0.06	116.48	\$17.82	2	No Change Required	0	0.00	0	\$0.00	\$0.00	\$0.00	0.00	0	0	0.00
27		Hall	2	2'x4' 2L T8 32W, Recessed, Electronic Ballast, Prismatic Lens	8736	58	0.12	1013.376	\$155.05	2	No Change Required	0	0.00	0	\$0.00	\$0.00	\$0.00	0.00	0	0	0.00
28		Court Office	21	2'x4' 2L T8 32W, Recessed, Electronic Ballast, Prismatic Lens	2912	58	1.22	3546.816	\$542.66	21	No Change Required	0	0.00	0	\$0.00	\$0.00	\$0.00	0.00	0	0	0.00
29		Restroom	1	4' 2L T8 32W Electronic Ballast, Egg Crate Wall Mount	2080	58	0.06	120.64	\$18.46	1	No Change Required	0	0.00	0	\$0.00	\$0.00	\$0.00	0.00	0	0	0.00
28		Court Room	15	2'x4' 2L T8 32W, Recessed, Electronic Ballast, Prismatic Lens	2912	58	0.87	2533.44	\$387.62	15	No Change Required	0	0.00	0	\$0.00	\$0.00	\$0.00	0.00	0	0	0.00
29			5	150W Incandescent High Hat	2912	150	0.75	2184	\$334.15	5	40W CFL Lamp	40	0.20	582.4	\$89.11	\$9.60	\$48.00	0.55	1601.6	245.0448	0.20
30		Janitor 1st Floor	1	4' 2L T8 32W, Electronic Ballast, Industrial	2080	58	0.06	120.64	\$18.46	1	No Change Required	0	0.00	0	\$0.00	\$0.00	\$0.00	0.00	0	0	0.00
31		Janitor 2nd Floor	1	4' 2L T8 32W, Electronic Ballast, Industrial	2080	58	0.06	120.64	\$18.46	1	No Change Required	0	0.00	0	\$0.00	\$0.00	\$0.00	0.00	0	0	0.00
32		Electrical 1st Floor	1	4' 1L T8 32W, Electronic Ballast, Industrial	2080	28	0.03	58.24	\$8.91	1	No Change Required	0	0.00	0	\$0.00	\$0.00	\$0.00	0.00	0	0	0.00
33		Electrical 2nd Floor	1	4' 1L T8 32W, Electronic Ballast, Industrial	2080	28	0.03	58.24	\$8.91	1	No Change Required	0	0.00	0	\$0.00	\$0.00	\$0.00	0.00	0	0	0.00
34		Elevator Equipment Room	1	4' 2L T8 32W, Electronic Ballast, Industrial	2080	58	0.06	120.64	\$18.46	1	No Change Required	0	0.00	0	\$0.00	\$0.00	\$0.00	0.00	0	0	0.00
35		Mens Room 1st Floor	6	2'x2' 2L U-Tube T8 32W Electronic Ballast, Prismatic Lens	2080	73	0.44	911.04	\$139.39	6	No Change Required	0	0.00	0	\$0.00	\$0.00	\$0.00	0.00	0	0	0.00
36		Mens Room 2nd Floor	6	2'x2' 2L U-Tube T8 32W Electronic Ballast, Prismatic Lens	2080	73	0.44	911.04	\$139.39	6	No Change Required	0	0.00	0	\$0.00	\$0.00	\$0.00	0.00	0	0	0.00
37		Womens Room 1st Floor	5	2'x2' 2L U-Tube T8 32W Electronic Ballast, Prismatic Lens	2080	73	0.37	759.2	\$116.16	5	No Change Required	0	0.00	0	\$0.00	\$0.00	\$0.00	0.00	0	0	0.00
38		Womens Room 2nd Floor	5	2'x2' 2L U-Tube T8 32W Electronic Ballast, Prismatic Lens	2080	73	0.37	759.2	\$116.16	5	No Change Required	0	0.00	0	\$0.00	\$0.00	\$0.00	0.00	0	0	0.00
39		Council Chambers	55	75W Incandescent	2080	75	4.13	8580	\$1,312.74	55	18W CFL Lamp	18	0.99	2059.2	\$315.06	\$5.75	\$316.25	3.14	6520.8	997.6824	0.32
40			5	4' 1L T8 32W Cove Lighting	2080	28	0.14	291.2	\$44.55	5	No Change Required	0	0.00	0	\$0.00	\$0.00	\$0.00	0.00	0	0	0.00
41		Room 102	6	2'x4' 2L T8 32W, Recessed, Electronic Ballast, Prismatic Lens	2080	58	0.35	723.84	\$110.75	6	No Change Required	0	0.00	0	\$0.00	\$0.00	\$0.00	0.00	0	0	0.00

42		Internal Affairs	21	2'x4' 2L T8 32W, Recessed, Electronic Ballast, Prismatic Lens	8736	58	1.22	10640.448	\$1,627.99	21	No Change Required	0	0.00	0	\$0.00	\$0.00	\$0.00	0.00	0	0	0.00
43		Office	4	2'x4' 2L T8 32W, Recessed, Electronic Ballast, Prismatic Lens	2080	58	0.23	482.56	\$73.83	4	No Change Required	0	0.00	0	\$0.00	\$0.00	\$0.00	0.00	0	0	0.00
44		Stairwell	4	2L Biaxial Wall Mount, Magnetic Ballast	8736	30	0.12	1048.32	\$160.39	4	No Change Required	0	0.00	0	\$0.00	\$0.00	\$0.00	0.00	0	0	0.00
45		Engineering	1	4' 1L T8 32W, Electronic Ballast, Industrial	2080	28	0.03	58.24	\$8.91	1	No Change Required	0	0.00	0	\$0.00	\$0.00	\$0.00	0.00	0	0	0.00
46			23	2'x4' 2L T8 32W, Recessed, Electronic Ballast, Prismatic Lens	2080	58	1.33	2774.72	\$424.53	23	No Change Required	0	0.00	0	\$0.00	\$0.00	\$0.00	0.00	0	0	0.00
47			1	100W Tabletop Incandescent	2080	100	0.10	208	\$31.82	1	18W CFL Lamp	18	0.02	37.44	\$5.73	\$5.75	\$5.75	0.08	170.56	26.09568	0.22
48		Mayor's Office	3	4' Cove Light T12 1L 28W, Electronic Ballast	2912	50	0.15	436.8	\$66.83	3	4' - 1-Lamp 32W T-8 Industrial Strip w/ Elect Ballast; Metalux M/N SNF132	28	0.08	244.608	\$37.43	\$123.00	\$369.00	0.07	192.192	29.405376	12.55
49			3	4' Cove Light T8 1L 32W, Electronic Ballast	2912	28	0.08	244.608	\$37.43	3	No Change Required	0	0.00	0	\$0.00	\$0.00	\$0.00	0.00	0	0	0.00
50			36	2'x4' 2L T8 32W, Recessed, Electronic Ballast, Prismatic Lens	2912	58	2.09	6080.256	\$930.28	36	No Change Required	0	0.00	0	\$0.00	\$0.00	\$0.00	0.00	0	0	0.00
51			4	3' 1L T8 32W Electronic Ballast, Surface Mount	2912	25	0.10	291.2	\$44.55	4	No Change Required	0	0.00	0	\$0.00	\$0.00	\$0.00	0.00	0	0	0.00
52		Bathroom	1	4' 2L T8 32W Electronic Ballast, Egg Crate Wall Mount	2080	58	0.06	120.64	\$18.46	1	No Change Required	0	0.00	0	\$0.00	\$0.00	\$0.00	0.00	0	0	0.00
53		Finance	7	1'x4' 2L T8 32W, Recessed, Electronic Ballast, Parabolic	2080	58	0.41	844.48	\$129.21	7	No Change Required	0	0.00	0	\$0.00	\$0.00	\$0.00	0.00	0	0	0.00
54			13	2'x4' 2L T8 32W, Recessed, Electronic Ballast, Prismatic Lens	2080	58	0.75	1568.32	\$239.95	13	No Change Required	0	0.00	0	\$0.00	\$0.00	\$0.00	0.00	0	0	0.00
55			2	4' 2L T8 32W, Electronic Ballast, Industrial	2080	58	0.12	241.28	\$36.92	2	No Change Required	0	0.00	0	\$0.00	\$0.00	\$0.00	0.00	0	0	0.00
56		Personnel	24	2'x4' 2L T8 32W, Recessed, Electronic Ballast, Prismatic Lens	2080	58	1.39	2895.36	\$442.99	24	No Change Required	0	0.00	0	\$0.00	\$0.00	\$0.00	0.00	0	0	0.00
57		Health	26	2'x4' 2L T8 32W, Recessed, Electronic Ballast, Prismatic Lens	2080	58	1.51	3136.64	\$479.91	26	No Change Required	0	0.00	0	\$0.00	\$0.00	\$0.00	0.00	0	0	0.00
58		Code Enforcement	63	2'x4' 2L T8 32W, Recessed, Electronic Ballast, Prismatic Lens	2080	58	3.65	7600.32	\$1,162.85	63	No Change Required	0	0.00	0	\$0.00	\$0.00	\$0.00	0.00	0	0	0.00

59		Community Development	67	2'x4' 2L T8 32W, Recessed, Electronic Ballast, Prismatic Lens	2080	58	3.89	8082.88	\$1,236.68	67	No Change Required	0	0.00	0	\$0.00	\$0.00	\$0.00	0.00	0	0	0.00
60		Room 206	10	2'x4' 2L T8 32W, Recessed, Electronic Ballast, Prismatic Lens	2080	58	0.58	1206.4	\$184.58	10	No Change Required	0	0.00	0	\$0.00	\$0.00	\$0.00	0.00	0	0	0.00
61		Stairwell	6	2L Biaxial Wall Mount, Magnetic Ballast	8736	30	0.18	1572.48	\$240.59	6	No Change Required	0	0.00	0	\$0.00	\$0.00	\$0.00	0.00	0	0	0.00
62			2	100W incandescent	8736	100	0.20	1747.2	\$267.32	2	40W CFL Lamp	40	0.08	698.88	\$106.93	\$9.60	\$19.20	0.12	1048.32	160.39296	0.12
63		2nd Floor Hallway	14	2'x4' 2L T8 32W, Recessed, Electronic Ballast, Prismatic Lens	8736	58	0.81	7093.632	\$1,085.33	14	No Change Required	0	0.00	0	\$0.00	\$0.00	\$0.00	0.00	0	0	0.00
			9	75W Incandescent High Hat	8736	75	0.68	5896.8	\$902.21	9	18W CFL Lamp	18	0.16	1415.232	\$216.53	\$5.75	\$51.75	0.51	4481.568	685.679904	0.08
			5	4' 1L T8 32W Perimeter Cove Lighting	8736	28	0.14	1223.04	\$187.13	5	No Change Required	0	0.00	0	\$0.00	\$0.00	\$0.00	0.00	0	0	0.00
64							0.00	0	\$0.00	0			0.00	0	\$0.00		\$0.00	0.00	0	0	0.00
Totals			783				46.51	167226.176	\$25,585.60	783			2.62	14276.29	\$2,184.27		\$1,093.95	7.34	38372.67	\$5,871.02	0.19

INVESTMENT GRADE LIGHTING AUDIT

CONCORD ENERGY SERVICES

CEG Job #: 9C09059
 Project: City of Passaic Energy Audit
 Address: 330 Passaic Street
 City: Passaic
 Building SF: 16,000

"Passaic Police Building"

DATE: 10/12/2009
 KWH COST: \$0.153

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	1st Floor Entry Hall	3	2'x4' 2L T8 32W, Recessed, Electronic Ballast, Prismatic Lens	8736	58	0.17	1520.064	\$232.57	3	No Change Required	0	0.00	0	0	\$0.00	\$0.00	0.00	0	0	0.00
2	Room 215	25	2'x4' 2L T8 32W, Recessed, Electronic Ballast, Prismatic Lens	8736	58	1.45	12667.2	\$1,938.08	25	No Change Required	0	0.00	0	\$0.00	\$0.00	\$0.00	0.00	0	0	0.00
3	Bathroom	1	4' 2L T8 32W Electronic Ballast, Egg Crate Wall Mount	8736	58	0.06	506.688	\$77.52	1	No Change Required	0	0.00	0	\$0.00	\$0.00	\$0.00	0.00	0	0	0.00
4	Admin Offices	67	2'x4' 2L T8 32W, Recessed, Electronic Ballast, Prismatic Lens	8736	58	3.89	33948.1	\$5,194.06	67	No Change Required	0	0.00	0	\$0.00	\$0.00	\$0.00	0.00	0	0	0.00
5	Bathroom	1	4' 2L T8 32W Electronic Ballast, Egg Crate Wall Mount	8736	58	0.06	506.688	\$77.52	1	No Change Required	0	0.00	0	\$0.00	\$0.00	\$0.00	0.00	0	0	0.00
6	Closet	1	4' 2L T8 32W, Electronic Ballast, Industrial Surface Mount	2080	58	0.06	120.64	\$18.46	1	No Change Required	0	0.00	0	\$0.00	\$0.00	\$0.00	0.00	0	0	0.00
7	Bathroom	1	4' 2L T8 32W Electronic Ballast, Egg Crate Wall Mount	8736	58	0.06	506.688	\$77.52	1	No Change Required	0	0.00	0	\$0.00	\$0.00	\$0.00	0.00	0	0	0.00
8	Room 233	53	2'x4' 2L T8 32W, Recessed, Electronic Ballast, Prismatic Lens	8736	58	3.07	26854.46	\$4,108.73	53	No Change Required	0	0.00	0	\$0.00	\$0.00	\$0.00	0.00	0	0	0.00
9	Restroom	1	4' 2L T8 32W Electronic Ballast, Egg Crate Wall Mount	8736	58	0.06	506.688	\$77.52	1	No Change Required	0	0.00	0	\$0.00	\$0.00	\$0.00	0.00	0	0	0.00
10	Locker Room	20	2'x4' 2L T8 32W, Recessed, Electronic Ballast, Prismatic Lens	8736	58	1.16	10133.76	\$1,550.47	20	No Change Required	0	0.00	0	\$0.00	\$0.00	\$0.00	0.00	0	0	0.00
11	Bathroom	2	2'x2' 2L T8 U-Tube 32W Electronic Ballast, Pendant Light	8736	73	0.15	1275.456	\$195.14	2	No Change Required	0	0.00	0	\$0.00	\$0.00	\$0.00	0.00	0	0	0.00
		2	60W Incandescent High Hat	8736	60	0.12	1048.32	\$160.39	2	18W CFL Lamp	18	0.04	314.496	\$48.12	\$5.75	\$11.50	0.08	733.824	112.275072	0.10
12	Room 224	6	2'x4' 2L T8 32W, Recessed, Electronic Ballast, Prismatic Lens	8736	58	0.35	3040.128	\$465.14	6	No Change Required	0	0.00	0	\$0.00	\$0.00	\$0.00	0.00	0	0	0.00
		2	2'x2' 2L T8 U-Tube 32W Electronic Ballast, Pendant Light	8736	73	0.15	1275.456	\$195.14	2	No Change Required	0	0.00	0	\$0.00	\$0.00	\$0.00	0.00	0	0	0.00
13	Room 223	3	2'x4' 2L T8 32W, Recessed, Electronic Ballast, Prismatic Lens	8736	58	0.17	1520.064	\$232.57	3	No Change Required	0	0.00	0	\$0.00	\$0.00	\$0.00	0.00	0	0	0.00
		3	2'x2' 2L T8 U-Tube 32W Electronic Ballast, Pendant Light	8736	73	0.22	1913.184	\$292.72	3	No Change Required	0	0.00	0	\$0.00	\$0.00	\$0.00	0.00	0	0	0.00

			2	100W Incandescent	8736	100	0.20	1747.2	\$267.32	2	18W CFL Lamp	18	0.04	314.496	\$48.12	\$5.75	\$11.50	0.16	1432.704	219.203712	0.05
14		Closet	1	1'x4' 2L T8 32W Industrial Pendant	2080	28	0.03	58.24	\$8.91	1	No Change Required	0	0.00	0	\$0.00	\$0.00	\$0.00	0.00	0	0	0.00
15		Hallway	11	2'x4' 2L T8 32W, Recessed, Electronic Ballast, Prismatic Lens	8736	58	0.64	5573.568	\$852.76	11	No Change Required	0	0.00	0	\$0.00	\$0.00	\$0.00	0.00	0	0	0.00
			1	2'x2' 2L T8 U-Tube 32W Electronic Ballast, Pendant Light	8736	73	0.07	637.728	\$97.57	1	No Change Required	0	0.00	0	\$0.00	\$0.00	\$0.00	0.00	0	0	0.00
			4	18W CFL	8736	18	0.07	628.992	\$96.24	4	No Change Required	0	0.00	0	\$0.00	\$0.00	\$0.00	0.00	0	0	0.00
16		Stairwell	5	2L Biaxial Wall Mount, Magnetic Ballast	8736	30	0.15	1310.4	\$200.49	5	No Change Required	0	0.00	0	\$0.00	\$0.00	\$0.00	0.00	0	0	0.00
			3	4' 2L T8 32W, Electronic Ballast, Prismatic Lens, Surface Mount	8736	58	0.17	1520.064	\$232.57	3	No Change Required	0	0.00	0	\$0.00	\$0.00	\$0.00	0.00	0	0	0.00
			2	100W Incandescent	8736	100	0.20	1747.2	\$267.32	2	18W CFL Lamp	18	0.04	314.496	\$48.12	\$5.75	\$11.50	0.16	1432.704	219.203712	0.05
17		B02	4	4' 2L T8 32W, Electronic Ballast, Prismatic Lens, Surface Mount	8736	58	0.23	2026.752	\$310.09	4	No Change Required	0	0.00	0	\$0.00	\$0.00	\$0.00	0.00	0	0	0.00
18		Parking Garage	9	300W Orange High Pressure Sodium	8736	300	2.70	23587.2	\$3,608.84	9	3-Lamp T-5 HO Cooper F-Bay	182	1.64	14309.57	\$2,189.36	\$300.00	\$2,700.00	1.06	9277.632	1419.477696	1.90
			30	300W Light Orange High Pressure Sodium	8736	300	9.00	78624	\$12,029.47	30	3-Lamp T-5 HO Cooper F-Bay	182	5.46	47698.56	\$7,297.88	\$300.00	\$9,000.00	3.54	30925.44	4731.59232	1.90
19		Electrical	2	8' 2L T12 60W Industrial, Magnetic Ballast	2080	58	0.12	241.28	\$36.92	2	No Change Required	0	0.00	0	\$0.00	\$0.00	\$0.00	0.00	0	0	0.00
20		Basement Room	12	4' 2L T8 32W, Electronic Ballast, Prismatic Lens, Surface Mount	2080	58	0.70	1447.68	\$221.50	12	No Change Required	0	0.00	0	\$0.00	\$0.00	\$0.00	0.00	0	0	0.00
21		1st Floor Offices	56	2'x4' 2L T8 32W, Recessed, Electronic Ballast, Prismatic Lens	8736	58	3.25	28374.53	\$4,341.30	56	No Change Required	0	0.00	0	\$0.00	\$0.00	\$0.00	0.00	0	0	0.00
22		Bathroom	1	4' 2L T8 32W Electronic Ballast, Egg Crate Wall Mount	8736	58	0.06	506.688	\$77.52	1	No Change Required	0	0.00	0	\$0.00	\$0.00	\$0.00	0.00	0	0	0.00
23		Server Room	4	2'x4' 2L T8 32W, Recessed, Electronic Ballast, Prismatic Lens	8736	58	0.23	2026.752	\$310.09	4	No Change Required	0	0.00	0	\$0.00	\$0.00	\$0.00	0.00	0	0	0.00
24		Closet	2	4' 2L T8 32W, Electronic Ballast, Prismatic Lens, Surface Mount	2080	58	0.12	241.28	\$36.92	2	No Change Required	0	0.00	0	\$0.00	\$0.00	\$0.00	0.00	0	0	0.00
25		Bathroom	1	4' 2L T8 32W Electronic Ballast, Egg Crate Wall Mount	8736	58	0.06	506.688	\$77.52	1	No Change Required	0	0.00	0	\$0.00	\$0.00	\$0.00	0.00	0	0	0.00
26		Muster Room Lounge	24	2'x4' 2L T8 32W, Recessed, Electronic Ballast, Prismatic Lens	8736	58	1.39	12160.51	\$1,860.56	24	No Change Required	0	0.00	0	\$0.00	\$0.00	\$0.00	0.00	0	0	0.00
			1	4' 2L T8 32W, Electronic Ballast, Prismatic Lens, Surface Mount	8736	58	0.06	506.688	\$77.52	1	No Change Required	0	0.00	0	\$0.00	\$0.00	\$0.00	0.00	0	0	0.00
27		Hallway	4	2'x4' 2L T8 32W, Recessed, Electronic Ballast, Prismatic Lens	8736	58	0.23	2026.752	\$310.09	4	No Change Required	0	0.00	0	\$0.00	\$0.00	\$0.00	0.00	0	0	0.00
			3	100W Incandescent High Hat	8736	100	0.30	2620.8	\$400.98	3	18 W CFL Lamp	18	0.05	471.744	\$72.18	\$5.75	\$17.25	0.25	2149.056	328.805568	0.05

28	Shift Commander	16	4' 2L T8 32W, Electronic Ballast, Industrial	8736	58	0.93	8107.008	\$1,240.37	16	No Change Required	0	0.00	0	\$0.00	\$0.00	\$0.00	0.00	0	0	0.00
		10	2'x4' 2L T8 32W, Recessed, Electronic Ballast, Prismatic Lens	8736	58	0.58	5066.88	\$775.23	10	No Change Required	0	0.00	0	\$0.00	\$0.00	\$0.00	0.00	0	0	0.00
29	Dispatch	16	65W Track Flood Lights	8736	65	1.04	9085.44	\$1,390.07	16	18W CFL Lamp	18	0.29	2515.968	\$384.94	\$5.75	\$92.00	0.75	6569.472	1005.129216	0.09
		4	2'x4' 2L T8 32W, Recessed, Electronic Ballast, Prismatic Lens	8736	58	0.23	2026.752	\$310.09	4	No Change Required	0	0.00	0	\$0.00	\$0.00	\$0.00	0.00	0	0	0.00
30	Room 110	1	14W CFL	8736	14	0.01	122.304	\$18.71	1	No Change Required	0	0.00	0	\$0.00	\$0.00	\$0.00	0.00	0	0	0.00
		1	2'x4' 2L T8 32W, Recessed, Electronic Ballast, Prismatic Lens	8736	58	0.06	506.688	\$77.52	1	No Change Required	0	0.00	0	\$0.00	\$0.00	\$0.00	0.00	0	0	0.00
31	Cell Area	7	100W Metal Halide	8736	100	0.70	6115.2	\$935.63	7	28 W CFL Lamp	28	0.20	1712.256	\$261.98	\$6.88	\$48.16	0.50	4402.944	673.650432	0.07
		6	60W Incandescent	8736	60	0.36	3144.96	\$481.18	6	18 W CFL Lamp	18	0.11	943.488	\$144.35	\$5.75	\$34.50	0.25	2201.472	336.825216	0.10
		1	4' 2L T8 32W, Electronic Ballast, Industrial	8736	28	0.03	244.608	\$37.43	1	No Change Required	0	0.00	0	\$0.00	\$0.00	\$0.00	0.00	0	0	0.00
		2	18W CFL	8736	18	0.04	314.496	\$48.12	2	No Change Required	0	0.00	0	\$0.00	\$0.00	\$0.00	0.00	0	0	0.00
32	Restroom	1	4' 2L T8 32W Electronic Ballast, Egg Crate Wall Mount	8736	58	0.06	506.688	\$77.52	1	No Change Required	0	0.00	0	\$0.00	\$0.00	\$0.00	0.00	0	0	0.00
		10	2'x4' 2L T8 32W, Recessed, Electronic Ballast, Prismatic Lens	8736	58	0.58	5066.88	\$775.23	10	No Change Required	0	0.00	0	\$0.00	\$0.00	\$0.00	0.00	0	0	0.00
33	Stairwell	5	100W Incandescent	8736	100	0.50	4368	\$668.30	5	18 W CFL Lamp	18	0.09	786.24	\$120.29	\$5.75	\$28.75	0.41	3581.76	548.00928	0.05
34	Car Port	7	2'x4' 2L T8 32W, Recessed, Electronic Ballast, Prismatic Lens	8736	58	0.41	3546.816	\$542.66	7	No Change Required	0	0.00	0	\$0.00	\$0.00	\$0.00	0.00	0	0	0.00
35	Stairwell	4	28W CFL Surface Mount	8736	28	0.11	978.432	\$149.70	4	No Change Required	0	0.00	0	\$0.00	\$0.00	\$0.00	0.00	0	0	0.00
		1	Biaxial Fluorescent	8736	30	0.03	262.08	\$40.10	1	No Change Required	0	0.00	0	\$0.00	\$0.00	\$0.00	0.00	0	0	0.00
36	Shooting Range	7	8' 2L T12 60W Industrial, Magnetic Ballast	2080	210	1.47	3057.6	\$467.81	7	8' 2-Lamp T-8 Cooper Metalux, Electronic Ballast M/N 8TDM-232-UNV-EB81-U	118	0.83	1718.08	\$262.87	\$207.00	\$1,449.00	0.64	1339.52	204.94656	7.07
		1	4' 2L T12 94W Industrial, Magnetic Ballast	2080	94	0.09	195.52	\$29.91	1	4' - 2-Lamp 32W T-8 Industrial Strip w/ Elect Ballast; Metalux M/N SNF232	73	0.07	151.84	\$23.23	\$123.00	\$123.00	0.02	43.68	6.68304	18.40
		18	100W Incandescent	2080	100	1.80	3744	\$572.83	18	18 W CFL Lamp	18	0.32	673.92	\$103.11	\$5.75	\$103.50	1.48	3070.08	469.72224	0.22
37	Storage	8	100W Incandescent	2080	100	0.80	1664	\$254.59	8	18 W CFL Lamp	18	0.14	299.52	\$45.83	\$5.75	\$46.00	0.66	1364.48	208.76544	0.22
	Totals	499				40.99	323588.9	\$49,509.11	499			9.31	72224.67	\$11,050.37		\$13,676.66	9.98	68524.77	\$10,484.29	1.30

INVESTMENT GRADE LIGHTING AUDIT

CONCORD ENERGY SERVICES

CEG Job #: 9C09059
 Project: City of Passaic Energy Audit
 Address: 330 Passaic Street
 City: Passaic
 Building SF: 8,500

"Passaic Senior Citizen Building"

DATE: 10/12/2009
 KWH COST: \$0.153

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	Kitchen	7	2'x4' 2L T8 32W, Recessed, Electronic Ballast, Prismatic Lens	2080	58	0.41	844.48	\$129.21	7	No Change Required	0	0.00	0	0	\$0.00	\$0.00	0.00	0	0	0	0.00		
		34	4' 2L T8 32W, Electronic Ballast, Prismatic Lens, Surface Mount	2080	58	1.97	4101.76	\$627.57	34	No Change Required	0	0.00	0	\$0.00	\$0.00	\$0.00	0.00	0	0	0	0.00		
		1	13W Porcelain CFL	2080	13	0.01	27.04	\$4.14	1	No Change Required	0	0.00	0	\$0.00	\$0.00	\$0.00	0.00	0	0	0	0.00		
		14	18W CFL	2080	18	0.25	524.16	\$80.20	14	No Change Required	0	0.00	0	\$0.00	\$0.00	\$0.00	0.00	0	0	0	0.00		
		16	4' 2L T8 32W, Electronic Ballast, Parabolic Lens	2080	58	0.93	1930.24	\$295.33	16	No Change Required	0	0.00	0	\$0.00	\$0.00	\$0.00	0.00	0	0	0	0.00		
2	Office	4	2'x4' 2L T8 32W, Recessed, Electronic Ballast, Prismatic Lens	2080	58	0.23	482.56	\$73.83	4	No Change Required	0	0.00	0	\$0.00	\$0.00	\$0.00	0.00	0	0	0	0.00		
3	Mens Room	3	2'x2' 2L T5 24W Prismatic Lens Electronic Ballast	2080	55	0.17	343.2	\$52.51	3	No Change Required	0	0.00	0	\$0.00	\$0.00	\$0.00	0.00	0	0	0	0.00		
4	Womens Room	3	2'x2' 2L T5 24W Prismatic Lens Electronic Ballast	2080	55	0.17	343.2	\$52.51	3	No Change Required	0	0.00	0	\$0.00	\$0.00	\$0.00	0.00	0	0	0	0.00		
5	Vestibule	1	100W Mercury Vapor High Hat	2080	100	0.10	208	\$31.82	1	28W CFL Lamp	28	0.03	58.24	\$8.91	\$6.88	\$6.88	0.07	149.76	22.91328	0.30			
6	Lobby/ Hall	22	18W CFL	2080	18	0.40	823.68	\$126.02	22	No Change Required	0	0.00	0	\$0.00	\$0.00	\$0.00	0.00	0	0	0	0.00		
7	Office	6	2'x4' 2L T8 32W, Recessed, Electronic Ballast, Prismatic Lens	2080	58	0.35	723.84	\$110.75	6	No Change Required	0	0.00	0	\$0.00	\$0.00	\$0.00	0.00	0	0	0	0.00		
8	Office	8	2'x4' 2L T8 32W, Recessed, Electronic Ballast, Prismatic Lens	2080	58	0.46	965.12	\$147.66	8	No Change Required	0	0.00	0	\$0.00	\$0.00	\$0.00	0.00	0	0	0	0.00		
9	Closet	1	4' 2L T8 32W, Electronic Ballast, Prismatic Lens, Surface Mount	2080	58	0.06	120.64	\$18.46	1	No Change Required	0	0.00	0	\$0.00	\$0.00	\$0.00	0.00	0	0	0	0.00		
10	Rec Room	24	2'x4' 2L T8 32W, Recessed, Electronic Ballast, Prismatic Lens	2080	58	1.39	2895.36	\$442.99	24	No Change Required	0	0.00	0	\$0.00	\$0.00	\$0.00	0.00	0	0	0	0.00		
Totals		144				6.89	14333.3	\$2,192.99	144			0.03	58.24	\$8.91		\$6.88	0.07	149.76	\$22.91	0.30			

Project Name: LGEA Solar PV Project - City of Passaic Municipal Complex									
Location: Passaic, NJ									
Description: Photovoltaic System 95% Financing - 20 year									
Simple Payback Analysis									
		Photovoltaic System 95% Financing - 20 year							
Total Construction Cost		\$1,931,310							
Annual kWh Production		247,969							
Annual Energy Cost Reduction		\$37,939							
Annual SREC Revenue		\$86,789							
First Cost Premium		\$1,931,310							
Simple Payback:		15.48 Years							
Life Cycle Cost Analysis									
Analysis Period (years):	25							Financing %:	95%
Financing Term (mths):	240							Maintenance Escalation Rate:	3.0%
Average Energy Cost (\$/kWh)	\$0.153							Energy Cost Escalation Rate:	3.0%
Financing Rate:	7.00%							SREC Value (\$/kWh)	\$0.350
Period	Additional Cash Outlay	Energy kWh Production	Energy Cost Savings	Additional Maint Costs	SREC Revenue	Interest Expense	Loan Principal	Net Cash Flow	Cumulative Cash Flow
0	\$96,566	0	0	0	\$0	0	0	(96,566)	0
1	\$0	247,969	\$37,939	\$0	\$86,789	\$127,049	\$43,648	(\$45,969)	(\$142,534)
2	\$0	246,729	\$39,077	\$0	\$86,355	\$123,894	\$46,803	(\$45,264)	(\$187,799)
3	\$0	245,496	\$40,250	\$0	\$85,923	\$120,511	\$50,186	(\$44,524)	(\$232,322)
4	\$0	244,268	\$41,457	\$0	\$85,494	\$116,883	\$53,814	(\$43,746)	(\$276,068)
5	\$0	243,047	\$42,701	\$2,503	\$85,066	\$112,993	\$57,705	(\$45,433)	(\$321,502)
6	\$0	241,831	\$43,982	\$2,491	\$84,641	\$108,821	\$61,876	(\$44,565)	(\$366,066)
7	\$0	240,622	\$45,301	\$2,478	\$84,218	\$104,348	\$66,349	(\$43,656)	(\$409,723)
8	\$0	239,419	\$46,661	\$2,466	\$83,797	\$99,552	\$71,145	(\$42,706)	(\$452,429)
9	\$0	238,222	\$48,060	\$2,454	\$83,378	\$94,409	\$76,289	(\$41,713)	(\$494,141)
10	\$0	237,031	\$49,502	\$2,441	\$82,961	\$88,894	\$81,803	(\$40,676)	(\$534,817)
11	\$0	235,846	\$50,987	\$2,429	\$82,546	\$82,980	\$87,717	(\$39,593)	(\$574,410)
12	\$0	234,667	\$52,517	\$2,417	\$82,133	\$76,639	\$94,058	(\$38,464)	(\$612,874)
13	\$0	233,493	\$54,092	\$2,405	\$81,723	\$69,840	\$100,858	(\$37,287)	(\$650,161)
14	\$0	232,326	\$55,715	\$2,393	\$81,314	\$62,549	\$108,149	(\$36,061)	(\$686,222)
15	\$0	231,164	\$57,387	\$2,381	\$80,907	\$54,730	\$115,967	(\$34,784)	(\$721,006)
16	\$0	230,008	\$59,108	\$2,369	\$80,503	\$46,347	\$124,350	(\$33,455)	(\$754,461)
17	\$0	228,858	\$60,881	\$2,357	\$80,100	\$37,358	\$133,339	(\$32,073)	(\$786,533)
18	\$0	227,714	\$62,708	\$2,345	\$79,700	\$27,719	\$142,978	(\$30,635)	(\$817,168)
19	\$0	226,575	\$64,589	\$2,334	\$79,301	\$17,383	\$153,314	(\$29,140)	(\$846,309)
20	\$0	225,443	\$66,527	\$2,322	\$78,905	\$6,300	\$164,397	(\$27,587)	(\$873,896)
21	\$0	224,315	\$68,523	\$2,310	\$78,510	\$5,341	\$175,131	(\$11,750)	(\$885,646)
22	\$0	223,194	\$70,578	\$2,299	\$78,118	\$3,656	\$186,667	\$18,374	(\$867,272)
23	\$0	222,078	\$72,696	\$2,287	\$77,727	\$0	\$0	\$148,135	(\$719,136)
24	\$0	220,967	\$74,876	\$2,276	\$77,339	\$0	\$0	\$149,939	(\$569,197)
25	\$0	219,863	\$77,123	\$2,265	\$76,952	\$0	\$0	\$151,810	(\$417,387)
Totals:		4,730,729	\$1,019,442	\$38,587	\$1,655,755	\$1,579,197	\$1,834,744	\$2,110,243	(\$14,199,078)
Net Present Value (NPV)								(\$384,184)	
Internal Rate of Return (IRR)								#DIV/0!	

Project Name: LGEA Solar PV Project - City of Passaic Municipal Complex									
Location: Passaic, NJ									
Description: Photovoltaic System 95% Financing - 20 year									
Simple Payback Analysis									
		Photovoltaic System 95% Financing - 20 year							
Total Construction Cost		\$1,049,490							
Annual kWh Production		134,748							
Annual Energy Cost Reduction		\$20,616							
Annual SREC Revenue		\$47,162							
First Cost Premium		\$1,049,490							
Simple Payback:		15.48 Years							
Life Cycle Cost Analysis									
Analysis Period (years):	25							Financing %:	95%
Financing Term (mths):	240							Maintenance Escalation Rate:	3.0%
Average Energy Cost (\$/kWh)	\$0.153							Energy Cost Escalation Rate:	3.0%
Financing Rate:	7.00%							SREC Value (\$/kWh)	\$0.350
Period	Additional Cash Outlay	Energy kWh Production	Energy Cost Savings	Additional Maint Costs	SREC Revenue	Interest Expense	Loan Principal	Net Cash Flow	Cumulative Cash Flow
0	\$52,475	0	0	0	\$0	0	0	(52,475)	0
1	\$0	134,748	\$20,616	\$0	\$47,162	\$69,040	\$23,719	(\$24,980)	(\$77,454)
2	\$0	134,074	\$21,235	\$0	\$46,926	\$67,325	\$25,433	(\$24,597)	(\$102,052)
3	\$0	133,404	\$21,872	\$0	\$46,691	\$65,487	\$27,272	(\$24,195)	(\$126,247)
4	\$0	132,737	\$22,528	\$0	\$46,458	\$63,515	\$29,243	(\$23,772)	(\$150,019)
5	\$0	132,073	\$23,204	\$1,360	\$46,226	\$61,401	\$31,357	(\$24,689)	(\$174,708)
6	\$0	131,413	\$23,900	\$1,354	\$45,994	\$59,134	\$33,624	(\$24,217)	(\$198,925)
7	\$0	130,756	\$24,617	\$1,347	\$45,765	\$56,704	\$36,055	(\$23,723)	(\$222,648)
8	\$0	130,102	\$25,356	\$1,340	\$45,536	\$54,097	\$38,661	(\$23,207)	(\$245,855)
9	\$0	129,451	\$26,116	\$1,333	\$45,308	\$51,302	\$41,456	(\$22,667)	(\$268,522)
10	\$0	128,804	\$26,900	\$1,327	\$45,081	\$48,306	\$44,453	(\$22,104)	(\$290,626)
11	\$0	128,160	\$27,707	\$1,320	\$44,856	\$45,092	\$47,666	(\$21,515)	(\$312,141)
12	\$0	127,519	\$28,538	\$1,313	\$44,632	\$41,646	\$51,112	(\$20,902)	(\$333,043)
13	\$0	126,882	\$29,394	\$1,307	\$44,409	\$37,951	\$54,807	(\$20,262)	(\$353,306)
14	\$0	126,247	\$30,276	\$1,300	\$44,187	\$33,989	\$58,769	(\$19,596)	(\$372,902)
15	\$0	125,616	\$31,184	\$1,294	\$43,966	\$29,741	\$63,017	(\$18,902)	(\$391,804)
16	\$0	124,988	\$32,120	\$1,287	\$43,746	\$25,185	\$67,573	(\$18,180)	(\$409,984)
17	\$0	124,363	\$33,083	\$1,281	\$43,527	\$20,301	\$72,458	(\$17,429)	(\$427,413)
18	\$0	123,741	\$34,076	\$1,275	\$43,309	\$15,063	\$77,696	(\$16,647)	(\$444,060)
19	\$0	123,123	\$35,098	\$1,268	\$43,093	\$9,446	\$83,312	(\$15,835)	(\$459,895)
20	\$0	122,507	\$36,151	\$1,262	\$42,877	\$3,423	\$89,335	(\$14,992)	(\$474,887)
21	\$0	121,894	\$37,236	\$1,256	\$42,663	\$2,902	\$82,126	(\$6,385)	(\$481,272)
22	\$0	121,285	\$38,353	\$1,249	\$42,450	\$1,986	\$67,582	\$9,985	(\$471,288)
23	\$0	120,679	\$39,503	\$1,243	\$42,237	\$0	\$0	\$80,498	(\$390,790)
24	\$0	120,075	\$40,688	\$1,237	\$42,026	\$0	\$0	\$81,478	(\$309,312)
25	\$0	119,475	\$41,909	\$1,231	\$41,816	\$0	\$0	\$82,495	(\$226,817)
Totals:		2,570,709	\$553,972	\$20,968	\$899,748	\$858,149	\$997,015	\$1,146,724	(\$7,715,971)
Net Present Value (NPV)							(\$208,760)		
Internal Rate of Return (IRR)							#DIV/0!		

Project Name: LGEA Solar PV Project - City of Passaic Municipal Complex									
Location: Passaic, NJ									
Description: Photovoltaic System 95% Financing - 20 year									
Simple Payback Analysis									
		Photovoltaic System 95% Financing - 20 year							
Total Construction Cost		\$645,840							
Annual kWh Production		82,922							
Annual Energy Cost Reduction		\$12,687							
Annual SREC Revenue		\$29,023							
First Cost Premium		\$645,840							
Simple Payback:		15.48 Years							
Life Cycle Cost Analysis									
Analysis Period (years):	25							Financing %:	95%
Financing Term (mths):	240							Maintenance Escalation Rate:	3.0%
Average Energy Cost (\$/kWh)	\$0.153							Energy Cost Escalation Rate:	3.0%
Financing Rate:	7.00%							SREC Value (\$/kWh)	\$0.350
Period	Additional Cash Outlay	Energy kWh Production	Energy Cost Savings	Additional Maint Costs	SREC Revenue	Interest Expense	Loan Principal	Net Cash Flow	Cumulative Cash Flow
0	\$32,292	0	0	0	\$0	0	0	(32,292)	0
1	\$0	82,922	\$12,687	\$0	\$29,023	\$42,486	\$14,596	(\$15,372)	(\$47,664)
2	\$0	82,507	\$13,068	\$0	\$28,878	\$41,431	\$15,651	(\$15,137)	(\$62,801)
3	\$0	82,095	\$13,460	\$0	\$28,733	\$40,299	\$16,783	(\$14,889)	(\$77,690)
4	\$0	81,684	\$13,863	\$0	\$28,590	\$39,086	\$17,996	(\$14,629)	(\$92,319)
5	\$0	81,276	\$14,279	\$837	\$28,447	\$37,785	\$19,297	(\$15,193)	(\$107,512)
6	\$0	80,870	\$14,708	\$833	\$28,304	\$36,390	\$20,692	(\$14,903)	(\$122,415)
7	\$0	80,465	\$15,149	\$829	\$28,163	\$34,895	\$22,187	(\$14,599)	(\$137,014)
8	\$0	80,063	\$15,603	\$825	\$28,022	\$33,291	\$23,791	(\$14,281)	(\$151,295)
9	\$0	79,663	\$16,072	\$821	\$27,882	\$31,571	\$25,511	(\$13,949)	(\$165,244)
10	\$0	79,264	\$16,554	\$816	\$27,742	\$29,726	\$27,355	(\$13,602)	(\$178,846)
11	\$0	78,868	\$17,050	\$812	\$27,604	\$27,749	\$29,333	(\$13,240)	(\$192,086)
12	\$0	78,474	\$17,562	\$808	\$27,466	\$25,628	\$31,454	(\$12,863)	(\$204,949)
13	\$0	78,081	\$18,089	\$804	\$27,328	\$23,355	\$33,727	(\$12,469)	(\$217,418)
14	\$0	77,691	\$18,631	\$800	\$27,192	\$20,917	\$36,165	(\$12,059)	(\$229,477)
15	\$0	77,302	\$19,190	\$796	\$27,056	\$18,302	\$38,780	(\$11,632)	(\$241,109)
16	\$0	76,916	\$19,766	\$792	\$26,921	\$15,499	\$41,583	(\$11,188)	(\$252,297)
17	\$0	76,531	\$20,359	\$788	\$26,786	\$12,493	\$44,589	(\$10,725)	(\$263,022)
18	\$0	76,149	\$20,970	\$784	\$26,652	\$9,269	\$47,813	(\$10,244)	(\$273,266)
19	\$0	75,768	\$21,599	\$780	\$26,519	\$5,813	\$51,269	(\$9,745)	(\$283,011)
20	\$0	75,389	\$22,247	\$777	\$26,386	\$2,107	\$54,975	(\$9,225)	(\$292,236)
21	\$0	75,012	\$22,914	\$773	\$26,254	\$1,786	\$50,539	(\$8,929)	(\$296,166)
22	\$0	74,637	\$23,602	\$769	\$26,123	\$1,222	\$41,589	\$6,144	(\$290,021)
23	\$0	74,264	\$24,310	\$765	\$25,992	\$0	\$0	\$49,537	(\$240,484)
24	\$0	73,893	\$25,039	\$761	\$25,862	\$0	\$0	\$50,140	(\$190,344)
25	\$0	73,523	\$25,790	\$757	\$25,733	\$0	\$0	\$50,766	(\$139,578)
Totals:		1,581,978	\$340,906	\$12,904	\$553,692	\$528,091	\$613,548	\$705,676	(\$4,748,263)
Net Present Value (NPV)							(\$128,458)		
Internal Rate of Return (IRR)							#DIV/0!		

Project Name: LGEA Solar PV Project - City of Passaic Municipal Complex									
Location: Passaic, NJ									
Description: Photovoltaic System 95% Financing - 20 year									
Simple Payback Analysis									
		Photovoltaic System 95% Financing - 20 year							
Total Construction Cost		\$235,980							
Annual kWh Production		30,298							
Annual Energy Cost Reduction		\$4,636							
Annual SREC Revenue		\$10,604							
First Cost Premium		\$235,980							
Simple Payback:		15.48 Years							
Life Cycle Cost Analysis									
Analysis Period (years):	25							Financing %:	95%
Financing Term (mths):	240							Maintenance Escalation Rate:	3.0%
Average Energy Cost (\$/kWh)	\$0.153							Energy Cost Escalation Rate:	3.0%
Financing Rate:	7.00%							SREC Value (\$/kWh)	\$0.350
Period	Additional Cash Outlay	Energy kWh Production	Energy Cost Savings	Additional Maint Costs	SREC Revenue	Interest Expense	Loan Principal	Net Cash Flow	Cumulative Cash Flow
0	\$11,799	0	0	0	\$0	0	0	(11,799)	0
1	\$0	30,298	\$4,636	\$0	\$10,604	\$15,524	\$5,333	(\$5,617)	(\$17,416)
2	\$0	30,147	\$4,775	\$0	\$10,551	\$15,138	\$5,719	(\$5,531)	(\$22,947)
3	\$0	29,996	\$4,918	\$0	\$10,499	\$14,725	\$6,132	(\$5,440)	(\$28,387)
4	\$0	29,846	\$5,065	\$0	\$10,446	\$14,281	\$6,575	(\$5,345)	(\$33,733)
5	\$0	29,697	\$5,217	\$306	\$10,394	\$13,806	\$7,051	(\$5,552)	(\$39,284)
6	\$0	29,548	\$5,374	\$304	\$10,342	\$13,296	\$7,560	(\$5,445)	(\$44,730)
7	\$0	29,400	\$5,535	\$303	\$10,290	\$12,750	\$8,107	(\$5,334)	(\$50,064)
8	\$0	29,253	\$5,701	\$301	\$10,239	\$12,164	\$8,693	(\$5,218)	(\$55,283)
9	\$0	29,107	\$5,872	\$300	\$10,187	\$11,535	\$9,321	(\$5,097)	(\$60,380)
10	\$0	28,962	\$6,048	\$298	\$10,137	\$10,862	\$9,995	(\$4,970)	(\$65,350)
11	\$0	28,817	\$6,230	\$297	\$10,086	\$10,139	\$10,718	(\$4,838)	(\$70,188)
12	\$0	28,673	\$6,417	\$295	\$10,035	\$9,364	\$11,493	(\$4,700)	(\$74,888)
13	\$0	28,529	\$6,609	\$294	\$9,985	\$8,533	\$12,323	(\$4,556)	(\$79,444)
14	\$0	28,387	\$6,808	\$292	\$9,935	\$7,643	\$13,214	(\$4,406)	(\$83,850)
15	\$0	28,245	\$7,012	\$291	\$9,886	\$6,687	\$14,170	(\$4,250)	(\$88,101)
16	\$0	28,103	\$7,222	\$289	\$9,836	\$5,663	\$15,194	(\$4,088)	(\$92,189)
17	\$0	27,963	\$7,439	\$288	\$9,787	\$4,565	\$16,292	(\$3,919)	(\$96,108)
18	\$0	27,823	\$7,662	\$287	\$9,738	\$3,387	\$17,470	(\$3,743)	(\$99,851)
19	\$0	27,684	\$7,892	\$285	\$9,689	\$2,124	\$18,733	(\$3,561)	(\$103,412)
20	\$0	27,546	\$8,129	\$284	\$9,641	\$770	\$20,087	(\$3,371)	(\$106,783)
21	\$0	27,408	\$8,372	\$282	\$9,593	\$653	\$18,466	(\$1,436)	(\$108,219)
22	\$0	27,271	\$8,624	\$281	\$9,545	\$447	\$15,196	\$2,245	(\$105,974)
23	\$0	27,134	\$8,882	\$279	\$9,497	\$0	\$0	\$18,100	(\$87,874)
24	\$0	26,999	\$9,149	\$278	\$9,450	\$0	\$0	\$18,320	(\$69,554)
25	\$0	26,864	\$9,423	\$277	\$9,402	\$0	\$0	\$18,549	(\$51,005)
Totals:		578,022	\$124,560	\$4,715	\$202,308	\$192,956	\$224,181	\$257,843	(\$1,735,015)
Net Present Value (NPV)								(\$46,924)	
Internal Rate of Return (IRR)								#DIV/0!	

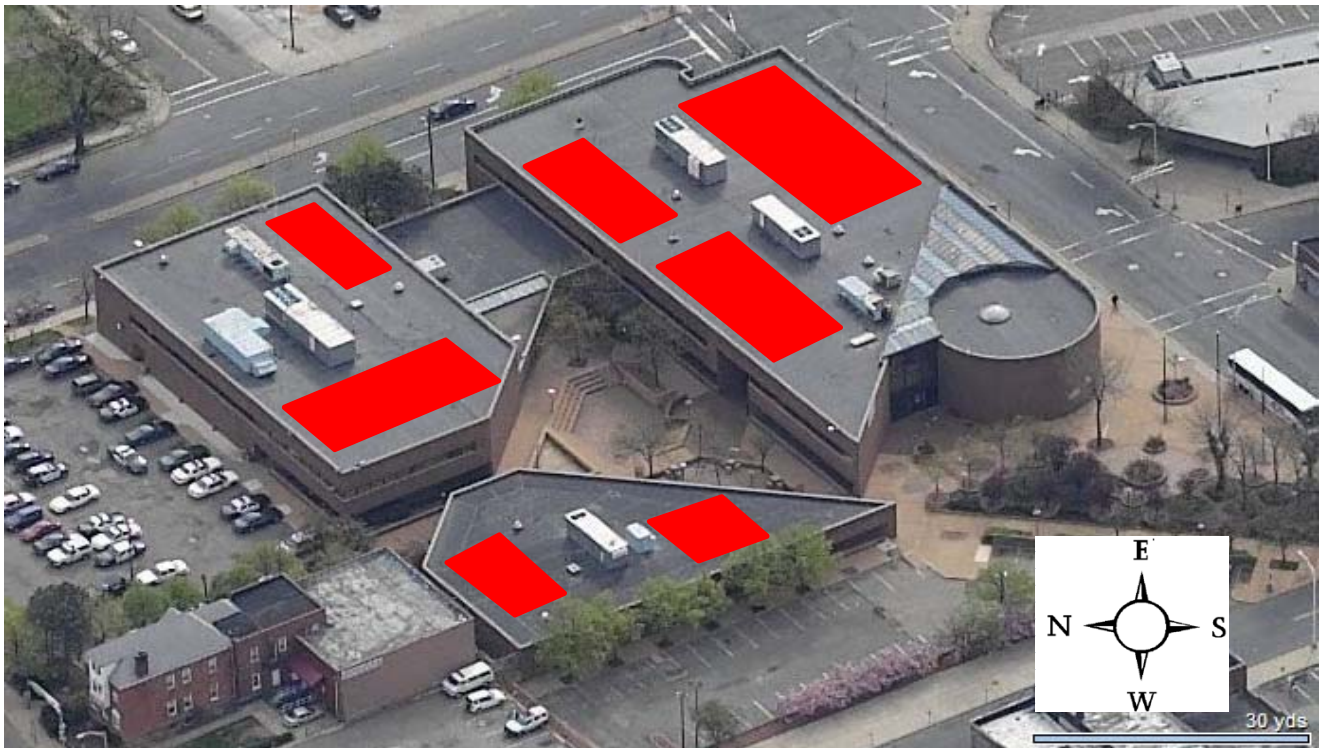
Project Name: LGEA Solar PV Project - City of Passaic Municipal Complex							
Location: Passaic, NJ							
Description: Photovoltaic System - Direct Purchase							
Simple Payback Analysis							
		Photovoltaic System - Direct Purchase					
Total Construction Cost		\$1,931,310					
Annual kWh Production		247,969					
Annual Energy Cost Reduction		\$37,939					
Annual SREC Revenue		\$86,789					
First Cost Premium		\$1,931,310					
Simple Payback:		15.48 Years					
Life Cycle Cost Analysis							
Analysis Period (years):	25					Financing %:	0%
Financing Term (mths):	0					Maintenance Escalation Rate:	3.0%
Average Energy Cost (\$/kWh)	\$0.153					Energy Cost Escalation Rate:	3.0%
Financing Rate:	0.00%					SREC Value (\$/kWh)	\$0.350
Period	Additional Cash Outlay	Energy kWh Production	Energy Cost Savings	Additional Maint Costs	SREC Revenue	Net Cash Flow	Cumulative Cash Flow
0	\$1,931,310	0	0	0	\$0	(1,931,310)	0
1	\$0	247,969	\$37,939	\$0	\$86,789	\$124,728	(\$1,806,582)
2	\$0	246,729	\$39,077	\$0	\$86,355	\$125,433	(\$1,681,149)
3	\$0	245,496	\$40,250	\$0	\$85,923	\$126,173	(\$1,554,976)
4	\$0	244,268	\$41,457	\$0	\$85,494	\$126,951	(\$1,428,025)
5	\$0	243,047	\$42,701	\$2,503	\$85,066	\$125,264	(\$1,302,761)
6	\$0	241,831	\$43,982	\$2,491	\$84,641	\$126,132	(\$1,176,629)
7	\$0	240,622	\$45,301	\$2,478	\$84,218	\$127,041	(\$1,049,588)
8	\$0	239,419	\$46,661	\$2,466	\$83,797	\$127,991	(\$921,597)
9	\$0	238,222	\$48,060	\$2,454	\$83,378	\$128,984	(\$792,612)
10	\$0	237,031	\$49,502	\$2,441	\$82,961	\$130,022	(\$662,591)
11	\$0	235,846	\$50,987	\$2,429	\$82,546	\$131,104	(\$531,487)
12	\$0	234,667	\$52,517	\$2,417	\$82,133	\$132,233	(\$399,254)
13	\$0	233,493	\$54,092	\$2,405	\$81,723	\$133,410	(\$265,844)
14	\$0	232,326	\$55,715	\$2,393	\$81,314	\$134,636	(\$131,207)
15	\$0	231,164	\$57,387	\$2,381	\$80,907	\$135,913	\$4,706
16	\$0	230,008	\$59,108	\$2,369	\$80,503	\$137,242	\$141,947
17	\$0	228,858	\$60,881	\$2,357	\$80,100	\$138,625	\$280,572
18	\$0	227,714	\$62,708	\$2,345	\$79,700	\$140,062	\$420,634
19	\$0	226,575	\$64,589	\$2,334	\$79,301	\$141,557	\$562,191
20	\$0	225,443	\$66,527	\$2,322	\$78,905	\$143,110	\$705,301
21	\$1	224,315	\$68,523	\$2,310	\$78,510	\$144,722	\$850,023
22	\$2	223,194	\$70,578	\$2,299	\$78,118	\$146,397	\$996,420
23	\$3	222,078	\$72,696	\$2,287	\$77,727	\$148,135	\$1,144,555
24	\$4	220,967	\$74,876	\$2,276	\$77,339	\$149,939	\$1,294,495
25	\$5	219,863	\$77,123	\$2,265	\$76,952	\$151,810	\$1,446,305
Totals:		4,730,729	\$1,019,442	\$38,587	\$1,655,755	\$3,377,615	\$2,636,611
Net Present Value (NPV)						\$1,446,330	
Internal Rate of Return (IRR)						4.7%	

Project Name: LGEA Solar PV Project - City of Passaic Municipal Complex							
Location: Passaic, NJ							
Description: Photovoltaic System - Direct Purchase							
Simple Payback Analysis							
		Photovoltaic System - Direct Purchase					
Total Construction Cost		\$1,049,490					
Annual kWh Production		134,748					
Annual Energy Cost Reduction		\$20,616					
Annual SREC Revenue		\$47,162					
First Cost Premium		\$1,049,490					
Simple Payback:		15.48 Years					
Life Cycle Cost Analysis							
Analysis Period (years):	25					Financing %:	0%
Financing Term (mths):	0					Maintenance Escalation Rate:	3.0%
Average Energy Cost (\$/kWh)	\$0.153					Energy Cost Escalation Rate:	3.0%
Financing Rate:	0.00%					SREC Value (\$/kWh)	\$0.350
Period	Additional Cash Outlay	Energy kWh Production	Energy Cost Savings	Additional Maint Costs	SREC Revenue	Net Cash Flow	Cumulative Cash Flow
0	\$1,049,490	0	0	0	\$0	(1,049,490)	0
1	\$0	134,748	\$20,616	\$0	\$47,162	\$67,778	(\$981,712)
2	\$0	134,074	\$21,235	\$0	\$46,926	\$68,161	(\$913,551)
3	\$0	133,404	\$21,872	\$0	\$46,691	\$68,563	(\$844,987)
4	\$0	132,737	\$22,528	\$0	\$46,458	\$68,986	(\$776,001)
5	\$0	132,073	\$23,204	\$1,360	\$46,226	\$68,069	(\$707,932)
6	\$0	131,413	\$23,900	\$1,354	\$45,994	\$68,541	(\$639,391)
7	\$0	130,756	\$24,617	\$1,347	\$45,765	\$69,035	(\$570,356)
8	\$0	130,102	\$25,356	\$1,340	\$45,536	\$69,551	(\$500,805)
9	\$0	129,451	\$26,116	\$1,333	\$45,308	\$70,091	(\$430,714)
10	\$0	128,804	\$26,900	\$1,327	\$45,081	\$70,655	(\$360,059)
11	\$0	128,160	\$27,707	\$1,320	\$44,856	\$71,243	(\$288,817)
12	\$0	127,519	\$28,538	\$1,313	\$44,632	\$71,856	(\$216,960)
13	\$0	126,882	\$29,394	\$1,307	\$44,409	\$72,496	(\$144,465)
14	\$0	126,247	\$30,276	\$1,300	\$44,187	\$73,162	(\$71,302)
15	\$0	125,616	\$31,184	\$1,294	\$43,966	\$73,856	\$2,554
16	\$0	124,988	\$32,120	\$1,287	\$43,746	\$74,578	\$77,132
17	\$0	124,363	\$33,083	\$1,281	\$43,527	\$75,329	\$152,461
18	\$0	123,741	\$34,076	\$1,275	\$43,309	\$76,111	\$228,572
19	\$0	123,123	\$35,098	\$1,268	\$43,093	\$76,923	\$305,495
20	\$0	122,507	\$36,151	\$1,262	\$42,877	\$77,767	\$383,262
21	\$1	121,894	\$37,236	\$1,256	\$42,663	\$78,643	\$461,905
22	\$2	121,285	\$38,353	\$1,249	\$42,450	\$79,553	\$541,458
23	\$3	120,679	\$39,503	\$1,243	\$42,237	\$80,498	\$621,956
24	\$4	120,075	\$40,688	\$1,237	\$42,026	\$81,478	\$703,434
25	\$5	119,475	\$41,909	\$1,231	\$41,816	\$82,495	\$785,928
Totals:		2,570,709	\$553,972	\$20,968	\$899,748	\$1,835,418	\$1,432,752
Net Present Value (NPV)						\$785,953	
Internal Rate of Return (IRR)						4.7%	

Project Name: LGEA Solar PV Project - City of Passaic Municipal Complex							
Location: Passaic, NJ							
Description: Photovoltaic System - Direct Purchase							
Simple Payback Analysis							
	Photovoltaic System - Direct Purchase						
Total Construction Cost	\$645,840						
Annual kWh Production	82,922						
Annual Energy Cost Reduction	\$12,687						
Annual SREC Revenue	\$29,023						
First Cost Premium	\$645,840						
Simple Payback:	15.48 Years						
Life Cycle Cost Analysis							
Analysis Period (years):	25			Financing %:	0%		
Financing Term (mths):	0			Maintenance Escalation Rate:	3.0%		
Average Energy Cost (\$/kWh)	\$0.153			Energy Cost Escalation Rate:	3.0%		
Financing Rate:	0.00%			SREC Value (\$/kWh)	\$0.350		
Period	Additional Cash Outlay	Energy kWh Production	Energy Cost Savings	Additional Maint Costs	SREC Revenue	Net Cash Flow	Cumulative Cash Flow
0	\$645,840	0	0	0	\$0	(645,840)	0
1	\$0	82,922	\$12,687	\$0	\$29,023	\$41,710	(\$604,130)
2	\$0	82,507	\$13,068	\$0	\$28,878	\$41,945	(\$562,185)
3	\$0	82,095	\$13,460	\$0	\$28,733	\$42,193	(\$519,992)
4	\$0	81,684	\$13,863	\$0	\$28,590	\$42,453	(\$477,539)
5	\$0	81,276	\$14,279	\$837	\$28,447	\$41,889	(\$435,650)
6	\$0	80,870	\$14,708	\$833	\$28,304	\$42,179	(\$393,471)
7	\$0	80,465	\$15,149	\$829	\$28,163	\$42,483	(\$350,988)
8	\$0	80,063	\$15,603	\$825	\$28,022	\$42,801	(\$308,187)
9	\$0	79,663	\$16,072	\$821	\$27,882	\$43,133	(\$265,054)
10	\$0	79,264	\$16,554	\$816	\$27,742	\$43,480	(\$221,574)
11	\$0	78,868	\$17,050	\$812	\$27,604	\$43,842	(\$177,732)
12	\$0	78,474	\$17,562	\$808	\$27,466	\$44,219	(\$133,513)
13	\$0	78,081	\$18,089	\$804	\$27,328	\$44,613	(\$88,900)
14	\$0	77,691	\$18,631	\$800	\$27,192	\$45,023	(\$43,877)
15	\$0	77,302	\$19,190	\$796	\$27,056	\$45,450	\$1,573
16	\$0	76,916	\$19,766	\$792	\$26,921	\$45,894	\$47,467
17	\$0	76,531	\$20,359	\$788	\$26,786	\$46,357	\$93,824
18	\$0	76,149	\$20,970	\$784	\$26,652	\$46,837	\$140,661
19	\$0	75,768	\$21,599	\$780	\$26,519	\$47,337	\$187,998
20	\$0	75,389	\$22,247	\$777	\$26,386	\$47,857	\$235,855
21	\$1	75,012	\$22,914	\$773	\$26,254	\$48,396	\$284,251
22	\$2	74,637	\$23,602	\$769	\$26,123	\$48,956	\$333,207
23	\$3	74,264	\$24,310	\$765	\$25,992	\$49,537	\$382,744
24	\$4	73,893	\$25,039	\$761	\$25,862	\$50,140	\$432,884
25	\$5	73,523	\$25,790	\$757	\$25,733	\$50,766	\$483,650
Totals:		1,581,978	\$340,906	\$12,904	\$553,692	\$1,129,490	\$881,695
Net Present Value (NPV)						\$483,675	
Internal Rate of Return (IRR)						4.7%	

Project Name: LGEA Solar PV Project - City of Passaic Municipal Complex							
Location: Passaic, NJ							
Description: Photovoltaic System - Direct Purchase							
Simple Payback Analysis							
	Photovoltaic System - Direct Purchase						
Total Construction Cost	\$235,980						
Annual kWh Production	30,298						
Annual Energy Cost Reduction	\$4,636						
Annual SREC Revenue	\$10,604						
First Cost Premium	\$235,980						
Simple Payback:	15.48 Years						
Life Cycle Cost Analysis							
Analysis Period (years):	25			Financing %:	0%		
Financing Term (mths):	0			Maintenance Escalation Rate:	3.0%		
Average Energy Cost (\$/kWh)	\$0.153			Energy Cost Escalation Rate:	3.0%		
Financing Rate:	0.00%			SREC Value (\$/kWh)	\$0.350		
Period	Additional Cash Outlay	Energy kWh Production	Energy Cost Savings	Additional Maint Costs	SREC Revenue	Net Cash Flow	Cumulative Cash Flow
0	\$235,980	0	0	0	\$0	(235,980)	0
1	\$0	30,298	\$4,636	\$0	\$10,604	\$15,240	(\$220,740)
2	\$0	30,147	\$4,775	\$0	\$10,551	\$15,326	(\$205,414)
3	\$0	29,996	\$4,918	\$0	\$10,499	\$15,416	(\$189,998)
4	\$0	29,846	\$5,065	\$0	\$10,446	\$15,511	(\$174,486)
5	\$0	29,697	\$5,217	\$306	\$10,394	\$15,305	(\$159,181)
6	\$0	29,548	\$5,374	\$304	\$10,342	\$15,411	(\$143,770)
7	\$0	29,400	\$5,535	\$303	\$10,290	\$15,522	(\$128,247)
8	\$0	29,253	\$5,701	\$301	\$10,239	\$15,639	(\$112,609)
9	\$0	29,107	\$5,872	\$300	\$10,187	\$15,760	(\$96,849)
10	\$0	28,962	\$6,048	\$298	\$10,137	\$15,887	(\$80,962)
11	\$0	28,817	\$6,230	\$297	\$10,086	\$16,019	(\$64,943)
12	\$0	28,673	\$6,417	\$295	\$10,035	\$16,157	(\$48,786)
13	\$0	28,529	\$6,609	\$294	\$9,985	\$16,301	(\$32,486)
14	\$0	28,387	\$6,808	\$292	\$9,935	\$16,450	(\$16,035)
15	\$0	28,245	\$7,012	\$291	\$9,886	\$16,606	\$571
16	\$0	28,103	\$7,222	\$289	\$9,836	\$16,769	\$17,340
17	\$0	27,963	\$7,439	\$288	\$9,787	\$16,938	\$34,278
18	\$0	27,823	\$7,662	\$287	\$9,738	\$17,113	\$51,391
19	\$0	27,684	\$7,892	\$285	\$9,689	\$17,296	\$68,687
20	\$0	27,546	\$8,129	\$284	\$9,641	\$17,486	\$86,173
21	\$1	27,408	\$8,372	\$282	\$9,593	\$17,683	\$103,856
22	\$2	27,271	\$8,624	\$281	\$9,545	\$17,887	\$121,744
23	\$3	27,134	\$8,882	\$279	\$9,497	\$18,100	\$139,843
24	\$4	26,999	\$9,149	\$278	\$9,450	\$18,320	\$158,164
25	\$5	26,864	\$9,423	\$277	\$9,402	\$18,549	\$176,713
Totals:		578,022	\$124,560	\$4,715	\$202,308	\$412,693	\$322,153
Net Present Value (NPV)						\$176,738	
Internal Rate of Return (IRR)						4.7%	

Building	Roof Area (sq ft)	Panel	Qty	Panel Sq Ft	Panel Total Sq Ft	Total KW	Total Annual kWh	Panel Weight (33 lbs)	W/SQFT
Municipal Complex	13700	Sunpower SPR230	933	14.7	13,719	214.59	247,969	30,789	15.64
Administration Building	7450	Sunpower SPR231	507	14.7	7,455	116.61	134,748	16,731	15.64
Police Building	4575	Sunpower SPR232	312	14.7	4,588	71.76	82,922	10,296	15.64
Senior Citizen Center	1675	Sunpower SPR233	114	14.7	1,676	26.22	30,298	3,762	15.64



:= Proposed PV Layout

Notes:

1. Estimated kWh based on 4.68 hours full output per day per 365 day year. Actual kWh will vary day to day.