LOCAL GOVERNMENT ENERGY AUDIT PROGRAM: ENERGY AUDIT REPORT

PREPARED FOR:

WOODBINE BOROUGH FIRE DEPT.
501 WASHINGTON AVE
WOODBINE, NJ 08270
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TOWNSHIP ADMINISTRATOR

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I. EXECUTIVE SUMMARY

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

Borough of Woodbine
Woodbine Fire Department
521 De Hirsch Ave Avenue
Woodbine, NJ 08270

Municipal Contact Person: Jack Miller
Facility Contact Person: Jim

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	$ 4,247
Natural Gas	$ 4,665
Total	$ 8,912

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

Table 1
Financial Summary Table

ENERGY CONSERVATION MEASURES (ECM's)					
ECM NO.	**DESCRIPTION**	**NET INSTALLATION COST[A]**	**ANNUAL SAVINGS[B]**	**SIMPLE PAYBACK (Yrs)**	**SIMPLE LIFETIME ROI**
ECM #1	Lighting Upgrade	$380	$162	2.3	538.5%
ECM #2	Lighting Controls	$1,120	$84	13.3	12.5%
ECM #3	Install Programmable Thermostat	$280	$90	3.1	382.1%
ECM #4	Indirect Tank for Domestic Hot Water	$2,500	$94	26.6	-6.0%
RENEWABLE ENERGY MEASURES (REM's)					
ECM NO.	**DESCRIPTION**	**NET INSTALLATION COST**	**ANNUAL SAVINGS**	**SIMPLE PAYBACK (Yrs)**	**SIMPLE LIFETIME ROI**
REM #1	8.97 KW PV System	$80,730	$5,796	13.9	79.5%

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

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

Table 2
Estimated Energy Savings Summary Table

ENERGY CONSERVATION MEASURES (ECM's)				
ECM NO.	**DESCRIPTION**	**ANNUAL UTILITY REDUCTION**		
		ELECTRIC DEMAND (KW)	**ELECTRIC CONSUMPTION (KWH)**	**NATURAL GAS (Gallons)**
ECM #1	Lighting Upgrade	0.6	865.2	0.0
ECM #2	Lighting Controls	0.3	468.0	0.0
ECM #3	Install Programmable Thermostat	0.0	503.0	0.0
ECM #4	Indirect Tank for Domestic Hot Water	0.0	779.0	-22.0
RENEWABLE ENERGY MEASURES (REM's)				
ECM NO.	**DESCRIPTION**	**ANNUAL UTILITY REDUCTION**		
		ELECTRIC DEMAND (KW)	**ELECTRIC CONSUMPTION (KWH)**	**NATURAL GAS (Gallons)**
REM #1	8.97 KW PV System	8.97	10958.0	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:** Lighting Upgrade
- **ECM #3:** Install Programmable Thermostat

Further Considerations:

ECM #2 Lighting Controls: Lighting controls help a facility that usually has lighting left on for extended period of time in places where it does not necessarily need to be on. The lighting controls ECM does not pay back for this facility because the Woodbine Fire Department is a volunteer facility and does not have enough run-time hours to warrant this ECM.

ECM #4 Indirect Tank for Domestic Hot Water: The domestic hot water for this facility is provided by an electric hot water heater. Even though this hot water heater is very efficient, the cost of electricity balances the unit's total efficiency by making it non cost effective. Installing an alternate fuel consuming product for hot water production would be ill advised because of the small amount of water use the facility uses. Although an indirect water tank does not pay back in the allotted time period, it is cost effective over a longer period of time, mostly because alleviating any of the facilities in the Woodbine area from electric use, which has a high cost rate, will lower the budget for any facility in the area.

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

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

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

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 8.97 kW PV system will produce approximately 10,958 kWh of electricity annually and will reduce the schools electrical consumption from the grid by 46%. The system's calculated simple payback of 13.93 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 Fire Department appears to be operating at a high efficiency level compared to other buildings in the region. This high efficiency can be attributed to the low amount of occupied hours for the facility, which inherently keeps the cost for electricity at a minimum. With the implementation of the above recommended measures the Borough will realize further energy savings at the Fire Department.

II. INTRODUCTION

The comprehensive energy audit covers the 5,935 square foot Woodbine Borough Fire Department, which includes the following spaces: garages, boiler room, restrooms, meeting room, kitchen, and offices.

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

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

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

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

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

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

III. METHOD OF ANALYSIS

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

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

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

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

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

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

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

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

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

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

IV. HISTORIC ENERGY CONSUMPTION/COST

A. Energy Usage / Tariffs

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

The electric usage profile represents the actual electrical usage for the facility. 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 oil usage profile shows the actual oil consumption for the facility. Oil is provided by Major Petroleum Industries to the facility. The oil provider measures consumption in gallons. One Gallon of #2 oil is equivalent to 140,000 BTUs of energy.

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

Description	Average
Electricity	17.9¢ / kWh
Oil #2	$2.03 / Gallon

Table 3
Electricity Billing Data

ELECTRIC USAGE SUMMARY

Utility Provider: Atlantic City Electric
Rate: Monthly General
Meter No: 84898654
Customer ID No: 0431 0029 9999

MONTH OF USE	CONSUMPTION KWH	DEMAND	TOTAL BILL
Mar-09	1,822	10.4	$293
Apr-09	1,845	10.4	$297
May-09	1,527	12.5	$246
Jun-09	1,596	10.0	$278
Jul-09	1,936	7.8	$386
Aug-09	2,354	9.6	$475
Sep-09	2,906	9.9	$570
Oct-09	1,551	10.1	$297
Nov-09	1,626	13.4	$280
Dec-09	2,042	12.3	$349
Jan-10	2,465	12.3	$421
Feb-10	2,055	10.6	$354
Totals	**23,725**	**13.4 Max**	**$4,247**

AVERAGE DEMAND **10.8 KW average**

AVERAGE RATE **$0.179** **$/kWh**

Figure 1
Electricity Usage Profile

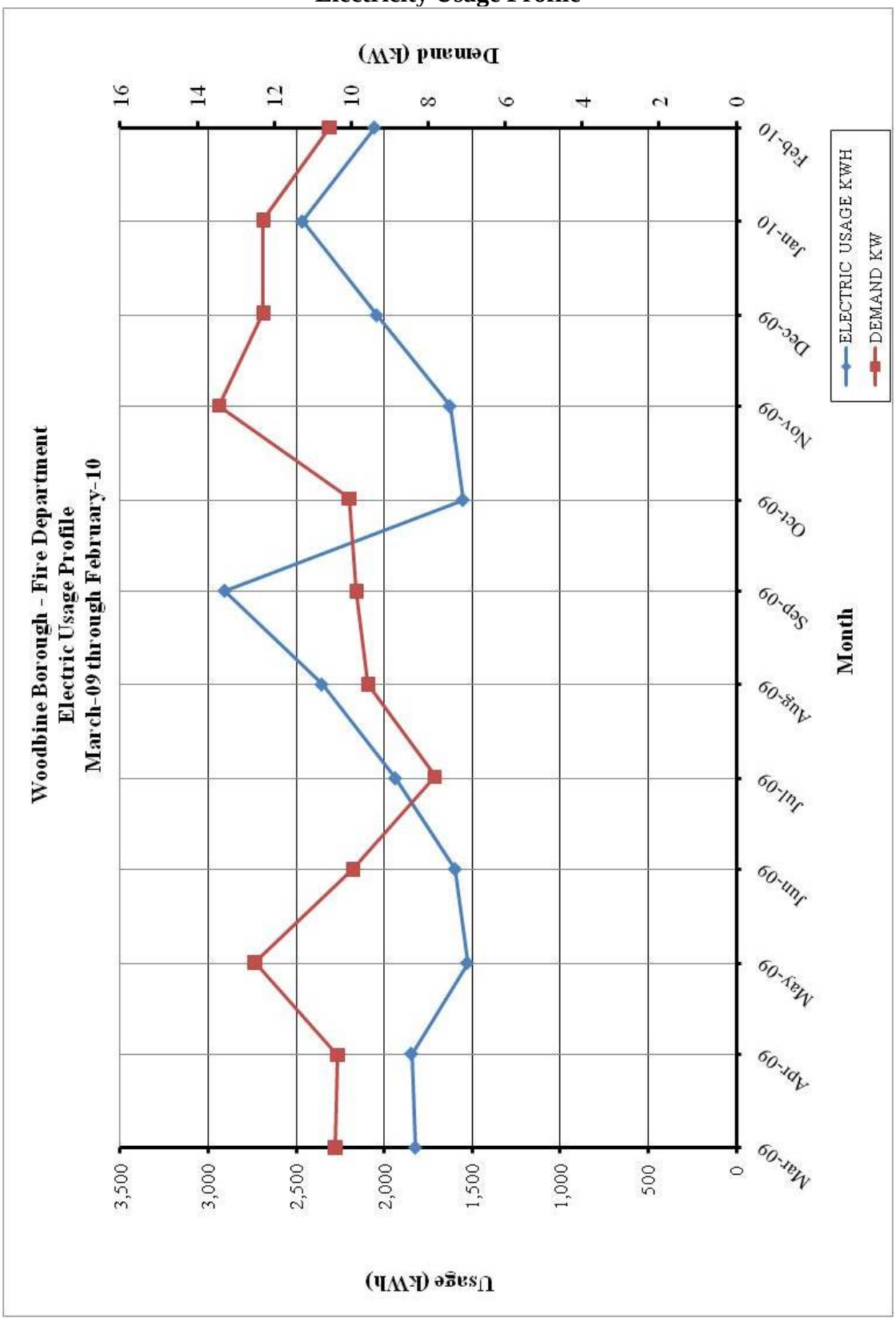
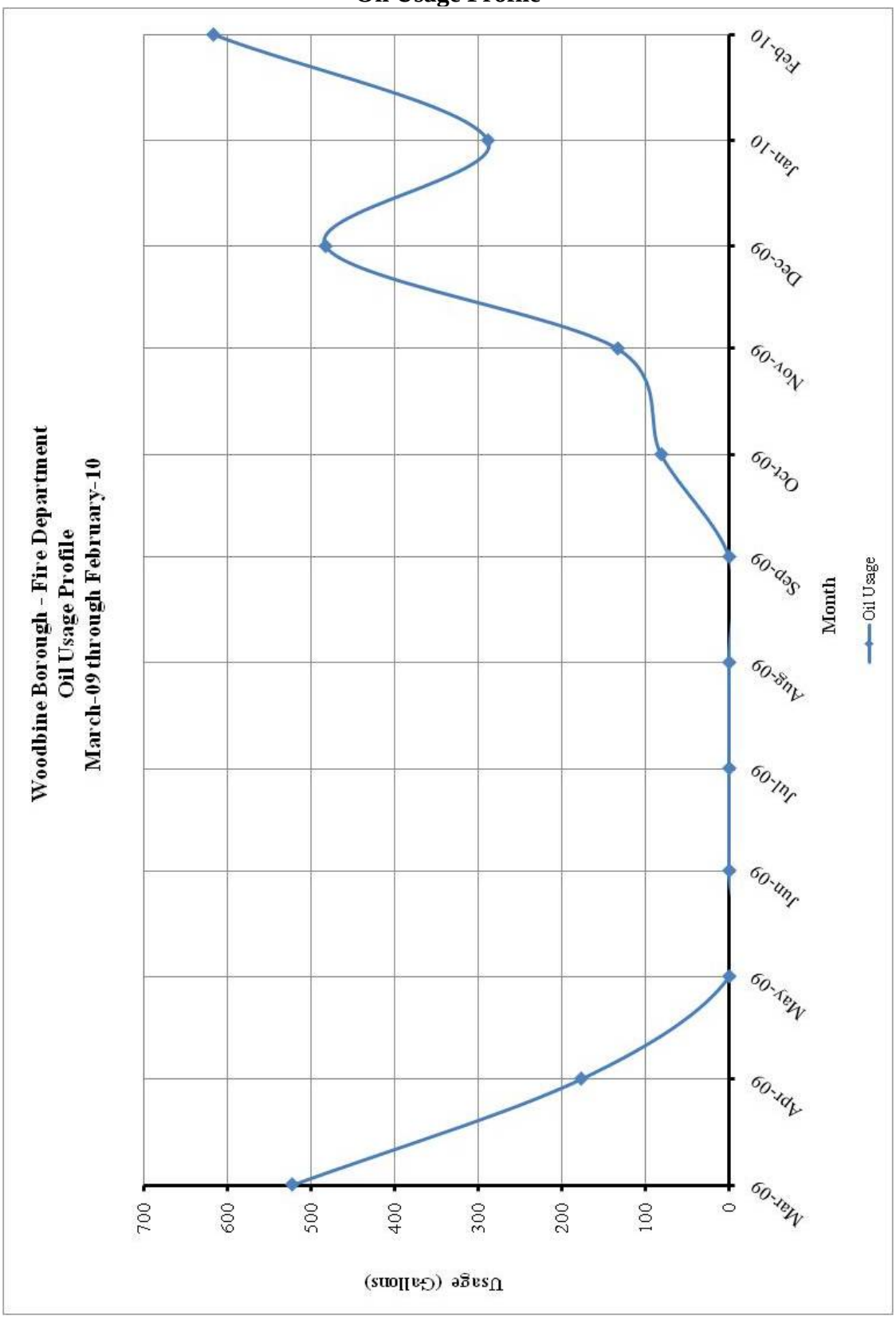


Table 4
Oil Billing Data

OIL USAGE SUMMARY		
Utility Provider: Major Petrolium Industries		
MONTH OF USE	**CONSUMPTION (GALLONS)**	**TOTAL BILL**
Mar-09	522.00	$768.09
Apr-09	176.90	$277.82
May-09	0.00	$0.00
Jun-09	0.00	$0.00
Jul-09	0.00	$0.00
Aug-09	0.00	$0.00
Sep-09	0.00	$0.00
Oct-09	81.10	$185.48
Nov-09	133.10	$292.15
Dec-09	482.10	$1,082.74
Jan-10	288.10	$669.54
Feb-10	616.00	$1,388.78
TOTALS	**2,299.30**	**$4,664.60**
AVERAGE RATE:	**$2.03**	**$/GALLON**

Figure 2
Oil Usage Profile



B. Energy Use Index (EUI)

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

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

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

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

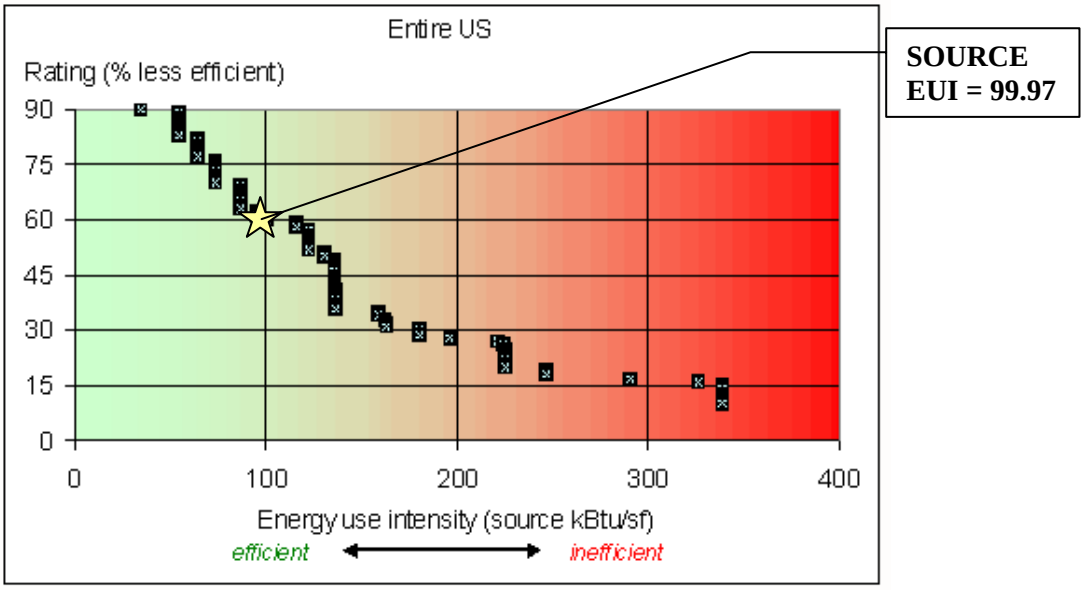
$$Building\ \ Source\ EUI = \frac{(Electric\ Usage\ in\ kBtu\ \ X\ \ SS\ \ Ratio + Gas\ Usage\ in\ kBtu\ \ X\ \ SS\ \ Ratio)}{Building\ \ Square\ \ Footage}$$

Table 5
Facility Energy Use Index (EUI) Calculation

ENERGY USE INTENSITY CALCULATION						
ENERGY TYPE	**BUILDING USE**			**SITE ENERGY**	**SITE-SOURCE RATIO**	**SOURCE ENERGY**
	kWh	**Therms**	**Gallons**	**kBtu**		**kBtu**
ELECTRIC	23725.0			80,997	3.340	270,530
NATURAL GAS		0.0		0	1.047	0
FUEL OIL			2299.3	319,603	1.010	322,799
PROPANE			0.0	0	1.010	0
TOTAL				400,600		593,329
*Site - Source Ratio data is provided by the Energy Star Performance Rating Methodology for Incorporating Source Energy Use document issued Dec 2007.						
BUILDING AREA		5,935	SQUARE FEET			
BUILDING SITE EUI		*67.50*	kBtu/SF/YR			
BUILDING SOURCE EUI		*99.97*	kBtu/SF/YR			

Figure 3 below depicts a national EUI grading for the source use of Fire-Police Stations.

Figure 3
Source Energy Use Intensity Distributions: Fire-Police Station



C. EPA Energy Benchmarking System

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

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

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

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

User Name: 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**
Woodbine Fire Dept.	N/A	50

The Fire Department falls under the "other" category which is not applicable for Energy Performance Rating. See the **Statement of Energy Performance Appendix** for the detailed energy summary.

V. FACILITY DESCRIPTION

The 5,935 SF Municipal Building is a two story facility comprised of two garages on the ground floor, a meeting room, kitchen, and lounges on the second floor. The typical hours of operation for this volunteer facility vary as needed but can be occupied as much as 40 hours a week. Exterior walls are brick face with concrete masonry unit 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, ¼" clear glass with vinyl frames. There are two types of roofing utilized on the fire department, one is built up rubber roofing on the flat section of roof, and the other is shingled roofing on the sloped roof. The amount of insulation below the roofing is unknown. The building was built in 1903 with no additions since the original construction.

HVAC Systems

The Woodbine Borough Fire Department is conditioned by a Trane model TTA split system unit. A single local thermostat located in the second floor meeting room, is non-programmable and controls the split system to regulate space temperature. The split system only serves the second floor meeting room, kitchen, and lounge zones.

The heating load for the Fire Department is provided by two (2), oil fired Weil McLain boilers, model WGO. These boilers provide hot water to the hydronic baseboard heaters around the perimeter of each room on the second floor and in the stairway leading to the second floor. The Firehouse truck bays are heated by three (3) hot water coil unit heaters which are in poor condition due to equipment aging however these units appear to be operating properly and very minimal energy savings is anticipated through the replacement of the fractional horse power fan motor, therefore these units are not recommended for replacement.

Exhaust System

Woodbine Borough Fire Department has installed a vehicle exhaust system in the garage bays which hooks directly up to truck exhausts and expels harmful gasses in a safe and efficient way. This system removes the need to open the garage doors allowing for minimal heat loss during the winter months. Air is exhausted from the toilet rooms through the roof exhausters.

HVAC System Controls

The facility is controlled via standard non-programmable thermostats. There are two (2) thermostats which control the HVAC, one for each of the boiler zones and unit heaters and one for the Trane split system unit.

Domestic Hot Water

Domestic hot water for the restrooms and office lounge is provided by a 40 gallon Bradford White electric hot water heater, capacity of 4,500 Watts. The domestic hot water is circulated throughout the building by a hot water re-circ pump. There is no insulation on the domestic hot

water piping and although this model was manufactured in 2008, it looks dirty and in poor condition, however it does not appear to be leaking.

Lighting

Typical lighting throughout building is fluorescent tube lay-in fixtures with T-8 lamps and electronic ballasts. Various areas like garages and bathrooms have fluorescent T-12 fixtures with magnetic ballasts as well as incandescent lamps. Outside the facility are metal halide wall packs mixed in with incandescent spot lamps. All the lights are controlled by manual 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: Lighting Upgrade

Description:

The lighting in the Woodbine Fire Department is primarily made up of fluorescent T-8 fixtures with electronic ballasts and fluorescent T-12 fixtures with magnetic ballasts. Several areas, such as bathrooms and hallways still contain incandescent bulbs.

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

This ECM also includes replacement of all incandescent lamps to compact fluorescent lamps. 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.

Although the current replacement costs for CFL bulbs are substantially higher than incandescent bulbs (approximately $5 per CFL bulb compared to $0.50 per incandescent bulb), the bulb life for compact fluorescent bulbs is substantially longer than incandescent bulbs (approximately 8,000 to 15,000 hrs per CFL compared to 1000 hrs per incandescent bulb). The total effective operating / maintenance costs for CFL replacements are therefore equivalent and no additional maintenance is required through the replacement of incandescent with CFLs.

Energy Savings Calculations:

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

From the **Smart Start Incentive Appendix**, the following incentives are warranted:

Retrofit fluorescent T12 lamps and magnetic ballast with T-5 or T-8 lamps w/electronic ballast (1-4 lamp retrofitted) = $15 per fixture.

$$\text{Smart Start®}\ \textit{Incentive} = \left(\#\ \textit{of}\ 1-4\ \textit{lamp fixtures retrofitted} \times\ \$15\right)$$
$$\text{Smart Start®}\ \textit{Incentive} = \left(4 \times\ \$15\right) = \underline{\$60}$$

Replacement and Maintenance Savings are calculated as follows:

$$Savings = (reduction\ in\ lamps\ replaced\ \ per\ \ year) \times (repacment\ \$\ per\ lamp + Labor\ \$\ per\ lamp)$$
$$Savings = (1\ lamps\ \ per\ \ year) \times (\$2.00 + \$5.00) = \$7$$

From the Smart Start Incentive appendix, there is no incentive for replacing incandescent lamps with compact fluorescent lamps. The incentive is only available if the entire light fixture is replaced. In most cases, the existing fixtures can be re-lamped by the facility's staff to obtain the energy savings without the expense of a new fixture and the involvement of an electrician to install a new fixture.

Energy Savings Summary:

ECM #1 - ENERGY SAVINGS SUMMARY	
Installation Cost ($):	$440
NJ Smart Start Equipment Incentive ($):	$60
Net Installation Cost ($):	$380
Maintenance Savings ($/Yr):	$7
Energy Savings ($/Yr):	$155
Total Yearly Savings ($/Yr):	$162
Estimated ECM Lifetime (Yr):	15
Simple Payback	2.3
Simple Lifetime ROI	538.5%
Simple Lifetime Maintenance Savings	$105
Simple Lifetime Savings	$2,428
Internal Rate of Return (IRR)	42%
Net Present Value (NPV)	$1,552.14

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 = 2,339 kWh/Yr. occupancy sensor controlled lighting

Energy Savings Calculations:

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

$$Energy\ Savings = 20\% \times 2{,}339\ (kWh) = 468\ (kWh)$$

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

$$Savings. = 468\ (kWh) \times 0.179\left(\frac{\$}{kWh}\right) = \$84$$

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

Installation Cost = $160 x 8 occupancy sensors = $1,280

NJ Smart Start® Program Incentives are calculated as follows:

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

$$\text{Smart Start®}\ Incentive = (\#\ of\ \ wall\ mount\ devices \times\ \$\ 20) = (8 \times \$20) = \$160$$

Energy Savings Summary:

ECM #2 - ENERGY SAVINGS SUMMARY	
Installation Cost ($):	$1,280
NJ Smart Start Equipment Incentive ($):	$160
Net Installation Cost ($):	$1,120
Maintenance Savings ($/Yr):	$0
Energy Savings ($/Yr):	$84
Total Yearly Savings ($/Yr):	$84
Estimated ECM Lifetime (Yr):	15
Simple Payback	13.3
Simple Lifetime ROI	12.5%
Simple Lifetime Maintenance Savings	$0
Simple Lifetime Savings	$1,260
Internal Rate of Return (IRR)	2%
Net Present Value (NPV)	($117.21)

ECM #3: Install Programmable Thermostat

Description:

The upstairs meeting room and offices of the Fire Department is cooled by a Trane cooling only split system air conditioner. The thermostat controlling this unit is a standard non programmable thermostat. The thermostat is set manually in the summer. Although it is the intent to set back or turn off the AC unit when not occupied, the thermostat remains on at the same temperature setting for many unoccupied hours throughout the summer. Since the Fire Department is unoccupied for large periods throughout the day, the energy savings through setting back the thermostat is amplified.

Programmable thermostats provide automatic control of the space temperature during occupied and unoccupied periods of the day. When the space is not occupied the equipment can operate at the unoccupied set point. At the scheduled occupancy time period the thermostat automatically adjusts the temperature of the space to the occupied set point. This control system approach is ideal for facilities with low occupancy levels and long unoccupied periods. New programmable thermostats have a built in capability to adjust heating start times to ensure the space is up to temperature by the specified occupancy period. This is an added comfort feature so programming does not need to be re-adjusted as the season heating load changes.

This ECM includes replacement of the one (1) programmable thermostat with 7-day programmability and night time setback control. The recommended thermostat set points for cooling in the Fire House is as follows:

Occupied Cooling = 75° F (3 Hrs per day)

Unoccupied Cooling = 82° F (21 hours per day)

CEG recommends replacement of Trane's cooling only dedicated thermostat in the offices and meeting areas of the Fire Department Building. This ECM is based on the Honeywell RTH7500D 7-day programmable thermostats or equivalent.

Energy Savings Calculations:

The energy savings of the 7-day programmable thermostats was calculated by using Energy Star Life Cycle Cost Estimate software for qualified programmable thermostats. Additional information on the referenced calculator can be found at www.energystar.gov or refer to the **Programmable Thermostats Calculator Appendix** for a detailed energy savings calculation for the replacement of the thermostats in the facility.

Energy Savings Summary:

ECM #3 - ENERGY SAVINGS SUMMARY	
Installation Cost ($):	$280
NJ Smart Start Equipment Incentive ($):	$0
Net Installation Cost ($):	$280
Maintenance Savings ($/Yr):	$0
Energy Savings ($/Yr):	$90
Total Yearly Savings ($/Yr):	$90
Estimated ECM Lifetime (Yr):	15
Simple Payback	3.1
Simple Lifetime ROI	382.1%
Simple Lifetime Maintenance Savings	$0
Simple Lifetime Savings	$1,350
Internal Rate of Return (IRR)	32%
Net Present Value (NPV)	$794.41

ECM #4: Install Indirect Tank for Domestic Hot Water

Description:

The existing domestic hot water heater serving the facility is a 4.5 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 40 gallon electric hot water heater with an indirect hot water heater fed from the existing boiler loop. The proposed hot water heater would benefit from the heat produced from the oil fired boiler, which is produced at a reduced cost compared to the electric HWH. The electric hot water heater would remain piped and available for switching hot water production based on the seasonal cost of electricity and fuel oil.

Existing Electric DW Heater

Rated Capacity = 4,500 Watt (15.4 MBH) input; 40 gallons storage

Proposed Indirect HWH

Rated Capacity = 120 MBH input; 40 gallons storage

Thermal Efficiency = 85% (based on boiler efficiency)

Calculation of Indirect HWH Energy Savings:

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

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

Energy Savings Calculations:

INDIRECT DOM. HOT WATER BOILER CALCULATIONS			
ECM INPUTS	**EXISTING**	**PROPOSED**	**SAVINGS**
ECM INPUTS	Existing Oil Fired Hot Water Heater	Indirect Tank	
Number of People	5	5	
Lavatory Sink Time (Minutes)	0.25	0.25	
Sink Uses per Day	4	4	
Faucet Gallons Per Minute (GPM)	2.5	2.5	
Domestic Water Temperature Change (°F)	70	70	
Electric Cost ($/kWh)	0.179	0.179	
Oil Cost ($/Gallon)	2.03	2.03	
ENERGY SAVINGS CALCULATIONS			
ECM RESULTS	**EXISTING**	**PROPOSED**	**SAVINGS**
Sink Usage (BTU)	2,660,394	2,660,394	
Heating Efficiency	100%	85%	0
Electric Consumption (kWh)	779	0	779
Oil Consumption (Gallon)	0	22	-22
Energy Cost ($)	$140	$45	$94
COMMENTS:	*Savings are based on LEED-NC Version 2.2 Reference Guide for faucet and shower flow rates.		

Energy Savings Summary:

ECM #4 - ENERGY SAVINGS SUMMARY	
Installation Cost ($):	$2,500
NJ Smart Start Equipment Incentive ($):	$0
Net Installation Cost ($):	$2,500
Maintenance Savings ($/Yr):	$0
Energy Savings ($/Yr):	$94
Total Yearly Savings ($/Yr):	$94
Estimated ECM Lifetime (Yr):	25
Simple Payback	26.6
Simple Lifetime ROI	-6.0%
Simple Lifetime Maintenance Savings	$0
Simple Lifetime Savings	$2,350
Internal Rate of Return (IRR)	0%
Net Present Value (NPV)	($863.16)

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 624 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 8.97 kilowatts could be installed. A system of this size has an estimated kilowatt hour production of 10,958 KWh annually, reducing the overall utility bill by approximately 46% 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 net generate (produce more electricity than they use), the customer will be credited those kilowatt-hours generated to be carried over for future usage on a month to month basis. Then, on an annual basis if the customer is a net generator the customer will then be compensated by the utility the average annual PJM Grid LMP price per kilowatt-hour for the over generation. Due to the aforementioned legislation, the customer is at limited risk if they generate more than they use at times throughout the year. With the inefficiency of today's energy storage systems, such as batteries, the added cost of storage systems is not warranted and was not considered in the proposed design.

Direct purchase involves the Fire Department 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

FINANCIAL SUMMARY - PHOTOVOLTAIC SYSTEM			
PAYMENT TYPE	**SIMPLE PAYBACK**	**SIMPLE ROI**	**INTERNAL RATE OF RETURN**
Direct Purchase	13.93 Years	79.5%	5.8%

*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 Fire Department to invest in a solar system through a Direct Purchase CEG does not recommend the Fire Department pursue this route. It would be more advantageous for the Fire Department 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 Fire Department 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 Oil Usage Profiles included within this report to reference the respective electricity and gas usage load profiles.

Electricity:

The Electric Usage Profile demonstrates a somewhat typical cooling load profile with increased cooling energy as seen in the months of July through September. There is another rise of electrical energy use in the winter months from December through February. It is unclear from where the increase in electrical energy is in the winter season. Based on the survey and discussion with the operations personnel, there is no electric heat in the building. This facility has irregular operating hours and increased use of the facility in the winter could be responsible for the increase in energy. The electrical demand is peaked in the month of November at 13.4 KW. The overall load factor (L.F.) of the building is 20%. Load factor is the total usage divided by the demand times the hours. A load factor of 20% means that the equivalent full load electrical draw only accounts for 20% 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.

Heating Oil:

The oil usage profile demonstrates a very typical heat load profile. The summer months demonstrate very low consumption May through October (other than small fill ups). There is an increase in consumption in December through April. The heat is provide by two oil fired hot water boilers, which is the only equipment using the fuel oil and therefore directly responsible for the usage. Heating oil 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. 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.

Heating Oil:

This facility receives deliveries of oil 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 heating oil are fairly competitive at $2.03 per gallon. As a comparison oil 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 Fire House's electrical average costs were very high at $0.179 / kWh compared to most buildings and 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 oil costs. The oil costs are fairly competitive at this point, however this commodity's pricing fluctuates dramatically. It is recommended to take advantage of the current 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. The BOE 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 par for the costs using the value of energy savings that result from the improvements. The "Energy Savings Improvement Program (ESIP)" law provides a flexible approach that can allow all government agencies in New Jersey to improve and reduce energy usage with minimal expenditure of new financial resources.

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

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

iv. *Pay For Performance* – The New Jersey Smart Start Pay for Performance program includes incentives based on savings resulted from implemented ECMs. The program is available for all buildings 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 shown at least 15% reduction in the building's current energy use. Multiple energy conservation measures implemented together are applicable toward the total savings of at least 15%. No more than 50% of the total energy savings can result from lighting upgrades / changes.

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

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

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

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

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) 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 windows and doors.

C. Clean all light fixtures to maximize light output.

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

ECM COST & SAVINGS BREAKDOWN

CONCORD ENGINEERING GROUP

Woodbine Borough - Fire Department

ECM NO.	DESCRIPTION	INSTALLATION COST				YEARLY SAVINGS			ECM LIFETIME	LIFETIME ENERGY SAVINGS	LIFETIME MAINTENANCE SAVINGS	LIFETIME ROI	SIMPLE PAYBACK	INTERNAL RATE OF RETURN (IRR)	NET PRESENT VALUE (NPV)
		MATERIAL	LABOR	REBATES, INCENTIVES	NET INSTALLATION COST	ENERGY	MAINT. / SREC	TOTAL		(Yearly Saving * ECM Lifetime)	(Yearly Maint Svaing * ECM Lifetime)	(Lifetime Savings - Net Cost) / (Net Cost)	(Net cost / Yearly Savings)	$\sum_{n=0}^{N} \frac{C_n}{(1+IRR)^n}$	$\sum_{n=0}^{N} \frac{C_n}{(1+DR)^n}$
		($)	($)	($)	($)	($/Yr)	($/Yr)	($/Yr)	(Yr)	($)	($)	(%)	(Yr)	($)	($)
ECM ENERGY AND FINANCIAL COSTS AND SAVINGS SUMMARY															
ECM #1	Lighting Upgrade	$440	$0	$60	$380	$155	$7	$162	15	$2,428	$105	538.5%	2.3	42.36%	$1,552.14
ECM #2	Lighting Controls	$1,280	$0	$160	$1,120	$84	$0	$84	15	$1,260	$0	12.5%	13.3	1.51%	($117.21)
ECM #3	Install Programmable Thermostat	$280	$0	$0	$280	$90	$0	$90	15	$1,350	$0	382.1%	3.1	31.62%	$794.41
ECM #4	Indirect Tank for Domestic Hot Water	$2,500	$0	$0	$2,500	$94	$0	$94	25	$2,350	$0	-6.0%	26.6	-0.47%	($863.16)
REM RENEWABLE ENERGY AND FINANCIAL COSTS AND SAVINGS SUMMARY															
REM #1	8.97 KW PV System	$80,730	$0	$0	$80,730	$1,961	$3,835	$5,796	25	$144,900	$95,875	79.5%	13.9	5.12%	$20,196.60

Notes: 1) The variable Cn in the formulas for Internal Rate of Return and Net Present Value stands for the cash flow during each period.
2) The variable DR in the NPV equation stands for Discount Rate
3) For NPV and IRR calculations: From n=0 to N periods where N is the *lifetime of ECM* and Cn is the *cash flow during each period* .

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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

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 ≥ 16 $600 per ton, EER ≥ 18 $750 per ton, EER ≥ 20

Energy Efficiency must comply with ASHRAE 90.1-2004

Gas Heating

Gas Fired Boilers < 300 MBH	$300 per unit
Gas Fired Boilers ≥ 300 - 1500 MBH	$1.75 per MBH
Gas Fired Boilers ≥1500 - ≤ 4000 MBH	$1.00 per MBH
Gas Fired Boilers > 4000 MBH	(Calculated through Custom Measure Path)
Gas Furnaces	$300 - $400 per unit, AFUE ≥ 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 ≤ 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 ≥ 100w Retrofit with induction lamp, power coupler and generator (must be 30% less watts/fixture than HID system)	$50 per fixture
HID ≥ 100w Replacement with new HID ≥ 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%

OMB No. 2060-0347

STATEMENT OF ENERGY PERFORMANCE
Woodbine Borough - Fire Department

Building ID: 2284369
For 12-month Period Ending: February 28, 2010[1]
Date SEP becomes ineligible: N/A
Date SEP Generated: April 20, 2010

Facility
Woodbine Borough - Fire Department
521 De Hirsch Ave 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: 1903
Gross Floor Area (ft²): 5,935

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

Site Energy Use Summary[3]

Electricity - Grid Purchase(kBtu)	80,950
Propane (kBtu)	210,725
Natural Gas - (kBtu)[4]	0
Total Energy (kBtu)	291,675

Energy Intensity[5]

Site (kBtu/ft²/yr)	49
Source (kBtu/ft²/yr)	81

Emissions (based on site energy use)

Greenhouse Gas Emissions ($MtCO_2e$/year)	26

Electric Distribution Utility
Pepco - Atlantic City Electric Co

National Average Comparison

National Average Site EUI	78
National Average Source EUI	157
% Difference from National Average Source EUI	-48%
Building Type	Fire Station/Police Station

Stamp of Certifying Professional

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

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

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

Certifying Professional
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	☑
Building Name	Woodbine Borough - Fire Department	Is this the official building name to be displayed in the ENERGY STAR Registry of Labeled Buildings?		☐
Type	Fire Station/Police Station	Is this an accurate description of the space in question?		☐
Location	521 De Hirsch Ave Avenue, Woodbine, NJ 08270	Is this address accurate and complete? Correct weather normalization requires an accurate zip code.		☐
Single Structure	Single Facility	Does this SEP represent a single structure? SEPs cannot be submitted for multiple-building campuses (with the exception of acute care or children's hospitals) nor can they be submitted as representing only a portion of a building		☐
Fire Department (Other)				
CRITERION	**VALUE AS ENTERED IN PORTFOLIO MANAGER**	**VERIFICATION QUESTIONS**	**NOTES**	☑
Gross Floor Area	5,935 Sq. Ft.	Does this square footage include all supporting functions such as kitchens and break rooms used by staff, storage areas, administrative areas, elevators, stairwells, atria, vent shafts, etc. Also note that existing atriums should only include the base floor area that it occupies. Interstitial (plenum) space between floors should not be included in the total. Finally gross floor area is not the same as leasable space. Leasable space is a subset of gross floor area.		☐
Number of PCs	2(Optional)	Is this the number of personal computers in the space?		☐
Weekly operating hours	25Hours(Optional)	Is this the total number of hours per week that the space is 75% occupied? This number should exclude hours when the facility is occupied only by maintenance, security, or other support personnel. For facilities with a schedule that varies during the year, "operating hours/week" refers to the total weekly hours for the schedule most often followed.		☐
Workers on Main Shift	10(Optional)	Is this the number of employees present during the main shift? Note this is not the total number of employees or visitors who are in a building during an entire 24 hour period. For example, if there are two daily 8 hour shifts of 100 workers each, the Workers on Main Shift value is 100.		☐

ENERGY STAR® Data Checklist for Commercial Buildings

Energy Consumption

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

Fuel Type: Electricity

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

Start Date	End Date	Energy Use (kWh (thousand Watt-hours))
02/01/2010	02/28/2010	2,055.00
01/01/2010	01/31/2010	2,465.00
12/01/2009	12/31/2009	2,042.00
11/01/2009	11/30/2009	1,626.00
10/01/2009	10/31/2009	1,551.00
09/01/2009	09/30/2009	2,906.00
08/01/2009	08/31/2009	2,354.00
07/01/2009	07/31/2009	1,936.00
06/01/2009	06/30/2009	1,596.00
05/01/2009	05/31/2009	1,527.00
04/01/2009	04/30/2009	1,845.00
03/01/2009	03/31/2009	1,822.00
Electric Consumption (kWh (thousand Watt-hours))		**23,725.00**
Electric Consumption (kBtu (thousand Btu))		**80,949.70**
Total Electricity (Grid Purchase) Consumption (kBtu (thousand Btu))		**80,949.70**
Is this the total Electricity (Grid Purchase) consumption at this building including all Electricity meters?		☐

Fuel Type: Propane

Meter: Gas (Gallons)
Space(s): Entire Facility

Start Date	End Date	Energy Use (Gallons)
02/01/2010	02/28/2010	616.00
01/01/2010	01/31/2010	288.10
12/01/2009	12/31/2009	482.10
11/01/2009	11/30/2009	133.10
10/01/2009	10/31/2009	81.10
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	0.00
05/01/2009	05/31/2009	0.00

04/01/2009	04/30/2009	176.90
03/01/2009	03/31/2009	522.00
Gas Consumption (Gallons)		**2,299.30**
Gas Consumption (kBtu (thousand Btu))		**210,725.33**
Total Propane Consumption (kBtu (thousand Btu))		**210,725.33**
Is this the total Propane consumption at this building including all Propane meters?		☐

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

On-Site Solar and Wind Energy	
Do the fuel consumption totals shown above include all on-site solar and/or wind power located at your facility? Please confirm that no on-site solar or wind installations have been omitted from this list. All on-site systems must be reported.	☐

Certifying Professional

(When applying for the ENERGY STAR, the Certifying Professional must be the same as the PE that signed and stamped the SEP.)

Name: _____ Date: _____

Signature: _____

Signature is required when applying for the ENERGY STAR.

FOR YOUR RECORDS ONLY. DO NOT SUBMIT TO EPA.

Please keep this Facility Summary for your own records; do not submit it to EPA. Only the Statement of Energy Performance (SEP), Data Checklist and Letter of Agreement need to be submitted to EPA when applying for the ENERGY STAR.

Facility
Woodbine Borough - Fire Department
521 De Hirsch Ave 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 - Fire Department	
Gross Floor Area Excluding Parking: (ft^2)	5,935
Year Built	1903
For 12-month Evaluation Period Ending Date:	February 28, 2010

Facility Space Use Summary

Fire Department	
Space Type	Other - Fire Station/Police Station
Gross Floor Area(ft^2)	5,935
Number of PCs[o]	2
Weekly operating hours[o]	25
Workers on Main Shift[o]	10

Energy Performance Comparison

	Evaluation Periods		Comparisons		
Performance Metrics	**Current** (Ending Date 02/28/2010)	**Baseline** (Ending Date 02/28/2010)	**Rating of 75**	**Target**	**National Average**
Energy Performance Rating	N/A	N/A	75	N/A	N/A
Energy Intensity					
Site (kBtu/ft^2)	49	49	0	N/A	78
Source (kBtu/ft^2)	81	81	0	N/A	157
Energy Cost					
$/year	$ 8,910.60	$ 8,910.60	N/A	N/A	$ 14,143.81
$/$ft^2$/year	$ 1.50	$ 1.50	N/A	N/A	$ 2.38
Greenhouse Gas Emissions					
$MtCO_2e$/year	26	26	0	N/A	41
$kgCO_2e/ft^2$/year	4	4	0	N/A	6

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

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

MAJOR EQUIPMENT LIST

Concord Engineering Group

Fire Department

Boiler

Tag	Location	Area Served	Manufacturer	Qty.	Model #	Serial #	Input (MBh)	Output (MBh)	Efficiency (%)	Fuel	Approx. Age	ASHRAE Service Life	Remaining Life	Notes
	Basement	Building	Weil McLain	2	A/B-WGO-7	3	280	242	85	Oil	10	35	25	

Domestic Water Heater

Tag	Location	Area Served	Manufacturer	Qty	Model #	Serial #	Input (MBh)	Recovery (gal/h)	Capacity (gal)	Efficiency (%)	Fuel	Approx. Age	ASHRAE Service Life	Remaining Life	Notes
	Basement	Building	Bradford White	1	M40S5DS-8	EH	4500		40	10	Electric		12	12	

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	Trane	1	2TTA0060A3000AA	3465RJ3F	5 Ton	10 SEER	R-22	200/230/3	7	15	8	

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
	Garage	Garage	Modine	2	-	-	-	-	-	-	-	10	13	3	
	Garage	Garage	Beacon Morris Corp.	1	-	-	-	-	-	-	-				

Investment Grade Lighting Audit

CEG Job #: Insert CEG Job Number Here
Project: Project Name
Address: Address
Address
Building SF: 5,935

Fire Department

KWH COST: $0.179

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	Garage 1	1400	8	3	3-Lamp, T8, Electronic Ballast, Recessed Mounted, Prismatic Lens	82	0.66	918.4	$164.39	8	3	No Change	82	0.66	918.4	$164.39	$0.00	$0.00	0.00	0	$0.00	0.00
1	Garage 2	1400	24	3	3-Lamp, T8, Electronic Ballast, Recessed Mounted, Prismatic Lens	82	1.97	2,755.2	$493.18	24	3	No Change	82	1.97	2755.2	$493.18	$0.00	$0.00	0.00	0	$0.00	0.00
1	Back Room	1400	4	3	3-Lamp, T8, Electronic Ballast, Recessed Mounted, Prismatic Lens	82	0.33	459.2	$82.20	4	3	No Change	82	0.33	459.2	$82.20	$0.00	$0.00	0.00	0	$0.00	0.00
31	Front Entrance	1400	2	2	2 Lamp Incandescents	100	0.20	280.0	$50.12	2	2	26 W CFL Lamp	26	0.05	72.8	$13.03	$5.75	$11.50	0.15	207.2	$37.09	0.31
1	Back Hallway	1400	1	3	3-Lamp, T8, Electronic Ballast, Recessed Mounted, Prismatic Lens	82	0.08	114.8	$20.55	1	3	No Change	82	0.08	114.8	$20.55	$0.00	$0.00	0.00	0	$0.00	0.00
30	Mens Room	1400	1	0	1 Lamp Incandescents	100	0.10	140.0	$25.06	1	0	26 W CFL Lamp	26	0.03	36.4	$6.52	$5.75	$5.75	0.07	103.6	$18.54	0.31
29	Womens Room	1400	1	0	1-Lamp Compact Flourescent	13	0.01	18.2	$3.26	1	0	No Change	13	0.01	18.2	$3.26	$0.00	$0.00	0.00	0	$0.00	0.00
1	Meeting Room	1400	9	3	3-Lamp, T8, Electronic Ballast, Recessed Mounted, Prismatic Lens	82	0.74	1,033.2	$184.94	9	3	No Change	82	0.74	1033.2	$184.94	$0.00	$0.00	0.00	0	$0.00	0.00
1	Lounge	1400	2	3	3-Lamp, T8, Electronic Ballast, Recessed Mounted, Prismatic Lens	82	0.16	229.6	$41.10	2	3	No Change	82	0.16	229.6	$41.10	$0.00	$0.00	0.00	0	$0.00	0.00
1	Office #1	1400	2	3	3-Lamp, T8, Electronic Ballast, Recessed Mounted, Prismatic Lens	82	0.16	229.6	$41.10	2	3	No Change	82	0.16	229.6	$41.10	$0.00	$0.00	0.00	0	$0.00	0.00
1	Office #2	1400	1	3	3-Lamp, T8, Electronic Ballast, Recessed Mounted, Prismatic	82	0.08	114.8	$20.55	1	3	No Change	82	0.08	114.8	$20.55	$0.00	$0.00	0.00	0	$0.00	0.00
1	Kitchen	1400	1	3	3-Lamp, T8, Electronic Ballast, Recessed Mounted, Prismatic Lens	82	0.08	114.8	$20.55	1	3	No Change	82	0.08	114.8	$20.55	$0.00	$0.00	0.00	0	$0.00	0.00
28	Outside Wall	1400	4	0	1-Lamp Metal Halide	250	1.00	1,400.0	$250.60	4	0	No Change	250	1.00	1400	$250.60	$0.00	$0.00	0.00	0	$0.00	0.00
30	Outside Doors	1400	3	0	1 Lamp Incandescents	100	0.30	420.0	$75.18	3	0	26 W CFL Lamp	26	0.08	109.2	$19.55	$5.75	$17.25	0.22	310.8	$55.63	0.31
30	Boiler Room	1400	1	0	1 Lamp Incandescents	100	0.10	140.0	$25.06	1	0	26 W CFL Lamp	26	0.03	36.4	$6.52	$5.75	$5.75	0.07	103.6	$18.54	0.31
14	Garage	1400	4	2	2-Lamp, T12, Magnetic Ballast, Pendant Mounted, Industrial	80	0.32	448.0	$80.19	4	2	1'X4' 2-Lamp 32W T-8 Elect Ballast; Metalux M/N GC	55	0.22	308	$55.13	$100.00	$400.00	0.10	140	$25.06	15.96
	Totals		68	31			6.30	8,815.8	$1,578.03	68	31			5.679	7950.6	$1,423.16		$440.25	0.62	865.2	$154.87	2.84

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

CEG Job #: Insert CEG Job Number Here
Project: Project Name
Address: Address
Address
Building SF: 5935

Fire Department

KWH COST: $0.179

ECM #2: Lighting Controls

EXISTING LIGHTINC										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	Garage 1	1400	8	3	3-Lamp, T8, Electronic Ballast, Recessed Mounted, Prismatic Lens	82	0.66	918.4	$164.39	8	3	None	82	0%	0.66	918	$164.39	$0.00	$0.00	0.00	0.0	$0.00	0.00
1	Garage 2	1400	24	3	3-Lamp, T8, Electronic Ballast, Recessed Mounted, Prismatic Lens	82	1.97	2,755.2	$493.18	24	3	None	82	0%	1.97	2755	$493.18	$0.00	$0.00	0.00	0.0	$0.00	0.00
1	Back Room	1400	4	3	3-Lamp, T8, Electronic Ballast, Recessed Mounted, Prismatic Lens	82	0.33	459.2	$82.20	4	3	Dual Technology Occupancy Sensor	82	20%	0.26	367	$65.76	$160.00	$160.00	0.07	91.8	$16.44	9.73
31	Front Entrance	1400	2	2	2 Lamp Incandescents	100	0.20	280.0	$50.12	2	2	None	100	0%	0.20	280	$50.12	$0.00	$0.00	0.00	0.0	$0.00	0.00
1	Back Hallway	1400	1	3	3-Lamp, T8, Electronic Ballast, Recessed Mounted, Prismatic Lens	82	0.08	114.8	$20.55	1	3	None	82	0%	0.08	115	$20.55	$0.00	$0.00	0.00	0.0	$0.00	0.00
30	Mens Room	1400	1	0	1 Lamp Incandescents	100	0.10	140.0	$25.06	1	0	Dual Technology Occupancy Sensor	100	20%	0.08	112	$20.05	$160.00	$160.00	0.02	28.0	$5.01	31.92
29	Womens Room	1400	1	0	1-Lamp Compact Flourescent	13	0.01	18.2	$3.26	1	0	Dual Technology Occupancy Sensor	13	20%	0.01	15	$2.61	$160.00	$160.00	0.00	3.6	$0.65	245.56
1	Meeting Room	1400	9	3	3-Lamp, T8, Electronic Ballast, Recessed Mounted, Prismatic Lens	82	0.74	1,033.2	$184.94	9	3	Dual Technology Occupancy Sensor	82	20%	0.59	827	$147.95	$160.00	$160.00	0.15	206.6	$36.99	4.33
1	Lounge	1400	2	3	3-Lamp, T8, Electronic Ballast, Recessed Mounted, Prismatic Lens	82	0.16	229.6	$41.10	2	3	Dual Technology Occupancy Sensor	82	20%	0.13	184	$32.88	$160.00	$160.00	0.03	45.9	$8.22	19.47
1	Office #1	1400	2	3	3-Lamp, T8, Electronic Ballast, Recessed Mounted, Prismatic Lens	82	0.16	229.6	$41.10	2	3	Dual Technology Occupancy Sensor	82	20%	0.13	184	$32.88	$160.00	$160.00	0.03	45.9	$8.22	19.47
1	Office #2	1400	1	3	3-Lamp, T8, Electronic Ballast, Recessed Mounted, Prismatic Lens	82	0.08	114.8	$20.55	1	3	Dual Technology Occupancy Sensor	82	20%	0.07	92	$16.44	$160.00	$160.00	0.02	23.0	$4.11	38.93
1	Kitchen	1400	1	3	3-Lamp, T8, Electronic Ballast, Recessed Mounted, Prismatic Lens	82	0.08	114.8	$20.55	1	3	Dual Technology Occupancy Sensor	82	20%	0.07	92	$16.44	$160.00	$160.00	0.02	23.0	$4.11	38.93
28	Outside Wall	1400	4	0	1-Lamp Metal Halide	250	1.00	1,400.0	$250.60	4	0	None	250	0%	1.00	1400	$250.60	$0.00	$0.00	0.00	0.0	$0.00	0.00

30	Outside Doors	1400	3	0	1 Lamp Incandescents	100	0.30	420.0	$75.18	3	0	None	100	0%	0.30	420	$75.18	$0.00	$0.00	0.00	0.0	$0.00	0.00
30	Boiler Room	1400	1	0	1 Lamp Incandescents	100	0.10	140.0	$25.06	1	0	None	100	0%	0.10	140	$25.06	$0.00	$0.00	0.00	0.0	$0.00	0.00
14	Garage	1400	4	2	2-Lamp, T12, Magnetic Ballast, Pendant Mounted, Industrial	80	0.32	448.0	$80.19	4	2	None	80	0%	0.32	448	$80.19	$0.00	$0.00	0.00	0.0	$0.00	0.00
	Totals		68	31			6.30	8,815.8	$1,578.03	68	31				5.9628	8347.92	$1,494.28		$1,280.00	0.33	467.9	$83.75	15.28

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

160

240

Project Name: LGEA Solar PV Project -Fire Department
Location: Woodbine, NJ
Description: Photovoltaic System - Direct Purchase

Simple Payback Analysis

	Photovoltaic System - Direct Purchase
Total Construction Cost	$80,730
Annual kWh Production	10,958
Annual Energy Cost Reduction	$1,961
Annual SREC Revenue	$3,835
First Cost Premium	**$80,730**
Simple Payback:	**13.93** **Years**

Life Cycle Cost Analysis

Analysis Period (years):	25	Financing %:	0%
Financing Term (mths):	0	Maintenance Escalation Rate:	3.0%
Average Energy Cost ($/kWh)	**$0.179**	Energy Cost Escalation Rate:	3.0%
Financing Rate:	0.00%	SREC Value ($/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	$80,730	0	0	0	$0	(80,730)	0
1	$0	10,958	$1,961	$0	$3,835	$5,797	($74,933)
2	$0	10,903	$2,020	$0	$3,816	$5,836	($69,097)
3	$0	10,849	$2,081	$0	$3,797	$5,878	($63,219)
4	$0	10,794	$2,143	$0	$3,778	$5,921	($57,297)
5	$0	10,740	$2,208	$111	$3,759	$5,856	($51,441)
6	$0	10,687	$2,274	$110	$3,740	$5,904	($45,537)
7	$0	10,633	$2,342	$110	$3,722	$5,954	($39,583)
8	$0	10,580	$2,412	$109	$3,703	$6,006	($33,576)
9	$0	10,527	$2,485	$108	$3,685	$6,061	($27,515)
10	$0	10,475	$2,559	$108	$3,666	$6,118	($21,398)
11	$0	10,422	$2,636	$107	$3,648	$6,177	($15,221)
12	$0	10,370	$2,715	$107	$3,630	$6,238	($8,983)
13	$0	10,318	$2,797	$106	$3,611	$6,302	($2,682)
14	$0	10,267	$2,881	$106	$3,593	$6,368	$3,686
15	$0	10,215	$2,967	$105	$3,575	$6,437	$10,123
16	$0	10,164	$3,056	$105	$3,558	$6,509	$16,632
17	$0	10,113	$3,148	$104	$3,540	$6,583	$23,215
18	$0	10,063	$3,242	$104	$3,522	$6,660	$29,876
19	$0	10,013	$3,339	$103	$3,504	$6,741	$36,616
20	$0	9,963	$3,439	$103	$3,487	$6,824	$43,440
21	$1	9,913	$3,543	$102	$3,469	$6,910	$50,350
22	$2	9,863	$3,649	$102	$3,452	$6,999	$57,350
23	$3	9,814	$3,758	$101	$3,435	$7,092	$64,442
24	$4	9,765	$3,871	$101	$3,418	$7,188	$71,630
25	$5	9,716	$3,987	$100	$3,401	$7,288	$78,918
	Totals:	258,126	$71,514	$2,211	$90,344	$159,648	($24,205)
				Net Present Value (NPV)		**$78,943**	
				Internal Rate of Return (IRR)		**5.8%**	

Building	Roof Area (sq ft)	Panel	Qty	Panel Sq Ft	Panel Total Sq Ft	Total KW_{DC}	Total Annual kWh	Panel Weight (33 lbs)	W/SQFT
Fire Department	624	Sunpower SPR230	39	14.7	573	8.97	10,958	1,287	15.64

PVWatts

AC Energy & Cost Savings

Cautions for Interpreting the Results

Station Identification	
City:	Atlantic_City
State:	New_Jersey
Latitude:	39.45° N
Longitude:	74.57° W
Elevation:	20 m
PV System Specifications	
DC Rating:	9.0 kW
DC to AC Derate Factor:	0.810
AC Rating:	7.3 kW
Array Type:	Fixed Tilt
Array Tilt:	10.0°
Array Azimuth:	180.0°
Energy Specifications	
Cost of Electricity:	11.2 ¢/kWh

Results			
Month	Solar Radiation (kWh/m²/day)	AC Energy (kWh)	Energy Value ($)
1	2.58	583	65.30
2	3.33	688	77.06
3	4.31	961	107.63
4	5.20	1095	122.64
5	5.85	1250	140.00
6	6.14	1217	136.30
7	6.06	1229	137.65
8	5.54	1130	126.56
9	4.85	971	108.75
10	3.76	793	88.82
11	2.65	556	62.27
12	2.23	487	54.54
Year	4.38	10958	1227.30

.= Proposed PV Layout

Notes:

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

Products that earn the ENERGY STAR prevent greenhouse gas emissions by meeting strict energy efficiency guidelines set by the U.S. Environmental Protection Agency and the U.S. Department of Energy.
www.energystar.gov

CHANGE FOR THE BETTER WITH ENERGY STAR

Life Cycle Cost Estimate for 1 ENERGY STAR Qualified Programmable Thermostat(s)

This energy savings calculator was developed by the U.S. EPA and U.S. DOE and is provided for estimating purposes only. Actual energy savings may vary based on use and other factors.

Enter your own values in the gray boxes or use our default values.

Number of Units	1
Initial Cost per ENERGY STAR Unit (retail price)	$280
Initial Cost per Conventional Unit (retail price)	$0
Unit Fuel Cost (Cooling) ($/kWh)	$0.179
Unit Fuel Cost (Heating)	$0.00

24 Hour Typical Usage Patterns*

	Weekday	Weekend
Nighttime Set-Back/Set-Up Hours	21	21
Daytime Set-Back/Set-Up Hours	3	3
Hours without Set-Back/Set-Up	0	0

Choose your city from the drop-down menu → **City**: NJ-Atlantic City

Heating Season*

Typical Indoor Temperature w/o Set-Back	70
Nighttime Set-Back Temperature (Average)	55
Daytime Set-Back Temperature (Average)	65
Heating System Type	None

Cooling Season*

Typical Indoor Temperature w/o Set-Up	75
Nighttime Set-Up Temperature (Average)	82
Daytime Set-Up Temperature (Average)	75
Cooling System Type	Central AC

**All temperatures are in degrees Fahrenheit. Setpoint is defined as the temperature setting for any given time period. Set-back temperature is defined as the lower setpoint temperature for the energy-savings periods during the heating season, generally nighttime and daytime. Set-up temperature is defined as the higher setpoint temperature for the energy-savings periods during the cooling season, generally nighttime and daytime.*

Annual and Life Cycle Costs and Savings for 1 Programmable Thermostat(s)

	1 ENERGY STAR Unit(s)	1 Conventional Unit(s)	Savings with ENERGY STAR
Annual Energy Costs			
Heating Energy Cost	$0	$0	$0
Heating Energy Consumption (MBTU)	*0*	*0*	*0*
Cooling Energy Cost	$140	$230	$90
Cooling Energy Consumption (MBTU)	*2.7*	*4.4*	*2*
Total	**$140**	**$230**	**$90**
Life Cycle Costs			
Energy Costs	$1,557	$2,557	$1,000
Heating Energy Costs	*$0*	*$0*	*$0*
Heating Energy Consumption (MBTU)	0	0	0
Cooling Energy Costs	$1,557	$2,557	$1,000
Cooling Energy Consumption (MBTU)	40	66	26
Purchase Price for 1 Unit(s)	*$280*	*$0*	*-$280*
Total	**$1,837**	**$2,557**	**$720**
		Simple payback of initial cost (years)	**3.1**

Summary of Benefits for 1 Programmable Thermostat(s)

Initial cost difference	**$280**
Life cycle savings	**$1,000**
Net life cycle savings (life cycle savings - additional cost)	**$720**
Life cycle energy saved (MBTU)-includes both Heating and Cooling	**26**
Simple payback of additional cost (years)	**3.1**
Life cycle air pollution reduction (lbs of CO_2)	**7,539**
Air pollution reduction equivalence (number of cars removed from the road for a year)	**1**
Air pollution reduction equivalence (acres of forest)	**1**
Savings as a percent of retail price	**257%**

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	∑ (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