ENERGY AUDIT – FINAL REPORT

CITY OF HOBOKEN
CITY HALL
94 WASHINGTON STREET
HOBOKEN, NJ 07030
ATTN: MR. JOHN POPE

CEG PROPOSAL NO. 9C08143

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I. EXECUTIVE SUMMARY

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

City of Hoboken
City Hall
94 Washington Street
Hoboken, NJ 07030

Municipal Contact Person: John Pope
Facility Contact Person: Rick Repetti

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	$ 56,556
Natural Gas	$ 45,850
Total	$ 102,406

The potential annual energy cost savings are shown below in Table 1. Be aware that the measures are not additive because of the interrelation of several of the measures. The cost of each measure for this level of auditing is ± 20% until detailed engineering, specifications, and hard proposals are obtained.

Table 1
Energy Conservation Measures (ECM's)

ECM NO.	DESCRIPTION	COST[A]	ANNUAL SAVINGS	SIMPLE PAYBACK (YEARS)	SIMPLE RETURN ON INVESTMENT
1	Lighting Upgrade	$4,070	$3,350	1.2	83.3%
2	Lighting Controls	$2,200	$953	2.3	43.5%
3	Domestic Hot Water Heater Replacement	$4,150	$491.67	8.4	11.9%
4	Weather Seal Replacement	$20	$67.53	0.3	333%
5	Courtroom AC Upgrade	$5,792	$66.88	86.6	1.15

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

The estimated demand and energy savings are shown below in Table 2. The information in this table corresponds to the ECM's in Table 1.

Table 2
Estimated Energy Savings

ECM NO.	DESCRIPTION	ANNUAL UTILITY REDUCTION		
		ELECT DEMAND (KW)	ELECT CONSUMPTION (KWH)	NAT GAS (THERMS)
1	Lighting Upgrade	7.03	19,993	-
2	Lighting Controls	-	6,270	-
3	Domestic Hot Water Heater Replacement	-	92	-
4	Weather Seal Replacement	-	56.85	42.4
5	Courtroom AC Upgrade	-	440	-

Concord Engineering Group (CEG) 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 Hoboken City Hall:

- **ECM #1:** Lighting Upgrade
- **ECM #2:** Lighting Controls
- **ECM #4:** Weather Seal Replacement

II. INTRODUCTION

This comprehensive energy audit covers the 22,500 square foot Hoboken City Hall that includes the City's department offices and the City Court House.

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

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

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

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

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

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

III. METHOD OF ANALYSIS

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

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

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

Cost savings are calculated based on the actual historical energy costs for the facility. Installation costs include labor and equipment 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 SmartStart 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 costs and savings are applied and a simple payback and simple return on investment (ROI) is calculated. The simple payback is based on the years that it takes for the savings to pay back the net installation cost (Net Installation divided by Net Savings.) A simple return on investment is calculated as the percentage of the net installation cost that is saved in one year (Net Savings divided by Net Installation.)

A simple life-time calculation is shown for each ECM. The life-time for each ECM is estimated based on the typical life of the equipment being replaced or altered. The energy savings is extrapolated throughout the life-time of the ECM. The total energy savings is calculated as the total life-time multiplied by the yearly savings.

IV. HISTORIC ENERGY CONSUMPTION/COST

A. Energy Usage / Tariffs

Table 3 and Figure 1 represent the electrical usage for the surveyed facility from Jan-07 to Dec-07. The Owner was able to gather the information for the above-reference period for our review and analysis. During 2007, Public Service Electric & Gas (PSE&G) provided electricity to the facility under the GLP (General Lighting and Power) rate structure. 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.

Table 4 and Figure 2 show the natural gas energy usage for the surveyed facility from Jan-07 to Dec-07. PSE&G supplies the natural gas to the facility under two different rate tariffs, the LVG (Large Volume Gas) rate as well as the GSGH Multi Family rate. Below is the average unit cost for the utilities at this facility.

Based on the utility data provide by the Owner, the average cost for utilities at this facility are as follows:

Description	Average
Electricity	15.2¢ / kWh
Natural Gas	$1.389 / Therm

Table 3
Electricity Billing Data

MONTH OF USE	CONSUMPTION KWH	DEMAND	TOTAL BILL
1/08	29,064	96	$3,428
2/08	30,340	97	$3,574
3/08	30,276	93	$3,605
4/08	27,640	96	$3,355
5/08	26,320	97	$3,232
6/08	31,276	138	$5,644
7/08	36,696	153	$7,207
8/08	42,822	150	$8,022
9/08	36,692	138	$7,117
10/08	29,980	136	$4,624
11/08	24,426	105	$3,344
12/08	26,745	100	$3,403
Totals	**372,277**	**153 Max**	**$56,556**

Figure 1
Electricity Usage Profile

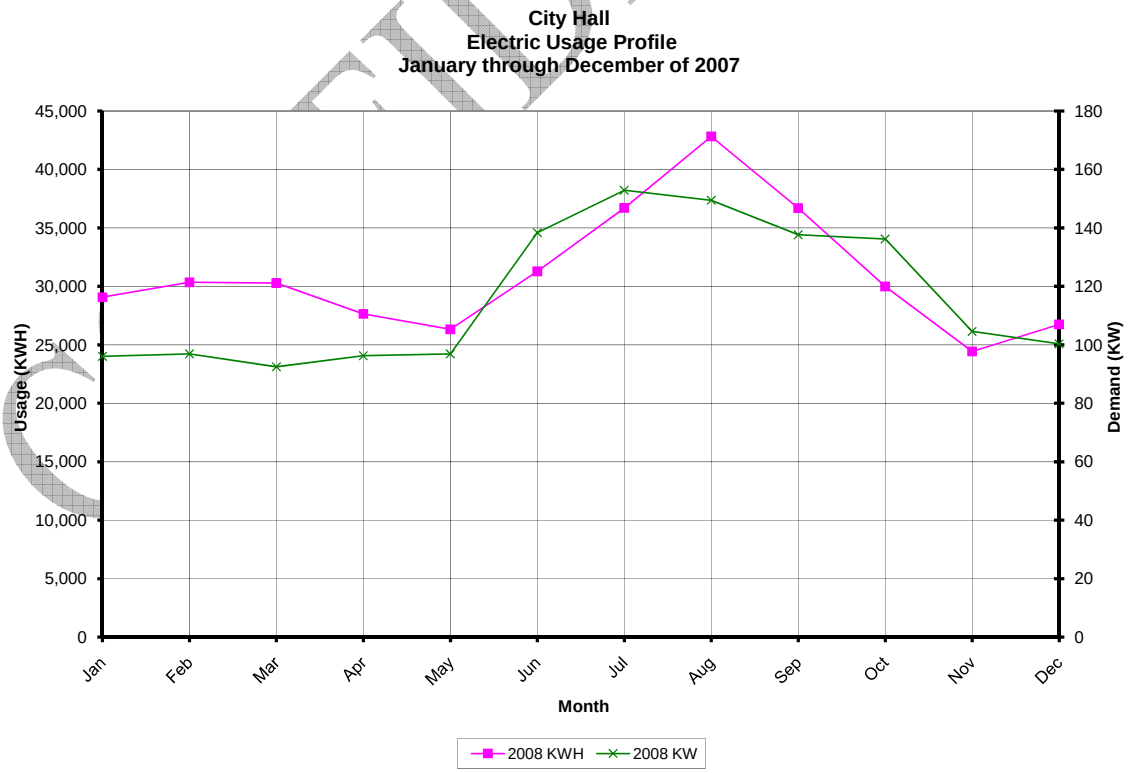
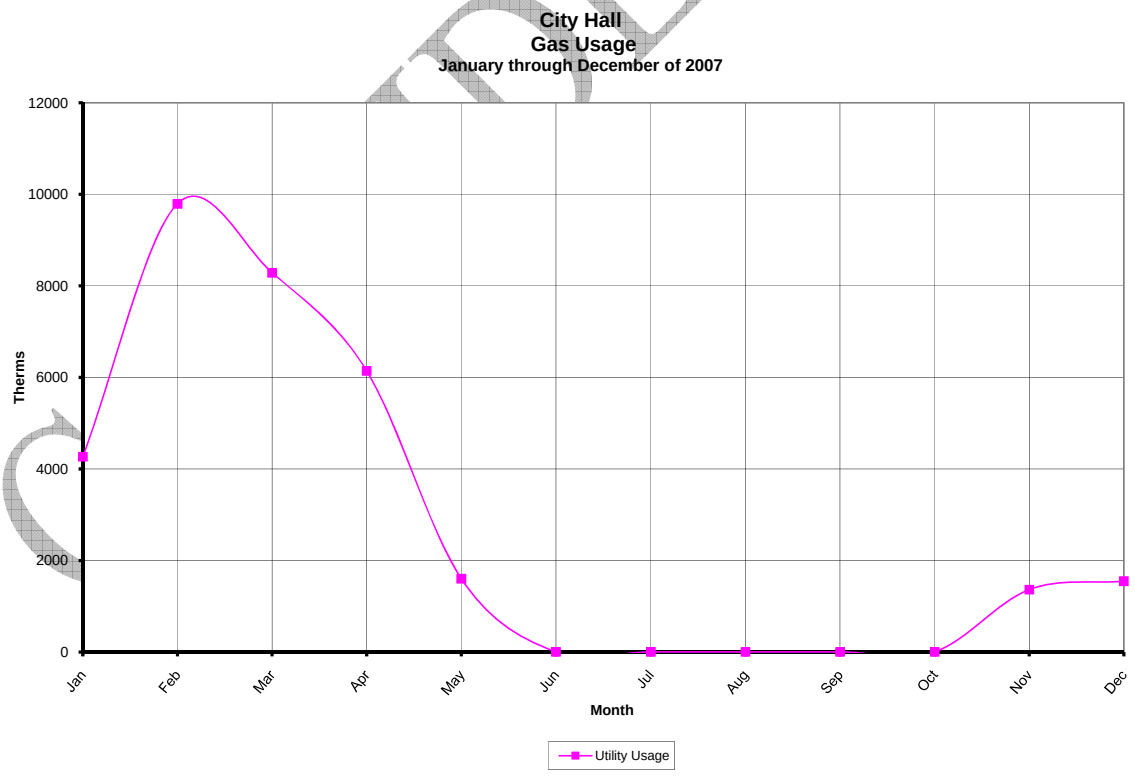


Table 4
Natural Gas Billing Data

MONTH OF USE	CONSUMPTION (THERMS)	TOTAL BILL
1/08	4,268.9	$6,225
2/08	9,796.4	$11,835
3/08	8,286.9	$11,101
4/08	6,141.0	$7,038
5/08	1,598.7	$1,900
6/08	2.1	$105
7/08	2.1	$105
8/08	4.2	$107
9/08	3.2	$106
10/08	2.1	$105
11/08	1,364.5	$2,740
12/08	1,546.8	$4,483
Totals	**33,017**	**$45,850**

Figure 2
Natural Gas Usage Profile



B. Energy Use Index (EUI)

Energy Use Index (EUI) is a measure of a building's energy utilization per square foot of building. This calculation is completed by converting all utility usage (gas, electric, oil) consumed by a building over a specified time period, typically 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 amongst building of similar type. 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. Their website allows the user to determine how well the client's building energy use intensity (EUI) compares with similar facilities throughout the U.S. and in your specific region or state. Figure 3 below depicts a national EUI grading for office buildings. The EUI for this facility is calculated as follows:

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

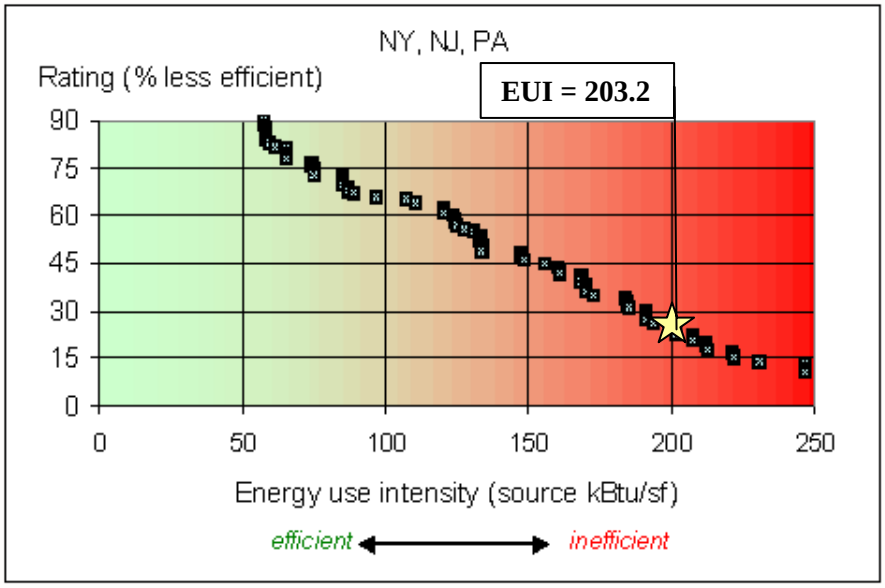
Electric = ((372,277 kWh) * (1000 W/kW) * (3.414 Btu/h / 1 W))/ (1000 Btu/h / 1 kBtu/h)
= 1,270,954 kBtu/h

Gas = ((33,017 therms) * (100,000 Btu/h / 1 W)) / (1000 Btu/h / 1 kBtu/h) = 3,301,700 kBtu/h

$$Building\ \ EUI = \frac{(1{,}270{,}954\ kBtu/h + 3{,}301{,}700\ kBtu/h)}{22{,}500\ SF} = \frac{4{,}572{,}654\ kBtu/h}{22{,}500\ SF}$$

Hoken City Hall EUI = 203.2 kBtu/SF

Figure 3
Energy Use Intensity Distributions: Office



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 you to track and assess 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 more emphasis is being placed throughout multiple arenas 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. Therefore, it is vital that local government municipalities assess their energy usage, benchmark this usage utilizing Portfolio Manager, set priorities and goals to lessen their energy usage and move forward with these priorities and goals. Saving energy will in-turn save the environment.

In accordance with the Local Government Energy Audit Program, CEG has created an Energy Star account for the facility in order to allow the municipal access to monitoring their yearly energy usage as it compares to facilities of similar type. The following is the user name and password for this account:

User Name:	hobokencity
Password:	lgeaceg2009
Security Question:	What is your birth city? hoboken city

Utilizing the utility bills and other information gathered during the energy audit process, CEG entered the respective data into Portfolio Manager and the following is a summary of the results:

Table 5
ENERGY STAR Performance Rating

FACILITY DESCRIPTION	ENERGY PERFORMANCE RATING	NATIONAL AVERAGE
Hoboken City Hall	28	50

Refer to Appendix D for detailed energy benchmarking report entitled “STATEMENT OF ENERGY PERFORMANCE.”

V. FACILITY DESCRIPTION

The 22,500 SF Hoboken City Hall is comprised of departmental offices, the city court house, Mayor's Office and a large attic storage space. This facility typically operates between 50 and 60 hours a week. The building construction is typical throughout. Exterior walls are constructed of brick and block construction. The windows throughout the facility are in decent shape but are in need of maintenance. A complete window and door seal evaluation needs to be completed to fix infiltration and occupant comfort issues in the building. Windows throughout the facility are double pane, ¼" thermal panels with aluminum frames and external blinds. The external blinds are valuable because they help to reduce heat loss in the winter and reduce solar heat gain in the summer. The flat areas of the roof consist of EPDM rubber, the pitched area is of typical metal roofing construction. Two (2) inches of rigid insulation exist below the roof surface, according to the architectural plans.

Heating Plant

The facility is heated via a steam boiler plant located in the basement boiler room. The boiler plant consists of one (1) natural gas-fired, Burnham Series 3 steam boiler, three pass, full wetback, firetube design; this boiler is 5 years old and has a 35 year service life. The boiler has an input capacity of 8,369 MBh with a total output of 6,695 MBh. This boiler is 80% efficient when running at full load. This boiler delivers steam to cast iron radiators throughout the facility. The steam piping is not insulated and in many cases radiators have been removed because of overheating and the un-insulated steam pipe is being utilized to heat the space. The boiler is manually turned on and off to satisfy the building heating needs. Further heating is provided by gas-fired furnaces that are zoned to heat first floor office areas. The majority of these units are manufactured by the Goodman Manufacturing Company.

Cooling System

Cooling for the facility is provided by small residential style cooling units scattered throughout the facility. The Traffic Violations office is conditioned by four (4) Goodman air handling units with remote condensing units. The conference room across from the Violations office is conditioned by an antiquated Fraser-Johnson split system heat pump. This heat pump unit is past it's usefully service life and operates at less than its original efficiency. The construction office has a Trane Air Handling unit mounted in the ceiling above the restroom. The reminder of the buildings cooling needs are satisfied by window air conditioning units, typically having a 1 ½ ton cooling capacity and an EER of 9.9.

Exhaust System

There is no permanent exhaust system in place at the facility. Operable windows satisfy the buildings ventilation needs.

Domestic Hot Water

Three (3) domestic hot water heaters were observed during the field survey of the facility, one (1) 50 gallon, 4,500 W A.O. Smith hot water heater along with two (2) 19 gallon, 2,500 W A.O.

Smith point of use units. These units utilize electric resistance heating elements to heat the domestic hot water to the desired temperature. Electric resistance heating is not the best means of heating water and is typically utilized to eliminate routing run natural gas piping throughout the facility.

HVAC Control System

Standard programmable thermostats control the Air Handling units located throughout the facility. The use of temperature setbacks was not observed during the survey. The boiler is manually turned on and off to satisfy the buildings heating needs. There are no zone controls for the heating hot water system. It is pertinent to note that during the survey the actual number of zones and final pipe routing was not able to be verified due to concealed piping.

Lighting

A mix of T8 and T12 fluorescent lighting is used throughout the facility. A detailed lighting count and description can be found in Appendix F of this report.

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. In addition, 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 Appendix E for the Major Equipment List for this facility.

VII. ENERGY CONSERVATION MEASURES

ECM #1: Lighting Upgrade

Description:

New fluorescent lamps and ballasts are available as direct replacements for the existing lamps and ballasts. A simple change from the old to the new can provide substantial savings. A typical drop-ceiling lay in fixture with four, 4-foot lamps (34 Watt lamps) has a total wattage of about 154 Watts. By retrofitting with new lamps, reflector and electronic ballasts the total wattage would be reduced to about 91 Watts per fixture and the space light levels and light quality would increase by about 15% and 35%, respectively.

CEG recommends a replacement of the existing fixtures containing T12 lamps and magnetic ballasts with fixtures containing T8 lamps and electronic ballasts. The new energy efficient, T8 fixtures will provide adequate lighting and will save the Owner on electrical costs due to the improved performance of the electronic ballasts. In addition to functional cost savings, the fixture replacement will also provide operational cost savings. The operational cost savings will be realized through the lesser number of lamps that will be required to be replaced per year. The expected lamp life of a T8 lamp, approximately 30,000 burn-hours, in comparison to the existing T12 lamps, approximately 20,000 burn-hours, will provide the Owner with fewer lamps to replace per year. Based on the operating hours of this portion of the facility, approximately 2,080 hours per year, the Owner will be changing approximately 33% less lamps per year.

Energy Savings Calculations:

A detailed Investment Grade Lighting Audit can be found in Appendix F that outlines the proposed retrofits, costs, savings, and payback periods. This ECM recommends that all T12 fixtures be replaced with T8 as well as all incandescent lamps replaced with compact fluorescent fixtures.

NJ Smart Start® Program Incentives are calculated as follows:

From Appendix C, the replacement of a T-12 fixture to a T-5 or T-8 fixture warrants the following incentive: T-5 or T-8 (1-2 lamp) = $25 per fixture; T-5 or T-8 (3-4 lamp) = $30 per fixture.

$$\text{Smart Start®}\ Incentive = (\#\ of\ 1-2\ lamp\ \ fixtures \times\ \$\ 25) + (\#\ of\ 3-4\ lamp\ \ fixtures \times\ \$\ 30)$$

$$\text{Smart Start®}\ Incentive = (59 \times\ \$\ 30) = \underline{\$1{,}770}$$

Maintenance Savings are calculated as follows:

$$Maintenance\ Savings = (\#\ of\ \ lamps \times \%\ reduction \times \$\ per\ lamp) + Installation\ Labor$$

$$Maintenance\ Savings = (236 \times 33\%\ reduction \times \$\ 2.00) + (\$2 \times 78) = \underline{\$312}$$

Energy Savings Summary:

ECM #1 - ENERGY SAVINGS SUMMARY	
Installation Cost ($):	$5,840
NJ Smart Start Equipment Incentive ($):	($1,770)
Net Installation Cost ($):	*$4,070*
Maintenance Savings ($ / yr):	*$312*
Energy Savings ($ / yr):	*$3,038*
Net Savings ($ / yr):	*$3,350*
Simple Payback (yrs):	*1.2*
Simple Return On Investment (%):	*83.3%*
Estimated ECM Lifetime (yr):	*15*
Simple Lifetime Savings ($):	*$50,250*

ECM #2: Lighting Controls

Description:

During the survey it was noted that some areas the lighting is left on unnecessarily. Many times this is due to the idea that it is better to keep the lights on rather than to continuously switch them on and off. The on/off dilemma was studied and it was found that the best option is to turn the lights off whenever possible. Although this does reduce the lamp life, the energy savings far outweigh the lamp replacement costs. The cutoff for when to turn the lights off is around two minutes. If the lights can be off for only a two minute interval, then it pays to shut them off.

Lighting controls come in many forms. Sometimes an additional switch is all it would take. Occupancy sensors detect motion and will switch the lights on when the room is occupied. They can either be mounted in place of the current wall switch, or they can be mounted on the ceiling to cover large areas. Lastly, photocells are a lighting control that sense light levels and will turn the lights off when there is adequate daylight. These are mostly used outside, but they are becoming much more popular in energy-efficient office designs as well.

To determine an estimated savings for lighting controls, we used ASHRAE 90.1-2004 (NJ Energy Code). Appendix G of the referenced standard, states that occupancy sensors have a 10% power adjustment factor for daytime occupancies for buildings over 5,000 SF. CEG recommends the installation of dual technology occupancy sensors in all private offices, conference rooms, restrooms, lunch rooms, storage rooms, locker rooms, file rooms, etc.

CEG would recommend wall switches for individual rooms, ceiling mount sensors for larger rooms, office areas or restrooms, and fixture mount box sensors for some applications as manufactured by Sensorswitch, Watt Stopper or equivalent. There are approximately forty (40) sensors required for this project (20,000 SF).

Energy Savings Calculations:

From Appendix F of this report, we calculated the lighting power density (Watts/ft^2) of the existing offices, conferences rooms, file rooms, copy rooms, storage rooms, equipment rooms, etc. to be 1.14 Watts/SF. Ten percent of this value is the resultant energy savings due to installation of occupancy sensors:

$$Energy\ Savings = (10\% \times\ Watts/SF \times Building\ SF \times Operating\ Hours \times \$/kWh)$$

$$Energy\ Savings = (10\% \times\ 1.14\ Watts/SF \times 20{,}000\ SF \times 2{,}750 \times \$0.152/kWh) = \underline{\$\ 953\ per\ year}$$

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

$$Installation\ Cost = (\#\ of\ \ sensors \times\ \$\ per\ sensor) = (40 \times \$75) = \underline{\$3{,}000}$$

NJ Smart Start® Program Incentives are calculated as follows:

From Appendix C, the incentive for installing a lighting control is $20 per controller.

$$\text{Smart Start®}\ Incentive = (\#\ of\ \ controller \times\ \$\ 20) = (40 \times \$\ 20) = \underline{\$800}$$

Energy Savings Summary:

ECM #2 - ENERGY SAVINGS SUMMARY	
Installation Cost ($):	$3,000
NJ Smart Start Equipment Incentive ($):	($800)
Net Installation Cost ($):	*$2,200*
Maintenance Savings ($ / yr):	-
Energy Savings ($ / yr):	*$953*
Total Energy Savings ($ / yr):	*$953*
Simple Payback (yrs):	*2.3*
Simple Return On Investment (%):	*43.5%*
Estimated ECM Lifetime (yr):	*15*
Simple Lifetime Savings ($):	*$14,295*

ECM #3: Domestic Hot Water Heater Replacement

Description:

The Violations Office existing domestic hot water heater is powered by a 4,500W electric heating element. This style of hot water heating, although 100% efficient (100% of Btu's from electricity transferred into heating the water), is very expensive due to the high cost of electricity.

This energy conservation measure will replace the existing electric, 50-gallon capacity domestic hot water heater with a 90% thermal efficient A.O. Smith Cyclone HE gas fired domestic hot water heater with 50-gallon storage capacity or equivalent. This ECM requires coordination with the utility due to increase in natural gas demand for the facility. CEG advises the owner to contact the utility provider regarding the installation of this ECM.

Energy Savings Calculations:

Existing Electric DHW Heater

Rated Capacity = 4,500 Watt (154 MBH) input; 50 gallons storage

Proposed Natural Gas-Fired, High-Efficiency DHW Heater

Rated Capacity = 76 MBH input; 50 gallons storage

Thermal Efficiency = 90%
Radiation Losses = 0.5%
Net Efficiency = 89.5%

Operating Data for DHW Heater

Estimated Daily DHW Load = 50 gal/h

DHW Boiler Operating Hrs/Yr. = 2,750 Hrs.

Electric Heating Consumption = 4,741 kWh = $720.66/year

Natural Gas Heating Consumption = 165 Therms = $228.99/year

Yearly Savings = $720.66/year - $228.99/year = $491.57/year

Cost of Domestic Hot Water Heater and Installation = $4,200

Simple Payback = $4,200 / $491.67 = 8.5 years

Refer to Appendix G for a detailed domestic hot water calculation.

Energy Savings Summary:

ECM #3 - ENERGY SAVINGS SUMMARY	
Installation Cost ($):	$4,200
NJ Smart Start Equipment Incentive ($):	($50)
Net Installation Cost ($):	*$4,150*
Maintenance Savings ($ / yr):	-
Energy Savings ($ / yr):	*$491.67*
Total Energy Savings ($ / yr):	*$491.67*
Simple Payback (yrs):	*8.4*
Simple Return On Investment (%):	*11.9%*
Estimated ECM Lifetime (yr):	*12*
Simple Lifetime Savings ($):	*$5,900*

ECM #4: Weather Seal Replacement

Description:

Outside air infiltration can become a large financial burden on a building owner if not controlled properly. The proper door and window weather stripping can lower utility costs by reducing the run times of heating and cooling equipment. This is an inexpensive change measure that can yield substantial savings.

During CEG survey of the facility it was a potential savings was observed through the proper weather sealing of the violations office door. CEG witnessed a large gap between the door and the door jam, this gap allows outside air to infiltrate into the facility.

This ECM installs weather stripping on the Violations Office entry door into the facility. This ECM illustrates a particular example but this calculation can be utilized on all doors and windows in the facility. The following calculation represents the potential savings from the installation of weather stripping. Frost King™ weather stripping was used for the basis of design or equivalent product.

Energy Savings Calculations:

Heating Degree Days (HDD) = 5,255°F – day/yr.

Cooling Degree Days (CDD) = 1,251°F – day/yr.

Heating and cooling degree days from the Teterboro Airport were used for the calculation.

Area of Gap in Doors = 78 in^2 = 0.541 ft^2

Average Wind Speed = 6 mph

Effectiveness of Opening = 0.5 for perpendicular opening

Unit Conversion factor = 88.0

The following equation calculates the flow rate of air through the gap in the door, Equation 29 from ASHRAE Fundamentals Chapter 26.

Airflow Rate = (Unit Conversion factor) x (Effectiveness of Opening) x (Area of Gap) x (Wind Speed)

Airflow Rate = (88.0) x (0.5) x (0.541 ft^2) x (6 mph) = 143 cfm

$$\text{Heating energy savings} = \frac{(\text{cfm x } 1.085 \text{ x HDD})}{100{,}000 \text{ btu/1therm nat. gas}}$$

$$\text{Heating energy savings} = \frac{(143 \text{ x } 1.085 \text{ x } 5{,}255)}{100{,}000 \text{ btu/1therm nat. gas}} = 42.4 \textit{ therms} \times \$1.389 / \textit{therm} = \$58.89$$

$$\text{Cooling energy savings} = \frac{(\text{cfm x } 1.085 \text{ x CDD})}{3414 \text{ btu/1 kWh}}$$

$$\text{Cooling energy savings} = \frac{(143 \text{ x } 1.085 \text{ x } 1{,}251)}{3{,}414 \text{ btu/1 kWh}} = 56.85 \textit{ kWh} \times \$0.152 / \textit{kWh} = \$8.64$$

Total Energy Savings = (Heating Energy Savings + Cooling Energy Savings)

Total Energy Savings = ($58.89 + $8.64) = $67.53

Door Seal Cost = $20

Energy Savings Summary:

ECM #4 - ENERGY SAVINGS SUMMARY	
Installation Cost ($):	$20
NJ Smart Start Equipment Incentive ($):	-
Net Installation Cost ($):	*$20*
Maintenance Savings ($ / yr):	-
Energy Savings ($ / yr):	*$67.53*
Total Energy Savings ($ / yr):	*$67.53*
Simple Payback (yrs):	*0.3*
Simple Return On Investment (%):	*333%*
Estimated ECM Lifetime (yr):	*25*
Simple Lifetime Savings ($):	*$1,688*

ECM #5: Courtroom AC Upgrade

Description:

Air-conditioning is provided to the court room with outdated Sanyo split system air conditioning units. The existing units are inefficient with an estimated energy efficiency ratio (EER) of 9.9. The NJ State Energy Code (ASHRAE 90.1-2004) mandates a minimum energy efficiency of 10.6 EER for units of this type. The existing Sanyo units are aged and are approaching their service life as outlined in Chapter 36 of the 2007 ASHRAE Applications Handbook. The estimated service life for this style of split system air conditioner is fifteen (15) years.

This energy conservation measure would replace the split system units serving the court room; total two (2) units. The existing units will be replaced with high energy efficient, ductless split system air-conditioning units with cooling capacities typical of the existing units; Basis of Design: Sanyo or equivalent. The average EER of the new equipment will be upwards of 14.9 EER.

Energy Savings Calculations:

Existing Air Conditioning Units

Rated Capacity = 2 Tons (x2 Unit)

Condenser Unit Efficiency = 9.9 EER

Cooling Season Hrs. of Operation = 1,800 hrs/yr.

Average Cost of Electricity - $0.152/kWh

Proposed High-Efficiency Air Conditioning Unit

Rated Capacity = 2 Tons (x2 Unit)

New Condenser Unit Efficiency = 14.9 EER

$$EnergySavings = \frac{[CoolingTons \times 12{,}000\,Btu/ton]}{[1000W/kW]} \times \left(\frac{1}{EER_{OLD}} - \frac{1}{EER_{NEW}} \right) \times Avg.LoadFactor \times Hrs.ofCooling$$

$$EnergySavings = \frac{[2\ CoolingTons \times 12{,}000\,Btu/ton]}{[1000W/kW]} \times \left(\frac{1}{9.9\ EER_{OLD}} - \frac{1}{14.9\ EER_{NEW}} \right) \times 0.15 \times 1{,}800\ hours \times 2\ units$$

$$= 440\ kWh/yr$$

Cost Savings = (440 kWh) * $0.152/kWh = $66.88 / Yr.

Smart Start Equipment Incentive = ($92/Ton) = (4 Tons x $92) = $368

Energy Savings Summary:

ECM #5 - ENERGY SAVINGS SUMMARY	
Installation Cost ($):	$6,160
NJ Smart Start Equipment Incentive ($):	($368)
Net Installation Cost ($):	*$5,792*
Maintenance Savings ($ / yr):	-
Energy Savings ($ / yr):	*$66.88*
Total Energy Savings ($ / yr):	*$66.88*
Simple Payback (yrs):	*86.6*
Simple Return On Investment (%):	*1.15%*
Estimated ECM Lifetime (yr):	*15*
Simple Lifetime Savings ($):	*$1,003*

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 Hoboken City, and concluded that there is potential for solar and wind 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 would be necessary before the installation of PV panels is considered). The state of NJ has instituted a program in which one Solar Renewable Energy Certificate (SREC) is given to the Owner for every 1000 kWh of generation. SREC's can be sold anytime on the market at their current market value. The value of the credit varies upon the current need of the power companies. The average value per credit is around $350, this value was used in our financial calculations. This equates to $0.35 per kWh generated.

CEG has reviewed the existing roof area of the building being audited for the purposes of determining a potential for a roof mounted photovoltaic system. A roof area of 1,875 S.F. can be utilized for a PV system. A depiction of the area utilized is shown in Appendix G. Using this square footage it was determined that a system size of 29.44 kilowatts could be installed. A system of this size has an estimated kilowatt hour production of 45,942 KWh annually, reducing the overall utility bill by approximately 12% percent. A detailed financial analysis can be found in Appendix G. 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.

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 20 years. Direct purchase involves the local government paying for 100% of the total project cost upfront via one of the methods noted in Section X, Installation Funding Options. 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	11.49 Years	10.3%
Direct Purchase	11.49 Years	7.7%

The resultant Internal Rate of Return indicates that if the Owner was able to "self-finance" the solar project, the project would be slightly more beneficial to the Owner. However, if the Owner was able to work out a Power Purchase Agreement with a third-party and agree upon a decent base energy rate for kilowatt hour production, the "direct purchase" option could also, prove to be a beneficial route.

In addition to the Solar Analysis, CEG also conducted a review of the applicability of wind energy for the Hoboken City Hall. Wind energy production is another option available through the Renewable Energy Incentive Program. Wind turbines of various types can be utilized to produce clean energy on a per building basis. Cash incentives are available per kWh of electric usage. Based on CEG's review of the applicability of wind energy for Hoboken City Hall it was determined that there is not enough free land available for the installation of wind turbines at this project site.

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 Section III, Figures 1 and 2 included within this report to reference the respective electricity and natural gas usage load profile for June 2007 through May 2008.

Electricity:

Section IV, Figure 1 demonstrates a typical cooling profile, (April –October), complimenting the heating load. It is evident that there is a reduction in the consumption November through March with some spiking in usage from July and August (peak hot season). The summer peaking is due to increased electric load from air conditioning. Air conditioning is supplied by 4 air handling units, split system heat pump, Trane air handling unit and various window units. Additional electric consumption derives from electric hot water heaters. Other than summer, the load-profile is fairly flat or base-loaded. The base-load shaping is important because a flat consumption profiles will yield more competitive energy prices.

Natural Gas:

Section IV, Figure 2 demonstrates a fairly typical heating load (January –April), and complimentary cooling load (April –October). Consequently there is a clear separation between summer and winter loads consistent with energy commodities traded on the New York Mercantile Exchange. Heating loads carry a much higher average cost because of the higher demand for natural gas to heat during the winter. This facility supplies heating needs through a natural gas-fired boiler.

Tariff Analysis:

Electricity:

The City Hall receives electrical service through Public Service Electric and Gas Company (PSE&G) on a GLP (General Large Power) rate. The facility has two meters present; meter # 778006143 and meter # 236010400. This 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. The 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).

While Hoboken may be on a typical rate structure with the local utility (GPL), some variations in price do cause some concern, and are worth investigating further. Electrical costs June through September, are extremely costly. By managing the energy costs, the city will see consistent and reduced pricing.

Natural Gas:

City Hall receives natural gas service through Public Service Electric and Gas Company (PSE&G) on a LVG (Large Volume Gas Service) rate class, and GSGH (General Service Gas-Heating) rate when not receiving commodity by a Third Party Supplier. The utility tariff rate (LVG) is for firm delivery service for general purposes. The utility tariff rate (GSGH) General Service. This is a firm delivery service for general purposes where 1) customer does not qualify for RSG (residential) and 2) customers usage does not exceed 3,000 therms in any month. Customers may either purchase gas supply from a Third Party (TPS) of from Public Services Basic Gas Supply Service default service as detailed in the rate schedule.

This rate schedules have a Delivery Charge Mechanism which includes: 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 Supply Charge (Commodity Charge) serviced through the utility or by a Third Party Supplier (TPS). It is pertinent to note, should the TPS not deliver, the customer may receive service from PSE&G under Emergency Sales Service. Emergency Sales Service carries an extremely high penalty cost of service.

Imbalances occur when Third Party Suppliers are used to supply natural gas, 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, imbalances can occur, jeopardizing economics and scheduling.
From review of the information provided, it appears that Hoboken could improve its energy costs by between 20 -25% from the costs provided (the historical costs were compared to present market prices for a fixed one year term).

Recommendations:

CEG recommends a global approach that will be consistent with all facilities within City of Hoboken. CEG's primary observation is seen in the electric costs. The average price per kWh (kilowatt hour) for all buildings based on 1-year historical costs is $.15/kWh (kWh is the common unit of electric measure). The average price per decatherm for natural gas is $ 13.71dth (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. Hoboken could see significant savings if it were to take advantage of these current market prices quickly, before energy increases. Based on annual historical consumption (January through December 2007) and current electric rates, an annual savings of over $100,000 per year (Note: Savings were calculated using Hoboken's Average Annual Consumption of kWh and a variance to a fixed 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 Hoboken's natural gas costs. Based on the current market, Hoboken could improve its natural gas costs by approximately 25% annually. CEG recommends further advisement on these prices. The City should also consider procuring energy (natural gas) through alternative supply sources. CEG recommends energy advisory services.

CEG also recommends that the city schedule a meeting with their 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 city will learn more about the competitive supply process. Hoboken can acquire a list of approved Third Party Suppliers from the New Jersey Board of Public Utilities website at www.nj.gov/bpu, and should also consider using a billing-auditing service to further analyze the utility invoices, manage the data and use the data to manage ongoing demand-side management projects. Furthermore, CEG recommends special attention to credit mechanisms, imbalances, balancing charges and commodity charges when meeting with their utility representative. In addition, they should also ask the utility representative about alternative billing options. Some utilities allow for consolidated billing options when utilizing the service of a Third Party Supplier.

Finally, if Hoboken frequently changes or plans on changing its supplier for energy (natural gas), it needs to closely monitor balancing, particularly when the contract is close to termination.

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 par for the costs using the value of energy savings that result from the improvements. The "Energy Savings Improvement Program (ESIP)" law provides a flexible approach that can allow all government agencies in New Jersey to improve and reduce energy usage with minimal expenditure of new financial resources.

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

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

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. Maintain all weather stripping on windows and doors.

B. Use cog-belts instead of v-belts on all belt-driven fans, etc. These can reduce electrical consumption of the motor by 2-5%.

C. Reduce lighting in specified areas where the foot candle levels are above 70 in private offices and above 30 in corridor, lobbies, etc.

D. Provide more frequent air filter changes to decrease overall fan horsepower requirements and maintain better IAQ.

E. Recalibrate existing temperature sensors serving the HVAC control system.

F. Install a Vending Miser system to turn off the vending machines when not in use.

G. Clean all light fixtures to maximize light output.

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

I. Verify programming of existing programmable thermostats to utilize full capabilities of temperature setbacks.

In addition to the recommendations above, CEG would also like to suggest Retro-Commissioning. Retro-Commissioning is a means to verify your current equipment is operating at its designed capacity, airflow, etc. Commissioning Agents, after defining what the original system design parameters are, would recommend revisions to the current system operating characteristics and utilize an independent testing and balancing company to perform air and water balancing on the existing systems.

Electric Cost Summary

CITY HALL

PSE&G (Rate - GLP)

2007

Account # 21 324 063 40
Meter # 236010400

Month	Jan-07	Feb-07	Mar-07	Apr-07	May-07	Jun-07	Jul-07	Aug-07	Sep-07	Oct-07	Nov-07	Dec-07	Total	
Billing Days	31	28	31	30	31	30	31	31	30	31	30	31	0	
KWH	2,904	3,300	3,636	3,720	3,840	3,516	3,576	4,182	3,732	3,180	2,586	2,745	40,917	
KW	14	12	13	14	13	16	16	15	16	14	14	14	16	Max
Monthly Load Factor	28%	41%	37%	37%	40%	31%	30%	37%	32%	31%	25%	26%	33%	
Electric Delivery, $	$123	$125	$137	$143	$141	$284	$285	$292	$290	$130	$119	$121	$2,189	
Delivery $/kwh	$0.042	$0.038	$0.038	$0.038	$0.037	$0.081	$0.080	$0.070	$0.078	$0.041	$0.046	$0.044	$0.054	
Electric Supply, $	$242	$272	$303	$308	$318	$355	$439	$506	$462	$359	$249	$246	$4,060	
Supply $/kwh	$0.083	$0.082	$0.083	$0.083	$0.083	$0.101	$0.123	$0.121	$0.124	$0.113	$0.096	$0.090	$0.099	
Total Cost, $	$365	$397	$441	$450	$459	$639	$725	$798	$752	$489	$369	$367	$6,249	
$/KWH	$0.1255	$0.1202	$0.1212	$0.1211	$0.1196	$0.1816	$0.2027	$0.1908	$0.2015	$0.1538	$0.1426	$0.1336	**$0.153**	

Utility information estimated. Utility data not provided by owner.

PSE&G (Rate - GLP)

2007

Account # 21 324 155 44
Meter # 778006143

Month	Jan-07	Feb-07	Mar-07	Apr-07	May-07	Jun-07	Jul-07	Aug-07	Sep-07	Oct-07	Nov-07	Dec-07	Total	
Billing Days	31	28	31	30	31	30	31	31	30	31	30	31	0	
KWH	26,160	27,040	26,640	23,920	22,480	27,760	33,120	38,640	32,960	26,800	21,840	24,000	331,360	
KW	82	85	79	82	84	122	137	134	122	122	90	86	137	Max
Monthly Load Factor	43%	47%	45%	40%	36%	31%	33%	39%	38%	29%	34%	37%	38%	
Electric Delivery, $	$910	$935	$907	$866	$840	$2,158	$2,471	$2,602	$2,297	$1,092	$861	$888	$16,825	
Delivery $/kwh	$0.035	$0.035	$0.034	$0.036	$0.037	$0.078	$0.075	$0.067	$0.070	$0.041	$0.039	$0.037	$0.051	
Electric Supply, $	$2,154	$2,242	$2,258	$2,038	$1,934	$2,848	$4,012	$4,623	$4,068	$3,043	$2,114	$2,148	$33,482	
Supply $/kwh	$0.082	$0.083	$0.085	$0.085	$0.086	$0.103	$0.121	$0.120	$0.123	$0.114	$0.097	$0.090	$0.101	
Total Cost, $	$3,063	$3,177	$3,165	$2,904	$2,773	$5,006	$6,483	$7,224	$6,365	$4,135	$2,975	$3,036	$50,307	
$/KWH	$0.1171	$0.1175	$0.1188	$0.1214	$0.1234	$0.1803	$0.1957	$0.1870	$0.1931	$0.1543	$0.1362	$0.1265	**$0.152**	

Total City Hall Electric Usage

2007

Month	Jan-07	Feb-07	Mar-07	Apr-07	May-07	Jun-07	Jul-07	Aug-07	Sep-07	Oct-07	Nov-07	Dec-07	Total	
Billing Days	31	28	31	30	31	30	31	31	30	31	30	31	0	
KWH	29,064	30,340	30,276	27,640	26,320	31,276	36,696	42,822	36,692	29,980	24,426	26,745	372,277	
KW	96	97	93	96	97	138	153	150	138	136	105	100	153	Max
Monthly Load Factor	41%	47%	44%	40%	37%	31%	32%	38%	37%	30%	32%	36%	37%	
Electric Delivery, $	$1,032	$1,060	$1,044	$1,008	$981	$2,441	$2,756	$2,893	$2,587	$1,222	$980	$1,009	$19,014	
Delivery $/kwh	$0.036	$0.035	$0.034	$0.036	$0.037	$0.078	$0.075	$0.068	$0.071	$0.041	$0.040	$0.038	$0.051	
Electric Supply, $	$2,396	$2,514	$2,562	$2,346	$2,252	$3,203	$4,451	$5,129	$4,530	$3,402	$2,364	$2,394	$37,542	
Supply $/kwh	$0.082	$0.083	$0.085	$0.085	$0.086	$0.102	$0.121	$0.120	$0.123	$0.113	$0.097	$0.090	$0.101	
Total Cost, $	$3,428	$3,574	$3,605	$3,355	$3,232	$5,644	$7,207	$8,022	$7,117	$4,624	$3,344	$3,403	$56,556	
$/KWH	$0.1179	$0.1178	$0.1191	$0.1214	$0.1228	$0.1805	$0.1964	$0.1873	$0.1940	$0.1542	$0.1369	$0.1272	**$0.152**	

Summary of Natural Gas Cost

CITY HALL

2007

PSE&G (Rate - LVG)

Account # 21 324 063 40	Jan-07	Feb-07	Mar-07	Apr-07	May-07	Jun-07	Jul-07	Aug-07	Sep-07	Oct-07	Nov-07	Dec-07	Total
Meter # 3164294	31	28	31	30	31	30	31	31	30	31	30	31	
Therms (Burner Tip)	4266.8	9783.8	8265.9	6137.8	1595.6	0.0	0.0	0.0	0.0	0.0	1360.3	1543.7	32,954
Total Distribution Cost	$1,727	$2,991	$2,735	$669	$259	$92	$92	$92	$92	$92	$1,467	$1,597	$11,905.11
Cost per Therm	$0.405	$0.306	$0.331	$0.109	$0.162	$0.000	$0.000	$0.000	$0.000	$0.000	$1.078	$1.035	$0.361
Total Commodity Cost	$4,485	$8,818	$8,327	$6,355	$1,627	$0	$0	$0	$0	$0	$1,257	$2,871	$33,740.79
Cost per Therm	$1.05	$0.90	$1.01	$1.04	$1.02	$0.00	$0.00	$0.00	$0.00	$0.00	$0.92	$1.86	$1.02
Total Cost	$6,212	$11,809	$11,062	$7,024	$1,886	$92	$92	$92	$92	$92	$2,724	$4,468	$45,646
Cost per Therm	$1.46	$1.21	$1.34	$1.14	$1.18	$0.00	$0.00	$0.00	$0.00	$0.00	$2.00	$2.89	**$1.385**

Utility information estimated. Utility data not provided by owner.

PSE&G (Rate - GSGH)

2007

CITY HALL

Account # 21 324 155 44	Jan-07	Feb-07	Mar-07	Apr-07	May-07	Jun-07	Jul-07	Aug-07	Sep-07	Oct-07	Nov-07	Dec-07	Total
Meter # 1477519	31	28	31	30	31	30	31	31	30	31	30	31	
Therms (Burner Tip)	2.1	12.6	20.9	3.1	3.1	2.1	2.1	4.2	3.2	2.1	4.2	3.1	63
Total Distribution Cost	$11	$15	$18	$11	$11	$11	$11	$11	$11	$11	$11	$12	$143.89
Cost per Therm	$5.107	$1.178	$0.869	$3.517	$3.520	$5.117	$5.107	$2.703	$3.504	$5.102	$2.730	$3.860	$2.290
Total Commodity Cost	$2	$11	$21	$3	$3	$2	$2	$4	$3	$2	$4	$3	$60.19
Cost per Therm	$1.01	$0.90	$1.01	$1.04	$1.02	$1.02	$0.99	$0.91	$0.83	$0.82	$0.92	$0.95	$0.96
Total Cost	$13	$26	$39	$14	$14	$13	$13	$15	$14	$12	$15	$15	$204
Cost per Therm	$6.12	$2.08	$1.88	$4.55	$4.54	$6.14	$6.10	$3.61	$4.33	$5.92	$3.65	$4.81	**$3.248**

Total City Hall Natural Gas Usage

2007

	Jan-07	Feb-07	Mar-07	Apr-07	May-07	Jun-07	Jul-07	Aug-07	Sep-07	Oct-07	Nov-07	Dec-07	Total
	31	28	31	30	31	30	31	31	30	31	30	31	
Therms (Burner Tip)	4268.9	9796.4	8286.9	6141.0	1598.7	2.1	2.1	4.2	3.2	2.1	1364.5	1546.8	33,017
Total Distribution Cost	$1,737.78	$3,006.20	$2,753.19	$679.73	$269.85	$102.74	$102.71	$103.37	$103.04	$102.83	$1,478.40	$1,609.16	$12,049.00
Cost per Therm	$0.407	$0.307	$0.332	$0.111	$0.169	$49.087	$48.979	$24.577	$32.701	$48.990	$1.083	$1.040	$0.365
Total Commodity Cost	$4,487.49	$8,829.05	$8,347.89	$6,358.55	$1,630.21	$2.14	$2.08	$3.83	$2.60	$1.72	$1,261.12	$2,874.30	$33,800.98
Cost per Therm	$1.05	$0.90	$1.01	$1.04	$1.02	$1.02	$0.99	$0.91	$0.83	$0.82	$0.92	$1.86	$1.02
Total Cost	$6,225	$11,835	$11,101	$7,038	$1,900	$105	$105	$107	$106	$105	$2,740	$4,483	$45,850
Cost per Therm	$1.46	$1.21	$1.34	$1.15	$1.19	$50.11	$49.97	$25.49	$33.53	$49.81	$2.01	$2.90	**$1.389**

DETAILED COST BREAKDOWN PER ECM

CONCORD ENGINEERING GROUP

Hoboken City Hall

ECM 1 Lighting Upgrade

	Qty	Unit Cost $	Material $	Labor $	Total $
Lighting Retrofit	LS	$5,840	$0	$0	$5,840
Total Cost			$0	$0	$5,840
Utility Incentive - NJ Smart Start (1-2 lamp fixture $25, 3-4 lamp fixture $30)					($1,770)
Total Cost Less Incentive					$4,070

ECM 2 Lighting Controls

	Qty	Unit Cost $	Material $	Labor $	Total $
Dual - Technology Sensor	40	$75	$1,200	$1,800	$3,000
Total Cost			$1,200	$1,800	$3,000
Utility Incentive - NJ Smart Start ($20 per Sensor)					($800)
Total Cost Less Incentive					$2,200

ECM 3 Domestic Hot Water Heater Replacement

	Qty	Unit Cost $	Material $	Labor $	Total $
New Hot Water Heater	1	$4,200	$2,200	$2,000	$4,200
Total Cost			$2,200	$2,000	$4,200
Utility Incentive - NJ Smart Start ($50 per 50 Gallon Unit)					($50)
Total Cost Less Incentive					$4,150

ECM 4 Weather Seal Replacement

	Qty	Unit Cost $	Material $	Labor $	Total $
New Weather Seal	1	$20	$0	$0	$20
Total Cost			$0	$0	$20
Utility Incentive - N/A					$0
Total Cost Less Incentive					$20

ECM 5 Courtroom AC Upgrade

	Qty	Unit Cost $	Material $	Labor $	Total $
New 2-Ton Split System AC Units	2	$3,080	$1,580	$1,500	$6,160
Total Cost			$1,580	$1,500	$6,160
Utility Incentive - NJ Smart Start ($92 per Ton)					($368)
Total Cost Less Incentive					$5,792

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
City Hall

Building ID: 1773708
For 12-month Period Ending: December 31, 2007[1]
Date SEP becomes ineligible: N/A
Date SEP Generated: June 30, 2009

Facility
City Hall
94 Washington St.
Hoboken, NJ 07030

Facility Owner
City of Hoboken
94 Washington Street
Hoboken, NJ 07030

Primary Contact for this Facility
James Ronga
94 Washington Street
Hoboken, NJ 07030

Year Built: 1911
Gross Floor Area (ft²): 22,500

Energy Performance Rating[2] (1-100) 28

Site Energy Use Summary[3]

Natural Gas (kBtu)[4]	3,301,690
Electricity (kBtu)	1,270,209
Total Energy (kBtu)	4,571,899

Energy Intensity[5]

Site (kBtu/ft²/yr)	203
Source (kBtu/ft²/yr)	342

Emissions (based on site energy use)

Greenhouse Gas Emissions ($MtCO_2e$/year)	369

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

National Average Comparison

National Average Site EUI	160
National Average Source EUI	269
% Difference from National Average Source EUI	27%
Building Type	Office

Stamp of Certifying Professional

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

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

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

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

Notes:
1. Application for the ENERGY STAR must be submitted to EPA within 4 months of the Period Ending date. Award of the ENERGY STAR is not final until approval is received from EPA.
2. The EPA Energy Performance Rating is based on total source energy. A rating of 75 is the minimum to be eligible for the ENERGY STAR.
3. Values represent energy consumption, annualized to a 12-month period.
4. Natural Gas values in units of volume (e.g. cubic feet) are converted to kBtu with adjustments made for elevation based on Facility zip code.
5. Values represent energy intensity, annualized to a 12-month period.
6. Based on Meeting ASHRAE Standard 62 for ventilation for acceptable indoor air quality, ASHRAE Standard 55 for thermal comfort, and IESNA Lighting Handbook for lighting quality.

ENERGY STAR® Data Checklist for Commercial Buildings

In order for a building to qualify for the ENERGY STAR, a Professional Engineer (PE) must validate the accuracy of the data underlying the building's energy performance rating. This checklist is designed to provide an at-a-glance summary of a property's physical and operating characteristics, as well as its total energy consumption, to assist the PE in double-checking the information that the building owner or operator has entered into Portfolio Manager.

Please complete and sign this checklist and include it with the stamped, signed Statement of Energy Performance.
NOTE: You must check each box to indicate that each value is correct, OR include a note.

CRITERION	VALUE AS ENTERED IN PORTFOLIO MANAGER	VERIFICATION QUESTIONS	NOTES	☑
Building Name	City Hall	Is this the official building name to be displayed in the ENERGY STAR Registry of Labeled Buildings?		☐
Type	Office	Is this an accurate description of the space in question?		☐
Location	94 Washington St., Hoboken, NJ 07030	Is this address accurate and complete? Correct weather normalization requires an accurate zip code.		☐
Single Structure	Single Facility	Does this SEP represent a single structure? SEPs cannot be submitted for multiple-building campuses (with the exception of acute care or children's hospitals) nor can they be submitted as representing only a portion of a building		☐
City Hall (Office)				
CRITERION	**VALUE AS ENTERED IN PORTFOLIO MANAGER**	**VERIFICATION QUESTIONS**	**NOTES**	☑
Gross Floor Area	22,500 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.		☐
Weekly operating hours	60 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.		☐
Workers on Main Shift	223	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)		☐
Number of PCs	122	Is this the number of personal computers in the Office?		☐
Percent Cooled	50% or more	Is this the percentage of the total floor space within the facility that is served by mechanical cooling equipment?		☐
Percent Heated	50% or more	Is this the percentage of the total floor space within the facility that is served by mechanical heating equipment?		☐

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: City Hall Meter (kWh)
Space(s): Entire Facility

Start Date	End Date	Energy Use (kWh)
12/01/2007	12/31/2007	29,064.00
11/01/2007	11/30/2007	30,340.00
10/01/2007	10/31/2007	30,276.00
09/01/2007	09/30/2007	27,640.00
08/01/2007	08/31/2007	26,320.00
07/01/2007	07/31/2007	31,276.00
06/01/2007	06/30/2007	36,696.00
05/01/2007	05/31/2007	42,822.00
04/01/2007	04/30/2007	36,692.00
03/01/2007	03/31/2007	29,980.00
02/01/2007	02/28/2007	24,426.00
01/01/2007	01/31/2007	26,745.00
City Hall Meter Consumption (kWh)		**372,277.00**
City Hall Meter Consumption (kBtu)		**1,270,209.12**
Total Electricity Consumption (kBtu)		**1,270,209.12**
Is this the total Electricity consumption at this building including all Electricity meters?		☐

Fuel Type: Natural Gas

Meter: City Hall Gas (therms)
Space(s): Entire Facility

Start Date	End Date	Energy Use (therms)
12/01/2007	12/31/2007	4,268.90
11/01/2007	11/30/2007	9,796.40
10/01/2007	10/31/2007	8,286.90
09/01/2007	09/30/2007	6,141.00
08/01/2007	08/31/2007	1,598.70
07/01/2007	07/31/2007	2.10
06/01/2007	06/30/2007	2.10
05/01/2007	05/31/2007	4.20
04/01/2007	04/30/2007	3.20

03/01/2007	03/31/2007	2.10
02/01/2007	02/28/2007	1,364.50
01/01/2007	01/31/2007	1,546.80
City Hall Gas Consumption (therms)		**33,016.90**
City Hall Gas Consumption (kBtu)		**3,301,690.00**
Total Natural Gas Consumption (kBtu)		**3,301,690.00**
Is this the total Natural Gas consumption at this building including all Natural Gas meters?		☐

Additional Fuels	
Do the fuel consumption totals shown above represent the total energy use of this building? Please confirm there are no additional fuels (district energy, generator fuel oil) used in this facility.	☐

Certifying Professional

(When applying for the ENERGY STAR, this must be the same 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
City Hall
94 Washington St.
Hoboken, NJ 07030

Facility Owner
City of Hoboken
94 Washington Street
Hoboken, NJ 07030

Primary Contact for this Facility
James Ronga
94 Washington Street
Hoboken, NJ 07030

General Information

City Hall	
Gross Floor Area Excluding Parking: (ft^2)	22,500
Year Built	1911
For 12-month Evaluation Period Ending Date:	December 31, 2007

Facility Space Use Summary

City Hall	
Space Type	Office
Gross Floor Area(ft^2)	22,500
Weekly operating hours	60
Workers on Main Shift	223
Number of PCs	122
Percent Cooled	50% or more
Percent Heated	50% or more

Energy Performance Comparison

	Evaluation Periods		Comparisons		
Performance Metrics	**Current** (Ending Date 12/31/2007)	**Baseline** (Ending Date 12/31/2007)	**Rating of 75**	**Target**	**National Average**
Energy Performance Rating	28	28	75	N/A	50
Energy Intensity					
Site (kBtu/ft^2)	203	203	118	N/A	160
Source (kBtu/ft^2)	342	342	199	N/A	269
Energy Cost					
$/year	$ 102,405.00	$ 102,405.00	$ 59,548.10	N/A	$ 80,512.91
$/$ft^2$/year	$ 4.55	$ 4.55	$ 2.65	N/A	$ 3.58
Greenhouse Gas Emissions					
$MtCO_2e$/year	369	369	215	N/A	290
$kgCO_2e/ft^2$/year	16	16	9	N/A	13

More than 50% of your building is defined as Office. Please note that your rating accounts for all of the spaces listed. The National Average column presents energy performance data your building would have if your building had an average rating of 50.

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

MAJOR EQUIPMENT LIST

Concord Engineering Group

"Hoboken City Hall"

Boiler

Location	Area Served	Manufacturer	Qty.	Model #	Serial #	Input (MBh)	Output (MBh)	Efficiency (%)	Fuel	Approx. Age	ASHRAE Service Life	Remaining Life	Notes
Boiler Room	-	Burnham	1	3L-200-50-G-IF	27855	8369	6695	80%	Nat Gas	5	35	30	Steam Boiler, (3-pass) 5 LB Distribution

Boiler - Burner

Location	Area Served	Manufacturer	Qty.	Model #	Serial #	Input (MBh)	Efficiency (%)	Fuel	Approx. Age	ASHRAE Service Life	Remaining Life	Notes
Boiler Room	-	Iron Fireman	1	EED-G-10.6	259805-10020075	-	-	Nat Gas	5	21	16	5 HP Combustion Air Motor (208/3/60). Heat Timer Auto Heating Control Panel. Owner manually shuts down boiler based on O/A Temperature.

Domestic Hot Water Heater

Location	Area Served	Manufacturer	Qty	Model #	Serial #	Input (MBh or W)	Recovery (gal/h)	Capacity (gal)	Energy Factor	Fuel	Approx. Age	ASHRAE Service Life	Remaining Life
Traffic Violations Office	Traffic Violations	AO Smith	1	52913	ME96-0046956-913	4500 (W)	21	50	0.91	Electric	13	12	-1
Construction Office Attic	Construction Office	AO Smith	1	ELJF20917	GB99-4765001-917	2500 (W)	11	19	N/A	Electric	2	12	10
Attic Above 1st Flr Restroom	1st Flr Restroom	AO Smith	1	ELJF20917	GB99-4765001-917	2500 (W)	11	19	N/A	Electric	2	12	10

Air Handling Units

Location	Area Served	Equipment Tag	Qty	Manufacturer	Model #	Serial #	Cooling Coil	Cooling Eff. (EER)	Cooling Capacity	Heating Type	Input (MBh)	Output (MBh)	Heating Eff. (%)	Fuel	Volts	Approx. Age	ASHRAE Service Life	Remaining Life
Traffic Violation Office	Traffic Violatior	-	1	Goodman	GMPN120-5	9511810966		-	-	Gas HX	210 MBh	108.6 MBh	80.00%	Nat Gas		14	18	4
Conf Room Across from Violations office	Traffic Violation Conf.	-	1	Fraser - Johnson	NAMB-FD16AANA	MDWS202895	DX R-22	-	-	Heat Pump				Electric	208-230	20	15	-5
Violations Office	Violations	AHU #1	1	Goodman	GMPN100-4		DX R-22	-	-	Gas HX	100 MBh	90.5 MBh	80.00%	Nat Gas		4	18	14
Violations Office	Violations	AHU #2	1	Goodman	GMPN100-4	9605835510	DX R-22	-	-	Gas HX	100 MBh	90.5 MBh	80.00%	Nat Gas		4	18	14
Violations Office	Violations	AHU #3	1	Goodman	GMPN100-4		DX R-22	-	-	Gas HX	100 MBh	90.5 MBh	80.00%	Nat Gas		4	18	14
Construction Office Ceiling	Construction Office	-	1	Trane				-	-	Gas HX				Nat Gas		2	18	16

Split Systems and AC Condensers

Location	Area Served	Manufacturer	Qty.	Model #	Serial #	Cooling Capacity	Eff.	Refrigerant	Volts	Phase	Hz	Approx. Age	ASHRAE Service Life	Remaining Life	Notes
Judge's Chambers Balcony	Court Room	Sanyo	2	CH2422	0001151 0000951	25,000 Btu	9.9 EER	R-22	208-230	1	60	14	15	1	
Judge's Chambers	Judge's Chambers	Carrier	1	Window Uni	-	9,000 Btu		R-22		1	60	8	10	2	
Construction Office	Construction Office	Friedrich	1	RM18J30A-A	-	18.300 btu	10	R-22	203/208	1	60	8	10	2	

INVESTMENT GRADE LIGHTING AUDIT

CONCORD ENERGY SERVICES

CEG Job #: 9C08143
Project: Hoboken, LGEA
Address: 94 washington Street
City: Hoboken, NJ
Building SF: 22,500

"CITY HALL"

DATE: 7/27/2009
KWH COST: $0.152

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
	A	Boiler Room	4	4' 3-Lamp T-8 No Lens Electric Ballast	800	58	0.23	185.6	$28.21	4	No Change Required	0	0.00	0	$0.00	$0.00	$0.00	0.00	0	$0.00	N/A
	B	Boiler Room	3	4' 1-Lamp T-8 No Lens Electric Ballast	800	28	0.08	67.2	$10.21	3	No Change Required	0	0.00	0	$0.00	$0.00	$0.00	0.00	0	$0.00	N/A
1	D	Traffic Violations Lobby	6	2'X4' 2-Lamp T-8 Prism Reflect Electric Ballast 32 W	2750	58	0.35	957	$145.46	6	No Change Required	0	0.00	0	$0.00	$0.00	$0.00	0.00	0	$0.00	N/A
2	G	Traffic Violations Offices	5	8' 4-Lamp T-12 Prism Reflector Magnetic Ballast	2750	316	1.58	4345	$660.44	10	4' 3-Lamp T-8 Prism Reflector Electronic Ballast Cooper Metalux	82	0.82	2255	$342.76	$80.00	$800.00	0.76	2090	$317.68	2.52
	H		14	4' 4-Lamp T-8 Prism Reflector Electric Ballast	2750	109	1.53	4196.5	$637.87	14	No Change Required	0	0.00	0	$0.00	$0.00	$0.00	0.00	0	$0.00	N/A
	I		4	2'X4' 4-Lamp T-12 Prism Reflector Magnetic Ballast	2750	160	0.64	1760	$267.52	4	2'X4' 3-Lamp T-8 Prism Reflector Electronic Ballast Cooper Metalux	82	0.33	902	$137.10	$140.00	$560.00	0.31	858	$130.42	4.29
3	E	Basement Conferences	6	8' 4-Lamp T-8 Prism Reflector Electric Ballast	2750	224	1.34	3696	$561.79	6	No Change Required	0	0.00	0	$0.00	$0.00	$0.00	0.00	0	$0.00	N/A
	F		2	2' 4-Lamp T-8 Prism Reflector Electric Ballast	2750	56	0.11	308	$46.82	2	No Change Required	0	0.00	0	$0.00	$0.00	$0.00	0.00	0	$0.00	N/A
	G	Parking Utility Office	14	8' 4-Lamp T-12 Prism Reflector Magnetic Ballast	2750	316	4.42	12166	$1,849.23	28	4' 3-Lamp T-8 Prism Reflector Electronic Ballast Cooper Metalux	82	2.30	6314	$959.73	$80.00	$2,240.00	2.13	5852	$889.50	2.52
	I		5	2'X4' 4-Lamp T-12 Prism Reflector Magnetic Ballast	2750	160	0.80	2200	$334.40	5	2'X4' 3-Lamp T-8 Prism Reflector Electronic Ballast Cooper Metalux	82	0.41	1127.5	$171.38	$140.00	$700.00	0.39	1072.5	$163.02	4.29
			4	High Hat - 60W Incandescent	2750	60		660	$100.32	4	Replace Incandescent Lamp with 13 W Compact Flourescent Lamp	13	0.05	143	$21.74	$5.00	$20.00	-0.05	517	$78.58	0.25
4		Court Room	6	Compact Flourescent	2750	39	0.23	643.5	$97.81	6	No Change Required	0	0.00	0	$0.00	$0.00	$0.00	0.00	0	$0.00	N/A
5		Court Room Offices	10	Incandescent Lamp	2750	60	0.60	1650	$250.80	10	Replace Incandescent Lamp with 13 W Compact Flourescent Lamp	13	0.13	357.5	$54.34	$5.00	$50.00	0.47	1292.5	$196.46	0.25
			2	High Hat	2750	60	0.12	330	$50.16	2	Replace Incandescent Lamp with 13 W Compact Flourescent Lamp	13	0.03	71.5	$10.87	$5.00	$10.00	0.09	258.5	$39.29	0.25

6	I	Clerks Office	1	2'X4' 4-Lamp T-12 Prism Reflector Magnetic Ballast	2750	160	0.16	440	$66.88	1	2'X4' 3-Lamp T-8 Prism Reflector Electronic Ballast Cooper Metalux	82	0.08	225.5	$34.28	$140.00	$140.00	0.08	214.5	$32.60	4.29
	G		2	8' 4-Lamp T-12 Prism Reflector Magnetic Ballast	2750	316	0.63	1738	$264.18	4	4' 3-Lamp T-8 Prism Reflector Electronic Ballast Cooper Metalux	82	0.33	902	$137.10	$80.00	$320.00	0.30	836	$127.07	2.52
	J		12	4' 2-Lamp T-8 No Lens Electric Ballast	2750	58	0.70	1914	$290.93	12	No Change Required	0	0.00	0	$0.00	$0.00	$0.00	0.00	0	$0.00	N/A
7	J	Tax and Licensing	2	4' 2-Lamp T-8 No Lens Electric Ballast	2750	58	0.12	319	$48.49	2	No Change Required	0	0.00	0	$0.00	$0.00	$0.00	0.00	0	$0.00	N/A
8	B	Tax Collector	1	4' 1-Lamp T-8 No Lens Electric Ballast	2750	25	0.03	68.75	$10.45	1	No Change Required	0	0.00	0	$0.00	$0.00	$0.00	0.00	0	$0.00	N/A
	K		9	2'X4' 4-Lamp T-8 Prism Reflector Electric Ballast	2750	188	1.69	4653	$707.26	9	No Change Required	0	0.00	0	$0.00	$0.00	$0.00	0.00	0	$0.00	N/A
	J		1	4' 2-Lamp T-8 No Lens Electric Ballast	2750	58	0.06	159.5	$24.24	1	No Change Required	0	0.00	0	$0.00	$0.00	$0.00	0.00	0	$0.00	N/A
9	K	Construction Office	4	2'X4' 4-Lamp T-8 Prism Reflector Electric Ballast	2750	188	0.75	2068	$314.34	4	No Change Required	0	0.00	0	$0.00	$0.00	$0.00	0.00	0	$0.00	N/A
	H		4	4' 4-Lamp T-8 Prism Reflector Electric Ballast	2750	109	0.44	1199	$182.25	4	No Change Required	0	0.00	0	$0.00	$0.00	$0.00	0.00	0	$0.00	N/A
	J		5	4' 2-Lamp T-8 No Lens Electric Ballast	2750	58	0.29	797.5	$121.22	5	No Change Required	0	0.00	0	$0.00	$0.00	$0.00	0.00	0	$0.00	N/A
10		Attic Above Bathroom	1	Compact Flourescent	2750	13	0.01	35.75	$5.43	1	No Change Required	0	0.00	0	$0.00	$0.00	$0.00	0.00	0	$0.00	N/A
11		2nd Floor Lobby	7	3 Lamp Compact Flourescent	2750	39	0.27	750.75	$114.11	7	No Change Required	0	0.00	0	$0.00	$0.00	$0.00	0.00	0	$0.00	N/A
12	J	Law Department	4	4' 2-Lamp T-8 No Lens Electric Ballast	2750	58	0.23	638	$96.98	4	No Change Required	0	0.00	0	$0.00	$0.00	$0.00	0.00	0	$0.00	N/A
13	J	Historic Preservation	6	4' 2-Lamp T-8 No Lens Electric Ballast	2750	58	0.35	957	$145.46	6	No Change Required	0	0.00	0	$0.00	$0.00	$0.00	0.00	0	$0.00	N/A
14	J	Director of Community Development	4	4' 2-Lamp T-8 No Lens Electric Ballast	2750	58	0.23	638	$96.98	4	No Change Required	0	0.00	0	$0.00	$0.00	$0.00	0.00	0	$0.00	N/A
			2	3-Lamp CFL	2750	39	0.08	214.5	$32.60	2	No Change Required	0	0.00	0	$0.00	$0.00	$0.00	0.00	0	$0.00	N/A
15	J	Mayor Conference	4	4' 2-Lamp T-8 No Lens Electric Ballast	2750	58	0.23	638	$96.98	4	No Change Required	0	0.00	0	$0.00	$0.00	$0.00	0.00	0	$0.00	N/A
16		Mayor Office	16	Incandescent Lamp	2750	60	0.96	2640	$401.28	16	Replace Incandescent Lamp with 13 W Compact Flourescent Lamp	13	0.21	572	$86.94	$5.00	$80.00	0.75	2068	$314.34	0.25
17	H	Adm Sect	4	4' 4-Lamp T-8 Prism Reflector Electric Ballast	2750	109	0.44	1199	$182.25	4	No Change Required	0	0.00	0	$0.00	$0.00	$0.00	0.00	0	$0.00	N/A
	K		1	2'X4' 4-Lamp T-12 Prism Reflector Magnetic Ballast	2750	188	0.19	517	$78.58	1	2'X4' 3-Lamp T-8 Prism Reflector Electronic Ballast Cooper Metalux	82	0.08	225.5	$34.28	$140.00	$140.00	0.11	291.5	$44.31	3.16
			3	3-Lamp CFL	2750	39	0.12	321.75	$48.91	3	No Change Required	0	0.00	0	$0.00	$0.00	$0.00	0.00	0	$0.00	N/A

18	G	Mail Rooms	1	8' 4-Lamp T-12 Prism Reflector Magnetic Ballast	2750	316	0.32	869	$132.09	2	4' 3-Lamp T-8 Prism Reflector Electronic Ballast Cooper Metalux	82	0.16	451	$68.55	$80.00	$160.00	0.15	418	$63.54	2.52
	I		2	2'X4' 4-Lamp T-12 Prism Reflector Magnetic Ballast	2750	160	0.32	880	$133.76	2	2'X4' 3-Lamp T-8 Prism Reflector Electronic Ballast Cooper Metalux	82	0.16	451	$68.55	$140.00	$280.00	0.16	429	$65.21	4.29
19	J	Human Services	2	4' 2-Lamp T-8 No Lens Electric Ballast	2750	58	0.12	319	$48.49	2	No Change Required	0	0.00	0	$0.00	$0.00	$0.00	0.00	0	$0.00	N/A
			2	Compact Flourescent	2750	13	0.03	71.5	$10.87	2	Replace Incandescent Lamp with 13 W Compact Flourescent Lamp	13	0.03	71.5	$10.87	$5.00	$10.00	0.00	0	$0.00	#DIV/0!
20	J	Finance Department	9	4' 2-Lamp T-8 No Lens Electric Ballast	2750	58	0.52	1435.5	$218.20	9	No Change Required	0	0.00	0	$0.00	$0.00	$0.00	0.00	0	$0.00	N/A
21	J	Environmental Services	6	4' 2-Lamp T-8 No Lens Electric Ballast	2750	58	0.35	957	$145.46	6	No Change Required	0	0.00	0	$0.00	$0.00	$0.00	0.00	0	$0.00	N/A
22	J	Purchasing	4	4' 2-Lamp T-8 No Lens Electric Ballast	2750	58	0.23	638	$96.98	4	No Change Required	0	0.00	0	$0.00	$0.00	$0.00	0.00	0	$0.00	N/A
23	I	Mens Bathroom	1	2'X4' 4-Lamp T-12 Prism Reflector Magnetic Ballast	2750	160	0.16	440	$66.88	1	2'X4' 3-Lamp T-8 Prism Reflector Electronic Ballast Cooper Metalux	82	0.08	225.5	$34.28	$140.00	$140.00	0.08	214.5	$32.60	4.29
24	I	Women's Bathroom	1	2'X4' 4-Lamp T-12 Prism Reflector Magnetic Ballast	2750	160	0.16	440	$66.88	1	2'X4' 3-Lamp T-8 Prism Reflector Electronic Ballast Cooper Metalux	82	0.08	225.5	$34.28	$140.00	$140.00	0.08	214.5	$32.60	4.29
25		Public Safety	8	2' 4-Lamp T-8 Prism Reflector Electric Ballast	2750	28	0.22	616	$93.63	8	No Change Required	0	0.00	0	$0.00	$0.00	$0.00	0.00	0	$0.00	N/A
26	J	3rd Floor Corridor	2	4' 2-Lamp T-8 No Lens Electric Ballast	2750	58	0.12	319	$48.49	2	No Change Required	0	0.00	0	$0.00	$0.00	$0.00	0.00	0	$0.00	N/A
27		Housing Inspection	9	60 Watt incandescent	2750	60	0.54	1485	$225.72	9	Replace Incandescent Lamp with 13 W Compact Flourescent Lamp	13	0.12	321.75	$48.91	$5.00	$45.00	0.42	1163.25	$176.81	0.25
28		Hall	6	4' 1-Lamp T-8 No Lens Electric Ballast	2750	28	0.17	462	$70.22	6	No Change Required	0	0.00	0	$0.00	$0.00	$0.00	0.00	0	$0.00	N/A
29	D	Rent Controls	9	2'X4' 2-Lamp T-8 Prism Reflect Electric Ballast 32 W	2750	58	0.52	1435.5	$218.20	9	No Change Required	0	0.00	0	$0.00	$0.00	$0.00	0.00	0	$0.00	N/A
30	D	Board of Health	13	2'X4' 2-Lamp T-8 Prism Reflect Electric Ballast 32 W	2750	58	0.75	2073.5	$315.17	13	No Change Required	0	0.00	0	$0.00	$0.00	$0.00	0.00	0	$0.00	N/A
31	J	Supply Room	1	4' 2-Lamp T-8 No Lens Electric Ballast	2750	58	0.06	159.5	$24.24	1	No Change Required	0	0.00	0	$0.00	$0.00	$0.00	0.00	0	$0.00	N/A
32	D	Plannings	12	2'X4' 2-Lamp T-8 Prism Reflect Electric Ballast 32 W	2750	58	0.70	1914	$290.93	12	No Change Required	0	0.00	0	$0.00	$0.00	$0.00	0.00	0	$0.00	N/A
33	D	Payrolls	9	2'X4' 2-Lamp T-8 Prism Reflect Electric Ballast 32 W	2750	58	0.52	1435.5	$218.20	9	No Change Required	0	0.00	0	$0.00	$0.00	$0.00	0.00	0	$0.00	N/A
34	A	Lead Office	3	4' 3-Lamp T-8 No Lens Electric Ballast	2750	82	0.25	676.5	$102.83	3	No Change Required	0	0.00	0	$0.00	$0.00	$0.00	0.00	0	$0.00	N/A

35	J	Assessors	13	4' 2-Lamp T-8 No Lens Electric Ballast	2750	58	0.75	2073.5	$315.17	13	No Change Required	0	0.00	0	$0.00	$0.00	$0.00	0.75	2073.5	$315.17	0.00
36		Storage	1	60 Watt Lamp	2750	60	0.06	165	$25.08	1	Replace Incandescent Lamp with 13 W Compact Flourescent Lamp	13	0.01	35.75	$5.43	$5.00	$5.00	0.05	129.25	$19.65	0.25
		Totals	285				26.55	73683.5	$11,199.89	307			5.41	14877.5	$2,261.38		$5,840.00	7.03	19992.5	$3,038.86	1.92

Domestic Hot Water Calculator

About

Water Heater Characteristics

Physical		Thermal	
? Diameter (feet)	1.5	? Water Inlet Temperature (Degrees F)	58
? Capacity (gallons)	50	? Ambient Temperature (Degrees F)	70
? Surface Area (calculated - sq ft)	21.36	? Hot Water Temperature (Degrees F)	135
? Effective R-value	11.85	? Hot Water Usage (Gallons per Day)	64.3

Energy Use

1694	? Heat Delivered in Hot Water (BTU/hr)	
117.2	? Heat loss through insulation (BTU/hr)	

Gas vs. Electric Water Heating

Gas		Electric
0.9	? Overall Efficiency	0.9166
0.9623	? Conversion Efficiency	0.98
1882 BTU/hr	? Power Into Water Heater	1848 BTU/hr

Cost

$ 1.389 /Therm	? Utility Rates	$ .152 /kWh
$ 228.9949848	? Yearly Water Heating Cost	$ 720.66256416

Project Name: LGEA Solar PV Project - City Hall
Location: City Hall, NJ
Description: Photovoltaic System 95% Financing - 20 year

Simple Payback Analysis

	Photovoltaic System 95% Financing - 20 year
Total Construction Cost	$264,960
Annual kWh Production	45,942
Annual Energy Cost Reduction	$6,983
Annual SREC Revenue	$16,080
First Cost Premium	**$264,960**
Simple Payback:	**11.49** Years

Life Cycle Cost Analysis

Analysis Period (years):	25	Financing %:	95%
Financing Term (mths):	240	Maintenance Escalation Rate:	3.0%
Average Energy Cost ($/kWh)	**$0.152**	Energy Cost Escalation Rate:	3.0%
Financing Rate:	7.00%	SREC Value ($/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	$13,248	0	0	0	$0	0	0	(13,248)	0
1	$0	45,942	$6,983	$0	$16,080	$17,430	$5,988	($355)	($13,603)
2	$0	45,713	$7,193	$0	$15,999	$16,997	$6,421	($226)	($13,829)
3	$0	45,484	$7,409	$0	$15,919	$16,533	$6,885	($90)	($13,919)
4	$0	45,257	$7,631	$0	$15,840	$16,035	$7,383	$52	($13,867)
5	$0	45,030	$7,860	$464	$15,761	$15,502	$7,917	($262)	($14,129)
6	$0	44,805	$8,096	$461	$15,682	$14,929	$8,489	($102)	($14,231)
7	$0	44,581	$8,338	$459	$15,603	$14,316	$9,103	$64	($14,167)
8	$0	44,358	$8,589	$457	$15,525	$13,658	$9,761	$239	($13,928)
9	$0	44,137	$8,846	$455	$15,448	$12,952	$10,466	$421	($13,507)
10	$0	43,916	$9,112	$452	$15,371	$12,195	$11,223	$612	($12,895)
11	$0	43,696	$9,385	$450	$15,294	$11,384	$12,034	$810	($12,085)
12	$0	43,478	$9,666	$448	$15,217	$10,514	$12,904	$1,018	($11,067)
13	$0	43,260	$9,956	$446	$15,141	$9,581	$13,837	$1,234	($9,833)
14	$0	43,044	$10,255	$443	$15,065	$8,581	$14,837	$1,459	($8,374)
15	$0	42,829	$10,563	$441	$14,990	$7,509	$15,910	$1,694	($6,681)
16	$0	42,615	$10,880	$439	$14,915	$6,358	$17,060	$1,938	($4,743)
17	$0	42,402	$11,206	$437	$14,841	$5,125	$18,293	$2,192	($2,551)
18	$0	42,190	$11,542	$435	$14,766	$3,803	$19,615	$2,456	($95)
19	$0	41,979	$11,889	$432	$14,693	$2,385	$21,033	$2,730	$2,635
20	$0	41,769	$12,245	$430	$14,619	$864	$22,554	$3,016	$5,651
21	$0	41,560	$12,613	$428	$14,546	$733	$20,734	$5,264	$10,915
22	$0	41,352	$12,991	$426	$14,473	$502	$17,062	$9,475	$20,389
23	$0	41,145	$13,381	$424	$14,401	$0	$0	$27,358	$47,747
24	$0	40,940	$13,782	$422	$14,329	$0	$0	$27,689	$75,436
25	$0	40,735	$14,196	$420	$14,257	$0	$0	$28,033	$103,469
	Totals:	876,486	$187,643	$7,149	$306,770	$216,653	$251,712	$289,508	$72,738
					Net Present Value (NPV)			**$11,027**	
					Internal Rate of Return (IRR)			**10.3%**	

Project Name: LGEA Solar PV Project - City Hall
Location: City Hall, NJ
Description: Photovoltaic System - Direct Purchase

Simple Payback Analysis

	Photovoltaic System - Direct Purchase
Total Construction Cost	$264,960
Annual kWh Production	45,942
Annual Energy Cost Reduction	$6,983
Annual SREC Revenue	$16,080
First Cost Premium	**$264,960**
Simple Payback:	**11.49** **Years**

Life Cycle Cost Analysis

Analysis Period (years):	25	Financing %:	0%
Financing Term (mths):	0	Maintenance Escalation Rate:	3.0%
Average Energy Cost ($/kWh)	**$0.152**	Energy Cost Escalation Rate:	3.0%
Financing Rate:	0.00%	SREC Value ($/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	$264,960	0	0	0	$0	(264,960)	0
1	$0	45,942	$6,983	$0	$16,080	$23,063	($241,897)
2	$0	45,713	$7,193	$0	$15,999	$23,192	($218,705)
3	$0	45,484	$7,409	$0	$15,919	$23,328	($195,377)
4	$0	45,257	$7,631	$0	$15,840	$23,471	($171,906)
5	$0	45,030	$7,860	$464	$15,761	$23,157	($148,749)
6	$0	44,805	$8,096	$461	$15,682	$23,316	($125,434)
7	$0	44,581	$8,338	$459	$15,603	$23,483	($101,951)
8	$0	44,358	$8,589	$457	$15,525	$23,657	($78,294)
9	$0	44,137	$8,846	$455	$15,448	$23,839	($54,454)
10	$0	43,916	$9,112	$452	$15,371	$24,030	($30,425)
11	$0	43,696	$9,385	$450	$15,294	$24,229	($6,196)
12	$0	43,478	$9,666	$448	$15,217	$24,436	$18,240
13	$0	43,260	$9,956	$446	$15,141	$24,652	$42,892
14	$0	43,044	$10,255	$443	$15,065	$24,877	$67,769
15	$0	42,829	$10,563	$441	$14,990	$25,112	$92,881
16	$0	42,615	$10,880	$439	$14,915	$25,356	$118,237
17	$0	42,402	$11,206	$437	$14,841	$25,610	$143,847
18	$0	42,190	$11,542	$435	$14,766	$25,874	$169,721
19	$0	41,979	$11,889	$432	$14,693	$26,149	$195,870
20	$0	41,769	$12,245	$430	$14,619	$26,434	$222,304
21	$1	41,560	$12,613	$428	$14,546	$26,730	$249,034
22	$2	41,352	$12,991	$426	$14,473	$27,038	$276,072
23	$3	41,145	$13,381	$424	$14,401	$27,358	$303,430
24	$4	40,940	$13,782	$422	$14,329	$27,689	$331,120
25	$5	40,735	$14,196	$420	$14,257	$28,033	$359,153
	Totals:	876,486	$187,643	$7,149	$306,770	$624,113	$487,264
				Net Present Value (NPV)		**$359,178**	
				Internal Rate of Return (IRR)		**7.7%**	

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
City Hall	1875	Sunpower SPR230	128	14.7	1,882	29.44	45,942	4,224	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.