



# **LOCAL GOVERNMENT ENERGY AUDIT PROGRAM: ENERGY AUDIT REPORT**

**PREPARED FOR:**           **WOODBINE BOROUGH HALL**  
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## I. EXECUTIVE SUMMARY

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

Woodbine Borough  
Borough Hall  
501 Washington Ave.  
Woodbine, NJ 08270

Municipal Contact Person: Jack Miller  
Facility Contact Person: Jim Gurdgiel

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

The annual energy costs at this facility are as follows:

Electricity	\$ 11,474
Propane Gas	\$ 6,537
<hr/>	
Total	\$ 18,011

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's 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**

<b>ENERGY CONSERVATION MEASURES (ECM's)</b>					
<b>ECM NO.</b>	<b>DESCRIPTION</b>	<b>NET INSTALLATION COST<sup>A</sup></b>	<b>ANNUAL SAVINGS<sup>B</sup></b>	<b>SIMPLE PAYBACK (Yrs)</b>	<b>SIMPLE LIFETIME ROI</b>
ECM #1	Interior Incandescent Lighting Upgrades	\$1,357	\$1,024	1.3	1031.7%
ECM #2	Lighting Controls	\$2,240	\$486	4.6	225.4%
ECM #3	Domestic Hot Water Replacement	\$2,000	\$368	5.4	120.8%
<b>RENEWABLE ENERGY MEASURES (REM's)</b>					
<b>ECM NO.</b>	<b>DESCRIPTION</b>	<b>NET INSTALLATION COST</b>	<b>ANNUAL SAVINGS</b>	<b>SIMPLE PAYBACK (Yrs)</b>	<b>SIMPLE LIFETIME ROI</b>
REM #1	9.89 KW PV System	\$89,010	\$6,630	13.4	86.2%

**Notes:** A. Cost takes into consideration applicable NJ Smart Start<sup>TM</sup> 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**

<b>ENERGY CONSERVATION MEASURES (ECM's)</b>				
<b>ECM NO.</b>	<b>DESCRIPTION</b>	<b>ANNUAL UTILITY REDUCTION</b>		
		<b>ELECTRIC DEMAND (KW)</b>	<b>ELECTRIC CONSUMPTION (KWH)</b>	<b>NATURAL GAS (THERMS)</b>
ECM #1	Interior Incandescent Lighting Upgrades	2.8	5849.0	0.0
ECM #2	Lighting Controls	0.9	2779.0	0.0
ECM #3	Domestic Hot Water Replacement	0.0	2923.0	-115.0
<b>RENEWABLE ENERGY MEASURES (REM's)</b>				
<b>ECM NO.</b>	<b>DESCRIPTION</b>	<b>ANNUAL UTILITY REDUCTION</b>		
		<b>ELECTRIC DEMAND (KW)</b>	<b>ELECTRIC CONSUMPTION (KWH)</b>	<b>NATURAL GAS (THERMS)</b>
REM #1	9.89 KW PV System	9.89	12628.0	0.0

**Notes:** A. Demand Savings for Renewable Energy Measures fluctuate with the seasons and are estimated based on the demand the Photovoltaic System will produce.

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

- **ECM #1:** Interior Incandescent Lighting Upgrades
- **ECM #2:** Lighting Controls
- **ECM #3:** Domestic Hot Water Replacement

In addition to the ECMs, there are maintenance and operational measures that can provide significant energy savings and provide immediate benefit. These 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 (low to no cost ECMs) 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, to avoid the unnecessary use of additional task lighting.
4. Provide more frequent air filter changes to decrease overall system power usage and maintain better IAQ.
5. Utilize programmable functionality in all programmable thermostats within the facility. Program unoccupied periods with a "set back" temperature (approximately 10°F away from occupied mode) to limit energy use when the building or space does not need it.
6. Turn off all computers when not in use or set computer to automatically sleep. Do not allow computers to simply run in screen saver mode (this does not save any energy).

A great opportunity for Woodbine Borough is the New Jersey Clean Energy's Direct Install Program. This program is state funded and targets small commercial and industrial facilities with peak demand of less than 200 kW. This turnkey program is aimed at providing owners a seamless, comprehensive process for analysis, equipment replacement and financial incentives to reduce consumption, lower utility costs and improve profitability. The program covers up to 60% of the cost for eligible upgrades including lighting, lighting controls, refrigeration, HVAC, motors, variable speed drives, natural gas and food service. Woodbine Borough should utilize the participating contractor to conduct a facility assessment and determine feasibility to install the cost-effective measures. The following is the contractor which provides services for Cape May County:

South Jersey Energy Service Plus  
Direct Install Program Hotline, Robert Senski  
Phone: 866-720-2555  
Email: [directinstall@sjindustries.com](mailto:directinstall@sjindustries.com)

Renewable Energy Measures (REMs) were also reviewed for implementation at the Memorial Elementary School. CEG utilized a roof mounted solar array to house a substantial PV system. The recommended 9.89 kW PV system will produce approximately 12,628 kWh of electricity annually and will reduce the schools electrical consumption from the grid by 19.3%. The system's calculated simple payback of 13.43 years is past the standard 10 year simple payback threshold; however, with alternative funding this payback could be lessened. CEG recommends the Owner review all funding options before deciding to not implement this renewable energy measure.

Overall, the Woodbine Borough Hall appears to be operating at a high efficiency level compared to other buildings in the region. This facility is relatively new and the energy savings from all ECMs listed above is approximately 16%. Electric rates are very high compared to most facilities putting emphasis on electric energy reduction measures. Additionally, low to no cost measures can be implemented immediately without much or any capital investment. It was noted during the survey that the thermostats in most spaces were put on "hold" temperature mode. It is strongly recommended to take advantage of all energy savings opportunities available such as programming the thermostats correctly with unoccupied set-back modes. With the implementation the recommended measures and taking action on the low cost maintenance improvements, the Borough will realize energy savings and operating cost reductions at the Borough Hall.



## II. INTRODUCTION

The comprehensive energy audit covers the 6,320 square foot Borough Hall Building, which includes the following spaces: offices, reception area, courtroom, judge's chamber, and restrooms.

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<sup>2</sup>/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. See the **Energy Conservation Measure Calculation Values Appendix** for details.

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

ECM Calculation Equations:

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

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

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

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

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

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

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

#### IV. HISTORIC ENERGY CONSUMPTION/COST

##### A. Energy Usage / Tariffs

The energy usage for the facility has been tabulated and plotted in graph form as depicted within this section. Each energy source has been identified and monthly consumption and cost noted per the information provided by the Owner.

The electric usage profile represents the actual electrical usage for the facility. Atlantic City Electric (ACE) provides electricity to the facility under their Monthly General Service rate structure. The electric utility measures consumption in kilowatt-hours (KWH) and maximum demand in kilowatts (KW). One KWH usage is equivalent to 1000 watts running for one hour. One KW of electric demand is equivalent to 1000 watts running at any given time. The basic usage charges are shown as generation service and delivery charges along with several non-utility generation charges. Rates used in this report reflect the historical data received for the facility.

The propane usage profile shows the actual propane consumption for the facility. Propane is provided by Modern Gas Company to the facility. The propane provider measures consumption in gallons. One Gallon of propane is equivalent to 91,600 BTUs of energy.

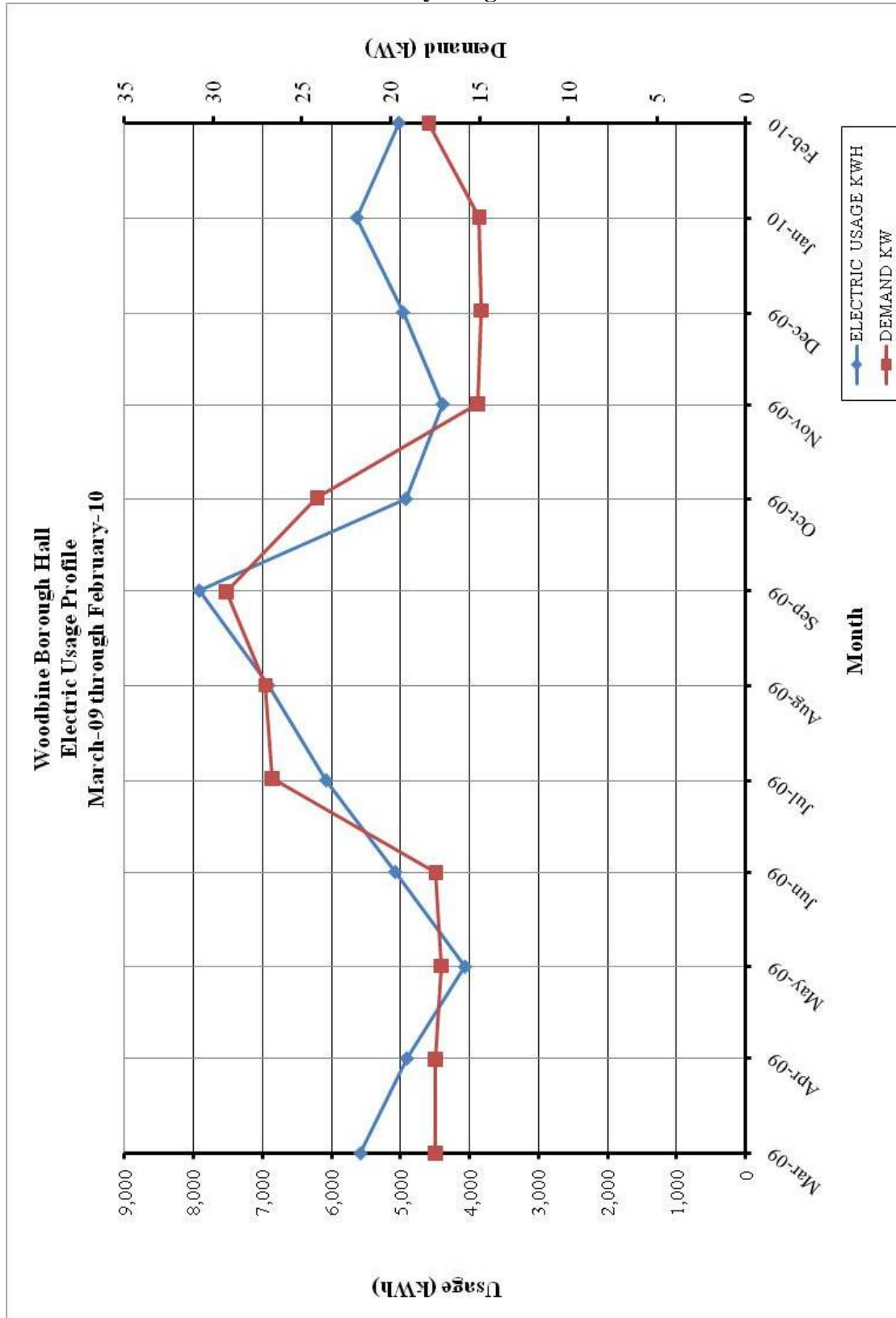
The overall cost for utilities is calculated by dividing the total cost by the total usage. Based on the utility history provided, the average cost for utilities at this facility is as follows:

<u>Description</u>	<u>Average</u>
Electricity	17.5¢ / kWh
Propane Gas	\$1.25 / Gallon

**Table 3**  
**Electricity Billing Data**

<b>ELECTRIC USAGE SUMMARY</b>			
Utility Provider: Atlantic City Electric Rate: Monthly General Service Meter No: Customer ID No: 0431 1939 9970 Third Party Utility TPS Meter / Acct No:			
<b>MONTH OF USE</b>	<b>CONSUMPTION KWH</b>	<b>DEMAND</b>	<b>TOTAL BILL</b>
Mar-09	5,576	17.5	\$856
Apr-09	4,906	17.5	\$760
May-09	4,063	17.2	\$636
Jun-09	5,074	17.5	\$871
Jul-09	6,075	26.7	\$1,194
Aug-09	6,913	27.1	\$1,377
Sep-09	7,914	29.3	\$1,589
Oct-09	4,922	24.1	\$931
Nov-09	4,387	15.1	\$728
Dec-09	4,963	14.9	\$801
Jan-10	5,629	15.0	\$907
Feb-10	5,022	17.9	\$824
<b>Totals</b>	<b>65,444</b>	<b>29.3 Max</b>	<b>\$11,474</b>
<b>AVERAGE DEMAND      20.0 KW average</b> <b>AVERAGE RATE      \$0.175 \$/kWh</b>			

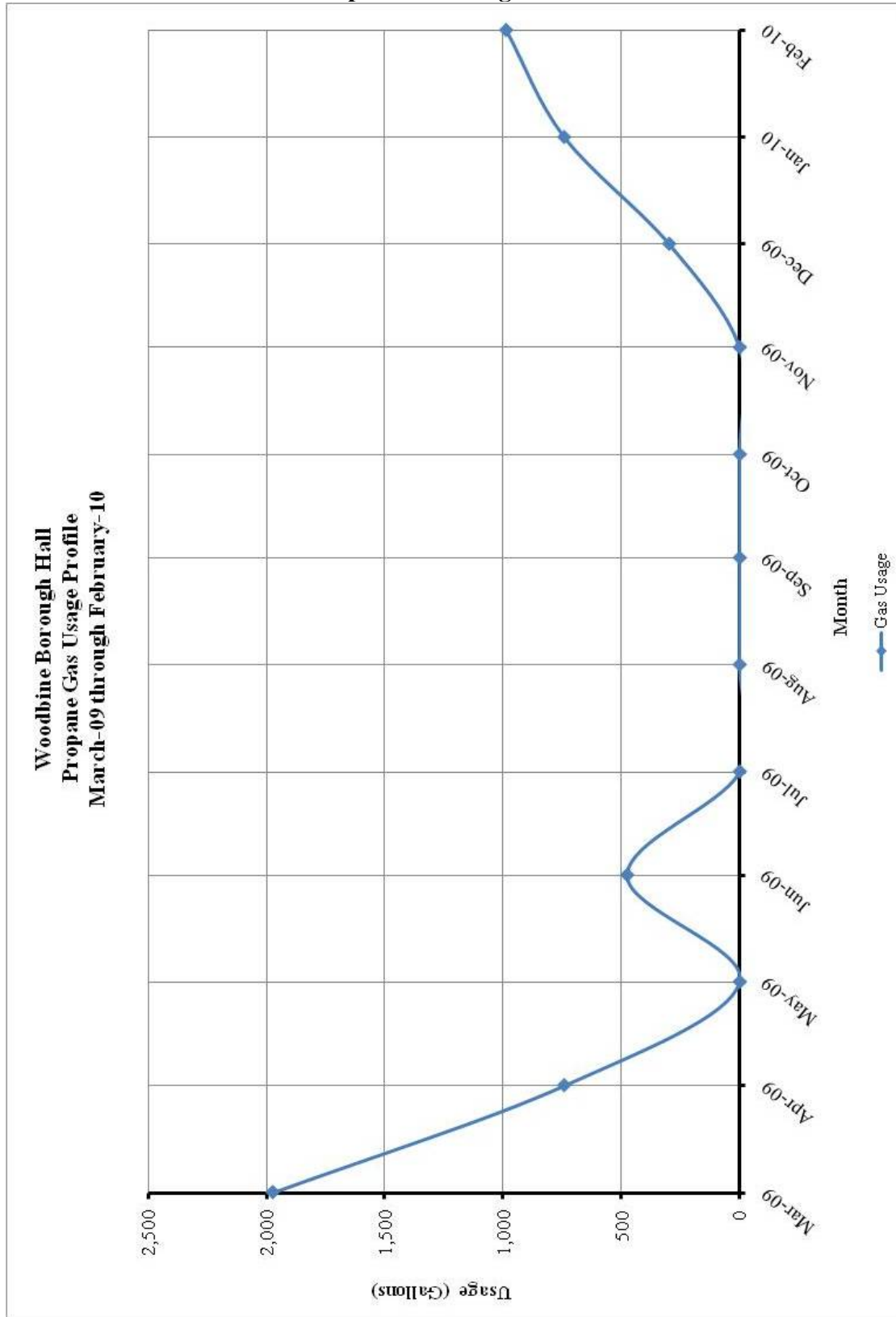
**Figure 1**  
**Electricity Usage Profile**



**Table 4**  
**Propane Gas Billing Data**

<b>PROPANE GAS USAGE SUMMARY</b>		
Utility Provider: Modern Gas Co.		
<b>MONTH OF USE</b>	<b>CONSUMPTION (GALLONS)</b>	<b>TOTAL BILL</b>
Mar-09	1,974.20	\$2,188.35
Apr-09	742.30	\$757.15
May-09	0.00	\$0.00
Jun-09	475.90	\$483.04
Jul-09	0.00	\$0.00
Aug-09	0.00	\$0.00
Sep-09	0.00	\$0.00
Oct-09	0.00	\$0.00
Nov-09	0.00	\$0.00
Dec-09	298.00	\$417.20
Jan-10	742.20	\$1,091.30
Feb-10	987.50	\$1,599.75
<b>TOTALS</b>	<b>5,220.10</b>	<b>\$6,536.79</b>
<b>AVERAGE RATE:</b> <b>\$1.25</b> <b>\$/GALLON</b>		

**Figure 2**  
**Propane Gas Usage Profile**





## B. Energy Use Index (EUI)

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

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

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

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

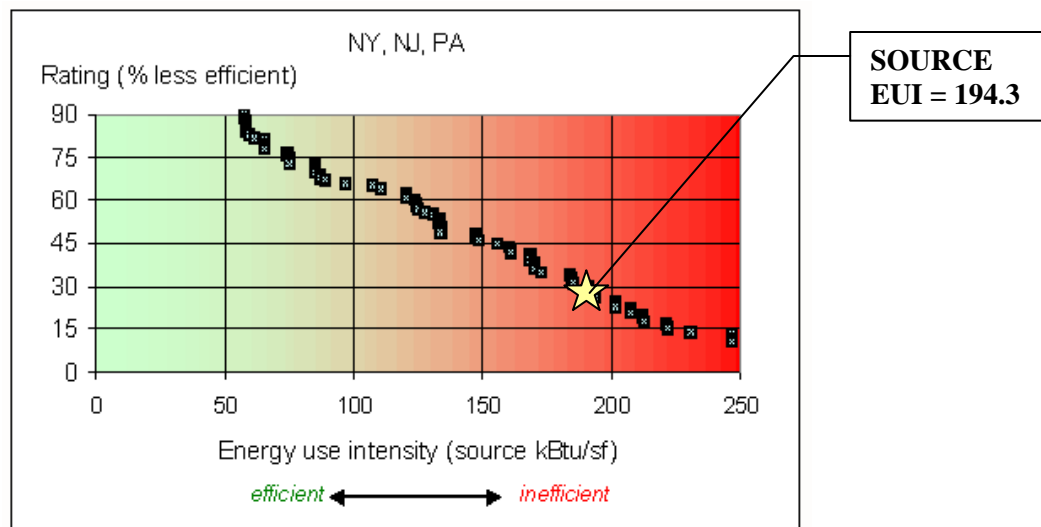
$$\text{Building Source EUI} = \frac{(\text{Electric Usage in kBtu} \times \text{SS Ratio} + \text{Gas Usage in kBtu} \times \text{SS Ratio})}{\text{Building Square Footage}}$$

**Table 5**  
**Facility Energy Use Index (EUI) Calculation**

ENERGY USE INTENSITY CALCULATION						
ENERGY TYPE	BUILDING USE			SITE ENERGY	SITE-SOURCE RATIO	SOURCE ENERGY
	kWh	Therms	Gallons	kBtu		kBtu
ELECTRIC	65444.0			223,426	3.340	746,242
NATURAL GAS		0.0		0	1.047	0
FUEL OIL			0.0	0	1.010	0
PROPANE			5220.1	476,752	1.010	481,519
TOTAL				700,178		1,227,761
*Site - Source Ratio data is provided by the Energy Star Performance Rating Methodology for Incorporating Source Energy Use document issued Dec 2007.						
BUILDING AREA	6,320 SQUARE FEET					
BUILDING SITE EUI	110.79 kBtu/SF/YR					
BUILDING SOURCE EUI	194.27 kBtu/SF/YR					

Figure 3 below depicts a national EUI grading for the source use of *Office Buildings*.

**Figure 3**  
**Source Energy Use Intensity Distributions: Office Building**



### 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](http://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: woodbineboro  
Password: lgeaceg2010

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

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

**Table 6**  
**ENERGY STAR Performance Rating**

ENERGY STAR PERFORMANCE RATING		
FACILITY DESCRIPTION	ENERGY PERFORMANCE RATING	NATIONAL AVERAGE
Borough Hall	18	50

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

## V. FACILITY DESCRIPTION

The 6,320 SF Woodbine Borough Hall is a single story facility comprised of a courtroom and entry waiting area, and administration offices. The typical hours of operation for this facility are between 8:00 am and 4:30 pm. Exterior walls are concrete masonry unit and brick construction with minimum insulation typical of the time period. The amount of insulation within the wall is unknown. The windows throughout the facility are in good condition and appear to be maintained. Typical windows throughout the facility are double pane, 1/4" clear glass with vinyl frames. Blinds are utilized through the facility per occupant comfort. The blinds are valuable because they help to reduce heat loss in the winter and reduce solar heat in the summer. The roof is a wood truss system with shingled exterior. The amount of insulation below the roofing is unknown. The building was built in 2002 with no additions since the original construction.

### HVAC Systems

The Borough Hall is conditioned by a combination furnace and split air conditioning system. The furnaces are York Diamond 80 units which provide 100 MBH of heating per unit. These furnaces are in good condition and are combined into pairs of two which provide a total of 200 MBH heating to each zone. There are four sets of paired furnaces which provide conditioning to the four zones within the building. All of the furnaces are located in the electrical room except the furnaces serving the courtroom which is located in the attic.

The cooling load is satisfied via four split system air conditioners manufactured by York. There are three (3) 6.3 Ton cooling units which serve the offices and common areas and one (1) 7.5 Ton cooling unit which serves the courtroom. The units are in good condition and are only 8 years old.

### Exhaust System

Air is exhausted from the toilet rooms through the roof exhausters. The toilet room exhaust fan is operated by an on/off switch which controls both the lighting and the fan in the bathroom.

### HVAC System Controls

There are four zones for heating and air conditioning within the building. These zones are conditioned by a combination of a furnace and a split system air conditioner. The four zones are controlled via programmable thermostats linked with each furnace/split system. At the time of the survey, all the thermostats were on hold; therefore no setbacks were implemented into the system.

### Domestic Hot Water

Domestic hot water for the restrooms and office lounge is provided by a 50 gallon Bradford White electric hot water heater, capacity of 12,000 Watts. The domestic hot water is circulated throughout the building by a hot water re-circ pump. The domestic hot water piping insulation appeared to be in good condition.

Lighting

Typical lighting throughout building is fluorescent tube lay-in fixtures with T-8 lamps and electronic ballasts. Storage rooms and closets lit with a mixture of incandescent lamps and compact fluorescent lamps. The parking lot is lit with light poles and high pressure sodium lamps. Lights are manually controlled with wall switches.

## **VI. MAJOR EQUIPMENT LIST**

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

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

## **VII. ENERGY CONSERVATION MEASURES**

### **ECM #1: Interior Incandescent Lighting Upgrades**

#### **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 60-Watt incandescent lamp, an 18-Watt CFL for a 75-Watt incandescent lamp, and a 26-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 also includes replacement of all incandescent bulbs to compact fluorescent bulbs. Where the existing fixture is controlled by a dimmer switch, the CFL bulb must be compatible with a dimmer switch. In some locations the bulb replacement will need to be tested to make sure the larger base of the CFL will fit into the existing fixture. The energy usage of an incandescent compared to a compact fluorescent approximately 3 to 4 times greater. In addition to the energy savings, compact fluorescent fixtures burn-hours are 8 to 15 times longer than incandescent fixtures ranging from 6,000 to 15,000 burn-hours compared to incandescent fixtures ranging from 750 to 1000 burn-hours.

#### **Energy Savings Calculations:**

Refer to the **Investment Grade Lighting Audit Appendix** for a detailed energy savings calculation for the replacement of the incandescent lamps with compact fluorescent lamps.

**Energy Savings Summary:**

<b>ECM #1 - ENERGY SAVINGS SUMMARY</b>	
<b>Installation Cost (\$):</b>	\$1,357
<b>NJ Smart Start Equipment Incentive (\$):</b>	\$0
<b>Net Installation Cost (\$):</b>	\$1,357
<b>Maintenance Savings (\$/Yr):</b>	\$0
<b>Energy Savings (\$/Yr):</b>	\$1,024
<b>Total Yearly Savings (\$/Yr):</b>	\$1,024
<b>Estimated ECM Lifetime (Yr):</b>	15
<b>Simple Payback</b>	1.3
<b>Simple Lifetime ROI</b>	1031.7%
<b>Simple Lifetime Maintenance Savings</b>	\$0
<b>Simple Lifetime Savings</b>	\$15,354
<b>Internal Rate of Return (IRR)</b>	75%
<b>Net Present Value (NPV)</b>	\$10,862.57



## ECM #2: Occupancy Sensors

### Description:

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

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

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

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

Energy savings achieved for “Occupancy Sensors for Lighting Control” average 20%-28%. Savings resulting from the implementation of this ECM for energy management controls are estimated to be 20% of the total light energy controlled by occupancy sensors.

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

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

Light Energy = 13,897 kWh/Yr. occupancy sensor controlled lighting

**Energy Savings Calculations:**

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

$$\text{Energy Savings} = 20\% \times 13,897 \text{ (kWh)} = 2,779 \text{ (kWh)}$$

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

$$\text{Savings.} = 2,779 \text{ (kWh)} \times 0.175 \left( \frac{\$}{\text{kWh}} \right) = \$486$$

Installation cost per dual-technology sensor (Basis: Sensor switch or equivalent) is \$160/unit including material and labor.

$$\text{Installation Cost} = \$160 \times 16 \text{ occupancy sensors} = \underline{\$2,560}$$

NJ Smart Start<sup>®</sup> Program Incentives are calculated as follows:

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

$$\text{Smart Start}^{\text{®}} \text{ Incentive} = (\# \text{ of wall mount devices} \times \$20) = (16 \times \$20) = \underline{\$320}$$

**Energy Savings Summary:**

<b>ECM #2 - ENERGY SAVINGS SUMMARY</b>	
<b>Installation Cost (\$):</b>	\$2,560
<b>NJ Smart Start Equipment Incentive (\$):</b>	\$320
<b>Net Installation Cost (\$):</b>	\$2,240
<b>Maintenance Savings (\$/Yr):</b>	\$0
<b>Energy Savings (\$/Yr):</b>	\$486
<b>Total Yearly Savings (\$/Yr):</b>	\$486
<b>Estimated ECM Lifetime (Yr):</b>	15
<b>Simple Payback</b>	4.6
<b>Simple Lifetime ROI</b>	225.4%
<b>Simple Lifetime Maintenance Savings</b>	\$0
<b>Simple Lifetime Savings</b>	\$7,290
<b>Internal Rate of Return (IRR)</b>	20%
<b>Net Present Value (NPV)</b>	\$3,561.84

### ECM #3: Electric Water Heater Replacement

#### Description:

The existing domestic hot water heater serving the facility is a 12 kW electric resistance hot water heater. 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 ECM includes replacement the existing 50 gallon electric hot water heater with an ultra high efficiency gas-fired hot water heater (95% thermal efficient, Bradford White HWH). This hot water heater would utilize the existing propane piping distribution to serve a new propane hot water heater in lieu of the electric unit. The gas piping would be extended to serve the new unit. The line size and available capacity of the existing service must be confirmed prior to implementation of this ECM.

#### Existing Electric DW Heater

Rated Capacity = 12,000 Watt (41 MBH) input; 50 gallons storage

#### Proposed Natural Gas-Fired, High-Efficiency DHW Heater

Rated Capacity = 120 MBH input; 60 gallons storage

Thermal Efficiency = 95%

$$\text{Dom.HW Heat Consumption} = \left( \frac{\text{Gal}}{\text{Min}} \right) \times 8.33 \left( \frac{\text{lb}}{\text{Gal}} \right) \times \Delta T(^{\circ}\text{F}) \times \text{Time}(\text{Min}) \times \dots$$

$$(\# \text{ People}) \times \left( \frac{\text{Use}}{\text{Day/Person}} \right) \times 365 \left( \frac{\text{Days}}{\text{Yr}} \right)$$

$$\text{Dom. HW Elec Usage} = \frac{\text{Dom HW Heat Cons.}(Btu)}{\text{Heating Eff.}(\%) \times \text{Fuel Heat Value} \left( \frac{BTU}{kWh} \right)}$$

$$\text{Dom. HW Gas Usage} = \frac{\text{Dom HW Heat Cons.}(Btu)}{\text{Heating Eff.}(\%) \times \text{Fuel Heat Value} \left( \frac{BTU}{Gallon} \right)}$$

$$\text{Elec Energy Cost} = \text{Heating Usage}(kWh) \times \text{Ave Fuel Cost} \left( \frac{\$}{kWh} \right)$$

$$\text{Gas Energy Cost} = \text{Heating Gas Usage (Therms)} \times \text{Ave Fuel Cost} \left( \frac{\$}{\text{Gallon}} \right)$$

**Energy Savings Calculations:**

<b>DOM. HOT WATER BOILER CALCULATIONS</b>			
<b>ECM INPUTS</b>	<b>EXISTING</b>	<b>PROPOSED</b>	<b>SAVINGS</b>
<b>ECM INPUTS</b>	Existing Electric Hot Water Heater	Bradford White High Efficiency	
<b>Number of People</b>	15	15	
<b>Lavatory Sink Time (Minutes)</b>	0.25	0.25	
<b>Sink Uses per Day</b>	5	5	
<b>Faucet Gallons Per Minute (GPM)</b>	2.5	2.5	
<b>Domestic Water Temperature Change (°F)</b>	70	70	
<b>Electric Cost (\$/kWh)</b>	0.18	0.18	
<b>Propane Cost (\$/Gallon)</b>	1.25	1.25	
<b>ENERGY SAVINGS CALCULATIONS</b>			
<b>ECM RESULTS</b>	<b>EXISTING</b>	<b>PROPOSED</b>	<b>SAVINGS</b>
<b>Sink Usage (BTU)</b>	9,976,477	9,976,477	
<b>Heating Efficiency</b>	100%	95%	
<b>Electric Consumption (kWh)</b>	2,923	0	2,923
<b>Propane Consumption (Gallon)</b>	0	115	-115
<b>Energy Cost (\$)</b>	\$512	\$143	\$368
<b>COMMENTS:</b>	*Savings are based on LEED-NC Version 2.2 Reference Guide for faucet and shower flow rates.		

**Energy Savings Summary:**

<b>ECM #3 - ENERGY SAVINGS SUMMARY</b>	
<b>Installation Cost (\$):</b>	\$2,000
<b>NJ Smart Start Equipment Incentive (\$):</b>	\$0
<b>Net Installation Cost (\$):</b>	\$2,000
<b>Maintenance Savings (\$/Yr):</b>	\$0
<b>Energy Savings (\$/Yr):</b>	\$368
<b>Total Yearly Savings (\$/Yr):</b>	\$368
<b>Estimated ECM Lifetime (Yr):</b>	12
<b>Simple Payback</b>	5.4
<b>Simple Lifetime ROI</b>	120.8%
<b>Simple Lifetime Maintenance Savings</b>	\$0
<b>Simple Lifetime Savings</b>	\$4,416
<b>Internal Rate of Return (IRR)</b>	15%
<b>Net Present Value (NPV)</b>	\$1,663.07

## VIII. RENEWABLE/DISTRIBUTED ENERGY MEASURES

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

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

CEG has reviewed the 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 700 S.F. can be utilized for a PV system. A depiction of the area utilized is shown in **Renewable / Distributed Energy Measures Calculation Appendix**. Using this square footage it was determined that a system size of 9.89 kilowatts could be installed. A system of this size has an estimated kilowatt hour production of 12,628 KWh annually, reducing the overall utility bill by approximately 19.3% percent. A detailed financial analysis can be found in the **Renewable / Distributed Energy Measures Calculation Appendix**. 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 not generate (produce more electricity than they use), the customer will be credited those kilowatt-hours generated to be carried over for future usage on a month to month basis. Then, on an annual basis if the customer is a net generator the customer will then be compensated by the utility the average annual PJM Grid LMP price per kilowatt-hour for the over generation. Due to the aforementioned legislation, the customer is at limited risk if they generate more than they use at times throughout the year. With the inefficiency of today's energy storage systems, such as batteries, the added cost of storage systems is not warranted and was not considered in the proposed design.

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

**Table 7**  
**Financial Summary – Photovoltaic System**

<b>FINANCIAL SUMMARY - PHOTOVOLTAIC SYSTEM</b>			
<b>PAYMENT TYPE</b>	<b>SIMPLE PAYBACK</b>	<b>SIMPLE ROI</b>	<b>INTERNAL RATE OF RETURN</b>
Direct Purchase	13.43 Years	86.2%	6.2%

\*The solar energy measure is shown for reference in the executive summary Renewable Energy Measure (REM) table

Given the large amount of capital required by the Borough to invest in a solar system through a Direct Purchase CEG does not recommend the Borough pursue this route. It would be more advantageous for the Borough to solicit Power Purchase Agreement (PPA) Providers who will own, operate, and maintain the system for a period of 15 years. During this time the PPA

Provider would sell all of the electric generated by Solar Arrays to the Borough at a reduced rate compared to their existing electric rate.

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



## **IX. ENERGY PURCHASING AND PROCUREMENT STRATEGY**

### **Load Profile:**

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

### Electricity:

The Electric Usage Profile demonstrates a fairly typical cooling load profile for an office / town hall. The increased cooling energy is seen in the months of July through September. There is a slight rise of electrical energy use in the winter months from January through March likely due to small unit heaters throughout the building. The electrical demand is peaked in the month of September, which coincides with the month with the largest electrical use. The overall load factor (L.F.) of the building is 25%. Load factor is the total usage divided by the demand times the hours. A load factor of 25% means that the equivalent full load electrical draw accounts for only 25% of the total time. A higher load factor of 50% or more along with a flat load profile will allow for more competitive energy prices when shopping for alternative suppliers.

### Propane:

The Propane usage profile demonstrates a very typical heat load profile. The summer months demonstrate very low consumption May through November (other than small fill ups). There is an increase in consumption in December through April. The heat is provide by gas fired furnaces which is the only type of equipment using the propane gas and therefore directly responsible for the usage. Propane is purchased based on market driven pricing and delivered on an as needed bases. This utility is unlike natural gas and electric utilities where time of use and load profiling has a more significant role.

**Tariff Analysis:**Electricity:

This facility receives electrical service through Atlantic City Electric on their Monthly General Service (MGS-Secondary) rate. This service classification is available for general service purposes on secondary voltages. This facility's rate is a three phase service at secondary voltages. For electric supply (generation), the customer has the option to purchase energy through the utility's Generation Charge or a Third Party Supplier (TPS). This facility utilizes the generation service provide through Atlantic City Electric (BGS). Therefore, they will pay according to the default service. The Delivery Service includes the following charges: Customer Charge, Distribution Charge (kW Demand), Reactive Demand Charge (kvar Demand, over 1/3 kW), Distribution Charge kWh, Non-utility Generation Charge, Societal benefits Charge kWh, Regulatory Assets Recovery Charge kWh, Transition Bond Charge kWh, Market Transition Charge Tax kWh, System Control Charge kWh, CIEP Standby Fee kWh, Transmission Demand Charge kW, Reliability Must Run Transmission Surcharge kWh, Transmission Enhancement Charge kWh, Basic Generation Service Charge kWh, Regional Greenhouse Gas Initiative Recovery Charge kWh, Infrastructure Investment Surcharge.

The Demand charges are based on measured demand for each month. Unlike Annual General Service, the Monthly General Service does not include a ratchet demand rate. The usage charges are based on a stepped rate structure. The demand charges are far less than the usage charges on a typical basis making this rate structure less dependent on demand versus usage. The steps for the usage charges are very small increments of change, which result in fairly steady costs per kWh per month despite the changes in electrical usage and demand. The rate structure's largest changes occur with the changing seasons. Electric costs on average are approximately 33% higher in the summer months June through September than the winter months.

Propane:

This facility receives deliveries of propane on an as needed basis. The cost per gallon is determined based on the market driven costs. These utilities do not include tariffs and rate structures. The current average prices being paid for propane are fairly competitive at \$1.25 per gallon. As a comparison propane provides more than 3.5 times the energy per dollar than electricity at the average rates for this facility.

**Recommendations:**

CEG recommends a global approach that will be consistent with all facilities within the Borough. Based on the utility information, the average price per kWh (kilowatt hour) for the building based on 1-year historical average price is \$.1248/kWh (this is the average “price to compare” if the client intends to shop for energy). Energy commodities are among the most volatile of all commodities, however at this point and time, energy is fairly competitive. The Borough should consider procuring energy through alternative supply sources to shop for the most competitive prices. In addition, it was noted that the Borough Hall’s electrical average costs were very high at \$0.175 / kWh compared to most buildings. The summertime average is approximately \$0.20 / kWh. It is important to keep this in mind particularly in the summer months to limit electrical energy use as much as possible. Remember to turn off lights, computers, computer monitors and plug in equipment to help limit the high costs.

CEG’s secondary recommendation coincides with propane costs. The propane costs are very competitive at this point, however this commodity’s pricing is directly related to oil prices which can fluctuate dramatically. It is recommended to take advantage of the current propane rates, while leaving as much versatility as possible to utilize other commodities in the future. CEG recommends that the Borough receive further advisement on these prices through an energy advisor.

CEG also recommends that the Borough schedule a meeting with the current utility providers to review their utility charges and current tariff structures for electricity and any other proposed energy sources. This meeting would provide insight regarding alternative procurement options that are currently available. Through its meeting with the Local Distribution Company (LDC), the Borough can learn more about the competitive supply process. Woodbine can acquire a list of approved Third Party Suppliers from the New Jersey Board of Public Utilities website at [www.nj.gov/bpu](http://www.nj.gov/bpu). The Borough should ask the utility representative about alternative billing options, such as consolidated billing when utilizing the service of a Third Party Supplier. This could be performed with the aid of an “energy advisor”.

## **X. INSTALLATION FUNDING OPTIONS**

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

- i. *Energy Savings Improvement Program (ESIP)* – Public Law 2009, Chapter 4 authorizes government entities to make energy related improvements to their facilities and 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.
- iv. *Pay For Performance* – The New Jersey Smart Start Pay for Performance program includes incentives based on savings resulted from implemented ECMs. The program is available for all buildings that were audited as part of the NJ Clean Energy’s Local Government Energy Audit Program. The facility’s participation in the program is assisted by an approved program partner. An “Energy Reduction Plan” is created with the facility and approved partner to show at least 15% reduction in the building’s current energy use. Multiple energy conservation measures implemented together are applicable toward the total savings of at least 15%. No more than 50% of the total energy savings can result from lighting upgrades / changes.

Total incentive is capped at 50% of the project cost. The program savings is broken down into three benchmarks; Energy Reduction Plan, Project Implementation, and Measurement and Verification. Each step provides additional incentives as the energy reduction project continues. The benchmark incentives are as follows:

1. Energy Reduction Plan – Upon completion of an energy reduction plan by an approved program partner, the incentive will grant \$0.10 per square foot between \$5,000 and \$50,000, and not to exceed 50% of the facility's annual energy expense. (Benchmark #1 is not provided in addition to the local government energy audit program incentive.)
  2. Project Implementation – Upon installation of the recommended measures along with the "Substantial Completion Construction Report," the incentive will grant savings per KWH or Therm based on the program's rates. Minimum saving must be 15%. (Example \$0.11 / kWh for 15% savings, \$0.12/ kWh for 17% savings, ... and \$1.10 / Therm for 15% savings, \$1.20 / Therm for 17% saving, ...) Increased incentives result from projected savings above 15%.
  3. Measurement and Verification – Upon verification 12 months after implementation of all recommended measures, that actual savings have been achieved, based on a completed verification report, the incentive will grant additional savings per kWh or Therm based on the program's rates. Minimum savings must be 15%. (Example \$0.07 / kWh for 15% savings, \$0.08/ kWh for 17% savings, ... and \$0.70 / Therm for 15% savings, \$0.80 / Therm for 17% saving, ...) Increased incentives result from verified savings above 15%.
- v. *Direct Install Program* – The New Jersey Clean Energy's Direct Install Program is a state funded program that targets small commercial and industrial facilities with peak demand of less than 200 kW. This turnkey program is aimed at providing owners a seamless, comprehensive process for analysis, equipment replacement and financial incentives to reduce consumption, lower utility costs and improve profitability. The program covers up to 60% of the cost for eligible upgrades including lighting, lighting controls, refrigeration, HVAC, motors, variable speed drives, natural gas and food service. Participating contractors (refer to [www.njcleanenergy.com](http://www.njcleanenergy.com)) conduct energy assessments in addition to your standard local government energy audit and install the cost-effective measures.

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 entrance doors.
- C. Clean all light fixtures to maximize light output, to avoid the unnecessary use of additional task lighting.
- D. Provide more frequent air filter changes to decrease overall system power usage and maintain better IAQ.
- E. Utilize programmable functionality in all programmable thermostats within the facility. Program unoccupied periods with a “set back” temperature (approximately 10°F away from occupied mode) to limit energy use when the building or space does not need it.
- F. Turn off all computers when not in use or set computer to automatically sleep. Do not allow computers to simply run in screen saver mode (this does not save any energy).

**ECM COST & SAVINGS BREAKDOWN**  
CONCORD ENGINEERING GROUP

Woodbine Borough Hall

ECM ENERGY AND FINANCIAL COSTS AND SAVINGS SUMMARY															
ECM NO.	DESCRIPTION	INSTALLATION COST				YEARLY SAVINGS			ECM LIFETIME	LIFETIME ENERGY SAVINGS	LIFETIME MAINTENANCE SAVINGS	LIFETIME ROI	SIMPLE PAYBACK	INTERNAL RATE OF RETURN	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	Interior Incandescent Lighting Upgrades	\$1,357	\$0	\$0	\$1,357	\$1,024	\$0	\$1,024	15	\$15,354	\$0	1031.7%	1.3	75.43%	\$10,862.57
ECM #2	Lighting Controls	\$2,560	\$0	\$320	\$2,240	\$486	\$0	\$486	15	\$7,290	\$0	225.4%	4.6	20.35%	\$3,561.84
ECM #3	Domestic Hot Water Replacement	\$2,000	\$0	\$0	\$2,000	\$368	\$0	\$368	12	\$4,416	\$0	120.8%	5.4	14.94%	\$1,663.07
REM RENEWABLE ENERGY AND FINANCIAL COSTS AND SAVINGS SUMMARY															
REM #1	9.89 KW PV System	\$89,010	\$0	\$0	\$89,010	\$2,210	\$4,420	\$6,630	25	\$165,750	\$110,500	86.2%	13.4	5.49%	\$26,439.17

**Notes:** 1) The variable C<sub>n</sub> 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 C<sub>n</sub> is the *cash flow during each period*.



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## SmartStart Building Incentives

The NJ SmartStart Buildings Program offers financial incentives on a wide variety of building system equipment. The incentives were developed to help offset the initial cost of energy-efficient equipment. The following tables show the current available incentives as of February, 2010:

### **Electric Chillers**

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

Energy Efficiency must comply with ASHRAE 90.1-2004

### **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
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### **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
Occupancy Controlled Thermostat (Hospitality & Institutional Facility)	\$75 per thermostat

Energy Efficiency must comply with ASHRAE 90.1-2004

### **Ground Source Heat Pumps**

Closed Loop & Open Loop	\$450 per ton, EER $\geq$ 16 \$600 per ton, EER $\geq$ 18 \$750 per ton, EER $\geq$ 20
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Energy Efficiency must comply with ASHRAE 90.1-2004



### Gas Heating

Gas Fired Boilers < 300 MBH	\$300 per unit
Gas Fired Boilers $\geq$ 300 - 1500 MBH	\$1.75 per MBH
Gas Fired Boilers $\geq$ 1500 - $\leq$ 4000 MBH	\$1.00 per MBH
Gas Fired Boilers > 4000 MBH	(Calculated through Custom Measure Path)
Gas Furnaces	\$300 - \$400 per unit, AFUE $\geq$ 92%

### 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 $\leq$ 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
Gas Fired Tankless Water Heaters	\$300 per unit

### Premium Motors

Three-Phase Motors	\$45 - \$700 per motor
Fractional HP Motors Electronic Communicated Motors (replacing shaded pole motors in refrigerator/freezer cases)	\$40 per electronic communicated motor

### Prescriptive Lighting

T-5 and T-8 Lamps w/Electronic Ballast in Existing Facilities	\$15 per fixture (1-4 lamps)
T-8 reduced Wattage (28w/25w 4', 1-4 lamps) Lamp & ballast replacement	\$10 per fixture
Hard-Wired Compact Fluorescent	\$25 - \$30 per fixture
Metal Halide w/Pulse Start	\$25 per fixture
LED Exit Signs	\$10 - \$20 per fixture
T-5 and T-8 High Bay Fixtures	\$16 - \$284 per fixture
HID $\geq$ 100w Retrofit with induction lamp, power coupler and generator (must be 30% less watts/fixture than HID system)	\$50 per fixture
HID $\geq$ 100w Replacement with new HID $\geq$ 100w	\$70 per fixture
LED Refrigerator/Freezer case lighting replacement of fluorescent in medium and low temperature display case	\$42 per 5 foot \$65 per 6 foot

### Lighting Controls – Occupancy Sensors

Wall Mounted	\$20 per control
Remote Mounted	\$35 per control
Daylight Dimmers	\$25 per fixture
Occupancy Controlled hi-low Fluorescent Controls	\$25 per fixture controlled

### Lighting Controls – HID or Fluorescent Hi-Bay Controls

Occupancy hi-low	\$75 per fixture controlled
Daylight Dimming	\$75 per fixture controlled
Daylight Dimming - office	\$50 per fixture controlled

### 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
Custom Measures	\$0.16 KWh and \$1.60/Therm of 1st year savings, or a buy down to a 1 year payback on estimated savings. Minimum required savings of 75,000 KWh or 1,500 Therms and a IRR of at least 10%.
Multi Measures Bonus	15%



# STATEMENT OF ENERGY PERFORMANCE

## Woodbine Borough - Borough Hall

Building ID: 2283967  
For 12-month Period Ending: February 28, 2010<sup>1</sup>  
Date SEP becomes ineligible: N/A

Date SEP Generated: April 20, 2010

### Facility

Woodbine Borough - Borough Hall  
501 Washington Avenue  
Woodbine, NJ 08270

### Facility Owner

Borough of Woodbine  
501 Washington Avenue  
Woodbine, NJ 08270

### Primary Contact for this Facility

Jack Miller  
501 Washington Avenue  
Woodbine, NJ 08270

Year Built: 2002

Gross Floor Area (ft<sup>2</sup>): 6,320

Energy Performance Rating<sup>2</sup> (1-100) 18

### Site Energy Use Summary<sup>3</sup>

Electricity - Grid Purchase(kBtu)	223,295
Propane (kBtu)	478,410
Natural Gas - (kBtu) <sup>4</sup>	0
Total Energy (kBtu)	701,705

### Energy Intensity<sup>5</sup>

Site (kBtu/ft <sup>2</sup> /yr)	111
Source (kBtu/ft <sup>2</sup> /yr)	194

### Emissions (based on site energy use)

Greenhouse Gas Emissions (MtCO <sub>2</sub> e/year)	64
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### Electric Distribution Utility

Pepco - Atlantic City Electric Co

### National Average Comparison

National Average Site EUI	77
National Average Source EUI	134
% Difference from National Average Source EUI	45%
Building Type	Office

### Meets Industry Standards<sup>6</sup> 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

Michael Fischette  
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"/>
<b>Building Name</b>	Woodbine Borough - Borough Hall	Is this the official building name to be displayed in the ENERGY STAR Registry of Labeled Buildings?		<input type="checkbox"/>
<b>Type</b>	Office	Is this an accurate description of the space in question?		<input type="checkbox"/>
<b>Location</b>	501 Washington Avenue, Woodbine, NJ 08270	Is this address accurate and complete? Correct weather normalization requires an accurate zip code.		<input type="checkbox"/>
<b>Single Structure</b>	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"/>
Borough Hall (Office)				
CRITERION	VALUE AS ENTERED IN PORTFOLIO MANAGER	VERIFICATION QUESTIONS	NOTES	<input checked="" type="checkbox"/>
<b>Gross Floor Area</b>	6,320 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"/>
<b>Weekly operating hours</b>	50 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"/>
<b>Workers on Main Shift</b>	10	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"/>
<b>Number of PCs</b>	10	Is this the number of personal computers in the Office?		<input type="checkbox"/>
<b>Percent Cooled</b>	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"/>
<b>Percent Heated</b>	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"/>

# ENERGY STAR® Data Checklist for Commercial Buildings

## Energy Consumption

**Power Generation Plant or Distribution Utility:** Pepco - Atlantic City Electric Co

Fuel Type: Electricity		
<b>Meter: Electric (kWh (thousand Watt-hours))</b> <b>Space(s):</b> Entire Facility <b>Generation Method:</b> Grid Purchase		
Start Date	End Date	Energy Use (kWh (thousand Watt-hours))
02/01/2010	02/28/2010	5,022.00
01/01/2010	01/31/2010	5,629.00
12/01/2009	12/31/2009	4,963.00
11/01/2009	11/30/2009	4,387.00
10/01/2009	10/31/2009	4,922.00
09/01/2009	09/30/2009	7,914.00
08/01/2009	08/31/2009	6,913.00
07/01/2009	07/31/2009	6,075.00
06/01/2009	06/30/2009	5,074.00
05/01/2009	05/31/2009	4,063.00
04/01/2009	04/30/2009	4,906.00
03/01/2009	03/31/2009	5,576.00
<b>Electric Consumption (kWh (thousand Watt-hours))</b>		<b>65,444.00</b>
<b>Electric Consumption (kBtu (thousand Btu))</b>		<b>223,294.93</b>
<b>Total Electricity (Grid Purchase) Consumption (kBtu (thousand Btu))</b>		<b>223,294.93</b>
Is this the total Electricity (Grid Purchase) consumption at this building including all Electricity meters?		<input type="checkbox"/>
Fuel Type: Propane		
<b>Meter: Propane (Gallons)</b> <b>Space(s):</b> Entire Facility		
Start Date	End Date	Energy Use (Gallons)
02/01/2010	02/28/2010	987.50
01/01/2010	01/31/2010	742.20
12/01/2009	12/31/2009	298.00
11/01/2009	11/30/2009	0.00
10/01/2009	10/31/2009	0.00
09/01/2009	09/30/2009	0.00
08/01/2009	08/31/2009	0.00
07/01/2009	07/31/2009	0.00
06/01/2009	06/30/2009	475.90
05/01/2009	05/31/2009	0.00

04/01/2009	04/30/2009	742.30
03/01/2009	03/31/2009	1,974.20
<b>Propane Consumption (Gallons)</b>		<b>5,220.10</b>
<b>Propane Consumption (kBtu (thousand Btu))</b>		<b>478,409.64</b>
<b>Total Propane Consumption (kBtu (thousand Btu))</b>		<b>478,409.64</b>
<b>Is this the total Propane consumption at this building including all Propane meters?</b>		<input type="checkbox"/>

<b>Additional Fuels</b>	
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"/>

<b>On-Site Solar and Wind Energy</b>	
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**

Woodbine Borough - Borough Hall  
501 Washington Avenue  
Woodbine, NJ 08270

**Facility Owner**

Borough of Woodbine  
501 Washington Avenue  
Woodbine, NJ 08270

**Primary Contact for this Facility**

Jack Miller  
501 Washington Avenue  
Woodbine, NJ 08270

**General Information**

Woodbine Borough - Borough Hall	
Gross Floor Area Excluding Parking: (ft <sup>2</sup> )	6,320
Year Built	2002
For 12-month Evaluation Period Ending Date:	February 28, 2010

**Facility Space Use Summary**

Borough Hall	
Space Type	Office
Gross Floor Area(ft <sup>2</sup> )	6,320
Weekly operating hours	50
Workers on Main Shift	10
Number of PCs	10
Percent Cooled	50% or more
Percent Heated	50% or more

**Energy Performance Comparison**

Performance Metrics	Evaluation Periods		Comparisons		
	Current (Ending Date 02/28/2010)	Baseline (Ending Date 02/28/2010)	Rating of 75	Target	National Average
Energy Performance Rating	18	18	75	N/A	50
Energy Intensity					
Site (kBtu/ft <sup>2</sup> )	111	111	57	N/A	77
Source (kBtu/ft <sup>2</sup> )	194	194	99	N/A	134
Energy Cost					
\$/year	\$ 18,010.79	\$ 18,010.79	\$ 9,197.62	N/A	\$ 12,437.06
\$/ft <sup>2</sup> /year	\$ 2.85	\$ 2.85	\$ 1.46	N/A	\$ 1.97
Greenhouse Gas Emissions					
MtCO <sub>2</sub> e/year	64	64	33	N/A	44
kgCO <sub>2</sub> e/ft <sup>2</sup> /year	10	10	5	N/A	7

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.

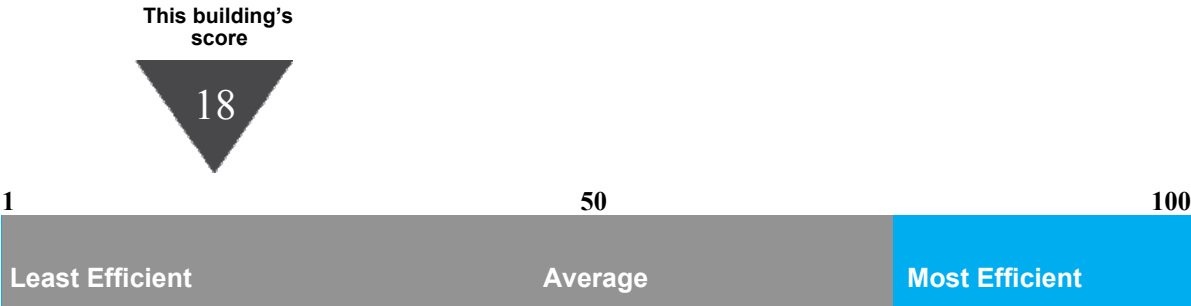
d - A default value has been supplied by Portfolio Manager.

# Statement of Energy Performance

**2010**

Woodbine Borough - Borough Hall  
501 Washington Avenue  
Woodbine, NJ 08270  
Portfolio Manager Building ID: 2283967

The energy use of this building has been measured and compared to other similar buildings using the Environmental Protection Agency's (EPA's) Energy Performance Scale of 1–100, with 1 being the least energy efficient and 100 the most energy efficient. For more information, visit [energystar.gov/benchmark](http://energystar.gov/benchmark).



This building uses 194 kBtu per square foot per year.\*

\*Based on source energy intensity for the 12 month period ending February 2010

Buildings with a score of 75 or higher may qualify for EPA's ENERGY STAR.

I certify that the information contained within this statement is accurate and in accordance with U.S. Environmental Protection Agency's measurement standards, found at [energystar.gov](http://energystar.gov)

Date of certification





**MAJOR EQUIPMENT LIST**

Concord Engineering Group

Woodbine Borough Hall

Domestic Water Heater															
Tag	Location	Area Served	Manufacturer	Qty	Model #	Serial #	Input	Recovery (gal/h)	Capacity (gal)	Efficiency (%)	Fuel	Approx. Age	ASHRAE Service Life	Remaining Life	Notes
	Electric Room	building	Bradford White	1	MIJ50123SF16	YC002318	12 KW	50	50	100	Electric	8	12	4	

Air Handling Units																				
Tag	Location	Area Served	Manufacturer	Qty	Model #	Serial #	Cooling Coil	Cooling Eff. (EER)	Cooling Capacity	Heating Type	Input (MBh)	Output (MBh)	Heating Eff. (%)	Fuel	Volts / Phase	Amps	Approx. Age	ASHRAE Service Life	Remaining Life	Notes
	Electric Room	Building	York	8	P4HUB12N08001A	WHKM015017	-	-	-	HX	100	80	80%	Propane	115/1	-	9	15	6	

AC Condensers														
Tag	Location	Area Served	Manufacturer	Qty.	Model #	Serial #	Cooling Capacity	Eff.	Refrigerant	Volts / Phase	Approx. Age	ASHRAE Service Life	Remaining Life	Notes
	Outside on grade	Building	York	3	H1RA076S25A	WFJP013195	6.3 Tons	10 SEER	R-22	208-230/3	8	15	7	
	Outside on grade	Building	York	1	H1RA090S25A	WHKM007614	7.5 Tons	10 SEEr	R-22	208-230/3	8	15	7	

Unit Heaters and Cabinet Unit Heaters															
Tag	Location	Area Served	Manufacturer	Qty.	Model #	Serial #	Heating Type	Heating Capacity (MBH)	CFM	RPM / HP	GPM	Approx. Age	ASHRAE Service Life	Remaining Life	Notes
	Electric Room	Electric Room	-	1	HWUH5884	-	-	-	-	-	-	8	13	5	

## Investment Grade Lighting Audit

Appendix E-1  
Page 1 of 5

CEG Job #: Insert CEG Job Number Here

Project: Project Name

Address: Address

Address

Building SF: 6,320

Woodbine Borough Hall

KWH COST: \$0.175

### ECM #1: Lighting Upgrade - General

EXISTING LIGHTING									PROPOSED LIGHTING									SAVINGS							
CEG Type	Fixture Location	Yearly Usage	No. Fixts	No. Lamps	Fixture Type	Fixt Watts	Total kW	kWh/Yr Fixtures	Yearly \$ Cost	No. Fixts	No. Lamps	Retro-Unit Description	Watts Used	Total kW	kWh/Yr Fixtures	Yearly \$ Cost	Unit Cost (INSTALLED)	Total Cost	kW Savings	kWh/Yr Savings	Yearly \$ Savings	Yearly Simple Payback			
1	Mech Room	2080	2	2	2-Lamp, T8, Electronic Ballast, Pendant Mounted, Strip	58	0.12	241.3	\$42.22	2	2	No Change	58	0.12	241.28	\$42.22	\$0.00	\$0.00	0.00	0	\$0.00	0.00			
2	Hallway	2080	19	2	2-Lamp, 2x2 Biax, T8, Electric Ballast, Recessed Mount, Prismatic Lens	71	1.35	2,805.9	\$491.04	19	2	No Change	71	1.35	2805.92	\$491.04	\$0.00	\$0.00	0.00	0	\$0.00	0.00			
22	Holding Cell	2080	1	4	4-Lamp, T8, Electronic Ballast, Surface Mounted, Prismatic Lens Sexurity Fixture	109	0.11	226.7	\$39.68	1	4	No Change	109	0.11	226.72	\$39.68	\$140.00	\$140.00	0.00	0	\$0.00	0.00			
23	Office	2080	2	4	4-Lamp, T8, Electronic Ballast, Recessed Mounted, Prismatic Lens	109	0.22	453.4	\$79.35	2	4	No Change	109	0.22	453.44	\$79.35	\$29.36	\$58.72	0.00	0	\$0.00	0.00			
3	Courtroom	2080	16	3	3-Lamp, 2x2 Biax, T8, Electric Ballast, Recessed Mount, Parabolic Lens	120	1.92	3,993.6	\$698.88	16	3	No Change	120	1.92	3993.6	\$698.88	\$0.00	\$0.00	0.00	0	\$0.00	0.00			
31		2080	20	0	1 Lamp Incandescents	100	2.00	4,160.0	\$728.00	20	0	26 W CFL Lamp	26	0.52	1081.6	\$189.28	\$5.75	\$115.00	1.48	3078.4	\$538.72	0.21			
23	Records Room	2080	4	4	4-Lamp, T8, Electronic Ballast, Recessed Mounted, Prismatic Lens	109	0.44	906.9	\$158.70	4	4	No Change	109	0.44	906.88	\$158.70	\$29.36	\$117.44	0.00	0	\$0.00	0.00			
23	Judge's Chamber	2080	2	4	4-Lamp, T8, Electronic Ballast, Recessed Mounted, Prismatic Lens	109	0.22	453.4	\$79.35	2	4	No Change	109	0.22	453.44	\$79.35	\$29.36	\$58.72	0.00	0	\$0.00	0.00			
23	Copy Room	2080	2	4	4-Lamp, T8, Electronic Ballast, Recessed Mounted, Prismatic Lens	109	0.22	453.4	\$79.35	2	4	No Change	109	0.22	453.44	\$79.35	\$29.36	\$58.72	0.00	0	\$0.00	0.00			
23	IT Room	2080	1	4	4-Lamp, T8, Electronic Ballast, Recessed Mounted, Prismatic Lens	109	0.11	226.7	\$39.68	1	4	No Change	109	0.11	226.72	\$39.68	\$29.36	\$29.36	0.00	0	\$0.00	0.00			
21	Court Admin	2080	6	0	3-Lamp, T8, Electronic Ballast, Recessed, Prismatic Lens	82	0.49	1,023.4	\$179.09	6	0	No Change	82	0.49	1023.36	\$179.09	\$0.00	\$0.00	0.00	0	\$0.00	0.00			
2	Lobby	2080	8	2	2-Lamp, 2x2 Biax, T8, Electric Ballast, Recessed Mount, Prismatic Lens	71	0.57	1,181.4	\$206.75	8	2	No Change	71	0.57	1181.44	\$206.75	\$0.00	\$0.00	0.00	0	\$0.00	0.00			
12		2080	2	0	2-Lamp Compact Flourescent	52	0.10	216.3	\$37.86	2	0	No Change	52	0.10	216.32	\$37.86	\$0.00	\$0.00	0.00	0	\$0.00	0.00			

## Investment Grade Lighting Audit

Appendix E-1  
Page 2 of 5

23	Planning Zoan Office	2080	4	4	4-Lamp, T8, Electronic Ballast, Recessed Mounted, Prismatic Lens	109	0.44	906.9	\$158.70	4	4	No Change	109	0.44	906.88	\$158.70	\$29.36	\$117.44	0.00	0	\$0.00	0.00
23	Borough Clerk	2080	2	4	4-Lamp, T8, Electronic Ballast, Recessed Mounted, Prismatic Lens	109	0.22	453.4	\$79.35	2	4	No Change	109	0.22	453.44	\$79.35	\$29.36	\$58.72	0.00	0	\$0.00	0.00
23	Tax Office	2080	7	4	4-Lamp, T8, Electronic Ballast, Recessed Mounted, Prismatic Lens	109	0.76	1,587.0	\$277.73	7	4	No Change	109	0.76	1587.04	\$277.73	\$29.36	\$205.52	0.00	0	\$0.00	0.00
23	CFO Office	2080	3	4	4-Lamp, T8, Electronic Ballast, Recessed Mounted, Prismatic Lens	109	0.33	680.2	\$119.03	3	4	No Change	109	0.33	680.16	\$119.03	\$29.36	\$88.08	0.00	0	\$0.00	0.00
31		2080	6	0	1 Lamp Incandescents	100	0.60	1,248.0	\$218.40	6	0	26 W CFL Lamp	26	0.16	324.48	\$56.78	\$5.75	\$34.50	0.44	923.52	\$161.62	0.21
2	Mens Room	2080	1	2	2-Lamp, 2x2 Biax, T8, Electric Ballast, Recessed Mount, Prismatic Lens	71	0.07	147.7	\$25.84	1	2	No Change	71	0.07	147.68	\$25.84	\$0.00	\$0.00	0.00	0	\$0.00	0.00
23		2080	1	4	4-Lamp, T8, Electronic Ballast, Recessed Mounted, Prismatic Lens	109	0.11	226.7	\$39.68	1	4	No Change	109	0.11	226.72	\$39.68	\$29.36	\$29.36	0.00	0	\$0.00	0.00
2	Womens Room	2080	1	2	2-Lamp, 2x2 Biax, T8, Electric Ballast, Recessed Mount, Prismatic Lens	71	0.07	147.7	\$25.84	1	2	No Change	71	0.07	147.68	\$25.84	\$0.00	\$0.00	0.00	0	\$0.00	0.00
23		2080	1	4	4-Lamp, T8, Electronic Ballast, Recessed Mounted, Prismatic Lens	109	0.11	226.7	\$39.68	1	4	No Change	109	0.11	226.72	\$39.68	\$29.36	\$29.36	0.00	0	\$0.00	0.00
21	Lunch	2080	4	0	3-Lamp, T8, Electronic Ballast, Recessed, Prismatic Lens	82	0.33	682.2	\$119.39	4	0	No Change	82	0.33	682.24	\$119.39	\$0.00	\$0.00	0.00	0	\$0.00	0.00
23	Assistant to Mayor	2080	2	4	4-Lamp, T8, Electronic Ballast, Recessed Mounted, Prismatic Lens	109	0.22	453.4	\$79.35	2	4	No Change	109	0.22	453.44	\$79.35	\$29.36	\$58.72	0.00	0	\$0.00	0.00
2	Conference Room	2080	3	2	2-Lamp, 2x2 Biax, T8, Electric Ballast, Recessed Mount, Prismatic Lens	71	0.21	443.0	\$77.53	3	2	No Change	71	0.21	443.04	\$77.53	\$0.00	\$0.00	0.00	0	\$0.00	0.00
31		2080	6	0	1 Lamp Incandescents	100	0.60	1,248.0	\$218.40	6	0	26 W CFL Lamp	26	0.16	324.48	\$56.78	\$5.75	\$34.50	0.44	923.52	\$161.62	0.21
23	Mayor's Office	2080	3	4	4-Lamp, T8, Electronic Ballast, Recessed Mounted, Prismatic Lens	109	0.33	680.2	\$119.03	3	4	No Change	109	0.33	680.16	\$119.03	\$29.36	\$88.08	0.00	0	\$0.00	0.00
31		2080	6	0	1 Lamp Incandescents	100	0.60	1,248.0	\$218.40	6	0	26 W CFL Lamp	26	0.16	324.48	\$56.78	\$5.75	\$34.50	0.44	923.52	\$161.62	0.21
	Totals		135	71			12.85	26,721.8	\$4,676.31	135	71			10.035	20872.8	\$3,652.74		\$1,356.74	2.81	5849.0	\$1,023.57	1.33

**NOTES:** 1. Simple Payback noted in this spreadsheet does not include Maintenance Savings and NJ Smart Start Incentives.

2. Lamp totals only include T-12 tube replacement calculations

**Investment Grade Lighting Audit**

CEG Job #: Insert CEG Job Number Here  
Project: Project Name  
Address: Address  
Address  
Building SF: 6320

Woodbine Borough Hall

KWH COST: **\$0.175**

## ECM #2: Lighting Controls

EXISTING LIGHTING					PROPOSED LIGHTING CONTROLS								SAVINGS										
CEG Type	Fixture Location	Yearly Usage	No. Fixts	No. Lamps	Fixture Type	Fixt Watts	Total kW	kWh/Yr Fixtures	Yearly \$ Cost	No. Fixts	No. Lamps	Controls Description	Watts Used	Reduction (%)	Total kW	kWh/Yr Fixtures	Yearly \$ Cost	Unit Cost (INSTALLED)	Total Cost	kW Savings	kWh/Yr Savings	Yearly \$ Savings	Yearly Simple Payback
1	Mech Room	2080	2	2	2-Lamp, T8, Electronic Ballast, Pendant Mounted, Strip	58	0.12	241.3	\$42.22	2	2	None	58	0%	0.12	241	\$42.22	\$0.00	\$0.00	0.00	0.0	\$0.00	0.00
2	Hallway	2080	19	2	2-Lamp, 2x2 Biax, T8, Electric Ballast, Recessed Mount, Prismatic Lens	71	1.35	2,805.9	\$491.04	19	2	None	71	0%	1.35	2806	\$491.04	\$0.00	\$0.00	0.00	0.0	\$0.00	0.00
22	Holding Cell	2080	1	4	4-Lamp, T8, Electronic Ballast, Surface Mounted, Prismatic Lens Sexurity Fixture	109	0.11	226.7	\$39.68	1	4	None	109	0%	0.11	227	\$39.68	\$0.00	\$0.00	0.00	0.0	\$0.00	0.00
23	Office	2080	2	4	4-Lamp, T8, Electronic Ballast, Recessed Mounted, Prismatic Lens	109	0.22	453.4	\$79.35	2	4	Dual Technology Occupancy Sensor	109	20%	0.17	363	\$63.48	\$160.00	\$160.00	0.04	90.7	\$15.87	10.08
3	Courtroom	2080	16	3	3-Lamp, 2x2 Biax, T8, Electric Ballast, Recessed Mount, Parabolic Lens	120	1.92	3,993.6	\$698.88	16	3	None	120	0%	1.92	3994	\$698.88	\$0.00	\$0.00	0.00	0.0	\$0.00	0.00
31		2080	20	0	1 Lamp Incandescents	100	2.00	4,160.0	\$728.00	20	0		100	0%	2.00	4160	\$728.00	\$0.00	\$0.00	0.00	0.0	\$0.00	0.00
23	Records Room	2080	4	4	4-Lamp, T8, Electronic Ballast, Recessed Mounted, Prismatic Lens	109	0.44	906.9	\$158.70	4	4	Dual Technology Occupancy Sensor	109	20%	0.35	726	\$126.96	\$160.00	\$160.00	0.09	181.4	\$31.74	5.04
23	Judge's Chamber	2080	2	4	4-Lamp, T8, Electronic Ballast, Recessed Mounted, Prismatic Lens	109	0.22	453.4	\$79.35	2	4	Dual Technology Occupancy Sensor	109	20%	0.17	363	\$63.48	\$160.00	\$160.00	0.04	90.7	\$15.87	10.08
23	Copy Room	2080	2	4	4-Lamp, T8, Electronic Ballast, Recessed Mounted, Prismatic Lens	109	0.22	453.4	\$79.35	2	4	Dual Technology Occupancy Sensor	109	20%	0.17	363	\$63.48	\$160.00	\$160.00	0.04	90.7	\$15.87	10.08
23	IT Room	2080	1	4	4-Lamp, T8, Electronic Ballast, Recessed Mounted, Prismatic Lens	109	0.11	226.7	\$39.68	1	4	Dual Technology Occupancy Sensor	109	20%	0.09	181	\$31.74	\$160.00	\$160.00	0.02	45.3	\$7.94	20.16
21	Court Admin	2080	6	0	3-Lamp, T8, Electronic Ballast, Recessed, Prismatic Lens	82	0.49	1,023.4	\$179.09	6	0	Dual Technology Occupancy Sensor	82	20%	0.39	819	\$143.27	\$160.00	\$160.00	0.10	204.7	\$35.82	4.47
2	Lobby	2080	8	2	2-Lamp, 2x2 Biax, T8, Electric Ballast, Recessed Mount, Prismatic Lens	71	0.57	1,181.4	\$206.75	8	2	None	71	0%	0.57	1181	\$206.75	\$0.00	\$0.00	0.00	0.0	\$0.00	0.00
12		2080	2	0	2-Lamp Compact Fluorescent	52	0.10	216.3	\$37.86	2	0		52	0%	0.10	216	\$37.86	\$0.00	\$0.00	0.00	0.0	\$0.00	0.00

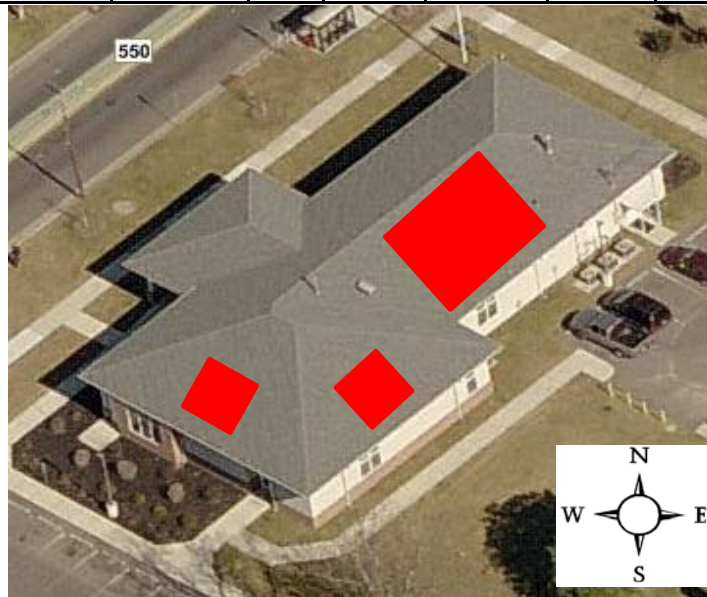
23	Planning Zoan Office	2080	4	4	4-Lamp, T8, Electronic Ballast, Recessed Mounted, Prismatic Lens	109	0.44	906.9	\$158.70	4	4	Dual Technology Occupancy Sensor	109	20%	0.35	726	\$126.96	\$160.00	\$160.00	0.09	181.4	\$31.74	5.04
23	Borough Clerk	2080	2	4	4-Lamp, T8, Electronic Ballast, Recessed Mounted, Prismatic Lens	109	0.22	453.4	\$79.35	2	4	Dual Technology Occupancy Sensor	109	20%	0.17	363	\$63.48	\$160.00	\$160.00	0.04	90.7	\$15.87	10.08
23	Tax Office	2080	7	4	4-Lamp, T8, Electronic Ballast, Recessed Mounted, Prismatic Lens	109	0.76	1,587.0	\$277.73	7	4	Dual Technology Occupancy Sensor	109	20%	0.61	1270	\$222.19	\$160.00	\$160.00	0.15	317.4	\$55.55	2.88
23	CFO Office	2080	3	4	4-Lamp, T8, Electronic Ballast, Recessed Mounted, Prismatic Lens	109	0.33	680.2	\$119.03	3	4	Dual Technology Occupancy Sensor	109	20%	0.26	544	\$95.22	\$160.00	\$160.00	0.07	136.0	\$23.81	6.72
31		2080	6	0	1 Lamp Incandescents	100	0.60	1,248.0	\$218.40	6	0		100	20%	0.60	998	\$174.72	\$0.00	\$0.00	0.00	249.6	\$43.68	0.00
2	Mens Room	2080	1	2	2-Lamp, 2x2 Biax, T8, Electric Ballast, Recessed Mount, Prismatic Lens	71	0.07	147.7	\$25.84	1	2	Dual Technology Occupancy Sensor	71	20%	0.06	118	\$20.68	\$160.00	\$160.00	0.01	29.5	\$5.17	30.95
23		2080	1	4	4-Lamp, T8, Electronic Ballast, Recessed Mounted, Prismatic Lens	109	0.11	226.7	\$39.68	1	4		109	20%	0.11	181	\$31.74	\$0.00	\$0.00	0.00	45.3	\$7.94	0.00
2	Womens Room	2080	1	2	2-Lamp, 2x2 Biax, T8, Electric Ballast, Recessed Mount, Prismatic Lens	71	0.07	147.7	\$25.84	1	2	Dual Technology Occupancy Sensor	71	20%	0.06	118	\$20.68	\$160.00	\$160.00	0.01	29.5	\$5.17	30.95
23		2080	1	4	4-Lamp, T8, Electronic Ballast, Recessed Mounted, Prismatic Lens	109	0.11	226.7	\$39.68	1	4		109	20%	0.11	181	\$31.74	\$0.00	\$0.00	0.00	45.3	\$7.94	0.00
21	Lunch	2080	4	0	3-Lamp, T8, Electronic Ballast, Recessed, Prismatic Lens	82	0.33	682.2	\$119.39	4	0	Dual Technology Occupancy Sensor	82	20%	0.26	546	\$95.51	\$160.00	\$160.00	0.07	136.4	\$23.88	6.70
23	Assistant to Mayor	2080	2	4	4-Lamp, T8, Electronic Ballast, Recessed Mounted, Prismatic Lens	109	0.22	453.4	\$79.35	2	4	Dual Technology Occupancy Sensor	109	20%	0.17	363	\$63.48	\$160.00	\$160.00	0.04	90.7	\$15.87	10.08
2	Conference Room	2080	3	2	2-Lamp, 2x2 Biax, T8, Electric Ballast, Recessed Mount, Prismatic Lens	71	0.21	443.0	\$77.53	3	2	Dual Technology Occupancy Sensor	71	20%	0.17	354	\$62.03	\$160.00	\$160.00	0.04	88.6	\$15.51	10.32
31		2080	6	0	1 Lamp Incandescents	100	0.60	1,248.0	\$218.40	6	0		100	20%	0.60	998	\$174.72	\$0.00	\$0.00	0.00	249.6	\$43.68	0.00
23	Mayor's Office	2080	3	4	4-Lamp, T8, Electronic Ballast, Recessed Mounted, Prismatic Lens	109	0.33	680.2	\$119.03	3	4	Dual Technology Occupancy Sensor	109	20%	0.26	544	\$95.22	\$160.00	\$160.00	0.07	136.0	\$23.81	6.72
31		2080	6	0	1 Lamp Incandescents	100	0.60	1,248.0	\$218.40	6	0		100	20%	0.60	998	\$174.72	\$0.00	\$0.00	0.00	249.6	\$43.68	0.00
	Totals		135	71			12.85	26,721.8	\$4,676.31	135	71				11.9144	23942	\$4,189.93		\$2,560.00	0.93	2779.3	\$486.38	5.26

NOTES: 1. Simple Payback noted in this spreadsheet does not include Maintenance Savings and NJ Smart Start Incentives.

2. Lamp totals only include T-12 tube replacment calculations

Project Name: LGEA Solar PV Project - Woodbine Borough Hall							
Location: Woodbine, NJ							
Description: Photovoltaic System - Direct Purchase							
Simple Payback Analysis							
		Photovoltaic System - Direct Purchase					
Total Construction Cost		\$89,010					
Annual kWh Production		12,628					
Annual Energy Cost Reduction		\$2,210					
Annual SREC Revenue		\$4,420					
First Cost Premium		\$89,010					
Simple Payback:		13.43					Years
Life Cycle Cost Analysis							
Analysis Period (years):		25		Financing %:		0%	
Financing Term (mths):		0		Maintenance Escalation Rate:		3.0%	
Average Energy Cost (\$/kWh)		\$0.175		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	\$89,010	0	0	0	\$0	(89,010)	0
1	\$0	12,628	\$2,210	\$0	\$4,420	\$6,630	(\$82,380)
2	\$0	12,565	\$2,276	\$0	\$4,398	\$6,674	(\$75,706)
3	\$0	12,502	\$2,344	\$0	\$4,376	\$6,720	(\$68,986)
4	\$0	12,440	\$2,415	\$0	\$4,354	\$6,769	(\$62,218)
5	\$0	12,377	\$2,487	\$127	\$4,332	\$6,692	(\$55,526)
6	\$0	12,315	\$2,562	\$127	\$4,310	\$6,745	(\$48,780)
7	\$0	12,254	\$2,639	\$126	\$4,289	\$6,801	(\$41,979)
8	\$0	12,193	\$2,718	\$126	\$4,267	\$6,860	(\$35,119)
9	\$0	12,132	\$2,799	\$125	\$4,246	\$6,921	(\$28,199)
10	\$0	12,071	\$2,883	\$124	\$4,225	\$6,984	(\$21,215)
11	\$0	12,011	\$2,970	\$124	\$4,204	\$7,050	(\$14,165)
12	\$0	11,951	\$3,059	\$123	\$4,183	\$7,119	(\$7,046)
13	\$0	11,891	\$3,151	\$122	\$4,162	\$7,190	\$144
14	\$0	11,831	\$3,245	\$122	\$4,141	\$7,264	\$7,408
15	\$0	11,772	\$3,343	\$121	\$4,120	\$7,342	\$14,750
16	\$0	11,713	\$3,443	\$121	\$4,100	\$7,422	\$22,172
17	\$0	11,655	\$3,546	\$120	\$4,079	\$7,505	\$29,677
18	\$0	11,597	\$3,653	\$119	\$4,059	\$7,592	\$37,269
19	\$0	11,539	\$3,762	\$119	\$4,038	\$7,682	\$44,951
20	\$0	11,481	\$3,875	\$118	\$4,018	\$7,775	\$52,726
21	\$1	11,423	\$3,991	\$118	\$3,998	\$7,872	\$60,598
22	\$2	11,366	\$4,111	\$117	\$3,978	\$7,972	\$68,570
23	\$3	11,309	\$4,234	\$116	\$3,958	\$8,076	\$76,647
24	\$4	11,253	\$4,361	\$116	\$3,939	\$8,184	\$84,831
25	\$5	11,197	\$4,492	\$115	\$3,919	\$8,296	\$93,126
Totals:		297,465	\$80,571	\$2,548	\$104,113	\$182,136	\$51,552
Net Present Value (NPV)						\$93,151	
Internal Rate of Return (IRR)						6.2%	

Building	Roof Area (sq ft)	Panel	Qty	Panel Sq Ft	Panel Total Sq Ft	Total KW <sub>DC</sub>	Total Annual kWh	Panel Weight (33 lbs)	W/SQFT
Woodbine Borough Hall	700	Sunpower SPR230	43	14.7	632	9.89	12,628	1,419	15.64



AC Energy  
&  
Cost Savings



Station Identification	
City:	Atlantic_City
State:	New_Jersey
Latitude:	39.45° N
Longitude:	74.57° W
Elevation:	20 m
PV System Specifications	
DC Rating:	9.9 kW
DC to AC Derate Factor:	0.810
AC Rating:	8.0 kW
Array Type:	Fixed Tilt
Array Tilt:	18.0°
Array Azimuth:	180.0°
Energy Specifications	
Cost of Electricity:	11.2 ¢/kWh

Results			
Month	Solar Radiation (kWh m <sup>2</sup> day)	AC Energy (kWh)	Energy Value (\$)
1	2.92	742	83.10
2	3.64	836	93.63
3	4.53	1113	124.66
4	5.31	1230	137.76
5	5.85	1376	154.11
6	6.07	1326	148.51
7	6.03	1348	150.98
8	5.61	1259	141.01
9	5.06	1117	125.10
10	4.08	952	106.62
11	2.97	700	78.40
12	2.55	627	70.22
Year	4.56	12628	1414.34

 = Proposed PV Layout

Notes:

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





# Concord Engineering Group, Inc.

520 BURNT MILL ROAD  
VOORHEES, NEW JERSEY 08043  
PHONE: (856) 427-0200  
FAX: (856) 427-6508

## Energy Conservation Measure Calculation Values

FUEL HEAT VALUES		
DESCRIPTION	VALUE	UNITS
Electric Heat Value	3413	Btu/kWh
Nat Gas Heat Value	100,000	Btu/Therm
#2 Oil Heat Value	140,000	Btu/Gallon
Propane Heat Value	91,600	Btu/Gallon

CONVERSION FACTORS		
DESCRIPTION	VALUE	EQUIVALENT VALUE
British Thermal Unit	1 Btu	(Lb-°F) Heat to raise 1 lb water 1°F (liquid)
Water Conversion	1 gallon water	8.33 lbs water
Cooling Capacity	1 Ton	12,000 Btu/Hr.
Heating Capacity	1 MBH	1000 Btu/Hr
Horse Power	1 HP	0.746 kWh

EFFICIENCY / ENERGY DEFINITIONS		
DESCRIPTION	VALUE	DEFINITION
Full Load Cooling Efficiency	EER	Btu/Wh or kBtu/kWh (output Btus per input Watt-Hr)
Seasonal Cooling Efficiency	SEER	Btu/Wh or kBtu/kWh (output Btus per input Watt-Hr)
Cooling Efficiency	KW/Ton	Input kilo-Watt per output Tons
Heating Efficiency	%	Ratio Output to Input Energy
Heating Efficiency (Heat Pumps)	HSPF	Btu/Wh or kBtu/kWh (output Btus per input Watt-Hr)
Heating / Cooling Efficiency	COP	Ratio Output to Input Energy
Heating Degree Days	HDD	$\sum$ (degrees below room set point X heating days)
Full Load Cooling Hrs	Hrs/Yr	Estimated equivalent total hours for cooling system operating at full load